SCOTT'S MILL HYDRO, LLC

December 8, 2017

The Honorable Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

*RE: DRAFT APPLICATION FOR ORIGINAL LICENSE FOR
MAJOR WATER POWER PROJECTS 5 MEGAWATTS OR LESS
SCOTT'S MILL DAM HYDROELECTRIC PROJECT,*
FERC PROJECT NO. 14425

Dear Secretary Bose:

Scott's Mill Hydro, LLC (Scott's Mill) is pleased to submit to the Federal Energy Regulatory Commission (Commission or FERC) the enclosed draft Application (Initial Statement, Exhibits A, E, F, and G) for an original license for the Scott's Mill Hydropower Project, FERC No. 14425 ("Project"). Exhibit F contains design drawings of the project works and qualifies as CEII according to the criteria set forth in 18 C.F.R. 388.113(c). However, because Scott's Mill is a low hazard dam and the modular design of the project may be of value to other hydropower developers, we are requesting that the Commission not make the drawings CEII.

The Application is submitted pursuant to the Commission regulations 18 C.F.R. §4.60 and 4.61. By letter dated October 23, 2015, the Commission approved the Traditional Licensing Process (TLP) for this original licensing.

Per 18 C.F.R, §4.38 Scott's Mill is requesting comments within 90 days of the transmittal date (i.e., March 8, 2018). Scott's Mill intends to file a final license application once comments on the draft application are resolved.

Sincerely,

Wayne M Dyok for

Mark Fendig, President

P.O. Box 13 | Coleman Falls, VA 24536 | www.scottsmillhydro.com

Scott's Mill Hydropower Project Distribution

- Ms. Kimberly Bose, Secretary, Federal Energy Regulatory Commission
- Mr. Jon Smith, Federal Energy Regulatory Commission
- Mr. Jody Callihan, Federal Energy Regulatory Commission
- Division of Dam Safety and Inspection, Federal Energy Regulatory Commission
- Ms. Catherine Gray, Cultural Resources Specialist, Cherokee Nation
- Chief, Tuscarora Indian Nation
- Ms. Diane Shields, Monacan Tribe
- R. Duschane, Tribal Historical Preservation Officer, Absentee-Shawnee
- Kim Jumper, Tribal Historical Preservation Officer, Eastern Shawnee Tribe of Oklahoma
- Tribal Historical Preservation Officer, Shawnee Tribe
- Resources Department, Eastern Band of Cherokee Indians
- Chief, United Keetoowah Band of Cherokee Indians
- Virginia Council On Indians
- District Engineer, Norfolk District, U.S. Army Corps of Engineers (Jeanne Richardson)
- Mr. David Sutherland, U.S. Fish and Wildlife Service
- Ms. Cindy Shultz, Virginia Field Office, U.S. Fish and Wildlife Service
- Southwest Virginia Field Office, U. S Fish and Wildlife Service
- Director, National Marine Fisheries Service
- Administrator, National Oceanic and Atmospheric Admin., Fisheries Regional Office
- James River District Ranger, National Park Service
- Ms. Joan Harn, National Park Service
- U.S. Department of Agriculture, Forest Service, Washington, DC
- U.S. Forest Service, Roanoke
- Environmental Impact Review Officer, U.S. Environmental Protection Agency
- Advisory Council on Historic Preservation
- U.S. Bureau of Indian Affairs

- U.S. Bureau of Land Management, Springfield VA Office
- Mr. Scott Smith, Virginia Department of Game and Inland Fisheries
- Mr. Greg Palmer, Virginia Department of Game and Inland Fisheries
- Manager Environmental Services Section, Virginia Dept. of Game and Inland Fisheries
- Ms. Lynn Crump, Virginia Department of Conservation and Recreation
- Mr. Robert Bennett, Virginia Department of Conservation and Recreation
- Ms. Jennifer Wampler, Virginia Department of Conservation and Recreation
- Mr. Robert Ruhr, Virginia Department of Conservation and Recreation
- Director Water Division, Virginia Department of Environmental Quality
- Ms. Amanda Grey, Virginia Department of Environmental Quality
- Mr. Brian McGurk, Env. Program Planner, Virginia Department of Environmental Quality
- Blue Ridge Regional Office, VDEQ
- Ms. Roger W. Kirchen, Virginia Department of Historic Resources
- Mr. Marc Holma, Virginia Department of Historic Resources
- Ms. Julie Langan, Virginia Department of Historic Resources
- Virginia Marine Resources Commission
- Director, DCR Dam Safety
- Ms. Sara Lu Christian, Director, Amherst County
- Amherst County Library
- Bedford County Administration
- Bedford County Library
- Lynchburg Library
- Mr. Timothy Mitchell, City of Lynchburg Utilities
- Mr. Clay Simmons, City of Lynchburg
- Mr. Justin Stauder, City of Lynchburg
- Mr. Greg Poff, City of Lynchburg
- Kristian M. Dahl, McGuire Woods, LLP

- Pat Culvert, Virginia Conservation Network
- Mr. Rob Campbell, James River Association
- Mr. Kevin Daniels, Trout Unlimited, Virginia Chapter
- Mr. Thomas W. Evans, Virginia Wildlife Federation
- Technical Services Director, Georgia Pacific
- Ms. Jesse Blate-Thomas, American Rivers, Washington, DC Headquarters
- Executive Director, American Whitewater
- National Coordinator, Hydropower Reform Coalition
- The Nature Conservancy – VA Field Office
- Mr. Chris Raab, American Canoe Association
- Sierra Club, Virginia Chapter
- Mr. Scott Lyng
- Mr. Eric Thompson, Natel
- Mr. Jon Wagner, Bedford Electrical Department
- Mayor R. Wandrei, Town of Bedford
- Mr. Corey Chamberlain, Virginia Power
- Mr. Bob Gates, Eagle Creek Energy, Inc.
- Mr. Ben Leatherland, Hurt and Proffitt Inc.
- Mr. Mark Fendig, Luminaire Technologies
- Mr. Wayne Dyok, H2O EcoPower
- Mr. Jonathan Whitt, Liberty University
- Mr. Jerry Falwell, Liberty University

SCOTT'S MILL DAM

HYDROELECTRIC PROJECT
FERC PROJECT NO. 14425

Application for Federal Energy Regulatory Commission License

December 8, 2017

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ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effects
ASA	American Sportfishing Association
AVG	Average
AW	American Whitewater
BOD	Biological Oxygen Demand
CC	Coastal Canoeist
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CPUE	Catch Per Unit Effort
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	Decibel
DO	Dissolved Oxygen
DOI	Department of the Interior
EL	Elevation
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
GPS	Global Positioning System
HPMP	Historic Properties Management Plan
HW	High Water
ILP	Integrated Licensing Process
in	Inch
km	Kilometer
km^2	Square Kilometer
kV	Kilovolt
kVA	Kilovolt amp
kW	Kilowatt
kWh	Kilowatt Hour
LRMP	Land Resources Management Plan
m	Meter
mi	Mile
mm	Millimeter
MOA	Memorandum of Agreement
msl	Mean Sea Level
MW	Megawatt
MWh	Megawatt – hour
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPS	National Park Service

NRHP .... National Register of Historic Places
O&M .... Operations and Maintenance
PCB .... Polychlorinated Biphenyls
PMF .... Probable Maximum Flood
ppb .... Parts Per Billion
PURPA .... Public Utility Regulatory Policy Act
REA .... Ready for Environmental Analysis
RM .... River Mile
ROS .... Recreation Opportunity Spectrum
ROW .... Right-of-Way
rpm .... Revolutions Per Minute
SC .... Special Concern
SCC .... Virginia State Corporation Commission
SHPO .... Virginia State Historic Preservation Officer
SIO .... Scenic Integrity Objectives
SF .... Safety Factor
SMS .... Scenery Management System
SOC .... Species of Special Concern
sq .... Square
SR .... State Route
TLP .... Traditional Licensing Process
tsf .... Tons Per Square Foot
TW .... Tail Water
USEPA .... U.S. Environmental Protection Agency
USFS .... U.S. Forest Service
USFWS .... U.S. Fish and Wildlife Services
USGS .... U.S. Geological Survey
V .... Volt
VA .... Virginia
VDCR .... Virginia Department of Conservation and Recreation
VDEQ .... Virginia Department of Environmental Quality
VDGIF .... Virginia Department of Game and inland Fish
VDOT .... Virginia Department of Transportation
VFWIS .... Virginia Fish and Wildlife Information Service
VMRC .... Virginia Marine Resources Commission
VMS .... Visual Management System
VPSC .... Virginia Public Service Corporation
VQO .... Visual Quality Objectives
VWC .... Virginia Wilderness Committee
WCA .... Wildlife Coordination Act

INITIAL STATEMENT

BEFORE THE FEDERAL ENERGY REGULATORY COMISSION

Application for a License for a Major Water Power Project, 5 Megawatts or Less

(1) Scott's Mill Hydro, LLC, applies to the Federal Energy Regulatory Commission (the "Commission" or "FERC") for an original license for the Scott's Mill Hydropower Project (the "Project"), FERC 14425, as described hereinafter.

(2) Location of the Project is:
State: Virginia
County: Bedford and Amherst Counties
Township or nearby town: Lynchburg
Stream or other body of water: James River

(3) Name and Business Address:
Scott's Mill Hydro, LLC
Attention: Mark Fendig
P.O. Box 13
Coleman Falls, VA 24536
Telephone: (540) 320-6762

(4) Applicant's Authorized Agent's Address and Phone Number:
Mr. Mark Fendig
Luminaire Technologies, Inc
9932 Wilson Highway
Mouth-of-Wilson, VA 24363
Telephone: (540) 320-6762

(5) Scott's Mill Hydro, LLC is a limited liability company and is not claiming preference under Section 7(a) of the Federal Power Act.

(6)

(i) The statutory or regulatory requirements of Virginia that affect the project as proposed, with respect to bed and banks and to the appropriation, division, 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:

- Virginia Code: Title 10.1, Conservation (600-659, 1182-1197.4, 2117-2134); Title 29.1 Game, Inland Fisheries, and Boating (500-577, 700-750); and Title 62.1, Waters of the State, Ports and Harbors (10-13, 44.2-45.108, 80-115.1)

(ii) Scott's Mill Hydro, LLC will continue to comply with each of the above-cited laws as applicable.

- Scott's Mill Hydro, LLC has consulted with the Virginia Department of Game and Inland Fisheries and the Virginia Department of Marine Resources in compliance with the above-cited Virginia Code.

- In addition, Applicant is, contemporaneously herewith, filing an application for Water Quality Certification with the Commonwealth of Virginia under Section 401 of the Clean Water Act.

(7) Project Description:
The existing Scott's Mill dam was constructed in the 1840s. Applicant proposes to install nine 54-inch turbine/generator units provided by Littoral Power Systems Inc. (LPS) and originally manufactured for LPS by Rickly Hydrological Co., Inc. (Rickly). LPS is the provider of the Project's modular civil works and related subassemblies. The Project's total capacity is 4.5 MW. The powerplant will be constructed immediately downstream of the existing arch section of the dam. After construction of the powerplant, a two-foot high concrete cap will be added to the existing spillway to maintain water elevations similar to existing conditions when flows equal the hydraulic capacity of the plant. The Scott's Mill Dam is owned by:

Luminaire Technologies, Inc.
Attention: Mr. Mark Fendig
9932 Wilson Highway
Mouth-of-Wilson VA, 24363

(8) There are no lands of the United States affected by the Project.

(9) Construction of the Project is planned to start within one year of license issuance.
The following exhibits are filed herewith and are hereby made a part of this application:

Exhibit A .... Project Description and Proposed Mode of Operation

Exhibit E .... Environmental Report

Exhibit F .... Drawings of the Project Works, Supporting Design Report

Exhibit G .... Map of Project

EXHIBIT A

PROJECT DESCRIPTION AND PROPOSED MODE OF OPERATION

Scott's Mill Hydropower Project

FERC Project No. 14425

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EXHIBIT A

PROJECT DESCRIPTION AND MODE OF OPERATION

1.0 GENERAL PROJECT DESCRIPTION

The Scott's Mill Hydroelectric Project is located on the upper James River at river-mile 252[1] in Bedford and Amherst Counties, Virginia and is within the City of Lynchburg, Virginia. The Project is approximately half a mile north-northeast of downtown Lynchburg. The existing Scott's Mill Dam was constructed in the 1840s. A 3.6-mile long pool extends upstream of the dam to the next dam upriver, Reusens Dam (FERC No. 2376). Several islands lie within the Scott's Mill Dam pool, including Daniel Island, Treasure Island and Woodruff Island. Harris Creek enters the James River from the north near Treasure Island.

The nearest U.S. Geological Survey gage is at Holcomb Rock (Station No. 02025500), approximately 11 miles upstream of Scott's Mill Dam (the "Holcomb Rock Gage"). The total drainage area at the Holcomb Rock Gage is 3,256 square miles, representing about one third of the drainage of the James River Basin.

The global positioning system (GPS) location of the Project is 37.424466 N, -79.140858 W. **Figure A-1** shows the general location of the project in the James River Basin. **Figures A-2, A-3** and **A-4** show the general vicinity of the project, the local project area and FERC project boundaries, respectively. Photographs taken at the Dam and vicinity of the project are included in Exhibit E, **Appendix C**.

Applicant proposes to construct a 4.5 MW powerplant immediately downstream of the arch section of the dam on the right side (west side) of the James River (see artist rendering in **Figure A-5**). At low and average flows, there is a one-to-two foot head over the existing spillway. After the powerplant is constructed, Applicant proposes to place a two-foot high concrete cap on the existing dam to maintain approximately the same water elevation as occurs during flow conditions comparable to the hydraulic capacity of the turbines (i.e., 4,500 cfs).

2.0 PHYSICAL COMPOSITION OF EXISTING AND FUTURE DEVELOPMENTS

This Project is comprised of an existing dam and headpond each of which is described below. This is followed by a discussion of potential development options.

[1] River mile is distance upstream from Chesapeake Bay and taken from FEMA 2008.

2.1 DAM

The Scott's Mill Dam was constructed between 1830 and 1840. From left to right looking downstream, the left overflow spillway is a 735-foot-long by 15-foot-high masonry construction with a crest elevation of 514.4 feet (NAVD 88). There is a stone pier (old fishway) between the spillway and arch sections of the dam that is 25 feet wide. The right overflow spillway (arch section) is a 140-foot-long by 16-foot-high masonry construction with a crest elevation of 514.8 feet. The right abutment is 36 feet wide and constructed of concrete. To the west of the abutment is a 22-foot side canal head gate (water works) structure with three sluice gates each measuring 3 feet by 3 feet. Pertinent Project data is summarized in **Table A-1**.

2.2 HEADPOND

The headpond upstream of Scott's Mill Dam encompasses approximately 316 acres at a normal operating pool elevation of 516 feet above msl. There is no usable storage as the Project is a run-of-river facility. The total drainage area at the Holcomb Rock Gage is 3,256 square miles, representing about one-third of the drainage of the James River Basin.

The average daily flow at the Holcomb Rock Gage, from July 1927 to 2017 was 3,632 cfs. During this period, the highest discharge recorded was 180,000 cfs on November 5, 1985, and the lowest discharge was 223 cfs on July 27, 1930. The highest daily flows most frequently occur in March and, less frequently, in January, February and April. The lowest daily flows occur most frequently in September and, less frequently, in July, August, October and November. In general, flows in the James River can vary rapidly from one day to the next.

The 50 percent exceedance values for the period of record at the Holcomb Rock Gage range from 883 cfs (September) to 4,790 cfs (March). The Annual and Monthly flow duration curves at such location are presented in **Figures A-6 through A-18**.

2.3 PROPOSED DEVELOPMENT

Dam, Spillway, Penstock, Canal, Powerhouse, Tailrace and Other Structures

The proposed facilities would consist of the following: (1) a new modular powerhouse containing nine generating units with a total installed capacity of 4.5 MW; (2) a new 1200-foot-long underground transmission line; and (3) appurtenant facilities, which include the addition of a 2-foot high concrete cap onto the existing spillway (**Table A-2**).[2] The project would have an estimated annual generation of approximately 20,700 MWh. Generated power would be sold to United States Pipe and Foundry Company, LLC ("U.S. Pipe") located adjacent to the dam or a local utility. There are no federal or state lands associated with the project.

[2] Note that two foot flashboards were historically used at the dam.

Generating equipment alternatives evaluated include new turbines of various types, including vertical Kaplan, vertical Francis, bulb-type horizontal Kaplan, horizontal pit Kaplan, axial-flow pit type, and a Natel hydroEngine linear pelton. Vertical Kaplan turbines were considered uneconomical for this site due to the required negative runner setting and large volume of rock excavations that would be required for elbow draft tubes. A second vertical turbine option – Francis open-flume turbines — can be set above tailwater, but would require either large-diameter runners (which are costly and difficult to procure) or many smaller units, which would be uneconomical. Therefore, both types of vertical units were dismissed for the proposed project. Small, standard, horizontal bulb-style turbines are available in the required sizes, and would require less excavation for the draft tube as the setting is only slightly below (and in some cases above) the tailwater. Two potential layouts using bulb-style horizontal Kaplan turbines (Eco-bulbs manufactured by Andritz) were included in the evaluation. One option included the use of three 2,600-mm units, while the second included the use of four 2,240-mm units. These designs were rejected principally due to cost, not only of the units themselves but of the civil works entailed.

Two pre-owned equipment packages were offered to the Applicant. One such package that was evaluated was from an unknown Chinese supplier of horizontal tubular fixed-blade turbines, and included three 1,250-kW units and one 350-kW unit. Fixed Kaplans are not typically efficient over varying head and flow conditions, which are typical of run-of-river operations in general and the Project site in particular, and as such, this opportunity was not pursued. The second used equipment package was from Canadian Hydro Components. Two options were proposed, the first of which included three 2,000-mm units and one 1,250-mm unit, both horizontal pit Kaplans with belt-drive gearboxes. The second option proposed three 2,250-mm horizontal pit Kaplan units with right-angle gearboxes. Owing to cost and anticipated maintenance issues, this opportunity was also not pursued.

Applicant evaluated three less conventional equipment packages. The first was from Mavel and included two 2,800-mm horizontal pit Kaplan units with parallel gearboxes. The second was from Canadian Hydro Components and included two options. The first option was for four units, three having 2,000-mm runners and one having a 1,250-mm runner. The second option was for three equal-sized units with a runner diameter of 2,250 mm.

Applicant also evaluated Natel's hydroEngine linear pelton, but this option was rejected because it is still in development. The hydroEngine has the advantage of reducing fish mortality. However, at this time the turbine efficiencies have not proven to be equivalent to more traditional units. Should Natel complete development of their hydroEngine turbine, Applicant may reconsider use of this turbine considering cost, efficiency and fish survival through the turbines.

The package adopted for purposes herein includes the installation of nine 54-inch 0.5 MW LPS/Rickly axial flow turbine units. In addition to cost advantages particularly when factoring in civil works, the units are slower rotating – in the range of 60-400 rpm – thereby improving survival of fish that may become entrained . The units do not require speed increasers (i.e., gearboxes). Speed increasers have historically been prone to mechanical failure and require more maintenance than other equipment components. Eliminating any style of speed increaser will significantly reduce maintenance and project operational costs. Equipment selection was based on generation potential, cost and maintenance expectations. In sum, Applicant elected to go with the LPS/Rickly units because of all-in cost, ease of maintenance, and environmental factors. There is no provision for adding additional turbines in the future.

2.3.1 PROJECT LAYOUT

The proposed powerhouse will be approximately 136 feet wide and will be located immediately downstream of the 140-foot-long gravity arch spillway (see **Figure A-3**). The top portion of the existing arch spillway will be removed to allow water to flow into the powerhouse. Using this technique, the spillway can be used in conjunction with an upstream cofferdam during construction. The final elevation of the cofferdam will be determined during final design, but the height of the cofferdam is expected to have a maximum elevation of about 518.8 feet. A cofferdam at this elevation would provide protection for a 3-year flood (i.e, 60,000 cfs). Because of the prefabricated, modular nature of the construction, work is anticipated to be completed much more quickly than with a traditional poured-concrete structure. Additionally, the powerhouse is designed to survive full inundation, and the site characteristics do not give rise to material concern about inundation of adjacent lands. As such, a 3-year flood protection level should be sufficient, since such floods typically occur during the winter and spring months. Once the powerhouse is completed, a portion of the upstream spillway section will be removed in the wet.

While the Project's long, capacious existing spillway makes it highly unlikely that the powerhouse will be overtopped even in the most extreme flow conditions, as noted above, the powerhouse is designed to survive full inundation and allow flood flows to pass over it without limitation. In this regard, it should be noted the Project will not have any appreciable effect on pre- vs. post-construction water levels during a 100-year flood; this is because at very high flow rates, the Scott's Mill Dam is no longer a control point (FEMA, 2008).

2.3.2 PROJECT OPERATION

The headpond elevation at the site will be held constant at just above the dam crest until inflows exceed the maximum hydraulic capacity of the turbine array (4,500 cfs). The project will continue to be run-of-river. A possible future option would be to operate Scott's Mill in conjunction with the Reusens Dam hydroelectric project upstream, such that Reusens could be operated with some level of peaking capacity and constant flows could be released downstream from Scott's Mill. In the latter case, operations would be coordinated with the Reusens project to provide base flows into the Scott's Mill headpond plus some level of peaking flow during times of maximum power demand. The current normal headwater elevation is about 516 feet, about 1½ feet above the spillway crest.

Applicant proposes to increase the spillway height with a two-foot high concrete cap. This will achieve two goals: (i) maintaining the upstream water level at average flows closer to the existing water level and (i) increasing the gross head at the plant resulting in increased energy generation.

The minimum tailwater elevation at the site is about 499 feet (**Table A-3 and Figure A-19**). This tailwater elevation results in a maximum net head available for energy generation of 17 feet with the two-foot-high cap.

The available flow at Scott's Mill dam has been updated to include recent flow data at the Holcomb Rock Gage. A flow duration curve was developed using data from the Holcomb Rock Gage. The period of record is from 1927 to the present and represents 89 years of recorded flows. The drainage area for the Holcomb Rock Gage is about one percent less than the drainage area at the proposed Project. Thus, gage flow data is considered for purposes hereof to be representative of site flow without adjustment.

Fish passage flows for upstream migration of American Eel and Sea Lamprey are expected to be less than 1 cfs and would not be available for generation when these species are present. When a vertical slot fishway (or other fish passage design) is constructed for other fish species, approximately 25 to 50 cfs may be needed to operate such a facility. These flows are estimated to reduce generation about one percent (or about the same as the average inflow between Holcomb Rock and Scott's Mill) and have therefore not been included in the energy estimates.

Generation potential was estimated based on gross head and the flow duration curve. The flow duration curve shows the percentage of time that a specified flow is equaled or exceeded in a typical year. Theoretical annual generation potential is estimated to be about 20,700 MWh. This does not include an allowance for unscheduled outages of the plant, which would be expected to result in slightly reduced generation. Nevertheless, downtime is minimized owing to the Project's multiple-turbine configuration, which renders it significantly more tolerant of faults than a traditional installation.

Project operations during flood conditions would essentially remain unchanged from current conditions. A study conducted by the FEMA in 2008 indicates that Scott's Mill is no longer a control point during high flood flows. Estimates of headpond levels using the weir equation indicate that water levels during flows above 4,500 cfs will initially increase slightly faster under post-project conditions because of the reduced length of the spillway from powerplant construction. The maximum differential would be about 2.5 feet at a flow of about 25,000 cfs. As flows increase above that level, the differential decrease until there is essentially no difference at the 100-year flood level (**Table A-3 and Figure A-20**).

The project will be remotely operated.

Power from the project will either be used by U.S. Pipe which is located adjacent to the dam, or sold into the PJM grid.

Applicant estimates that the cost to develop the license application is approximately $300,000.

Since the project is proposed to operate in a run-of-river mode, the value of project power is not provided. Applicant considers this proprietary information.

Since the application is for an original license, the increase or decrease in project generation is not applicable. Additionally, the project has not yet been constructed so there is no book value.

Annual operation and maintenance expenses, including insurance and administrative and general expenses are estimated to be about $300,000.

The primary purpose of the project is to generate electrical energy.

A detailed single-line diagram will be provided in the final license application.

Applicant will ensure the safe operation of the project. Safety is of paramount importance to the Applicant. The Project will be operated by an experienced company that operates four other hydropower projects on the James River.

3.0 LANDS OF THE UNITED STATES

There are no lands of the United States within the project boundary.

TABLE A-1: SCOTT'S MILL DAM DATA

Dam	
Year Completed	ca. 1840
Type	concrete gravity
Length	875 feet
Maximum Height	16 feet
Top of Dam Elevation (based on msl) (Estimated at northeast abutment)	514.4 feet
Spillway	
Length (Estimated)	875 feet (140 feet) right + (735 feet) left[3]
Crest Elevation	514.8 feet arch section, 514.4 feet left section
Number of Tainter Gates	0
Number of Flashboards	0
Headpond	
Drainage Area	3,300 sq. mi. (approximately)
Normal Maximum Surface Area	316 acres
Normal Maximum Surface Elevation	516.3 feet
Gross Storage Capacity	N/A (run-of-river operation only)
Usable Storage	N/A (run-of-river operation only)
Federal Lands within Project Boundary	None
Hazard Potential Classification	"Low"

[3] Handedness is determined looking downstream

TABLE A-2: SCOTT'S MILL POWERPLANT AND COST DATA

Powerplant	
Number of Generating Units	9
Unit capacity	500 kW
Provision for Future Units	No
Type of Hydraulic Turbines	LPS/Rickly 54-inch axial turbines
Plant Operation	Automatic, Run-of-river
Average Annual Generation	20,700 MWh
Average Head on Plant	15 feet net at 3,630 cfs
Reservoir Surface Area	316 acres
Gross Storage Capacity	N/A; the Project is a run-of-river facility
Minimum Hydraulic Capacity	300 cfs
Maximum Hydraulic Capacity	4,500 cfs
Average Stream Flow	3,630 cfs
Powerhouse Dimensions	136 feet by 20 feet (see **Figure A-3**)
Transmission Line Length	1200 feet
Capital Cost	$14,000,000
Environmental Mitigation - Fish Passage	$TBD
Recreation	$100,000

TABLE A-3: TAILWATER AND HEADWATER LEVELS

Flow (cfs)	Exist HW Elev. (ft)	TW Elev. (ft)	Max OP US WL (ft)	US WL DIFF (ft)	Comments
700	515.2	499.4	516.4	1.2	
830	515.3		516,4	1.1	
980	515.3		516.4	1.1	
1190	515.3		516.4	1.1	
1200	515.4	499.7	516.4	1.0	
1440	515.4	499.8	516.4	1.0	
1540	515.5	499.8	516.4	0.9	
1690	515.5	500.2	516.4	0.9	
1860	515.4	500.4	516.4	1.0	
3200	515.9	501.4	516.4	0.5	
4800	516.3	503.1	516.6	0.3	
8800	516.9	504.9	517.8	0.9	
11,700	516.8		518.8	2.0	
25,100	518.5	507.8	521.0	2.5	powerplant shut down
79,100	524.0	518.0	526.2	2.2	10 year flood from FEMA
129,300	528.0	526.0	530.0	2.0	50 year flood
159,000	532.3	532.0	532.1	0.0	100 year flood
255,000	540.0	539.0	540.0	0.0	500 year flood

NOTES:

1. All elevations reference to NAVD 88.
2. Existing upstream water levels based on gauge readings. Above 25,000 cfs water levels based on FEMA analysis.
3. Tailwater levels based on measurements to 25,100 cfs. Above 25,000 cfs water levels based on FEMA analysis.
4. Operational water level maintained at or below 516.4 feet until hydraulic capacity of plant is reached (4500 cfs).
5. Operational upstream water level based on weir equation Q=CLH**1.5, where Q is flow in cfs, C is coefficient (3.5), L is spillway length in feet (735), and H is head in feet. Use FEMA level above 50 year flood.
6. Above 50 year flood backwater dominates water levels and Scott's Mill dam is no longer a control point. Without backwater effect, estimated 500 year flood would be 2 ft below FEMA projected water level.

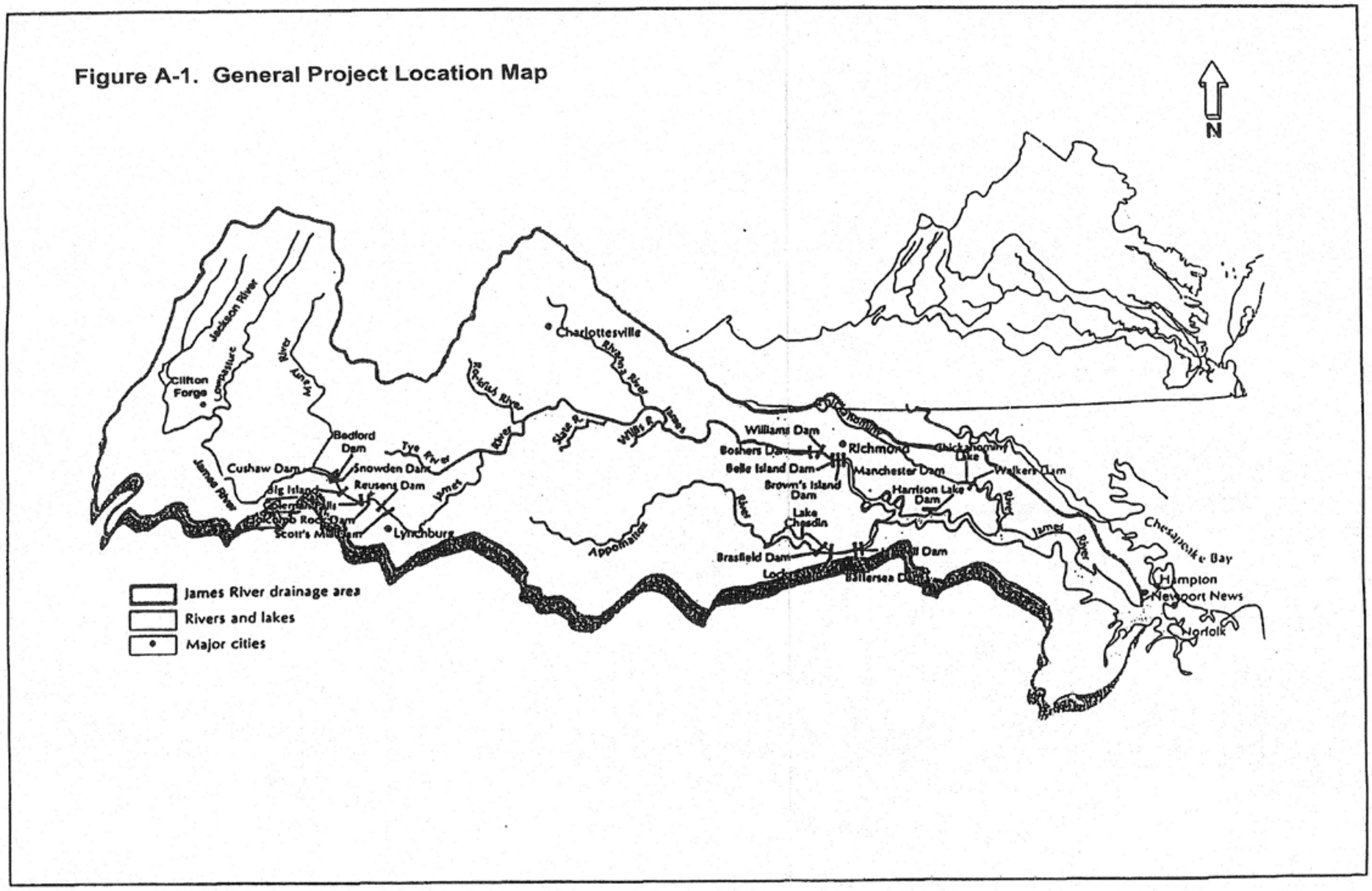


FIGURE A-1 GENERAL PROJECT LOCATION MAP

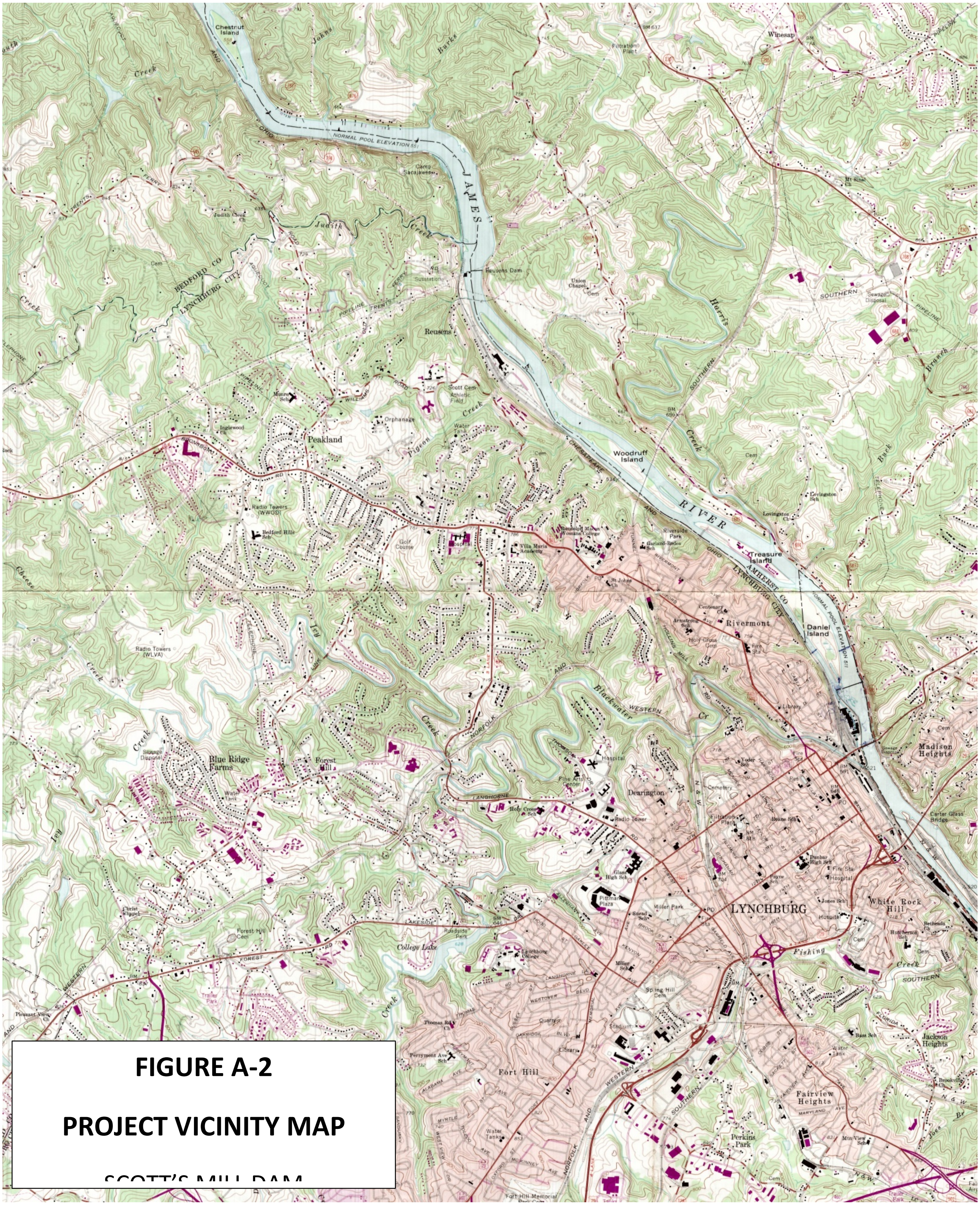


FIGURE A-2

PROJECT VICINITY MAP

SCOTT'S MILL DAM

FIGURE A-3 PROJECT LOCATION MAP

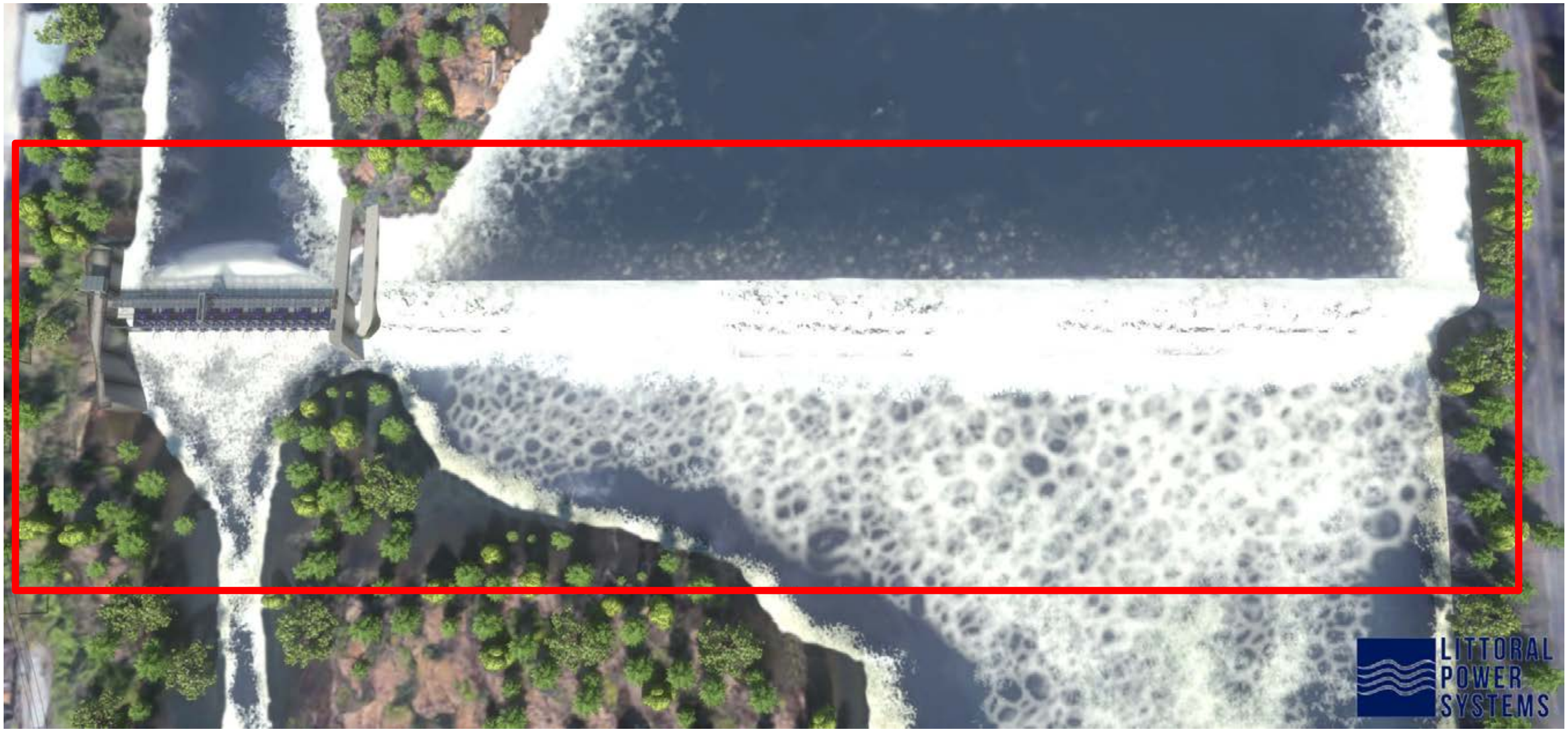


FIGURE A-4 PROJECT BOUNDARY MAP

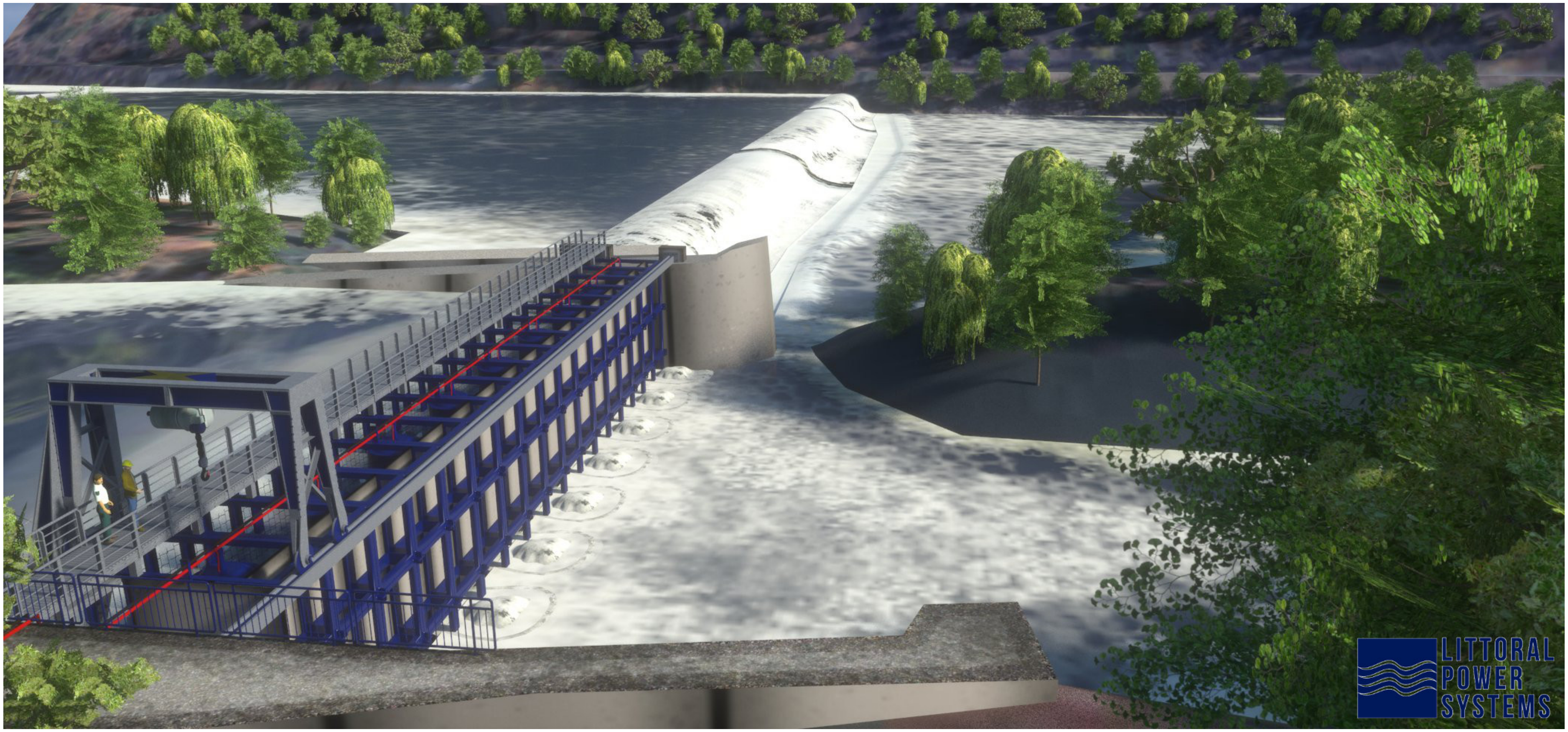


FIGURE A-5 ARTIST RENDERING

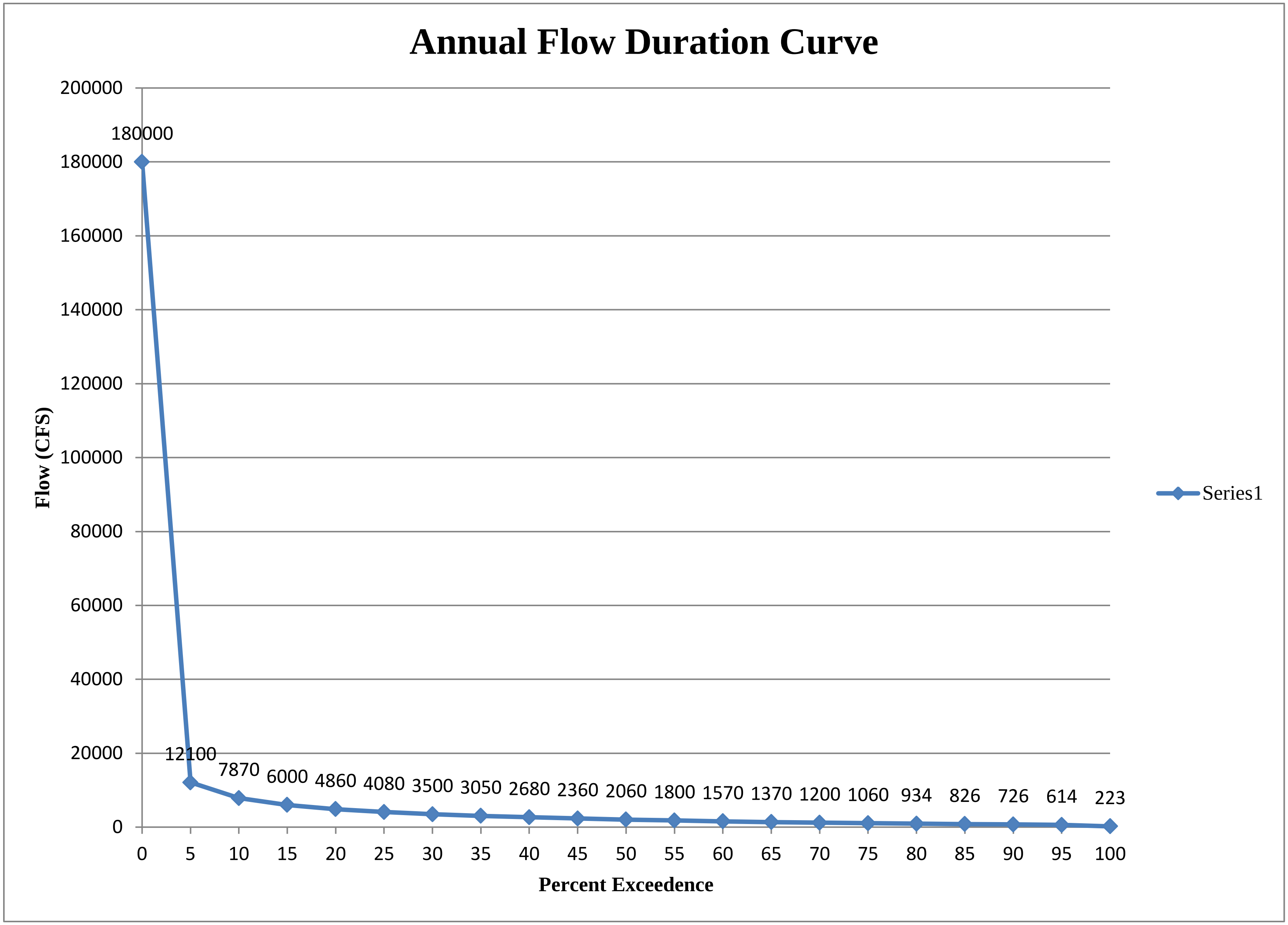

Annual Flow Duration Curve
Flow (CFS)
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
180000
12100
7870
6000
4860
4080
3500
3050
2680
2360
2060
1800
1570
1370
1200
1060
934
826
726
614
223
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-6

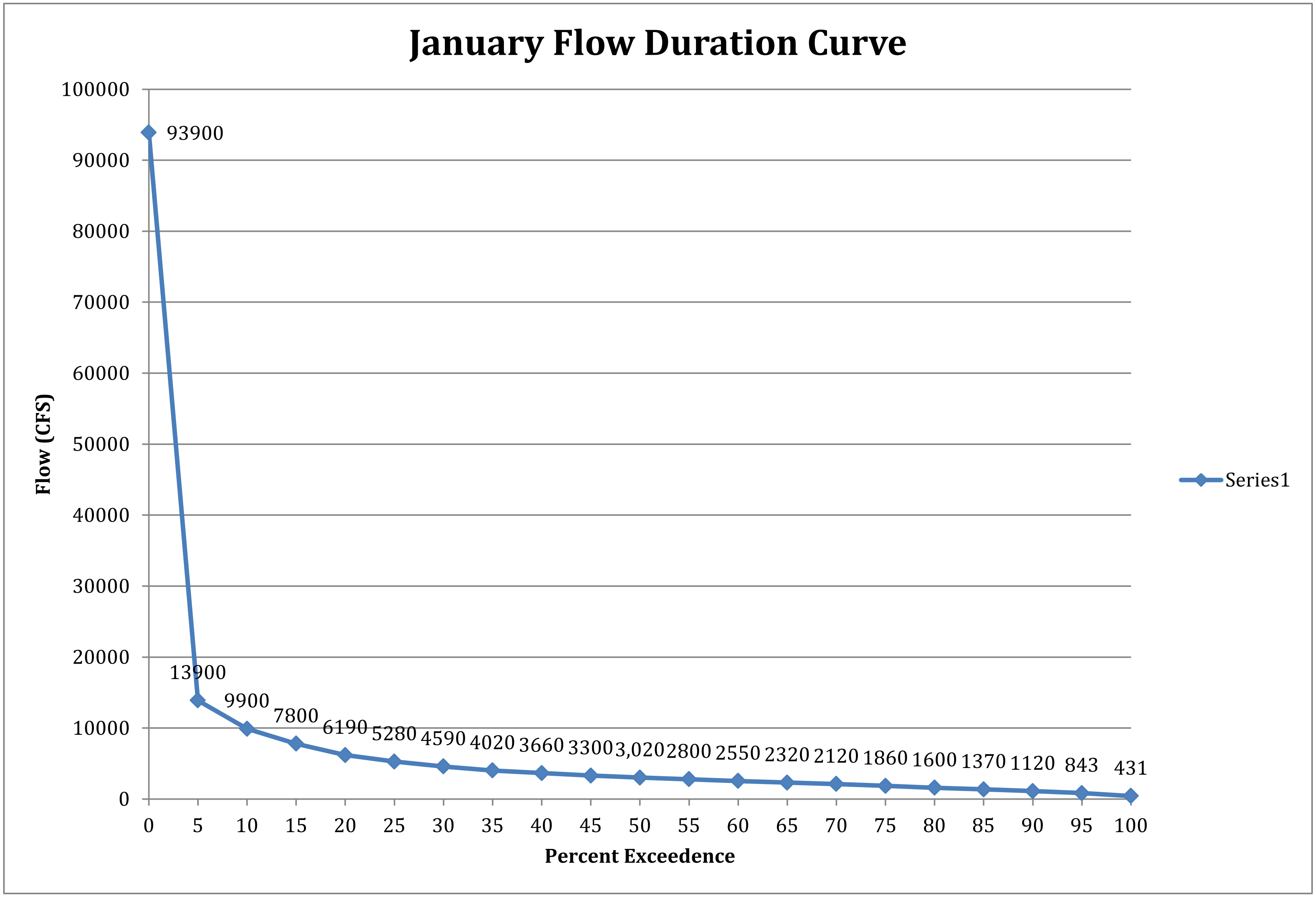
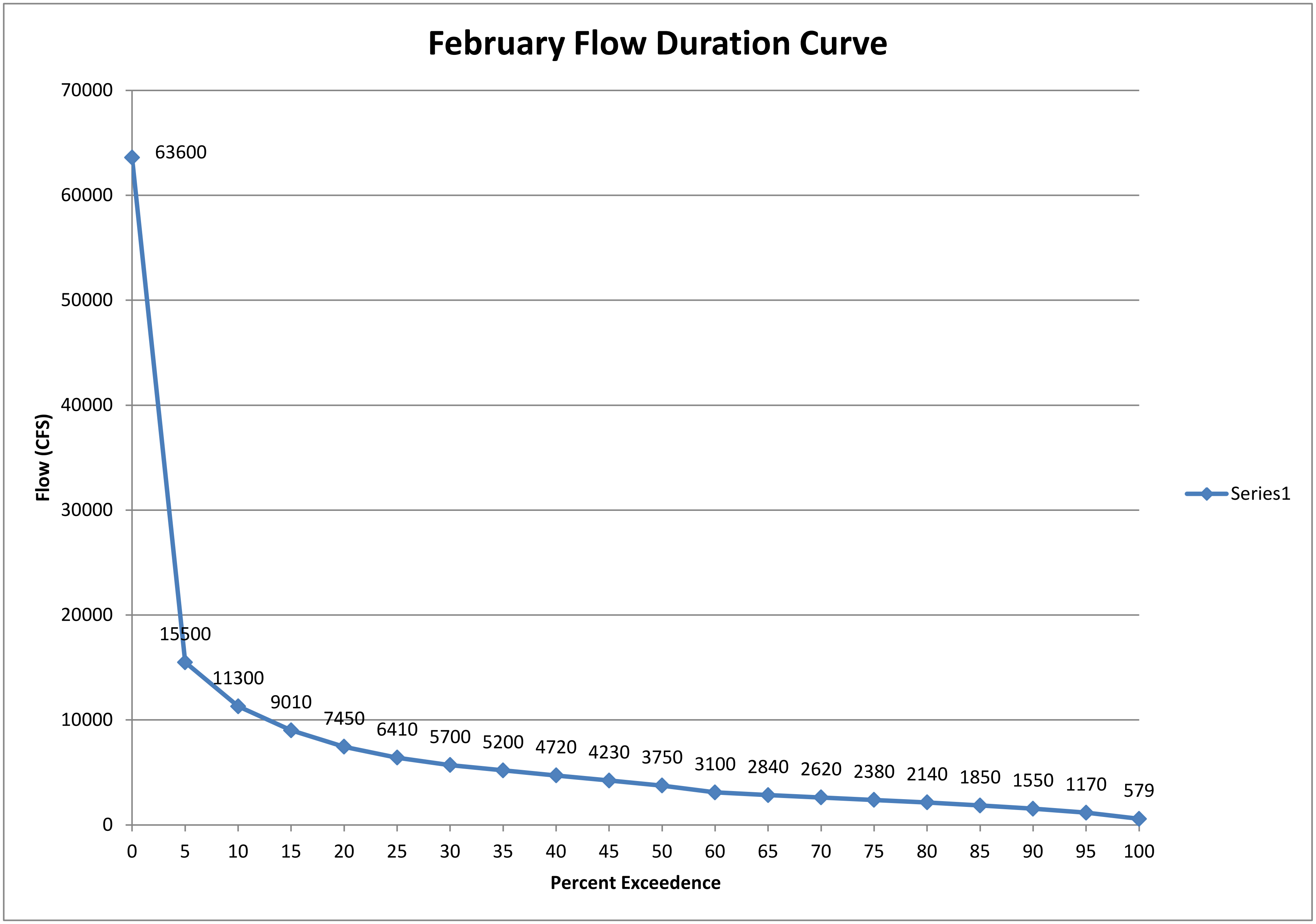
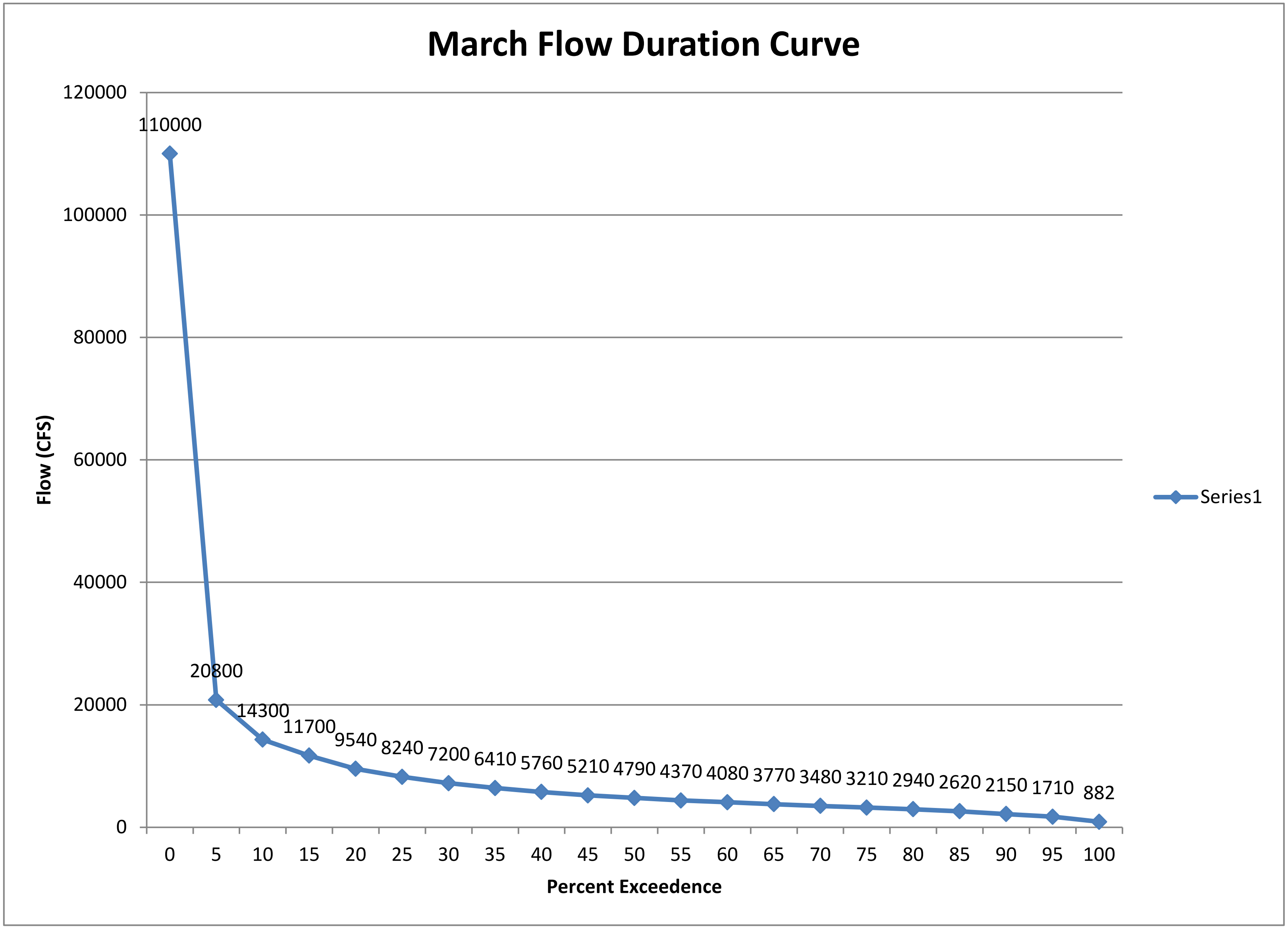

January Flow Duration Curve
Flow (CFS)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
93900
13900
9900
7800
6190
5280
4590
4020
3660
3300
3,020
2800
2550
2320
2120
1860
1600
1370
1120
843
431
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-7



February Flow Duration Curve
Flow (CFS)
70000
60000
50000
40000
30000
20000
10000
0
63600
15500
11300
9010
7450
6410
5700
5200
4720
4230
3750
3100
2840
2620
2380
2140
1850
1550
1170
579
0
5
10
15
20
25
30
35
40
45
50
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-8



March Flow Duration Curve
Flow (CFS)
120000
100000
80000
60000
40000
20000
0
110000
20800
14300
11700
9540
8240
7200
6410
5760
5210
4790
4370
4080
3770
3480
3210
2940
2620
2150
1710
882
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-9

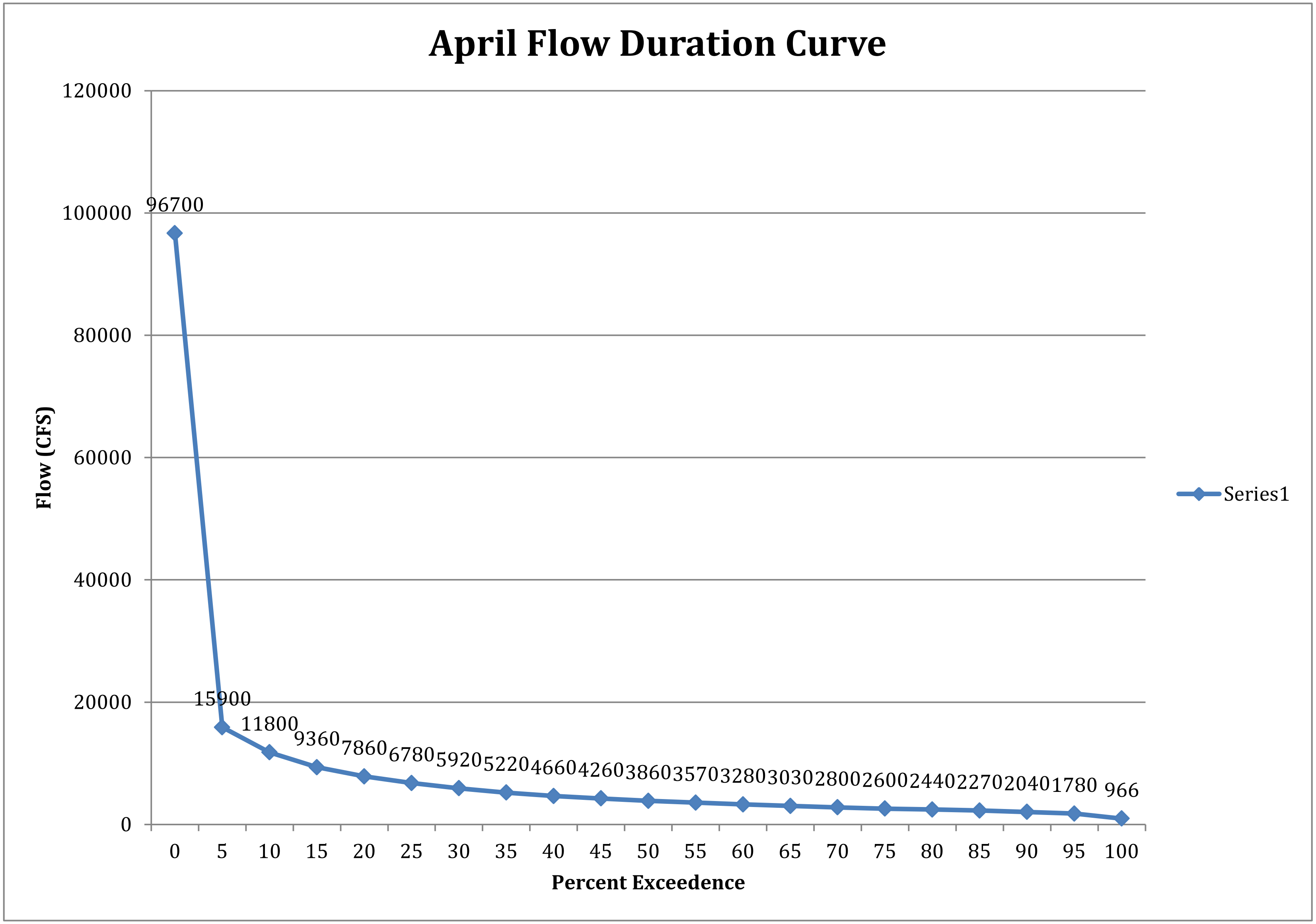

April Flow Duration Curve
Flow (CFS)
120000
100000
80000
60000
40000
20000
0
96700
15900
11800
9360
7860
6780
5920
5220
4660
4260
3860
3570
3280
3030
2800
2600
2440
2270
2040
1780
966
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-10

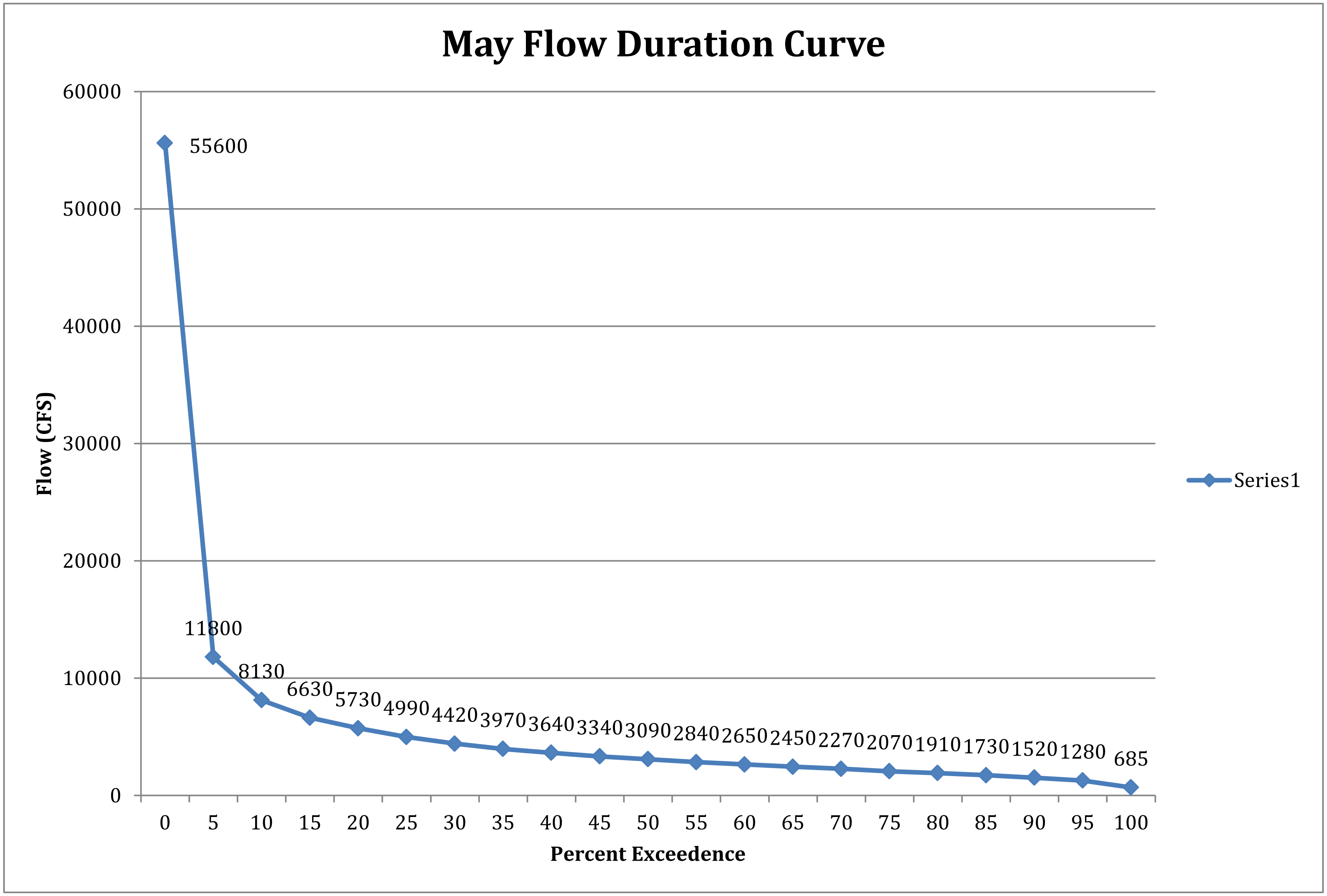

May Flow Duration Curve
Flow (CFS)
60000
50000
40000
30000
20000
10000
0
55600
11800
8130
6630
5730
4990
4420
3970
3640
3340
3090
2840
2650
2450
2270
2070
1910
1730
1520
1280
685
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-11

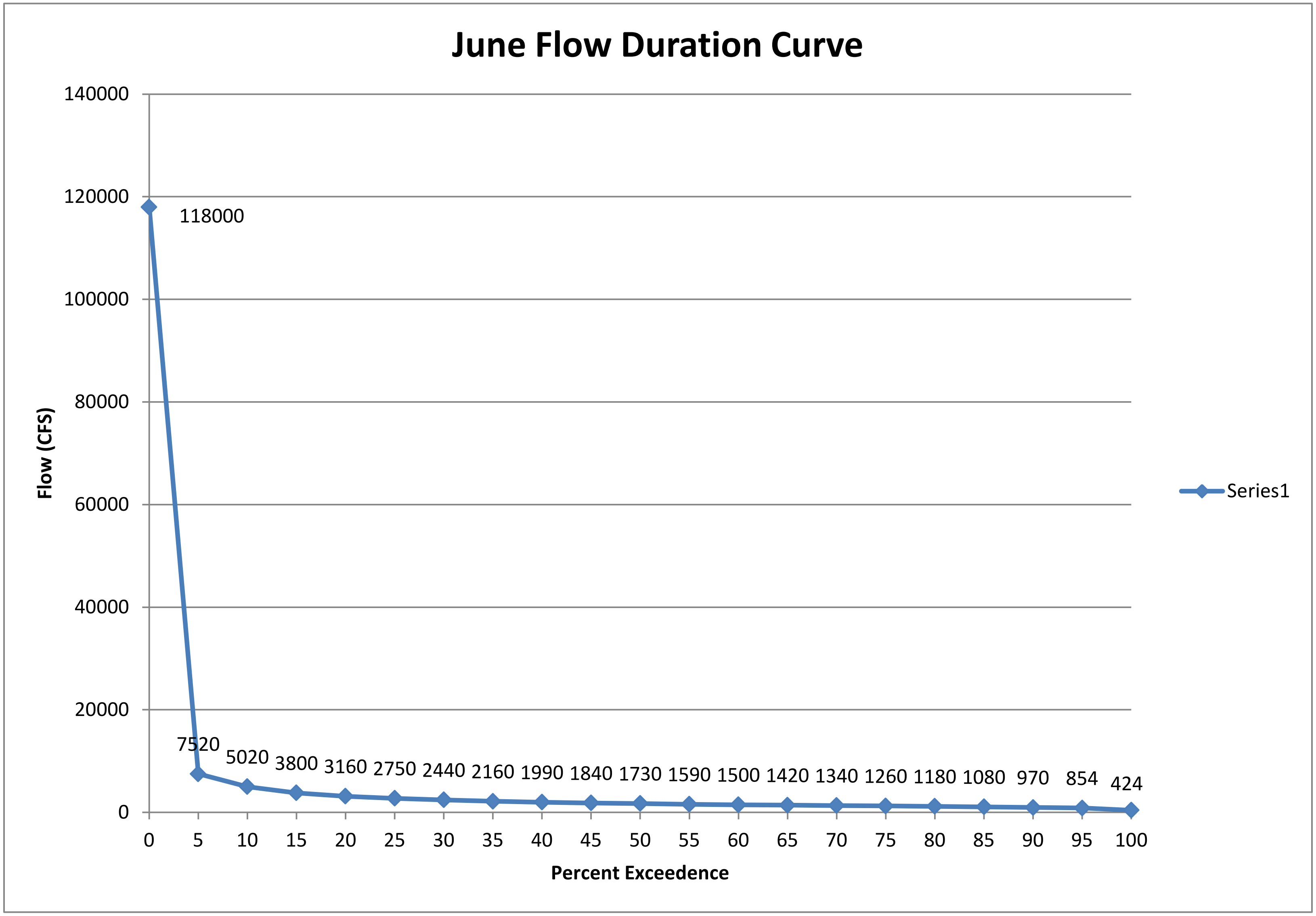

June Flow Duration Curve
140000
120000
100000
80000
60000
40000
20000
0
Flow (CFS)
118000
7520
5020
3800
3160
2750
2440
2160
1990
1840
1730
1590
1500
1420
1340
1260
1180
1080
970
854
424
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Percent Exceedence
Series1

FIGURE A-12

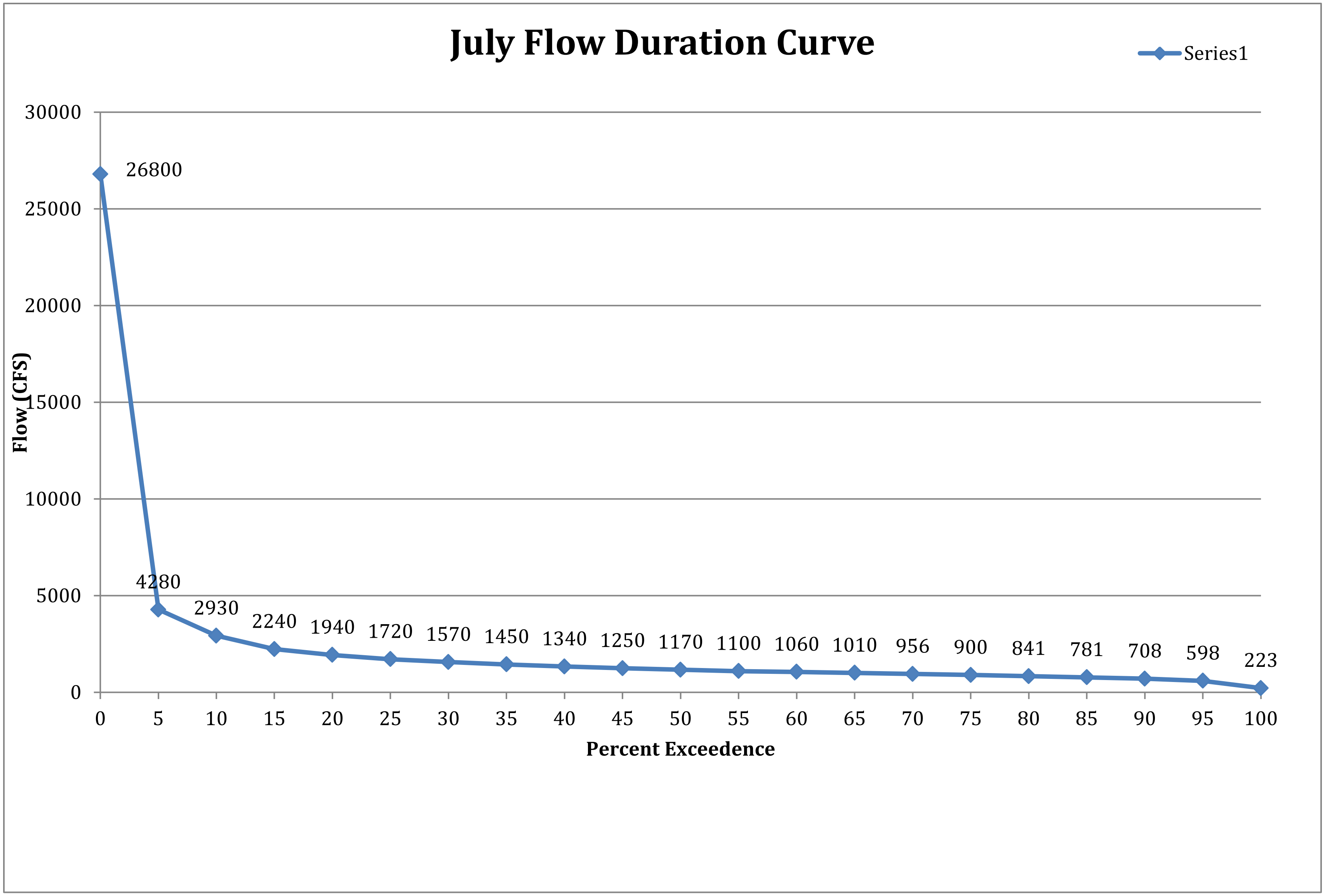

July Flow Duration Curve
Series1
Flow (CFS)
Percent Exceedence
30000
25000
20000
15000
10000
5000
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
26800
4280
2930
2240
1940
1720
1570
1450
1340
1250
1170
1100
1060
1010
956
900
841
781
708
598
223

FIGURE A-13

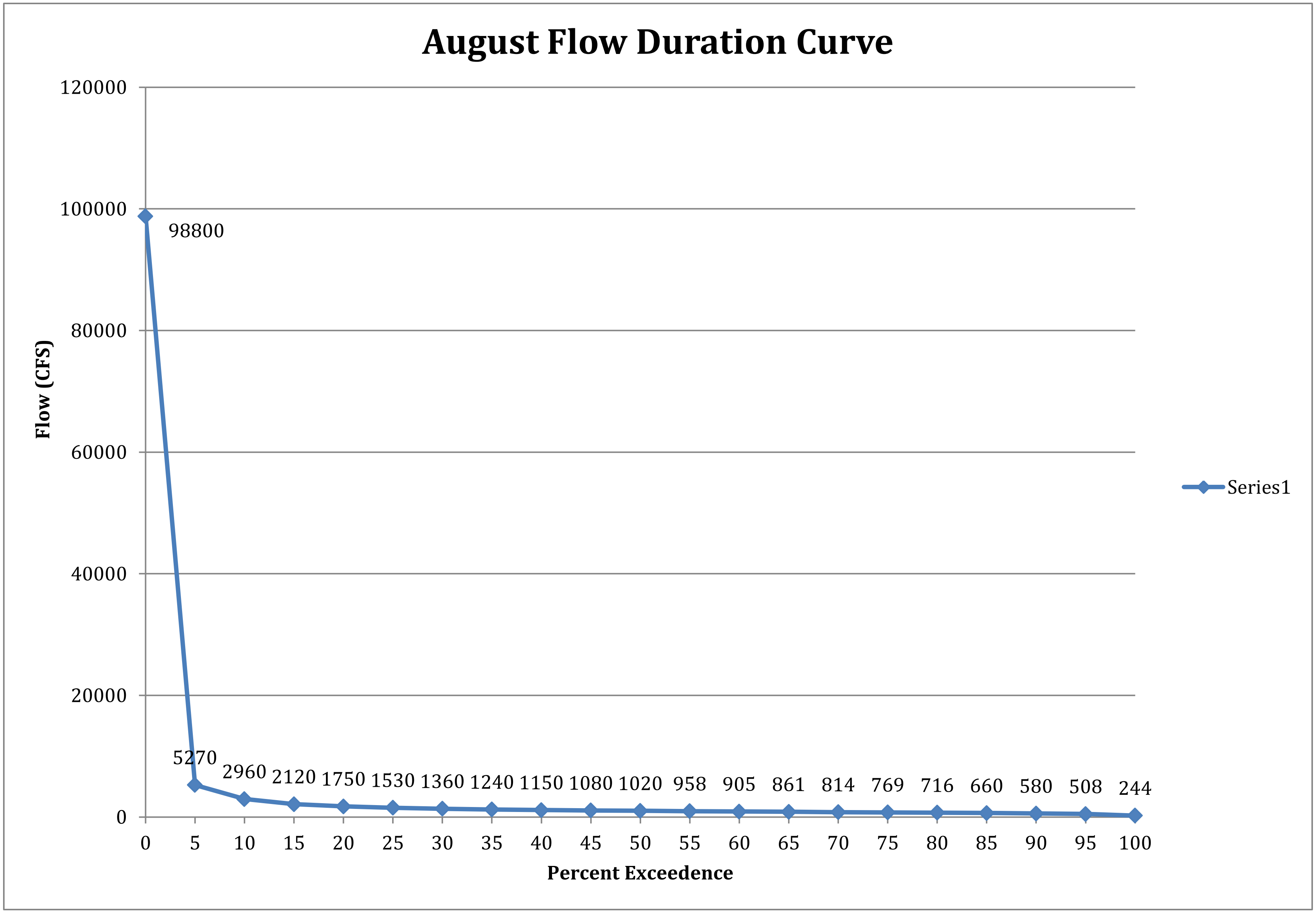

August Flow Duration Curve
Flow (CFS)
120000
100000
80000
60000
40000
20000
0
98800
5270
2960
2120
1750
1530
1360
1240
1150
1080
1020
958
905
861
814
769
716
660
580
508
244
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Percent Exceedence
Series1

FIGURE A-14

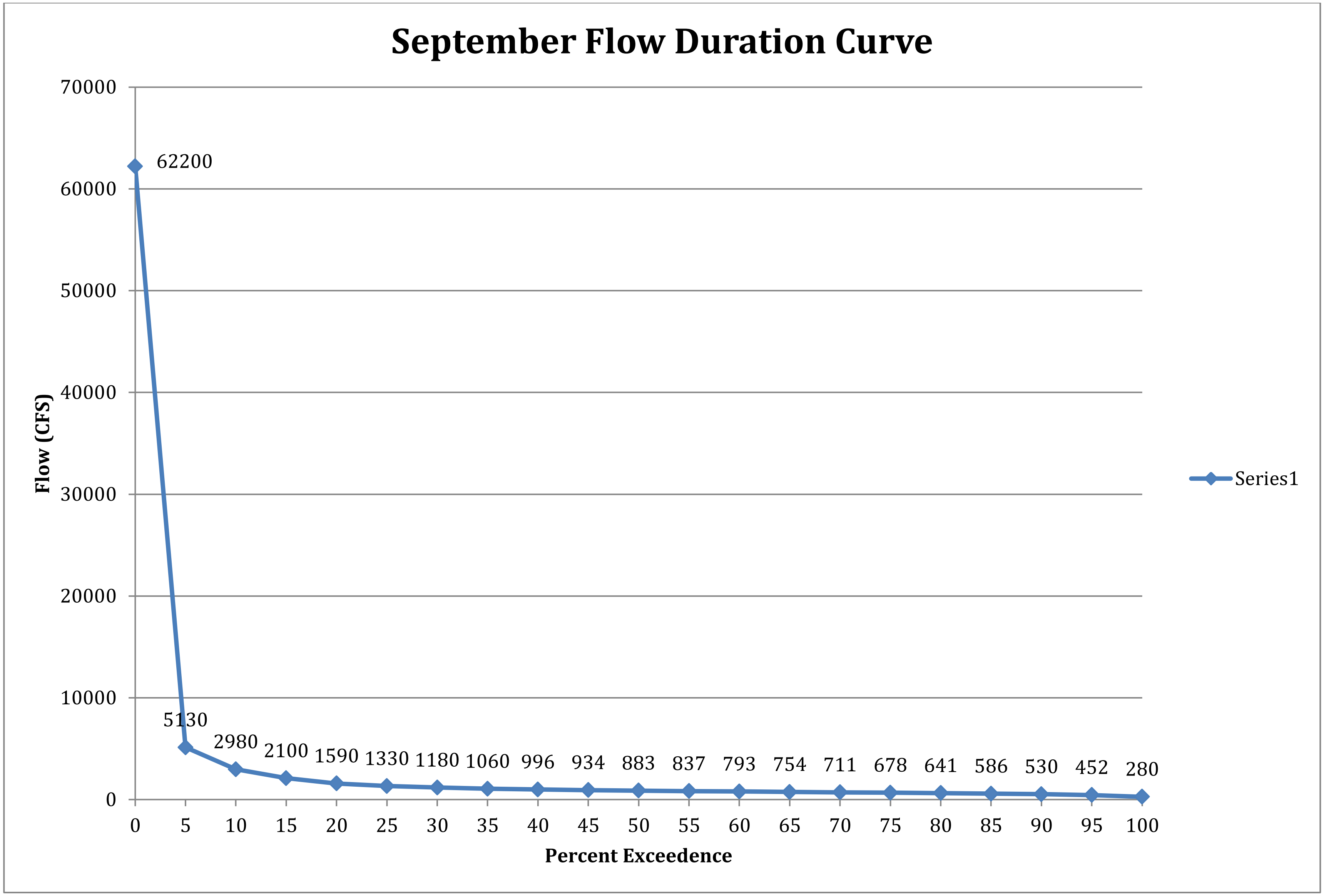
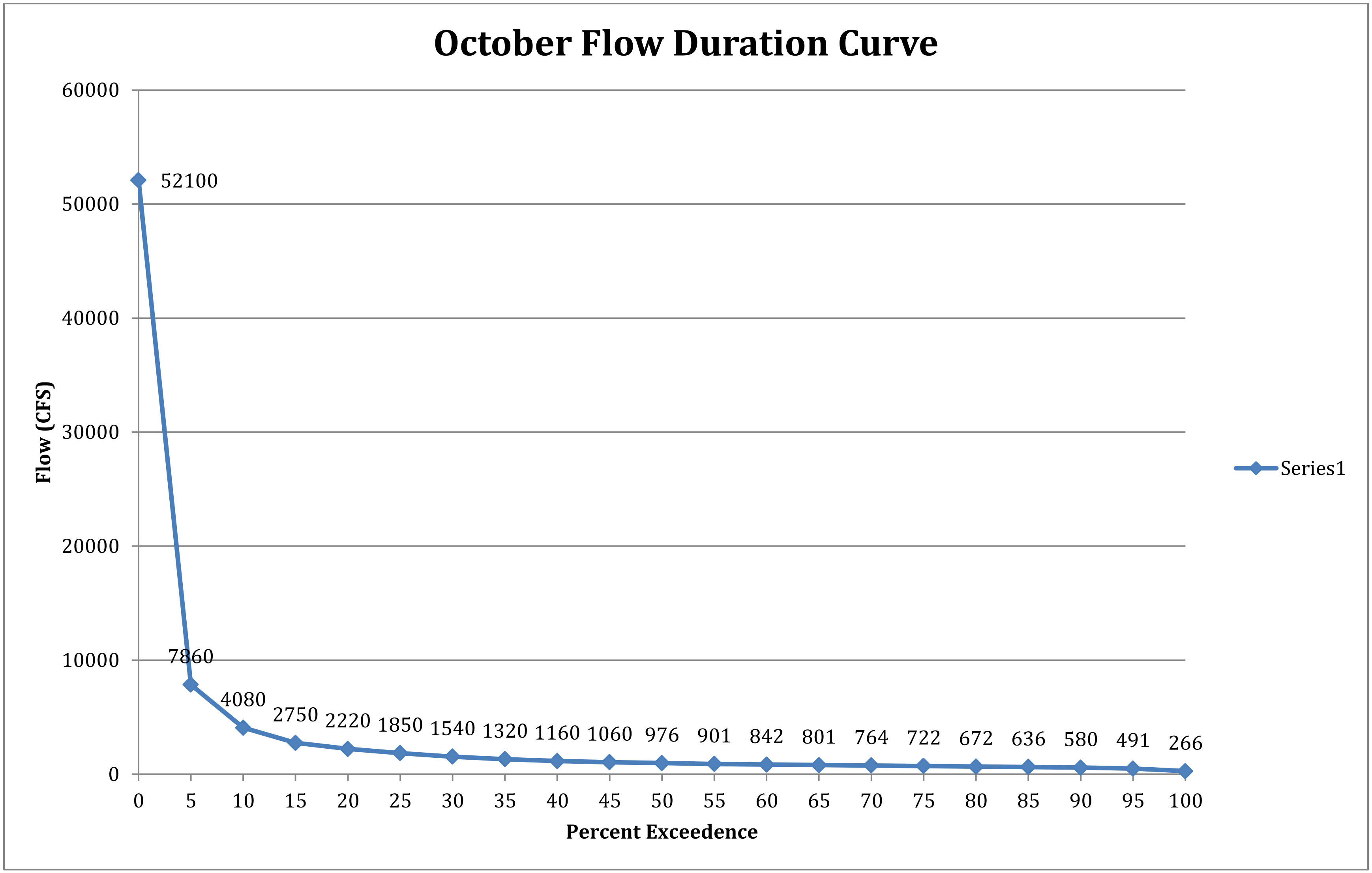
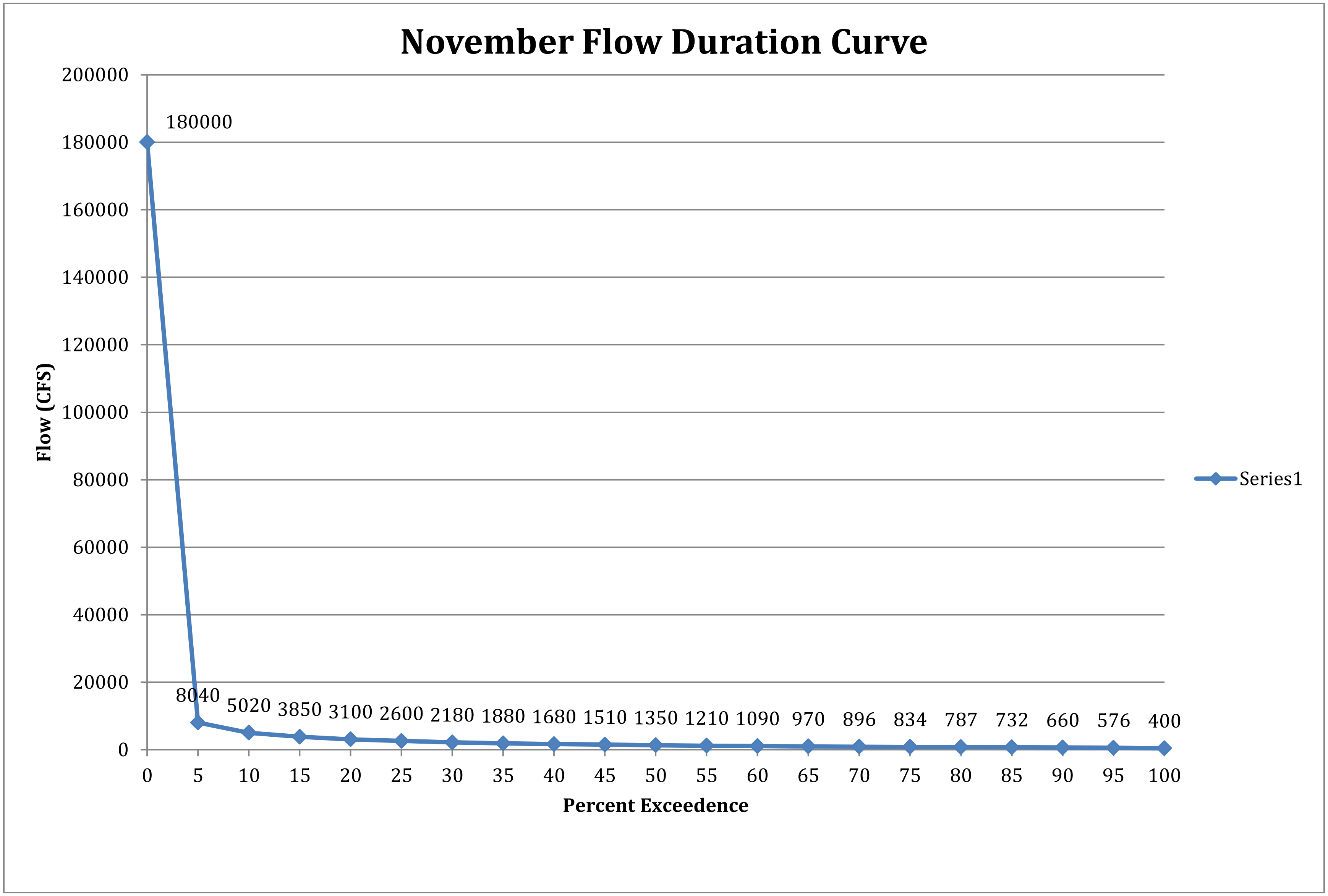

September Flow Duration Curve
Flow (CFS)
70000
60000
50000
40000
30000
20000
10000
0
62200
5130
2980
2100
1590
1330
1180
1060
996
934
883
837
793
754
711
678
641
586
530
452
280
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Percent Exceedence
Series1

FIGURE A-15



October Flow Duration Curve
Flow (CFS)
60000
50000
40000
30000
20000
10000
0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Percent Exceedence
52100
7860
4080
2750
2220
1850
1540
1320
1160
1060
976
901
842
801
764
722
672
636
580
491
266
Series1

FIGURE A-16



November Flow Duration Curve
Flow (CFS)
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
180000
8040
5020
3850
3100
2600
2180
1880
1680
1510
1350
1210
1090
970
896
834
787
732
660
576
400
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Percent Exceedence
Series1

FIGURE A-17

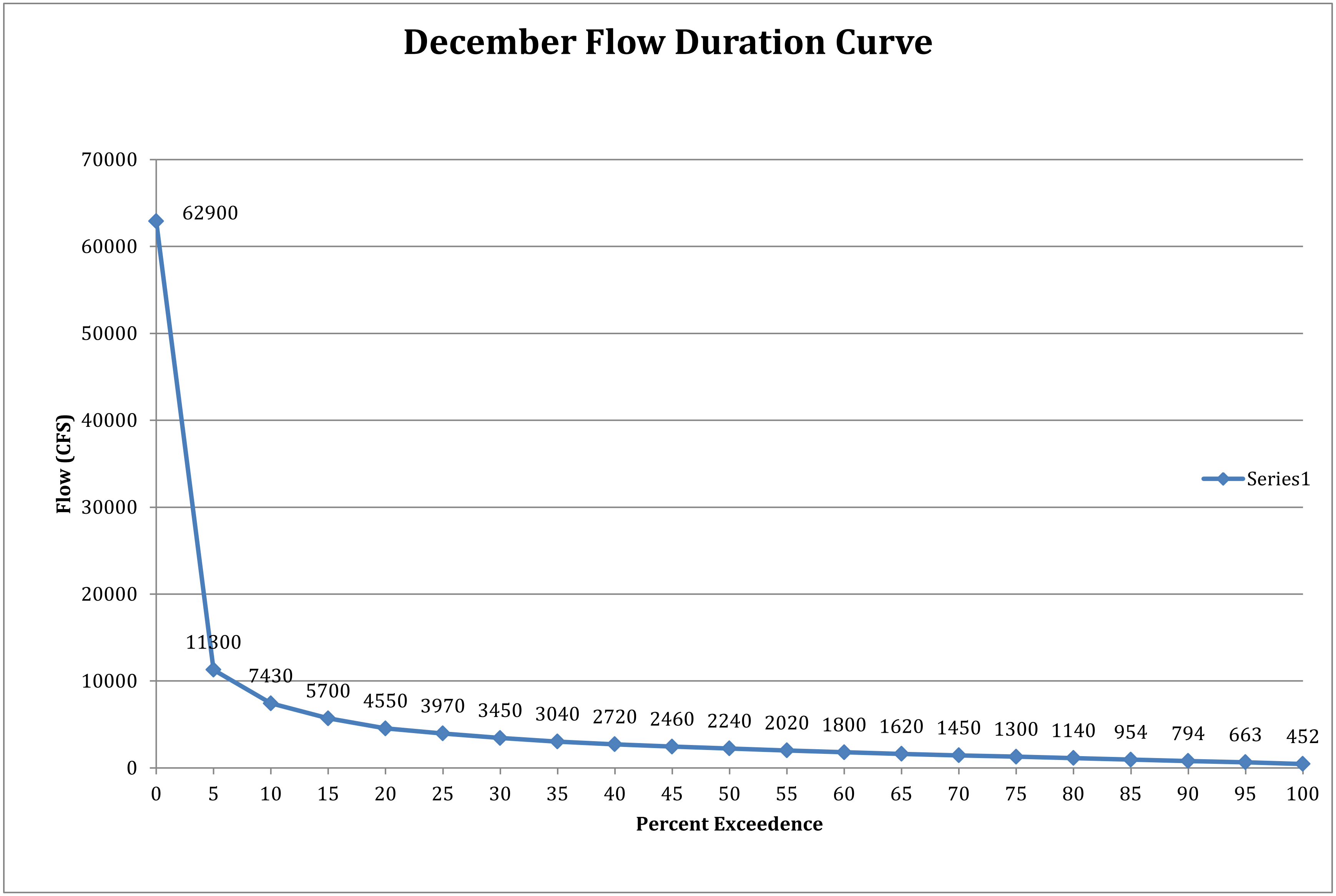

December Flow Duration Curve
70000
60000
50000
40000
30000
20000
10000
0
Flow (CFS)
62900
11300
7430
5700
4550
3970
3450
3040
2720
2460
2240
2020
1800
1620
1450
1300
1140
954
794
663
452
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence
Series1

FIGURE A-18

FIGURE A-19 TAILWATER ELEVATION CURVE

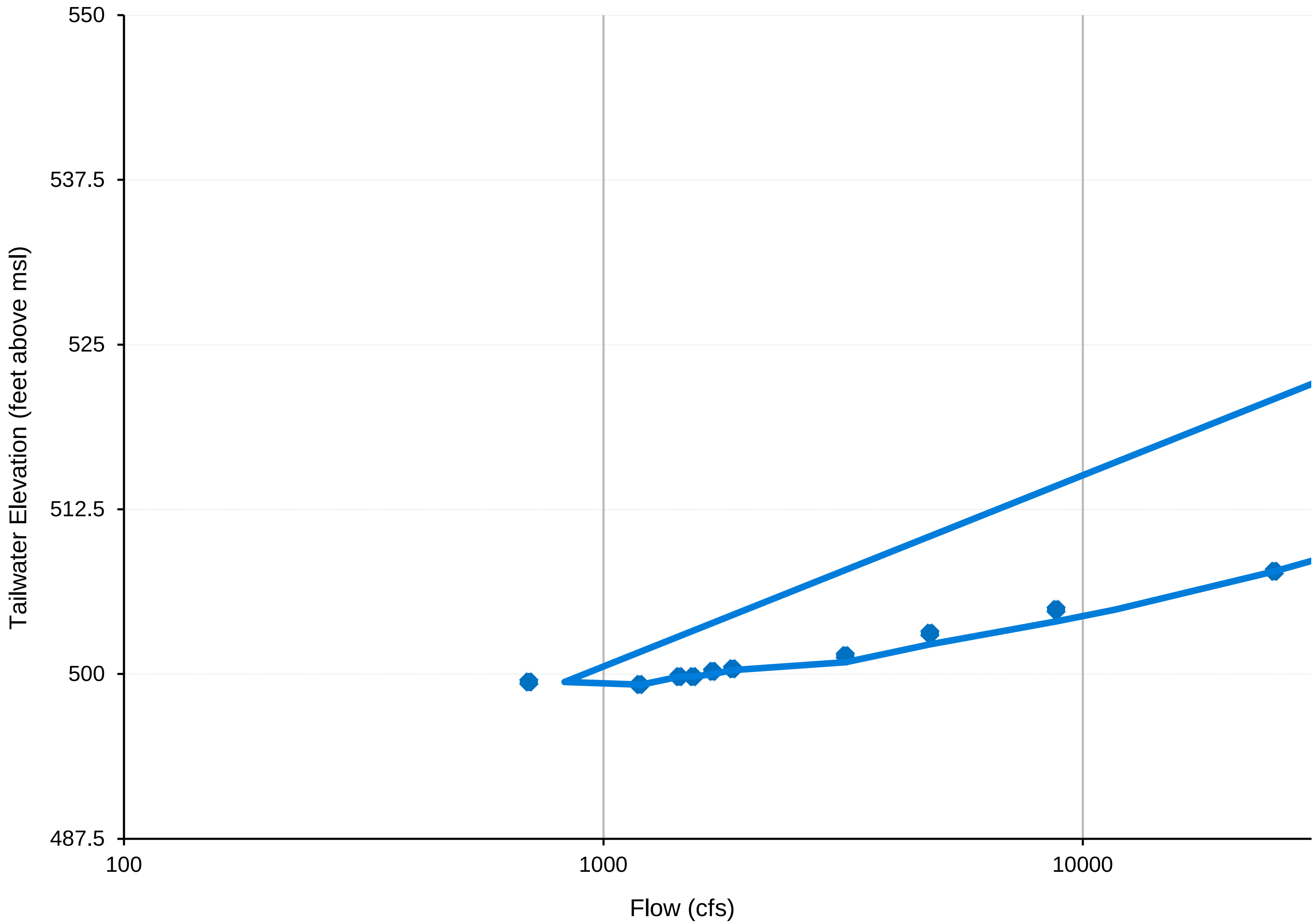


FIGURE A-20 HEADWATER ELEVATION CURVE

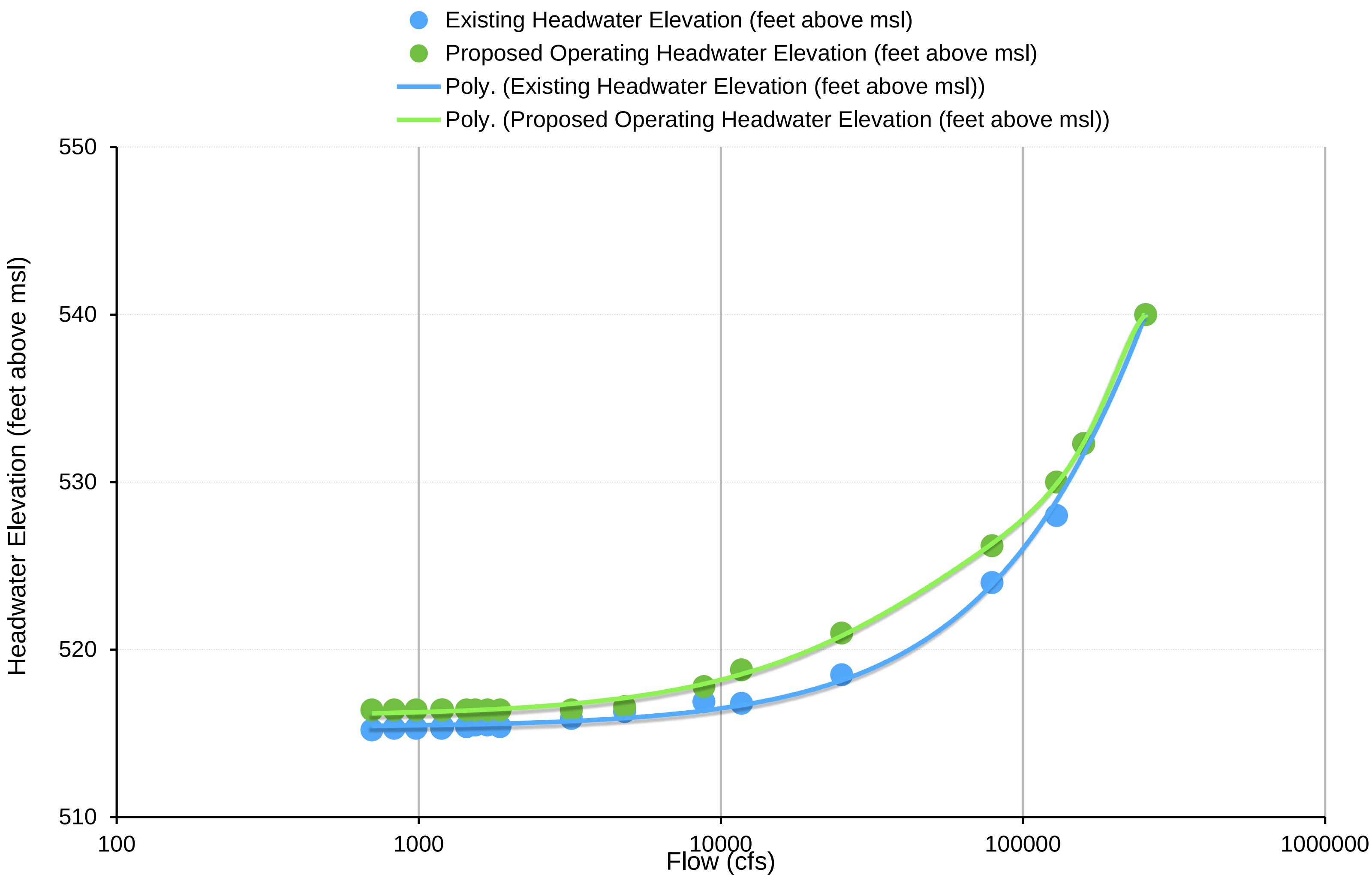


EXHIBIT E

Environmental Report

Scott's Mill Hydropower Project

FERC Project No. 14425

EXHIBIT E

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EXHIBIT E
ENVIRONMENTAL REPORT

1.0 SUMMARY

This draft Exhibit E analyzes and evaluates the effects associated with issuing an original license for the construction and operation of the Scott's Mill Hydroelectric Project (Federal Energy Regulatory Commission (FERC) Project 14425). This Exhibit E updates the Pre-Application Document (PAD), includes the results of the studies conducted by Scott's Mill Hydro, LLC (Applicant), presents an assessment of project impacts and Applicant's Protection, Mitigation and Enhancement Measures (PME), and includes documentation of Applicant's consultation. It follows the requirements of the Commission's regulations at 18 CFR § 4.61. Applicant intends to maintain the approximate normal maximum surface elevation of the existing impoundment. Further, Applicant analysis indicates that there would be no significant environmental impact from construction or operation of the project. In fact, Applicant intends to cooperate with resource agencies expedite diadromous and resident fish restoration in the upper James River basin.

In this relicensing proceeding, Applicant is using the Traditional Licensing Process (TLP). To facilitate processing of this application and for the convenience of the FERC staff, this Exhibit E has been prepared in a format that should facilitate the Commission's preparation of an Environmental Assessment.

This Exhibit E contains evaluations of two primary alternatives: a No-Action Alternative, and the Proposed Action. The No-Action Alternative is the continuation of project operation and maintenance without change (i.e., no hydropower). The Proposed Action is the inclusion of a 4.5 MW hydropower plant, a two-foot high spillway cap to essentially maintain existing headpond water elevations and provide additional energy, associated fish passage facilities, and additional mitigation and enhancement measures.

During the Joint meeting, the parties participating in the licensing process discussed an Action Alternative involving decommissioning the Project. The Applicant explained that the seven dams on this section of the James River are not likely to be decommissioned because two dams are used for water supply and a third is used for manufacturing paper products and is a significant employer in the area. The importance of these projects to the region suggests that there would be s significant threshold required for dam removal. Nonetheless, Applicant committed to preparing a brief decommissioning assessment as part of the study plan approval process in conjunction with American Rivers. Despite several requests to American Rivers to participate in the decommissioning assessment, American Rivers was unable to participate (see **Appendix A** Consultation Record). Accordingly, Applicant's decommissioning report was prepared solely by Applicant. American Rivers and other parties will have the opportunity to provide comments as part of the draft Application review process.

This draft Exhibit E analyzes the site-specific and cumulative effects associated with the construction and operation of the Project under the aforementioned Proposed Action and No-Action Alternative.

1.1 PROJECT OVERVIEW

Luminaire Technologies owns the Scott's Mill dam on the James River along the borders of Amherst and Bedford Counties, Virginia. Flows over the dam are uncontrolled. Headpond water levels at a median flow of 2,000 cfs are slightly greater than one foot over the spillway crest, which is at elevation 514.4 feet. During low flows, the tailwater elevation is approximately 499 feet, resulting in a potential gross head of about 15 feet. Applicant is proposing to add nine 500 kW units for a total plant capacity of 4.5 MW.

1.1.1 PROPOSED PROJECT OPERATION

Applicant proposes to operate the project in a run-of-river mode. After the hydro powerhouse is completed, Applicant plans to add a two-foot high concrete cap on the spillway with a new crest elevation of 516.4 feet. Applicant proposes to maintain a constant upstream water level at the dam just of up to ½ inch above the spillway crest elevation (i.e., veil of water) until inflows exceed the plant turbine capacity of 4,500 cfs, at which time flows over the spillway will be uncontrolled. If additional flows are needed for environmental purposes (e.g., water quality), Applicant will increase the veil over the dam.

With the addition of the concrete cap, during low flows the available gross head will be about 17 feet. Given that the tailwater rises more rapidly than the headwater as flows increase, the gross head decreases to about 14 feet at the hydraulic capacity of the project. At the upper end of project generation (i.e, about 25,000 cfs), the head continues to decrease to about 13 feet (see **Table A-3, Figures A-19 and A-20** for headwater and tailwater curves).

The estimated flow at Scott's Mill Dam has been updated from the PAD to include recent flow data at Holcomb Rock gaging station. A flow duration curve was developed using data from the US Geological Survey (USGS) Holcomb Rock Gage (Gage No. 02025500), which is located about 11 miles upstream of Scott's Mill Dam (see **Figures A-6 through A-18**). The period of record is from 1927 to the present and represents 90 years of recorded flows. The drainage area for the Holcomb Rock Gage is about one percent less than the drainage area at the proposed hydro project. Thus, gage flow data was considered to be representative of site flow without adjustment.

Fish passage flows required for American Eel and Sea Lamprey passage are expected to be less than one cfs. When a vertical slot fishway (or nature-like fishway) is constructed at the site, fish passage flows are likely to be in the 25-50 cfs range. These latter flows would reduce generation by about one percent. However, the energy estimates were not reduced, because the larger drainage area at the dam offsets the flow reduction.

Generation potential was estimated based on gross head, the flow duration curve, and estimated overall plant efficiency. The flow duration curve shows the percentage of time that a specified flow is equaled or exceeded in a typical year. Theoretical annual generation potential is estimated at 20,700 MWh annually. This excludes unscheduled plant outages, which could result in slightly reduced generation.

During flood events with a return interval of 100 years or more, project operations would essentially be unchanged from existing conditions, because the dam no longer acts as a control point.

1.2 MAJOR ISSUES ANALYZED

Evaluations of project effects have been made for water quality, aquatic resources (including fish passage), terrestrial resources, endangered species (i.e., mussels), cultural resources, recreational resources, and land management and aesthetics. These issues were identified during the Joint meeting of licensing stakeholders held on December 2, 2015 (**Appendix A**, Consultation Record).

The resource agencies have identified a long-term goal to restore American Eel, Sea Lamprey and American Shad to the upper James River and to permit resident fish species access to upstream and downstream habitat. Applicant has agreed to work cooperatively with resource agencies and other James River licensees to further these restoration goals. No endangered mussels were identified in the project boundary during a reconnaissance survey for mussels.

The City of Lynchburg also expressed concerns regarding the potential of a hydropower project at the Scott's Mill dam site to affect water rights and water supply for the Lynchburg area. Applicant's proposed operations will not affect the City's water supply or any associated water rights.

2.0 APPLICATION

2.1 THE APPLICANT PLANS TO FILE THE LICENSE APPLICATION IN EARLY 2018

2.2 APPLICANT'S NAME

Scott's Mill Hydro, LLC

2.3 TYPE OF LICENSE OR EXEMPTION

Scott's Mill Hydro LLC is applying for an Original license for Major Water Project, 5 Megawatts of Less. Applicant is using the Traditional Licensing Process.

2.4 SIZE AND LOCATION OF PROJECT

The proposed 4.5 MW Scott's Mill Dam Hydroelectric Project is located on the upper James River at river-mile 260 in Lynchburg, Virginia, Amherst County and Bedford County. The Project is approximately a mile north-northeast of downtown Lynchburg. The GPS location is 37.424466 N, -79.140858 W.

2.5 ENERGY BENEFITS PRODUCED BY PROJECT

The Project has an estimated average annual generation of 20,700 megawatt-hours.

2.6 FEDERAL LANDS, IF ANY, THE PROJECT OCCUPIES

The Project includes no federal lands.

3.0 PURPOSE OF ACTION AND NEED FOR POWER

3.1 PURPOSE OF ACTION

In compliance with the National Environmental Policy Act (NEPA), the Proposed Action addresses the future construction, operation, and maintenance of the Scott's Mill Hydropower Project for electric power generation, including the implementation of terms and conditions proposed for inclusion in an Original FERC hydroelectric license. The purpose of the Proposed Action is to determine whether to grant a license for the future operation of hydroelectric and related facilities in compliance with Federal Power Act (FPA) requirements and other laws. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the Project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

Applicant is seeking an Original Federal license; therefore, the purpose of the Proposed Action is to generate electric power while continuing to meet existing commitments and comply with regulations pertaining to water supply, flood control, the environment, and recreational opportunities. The Proposed Action includes future hydropower operation and maintenance of the Project with additional resource mitigation and enhancement measures. FERC will use the results of these evaluations to prepare a NEPA document to support its decision-making under the FPA and other Federal laws. The purpose of this Exhibit E is to analyze the site-specific and cumulative effects associated with the future operation of the Project under the Proposed Action.

3.2 NEED FOR POWER

The Scott's Mill Project is projected to generate an average of about 20,700 megawatt-hours annually. Additionally, operation of the Project improves the operating flexibility of the overall power system to help offset the cost and air quality effects of fossil fuels.

4.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the facilities and environmental measures proposed by Applicant in the application for an original license (referred to as the Proposed Action). An Action Alternative involving decommissioning the Project was discussed during the Joint meeting. Applicant agreed to conduct a decommissioning study, and to work with American Rivers in preparing the study report. Applicant had stated at the Joint meeting that decommissioning of the Scott's Mill dam, was not a likely alternative. Section 4.4 discusses the decommissioning option and Applicant's basis for eliminating decommissioning from further consideration. **Table E-4.1** provides a summary of the objectives of each alternative.

TABLE E-4-1

ALTERNATIVE OBJECTIVES

ALTERNATIVE	IMPLEMENTING OBJECTIVES
No-Action Alternative	1.) Provide existing environmental conditions as a basis for comparison.
Proposed Action	1.) Provide resource and social enhancements to meet public interest needs, specifically fish restoration, protection of water quality and aquatic habitat, protection of endangered species, wetlands mitigation, increased paddler recreation, and boating consistent with comprehensive land use plans. 2.) Provide power generation benefits.

4.1 EFFECTS OF CONTINUED OPERATION WITHOUT HYDROPOWER

The "existing conditions" is the baseline from which the Proposed Action and all alternatives are compared. Under existing conditions, the Scott's Mill Dam would continue to provide run-of-river flows, with no environmental or recreation enhancements. Passage of diadromous fish would continue to be obstructed by the presence of Scott's Mill Dam and the six dams upstream of Scott's Mill.

4.1.1 PROJECT DESCRIPTION

4.1.1.1 PROJECT FACILITES AND OPERATION

This information in Section 4.1 reflects Project facilities and operations applicable to both the Proposed Action and the No-Action Alternative.

4.1.1.2 DAMS AND SPILLWAYS

The Scott's Mill Dam was constructed in the 1840s. The Dam consists of an 875-foot long and 15-foot high masonry dam extending across the James River, creating a 316-acre reservoir. Pertinent Project data is summarized in **Exhibit A, Table A-1**.

4.1.1.3 RESERVOIRS

The reservoir behind Scott's Mill Dam extends over 316 acres at the normal pool elevation of 516 feet mean sea level (msl). The drainage area at the dam is approximately 2,960 square miles.

4.1.1.4 PROJECT LANDS WITHIN THE PROJECT BOUNDARY

Since the project will continue to remain run-of-river, Applicant proposes to exclude most lands around the shoreline and the three islands (Daniel, Treasure, and Woodruff) from the project boundary except for the southern tip of Daniel Island (see **Exhibit G** for a project boundary map). Applicant proposes to include in the project boundary only those lands necessary for project construction, operations, maintenance, and environmental enhancements. Applicant owns the lands on both sides of the river necessary for constructing the powerplant, fishway facilities and recreation enhancements.

4.2 PROPOSED ACTION

Applicant proposes to construct, operate and maintain the Project as described above in Section 4.1 with the additional measures set forth below.

4.2.1 PROJECT FACILITIES

Applicant will construct a powerplant with dimensions approximately 136 feet wide by 20 feet long, consisting of nine 500 kW turbines for a total plant capacity of 4.5 MW. The powerplant will contain trashracks with 2-inch openings, a trash rake, a travelling gantry crane, and other appurtenant facilities. Bedrock will be excavated to a depth of approximately 9.5 feet both upstream and downstream of the hydropower plant, which will be located about 20 feet downstream of the existing arch section of the Scott's Mill spillway. The plant will be connected to an AEP substation on US Pipe property approximately 1,200 feet from the proposed hydroelectric facility. The transmission line will be buried underground and will not affect US Pipe operations or adversely affect environmental resources since the US Pipe site is highly disturbed.

During construction, a water filled bladder dam will be secured to the arch section of the spillway to serve as an upstream cofferdam. For the downstream cofferdam, Applicant proposes to use a Portadam. Because the powerplant will be of modular construction, installation of the turbines will be on the order of weeks and will be scheduled to take place during the low flow period (i.e., late summer and fall). Because of the rapid installation of the pre-fabricated modular units, the level of flood protection for the construction site can be reduced from the typical 50-year flood to a 2 or 3-year flood for both the upstream and downstream cofferdams, thereby reducing construction costs.

4.2.2 ENVIRONMENTAL MEASURES

Applicant proposes to operate the Scott's Mill Project in a run-of-river mode to minimize environmental effects and to essentially maintain existing headpond water levels during project operations. **Table A-3** and **Figure A-19** compare the existing headpond levels to the proposed operation levels from low flows through flood flows. Although much of the flow will be directed to the right side of the river, the powerplant will also discharge directly to the area behind the straight section of the dam. The tailwater levels on the left side are expected to change only slightly because of this added flow and because a sill downstream in Riveredge Park causes a backwater at the dam. Applicant has also discussed with the US Fish and Wildlife Service (USFWS) and Virginia Department of Game and Inland Fisheries (VDGIF) the possibility of rotating the powerplant slightly to discharge more water to the left (north) side of the river.

Applicant intends to dredge an existing channel at the southern end of Daniel Island just upstream of the dam to allow flow from the main channel to the powerhouse. This will have the effect of increasing circulation and maintaining water quality upstream of the main section of the dam. Applicant intends to consider dredging dimensions during detailed design in conjunction with the specifics of turbine discharge, but the width of the channel is expected to be about 130 feet with a length of about 100 feet. If necessary during low flow conditions, flow can also be released over the spillway to maintain water quality. Applicant also proposes the following environmental measures:

- Provide immediate upstream passage for American Eel and Sea Lamprey.

- Work with other upstream dam owners, resource agencies, and other licensing participants to restore anadromous fish to the upper James River Basin. At this time, Applicant is working with resource agencies to fund and install a vertical slot fishway with a trap and haul component to enable upstream movement of all anadromous and resident species throughout the basin. The agencies have not yet determined the required timing for a vertical slot fishway, or a nature-like fishway (see **Appendix A**, notes of November 14, 2017 agency site reconnaissance.)

- Provide up to a ½-inch veil of water over the dam, to preserve downstream environmental water quality.

- Minimize and mitigate any effects to wetlands both upstream and downstream of Scott's Mill dam.

- Provide a canoe portage around Scott's Mill Dam on the left side of the James River. The portage will skirt the proposed American Eel and Sea Lamprey ladder on the left side of the river and will be designed in coordination with the American eel/Sea Lamprey facility on the left side of the river.

- Work with Virginia Marine Resources Commission (VMRC) and Virginia Department of Game and Inland Fisheries (VDGIF) to provide boat ramp facilities to the public in the headpond. (There are boat ramps on both sides of the river within a mile downstream of Scott's Mill Dam, so no additional boat ramps are needed downstream.)

- Provide a fishing pier on the left side of the river downstream of the dam.

- Prepare a Historic Properties Management Plan (HPMP) to protect cultural resources in the Area of Potential Effects (APE). The HPMP will include provision for signage to identify the various cultural resources in close proximity to the site (e.g., Scott's Mill Dam, Scott's Mill grist mill site, water works canal on the right bank).

- Applicant considered connector trails and public camping, but determined there is insufficient space along River Road to provide for these recreational opportunities. On the right side the existing railroad, US Pipe Company facility and the steep bank preclude connector trails to nearby existing trails.

4.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

American Rivers and the James River Association requested that Applicant consider the decommissioning and removal of Scott's Mill Dam as an alternative to the proposed Scott's Mill Hydropower Project. Since dams on other rivers have affected fish passage and free-flowing rivers, Applicant agreed to conduct an analysis of how dam removal would affect the regional economy and environment if Scott's Mill Dam were to be removed.

The decommissioning and removal of Scott's Mill Dam would restore approximately 3.6 miles of mainstem habitat, plus an undetermined amount of tributary habitat to pre-dam conditions. However, without the removal of six additional dams which lie upstream of

Scott's Mill (i.e., Resuens, Holcomb Rock, Coleman Falls, Big Island. Bedford and Cushaw), or major changes to operational modes, downstream flows would be similar to current operations and fish passage would be restricted from Reusens Dam upstream..

The removal of Scott's Mill Dam would allow for the passage of anadromous and catadromous species that traditionally migrated upstream of Scott's Mill Dam (e.g., American Shad, American Eel and Lamprey). However, only 3.6 additional miles of the James River would become available for spawning and rearing habitat if the dam were removed. The six additional dams discussed earlier also impede the passage of these species. Therefore, the removal of the dam would have minimal effect on the total restoration of these species and their ability to migrate the James River.

Removal of the Scott's Mill Dam would also allow for increased boating and watersport activities access for the 3.6 river miles upstream of the dam. However, due to the small length of river reach, this would likely have little positive impact on the local economy.

It is beyond the scope of this analysis to look at the benefits to the regional economy that would accrue from removal of all dams on the James River upstream of Lynchburg. However, there would be benefits from restoration of habitat for the diadromous fish species and for recreational boating. There also could be effects to the existing boating that occurs upstream of Scott's Mill Dam, but downstream of Cushaw Dam. Use of this reach of river is primarily for fishing. Turning the reaches between Scott's Mill and Cushaw from lentic to lotic waters could affect the species caught, the quantity of fish caught, and boater safety.

Removal of Scott's Mill Dam would also have adverse effects. The reservoir created by the Scott's Mill Dam also serves as a back-up emergency water supply for the town of Lynchburg, Virginia. The City has expressed concern about changes to the dam and existing water levels. The City has stated that it utilizes the river for raw water withdrawal (letter from Timothy Mitchell, Director Water Resources, City of Lynchburg, January 11, 2016 – see **Appendix A**). Removal of the dam would adversely affect the City's back up emergency water supply.

Removal of the 6 dams upstream of Scott's Mill would have significant adverse effects. The Big Island Dam (located above Scott's Mill) is critical for operations of Georgia Pacific's Big Island paper products manufacturing plant. Loss of this facility would adversely affect local employment, and local tax revenues, not to mention the significant investment that Georgia Pacific has made in upgrading the plant. Reusens Dam serves as a back up to Lynchburg's primary water supply source on the Pedlar River. Loss of the Reusens water supply source would likely be unacceptable to Lynchburg. The Snowden hydropower plant provides about 7.5 MW of power to the Town of Bedford's electric utility customers. Loss of the energy from Snowden would adversely affect Bedford rate payers. Cushaw, Holcomb Rock and Coleman Falls are privately owned projects. Removal of these dams would adversely affect the private ownership and could impact the cost of power to the off-takers.

Finally, the removal of Scott's Mill Dam and the 6 dams located upstream would cause an increase in carbon emissions since the power generated would have to be replaced though alternative sources, fossil fuels being the most likely. For the above reasons, dam removal is not considered a reasonable alternative and is eliminated from further consideration.

5.0 CONSULTATION AND COMPLIANCE

5.1 AGENCY CONSULTATION

The FERC regulations (18 Code of Federal Regulations [CFR] § 4.38) require an applicant to consult with appropriate resource agencies, Tribes and members of the public before filing an application for license. The consultation constitutes an initial step in compliance with the Fish and Wildlife Coordination Act, Endangered Species Act (ESA), National Historic Preservation Act (NHPA) and other Federal statutes.

In the first stage of the licensing process, FERC regulations require an applicant to engage the appropriate Federal, State and local resource agencies, Native American Tribes and interested parties to determine which studies should be conducted to support the licensing process. The Applicant held a public/agency meeting on December 2, 2015. The Pre-Application Document (PAD) described the Scott's Mill Project and environmental resources potentially affected by project construction and operations. It also contained a list of proposed studies the Licensee would conduct during the licensing process.

5.1.1 AGENCY CONSULTATION

Applicant held a Joint meeting on December 2, 2015 with members of resource agencies, interested parties and the public to discuss the licensing process, and to identify resources issues and alternatives. Numerous additional meetings and conference calls were held over the past two years. Meeting minutes and records of conversation are provided in **Appendix A**. (Meeting and telephone participants were all afforded the opportunity to edit the notes of the meetings/conference calls.)

DATE	ATTENDEES	PURPOSE
Dec. 2, 2015	Lynn Crump, Virginia Department of Conservation and Recreation	Public Scoping / Joint Meeting
	Jody Callihan, Federal Energy Regulatory Commission	
	Lary Jackson, APCO	
	Brian McGurk, Virginia Department of Environmental Quality	
	Justin Stauder, City of Lynchburg	
	Greg Poff, City of Lynchburg	

	Clay Simmons, City of Lynchburg	
	George Palmer, Virginia Department of Game and Inland Fisheries	
	Scott Smith, Virginia Department of Game and Inland Fisheries	
	Scott Lyng, Lyng and Son Lumber	
	Rob Campbell, James River Association	
	Pat Calvert, James River Association	
	Ben Leatherland, Hurt & Proffitt	
	Randy Lichtenberger, Hurt & Proffitt	
	Mark Fendig, Luminaire Technologies	
	Kim Stein, Consultant for Liberty University	
	Eric Thompson, Natel Energy	
	Luke Graham, Consultant	
	Wayne Dyok, Facilitator	

Applicant distributed copies of the draft study plans on February 10, 2016. Licensing participants provided comments on the study plan in March and April. Applicant continued to coordinate with licensing participants and finalized the study plans in late May with filing and distribution of the final study plans on June 16, 2016. Applicant implemented the study plans beginning in April 2016. Most studies were completed in 2016, but fish passage efforts continued through November 14, 2017. Applicant intends to continue consultation with licensing participants during the review period for the draft license application, and afterwards to the extent necessary.

5.1.1.1 COMMENTS ON DRAFT APPLICATION

On December 5, 2017 Applicant distributed copies of its draft application. Comments are due 90 days from that date. Responses to comments will be included in a future **Appendix B**. As appropriate, the application will be revised to incorporate the comments.

5.2 COMPLIANCE

5.2.1 WATER QUALITY CERTIFICATION UNDER SECTION 401 OF THE CELAN WATER ACT

The Virginia Department of Environmental Quality (VDEQ) is the agency responsible for issuing the Water Quality Certification for the Project. Applicant has consulted with the VDEQ in developing this draft application and will submit the 401 Water Quality Certification application on or before filing the final application.

5.2.2 SECTION 18 PRESCRIPTIONS FISHWAY PRESCRIPTIONS

Section 18 of the FPA states that the Commission must require a licensee to construct, operate and maintain such fishways as may be prescribed by the Secretary of the Interior and the Secretary of Commerce (16 U.S.C. § 811). The USFWS has a goal to restore American Eel and American Shad in the upper James River, above Scott's Mill dam. Some American Eel have been observed in the vicinity of and upstream of Scott's Mill Dam. However, American Shad restoration has not achieved the restoration goals after more than two decades of stocking and other restoration efforts. Consequently, Virginia has elected to halt the stocking program (Karl Blankenship, Bay Journal, September 17, 2017).

Agencies have stated that American Shad passage is not as critical as for other species, but could become critical in the future (see **Appendix A**, August 25, 2017 notes of resource agency conference call). Nonetheless, there is an immediate need for passage of American Eel and Sea Lamprey. Accordingly, Applicant has developed conceptual plans for upstream passage of American Eel and Sea Lamprey. The resource agencies have stated that all fish passage alternatives are still under review.

5.2.3 COASTAL ZONE MANAGEMENT ACT

The Scott's Mill Project is located upstream of the coastal zone. Amherst and Bedford Counties are not included in Virginia's Coastal Program Resource Management Area.[1] Therefore, the Coastal Zone Management Act does not apply to the Scott's Mill Project.

5.2.4 SECTION 4(e) FEDERAL LAND MANAGEMENT CONDITIONS

Section 4(e) of the FPA provides that if a project is located within a Federal reservation, the Department with management responsibility for the reservation, (including national forests and parks) may require such conditions necessary for the adequate protection and utilization of the reservation (16 U.S.C. § 797(e)). However, there are no federal lands within the Scott's Mill Project boundaries.

[1] Virginia Department of Environmental Quality. *Virginia Coastal Resources Management Area*. www.deq.state.va.us.

5.2.5 ENDANGERED SPECIES ACT

Section 7 of the Endangered Species Act (ESA) requires consultation with relevant resource agencies to ensure that FERC's issuance of a license does not jeopardize the continued existence of listed species or adversely modify designated critical habitat. (16 U.S.C. § 1536). Applicant has consulted with the USFWS pursuant to the ESA. Prior to conducting relicensing studies, Applicant requested a list of threatened and endangered species from the USFWS. The James spiny-mussel (federally endangered) was listed as potentially occurring in the project area. With the exception of the James spiny-mussel, no other ESA studies were requested for aquatic species. Applicant conducted a survey for freshwater mussels at seven specific sites in the pool located between Scott's Mill Dam and Reusens Dam. Additionally, the survey also included the tailrace below Scott's Mill Dam downstream to the confluence of Blackwater Creek.

No live target species of freshwater mussels were found. Project effects on the endangered James spiny-mussel are discussed in the environmental assessment. Applicant anticipates that the USFWS will issue its biological determination after FERC has issued its draft environmental assessment and biological assessment.

Applicant had intended to conduct a bat study, but after the Terrestrial Habitat Assessment and Applicant's decision to essentially maintain existing water levels, Applicant determined that no bat habitat would be affected by the project and abandoned plans for the bat study.

5.2.6 SECTION 10(j) FISH AND WILDLIFE COORDINATION ACT RECOMMENDATIONS

Applicant will respond to comments on the draft application that pertain to recommendations relating to the Fish and Wildlife Coordination Act in the final application. The USWFS and VDGIF will provide their recommendations in response to the Commission's request for formal recommendations.

6.0 ENVIRONMENTAL ANALYSIS

The Project effects discussed in Section 6.0 are based on a comparison to the existing environment (i.e., No-Action Alternative). They include all protection, mitigation and enhancement measures.

6.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The James River originates in the Allegheny Mountains at the junction of the Jackson and Cowpasture Rivers near Clifton Forge, Virginia (**Figure A-1**). The river flows generally southeast, traversing the Blue Ridge Mountains, the Piedmont Plateau and finally the Coastal Plain/Tidewater where it discharges into Chesapeake Bay (approximately 340 miles [544 kilometers] from its origin). The total drainage area of the basin is an estimated 10,060 square miles (approximately 25% of the state).

There are approximately 45 dams and associated hydroelectric facilities in the basin, half of which are in the lower third of the basin and half in the upper third of the basin, with approximately 80 miles of river in between (Dominion 2006). The dams cumulatively affect anadromous fisheries of the James River as well as canoeing and kayaking. A series of seven low-head dams over a 22-mile stretch of river begins as the river enters the Piedmont Plateau province (**Appendix C, Photographs**). The first of the seven dams (Cushaw Dam) is located a few miles below Balcony Falls (near Glasgow, Virginia), which is where the James River leaves the Blue Ridge Mountains and enters the Piedmont. The Scott's Mill Dam is the lowermost dam and is located approximately 260 river miles (416 km) upstream of Chesapeake Bay.

Topography of the basin is characterized by mountainous areas in the western portion, gradually changing to low, rounded hills and level areas of unconsolidated soils in the eastern portion. In the Project vicinity, the topography is characterized by hilly terrain.

Virginia's climate is classified as humid sub-tropical, but temperature and precipitation vary widely with topography. On average, approximately 43 to 45 inches of precipitation, mostly rain, fall annually in the vicinity of the Scott's Mill Hydropower Project. Precipitation varies markedly, however, with elevation and location within the gorge that cuts through the Blue Ridge Mountains. Exceptionally heavy rains can occur at the Project when Atlantic storms move inland and encounter the sharply rising mountain range (Woodward and Hoffman 1991).

Forests cover more than 75 percent of the land in the upper and middle James River watersheds, and agricultural uses constitute much of the rest. Amherst County comprises 475 square miles, with a population of around 32,000; Bedford County is 764 square miles with a population around 61,000. The 1990 population in the upper James River watershed was less than 37 people/square mile, and in the middle watershed between 37 and 67 people/square mile (Jones, et al. 1997).

The immediate area of the project site is industrial/urban with railroad tracks on the west side and River Road on the east side of the river at Scott's Mill Dam. The area in the vicinity of the Project is characterized as forested hills. Outside the floodplain area, there are steep slopes on both sides of the river.

Water withdrawals from the James River throughout its 340 miles are used by municipalities and industry for industrial uses (73 percent), public water supply (17 percent) and agriculture (ten percent).

6.2 CUMULATIVE EFFECTS

According to the Council on Environmental Quality's regulations implementing the NEPA (40 CFR 1508.7), an action may cause cumulative effects of the environment if its effects overlap in space and/or time with effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities. At this time, Applicant has identified fisheries and recreation as potentially cumulatively affected resources. The analysis of cumulative effects to these resources is found in the corresponding resources section.

6.2.1 GEOGRAPHIC SCOPE OF CUMULATIVE ANALYSIS

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary. However, in this instance the geographic scope for all identified resources is the same and would extend from downstream of Scott's Mill Dam near the City of Lynchburg, to upstream of the Cushaw Project.

The Scott's Mill Dam is the downstream most dam in a series of seven dams from Cushaw to Lynchburg. The seven dams inhibit fish passage and recreational boating. Resource agencies have a goal to restore American Eel, Sea Lamprey and American Shad to their historic spawning grounds.

6.2.2 TEMPORAL SCOPE OF ANALYSIS

The temporal scope of the cumulative effects analysis includes past, present, and future actions and their possible cumulative effects on each resource. Based on the license term, the temporal scope looks 30 to 50 years in the future, concentrating on the effects of the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited to the amount of available information for each resource.

6.3 PROPOSED ACTION AND ALTERNATIVES

6.3.1 GEOLOGICAL RESOURCES

6.3.1.1 AFFECTED ENVIRONMENT

The Scott's Mill Dam is located on a reach of the upper James River downstream of the Blue Ridge Physiographic Province. Typically seven to ten miles in width (but wider south of Roanoke Gap), the Blue Ridge Mountain range extends from Georgia to Pennsylvania and represents the eastern most ridge of the Appalachian Highlands (Hunt, 1974). Relatively rapid erosion has formed a terrain of high relief comprising resistant granites, greenstones and quartzites. In the general vicinity of the Project, the nearby hills rise from a river elevation of approximately 500 feet above msl to heights of almost 800 feet.

Although the area adjacent to the river is heavily wooded, landslides can occur, introducing large amounts of sediments and woody material into the James River. This can cause debris flows and flooding. Erosion along the reservoir shoreline is typically limited to localized sites where boaters and anglers have accessed the water and worn paths.

6.3.1.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

Applicant would implement best management practices to prevent soil erosion, particularly during the construction of the powerhouse. The work would be conducted within upstream and downstream cofferdams.

Applicant acknowledges that any fill or excavation below the ordinary high water mark in surface waters, or in wetlands, for any aspect of the Project, is required to be reported in the Joint Permit Application for Section 401 Certification by VDEQ's Virginia Water Protection Permit Program. Applicant would avoid to the extent possible, minimize, and mitigate any impacts to wetlands.

6.3.2 WATER RESOURCES

6.3.2.1 AFFECTED ENVIRONMENT

The nearest USGS gage is at Holcomb Rock (USGS gage no. 0202550), about 11.2 miles upstream of the Scott's Mill Dam. The total drainage area at the Holcomb Rock gage is 3,259 square miles, representing about one third of the drainage of the James River Basin. The average daily flow for the period of record from October 1, 1927 to the present is 3,632 cfs. During this period, the highest instantaneous discharge recorded at Holcomb Rock was 207,000 cfs on November 5, 1985, and the lowest discharge was 223 cfs on July 28, 1930. The highest daily flows most frequently occur in March and, less frequently, in January, February and April. The lowest daily flows occur most frequently in September and, less frequently, in July, August, October and November (**Table E-6-1**).

TABLE E-6-1

FLOW DURATION VALUES (CFS) FOR THE JAMES RIVER AT HOLCOMB ROCK GAGE, WATER YEARS 1928 - 2002

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum	93,900	63,600	110,000	96,700	55,600	118,000	26,800	98,800	62,200	52,100	180,000	62,900
Minimum	431	579	882	966	685	424	223	244	280	266	400	452
5	13,900	15,500	20,800	15,900	11,800	7,520	4,280	5,270	5,130	7,860	8,040	11,300
10	9,900	11,300	14,300	11,800	8,130	5,020	2,930	2,960	2,980	4,080	5,020	7,430
15	7,800	9,010	11,700	9,360	6,630	3,800	2,240	2,120	2,100	2,750	3,850	5,700
20	6,190	7,450	9,540	7,860	5,730	3,160	1,910	1,750	1,590	2,220	3,100	4,550
25	5,280	6,410	8,240	6,780	4,990	2,750	1,720	1,530	1,330	1,850	2,600	3,970
30	4,590	5,700	7,200	5,920	4,420	2,440	1,570	1,360	1,180	1,540	2,180	3,450
35	4,020	5,200	6,410	5,220	3,970	2,160	1,450	1,240	1,060	1,320	1,880	3,040
40	3,660	4,720	5,760	4,660	3,640	1,990	1,340	1,150	996	1,160	1,680	2,720
45	3,300	4,230	5,210	4,260	3,340	1,840	1,250	1,080	934	1,060	1,510	2,460
50	3,030	3,750	4,790	3,860	3,090	1,730	1,170	1,020	883	976	1,350	2,240
55	2,800	3,220	4,370	3,570	2,840	1,590	1,100	958	837	901	1,210	2,020
60	2,550	3,310	4,080	3,280	2,650	1,500	1,060	905	793	842	1,090	1,800
65	2,320	2,840	3,770	3,030	2,450	1,420	1.010	861	754	801	970	1,620
70	2,120	2,620	3,480	2,800	2,270	1,340	956	814	711	764	896	1,450
75	1,860	2,380	3,210	2,600	2,070	1,260	900	769	678	722	834	1,300
80	1,600	2,140	2,940	2,440	1,910	1,180	841	716	641	672	787	1,140
85	1,370	1,850	2,620	2,270	1,730	1,080	781	660	586	636	732	954
90	1,120	1,550	2,150	2,040	1,520	970	708	580	530	580	660	794
95	843	1,170	1,710	1780	1,280	854	598	508	452	491	576	663

Source: USGS Surface Water Monthly Statistics for Virginia (http://waterdata.usgs.gov/va)

6.3.2.1.1 STORAGE AND RELEASE OF PROJECT INFLOW

The Scott's Mill Dam currently operates as a run-of-river project. Under steady state flows, the headpond elevation is governed by the weir equation: $Q=CLH^{1.5}$, where Q is the James River flow in cfs, C is a coefficient, L is the spillway length in feet, and H is the head over the spillway crest in feet. The spillway length is 735 feet for the straight section of spillway and 140 feet for the arch section. Applicant measured the headpond level for various flow levels up to 25,000 cfs. Headpond levels as a function of discharge are presented in **Figure A-19**. These measurements verified that a coefficient of 3.5 provided accurate estimates of upstream water levels for specific flow levels. For example, in Applicant's final study plan Applicant estimated that a 4 foot head would equate to a flow of 23,800 cfs. Measurements at 25,000 cfs indicated a head of 4.1 feet over the dam crest, equivalent to an upstream water level of 518.5 feet (see **Table A-3, Figure A-19**). Given the excellent agreement of headpond water levels and discharges with the weir equation, applicant was able to extrapolate upstream water levels for flows above 25,000 cfs. However, for flood flows above 75,000 Applicant used the Federal Emergency Management Agency (FEMA) flood studies to estimate upstream and downstream water levels during flood events. Applicant cross checked these water levels with weir equation estimates.

During flood events, downstream backwater levels increase much faster than upstream water levels. The net effect is that the backwater levels drive the upstream water levels at floods greater than the 100-year flood, although at the 100-year flood, water levels using the weir equation are approximately equal to the water levels estimated by FEMA. Above the 100-year flood, Scott's Mill Dam has little effect on upstream water levels. FEMA estimated that the presence of Scott's Mill Dam increased water levels by about one foot.

Applicant also measured tailwater levels at flows from 700 cfs to 25,100 cfs, as illustrated in **Table A-3 and Figure A-20**. Downstream water level gauges installed by Applicant were washed downstream during a flood event. Consequently, Applicant surveyed downstream water levels at various James River flow levels to develop the tailwater rating curve below 25,000 cfs. (Applicant's first survey conducted by a registered land surveyor indicated that the actual crest elevation of the main spillway is 514.4 feet and the crest elevation of the arch section is at elevation 514.8 feet. Applicant determined that the 511-foot crest elevation shown on USGS maps is approximate and has used the corrected crest elevation is all current studies. Applicant's surveyed data corresponds with the FEMA elevation data.) Above 25,000 cfs, Applicant used the FEMA study to estimate downstream water levels.

Downstream water levels increase from 499 feet (NAVD) to about 507.8 feet over this range. This has the effect of reducing gross head for power generation as flows increase. The downstream water levels are controlled by a sill located at Riveredge Park (see **Appendix C, Photographs**).

As flows in the James River increase, the water level increases until a new equilibrium is established per the headwater rating curve. Similarly, as flows decrease, water levels fall until a new equilibrium is established.

During project operations, the project will be operated in a run-of-river mode. Flows equal to the headpond inflow will be maintained through the turbines and as necessary, over the dam to maintain a constant headpond elevation when flows are less than the hydraulic capacity of the turbines. Consequently, inflow and outflow from the Project will essentially be equal. The operators of the Scott's Mill powerhouse will monitor the flow and headpond levels, and when the river flow increases to a point that can support the addition of another unit without dropping the water level below the dam crest, a unit will be started. Conversely, units will be shut down when flow decreases to a point when flow cannot be maintained just above the crest level.

The operators at the Scott's Mill facility will have access to a live controllable video camera situated on the intake structure, which will allow them to visually monitor the headpond level and the entire crest of the dam. Additionally, a level probe will be situated on the right abutment of the dam which will provide headpond level relative to the crest of the dam. The level probe will provide operational input as to when it is possible to start a unit and when it is necessary to shut a unit down. The Scott's Mill facility will be operated remotely 24 hours-per-day, 7 days-per-week, and the standard operating procedure will be to review the video and probe level on an hourly basis. The level probe will be alarmed to alter operations if the pond level deviates significantly from the dam crest elevation.

The upstream and downstream USGS gauging stations, available on the internet, will also be monitored and utilized by the operators to anticipate flow changes that will be experienced at Scott's Mill over the next 24 to 48 hours. These changes can be from local/upstream precipitation, or as a result of changes of releases from the six dams upstream (Reusens being the first/closest).

6.3.2.1.2 BATHYMETRY STUDY

Applicant conducted a bathymetry study in April 2016 during near-constant flows of about 1800 cfs to better understand the hydraulic effects of the project on flows and aquatic habitat. **Figure E-6-1** shows bathymetric contours both upstream and downstream of Scott's Mill dam. Water levels downstream of the dam are about 1 foot above the water levels observed at a low flow of 700 cfs. **Figure E-6-2** orients the bathymetry map to Google Earth. (Note there is some distortion.) **Figure E-6-3** presents bathymetry data just upstream of the arch section of the dam.

Water levels immediately upstream of the main dam are shallow, gradually increasing from about 2 feet at the dam to about 8 feet 100 feet upstream. Further upstream in the main channel, water levels in the center of the channel upstream to the upper third of Daniel Island vary from about 15 to 20 feet deep with some holes as deep as 25 feet. From the upper third of Daniel Island to the upstream end of Treasure Island the maximum channel depth varies from about 9 to 12 feet. From the upstream end of Treasure Island to Reusens Dam maximum channel depth varies from 6 to 12 feet. Immediately upstream of the arch section channel depth are about 8 to 10 feet. Further upstream depth varies from 6 to 12 feet.

Downstream of the main section of the dam, depths are typically 3 to 6 feet with shallower areas (boulders) encroaching on the surface, such that at low flows boaters need to be aware of the locations of these boulders. Immediately downstream of the arch section of the dam where the proposed powerplant would be located there are shallow sections with riffles about 1 foot deep. However, average depth is about 3 to 6 feet in the area adjacent to the downstream island.

FIGURE E-6-1 Bathymetry of Scott's Mill Headpond and Downstream Area

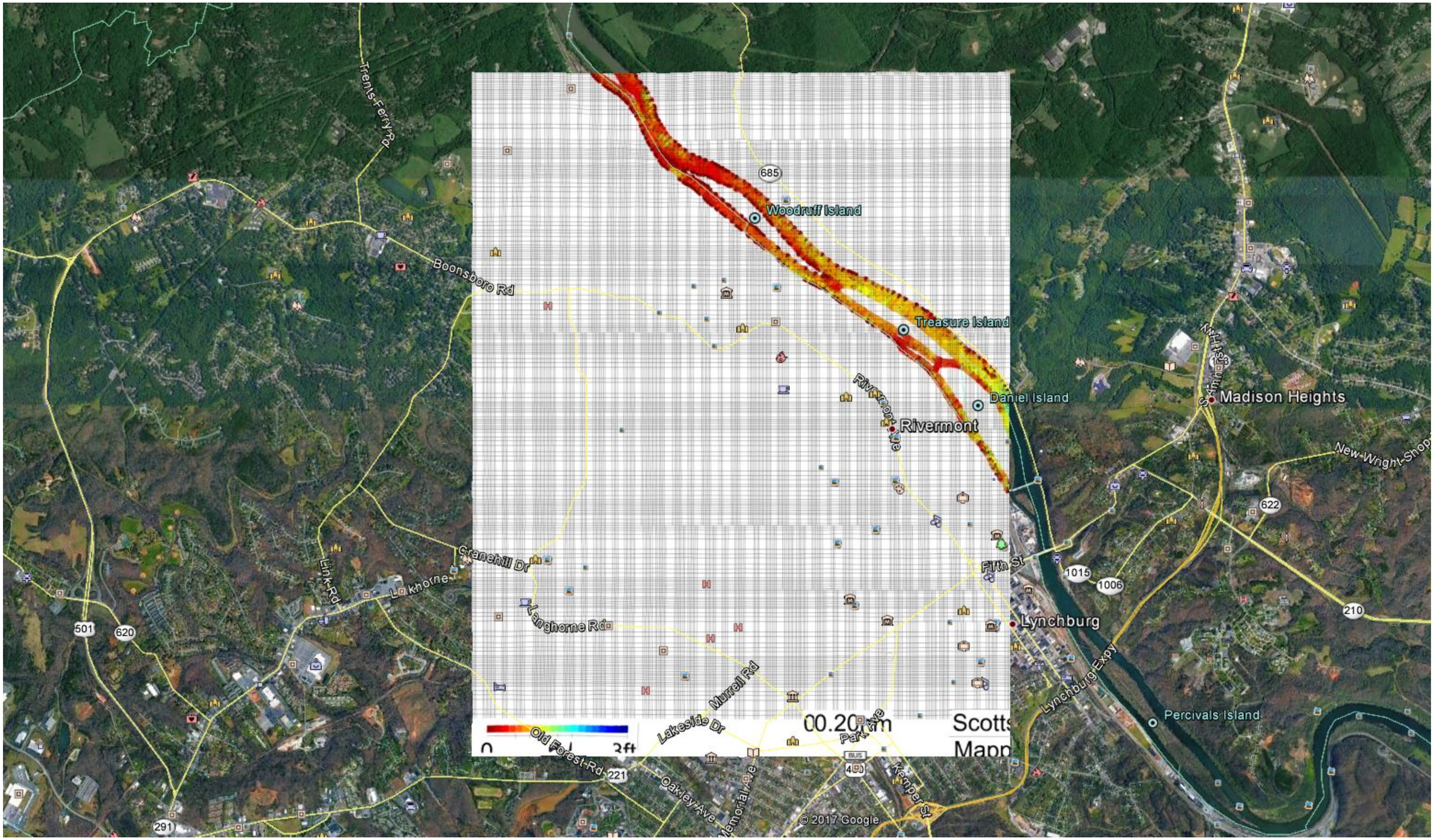

FIGURE E-6-2 Bathymetry of Scott's Mill With Reference to Google Earth

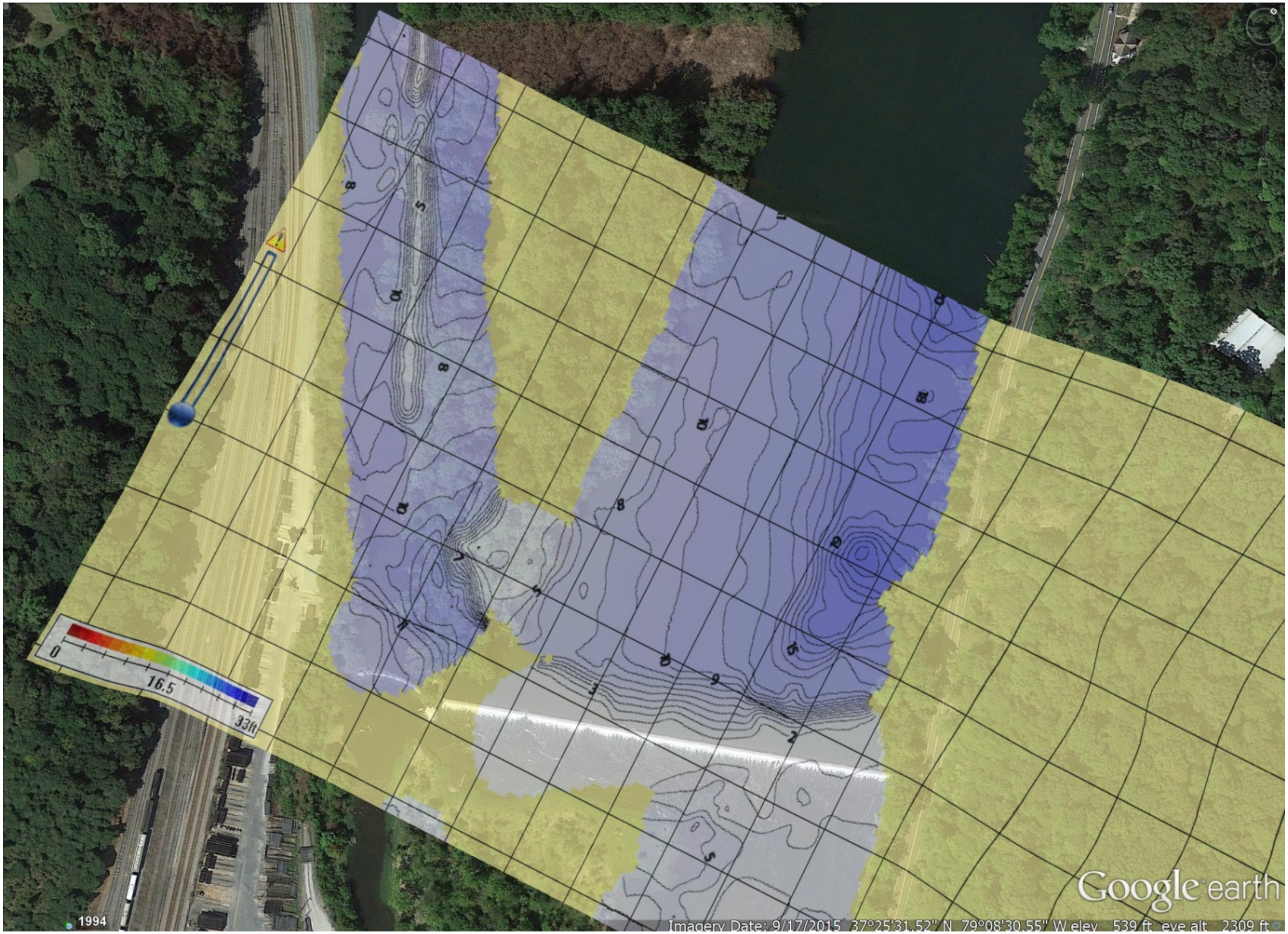

FIGURE E-6-3 Headpond Bathymetry Upstream of Scott's Mill Dam

6.3.2.1.3 EFFECTS OF FLOW RELEASES

Study plan 3 required Applicant to measure water velocities in the headpond during flow conditions. Specific locations included (1) at the buoys located several hundred feet upstream of the main section of the dam, (2) in the opening between the dam and the downstream end of Daniel Island, and (3) upstream of the arch section of the dam. Applicant measured velocities at 0.2 and 0.8 of the depth. Velocity measurements were at the lower end of the meter, measuring only a couple of tenths foot per second (fps). At the opening, just upstream of the old fish passage site to the left side of the arch section, velocities were below the meter detection limit. Velocities were not measured immediately upstream of the dam for safety reasons, but because of the depth, low flow conditions and the fact that the arch section is 0.4 feet higher than the main spillway section, average velocities were estimated to be less than 0.2 feet per second. Velocities measured at the buoys were on the order of 0.2 fps. This seems reasonable given the cross sectional area is on the order of 7,000 ft^2 and the flow through this reach was about 1600 cfs.

Based on the bathymetry and the surface area of 316 acres, Applicant estimates a headpond volume of about 2,000 acre-feet. Based on a median flow of 2,000 cfs, the residence time in the headpond is about 12 hours. For a low flow of 700 cfs residence time would be about 1 ½ days.

Under maximum generation conditions of 4,500 cfs, flows in the channel upstream of the arch section would be about 3.5 fps based on a depth of 10 feet and channel width of 130 feet, assuming all flow passed through this channel. Further upstream in the channel to the right of Daniel Island velocities could be on the order of 6 fps in some areas. However, by excavating the opening that is immediately upstream of the old fishway to the left of the arch dam, Applicant proposes to draw flow from the left side of the channel to the north of Daniel Island. Enlarging the opening to about 130 feet wide by 10 feet deep would approximately double the cross sectional area from which the hydro project would draw water, resulting in an average flow of less than 2 feet per second during maximum operating conditions of 4,500 cfs. This would result in about half the flow coming from the left side of the channel and half coming from the right side. Under lower flow conditions, Applicant expects that each channel would continue to provide half the flow for the turbines. Average velocities in the main channel would continue to be very low except in the vicinity of the cut where they will range from ¼ fps to 2 fps over the range of turbine flows from minimum to maximum. Since the cut would be designed to provide about half the flow from the left side of the river, residence time would effectively double to about 3 days.

Applicant plans to excavate about 5 feet of rock to elevation 493 feet at the powerplant site and for about 10 feet downstream. It may also be necessary to excavate the riffle area downstream of the arch dam and an area immediately downstream of the old fishway to the left of the arch section. Applicant's goal is to provide about half the flow to the area downstream of the main spillway section. Flow from the arch section currently flows in this direction. This will maintain flows in the area downstream of the main spillway section. The proportion of flow to be discharged will depend upon the design of any required fishways. The goal will be to attract fish to the fishway entrance and to provide quiescent flows on the right bank to facilitate eel passage.

6.3.2.1.4 FLOWS RELEASED FOR SPECIFIC PURPOSES

Water withdrawals from the James River throughout its 340 miles are used by municipalities and industry for industrial uses (73%), public water supply (17%) and agriculture (10%).

6.3.2.1.5 DESCRIPTION OF WATER RIGHTS, IF ANY

Under Virginia law, riparian water rights are real property rights appurtenant to the land in which the river or stream is located. The water rights required for the operation of the Project is included within the ownership in fee held by Applicant. (Virginia law recognizes that water rights can be severed and conveyed separately from the real property to which they are appurtenant.)

Virginia follows the "reasonable use" doctrine of riparian law. The owner of land adjoining a river or stream has the right to make a reasonable use of the waters flowing by his land, qualified by the right of other riparian owners "to have the stream substantially preserved in its size, flow, and purity, and to be protected against any material pollution of its waters." Project use of the water is non-consumptive and non-polluting, and retention of water in the reservoir does not and will not exceed Applicant's reasonable use rights.

6.3.2.1.6 WATER QUALITY IN PROJECT HEADPOND AND DOWNSTREAM

The Scott's Mill dam is located in a reach of the James River that Virginia Department of Environmental Quality (VDEQ) identifies as Section 11j. This Section is Class III, Nontidal Waters, in which VDEQ numerical water quality criteria for minimum and daily dissolved oxygen (DO), pH and maximum temperature are as follows (AC 25-260-5 et seq. Water Quality Standards):

Minimum DO (mg/l)	Daily Avg. DO (mg/l)	pH	Max Tem (^{0}C)
4.0	5.0	6.0 - 9.0	32^0

The City of Lynchburg has an emergency water withdrawal from the James River immediately downstream of Scott's Mill dam and as such, water quality criteria for parameters other than DO, pH and temperature are identified under the category "Aquatic Life, Freshwater (Acute and Chronic)", and "Human Health, All Other Surface Waters." The numerical water quality criteria for specific parameters other than DO, pH and temperature are included in **Appendix D**.

VDEQ has classified this portion of the James River as a Class III surface water, with Category 5D impairment (bacteria and polychlorinated biphenyls [PCB's]). According to the VDEQ, this 4.2 mile section of the river (VAC-H03R JMS 04A02, from Reusens Dam to Highway 29) currently supports aquatic life uses, public water supply uses, and wildlife uses, but does not support recreational uses or fish consumption. Elevated *E. coli* bacteria concentrations in the water and high PCB levels in fish tissue have resulted in these impairment classifications.

The VDEQ identifies the James River at the vicinity of the Project as "Impaired Waters" (VDEQ 2002 303(D) Impaired Waters Fact Sheet). It is identified as impaired for 2012 and 2014. A river segment located about four miles downstream of the Project, however, was listed in 1998 as impaired due to seven out of 59 fecal coliform bacteria samples exceeding 1,000 n/100 ml. VDEQ identified a mix of agricultural and industrial nonpoint source runoff as the likely sources. The listing was removed in 2002 because less than ten percent of sampling events did not exceed criteria.

VDEQ currently measures water quality (at about 0.3 m depth) bi-monthly in the James River near Scott's Mill dam at Percival's Island. This sampling location is identified by VDEQ as Station 2-JMS258.54. Results for selected parameters for the period 2014 to 2015 are provided in **Table E-6-2**. Water temperatures during the sampling events varied from 3.5 C to 29.45 C. Dissolved oxygen values ranged from 7.9 to 13.4 mg/l, while pH values ranged between 7.2 and 8.4. Turbidity was generally low and ranged from 1.8 to 210 NTU. Four of the 21 samples contained fecal coliform at concentrations exceeding the 1,000 n/100 ml criterion.

TABLE E-6-2 WATER QUALITY DATA IN VICINITY OF SCOTT'S MILL DAM

Station 2-JMS258.54 Percivals Island Lot (Under Rt 29 Bridge)																	
							TS RESIDUE, TOTAL (MG/L)	TSS RESIDUE, TOTAL NONFILTRABLE (MG/L)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, KJELDAHL, TOTAL, (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	HARDNESS, TOTAL (MG/L AS CACO3)	FECAL COLIFORM,MEMBR FILTER,M-FC BROTH,44.5 C	E. COLI - MTEC-MF N0/100ML	ENTEROCOCCI-ME-MF N0/100ML	TURBIDITY,LAB NEPHELOMETRIC TURBIDITY UNITS, NTU	E.COLI BY COLILERT SM 9223-B
							Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
Collection Date Time	Rec Code	Depth	Depth Desc	Temp Celcius	Do Probe (mg/l)	Field Ph											
2/13/2012 12:20	SCRO	0.3	S	6.56	10.03	7.68	140	2	0.48	0.2	0.02		25	25		2.2	
3/26/2012 15:00	SCRO	0.3	S	15.06	10.42	7.35	166	75	0.9	0.6	0.11		2000	1325		52.6	
5/9/2012 13:00	SCRO	0.3	S	19.89	9.12	7.81	149	30	0.67	0.4	0.07		2000	1200		41.2	
7/24/2012 15:00	SCRO	0.3	S	28.52	8.12	8.06	262	1	0.45	0.4	0.03		125	25		1.38	
9/6/2012 12:00	SCRO	0.3	S	26.79	8.45	8.07	235	3	0.38	0.3	0.03		75	50		2.76	
11/14/2012 13:50	SCRO	0.3	S	9.79	13.03	8.04	267	2	0.3	0.5	0.02		200	25		2.46	
1/15/2013 10:40	SCRO	0.3	S	7.6	11.95	7.64	167	14	0.57	0.4	0.04		275	300		12.8	
3/7/2013 10:30	SCRO	0.3	S	4.69	13.38	7.64	163	7	0.54	0.3	0.02		25	100		8.92	
5/8/2013 15:40	SCRO	0.3	S	12.79	10.88	7.63	337	259	1.21	1.6	0.34		2000	1300		210	
7/25/2013 16:50	SCRO	0.3	S	26.17	8.16	8.04	180	14	0.58	0.3	0.05		25	125		19.8	
9/25/2013 15:10	SCRO	0.3	S	21.1	9.5	8.23	231	2	0.35	0.3	0.03		100	25		2.13	
11/21/2013 15:20	SCRO	0.3	S	8.73	12.54	8.38	265	7	0.34	0.3	0.01		25	25		3.38	
1/21/2014 15:00	SCRO	0.3	S	3.51	13.58	7.91	133	6	0.66	0.2	0.03		50	25		7.43	
3/11/2014 15:40	SCRO	0.3	S	9.17	11.35	7.79	122	4	0.49	0.1	0.02		50	25		3.58	
5/7/2014 14:45	SCRO	0.3	S	18.76	9.64	7.76	121	8	0.57	0.2	0.03		100	25		6.37	
7/23/2014 17:45	SCRO	0.3	S	29.09	7.88	8.13	222	2	0.51	0.4	0.02		25	25		1.8	
9/25/2014 13:40	SCRO	0.3	S	21.29	10.13	8.28	226	1	0.56	0.3	0.04		25			2.22	
11/24/2014 14:10	SCRO	0.3	S	9.13	11.47	8	186	8	0.59	0.3	0.04		550			8.7	450
2/23/2015 9:30	SCRO	0.3	S	3.69	12.92	7.97	299	7	0.84	0.3	0.02	93	25		100	9.48	75
4/20/2015 9:45	SCRO	0.3	S	15.63	10.25	7.22	363	254	1.21	1.1	0.47	84	2000		800	222	2755
6/17/2015 13:00	SCRO	0.3	S	29.45	7.94	7.75	172	4	0.47	0.3	0.03	96	50		70	3.57	10

All state waters, including wetlands, are designated for the following uses: 1) recreation uses (e.g., swimming and boating); 2) the propagation and growth of a balance, indigenous population of aquatic life (including game fish) which might reasonably be expected to inhabit them; 3) wildlife; and 4) the production of edible and marketable natural resources (e.g., fish and shellfish). (Virginia Water Quality Standards; 9 VAC 25-260; January 2006.)

Applicant undertook a dissolved oxygen (DO) study during low flows and warm conditions in September 2016, pursuant to the Study Plan. The resource agencies concurred that because of the extensive data base that VDEQ has amassed, there was no need for collecting additional water quality data other than DO and water temperature. Applicant measured DO levels downstream from Reusens Dam to downstream of Scott's Mill Dam. Applicant then continuously recorded DO immediately upstream of the arch section of Scott's Mill dam to better understand diurnal DO patterns in the headpond. Applicant subsequently measured cross sectional and vertical DO profiles upstream of Scott's Mill Dam upstream of the warning buoys located upstream of Scott's Mill Dam. The data are presented on **Appendix E**.

Applicant collected the DO and temperature data from September 9 through 12, 2016 with day time temperatures in the range of 70-90 ^{0}F and no rain for the previous 4 to 5 days. Flow during this period varied between about 700 and 800 cfs. Data were collected using a YSI Pro ODO meter, which was calibrated to barometric pressure on September 9th according to YSI instructions. The September 9th river bank data and longer-term data (September 9 and 10) were from depths less than 0.5 meters. Applicant had intended to monitor DO to develop a longer continuous record, but battery life limited the data to 21 hours of continuous data collection.

The surface water temperature and DO in Reusens reservoir were higher than measurements in Scott's Mill headpond and downstream, possibly because water from Reusens is released from below the surface, resulting in slightly cooler water and lower DO in Scott's Mill. From upstream to downstream in the Scott's Mill headpond, DO was relatively constant at about 7.5 mg/l. Similarly, water temperatures varied between 28 and 30 ^{0}C. Downstream of Scott's Mill Dam, DO increased by about 0.5 mg/l to about 8 mg/l. This is likely due to the aeration from flow over Scott's Mill Dam and in the reach downstream.

Over the 24-hour period that DO was continuously measured immediately upstream of the arch section of Scott's Mill Dam, DO varied from a low of 6.6 mg/l at 3 am to a high of 9.0 mg/l at 9 am with an average of 7.6 mg/l over the period (**Table E-6-3**). Aquatic vegetation and algae may be partly responsible for the higher daytime DO levels.

TABLE E-6-3 WATER QUALITY AND TEMPERATURE DATA UPSTREAM OF SCOTT'S MILL DAM

50m u/s of Scott's Mill Dam arch section, 9/9/16-9/10/16, site 012, beginning at 16:24pm							
Meter time	**Actual time**	**DO (%)**	**DO (mg/L)**	**Temp (°C)**	**Pressure (mm Hg)**	**Depth (m)**	**Notes**
0:37	17:01	100.9	7.9	27.9	753.1	0.3	
1:37	18:01	99.6	7.8	27.9	752.9	0.3	6pm, 9/9/16
2:37	19:01	99.0	7.8	27.9	752.9	0.3	
3:37	20:01	96.5	7.6	27.8	752.8	0.3	8pm
4:37	21:01	95.1	7.5	27.8	753.2	0.3	
5:37	22:01	94.1	7.4	27.7	753.2	0.3	10pm
6:37	23:01	92.0	7.2	27.7	753.9	0.3	
7:37	0:01	89.8	7.1	27.6	754.3	0.3	12 midnight, 9/9/16
8:37	1:01	88.7	7.0	27.6	754.9	0.3	
9:37	2:01	86.0	6.8	27.6	755.5	0.3	2am, 9/10/16
10:37	3:01	**83.9**	**6.6**	27.5	755.9	0.3	
11:37	4:01	89.8	7.1	27.6	756.2	0.3	4am
12:37	5:01	91.8	7.2	27.8	756.1	0.3	
13:37	6:01	95.8	7.5	27.9	755.8	0.3	6am
14:37	7:01	97.5	7.6	28.0	755.6	0.3	
15:37	8:01	108.0	8.4	28.2	755.4	0.3	8am
16:37	9:01	114.9	9.0	28.2	755.0	0.3	
17:37	10:01	**113.2**	**8.8**	28.3	754.9	0.3	10am
18:37	11:01	109.2	8.5	28.1	755.2	0.3	
19:37	12:01	102.2	8.0	28.0	755.9	0.3	12 noon, 9/10/16
20:37	13:01	98.8	7.8	27.9	756.8	0.3	
21:37	14:01	95.3	7.5	27.8	757.3	0.3	2pm

The September 12, 2016 cross-section data (vertical depth data) were collected by trailing the meter cable/probe behind a canoe using 10 second logging intervals. Due to the forward movement of the canoe, the actual depths are slightly less than the noted cable lengths. This data was collected from the left bank to Daniel Island. The deepest measurements are generally within the first half of the data for each cross-section.

These data indicate that DO and water temperature were relatively constant across the river at each depth measured. DO near the surface was approximately 8.2 mg/l and water temperature was about 28 ^{0}C. DO and temperature were slightly lower on the left bank.

Four vertical profiles were measured, all in the main channel upstream of the straight section of Scott's Mill Dam. Profiles 1-2 were in the main channel, within 100 meters of the left river bank. Vertical Profile 3 was the deepest of the three. Vertical profile 4 was within 100 meters of Daniel Island.

The vertical profiles indicate a gradual decrease in temperature and DO with depth. The temperature range was generally between 1.2-2.0 C^{0}. The data indicate that there was little thermal stratification through the water column. This can be attributed to the short residence time of water in the headpond (i.e., less than one day). There was a general decrease in DO with depth, with the surface being about 8.5 mg/l and the bottom being about 6.8 mg/l.

Applicant collected and analyzed sediment data for the presence of low-level poly chlorinated biphenyls (PCBs) on November 16, 2016 on Daniel Island 250 feet upstream of the dam and in the James River 160 feet upstream of the dam. (Details of the data collection effort are described in Study Plan 4 and **Appendix F**.) The sediment analysis indicated that PCB concentrations varied between 9 and 422 pg/g (parts per trillion) on Daniel Island and 9-75 pg/g in the James River. These PCB levels are not a source of concern.

6.3.2.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.2.2.1 EXISTING STATE WATER QUALITY STANDARDS AND THE PROJECT'S EFFECTS ON WATER QUALITY.

The water quality in the Project area would likely remain within the State water quality criteria under the proposed operation and continue to follow a similar diurnal and seasonal trend as existing conditions. The proposed operations may have a small effect on DO and temperature.

During existing conditions with a flow of about 800 cfs, almost all flow passes over the main (straight section) of the spillway. During the September 2016 DO measurements, Applicant estimated that no more than 10 cfs flowed over the arch section of the spillway, whereas almost 800 cfs flowed over the main spillway. Using the weir equation, Applicant estimated that 7 cfs flowed over the arch section on September 12th given that the arch section crest is 0.4 feet higher than the main spillway section. Therefore, most of the flow passed downstream in the main section of the James River. During future project operations, Applicant estimates that about half the flow will pass downstream in the main section of the James River, approximately doubling the residence time from 1½ days to 3 days in this section of the James River. This could have the effect of slightly decreasing DO in this section of the James River. However, Applicant's measurements 50 meters upstream of the arch section of the dam where very little flow was coming from upstream showed DO levels varying from 6.63 mg/l to 8.96 mg/l, which were very similar to DO levels in the main portion of the river. Therefore, Applicant expects that DO (and water temperature) should not differ significantly from existing conditions during project operations.

However, Applicant proposes to monitor DO and water temperatures in the headpond upstream of the main spillway during low flow conditions during the first three years of operations and if DO falls below State water quality standards, Applicant will take steps to increase flow in the main channel area upstream of the Scott's Mill Dam by passing flow over the spillway as needed to meet water quality standards during low flow conditions.

Downstream of the main section of the spillway, DO could decrease by about 0.5 mg/l because of the reduced flows over the dam and associated reduction in reaeration. However, by directing flow from the powerhouse to the reach downstream of the main spillway section, Applicant intends to ensure state water quality standards are met downstream of the spillway. This should also preserve water quality for aquatic resources.

Construction of the powerhouse will require dredging of sediment upstream of Scott's Mill dam and excavation of rock downstream of the dam. Based on the results of the chemical analysis of sediment upstream of the dam, the sediments are not likely to be a source of elevated PCBs. To minimize dredging effects on turbidity and resuspension of sediments, Applicant will use best management practices. Accordingly, project effects on water quality should be localized and minor. Since Applicant intends to use modular (off-site) construction for the project to the extent possible to minimize costs, this should also result in minimizing the potential for water quality effects from spills.

Requirements of Section 401 Water Quality Certification. Section 401 of the Clean Water Act (CWA) provides that FERC may not issue an original license for a project unless the State certifies that the Project will comply with CWA

Sections 301, 302, 303, 306 and 307. These sections include State water quality standards approved by the U.S. Environmental Protection Agency (USEPA). Section 401 requires that any applicant for a Federal permit or license that may result in a discharge to waters of the United States must first obtain certification from the state. In Virginia, the agency authorized to issue Section 401 certifications is VDEQ. Applicant intends to file an application for Section 401 Water Quality Certification prior to filing the final license application to FERC.

Flow gaging and plans for monitoring water quality. Due to the run-of-river nature of the Project, the current flow gages are sufficient for operational purposes. Applicant proposes to monitor headpond levels through use of video cameras at the Scott's Mill Project. Because the VDEQ monitors water quality immediately downstream of the project, there is no need for Applicant to conduct additional water quality monitoring other than for the first three years after project completion in order to monitor temperature and DO.

Applicant will continue to utilize the USGS Holcomb Rock gauging station (USGS No. 02025500).

6.3.3 AQUATIC RESOURCES

6.3.3.1 AFFECTED ENVIRONMENT

6.3.3.1.1 CHARACTERIZATION OF FISH HABITAT IN THE JAMES RIVER BASIN

The James River is the largest river located entirely within Virginia, and the third largest tributary to the Chesapeake Bay. The James River originates in the Allegheny Mountains at the junction of the Jackson and Cowpasture Rivers near Clifton Forge, Virginia (**Figure A-1**). The river flows generally southeast, traversing the Blue Ridge Mountains, the Piedmont Plateau and finally the Coastal Plain where it discharges into Chesapeake Bay approximately 340 miles from its origin. The upper section is characterized by cool water with mainly swift boulder-filled rapids and pool/run complexes with gravel/cobble substrates (VDGIF 2015b). Within the project area, there is an array of habitat types, with areas of slow to moderate current and mixed substrate.

The Middle River, from Lynchburg downstream to Bosher Dam in Henrico, flows through the Piedmont Plateau. This section is the flattest portion of the non-tidal James, and is composed of mild to moderate rapids and long sandy runs (VDGIF 2015b). A fish passage facility has been in operation at Bosher Dam since 1999. Below the Middle River, the character of the river changes dramatically. The 9-mile stretch of the James River that flows through Richmond (known locally as the fall-line section) separates the non-tidal and tidal portions of the James River and contains various habitat types including rocky outcrops, large runs, deep pools, shallow riffles, and intense rapids (VDGIF 2015b).

There are 45 dams used for hydroelectric generation in the James River basin, about half of which occur in the lower portion of the river, while the other half are located in the upper 70-mile long section. There are approximately 80 miles separating the lower dams from the upper river dams. Anadromous fish are currently able to pass upstream only to Scott's Mill Dam (the first in a series of 7 dams between Lynchburg and Cushaw). None of the seven dams between currently provide fish passage. **Table E-6-4** identifies characteristics of the seven dams. Photos of the structures from Lynchburg to Cushaw are included in **Appendix C.**

TABLE E-6-4 STRUCTURAL COMPONENTS OF THE DAMS BETWEEN SCOTT'S MILL AND CUSHAW

	Scott's Mill	Reusens	Holcomb Rock	Coleman Falls	Big Island	Bedford	Cushaw
Approximate River Mile[1]	2600	264	272	274	278	281	282
Approximate Height (ft)	20	24	21	10-15	15	17	28
Length (ft)		416	644		657	1617	1550
Spillway Length (ft)		125.5	644		427	1617	1500
Approximate Angle of Face (degrees)	90	90	90	80	90	70-80	70-80
Construction Material	Concrete	Concrete with Flashboards[2]	Stone masonry / concrete	Concrete	Masonry and timber crib structure	Concrete	Concrete
Use	Drinking Water	Hydro	Hydro	Hydro	Hydro, water supply for mill	Hydro	Hydro
Average Eel CPUE[3]	D/S[4] 6.68 U/S[4] 7.02	U/S 0.25	Not a sample location	U/S 0.10	Not a sample location	Not a sample location	U/S 0.00

1) River mile is estimated based on the Cushaw location at RM 282.
2) Reusens Dam does not always have flow over the structure.
3) All CPUE's are calculated based on boat electrofishing conducted by VDGIF.
4) D/S = Downstream of dam; U/S = Upstream of dam.

Source: Dominion Virginia Power

6.3.3.1.2 JAMES RIVER RESIDENT AQUATIC SPECIES

The James River supports a variety of warmwater game and non-game fish and currently provides an excellent smallmouth bass fishery, with additional angling opportunities for muskellunge and catfish. Muskellunge are annually stocked in the James River. Smallmouth bass are the dominant game species, but spotted and largemouth bass can also be caught. Other plentiful species in the James River include Channel Catfish, Flathead Catfish, and various sunfish species (redbreast, bluegill, and rock bass). The James River also supports many nongame species including telescope shiner, spottail shiner, rosyface shiner and stripeback darter (endemic to the James River). Invertebrates potentially inhabiting the project area include the James spiny-mussel (described in the Threatened and Endangered Species section). A list of aquatic species confirmed by VDGIF to occur in the James River upstream of Scott's Mill (Snowden Pool) and downstream (Middle River) is presented in **Table E-6-5**.

Below Scott's Mill Dam, the Middle River is characterized by higher ictalurid (catfish) abundance, migratory species (American Eel and Gizzard Shad), and centrachids more common to low gradient habitats (Largemouth and Spotted Bass). Flathead and Channel Catfish abundance peaks in the Middle River section while Blue Catfish abundance is greatest in the Lower River.

TABLE E-6-5: LIST OF FISH SPECIES DOCUMENTED IN JAMES RIVER BASIN

Common Name	Scientific Name	Snowden Pool[a]	Middle River[b]
Bass, Largemouth	Micropterus salmoides	X	X
Bass, Rock	Ambloplites rupestris	X	X
Bass, Smallmouth	Micropterus dolomieu	X	X
Bass, Spotted	Micropterus punctulatus	X	X
Bluegill	Lepomis macrochirus	X	
Bullhead, Brown	Ameiurus nebulosus	X	
Bullhead, Yellow	Ameiurus natalis	X	
Common Carp	Cyprinus carpio	X	X
Catfish, Blue	Ictalurus furcatus		X
Catfish, Channel	Ictalurus punctatus	X	X
Catfish, Flathead	Pylodictis olivaris	X	X

Catfish, White	Ameiurus catus		
Chub, Bluehead	Nocomis leptocephalus	X	
Chub, Bull	Nocomis raneyi	X	X
Chub, Creek	Semotilus atromaculatus		
Chub, River	Nocomis micropogon		
Chubsucker, Creek	Erimyzon oblongus	X	
Crappie, Black	Pomoxis nigromaculatus	X	X
Dace, Blacknose	Rhinichthys atratulus		
Dace, Longnose	Rhinichthys cataractae		
Dace, Mountain Redbelly	Phoxinus oreas		
Dace, Rosyside	Clinostomus funduloides		
Darter, fantail	Etheostoma flabellare		
Darter, glassy	Etheostoma vitreum		
Darter, johnny	Etheostoma nigrum		
Darter, longfin	Etheostoma longimanum		
Darter, Roanoke	Percina roanoka	X	
Darter, Shield	Percina peltate		X
Darter, Stripeback	Percina notogramma	X	
Darter, tessellated	Etheostoma olmstedi		
Eel, American	Anguilla rostrate		X
Fallfish	Semotilus corporalis	X	
Gar, Longnose	Lepisosteus osseus		X
Goldfish	Carassius auratus		X
Hogsucker, Northern	Hypentelium nigricans	X	X
Jumprock, Black	Moxostoma cervinum	X	X
Lamprey, Sea	Petromyzon marinus		
Madtom, margined	Noturus insignis		
Minnow, Bluntnose	Pimephales notatus	X	

Minnow, Cutlips	Exoglossum maxillingua		
Muskellunge	Esox masquinongy	X	
Perch, Pirate	Aphredoderus sayanus sayanus		
Pumpkinseed	Lepomis gibbosus	X	
Quillback	Carpiodes cyprinus		X
Redhorse, Golden	Moxostoma erythrurum	X	
Redhorse, Shorthead	Moxostoma macrolepidotum	X	X
Sculpin, Mottled	Cottus bairdi		
Shad, American	Alosa sapidissima		
Shad, Gizzard	Dorosoma cepedianum		X
Shiner, Comely	Notropis amoenus	X	
Shiner, Common	Luxilus cornutus	X	
Shiner, Crescent	Luxilus cerasinus	X	
Shiner, Golden	Notemigonus crysoleucas	X	
Shiner, Mimic	Notropis volucellus	X	
Shiner, Rosefin	Lythrurus umbratilis	X	
Shiner, Rosyface	Notropis rubellus	X	
Shiner, Roughhead	Notropis semperasper	X	
Shiner, Satinfin	Cyprinella analostana	X	
Shiner, Spottail	Notropis hudsonius	X	
Shiner, Swallowtail	Notropis procne	X	
Shiner, Telescope	Notropis telescopus	X	
Stoneroller, Central	Campostoma anomalum	X	
Sucker, Torrent	Moxostoma rhothoecum		
Sucker, White	Catostomus commersonii	X	X
Sunfish, Green	Lepomis cyanellus	X	X
Sunfish, Hybrid	Lepomis sp	X	
Sunfish, Redbreast	Lepomis auritus	X	X

Sunfish, Redear	Lepomis microlophus	X	X
Trout, Brook	Salvelinus fontinalis		
Trout, Rainbow	Onchorhynchus mykiss		
Warmouth	Lepomis gulosus		

Source:

a: Snowden Pool sampling from 1991 through 2001, no sampling occurred in 1996 (Dominion 2003)

b: Middle James River between Columbia and Watkins Landing, October 2011 (VDGIF 2012)

The following paragraphs describe the key resident fish species found near Scott's Mill.

Muskellunge: Muskellunge (*Esox masquinongy*) are not native to Virginia rivers. They were first introduced in the 1960's, and have been stocked regularly since because of their high value as sport fish. Density of populations is dependent upon prey abundance, as well as stocking abundance. Muskellunges are voracious feeders, eating microcrustaceans and insect larvae as fry, switching to small fish as juveniles, and eating nearly anything as adults, including fish, amphibians, crustaceans, and even mammals and birds. If prey of suitable size is not available to adults, the population will be affected, even if the small fish are abundant (Cook and Solomon 1987, Jenkins and Burkhead 1993).

Muskellunge typically live 6-8 years (females typically outlive the males), but can live much longer. Sexual maturity is reached around 3-5 years, with males reaching sexual maturity before females. Spawning takes place in the spring, typically from April to June. Water temperatures near 13ºC are optimal, but spawning will take place at temperatures between 9.5 and 15.5ºC. A decrease in water temperature or an increase in flows can disrupt spawning and reduce reproductive success. Muskellunge spawn in shallow water, usually over detritus or living vegetation. Spawning takes place both during the day and night. They are broadcast spawners, and the eggs settle down to the substrate, and hatching takes place in 7 to 14 days (Cook and Solomon 1987, Jenkins and Burkhead 1993, Butler 2004).

Muskellunges are solitary fish, growing to very large sizes (up to 1,000 mm), and establish a home range in summer and winter. During the spawning season, however, the home range breaks down. Their preferred habitat is clear waters with temperatures between 17 and 25º C, streams with aquatic vegetation and submerged structures (Cook and Solomon 1987).

Smallmouth Bass: Smallmouth bass (*Micropterus dolomieu*) were introduced into the James River in the early 1800's, and have become a valuable sport fish in the watershed. They live in both cool and warm water environments, generally in large creeks or rivers greater than 10.5 m wide with clear water, gravelly or rocky substrates, and plenty of shade and cover. They also prefer systems with a frequent succession of riffles, runs and pools, though they mostly inhabit runs and pools. They are often the dominant species when occupying reservoirs and impounded streams. During winter, smallmouth bass occupy deep pool habitat (Edwards et al. 1983; Jenkins and Burkhead 1993).

Smallmouth bass exhibit strong cover-seeking behavior, preferring protection from sunlight during all life stages. They will use deep water, boulders, submerged woody debris, rootwads and crevices, without preference for any specific cover type. They can tolerate periodic bursts of increased turbidity, but will show a reduction in survival in areas with prolonged turbidity (Edwards et al. 1983; Jenkins and Burkhead 1993).

Smallmouth bass at all life stages are carnivorous, feeding on microcrustaceans, insects and small fish while fingerlings, and moving up to crayfish and larger fishes as adults.

Smallmouth bass typically live up to 7 years, and reach sexual maturity in 3-4 years. Spawning takes place in late April through May when water temperatures are between 16 and 22º C. Nests are defended by the males until several days following hatching (Edwards et al. 1983; Jenkins and Burkhead 1993).

Rock bass: Rock bass (*Ambloplites rupestris*) are found in streams with permanent flow, low turbidity, abundant cover and silt-free bottoms. They may occupy pools and backwaters. The rock bass is considered to be a sedentary and secretive fish spending much of its time passively hiding near underwater structures (http://www.rook.org/earl/bwca/nature/fish/ambloplites.html). They can change color very quickly to match their surroundings. Feeding occurs mainly at night with aquatic insects making up the bulk of the diet but they will also eat fish and crayfish (Jenkins and Burkhead 1993, http://dnr.state.il.us/lands/education/fish/sunfish.htm).

Sexual maturity is reached by age 3, and most do not live past 6 years. Spawning typically occurs between April to July when water temperatures are between 15.6 and 22º C. Eggs are released into a saucer-shaped nest fanned out by the male in course sand or fine gravel. The rock bass nests individually, and the male remains with the nest until the fry have dispersed. After hatching, the young fish are found only in quiet water areas protected from waves and strong currents (Jenkins and Burkhead 1993, http://dnr.state.il.us/lands/education/fish/sunfish.htm; http://www.rook.org/earl/bwca/nature/fish/ambloplites.html).

Redbreast sunfish: Redbreast sunfish (*Lepomis auritus*) are native to Virginia and the James River watershed and are a popular sportfish. The redbreast sunfish lives in small creeks to big rivers and reservoirs. They can tolerate silted, turbid water, but prefer warm, clear water. They prefer the same habitat as smallmouth bass and rock bass, and are often found in the larger rivers with them, but they also frequent the shallower water. They can be found in waters as warm as

39º C (Aho et al. 1986, Jenkins and Burkhead 1993; http://sites.state.pa.us/PA_Exec/Fish_Boat/pafish/fishhtms/chap22.htm).

Redbreast sunfish are generalists, feeding on aquatic and terrestrial insects, crayfish and other arthropods, mollusks, and sometimes fishes. Although widespread, redbreast sunfish are not as locally abundant as other sunfishes, and they are normally solitary when the water is warm. When the water cools, redbreasts form schools (Aho et al. 1986; Jenkins and Burkhead 1993, http://sites.state.pa.us/PA_Exec/Fish_Boat/pafish/fishhtms/chap22.htm).

Sexual maturity is reached by 2 years, and the life span is typically 4-5 years, though they can live up to 8 years. Spawning takes place in May through July with water temperatures between 16-28º C. Male redbreast sunfish construct a shallow nest in fine gravel or sand. They construct a single nest, but the nests may be grouped in closely packed colonies, when appropriate bottom material is in short supply. They guard the eggs and protect the young for a short while after the eggs hatch (Aho et al. 1986; Jenkins and Burkhead 1993; http://sites.state.pa.us/PA_Exec/Fish_Boat/pafish/fishhtms/chap22.htm).

Bluegill: Bluegill (*Lepomis macrochirus*) are native fish in the James River drainage, and are also considered a valuable sport fish in the system. Bluegill occupy areas of low velocity, including pools, backwater areas, lakes, reservoirs and ponds. They can be found in both clear and turbid waters, systems with hard or silted substrates, and in areas with submerged cover structures, such as boulders, woody debris or brush. Bluegill will use deep pools in the winter and summer. Optimal water temperatures for growth of adults, hatching, fry rearing, and juvenile rearing occurs at 27º C, 22-34º C, 25-32º C, and 22-34º C respectively (Stuber et al. 1982; Jenkins and Burkhead 1993).

Opportunistic feeders, bluegill will alter their diet based on available food. Fry feed on zooplankton and small insects. Adults and juveniles feed also on zooplankton and larger insects and on plant material (Stuber et al. 1982; Jenkins and Burkhead 1993).

Bluegill reach sexual maturity in 1-2 years, with most individuals living 4-6 years, but as long as 11 years. Spawning takes place from May to August or even September. Males construct nests in shallow water on sand or smaller gravel and will guard the nests. Hatching takes place 1-5 days following spawning (Stuber et al. 1982; Jenkins and Burkhead 1993).

Spottail shiner: The spottail shiner (*Notropis hudsonius*) is native to the James River. They inhabit creeks and small to large rivers. They live in rocky systems with clear water or turbid waters with sand and silt bottoms. They occupy pools, backwaters, runs and sometimes riffles. Spottail shiner feed mostly on microcrustaceans, terrestrial and aquatic invertebrates, fish eggs and plant material. They, like many in the minnow family, provide a primary food source for larger predatory fish (Jenkins and Burkhead 1993; http://lanier.sam.usace.army.mil/fishing/Spottail_Shiner.htm).

They reach sexual maturity by age 1 or 2, and live up to 5 years. Spawning depends upon water temperature, but typically occurs during mid-April to mid-June. Spottail shiner spawn in groups, either few individuals to large aggregates. Following spawning, eggs have been found attached to sand and gravel in shallow riffles (Jenkins and Burkhead 1993).

Stripeback darter: Stripeback darter (*Percina notogramma*) is endemic to the Atlantic slope from the Patuxent drainage in Maryland to the James River drainage of Virginia and West Virginia. There are two subspecies of stripeback darters; P. n. montuosa is endemic to the upper and middle James River drainage. They occupy warm, moderate-gradient streams and rivers with mostly clear water. Their preferred habitats are riffles, pools near riffles and sometimes weedbeds. They are often found among gravel, cobble and boulder substrates that were clean, silted or cloaked with detritus. Stripeback darter feeds on insects and other invertebrates (Jenkins and Burkhead 1993).

The life span of the stripeback darter is approximately 3 years. Females and males grow at similar rates. Sexual maturity is reached by year 2, and spawning occurs March to mid-May in water 7-16° C. Spawning probably occurs over gravel riffles. Fecundity is unknown. Stripeback darter naturally hybridize with the shield darter (P. peltata). (http://www.cnr.vt.edu/efish/families/stripeback.html; Jenkins and Burkhead 1993).

6.3.3.1.3 DIADROMOUS FISH SPECIES

Several diadromous fish species including American Shad, Alewife, Blueback Herring, Striped Bass, Sea Lamprey and American Eel occur in the James River. They are discussed below.

American Shad: American Shad are anadromous fish that spend the majority of their life at sea and only enter freshwater to spawn. Shad are river-specific; each major river along the Atlantic coast appears to have a discrete spawning stock.

Mixed stocks of American Shad enter the lower Chesapeake Bay in late winter-early spring and segregate into river-specific populations (ASMFC 2007). Most adults spawn once and die, repeat spawning does occur, the incidence of which increases with increasing latitude (NMFS 1999).

American Shad spawn in freshwater portions of the rivers, usually beginning in March and ending in June with peaks in April, by broadcasting a large quantity of eggs into the water column. The annual spawning run consists of virgin fish 3 to 7 years in age (based on analysis of scales) plus repeat spawners (age-4 through age-12). American Shad age-9 and older are rare; maximum age recorded is 12 years.

Fertilized eggs are carried by river currents and hatch within 2-17 days depending on water temperatures (NMFS 1999). Larvae drift with the current until they mature into juveniles. Juveniles remain in nursery areas, feeding on copepods, other crustaceans, zooplankton, chironomid larvae, and aquatic and terrestrial insects (NMFS 1999). By late fall, most juvenile shad migrate to nearshore coastal wintering areas. Immature shad will remain in the ocean for three to six years before returning to spawn. Little information is available on the life history of subadult and adult American Shad after they emigrate to the sea. American Shad is a highly migratory, schooling species. After spawning, iteroparous adult American Shad return to the sea and migrate northward to their summer feeding grounds in the Gulf of Maine/Bay of Fundy where they primarily feed on zooplankton and small fishes. Overwintering (winter habitat) occurs along the mid-Atlantic coast, particularly from Maryland to North Carolina (NMFS 1999). American Shad follow fairly specific temperature windows of 3 to 15ºC during their migration at sea (ASMFC 2007).

As an anadromous fish, American Shad are negatively impacted by obstructions to migration from marine and estuarine habitats to the upstream freshwater spawning and rearing habitats. Habitat degradation, water withdrawals and pollution, overfishing and dams that block migration to spawning grounds have contributed to the decline of the American Shad (Hilton et al. 2014).

In response to the declining populations, members of the ASMFC recommended the preparation of a cooperative Interstate Fishery Management Plan (FMP) for American Shad and River Herring, which was adopted in 1985. The FMP recommended management measures, focused primarily on regulating exploitation and enhancing stock restoration efforts. The FMP was amended and approved in 1999. The goal of Amendment 1 is to protect, enhance, and restore East Coast migratory spawning stock of American Shad, hickory shad, and river herring (Alewife and Blueback Herring collectively) in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. In the James River, the sampling program was to address: annual spawning stock survey and representative sampling for biological data; calculation of mortality and/or survival estimates; juvenile abundance surveys; hatchery evaluation; and monitoring of recreational landings, catch and effort every 5 years. In 2010, the Shad and River Herring Management Board approved Amendment 3, addressing American Shad management (ASMFC 2010). As a requirement of Amendment 3, biologists from Virginia Institute of Marine Science, Virginia Marine Resources Commission (VMRC), and VDGIF collaboratively developed the American Shad Habitat Plan for the Commonwealth of Virginia (Hilton et al. 2014).

Shad have historically ascended farther upriver than at present within tributaries that are obstructed. Construction of the Bosher Dam fishway, functional beginning in 1999, was intended to restore migration to these historic habitats. The goal for the Upper James River is to restore 500,000 shad passing Bosher Dam annually and 34.66 catch-per-unit-effort in the Lower River (Chesapeake Bay Program 2014). The Lower James River target is based on shad abundance levels during the 1950s and the Upper James River target is based on the number of shad that can be supported by the 137 miles (or 11,930 acres) of habitat available above the Bosher Dam fishway.

Between 2000 and 2014, abundance of American Shad in the James River has hovered around 10 percent of the target, with peaks of 14 percent in 2003 and 2011 and a low of 2 percent in 2006 (Chesapeake Bay Program 2014). Abundance estimates for the James are a weighted combination of data collected in the upper and lower portions of the river. In the Upper[2] James, abundance has remained minimal at less than 1 percent of the target. The range of shad passing Bosher Dam over this period was 24-669 annually, with an average of 217 fish. In the Lower James, abundance has fluctuated between 4 and 27 percent of the target. Between 2013 and 2014, abundance rose from 7 to 12 percent of the target. In the Upper James, abundance remained minimal at less than 1 percent of the target (from 192 to 24 shad passing Bosher Dam). In the Lower James, abundance rose from 13 to 21 percent of the target (4.5 to 7.4 CPUE) (Chesapeake Bay Program 2014).

The Virginia Marine Resources Commission imposed a moratorium on the taking of American Shad in Virginia rivers and the Chesapeake Bay in 1994 in response to sharp declines in commercial landings (Hilton et al. 2013). The ocean-intercept fishery in Virginia coastal waters was closed in December 2004 (ASMFC 2007). Drift-net fishing by two Native American tribal governments and the taking of brood stock by the Virginia Department of Game and Inland Fisheries on the spawning grounds of the York River system for stock restoration in the James River are permitted. An active catch and release recreational fishery exists on the James River.

[2] In this context the Upper James River is above Bosher’s dam.

In spring 1994, the VDGIF and the USFWS began hatchery-restocking efforts in the James and Pamunkey rivers. Adult shad from the Pamunkey River are used as brood stock for the James River releases. The success of the restoration program in the James River was evidenced by increasing adult catch rates by monitoring gear in 1998 through 2002 as large numbers of mature hatchery fish returned to the spawning grounds.

In the James River, juvenile abundance indices (JAI) show a period of relatively high values in early 1980s, a low period from the mid-1980s to the mid-1990s, and then occasional high values until 2005 when all Lower Chesapeake Bay River indices declined (ASMFC 2007). The James River JAI time series displays no measurable recruitment in most years with only 5 non-zero years since 1980. There has been a significant increase in staked gill net CPUE on the James River since the 1980s while there has been no trend in fishery-independent electrofishing or gill-net survey indices on the James River over the same time (ASMFC 2007).

A comparison of the historical and current catch indices indicates that the James River stock has not recovered from the severe declines in the 1980s and early 1990s. Although densities of larval shad are often high on the spawning grounds, there is little evidence of recruitment success on the James River, and the stock is dependent on hatchery inputs (ASMFC 2007). In 2012, 34% of the James River returns were composed of hatchery fish (Hilton et al. 2014).

The American Shad habitat plan (Hilton et al. 2014) identifies the need for further study of freshwater habitat use by American Shad in Virginia, specifically, quantification and analysis of specific reaches of riverine habitats used during residency (adults during the spawning run, larvae, and juveniles) to better manage and address habitat concerns of the species.

Recently, the Commonwealth of Virginia announced that it was halting the shad stocking program in the James River, because there were only limited signs of recovery (Karl Blankenship, Bay Journal, September 17, 2017), and the amount of money spent on shad fry stocking was not justified. It was originally thought that opening up the James River and placing a fishing moratorium on American Shad would trigger a restoration, but unfortunately the long-term average was only about 200 returning adults annually through the fall zone up to and through the fishway.

In a September 29, 2017 conference call with VDGIF and the USFWS, those agencies noted that passage of American Shad at Scott’s Mill may not be required for some time. However, the agency staff also said that restoration of American Shad in the James River is a matter of time.

The Bay Journal article stated that the Virginia Institute of Marine Science (VIMS) catch index, which is downriver of Richmond, has also been well below targets. There is no total American Shad annual population estimate for the James River, only indices of abundance from the fishway count and the VIMS catch index. There is spawning habitat on the James in the fall zone below Bosher's fishway and in several tidal miles downstream of Richmond. The total number returning to the James River annually is a much higher number than at the Bosher fishway. The Bosher count is only providing information on the numbers of Shad moving into the middle James beyond Richmond, not the number of Shad in the entire James River. While there is spawning habitat available downstream of Bosher Dam, access to all historical spawning and rearing habitat is considered to be a necessary part of **fully** restoring the James River American Shad population.

River Herring: The anadromous river herring (Alewife and Blueback Herring) spawn in the spring in rivers from Florida through Maine and up into Canada. The newly spawned fish migrate out of the rivers into the ocean in the fall, where they spend the next three to five years of their life (ASMFC 2012b). When they are sexually mature, they return to the river where they were born to spawn. Unlike salmon, river herring do not all die after spawning and may return to spawn several times over the course of their lives. The oldest observed ages for river herring are 14 years for Alewife and 11 for Blueback Herring, but the oldest fish seen in rivers today are six to eight years old (ASMFC 2012b).

The Fishery Management Plan (FMP) for Shad and River Herring was developed by the ASMFC in 1985. In 1994, the Shad and River Herring Management Board determined that the FMP was no longer adequate for protecting or restoring the remaining shad and river herring stocks (ASMFC 2012b). Amendment 1 recommended fishery-dependent and independent monitoring programs in order to improve stock assessment capabilities (ASMFC 2012b). In 2009, the Shad and River Herring Management Board approved Amendment 2, which strengthened river herring management by prohibiting state waters commercial and recreational fisheries beginning January 1, 2012, unless a state or jurisdiction has a sustainable management plan reviewed by the Technical Committee and approved by the Management Board (ASMFC 2012b). Amendment 2 required states to implement fisheries-dependent and independent monitoring programs, and contains recommendations to member states and jurisdictions to conserve, restore, and protect critical river herring habitat. As of January 1, 2012, the Shad and River Herring Management Board approved sustainable fishery management plans for Maine, New Hampshire, New York, North Carolina and South Carolina.

In 2011, the Natural Resources Defense Council petitioned NOAA Fisheries to list river herring on the endangered species list throughout all or part of the species range; NOAA Fisheries conducted a status review and found that the listing was not warranted in 2013. In May 2015, the Commission and NOAA Fisheries released the River Herring Conservation Plan (http://www.greateratlantic.fisheries.noaa.gov/protected/riverherring/conserv/index.html), with the goals of increasing public awareness about river herring (Alewife and Blueback Herring), and fostering cooperative research and conservation efforts to restore river herring along the Atlantic coast.

ASMFC completed a benchmark stock assessment of river herring in 2012. For many rivers, data were inadequate to conduct a model-based stock assessment. Estimates of abundance and fishing mortality could not be developed because of the lack of adequate data (ASMFC 2012b). Trend analysis was used to identify patterns in the available fishery-dependent and -independent data sets. James River data was inadequate to develop a stock status. However, of the 52 stocks of Alewife and Blueback Herring for which data were available, 23 were depleted relative to historic levels, one stock was increasing, and the status of 28 stocks could not be determined because the time-series of available data was too short (ASMFC 2012b).

Since the mid-1990s, commercial CPUE indices for alewives showed declining trends in the James River. The juvenile-adult indices from fisheries-independent seine, gillnet and electrofishing surveys showed a stable or increasing trend for Alewife and Blueback Herring in the James River. VDGIF has conducted annual electrofishing surveys; between 2002 and 2010, compared to alewives (<0.2 fish per minute), Blueback Herring (0.4-2 fish per minute) have dominated the catch (ASMFC 2012b). There are no obvious trends in the JAI time series for either of the species, and variability about the annual estimates has been fairly high.

American Eel: The American Eel (*Anguilla rostrata*) historically migrated throughout the James River watershed. However, the introductions of dams and passage barriers have reduced their use of the James River. The current stock status of the American Eel is classified as *depleted* (ASMFC 2012a). Resource agencies have a goal to restore American Eel to their historic habitat.

The American Eel is a catadromous species, which means it spawns in the ocean, but spends most of its time rearing in the estuarine or fresh waters. Typically, those individuals that occupy more northern habitats tend to migrate later, grow larger and older, and therefore, females from the northern regions of their range, typically have a higher fecundity.

After spawning, adults die, and eggs and leptocephali (larvae) are transported by the prevailing currents along coastal areas. Glass eels (metamorphosed leptocephali) are transparent eel ranging in size from 5 – 10 cm. They actively migrate towards land where they begin their ascension into estuaries and rivers during the winter and spring. Migration typically occurs at night and is related to reaching a minimum threshold temperature in rivers (usually 10 to 12 degrees Celsius), and the occurrence of a full or new moon and freshets (ASMFC 2012a).

Once the glass eel has entered brackish or freshwater, they transform again, become pigmented, and are then called elvers. Elvers are active at night but burrow in the substrate during daylight. Upstream migration of elvers occurs over a broad space of time, between May and October. It is assumed that they move upstream resulting from a change in water chemistry and water current velocities. Growth is slow and highly variable.

The last juvenile stage of the American eel is known as the yellow eel. These juveniles resemble adults, but are typically yellow or green in color. Sizes range up to 28 cm for males and 46 cm for females, and are up to 2 years of age. Yellow eels live in bays, estuaries, rivers, streams, lakes and ponds, feeding mostly on invertebrates and small fish. Migration up into the watershed takes place from March through October, and may continue until sexual maturity is achieved. Maturation in the Chesapeake Bay Region is 8 to 24 years. Upstream migration typically occurs in the glass eel and elver stage, but yellow American Eels sometimes continue upstream migrations.

Downstream migration triggers transformation into the adult phase (silver eel), which includes several physiological changes, including 1) a color change from yellow/green to a metallic bronze-black sheen, 2) body fattening, 3) skin thickening, 4) enlargement of the eye and change in visual pigment, 5) increased length of capillaries in the rete of the swim bladder, and 6) digestive tract degeneration.

Silver eels can make long migrations in a short period of time (as much as 38 km in 40 hours), but show no behavioral change with diel or tidal cycles. During downstream river migration, silver eels typically move at night during the darker moon phases, high water flows, and decreasing water temperatures (ASMFC 2012a). There is little information about the ocean spawning migration or how they orient to the Sargasso Sea. There is no information on the spawning requirements behaviors, or even the exact location of spawning.

Eels were formerly extremely abundant in inland waters of eastern North America, colonizing lakes, rivers, streams, and estuaries. The current depletion of the American Eel is in part due to fishing that occurred in the 1970s into the 1980s as export demand rose. A suite of stressors including habitat loss from dams or urbanization, turbine mortality, the non-native swim bladder parasitic nematode *Anguillicolla crassus*, toxic pollutants, and climate change are all factors that act in concert with fishing mortality on American Eel (ASMFC 2012a).

A. crassus may be reducing American Eel survival during the yellow and silver eel life stages. The nematode prefers freshwater but can survive brackish or salt water. Chesapeake Bay infection rates were between 10% and 29% in the late

1990s and had increased to between 13% and 82% by 1998 to 1999 (ASMFC 2012a). In 2007, infection rate in James River eels was 17.8% (ASMFC 2012a).

With the implementation of the ASMFC Interstate Fishery Management Plan for American Eel in 2001 (ASMFC 2000), Virginia among other states implemented a six-inch minimum size limit for American Eels; currently, there is no silver eel fishery in Virginia. Catch rates were calculated for the James River commercial eel pot fishery from data associated with positive effort by dividing the amount of harvest of American Eels landed by the number of eel pots. Annual catch rates were variable between 1994 and 2009, ranging from approximately 1.2 to 4.5 pounds per number of pots; catch rates demonstrated a decline during the mid- to late 1990s with the peak catch rate occurring in 2002. While not a target of recreational fishing, data has indicated a significant decline in American Eel as bycatch in the mid-Atlantic region since the 1980s.

Under the FMP for American Eel, Virginia is required to conduct an annual young-of-year (YOY) abundance survey (ASMFC 2000). Accordingly, sampling for young-of-year has occurred at Wareham's Pond on the lower James River since 2003 following the standard protocol approved by the ASMFC American Eel Technical Committee (ASMFC 2012a). However, annual recruitment indices have not been computed (ASMFC 2012a). VDGIF and USFS have also conducted investigations of eel movement in the Tye River between 1999 and 2001 (Strickland 2002).

Sea Lamprey: Sea Lamprey (*Petromyzon marinus*) are among the 20 species of fish passed at Bosher Dam. Adults can reach up to 120 cm in length and weigh up to 5 pounds. Sea Lamprey migrate up rivers to spawn. After several years in freshwater habitats, the larvae undergo a metamorphosis that allows young lampreys to migrate to the ocean. Resource agencies have noted the need for passage of Sea Lamprey (see **Appendix A**, September 29, 2017 teleconference notes in consultation record).

6.3.3.1.4 VDGIF ANNUAL FIELD SURVEYS

The VDGIF conducts annual surveys of fish resources in the upper James River, primarily targeting smallmouth bass. Results of electrofishing surveys conducted above and below the Scott's Mill Dam are available from 1991 through 2015. Smallmouth bass, telescope shiner, bluntnose minnow, rock bass, bluegill and redbreast sunfish were caught in every year sampled and were generally among the most abundant species.

During boat electrofishing conducted in September and October of 2014, a total of 48 species were documented at 27 sample sites located between river kilometer

(RKM) 168 and RKM 555[3] (VDGIF 2015a). The five most numerous species collected were Smallmouth Bass, Rock Bass, American Eel, Redbreast Sunfish, and Bull Chub, comprising 25.5, 12.8, 11.0, 6.7, and 6.2 percent of the total catch, respectively (VDGIF 2015a).

During the VDGIF fall 2014 sampling in the Upper River, 905 smallmouth bass were collected ranging from 3 to 22 inches (VDGIF 2015b). Approximately 51 percent of all smallmouth bass were juvenile smallmouth bass (less than 7 inches). Conversely, adult abundance was considerably low, likely still recovering from several years of poor recruitment. The majority of the adult smallmouth bass collected in the Upper River were between 7-14 inches and only 36 individuals greater than 14 inches were collected (VDGIF 2015b). Results for the Middle River were similar.

In recent years, recruitment has been poor throughout the river due to low spring and summer flow conditions (VDGIF 2012). However, 2014 flow conditions were ideal for young-of-year bass survival; the second highest CPUE of age zero fish since 1991 was documented during VDGIF fall 2014 sampling (VDGIF 2015a).

Analysis of the 2014 data indicated no significant trend in diversity by RKM; all sites were essentially equal in diversity score with the exception of one site that is possibly influenced by the Tye River (VDGIF 2015a). However, there was a significant difference in the fish assemblage between the Upper River (Eagle Rock to Lynchburg) and the middle and lower portion of the river. The difference in fish assemblages is most likely due to the seven dams between Buchanan and Lynchburg, impeding movement of migratory species, and a change in river morphology below Lynchburg associated with a change in physiographic province.

In October 2011, VDGIF sampled the fish community in the Middle James River at six locations between Columbia and Watkins Landings (VDGIF 2012). Twenty-three species were collected. American Eel was the most abundant species collected, followed by smallmouth bass, sunfish and Channel Catfish. Smallmouth bass were present at all six sampling sites. Redbreast Sunfish and Bluegill comprised the bulk (88%) of sunfish collected. Flathead Catfish were also found in the Middle River, but not nearly as abundant as Channel Catfish. Largemouth Bass were fairly uncommon throughout the Middle James River, and when collected largemouth bass were generally small (<12 inches) (VDGIF 2012).

The VDGIF records include capture of small numbers of American Eel in the reach between Lynchburg and Cushaw Dam. The average electrofishing CPUE

[3] This reach includes the Scott's Mill dam at approximately RKM 416.

(catchper-unit-effort) obtained by VDGIF for sample sites downstream of Reusens Dam was around 7 eels/hour, while the CPUE upstream of Reusens averaged less than 1 eel/hour (see **Table E-6-4**). VDGIF captured only one individual upstream of Big Island (in the 2005 fall sample) (Scott Smith, personal communication).

For its Cushaw relicensing effort, Dominion Generation conducted a field effort directed towards examining the presence of American eels in the vicinity of Cushaw Dam. The effort was developed in consultation with the USFWS, and the VDGIF. A total of 31 eels were collected over 3,881.1 hours of eel pot fishing - 26 eels were collected at Lynchburg downstream of Scott's Mill Dam, five were collected at Bedford downstream of Cushaw Dam, and no eels were captured upstream of the Cushaw Dam (Cushaw Application for FERC License, Dominion 2006). All eels captured in the eel pots were examined in the laboratory for the swim bladder parasite *Anguillicola crassus*. Seven of the 26 eels collected at Lynchburg (27%) were infested with *A. crassus,* with a maximum of 7 nematodes found in one 435 mm eel. No *A. crassus* were found in the eels from the Bedford pool.

6.3.3.1.5 DISEASE

Chronic spring-time fish mortality and disease events have occurred in the Upper James River from 2007-2010 (VDGIF 2014). These episodes have not been uniform in location or severity and have not occurred every year. These events have been less common since 2010. In 2014, mortality was low in the James River; angler reports of dead or diseased fish were almost non-existent. Adult smallmouth bass, redbreast sunfish and rock bass have been the primary fish affected, but several other species have also been inflicted. Affected fish typically exhibit open sores or lesions on the sides of their bodies while some dead and dying fish have no visible external abnormalities. Other external symptoms include: dark patches of skin, raised bumps, loss of scales, split or eroded fins, and discolored/eroded gills (VDGIF 2010).

The cause of these mortality/disease events has not been determined (VDGIF 2014). Scientists have and continue to conduct in-depth studies on fish health, pathogens, water quality, contaminant exposure and recently have begun looking at possible toxins released by bacteria. The fact that these events have occurred in multiple watersheds that differ in many ways has added to the complexity of understanding the primary cause.

6.3.3.1.6 RECREATIONAL FISHERY

The James River is an important regional recreational fishery. Angling pressure on the James River is exceptionally high. VDGIF conducted an angler survey of the Upper James River in summer and early fall of 2000 (Dominion 2003).

Approximately 78 percent of the anglers surveyed were targeting smallmouth bass, 16.5 percent expressed no species preference but were generally fishing for smallmouth bass, 4.0 percent were targeting muskellunge, and 1.0 percent flathead or Channel Catfish. Smallmouth bass constituted 82.3 percent of all fish caught, while rock bass accounted for 10.4 percent and sunfish 6.7 percent (Dominion 2003). All other species contributed less than 1 percent of the total estimated catch. Approximately ten percent of all smallmouth bass caught by anglers were greater than 14 inches in length, indicative of a high quality fishery. The survey also indicated an overall catch rate of 2.17 fish/hour, which is considered high compared to angler surveys on other water bodies. Seventy-three percent of the anglers surveyed practiced catch and release. Fish densities for the upper James River have not been quantitatively determined, but qualitative electrofishing data suggest a smallmouth bass density in the range of 10-20 fish $\geq$ 14 inches length/mile (Dominion 2003).

6.3.3.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.3.2.1 MANAGEMENT OBJECTIVES

The resource agency management objectives for the fishery or fish habitat are as follows:

- restore stream health to historic habitat conditions and to benefit aquatic threatened and endangered species;
- assist private landowners with riparian habitats through partnership program in efforts to improve fish habitat;
- maintain high quality sport fishery; and
- ensure fish passage upstream.

6.3.3.2.2 PROJECT EFFECTS ON AQUATIC HABITAT

During project construction, a short section of the reach immediately downstream of the arch section of Scott's Mill Dam will be dewatered for the construction effort. This will cause a short-term temporary loss of habitat. Applicant will use best management practices to limit project impacts to aquatic habitat both upstream and downstream of the construction zone.

Licensing participants expressed concern that changes to flows both upstream and downstream of Scott's Mill Dam during project operations could affect aquatic habitat and recommended use of the PHABSIM model. In Study Plan 7, Applicant proposed evaluating the effects of flow, water level, water velocity, bathymetry and water quality on fish habitat and if appropriate, proposed that a PHABSIM model would be employed. However, after examining the changes in water levels, water velocities, and water quality, Applicant determined that PHABSIM would not be necessary to assess habitat changes.

Applicant is proposing to maintain essentially constant water levels up to the 4,500 cfs hydraulic capacity of the project. That is, during lower flows, the water levels would be slightly greater than existing conditions by up to 1 to 1 ½ feet. During average flows and above, project operation water levels with a two-foot high concrete cap would be slightly higher than under current conditions. Since Applicant intends to draw about half the flow from the left side of the river through the powerplant up to the capacity of the plant (i.e., 4,500 cfs), flows through the main channel could be reduced by about half. Given that water levels will essentially be the same as during existing conditions, velocities in the main channel could therefore be decreased to half during low and median flows. However, given the existing bathymetry, velocity measurements during flow conditions of about 1,800 cfs indicated that velocities were on the order of ¼ foot per second. Therefore, during project operations, velocities in the main channel could be on the order of 1/8 fps. Thus during low and median flow conditions, the aquatic environment upstream would remain lentic and thus effects on fish habitat are expected to be very minor, especially since water quality upstream of the dam is also expected to be similar to existing conditions.

During high flow conditions, water will flow over the main section of the spillway similar to the way it does today. Therefore, water quality, sediment transport and flow velocities are not expected to vary significantly from existing conditions, resulting in similar aquatic habitat.

Downstream of the main section of Scott's Mill Dam, Applicant is proposing to provide about 50 percent of the turbine flow during project operations into this reach. This should assist in circulating water in this downstream reach. However, there will be localized effects immediately downstream of the spillway where turbulent flow will give way to lower velocity water. These effects will be more pronounced for the 50 to 100 feet immediately downstream from the dam. Downstream of this, average flow velocities during median and low flow conditions may decrease from about 1/3 to 1 fps during existing conditions to 1/6 to ½ fps during project operations.

Downstream water levels are expected to remain about the same because they are controlled by a rock sill at Riveredge Park. Dissolved oxygen could decrease on the order of ½ mg/l since the reaeration over the dam will be reduced. Thus for the majority of the reach downstream of the main spillway, habitat effects should be minor. However, for the first 100 or so feet immediately downstream of the dam during flows up to 4,500 cfs, it is difficult to predict exactly what effect the reduction in flows over the dam will be on fish habitat. Applicant believes that the turbulent flow in the short section provides additional cover that may not be present after project construction. (For safety reasons it was not safe to measure water velocities immediately downstream of dam.)

During project operations, the reach between the downstream island and US Pipe Company will experience increased flows. Applicant expects similar water levels, but higher flow velocities in this reach. This reach may become more favorable for those fish species preferring higher water velocities.

6.3.3.2.3 FISH PASSAGE

Historically, a number of anadromous fish species including American Shad, Alewife, Blueback Herring, Sea Lamprey, and striped bass and the catadromous American Eel occurred in the James River. Numerous dams on the James River and its tributaries have historically blocked migration of fishes. Prior to damming, which began in the colonial period, shad and river herring (Alewife and Blueback Herring) were reported to reach the headwaters and far into the major tributaries of the James River. The annual input of marine-derived biomass from post-spawning carcasses of anadromous fish was an important source of energy and nutrients for the non-tidal portion of the James River (NMFS 1999).

It is a goal of resource agencies to restore American Eel, Sea Lamprey, American Shad and other anadromous fishes to their historic spawning grounds by initially establishing upstream passage facilities at James River dams. Efforts are underway to restore anadromous fish runs in the James River below Lynchburg. Between 1989 and 1993 three dams in the fall zone of the James River were breached or notched, extending available habitat to the base of Bosher Dam. Fish passage was installed in Bosher Dam (built in 1823) in 1999, reopening 221 km of the upper James River and 322 km of its tributaries to American Shad and other anadromous fishes, including Sea Lamprey (Hilton et al. 2014; Fisher 2007). Scott’s Mill Dam is the next dam upstream on the mainstem. Currently there are no upstream or downstream fish passage facilities at the Scott’s Mill Project. Upstream of Scott’s Mill Dam, there are six dams spaced over a total of approximately 22 river miles.

The importance of migratory fish species was recognized in the 1987 Chesapeake Bay Agreement and re-affirmed in Chesapeake 2000. A commitment was endorsed to ‘provide for fish passage at dams and remove stream blockages whenever necessary to restore natural passage for migratory and resident fish’ (Hilton et al. 2014). The Fish Passage Work Group of the Bay Program's Living Resource Subcommittee developed strategies (1988) and implemented plans (1989) to fulfill this commitment. To date, the partners have reopened a grand total of 2,574.5 miles of Chesapeake Bay tributaries, which is 92% of the 2,807 mile goal (Hilton et al. 2014). The proposed new fish passage goal in the new Chesapeake Bay Agreement will be to reopen an additional 1,000 miles by 2025.

Few studies have looked at unassisted American Eel passage over structures such as dams. However, several experts have observed elvers and very small eels (mostly less than 100 mm in length) actually climbing over wetted surfaces of various sized structures at varying face angles (Haro 2001; Solomon and Beach 2004a and b; Haro personal communication). These experts have also noted that where a textured surface exists the climbing ability of eels is enhanced. There appears to be no consistency in what the fish will or will not pass. Size and age structure affect fish passage - if all eels are large and/or old, they will be less likely to pass a dam by climbing (they need to be small to adhere to extreme-angled substrate faces via surface tension). Eels are also known, during the wet season, to pass around the dam using small rivulets or even just wet ground close to the edge of the river (Scott Smith , VDGIF personal communication, Solomon and Beach 2004a). Applicant anticipates that with the reduced flow over the Scott's Mill Dam, more American Eels will be able to successfully climb over the dam.

As part of its relicensing for the Cushaw Project, Dominion conducted an evaluation of passage around the James River dams upstream of Cushaw (Cushaw FERC License Application, Dominion 2006). Dominion's preliminary evaluation of the flow regimes and the limited electrofishing data available for American Eel did not suggest a strong correlation between flow regimes and CPUE and was therefore inconclusive.

The number of eel captured by electrofishing was slightly lower immediately upstream of Scott's Mill Dam as it was immediately downstream, therefore, Scott's Mill Dam does not appear to be much of a barrier to eel passage, although it is likely that some fish will not, or cannot pass the structure for varying unknown reasons. CPUE drastically dropped upstream of Reusens Dam. This may be related to the lack of continuous flow over Reusens Dam. Reusens Dam appears to be a substantial (but not complete) barrier to eel passage, as a few individuals were captured above the structure.

The remaining structures, Holcomb Rock, Coleman Falls, Big Island, Bedford and Cushaw Dams, are relatively similar in structure to Scott's Mill Dam and would likely have similar effects on eel passage. Although eel are currently found upstream of the various structures between Scott's Mill and Cushaw Dams, the presence of eels does not necessarily imply adequate passability. Only a fraction of the eels attempting to pass a dam may in fact be successful. As well, structures downstream of Scott's Mill Dam may slow passage of upstream migrating eels enough to result in larger eels greater than 100 mm reaching the project area. The larger eels are not able to climb the face of the dam, and may move upstream only when suitable conditions are available.

Therefore, to facilitate restoration goals for American Eel, Applicant has closely coordinated with resource agencies to site and develop conceptual designs for upstream passage facilities for American Eel and Sea Lamprey at Scott's Mill Dam. To maximize the likelihood of success, resource agencies and Applicant agreed that there should be passage facilities on both banks of the James River at Scott's Mill Dam (see **Appendix A**, consultation record). Conceptual design drawings for American Eel and Sea Lamprey upstream passage are presented in **Exhibit F, Figures F-3, F-4 and F-5**.

Applicant plans to continue to consult with the resource agencies during the detail design phase for these passage facilities. Construction of the facilities would be undertaken in conjunction with the powerhouse construction. The upstream passage would extend the habitat upstream an additional 3.6 miles. Applicant anticipates that upstream dam owners would likewise add American Eel and Sea Lamprey passage facilities in the near future. Initially after operation of the Scott's Mill passage facilities, should the agencies elect to restore areas further upriver in anticipation of the future construction of upstream facilities, a trap and transport program also could be implemented.

Applicant proposes to monitor the success of the upstream passage facilities for a period of three years to ensure that the facilities are functional. Long-term monitoring would be undertaken in coordination with the resource agencies.

At this time. the resource agencies have not made a final decision on when upstream fish passage facilities would be required for American Shad, other anadromous fish and resident fish. Applicant proposes to design the powerhouse in anticipation that either a vertical slot fishway or a nature-like fishway will be constructed. Key considerations will be siting locations of the upstream passage facilities and attraction flows. Applicant proposes that when these upstream facilities are required all 6 dam owners upstream of Scott's Mill Dam work with the agencies and Applicant to install trapping facilities at either the vertical slot fishway or nature-like fishway and transport the captured fish upstream of Cushaw Dam.

For downstream fish passage, Applicant is proposing to allow the downstream migrants to pass over the main spillway section of the dam to the extent possible, particularly when flows exceed the hydraulic capacity of the turbines. Applicant intends to maximize survival of downstream migrants by installing low speed, fish friendly turbines and having trashracks with a spacing of 2 inches to avoid impingement and entrainment of larger fish. Applicant proposes to continue to consult with resource agencies on other low-cost measures for safe, timely, and effective downstream fish passage. If the powerhouse is rotated slightly during the final design, it may be appropriate to place guide vanes upstream of the turbine entrances to guide the fish to an overflow area where they can safely pass downstream.

6.3.3.2.4 IMPINGEMENT AND ENTRAINMENT OF FISHES

Fish can become impinged on intake screens or trashrack bars if fish are not able to overcome the approach velocity. An analysis conducted by APCO as part of the relicensing of the Reusens Project (FERC No. 2376) found that fish that encounter the intake screens were able to easily negotiate the currents (APCO 1991). Calculated velocities at the Reusens intake ranged from 1.4 to 2.6 feet per second. Similarly, water velocities calculated at the Cushaw Project (FERC No. 906-006) intake ranged from 1.4 to 2.6 feet per second. There has been no reported incidence of fish mortality at the Cushaw project intakes (FERC 2008). Based on the intake velocities at Cushaw and Reusen projects and the size of the trashrack bar spacing (3 inches) at Cushaw, it was concluded that most fish avoid impingement on the trashrack but would be susceptible to entrainment through the project turbines (FERC 2008).

At Scott's Mill, Applicant estimates that the maximum intake velocity at the trashracks would be about 3.5 feet per second at the maxim hydraulic capacity of the turbines of 4,500 cfs (trashrack area of 136 feet by 9.5 feet). More typically at the median flow of 2,000 cfs, the intake velocity would approach 1.4 feet per second, similar to the low estimates for Cushaw and Reusens. Based on the 2-inch trashrack spacing proposed for Scott's Mill, Applicant estimates that most fish should be able to avoid being impinged on the trashracks.

As part of Study Plan 6, Applicant proposed to assess turbine survival based on studies being conducted by Natel Energy for their hydroEngine turbine. Given that Natel is now developing a linear Pelton turbine, the studies Natel conducted are moot for their linear Pelton turbine and are therefore not reported here. Natel has plans to conduct survival studies for their Pelton turbine. Natel believes that their Pelton turbine will be fish friendly. Should Applicant determine that the Natel Pelton turbine is superior to other turbines and ultimately selects these turbines for installation, Applicant will provide the survival information with its application for license amendment to use these turbines.

Since the Natel Pelton turbine is still in development phase, Applicant's current proposal is to use 54-inch Rickly turbines. However, a final decision on use of these turbines will depend on the cost for these units and how fish friendly they are, as well as the development status of the Natel linear Pelton turbine and its associated "fish-friendly" index. Applicant proposes to consult with the resource agencies on the final selection of the turbines to ensure they are fish-friendly.

Applicant is currently working with Rickly on the specifics of the turbine design. Once the characteristics of the turbines are finalized and entrainment survival information becomes available, Applicant will consult with the resource agencies on the final selection of these units. At this time, the 54-inch Rickly turbines have a proposed speed of 400 rpm, but the Applicant is working with Rickly to determine if the speed can be reduced to 150 to 200 rpm without sacrificing efficiency. Given that Cushaw turbines rotate at 150 rpm, Scott's Mill should have similar survival to estimates reported for the Cushaw project, which have similar fish species (see below).

The potential for significant entrainment effects at the Reusens Project was found to be low; mortality of fishes that were entrained was estimated to be less than ten percent. Dominion calculated survival rates for fish of various lengths passing through the Cushaw Project using the Franke *et al.* (1997) model (**Table E-6-6**). Predicted fish survival ranged from 98.3 to 83.9 percent on average for fishes ranging in size from 2 to 18 inches, respectively (FERC 2008). In addition, a review of 16 projects with Kaplan or propeller-type turbines similar to those at the Cushaw Project corroborated, for the most part, the estimates from the Franke *et al.* analysis (**Table E-6-7**). For species common to the James River, centrarchids (sunfish and bass) and ictalurids (catfish), survival for fish less than 8 inches in total length ranged between 93 and 97.6 percent. For larger fish (up to 15 inches) of the same species, survival rates averaged 93 percent. Survival rates for American Eel were less at 73.5 percent.

TABLE E-6-6

PREDICTED* SURVIVAL VALUES DERIVED FROM THE FRANKE ET AL. (1997) MODEL FOR FISH OF VARIOUS LENGTHS IN PASSAGE THROUGH THE CUSHAW PROJECT

Correction Factor	Predicted Survival (%) by Fish Length (inch)						
	2	4	6	8	10	12	18
0.1	98.9	97.6	96.5	95.2	94.1	92.8	89.3
0.2	97.6	95.2	92.5	90.0	88.0	85.6	78.5
Average	**98.3**	**96.4**	**94.5**	**92.6**	**91.1**	**89.2**	**83.9**

* Survival values are average of two entry points of fish into turbine at a head of 28 feet. Values are given separately for two correlation factors.

TABLE E-6-7

AVERAGE EMPIRICAL TURBINE PASSAGE SURVIVAL RATES REPORTED FROM VARIOUS POWER STATIONS WITH KAPLAN/PROPELLER TYPE TURBINES

	Fish Length (inch)		
	< 8	**8 – 15**	**> 15**
American Eel			73.5
Alewife	90.8		
American Shad	96.6		85.0
Blueback Herring	96.0		
Centrarchids	97.6	92.9	
Ictalurid	93.0	93.0	
Percid	93.0	96.2	
Cyprinids	97.5	85.1	
Salmonids	92.7	94.0	
AVERAGE	**95%**	**94%**	**82%**

Based on the Cushaw studies and studies of Kaplan and propeller units, fish mortalities through the Scott's Mill powerhouse are expected to be on the order of 93 to 97 percent for fish less than 8 inches in length. For larger fish, survival would be expected to be less. Because Applicant will be passing American Eel upstream, it will be necessary to pass then downstream in a safe, effective, and timely manner. Applicant plans to work with resource agencies during the final design to accomplish this goal. Options include passing American Eel and other fish over the main spillway section, and rotating the powerhouse and installing guide vanes to move the fish to a collection/safe passage location in a manner similar to operation of an Eicher screen.

6.3.3.2.4 Cumulative Effects

The Scott's Mill Dam, the first in a series of seven dams with the six upstream dams lying between Cushaw and Lynchburg, water pollution and overfishing have contributed to the decline of American Shad and American Eel in the

James River. Each of these factors cumulatively affects diadromous fish within the James River. The resource agencies have identified a resource goal to restore both American Shad and American Eel to their historic spawning areas in the James River. Applicant will cooperate with the agencies and other licensees on the James River to further the agency restoration goal. The USFWS and National Marine Fisheries Service (NMFS) have authority to prescribe fish passage under Section 18 of the FPA.

6.3.4 TERRESTRIAL RESOURCES

6.3.4.1 AFFECTED ENVIRONMENT

The area in the vicinity of the Scott's Mill Project is characterized by forested hills that rise 200 to 300 feet from both sides of the James River. The James River valley near the project site has been significantly affected by human activities during the past 200 years. These have included road construction, canal/railroad construction and operation, industrial land uses (along the western riverbank), downtown urban center growth (Lynchburg, less than 0.5 mile to the southwest), river impoundment, and residential development (on valley slopes and hills east and west of the site). As a result, the dominant wildlife species present nearby are generalists that typically survive well in close proximity to human land uses. These include a variety of omnivores and opportunistic species.

The riverbank west of the Scott's Mill dam is characterized by a narrow 15-25'wide woody riparian buffer between the railroad and water, steep riverbanks (6-10' high with slopes generally greater than 2:1), railroad/railyard tracks (up to seven parallel tracks), and pipe foundry operations. Approximately 60-70 percent of this riverbank has been stabilized with riprap. Within this industrial corridor, there is very little undisturbed vegetation, and those species present are typically hardy pioneer/early successional herbaceous plants.

The area east of the Scott's Mill dam has generally experienced less previous human alteration and disturbance, likely due to the presence of a steep rocky 200' high hill slope approximately 50' east of the river. The steep riverbank and adjacent hill slope are dominated by young-mature hardwood tree species. A public road (River Road/Route 685) is located within the narrow relic terrace/floodplain along the eastern riverbank. Further upriver, significant portions of the riparian area are currently in use as residential lawns. Multiple piers, boat docks, and floating wooden platforms are also present along this portion of the riverbank.

The greatest abundance and diversity of vegetative species is on the three islands located upstream of Scott's Mill Dam: Daniel Island, Treasure Island and Woodruff Island. The islands were previously used for agriculture, but pedestrian/vehicle access to the islands has been cut off since the flood of 1985. There are remnants of structures and athletic fields on the islands. The island shorelines have experienced significant erosion. The erosion is likely due to periodic floods and the alluvial soils of the islands. The eroded shorelines of some islands are generally as steep and high as the riverbanks, though gravel bars and low-gradient slopes are present in isolated areas of low velocity flow. A list of vegetative species on the islands and riverbanks can be found in **Appendix G**. The Appendix includes several photographs of the shorelines.

6.3.4.1.1 WETLANDS

Due to the steep riverbanks and previous land development activities over the past 200 years, there do not appear to be any jurisdictional wetlands along the riverbanks. However, the US Army Corps of Engineers (USACE) has verified the presence of a jurisdictional wetland area on Daniel Island in the northern portion of the island (Jeanne Richardson, USACE, letter to Tim Reynolds, Liberty University dated January 22, 2014). Additionally, some portions of the alluvial island downstream of Scott's Mill dam may be potentially jurisdictional wetlands (though much of the island is rocky). The James River itself is classified as a jurisdictional surface water, and any impacts to it would be classified as stream impacts.

6.3.4.1.2 WILDLIFE

Wildlife species likely to occur in the immediate vicinity of the Project include white-tailed deer, herons, raptors, wild turkey, dove, ducks, squirrel, rabbit, woodchuck, opossum, muskrat and raccoon. Numerous resident and neotropical migrant bird species likely occur and breed within or in the vicinity of project boundaries.

Songbirds that utilize early successional wooded habitats in the vicinity of the Project, include common flicker, yellow-breasted chat, prairie warbler and mourning warbler. A list of observed avian and mammalian species is presented in **Appendix G**.

6.3.4.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

During construction, Applicant may need to expand the current opening in Daniel Island just upstream of the dam to obtain the necessary flow balance down the two river channels. The current opening is about 20 feet wide, but may need to be widened to about 100 to 130 feet to provide about half the powerplant capacity from the main channel for water quality purposes. The length of the enlargement across the island would be about 130 feet. Applicant estimates that the area disturbed would be about one-quarter acre. The U.S. Army Corps of Engineers (USACE) has identified this area as a probable wetland. Applicant would mitigate any wetland impacts, as required by the USACE.

Applicant proposes to place a 2-foot high concrete cap over the spillway and operate the project at a constant pool level of about 516.4 feet. This will have the effect of increasing water levels by 1.2 to 0.5 feet upstream during low and average flow conditions up to 3,200 cfs (see **Table A-3**). This increase will be dampened with distance upstream. Flows in this range occur 73 percent of the time. During moderate flows between 4,500 cfs and 12,000 cfs, which occurs 17 percent of the time, water levels will be between 0.3 and 2 feet higher, respectively. Flows at 25,000 cfs will see the highest increase at 2.5 feet relative to existing conditions, but at higher flood flows this differential will disappear.

It is not likely that the higher water levels up to the 4,500 cfs hydraulic capacity of the turbines will affect the vegetation because of the steep slopes of the shorelines and islands and low current velocities. For flows between 4,500 cfs and 12,000 cfs, average river flow velocities should be less than 2 feet per second and should not appreciably affect shoreline erosion, even though the water level will be 0.3 to 2 feet higher. At higher flows (e.g., between 25,000 cfs and 130,000) there could be an increase in shoreline erosion potential because of the higher water level. However, at the higher flood levels, there would be no difference in upstream water levels and thus no difference in erosion potential. Hence, project operations would likely have only a minor effect on upstream vegetation.

Since downstream of Scott's Mill Dam, the water level is controlled by a sill downstream of the dam and since Applicant intends to pass water into both channels downstream of the dam, downstream water level effects are expected to be very minor and hence, there should be little or no effect on riparian vegetation.

6.3.5 THREATENED AND ENDANGERED SPECIES

6.3.5.1 AFFECTED ENVIRONMENT

Protected species information from the USSFWS, VDGIF, and Virginia Department of Conservation and Recreation (VDCR) Natural Heritage has been reviewed for the project area. These records suggest the potential presence of the following species in proximity to the study area:

USFWS Protected Species (*per IPaC database*):

- James River spinymussel (*Pleurobema collina*) – Federal Endangered
- Northern long-eared bat (*Myotis septentrionalis*) – Federal Threatened

VDGIF Protected Species (*per VA Fish and Wildlife Information System*):

- James River spinymussel (*Pleurobema collina*) – Federal Endangered
- Peregrine falcon (*Falco peregrinus*) – State Threatened
- Loggerhead shrike (*Lanius ludovicianus*) – State Threatened
- Green floater (*Lasmigona subviridis*) – State Threatened

- Atlantic pigtoe (*Fusconaia masoni*) – State Threatened
- Migrant loggerhead shrike (*Lanius ludovicianus migrans*) – State Threatened
- Northern long-eared bat (*Myotis septentrionalis*) – Federal Threatened

VDCR Natural Heritage Species (*for James River HUC 020802030305 watershed*):

- Green floater (*Lasmigona subviridis*) – State Threatened

Legal protection under the federal Endangered Species Act (ESA) normally exists for species listed as Endangered or Threatened (and Candidate/Pending). The proposed project should not eliminate avian nesting or loafing habitat, and should not significantly affect feeding/foraging habitat for the birds listed above. The project should not significantly reduce the extent of mature forest or alter natural hibernacula for bat species. Since the project could affect some aquatic habitat however, the most significant protected species review will likely be associated with aquatic species (specifically James spinymussel, green floater, and Atlantic pigtoe). These species have not been found during nearby upstream and downstream mussel surveys during the past 15 years.

James spiny-mussel. The James spiny-mussel (*Pleurobema collina*) is a small freshwater mussel, less than 3 inches in length. It was widely distributed in the James River drainage upstream of Richmond; however, it has exhibited a precipitous decline in population over the last 30+ years, and has been extirpated from approximately 90 percent of its historic range. It is now only documented in a few small headwater tributaries to the James and Roanoke rivers with clear, unpolluted waters. This makes the species highly vulnerable to water quality perturbations, disease, and displacement by introduced species. As a result, the USFWS listed the James spiny-mussel as a Federally endangered species (53 FR 27689, July 22, 1988). A recovery plan was established by the USFWS in 1990. The Commonwealth of Virginia followed, also listing the James spiny-mussel as a State endangered species. Currently, the James spiny-mussel is known to inhabit Craig Creek and three of its tributaries (Johns, Dicks, and Patterson creeks); Jackson River drainage (South Fork Potts Creek, Potts Creek, Catawba Creek, and Pedlar River); Rivanna River (Mechums River, Moormans River and Rocky Run), Dan River and May River (USFWS 1990, http://216.109.117.135/search/cache?p=James+spinymussel&toggle=1&ei=UTF-8&u=www.insidewrc.org/divisionlinks/06_fish/habcon/Piedmont/W-

Piedmont/Stokes/Boxley%2520Final%2520Denial%2520%2523%25208509%2520adm.doc&w=james+spiny-mussel&d=38AE63A551&icp=1&.intl=us,

http://www.streamwatch.org/Watershed/index.php, http://ecos.fws.gov/docs.life_histories/F025.html).

The shell of juveniles typically has 1 to 3 short but prominent spines on each valve; adults typically do not have spines. The foot and mantle of adults are orange, and the mantle is darkly pigmented in a narrow band around and within the edges of the branchial and anal openings (USFWS, 1990).

James spiny-mussel live in streams with widths varying from 10 to 75 ft and depths between 0.5 to 3 ft. Its immediate habitat requirements include slow to moderate water velocity and sand or cobble bottom riverbeds. It requires fish hosts to complete its life cycle. Of those host species, only 4 occur in the project vicinity – bluehead chub, rosefin shiner, satinfin shiner and stoneroller. During spawning season, the male releases sperm into the water column, which are taken in by the female during siphoning. The fertilized eggs are held in the gills, which also serve as brood pouches for the developing larvae (glochidia). Spawning takes place in the spring, and the release of the glochidia occurs in the spring and summer. Once the glochidia are released into the water, they must, within 3 or 4 days, attach to a host fish. After attachment, the glochidia metamorphose and drop as free-living juvenile mussels (USFWS 1990).

Because they are sessile organisms, and rely on siphoning water into their gills, siltation caused by silviculture, agriculture and road construction is highly detrimental to James spiny-mussel populations. Silt can clog and abrade the gills of the filter feeders, eventually suffocating them. Industrial and municipal waste also poses a threat to the survival of the James spiny-mussel (USFWS, 1990).

Introduction of the Asian clam (***Corbicula fuminea***) has resulted in increased competition, thus depleting the food supply for the James spiny-mussel. The Asian clam is very prolific, rapidly spreading throughout the introduced watershed (densities of 1,000/m2 have been identified in the James River) (USFWS, 1990).

Other factors affecting the abundance of the James spiny-mussel include impoundments on the rivers, including flood control dams. The alteration of habitat from a lentic to a lotic system results in increased depth, increased siltation and reduced water velocity, as well as affecting the fish communities present, thereby potentially eliminating a host species (USFWS, 1990).

Applicant conducted a freshwater mussel survey specific to the Scott's Mill headpond and downstream area, with a specific focus on the Green Floater (*Lasmigona Subviridis*). The study was conducted in November 2016, consistent with Study Plan 9. No threatened or endangered mussels were found. The results of the study can be found in **Appendix H**.

Because the Scott's Mill hydro project will have little effect on water levels and primarily affect steep shoreline areas, Applicant relied primarily on the terrestrial habitat assessment and determined that bats were unlikely to be affected by the project. Accordingly, Applicant elected not to conduct Study Plan 13, Bat Study.

6.3.5.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

Given the limited disturbance of the project in an already disturbed area, the minor effect that the project will have on water levels and the lack of observances of any threatened or endangered species, Applicant concludes that the project would not affect threatened or endangered species. Accordingly, no mitigation is proposed.

6.3.6 RECREATIONAL RESOURCES

6.3.6.1 AFFECTED ENVIRONMENT

6.3.6.1.1 RECREATIONAL OPPORTUNITIES WITHIN 60 MILES OF THE PROJECT

The Scott’s Mill Project is within 60 miles (approximately a one-hour drive) of numerous recreational opportunities, including boating, fishing, hiking and viewing nature. These opportunities, which are managed by Federal, State, local and non-governmental entities, are listed below:

Federal

- George Washington National Forest;
- Jefferson National Forest;
- Lake Moomaw (managed by the U.S. Army Corps of Engineers);
- Bolar Mountain Recreation Area (managed by USFS);
- Shenandoah National Park;
- Blue Ridge Parkway (managed by the National Park Service);
- Appalachian National Scenic Trail;
- Monongahela (West Virginia) National Forest; and
- Appomattox Courthouse National Historic Park.

State

- Handley (West Virginia) State Wildlife Management Area (WMA);
- Calvin Price (West Virginia) State Forest;

- Cass Scenic Railroad (West Virginia) State Park;
- Havens (West Virginia) State WMA;
- T.M. Gathright State WMA
- Douthat State Park;
- Goshen-Little North Mountain State WMA;
- James River State WMA;
- Horsepen Lake WMA;
- Hardware River WMA;
- Appomattox-Buckingham State Forest;
- Smith Mountain Lake State Park;
- Lake Robertson State Recreation Area;
- Lake Albemarle (managed by Virginia Department of Game and Inland Fisheries, VDGIF); and
- Lake Nelson (also managed by VDGIF).

Local

- The City of Lynchburg, Virginia, (operates and maintains 850 acres of parkland);
- The City of Lexington, Virginia, (operates and maintains 2600 acres of parkland);
- City of Roanoke;
- City of Bedford;
- City of Staunton;
- City of Charlottesville; and
- Town of Crozet.

Other

- Smith Mountain Pumped Storage Hydroelectric Project (Smith Mountain Lake and Leesville Lake);
- Goshen Scout Reservation;
- Charlottesville Kampground of America;
- Circle H Campground (Clifton Forge);
- Dixie Caverns Campground (Roanoke);
- Lake Nelson Family Campground (Arrington);
- Misty Mountain Camp Resort (Greenwood);
- Shenandoah Acres Resort (Stuarts Draft);
- Silver Lake Campground (Haymarket);
- Verona KOA;
- Walnut Hills Campground (Staunton); and
- Yogi Bear's Jellystone Park Camp-Resort (Natural Bridge Station).

6.3.6.1.2 RECREATIONAL OPPORTUNITIES IN THE PROJECT VICINITY

The James River, Virginia's longest river, is an important recreational resource. It typically supports about 100,000 angling trips and about 50,000 boating trips annually (Stanovick et al., 1991), and is designated a State Scenic River in certain reaches including a reach that is upstream of the Cushaw Project.

VDGIF calculated from their survey conducted in 2000 that anglers accounted for 1,926 angling hours/mile on the upper James River, a value that VDGIF considered "very high." Most anglers interviewed lived within a one-hour drive of the river, indicating a generally local fishery. About 82 percent of the interviewed anglers were fishing from a boat, while about eleven percent were fishing from the shore and four percent were wading. Eighteen percent indicated that boating access was a negative attribute of the upper James River fishery, while about 34 percent indicated there were no negative attributes (Scott Smith, VDGIF).

James River Hydroelectric Projects. The following hydroelectric projects are located on the James River upstream from Scott's Mill Dam:

- Cushaw Hydroelectric project (FERC No. 906);
- Bedford Hydroelectric project (FERC No. 5596);
- Big Island Hydroelectric Project (FERC No. 2902);
- Coleman Falls (FERC No. 5456);
- Holcomb Rock Hydroelectric Project (FERC No. 2901); and,
- Reusens Hydroelectric Project (FERC No. 2376).

Various recreational facilities are associated with each of the projects.

The Cushaw Project has a boat ramp enabling anglers and recreational boaters to utilize the headpond. Canoeists and kayakers often paddle the free-flowing reach upstream of Cushaw Dam and typically take out their canoes and kayaks at the upper end of the headpond or further downstream.

The Bedford Hydroelectric Project at Snowden Dam is located on the James River approximately 1.2 miles downstream from the Cushaw Hydroelectric project. The upstream end of the 57-acre Bedford Reservoir overlaps the Cushaw Dam tailrace during high flows. Hunting for deer, bear and wild turkey is good throughout the project area. The public uses an old construction site along SR 130 for river access. This site has a concrete pier that is used for fishing by those in wheelchairs. A small ramp in this vicinity is used to place boats into the reservoir. Anglers reportedly use State Route 501 to access the right (west) bank of the Bedford headpond for fishing (FERC, 2001). FERC's 2001 Inspection Report noted that:

"Public recreational use at this small project is very limited. Because of the long, open spillway, boating use should not be encouraged. The site along the left (east) bank where the public is currently using lands for public access could be developed into a safe shoreline fishing area."

The Big Island Hydroelectric Project is located approximately 4 miles downstream from Bedford Dam. This small facility includes a 110-acre reservoir and boat ramp upstream of Big Island Dam, allowing boaters and anglers access from Big Island Dam upstream to the Bedford Project. A concrete boat ramp is located downstream of Big Island Dam, near the Georgia-Pacific mill entrance. This provides boating in the reach between Big Island Dam and Coleman Falls Dam. There is also a canoe portage around Big Island Dam.

Coleman Falls is an exempt FERC project and has no recreation facilities.

The Holcomb Rock Hydroelectric Project is located about seven miles downstream from Big Island. This facility includes a 127-acre reservoir, 2.5-mile canoe portage and boat ramp.

The Reusens Hydroelectric Project is located about eight miles downstream from Holcomb Rock and four miles upstream from the center of Lynchburg, Virginia. This facility includes a 500-acre reservoir and the following recreational facilities: two unimproved boat access areas, one improved boat launch, a nine-acre park, a playground and a picnic area.

The Scott's Mill impoundment offers little public opportunity for boating and fishing because of the limited access and lack of public boat ramps Within the headpond are a number of private boat docks on the east side of the river along River Road. There is also one private boat ramp located a short distance upstream from Scott's Mill Dam. Limited angling takes place in the 316-acre headpond due to the lack of public access. Immediately downstream of Scott's Mill Dam on the east side (left bank) of the river, anglers fish the tailrace of the dam. Although this area is posted as private property, this is a popular fishing area. There is informal parking along River Road adjacent to the dam.

There are two boat ramps located on either side of the river about one-half mile downstream from Scott's Mill Dam. The boat ramp in Riveredge Park accommodates motorized boats, whereas the ramp near the mouth of Blackwater Creek is for car top boats.

Anglers can often be seen fishing the reach downstream of Scott's Mill Dam. There are no portage facilities around Scott's Mill Dam. Access on the west side of the river is restricted due to the industrial activities at US Pipe and the Chesapeake and Ohio railroad that parallels the river.

6.3.6.1.3 EXISTING AND POTENTIAL RECREATIONAL USE AND NEEDS

The 2013 Virginia Outdoors Plan (State Comprehensive Outdoors Recreation Plan or SCORP) through a survey conducted in 2011, identified the top 6 most needed recreational facilities as 1) hiking and walking trails (68%), 2) fishing, swimming, and beaches (60%), 3) natural areas (55%), 4) bicycling trails (54%), 5) historic areas (51%), and 6) canoeing and kayaking (46%).

There are hiking and walking trails along Blackwater Creek and in downtown Lynchburg. Applicant surveyed these trails, but could not identify any locations that could link these trails to the project area because of the Chesapeake and Ohio railroad and the US Pipe industrial facility. On the east side of the river, development of a hiking trail along River Road is constrained by the steep shoreline topography, the adjacent steep hillside and River Road itself. Therefore, hiking and walking trails, natural areas, and bicycling trails were eliminated from further consideration for recreational improvements. However, Applicant has further considered fishing, the historic area of the dam and Scott's Mill remnants, and canoeing and kayaking for potential recreation developments.

6.3.6.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.6.2.1 RECREATION IMPACTS

The fishery downstream of the Scott's Mill Dam is locally important. Applicant intends to protect this important aquatic habitat by discharging a portion of the flow from the turbines towards the area downstream of the straight section of the spillway. This should help to preserve this important fish habitat. Seventy three percent of the time, there will be a veil of water flowing over the dam. The reduction in flow over the dam could reduce the value of the habitat for about 100 feet downstream of the dam, by reducing the turbulence and associated cover for fish. This could reduce the fish habitat along the 735-foot long dam for about 100 feet downstream. This may be somewhat mitigated by the turbulent conditions created immediately downstream of the turbines, which could provide additional cover.

The private boat docks along River Road would see approximately constant water levels 73 percent of the time. However, this water level would be about 0.3 to 1.5 feet above current average and low flow levels. Since most of the docks are built to handle these water levels, the near constant water levels may be considered a positive feature, since for most other hydropower projects, adjacent land owners prefer relatively constant water levels in project reservoirs. However, for flows above 25,000 cfs adjacent land owners could see up to a 2-foot increase relative to existing conditions, because of the reduced effective width of the spillway from construction of the powerhouse. These conditions would occur less than 5 percent of the time, but they could be considered an adverse impact. Because of the steep shorelines, this should not be a problem (see Photographs 13 through 18 in **Appendix G**, Terrestrial Habitat Assessment which depicts several boat docks located along the steep shorelines). Nonetheless, water velocities at the private boat docks would be slightly lower for a given flood flow, because of the greater cross-sectional area. This could help mitigate adverse effects on the docks. At the very high flood levels, there would be no impact since the dam is no longer a control point. Accordingly, Applicant is not proposing any mitigation for the upstream water level effects during high flow conditions.

6.3.6.2.2 RECREATION FACILITIES

As noted above, opportunities for improving shoreline and river access at the project are very limited, due to steep terrain extending to the river's edge, and the industrial development adjacent on the west side of the project. However, Applicant proposes to construct a canoe portage around the left abutment of Scott's Mill Dam. Applicant initially mapped out a portage route, but because the proposed upstream American Eel and Sea Lamprey fishway requires use of some of the same space that the portage would have used, Applicant curtailed design of the portage until detailed design details of the fishway are developed. Thus, Applicant proposes to design the portage in conjunction with the detailed design for the fishway, because of the limited space between River Road and the dam.

The portage take-out point will be located at least 100 feet upstream of the dam for safety reasons, even though there will be only a small flow over the dam 73 percent of the time. (During high flow periods canoeists and kayakers should not be using the river.) The downstream put-in location will be downstream of the entrance of the fishway. The fishway will be a secure site isolated from the portage. Applicant proposes to use metal construction (likely aluminum) for the take out and put in locations.

Applicant proposes to construct a fishing pier in the vicinity of the canoe put-in point downstream of the dam. Because of the significant variation in tailwater levels with river flow, the fishing pier will need to be designed to withstand high water levels. Applicant proposes to work with Amherst County to improve the informal parking areas adjacent to River Road to ensure the safety of both canoeists and kayakers using the portage and anglers using the fishing pier. Applicant also proposes to enter into an arrangement with VDGIF and VMRC so that these facilities are managed by the state agencies.

Applicant also plans to add signage to illustrate the historic aspects of Scott's Mill, the Scott's Mill Dam and the water works canal on the west side of the river. This would be done in conjunction with the Virginia Department of Historic Resources (VDHR).

With respect to public boating access to the Scott's Mill headpond, Applicant proposes to work with the private boat ramp owner to determine under what conditions they would assist in providing additional public usage of their boat ramp.

Adding a portage, a fishing pier, and public boat launch to Scott's Mill would add considerable recreational opportunities to the Project area. Additionally, restoration of American Eel and Sea Lamprey should help to improve angling opportunities. When a vertical slot fishway or nature-like fishway are constructed, this too will improve recreational opportunities in the James River.

6.3.6.2.3 CUMULATIVE EFFECTS

The seven dams on the James River from Cushaw Dam downstream to Lynchburg (Scott's Mill Dam) act as barriers to continuous boating along this reach of river. Few portages exist at the dams upstream of the Scott's Mill Project. As such the dams represent a cumulative impact to recreational boating. This will be partially mitigated at Scott's Mill through development of the portage facilities.

6.3.7 LAND MANAGEMENT AND AESTHETIC RESOURCES

6.3.7.1 AFFECTED ENVIRONMENT

6.3.7.1.1 USE OF PROJECT LANDS

The project area is primarily used by the public for fishing and recreational boating. The area in the vicinity of the Scott's Mill Dam and powerhouse will be off limits to the public for safety and security reasons, except for the proposed fishing pier and canoe portage.

6.3.7.1.2 WETLANDS AND FLOODPLAINS IN THE PROJECT VICINITY

Wetlands: As described in Section 6.3.4 (Terrestrial Resources), the US Army Corps of Engineers (USACE) has verified the probable presence of a jurisdictional wetland area on Daniel Island (just upstream of Scott's Mill Dam). Additionally, some portions of the alluvial island downstream of Scott's Mill dam may be potentially jurisdictional wetlands (though much of the island is rocky).

The James River itself is classified as a jurisdictional surface water, and any impacts to it would be classified as stream impacts. As noted previously, there is little riparian habitat west of the dam. While there is some forested riparian habitat east of the dam, this area has been bisected by a public roadway for many years.

6.3.7.1.3 AESTHETIC RESOURCES ASSOCIATED WITH THE PROJECT

The setting for the Scott's Mill dam and reservoir is industrial/urban. Photos 7 through 13 in **Appendix C** show the Scott's Mill dam at James River flow levels at at 800, 1800, 3200 and 25,000 cfs. Flow over the dam becomes more spectacular with increasing James River flows. From an aesthetics perspective, flow over the Scott's Mill Dam is the most significant perhaps feature that could be affected by the project.

The dam and headpond can be viewed primarily from the roadway on the east side of the river. During the summer foliate season, the dam is well screened (**Appendix C, Photo 16 and 17**). Only very limited views of the dam are visible from River Road. Views of the dam are significantly improved during the defoliate season, although partial screening remains (Photo 18). Unobstructed views of the dam can be seen from the 5th Avenue bridge (Photo 19), but there are no convenient stopping locations on the bridge. The best view of the dam is from the top of the hill on the west side of the river along Norwood Street(Photos 20 and 21). There are seven homes on Norwood that appear to have an unobstructed view of the straight portion of the dam (Photo 22). These homes also overlook the US Pipe industrial site. Along much of the route, vegetation partially blocks views of the arch section of the dam where the powerhouse would be located.

The James River and associated islands upstream and downstream (Photo 22) of the dam also contribute to the aesthetic character of the project area. In addition, the historic resources such as the Scott's Mill Dam itself, the Scott's Mill grist foundation (Photo 23), and the waterworks canal on the west side of the James River are part of the aesthetic setting. However, relative to the scenic area of the Blue Ridge Parkway upstream, the industrial setting diminishes the aesthetic value of the project area.

The three islands located within the impoundment: Daniel Island, Treasure Island, and Woodruff Island have no roadway access and can only be seen from the hilltop on the west side, from select areas along River Road, and by boat.

The annual natural water level fluctuation of the Scott's Mill dam impoundment is on the order of three feet between typical low and high flows, but can be considerably more during significant flood events. Because of the steepness of the shoreline on each side of the river, there is relatively little exposed shoreline.

On the west side of the dam, there is considerable noise from US Pipe and the railroad, but this is dampened on the east side where the noise primarily emanates from water flowing over the dam.

6.3.7.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.7.2.1 LAND MANAGEMENT

Applicant's management of Project lands is generally consistent with the surrounding industrial and rural uses. Applicant proposes to minimize impacts to the natural landscape.

6.3.7.2.2 AESTHETICS

The most significant aesthetic impact will the reduction in flows over the dam. The large, spectacular flows over the dam will occur 5 percent of the time when flows exceed 12,000 cfs. These high flows will not be significantly affected by project operations.

Applicant intends to provide a veil over the dam, but the visual effect will be significantly different from the typical 700 cfs to 4,500 cfs that is seen 73 percent of the time. For 22 percent of the time, there will be flow over the dam. This flow will be more visually pleasing than the veil flow and will generally resemble the visual effect of flow that is observed most of the time during average and low flow conditions.

Because views of the flow of water over the dam are limited from River Road and the view from the 5th Avenue bridge is distant, the impacts from these key viewing areas are not considered significant. The most significant effect will be to the seven homes on Norwood St and from the passerby view on the street. However, a large part of their view is also toward the US Pipe industrial site and the railroad. Because there are few observers with unobstructed views of the dam and because they will still be able to observe the more dramatic flows 5 percent of the time (i.e., about 18 days per year), Applicant does not propose any mitigative measures to preserve the aesthetics of the water flowing over the dam, other than to provide a veil over the dam 73 percent of the time that the flow is less than the hydraulic capacity of the turbines.

The powerhouse should blend into the surrounding and generally will be shielded from most viewing locations. This should not be a significant impact on the environment. Since the Applicant is not proposing changes to the headpond elevation, there should not any impacts to the natural surrounding.

6.3.8 CULTURAL RESOURCES

6.3.8.1 AFFECTED ENVIRONMENT

The Scott's Mill Hydropower Project has the potential to affect cultural resources that are eligible for or listed in the Virginia Landmarks Register (VLR) and the National Register of Historic Places (NRHP). The Area of Potential Effects (APE) for direct effects to cultural resources is the revised FERC project boundary as depicted in Exhibit G. The APE for indirect effects contains the area outside the direct effects APE that may experience visual or auditory effects and includes the downstream end of Daniel's Island, the pipe manufacturing yard on river right, Rocky Hill Road (Route 685) on river left and the area downstream of the project to the John Lynch Memorial Bridge (Route 163). This section provides a local history to set the context for potential effects on historic properties.

6.3.8.1.1 HISTORY OF THE JAMES RIVER AND KANAWHA CANAL IN THE PROJECT VICINITY

James River and Kanawha Canal Sites in Lynchburg (VDHR No. 118-5497)

The James River and Kanawha Canal was one of the nation's major commercial and transportation arteries during the mid-19th century. Lynchburg was the terminus of the "First Grand Division," which extended 146.5 miles from the Richmond basin to a feeder dam just above Lynchburg [Scott's Mill dam]. This section was opened to traffic in December 1840, and was the only one of three divisions which was completed. During the 1850s, the canal enjoyed its greatest prosperity and assisted in Lynchburg's development as the major commercial and industrial center of the Piedmont. The canal suffered some damage late in the Civil War, and during the 1870s was severely harmed by two disastrous floods. In 1880, the newly organized Richmond and Alleghany Railway Company was authorized to take over the canal company's property. By 1881, tracks had been laid on the towpath and trains were running from Richmond through Lynchburg to Clifton Forge. Although the remains of the Lynchburg portions of the canal have been largely ignored in the 20th century, three important features still remain: The 9th Street Bridge and canal right-of-way, Blackwater Aqueduct, and the Scott's Mill dam. Considered as a thematic group, these sites provide important information on the development of engineering and transportation technology in the first three-quarters of the 19th century. In addition, they are key monuments to the commercial development of the state as well as tangible reminders of the water power necessary for industrial development in the 19th century.

Lynchburg was the terminus of the First Grand Division of the James River and Kanawha Canal. As the expected center of a great deal of commerce, and as the result of a number of natural and manmade features which had to be accommodated at the city's waterfront, Lynchburg was given a number of components of the work. Only in a few short stretches through the city did the canal resemble the tranquil waterway with attendant towpath that characterized its approximately hundred and fifty-mile course upstream from Richmond. When the first boats arrived in Lynchburg in 1841, the major portions of the canal in Lynchburg consisted of the Lynchburg Basin (later to be termed the Lower Basin), a stone bridge carrying Water (now Ninth) Street over the canal, a major aqueduct over the Blackwater Creek, and a dam [Scott's Mill dam] supplying water both to the canal and to the city's pump house for its own water supply. Only between the aqueduct and the dam did the waterway assume the traditional appearance of a canal.

Although the canal bed can still be traced and records and plats do exist to pinpoint the locations of its various original features, a Historic American Engineering Record survey of the Lower Basin conducted in the summer of 1977 revealed that only a few of the Lynchburg portions of the long-abandoned canal exist in anything resembling their original state. Both the Lower Basin and a later Upper Basin survive primarily in name only -- as the traditional designations of the two major centers of the city's industrial activity on the banks of the James River. Both basins have been filled in, paved over, or built upon. In addition to buildings, a number of railroad tracks crisscross the spaces once occupied by the basins. Only at its upstream end, where the Lower Basin approached the Ninth Street Bridge, is there a relatively undisturbed, though filled, remnant of this feature. Only these portions of the canal, that are in relatively original condition, form components of this thematic nomination. These portions are divided into three sections, corresponding to the three nominated sites:

A: Upper portion of Lower Basin and Ninth Street Bridge

B: Blackwater Aqueduct

C: Waterworks dam, James River dam and guard locks.

Source: VDHR V-CRIS database and NRHP Nomination Form data for VDHR architectural Site ID 118-0209 (1/1/1984 and 12/11/1984) and VDHR archaeological Site ID 44CP0069 (2/17/1983 and 6/8/2000), 2015

6.3.8.1.2 ARCHEOLOGICAL RESOURCES

An Architectural survey of the Water Works Dam and Canal (118-0209-0002), James River Dam (118-209-0003), and Scott's Mill Ruin (118-5497), was performed by Hurt and Proffitt, pursuant to Study Plan 15. The results and findings of this survey are included in Appendix I. A summary of the report follows.

The Water Works Dam and Canal and the James River Dam are all included within the National Register boundaries of the James River and Kanawha Canal Sites in Lynchburg, Virginia. The James River and Kanawha Canal Sites in Lynchburg was listed on the Virginia Landmarks Register (VLR) and the National Register of Historic Places (NRHP) in 1984 and has a period of significance of 1836-1882. The Water Works Dam and Canal and the James River Dam are identified with tertiary numbers because these properties are within the boundaries of the James River and Kanawha Canal Sites in Lynchburg. The Scott's Mill Ruin was issued a separate number and is not considered a contributing resource to the James River and Kanawha Canal Sites in Lynchburg, Virginia NRHP property.

The Area of Potential Effects (APE) for architecture is the project footprint as well as the vicinity to the project where alterations to feeling and setting may occur. It was determined that the Water Works Dam and Canal, the James River Dam, and the Scott's Mill Ruin all fall within the project APE for architecture.

Based on the results of the survey, the Water Works Dam and Canal (VDHR No.118-0209-0002) were recommended as eligible for the NRHP. The James River Dam (VDHR No.118-0209-0003) was included as a contributing resource to the James River and Kanawha Canal Sites in Lynchburg nomination; however, research indicates that the James River Dam is a separate resource from that property, post-dating its period of significance. The James River Dam is recommended eligible for the NRHP but it is not a contributing resource to the James River and Kanawha Canal Sites in Lynchburg, Virginia property. The Scott's Mill Ruin (VDHR No.118-5497) was not recommended as individually eligible for the NRHP nor is it a contributing resource to the James River and Kanawha Canal Sites in Lynchburg, Virginia property.

6.3.8.1.3 Archaeological Resources

An inventory and assessment of archaeological resources will be conducted in late 2017/early 2018. The study will be conducted in accordance with Study Plan 15 and consists of the following. The ruins of Scott's Mill, located on river left, will be recorded as an archaeological site. The site's potential for listing in the VLR and NRHP will then be coordinated with the VDHR. Archival research will be used to determine the potential for underwater archaeological sites in the APE. The results of this research will also be coordinated with the VDHR.

6.3.8.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

Scott's Mill proposes to maintain the existing natural setting to the extent possible within the project boundary and APE. Applicant proposes to use the arch section of Scott's Mill Dam for construction of the powerhouse. Initially the arch section will be used to construct the upstream cofferdam. Once the powerhouse is completed, most of the arch section will be dismantled to allow flow to pass into the powerhouse. Applicant estimates that 4 to 10 feet of the top of the arch dam will be removed. After the hydro powerhouse is completed, Applicant plans to add a two-foot high concrete cap on the spillway with a new crest elevation of 516.4 feet. Additional construction proposed would be a canoe portage near the old mill site and the American Eel and Sea Lamprey fishway which will utilize the east abutment and old mill site.

Based on the project scope and current findings the project is unlikely to have adverse effects on archaeological historic properties or historic properties in the indirect APE. The Applicant anticipates that modifications to the Water Works Dam and Canal (VDHR No.118-0209-0002) and James River Dam (VDHR No.118-0209-0003) may constitute an adverse effect on these historic properties. Applicant will continue to consult with the Commission, SHPO and Section 106 consulting parties to prepare a Historic Properties Management Plan and Programmatic Agreement to address effects to historic properties. The HPMP will include procedures to be followed for construction of the powerhouse and fishways. If a nature-like fishway is constructed using the water works canal on river right, Applicant will consult with the SHPO to determine the best approach for adaptive reuse of the historic canal.

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EXHIBIT E

APPENDICES

Scott's Mill Hydropower Project

FERC Project No. 14425

Appendix A

Consultation Record

RECORD OF TELEPHONE CONVERSATION
Person Called – Scott Smith,
Affiliation – Virginia Department of Game & Inland Fisheries
Phone Number – (434) 525-7522 Ext. 106
Call Originator – Wayne Dyok
Date – March 23, 2015

Summary of Discussion

I contacted Scott Smith to discuss potential licensing issues for the proposed Scotts Mill Hydro Project and the FERC licensing process. Scott suggested that fish passage for American eel, American shad, and resident species would be a significant issue. In further discussing fish passage, Scott agreed that a trap and transport approach might make the most sense for eels and shad because there are seven dams that fish would need to pass. A second issue would be the type of operation. Scott thought a run of river would make the most sense. Wayne commented that the applicant may ask that a run of river with some deviations might be proposed. A third issue identified by Scott related to project effects on resident fish species. Scott also mentioned the issue of dam removable may come up and may need to be addressed.

With respect to the FERC licensing process, Wayne stated that the applicant would like to use the traditional licensing process (TLP). He asked Scott if the Virginia Department of Game and Inland Fisheries would support a TLP. Scott responded that a TLP would be a better process than the alternative licensing process (ALP). Scott said that he would work with the applicant in a TLP.

Prepared by

Wayne Dyok

RECORD OF TELEPHONE CONVERSATION

Person Called – David Sutherland,
Affiliation – U. Fish and Wildlife Service
Phone Number – (410) 573-4535
Call Originator – Wayne Dyok
Date – April 21, 2015

Summary of Discussion

I contacted David Sutherland to discuss potential licensing issues for the proposed Scott's Mill Hydro Project and the FERC licensing process. I had previously forwarded him the Record of Conversation that I had with Scott Smith of Virginia Department of Game and Inland Fisheries. David agreed with Scott on the issues and suggested that we also add river herring as a candidate species for fish passage.

With respect to the FERC licensing process, Wayne stated that the applicant would like to use the traditional licensing process (TLP). He asked David if the USFWS would object to the TLP. David did not commit to the TLP, but he also did not object to the applicant proposing to use the TLP.

Prepared by

Wayne Dyok

RECORD OF TELEPHONE CONVERSATION

Person Called – Brian McGurk
Affiliation – Virginia Department of Environmental Quality
Phone Number – (804) 698-4180
Call Originator – Wayne Dyok
Date – April 16, 2015

SUBJECT: Proposed Scotts Mill Hydropower Project

Summary of Discussion

I contacted Brian McGurk of the Virginia Department of Environmental Quality to discuss the proposed five MW Scotts Mill Hydro Power Project on the James River near Lynchburg. I explained that Liberty University has a preliminary permit issued by the Federal Energy Regulatory Commission. The applicant (Liberty University) is in the process of preparing a Pre- Application Document (PAD). The applicant would like to use the Traditional Licensing Process (TLP). I asked Brian if he had any objections to using the TLP. Brian responded that he had no preference for the licensing process. He has some familiarity with the TLP.

I mentioned that I had **spoken** with the Virginia Department of Game and Inland Fisheries and the US Fish and Wildlife Service. They indicated the following preliminary issues of concern; fish passage for American eel, American shad, river herring, and possibly resident fish species; recreational access to the headpond and downstream; and a portage around the dam.

I asked Brian what issues of concern DEQ would have; Brian responded that DEQ is concerned about both water quantity and water quality. I commented that a great deal of water quality and water quantity information exists for the James River and that the PAD would include existing information about water quality and quantity. Brian and I agreed that it would be premature for him to suggest studies until he had an opportunity to review the PAD.

Brian asked about the schedule for the issuance of the PAD. I responded that our goal is to distribute the PAD around the end of May. At that time the applicant would be requesting the use of the TLP from FERC. Assuming FERC approves the TLP, the applicant would hold a joint meeting about thirty days after FERC's approval.

Prepared by

Wayne Dyok

RECORD OF TELEPHONE CONVERSATION

Person Called – Jesse Thomas-Blate, Associate Director of River Restoration
Affiliation – American Rivers
Phone Number – 202 347-7550
Call Originator – Wayne Dyok
Date – June 11, 2015

SUBJECT: Proposed Scotts Mill Hydropower Project

Summary of Discussion

I contacted Jesse of American Rivers to discuss their May 26, 2015 letter to Luminaire Technologies wherein they were investigating the possibility of decommissioning Scott's Mill Dam. I explained the complexity of the situation given that there are 6 dams upstream of Scott's Mill within about 22 miles. Jesse understood the complexity of dam removal.

I asked Jesse if American Rivers would assist Luminaire Technologies in funding fish passage since that was one of AR's goals in removing dams. Jesse said she would talk internally and get back to me.

I explained that Liberty University was in the process of preparing a Pre-Application Document for Scott's Mill dam. I asked Jesse if American Rivers would support the Traditional Licensing Process. She responded that she was not the appropriate person for that. She directed me to AR's licensing staff. We agreed to talk again when the PAD was completed.

Prepared by

Wayne Dyok

From: LaBudde, Gregory (DHR) [mailto:Gregory.LaBudde@dhr.virginia.gov]
Sent: Thursday, May 21, 2015 11:58 AM
To: Ben Leatherland
Subject: Scott's Mill Dam Repairs (DHR File No. 2015-3292) | e-Mail #02913

Dear Mr. Leatherland,

The Department of Historic Resources (DHR) has received through our ePIX system the Scott's Mill Dam Repairs project (DHR File No. 2015-3292) for our review and comment. Our comments are provided as technical assistance in assessing the potential impacts of this project on historic resources. Although a U.S. Army Corps of Engineers (Corps) permit will likely be required for this project, at present, we have not been notified by the Corps or any other Federal agency of their involvement or the applicability of Section 106 of the National Historic Preservation Act. If a Federal agency is involved with this project in the future, we reserve the right to provide additional comments under Section 106, if warranted.

It is our understanding that the project involves repairs to the Scott's Mill dam on the James River in Lynchburg. Efforts will be made to repair existing stonework by replacing loose or dislodged stones. If damaged stonework cannot be repaired, then poured-in-place concrete will be used. Ground disturbances, limited to the parking of vehicles and equipment on the south riverbank and the placement of temporary cofferdams in the river during construction, are expected to be minor.

A review of our archives indicates that project area includes the James River and Kanawha Canal Sites in Lynchburg (DHR Inventory No. 118-0209), which is listed on the Virginia Landmarks Register, and the associated canal lock (Site 44CP0069), which is considered potentially eligible for listing in the National Register of Historic Places. However, based on the information submitted for our review, it is DHR's opinion that the proposed repairs will not adversely affect the dam and associated lock.

Thank you for giving us the opportunity to provide technical assistance on this project. If you have any questions concerning our comments, or if we may provide any further assistance, please do not hesitate to contact me.

Sincerely,

Greg LaBudde, Archaeologist
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6103
fax: 804-367-2391
gregory.labudde@dhr.virginia.gov

Wayne Dyok <dyok@prodigy.net>

To: Scott Smith McGurk Brian (DEQ) jody.callihan@ferc.gov

CC : Mark Fendig Mark Fendig Ben Leatherland Ben Ward

11/13/15 at 12:18 PM

Good afternoon Scott, Brian and Jody. Attached is the agenda for our December 2, 2015 joint meeting. Jody, even though FERC would not be participating in an official capacity, we hope you can make it. Brian and Scott, I look forward to catching up with you. If you have any questions, please contact me at 916 719-7022. I am currently on the east coast and will be until the joint meeting.

I hope you also get a chance to take a quick look at our website. Our plan is to keep everyone undated on project status via the website.

Regards,

Wayne

Ben Leatherland <bll@handp.com>
To
roger.kirchen@dhr.virginia.gov_Marc.Holma@dhr.virginia.gov
CC
Wayne Dyok_mfendig@aisva.net_Randy Lichtenberger
12/16/15 at 10:45 AM

Hi Roger/Marc,

Here are some photos of the existing Scotts Mill foundation (at the Scotts Mill Dam site on north/left bank side of the James River) that we are discussing on the conference call now (see attached). Please call with any questions. Thanks.

Ben Leatherland, PWD, PWS, CPESC
Sr. Environmental Scientist

HURT & PROFFITT
CIVIL ENGINEERING & SURVEYING SINCE 1973

2524 Langhorne Road, Lynchburg, VA 24501
Phone: 434-522-7686 - Fax: 434-847-0047 - Cell: 540-520-1533
Email: bll@handp.com - Web: www.handp.com

- 4 Attachments
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RECORD OF TELEPHONE CONVERSATION

Conference Call Participants
Roger Kirchen and Marc Holma, Virginia Department of Historic Resources
Phone Number – (804) 482-6069
Ben Leatherland and Randy Lichtenberger, Hurt and Proffitt – (434) 522-7686
Call Originator – Wayne Dyok – (916) 719-7022
Date – December 16, 2015

SUBJECT: Proposed Scott's Mill Hydropower Project, Cultural Resources Work Scope

Summary of Discussion

Update on Dam Repairs

Ben provided an overview of last week's meeting among the U.S. Army Corps of Engineers, the Virginia Marine Resources Commission and Luminaire Technology on permitting requirements for necessary dam repairs to Scott's Mill dam. Permits needed for the repairs will depend upon the repairs to be conducted. It is likely that a nation-wide permit will be needed and that Luminaire Technology will need to submit a pre-construction application. The Virginia Department of Historic Resources (DHR) will have a future opportunity to review any filed permit applications. Ben added that as the Federal Energy Regulatory Commission (FERC) licensing process moves forward, DHR will have an opportunity to review that information as well. Responsibility for implementing the National Historic Preservation Act (NHPA) rests with FERC.

Discussion on Scott's Mill Licensing

Wayne provided a summary of the December 2nd Joint Meeting including a description of the project. DHR representatives said that they had numerous questions on the project. In particular Marc and Roger asked to see maps showing the alternative powerhouse layouts as the Pre-Application Document (PAD) was not clear on the specific location of the powerhouse. **Action Item.** Wayne and Ben agreed to provide a map of the alternative layouts of the powerhouse.

Cultural Resource Issues and Study Plan

Randy began a discussion of potential cultural resources issues by noting that an Area of Potential Effect (APE) has not been firmly established. He continued that there are two known cultural resources: Scott's Mill VLR is National Register of Historic Places (NRHP) eligible but not listed. There are multiple properties listed. The canal lock on river right is identified as an archeological resource.

Randy stated that Figure 9 in the PAD shows the preliminary APE, but Ben added that that was just for the repair work. Roger said that typically the FERC project boundary serves as the APE for FERC projects, but other facilities outside the boundary may be included. For Scott's Mill, Roger thought that for the new powerhouse there may be a need to include other areas downstream. Randy further stated that the Daniel's Hill Historic District is in the viewshed, but Marc thought that unlikely.

Wayne noted that the powerhouse would likely be about the same height as the dam so water could flow over it during flood conditions. Randy commented that the old Scott's Mill on river left is being considered as an alternate location for a powerhouse. If the powerhouse is not on that side then there is likely to be some type of recreation bypass facility (e.g. portage or sluiceway) and/or a possible cut for fish passage. Roger stated that the Scott's Mill ruins have not been recorded. **Action Item.** Ben agreed to provide DHR with an historic photo of the ruins showing what is currently at the site. Roger asked that the ruins be included in the cultural resources study.

Randy continued that the Liberty University (LU or applicant) plans to solicit feedback from the consulting parties on the study plan in early 2016. The applicant proposes to develop an inventory of cultural resources in 2016. In response to a question from Marc on who the consulting parties are, Wayne responded that the applicant has an initial list of contacts including a number of Indian tribes, but it is preferable if the applicant could work with DHR to ensure that the list was comprehensive. A list of parties consulted to date is included in the PAD. It was agreed that the Virginia Canals and Navigations Society (VC&NS) should be a consulting party.

Action Item. Wayne agreed to prepare a Record of Conversation for the conference call.

Randy said that an intensive survey of the dam would be needed as part of the cultural resources study. Roger responded that it may be useful to have a full inventory. The dam is listed as part of the NPD and several aspects may be impacted by the proposed project. Marc concurred that because the dam contributes to a larger resource it would be a good idea to do the inventory.

Roger said that if the pool is raised, potential impacts to cultural resources that could be flooded and subject to erosion would need to be considered. Wayne responded that the applicant plans to provide a Digital Elevation Terrain (DEM) model of the upstream area, but that the applicant does not plan to raise the flood pool. Randy added that the shoreline of the upstream islands was relatively steep (e.g., Daniel's Island) so he did not anticipate that shoreline erosion would be a problem.

Roger said he would take a look at the upstream water level changes and then make a determination as to whether a survey would be needed. Wayne noted that the island immediately downstream of the project was flooded during the Joint Meeting site visit on December 2nd when flows were about 10,000 cfs.

Randy stated that the transmission line would be a buried 500 foot-long line across the Griffin Pipe yard and this would require a cultural resources survey. Wayne suggested that because this area has been highly disturbed, it should only need a Phase 1 survey.

Roger said that he has already been receiving calls about the project. He recommended that all cultural resources elements be discussed in LU's license application even if they are later dismissed as not being affected.

Randy asked if Roger could pass on the names and numbers of the consulting parties who have expressed an interest in the project. Roger responded that DHR has not coalesced the list yet. The parties agreed that they would share contacts as appropriate among LU, FERC, and DHR.

Wayne proposed that similar to the FERC licensing process for the upstream Cushaw project, the cultural resources effort should include the cultural resources study which would feed into a Programmatic Agreement (PA) and a Historic Properties Management Plan (HPMP). Roger responded that that was DHR's expectation as well.

Action Item. Randy proposed to conduct a reconnaissance level survey and then develop a draft study plan for DHR review in January. Randy agreed to include photographs in the study plan. The study plan will be circulated to consulting parties. Roger noted that underwater archeological resources should be considered in the study plan.

Roger asked that LU consult directly with DHR on cultural resources issues. Wayne responded affirmatively, adding that as FERC's designated Federal representative that was appropriate. Randy will be LU's principal contact with DHR. LU will also add DHR to the project e-list so Roger and Marc will receive addition correspondence associated with the project to keep them informed of other developments as well.

Kirchen, Roger (DHR) <Roger.Kirchen@dhr.virginia.gov>
To
Wayne Dyok Holma, Marc (DHR) Ben Leatherland Randy Lichtenberger
CC
Mark Fendig Luke Graham
01/14/16 at 1:07 PM

This looks fine to me and we support Randy's comments.

Roger W. Kirchen, Director
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6091
fax: 804-367-2391
roger.kirchen@dhr.virginia.gov

Re: Scott's Mill Hydroelectirc Project - Draft Joint Meeting Summary

On Sunday, December 27, 2015 1:25 PM, Wayne Dyok <dyok@prodigy.net> wrote:

Greetings all. I hope you are having a great holiday. Attached are draft notes from our December 2, 2015 joint meeting. We propose to post the draft minutes on the http://www.scottsmillhydro.com/ website on Tuesday. If you notice any major errors in the notes that should be immediately corrected, please let me know by early Tuesday morning.

We would appreciate any edits that you might have to the notes by January 11th. We will then incorporate the edits, finalize the notes, post on the web site and file with FERC. It would also be great if you could identify any issues that we may have missed. We can add them as a postscript. Also feel free to use poetic license for the comments you made that we may have not worded the way you intended. We did review the audio and amended our written notes to better reflect what was said.

We are trying to figure out how to post the audio on the website. Unfortunately it is about 240 MB. At a minimum we will be filing with FERC. Hopefully the notes will suffice as the audio is 2 hours and 40 minutes.

We are in the process of preparing the study plans and will have them to you in January. We propose a 30 day review period but if you need a little more time that should be fine.

Again, thank you for attending the site visit and joint meeting.

Regards,

Wayne

SCOTT'S MILL HYDROPOWER PROJECT (FERC NO. 14425)
NOTES OF JOINT MEETING
HELD AT HURT & PROFFITT
2524 LANGHORNE ROAD, LYNCHGBURG VIRGINIA
DECEMBER 2, 2015

Attendees

Lynn Crump, Virginia Department of Conservation and Recreation

Jody Callihan, Federal Energy Regulatory Commission

Larry Jackson, APCO

Brian McGurk, Virginia Department of Environmental Quality

Justin Stauder, City of Lynchburg

Greg Poff, City of Lynchburg

Clay Sinerous, City of Lynchburg

George Palmer, Virginia Department of Game and Inland Fisheries

Scott Smith, Virginia Department of Game and Inland Fisheries

Scott Lyng, Lyng and Son Lumber

Rob Campbell, James River Association

Pat Calvert, James River Association

Ben Leatherland, Hurt & Proffitt

Randy Lichtenberger, Hurt & Proffitt

Mark Fendig, Luminaire Technologies

Kim Stein, Consultant for Liberty University

Eric Thompson, Natel Energy

Luke Graham, Consultant

Wayne Dyok, Facilitator

Site Reconnaissance

Joint Meeting participants attended a site visit in the morning. The site visit began at the James River Canoe Boat Ramp approximately one half mile downstream from Scott's Mill dam. Participants then drove along the south side of the river (river left) from the dam to an upstream railroad trestle crossing of the James River. The participants returned to the south side of the dam and observed the flow over the dam (i.e., approximately 10,000 cfs), the foundation of the old Scott's Mill grist mill, the general location of the hydro project facilities, and a potential portage/boat passage site on the south side of the river. Due to safety considerations participants did not observe conditions on the north side of the river as that is an active industrial facility operated by Griffin Pipe Products[1].

Joint Meeting Introductions

The agency joint meeting commenced at 1:30 pm at the office of Hurt and Proffitt. Wayne Dyok facilitated the meeting. Wayne announced that the meeting was being recorded as required by Federal Energy Regulatory Commission (FERC) regulations. He noted that a goal of the meeting was to capture issues of interest to participants. He also reviewed the agenda: project overview, presentation on Natel Energy concepts, process plan and schedule, and discussion on environmental resource issues. Wayne noted that Liberty University (LU) proposes to provide draft study plans in January and then have participants react to them rather than have participants propose studies by February 2, 2016 as required by FERC regulations. Participants then introduced themselves.

Project Description and Operation

Wayne provided an overview of the project and its operation based on information provided in the Pre-Application Document (PAD). The proposed project is a low head hydropower project similar to what has previously been proposed, except that LU is considering new technology and proposes to work with licensing participants to develop a fish passage plan. The capacity would be about 3.8 MW, but that capacity has not yet been firmed. Approximately 13,500 MWh of energy would be generated annually. The project would require a short transmission line about 500 feet in length.

The project would be run of river, essentially providing constant flows downstream of Scott's Mill dam. LU is considering using flashboards at the dam and possibly raising the height of the headpond up to 3 feet. If this is done, the project would operate in coordination with the upstream Reusens Project which could then be operated in somewhat of a peaking mode. However, this is only an option to be considered at this time. Wayne commented that there is an opening between the dam and an upstream island. Water from the left side of the river could be passed through this opening to ensure that there is flow down the left side of the river.

Eric Thompson, Natel Energy, presented preliminary concepts for the powerhouse. The current thought is to place the powerhouse in the arch section of the dam towards the right side. Seven or eight turbine units are anticipated. However, the location of the powerhouse could change based upon input from interested parties.

Eric was asked what the hydraulic capacity of the powerhouse would be. This has yet to be determined, but typically run of river projects are designed to accommodate the mean flow or greater.

[1] Participants were shown aerial photographs of the north side of the river during the afternoon meeting.

Hence a capacity of slightly over 3,000 cfs may be a reasonable estimate[2]. As the design is refined, the hydraulic capacity will be confirmed.

Pat Calvert, James River Association, said he envisioned that there would be adverse impacts to the dam and asked if there would be a mitigation plan. Wayne replied that no one from the Virginia Department of Historic Resources (DHR) was able to attend today's meeting, but LU plans to work closely with DHR to address potential impacts. LU would develop a Historic Properties Management Plan. Wayne also noted that parts of the dam are crumbling and the dam owner is working with DHR and the U.S. Army Corps of Engineers to address maintenance issues[3].

Scott Ling, Ling and Son Lumber, asked if LU would consider placing the dam on the east (south) side of the river. Although LU would prefer a site nearer to the transmission line interconnection on the north side, it proposed to work with participants to evaluate reasonable alternatives. In a previous FERC license application, the applicant had proposed a powerhouse on the south side.

Jody Callihan, FERC, asked about the volume of sediment to be excavated for powerhouse construction. There would need to be some level of excavation and construction of a downstream cofferdam (the Scotts Mill dam could serve as the upstream cofferdam). Eric stated that the Natel units do not require a draft tube for unit submergence, and this could result in minimal excavation. However, it may be desirable to have some level of excavation to improve energy generation efficiency.

In response to a question from Jody about access, Mark Fendig, Luminaire Technologies, responded that he has an easement across the property being leased by Griffin Pipe and across the railroad tracks to obtain construction access. Mark added that the transmission line would likely be constructed underground.

Scott asked if water to the powerhouse could be drawn from the right side of the river. LU representatives responded affirmatively. The canal side may be a third option for LU to investigate for a powerhouse.

Pat asked where the power would be used. Mark replied that it would go into the grid, but Griffin Pipe has a greater demand than the power output from the project. Pat noted that a great selling point for the project would be if it could be used locally to minimize power outage disruptions. Wayne said it could and added that project power could be used to restart the local grid after an outage since hydro has that advantage over other generation forms.

There was a discussion on the current status of the dam. It is classified as a low hazard dam, but Luminaire Technologies is in the process of getting approvals to make repairs to the dam.

After the dam discussions, Eric completed his presentation on Natel and the preliminary powerhouse design (see associated Joint Meeting PowerPoint presentation). Natel's objective is to develop

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[2] With a 17 foot head and 80 percent turbine efficiency, a 3.8 MW project equates to a powerhouse flow of 3,300 cfs.

[3] Applicant and DHR discussed cultural resources issues on December 16, 2015. Notes from this discussion can be found on the project website at www.scottsmillhydro.com.

standardized turbine/generator designs. One of the advantages of the Natel units is that they are less expensive than traditional low head turbine units.

Process Plan and Schedule

Wayne next reviewed the Process Plan and Schedule. He noted that FERC had recently approved use of the Traditional Licensing Process (TLP). Further FERC designated LU as its Federal representative for Endangered Species Act (ESA) consultation and for consultation with the State Historic Preservation Officer (DHR). LU will be preparing a meeting summary within the next couple of weeks. Comments on proposed studies are due on February 2, 2016, but LU proposes to transmit draft study plans prior to that date so licensing participants can react to LU's draft plans rather than propose studies pursuant to FERC's guidelines. LU would also like to maximize use of its project website at www.scottsmillhydro.com and proposes to communicate with participants using electronic media.

Pat asked about how the Scott's Mill Project would affect Reusens Project operation. Although Reusens is currently not operating, once it is refurbished, it could operate in a coordinated fashion with Scott's Mill. Reusens could release more water during the day filling the 316 acre head pond up to three feet above current water levels. Scott's Mill would release water in a constant flow fashion, lowering the headpond level during the evening. This assumes that flashboards would be added. LU noted that the flashboard heights could be as high as three feet, but could be less than that.

Resource Issues

Recreation - Due to participant schedules, LU began the resources issues discussion with recreation.

Lynn Crump, Virginia Department of Conservation and Recreation (DCR), asked if LU has been in contact with the federal and state agencies responsible for threatened and endangered species (i.e., U.S. Fish and Wildlife Service and DCR Natural Heritage Program). Wayne replied that Hurt & Proffitt will be coordinating with the DCR Natural Heritage Program to get the most updated list of state threatened and endangered species. LU will work with licensing participants to ensure potential effects are addressed.

Wayne summarized the recreation needs presented in the PAD that were extracted from the State Comprehensive Outdoor Recreation Plan. LU believes that there is an opportunity for a canoe portage on the left side of the river, but wants to ensure that they do not incur liability. Lynn cited Commonwealth law that as long as LU did not charge for usage, LU would not be liable. She suggested that LU consider breaching the dam on the left side of the river and creating a flume that would avoid the need to portage. This would also minimize the likelihood of that side of the river from stagnating. The Russel Fork River in Dickenson County and the Appomattox River at Harvell were cited as examples. LU reps agreed to investigate this concept as well as a portage around the dam. Lynn added that if breaching of the left side of the river is provided, it could also facilitate fish passage at the site. Other aspects of the recreation included provision of parking facilities and making facilities Americans with Disability Act (ADA) compliant.

Lynn continued that LU should consider looking at River Road as part of the scenic byway system. Wayne responded that safety is the greatest concern in any recreation endeavor.

Pat recommended that LU consider a boat landing upstream of the dam in the vicinity of or upstream of Harris Creek. Scott Smith, Virginia Department of Game and Inland Fisheries (DGIF), echoed that there was a need for upstream boat access in the headpond.

There was some discussion of what should be included in the project area. Wayne noted that there are two schools of thought. The first is to include only the project facilities within the project boundary and the second is to include the project facilities and the headpond. Typically FERC wants to make sure a licensee has full control over the headpond, especially if it fluctuates. However, on the downside, this could constrain LU from developing their property located upstream of the dam. Pat suggested that the project boundary include the headpond. Scott Smith added that recreation improvements do not necessarily need to be within a FERC project boundary.

Lynn expressed a concern about potential pollution related to the river sediments, particularly if the dam is breached. Wayne commented that LU will be looking at decommissioning as an alternative but because there are 7 dams within a short distance, he postulated decommissioning would not be a viable option. Pollution is an issue that will be considered. Wayne offered that the silt within the impoundment is likely in equilibrium.

Lynn also suggested that LU include some interpretation signage at the mill site, as well as natural heritage interpretation and how this might relate to the James River trail.

Pat commented that he receives the FERC recreation reports for the James River projects and there are essentially no recreation facilities. He added that there is a huge opportunity for camping, hiking and biking. He hoped that LU would consider all these resources.

Rob Campbell, James River Association, said that Amherst County should be engaged on recreation access. He noted that this project could be the start of a water trail. Wayne responded that LU had been in contact with Sara Lu Christian of Amherst County, but she was unable to attend the meeting. He added that LU intends to follow up with her. Discussion ensued about bicycling along River Road, possibly including a bike lane. Lynn suggested that a simple bench would be nice for cyclists. It was also noted that there are no public areas for camping within the Lynchburg area.

Water Resources - Discussion next turned to water resources/water quality issues. It was noted that water rights originating from the J.R. Canal Company had been passed on to the railroad, City of Lynchburg, and Luminaire as successor to the dam. These are flowage rights wherein there is a shared percentage of the river. It was also noted that these rights have not been exercised. Brian McGurk, Virginia Department of Environmental Quality (DEQ), stated that the Commonwealth has a different perspective on water rights. That is, the people own the water based on a 1914 Supreme Court ruling.

Brian said that LU would need to file water protection permits for the project. This includes protection of wetlands and fisheries among others, essentially all components of what goes into a Virginia Water Permit application. He said that DEQ would coordinate with FERC on the permit conditions. The conditions would be finalized after the application is submitted. The application would also need to be submitted to the U.S. Army Corps of Engineers.

Brian asked if the flashboards are added and the headpond water level is raised, would the wetlands be affected? Ben Leatherland, Hurt & Proffitt responded that one third of the island upstream of the dam is comprised of jurisdictional wetlands, with the center portion scooped out. On the left side of the island there is a 10:1 slope. This area may be forested. Depending upon the hydrological regime these trees may be able to survive. It was agreed that the wetland effects would need to be studied as the project moves forward.

Because DEQ collects water quality data immediately downstream of Scott's Mill, further water quality baseline data collection was deemed unnecessary. However, LU will need to assess the effects of diverting water through the powerhouse and away from the left side of the river on water quality both immediately upstream and downstream of Scott's Mill dam. Wayne noted that LU has already flagged this as an issue and had included the issue in the PowerPoint presentation.

Fishery Resources – Participants next discussed fish entrainment and mortality issues. Eric commented that one of the advantages of Natel's turbines is that there is no pressure drop across the turbine blades and that this should reduce fish entrainment injury, as a sudden pressure drop can adversely affect fish. Further turbine blade strikes which can be a cause of fish mortality should be reduced because the blades are spinning at half the speed of water, and this is much slower than with traditional turbines which spin at much greater speeds. Eric added that "computer" fish have fared well in entrainment tests to date on the Natel units. Pat stated that he would like to see real statistics on turbine mortality before he commits to this technology. Eric responded that Natel would have specific entrainment study results by the end of 2016.

Scott Smith said that fish passage would be an important part of the fishery studies. Both migratory and resident species would need to be passed. He said that some species are already present at the dam and there is no sense in delaying passage (e.g., American eel). Scott concurred that there may need to be triggers for other species like American shad. Wayne suggested that since there are seven dams involved, a trap and haul program may make the most sense. Scott agreed that trap and transport was likely the only way to go, but different options should also be considered. It was agreed that American eels could easily be passed upstream, but there is a problem getting them downstream. Wayne suggested that LU capitalize on the downstream passage research being conducted at other hydro projects and include a literature study on downstream passage as part of the study plan. There was general consensus on this but Scott added that nighttime shutdown should be considered. Scott recommended that adaptive management adjustments should be built into the fish passage program. There was no disagreement on this.

Scott continued that mussel surveys were lacking in the impoundment and immediately downstream. He thought there was some likelihood of a few mussel species being present including green floaters. He recommended that LU talk with Brian Watson at DGIF.

Pat said he wanted to see real data for fish species that may be present in the impoundment. The PAD shows that there is little difference in fish species from downstream of Scott's Mill to upstream of Cushaw dam. However, no specific data on impoundment fish species was presented in the PAD. Wayne expressed concern about the cost of potential studies to identify fish species in the impoundment. A species presence/absence assessment would not be a costly study but the cost for distribution and abundance studies could be significant because the studies would need to consider different habitat types, seasonality, life stages, potentially year to year variability, and possibly require different sampling gear types. Wayne showed a slide of the criteria FERC uses to justify studies, the last criterion of which is cost. Wayne also said that the participants should consider how the fish species data would be used in decision-making. It was agreed that LU would work with DGIF to determine what existing species data was available for the impoundment and what would be required to satisfy study needs.

Scott further requested that LU assess how fish habitat would change with flow changes from one side of the river to the other and the associated water quality effects. He also asked that effects on fish habitat on either side of the river downstream of Scott's Mill dam be evaluated. It was agreed that bathymetry both upstream and downstream of the dam would likely be needed for this assessment. Brian specifically noted that LU should assess effects that may occur during drought conditions.

Wildlife Resources – Although there is not a significant amount of wildlife habitat associated with the project, participants requested that the effects of water level changes from flashboard installation on furbearers be assessed.

Scott said that LU should contact Rick Reynolds, DGIF's bat expert, to determine what studies may be needed to assess the effects on bats, particularly if there might be a loss of trees from water level changes.

Other Issues – No specific land use or socio-economic issues were raised. Wetland issues were covered under water resources. Cultural resources issues were partially discussed under recreation, but LU emphasized that they would be working closely with DHR and other interested parties including the Canal Society and Indian tribes to fully address these issues.

Public Session – There were no attendees to the evening public session except for FERC and LU representatives. No additional issues were identified.

Water Resources
525 Taylor Street • Lynchburg •Virginia • 24501
www.lynchburgva.gov • P 434455-4250 • F 434-845-7353

January 11, 2016

WayneDyok dyok@prodigy.net

Mark Fendig mfendig@web-o.net

Kim Stein (Liberty University). kstein
1609@earthlink.net

Re: Scott's Mill Hydropower Project (FERC No. 14425)
December 2, 2015 Joint Meeting

I am writing on behalf of the City of Lynchburg, Water Resources, to address questions concerning information presented at the Joint Meeting on December 2, 2015. While the City may have additional questions as the plans for the Scott's Mill Hydropower Project (FERC No. 14425) ("Project") progresses, we did want to raise two fundamental questions early to provide an opportunity for further discussion and consideration of the needs of the City of Lynchburg. The most apparent issues for Water Resources, arising from the joint meeting, concern existing rights and obligations related to the dam and protection of the water and wastewater infrastructure of the City of Lynchburg.

1. Subject: Flashboards/ pond level — "LU is considering using flashboards at the dam and possibly raising the height of the headpond up to 3 feet. If this is done, the project would operate in coordination with the upstream Reusens Project, which could then be operated in somewhat of a peaking mode."

   Question: Has the impact to raw water withdrawals and pond level to surrounding City infrastructure been considered? The City utilizes the river for raw water withdrawals and the surrounding area contains public water and wastewater infrastructure (including a major wastewater interceptor and combined sewer overflow ("CSO") structures) that may be impacted.

2. Subject: Maintenance of the Dam and Cost— "Pat Calvert, James River Association, said he envisioned that there would be adverse impacts to the dam and asked if there would be a mitigation plan. Wayne replied that no one from the Virginia Department of Historic Resources (DHR) was able to attend today's meeting, but LU plans to work closely with DI--IR to address potential impacts. LU would develop a Historic Properties

   Management Plan. Wayne also noted that parts of the dam are crumbling and the dam owner is working with DHR and the U.S. Army Corps of Engineers to address maintenance issues."

Question: What has been done to consider existing rights and obligations between the

City and other parties relating, in part, to the City's right to withdraw water from the

James River and the construction and maintenance of the dam across the James River (the Scotts Mill Dam)? Maintenance of the Scotts Mill is the subject of various agreements and amendments to those agreements. The City has an interest in the protection of its rights and the management of its obligations under agreements related to the dam and the water resources in the James River.

Thank you for the opportunity to review the draft joint meeting notes. We look forward to continued discussion concerning the Project. Please refer responses to timothy.mitchell@lynchburgva.gov

Sincerely,

Timothy A. Mitchell, P.E.
Director

cc: L. Kimball Payne, Ill, City Manager
Walter Erwin, City Attorney
Department File

Luke Graham <scottsmillhydro@yahoo.com>
01/18/16 at 6:16 PM

Dear Interested Party

On behalf of Liberty University we would like to thank those who attended the Scott's Mill Dam Joint Meeting on December 2, 2015. Also a big thank you to those who helped us finalize the minutes from the meeting. The final minutes are posted on LU's project website at www.scottsmillhydro.com.

Additionally we have posted Records of Conversations that we believe are relevant to the licensing process, as well as recent filings with FERC. LU intends to keep you updated on events through the website. If your situation changes and you no longer wish to receive periodic updates on the project please send an email to scottsmillhydro@yahoo.com

LU is in the process of preparing draft study plans. We expect to post them on the website this month. Our thinking is to provide a one month review. Please let us know if this does not work for you after you receive the draft plans. We plan to work with participants to try to reach agreement on the study plans prior to executing them.

Federal Energy Regulatory Commission regulations indicate that comments on the PAD and any proposed study plans are due on February 2, 2016. However, the participants agreed at the Joint Meeting that LU would provide draft plans and participants would have an opportunity to comment after receiving the draft plans. Accordingly it is not necessary to submit comments on February 2, 2016 to LU. However, LU would welcome any comments on the PAD that you care to provide at that time.

We look forward to continue working with you on the licensing.

Regards,

Liberty University licensing team

Reply Reply to All Forward More

Luke Graham <scottsmillhydro@yahoo.com>
To
julie.crocker@noaa.gov jeddings@achp.gov slchristian@countyofamherst.com glen.besa@sierraclub.org catherine-gray@cherokee.org and 38 more...

02/01/16 at 4:54 PM

Good afternoon. Liberty University (LU) had planned to distribute the study plans for the proposed Scott's Mill Hydropower Project last Friday. Regrettably we were unable to do so. LU is continuing to finalize these plans. We have a scheduled site visit to finalize one of the remaining plans on Friday. Accordingly, we anticipate posting these plans on our website early next week. We will allow adequate time for your review once we notify you that the study plans have been posted on the Scott's ll webiste. Again we apologize for any inconvenience.

On behalf of LU,

Wayne and Mark

Pat Calvert <pcalvert@jrava.org>
02/02/16 at 6:25 PM

Please accept the attached comments on behalf of James River Association.

Pat Calvert
Upper James Riverkeeper
James River Association
434.964.7635
pcalvert@jrava.org

February 2, 2016
RE: Application for FERC Project No. 14425, Scott's Mill dam hydropower proposal

To Whom It May Concern:

James River Association (JRA) is a conservation organization that has been solely dedicated to restoring and protecting the James River for over thirty-five years. On behalf of our thousands of members and supporters throughout Virginia, JRA provides these comments on the proposed licensure of the Scotts Mill dam hydropower project.

The JRA staff uses Virginia water bodies for scientific study, educational programs and recreational purposes that are vital to our mission. The JRA owns land and holds a lease to other property adjacent to the James River giving it valuable economic interests in protecting water quality. JRA members enjoy a wide range of recreational activities, including fishing, swimming, and boating, throughout the James River basin and in other Virginia water
bodies. Also, our members have important economic, professional and aesthetic interests in the health of Virginia water bodies. Thus, JRA and our members have direct, substantial, past, and ongoing interests that will be affected by this proposed project.

Aquatic Organism Passage

Scott's Mill dam serves as the first upstream complete blockage to fish and aquatic organism passage in the 340-mile mainstem James River. This proposal creates a distinct opportunity to mitigate the effects of this physical obstruction for diadromous and resident freshwater species. As restored passage is an established goal of the both state and federal initiatives in this waterbody, species of concern to consider for restored river passage include: freshwater mussels and host fish species, resident fish species (including smallmouth bass and centrarchids), migratory species (including river herring and shad, lamprey and American eel) and state and federally listed species documented within the impounded and immediate downstream waters.

Documentation Regarding Proposed Generator Units

The Applicant has proposed the use of Natel hydro units for this project. Modeling analyses are insufficient to establish operational impact of these units. Observational data and statistics that provide critical information -- such as fish impingement and entrainment, measured fish mortality and passage success -- are necessary in order to determine specific product appropriateness for potential application. We request that these units be thoroughly tested and analyzed for effectiveness in protecting aquatic life and ecological integrity. These data and conclusions should subsequently be publicized and scrutinized for review prior to licensure.

Effects of Enhanced Dam Elevation

It was suggested at the December 2, 2015 joint meeting that the dam is proposed to be raised 2 to 3 feet in height. The effects of this alteration both upstream and downstream of the dam should be determined and publicized both in writing and in visual map format. Of particular concern are resulting alterations to shoreline habitats, to downstream amenities (including public boat ramps), to available aquatic habitat and to overall downriver conditions.

Effects of Water Diversion

Also on December 2, 2015, there was a reference to the possibility of physically diverting and concentrating the impounded waters toward the hydro units. It is recommended that the Applicant provide detailed engineering specifications on the effects of such a diversion of water. Of particular concern again are resulting alterations to shoreline habitats, to downstream amenities (including public boat ramps), to available aquatic habitat and to overall downriver conditions.

Determination of Project Area

It was unclear on December 2, 2015 as to where the formal Project Area would extend. It is recommended that the Project Area parameters and boundaries be publicized utilizing map and aerial photography formats.

Water Rights

It was suggested on December 2, 2015 meeting that a claim or claims to private water rights may exist in the Project Area. It is recommended that any claim to and intent to exercise private water rights be forfeited by involved parties as a term of licensure.

Public Boating Access

As no public access is available upstream of Scott's Mill dam, there exist opportunities to create public access to the upstream, impounded waters and for safe boat passage through the renovated dam. Additional public access to the river in this section would directly contribute to the stated goals of the James River Heritage Trail, as well as the Region 2000 Greenway/Blueway initiative. Public access needs for these navigable waters are listed below:

- Public Boating Access point(s) to impounded waters. Applicant property on River Rd. in Amherst County adjoining the Project Area could serve as a sufficient location for public boating and recreational river access due to its proximity to both the river and the road. Sufficient space is available for parking and for an improved boat ramp.

- Boat passage. Dam designs provide for safe navigation of small watercraft (e.g. canoe, kayak) to safely descend from the impounded section into the free flowing James. Example: Bartlick Dam on Russell Fork in Southwest Virginia.

- Boat portage. The applicant should consider designing safe and public portage that would serve to connect river users between the impounded section and the downstream, free- flowing river.

Public Fishing Access

In submitting their proposal, we request that the applicant consider public access to fishermen and sportsmen. Some of these needs may be supported by the public river access as previously mentioned, but would effectively serve more people if specific fishing areas were provided for the public that will be fishing from the shore or wading from either side of the river. The immediate Project Area regularly supports sport and subsistence fishermen but is limited to areas located downstream of the dam. Suggestions for improvements to and needs for public fishing access are as follows:

- Public Fishing Areas/Shores. The Applicant owns property on River Rd. that could serve as a location to create several suitable public fishing sites. Similar opportunities should be sought on the Lynchburg side as well.

- Public Fishing Areas/Island within impounded waters. The Applicant owns a sizeable island in the impounded section, locally known as Treasure Island. The Applicant should consider providing designated public fishing areas on this island for boater access.

Public Walking / Multi-Use Trails

When drafting their proposal, the applicant should consider installing Multi-use Pedestrian Trails. There are several local trail networks that are in close proximity to the project area and could easily be adjoined to create a larger public trail network. The island which the applicant currently owns would make a green park space and wildlife habitat to add to the nearby urban public spaces in the City of Lynchburg. The applicant also owns property on the Amherst County side of the project area that can serve as a connection to the existing trail network one half mile east on River road. Specific suggestions are listed below:

- Connector Trail to the Blackwater Creek Trail Network. Providing a connection from the project area to the existing trail would make available a new dimension for trail users and provide them with an opportunity to experience a forested space. This feature would further connect the affected community to the City of Lynchburg via a pedestrian pathway.

- Connector Trail to Riveredge Park / Trail Network. This recently renovated park and newly installed trail lies directly downstream from the Project Area in Amherst County. This County intends for this trail to connect Amherst County (Riveredge Park) with the City of Lynchburg (Blackwater Creek Trail) to provide pedestrian and bicycle cross-river transit between Lynchburg and Amherst County. To serve this community, the applicant should look to connect their project area to these existing trail networks.

Public Camping

When considering recreational use of lands near the Project Area, the Applicant should consider providing designated public spaces for camping and outdoor recreation. Treasure Island would meet this need, and could provide the requisite space to allow several campsites separated from a picnic area. There are no such sites for the public to access in the surrounding area and would benefit recreational needs in this section of river. A pedestrian/bicycle bridge to the island would permit access for those who are unable to access the island by boat.

- Treasure Island. This location would be ideal for several primitive campsites, and still have a significant area for picnic tables without disturbing the natural values of this largely vegetated island and wildlife habitat.

- Daniels Island. Same situation could be applied here if the applicant owns the island. It to lies within the impounded area.

Public Parkland

The applicant should consider dedication of public parkland to both view and recreate in the impounded section. As an example, Amherst County's Monacan Park is located immediately upstream of the adjacent Reusens Dam (FERC Project No. 2376) as part of this dam's licensure. The owners of the dam own the parkland and lease that land to the county to have a public area for the community to enjoy the river. This park contains improved boating access, picnic and pavilion facilities, docks and fishing opportunities for the public to enjoy at their convenience. The aforementioned property on River Road would meet this need. Treasure Island was historically a park that served as a frequented and popular destination for the public. Restoring the island to this use would be a tremendous asset for the surrounding communities.

Historical Interpretation

The proposed area for this hydropower project will likely impact several historical community features. The portion of the dam that is located closest to Lynchburg, which is the proposed site of the generator units, is the oldest dam structure -- known as the Horseshoe Dam. This significant historical construction supported and made possible the existence of the James River and Kanawha Canal. Impacts to any portion of the Horseshoe Dam would alter its original state in a way that would make this piece of Lynchburg history remain incomplete in perpetuity. On the Amherst County (north) side of the dam are the remains of the historic dam's namesake -- Scotts Mill. These structures too are an important historical site that will be potentially impacted by proposed activities. Furthermore, the impounded waters created by this project were once readily available to bateaux, packet boats and to commercial river traffic, which were paramount to the founding of Lynchburg.

As these historical features will be impacted, we recommend that the Applicant develop -- in collaboration with the Lynchburg Museum System and/or qualified stakeholders -- appropriately designed historical interpretive signage that will preserve these critical properties. Signage could be installed at public river access locations and within the project area to inform the public of the historical, commercial and social significance of this section of the James River. Prospective locations where signage could be placed listed are:

- Riveredge Park (Amherst County)
- 7th Street Public Boat Landing (City of Lynchburg)
- River Front Park and Percival's Island (City of Lynchburg)
- Newly dedicated public access areas and parklands

We are optimistic that these comments will prove helpful towards a meaningful and cooperative licensure process. Thank you for providing James River Association with this opportunity to voice our interests through these requests for study consideration. Please feel free to contact me at (434) 964-7635 or PCalvert@JRAva.org if you have any questions or additional requests.

Respectfully submitted,

Patrick L. Calvert
Upper James RIVERKEEPER®

Cc: Mark Fendig, Wayne Dyok, Kim Stein

Wayne Dyok <dyok@prodigy.net>

02/02/16 at 8:02 PM

Pat - Thanks for your comments. I think we are addressing them in the various study plans, but I will go back and verify that we have addressed all of them. This is very helpful.

Wayne

Luke Graham <scottsmillhydro@yahoo.com>
02/08/16 at 4:58 PM

BCC
jeddings@achp.gov Robert Bennet Glen Besa sbanks@blm.gov bmcgreg2010@gmail.com and 38 more...

Dear Licensing Participant:

Liberty University (LU) has now posted the draft study plans for the proposed Scott's Mill Hydroelectric Project on its web site at http://www.scottsmillhydro.com./ Based on informal discussions with licensing participants and the December 2, 2015 Joint Meeting LU developed 17 study plans. These draft plans along with Appendices can be assessed on the web site under the Study Plan tab. http://www.scottsmillhydro.com/study-plan.html The Appendices also show recent photographs of the portion of the site that we were unable to access on December 2nd due to safety considerations.

The study plans reference cultural resources Site Assessment forms. At this time these forms are not being made public.

We respectfully request that you provide your comments on the Pre-Application Document and draft study plans by Wednesday, March 10, 2016. Comments should be emailed to scottsmillhydro@yahoo.com. We would appreciate if you could copy Wayne Dyok at dyok@prodigy.net and Mark Fendig at mfendig@aisva.net. Please let us know if you cannot make that date. Thank you.

Regards,

Mark, Kim, Ben, Luke and Wayne

-----Original Message-----
From: Randy Lichtenberger [mailto:rml@handp.com]
Sent: Tuesday, February 09, 2016 9:48 AM
To: Kirchen, Roger (DHR)

Cc: dyok@prodigy.net; Ben Leatherland; kstein1609@earthlink.net; mfendig@aisva.net
Subject: Scott's Mill Hydro draft CR study plan

Roger,

Please find attached a copy of the draft study plan for cultural resources (see page 51) for the proposed Scott's Mill Hydro Project and corresponding appendices. These have also been posted to and are available for download from the website www.scottsmillhydro.com. I have also attached three site forms, representing the previously recorded resources in the preliminary APE. They are referred to in the draft study plan as Attachments 1 - 3. We have refrained from posting these online until ascertaining from the VDHR that these may be publicly shared. It is my opinion that they do not contain sensitive information and could be shared online, but please let us know if you concur.

We look forward to receiving VDHR's comments on the draft study plan.

Randy Lichtenberger
Director of Cultural Resources

HURT & PROFFITT
2524 Langhorne Road, Lynchburg, VA 24501
Phone: 434-546-6158 - Fax: 434-847-0047
Email: rml@handp.com - Web: www.handp.com

Kirchen, Roger (DHR) <Roger.Kirchen@dhr.virginia.gov>
To
Randy Lichtenberger
CC
dyok@prodigy.net Ben Leatherland kstein1609@earthlink.net mfendig@aisva.net
03/17/16 at 7:08 AM

DHR supports the proposed Cultural Resources Study Plan and has no comment at this time. Further, we do not object to the posting of the three site forms as attachments to the Study Plan; however, we ask that the locational maps appended to each of the forms be removed to protect sensitive locational information for these and adjacent sites.

____

Roger W. Kirchen, Director
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6091
fax: 804-367-2391
roger.kirchen@dhr.virginia.gov

Luke Graham <scottsmillhydro@yahoo.com>

Dear Interested Party:

Liberty University has filed with FERC the attached letter and the draft Study Plan for the Scott's Mill Hydroelectric Project.

Also, there was a typographical error in the weir equation Study Plan 1, with the H and Q being transposed. This was corrected and the document was reposted yesterday. The calculations were correct however.

If you have any questions, feel free to contact Wayne Dyok at 916 719-7022. We look forward to receipt of your comments in March.

Regards,
Wayne

02/12/16 at 11:53 PM

February 12, 2016
Via Electronic Filing
Ms. Kimberly D**.** Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: FERC Project No. P14425-000
Scott's Mill Hydroelectric Power Project
Transmittal of Draft Study Plan

Dear Secretary Ms. Bose:

On behalf of Liberty University (LU), enclosed please find the draft Study Plan for the Scott's Mill Hydroelectric Power Project. LU posted the draft Study Plan on its web site at www.scottsmillhydro.com on February 8, 2016 and pursuant to the Communications Protocol simultaneously emailed resource agencies, Indian tribes, non-government organizations and other interested parties of the availability of the draft Study Plan. LU is requesting that participants comment on the PAD and draft Study Plan by March 10, 2016. LU intends to continue to work with licensing participants to finalize the Study Plan after comments have been received.

Licensing participants and LU agreed at the December 2, 2015 Joint Meeting that LU would prepare the draft Study Plan based upon comments received at the Joint Meeting and additional consultation. LU suggested at the meeting that participants provide their Study Plan comments one month after receipt of the draft Study Plan.

If you have any questions please contact the undersigned at (916) 719-7022.

Respectfully submitted,

Wayne M Dyok

McGurk, Brian (DEQ) <Brian.McGurk@deq.virginia.gov>
03/11/16 at 11:58 AM

Please see the attached memorandum containing comments on the Study Plans.

Brian McGurk, P. G.
Office of Water Supply
Virginia Department of Environmental Quality

brian.mcgurk@deq.virginia.gov
804-698-4180
mailing address: P.O. Box 1105, Richmond VA 23218

Molly Joseph Ward Secretary of Natural Resources
MEMORANDUM

March 11, 2016
COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY Street address: 629 East Main Street, Richmond, Virginia 23219 Mailing address: P.O. Box 1105, Richmond, Virginia 23218 Fax: 804-698-4019 - TDD (804) 698-4021
To: Kim Stein, Liberty University
From: Brian McGurk, Mark Richards, Mark Bushing (DEQ)
www.deq.virginia.gov

Re: Scotts Mill Hydropower Project (FERC P-14425), Request for Comments on Draft Study Plans
Thank you for the opportunity to provide comments on the Draft Study Plans. Following below are DEQ comments on the draft plan.
Study Plan 1: Water Levels

According to the description of the project, inflow that is less than the hydraulic capacity of the hydropower facility will be diverted to the facility, causing little to no flow over the top of the dam. This will apparently result in little to no flow to a portion of the river downstream for significant periods during low flow conditions on the river. The study plan should include the following:

- Specification of the number and location of upstream and downstream staff gauges and the planned frequency of water level monitoring at each gauge

- It was stated that due to the long period of flow recording in the James, no additional flow data are needed. The study plan should identify the flow gauge(s) from which data will be relied upon and how discharge at other locations will be transferred to the dam location.

- The monitoring should 1) capture low flow periods when there is little to no flow over the dam under the current condition, and 2) occur downstream of the dam along the left side of the river so that post-project effects upon the area immediately downstream can be estimated.

The plan should specify who will perform the monitoring and describe how the proficiency and/or experience of the workers will be determined.

Study Plan 2: Bathymetry Survey

The plan should specify who will perform the survey and describe how the proficiency and/or experience of the surveyors will be determined. Why is the use of sidescan sonar the most appropriate methodology?

David K. Paylor Director
(804) 698-4020 1-800-592-5482
P-14425 Study Plan Comments March 11, 2016

How will the map mentioned in section 10 be used to help determine flow pattern changes for pre- and post-project conditions?

Study Plan 3: Water Quality Effects of Flow and Water Level Changes

The PAD stated that the powerhouse will be located behind the 140-ft long gravity arch spillway. If the project layout has been changed or might be changed from that described in the PAD then the alternative project layouts should be identified explicitly as dependent upon the results of the studies.

The plan should specify who will perform the monitoring and describe how the workers' proficiency and/or experience will be determined. How will appropriate sampling points be determined? Will the sampling include the entire water column?

The plan states that it may be necessary to measure water velocities upstream of Scott's Mill dam to verify existing flow patterns during low flow conditions. Such measurements would be used to verify the accuracy of flow pattern predictions based on bathymetry and water level data. These measurements should be considered as definitely necessary and not optional.

The plan should explain why the approach considered (without a modeling effort to assess changes in flow patterns) should yield reasonable results rather than just including a statement to that effect.

Study Plan 4: Sediment Chemical Analysis

There is obvious concern that PCB contaminated sediment exists upstream of the dam and could be re-suspended during the dredging/sediment excavation effort. While recognized within this proposed study, the characterization appears to fall short.

First, DEQ suggests U.S. EPA Method 1668 be used for a portion of the sediment samples. This will provide a complete characterization within those samples for all PCB congeners and will account for weathering that may have occurred particularly in the deeper, anaerobic sediments. Targeting a small list of PCB congeners, such as those proposed can lead to an underestimation of total PCBs and an inaccurate level of existing contamination. A list of VELAP certified labs that perform method 1668 can be found on DEQ's PCB TMDL website. EPA Method SW-846- 8082 can also be used but should be calibrated against 1668 to see what percentage of PCB may be missed. A couple of side by side samples should accomplish this task.

Second, the characterization should be spatially more robust. Two samples above and below the dam seems inadequate and would not accurately characterize the existing sediments, especially above the dam. Apparently there are currently three separate locations where the powerhouse could potentially be located. Sampling should occur in each of the three potential powerhouse locations if there is a potential for sediment disturbance in these areas. Also, without knowing the depth of the existing sediments that have accumulated, a 6'depth may not be adequate.

Third, if the sediment is contaminated what measures will be taken to minimize re-suspension and release of the sediment? Also, how and where will the sediment be disposed? Depending on the level of contamination in the sediments, it may be necessary to collect water samples during excavation and have them analyzed for PCBs using method 1668.

The broader list of analytes appears adequate. DDT and metabolites should be retained for evaluation particularly for the deeper sediments.

Study Plan 8: Fish Passage

The development of trigger numbers for implementing upstream fish passage should not be completed until the powerhouse facility specifications have been completed.

Study Plan 10: Wetland Assessment

Jurisdictional determinations have previously been confirmed for Daniel Island and Treasure Island. Digital files are available from DEQ.

Daniel Island has contains wetlands (19.10 acres) on the southern tip of the island (closest to the dam) and an increase of 2-3 feet of water height (somewhere around 514 to 516 elevation) will flood a portion of that area. There are two vernal pools on this island. The study should include an assessment to see if there are rare or endangered species utilizing these pools.

Finally, it is important to note that the additional information and/or results from the studies, along with any other information collected to support the Scotts Mill Project License Application process, should be incorporated into a Virginia Water Protection (VWP) permit application so that the §401 certification is included as part of the Final License Application. It is recommended that, in order to expedite the §401 certification process, the licensee should begin the VWP permit application process as soon as possible.

Please contact Brian McGurk using the contact information below if you have any questions about these comments:

Brian McGurk
DEQ Office of Water Supply
P. O. Box 1105
Richmond VA 23218 Brian.McGurk@deq.virginia.gov 804-698-4180

Cc: Craig Nicol Wayne Dyok Mark Fendig

Scott.Smith@dgif.virginia.gov> Scotts Mill Hydro Team:

Attached are DGIF's comments regarding the proposed study plans for the Scotts Mill Hydro FERC licensing. Please let me know if you have any questions or comments. Scott M. S

To: scottsmillydro@yahoo.com

CC: Wayne Dyok Mark Fendig Palmer, George (DGIF) ProjectReview (DGIF) luke graham

03/11/16 at 1:17 PM

Scotts Mill Hydro Team:

Attached are DGIF's comments regarding the proposed study plans for the Scotts Mill Hydro FERC licensing. Please let me know if you have any questions or comments.

Scott M. Smith

Scott M. Smith
Region 2 Fisheries Manager
Virginia Dept. of Game and Inland Fisheries
1132 Thomas Jefferson Rd.
Forest, VA 24551
434/525-7522 (ext. 106)
scott.smith@dgif.virginia.gov

Molly J. Ward
Secretary of Natural Resources

COMMONWEALTH of VIRGINIA

Department of Game and Inland Fisheries

Robert W. Duncan
Executive Director

10 March, 2016

To: Scotts Mill Hydro FERC Licensing Team

RE: Scotts Mill Hydroelectric Project (FERC No. 14425)
Application for New License
Comments on Draft Study Proposals

Dear Scotts Mill Hydro Team:

The Virginia Dept. of Game and Inland Fisheries (DGIF) has reviewed the Draft Study Plan proposals, and offers the following comments on these proposals.

Study 1 – Water Level Assessment

It is unclear from the document where the staff gages will be located. Particularly downstream from the dam, the location of the gages could be critical. Additional information (planned locations) of these gages is needed to fully assess this study. Additionally, if this study is completed during the first half of 2016, it will likely only cover a relatively narrow range of potential river flows. How will water levels be assessed at unmeasured flows, particularly on the low end of the scale? Finally, it is unclear how water levels downstream can be assessed without the powerhouse in place. Water levels are likely to change substantially downstream once flows are diverted through the powerhouse.

Study 2 – Bathymetric Survey

We believe the bathymetric survey should extend upstream to the base of Reusens Dam, and downstream to the hydraulic control feature located immediately above the mouth of Blackwater Creek. This is the area that will be impacted by elevation changes in the reservoir and flow diversion through the powerhouse. Thus, data will be needed throughout this entire area to evaluate potential impacts from the project operations.

Study 3 – Water Quality

The draft proposes to use water quality data collected approximately 1.25 km below the dam to evaluate the impacts of project operations on temperature and dissolved oxygen (DO). We have concerns that, particularly in the case of DO, this may not be representative of conditions immediately below the dam. In addition, currently water flows over the top of the dam, which would change when flows are diverted through the powerhouse. Thus, DO levels below the dam may be significantly different under project operating conditions compared with current conditions. Temperature and DO data from the reservoir (particularly under low flow and high temperature conditions) are needed to ascertain the potential for downstream impacts. We would also need to evaluate the alteration of water quality parameters associated with diversion of flows to the powerhouse. Additionally, should project operations result in low DO levels, potential mitigation measures should be investigated.

Study 4 – Sediment Analysis

You may wish to consider adding copper to the metals analysis of the sediments, as this element has been demonstrated to be toxic to aquatic life at elevated levels.

Study 5 – Impoundment Fish Community

We have no additional comments on this proposed study.

Study 6 – Turbine Entrainment/Impingement

Given that a final design for the turbines has not been completed, we cannot provide a determination regarding the adequacy of this proposed study. Since the applicant is considering a novel design (as well as more traditional ones), there are no extant data to evaluate fish entrainment/impingement and passage survival. As such, we cannot evaluate this until a turbine design is determined. Once that has been done, we can then provide guidance as to the appropriate study design. Additionally, a literature-based study may be insufficient to evaluate impacts to aquatic resources, but we cannot determine whether or not empirical data are needed until we know what the turbine design and capacity will be. Therefore, we recommend delaying the design and implementation of this study until the engineering aspects have been completed. This would be particularly applicable should the novel turbine design be chosen.

Study 7 – Impacts to Aquatic Habitat

It is unclear how aquatic habitat will be assessed from the study proposal. Diversion of flows through the powerhouse will result in substantial habitat changes downstream. Given the high quality of the existing habitat, any changes will potentially have deleterious effects on aquatic life. We suggest that, in consultation with stakeholders, a PHABSIM study be undertaken in the reach between the dam and Blackwater Creek. This would include collection of pre- and post-construction data to empirically compare habitat alterations associated with flow diversion. Should these comparisons indicate changes in quantity/quality of habitat, potential mitigation measures should be evaluated as part of this study.

Study 8 – Fish Passage

Based upon the proposed study, we have significant concerns regarding downstream fish passage. The proposal was vague as to how downstream passage would be undertaken and coordinated, particularly among multiple dam operators. We suggest a much more detailed study design regarding downstream passage. We disagree with the statement that little habitat for migratory species currently exists between Cushaw and Scotts Mill dams. In reality, there is a substantial amount of habitat in this reach, particularly when tributaries are included. As such, we believe that fish passage (upstream and downstream) is warranted at all of these dams. Currently, the only migratory species present in substantial numbers in the project area are American Eel and Sea Lamprey. This study proposal should include provisions for passing these species (as well as resident species) around Scotts Mill Dam (upstream and downstream). Additionally, the study should examine upstream/downstream passage of American Shad and resident species in greater detail. As it is currently drafted, the proposed study does not provide sufficient information to determine its suitability, and significantly greater detail is needed.

Study 9 – Mussel Survey

The geographic scope of this study should be Reusens Dam to the mouth of Blackwater Creek, as this is the river segment that will be potentially impacted by project operations. Other than this, we concur with the design of this study.

Study 10 – Wetland Assessment

We have no additional comments on this proposed study.

Study 11 – Terrestrial Resources

We have no additional comments on this proposed study.

Study 12 – Protected Species

We have no additional comments on this proposed study.

Study 13 – Bat Survey

We have no additional comments on this proposed study.

Study 14 – Recreation Resources

We have no additional comments on this proposed study.

Study 15 – Cultural Resources

We have no additional comments on this proposed study.

Study 16 – Visual Resources

We have no additional comments on this proposed study.

Study 17 – Decommissioning

We have no additional comments on this proposed study.

Submitted by
Scott M. Smith
Regional Fisheries Manager
Virginia Dept. of Game and Inland Fisheries
1132 Thomas Jefferson Rd.
Forest, VA 24551
434/525-7522
Scott.Smith@dgif.virginia.gov

Luke Graham <scottsmillhydro@yahoo.com>

03/22/16 at 11:25 AM

Glen,

We talked on Friday about the Scotts Mill Hydropower project. The public comments deadline regarding the study plans for this project has already passed. However, if you still wish to submit comments we will accept them until this Friday (3/25/2016). You can access the proposed study plans at the project website: www.scottsmillhydro.com . If you have any further questions feel free to email us at scottsmillhydro@yahoo.com or you can call me at (907) 227-9861. Hope to see your comments soon.

Regards,

Luke Graham

Luke Graham <scottsmillhydro@yahoo.com>

03/23/16 at 7:34 PM

Pat,

I have attached a copy of my write up for the conversation we had on 3/16/2016 regarding the Scotts Mill Hydropower project study plans. If you have any additional comments or changes you would like to add please let me know and I will make them before posting this record to the website.

Sincerely,

Luke Graham

RECORD OF TELEPHONE CONVERSATION

Person Called- Pat Calvert
Affiliation- James River Association
Phone Number- (434) 964-7635
Call Originator- Luke Graham
Date- March 16, 2016

Summary of Discussion

I contacted Pat Calvert of the James River Association to ask if he had any additional comments regarding the study plans submitted for the Scotts Mill Dam Hydropower Project. Pat expressed that he had already addressed most of his concerns in comments he had previously submitted. However, he did add that he was concerned about the lack of investigation into the perceived water rights of the owners/licensee of the Scotts Mill Dam Hydropower project. Pat stated that he would like to know if the owners/licensee of the Scotts Mill Hydropower Project would seek to exercise any water rights. Additionally, he wanted to know what specific water rights are granted to the owner/licensee of the project according to the Virginia Dept. of Environmental Equality. Pat stated that most of this concern came from the fact that many downstream users (City of Lynchburg, VA) depend upon the James River as a secondary source of drinking water.

Prepared By:

Luke Graham

To
Randy Lichtenberger
CC
dyok@prodigy.net Ben Leatherland kstein1609@earthlink.net mfendig@aisva.net
03/17/16 at 7:08 AM

DHR supports the proposed Cultural Resources Study Plan and has no comment at this time. Further, we do not object to the posting of the three site forms as attachments to the Study Plan; however, we ask that the locational maps appended to each of the forms be removed to protect sensitive locational information for these and adjacent sites.

Roger W. Kirchen, Director
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6091
fax: 804-367-2391
roger.kirchen@dhr.virginia.gov

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daniel crawford <dbcrawford@cox.net>
03/24/16 at 7:47 PM

The use of an existing dam to generate power seems a win-win for all. The Sierra Club's primary focus for decades has been rapid climate change, and robust investment in renewable energy sources is our only hope for avoiding the worst consequences of climate disruption. The Scotts Mill Hydro Project is a step in the right direction.

Dan Crawford
Chair, Roanoke Group, Sierra Club
2311 Kipling St. S.W.
Roanoke, Va. 24018
dbcrawford@cox.net
540-343-5080

To: dyok@prodigy.net

03/29/16 at 8:23 AM

Hi Wayne,

I'm sorry I have not returned your calls. I am in the middle of pulling together a big report that is due out on April 12. Unfortunately, I won't have any time to dedicate to looking at this until after that time. I'm sorry if you've been waiting to hear from me.

Regards,

Jessie

Jessie Thomas-Blate
Associate Director of River Restoration and Most Endangered Rivers Coordinator

American Rivers
1101 14th St., NW, Suite 1400 | Washington, D.C. 20005
Phone: (202) 347-7550 | Email: jthomas@amrivers.org
www.americanrivers.org | Facebook.com/AmericanRivers | Twitter.com/AmericanRivers

Hi Brian, Mark, Mark, and Tony.

Attached are draft notes of our April 19th meeting. They are succinct, but I believe they capture the essence of our discussions. Can you take a quick look at them and edit as you deem appropriate. Thanks.

We would like to file these notes with FERC along with a revised study plan and also include your study plan comment letters and our responses. I hope to send out the revised study plan and comment letters tomorrow.

We will also post everything on the Scott's Mill website once we hear back from you. We have been implementing the study plan and will also have an update on that to our participant list in the next week or so.

Regards,

Wayne.

SCOTT'S MILL HYDROPOWER PROJECT (FERC NO. 14425)
NOTES OF MEETING
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY AND LIBERTY UNIVERSITY REPRESENTATIVES
VDEQ OFFICE
7705 TIMBERLAKE ROAD, LYNCHBURG VIRGINIA
APRIL 19, 2016

Attendees

Brian McGurk, Virginia Department of Environmental Quality (VDEQ)

Mark Bushing, VDEQ

Mark Richards, VDEQ

Anthony Cario, VDEQ

Ben Leatherland, Hurt & Proffitt

Mark Fendig, Luminaire Technologies

Wayne Dyok, H2O EcoPower

Site Reconnaissance

The attendees conducted a site reconnaissance of the north side of Scott's Mill dam adjacent to Griffin Pipe Company property. They observed firsthand the arch section of the dam, canal remnants, water level gauge locations, and potential construction approach.

Meeting Notes

The meeting attendees discussed VDEQ's March 11, 2016 comments on the Scott's Mill Hydropower Project (FERC No. P-14425) draft study plan. Wayne Dyok provided an overview of the water level measurements. Liberty University (LU) concurred with VDEQ comments on water levels. Monitoring will capture low flow periods both upstream and downstream of the dam.

Wayne said that the bathymetry survey was currently being undertaken. He explained how the survey was being conducted and the equipment being used.

Mark Fendig noted that flashboards were installed in the 1960s on Scott's Mill dam. He also commented that debris will be an issue in operating the project.

Mark Bushing stated that VDEQ is not looking for water quality improvements, but is concerned that construction and operation of the project not exacerbate water quality problems.

LU agreed that both water velocity and dissolved oxygen (DO) measurements are appropriate in the headpond and downstream. LU will take synoptic DO measurements during low flow conditions downstream of Reusens dam, halfway between Reusens and Scott's Mill, and immediately upstream of Scott's Mill dam upstream of the arch section of the dam. Additional DO measurements will be made downstream of the Scott's Mill dam. Continuous DO measurements will be taken upstream of the arch section of the dam to better understand diurnal DO variability during low flow conditions. Tony suggested that LU consider pre- and post-project DO sampling. LU concurred with Tony's suggestion.

Attendees next discussed the sediment chemical analysis. VDEQ noted that this part of the James River is impaired for fish tissue and PCBs. A TMDL (total maximum daily load) is expected by 2022. VDEQ commented that some point source measurement of PCBs appear high in the Lynchburg area, suggesting that something is happening upstream. VDEQ asked if there would be resuspension of sediment during construction and operation. Other than dredging upstream during construction, LU does not anticipate resuspension beyond what takes place during current conditions.

LU concurred with using EPA Method 1668. However, because less sediment would be disturbed during construction than originally thought by VDEQ, it was agreed that the number of samples needed could be reduced from VDEQ's March 11 recommendations. Ben Leatherland recommended one or two samples with composites at various depths. Since there is little sediment immediately downstream of the dam, it was thought that only one surficial sample might be needed. (See revised study plan for additional details.)

VDEQ asked about disposal of the dredged sediments. Mark Fendig responded that LU planned to place the dredged sediments on Daniel Island. VDEQ asked that LU define the excavation boundary and the volume of material to be dredged. LU will do this as part of the engineering effort and include in the draft license application. VDEQ said they were not concerned about other organic chlorines.

Attendees next discussed the wetlands assessment. VDEQ stated that there are no wetlands on Treasure Island.

It was also noted that no sediments are behind Rock 10 dam (also known as West Rock Dam), which is downstream from Scott's Mill.

Attendees lastly discussed the Virginia Water Protection permit application. Ideally this permit should be filed as part of the draft license application. VDEQ noted there will be a public noticing period and potentially a public meeting. VDEQ staff noted the process is likely to take 120 days or more with a 30-day public notice. It will be incumbent upon LU to notice the pre-application.

RECORD OF CONVERSATION

Person Called- Alan Weaver

Affiliation- Virginia Department of Game and Inland Fisheries

Phone Number- (804) 367-6795

Call Originator- Luke Graham

Date- May 16, 2016

Summary of Discussion:

I contacted Alan Weaver of Virginia Dept. of Game and Inland fisheries to inquire about fish passage for Scott's Mill Dam. I asked what requirements there would be (in regards to run numbers) to initiate a trap and transport program for American Shad on the James River (at Scott's Mill Dam). Mr. Weaver stated that currently the Shad run on the James River (as well as the Susquehanna river) has been far below their targeted population levels with runs only reaching numbers from ~100- 1000 fish in recent years at Bosher's Dam. He stated that this was far lower than the targeted goal of 1,000,000 fish for the entire James River. Additionally, he noted that instead of having a targeted number of shad reaching Scott's Mill Dam to initiate a trap and transport program, he would be more likely to recommend a daily trap and transport program during peak shad run dates.

However, Mr. Weaver stressed during the conversation that he was more concerned with the passage of American Eel and Lamprey at Scott's Mill Dam. Mr. Weaver stated that currently there is a trap and transport program for American Eel at the Roanoke Rapids Dam. However, he recommended that instead of a trap and transport program, he would rather see Scott's Mill Dam install a vertical slot fishway to allow passage of all fish species within the James River. This was due to the difficulty in having to create different capture/transport programs for all migratory fish species (i.e. American Shad, American Eel, Lamprey etc.) He also noted the importance of resident species fish passage within the James as another reason for being in favor of a vertical slot fishway over other fish passage methods.

Prepared By:

Luke Graham

Pat Calvert <pcalvert@jrava.org>
06/08/16 at 7:52 AM
This message contains blocked images.

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Wayne,

Is LU still pursuing licensure of Scott's Mill dam hydro project?

Thank you,

Pat Calvert
Upper James Riverkeeper
Tel. (434) 964-7635

Wayne Dyok <dyok@prodigy.net>
06/08/16 at 5:06 PM
This message contains blocked images.

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Change this setting

Hi Pat. Yes. I will be filing a revised study plan next week. We have been talking with DEQ, DGIF and USFWS.

We also did the bathymetry study and have been monitoring the gauges we installed.

I have been meaning to get out an email to the distribution list.

Feel free to call me at 916 719-7022.

Sent from my iPhone

Wayne Dyok <dyok@prodigy.net>
06/08/16 at 10:09 PM

To: Scott Smith McGurk Brian (DEQ) David Sutherland Kirchen Roger (DHR) Holma Marc (DHR) and 4 more...

CC: Luke Graham Mark Fendig kstein1609@earthlink.net Ben Leatherland Randy Lichtenberger and 2 more...

06/16/16 at 1:19 PM

Good afternoon everyone. After a very frustrating time trying to file the revised study plan for the Scott's Mill Hydropower Project, we were finally successful in getting it filed with FERC this morning. It turns out the problem was on their end, and was not my computer after all. I should have had more faith in my system.

I want to thank all of you for commenting on the draft study plan/Pre-Application Document. We carefully reflected on all the comments and revised the draft plan accordingly. We are including the revised study plan, your comment letters, LU's responses, notes of our meeting with VDEQ, and a record of conversation with Alan Weaver of VDGIF on fish passage as part of this email. We are not including the cultural resources appendices to the study plan because that file is voluminous. You can access it on the Scott's Mill (or FERC) website if you are interested. It does have nice photos of the project, which causes the file to be large.

We will be adding all these files to the website this weekend. We will also get out an update on the project to all participants by next Monday.

As a quick update on the project, we have sufficient water level data at various James River flows to understand the flow/water level relationships up to about 12,000 cfs. We are in the process of examining existing flow patterns. We learned from the bathymetry and velocity measurements taken to date that the flow velocities in the headpond are very slow. This is due to the fact that the headpond is much deeper than we anticipated. Water levels are constant across the river at the dam site. Downstream is a little different. The river is shallow and there is a small water level differential across the dam, with the right side being about 0.2 to 0.3 feet higher than the left side, thus causing some flow from the arch section, laterally to the left side of the river.

We have also been talking to Alan Weaver at VDGIF on fish passage. At this time there seems to be a desire to have fish passage at Scott's Mill immediately into the headpond. This would certainly work to get fish into Scott's Mill headpond and tributaries that feed the headpond. However, we are concerned that if fish passage is added to all the dams, we might not be able to restore fish habitat upstream of Cushaw Dam. While we acknowledge that the James River and Susquehanna Rivers are different, we are well aware of the problems with timely upstream passage when the American shad negotiate each of the 4 dams on the Susquehanna versus when they used to trap and haul the shad. I know David Sutherland is well aware of this, so we plan to counsel with him and VDGIF as the fish passage study effort progresses.

Eric Thompson of Natel has been working with us on the entrainment study. We provided the list of fish species for Natel to evaluate for downstream passage. These include American eel, lamprey, American shad, river herring, and resident species (e.g., bass and suckers). If we have omitted any key fish species, please let us know.

Our critical path study is likely the dissolved oxygen study. We need low flow, hot conditions before we undertake that effort. Once we get that data, we will be assembling the draft license application and draft VWP application. We will certainly stay in touch as the studies progress.

Also feel free to contact me if you have any questions or further comments.

Regards,

Wayne

SCOTT'S MILL HYDROELECTRIC PROJECT (FERC No. 14425)

STUDY PLAN COMMENT RESPONSES

VIRGINIA DEPARTMENT OF GAME AND INLAND FISHERIES

Study 1- Water Level Assessment

Liberty University (LU) proposes to locate staff gauges on the left side of the river, immediately upstream and approximately 100 feet downstream of Scott's Mill dam, and on the right side approximately 50 to 100 feet upstream and downstream of the dam. Two four-foot high gauges will be placed on the left side of the river (north side) on the bank. The bottom elevation of the gauge will be approximately dam crest height in order to capture water levels at the lowest flows and moderately high discharges. The downstream gauge will be similarly placed on the left bank so that the zero point captures the water level during the low summer flows.

Two gauges will be placed on the right bank or on the south side of Daniel Island about 50 feet upstream of the proposed powerhouse location. One gauge will have the zero point at about the dam crest elevation to measure low summer flows. The second 4-foot high gauge will be placed higher on the bank with the zero point just below the four-foot level of the first gauge to provide a continuous record of water levels over about an 8-foor range. This will cover water levels from very low flows to flood flows.

The two downstream gauges will be placed on the right bank downstream of the powerhouse in the vicinity of the tailrace. There will be a similar overlap in gauges heights to span about an 8-foot range in tailwater levels.

The gauges will be surveyed to provide relative water level differences among all gauges and the dam crest elevation.

The gauges will be read manually. The date/hour will be recorded so the data can be correlated with the Holcomb Rock gauge. The goal of this study is to take sufficient readings under various flow conditions to span water levels from flood conditions to low water.

The water levels will be used to verify the coefficient of discharge for the dam. Assuming that sufficient flow ranges are measured, LU will be able to accurately predict upstream and downstream water levels for Holcomb Rock flows.

Periodic measurements of the gauge located near the 7th Street Boat Ramp will also be taken to assist in the overall understanding of streamflow downstream of Scott's Mill Dam.

To assess post project conditions, LU will consider both flashboard and no-flashboard conditions. For the no-flashboard conditions, LU will be able to manage water levels at the dam crest height until the maximum hydraulic capacity of the turbines is reached (i.e., about 4,500 cfs). For flows above 4,500 cfs, water levels will be a function of the weir equation developed for existing conditions, less the flow that is discharged through the powerhouse. LU will look at the downstream bathymetry and channel hydraulics to estimate backwater conditions on the left side of the river. LU will then be able to determine if some water should be diverted to the left side of the river or if some water should be discharged over the dam to protect water quality and aquatic habitat.

For flashboard conditions, the weir coefficient will be replaced by the discharge coefficient for the proposed flashboards. These coefficients will be obtained from manufacturer data as that information is routinely provided. LU will be able to manage upstream water levels up to the hydraulic capacity of the powerhouse. Above that flow, water will flow over the flashboards. LU's proposed operations will dictate what the water levels will be up to the hydraulic capacity of the turbines. LU will calculate upstream water levels for flow conditions that exceed the hydraulic capacity of the turbines.

Study 2 – Bathymetric Survey

Our sense is that flow patterns upstream near Reusens dam will be dictated by how flow is released over the dam and/or through the turbines. Our initial assessment was that flow patterns upstream of Scott's Mill would be influenced by powerhouse/spillway releases upstream to just upstream of Woodruff Island. Flow patterns may be a little more complicated if flashboards are installed. Because of the uncertainty of flow patterns at this stage since we do not have the bathymetry, LU agrees to expand the bathymetry effort to Reusens Dam. LU concurs with VDGIF to extend the downstream bathymetry to the mouth of Blackwater Creek.

Study 3 – Water Quality

LU agrees that there may be changes in DO and water temperature during low flow and high air temperature conditions. Under current conditions, reaeration of flow is expected downstream of Scott's Mill even if DO is low immediately upstream. This may not be the case during project operations. LU agrees to monitor DO and water temperature at low flow higher temperature conditions upstream and downstream of Scott's Mill Dam. LU will also measure water temperature downstream of Reusens Dam to measure DO degradation as flow moves downstream. LU estimates that it would take aseveral days for water to travel from Reusens Dam to Scott's Mill Dam under existing low flow conditions. This time could be increased if flashboards are installed. Having this information will aide LU in determining potential mitigation measures should DO degrade during post-project conditions. As part of this study LU will investigate mitigation options to protect habitat from decreased DO and higher water temperatures during hot, low flow conditions. Such measures may include discharge of water over the spillway.

Study 4 – Sediment Analysis

LU met with Virginia Department of Environmental Qualtiy on April 19. Based on that meeting it was determined that metals analysis of sediments is not warranted.

Study 6 – Turbine Entrainment/Impingement

LU will consult with VDGIF on the turbine entrainment study as the design is developed. The study will be deferred until more information on the design is available.

Study 7 – Impacts to Aquatic Habitat

LU has concerns that PHABSIM will not provide the requisite data to evaluate impact to aquatic habitat. To our knowledge PHABSIM does not have the ability to determine flow pattern changes. LU's proposal is to assess changes in flow patterns and water quality to estimate habitat effects. Under normal flow conditions, LU expects that velocities upstream of the dam will be less than 1 foot per second (e.g., 3,000 cfs average flow divided by 800 foot width and 5 foot average depth). LU will be able to determine post project depth changes and intends to estimate velocity changes. As a check on velocity, LU proposes to collect velocity data during the bathymetry study at various locations in the impoundment and at two cross sections downstream of Scott's Mill Dam. These velocity measurements can be used as a check on the flow pattern analysis.

Study 8 – Fish Passage

We agree that there is some vagueness in the fish passage study as we have not held discussions with the upstream dam owners. We propose to conduct this as an iterative study with VDGIF, USFWS and other parties that have an interest in fish passage. The first part would be to conduct the literature survey and better understand the current status of fish restoration and timing and initial plans for fish passage (e.g., pass American shad upstream of Scott's Mill only or haul them upstream of Cushaw dam).

We defer to VDGIF on the restoration of habitat between Scott's Mill and Cushaw Dam. We will work with VDGIF on an initial proposal to pass American eel and Sea Lamprey upstream of Scott's Mill. Eel and lamprey passage can be incorporated into project construction. We will expand the study to include passage upstream and downstream of Scott's Mill.

Study 9 – Mussel Survey

LU will expand the mussel survey to include the area from Reusens Dam to the mouth of Blackwater Creek.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Study 1- Water Level Assessment

LU concurs with DEQ's recommendations for Study Plan 1. (See response to VDGIF.) LU will correlate the water levels with the Holcomb Rock gauge. LU will also capture water levels during low flow conditions. LU staff or Hurt and Proffitt staff will record water levels.

Study 2 – Bathymetric Survey

The bathymetric survey will be conducted by Luke Graham with local support. As a fishing guide, Mr. Graham routinely uses side scan sonar to monitor bathymetry. He is familiar with mapping water depths. LU plans to use a Humingbird Helix Series side scan sonar. LU will be able to distinguish between soft and hard sediments using this type of sonar. LU believes that side scan sonar will provide the needed results in a cost effective manner.

The map will be used in conjunction with upstream water levels to determine flow patterns. LU will use transects, water level differences, river slope, velocity patterns under existing conditions, and proposed project operations to estimate flow patterns. That information will be used to determine water temperature and DO effects.

Study 3 – Water Quality

LU concurs that the alternative project layouts should utilize study results. As appropriate, mitigation measures will be undertaken to minimize project effects.

LU anticipates that experienced technicians from Hurt and Proffitt will measure water quality parameters. Resumes will be provided to DEQ at DEQ's request.

LU concurs that velocity measurements will be valuable in verifying existing flow patterns. Accordingly LU will take velocity measurements at a number of locations upstream of Scott's Mill Dam and at two cross sections downstream. Because of the relative shallow depth of the river, LU proposes to take velocity measurements at 0.2 and 0.8 depths as that will provide a reasonable average velocity for that location.

LU will explain why this approach is sufficient. Should resource agencies determine that this approach yields insufficient accuracy, a numerical modeling approach could be undertaken. LU will have the necessary information to conduct such modeling with the bathymetry and water level data. Modelers should also be able to estimate Mannings n for the modeling analysis. LU believes that costly modeling is unwarranted because mitigation steps can be undertaken to minimize project effects including passing low flows over the Scott's Mill Dam during low flow, warm conditions.

Study 4 – Sediment Chemical Analysis

During our April 19th meeting, LU discussed the sediment chemical analysis and procedures to minimize re-suspension of materials during construction. Study 4 has been modified accordingly.

Study 5 – Fish Passage

LU is proposing an iterative fish passage study approach (see response to VDGIF). We concur that trigger numbers should be developed later in the fish passage study process.

Study 10 – Wetland Assessment6

Hurt and Proffitt will work with VDEQ to obtain the jurisdictional wetlands information currently available. LU will modify the study plan to assess if there are rare or endangered species using the vernal pools on Daniel Island.

LU will discuss with VDEQ on how best to incorporate information from the licensing process into the Virginia Water Protection permit application.

Wayne Dyok <dyok@prodigy.net>
06/20/16 at 9:19 PM

To: Larry Jackson, APC
Hi Larry. Attached is a letter Liberty University LU) filed with FERC today under the Reusens docket. (It will be posted tomorrow.) Because the proposed Scott's Mill Project can affect Reusens in two significant ways, we deemed it appropriate to notify you through this email and through the FERC docket. I am sure you are aware that LU is considering flashboards at Scott's Mill and these could affect generation at Reusens. Secondly, we are working with the USFWS and VDGIF on fish passage. We initially thought that this would be a trap and haul program. However, in talking further with the resource agencies, we have added volitional fish passage. Given that Reusens is coming up for relicensing we would like to work with you and the resource agencies to determine the best plan going forward. Can you provide the name and contact information for someone at APC that we can include in the consultation process? We expect to contact that individual in July once we have gathered additional information on fish passage.

Kindest regards,
Wayne Dyok

2 Attachments
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June 20, 2016

Via Electronic Filing

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Re: FERC Project No. P-2376

Reusens Hydropower Project,

Notification of Issues on Scott's Mill Hydropower Project
Potentially Affecting Reusens Relicensing

Dear Ms. Bose:

Liberty University (LU), preliminary permit holder for the proposed Scott's Mill Project (FERC Project No. 14425), LU is providing advance notification to the Federal Energy Regulatory Commission (FEFC) and Appalachian Power Company (APC) that the licensing of the Scott's Mill Hydropower Project could affect the Reusens Project in at least two ways. LU is potentially proposing to add flashboards to Scott's Mill Dam that could back water up to Reusens Dam and affect power generation. Secondly, LU is working with resource agencies and interested parties to develop a fish passage plan for the James River upstream of Scott's Mill. Both a trap and haul and a volitional fish passage plan are being considered. At the request of resource agencies LU is considering passage for American shad, river herring, American eel, lamprey, and resident fish species.

LU informed APC of these issues at the Scott's Mill Pre-Application Document joint meeting held on December 2, 2015, at which an APC representative attended. However, at that time LU was considering only a trap and haul program. Through continued discussions with resource agencies, LU and the resource agencies have expanded the study plan to include upstream and downstream passage at Scott's Mill. LU's revised study plan is included in this filing.

Over the several months LU has been implementing the Study Plan for the Scott's Mill Project. In particular, LU is undertaking the initial phase of the fish passage study which is being conducted in an iterative manner.

LU is copying APC on this filing and anticipates APC's full participation in that study, particularly since the license for the Reusens Project expires on March 1, 2022, necessitating APC filing a Notice of Intent with FERC by March 1, 2017 that APC intends to either file for a new license or surrender their existing license for the Reusens Project. LU is also copying the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries who have been working cooperatively with LU on this issue. LU also understands that the Reusens Project has not operated for the last six years and that APC is currently considering upgrades to the project, which could affect future fish passage plans.

Please contact the undersigned at (916) 719-7022 if you have any questions or comments.

Respectfully submitted,

Wayne M Dyok

Wayne M. Dyok for

LIBERTY UNIVERSITY, INC.

Cc Larry Jackson, APC
Scott Smith, VDGIF
David Sutherland, USFWS
Kim Stein
Mark Fendig, Luminaire Technologies

From: Wayne Dyok [mailto:dyok@prodigy.net]
Sent: Friday, September 16, 2016 1:04 PM
To: McGurk, Brian (DEQ); Smith, Scott (DGIF); Pat Calvert; Cario, Anthony (DEQ); David Sutherland
Cc: Luke Graham; Mark Fendig; Ben Leatherland
Subject: Fw: DO data compilation

Hi Brian, Scott, Pat, Anthony, and David. Attached are dissolved oxygen data collected by Ben Leatherland of Hurt and Proffitt last Friday and Monday of this week. On Friday, Ben took a longitudinal DO profile from upstream of Reusens to Blackwater Creek. He left the meter in the river just upstream of the arch section over the weekend to get a time history. On Monday, Ben took cross section and vertical profiles. Flow at Holcomb Rock on Monday was about 740 cfs and the air temperature was relatively high at approximately 90 F (32 degrees C). There was almost no flow over the arch section of the dam. (Luke will be putting up some pictures on our website of flow over the dam next week when we have a chance to organize the photos.)

I was pleasantly surprised by the results. The DO was higher than what I would have expected given the low flows and hot temperatures. Upstream of the dam DO varied from 6.6 to 9.0 mg/l over a day. The water temperature varied by less than a degree C. We did see a minor change in DO from surface to bottom in the deepest section of the river (i.e., about 23 feet deep), but that was expected. In essence there was little stratification. Similarly there was not much change in DO longitudinally. In particular with almost no flow going through the section on the right side of Daniel Island the DO in that section of the river was similar to what was measured on the left side (looking downstream). I believe the data provided by Ben are self explanatory.

Based on the results of the DO sampling, our thoughts are that we have sufficient DO data to characterize the baseline DO in the river during hot, low conditions. (Over the week the flow at Holcomb Rock has fallen slightly rom 740 to 704 cfs.) Brian do you agree we have sufficient DO data?

We have coordinated the mussel survey with Brian Watson. That is planned for the first two weeks in October. Brian plans to participate in the survey.

We are also talking to Eagle Creek Energy, the entity that is purchasing Reusens, on fish passage. Scott, I hope to get in touch with you soon to coordinate that effort.

The remaining studies are moving along including the engineering effort. We should have an update for licensing participants in the next couple of weeks.

Mark and I met with LU on Monday and we plan to have further discussions with LU in the coming weeks as we map out the licensing schedule and further develop the engineering design and cost estimate.

Please let me know if you have any questions.

Kindest regards,

Wayne

On Tuesday, September 13, 2016 6:59 AM, Ben Leatherland <bll@handp.com> wrote:

Hi Mark/Wayne,

Attached, please find the compiled DO data from the riverbank (on Friday, 9/9/16), from upstream of the Scott's Mill Dam arch section (Friday-Saturday, 9/9/16-9/10/16), and from the main channel of the river near the buoys (Monday, 9/12/16).

A few notes and observations:

1) The data were collected on sunny days in late summer, with daytime temperatures of 75-90 degrees F, when there had been no rain in the previous four to five days.

2) Data were collected using a YSI Pro ODO meter (s/n 16F102537), which was new at the time of sampling, and was calibrated to barometric pressure on 9/9/16, according to YSI instructions (and based on Lynchburg Airport NWS/NOAA preceding 72-hr data, corrected for sea level).

3) The 9/9/16 riverbank data and longer-term 9/9/16-9/10/16 data were from depths of less than 0.5m.

4) The batteries in the DO meter died on 9/10/16, and therefore limited the volume of 9/9/16-9/10/16 data.

5) Aquatic vegetation and algae may be partly responsible for the higher daytime DO measurements.

6) The 9/12/16 cross-section data were collected by trailing the meter cable/probe behind a canoe, using 10s logging intervals. Due to the forward movement of the canoe, the actual measurement depths are likely slightly less than the noted cable lengths.

7) The 9/12/16 cross-section data were collected from the left riverbank to Daniel Island. As a result, the deepest/fastest water measurements are generally within the first half of the data for each cross-section.

8) A total of four vertical profiles were measured, all in the main river channel upstream of the Scotts Mill Dam straight section. Profiles 1-3 were in the main channel of the river, within 100m of the left riverbank. Vertical Profile 3 was the deepest of the three. Vertical Profile 4 was within 100m of Daniel Island. No vertical profile data was collected upstream of the Scotts Mill Dam arch section.

9) The 9/12/16 vertical profiles suggest a gradual decrease in temp and DO with increasing depth. The temp range was generally 1.2-2.0 degrees C, which would seem to indicate little thermal stratification through the water column.

10) The 9/12/16 vertical profiles suggest a general decrease in DO with increasing depth, with 20.8-25.9% difference between highest and lowest measurements. The lowest measured DO was 82.5% (Vertical Profile 3, at approximately 8-10m depth). The highest DO measurement was 108.5% (Vertical Profile 1, within 1-2m of the water surface).

Please review these data, and call with any questions. Thanks, and have a great day.

Ben Leatherland
Environmental Scientist

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2524 Langhorne Road, Lynchburg, VA 24501
Phone: 434-847-7796 x686 - Fax: 434-847-0047 - Cell: 540-520-1533
Email: bll@handp.com - Web: www.handp.com

From: Wayne Dyok [mailto:dyok@prodigy.net]
Sent: Monday, September 12, 2016 1:20 PM
To: Ben Leatherland
Cc: mfendig@aisva.net
Subject: Re: DO data from deployed meter

If that is possible, can you take a reading across the river where the buoys are. And take a couple of vertical profiles.

Sent from my iPhone

On Sep 12, 2016, at 1:15 PM, Ben Leatherland <bll@handp.com> wrote:

Hi Mark/Wayne,

Here are the DO data from the deployed meter (see below). Unfortunately, the measurements ended after 21 hours. The batteries were dead when we picked up the meter this morning. As expected, the lowest DO measurement was at night (at about 3am) and the highest measurement was during the day (at about 10am). Please review, and give me a call to discuss. I'm on a conference call until about 2:00pm. Do you want us to go collect deeper water data today?

Thanks.

50m u/s of Scott's Mill Dam arch section, 9/9/16-9/10/16, site 012, beginning at 16:24pm							
Meter time	**Actual time**	**DO (%)**	**DO (mg/L)**	**Temp (^{o}C)**	**Pressure (mm Hg)**	**Depth (m)**	**Notes**
0:37	17:01	100.9	7.9	27.9	753.1	0.3	
1:37	18:01	99.6	7.8	27.9	752.9	0.3	6pm, 9/9/16
2:37	19:01	99.0	7.8	27.9	752.9	0.3	
3:37	20:01	96.5	7.6	27.8	752.8	0.3	8pm
4:37	21:01	95.1	7.5	27.8	753.2	0.3	
5:37	22:01	94.1	7.4	27.7	753.2	0.3	10pm
6:37	23:01	92.0	7.2	27.7	753.9	0.3	
7:37	0:01	89.8	7.1	27.6	754.3	0.3	12 midnight, 9/9/16
8:37	1:01	88.7	7.0	27.6	754.9	0.3	
9:37	2:01	86.0	6.8	27.6	755.5	0.3	2am, 9/10/16
10:37	3:01	**83.9**	**6.6**	27.5	755.9	0.3	
11:37	4:01	89.8	7.1	27.6	756.2	0.3	4am
12:37	5:01	91.8	7.2	27.8	756.1	0.3	
13:37	6:01	95.8	7.5	27.9	755.8	0.3	6am
14:37	7:01	97.5	7.6	28.0	755.6	0.3	

15:37	8:01	108.0	8.4	28.2	755.4	0.3	8am
16:37	9:01	114.9	9.0	28.2	755.0	0.3	
17:37	10:01	**113.2**	**8.8**	28.3	754.9	0.3	10am
18:37	11:01	109.2	8.5	28.1	755.2	0.3	
19:37	12:01	102.2	8.0	28.0	755.9	0.3	12 noon, 9/10/16
20:37	13:01	98.8	7.8	27.9	756.8	0.3	
21:37	14:01	95.3	7.5	27.8	757.3	0.3	2pm

Ben Leatherland
Environmental Scientist

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McGurk, Brian (DEQ) <Brian.McGurk@deq.virginia.gov>

To: Wayne Dyok
CC: Cario, Anthony (DEQ) Bushing, Mark (DEQ) Richards, Mark (DEQ)
09/29/16 at 9:45 AM

Wayne

I got your phone message yesterday. I consulted with my colleagues about the sufficiency of the water quality data that you sent. Please see their questions that I've highlighted in the emails below.

Also, I presume that a report describing Study #3 and its results will be prepared and submitted to FERC, as with results from the other Studies. Is that correct? I see on your website that there are images of the bathymetry. Have reports been prepared for Studies #1 & #2?

Once the reports of the Studies are complete, I'm figuring that you will prepare and submit to DEQ an application for a Virginia Water Protection (VWP) permit. Do you have a projected time frame for the preparation and submittal of that application?

Thanks!

Brian

Brian McGurk, P. G.
Office of Water Supply
Virginia Department of Environmental Quality
brian.mcgurk@deq.virginia.gov
804-698-4180
mailing address: P.O. Box 1105, Richmond VA 23218

From: Cario, Anthony (DEQ)
Sent: Thursday, September 29, 2016 12:04 PM
To: Bushing, Mark (DEQ); McGurk, Brian (DEQ)
Subject: RE: DO data compilation

Brian,

I would also like to see a map of where these samples were taken and some more weather info.

I would like them to submit a comparison of their data to other ambient data for that section of the James River to show that it falls in the range of what's expected. The air temperature is not terribly high when they measured. Higher day and night temperatures earlier in the summer may cause some lower DO numbers and temp numbers but hard to say really.

Tony Cario

Environmental Specialist
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218
804-698-4089
anthony.cario@deq.virginia.gov
www.deq.virginia.gov

From: Bushing, Mark (DEQ)
Sent: Thursday, September 29, 2016 7:44 AM
To: McGurk, Brian (DEQ)
Cc: Cario, Anthony (DEQ)
Subject: RE: DO data compilation

Agree, this seems to be Study Plan #3.

Couple quick things I would request;

- the time that the samples (only one with times is the Deployed DOP meter) were taken;

- a little more weather info (have that it was sunny on 9/9, but what about the other days? have no rain within 4 days on the 9th, but on the 12th, no rain within 5 days – hum, how can that be?);

- a map showing where each of the sites (12) and the cross-sections and vertical profiles were taken (not shown in the study plan);

- what is the difference between these Cross-sections (1vs. 2 and 3a vs. 3b? these say the same things?);

- vertical profiles should be known depth, not approximate. Looking at the vertical profiles, I am quite surprised that there is 30 feet of depth anywhere in that stretch of the river. could be wrong.

Mark F. Bushing
DEQ BRRO-L
434-582-6240

From: McGurk, Brian (DEQ)
Sent: Wednesday, September 28, 2016 7:53 AM
To: Bushing, Mark (DEQ)
Cc: Cario, Anthony (DEQ)
Subject: FW: DO data compilation

Hey Mark

Could you take a look at these water quality data collected around Scotts Mill Dam? Wayne has asked me whether these data are sufficient for their study. It appears to me that what they've reported follows Study Plan #3 (Water Quality Effects of Flow and Water Level Changes, attached). Do you think that this is sufficient?

Thanks!

Brian McGurk, P. G.
Office of Water Supply
Virginia Department of Environmental Quality
brian.mcgurk@deq.virginia.gov
804-698-4180
mailing address: P.O. Box 1105, Richmond VA 23218

Reply Reply to All Forward More
Wayne Dyok <dyok@prodigy.net> .

Good afternoon Brian, Tony, Mark and Mark. Here is our initial response to your email.

First, we have completed studies 1 and 2, but not prepared reports. We have not made a final determination whether we will do short specific reports or include the information in the draft application and as a supplement to the Virginia Water Protection Permit. For the water level measurements, we have data at the lower and average flows and even moderately high flows. I am hopeful that Mark will get the water levels for the flows currently being experienced (i.e., about 20,000 cfs). The upstream water levels behave exactly as we predicted from the weir equation.

We did experience some vandalism or flow destruction of the downstream gage on the left side of the river, but we have sufficient data for the tailwater rating curve and updated our energy calculation accordingly.

Believe it or not, the deepest point in the headpond is about 25 feet deep. This was measured by Luke in the bathymetry survey and then Ben went out and collected water temperature and DO data in the area where the buoys are located which is the deepest part of the headpond. His measurement corroborated the bathymetry study results as he measured a depth of about 8 meters (i.e., 26 feet).

I forwarded your email to Ben. He will factor your questions/requests into his report or section write up for the draft application.   For sure we will include a map with the locations of the measurements. We will also include additional information about the weather on all sampling days. To the extent that Ben can come up with ambient DO data, we ill include that with our assessment.

We had to wait until flows got to about 1,000 cfs before we could take the DO measurements as we felt low flows would be most critical for the DO measurements. When we got to a low flow level, we were still experiencing relatively hot conditions. We just did not get the low flows until around the end of August. The good news is that DO was not a problem even in the areas with very little or no flow such as upstream of the arch arch section of the dam.

As for when we file the draft application, I cannot give you a definitive date. We are planning for about the end of the year. We have another internal meeting with LU coming up in about two weeks and I am hopeful that everything will come together to proceed as quickly as possible to wrap up all studies and prepare the draft application and VWPP.

Brian - Mark Fendig and I will be back in touch with you after the LU meeting.

Wayne

McGurk, Brian (DEQ) <Brian.McGurk@deq.virginia.gov>

Hi Wayne I hope that you are enjoying the Holidays immensely. Just checking in with you regarding the status of preparing a JPA for the Scotts Mill Dam project.

Take care,

Brian

Brian McGurk, P. G.
Office of Water Supply
Virginia Department of Environmental Quality
brian.mcgurk@deq.virginia.gov
804-698-4180
mailing address: P.O. Box 1105, Richmond VA 23218

From: Wayne Dyok [mailto:dyok@prodigy.net] Sent: Saturday, October 01, 2016 6:00 PM To: McGurk, Brian (DEQ) Cc: Cario, Anthony (DEQ); Bushing, Mark (DEQ);

To: Wayne Dyok
12/28/16 at 12:57 PM

To: McGurk, Brian (DEQ)
CC: Cario, Anthony (DEQ) Mark Fendig
12/28/16 at 1:41 PM

Hi Brian. First, happy holidays and best wishes for the new year.

Yes, we are working on the license application and the 401 application. We have completed all the field studies. The engineering is lagging a bit because our consultant was overbooked, but they should catch up in January. I need their input before we can complete a couple of the studies.

I expect to have an update in about 2 weeks. Starting next Tuesday, I will be out of pocket until about mid-January as I am having a surgical procedure to repair my shoulder.

Kindest regards,

Wayne

From: Wayne Dyok [mailto:dyok@prodigy.net]
Sent: Friday, August 04, 2017 12:10 AM
To: Sutherland, David; Smith, Scott (DGIF)
Cc: Brett Towler; Mark Fendig
Subject: Re: Scotts mill dam on the James River

David, Scott and Brett - Would you be available for a conference call with Eagle Creek Energy (Reusens) and Mark Fendig and me (Scott's Mill) on either August 24 or 25?

Mark and I convened a conference call with Eagle Creek to coordinate our fish passage efforts. We discussed options for passing both Sea Lamprey and American eel and potentially American shad down the road. They would like to hear directly from you on what species need passing, the associated timing of fish passage, and your thoughts on how best to pass the fish (e.g., trap and haul and some type of fish ladder).

Brett, can we talk early next week? As David likely mentioned to you, we are in the final stages of preparing our draft license application for the Scott's Mill Hydropower Project. Irrespective of how the discussion with Eagle Creek turns out, I would like to get your thoughts on fish passage, monitoring, and O&M.

Regards,
Wayne

RECORD OF TELEPHONE CONVERSATION
REUSENS AND SCOTT'S MILL HYDROPOWER PROJECTS

Conference Call Participants
Scott Smith – Virginia Department of Game and Inland Fisheries (VDGIF)
Alan Weaver – Virginia Department of Game and Inland Fisheries
David Sutherland – US Fish and Wildlife Service (USFWS)
Jessica Pica – USFWS
Brett Towler – USFWS
Bob Gates – Eagle Creek Energy (Reusens Project)
Dan Parker – Eagle Creek Energy (Reusens Project)
Mark Fendig – Owner Scott's Mill Dam, rep for Liberty University
Wayne Dyok – Consultant for Scott's Mill Project Licensing

Date – August 25, 2017

Agenda

1. Fish species to pass
2. Upstream Passage
3. Downstream Passage
4. Monitoring
5. Maintenance

Summary of Discussion

Fish Species Passage

After the introductions, the resource agencies[4] stated that they would like to see river connectivity, passage of anadromous and catadromous fish and resident fish species. More specifically, there appears to be an immediate need to pass American Eel and Sea Lamprey. Scott's Mill representatives noted that they have been moving forward on the licensing of Scott's Mill assuming that, at a minimum, American Eel and Sea Lamprey would need to be passed.

Eagle Creek asked if there was a fish restoration plan for the James River. At this time, no James River restoration plan has been developed, but the agencies operate under the Atlantic States Marine Fisheries management plans. However, there has been a concerted effort to restore anadromous fish, and specifically American Shad. The VDGIF pointed out that American Shad, American Eel and Sea Lamprey pass through the Boshers vertical slot fishway annually along with 20 plus other riverine fish species. The participants concurred that restoration of American Shad has not yet achieved target levels to fill the amount of spawning

[4] Collectively VDGIF and USFWS are referred to as resource agencies. Since they are working together on fish passage, these notes do not differentiate among agency participants.

and rearing habitat upstream of Bosher's Dam. The agencies commented that there are a variety of reasons for the low abundance. Hence in the short-term, American Shad passage is not as critical as for other species, but could become critical in the future.

Besides American Eel and Sea Lamprey, there was no final decision as to what additional species need to be passed now or in the longer term. The agencies will make a final decision later that will consider the James River basin upstream of Richmond, including the 7 dams situated within a 22-mile section of the James River, species needs, passage cost, and likelihood of success. (There is approximately 137 miles of mainstem habitat between Bosher's Dam and Scott's Mill Dam. There is an additional 153 miles of habitat on major James River tributaries between Scott's Mill and Boshers Dam. Upstream of Cushaw Dam, there is a considerable amount of mainstem and tributary habitat that historically supported diadromous fish, although dams on the James River have limited fish movement since the 1840's.)

Eagle Creek observed that a trap and haul program might best serve the needs of the basin upstream of Scott's Mill because of the challenges and costs associated with moving aquatic species upstream of 7 dams. (This could be a more significant challenge at Reusens as the Reusens Dam is about 40 feet high.)

Scott's Mill representatives observed that Gizzard Shad have been reported by anglers to be immediately downstream of Scott's Mill dam and American Eel have been observed as far upstream as Cushaw Dam, but not in great numbers. This was confirmed by VDGIF.

In response to a question about the Scott's Mill dam licensing status, Wayne responded that the draft application is expected to be distributed in September. For a variety of reasons, Liberty University will likely transfer the license to another entity after the license is issued. In the meantime, the application is being prepared with the intent to have safe, timely, and effective fish passage for both American Eel and Sea Lamprey.

Eagle Creek noted that they expected to start relicensing of Reusens in about 18 to 24 months. (The Reusens license expires on February 29, 2024.)

Upstream Fish Passage

The agencies suggested that Scott's Mill work closely with them on the upstream design before a draft license application is developed. Wayne responded that is the intent, particularly once conceptual ideas and resource goals are integrated. **Action Item.** Scott's Mill will work with its fish passage consultant and the USFWS to lay out potential fish passage approaches. This will include a trap and haul program, a nature-like fishway around the dam, and a fishway design to move American Eel and Sea Lamprey into the Scott's Mill headpond. Agencies specifically asked about the potential for a nature-like fishway. Preliminary work done by Scott's Mill indicates that a nature-like fishway would be on the order of 400 to 600 feet-long based on a head of about 17 feet. Given the limited room on the left side of the James River, necessary fishway length, and the fact that most flow will be on the right side of the river, the left side may not be feasible. Also on the right side, space is limited by the needs of U.S. Pipe Company for storing their pipe. Hence Scott's Mill has been focusing on the area immediately to the left of the arch section of the dam as that area was historically used to provide for fish passage.

Action Item. Wayne suggested that it might be best to include the options for fish passage in the draft license application and then continue to work on the approach that is in the best public interest during the 90-day application review period.

Action Item. Scott's Mill representatives will contact the other owners of the hydropower projects upstream (i.e., Holcomb Rock, Coleman Falls, Big Island, Snowden and Cushaw) to set up another conference call with resource agencies and dam owners. This meeting should occur once Scott's Mill preliminary information on fish passage becomes available.

Downstream Passage

This agenda item was not discussed due to lack of time.

Monitoring

Wayne asked what type of monitoring requirements the resource agencies would expect to see. Because these are relatively small run-of-river projects, they cannot afford high monitoring costs. It was agreed that fish counts would be needed at least initially to monitor passage success. VDGIF monitors the James River mainstem annually and that will certainly help with the monitoring. However, tributaries are not currently monitored. Scott's Mill requested that the agencies work with the dam owners to develop a plan that limits overall costs and possibly includes more agency involvement. This should be at a basin level upstream of Bosher's dam.

Maintenance

This agenda item was also not discussed due to lack of time.

Agencies also asked about mussels. Wayne responded that Brian Watson of VDGIF had been provided a copy of the mussel survey conducted upstream and downstream of Scott's Mill dam. The report will be included as an appendix in the Scott's Mill license application.

September 29. 2017
RECORD OF TELEPHONE CONVERSATION for SCOTT'S MILL HYDROPOWER PROJECTS, P-14425

Conference Call Participants
Scott Smith – Virginia Department of Game and Inland Fisheries (VDGIF)
Alan Weaver – VDGIF
David Sutherland – US Fish and Wildlife Service (USFWS)
Jessica Pica – USFWS
Brett Towler – USFWS
Greg Allen – Alden Research Laboratory (Alden)
Steve Amaral - Alden
Wayne Dyok – Consultant for Scott's Mill Project Licensing

Agenda

6. Overview of Alden Fish Passage Report
7. Status of James River American Shad Stocking
8. Short-term Fish Passage Approach
9. Longer-term Fish Passage Approach
10. DOE Fish Passage Funding Opportunity Announcement
11. Scott's Mill License Application Status

Summary of Discussion

Before the participants discussed the agenda, David Sutherland asked if the applicant had filed the last conference call notes with FERC. Wayne Dyok responded that they would be included in the consultation record, but if the agencies preferred, the record of conversation could be filed on its own. He suggested that it might be better if both those notes and the notes from the ensuing conversation be filed at the same time. The call summary notes will be filed with the FERC following the review of this summary.

1. Overview of Alden Fish Passage Report

Alden provided an overview of their September 21, 2017 Hydro Fish Passage Initial Assessment report that they had prepared for the Scott's Mill Hydropower Project. Alden considered American Eel, Sea Lamprey, American Shad and other riverine fish species.

Wayne was asked if FERC had agreed to the increased head that Scott's Mill is proposing for the project by adding either 2-foot high flashboards or a 2-foot high cap. Wayne explained that the applicant has not discussed this in detail with FERC, but plans to propose the spillway cap/flashboards to essentially maintain similar upstream water levels to what are experienced today and to increase annual generation. Applicant proposes to maintain a constant water level just below the proposed crest elevation of 516.4 feet until the hydraulic capacity of the plant is reached (i.e., about 4500 cfs). Under existing conditions, water levels during flows of 3200 cfs are about 1 1/2 feet above the dam crest and under low flows about one foot. (Applicant will provide a table comparing pre- and post-project water levels in the license application and how the change affects flooding and fish passage.)

Alden described the American eel and sea lamprey upstream passage approach to use a ramp with substrate and pegs for smaller eel, which could be used at the project.

The participants discussed examples of sea lamprey passage on the west coast and in Ireland. Alan Weaver noted that Bosher's dam passes large numbers of sea lamprey. Data on passage is contained in a thesis prepared by a Virginia Commonwealth University student. **Action Item.** Alan will send a digital version of the thesis and provide to Alden and the rest of the group. David Sutherland noted that Turner's Falls fishway on the Connecticut River has quite a few lamprey. Wayne agreed that the license application will discuss the need for lamprey passage.

Scott observed that the middle James River has eels in the 180 mm range with the smallest being about 130 to 140 mm. Alan added that the eels at Bosher's range from 6 to 9 inches (150 to 230 mm).

Greg Allen stated that a key consideration in passage of American eel and sea lamprey would be where to site the ramp. It was noted that American eel and sea lamprey are not great swimmers. How Sea Lamprey release and reattach will also be a passage design criteria as well as a suitable substrate to accommodate passage of both species.

Steve Amaral commented that sea lamprey passage experience is limited, but Steve believes that current eel ramps have been functioning in a manner that facilitates sea lamprey passage. Brett Towler noted the design work that the U.S. Army Corps of Engineers has been doing with lamprey on the west coast. Pacific Lamprey (Lampetra tridentate) are not exactly the same as Sea Lamprey (Petromyzon marinus) so we need to be sure that design is based on our east coast Sea Lamprey's ascending ability. Wayne said that Alden would work with the agencies on a ramp design as soon as agreement could be reached on how best to move forward with fish passage.

Alden then summarized the design approach for riverine and anadromous fish passage. A vertical slot fishway was found to be the best option, but could be 520 feet long to accommodate potential dam elevation changes. Alan suggested that the Alden design was conservative compared to the Bosher's design which has a 0.75 foot drop per pool with 13 pools 10 feet by 12 feet long and a slope of 6.25 percent. Slot width is 16". Alan felt that Bosher's was effective in passing fish, specifically noting that Bosher's passed as many as 4000 gizzard shad per hour. Greg responded that Alden had used the new guidelines from the US Fish and Wildlife Service, resulting in a more conservative design than at Bosher's dam. Participants acknowledged that if the Bosher's design criteria were to be used the estimated $5 to $10 million cost could be reduced.

Greg also noted that a vertical slot design was preferable to a Denil fishway, because of the number of species to be passed. Wayne cautioned the group that Alden's design was a high-level approach based on the guidelines and that if this option were selected, the applicant would work with the agencies on the specifics of the design.

Greg next described the nature-like fishway, which based on a 2 percent slope could require a length of 850 feet. The challenge is in finding a location for the nature-like fishway. Wayne suggested that the abandoned water supply canal could be considered if channel width could be reduced from the 20-foot design width assumed by Alden. The cost of the nature-like fishway was similar to the vertical slot and perhaps less if the US Fish and Wildlife Service guidelines are used. An agency field visit to Scott's Mill is being considered in the next few weeks to consider passage options.

Lastly Greg described the trap and haul approach. Although the cost is similar to that of other designs, an advantage is that it could provide upstream passage at more than one dam. The agencies suggested that Alternative 2 (vertical slot) provides more bang for the buck, because a trap and haul program could be built in with that option, as well as the immediate volitional passage for all species. The agencies also mentioned that quite a bit of habitat exists between the dams (main stem and accessible tributaries). Further discussion on the preferred approach was deferred to later in the discussion.

2. James River American Shad Stocking Program

Wayne Dyok noted that Alden had provided him with a "Bay Journal" article that Virginia was halting the shad stocking program in the James River, because there were only limited signs of recovery (Karl Blankenship, Bay Journal, September 17, 2017), and the amount of money spent on shad fry stocking was not justified. It was originally thought that opening up the James River and placing a fishing moratorium on American shad would trigger a restoration, but unfortunately the long-term average was only about 200 returning adults annually through the fall zone up to and through the fishway. It was thought that passage of American shad at Scott's Mill will not be required for some time. The Virginia Institute of Marine Science (VIMS) catch index is downriver of Richmond, but has also been well below targets. There is no total American Shad annual population estimate for the James River, only indices of abundance from the fishway count and the VIMS catch index. There is spawning habitat on the James in the fall zone below Bosher's fishway and in several tidal miles downstream of Richmond. The total number returning to the James River annually is a much higher number than at the Bosher's fishway. The Bosher's count is only providing information on the numbers of Shad moving into the middle James beyond Richmond, not the number of Shad in the entire James River. While there is spawning habitat available downstream of Boshers Dam, access to all historical spawning and rearing habitat is considered to be a necessary part of **fully** restoring the James River American Shad population.

In response to a question from Wayne on what might be the cause of the low returns, it was thought that the inshore and off-shore commercial fishing, as well as loss of habitat are important factors effecting the stock abundance. Wayne asked why the Potomac American shad restoration program seemed to be doing well. David responded that the Potomac River was an unregulated river with high quality habitat and good water quality. David added that passage on the Susquehanna might also be better if the fish were better managed with the hydro turbines. It may just be a matter of time for the James River.

3. Short-term Fish Passage Approach

Wayne presented the applicant's short-term approach. He suggested that it makes sense to immediately pass American eel and sea lamprey and the applicant is prepared to do so. He suggested that in the longer term a trap and haul program could be implemented, or perhaps a vertical slot fishway at Scott's Mill. He expressed concern that the cost of fish passage at each dam via a vertical slot fishway may not be supported by the upstream projects, especially the smaller ones, and a project like Reusens that has about a 40-foot head would have a very large cost. He then added that the Big Island dam is key to the operation of Georgia Pacific's mill located there. He did not see that dam being removed. He further noted that Reusens serves as a water supply reservoir for the City of Lynchburg. Scott Smith commented that Reusens is actually the secondary water supply source for Lynchburg. It is unlikely that Reusens dam would be decommissioned if the hydro project became uneconomic to operate because of a fish passage requirement. Wayne also stated that it is also unlikely for the Scott's Mill dam to be decommissioned because it serves as an emergency water supply.

Scott noted that he had previously talked to the City engineers and they informed him that Scott's Mill dam was not needed for operation of the emergency supply. He had previously had the same understanding as Wayne that the City needed Scott's Mill dam for its emergency supply. **Action Item.** Wayne to verify with the City of Lynchburg whether Scott's Mill dam is needed for the City's emergency water supply.[5]

David commented that the USFWS would work with all upstream dam owners to ensure passage at all dams with consideration of the economic costs associated with passage. David continued that he favored the one stage passage option (i.e., something like the vertical slot fishway that could pass all species including American eel and sea lamprey) He did not prefer the trap and transport option. He also noted it would be a Herculean task to get all participants to agree on a fish passage program now, considering that licenses expire at different times. He also said it is challenging to get FERC to open up a project license.

Alan echoed David's thoughts. He expressed concern that if only American eel and sea lamprey are passed now, developing a trigger for non-diadromous fish passage would be problematic because non-diadromous fish that would benefit from a passage facility are already present. These local fish that spend their entire life cycle in the freshwater river still move up and down stream for spawning and feeding purposes. Additionally, if Scott's Mill includes a vertical slot fishway then that could be used to trap fish and transport fish upstream. Wayne commented that is a possibility but the applicant either needs additional outside funding from grants or upstream dam owners, who might be inclined to participate in a trap and haul program if that avoided the high cost of upstream fish passage at their facility. He noted that Scott's Mill will produce about

[5] Subsequent to the conference call Wayne spoke with Mark Fendig, owner of Scott's Mill dam. He stated that Scott's Mill dam is needed for the City to maintain its water right. Point of technicality here, Lynchburg does not have a "water right", per se. They have a valid Virginia Water Protection Permit that allows them to withdraw a permitted amount of water. However, this is not the same thing as a "water right".

20,000 MWh annually. At about $50/MWh that equates to an annual income of $1,000,000. Adding $5 to $10 million in capital costs would almost surely render Scott's Mill uneconomic without additional outside funding. At this time, Scott's Mill is able to accommodate some level of fish passage, but not the full amount for a vertical slot fishway.

Wayne acknowledged the agencies desires. He reiterated his concern that the hydropower projects on the James River could not support fish passage at each dam because of the high cost. He said that he had hoped the agencies would approve a short-term plan for passage of American eel and sea lamprey, with a longer-term goal of passage for resident and other anadromous species. Given that the agencies did not want to take that direction, he asked the agencies to conference and get back to the applicant on how they would like to proceed with fish passage. **Action Item.** The agencies will discuss and amend the minutes to reflect how they wish to continue fish passage discussions or inform the applicant of their fish passage requirements and have the applicant work directly with them on the design, assuming the applicant is willing to try that approach.

David said this discussion did not cover downstream migration. Wayne agreed and said that the Scott's Mill power plant was being designed to minimize mortality to downstream migrants to the extent possible. Further the turbines being proposed are slower rotating turbines. Since there would be flow over the dam when flows exceed the hydraulic capacity of the plant, this could also be a mechanism for downstream passage. Wayne also said that the upstream dam owners would also be required to implement downstream fish passage. Wayne recommended that a conference call be held among all dam owners and the agencies to talk about fish passage. David suggested that such a conference call was premature.

4. Longer-term Fish Passage

Because the agencies preferred a one stage alternative, the longer-term approach was subsumed in agenda item 3.

5. DOE Funding Opportunity Announcement

Wayne noted that the US Department of Energy had recently issued a Funding Opportunity Announcement for grant funding for modular fish passage designs. He asked if the agencies would be willing to draft letters of support for Scott's Mill being used as a test site. David agreed that USFWS would be willing to support Scott's Mill as a test site for cost-effective and safe fish passage.

6. Scott's Mill License Application Status

Wayne said that although there is a little more work needed to wrap up the Scott's Mill license application, the hope is to get agreement on the fish passage approach and then expeditiously wrap up the application. Wayne had hoped to get concurrence on a short- and longer-term approach and then have Alden work directly with the agencies to develop a conceptual approach for fish passage. He noted that since there is no agreement yet, the collaborative fish passage design approach would need to wait until after the agencies conferred and Wayne could talk with his client.

David asked to have the study reports provided to the agencies. **Action Item.** Wayne agreed to talk with the applicant to see if he would release the letter reports for the studies. Some are stand alone, but others are included directly into the license application, making it difficult to pull out those studies. Wayne decided that since the application needs to be filed soon because the preliminary permit is expiring, he was just planning to include the reports with the draft application.

<u>Additional Agency Comments October 17, 2017</u>

As requested by the applicant's consultant in the October 29, 2017 call summary, and in light of the pending expiration of the preliminary permit application on November 13, 2017, the State of Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service (Agencies) would like to provide the following comments on the Scott's Mill Preliminary Permit coordination leading to the draft application. The following recommendations are likely the most cost effective for the applicant and provides the most assurance for safe, timely and effective fish passage at the proposed Scott's Mill Project. A bypass around the dam with a nature-like-fishway is still a consideration pending a site visit later this year.

1. The Agencies requested copies of the study results, but have not received most of the reports. While the freshwater mussel survey report was provided to us weeks ago, all of the other reports regarding hydrology, flow and habitat have not been provided to the agencies. The Agencies requested recommendations on fish passage must be considered preliminary in the absence of the study reports. The agencies will conduct a site visit as soon as November and look forward to our review of the studies for the hydroelectric project.

2. The Agencies first recommendation is for construction of volitional American eel (eel) and sea lamprey (lamprey) passage over the Scott's Mill Dam and in to the headpond behind the dam. This permanent eel and lamprey passage structure, and or passage structures, may need to be removable during the winter for safety. The Agencies consider this the preferred measure for eel and lamprey passage at Scott's Mill Dam.

3. A second recommendation is providing fish passage for American shad and non-diadromous species from downstream of Scott's Mill Dam to the headpond upstream of the dam. This could be in the form of a vertical-slot fishway, a nature-like fishway, or a trap and transport facility. The Agencies can provide additional comments regarding the design, location, time of construction etc. of any proposed fish passage facility once the applicant determines the type of fish passage facility they wish to pursue.

RECORD OF TELEPHONE CONVERSATION
SCOTT'S MILL HYDROPOWER PROJECT

Conference Call Participants
Scott Smith – Virginia Department of Game and Inland Fisheries (VDGIF)
Alan Weaver – VDGIF
David Sutherland – US Fish and Wildlife Service (USFWS)
Greg Allen – Alden Research Laboratory (Alden)
Brian McMann – Alden
Kathie Leighton – Littoral Power Systems (LPS)
Wayne Dyok – Consultant for Scott's Mill Project Licensing

Date – November 6, 2017

Agenda

12. American Eel and Sea Lamprey Conceptual Fish Passage Design
13. Upstream Anadromous and Resident Fish Passage
14. Department of Energy Fish Passage Funding Opportunity Announcement

Summary of Discussion

1. American Eel and Sea Lamprey Conceptual Fish Passage Design

After introductions, Greg Allen, Alden, provided an overview of the American Eel and Sea Lamprey conceptual fish passage design. He referred to the design figures previously transmitted to the agencies. Since American eel migrate along the margins, Alden determined that the best location for siting the upstream passage was on the river banks. Since there are no specific upstream fishway designs for Sea Lamprey on the east coast, experience at other passage facilities provided the basis for siting. At these locations, Sea Lamprey tend to follow the main flow. Accordingly, Alden sited the first ladder on the north (left) side of the river adjacent to the dam abutment and the second facility adjacent to the powerhouse, at the location of the old fishway. Greg noted that the ramp design for American Eel and Sea Lamprey is similar in slope and width. Alden is proposing one ramp at each location as identified on drawings A1 and B1. Alden proposes to adjust the substrate for species and size. Vertical pegs will be used for larger American eel. Geotech fabric will be used for smaller eels and smother surfaces for Sea Lamprey. As we get further into the design, the design will be adjusted to include additional specifics on dimensions and substrate. The design is based on a maximum head of 17 feet, with resting boxes being placed every 10 vertical feet. Sea Lamprey require about the same number of resting boxes.

Alan Weaver, VDGIF, said that upstream eel passage was fairly well known. He noted Sea Lamprey are not the same as what is passed on the west coast and may require a ground-breaking design.

Wayne observed that the Scott's Mill dam owner embraces fish passage and is willing to work towards installing a vertical slot fishway. If Sea Lamprey passage is not successful at the American eel/Sea Lamprey passage locations, then a vertical slot fishway would resolve that concern, assuming licensing parties could agree on design and funding of a cost-effective vertical slot fishway. Alan thought that use of the various substrates for the ramp design may cover his concerns.

David Sutherland, USFWS, inquired why the second American eel/Sea Lamprey passage facility was more towards the middle of the dam, rather than on the south bank. He suggested that it may be difficult for American Eel swimming up the south bank to get across the powerhouse flow. He recommended an entrance downstream of the tailrace as an alternative. Greg agreed that the eel ramp could be placed on the south (right) bank. Participants agreed that the location of the second eel ramp should be moved to the right bank.

Alan stated that if the eel ramp is moved to the right bank. Then the vertical slot fishway could be located at the site of the old fishway, adjacent to the powerhouse. **Action Item.** The participants agreed to move the second American Eel/Sea Lamprey ramp to the right bank. This permits the vertical slot fishway to be located immediately to the left of the powerhouse.

Alan inquired about the near field and far field for American Eel and Sea Lamprey attraction flow. The concern was that American Eel and Sea Lamprey may not be attracted in the same way. If attraction flow conditions need to be species specific, it may require having separate entrances and one common passage channel – if that is even feasible. David concurred and asked about where the quiescent water would be. Wayne responded that during upstream migration periods, the powerhouse could be operated such that the turbine units on the right side could be left off if flows are less than the 4,500 cfs hydraulic capacity of the plant. This may result in quiescent water being available on the right bank (south side). Engineering analysis is required with any design.

In response to a question about the turbine units, Kathie Leighton, LPS, said that a couple of turbines are slightly different than other units in that they have controls while other units are fixed. Since the controlled units would operate more frequently, Wayne recommended that these units be put further away from the right bank. USFWS has expressed the importance of fish friendly turbines, and plan to withhold additional comments until they have designs to evaluate.

Kathie continued that these "controller" units have pitch and frequency control to optimize efficiency over a range of flow conditions. The remaining units would be fixed to minimize turbine costs. In response to a question about turbine speed, Kathie stated that LPS is working with the manufacturer to reduce the turbine speed. At this time, the maximum speed is 400 rpm, but it is hoped that the speed could be reduced to between 150 to 200 rpm.

Alan postulated that the overall attraction flow at location A may be quiescent and that might not be best for the vertical slot fishway. He asked if it might be possible to adjust the location of the vertical slot fishway to find the appropriate flow field. To ensure appropriate attraction flows at the vertical slot fishway, Wayne suggested that discharge from one or possibly two turbine units on the left side of the powerhouse could be adjusted to direct flow to the left. He noted that the discharge point from the tailrace would be about 60 feet downstream of the arch section based on the current design. This could act as both an attraction flow and to facilitate circulation of water immediately downstream of the spillway during lower flow periods when there is little or no flow passing over the spillway. At present there is an island that separates the proposed tailrace discharge from the area downstream of the spillway. Deepening of the opening between the island and the dam may be needed to provide some flow on the left side of the island.

Alan asked if the Applicant is proposing one eel ramp at either location A or location B, or two ramps. Greg responded that Alden had recommended providing ramps at both locations. Alan commented that made sense. Wayne added that Alden was given design flexibility to propose superior solutions. If the ramp costs were prohibitive, then the concept of one or two ramps could have been revisited, but based on the estimated cost, Applicant concurs that both ramps should be installed.

Wayne continued that for the short term after construction, the Applicant would be responsible for testing and monitoring of the ramps to ensure that they functioned properly. As for long term operation and monitoring, he proposed that the Applicant continue to work with the agencies on a longer-term plan. Agency participation in operation and monitoring of the ramps will be important. The agencies responded that that sounded good. It will be important to get good passage numbers at the ramps.

Greg noted that the current ramp design is compatible with monitoring since the outlet has a higher elevation than the headpond. In response to a question from David about whether the plan includes a location for collection and monitoring, Greg said that the plan is simpler than that. The passed fish could be monitored by placing a bucket at the end of the ramp and checked on a daily basis. David recommended that Alden talk to Stuart Welsh of the Shenandoah Cooperative Unit since they have a fully functioning monitoring system at the Millville site. This is a secure location that is automated. He suggested that something like this be integrated into the eel passage. **Action Item.** Greg agreed to look into this and contact Stuart (304-293-2941 x35006).

Alan asked if the eel ramp would be removable for floods. Greg replied that Alden has looked into this. The ramps could be removed in the fall. However, the locations are relatively sheltered and it might be more cost effective to leave the ramps in place and just repair them after floods. This can be more fully addressed during the detailed design.

David commented that Potomac 4 and 5 designs are protected. Jessica Pica commented that typically the USFWS designs for a 50-year flood. Wayne responded that a 50-year flood design may not be needed here because the tailwater rises so quickly that there is little head difference between the upstream and downstream water levels at high flood flows. A more critical case could be at lower floods. This will need to be examined during the detailed design phase. Greg concurred that based on his review of the flood conditions, a 50-year flood may not be the best approach for the design.

Participants next talked about having a site visit to review the design location options for both the ramps and vertical slot fishway. Wayne mentioned that the site visit should also consider the old, abandoned waterworks canal on the right bank as a nature-like fishway. The participants agreed that this made sense as an alternative.

Wayne mentioned that the Applicant is looking at distributing the draft license application on November 20th. A November 14th site visit to confirm locations was deemed appropriate. Scott Smith will provide a boat to better observe the potential fish passage locations.

Alan and Greg discussed the separate substrates that will be incorporated into the ramp design. Alan said he was satisfied that one ramp could accommodate both American Eel and Sea Lamprey and the various size categories of each species subject to proof by monitoring in the case of Sea Lamprey since less is known about using this type of passage for Sea Lamprey.

Wayne mentioned that the location of the ramp on the left bank makes it more challenging to have a canoe portage on the left side of the river as there is little room on that side of the river between the dam and road. Scott agreed that a portage around the dam was an important element of the project. **Action Item.** Wayne and Scott will discuss the location of the canoe/kayak portage at the November 14th site visit.

2. Upstream Anadromous and Resident Passage

Wayne presented two options for moving forward with the vertical slot fishway. The preferred option is to have all dam owners between Scott's Mill and Cushaw cooperate to fund the vertical slot fishway with a trap and haul component. In this way, at least for the next licensing period, the dam owners would not need to install similar upstream facilities at their projects, other than the American Eel and Sea Lamprey ramps. The second option is to acquire grant funding similar to what was done at Bosher's dam. It was agreed that obtaining grant funding if the hydropower project moves forward would be difficult because many potential funding entities cannot fund private developments.

Wayne commented that some third-party funding may already be available since a need for fish passage has already been established. He continued that the owner of the dam, and not necessarily the Applicant, would like to see fish passage move forward irrespective of whether the Scott's Mill Hydropower Project moves forward. At this time, the project economics look reasonable, particularly since LPS has come in to design a modular system and reduced costs by about 30 percent from a conventional design. Therefore, it is likely that the project will move ahead, but potential power off-takers will not commit to a power sales agreement until after a license is issued and the project is real. If a power sales agreement cannot be reached (a more unlikely outcome) and the project needs to sell into the PJM system, the power sales rates could make the project marginally uneconomic. In that event, the agencies could still work with the dam owner to obtain the necessary grant funding. Wayne said the dam owner would like to make this a win-win situation for the fish.

Scott asked if the nature-like fishway is a viable option, and could it be built to also serve as a trap and transport facility. Greg answered that the nature-like fishway could be designed more like a traditional fishway at the exit point, so it could be used for trap and transport. In this way, flow can also be controlled. Scott stated that if this turns out to be the more viable option then VDGIF would be fine with that approach as well.

3, <u>Department of Energy Fish Passage Funding Opportunity Announcement</u>

Kathie provided an overview of the US Department of Energy (DOE) Funding Opportunity Announcement (FOA) on Fish Passage. DOE is soliciting proposals for new approaches to fish passage in an effort to reduce the design and construction costs. Given that there are about 412 projects that will be up for relicensing in the near future and that many of these are smaller projects, DOE is looking for innovative approaches to pass key fish species. LPS is pursuing this opportunity and has taken a modular approach to reduce costs. If the fish passage components can be standardized and applied across a variety of sites, these building blocks can be constructed off-site and capitalize on economies of scale. This could reduce construction costs. LPS is preliminarily considering using the Bosher's dam vertical slot fishway as a reference site. LPS would like to reduce civil costs on the order of 50 percent.

Kathie continued that LPS is interested in working with the resource agencies on establishing engineering criteria for a large number of facilities. If Bosher's Dam is used, then Scott's Mill Dam might present a good opportunity to verify the approach. The DOE FOA would provide some grant funding, but it would be great if additional grant funding could be made available. Kathie added that Alden is a key member of the LPS team.

Scott asked if this was akin to a Lego fishway. Kathie agreed with Scott's analogy.

Alan noted that he had worked on the design and monitoring at Bosher's Dam. He said the agencies already have the criteria for fish passage established and the basic design has not changed. The key is to site the fishway properly. Both rock excavation and dam alteration were deemed necessary at Bosher's Dam. The construction cost in 1999 was $1.5 million. Similar fishways today might be on the order of $3.5 to 5 million. Alan added that it would be hard for him to imagine that a new (modular type) facility could be built for less money. He continued that they were able to obtain grant funding and private donations because the dam was a municipal facility. Henrico draws water from behind the dam. He was doubtful that state and federal grant monies could be obtained for a private venture.

Wayne commented that that it is understood for a FERC licensed project and that is why the base plan is to work with upstream dam owners to develop a trap and transport approach and thereby limit the upstream owners' liability. Both the Reusens and Snowden projects are coming up for relicensing soon. It is hoped that they will cooperate on a basin-wide approach. If that fails, it may still be possible to move forward with the Scott's Mill Hydro development, but the Applicant would need to consider all the variables affecting project economics. As noted previously in these minutes, the Dam owner is willing to continue to work with the agencies if cooperation is not forthcoming and the project economics no longer work. In a worst-case scenario, the hydropower project does not go forward, but the fish passage facility does through additional grant funding. The Scott's Mill Dam owner is willing to move forward on the basis that the dam remains and additional grant monies can be made available beyond which the dam owner can raise. The Scott's Mill Dam owner cannot afford to be out-of-pocket for the fish passage costs, but will certainly cooperate to make fish passage happen. If this worst case happens, then the upstream owners will need to deal with fish passage as part of their own relicensing.

Scott thought this approach looked reasonable to him. David asked what species would be passed. Wayne responded that the agencies would need to make that determination, but it could include resident fish species, Gizzard Shad, and in future, American Shad. Of course, American Eel and Sea Lamprey would also be passed.

Alan noted that Bosher's was the only vertical slot fishway in Virginia, but there were numerous others going in elsewhere. These are cast in place projects, but he thought that there could be cost savings for portions of fishways that are constructed off-site and shipped.

David asked Kathie about whether DOE has established criteria for upstream and downstream passage. She responded that this would be one of the first tasks to be undertaken if LPS is awarded a DOE grant. She proposed that this could be developed with the resource agencies. At this time, DOE's preference is for passage of fish species of concern (e.g. Endangered Species Act-listed fish, adult American Eel, and migratory fish). LPS has considered the species being passed at Bosher's and thought that the species being passed there would be a good first start.

David talked about the Susquehanna River as an example for establishing the passage criteria. He also spoke about the eel passage opportunities on the Potomac River. **Action Item.** Kathie agreed to share a non-proprietary summary of the concept paper submitted to DOE. If the agencies are interested in participating, then LPS would like to work with them to help define the requirements. **Action Item.** Wayne agreed to provide Kathie with the contact information for the agency call participants.

SCOTT'S MILL HYDROPOWER PROJECT
FISH PASSAGE SITE RECONNAISSANCE

<u>Participants</u>
Scott Smith – Virginia Department of Game and Inland Fisheries (VDGIF)
Alan Weaver – VDGIF
Dan Goetz - VDGIF
David Sutherland – US Fish and Wildlife Service (USFWS)
Jessica Pica - USFWS
Mark Fendig – Luminaire Technologies
Wayne Dyok – Consultant for Scott's Mill Project Licensing

Date – November 14, 2017

Summary of Site Reconnaissance

The USFWS and VDGIF met with representatives of the proposed Scott's Mill Hydropower Project at the Scott's Mill Dam site to identify potential sites for: (1) American Eel and Sea Lamprey upstream passage, (2) a vertical slot fishway for passage of anadromous and resident fish species, and (3) a nature-like fishway. James River flow during the site reconnaissance was approximately 1,200 cfs at Holcomb Rock gauge.

The USFWS, VDGIF, and Scott's Mill representatives were in agreement at the outset that upstream fish passage is immediately needed for American Eel and Sea Lamprey irrespective of whether hydropower is a part of the project. The parties agreed to work together to make that happen. It makes most sense to construct the upstream passage at the same time as the proposed power plant is constructed in order to minimize project costs. No decision has yet been made on the timing for the installation of upstream passage of other anadromous fish and resident fish species pending an alternative analysis.

The participants first observed the arch section of the dam on the right side of the river (west side) and the old "fishway" located adjacent to the arch section of the dam. There was general agreement that the American Eel/Sea Lamprey passage structure on the right side of the arch section was appropriately located along the bank. Under certain alternatives, it is preferable to provide a quiescent water area on the right side of the arch section to attract American Eel. Other alternatives could be enhanced by rotating the power plant so that the discharge is directed away from the right bank, and the turbine discharge is across the river and along the upstream end of the island. The area across the river from the power plant is a productive fish habitat area. To reduce head loss, it may be requested to deepen the existing approximately 100-foot wide opening. This will be done during the detailed design of the power plant and fishways. Wetland impacts to the island habitat should be minimized to the maximum extent possible in the later designs.

The VDGIF and USFWS were pleased with the concept designs Alden Laboratory has completed for American Eel/Sea Lamprey fishway at the Scott's Mill Dam. The resource agencies and Scott's Mill representatives were in agreement that the detail designs should continue to involve all parties to ensure the design meets the needs of the target fish species.

The participants next examined the proposed location for a vertical slot fishway. The old fishway location may be an appropriate location if required attraction flows can be established in conjunction with the fishway entrance. A potential concern for fish swimming up the right side might be how they would get across the powerhouse flow. This will need to be given further consideration during the detailed design phase of the project. Since long-term plans call for fish passage, consideration of the vertical slot or nature-like fishway should be taken into account during the design of the power plant. All the alternatives are still in review by the fish biologists and fish passage engineers.

The site reconnaissance participants next assessed the existing 22-foot wide water works canal as a possibility for a nature-like fishway. This is the only feasible location on the right side of the dam for a nature-like fishway. If the 22-foot width is acceptable for the nature-like fishway, the portion of the water works canal near the dam seemed suitable, as well as the area upstream of the dam. The water works canal would be suitable for the first 200 feet downstream of the dam. Downstream of that, the nature-like fishway would conflict with the US Pipe Company operations. The existing pipe storage area could be relocated, but it would be important to avoid siting of the nature-like fishway near the US Pipe buildings. There appears to be sufficient room to locate the nature-like fishway entrance upstream of the US Pipe buildings, but the vertical bank would need to be excavated where the entrance would be located. Further downstream the water works canal discharges into the James River and that would simplify the construction effort, but use of this portion would adversely affect US Pipe operations. Accordingly, it was thought that having the entrance about 500 feet downstream of the dam would be the least disruptive to the US Pipe operations. Having the nature-like fishway entrance this far downstream of the dam is a potential concern because the upstream migrants may have a difficult time finding the entrance and may swim upstream of it and possibly never find the fishway entrance. An initial recommendations would place the entrance less than 100 feet downstream of the turbine discharge. The installation of a low-head check dam or some other directional device was discussed as a possible way to direct upstream migrants into the nature-like fishway. However, this may not accommodate upstream migrants that end up on the far side of the large island. Use of the waterworks canal would require coordination with the Virginia Department of Historic Resources as the waterworks canal is listed on the National Register of Historic Places.

The last stop on the reconnaissance was to examine the American Eel/Sea Lamprey fishway on the left (east) side of the river. There was general agreement on the location of the fishway as shown on the Alden drawings. It was thought that it might be preferable to locate most of the fishway structure on the left side of the abutment wall to protect it from flood flows and debris. Scott's Mill representatives also plan to construct a canoe portage on the left side of the river. It is hoped that this could be constructed to the left of the fishway. Design of the portage will need to wait until the fishway design is completed. There is not a lot of room between the dam abutment and River Road, so the two items will need to be coordinated.

The USFWS asked if the Applicant was proposing a veil over the spillway. The Applicant stated that they had not intended to have a veil unless it was needed for water quality purposes, but they would look into having a veil similar to the requirement at Cushaw Dam.[6] The challenge in having a veil over the dam is lack of control of the water surface to the level required, particularly since the dam is so wide. The applicant had planned to maintain the water level at the crest of the dam to maximize the head for power generation. Applicant recognizes that at times controlling the water level at the crest would periodically cause some water to flow over the dam, particularly when upstream flows increase. Water also would flow over the dam when flows exceed the 4,500 cfs capacity of the turbines. The agencies are concerned with maintaining a minimum flow across the width of the river during the summer month's low flow period. The results of the bathymetry and hydrology studies under the proposed operating conditions will assist the agencies with understanding the water conditions in the river channel during project operations.

[6] After the site reconnaissance, Scott's Mill representatives estimated that a 1-inch veil would be equivalent to a flow of 60 cfs and a ½ inch veil would be about 30 cfs. The flow over the dam was 1200 cfs, equivalent to about 7.5 inches. A one foot head over the dam is about 2500 cfs.

Appendix B

Responses to Comments on Draft License Application

Appendix C

Photographs

Photo 1 – Cushaw Dam

Photo 2 – Snowden Dam

Photo 3 – Big Island Dam

Photo 4 – Coleman Falls Dam

Photo 5 – Holcomb Rock Dam

Photo 6 – Reusens Dam

Photo 7 – Scott's Mill Dam April 2016 – 1,800 cfs

Photo 8 – Scott's Mill Dam September 12, 2016 – Low Flow about 800 cfs

Photo 9 – Scott's Mill Dam November 14, 2017 – Flow 1,500 cfs – Note Flow Over Arch Section and Old Fishway

Photo 10 – Scott's mill Dam May 5, 2017 – High Flow about 25,000 cfs

Photo 11 – Scott's Mill Dam May 5, 2017 – Note Turbulent Flow and Reduced Head

Photo 12 – Scott's Mill Dam July 7, 2017 – Flow 1,400 cfs

Photo 13 – Scott's Mill Dam February 2, 2017 – Average Flow 3,200 cfs

Photo 14 – 1,400 cfs Flow Over Sill at Riveredge Park

Photo 15 – 800 cfs Flow at Riveredge Park Sill

Photo 16 – July 7, 2017 Vegetation Screening the James River Immediately Downstream of Scott's Mill

Photo 17 – July 7, 2017 Slight View of River from River Road Downstream from Scott's mill Dam

Photo 18 – November 28, 2016 Scott's mill Dam from River Road in Defoliated Season

Photo 19 – April 18, 2016 Scott's Mill Dam as viewed from 5th Street Bridge

Photo 20 – April 20, 2016 Scott's Mill dam Viewed from North Side of Norwood Street (Note Pipe Storage Area)

Photo 21 – April 20, 2016 Scott's Mill Dam from Norwood Street

Photo 22 – November 14, 2017 Views of Homes on Norwood Street with Views of Scott's Mill Dam (Note Downstream Island in Foreground)

Photo 23 – November 28, 2016 View of Scott's Mill Grist Foundation (Left Abutment) Showing Grist Mill Discharge Location

Appendix D

Virginia Water Quality Standards

Part I

Surface Water Standards with General, Statewide Application

9VAC25-260-5. Definitions.

The following words and terms when used in this chapter shall have the following meanings unless the context clearly indicates otherwise:

"Algicides" means chemical substances, most commonly copper-based, used as a treatment method to control algae growths.

"Board" means State Water Control Board.

"Chesapeake Bay and its tidal tributaries" means all tidally influenced waters of the Chesapeake Bay; western and eastern coastal embayments and tributaries; James, York, Rappahannock and Potomac Rivers and all their tidal tributaries to the end of tidal waters in each tributary (in larger rivers this is the fall line); and includes subdivisions 1, 2, 3, 4, 5, and 6 of 9VAC25-260-390, subdivisions 1, 1b, 1d, 1f and 1o of 9VAC25-260-410, subdivisions 5 and 5a of 9VAC25-260-415, subdivisions 1 and 1a of 9VAC25-260-440, subdivisions 2, 3, 3a, 3b and 3e of 9VAC25-260-520, and subdivision 1 of 9VAC25-260-530. This definition does not include free flowing sections of these waters.

"Criteria" means elements of the board's water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use.

"Designated uses" means those uses specified in water quality standards for each water body or segment whether or not they are being attained.

"Drifting organisms" means planktonic organisms that are dependent on the current of the water for movement.

"Epilimnion" means the upper layer of nearly uniform temperature in a thermally stratified man-made lake or reservoir listed in 9VAC25-260-187 B.

"Existing uses" means those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.

"Lacustrine" means the zone within a lake or reservoir that corresponds to nonflowing lake-like conditions such as those near the dam. The other two zones within a reservoir are riverine (flowing, river-like conditions) and transitional (transition from river to lake conditions).

"Man-made lake or reservoir" means a constructed impoundment.

"Mixing zone" means a limited area or volume of water where initial dilution of a discharge takes place and where numeric water quality criteria can be exceeded but designated uses in the water body on the whole are maintained and lethality is prevented.

"Natural lake" means an impoundment that is natural in origin. There are two natural lakes in Virginia: Mountain Lake in Giles County and Lake Drummond located within the boundaries of Chesapeake and Suffolk in the Great Dismal Swamp.

"Passing organisms" means free swimming organisms that move with a mean velocity at least equal to the ambient current in any direction.

"Primary contact recreation" means any water-based form of recreation, the practice of which has a high probability for total body immersion or ingestion of water (examples include but are not limited to swimming, water skiing, canoeing and kayaking).

"Pycnocline" means the portion of the water column where density changes rapidly because of salinity and/or temperature. In an estuary the pycnocline is the zone separating deep, cooler more saline waters from the less saline, warmer surface waters. The upper and lower boundaries of a pycnocline are measured as a change in density per unit of depth that is greater than twice the change of the overall average for the total water column.

"Secondary contact recreation" means a water-based form of recreation, the practice of which has a low probability for total body immersion or ingestion of waters (examples include but are not limited to wading, boating and fishing).

"Swamp waters" means waters with naturally occurring low pH and low dissolved oxygen caused by: (i) low flow velocity that prevents mixing and reaeration of stagnant, shallow waters and (ii) decomposition of vegetation that lowers dissolved oxygen concentrations and causes tannic acids to color the water and lower the pH.

"Use attainability analysis" means a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in 9VAC25-260-10 H.

"Water quality standards" means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§ 62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC § 1251 et seq.).

"Wetlands" means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

9VAC25-260-50. Numerical criteria for dissolved oxygen, pH, and maximum temperature.***

CLASS	DESCRIPTION OF WATERS	DISSOLVED OXYGEN (mg/l)****		pH****	Max. Temp. (°C)
		Min.	Daily Avg.		
I	Open Ocean	5.0	--	6.0-9.0	--
II	Estuarine Waters (Tidal Water-Coastal Zone to Fall Line)	4.0	5.0	6.0-9.0	--
III	Nontidal Waters (Coastal and Piedmont Zones)	4.0	5.0	6.0-9.0	32
IV	Mountainous Zones Waters	4.0	5.0	6.0-9.0	31
V	Stockable Trout Waters	5.0	6.0	6.0-9.0	21
VI	Natural Trout Waters	6.0	7.0	6.0-9.0	20
VII	Swamp Waters	*	*	3.7-8.0*	**

*This classification recognizes that the natural quality of these waters may fluctuate outside of the values for D.O. and pH set forth above as water quality criteria in Class I through VI waters. The natural quality of these waters is the water quality found or expected in the absence of human-induced pollution. Water quality standards will not be considered violated when conditions are determined by the board to be natural and not due to human-induced sources. The board may develop site specific criteria for Class VII waters that reflect the natural quality of the waterbody when the evidence is sufficient to demonstrate that the site specific criteria rather than narrative criterion will fully protect aquatic life uses. Virginia Pollutant Discharge Elimination System limitations in Class VII waters shall not cause significant changes to the naturally occurring dissolved oxygen and pH fluctuations in these waters.

**Maximum temperature will be the same as that for Classes I through VI waters as appropriate.

***The water quality criteria in this section do not apply below the lowest flow averaged (arithmetic mean) over a period of seven consecutive days that can be statistically expected to occur once every 10 climatic years (a climatic year begins April 1 and ends March 31). See 9VAC25-260-310 and 9VAC25-260-380 through 9VAC25-260-540 for site specific adjustments to these criteria.

****For a thermally stratified man-made lake or reservoir in Class III, IV, V or VI waters that are listed in 9VAC25-260-187, these dissolved oxygen and pH criteria apply only to the epilimnion of the water body. When these waters are not stratified, the dissolved oxygen and pH criteria apply throughout the water column.

9VAC25-260-140. Criteria for surface water.

A. Instream water quality conditions shall not be acutely[1] or chronically[2] toxic except as allowed in 9VAC25-260-20 B (mixing zones). The following are definitions of acute and chronic toxicity conditions:

"Acute toxicity" means an adverse effect that usually occurs shortly after exposure to a pollutant. Lethality to an organism is the usual measure of acute toxicity. Where death is not easily detected, immobilization is considered equivalent to death.

"Chronic toxicity" means an adverse effect that is irreversible or progressive or occurs because the rate of injury is greater than the rate of repair during prolonged exposure to a pollutant. This includes low level, long-term effects such as reduction in growth or reproduction.

B. The following table is a list of numerical water quality criteria for specific parameters.

Table of Parameters [6, 7]

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Acenapthene (µg/l) 83329					670	990
Acrolein (µg/l) 107028	3.0	3.0			6.1	9.3
Acrylonitrile (µg/l) 107131 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.51	2.5
Aldrin (µg/l) 309002 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.	3.0		1.3		0.00049	0.00050
Ammonia (µg/l) 766-41-7 Chronic criterion is a 30-day average concentration not to be exceeded more than once every three (3) years on the average.(see 9VAC25-260-155)						
Anthracene (µg/l) 120127					8,300	40,000

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Antimony (µg/l) 7440360					5.6	640
Arsenic (µg/l)[5] 7440382	340	150	69	36	10	
Bacteria (see 9VAC25-260-160 and 170)						
Barium (µg/l) 7440393					2,000	
Benzene (µg/l) 71432 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					22	510
Benzidine (µg/l) 92875 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.00086	0.0020
Benzo (a) anthracene (µg/l) 56553 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.038	0.18
Benzo (b) fluoranthene (µg/l) 205992 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.038	0.18
Benzo (k) fluoranthene (µg/l) 207089 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.038	0.18

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Benzo (a) pyrene (µg/l) 50328 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.038	0.18
Bis2-Chloroethyl Ether (µg/l) 111444 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.30	5.3
Bis2-Chloroisopropyl Ether (µg/l) 108601					1,400	65,000
Bis2-Ethylhexyl Phthalate (µg/l) 117817 Known or suspected carcinogen; human health criteria at risk level 10^{-5}. Synonym = Di-2-Ethylhexyl Phthalate.					12	22
Bromoform (µg/l) 75252 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					43	1,400
Butyl benzyl phthalate (µg/l) 85687					1,500	1,900

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Cadmium (µg/l)[5] 7440439 Freshwater values are a function of total hardness as calcium carbonate ($CaCO_3$) mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER ~~$e^{\{1.128[ln(hardness)] - 3.828\}}$~~ [$e^{\{0.8407[ln(hardness)] - 3.279\}}$] Freshwater chronic criterion (µg/l) WER ~~[$e^{\{0.7852[ln(hardness)] - 3.490\}}$]~~ [$e^{\{0.6247[ln(hardness)] - 3.384\}}$] CFc WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CFc = chronic conversion factor CFc = 1.101672-[(ln hardness)(0.041838)]	~~3.9~~ 1.8 $CaCO_3$ = 100	~~1.1~~ 0.55 $CaCO_3$ = 100	40 X WER	8.8 X WER	5	
Carbon tetrachloride (µg/l) 56235 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					~~2.3~~ 4.3	~~16~~ 30

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Carbaryl (µg/l) 63252	2.1	2.1	1.6			
Chlordane (µg/l) 57749 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$	2.4	0.0043	0.09	0.0040	0.0080	0.0081
Chloride (µg/l) 16887006 Human Health criterion to maintain acceptable taste and aesthetic quality and applies at the drinking water intake. Chloride criteria do not apply in Class II transition zones (see subsection C of this section).	860,000	230,000			250,000	
Chlorine, Total Residual (µg/l) 7782505 In DGIF class i and ii trout waters (9VAC25-260-390 through 9VAC25-260-540) or waters with threatened or endangered species are subject to the halogen ban (9VAC25-260-110).	19 See 9VAC25-260-110	11 See 9VAC25-260-110				
Chlorine Produced Oxidant (µg/l) 7782505			13	7.5		
Chlorobenzene (µg/l) 108907					130	1,600

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Chlorodibromomethane (µg/l) 124481 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					4.0	130
Chloroform (µg/l) 67663					340	11,000
2-Chloronaphthalene (µg/l) 91587					1,000	1,600
2-Chlorophenol (µg/l) 95578					81	150
Chlorpyrifos (µg/l) 2921882	0.083	0.041	0.011	0.0056		

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Chromium III (µg/l)[5] 16065831 Freshwater values are a function of total hardness as calcium carbonate $CaCO_3$ mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion µg/l WER $[e^{\{0.8190[\ln(hardness)]+3.7256\}}]$ (CF_a) Freshwater chronic criterion µg/l WER $[e^{\{0.8190[\ln(hardness)]+0.6848\}}]$ (CF_c) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140.F e = natural antilogarithm ln=natural logarithm CF = conversion factor a (acute) or c (chronic) CF_a= 0.316 CF_c=0.860	570 ($CaCO_3$ = 100)	74 ($CaCO_3$ = 100)			100 (total Cr)	
Chromium VI (µg/l)[5] 18540299	16	11	1,100	50		

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Chrysene (µg/l) 218019 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					~~0.0038~~ 0.038	0.018

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Copper (µg/l)[5] 7440508 Freshwater values are a function of total hardness as calcium carbonate $CaCO_3$ mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER $[e^{\{0.9422[\ln(hardness)]-1.700\}}]$ (CF_a) Freshwater chronic criterion (µg/l) WER $[e^{\{0.8545[\ln(hardness)]-1.702\}}]$ (CF_c) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F. e = natural antilogarithm ln=natural logarithm CF = conversion factor a (acute) or c (chronic) CF_a = 0.960 CF_c = 0.960 Alternate Copper Criteria in Freshwater: The freshwater criteria for copper can also be calculated using the EPA 2007 Biotic Ligand Model (See 9VAC 25-260-140.G) Acute saltwater criterion is a 24-hour average not to be exceeded more than once every three years on the average.	13 $CaCO_3$ = 100	9.0 $CaCO_3$ = 100	9.3 X WER	6.0 X WER	1,300	
Cyanide, Free (µg/l) 57125	22	5.2	1.0	1.0	~~140~~ 4.2	~~16,000~~ 480

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
DDD (µg/l) 72548 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					0.0031	0.0031
DDE (µg/l) 72559 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					0.0022	0.0022
DDT (µg/l) 50293 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$ Total concentration of DDT and metabolites shall not exceed aquatic life criteria.	1.1	0.0010	0.13	0.0010	0.0022	0.0022
Demeton (µg/l) 8065483		0.1		0.1		
Diazinon (µg/l) 333415	0.17	0.17	0.82	0.82		
Dibenz (a, h) anthracene (µg/l) 53703 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					0.038	0.18
1,2–Dichlorobenzene (µg/l) 95501					420	1,300
1,3– Dichlorobenzene (µg/l) 541731					320	960
1,4 Dichlorobenzene (µg/l) 106467					63	190

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
3,3 Dichlorobenzidine (µg/l) 91941 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					0.21	0.28
Dichlorobromomethane (µg/l) 75274 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					5.5	170
1,2 Dichloroethane (µg/l) 107062 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					3.8	370
1,1 Dichloroethylene (µg/l) 75354					330	7,100
1,2-trans-dichloroethylene (µg/l) 156605					140	10,000
2,4 Dichlorophenol (µg/l) 120832					77	290
2,4 Dichlorophenoxy acetic acid (2,4-D) (µg/l) 94757					100	
1,2-Dichloropropane (µg/l) 78875 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					5.0	150
1,3-Dichloropropene (µg/l) 542756 Known or suspected carcinogen; human health criteria at risk level $10^{-5.}$					3.4	210

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Dieldrin (µg/l) 60571 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.	0.24	0.056	0.71	0.0019	0.00052	0.00054
Diethyl Phthalate (µg/l) 84662					17,000	44,000
2,4 Dimethylphenol (µg/l) 105679					380	850
Dimethyl Phthalate (µg/l) 131113					270,000	1,100,000
Di-n-Butyl Phthalate (µg/l) 84742					2,000	4,500
2,4 Dinitrophenol (µg/l) 51285					69	5,300
2-Methyl-4,6-Dinitrophenol (µg/l) 534521					13	280
2,4 Dinitrotoluene (µg/l) 121142 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					1.1	34
Dioxin 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (µg/l) 1746016					5.0 E-8	5.1 E-8
1,2-Diphenylhydrazine (µg/l) 122667 Known or suspected carcinogen; human health criteria at risk level 10^{-5}					0.36	2.0
Dissolved Oxygen (µg/l) (See 9VAC25-260-50)						

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Alpha-Endosulfan (μg/l) 959988 Total concentration alpha and beta-endosulfan shall not exceed aquatic life criteria.	0.22	0.056	0.034	0.0087	62	89
Beta-Endosulfan (μg/l) 33213659 Total concentration alpha and beta-endosulfan shall not exceed aquatic life criteria.	0.22	0.056	0.034	0.0087	62	89
Endosulfan Sulfate (μg/l) 1031078					62	89
Endrin (μg/l) 72208	0.086	0.036	0.037	0.0023	0.059	0.060
Endrin Aldehyde (μg/l) 7421934					0.29	0.30
Ethylbenzene (μg/l) 100414					530	2,100
Fecal Coliform (see 9VAC25-260-160						
Fluoranthene (μg/l) 206440					130	140
Fluorene (μg/l) 86737					1,100	5,300
Foaming Agents (μg/l) Criterion measured as Methylene blue active substances. Criterion to maintain acceptable taste, odor, or aesthetic quality of drinking water and applies at the drinking water intake.					500	
Guthion (μg/l) 86500		0.01		0.01		

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Heptachlor (µg/l) 76448 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.	0.52	0.0038	0.053	0.0036	0.00079	0.00079
Heptachlor Epoxide (µg/l) 1024573 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.	0.52	0.0038	0.053	0.0036	0.00039	0.00039
Hexachlorobenzene (µg/l) 118741 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.0028	0.0029
Hexachlorobutadiene (µg/l) 87683 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					4.4	180
Hexachlorocyclohexane Alpha-BHC (µg/l) 319846 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.026	0.049
Hexachlorocyclohexane Beta-BHC (µg/l) 319857 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.091	0.17

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Hexachlorocyclohexane (µg/l) (Lindane) Gamma-BHC 58899 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.	0.95		0.16		0.98	1.8
Hexachlorocyclopentadiene (µg/l) 77474					40	1,100
Hexachloroethane (µg/l) 67721 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					~~14~~ 5.0	~~33~~ 12
Hydrogen sulfide (µg/l) 7783064		2.0		2.0		
Indeno (1,2,3,-cd) pyrene (µg/l) 193395 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.038	0.18
Iron (µg/l) 7439896 Criterion to maintain acceptable taste, odor or aesthetic quality of drinking water and applies at the drinking water intake.					300	
Isophorone (µg/l) 78591 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					350	9,600
Kepone (µg/l) 143500		zero		zero		

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Lead (µg/l)[5] 7439921 Freshwater values are a function of total hardness as calcium carbonate $CaCO_3$ mg/l and the water effect ratio. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (µg/l) WER [e $^{\{1.273[\ln(hardness)]-1.084\}}$] ($CF_a$) Freshwater chronic criterion (µg/l) WER [e $^{\{1.273[\ln(hardness)]-3.259\}}$] ($CF_c$) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF_a = 1.46203-[(ln hardness)(0.145712)] CFc = 1.46203-[(ln hardness)(0.145712)]	~~120~~ 94 $CaCO_3$ = 100	~~14~~ 11 $CaCO_3$ = 100	240 X WER	9.3 X WER	15	
Malathion (µg/l) 121755		0.1		0.1		

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
~~Manganese (µg/l)~~ ~~7439965~~ ~~Criterion to maintain acceptable taste, odor or aesthetic quality of drinking water and applies at the drinking water intake~~.					~~50~~	
Mercury (µg/l)[5] 7439976	1.4	0.77	1.8	0.94		
Methyl Bromide (µg/l) 74839					47	1,500
Methyl Mercury (Fish Tissue Criterion mg/kg)[8] 22967926					0.30	0.30
Methylene Chloride (µg/l) 75092 Known or suspected carcinogen; human health criteria at risk level 10^{-5} Synonym = Dichloromethane					~~46~~ 170	~~5,900~~ 22,000
Methoxychlor (µg/l) 72435		0.03		0.03	100	
Mirex (µg/l) 2385855		zero		zero		

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Nickel (μg/l)[5] 744002 Freshwater values are a function of total hardness as calcium carbonate $CaCO_3$ mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion μg/l WER [$e^{\{0.8460[\ln(hardness)] + 1.312\}}$] ($CF_a$) Freshwater chronic criterion (μg/l) WER [$e^{\{0.8460[\ln(hardness)] – 0.8840\}}$] ($CF_c$) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln = natural logarithm CF = conversion factor a (acute) or c (chronic) CF_a = 0.998 CF_c = 0.997	180 $CaCO_3$ = 100	20 $CaCO_3$ = 100	74 X WER	8.2 X WER	610	4,600
Nitrate as N (μg/l) 14797558					10,000	
Nitrobenzene (μg/l) 98953					~~17~~ 68	~~690~~ 2,800

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
N-Nitrosodimethylamine (µg/l) 62759 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.0069	30
N-Nitrosodiphenylamine (µg/l) 86306 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					33	~~160~~ 60
N-Nitrosodi-n-propylamine (µg/l) 621647 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.050	5.1
Nonylphenol (µg/l) ~~1044051~~ 84852153	28	6.6	7.0	1.7		
Parathion (µg/l) 56382	0.065	0.013				
PCB Total (µg/l) 1336363 Known or suspected carcinogen; human health criteria at risk level 10^{-5}		0.014		0.030	0.00064	0.00064
Pentachlorophenol (µg/l) 87865 Known or suspected carcinogen; human health criteria risk level at 10^{-5} Freshwater acute criterion (µg/l) $e^{(1.005(pH)-4.869)}$ Freshwater chronic criterion (µg/l) $e^{(1.005(pH)-5.134)}$	8.7 pH = 7.0	6.7 pH = 7.0	13	7.9	~~2.7~~ 0.80	~~30~~ 9.1

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
pH See 9VAC25-260-50						
Phenol (µg/l) 108952					10,000	860,000
Phosphorus Elemental (µg/l) 7723140				0.10		
Pyrene (µg/l) 129000					830	4,000
Radionuclides						
Gross Alpha Particle Activity (pCi/L)					15	
Beta Particle & Photon Activity (mrem/yr) (formerly man-made radionuclides)					4	
Combined Radium 226 and 228 (pCi/L)					5	
Uranium (µg/L)					30	
Selenium (µg/l)[5] 7782492 WER shall not be used for freshwater acute and chronic criteria. Freshwater criteria expressed as total recoverable.	20	5.0	290 X WER	71 X WER	170	4,200

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PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Silver (μg/l)[5] 7440224 Freshwater values are a function of total hardness as calcium carbonate ($CaCO_3$) mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion (μg/l) WER $[e^{\{1.72[\ln(hardness)]-6.52\}}]$ (CF_a) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = natural antilogarithm ln=natural logarithm CF = conversion factor a (acute) or c (chronic) CF_a = 0.85	3.4; $CaCO_3$ = 100		1.9 X WER			
Sulfate (μg/l) Criterion to maintain acceptable taste, odor or aesthetic quality of drinking water and applies at the drinking water intake.					250,000	
Temperature See 9VAC25-260-50						

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
1,1,2,2-Tetrachloroethane (µg/l) 79345 Known or suspected carcinogen; human health criteria at risk level 10^{-5})					1.7	40
Tetrachloroethylene (µg/l) 127184 Known or suspected carcinogen; human health criteria at risk level 10^{-5})					~~6.9~~ 130	~~33~~ 620
Thallium (µg/l) 7440280					0.24	0.47
Toluene (µg/l) 108883					510	6,000
Total Dissolved Solids (µg/l) Criterion to maintain acceptable taste, odor or aesthetic quality of drinking water and applies at the drinking water intake.					500,000	
Toxaphene (µg/l) 8001352 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.	0.73	0.0002	0.21	0.0002	0.0028	0.0028
Tributyltin (µg/l) 60105	0.46	0.072	0.42	0.0074		
1, 2, 4 Trichlorobenzene (µg/l) 120821					35	70
1,1,2-Trichloroethane (µg/l) 79005 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					5.9	160

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Trichloroethylene (µg/l) 79016 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					~~25~~ 7.0	~~300~~ 82
2, 4, 6 –Trichlorophenol (µg/l) 88062 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					14	24
2–(2, 4, 5 –Trichlorophenoxy propionic acid (Silvex) (µg/l) 93721					50	
Vinyl Chloride (µg/l) 75014 Known or suspected carcinogen; human health criteria at risk level 10^{-5}.					0.25	24

PARAMETER CAS Number	USE DESIGNATION					
	AQUATIC LIFE				HUMAN HEALTH	
	FRESHWATER		SALTWATER		Public Water Supply[3]	All Other Surface Waters[4]
	Acute[1]	Chronic[2]	Acute[1]	Chronic[2]		
Zinc (µg/l)[5] 7440666 Freshwater values are a function of total hardness as calcium carbonate ($CaCO_3$) mg/l and the WER. The minimum hardness allowed for use in the equation below shall be 25 and the maximum, hardness shall be 400 even when the actual ambient hardness is less than 25 or greater than 400. Freshwater acute criterion µg/l WER [$e^{\{0.8473[ln(hardness)]+0.884\}}$] ($CF_a$) Freshwater chronic criterion µg/l WER [$e^{\{0.8473[ln(hardness)]+0.884\}}$] ($CF_c$) WER = Water Effect Ratio = 1 unless determined otherwise under 9VAC25-260-140 F e = base e exponential function. ln = log normal function CF_a = 0.978 CF_c = 0.986	120 $CaCO_3$ = 100	120 $CaCO_3$ = 100	90 X WER	81 X WER	7,400	26,000

[1]One hour average concentration not to be exceeded more than once every 3 years on the average, unless otherwise noted.

[2]Four-day average concentration not to be exceeded more than once every 3 years on the average, unless otherwise noted.

[3]Criteria have been calculated to protect human health from toxic effects through drinking water and fish consumption, unless otherwise noted and apply in segments designated as PWS in 9VAC25-260-390-540.

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[4]Criteria have been calculated to protect human health from toxic effects through fish consumption, unless otherwise noted and apply in all other surface waters not designated as PWS in 9VAC25-260-390-540.

[5]Acute and chronic saltwater and freshwater aquatic life criteria apply to the biologically available form of the metal and apply as a function of the pollutant's water effect ratio (WER) as defined in 9VAC25-260-140 F (WER X criterion). Metals measured as dissolved shall be considered to be biologically available, or, because local receiving water characteristics may otherwise affect the biological availability of the metal, the biologically available equivalent measurement of the metal can be further defined by determining a Water Effect Ratio (WER) and multiplying the numerical value shown in 9VAC25-260-140 B by the WER. Refer to 9VAC25-260-140 F. Values displayed above in the table are examples and correspond to a WER of 1.0. Metals criteria have been adjusted to convert the total recoverable fraction to dissolved fraction using a conversion factor. Criteria that change with hardness have the conversion factor listed in the table above.

[6]The flows listed below are default design flows for calculating steady state waste load allocations unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

Aquatic Life:	
Acute criteria	1Q10
Chronic criteria	7Q10
Chronic criteria (ammonia)	30Q10
Human Health:	
Noncarcinogens	30Q5
Carcinogens	Harmonic mean

The following are defined for this section:

"1Q10" means the lowest flow averaged over a period of one day which on a statistical basis can be expected to occur once every 10 climatic years.

"7Q10" means the lowest flow averaged over a period of seven consecutive days that can be statistically expected to occur once every 10 climatic years.

"30Q5" means the lowest flow averaged over a period of 30 consecutive days that can be statistically expected to occur once every five climatic years.

"30Q10" means the lowest flow averaged over a period of 30 consecutive days that can be statistically expected to occur once every 10 climatic years.

"Averaged" means an arithmetic mean.

"Climatic year" means a year beginning on April 1 and ending on March 31.

[7]The criteria listed in this table are two significant digits. For other criteria that are referenced to other sections of this regulation in this table, all numbers listed as criteria values are significant.

[8]The fish tissue criterion for methylmercury applies to a concentration of 0.30 mg/kg as wet weight in edible tissue for species of fish and/or shellfish resident in a waterbody that are commonly eaten in the area and have commercial, recreational, or subsistence value.

C. Application of freshwater and saltwater numerical criteria. The numerical water quality criteria listed in subsection B of this section (excluding dissolved oxygen, pH, temperature) shall be applied according to the following classes of waters (see 9VAC25-260-50) and boundary designations:

CLASS OF WATERS	NUMERICAL CRITERIA
I and II (Estuarine Waters)	Saltwater criteria apply
II (Transition Zone)	More stringent of either the freshwater or saltwater criteria apply
II (Tidal Freshwater), III, IV, V, VI and VII	Freshwater criteria apply

The following describes the boundary designations for Class II, (estuarine, transition zone and tidal freshwater waters) by river basin:

1. Rappahannock Basin. Tidal freshwater is from the fall line of the Rappahannock River to the upstream boundary of the transition zone including all tidal tributaries that enter the tidal freshwater Rappahannock River.

Transition zone upstream boundary – 38° 4' 56.59"/-76° 58' 47.93" (430 feet east of Hutchinson Swamp) to 38° 5' 23.33"/-76° 58' 24.39" (0.7 miles upstream of Peedee Creek).

Transition zone downstream boundary - 37° 58' 45.80"/-76° 55' 28.75" (1,000 feet downstream of Jenkins Landing) to 37° 59' 20.07/ -76° 53' 45.09" (0.33 miles upstream of Mulberry Point). All tidal waters that enter the transition zone are themselves transition zone waters.

Estuarine waters are from the downstream boundary of the transition zone to the mouth of the Rappahannock River (Buoy 6), including all tidal tributaries that enter the estuarine waters of the Rappahannock River.

2. York Basin. Tidal freshwater is from the fall line of the Mattaponi River at N37° 47' 20.03"/W77° 6' 15.16" (800 feet upstream of the Route 360 bridge in Aylett) to the upstream boundary of the Mattaponi River transition zone, and from the fall line of the Pamunkey River at N37° 41' 22.64" /W77° 12' 50.83" (2,000 feet upstream of Totopotomy Creek) to the upstream boundary of the Pamunkey River transition zone, including all tidal tributaries that enter the tidal freshwaters of the Mattaponi and Pamunkey Rivers.

Mattapon~~n~~i River transition zone upstream boundary – N37° 39' 29.65"/W76° 52' 53.29" (1,000 feet upstream of Mitchell Hill Creek) to N37° 39' 24.20"/W76° 52' 55.87" (across from Courthouse Landing). Mattaponi River transition zone downstream boundary – N37° 32' 19.76"/W76° 47' 29.41" (old Lord Delaware Bridge, west side) to N37° 32' 13.25"/W76° 47' 10.30" (old Lord Delaware Bridge, east side).

Pamunkey River transition zone upstream boundary – N37° 32' 36.63"/W76° 58' 29.88" (Cohoke Marsh, 0.9 miles upstream of Turkey Creek) to N37° 32' 36.51"/W76° 58' 36.48" (0.75 miles upstream of creek at Cook Landing). Pamunkey River transition zone downstream boundary – N37° 31' 57.90"/ 76° 48' 38.22" (old Eltham Bridge, west side) to N37° 32' 6.25"/W76 48' 18.82" (old Eltham Bridge, east side).

All tidal tributaries that enter the transition zones of the Mattaponi and Pamunkey Rivers are themselves in the transition zone.

Estuarine waters are from the downstream boundary of the transition zones of the Mattaponi and Pamunkey Rivers to the mouth of the York River (Tue Marsh Light) including all tidal tributaries that enter the estuarine waters of the York River.

3. James Basin. Tidal Freshwater is from the fall line of the James River in the City of Richmond upstream of Mayo Bridge to the upstream boundary of the transition zone, including all tidal tributaries that enter the tidal freshwater James River.

James River transition zone upstream boundary – N37° 14' 28.25"/W76° 56' 44.47" (at Tettington) to N37° 13' 38.56"/W76° 56' 47.13" 0.3 miles downstream of Sloop Point.

Chickahominy River transition zone upstream boundary – N37° 25' 44.79"/W77° 1' 41.76" (Holly Landing).

Transition zone downstream boundary – N37° 12' 7.23/W76° 37' 34.70" (near Carters Grove Home, 1.25 miles downstream of Grove Creek) to N37° 9' 17.23/W76° 40' 13.45" (0.7 miles upstream of Hunnicutt Creek). All tidal waters that enter the transition zone are themselves transition zone waters.

Estuarine waters are from the downstream transition zone boundary to the mouth of the James River (Buoy 25) including all tidal tributaries that enter the estuarine waters of the James River.

4. Potomac Basin. Tidal Freshwater includes all tidal tributaries that enter the Potomac River from its fall line at the Chain Bridge (N38° 55' 46.28"/W77° 6' 59.23") to the upstream transition zone boundary near Quantico, Virginia.

Transition zone includes all tidal tributaries that enter the Potomac River from N38° 31' 27.05"/W77° 17' 7.06" (midway between Shipping Point and Quantico Pier) to N38° 23' 22.78"/W77° 1' 45.50" (one mile southeast of Mathias Point).

Estuarine waters includes all tidal tributaries that enter the Potomac River from the downstream transition zone boundary to the mouth of the Potomac River (Buoy 44B).

5. Chesapeake Bay, Atlantic Ocean, and small coastal basins. Estuarine waters include the Atlantic Ocean tidal tributaries, and the Chesapeake Bay and its small coastal basins from the Virginia state line to the mouth of the bay (a line from Cape Henry drawn through Buoys 3 and 8 to Fishermans Island), and its tidal tributaries, excluding the Potomac tributaries and those tributaries listed above.

6. Chowan River Basin. Tidal freshwater includes the Northwest River and its tidal tributaries from the Virginia-North Carolina state line to the free flowing portion, the Blackwater River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately state route 611 at river mile 20.90, the Nottoway River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately Route 674, and the North Landing River and its tidal tributaries from the Virginia-North Carolina state line to the Great Bridge Lock.

Transition zone includes Back Bay and its tributaries in the City of Virginia Beach to the Virginia-North Carolina state line.

D. Site-specific modifications to numerical water quality criteria.

1. The board may consider site-specific modifications to numerical water quality criteria in subsection B of this section where the applicant or permittee demonstrates that the alternate numerical water quality criteria are sufficient to protect all designated uses (see 9VAC25-260-10) of that particular surface water segment or body.

2. Any demonstration for site-specific human health criteria shall be restricted to a reevaluation of the bioconcentration or bioaccumulation properties of the pollutant. The

exceptions to this restriction are for site-specific criteria for taste, odor, and aesthetic compounds noted by double asterisks in subsection B of this section and nitrates.

3. Procedures for promulgation and review of site-specific modifications to numerical water quality criteria resulting from subdivisions 1 and 2 of this subsection.

a. Proposals describing the details of the site-specific study shall be submitted to the board's staff for approval prior to commencing the study.

b. Any site-specific modification shall be promulgated as a regulation in accordance with the Administrative Process Act. All site-specific modifications shall be listed in 9VAC25-260-310 (Special standards and requirements).

E. Variances to water quality standards.

1. A variance from numeric criteria may be granted to a discharger if it can be demonstrated that one or more of the conditions in 9VAC25-260-10 H limit the attainment of one or more specific designated uses.

a. Variances shall apply only to the discharger to whom they are granted and shall be reevaluated and either continued, modified or revoked at the time of permit issuance. At that time the permittee shall make a showing that the conditions for granting the variance still apply.

b. Variances shall be described in the public notice published for the permit. The decision to approve a variance shall be subject to the public participation requirements of the Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation, 9VAC25-31 (Permit Regulation).

c. Variances shall not prevent the maintenance and protection of existing uses or exempt the discharger or regulated activity from compliance with other appropriate technology or water quality-based limits or best management practices.

d. Variances granted under this section shall not apply to new discharges.

e. Variances shall be submitted by the department's Division of Scientific Research or its successors to the Environmental Protection Agency for review and approval/disapproval.

f. A list of variances granted shall be maintained by the department's Division of Scientific Research or its successors.

2. None of the variances in this subsection shall apply to the halogen ban section (9VAC25-260-110) or temperature criteria in 9VAC25-260-50 if superseded by § 316(a) of the Clean Water Act requirements. No variances in this subsection shall apply to the criteria that are designed to protect human health from carcinogenic and noncarcinogenic toxic effects (subsection B of this section) with the exception of the metals, and the taste, odor, and aesthetic compounds noted by double asterisks and nitrates, listed in subsection B of this section.

F. Water effect ratio.

1. A water effects ratio (WER) shall be determined by measuring the effect of receiving water (as it is or will be affected by any discharges) on the bioavailability or toxicity of a metal by using standard test organisms and a metal to conduct toxicity tests simultaneously in receiving water and laboratory water. The ratio of toxicities of the metal(s) in the two waters is the WER (toxicity in receiving water divided by toxicity in laboratory water = WER). Once an acceptable WER for a metal is established, the numerical value for the metal in subsection B of this section is multiplied by the WER to

produce an instream concentration that will protect designated uses. This instream concentration shall be utilized in permitting decisions.

2. The WER shall be assigned a value of 1.0 unless the applicant or permittee demonstrates to the department's satisfaction in a permit proceeding that another value is appropriate, or unless available data allow the department to compute a WER for the receiving waters. The applicant or permittee is responsible for proposing and conducting the study to develop a WER. The study may require multiple testing over several seasons. The applicant or permittee shall obtain the department's Division of Scientific Research or its successor approval of the study protocol and the final WER.

3. The Permit Regulation at 9VAC25-31-230 C requires that permit limits for metals be expressed as total recoverable measurements. To that end, the study used to establish the WER may be based on total recoverable measurements of the metals.

4. ~~The Environmental Protection Agency views the WER in any particular case as a site-specific criterion. Therefore, the department's Division of Scientific Research or its successor shall submit the results of the study to the Environmental Protection Agency for review and approval/disapproval within 30 days of the receipt of certification from the state's Office of the Attorney General. Nonetheless, the~~ The WER is established in a permit proceeding, shall be described in the public notice associated with the permit proceeding, and applies only to the applicant or permittee in that proceeding. The department's action to approve or disapprove a WER is a case decision, not an amendment to the present regulation.

The decision to approve or disapprove a WER shall be subject to the public participation requirements of the Permit Regulation, 9VAC25-31-260 et seq. A list of final WERs will be maintained by the department's Division of Scientific Research or its successor.

5. A WER shall not be used for the freshwater and saltwater chronic mercury criteria or the freshwater acute and chronic selenium criteria.

G. Biotic Ligand Model (BLM) for copper.

1. On a case by case basis, EPA's 2007 copper criteria (EPA-822-F-07-001) biotic ligand model (BLM) for copper may be used to determine alternate copper criteria for freshwater sites. The BLM is a bioavailability model that uses receiving water characteristics to develop site-specific criteria. Site-specific data for ten parameters are needed to use the BLM. These parameters are; temperature, pH, dissolved organic carbon, calcium, magnesium, sodium, potassium, sulfate, chloride and alkalinity. If sufficient data for these parameters are available, the BLM can be used to calculate alternate criteria values for the copper criteria. The BLM would be used instead of the hardness based criteria and a takes the place of the hardness adjustment and the WER. A WER will not be applicable with the BLM.

9VAC25-260-155. Ammonia surface water quality criteria.

The Department of Environmental Quality, after consultation with the Virginia Department of Game and Inland Fisheries and the US Fish and Wildlife Service, has determined that the majority of Virginia freshwaters are likely to contain, or have contained in the past, freshwater mussel species in the family Unionidae and contain early life stages of fish during most times of the year. Therefore, the ammonia criteria presented in sections A, and B are designed to provide protection to these species and life stages. In an instance where it can be adequately demonstrated that either freshwater mussels and/or early life stages of fish are not present in a specific waterbody, potential options for alternate, site-specific criteria are presented in section C. Acute criteria are a one hour average concentration not to be exceeded more than once every 3 years[1] on the average and chronic criteria are thirty-day average concentrations not to be exceeded more than once every 3 years on the average[2].

A. The one-hour average concentration of total ammonia nitrogen (in mg N/L) in freshwater shall not exceed, more than once every three years on the average[1], the acute criteria for total ammonia (in mg N/L) for freshwaters with trout absent or present are below:

Acute Ammonia Freshwater Criteria
Total Ammonia Nitrogen (mg N/L)

pH	Trout Present	Trout Absent
6.5	32.6	48.8
6.6	31.3	46.8
6.7	29.8	44.6
6.8	28.1	42.0
6.9	26.2	39.1
7.0	24.1	36.1
7.1	22.0	32.8
7.2	19.7	29.5
7.3	17.5	26.2
7.4	15.4	23.0
7.5	13.3	19.9
7.6	11.4	17.0
7.7	9.65	14.4
7.8	8.11	12.1
7.9	6.77	10.1
8.0	5.62	8.40
8.1	4.64	6.95
8.2	3.83	5.72
8.3	3.15	4.71
8.4	2.59	3.88

~~8.5~~	~~2.14~~	~~3.20~~
~~8.6~~	~~1.77~~	~~2.65~~
~~8.7~~	~~1.47~~	~~2.20~~
~~8.8~~	~~1.23~~	~~1.84~~
~~8.9~~	~~1.04~~	~~1.56~~
~~9.0~~	~~0.885~~	~~1.32~~

Acute Ammonia Freshwater Criteria
Total Ammonia Nitrogen (mg N/L)

TROUT ABSENT

	Temperature (°C)																				
pH	0-10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	51	48	44	41	37	34	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	49	46	42	39	36	33	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	46	44	40	37	34	31	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	44	41	38	35	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	41	38	35	32	30	28	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	38	35	33	30	28	25	23	21	20	18	**17**	15	14	13	12	11	10	9.4	8.6	7.9	7.3
7.1	34	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	31	29	27	25	23	21	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	27	26	24	22	20	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	21	19	18	17	15	14	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	18	17	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	2.9
7.8	13	12	11	10	9.3	8.5	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	11	9.9	9.1	8.4	7.7	7.1	6.6	3.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	8.8	8.2	7.6	7.0	6.4	5.9	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	7.2	6.8	6.3	5.8	5.3	4.9	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	6.0	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	4.9	4.6	4.3	3.9	3.6	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	3.3	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.58	0.54
8.7	2.3	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.9	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Acute Ammonia Freshwater Criteria Total Ammonia Nitrogen (mg N/L) TROUT PRESENT																	
	Temperature (°C)																
pH	0-14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	33	33	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	31	31	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	30	30	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	28	28	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	26	26	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	24	24	23	21	20	18	**17**	15	14	13	12	11	10	9.4	8.6	8.0	7.3
7.1	22	22	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	20	20	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	18	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	15	15	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	13	13	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	11	11	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	9.6	9.6	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	3.0
7.8	8.1	8.1	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	6.8	6.8	6.6	6.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	5.6	5.6	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	4.6	4.6	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	3.8	3.8	3.7	3.5	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	3.1	3.1	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	2.6	2.6	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	2.1	2.1	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.59	0.54
8.7	1.5	1.5	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.2	1.2	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.0	1.0	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	0.88	0.88	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

The acute criteria for trout present shall apply to all Class V-Stockable Trout Waters and Class VI-Natural Trout Waters as listed in 9VAC25-260-390 through 9VAC25-260-540. The acute criteria for trout absent apply to all other fresh waters.

To calculate total ammonia nitrogen acute criteria values in freshwater at different pH values than those listed in this subsection, use the following ~~formulas~~ equations and round the result to 2 significant digits.

Where trout are ~~present~~ absent:

Acute Criterion Concentration (mg N/L) =

~~$$\frac{0.275}{(1 + 10^{7.204-pH})} + \frac{39.0}{(1 + 10^{pH-7.204})}$$~~

$$0.7249 \times \left(\frac{0.0114}{(1 + 10^{7.204-pH})} + \frac{1.6181}{(1 + 10^{pH-7.204})} \right) \times MIN$$

Where MIN = 51.93 or 23.12 X $10^{0.036 \times (20 - T)}$, whichever is less.

T = Temperature in ^{o}C.

Or where trout are ~~absent~~ present, whichever of the below calculation results is less:

Acute Criterion Concentration (mg N/L) =

~~$$\frac{0.411}{(1 + 10^{7.204-pH})} + \frac{58.4}{(1 + 10^{pH-7.204})}$$~~

$$\left(\frac{0.275}{(1 + 10^{(7.204-pH)})} + \frac{39.0}{(1 + 10^{(pH-7.204)})} \right)$$

Or

$$0.7249 \times \left(\frac{0.0114}{(1 + 10^{7.204-pH})} + \frac{1.6181}{(1 + 10^{pH-7.204})} \right) \times (23.12 \times 10^{0.036 \times (20 - T)})$$

T = Temperature in ^{o}C.

~~[1]The default design flow for calculating steady state waste load allocations for the acute ammonia criterion is the 1Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.~~

B. The ~~30-day average concentration of~~ chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels and early life stages of fish are present in freshwater ~~shall not exceed, more than once every three years on the average[2], the chronic criteria~~ are below:

Chronic Ammonia Freshwater Criteria
Early Life Stages of Fish Present
Total Ammonia Nitrogen (mg N/L)

-	Temperature (°C)									
pH	0	14	16	18	20	22	24	26	28	30
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	5.39	5.39	4.90	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.897
8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.700	0.615	0.541	0.475
8.5	1.09	1.09	0.990	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.920	0.920	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.661	0.661	0.601	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.486	0.486	0.442	0.389	0.342	0.300	0.264	0.232	0.204	0.179

Chronic Ammonia Freshwater Criteria
Mussels and Early Life Stages of Fish Present
Total Ammonia Nitrogen (mg N/L)

	Temperature (°C)																						
pH	0-7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	4.9	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.2	1.1
6.6	4.8	4.5	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1
6.7	4.8	4.5	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
6.8	4.6	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1
6.9	4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0
7.0	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.2	2.0	**1.9**	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	0.99
7.1	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95
7.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90
7.3	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.97	0.91	0.85
7.4	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90	0.85	0.79
7.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.83	0.78	0.73
7.6	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.4	1.3	1.2	1.1	1.1	0.98	0.92	0.86	0.81	0.76	0.71	0.67
7.7	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60
7.8	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53
7.9	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47
8.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60	0.56	0.53	0.50	0.44	0.44	0.41
8.1	1.5	1.5	1.4	1.3	1.2	1.1	1.1	0.99	0.92	0.87	0.81	0.76	0.71	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35
8.2	1.3	1.2	1.2	1.1	1.0	0.96	0.90	0.84	0.79	0.74	0.70	0.65	0.61	0.57	0.54	0.50	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30
8.3	1.1	1.1	0.99	0.93	0.87	0.82	0.76	0.72	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26
8.4	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.26	0.25	0.23	0.22
8.5	0.80	0.75	0.71	0.67	0.62	0.58	0.55	0.51	0.48	0.45	0.42	0.40	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.18
8.6	0.68	0.64	0.60	0.56	0.53	0.49	0.46	0.43	0.41	0.38	0.36	0.33	0.31	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.16	0.15
8.7	0.57	0.54	0.51	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13
8.8	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11
8.9	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09
9.0	0.36	0.34	0.32	0.30	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08

To calculate total ammonia nitrogen chronic criteria values in freshwater when freshwater mussels and fish early life stages are present at different pH and temperature values than those listed in this subsection, use the following ~~formulas~~ equation and round the result to 2 significant digits.

Chronic Criteria Concentration =

~~$$\left(\frac{0.0577}{(1 + 10^{7.688-pH})} + \frac{2.487}{(1 + 10^{pH-7.688})} \right) \text{ x MIN}$$~~

~~Where MIN = 2.85 or 1.45 x $10^{0.028(25-T)}$, whichever is less.~~

$$0.8876 \text{ X } \left(\frac{0.0278}{(1 + 10^{7.688-pH})} + \frac{1.1994}{(1 + 10^{pH-7.688})} \right) \text{ X}(2.126 \text{ X } 10^{0.028} \text{ X } (20 - {}^{MAX(T,7)}))$$

Where MAX = 7 or temperature in degrees Celsius, whichever is greater.

T = temperature in °C

~~[2]The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion where early life stages of fish are present is the 30Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.~~

C. Site-Specific Considerations and Alternate Criteria.
If it can be adequately demonstrated that freshwater mussels and/or early life stages of fish are not present at a site, then alternate site-specific criteria can be considered using the information provided in this subsection. Recalculated site-specific criteria shall provide for the attainment and maintenance of the water quality standards of downstream waters.

1. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of freshwater mussels and/or early life stages of fish shall be conducted in accordance with the procedures contained in this subdivision. Because the department presumes that most state waterbodies have freshwater mussels and early life stages of fish present during most times of the year, the criteria shall be calculated assuming freshwater mussels and early life stages of fish are present using subsections A and B of this section unless the following demonstration that freshwater mussels and/or early life stages are absent is successfully completed. Determination of the absence of freshwater mussels requires special field survey methods. This determination must be made after an adequate survey of the waterbody is conducted by an individual certified by the Virginia Department of Game and Inland Fisheries (DGIF) for freshwater mussel identification and surveys. Determination of absence of freshwater mussels will be done in consultation with the DGIF. Early life stages of fish are defined in subdivision 2 of this subsection. Modifications to the ambient water quality criteria for ammonia based on the presence or absence of early life stages of fish shall only apply at temperatures below 15°C.

a. During the review of any new or existing activity that has a potential to discharge ammonia in amounts that may cause or contribute to a violation of the ammonia criteria contained in subsection B of this section, the department may examine data from the following approved sources in subdivisions 1 a (1) through (5) of this subsection or may require the gathering of data in accordance with subdivisions 1 a (1) through (5) on the presence or absence of early life stages of fish in the affected waterbody.

(1) Species and distribution data contained in the Virginia Department of Game and Inland Fisheries Wildlife Information System database.

(2) Species and distribution data contained in Freshwater Fishes of Virginia, 1994.

(3) Data and fish species distribution maps contained in Handbook for Fishery Biology, Volume 3, 1997.

(4) Field data collected in accordance with U.S. EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Second Edition, EPA 841-B-99-002. Field data must comply with all quality assurance/quality control criteria.

(5) The American Society for Testing and Materials (ASTM) Standard E-1241-88, Standard Guide for Conducting Early Life-Stage Toxicity Tests with Fishes.

b. If data or information from sources other than subdivisions 1 a (1) through (5) of this subsection are considered, then any resulting site-specific criteria modifications shall be reviewed and adopted in accordance with the site-specific criteria provisions in 9VAC25-260-140 D, and submitted to EPA for review and approval.

c. If the department determines that the data and information obtained from subdivisions 1 a (1) through (5) of this subsection demonstrate that there are periods of each year when no early life stages are expected to be present for any species of fish that occur at the site, the department shall issue a notice to the public and make available for public comment the supporting data and analysis along with the department's preliminary decision to authorize the site-specific modification to the ammonia criteria. Such information shall include, at a minimum:

(1) Sources of data and information.

(2) List of fish species that occur at the site as defined by subdivision 3 of this subsection.

(3) Definition of the site. Definition of a "site" can vary in geographic size from a stream segment to a watershed to an entire eco-region.

(4) Duration of early life stage for each species in subdivision 1 c (2) of this subsection.

(5) Dates when early life stages of fish are expected to be present for each species in subdivision 1 c (2) of this subsection.

(6) Based on subdivision 1 c (5) of this subsection, identify the dates (beginning date, ending date), if any, where no early life stages are expected to be present for any of the species identified in subdivision 1 c (2) of this subsection.

d. If, after reviewing the public comments received in subdivision 1 c of this subsection and supporting data and information, the department determines that there are times of the year where no early life stages are expected to be present for any fish species that occur at the site, then the applicable ambient water quality criteria for ammonia for those time periods shall be calculated using the table in this subsection, or the formula for calculating the chronic criterion concentration for ammonia when fish early life stages are absent.

e. The department shall maintain a comprehensive list of all sites where the department has determined that early life stages of fish are absent. For each site the list will identify the waterbodies affected and the corresponding times of the year that early life stages are absent. This list is available either upon request from the Office of Water Quality

Programs at 629 E. Main Street, Richmond, VA 23219 or from the department website http://deq.state.va.us/wqs/.

2. The duration of the "early life stages" extends from the beginning of spawning through the end of the early life stages. The early life stages include the prehatch embryonic period, the post-hatch free embryo or yolk-sac fry, and the larval period, during which the organism feeds. Juvenile fish, which are anatomically similar to adults, are not considered an early life stage. The duration of early life stages can vary according to fish species. The department considers the sources of information in subdivisions 1 a (1) through (5) of this subsection to be the only acceptable sources of information for determining the duration of early life stages of fish under this procedure.

3. "Occur at the site" includes the species, genera, families, orders, classes, and phyla that: are usually present at the site; are present at the site only seasonally due to migration; are present intermittently because they periodically return to or extend their ranges into the site; were present at the site in the past or are present in nearby bodies of water, but are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve. "Occur at the site" does not include taxa that were once present at the site but cannot exist at the site now due to permanent physical alteration of the habitat at the site.

4. Any modifications to ambient water quality criteria for ammonia in subdivision 1 of this subsection shall not likely jeopardize the continued existence of any federal or state listed, threatened or endangered species or result in the destruction or adverse modification of such species' critical habitat.

5. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of freshwater mussels shall be conducted in accordance with the procedures contained in this subdivision. Because the department presumes that most state waterbodies have freshwater mussel species, the criteria shall be calculated assuming mussels are present using subsections A and B of this section unless the demonstration that freshwater mussels are absent is successfully completed and accepted by DEQ and DGIF.

6. Equations for calculating ammonia criteria for four different site-specific scenarios are provided below; a) acute criteria when mussels are absent but trout are present, b) acute criteria when mussels and trout are absent, c) chronic criteria when mussels are absent and early life stages of fish are present, and d) chronic criteria when mussels and early life stages of fish are absent. Additional information regarding site-specific criteria can be reviewed in Appendix N (pages 225-242) of the EPA .2013 ammonia criteria document (EPA 822-R-13-001).

Acute Criteria: Freshwater Mussels Absent and Trout Present

To calculate total ammonia nitrogen acute criteria values in freshwaters with freshwater mussels absent (procedures for making this determination are in subdivisions 1 through 5 of this subsection) and trout present, use the below equations. The acute criterion is whichever of the below calculation results is less. The final result is rounded to 2 significant digits.

$$\left(\frac{0.275}{1 + 10^{(7.204-pH)}} + \frac{39.0}{1 + 10^{(pH-7.204)}} \right)$$

Or

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204-pH}} + \frac{1.6181}{1 + 10^{pH-7.204}} \right) \times (62.15 \times 10^{0.036 \times (20 - T)})$$

T = Temperature in ^{o}C.

Acute Criteria: Freshwater Mussels Absent and Trout Absent

To calculate total ammonia nitrogen acute criteria values (in mg N/L) in freshwater where freshwater mussels are absent and trout are absent, use the following equation and round the result to 2 significant digits.

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204-pH}} + \frac{1.6181}{1 + 10^{pH-7.204}} \right) \times MIN$$

Where MIN = 51.93 or 62.15 X $10^{0.036 \times (20 - T)}$, whichever is less.

T = Temperature in ^{o}C.

Chronic Criteria: Freshwater Mussels Absent and Early Life Stages of Fish Present

The ~~30-day average concentration of~~ chronic criteria for total ammonia nitrogen (in mg N/L) where ~~early life stages of fish~~ freshwater mussels are absent (procedures for making this determination are in subdivision~~s~~ 1 through ~~4~~ 5 of this subsection) and early life stages of fish are present in freshwater shall not exceed~~, more than once every three years on the average[3], the chronic criteria~~ concentration values calculated using the equation below and round the result to 2 significant digits.

~~Chronic Ammonia Freshwater Criteria~~

~~Early Life Stages of Fish Absent~~

~~Total Ammonia Nitrogen (mg N/L)~~

-	~~Temperature (°C)~~									
~~pH~~	~~0-7~~	~~8~~	~~9~~	~~10~~	~~11~~	~~12~~	~~13~~	~~14~~	~~15~~	~~16~~
~~6.5~~	~~10.8~~	~~10.1~~	~~9.51~~	~~8.92~~	~~8.36~~	~~7.84~~	~~7.35~~	~~6.89~~	~~6.46~~	~~6.06~~
~~6.6~~	~~10.7~~	~~9.99~~	~~9.37~~	~~8.79~~	~~8.24~~	~~7.72~~	~~7.24~~	~~6.79~~	~~6.36~~	~~5.97~~
~~6.7~~	~~10.5~~	~~9.81~~	~~9.20~~	~~8.62~~	~~8.08~~	~~7.58~~	~~7.11~~	~~6.66~~	~~6.25~~	~~5.86~~
~~6.8~~	~~10.2~~	~~9.58~~	~~8.98~~	~~8.42~~	~~7.90~~	~~7.40~~	~~6.94~~	~~6.51~~	~~6.10~~	~~5.72~~

6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93	5.56
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73	5.37
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49	5.15
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22	4.90
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92	4.61
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59	4.30
7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23	3.97
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85	3.61
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47	3.25
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71	2.54
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36	2.21
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03	1.91
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74	1.63
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48	1.39
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06	0.990
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892	0.836
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754	0.707
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641	0.601
8.9	0.917	0.860	0.806	0.756	0.709	0.664	0.623	0.584	0.548	0.513
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471	0.442

~~At 15°C and above, the criterion for fish early life stages absent is the same as the criterion for fish early life stages present.~~

~~To calculate total ammonia nitrogen chronic criteria values in freshwater when fish early life stages are absent at different pH and temperature values than those listed in this subsection, use the following formulas:~~

~~Chronic Criteria Concentration =~~

$$\left(\frac{0.0577}{(1 + 10^{7.688-pH})} + \frac{2.487}{(1 + 10^{pH-7.688})} \right) \quad x\ 1.45(10^{0.028(25-MAX)})$$

~~MAX = temperature in °C or 7, whichever is greater.~~

$$0.9405\ X\ X \left(\frac{0.0278}{(1 + 10^{7.688-pH})} \pm \frac{1.1994}{(1 + 10^{pH-7.688})} \right) MIN$$

Where MIN = 6.920 or 7.547 X $10^{0.028 \times (20 - T)}$ whichever is less

T = temperature in °C

[3]The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion where early life stages of fish are absent is the 30Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed that demonstrate compliance with the duration and return frequency of the water quality criteria.

1. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of early life stages of fish shall be conducted in accordance with the procedures contained in this subdivision. Because the department presumes that most state waterbodies have early life stages of fish present during most times of the year, the criteria shall be calculated assuming early life stages of fish are present using subsection B of this section unless the following demonstration that early life stages are absent is successfully completed. Early life stages of fish are defined in subdivision 2 of this subsection. Modifications to the ambient water quality criteria for ammonia based on the presence or absence of early life stages of fish shall only apply at temperatures below 15°C.

a. During the review of any new or existing activity that has a potential to discharge ammonia in amounts that may cause or contribute to a violation of the ammonia criteria contained in subsection B of this section, the department may examine data from the following approved sources in subdivisions 1 a (1) through (5) of this subsection or may require the gathering of data in accordance with subdivisions 1 a (1) through (5) on the presence or absence of early life stages of fish in the affected waterbody.

(1) Species and distribution data contained in the Virginia Department of Game and Inland Fisheries Wildlife Information System database.

(2) Species and distribution data contained in Freshwater Fishes of Virginia, 1994.

(3) Data and fish species distribution maps contained in Handbook for Fishery Biology, Volume 3, 1997.

(4) Field data collected in accordance with U.S. EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Second Edition, EPA 841-B-99-002. Field data must comply with all quality assurance/quality control criteria.

(5) The American Society for Testing and Materials (ASTM) Standard E-1241-88, Standard Guide for Conducting Early Life-Stage Toxicity Tests with Fishes.

b. If data or information from sources other than subdivisions 1 a (1) through (5) of this subsection are considered, then any resulting site-specific criteria modifications shall be reviewed and adopted in accordance with the site-specific criteria provisions in 9VAC25-260-140 D, and submitted to EPA for review and approval.

c. If the department determines that the data and information obtained from subdivisions 1 a (1) through (5) of this subsection demonstrate that there are periods of each year when no early life stages are expected to be present for any species of fish that occur at the site, the department shall issue a notice to the public and make available for public comment the supporting data and analysis along with the department's preliminary decision to authorize the site-specific modification to the ammonia criteria. Such information shall include, at a minimum:

(1) Sources of data and information.

(2) List of fish species that occur at the site as defined by subdivision 3 of this subsection.

(3) Definition of the site. Definition of a "site" can vary in geographic size from a stream segment to a watershed to an entire eco-region.

(4) Duration of early life stage for each species in subdivision 1 c (2) of this subsection.

(5) Dates when early life stages of fish are expected to be present for each species in subdivision 1 c (2) of this subsection.

(6) Based on subdivision 1 c (5) of this subsection, identify the dates (beginning date, ending date), if any, where no early life stages are expected to be present for any of the species identified in subdivision 1 c (2) of this subsection.

d. If, after reviewing the public comments received in subdivision 1 c of this subsection and supporting data and information, the department determines that there are times of the year where no early life stages are expected to be present for any fish species that occur at the site, then the applicable ambient water quality criteria for ammonia for those time periods shall be calculated using the table in this subsection, or the formula for calculating the chronic criterion concentration for ammonia when fish early life stages are absent.

e. The department shall maintain a comprehensive list of all sites where the department has determined that early life stages of fish are absent. For each site the list will identify the waterbodies affected and the corresponding times of the year that early life stages are absent. This list is available either upon request from the Office of Water Quality Programs at 629 E. Main Street, Richmond, VA 23219 or from the department website http://deq.state.va.us/wqs/.

2. The duration of the "early life stages" extends from the beginning of spawning through the end of the early life stages. The early life stages include the prehatch embryonic period, the post-hatch free embryo or yolk-sac fry, and the larval period, during which the organism feeds. Juvenile fish, which are anatomically similar to adults, are not considered an early life stage. The duration of early life stages can vary according to fish species. The department considers the sources of information in subdivisions 1 a (1) through (5) of this subsection to be the only acceptable sources of information for determining the duration of early life stages of fish under this procedure.

3. "Occur at the site" includes the species, genera, families, orders, classes, and phyla that: are usually present at the site; are present at the site only seasonally due to migration; are present intermittently because they periodically return to or extend their ranges into the site; were present at the site in the past or are present in nearby bodies of water, but are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve. "Occur at the site" does not include taxa that were once present at the site but cannot exist at the site now due to permanent physical alteration of the habitat at the site.

4. Any modifications to ambient water quality criteria for ammonia in subdivision 1 of this subsection shall not likely jeopardize the continued existence of any federal or state listed, threatened or endangered species or result in the destruction or adverse modification of such species' critical habitat.

Chronic Criteria: Freshwater Mussels Absent and Early Life Stages of Fish Absent

The chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels are absent and early life stages of fish are absent (procedures for making this determination are in subdivisions 1 through 5 of subsection C) in freshwater shall not exceed concentration values calculated using the equation below and the result rounded to 2 significant digits:

$$0.9405 \times \left(\frac{0.0278}{1 + 10^{7.688-pH}} + \frac{1.1994}{1 + 10^{pH-7.688}} \right) \times \left(7.547 \times 10^{0.028 \times (20 - MAX(T,7))}\right)$$

Where MAX = 7 or temperature in degrees Celsius, whichever is greater.

T = temperature in °C

D. The one-hour average concentration of total ammonia nitrogen (in mg N/L) in saltwater shall not exceed, more than once every three years on the average, the acute criteria below:

Acute Ammonia Saltwater Criteria

Total Ammonia Nitrogen (mg N/L)

Salinity = 10 g/kg

	Temperature °C							
pH	0	5	10	15	20	25	30	35
7.00	231.9	159.8	110.1	75.88	52.31	36.08	24.91	17.21
7.20	146.4	100.9	69.54	47.95	33.08	22.84	15.79	10.93
7.40	92.45	63.73	43.94	30.32	20.94	14.48	10.03	6.97
7.60	58.40	40.28	27.80	19.20	13.28	9.21	6.40	4.47
7.80	36.92	25.48	17.61	12.19	8.45	5.88	4.11	2.89
8.00	23.37	16.15	11.18	7.76	5.40	3.78	2.66	1.89
8.20	14.81	10.26	7.13	4.97	3.48	2.46	1.75	1.27
8.40	9.42	6.54	4.57	3.20	2.27	1.62	1.18	0.87
8.60	6.01	4.20	2.95	2.09	1.50	1.09	0.81	0.62
8.80	3.86	2.72	1.93	1.39	1.02	0.76	0.58	0.46
9.00	2.51	1.79	1.29	0.95	0.71	0.55	0.44	0.36

Salinity = 20 g/kg

	Temperature °C							
pH	0	5	10	15	20	25	30	35
7.00	247.6	170.5	117.5	80.98	55.83	38.51	26.58	18.36
7.20	156.3	107.7	74.21	51.17	35.30	24.37	16.84	11.66
7.40	98.67	68.01	46.90	32.35	22.34	15.44	10.70	7.43
7.60	62.33	42.98	29.66	20.48	14.17	9.82	6.82	4.76
7.80	39.40	27.19	18.78	13.00	9.01	6.26	4.37	3.07
8.00	24.93	17.23	11.92	8.27	5.76	4.02	2.83	2.01
8.20	15.80	10.94	7.59	5.29	3.70	2.61	1.86	1.34
8.40	10.04	6.97	4.86	3.41	2.41	1.72	1.24	0.91

8.60	6.41	4.47	3.14	2.22	1.59	1.15	0.85	0.65
8.80	4.11	2.89	2.05	1.47	1.07	0.80	0.61	0.48
9.00	2.67	1.90	1.36	1.00	0.75	0.57	0.46	0.37

Salinity = 30 g/kg

	Temperature °C							
pH	0	5	10	15	20	25	30	35
7.00	264.6	182.3	125.6	86.55	59.66	41.15	28.39	19.61
7.20	167.0	115.1	79.31	54.68	37.71	26.03	17.99	12.45
7.40	105.5	72.68	50.11	34.57	23.87	16.50	11.42	7.92
7.60	66.61	45.93	31.69	21.88	15.13	10.48	7.28	5.07
7.80	42.10	29.05	20.07	13.88	9.62	6.68	4.66	3.27
8.00	26.63	18.40	12.73	8.83	6.14	4.29	3.01	2.13
8.20	16.88	11.68	8.10	5.64	3.94	2.78	1.97	1.42
8.40	10.72	7.44	5.18	3.63	2.56	1.82	1.31	0.96
8.60	6.83	4.77	3.34	2.36	1.69	1.22	0.90	0.68
8.80	4.38	3.08	2.18	1.56	1.13	0.84	0.64	0.50
9.00	2.84	2.01	1.45	1.06	0.79	0.60	0.47	0.39

To calculate total ammonia nitrogen acute criteria values in saltwater at different pH and temperature values than those listed in this subsection, use the following formulas:

$$I = \frac{19.9273S}{(1000 - 1.005109S)}$$

Where I = molal ionic strength of water

S = Salinity ppt (g/kg)

The regression model used to relate I to pKa (negative log of the ionization constant) is

$pKa = 9.245 + .138I$

pKa as defined by these equations is at 298 degrees Kelvin (25°C). T °Kelvin = °C + 273

To correct for other temperatures:

$pKa^S_T = pKa^S_{298} + .0324(298 - T\ °Kelvin)$

The unionized ammonia fraction (UIA) is given by:

$$UIA = \frac{1}{1 + 10^{(pKa^S_T - pH)}}$$

The acute ammonia criterion in saltwater is given by:

$$Acute = \frac{.233}{UIA}$$

Multiply the acute value by .822 to get the ammonia-N acute criterion.

E. The 30-day average concentration of total ammonia nitrogen (in mg N/L) in saltwater shall not exceed, more than once every three years on the average, the chronic criteria below:

Chronic Ammonia Saltwater Criteria

Total Ammonia Nitrogen (mg N/L)

Salinity = 10 g/kg

	Temperature °C							
pH	0	5	10	15	20	25	30	35
7.00	34.84	24.00	16.54	11.40	7.86	5.42	3.74	2.59
7.20	21.99	15.15	10.45	7.20	4.97	3.43	2.37	1.64
7.40	13.89	9.57	6.60	4.55	3.15	2.18	1.51	1.05
7.60	8.77	6.05	4.18	2.88	2.00	1.38	0.96	0.67
7.80	5.55	3.83	2.65	1.83	1.27	0.88	0.62	0.43
8.00	3.51	2.43	1.68	1.17	0.81	0.57	0.40	0.28
8.20	2.23	1.54	1.07	0.75	0.52	0.37	0.26	0.19
8.40	1.41	0.98	0.69	0.48	0.34	0.24	0.18	0.13
8.60	0.90	0.63	0.44	0.31	0.23	0.16	0.12	0.09
8.80	0.58	0.41	0.29	0.21	0.15	0.11	0.09	0.07
9.00	0.38	0.27	0.19	0.14	0.11	0.08	0.07	0.05

Salinity = 20 g/kg

	Temperature °C							
pH	0	5	10	15	20	25	30	35
7.00	37.19	25.62	17.65	12.16	8.39	5.78	3.99	2.76
7.20	23.47	16.17	11.15	7.69	5.30	3.66	2.53	1.75
7.40	14.82	10.22	7.04	4.86	3.36	2.32	1.61	1.12
7.60	9.36	6.46	4.46	3.08	2.13	1.47	1.02	0.71
7.80	5.92	4.08	2.82	1.95	1.35	0.94	0.66	0.46
8.00	3.74	2.59	1.79	1.24	0.86	0.60	0.43	0.30
8.20	2.37	1.64	1.14	0.79	0.56	0.39	0.28	0.20
8.40	1.51	1.05	0.73	0.51	0.36	0.26	0.19	0.14
8.60	0.96	0.67	0.47	0.33	0.24	0.17	0.13	0.10
8.80	0.62	0.43	0.31	0.22	0.16	0.12	0.09	0.07
9.00	0.40	0.28	0.20	0.15	0.11	0.09	0.07	0.06

Salinity = 30 g/kg

	Temperature °C

pH	0	5	10	15	20	25	30	35
7.00	39.75	27.38	18.87	13.00	8.96	6.18	4.27	2.95
7.20	25.09	17.29	11.91	8.21	5.67	3.91	2.70	1.87
7.40	15.84	10.92	7.53	5.19	3.59	2.48	1.72	1.19
7.60	10.01	6.90	4.76	3.29	2.27	1.57	1.09	0.76
7.80	6.32	4.36	3.01	2.08	1.44	1.00	0.70	0.49
8.00	4.00	2.76	1.91	1.33	0.92	0.64	0.45	0.32
8.20	2.53	1.75	1.22	0.85	0.59	0.42	0.30	0.21
8.40	1.61	1.12	0.78	0.55	0.38	0.27	0.20	0.14
8.60	1.03	0.72	0.50	0.35	0.25	0.18	0.14	0.10
8.80	0.66	0.46	0.33	0.23	0.17	0.13	0.10	0.08
9.00	0.43	0.30	0.22	0.16	0.12	0.09	0.07	0.06

To calculate total ammonia nitrogen chronic criteria values in saltwater at different pH and temperature values than those listed in this subsection, use the following formulas:

$$I = \frac{19.9273S}{(1000 - 1.005109S)}$$

Where I = molal ionic strength of water

S = Salinity ppt (g/kg)

The regression model used to relate I to pKa (negative log of the ionization constant) is

pKa = 9.245 +.138I

pKa as defined by these equations is at 298 degrees Kelvin (25°C). T °Kelvin = °C + 273

To correct for other temperatures:

$pKa^S_T = pKa^S_{298} + .0324(298 - T\ °Kelvin)$

The unionized ammonia fraction (UIA) is given by:

$$UIA = \frac{1}{1 + 10^{(pKa^S_T - pH)}}$$

The chronic ammonia criterion in saltwater is given by:

$$Chronic = \frac{.035}{UIA}$$

Multiply the chronic value by .822 to get the ammonia-N chronic criterion.

[1]The default design flow for calculating steady state waste load allocations for the acute ammonia criterion for freshwater is the 1Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

[2]The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion for freshwater is the 30Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

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9VAC25-260-185. Criteria to protect designated uses from the impacts of nutrients and suspended sediment in the Chesapeake Bay and its tidal tributaries.

A. Dissolved oxygen. <u>The dissolved oxygen criteria in the below table apply to all Chesapeake Bay waters according to their specified designated use and supersede the dissolved oxygen criteria in 9VAC25-260-50.</u>

Designated Use	Criteria Concentration/ Duration	Temporal Application
Migratory fish spawning and nursery	7-day mean ≥ 6 mg/l (tidal habitats with 0-0.5 ppt salinity)	February 1 - May 31
	Instantaneous minimum ≥ 5 mg/l	
Open water[1]	30 day mean ≥ 5.5 mg/l (tidal habitats with 0-0.5 ppt salinity)	year-round[2]
	30 day mean ≥ 5 mg/l (tidal habitats with > 0.5 ppt salinity)	
	7 day mean ≥ 4 mg/l	
	Instantaneous minimum ≥ 3.2 mg/l at temperatures < 29°C Instantaneous minimum ≥ 4.3 mg/l at temperatures ≥ 29°C	
Deep water	30 day mean ≥ 3 mg/l	June 1 - September 30
	1 day mean ≥ 2.3 mg/l	
	Instantaneous minimum ≥ 1.7 mg/l	
Deep channel	Instantaneous minimum ≥ 1 mg/l	June 1 - September 30

[1]In applying this open water instantaneous criterion to the Chesapeake Bay and its tidal tributaries where the existing water quality for dissolved oxygen exceeds an instantaneous minimum of 3.2 mg/l, that higher water quality for dissolved oxygen shall be provided antidegradation protection in accordance with 9VAC25-260-30 A 2.

[2]Open-water dissolved oxygen criteria attainment is assessed separately over two time periods: summer (June 1- September 30) and nonsummer (October 1-May 31) months.

B. Submerged aquatic vegetation and water clarity. Attainment of the shallow-water submerged aquatic vegetation designated use shall be determined using any one of the following criteria:

Designated Use	Chesapeake Bay Program Segment	SAV Acres[1]	Percent Light-Through-Water[2]	Water Clarity Acres[1]	Temporal Application
Shallow Water Submerged Aquatic Vegetation Use	CB5MH	7,633	22%	14,514	April 1 - October 31
	CB6PH	1,267	22%	3,168	March 1 - November 30
	CB7PH	15,107	22%	34,085	March 1 - November

					30
	CB8PH	11	22%	28	March 1 - November 30
	POTTF	2,093	13%	5,233	April 1 - October 31
	POTOH	1,503	13%	3,758	April 1 - October 31
	POTMH	4,250	22%	10,625	April 1 - October 31
	RPPTF	66	13%	165	April 1 - October 31
	RPPOH	4	13%	10	April 1 - October 31
	RPPMH	1700	22%	5000	April 1 - October 31
	CRRMH	768	22%	1,920	April 1 - October 31
	PIAMH	3,479	22%	8,014	April 1 - October 31
	MPNTF	85	13%	213	April 1 - October 31
	MPNOH	-	-	-	-
	PMKTF	187	13%	468	April 1 - October 31
	PMKOH	-	-	-	-
	YRKMH	239	22%	598	April 1 - October 31
	YRKPH	2,793	22%	6,982	March 1 - November 30
	MOBPH	15,901	22%	33,990	March 1 - November 30
	JMSTF2	200	13%	500	April 1 - October 31
	JMSTF1	1000	13%	2500	April 1 - October 31
	APPTF	379	13%	948	April 1 - October 31
	JMSOH	15	13%	38	April 1 - October 31
	CHKOH	535	13%	1,338	April 1 - October 31
	JMSMH	200	22%	500	April 1 - October 31
	JMSPH	300	22%	750	March 1 - November 30
	WBEMH	-	-	-	-
	SBEMH	-	-	-	-
	EBEMH	-	-	-	-
	ELIPH	-	-	-	-
	LYNPH	107	22%	268	March 1 - November 30

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	POCOH	-	-	-	-
	POCMH	4,066	22%	9,368	April 1 - October 31
	TANMH	13,579	22%	22,064	April 1 - October 31

[1]The assessment period for SAV and water clarity acres shall be the single best year in the most recent three consecutive years. When three consecutive years of data are not available, a minimum of three years within the data assessment window shall be used.

[2]Percent Light through Water = $100e^{(-K_dZ)}$ where K_d is water column light attenuation coefficient and can be measured directly or converted from a measured secchi depth where K_d = 1.45/secchi depth. Z = depth at location of measurement of K_d.

C. Chlorophyll a.

Designated Use	Chlorophyll a Narrative Criterion	Temporal Application
Open Water	Concentrations of chlorophyll a in free-floating microscopic aquatic plants (algae) shall not exceed levels that result in undesirable or nuisance aquatic plant life, or render tidal waters unsuitable for the propagation and growth of a balanced, indigenous population of aquatic life or otherwise result in ecologically undesirable water quality conditions such as reduced water clarity, low dissolved oxygen, food supply imbalances, proliferation of species deemed potentially harmful to aquatic life or humans or aesthetically objectionable conditions.	March 1 - September 30

*See 9VAC25-260-310 special standard bb for numerical chlorophyll criteria for the tidal James River.

D. Implementation.

1. Chesapeake Bay program segmentation scheme as described in Chesapeake Bay Program, 2004 Chesapeake Bay Program Analytical Segmentation Scheme-Revisions, Decisions and Rationales: 1983—2003, CBP/TRS 268/04, EPA 903-R-04-008, Chesapeake Bay Program, Annapolis, Maryland, and the Chesapeake Bay Program published 2005 addendum (CBP/TRS 278-06; EPA 903-R-05-004) is listed below and shall be used as the spatial assessment unit to determine attainment of the criteria in this section for each designated use.

Chesapeake Bay Segment Description	Segment Name[1]	Chesapeake Bay Segment Description	Segment Name[1]
Lower Central Chesapeake Bay	CB5MH	Mobjack Bay	MOBPH
Western Lower Chesapeake Bay	CB6PH	Upper Tidal Fresh James River	JMSTF2

Eastern Lower Chesapeake Bay	CB7PH	Lower Tidal Fresh James River	JMSTF1
Mouth of the Chesapeake Bay	CB8PH	Appomattox River	APPTF
Upper Potomac River	POTTF	Middle James River	JMSOH
Middle Potomac River	POTOH	Chickahominy River	CHKOH
Lower Potomac River	POTMH	Lower James River	JMSMH
Upper Rappahannock River	RPPTF	Mouth of the James River	JMSPH
Middle Rappahannock River	RPPOH	Western Branch Elizabeth River	WBEMH
Lower Rappahannock River	RPPMH	Southern Branch Elizabeth River	SBEMH
Corrotoman River	CRRMH	Eastern Branch Elizabeth River	EBEMH
Piankatank River	PIAMH	Lafayette River	LAFMH
Upper Mattaponi River	MPNTF	Mouth of the Elizabeth River	ELIPH
Lower Mattaponi River	MPNOH	Lynnhaven River	LYNPH
Upper Pamunkey River	PMKTF	Middle Pocomoke River	POCOH
Lower Pamunkey River	PMKOH	Lower Pocomoke River	POCMH
Middle York River	YRKMH	Tangier Sound	TANMH
Lower York River	YRKPH		

[1]First three letters of segment name represent Chesapeake Bay segment description, letters four and five represent the salinity regime of that segment (TF = Tidal Fresh, OH = Oligohaline, MH = Mesohaline and PH = Polyhaline) and a sixth space is reserved for subdivisions of that segment.

2. The assessment period shall be the most recent three consecutive years. When three consecutive years of data are not available, a minimum of three years within the ~~the~~ data assessment window shall be used.

3. Attainment of these criteria shall be assessed through comparison of the generated cumulative frequency distribution of the monitoring data to the applicable criteria reference curve for each designated use. If the monitoring data cumulative frequency curve is completely contained inside the reference curve, then the segment is in attainment of the designated use. The reference curves and procedures to be followed are published in the USEPA, Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries, EPA 903-R-03-002, April 2003 and the 2004 (EPA 903-R-03-002 October 2004) and 2007 (CBP/TRS 285-07, EPA 903-R-07-003), 2007 (CBP/TRS 288/07, EPA 903-R-07-005), 2008 (CBP/TRS 290-08, EPA 903-R-08-001, and 2010 (CBP/TRS 301-10, EPA 903-R-10-002) addenda. An

exception to this requirement is in measuring attainment of the SAV and water clarity acres, which are compared directly to the criteria.

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9VAC25-260-187. Criteria for man-made lakes and reservoirs to protect aquatic life and recreational designated uses from the impacts of nutrients.

A. The criteria in subsection B of this section apply to the man-made lakes and reservoirs listed in this section. Additional man-made lakes and reservoirs may be added as new reservoirs are constructed or monitoring data become available from outside groups or future agency monitoring.

B. Whether or not algicide treatments are used, the chlorophyll a criteria apply to all waters on the list. The total phosphorus criteria apply only if a specific man-made lake or reservoir received algicide treatment during the monitoring and assessment period of April 1 through October 31.

The 90th percentile of the chlorophyll a data collected at one meter or less within the lacustrine portion of the man-made lake or reservoir between April 1 and October 31 shall not exceed the chlorophyll a criterion for that water body in each of the two most recent monitoring years that chlorophyll a data are available. For a water body that received algicide treatment, the median of the total phosphorus data collected at one meter or less within the lacustrine portion of the man-made lake or reservoir between April 1 and October 31 shall not exceed the total phosphorus criterion in each of the two most recent monitoring years that total phosphorus data are available.

Monitoring data used for assessment shall be from sampling location(s) within the lacustrine portion where observations are evenly distributed over the seven months from April 1 through October 31 and are in locations that are representative, either individually or collectively, of the condition of the man-made lake or reservoir.

Man-made Lake or Reservoir Name	Location	Chlorophyll a (µg/L)	Total Phosphorus (µg/L)
~~Able~~ Abel Lake	Stafford County	35	40
Airfield Pond	Sussex County	35	40
Amelia Lake	Amelia County	35	40
Aquia Reservoir (Smith Lake)	Stafford County	35	40
Bark Camp Lake (Corder Bottom Lake, Lee/Scott/Wise Lake)	Scott County	35	40
Beaver Creek Reservoir	Albemarle County	35	40
Beaverdam Creek Reservoir (Beaverdam Reservoir)	Bedford County	35	40
Beaverdam Reservoir	Loudoun County	35	40
Bedford Reservoir (Stony Creek Reservoir)	Bedford County	35	40
Big Cherry Lake	Wise County	35	40
Breckenridge Reservoir	Prince William County	35	40
Briery Creek Lake	Prince Edward County	35	40
Brunswick Lake (County Pond)	Brunswick County	35	40

Burke Lake	Fairfax County	60	40
Carvin Cove Reservoir	Botetourt County	35	40
Cherrystone Reservoir	Pittsylvania County	35	40
Chickahominy Lake	Charles City County	35	40
Chris Green Lake	Albemarle County	35	40
Claytor Lake	Pulaski County	25	20
Clifton Forge Reservoir (Smith Creek Reservoir)	Alleghany County	35	20
Coles Run Reservoir	Augusta County	10	10
Curtis Lake	Stafford County	60	40
Diascund Creek Reservoir	New Kent County	35	40
Douthat Lake	Bath County	25	20
Elkhorn Lake	Augusta County	10	10
Emporia Lake (Meherrin Reservoir)	Greensville County	35	40
Fairystone Lake	Henry County	35	40
Falling Creek Reservoir	Chesterfield County	35	40
Fluvanna Ruritan Lake	Fluvanna County	60	40
Fort Pickett Reservoir	Nottoway/ Brunswick County	35	40
Gatewood Reservoir	Pulaski County	35	40
Georges Creek Reservoir	Pittsylvania County	35	40
Goose Creek Reservoir	Loudoun County	35	40
Graham Creek Reservoir	Amherst County	35	40
Great Creek Reservoir	Lawrenceville	35	40
Harrison Lake	Charles City County	35	40
Harwood Mills Reservoir	York County	60	40
Hidden Valley Lake	Washington County	35	40
Hogan Lake	Pulaski County	35	40
Holiday Lake	Appomattox County	35	40
Hungry Mother Lake	Smyth County	35	40
Hunting Run Reservoir	Spotsylvania County	35	40
J. W. Flannagan Reservoir	Dickenson County	25	20

Kerr Reservoir, Virginia portion (Buggs Island Lake)	Halifax County	25	30
Keysville Reservoir	Charlotte County	35	40
Lake Albemarle	Albemarle County	35	40
Lake Anna	Louisa County	25	30
Lake Arrowhead	Page County	35	40
Lake Burnt Mills	Isle of Wight County	60	40
Lake Chesdin	Chesterfield County	35	40
Lake Cohoon	Suffolk City	60	40
Lake Conner	Halifax County	35	40
Lake Frederick	Frederick County	35	40
Lake Gaston, (Virginia portion)	Brunswick County	25	30
Lake Gordon	Mecklenburg County	35	40
Lake Keokee	Lee County	35	40
Lake Kilby	Suffolk City	60	40
Lake Lawson	Virginia Beach City	60	40
Lake Manassas	Prince William County	35	40
Lake Meade	Suffolk City	60	40
Lake Moomaw	Bath County	10	10
Lake Nelson	Nelson County	60	40
Lake Nottoway (Lee Lake, Nottoway Lake)	Nottoway County	35	40
Lake Orange	Orange County	60	40
Lake Pelham	Culpeper County	35	40
Lake Prince	Suffolk City	60	40
Lake Robertson	Rockbridge County	35	40
Lake Smith	Virginia Beach City	60	40
Lake Whitehurst	Norfolk City	60	40
Lake Wright	Norfolk City	60	40
Lakeview Reservoir	Chesterfield County	35	40
Laurel Bed Lake	Russell County	35	40
Lee Hall Reservoir (Newport News	Newport News City	60	40

Reservoir)			
Leesville Reservoir	Bedford County	25	30
Little Creek Reservoir	Virginia Beach City	60	40
Little Creek Reservoir	James City County	25	30
Little River Reservoir	Montgomery County	35	40
Lone Star Lake F (Crystal Lake)	Suffolk City	60	40
Lone Star Lake G (Crane Lake)	Suffolk City	60	40
Lone Star Lake I (Butler Lake)	Suffolk City	60	40
Lunga Reservoir	Prince William County	35	40
Lunenburg Beach Lake (Victoria Lake)	Town of Victoria	35	40
Martinsville Reservoir (Beaver Creek Reservoir)	Henry County	35	40
Mill Creek Reservoir	Amherst County	35	40
Modest Creek Reservoir	Town of Victoria	35	40
Motts Run Reservoir	Spotsylvania County	25	30
Mount Jackson Reservoir	Shenandoah County	35	40
Mountain Run Lake	Culpeper County	35	40
Ni Reservoir	Spotsylvania County	35	40
North Fork Pound Reservoir	Wise County	35	40
Northeast Creek Reservoir	Louisa County	35	40
Occoquan Reservoir	Fairfax County	35	40
Pedlar Lake	Amherst County	25	20
Philpott Reservoir	Henry County	25	30
Phelps Creek Reservoir (Brookneal Reservoir)	Campbell County	35	40
Powhatan Lakes (Upper and Lower)	Powhatan County	35	40
Ragged Mountain Reservoir	Albemarle County	35	40
Rivanna Reservoir (South Fork Rivanna Reservoir)	Albemarle County	35	40
Roaring Fork	Pittsylvania County	35	40

Rural Retreat Lake	Wythe County	35	40
Sandy River Reservoir	Prince Edward County	35	40
Shenandoah Lake	Rockingham County	35	40
Silver Lake	Rockingham County	35	40
Smith Mountain Lake	Bedford County	25	30
South Holston Reservoir	Washington County	25	20
Speights Run Lake	Suffolk City	60	40
Spring Hollow Reservoir	Roanoke County	25	20
Staunton Dam Lake	Augusta County	35	40
Stonehouse Creek Reservoir	Amherst County	60	40
Strasburg Reservoir	Shenandoah County	35	40
Stumpy Lake	Virginia Beach	60	40
Sugar Hollow Reservoir	Albemarle County	25	20
Swift Creek Lake	Chesterfield County	35	40
Swift Creek Reservoir	Chesterfield County	35	40
Switzer Lake	Rockingham County	10	10
Talbott Reservoir	Patrick County	35	40
Thrashers Creek Reservoir	Amherst County	35	40
Totier Creek Reservoir	Albemarle County	35	40
Townes Reservoir	Patrick County	25	20
Troublesome Creek Reservoir	Bucking-ham County	35	40
Waller Mill Reservoir	York County	25	30
Western Branch Reservoir	Suffolk City	25	20
Wise Reservoir	Wise County	25	20

C. When the board determines that the applicable criteria in subsection B of this section for a specific man-made lake or reservoir are exceeded, the board shall consult with the Department of Game and Inland Fisheries regarding the status of the fishery in determining whether or not the designated use for that water body is being attained. If the designated use of the subject water body is not being attained, the board shall assess the water body as impaired in accordance with § 62.1-44.19:5 of the Code of Virginia. If the designated use is being attained, the board shall assess the water body as impaired in accordance with § 62.1-44.19:5 of the Code of Virginia until site-specific criteria are adopted and become effective for that water body.

D. If the nutrient criteria specified for a man-made lake or reservoir in subsection B of this section do not provide for the attainment and maintenance of the water quality standards of downstream waters as required in 9VAC25-260-10 C, the nutrient criteria herein may be modified on a site-specific basis to protect the water quality standards of downstream waters.

9VAC25-260-310. Special standards and requirements.

The special standards are shown in small letters to correspond to lettering in the basin tables. The special standards are as follows:

a. Shellfish waters. In all open ocean or estuarine waters capable of propagating shellfish or in specific areas where public or leased private shellfish beds are present, including those waters on which condemnation classifications are established by the State Department of Health, the following criteria for fecal coliform bacteria will apply:

The geometric mean fecal coliform value for a sampling station shall not exceed an MPN (most probable number) or MF (membrane filtration using mTEC culture media) of 14 per 100 milliliters (ml) of sample and the estimated 90th percentile shall not exceed an MPN of 43 per 100 ml for a 5-tube decimal dilution test or an MPN of 49 per 100 ml for a 3-tube decimal dilution test or MF test of 31 CFU (colony forming units) per 100 ml.

The shellfish area is not to be so contaminated by radionuclides, pesticides, herbicides, or fecal material that the consumption of shellfish might be hazardous.

b. Policy for the Potomac Embayments. At its meeting on September 12, 1996, the board adopted a policy (9VAC25-415. Policy for the Potomac Embayments) to control point source discharges of conventional pollutants into the Virginia embayment waters of the Potomac River, and their tributaries, from the fall line at Chain Bridge in Arlington County to the Route 301 bridge in King George County. The policy sets effluent limits for BOD_5, total suspended solids, phosphorus, and ammonia, to protect the water quality of these high profile waterbodies.

c. Cancelled.

d. Cancelled.

e. Cancelled.

f. Cancelled.

g. Occoquan watershed policy. At its meeting on July 26, 1971 (Minute 10), the board adopted a comprehensive pollution abatement and water quality management policy for the Occoquan watershed. The policy set stringent treatment and discharge requirements in order to improve and protect water quality, particularly since the waters are an important water supply for Northern Virginia. Following a public hearing on November 20, 1980, the board, at its December 10-12, 1980 meeting, adopted as of February 1, 1981, revisions to this policy (Minute 20). These revisions became effective March 4, 1981. Additional amendments were made following a public hearing on August 22, 1990, and adopted by the board at its September 24, 1990, meeting (Minute 24) and became effective on December 5, 1990. Copies are available upon request from the Department of Environmental Quality.

h. Cancelled.

i. Cancelled.

j. Cancelled.

k. Cancelled.

l. Cancelled.

m. The following effluent limitations apply to wastewater treatment facilities treating an organic nutrient source in the entire Chickahominy watershed above Walker's Dam (this excludes discharges consisting solely of stormwater):

CONSTITUENT	CONCENTRATION
1. Biochemical Oxygen demand 5-day	6 mg/l monthly average, with not more than 5% of individual samples to exceed 8 mg/l
2. Settleable Solids	Not to exceed 0.1 ml/l monthly average
3. Suspended Solids	5.0 mg/l monthly average, with not more than 5% of individual samples to exceed 7.5 mg/l
4. Ammonia Nitrogen	Not to exceed 2.0 mg/l monthly average as N
5. Total Phosphorus	Not to exceed 0.10 mg/l monthly average for all discharges with the exception of Tyson Foods, Inc. which shall meet 0.30 mg/l monthly average and 0.50 mg/l daily maximum.
6. Other Physical and Chemical Constituents	Other physical or chemical constituents not specifically mentioned will be covered by additional specifications as conditions detrimental to the stream arise. The specific mention of items 1 through 5 does not necessarily mean that the addition of other physical or chemical constituents will be condoned.

n. No sewage discharges, regardless of degree of treatment, should be allowed into the James River between Bosher and Williams Island Dams.

o. The concentration and total amount of impurities in Tuckahoe Creek and its tributaries of sewage origin shall be limited to those amounts from sewage, industrial wastes, and other wastes which are now present in the stream from natural sources and from existing discharges in the watershed.

p. Cancelled.

q. Cancelled.

r. Cancelled.

s. Cancelled.

t. Cancelled.

u. Maximum temperature for the New River Basin from West Virginia state line upstream to the Giles-Montgomery County line:

The maximum temperature shall be 27°C (81°F) unless caused by natural conditions; the maximum rise above natural temperatures shall not exceed 2.8°C (5°F).

This maximum temperature limit of 81°F was established in the 1970 water quality standards amendments so that Virginia temperature criteria for the New River would be consistent with those of West Virginia, since the stream flows into that state.

v. The maximum temperature of the New River and its tributaries (except trout waters) from the Montgomery-Giles County line upstream to the Virginia-North Carolina state line shall be 29°C (84°F).

w. Cancelled.

x. Clinch River from the confluence of Dumps Creek at river mile 268 at Carbo downstream to river mile 255.4. The special water quality criteria for copper (measured as total recoverable) in this section of the Clinch River are 12.4 µg/l for protection from chronic effects and 19.5 µg/l for protection from acute effects. These site-specific criteria are needed to provide protection to several endangered species of freshwater mussels.

y. Tidal freshwater Potomac River and tidal tributaries that enter the tidal freshwater Potomac River from Cockpit Point (below Occoquan Bay) to the fall line at Chain Bridge. During November 1 through February 14 of each year the 30-day average concentration of total ammonia nitrogen (in mg N/L) shall not exceed, more than once every three years on the average, the following chronic ammonia criterion:

$$\left(\frac{0.0577}{1 + 10^{7.688-pH}} + \frac{2.487}{1 + 10^{pH-7.688}} \right) \times 1.45(10^{0.028(25-MAX)})$$

MAX = temperature in °C or 7, whichever is greater.

The default design flow for calculating steady state waste load allocations for this chronic ammonia criterion is the 30Q10, unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of this water quality criterion.

z. A site specific dissolved copper aquatic life criterion of 16.3 µg/l for protection from acute effects and 10.5 µg/l for protection from chronic effects applies in the following area:

Little Creek to the Route 60 (Shore Drive) bridge including Little Channel, Desert Cove, Fishermans Cove and Little Creek Cove.

Hampton Roads Harbor including the waters within the boundary lines formed by I-664 (Monitor-Merrimac Bridge Tunnel) and I-64 (Hampton Roads Bridge Tunnel), Willoughby Bay and the Elizabeth River and its tidal tributaries.

This criterion reflects the acute and chronic copper aquatic life criterion for saltwater in 9VAC25-260-140 B X a water effect ratio. The water effect ratio was derived in accordance with 9VAC25-260-140 F.

aa. The following site-specific dissolved oxygen criteria apply to the tidal Mattaponi and Pamunkey Rivers and their tidal tributaries because of seasonal lower dissolved oxygen concentration due to the natural oxygen depleting processes present in the extensive surrounding tidal wetlands. These criteria apply June 1 through September 30 to Chesapeake Bay segments MPNTF, MPNOH, PMKTF, PMKOH and are implemented in accordance with subsection D of 9VAC25-260-185. These criteria supersede the open water criteria listed in subsection A of 9VAC25-260-185.

Designated use	Criteria Concentration/ Duration	Temporal Application
Open Water	30 day mean ≥ 4.0 mg/l	June 1 - September 30
	Instantaneous minimum ≥ 3.2 mg/l at temperatures <29°C Instantaneous minimum ≥ 4.3 mg/l at temperatures ≥ 29°C	

A site-specific pH criterion of 5.0-8.0 applies to the tidal freshwater Mattaponi Chesapeake Bay segment MPNTF to reflect natural conditions.

bb. The following site specific numerical chlorophyll a criteria apply March 1 through May 31 and July 1 through September 30 as seasonal means to the tidal James River (excludes tributaries) segments JMSTF2, JMSTF1, JMSOH, JMSMH, JMSPH and are implemented in accordance with subsection D of 9VAC25-260-185.

Designated Use	Chlorophyll a µ/l	Chesapeake Bay Program Segment	Temporal Application
Open Water	10	JMSTF2	March 1 - May 31
	15	JMSTF1	
	15	JMSOH	
	12	JMSMH	
	12	JMSPH	
	15	JMSTF2	July 1 - September 30
	23	JMSTF1	
	22	JMSOH	
	10	JMSMH	
	10	JMSPH	

cc. For Mountain Lake in Giles County, chlorophyll a shall not exceed 6 µg/L at a depth of 6 meters and orthophosphate-P shall not exceed 8 µg/L at a depth of one meter or less.

dd. For Lake Drummond, located within the boundaries of Chesapeake and Suffolk in the Great Dismal Swamp, chlorophyll a shall not exceed 35 µg/L and total phosphorus shall not exceed 40 µg/L at a depth of one meter or less.

ee. ~~Reserved.~~ Maximum temperature for these seasonally stockable trout waters is 26°C and applies May 1 through October 31.

ff. ~~Reserved.~~ Maximum temperature for these seasonally stockable trout waters is 28°C and applies May 1 through October 31.

gg. Little Calfpasture River from the Goshen Dam to 0.76 miles above its confluence with the Calfpasture River has a stream condition index (A Stream Condition Index for Virginia Non-Coastal Streams, September 2003, Tetra Tech, Inc.) of at least 20.5 to protect the subcategory of aquatic life that exists here as a result of the hydrologic modification. From 0.76 miles to 0.02 miles above its confluence with the Calfpasture River, aquatic life conditions are expected to gradually recover and meet the general aquatic life uses at 0.02 miles above its confluence with the Calfpasture River.

hh. Maximum temperature for these seasonally stockable trout waters is 31°C and applies May 1 through October 31.

9VAC25-260-390. Potomac River Basin (Potomac River Subbasin).

Potomac River Subbasin

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	II	a	Tidal tributaries of the Potomac River from Smith Point to Upper Machodoc Creek (Baber Point).
1a	III		All free flowing portions of tributaries to the Potomac River from Smith Point to the Route 301 Bridge in King George County unless otherwise designated in this chapter.
	VII		Swamp waters in Section 1a
			Lodge Creek and its tributaries from the head of tidal waters to their headwaters.
			Mattox Creek and its tributaries from the head of tidal waters to their headwaters.
			Monroe Creek and tributaries from the head of tidal waters at Route 658 to their headwaters.
			Pine Hill Creek and its tributaries from the confluence with Rosier Creek to their headwaters.
			Popes Creek and Canal Swamp (a tributary to the tidal portion of Popes Creek) and their tributaries from the head of tidal waters to their respective headwaters.
			Thompson Branch and its tributaries from the head of tidal waters to their headwaters.
1b	III	b	All free flowing portions of tributaries to the Potomac River from the Route 301 Bridge in King George County to, and including, Potomac Creek, unless otherwise designated in this chapter.
1c	III	PWS,b	Potomac Creek and its tributaries from the Stafford County water supply dam (~~Able~~ Abel Lake Reservoir) to their headwaters.
2	II	a	Tidal Upper Machodoc Creek and the tidal portions of its tributaries.
2a	III		Free flowing portions of Upper Machodoc Creek and its tributaries.
3	II	b	Tidal portions of the tributaries to the Potomac River from the Route 301 Bridge in King George County to Marlboro Point.
4	II	b~~,d~~	Tidal portions of the tributaries to the Potomac River from Marlboro Point to Brent Point (to include Aquia Creek and its tributaries).
4a	III	b~~,d~~	Free flowing portions of tributaries to the Potomac River in Section 4 up to the Aquia Sanitary District Water

			Impoundment.
4b	III	PWS,b~~,d~~	Aquia Creek from the Aquia Sanitary District Water Impoundment, and other tributaries into the impoundment, including Beaverdam Run and the Lunga Reservoir upstream to their headwaters.
5	II	b	Tidal portions of tributaries to the Potomac River from Brent Point to Shipping Point, including tidal portions of Chopawamsic Creek and its tidal tributaries.
5a	III	b	Free flowing portions of Chopawamsic Creek and its tributaries upstream to Quantico Marine Base water supply dam.
5b	III	PWS,b	Chopawamsic Creek and its tributaries above the Quantico Marine Base water supply intakes at the Gray and Breckenridge Reservoirs to their headwaters.
6	II	b, y	Tidal portions of tributaries to the Potomac River from Shipping Point to Chain Bridge.
7	III	b	Free flowing portions of tributaries to the Potomac River from Shipping Point to Chain Bridge, unless otherwise designated in this chapter.
7a	III	g	Occoquan River and its tributaries to their headwaters above Fairfax County Water Authority's water supply impoundment, unless otherwise designated in this chapter.
7b	III	PWS,g	The impounded waters of Occoquan River above the water supply dam of the Fairfax County Water Authority to backwater of the impoundment on Bull Run and Occoquan River, and the tributaries of Occoquan above the dam to points 5 miles above the dam.
7c	III	PWS,g	Broad Run and its tributaries above the water supply dam of the City of Manassas upstream to points 5 miles above the dam.
7d			(Deleted)
7e	III	PWS,g	Cedar Run and its tributaries from the Town of Warrenton's raw water intake to points 5 miles upstream (Fauquier County).
7f	III	PWS,g	The Quantico Marine Base Camp Upshur and its tributaries' raw water intake on Cedar Run (located approximately 0.2 mile above its confluence with Lucky Run) to points 5 miles upstream.
7g	III	PWS,g	The proposed impounded waters of Licking Run above the multiple purpose impoundment structure in Licking Run near Midland (Fauquier County) upstream to points 5 miles above the proposed impoundment.
7h	III	PWS,g	The proposed impounded waters of Cedar Run above the proposed multiple purpose impoundment structure on the

			main stem of Cedar Run near Auburn (Fauquier County), to points 5 miles above the impoundment.
8	III	PWS	Tributaries to the Potomac River in Virginia between Chain Bridge and the Monacacy River from their confluence with the Potomac upstream 5 miles, to include Goose Creek to the City of Fairfax's raw water intake, unless otherwise designated in this chapter.
8a	VI	PWS	Big Spring Creek and its tributaries in Loudoun County, from its confluence with the Potomac River upstream to their headwaters. (The temperature standard for natural trout water may be exceeded in the area above Big Spring and Little Spring at Routes 15 and 740 due to natural conditions). This section was given a PWS designation due to the Town of Leesburg's intake on the Potomac as referenced in Section 8b below.
	iii		Big Spring Creek from its confluence with the Potomac River upstream to Big Spring.
8b	III	PWS	Those portions of Virginia tributaries into the Potomac River that are within a 5 mile distance upstream of the Town of Leesburg's intake on the Potomac River, unless otherwise designated in this chapter.*
8c	III	PWS	Those portions of Virginia tributaries into the Potomac River that are within a 5 mile distance upstream of the County of Fairfax's intake on the Potomac River.*
9	III		Broad Run, Sugarland Run, Difficult Run, Tuscarora Creek, ~~Sycoline~~ Sycolin Creek, and other streams tributary to streams in Section 8 from a point 5 miles above their confluence with the Potomac River to their headwaters, unless otherwise designated in this chapter.
9a	III	PWS	All the impounded water of Goose Creek from the City of Fairfax's water supply dam upstream to backwater, and its tributaries above the dam to points 5 miles above the dam.
9b	III	PWS	The Town of Round Hill's (inactive-early 1980's) raw water intake at the Round Hill Reservoir, and including the two spring impoundments located northwest of the town on the eastern slope of the Blue Ridge Mountains.
9c	III	PWS	Unnamed tributary to Goose Creek, from Camp Highroad's (inactive-late 1980's) raw water intake (Loudoun County) located in an old quarry to its headwaters.
9d	III	PWS	Sleeter Lake (Loudoun County).
10	III		Tributaries of the Potomac River from the Monacacy River to the West Virginia-Virginia state line in Loudoun County, from their confluence with the Potomac River upstream to their headwaters, unless otherwise designated in this chapter.
10a	III	PWS	North Fork Catoctin Creek and its tributaries from

			Purcellville's raw water intake to their headwaters.
10b	III		South Fork Catoctin Creek and its tributaries from its confluence with the North Fork Catoctin Creek to its headwaters.
11	IV	pH-6.5-9.5	Tributaries of the Potomac River in Frederick and Clarke Counties, Virginia, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 11**
	***	pH-6.5-9.5	Back Creek (upper) from Rock Enon 4 miles upstream.
	***	pH-6.5-9.5	Back Creek (lower) from Route 600 to the mouth of Hogue Creek - 2 miles.
	***	hh	Hogue Creek from Route 679 upstream 6 miles to the Forks below Route 612.
	vi	pH-6.5-9.5	Opequon Creek (in Frederick County) from its confluence with Hoge Run upstream to the point at which Route 620 first crosses the stream.
	vi	pH-6.5-9.6	Turkey Run (Frederick County) from its confluence with Opequon Creek 3.6 miles upstream.
	VI		**Natural Trout Waters in Section 11**
	ii	pH-6.5-9.5	Bear Garden Run from its confluence with Sleepy Creek 3.1 miles upstream.
	iii	pH-6.5-9.5	Redbud Run from its confluence with Opequon Creek 4.4 miles upstream.
11a	IV	pH-6.5-9.5	Hot Run and its tributaries from its confluence with Opequon Creek to its headwaters.
	V		**Stockable Trout Waters in Section 11a**
	vi	pH-6.5-9.5	Clearbrook Run from its confluence with Hot Run 2.1 miles upstream.
12	IV	ESW-6	South Branch Potomac River and its tributaries, such as Strait Creek, and the North Fork River and its tributaries from the Virginia-West Virginia state line to their headwaters.
	V		**Stockable Trout Waters in Section 12**
	vi		Frank Run from its confluence with the South Branch Potomac River 0.8 mile upstream.
	vii	pH-6.5-9.5	South Branch Potomac River (in Highland County) from 69.2 miles above its confluence with the Potomac River 4.9 miles upstream.
	VI		**Natural Trout Waters in Section 12**
	ii		Blights Run from its confluence with Laurel Fork (Highland County) upstream including all named and unnamed

			tributaries.
	ii		Buck Run (Highland County) from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	ii		Collins Run from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	ii		Laurel Fork (Highland County) from 1.9 miles above its confluence with the North Fork South Branch Potomac River upstream including all named and unnamed tributaries.
	iii	pH-6.5-9.5	Laurel Run (Highland County) from its confluence with Strait Creek upstream including all named and unnamed tributaries.
	ii		Locust Spring Run from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	ii		Lost Run from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	ii		Mullenax Run from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	ii		Newman Run from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	ii		Slabcamp Run from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
	iii	pH-6.5-9.5	Strait Creek (Highland County) from its confluence with the South Branch Potomac River upstream to the confluence of West Strait Creek.

9VAC25-260-400. Potomac River Basin (Shenandoah River Subbasin).

Shenandoah River Subbasin

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	IV	pH-6.5-9.5	Shenandoah River and its tributaries in Clarke County, Virginia, from the Virginia-West Virginia state line to Lockes Landing, unless otherwise designated in this chapter.
1a	IV	PWS pH-6.5-9.5	Shenandoah River and its tributaries from river mile 24.66 (latitude 39°16'19"; longitude 77°54'33") approximately 0.7 mile downstream of the confluence of the Shenandoah River and Dog Run to 5 miles above Berryville's raw water intake, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 1a**
	vi	pH-6.5-9.5	Chapel Run (Clarke County) from its confluence with the Shenandoah River 5.7 miles upstream.

	vi	pH-6.5-9.5	Spout Run (Clarke County) from its confluence with the Shenandoah River (in the vicinity of the Ebenezer Church at Route 604) to its headwaters.
1b			(Deleted)
1c	IV	pH-6.5-9.5	Shenandoah River and its tributaries from a point 5 miles above Berryville's raw water intake to the confluence of the North and South Forks of the Shenandoah River.
	VI		**Natural Trout Waters in Section 1c**
	iii	pH-6.5-9.5	Page Brook from its confluence with Spout Run, 1 mile upstream.
	***	pH-6.5-9.5	Roseville Run (Clarke County) from its confluence with Spout Run upstream including all named and unnamed tributaries.
	iii	pH-6.5-9.5	Spout Run (Clarke County) from its confluence with the Shenandoah River (in the vicinity of Calmes Neck at Rts 651 and 621), 3.9 miles upstream.
	***	pH-6.5-9.5	Westbrook Run (Clarke County) from its confluence with Spout Run upstream including all named and unnamed tributaries.
1d			(Note: Moved to section 2 b).
2	IV	~~EWS~~ ESW-12.14.15	South Fork Shenandoah River from its confluence with the North Fork Shenandoah River, upstream to a point 5 miles above the Town of Shenandoah's raw water intake and its tributaries to their headwaters in this section, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 2**
	vii	pH-6.5-9.5	Bear Lithia Spring from its confluence with the South Fork Shenandoah River 0.8 miles upstream.
	vi	pH-6.5-9.5	Flint Run from its confluence with the South Fork Shenandoah River 4 miles upstream.
	***	pH-6.5-9.5	Gooney Run from the mouth to its confluence with Broad Run above Browntown (in the vicinity of Route 632).
	***	pH-6.5-9.5, hh	Hawksbill Creek from Route 675 in Luray to 1 mile above Route 631.
	VI		**Natural Trout Waters in Section 2**
	ii	pH-6.5-9.5	Big Creek (Page County) from its confluence with the East Branch Naked Creek upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Big Ugly Run from its confluence with the South Branch Naked Creek upstream including all named and

		unnamed tributaries.
ii		Boone Run from 4.6 miles above its confluence with the South Fork Shenandoah River (in the vicinity) of Route 637 upstream including all named and unnamed tributaries.
iii	pH-6.5-9.5	Browns Run from its confluence with Big Run upstream including all named and unnamed tributaries.
ii		Cub Run (Page County) from Pitt Spring Run upstream including all named and unnamed tributaries.
***	pH-6.5-9.5	Cub Run from its mouth to Pitt Spring Run.
i	pH-6.5-9.5	East Branch Naked Creek from its confluence with Naked Creek at Route 759 upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Fultz Run from the Park boundary (river mile 1.8) upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Gooney Run (in Warren County) from 6.6 miles above its confluence with the South Fork Shenandoah River 3.9 miles upstream.
ii	pH-6.5-9.5	Hawksbill Creek in the vicinity of Pine Grove at Route 624 (river mile 17.7) 1.5 miles upstream.
ii	pH-6.5-9.5	Jeremys Run from the National Park boundary upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Lands Run from its confluence with Gooney Run upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Little Creek (Page County) from its confluence with Big Creek upstream including all named and unnamed tributaries.
i	pH-6.5-9.5	Little Hawksbill Creek from Route 626 upstream including all named and unnamed tributaries.
ii		Morgan Run (Page County) from its confluence with Cub Run upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Overall Run from its confluence with the South Fork Shenandoah River 4.8 miles upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Pass Run (Page County) from its confluence with Hawksbill Creek upstream including all named and unnamed tributaries.
ii		Pitt Spring Run from its confluence with Cub Run upstream including all named and unnamed tributaries.
ii		Roaring Run from its confluence with Cub Run upstream including all named and unnamed tributaries.

	ii	pH-6.5-9.5	South Branch Naked Creek from 1.7 miles above its confluence with Naked Creek in the vicinity of Route 607 upstream including all named and unnamed tributaries.
	iv	pH-6.5-9.5	Stony Run (Page County) from 1.6 miles above its confluence with Naked Creek upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	West Branch Naked Creek from 2.1 miles above its confluence with Naked Creek upstream including all named and unnamed tributaries.
2a	IV	PWS, pH-6.5-9.5	Happy Creek and Sloan Creek from Front Royal's raw water intake to its headwaters.
2b	IV	PWS	The South Fork Shenandoah River and its tributaries from the Town of Front Royal's raw water intake (at the State Route 619 bridge at Front Royal) to points 5 miles upstream.
2c			(Deleted)
2d			(Deleted)
	V		**Stockable Trout Waters in Section 2d**
	VI		Natural Trout Waters in Section 2d
3	IV	pH-6.5-9.5, ESW-16	South Fork Shenandoah River from 5 miles above the Town of Shenandoah's raw water intake to its confluence with the North and South Rivers and its tributaries to their headwaters in this section, and the South River and its tributaries from its confluence with the South Fork Shenandoah River to their headwaters, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 3**
	vi	pH-6.5-9.5	Hawksbill Creek (Rockingham County) from 0.8 mile above its confluence with the South Fork Shenandoah River 6.6 miles upstream.
	vi	pH-6.5-9.5	Mills Creek (Augusta County) from 1.8 miles above its confluence with Back Creek 2 miles upstream.
	vi	pH-6.5-9.5	North Fork Back Creek (Augusta County) from its confluence with Back Creek 2.6 miles upstream, unless otherwise designated in this chapter.
	VI		**Natural Trout Waters in Section 3**
	i	pH-6.5-9.5	Bearwallow Run from its confluence with Onemile Run upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Big Run (Rockingham County) from 3.3 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
	iii	pH-6.5-9.5	Cold Spring Branch (Augusta County) from Sengers

		Mountain Lake (Rhema Lake) upstream including all named and unnamed tributaries.
iv	pH-6.5-9.5	Cool Springs Hollow (Augusta County) from Route 612 upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Deep Run (Rockingham County) from 1.8 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	East Fork Back Creek from its confluence with the South Fork Back Creek upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Gap Run from 1.7 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
iii		Inch Branch (Augusta County) from the dam upstream including all named and unnamed tributaries.
ii		Johns Run (Augusta County) from its confluence with the South River upstream including all named and unnamed tributaries.
iv		Jones Hollow (Augusta County) from 1.1 miles above its confluence with the South River upstream including all named and unnamed tributaries.
ii		Kennedy Creek from its confluence with the South River upstream including all named and unnamed tributaries.
iv	pH-6.5-9.5	Lee Run from 0.6 mile above its confluence with Elk Run 3.3 miles upstream.
iii	pH-6.5-9.5	Loves Run (Augusta County) from 2.7 miles above its confluence with the South River upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Lower Lewis Run (Rockingham County) from 1.7 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Madison Run (Rockingham County) from 2.9 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Meadow Run (Augusta County) from its confluence with the South River upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	North Fork Back Creek (Augusta County) from river mile 2.6 (in the vicinity of its confluence with Williams Creek) upstream including all named and unnamed tributaries.
i	pH-6.5-9.5	Onemile Run (Rockingham County) from 1.5 miles above its confluence with the South Fork Shenandoah

			River upstream including all named and unnamed tributaries.
	iv		Orebank Creek from its confluence with Back Creek upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Paine Run (Augusta County) from 1.7 miles above its confluence with the South River upstream including all named and unnamed tributaries.
	ii		Robinson Hollow (Augusta County) from the dam upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Rocky Mountain Run from its confluence with Big Run upstream including all named and unnamed tributaries.
	iv	pH-6.5-9.5	Sawmill Run from 2.5 miles above its confluence with the South River upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	South Fork Back Creek from its confluence with Back Creek at Route 814 (river mile 2.1) upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Stony Run (Augusta County) from 3.5 miles above its confluence with the South River upstream including all named and unnamed tributaries.
	iii	pH-6.5-9.5	Stony Run (Rockingham County) from 4.1 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
	iii		Toms Branch (Augusta County) from 1.1 miles above its confluence with Back Creek upstream including all named and unnamed tributaries.
	i	pH-6.5-9.5	Twomile Run from 1.4 miles above its confluence with the South Fork Shenandoah River upstream including all named and unnamed tributaries.
	iv	pH-6.5-9.5	Upper Lewis Run from 0.5 mile above its confluence with Lower Lewis Run upstream including all named and unnamed tributaries.
	iv	pH-6.5-9.5	West Swift Run (Rockingham County) from the Route 33 crossing upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Whiteoak Run from its confluence with Madison Run upstream including all named and unnamed tributaries.
3a	IV	pH-6.5-9.5	South River from the dam above Waynesboro (all waters of the impoundment).
3b	IV	PWS	Coles Run and Mills Creek from South River Sanitary District's raw water intake to their headwaters.
	VI	PWS	**Natural Trout Waters in Section 3b**

	ii		Coles Run (Augusta County) from 3.9 miles above its confluence with the South River Sanitary District's raw water intake (Coles Run Dam) upstream including all named and unnamed tributaries.
	ii		Mills Creek (Augusta County) from the South River Sanitary District's raw water intake (river mile 3.8) upstream including all named and unnamed tributaries.
3c	IV	PWS pH-6.5-9.5	A tributary to Coles Run from Stuarts Draft raw water intake approximately one-half mile south of Stuarts Draft and just off Route 610, to its headwaters.
4	IV	pH-6.5-9.5	Middle River and its tributaries from the confluence with the North River upstream to its headwaters, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 4**
	v	pH-6.5-9.5	Barterbrook Branch from its confluence with Christians Creek 2.8 miles upstream.
	***	pH-6.5-9.5	East Dry Branch from its confluence with the Buffalo Branch to its confluence with Mountain Run.
	vi	pH-6.5-9.5	Folly Mills Creek from 2.4 miles above its confluence with Christians Creek (in the vicinity of Route 81) 4.5 miles upstream.
	VI		**Natural Trout Waters in Section 4**
	iv		Buffalo Branch from Route 703 upstream including all named and unnamed tributaries.
	ii		Cabin Mill Run (Augusta County) from the Camp Shenandoah Boy Scout Lake upstream including all named and unnamed tributaries.
	iv		East Dry Branch (Augusta County) from the confluence of Mountain Run upstream including all named and unnamed tributaries.
	iv		Jennings Branch (Augusta County) from the confluence of White Oak Draft upstream including all named and unnamed tributaries.
4a	IV	PWS pH-6.5-9.5	Middle River and its tributaries from Staunton's raw water intake at Gardner Spring to points 5 miles upstream.
5	IV	pH-6.5-9.5	North River and its tributaries from its confluence with the South River upstream to its headwaters, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 5**
	v	pH-6.5-9.5	Beaver Creek (Rockingham County) from its confluence with Briery Branch to the spring at a point 2.75 miles upstream.

	v	pH-6.5-9.5	Naked Creek (Augusta County) from 3.7 miles above its confluence with the North River at Route 696, 2 miles upstream.
	VI		**Natural Trout Waters in Section 5**
	iv		Big Run (Augusta County) from 0.9 mile above its confluence with Little River upstream including all named and unnamed tributaries.
	ii		Black Run (Rockingham County) from its mouth upstream including all named and unnamed tributaries.
	iii		Briery Branch (Rockingham County) from river mile 6.9 upstream including all named and unnamed tributaries.
	iv		Gum Run from its mouth upstream including all named and unnamed tributaries.
	iii		Hone Quarry Run from its confluence with Briery Branch upstream including all named and unnamed tributaries.
	iv		Little River from its confluence with the North River at Route 718 upstream including all named and unnamed tributaries.
	iv		Maple Spring Run from its mouth upstream including all named and unnamed tributaries.
	iv		Mines Run from its confluence with Briery Branch upstream including all named and unnamed tributaries.
	iv		Rocky Run (which is tributary to Briery Branch in Rockingham County) from its mouth upstream including all named and unnamed tributaries.
	iii		Rocky Run (which is tributary to Dry River in Rockingham County) from its mouth upstream including all named and unnamed tributaries.
	ii		Union Springs Run from 3 miles above its confluence with Beaver Creek upstream including all named and unnamed tributaries.
	iv		Wolf Run (Augusta County) from its confluence with Briery Branch upstream including all named and unnamed tributaries.
5a	IV	PWS pH-6.5-9.5	Silver Lake
5b	IV	PWS pH-6.5-9.5	North River and its tributaries from Harrisonburg's raw water intake at Bridgewater to points 5 miles above Bridgewater's raw water intake to include Dry River and Muddy Creek.
	V	PWS	**Stockable Trout Waters in Section 5b**
	v	pH-6.5-9.5	Mossy Creek from its confluence with the North River

			7.1 miles upstream.
	v	pH-6.5-9.5	Spring Creek (Rockingham County) from its confluence with the North River 2 miles upstream.
5c	IV	PWS	Dry River in Rockingham County from Harrisonburg's raw water intake (approximately 11.7 miles above its confluence with the North River) to a point 5 miles upstream, unless otherwise designated in this chapter.
	V	PWS	**Stockable Trout Waters in Section 5c**
	viii		Raccoon Run (Rockingham County) from its confluence with Dry River to its headwaters.
	VI	PWS	**Natural Trout Waters in Section 5c**
	iv		Dry River (Rockingham County) from Harrisonburg's raw water intake (approximately 11.7 miles above its confluence with the North River) to a point 5 miles upstream.
	iv		Dry Run (Rockingham County) from its confluence with Dry River upstream including all named and unnamed tributaries.
	iv		Hopkins Hollow from its confluence with Peach Run upstream including all named and unnamed tributaries.
	iv		Kephart Run from its confluence with Dry River upstream including all named and unnamed tributaries.
5d	VI		Dry River and its tributaries from 5 miles above Harrisonburg's raw water intake to its headwaters.
	VI		**Natural Trout Waters in Section 5d**
	iv		Dry River (Rockingham County) from 5 miles above Harrisonburg's raw water intake upstream including all named and unnamed tributaries.
	ii		Laurel Run (Rockingham County) from its confluence with Dry River upstream including all named and unnamed tributaries.
	ii		Little Laurel Run from its confluence with Dry River upstream including all named and unnamed tributaries.
	ii		Low Place Run from its confluence with Dry River upstream including all named and unnamed tributaries.
	iv		Miller Spring Run from its confluence with Dry River upstream including all named and unnamed tributaries.
	iii		Sand Run from its confluence with Dry River upstream including all named and unnamed tributaries.
	iv		Skidmore Fork from its confluence with Dry River upstream including all named and unnamed tributaries.

5e	VI	PWS	North River and its tributaries from Staunton Dam to their headwaters.
	VI		**Natural Trout Waters in Section 5e**
	iv		North River from Elkhorn Dam upstream including all named and unnamed tributaries.
6	IV	pH-6.5-9.5	North Fork Shenandoah River from its confluence with the Shenandoah River to its headwaters, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 6**
	vi	pH-6.5-9.5	Bear Run from its confluence with Foltz Creek to its headwaters.
	vi	pH-6.5-9.5	Bull Run (Shenandoah County) from its confluence with Foltz Creek to its headwaters.
	vi	pH-6.5-9.5	Falls Run from its confluence with Stony Creek to its headwaters.
	vi	pH-6.5-9.5	Foltz Creek from its confluence with Stony Creek to its headwaters.
	vi	pH-6.5-9.5	Little Passage Creek from its confluence with Passage Creek to the Strasburg Reservoir Dam.
	***	pH-6.5-9.5, hh	Mill Creek from Mount Jackson to Route 720 - 3.5 miles.
	vi	pH-6.5-9.5	Mountain Run from its mouth at Passage Creek to its headwaters.
	***	pH-6.5-9.5	Passage Creek from the U.S. Forest Service line (in the vicinity of Blue Hole and Buzzard Rock) 4 miles upstream.
	vi	pH-6.5-9.5	Passage Creek from 29.6 miles above its confluence with the North Fork Shenandoah River to its headwaters.
	vi	pH-6.5-9.5	Peters Mill Run from the mouth to its headwaters.
	***	pH-6.5-9.5	Shoemaker River from 612 at Hebron Church to its junction with Route 817 at the Shoemaker's confluence with Slate Lick Branch.
	v	pH-6.5-9.5	Stony Creek from its confluence with the North Fork Shenandoah River to Route 682.
	***	pH-6.5-9.5	Stony Creek from Route 682 above Edinburg upstream to Basye.
	VI		**Natural Trout Waters in Section 6**
	ii	pH-6.5-9.5	Anderson Run (Shenandoah County) from 1.1 miles above its confluence with Stony Creek upstream

		including all named and unnamed tributaries.
iv		Beech Lick Run from its confluence with the German River upstream including all named and unnamed tributaries.
iii		Bible Run from its confluence with Little Dry River upstream including all named and unnamed tributaries.
ii		Camp Rader Run from its confluence with the German River upstream including all named and unnamed tributaries.
iv		Carr Run from its confluence with Little Dry River upstream including all named and unnamed tributaries.
iv		Clay Lick Hollow from its confluence with Carr Run upstream including all named and unnamed tributaries.
iv		Gate Run from its confluence with Little Dry River upstream including all named and unnamed tributaries.
iv		German River (Rockingham County) from its confluence with the North Fork Shenandoah River (at Route 820) upstream including all named and unnamed tributaries.
ii		Laurel Run (Shenandoah County) from its confluence with Stony Creek upstream including all named and unnamed tributaries.
ii		Little Stony Creek from its confluence with Stony Creek upstream including all named and unnamed tributaries.
iv		Marshall Run (Rockingham County) from 1.2 miles above its confluence with the North Fork Shenandoah River upstream including all named and unnamed tributaries.
iii	pH-6.5-9.5	Mine Run (Shenandoah County) from its confluence with Passage Creek upstream including all named and unnamed tributaries.
ii	pH-6.5-9.5	Poplar Run (Shenandoah County) from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
iv	pH-6.5-9.5	Rattlesnake Run (Rockingham County) from its confluence with Spruce Run upstream including all named and unnamed tributaries.
iv		Root Run from its confluence with Marshall Run upstream including all named and unnamed tributaries.
iv		Seventy Buck Lick Run from its confluence with Carr Run upstream including all named and unnamed tributaries.
iv		Sirks Run (Spring Run) from 1.3 miles above its confluence with Crab Run upstream including all named

			and unnamed tributaries.
	iv	pH-6.5-9.5	Spruce Run (Rockingham County) from its confluence with Capon Run upstream including all named and unnamed tributaries.
	iv	pH-6.5-9.5	Sumac Run from its confluence with the German River upstream including all named and unnamed tributaries.
6a	IV	PWS pH-6.5-9.5	Little Passage Creek from the Strasburg Reservoir Dam upstream to its headwaters, unless otherwise designated in this chapter.
	V	PWS	**Stockable Trout Waters in Section 6a**
	vi	pH-6.5-9.5	Little Passage Creek from the Strasburg Reservoir Dam upstream to its headwaters.
6b	IV	PWS pH-6.5-9.5	North Fork Shenandoah River and its tributaries from the Winchester raw water intake to points 5 miles upstream (to include Cedar Creek and its tributaries to their headwaters).
	V	PWS	**Stockable Trout Waters in Section 6b**
	***	pH-6.5-9.5	Cedar Creek (Shenandoah County) from Route 55 (river mile 23.56) to the U.S. Forest Service Boundary (river mile 32.0) - approximately 7 miles.
	v	PWS pH-6.5-9.5	Meadow Brook (Frederick County) from its confluence with Cedar Creek 5 miles upstream.
	VI	PWS	**Natural Trout Waters in Section 6b**
	iii	pH-6.5-9.5	Cedar Creek (Shenandoah County) from the U.S. Forest Service boundary (river mile 32.0) near Route 600 upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Duck Run from its confluence with Cedar Creek upstream including all named and unnamed tributaries.
			Paddy Run (Frederick County) from the mouth upstream including all named and unnamed tributaries.
	***		(Paddy Run (Frederick County) from its mouth (0.0) to river mile 1.8.)
	vi**		(Paddy Run (Frederick County) from river mile 1.8 to 8.1-6.3 miles.)
	iii	pH-6.5-9.5	Sulphur Springs Gap (Shenandoah County) from its confluence with Cedar Creek 1.9 miles upstream.
6c	IV	PWS pH-6.5-9.5	North Fork Shenandoah River and its tributaries from Strasburg's raw water intake to points 5 miles upstream.
6d	IV	PWS pH-6.5-9.5	North Fork Shenandoah River and its tributaries from Woodstock's raw water intake (approximately 1/4 mile upstream of State Route 609 bridge near Woodstock) to points 5 miles upstream.

6e	IV	PWS pH-6.5-9.5	Smith Creek and its tributaries from New Market's raw water intake to their headwaters.
	VI		**Natural Trout Waters in Section 6e**
	iv	pH-6.5-9.5	Mountain Run (Fridley Branch, Rockingham County) from Route 722 upstream including all named and unnamed tributaries.
6f	IV	PWS pH-6.5-9.5	North Fork Shenandoah River and its tributaries from the Food Processors Water Coop, Inc. dam at Timberville and the Town of Broadway's intakes on Linville Creek and the North Fork Shenandoah to points 5 miles upstream.
6g	IV		Shoemaker River and its tributaries from Slate Lick Run, and including Slate Lick Run, to its headwaters.
	V		**Stockable Trout Waters in Section 6g**
	***		Slate Lick Run from its confluence with the Shoemaker River upstream to the 1500 foot elevation.
	VI		**Natural Trout Waters in Section 6g**
	iv		Long Run (Rockingham County) from its confluence with the Shoemaker River upstream including all named and unnamed tributaries.
	iv		Slate Lick Run from the 1500 foot elevation upstream including all named and unnamed tributaries.
6h	IV	PWS pH-6.5-9.5	Unnamed tributary of North Fork Shenandoah River (on the western slope of Short Mountain opposite Mt. Jackson) from the Town of Mt. Jackson's (inactive mid-1992) raw water intake (north and east dams) to its headwaters.
6i	IV	PWS pH-6.5-9.5	Little Sulfur Creek, Dan's Hollow and Horns Gully (tributaries of the North Fork Shenandoah River on the western slope of Short Mountain opposite Mt. Jackson) which served as a water supply for the Town of Edinburg until March 31, 1992, from the Edinburg intakes upstream to their headwaters.

9VAC25-260-410. James River Basin (Lower).

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	II	a,z, bb, ESW-11	James River and its tidal tributaries from Old Point Comfort - Fort Wool to the end of tidal waters (fall line, Mayo's Bridge, 14th Street, Richmond), except prohibited or spoil areas, unless otherwise designated in this chapter.
1a	III		Free flowing or nontidal portions of streams in Section 1, unless otherwise designated in this chapter.

	VII		Swamp waters in Section 1a
			Gunns Run and its tributaries from the head of tide at river mile 2.64 to its headwaters.
1b	II	a,z	Eastern and Western Branches of the Elizabeth River and tidal portions of their tributaries from their confluence with the Elizabeth River to the end of tidal waters.
1c	III		Free flowing portions of the Eastern Branch of the Elizabeth River and its tributaries. Includes Salem Canal up to its intersection with Timberlake Road at N36°48'35.67"/W76°08'31.70".
1d	II	a,z	Southern Branch of the Elizabeth River from its confluence with the Elizabeth River to the lock at Great Bridge.
1e	III		Free flowing portions of the Western Branch of the Elizabeth River and of the Southern Branch of the Elizabeth River from their confluence with the Elizabeth River to the lock at Great Bridge.
1f	II	a	Nansemond River and its tributaries from its confluence with the James River to Suffolk (dam at Lake Meade), unless otherwise designated in this chapter.
1g	III		Shingle Creek from its confluence with the Nansemond River to its headwaters in the Dismal Swamp.
	VII		Swamp waters in Section 1g
			Shingle Creek and tributaries from the head of tide (approximately 500 feet downstream of Route 13/337) to their headwaters.
1h	III	PWS	Lake Prince, Lake Burnt Mills and Western Branch impoundments for Norfolk raw water supply and Lake Kilby - Cahoon Pond, Lake Meade and Lake Speight impoundments for Portsmouth raw water supply and including all tributaries to these impoundments.
	VII		Swamp waters in Section 1h
			Eley Swamp and its tributaries from Route 736 upstream to their headwaters.
1i	III		Free flowing portions of the Pagan River and its free flowing tributaries.
1j			(Deleted)
1k	III	PWS	Skiffes Creek Reservoir (Newport News water impoundment).
1l	III	PWS	The Lone Star lakes and impoundments in the City of Suffolk, Chuckatuck Creek watershed which serve as a water source for the City of Suffolk.
1m	III	PWS	The Lee Hall Reservoir system, near Skiffes Creek and the

			Warwick River, in the City of Newport News.
1n	III	PWS	Chuckatuck Creek and its tributaries from Suffolk's raw water intake (at Godwin's Millpond) to a point 5 miles upstream.
1o	II	PWS, bb	James River from City Point (Hopewell) to a point 5 miles ~~above American Tobacco Company's raw water intake~~ upriver.
1p	III	PWS ,	Free flowing tributaries to section 1o.
2	III		~~Free flowing tributaries of the James River from Buoy 64 to Brandon and free~~ Free flowing tributaries of the Chickahominy River to Walkers Dam, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 2
			Morris Creek and its tributaries from the head of tide at river mile 5.97 upstream to its headwaters.
2a	III	PWS	Diascund Creek and its tributaries from Newport News' raw water intake dam to its headwaters.
2b	III	PWS	Little Creek Reservoir and its tributaries from the City of Newport News impoundment dam to 5 miles upstream of the raw water intake.
3	III	m	Chickahominy River and its tributaries from Walkers Dam to Bottoms Bridge (Route 60 bridge), unless otherwise designated in this chapter.
	VII		Swamp waters in Section 3
		m	Chickahominy River from its confluence with Toe Ink Swamp at river mile 43.07 upstream to Bottoms Bridge (Route 60).
			Rumley Marsh and tributaries from the confluence of an unnamed tributary at river mile 2.61, upstream to the confluence with Beus Swamp. Beus Swamp, Piney Branch, and Pelham Swamp above the confluence of Beus Swamp are excluded.
		m	White Oak Swamp and its tributaries from its confluence with the Chickahominy River to their headwaters.
3a	III	PWS,m	Chickahominy River and its tributaries from Walkers Dam to points 5 miles upstream.
4	III	m	Chickahominy River and its tributaries, unless otherwise designated in this chapter, from Bottoms Bridge (Route 60 bridge) to its headwaters.
	VII		Swamp waters in Section 4
		m	Chickahominy River from Bottoms Bridge (Route 60) upstream to its confluence with Stony Run at rivermile 71.03.

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		m	Stony Run and tributaries from the confluence with Chickahominy River to their headwaters.
4a	III		Free flowing tributaries to the James River from Brandon to the fall line at Richmond, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 4a
			Fourmile Creek and its tributaries to their headwaters.

9VAC25-260-415. James River Basin (Lower) (Appomattox River Subbasin).

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
5	II		Appomattox River and its tidal tributaries from its confluence with the James River to the end of tidal waters.
5a	II	PWS	Appomattox River and its tidal tributaries from its mouth to 5 miles upstream of the Virginia-American Water Company's raw water intake.
5b	III	PWS	Free flowing tributaries to section 5a.
5c	III		Appomattox River from the head of tidal waters, and free flowing tributaries to the Appomattox River, to their headwaters, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 5c
			Skinquarter Creek from its confluence with the Appomattox River upstream to river mile 5.27.
			Deep Creek from the confluence with Winningham Creek downstream to the confluence of Little Creek, a distance of.~~54~~ 5.54 river miles.
			Winticomack Creek from its confluence with the Appomattox River to its headwaters including unnamed tributaries at river miles 1.92, 3.15, 8.77, and 11.16.
5d	III		Swift Creek and its tributaries from the dam at Pocahontas State Park upstream to Chesterfield County's raw water impoundment dam.
5e	III	PWS	Swift Creek and its tributaries from Chesterfield County's raw water impoundment dam to points 5 miles upstream.
5f	III	PWS	Appomattox River and its tributaries from Appomattox River Water Authority's raw water intake located at the dam at Lake Chesdin to the headwaters of the lake.
	VII		Swamp waters in Section 5f
			~~Winticomack Creek from its confluence with the Appomattox River to its headwaters including unnamed tributaries at river miles 1.92, 3.15, 8.77, and 11.16.~~

			Winterpock Creek and its tributaries (excluding Surline Branch) from its confluence with Lake Chesdin upstream to river mile 8.47.
5g	III	PWS	The Appomattox River and its tributaries from Farmville's raw water intake (approximately 2.5 miles above the Route 15/45 bridge) to points 5 miles upstream.

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9VAC25-260-440. Rappahannock River Basin.

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	II	a	Rappahannock River and the tidal portions of its tributaries from Stingray and Windmill Points to Route 1 Alternate Bridge at Fredericksburg.
1a	II		Hoskins Creek from the confluence with the Rappahannock River to its tidal headwaters.
2	III		Free flowing tributaries of the Rappahannock from Stingray and Windmill Points upstream to Blandfield Point, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 2
			Cat Point Creek and its tributaries, from their headwaters to the head of tide at river mile 10.54.
			Hoskins Creek and its nontidal tributaries from the head of tidal waters to their headwaters.
			Mason Mill Swamp and its tributaries from the head of tidal waters to their headwaters.
			Mount Landing Creek and its tributaries from the end of tidal waters at river mile 4.4 to their headwaters.
			Piscataway Creek and its tributaries from the confluence of Sturgeon Swamp to their headwaters.
3	III		The Rappahannock River from the Route 1 Alternate Bridge at Fredericksburg upstream to the low dam water intake at Waterloo (Fauquier County).
3a	III	PWS	The Rappahannock River and its tributaries from Spotsylvania County's raw water intake near Golin Run to points 5 miles upstream (excluding Motts Run and tributaries, which is in section 4c).
3b	III	PWS	The Rappahannock River and its tributaries from the low dam water intake at Waterloo, Fauquier County, to points 5 miles upstream.
4	III	ESW 17,18	Free flowing tributaries of the Rappahannock from Blandfield Point to its headwaters, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 4
			Goldenvale Creek from the head of tidal waters near the confluence with the Rappahannock River to its headwaters.
			Occupacia Creek and its tributaries from the end of tidal waters at river mile 8.89 on Occupacia Creek to their headwaters.
	V		**Stockable Trout Waters in Section 4**

***	Hughes River (Madison County) from Route 231 upstream to the upper crossing of Route 707 near the confluence of Rocky Run.
***	Robinson River from Route 231 to river mile 26.7.
***	Rose River from its confluence with the Robinson River 2.6 miles upstream.
***	South River from 5 miles above its confluence with the Rapidan River 3.9 miles upstream.
VI	**Natural Trout Waters in Section 4**
ii	Berry Hollow from its confluence with the Robinson River upstream including all named and unnamed tributaries.
~~Ii~~ ii	Bolton Branch from 1.7 miles above its confluence with Hittles Mill Stream upstream including all named and unnamed tributaries.
~~Ii~~ ii	Broad Hollow Run from its confluence with Hazel River upstream including all named and unnamed tributaries.
~~I~~ i	Brokenback Run from its confluence with the Hughes River upstream including all named and unnamed tributaries.
~~I~~ i	Bush Mountain Stream from its confluence with the Conway River upstream including all named and unnamed tributaries.
~~I~~ i	Cedar Run (Madison County) from 0.8 mile above its confluence with the Robinson River upstream including all named and unnamed tributaries.
~~I~~ i	Conway River (Greene County) from the Town of Fletcher upstream including all named and unnamed tributaries.
~~Ii~~ ii	Dark Hollow from its confluence with the Rose River upstream including all named and unnamed tributaries.
~~I~~ i	Devils Ditch from its confluence with the Conway River upstream including all named and unnamed tributaries.
iii	Entry Run from its confluence with the South River upstream including all named and unnamed tributaries.
iii	Garth Run from 1.9 miles above its confluence with the Rapidan River at the Route 665 crossing upstream including all named and unnamed tributaries.
ii	Hannah Run from its confluence with the Hughes River upstream including all named and unnamed tributaries.
ii	Hazel River (Rappahannock County) from the Route 707 bridge upstream including all named and unnamed tributaries.
ii	Hogcamp Branch from its confluence with the Rose River upstream including all named and unnamed tributaries.
i	Hughes River (Madison County) from the upper crossing of Route 707 near the confluence of Rocky Run upstream including

	all named and unnamed tributaries.
iii	Indian Run (Rappahannock County) from 3.4 miles above its confluence with the Hittles Mill Stream upstream including all named and unnamed tributaries.
ii	Jordan River (Rappahannock County) from 10.9 miles above its confluence with the Rappahannock River upstream including all named and unnamed tributaries.
iii	Kinsey Run from its confluence with the Rapidan River upstream including all named and unnamed tributaries.
ii	Laurel Prong from its confluence with the Rapidan River upstream including all named and unnamed tributaries.
ii	Mill Prong from its confluence with the Rapidan River upstream including all named and unnamed tributaries.
ii	Negro Run (Madison County) from its confluence with the Robinson River upstream including all named and unnamed tributaries.
ii	North Fork Thornton River from 3.2 miles above its confluence with the Thornton River upstream including all named and unnamed tributaries.
ii	Piney River (Rappahannock County) from 0.8 mile above its confluence with the North Fork Thornton River upstream including all named and unnamed tributaries.
ii	Pocosin Hollow from its confluence with the Conway River upstream including all named and unnamed tributaries.
ii	Ragged Run from 0.6 mile above its confluence with Popham Run upstream including all named and unnamed tributaries.
i	Rapidan River from Graves Mill (Route 615) upstream including all named and unnamed tributaries.
ii	Robinson River (Madison County) from river mile 26.7 to river mile 29.7.
i	Robinson River (Madison County) from river mile 29.7 upstream including all named and unnamed tributaries.
i	Rose River from river mile 2.6 upstream including all named and unnamed tributaries.
iv	Rush River (Rappahannock County) from the confluence of Big Devil Stairs (approximate river mile 10.2) upstream including all named and unnamed tributaries.
ii	Sams Run from its confluence with the Hazel River upstream including all named and unnamed tributaries.
ii	South River from 8.9 miles above its confluence with the Rapidan River upstream including all named and unnamed tributaries.
ii	Sprucepine Branch from its confluence with Bearwallow Creek

			upstream including all named and unnamed tributaries.
	i		Staunton River (Madison County) from its confluence with the Rapidan River upstream including all named and unnamed tributaries.
	ii		Strother Run from its confluence with the Rose River upstream including all named and unnamed tributaries.
	iii		Thornton River (Rappahannock County) from 25.7 miles above its confluence with the Hazel River upstream including all named and unnamed tributaries.
	ii		Wilson Run from its confluence with the Staunton River upstream including all named and unnamed tributaries.
4a			(Deleted)
4b	III	PWS	The Rappahannock River and its tributaries, to include the VEPCO Canal, from Fredericksburg's (inactive May 2000) raw water intake to points 5 miles upstream.
4c	III	PWS	Motts Run and its tributaries.
4d	III		Horsepen Run and its tributaries.
4e	III	PWS	Hunting Run and its tributaries.
4f	III		Wilderness Run and its tributaries.
4g	III		Deep Run and its tributaries.
4h			(Deleted)
4i	III	PWS	Mountain Run and its tributaries from Culpeper's raw water intake to points 5 miles upstream.
4j	III	PWS	White Oak Run and its tributaries from the Town of Madison's raw water intake to points 5 miles upstream.
4k	III	PWS	Rapidan River and its tributaries from Orange's raw water intake near Poplar Run to points 5 miles upstream.
4l	III	PWS	Rapidan River and its tributaries from the Rapidan Service Authority's raw water intake (just upstream of the Route 29 bridge) upstream to points 5 miles above the intake.
4m	III	PWS	Rapidan River and its tributaries from the Wilderness Shores raw water intake (Orange County - Rapidan Service Authority) to points 5 miles upstream.

9VAC25-260-450. Roanoke River Basin.

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	III	PWS	Lake Gaston and the John Kerr Reservoir in Virginia and their tributaries in Virginia, unless otherwise designated in this chapter (not including the Roanoke or the Dan Rivers). The Roanoke River Service Authority's water supply intake is in

			this section.
1a	III		Dockery Creek and its tributaries to their headwaters.
2	III		Dan River and its tributaries from the John Kerr Reservoir to the Virginia-North Carolina state line just east of the Pittsylvania-Halifax County line, unless otherwise designated in this chapter.
2a	III	PWS	Dan River and its tributaries from South Boston's raw water intake to points 5 miles upstream.
2b	III	PWS	Banister River and its tributaries from Burlington Industries' inactive raw water intake (about 2000 feet downstream of Route 360) inclusive of the Town of Halifax intake at the Banister Lake dam upstream to the Pittsylvania/Halifax County Line (designation for main stem and tributaries ends at the county line).
2c			(Deleted)
2d	III	PWS	Cherrystone Creek and its tributaries from Chatham's raw water intake upstream to their headwaters.
2e	III	PWS	Georges Creek from Gretna's raw water intake upstream to its headwaters.
2f	III	PWS	Banister River and its tributaries from point below its confluence with Bearskin Creek (at latitude 36°46'15"; longitude 79°27'08") just east of Route 703, upstream to their headwaters.
2g	III	PWS	Whitethorn Creek and its tributaries from its confluence with Georges Creek upstream to their headwaters.
3	III		Dan River and its tributaries from the Virginia-North Carolina state line just east of the Pittsylvania-Halifax County line upstream to the state line just east of Draper, N. C., unless otherwise designated in this chapter.
3a	III	PWS	Dan River and its tributaries from the Schoolfield Dam including the City of Danville's main water intake located just upstream of the Schoolfield Dam, upstream to the Virginia-North Carolina state line.
3b	IV	PWS	Cascade Creek and its tributaries.
3c	IV	PWS	Smith River and its tributaries from the Virginia-North Carolina state line to, but not including, Home Creek.
3d	VI	PWS	Smith River from DuPont's (inactive) raw water intake upstream to the Philpott Dam, unless otherwise designated in this chapter.
	VI	PWS	**Natural Trout Waters in Section 3d**
	ii		Smith River from DuPont's (inactive) raw water intake upstream to the Philpott Dam, unless otherwise designated in this chapter.

3e	IV		Philpott Reservoir, Fairystone Lake and their tributaries.
	V		**Stockable Trout Waters in Section 3e**
	v		Otter Creek from its confluence with Rennet Bag Creek (Philpott Reservoir) to its headwaters.
	v		Smith River (Philpott Reservoir portion) from the Philpott Dam (river mile 46.80) to river mile 61.14, just above the confluence with Small Creek.
	v		Rennet Bag Creek from its confluence with the Smith River to the confluence of Long Branch Creek.
	VI		**Natural Trout Waters in Section 3e**
	ii		Brogan Branch from its confluence with Rennet Bag Creek upstream including all named and unnamed tributaries.
	ii		Rennet Bag Creek from the confluence of Long Branch Creek upstream including all named and unnamed tributaries.
	ii		Roaring Run from its confluence with Rennet Bag Creek upstream including all named and unnamed tributaries.
3f	IV	PWS	North Mayo River and South Mayo River and their tributaries from the Virginia-North Carolina state line to points 5 miles upstream.
3g	IV		Interstate streams in the Dan River watershed above the point where the Dan crosses the Virginia-North Carolina state line just east of Draper, N. C., (including the Mayo and the Smith watersheds), unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 3g**
	vi		Dan River from the Virginia-North Carolina state line upstream to the Pinnacles Power House.
	***		Little Dan River from its confluence with the Dan River 7.8 miles upstream.
	v		Smith River from river mile 61.14 (just below the confluence of Small Creek), to Route 704 (river mile 69.20).
	VI		**Natural Trout Waters in Section 3g**
	ii		Dan River from Pinnacles Power House to Townes Dam.
	ii		Dan River from headwaters of Townes Reservoir to Talbott Dam.
	iii		Little Dan River from 7.8 miles above its confluence with the Dan River upstream including all named and unnamed tributaries.
	i		North Prong of the North Fork Smith River from its confluence with the North Fork Smith River upstream including all named and unnamed tributaries.
	ii		North Fork Smith River from its confluence with the Smith

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			River upstream including all named and unnamed tributaries.
	iii		Smith River from Route 704 (river mile 69.20) to Route 8 (river mile 77.55).
	ii		Smith River from Route 8 (approximate river mile 77.55) upstream including all named and unnamed tributaries.
	ii		South Mayo River from river mile 38.8 upstream including all named and unnamed tributaries.
3h	IV	PWS	South Mayo River and its tributaries from the Town of Stuart's raw water intake 0.4 mile upstream of its confluence with the North Fork Mayo River to points 5 miles upstream.
	VI		**Natural Trout Waters in Section 3h**
	iii		Brushy Fork from its confluence with the South Mayo River upstream including all named and unnamed tributaries.
	iii		Lily Cove Branch from its confluence with Rye Cove Creek upstream including all named and unnamed tributaries.
	iii		Rye Cove Creek from its confluence with the South Mayo River upstream including all named and unnamed tributaries.
	iii		South Mayo River from river mile 33.8 upstream including all named and unnamed tributaries.
3i	IV	PWS	Hale Creek and its tributaries from the Fairy Stone State Park's raw water intake 1.7 miles from its confluence with Fairy Stone Lake upstream to its headwaters.
3j	VI	PWS	Smith River and its tributaries from the Henry County Public Service Authority's raw water intake about 0.2 mile upstream of its confluence with Town Creek to points 5 miles upstream.
4	III		Intrastate tributaries to the Dan River above the Virginia-North Carolina state line just east of Draper, North Carolina, to their headwaters, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 4**
	vi		Browns Dan River from the intersection of Routes 647 and 646 to its headwaters.
	vi		Little Spencer Creek from its confluence with Spencer Creek to its headwaters.
	vi		Poorhouse Creek from its confluence with North Fork South Mayo River upstream to Route 817.
	***		Rock Castle Creek from its confluence with the Smith River upstream to Route 40.
	VI		**Natural Trout Waters in Section 4**
	ii		Barnard Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.
	ii		Big Cherry Creek from its confluence with Ivy Creek upstream

	including all named and unnamed tributaries.
iii	Ivy Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.
iii	Camp Branch from its confluence with Ivy Creek upstream including all named and unnamed tributaries.
iii	Haunted Branch from its confluence with Barnard Creek upstream including all named and unnamed tributaries.
ii	Hookers Creek from its confluence with the Little Dan River upstream including all named and unnamed tributaries.
iii	Ivy Creek from Coleman's Mill Pond upstream to Route 58 (approximately 2.5 miles).
iii	Little Ivy Creek from its confluence with Ivy Creek upstream including all named and unnamed tributaries.
iii	Little Rock Castle Creek from its confluence with Rock Castle Creek upstream including all named and unnamed tributaries.
ii	Maple Swamp Branch from its confluence with Round Meadow Creek upstream including all named and unnamed tributaries.
iii	Mayberry Creek from its confluence with Round Meadow Creek upstream including all named and unnamed tributaries.
ii	Mill Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.
iii	North Fork South Mayo River from its confluence with the South Mayo River upstream including all named and unnamed tributaries.
vi**	Patrick Springs Branch from its confluence with Laurel Branch upstream including all named and unnamed tributaries.
iii	Polebridge Creek from Route 692 upstream including all named and unnamed tributaries.
ii	Poorhouse Creek from Route 817 upstream including all named and unnamed tributaries.
ii	Rhody Creek from its confluence with the South Mayo River upstream including all named and unnamed tributaries.
iii	Rich Creek from Route 58 upstream including all named and unnamed tributaries.
ii	Roaring Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.
i	Rock Castle Creek from Route 40 upstream including all named and unnamed tributaries.
iii	Round Meadow Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.

	ii		Sawpit Branch from its confluence with Round Meadow Creek upstream including all named and unnamed tributaries.
	ii		Shooting Creek from its confluence with the Smith River upstream including all named and unnamed tributaries.
	vi**		Spencer Creek from Route 692 upstream including all named and unnamed tributaries.
	iii		Squall Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.
	ii		Tuggle Creek from its confluence with the Dan River upstream including all named and unnamed tributaries.
	ii		Widgeon Creek from its confluence with the Smith River upstream including all named and unnamed tributaries.
4a	III	PWS	Intrastate tributaries (includes Beaver Creek, Little Beaver Creek, and Jones Creek, for the City of Martinsville) to the Smith River from DuPont's (inactive) raw water intake to points 5 miles upstream from Fieldcrest Cannon's raw water intake.
4b	III	PWS	Marrowbone Creek and its tributaries from the Henry County Public Service Authority's raw water intake (about 1/4 mile upstream from Route 220) to their headwaters.
4c	III	PWS	Leatherwood Creek and its tributaries from the Henry County Public Service Authority's raw water intake 8 miles upstream of its confluence with the Smith River to points 5 miles upstream.
5	IV	PWS	Roanoke (Staunton) River from the headwaters of the John Kerr Reservoir to Leesville Dam unless otherwise designated in this chapter.
5a	III	PWS	Tributaries to the Roanoke (Staunton) River from the headwaters of the John Kerr Reservoir to Leesville Dam, unless otherwise designated in this chapter.
			Stockable Trout Waters in Section 5a
	V		
	vi		Day Creek from Route 741 to its headwaters.
	VI		**Natural Trout Waters in Section 5a**
	iii		Gunstock Creek from its confluence with Overstreet Creek upstream including all named and unnamed tributaries.
	ii		Overstreet Creek from its confluence with North Otter Creek upstream including all named and unnamed tributaries.
5b	III	PWS	Spring Creek from Keysville's raw water intake upstream to its headwaters.
5c	III	PWS	Falling River and its tributaries from a point just upstream from State Route 40 (the raw water source for Dan River,

			Inc.) to points 5 miles upstream and including the entire Phelps Creek watershed which contains the Brookneal Reservoir.
5d	III		Falling River and its tributaries from 5 miles above Dan River, Inc. raw water intake to its headwaters.
5e	III	PWS	Reed Creek and its tributaries from Altavista's raw water intake upstream to their headwaters.
5f	III	PWS	Big Otter River and its tributaries from Bedford's raw water intake to points 5 miles upstream, and Stony Creek and Little Stony Creek upstream to their headwaters.
	VI	PWS	**Natural Trout Waters in Section 5f**
	ii		Little Stony Creek from 1 mile above its confluence with Stony Creek upstream including all named and unnamed tributaries.
	ii		Stony Creek from the Bedford Reservoir upstream including all named and unnamed tributaries.
5g	III		Big Otter River and its tributaries from 5 miles above Bedford's raw water intake upstream to their headwaters.
5h	III		Ash Camp Creek and that portion of Little Roanoke Creek from its confluence with Ash Camp Creek to the Route 47 bridge.
5i	III	PWS	The Roanoke River and its tributaries from the Town of Altavista's raw water intake, 0.1 mile upstream from the confluence of Sycamore Creek, to points 5 miles upstream.
5j	III	PWS	Big Otter River and its tributaries from the Campbell County Utilities and Service Authority's raw water intake to points 5 miles upstream.
6	IV	pH-6.5-9.5	Roanoke River from a point (at latitude 37°15'53"; longitude 79°54'00") 5 miles above the headwaters of Smith Mountain Lake upstream to Salem's #1 raw water intake.
	V		**Stockable Trout Waters in Section 6**
	***	pH-6.5-9.5, ff	Roanoke River from its junction from Routes 11 and 419 to Salem's #1 raw water intake.
6a	III	NEW-1	Tributaries of the Roanoke River from Leesville Dam to Niagra Reservoir, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 6a**
	vi		Gourd Creek from 1.3 miles above its confluence with Snow Creek to its headwaters.
	vi		Maggodee Creek from Boones Mill upstream to Route 862 (approximately 3.8 miles).
	vii		South Fork Blackwater River form its confluence with the Blackwater River upstream to Roaring Run.

	vi		South Prong Pigg River from its confluence with the Pigg River to its headwaters.
	VI		**Natural Trout Waters in Section 6a**
	iii		Daniels Branch from its confluence with the South Fork Blackwater River upstream including all named and unnamed tributaries.
	ii		Green Creek from Roaring Run upstream including all named and unnamed tributaries.
	ii		Pigg River from 1 mile above the confluence of the South Prong Pigg River upstream including all named and unnamed tributaries.
	ii		Roaring Run from its confluence with the South Fork Blackwater River upstream including all named and unnamed tributaries.
6b			(Deleted)
6c	III	PWS	Falling Creek Reservoir and Beaverdam Reservoir.
6d	IV		Tributaries of the Roanoke River from Niagra Reservoir to Salem's #1 raw water intake, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 6d**
	vii	ee	Tinker Creek from its confluence with the Roanoke River north to Routes 11 and 220.
	VI		**Natural Trout Waters in Section 6d**
	iii		Glade Creek from its junction with Berkley Road NE to the confluence of Coyner Branch.
6e	IV	PWS	Carvin Cove Reservoir and its tributaries to their headwaters.
6f	IV	PWS, NEW-1	Blackwater River and its tributaries from the Town of Rocky Mount's raw water intake (just upstream of State Route 220) to points 5 miles upstream.
6g	IV	PWS	Tinker Creek and its tributaries from the City of Roanoke's raw water intake (about 0.4 mile downstream from Glebe Mills) to points 5 miles upstream.
6h	IV	PWS	Roanoke River from Leesville Dam to Smith Mountain Dam (Gap of Smith Mountain), excluding all tributaries to Leesville Lake.
6i	IV	PWS, NEW-1	Roanoke River from Smith Mountain Dam (Gap of Smith Mountain) upstream to a point (at latitude 37°15'53"; longitude 79°54'00" and its tributaries to points 5 miles above the 795.0 foot contour (normal pool elevation) of Smith Mountain Lake.
7	IV	pH-6.5-9.5,ESW-2	Roanoke River and its tributaries, unless otherwise designated in this chapter, from Salem's #1 raw water intake to their headwaters.

	V		**Stockable Trout Waters in Section 7**
	vi	pH-6.5-9.5	Elliott Creek from the confluence of Rocky Branch to its headwaters.
	vi	pH-6.5-9.5	Goose Creek from its confluence with the South Fork Roanoke River to its headwaters.
	vi	pH-6.5-9.5	Mill Creek from its confluence with Bottom Creek to its headwaters.
	***	pH-6.5-9.5	Roanoke River from 5 miles above Salem's #2 raw water intake to the Spring Hollow Reservoir intake (see section 7b).
	vi	pH-6.5-9.5	Smith Creek from its confluence with Elliott Creek to its headwaters.
	vi	pH-6.5-9.5	South Fork Roanoke River from 5 miles above the Spring Hollow Reservoir intake (see section 7b) to the mouth of Bottom Creek (river mile 17.1).
	VI		**Natural Trout Waters in Section 7**
	ii	pH-6.5-9.5	Big Laurel Creek from its confluence with Bottom Creek upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Bottom Creek from its confluence with the South Fork Roanoke River upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Lick Fork (Floyd County) from its confluence with Goose Creek upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Mill Creek from its confluence with the North Fork Roanoke River upstream including all named and unnamed tributaries.
	iii	pH-6.5-9.5	Purgatory Creek from Camp Alta Mons upstream including all named and unnamed tributaries.
	ii	pH-6.5-9.5	Spring Branch from its confluence with the South Fork Roanoke River upstream including all named and unnamed tributaries.
7a	IV	PWS pH-6.5-9.5	Roanoke River and its tributaries from Salem's #1 raw water intake to points 5 miles upstream from Salem's #2 raw water intake.
	V	PWS	**Stockable Trout Waters in Section 7a**
	***	pH-6.5-9.5, ff	Roanoke River from Salem's #1 raw water intake to a point 5 miles upstream from Salem's #2 raw water intake.
7b	IV	PWS pH-6.5-9.5	Roanoke River and its tributaries from the Spring Hollow Reservoir intake upstream to points 5 miles upstream.
	V	PWS	**Stockable Trout Waters in Section 7b**
	***	pH-6.5-9.5, ~~hh~~ ff	Roanoke River from the Spring Hollow Reservoir intake to the Montgomery County line.

vi	pH-6.5-9.5	South Fork Roanoke River from its confluence with the Roanoke River to 5 miles above the Spring Hollow Reservoir intake.

9VAC25-260-460. Yadkin River Basin.

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	IV	PWS	Yadkin River Basin in Virginia including Ararat River, Johnson Creek, Little Fisher River, Lovills Creek, Pauls Creek and Stewarts Creek - the entire reach of these streams from the Virginia-North Carolina state line to their headwaters.
	V	PWS	**Stockable Trout Waters in Section 1**
	***		Ararat River from Route 823 upstream to Route 671.
	vi		Halls Branch from its confluence with Lovills Creek 4.5 miles upstream.
	vi		Johnson Creek from the Virginia-North Carolina state line to its headwaters.
	vii		Lovills Creek from the Virginia-North Carolina state line 1.8 miles upstream (to the Natural Resource Conservation Service dam).
	vii		Pauls Creek (at the Carroll County line at Route 690) from 6.7 miles above its confluence with Stewarts Creek 4.2 miles upstream.
	VI	PWS	**Natural Trout Waters in Section 1**
	iii		Ararat River from Route 671 upstream including all named and unnamed tributaries.
	iii		East Fork Johnson Creek from its confluence with Johnson Creek upstream including all named and unnamed tributaries.
	iii		Elk Spur Branch from its confluence with Lovills Creek upstream including all named and unnamed tributaries.
	i		Little Fisher Creek from the Virginia-North Carolina state line upstream including all named and unnamed tributaries.
	ii		Little Pauls Creek in the vicinity of Route 692 (4 miles above its confluence with Pauls Creek) upstream including all named and unnamed tributaries.
	iii		Lovills Creek and its tributaries from the headwaters of the impoundment formed by the Natural Resource Conservation Service dam ~~(1.8 miles above the Virginia-North Carolina state line)~~ (Lovills Creek Lake) to ~~river mile 7.8 (at the confluence of Elk Spur and Waterfall Branch)~~ their headwaters.
	ii		North Fork Stewarts Creek from its confluence with Stewarts

	Creek upstream including all named and unnamed tributaries.
ii	Pauls Creek (Carroll County) from 10.9 miles above its confluence with Stewarts Creek upstream including all named and unnamed tributaries.
i	South Fork Stewarts Creek from its confluence with Stewarts Creek upstream including all named and unnamed tributaries.
iii	Stewarts Creek below Lambsburg in the vicinity of Route 696 (10.4 miles above its confluence with the Ararat River) to the confluence of the North and South Forks of Stewarts Creek.
iii	Sun Run from its confluence with the Ararat River upstream including all named and unnamed tributaries.
iii	Thompson Creek from its confluence with the Ararat River upstream including all named and unnamed tributaries.
ii	Turkey Creek from its confluence with Stewarts Creek upstream including all named and unnamed tributaries.
ii	Waterfall Branch from its confluence with Lovills Creek upstream including all named and unnamed tributaries.

9VAC25-260-470. Chowan and Dismal Swamp (Chowan River Subbasin).

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	II	NEW-21	Blackwater River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately State Route 611 at river mile 20.90; Nottoway River and its tidal tributaries from the Virginia-North Carolina state line to the end of tidal waters at approximately Route 674.
2	VII	NEW-21	Blackwater River from the end of tidal waters to its headwaters and its free-flowing tributaries in Virginia, unless otherwise designated in this chapter.
2a	VII	PWS	Blackwater River and its tributaries from Norfolk's auxiliary raw water intake near Burdette, Virginia, to points 5 miles above the raw water intake, to include Corrowaugh Swamp to a point 5 miles above the raw water intake.
2b	III		Nottoway River from the end of tidal waters to its headwaters and its free-flowing tributaries in Virginia, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 2b
			Assamoosick Swamp and its tributaries from river mile 2.50 to its headwaters.
			Black Branch Swamp from its confluence with the Nottoway River to its headwaters.
			Butterwood Creek from river mile 4.65 (near Route 622) upstream

			to river mile 14.59 (near Route 643).
			Cabin Point Swamp from its confluence with the Nottoway River to its headwaters.
			Cooks Branch from its confluence with Butterwood Creek to river mile 1.08
			Gosee Swamp and its tributaries from its confluence with the Nottoway River to river mile 6.88.
			Gravelly Run and its tributaries from its confluence with Rowanty Creek to river mile 8.56.
			Harris Swamp and its tributaries from its confluence with the Nottoway River to river mile 8.72.
			Hatcher Run and its tributaries from its confluence with Rowanty Creek to river mile 19.27 excluding Picture Branch.
			Hunting Quarter Swamp and its tributaries from its confluence with the Nottoway River to its headwaters.
			Moores and Jones Holes Swamp and tributaries from their confluence with the Nottoway River to its headwaters.
			Nebletts Mill Run and its tributaries from its confluence with the Nottoway River to its headwaters.
			Raccoon Creek and its tributaries from its confluence with the Nottoway River to its headwaters.
			Rowanty Creek and its tributaries from its confluence with the Nottoway River to Gravelly Run.
			Southwest Swamp and its tributaries from its confluence with Stony Creek to river mile 8.55.
			Three Creek and its tributaries from its confluence with the Nottoway River upstream to its headwaters Slagles Lake.
2c	III	PWS	Nottoway River and its tributaries from Norfolk's auxiliary raw water intake near Courtland, Virginia, to points 5 miles upstream unless otherwise designated in this chapter.
	VII		Swamp waters in Section 2c
			Assamoosick Swamp and its tributaries from its confluence with the Nottoway River to river mile 2.50.
2d			(Deleted)
2e	III	PWS	Nottoway River and its tributaries from the Georgia-Pacific and the Town of Jarratt's raw water intakes near Jarratt, Virginia, to points 5 miles above the intakes.
2f	III	PWS	Nottoway River and its tributaries from the Town of Blackstone's raw water intake to points 5 miles above the raw water intake.
2g	III	PWS	Lazaretto Creek and its tributaries from Crewe's raw water intake to points 5 miles upstream.

2h	III	PWS	Modest Creek and its tributaries from Victoria's raw water intake to their headwaters.
2i	III	PWS	Nottoway River and its tributaries from the Town of Victoria's raw water intake at the Falls (about 200 feet upstream from State Route 49) to points 5 miles upstream.
2j	III	PWS	Big Hounds Creek from the Town of Victoria's auxiliary raw water intake (on Lunenburg Lake) to its headwaters.
3	III		Meherrin River and its tributaries in Virginia from the Virginia-North Carolina state line to its headwaters, unless otherwise designated in this chapter.
	VII		Swamp waters in Section 3
			Cattail Creek and its tributaries from its confluence with Fontaine Creek to their headwaters.
			Tarrara Creek and its tributaries from its confluence with the Meherrin River to its headwaters.
			~~Fountains~~ Fontaine Creek and its tributaries from its confluence with the Meherrin River to Route 301.
3a	III	PWS	Meherrin River and its tributaries from Emporia's water supply dam to points 5 miles upstream.
3b	III	PWS	Great Creek from Lawrenceville's raw water intake to a point 7.6 miles upstream.
3c	III	PWS	Meherrin River and its tributaries from Lawrenceville's raw water intake to points 5 miles upstream.
3d	III	PWS	Flat Rock Creek from Kenbridge's raw water intake upstream to its headwaters.
3e	III	PWS	Meherrin River and its tributaries from South Hill's raw water intake to points 5 miles upstream.
3f	III		Couches Creek from a point 1.6 miles downstream from the Industrial Development Authority discharge to its headwaters.
4	III		Free flowing tributaries to the Chowan River in Virginia unless otherwise designated in this section.
	VII		Swamp waters in Section 4
			Unnamed tributary to Buckhorn Creek from its headwaters to the Virginia/North Carolina state line.
			Somerton Creek and its tributaries from the Virginia/North Carolina state line at river mile 0.00 upstream to river mile 13.78.

9VAC25-260-510. Tennessee and Big Sandy River Basins (Holston River Subbasin).

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	IV		North Fork Holston River and its tributaries, unless otherwise designated in this chapter, from the Virginia-Tennessee state line to their headwaters, and those sections of Timbertree Branch and Boozy Creek in Virginia.
	V		**Stockable Trout Waters in Section 1**
	vi		Greendale Creek from its confluence with the North Fork Holston River 4.1 miles upstream.
	v		Laurel Bed Creek from its confluence with Tumbling Creek 1.8 miles upstream.
	vi		Laurel Creek within the Thomas Jefferson National Forest boundaries.
	***		Laurel Creek from Route 16 to its confluence with Roaring Fork.
	vi		Lick Creek (Bland County) from 5.5 miles above its confluence with the North Fork Holston River 10.9 miles upstream.
	vi		Little Tumbling Creek from Tannersville upstream to where the powerline crosses the stream.
	vi		Lynn Camp Creek from its confluence with Lick Creek 3.9 miles upstream.
	vi		Punch and Judy Creek from its confluence with Laurel Creek 3.2 miles upstream.
	v		Tumbling Creek from its confluence with the North Fork Holston River ~~7.1 miles upstream~~ upstream including all named and unnamed tributaries.
	VI		**Natural Trout Waters in Section 1**
	ii		Barkcamp Branch from its confluence with Roaring Fork upstream including all named and unnamed tributaries.
	ii		Beartown Branch from its confluence with Sprouts Creek upstream including all named and unnamed tributaries.
	ii		Beaver Creek (Smyth County) from its confluence with the North Fork Holston River 2.8 miles upstream.
	***	-	~~Big Tumbling Creek from its confluence with the North Fork Holston River upstream including all named and unnamed tributaries.~~
	ii		Brier Cove from its confluence with Tumbling Creek upstream including all named and unnamed tributaries.
			Brumley Creek from its confluence with the North Fork Holston River upstream to the Hidden Valley Lake dam including all named and unnamed tributaries.

	***		Brumley Creek from its confluence with the North Fork Holston River (at Duncanville) 4 miles upstream.
	iii		Brumley Creek from 4 miles above its confluence with the North Fork Holston River (at Duncanville) 6.9 miles upstream.
	iii		Campbell Creek (Smyth County) from its confluence with the North Fork Holston River at Ellendale Ford 1 mile upstream.
	ii		Coon Branch from its confluence with Barkcamp upstream including all named and unnamed tributaries.
	ii		Cove Branch from its confluence with Roaring Fork upstream including all named and unnamed tributaries.
	ii		Henshaw Branch from its confluence with Lick Creek upstream including all named and unnamed tributaries.
	ii		Little Sprouts Creek from its confluence with Sprouts Creek upstream including all named and unnamed tributaries.
	ii		Little Tumbling Creek from the powerline crossing upstream including all named and unnamed tributaries.
	v**		Red Creek from its confluence with Tumbling Creek upstream including all named and unnamed tributaries.
	ii		Roaring Fork (Tazewell County) from its confluence with Laurel Creek upstream including all named and unnamed tributaries.
	ii		Sprouts Creek from its confluence with the North Fork Holston River upstream including all named and unnamed tributaries.
	ii		Toole Creek from its confluence with the North Fork Holston River 5.9 miles upstream.
1a	IV		North Fork Holston River from the Olin Corporation downstream to the Virginia-Tennessee state line.
1b	IV	PWS	Big Moccasin Creek and its tributaries from Weber City's raw water intake to points 5 miles upstream from Gate City's raw water intake.
1c			(Deleted)
1d	IV	PWS	Unnamed tributary to the North Fork Holston River from Hilton's Community No. 2 public water supply raw water intake to its headwaters.
2	IV	PWS	South Holston Lake in Virginia and South Holston Lake and its tributaries from the Bristol Virginia Utilities Board's raw water intake to points 5 miles upstream.
3	IV		Tributaries of the South Holston Lake, and Sinking Creek and Nicely Branch in Virginia, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 3**
	vi		Berry Creek from its confluence with Fifteenmile Creek

			(Washington County) 2 miles upstream.
	vi		Spring Creek from its confluence with the South Holston Lake to its headwaters.
	VI		**Natural Trout Waters in Section 3**
	ii		Cox Mill Creek from its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
3a			(Deleted)
4	IV		Steel Creek and Beaver Creek and their tributaries in Virginia.
	V		**Stockable Trout Waters in Section 4**
	vi		Beaver Creek (Washington County) and its tributaries from the flood control dam (near Route 11) to their headwaters.
	vi		Sinking Creek (tributary to Paperville Creek-Washington County) from the Virginia-Tennessee state line at Bristol 3.4 miles upstream.
5	IV		Middle Fork Holston River and its tributaries, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 5**
	vi		Dry Run from its confluence with the Middle Fork Holston River 1.6 miles upstream.
	vi		Dutton Branch from its confluence with the Middle Fork Holston River 2 miles upstream.
	vi		Laurel Springs Creek from its confluence with the Middle Fork Holston River 2 miles upstream.
	vi		Middle Fork Holston River from 5 miles above Marion's raw water intake (river mile 45.83) to the headwaters.
	vi		Preston Hollow from 0.5 mile above its confluence with the Middle Fork Holston River 1.5 miles upstream.
	vi		Staley Creek from its confluence with the Middle Fork Holston River 1 mile upstream.
	VI		**Natural Trout Waters in Section 5**
	iii		East Fork Nicks Creek from its confluence with Nicks Creek upstream including all named and unnamed tributaries.
	iii		Nicks Creek within the National Forest boundary (river mile 1.6) upstream including all named and unnamed tributaries.
	iii		Staley Creek from 1 mile above its confluence with the Middle Fork Holston River upstream including all named and unnamed tributaries.
5a	IV		Middle Fork Holston River and its tributaries from Edmondson Dam upstream to the Route 91 bridge.
5b	IV		Hungry Mother Creek from the dam upstream including all named

			and unnamed tributaries.
5c	IV	PWS	Middle Fork Holston River and its tributaries from Marion's raw water intake to points 5 miles upstream, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 5c**
	vi		Middle Fork Holston River from Marion's raw water intake at Mt. Carmel at river mile 45.83 to a point 5 miles upstream (river mile 50.83).
5d	IV	PWS	Middle Fork Holston River and its tributaries from Washington County Service Authority's raw water intake to points 5 miles upstream.
6	IV	ESW-10	South Fork Holston River and its tributaries in Virginia, unless otherwise designated in this chapter.
	V		**Stockable Trout Waters in Section 6**
	vi		Grosses Creek from its confluence with the South Fork Holston River 3.4 miles upstream.
	vi		Rush Creek (Washington County) from its confluence with the South Fork Holston River 2.2 miles upstream.
	vi		Straight Branch from its confluence with Whitetop Laurel Creek 2.5 miles upstream.
	VI		**Natural Trout Waters in Section 6**
	iii		Barkcamp Branch from its confluence with Rowland Creek upstream including all named and unnamed tributaries.
	iii		Beaverdam Creek (Washington County) from its confluence with Laurel Creek to the Virginia-Tennessee state line 2 miles upstream.
	iii		Bell Hollow from its confluence with Dickey Creek upstream including all named and unnamed tributaries.
	iii		Big Branch from its confluence with Big Laurel Creek upstream including all named and unnamed tributaries.
			Big Laurel Creek (Smyth County) from its confluence with Whitetop Laurel Creek upstream including all named and unnamed tributaries.
	iii		Big Laurel Creek (Smyth County) from its confluence with Whitetop Laurel Creek 2.6 miles upstream.
	ii		Big Laurel Creek (Smyth County) from 2.6 miles above its confluence with Whitetop Laurel Creek (at Laurel Valley Church) upstream including all named and unnamed tributaries.
	iii		Brush Creek from its confluence with Rush Creek upstream including all named and unnamed tributaries.
	iii		Buckeye Branch from its confluence with Green Cove Creek

upstream including all named and unnamed tributaries.

ii	Charlies Branch from its confluence with Big Laurel Creek upstream including all named and unnamed tributaries.
iii	Cold Branch from its confluence with Jerrys Creek upstream including all named and unnamed tributaries.
iv	Comers Creek from its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
ii	Cressy Creek from 1.7 miles above its confluence with the South Fork Holston River at Route 16 upstream including all named and unnamed tributaries.
ii	Daves Branch from its confluence with Big Laurel Creek upstream including all named and unnamed tributaries.
iii	Dickey Creek from 0.6 mile above its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
ii	Dry Fork from 1.2 miles above its confluence with St. Clair Creek upstream including all named and unnamed tributaries.
ii	Feathercamp Branch from its confluence with Straight Branch upstream including all named and unnamed tributaries.
ii	Grassy Branch from its confluence with Big Laurel Creek upstream including all named and unnamed tributaries.
ii	Green Cove Creek from its confluence with Whitetop Laurel Creek upstream including all named and unnamed tributaries.
ii	Grindstone Branch from its confluence with Big Laurel Creek upstream including all named and unnamed tributaries.
iii	High Trestle Branch from its confluence with Buckeye Branch upstream including all named and unnamed tributaries.
iii	Hopkins Branch from its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
iii	Houndshell Branch from its confluence with Cressy Creek upstream including all named and unnamed tributaries.
ii	Hurricane Creek (Smyth County) from its confluence with Comers Creek upstream including all named and unnamed tributaries.
iii	Hutton Branch from its confluence with Dickey Creek upstream including all named and unnamed tributaries.
iii	Jerrys Creek (Smyth County) from 1.5 miles above its confluence with Rowland Creek upstream including all named and unnamed tributaries.
ii	Little Laurel Creek (Smyth County) from its confluence with Whitetop Laurel Creek upstream including all named and unnamed tributaries.

***	Laurel Creek from its confluence with Beaverdam Creek (Washington County) to the state line.
ii	London Bridge Branch from its confluence with Beaverdam Creek (Washington County) 0.6 mile upstream.
iii	Long Branch from its confluence with Jerrys Creek upstream including all named and unnamed tributaries.
ii	Mill Creek (Washington County) from its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
iii	Parks Creek from its confluence with Cressy Creek upstream including all named and unnamed tributaries.
ii	Pennington Branch from its confluence with Whitetop Laurel Creek upstream including all named and unnamed tributaries.
iii	Quarter Branch from 1.1 miles above its confluence with Cressy Creek upstream including all named and unnamed tributaries.
iii	Raccoon Branch from its confluence with Dickey Creek upstream including all named and unnamed tributaries.
ii	Rowland Creek from 2.5 miles above its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
ii	Rush Creek (Washington County) from 2.2 miles above its confluence with the South Fork Holston River upstream including all named and unnamed tributaries.
iii	Scott Branch from its confluence with Dickey Creek upstream including all named and unnamed tributaries.
iii	Slemp Creek from 2 miles above its confluence with Cressy Creek upstream including all named and unnamed tributaries.
ii	South Fork Holston River from 101.8 miles above its confluence with the Holston River to the Thomas Bridge Water Corporation's raw water intake (see section 6a).
ii	South Fork Holston River from 5 miles above the Thomas Bridge Water Corporation's raw water intake to a point 12.9 miles upstream (see section 6a).
ii	Star Hill Branch from its confluence with Green Cove Creek upstream including all named and unnamed tributaries.
ii	St. Clair Creek from 3.3 miles above its confluence with the South Fork Holston River (at Route 600) above Horseshoe Bend upstream including all named and unnamed tributaries.
ii	Sturgill Branch from its confluence with Whitetop Laurel Creek upstream including all named and unnamed tributaries.
iii	Valley Creek (Washington County) from its confluence with Whitetop Laurel Creek upstream including all named and unnamed

			tributaries.
			Whitetop Laurel Creek from its confluence with Laurel Creek upstream including all named and unnamed tributaries.
	ii		Whitetop Laurel Creek from its confluence with Laurel Creek 8.1 miles upstream.
	i		Whitetop Laurel Creek from 8.1 miles above its confluence with Laurel Creek 4.4 miles upstream.
	iii		Whitetop Laurel Creek from 12.5 miles above its confluence with Laurel Creek 3.8 miles upstream.
6a	IV	PWS	South Fork Holston River and its tributaries from Thomas Bridge Water Corporation's raw water intake between Route 658 and Route 656 to points 5 miles upstream.
	VI		**Natural Trout Waters in Section 6a**
	ii		South Fork Holston River from Thomas Bridge Water Corporation's raw water intake to a point 5 miles upstream.

9VAC25-260-520. Chesapeake Bay, Atlantic Ocean and small coastal basins.

SEC.	CLASS	SP. STDS.	SECTION DESCRIPTION
1	I	a	The Atlantic Ocean from Cape Henry Light (Latitude 36°55'06" North; Longitude 76°00'04" West) east to the three mile limit and south to the North Carolina state line. The Atlantic Ocean from Cape Henry Light to Thimble Shoal Channel (Latitude 36°57'30" North; Longitude 76°02'30" West) from Thimble Shoal Channel to Smith Island (Latitude 37°07'04" North; Longitude 75°54'04" West) and north to the Virginia-Maryland state line.
1a	III		All free flowing portions of the streams, creeks and coves in Section 1 east of the east-west divide boundary on the Eastern Shore of Virginia.
1b	II	a	Tidal portions of streams, creeks and coves in Section 1 east of the east-west divide boundary on the Eastern Shore of Virginia.
2	II	a	Chesapeake Bay and its tidal tributaries from Old Point Comfort Tower (Latitude 37°00'00" North; Longitude 76°18'08" West) to Thimble Shoal Light (Latitude 37°00'09" North; Longitude 76°14'04" West) to and along the south side of Thimble Shoal Channel to its eastern end (Latitude 36°57'03" North; Longitude 76°02'03" West) to Smith Island (Latitude 37°07'04" North; Longitude 75°54'04" West) north to the Virginia-Maryland border following the east-west divide boundary on the Eastern Shore of Virginia, west along the Virginia-Maryland border, to the Virginia Coast, (Latitude 37°53'23" North; Longitude 76°14'25" West) and south following the Virginia Coast to Old Point Comfort Tower (previously described), unless otherwise designated in this chapter.

2a	III		Free flowing portions of streams lying on the Eastern Shore of Virginia west of the east-west divide boundary unless otherwise designated in this chapter.
2b	III		Drummonds Millpond including Coards Branch.
2c	III		The Virginia Department of Agriculture experimental station pond and its tributaries.
2d	III		The free flowing streams tributary to the western portion of the Chesapeake Bay lying between the Virginia-Maryland state line and Old Point Comfort.
	VII		Swamp waters in Section 2d
			Briery Swamp and tributaries from the confluence with Dragon Swamp to their headwaters.
			Contrary Swamp from the confluence with Dragon Swamp to its headwaters.
			Mainstem of Crany Creek from its confluence with Fox Mill Run to its headwaters.
			Dragon Run and its tributaries from the confluence with Dragon Swamp to their headwaters.
			Dragon Swamp and tributaries from the head of tidal waters at river mile 4.60 to their headwaters.
			Exol Swamp and tributaries from the confluence with Dragon Swamp to their headwaters.
			Mainstem of Fox Mill Run from the head of tidal waters to its headwaters.
			Holmes Swamp and its tributaries from the confluence with Exol Swamp to their headwaters.
			Northwest Branch Severn River from the head of tidal waters near Severn Hall Lane to its headwaters.
			Timber Branch Swamp and its tributaries from the confluence with Dragon Swamp to their headwaters.
			Yorkers Swamp and its tributaries from the confluence with Dragon Swamp to their headwaters.
			White Marsh and its tributaries form the confluence with Dragon Swamp to their headwaters.
2e	III	PWS	Harwood's Mill Reservoir (in Poquoson River's headwaters - a source of water for the City of Newport News) and its tributaries.
2f	III	PWS	Brick Kiln Creek and its tributaries from Fort Monroe's raw water intake (at the Big Bethel Reservoir) to points 5 miles upstream.
2g	III	PWS	Beaverdam Swamp and its tributaries (including Beaverdam Swamp Reservoir) from the Gloucester County Water System raw water intake to its headwaters.

3	II	a	Chesapeake Bay from Old Point Comfort Tower (Latitude 37°00'00" North; Longitude 76°18'08" West) to Thimble Shoal Light (Latitude 37°00'09" North; Longitude 76°14'04" West) along the south side of Thimble Shoal Channel to Cape Henry Light (Latitude 36°55'06" North; Longitude 76°00'04" West).
3a	II	a,z	Little Creek from its confluence with Chesapeake Bay (Lynnhaven Roads) to end of navigable waters.
3b	II	a	Tidal portions of Lynnhaven watershed from its confluence with the Chesapeake Bay (Lynnhaven Roads) to and including Lynnhaven Bay, Western Branch Lynnhaven River, Eastern Branch Lynnhaven River, Long Creek, Broad Bay and Linkhorn Bay, Thalia Creek and its tributaries to the end of tidal waters. Great Neck Creek and Little Neck Creek from their confluence with Linkhorn Bay and their tidal tributaries. Rainey Gut and Crystal Lake from their confluence with Linkhorn Bay.
3c	III		Free flowing portions of streams in Section 3b, unless otherwise designated in this chapter.
3d	III	PWS	The impoundments on the Little Creek watershed including Little Creek Reservoir, Lake Smith, Lake Whitehurst, Lake Lawson, and Lake Wright.
3e	II		London Bridge Creek from its confluence with the Eastern Branch of Lynnhaven River to the end of tidal waters. Wolfsnare Creek from its confluence with the Eastern Branch Lynnhaven River to the fall line.
3f	III		Free flowing portions of London Bridge Creek and Wolfsnare Creek to the Dam Neck Road Bridge at N36°47'20.00"/W76°04'12.10" (West Neck Creek) and their free flowing tributaries.
3g	III		Lake Joyce and Lake Bradford.

9VAC25-260-530. York River Basin.

SEC.	CLASS	SP. STDS	SECTION DESCRIPTION
1	II	a,aa	York River and the tidal portions of its tributaries from Goodwin Neck and Sandy Point upstream to Thorofare Creek and Little Salem Creek near West Point; Mattaponi River and the tidal portions of its tributaries from Little Salem Creek to the end of tidal waters; Pamunkey River and the tidal portions of its tributaries from Thorofare Creek near West Point to the end of tidal waters.
2	III		Free flowing tributaries of the York River, free flowing tributaries of the Mattaponi River to Clifton and the Pamunkey River to Romancoke, unless otherwise designated in this chapter.
2a	III	PWS	Waller Mill Reservoir and its drainage area above Waller Mill

			dam which serves as a raw water supply for the City of Williamsburg.
2b	III	PWS	Jones Pond (a tributary of Queen Creek near Williamsburg which serves as the raw water supply for Cheatham Annex Naval Station) and its tributaries to points 5 miles upstream.
3	III		Free flowing portions of the Mattaponi and Pamunkey Rivers, free flowing tributaries of the Mattaponi above Clifton, and free flowing tributaries of the Pamunkey above Romancoke, unless otherwise designated in this chapter.
	VII		Swamp Waters in Section 3
			Garnetts Creek and tributaries from the head of tidal waters upstream to include Dickeys Swamp and its tributaries.
			Herring Creek from its headwaters at river mile 17.2 downstream to the confluence with the Mattaponi River and three named tributaries: Dorrell Creek, Fork Bridge Creek and Millpond Creek from their headwaters to their confluence with Herring Creek.
			Hornquarter Creek from its confluence with the Pamunkey River to its headwaters.
			Jacks Creek and tributaries from the head of tidal waters to their headwaters.
			Matadequin Creek and its tributaries, from below an unnamed tributary to Matadequin Creek at river mile 9.93 (between Rt. 350 and Sandy Valley Creek) downstream to its confluence with the Pamunkey River.
			Mattaponi River from its confluence with Maracossic Creek at river mile 57.17 to the head of tidal waters.
			Mechumps Creek from the confluence with Slayden Creek to the Pamunkey River, Slayden Creek and its tributaries to their headwaters, and Campbell Creek from the unnamed tributary at river mile 3.86 downstream to the confluence with Mechumps Creek.
			Mehixen Creek and its tributaries from its confluence with the Pamunkey River to their headwaters.
			Monquin (Moncuin) Creek and its tributaries from the head of tidal waters to their headwaters.
			Reedy Creek from its headwaters to its confluence with Reedy Millpond at river mile 1.06.
			Totopotomoy Creek from its confluence with the Pamunkey River to its headwaters.
3a	III	PWS	South Anna River and its tributaries from Ashland's raw water intake to a point 5 miles upstream.
3b	III	PWS	Northeast Creek and its tributaries from the Louisa County

			Water Authority's impoundment dam (approximately 1/8 mile upstream of Route 33) to their headwaters.
3c	III		South Anna River from Route 15 upstream to a point 1.5 miles below the effluent from the Gordonsville Sewage Treatment Plant.
3d	III	PWS	Ni River and its tributaries from Spotsylvania's raw water intake near Route 627 to their headwaters.
3e	III	PWS	The North Anna River and its tributaries from Hanover County's raw water intake near Doswell (approximately 1/2 mile upstream from State Route 30) to points 5 miles upstream.
3f	III	PWS	Stevens Mill Run from the Lake Caroline water impoundment, and other tributaries into the impoundment upstream to their headwaters.

9VAC25-260-540. New River Basin.

SEC.	CLASS	SP. STDS	SECTION DESCRIPTION
1	IV	u	New River and its tributaries, unless otherwise designated in this chapter, from the Virginia-West Virginia state line to the Montgomery-Giles County line.
	V		**Stockable Trout Waters in Section 1**
	***		Laurel Creek (a tributary to Wolf Creek in Bland County) from Rocky Gap to the Route 613 bridge one mile west of the junction of Routes 613 and 21.
	viii		Laurel Creek (Bland County) from its confluence with Hunting Camp Creek 3.2 miles upstream.
	viii		Little Wolf Creek (Bland County) from its confluence with Laurel Creek 2.6 miles upstream.
	v		Sinking Creek from 5.1 miles above its confluence with the New River 10.8 miles upstream (near the Route 778 crossing).
	vi		Sinking Creek from the Route 778 crossing to the Route 628 crossing.
	vi		Spur Branch from its confluence with Little Walker Creek to its headwaters.
	v		Walker Creek from the Route 52 bridge to its headwaters.
	***		Wolf Creek (Bland County) from Grapefield to its headwaters.
	VI		**Natural Trout Waters in Section 1**
	ii		Bear Spring Branch from its confluence with the New River upstream including all named and unnamed tributaries.
	iii		Clear Fork (Bland County) from river mile 8.5 upstream including all named and unnamed tributaries.

ii	Cove Creek (Tazewell County) from its confluence with Clear Fork upstream including all named and unnamed tributaries.
ii	Cox Branch from its confluence with Clear Fork to Tazewell's raw water intake (river mile 1.6).
iii	Ding Branch from its confluence with Nobusiness Creek upstream including all named and unnamed tributaries.
ii	Dry Fork (Bland County) from 4.8 miles above its confluence with Laurel Creek upstream including all named and unnamed tributaries.
ii	East Fork Cove Creek (Tazewell County) from its confluence with Cove Creek upstream including all named and unnamed tributaries.
	Hunting Camp Creek from its confluence with Wolf Creek upstream including all named and unnamed tributaries.
***	Hunting Camp Creek from its confluence with Wolf Creek 8.9 miles upstream.
iii	Hunting Camp Creek from 8.9 miles above its confluence with Wolf Creek 3 miles upstream.
ii	Laurel Creek (tributary to Wolf Creek in Bland County) from Camp Laurel in the vicinity of Laurel Fork Church, upstream including all named and unnamed tributaries.
ii	Laurel Creek from a point 0.7 mile from its confluence with Sinking Creek upstream including all named and unnamed tributaries.
ii	Little Creek (Tazewell County) from 1.5 miles above its confluence with Wolf Creek above the Tazewell County Sportsmen's Club Lake upstream including all named and unnamed tributaries.
ii	Mercy Branch from its confluence with Mill Creek upstream including all named and unnamed tributaries.
ii	Mill Creek from the Narrows Town line upstream including all named and unnamed tributaries.
ii	Mudley Branch from its confluence with the West Fork Cove Creek upstream including all named and unnamed tributaries.
	Nobusiness Creek from its confluence with Kimberling Creek upstream including all named and unnamed tributaries.
***	(Nobusiness Creek from its confluence with Kimberling Creek 4.7 miles upstream.)
iii	(Nobusiness Creek from 4.7 miles above its confluence with Kimberling Creek upstream including all named and unnamed tributaries.)
ii	Oneida Branch from its confluence with the West Fork Cove Creek upstream including all named and unnamed tributaries.
iii	Panther Den Branch from its confluence with Nobusiness Creek

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			upstream including all named and unnamed tributaries.
	ii		Piney Creek from its confluence with the New River upstream including all named and unnamed tributaries.
	ii		Wabash Creek from its confluence with Walker Creek upstream including all named and unnamed tributaries.
	ii		West Fork Cove Creek from its confluence with Cove Creek upstream including all named and unnamed tributaries.
1a			(Deleted)
1b	IV	u	Wolf Creek and its tributaries in Virginia from its confluence with Mill Creek upstream to the Giles-Bland County line.
1c			(Deleted)
1d	IV	u	Stony Creek and its tributaries, unless otherwise designated in this chapter, from its confluence with the New River upstream to its headwaters, and Little Stony Creek and its tributaries from its confluence with the New River to its headwaters.
	V		**Stockable Trout Waters in Section 1d**
	vi		Stony Creek (Giles County) from its confluence with the New River to its confluence with Laurel Branch.
	VI		**Natural Trout Waters in Section 1d**
	iii		Dismal Branch from its confluence with Stony Creek upstream including all named and unnamed tributaries.
	ii		Dixon Branch from its confluence with North Fork Stony Creek upstream including all named and unnamed tributaries.
	ii		Hemlock Branch from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
	ii		Laurel Branch from its confluence with Stony Creek upstream including all named and unnamed tributaries.
	ii		Laurel Creek from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
	ii		Little Stony Creek from its confluence with the New River upstream including all named and unnamed tributaries.
	ii		Maple Flats Branch from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
	ii		Meredith Branch from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
	iii		Nettle Hollow from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
	ii		North Fork Stony Creek from its confluence with Stony Creek upstream including all named and unnamed tributaries.
	iii		Pine Swamp Branch from its confluence with Stony Creek upstream including all named and unnamed tributaries.

	ii		Pond Drain from its confluence with Little Stony Creek upstream including all named and unnamed tributaries.
	iii		Stony Creek (Giles County) from the confluence of Laurel Branch at Olean upstream including all named and unnamed tributaries.
	ii		White Rock Branch from its confluence with Stony Creek upstream including all named and unnamed tributaries.
	ii		Wildcat Hollow from its confluence with Stony Creek upstream including all named and unnamed tributaries.
1e	IV	PWS,u	Kimberling Creek and its tributaries from Bland Correctional Farm's raw water intake to points 5 miles upstream.
	VI	PWS	**Natural Trout Waters in Section 1e**
	iii		Dismal Creek from its confluence with Kimberling Creek upstream including all named and unnamed tributaries.
	iii		Pearis Thompson Branch from its confluence with Dismal Creek upstream including all named and unnamed tributaries.
	iii		Standrock Branch from its confluence with Dismal Creek upstream including all named and unnamed tributaries.
1f			(Deleted)
1g	IV	u	Bluestone River and its tributaries, unless otherwise designated in this chapter, from the Virginia-West Virginia state line upstream to their headwaters.
1h	IV	PWS,u	Bluestone River and its tributaries from Bluefield's raw water intake upstream to its headwaters.
	VI	PWS	**Natural Trout Waters in Section 1h**
	iii		Bluestone River from a point adjacent to the Route 650/460 intersection to a point 5.7 miles upstream.
1i	IV	PWS	Big Spring Branch from the Town of Pocahontas' intake, from the Virginia-West Virginia state line, including the entire watershed in Abbs Valley (the Town of Pocahontas' intake is located in West Virginia near the intersection of West Virginia State Route 102 and Rye Road.
1j			(Deleted)
1k	IV	PWS	Walker Creek and its tributaries from the Wythe-Bland Water and Sewer Authority's raw water intake (for Bland) to points 5 miles upstream.
1l	VI ii	PWS	Cox Branch and its tributaries from Tazewell's raw water intake at the Tazewell Reservoir (river mile 1.6) to headwaters.
2	IV	v, NEW-5	New River and its tributaries, unless otherwise designated in this chapter, from the Montgomery-Giles County line upstream to the Virginia-North Carolina state line (to include Peach Bottom Creek from its confluence with the New River to the mouth of Little Peach Bottom Creek).

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V	**Stockable Trout Waters in Section 2**
v	Beaverdam Creek from its confluence with the Little River to its headwaters.
v	Big Indian Creek from its confluence with the Little River to a point 7.4 miles upstream.
vi	Boyd Spring Run from its confluence with the New River to its headwaters.
***	Brush Creek from the first bridge on Route 617 south of the junction of Routes 617 and 601 to the Floyd County line.
vi	Camp Creek from its confluence with the Little River to its headwaters.
vi	Cove Creek (Wythe County) from Route 77, 8.1 miles above its confluence with Reed Creek, 10.5 miles upstream.
	Dodd Creek from its confluence with the West Fork Little River to its headwaters.
***	Dodd Creek from its confluence with the West Fork Little River 4 miles upstream.
vi	Dodd Creek from 4 miles above its confluence with the West Fork Little River to its headwaters.
vi	East Fork Stony Fork from its confluence with Stony Fork 4 miles upstream.
***	Elk Creek from its confluence with Knob Fork Creek to the junction of State Routes 611 and 662.
vi	Gullion Fork from its confluence with Reed Creek 3.3 miles upstream.
vi	Little Brush Creek from its confluence with Brush Creek 1.9 miles upstream.
vi	Lost Bent Creek from its confluence with the Little River to its headwaters.
vi	Middle Creek from its confluence with Little River to its headwaters.
vi	Middle Fox Creek from its confluence with Fox Creek 4.1 miles upstream.
vi	Mill Creek (Wythe County) from its confluence with the New River 3.7 miles upstream.
v	North Fork Greasy Creek from its confluence with Greasy Creek to its headwaters.
vi	Oldfield Creek from its confluence with the Little River to its headwaters.
vi	Peach Bottom Creek from the mouth of Little Peach Bottom Creek to its headwaters.

vi	Pine Branch from its confluence with the Little River to its headwaters.
vi	Pine Creek (Carroll County) from its confluence with Big Reed Island Creek to its headwaters.
vi	Piney Fork from its confluence with Greasy Creek to its headwaters.
vi	Poor Branch from its confluence with the New River to its headwaters.
vi	Poverty Creek (Montgomery County) from its confluence with Toms Creek to its headwaters.
vi	Reed Creek (Wythe County) within the Jefferson National Forest from 57 miles above its confluence with the New River 6.8 miles upstream, unless otherwise designated in this chapter.
vi	Shady Branch from its confluence with Greasy Creek to its headwaters.
vi	Shorts Creek from 6.2 miles above its confluence with the New River in the vicinity of Route 747, 3 miles upstream.
vi	South Fork Reed Creek from river mile 6.8 (at Route 666 below Groseclose) 11.9 miles upstream.
vi	St. Lukes Fork from its confluence with Cove Creek 1.4 miles upstream.
vi	Stony Fork (Wythe County) from 1.9 miles above its confluence with Reed Creek at the intersection of Routes 600, 682, and 21/52 at Favonia 5.7 miles upstream.
***	Toms Creek from its confluence with the New River to its headwaters.
vi	West Fork Big Indian Creek from its confluence with Big Indian Creek to its headwaters.
vi	Wolf Branch from its confluence with Poor Branch 1.2 miles upstream.
VI	**Natural Trout Waters in Section 2**
ii	Baker Branch from its confluence with Cabin Creek upstream including all named and unnamed tributaries.
ii	Baldwin Branch from 0.2 mile above its confluence with Big Horse Creek at the Grayson County - Ashe County state line upstream including all named and unnamed tributaries.
ii	Bear Creek (Carroll County) from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
iii	Beaver Creek from its confluence with the Little River upstream including all named and unnamed tributaries.

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iii	Beaverdam Creek (Carroll County) from its confluence with Crooked Creek upstream including all named and unnamed tributaries.
ii	Big Branch from its confluence with Greasy Creek upstream including all named and unnamed tributaries.
iii	Big Horse Creek from 12.8 miles above its confluence with the North Fork New River (above the state line below Whitetop) upstream including all named and unnamed tributaries.
ii	Big Indian Creek from a point 7.4 miles upstream of its confluence with the Little River upstream including all named and unnamed tributaries.
ii	Big Laurel Creek from its confluence with the Little River upstream including all named and unnamed tributaries.
iii	Big Laurel Creek from its confluence with Pine Creek upstream including all named and unnamed tributaries.
iii	Big Reed Island Creek from Route 221 upstream including all named and unnamed tributaries.
iii	Big Run from its confluence with the Little River upstream including all named and unnamed tributaries.
	Big Wilson Creek from its confluence with the New River upstream including all named and unnamed tributaries.
***	Big Wilson Creek from its confluence with the New River 8.8 miles upstream.
ii	Big Wilson Creek from 8.8 miles above its confluence with the New River 6.6 miles upstream.
iii	Blue Spring Creek from its confluence with Cripple Creek upstream including all named and unnamed tributaries.
ii	Boothe Creek from its confluence with the Little River upstream including all named and unnamed tributaries.
ii	Bournes Branch from its confluence with Brush Creek upstream including all named and unnamed tributaries.
iii	Brannon Branch from its confluence with Burks Fork upstream including all named and unnamed tributaries.
ii	Brier Run from its confluence with Big Wilson Creek upstream including all named and unnamed tributaries.
ii	Buffalo Branch from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
iii	Burgess Creek from its confluence with Big Horse Creek upstream including all named and unnamed tributaries.
iii	Burks Fork from the Floyd-Carroll County line upstream including all named and unnamed tributaries.

ii	Byars Creek from its confluence with Whitetop Creek upstream including all named and unnamed tributaries.
	Cabin Creek from its confluence with Helton Creek upstream including all named and unnamed tributaries.
ii	Cabin Creek from its confluence with Helton Creek 3.2 miles upstream.
i	Cabin Creek from 3.2 miles above its confluence with Helton Creek upstream including all named and unnamed tributaries.
ii	Cherry Creek from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
ii	Chisholm Creek from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
iv	Crigger Creek from its confluence with Cripple Creek upstream including all named and unnamed tributaries.
***	Cripple Creek from the junction of the stream and U. S. Route 21 in Wythe County upstream including all named and unnamed tributaries.
iii	Crooked Creek (Carroll County) from Route 707 to Route 620.
ii	Crooked Creek from Route 620 upstream including all named and unnamed tributaries.
iii	Daniel Branch from its confluence with Crooked Creek upstream including all named and unnamed tributaries.
iii	Dobbins Creek from its confluence with the West Fork Little River upstream including all named and unnamed tributaries.
iv	Dry Creek from 1.9 miles above its confluence with Blue Spring Creek upstream including all named and unnamed tributaries.
iii	Dry Run (Wythe County) from its confluence with Cripple Creek upstream including all named and unnamed tributaries.
iii	Earls Branch from its confluence with Beaver Creek upstream including all named and unnamed tributaries.
iii	East Fork Crooked Creek from its confluence with Crooked Creek upstream including all named and unnamed tributaries.
ii	East Fork Dry Run from its confluence with Dry Run upstream including all named and unnamed tributaries.
ii	East Prong Furnace Creek from its confluence with Furnace Creek upstream including all named and unnamed tributaries.
ii	Elkhorn Creek from its confluence with Crooked Creek upstream including all named and unnamed tributaries.
ii	Fox Creek from junction of the Creek and Route 734 upstream including all named and unnamed tributaries.
iii	Francis Mill Creek from its confluence with Cripple Creek

	upstream including all named and unnamed tributaries.
ii	Furnace Creek from its confluence with the West Fork Little River upstream including all named and unnamed tributaries.
***	Glade Creek (Carroll County) from its confluence with Crooked Creek upstream including all named and unnamed tributaries.
iii	Grassy Creek (Carroll County) from its confluence with Big Reed Island Creek at Route 641, upstream including all named and unnamed tributaries.
vi**	Grassy Creek (Carroll County) from its confluence with Little Reed Island Creek at Route 769, upstream including all named and unnamed tributaries.
iii	Greasy Creek from the Floyd-Carroll County line upstream including all named and unnamed tributaries.
iii	Greens Creek from its confluence with Stone Mountain Creek upstream including all named and unnamed tributaries.
iii	Guffey Creek from its confluence with Fox Creek upstream including all named and unnamed tributaries.
ii	Helton Creek from the Virginia-North Carolina state line upstream including all named and unnamed tributaries.
ii	Howell Creek from its confluence with the West Fork Little River upstream including all named and unnamed tributaries.
ii	Jerry Creek (Grayson County) from its confluence with Middle Fox Creek upstream including all named and unnamed tributaries.
iii	Jones Creek (Wythe County) from its confluence with Kinser Creek upstream including all named and unnamed tributaries.
ii	Killinger Creek from its confluence with Cripple Creek and White Rock Creek upstream including all named and unnamed tributaries.
iii	Kinser Creek from 0.4 mile above its confluence with Crigger Creek above the National Forest Boundary at Groseclose Chapel upstream including all named and unnamed tributaries.
iii	Laurel Branch (Carroll County) from its confluence with Staunton Branch upstream including all named and unnamed tributaries.
iii	Laurel Creek (Grayson County) from its confluence with Fox Creek upstream including all named and unnamed tributaries.
ii	Laurel Fork from the Floyd-Carroll County line upstream including all named and unnamed tributaries.
iii	Laurel Fork (Carroll County) from its confluence with Big Reed Island Creek to the Floyd-Carroll County line.
i	Lewis Fork from its confluence with Fox Creek upstream including all named and unnamed tributaries.

iii	Little Cranberry Creek from its confluence with Crooked Creek upstream including all named and unnamed tributaries.
ii	Little Helton Creek from the Grayson County-Ashe County state line upstream including all named and unnamed tributaries.
***	Little Reed Island Creek from the junction of the stream and State Routes 782 and 772 upstream including all named and unnamed tributaries, unless otherwise designated in this chapter.
***	Little River from its junction with Route 706 upstream including all named and unnamed tributaries.
ii	Little Snake Creek from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
ii	Little Wilson Creek from its confluence with Wilson Creek (at Route 16 at Volney) upstream including all named and unnamed tributaries.
ii	Long Mountain Creek from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
iii	Meadow Creek (Floyd County) from its confluence with the Little River upstream including all named and unnamed tributaries.
iii	Meadow View Run from its confluence with Burks Fork upstream including all named and unnamed tributaries.
iii	Middle Creek from its confluence with Crigger Creek upstream including all named and unnamed tributaries.
ii	Middle Fork Helton Creek from its confluence with Helton Creek 2.2 miles upstream.
i	Middle Fork Helton Creek from 2.2 miles above its confluence with Helton Creek upstream including all named and unnamed tributaries.
iii	Middle Fox Creek from 4.1 miles above its confluence with Fox Creek upstream including all named and unnamed tributaries.
iii	Mill Creek (Carroll County) from its confluence with Little Reed Island Creek upstream including all named and unnamed tributaries.
ii	Mill Creek (Grayson County) from its confluence with Fox Creek upstream including all named and unnamed tributaries.
iii	Mira Fork from its confluence with Greasy Creek upstream including all named and unnamed tributaries.
ii	North Branch Elk Creek from its confluence with Elk Creek upstream including all named and unnamed tributaries.
iii	North Prong Buckhorn Creek from its confluence with Buckhorn Creek upstream including all named and unnamed tributaries.
ii	Oldfield Creek from its confluence with Laurel Fork upstream including all named and unnamed tributaries.

ii	Opossum Creek from its confluence with Fox Creek upstream including all named and unnamed tributaries.
iii	Payne Creek from its confluence with the Little River upstream including all named and unnamed tributaries.
iii	Peak Creek from 19 miles above its confluence with the New River above the Gatewood Reservoir upstream including all named and unnamed tributaries.
iii	Pine Creek (Carroll County) from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
iii	Pine Creek (Floyd County) from its confluence with Little River upstream including all named and unnamed tributaries.
iii	Pipestem Branch from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
i	Quebec Branch from its confluence with Big Wilson Creek upstream including all named and unnamed tributaries.
iv	Raccoon Branch from its confluence with White Rock Creek upstream including all named and unnamed tributaries.
***	Reed Creek (Wythe County) from 5 miles above Wytheville's raw water intake upstream including all named and unnamed tributaries.
ii	Ripshin Creek from its confluence with Laurel Creek upstream including all named and unnamed tributaries.
iii	Road Creek (Carroll County) from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
ii	Roads Creek (Carroll County) from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
iv	Rock Creek from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
iii	Silverleaf Branch from its confluence with the Little River upstream including all named and unnamed tributaries.
iii	Snake Creek from Route 670 (3.2 miles above its confluence with Big Reed Island Creek) upstream including all named and unnamed tributaries.
ii	Solomon Branch from its confluence with Fox Creek upstream including all named and unnamed tributaries.
vi**	South Branch Elk Creek from its confluence with Elk Creek upstream including all named and unnamed tributaries.
iii	Spurlock Creek from its confluence with the West Fork Little River upstream including all named and unnamed tributaries.
iii	Staunton Branch from its confluence with Crooked Creek

	upstream including all named and unnamed tributaries.
iii	Stone Mountain Creek from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
iii	Straight Branch (Carroll County) from its confluence with Greens Creek upstream including all named and unnamed tributaries.
ii	Sulphur Spring Branch from its confluence with Big Reed Island Creek upstream including all named and unnamed tributaries.
iii	Tory Creek from its confluence with Laurel Fork upstream including all named and unnamed tributaries.
iii	Tract Fork from the confluence of Fortnerfield Branch upstream including all named and unnamed tributaries.
ii	Trout Branch from its confluence with Little Reed Island creek upstream including all named and unnamed tributaries.
iii	Turkey Fork from 2.6 miles above its confluence with Elk Creek upstream including all named and unnamed tributaries.
ii	Venrick Run from its confluence with Reed Creek upstream including all named and unnamed tributaries.
iii	West Fork Comers Rock Branch from its confluence with Comers Rock Branch upstream including all named and unnamed tributaries.
iii	West Fork Dodd Creek from its confluence with Dodd Creek upstream including all named and unnamed tributaries.
iii	West Fork Dry Run from its confluence with Dry Run 2 miles upstream.
iii	West Fork Little Reed Island Creek (Carroll County) from its confluence with Little Reed Island Creek upstream including all named and unnamed tributaries.
***	West Fork Little River from its confluence with Little River upstream including all named and unnamed tributaries.
iii	West Prong Furnace Creek from its confluence with Furnace Creek upstream including all named and unnamed tributaries.
	White Rock Creek from its confluence with Cripple Creek upstream including all named and unnamed tributaries.
***	White Rock Creek from its confluence with Cripple Creek 1.9 miles upstream.
iv	White Rock Creek from 1.9 miles above its confluence with Cripple Creek upstream including all named and unnamed tributaries.
ii	Whitetop Creek from its confluence with Big Horse Creek upstream including all named and unnamed tributaries.
i	Wilburn Branch from its confluence with Big Wilson Creek upstream including all named and unnamed tributaries.

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2a	IV	PWS,v	New River from Radford Army Ammunition Plant's raw water intake (that intake which is the further downstream), upstream to a point 5 miles above the ~~Blacksburg- Christiansburg, V.P.I.~~ NRV Water Authority's raw water intake and including tributaries in this area to points 5 miles above the respective raw water intakes.
2b	IV	PWS,v	New River from Radford's raw water intake upstream to Claytor Dam and including tributaries to points 5 miles above the intake.
2c	IV	v, NEW-4	New River and its tributaries, except Peak Creek above Interstate Route 81, from Claytor Dam to Big Reed Island Creek (Claytor Lake).
	V		**Stockable Trout Waters in Section 2c**
	vi		Chimney Branch from its confluence with Big Macks Creek to its headwaters.
	vi		White Oak Camp Branch from its confluence with Chimney Branch to its headwaters.
	VI		**Natural Trout Waters in Section 2c**
	ii		Bark Camp Branch from its confluence with Big Macks Creek upstream including all named and unnamed tributaries.
	ii		Big Macks Creek from Powhatan Camp upstream including all named and unnamed tributaries.
	iii		Little Macks Creek from its confluence with Big Macks Creek upstream including all named and unnamed tributaries.
	ii		Puncheoncamp Branch from its confluence with Big Macks Creek upstream including all named and unnamed tributaries.
2d	IV	PWS,v,NEW-5	Peak Creek and its tributaries from Pulaski's raw water intake upstream, including Hogan Branch to its headwaters and Gatewood Reservoir.
	V		**Stockable Trout Waters in Section 2d**
	***		(West Fork) Peak Creek from the Forest Service Boundary to its headwaters.
2e			(Deleted)
2f	IV	PWS,v	Little Reed Island Creek and its tributaries from Hillsville's upstream raw water intake near Cranberry Creek to points 5 miles above Hillsville's upstream raw water intake, including the entire watershed of the East Fork Little Reed Island Creek.
	VI	PWS	**Natural Trout Waters in Section 2f**
	iii		East Fork Little Reed Island Creek from its confluence with West Fork Little Reed Island Creek upstream including all named and unnamed tributaries.
	***		Little Reed Island Creek from Hillsville's upstream raw water intake to a point 5 miles upstream.

	Iii		Mine Branch from its confluence with the East Fork Little Reed Island Creek 2 miles upstream.
2g	IV	PWS,v	Reed Creek and its tributaries from Wytheville's raw water intake to points 5 miles upstream.
	VI	PWS,v	**Natural Trout Waters in Section 2g**
	***		Reed Creek from the western town limits of Wytheville to 5 miles upstream.
2h	IV	PWS,v	Chestnut Creek and its tributaries from Galax's raw water intake upstream to their headwaters or to the Virginia-North Carolina state line.
	VI	PWS	**Natural Trout Waters in Section 2h**
	***		Coal Creek from its confluence with Chestnut Creek upstream including all named and unnamed tributaries.
	ii		East Fork Chestnut Creek (Grayson County) from its confluence with Chestnut Creek upstream including all named and unnamed tributaries.
	iii		Hanks Branch from its confluence with the East Fork Chestnut Creek upstream including all named and unnamed tributaries.
	iii		Linard Creek from its confluence with Hanks Branch upstream including all named and unnamed tributaries.
2i	IV		Fries Reservoir section of the New River from river mile 141.36 to 144.29.
2j	IV	PWS	Eagle Bottom Creek from Fries' raw water intake upstream to its headwaters.
2k	IV		~~Stuart Reservoir section of the New River.~~ New River from Stuart Dam at 81°18'40"W / 36°36'08"N, upstream 2.29 miles.
2l	IV	PWS	New River and its tributaries inclusive of the Wythe County Water Department's Austinville intake near the Route 636 bridge, and the Wythe County Water Department's Ivanhoe intake on Powder Mill Branch just upstream of the Wythe/Carroll County line to points 5 miles above the intakes.
	V	PWS	**Stockable Trout Waters in Section 2l**
	vi		Powder Mill Branch (from 0.6 mile above its confluence with the New River) 2.1 miles upstream.
2m	IV	PWS, NEW-4,5	New River (Claytor Lake) from the Klopman Mills raw water intake to the Pulaski County Public Service Authority's raw water intake and tributaries to points 5 miles upstream of each intake.
2n			(Deleted)