



US Army Corps
of Engineers ®

DRAFT ENVIRONMENTAL ASSESSMENT

BLUESTONE LAKE WATER CONTROL MANUAL INITIAL DEVIATION



Bluestone Lake

FEBRUARY 2016
U.S. ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT
HUNTINGTON, WEST VIRGINIA

FINDING OF NO SIGNIFICANT IMPACT
BLUESTONE LAKE WATER CONTROL MANUAL INITIAL DEVIATION

1. Members of my staff have conducted an Environmental Assessment, in the overall public interest, concerning a deviation to the Bluestone Lake Water Control Manual. The purpose of the proposed action is to ensure Bluestone Lake is operated in a manner reducing the likelihood of dam failure, loss of life, and catastrophic damage. Due to hydrologic and structural deficiencies, construction efforts are currently underway to improve the overall structural stability of Bluestone Dam. Until the project can be safely operated to the designed maximum flood control pool (FCP), procedures for operation need to be established to address public safety concerns while minimizing impacts associated with downstream flooding.
2. The possible consequences of the proposed action were studied for environmental, cultural, health and safety, and social well-being effects.
3. The Proposed Action Alternative (PAA) and No Action Alternative (NAA) were the only alternatives carried forward for detailed evaluation. The PAA involves a deviation to the Water Control Manual and establishing a threshold pool and threshold discharge rate until the designed maximum FCP is restored. The threshold pool and discharge are a target elevation and release rate based upon probabilistic structural analysis and would only serve as a guide triggering the need to initiate dam safety actions. Given the potential consequences associated with dam failure, the Corps' responsibility to ensure public safety, the known dam safety concerns, and the requirement under the National Environmental Policy Act (NEPA) to consider reasonable alternatives, the PAA and NAA are very similar measures. The NAA assumes the existing Water Control Manual would remain intact, but emergency deviations would be made as necessary to ensure safe operation and reduce risk associated with dam failure and loss of life in the event of high in-flow/flooding conditions.
4. An evaluation of the PAA and NAA produced the following pertinent conclusions:
 - a. Environmental Considerations. The Huntington District took reasonable measures to assemble and present the known or foreseeable environmental impacts of the proposed and no action alternatives in the Final Environmental Assessment (FEA). The proposed action is not anticipated to result in any significant, adverse impacts on the quality of the natural and human environments as compared to the NAA.
 - b. Social Well-Being Considerations. The proposed action would facilitate operation of Bluestone Lake reducing risk associated with dam failure, loss of life, and catastrophic damage until the designed maximum FCP is restored. While the maximum flood storage of the dam would be temporarily reduced and downstream communities may be subjected to flooding on a more frequent basis, no disproportionate effects on minority or low-income populations are anticipated under the proposed action.

- c. Coordination with Resource Agencies. Pursuant to the Fish and Wildlife Coordination Act of 1958, as amended, coordination with the U.S. Fish and Wildlife Service was conducted. Coordination with the U.S. Environmental Protection Agency, Natural Resource Conservation Service, National Park Service, West Virginia Division of Natural Resources, West Virginia Department of Environmental Protection, West Virginia Division of Homeland Security and Emergency Management, West Virginia State Historic Preservation Office, and West Virginia Department of Transportation was also conducted through the NEPA process. Also, in accordance with the Endangered Species Act of 1970, as amended, no significant adverse impacts to Federally listed species are anticipated under the proposed action.
 - d. Other Pertinent Compliance. The proposed action is in compliance with the National Historic Preservation Act (NHPA Section 106, 36 CFR 800), Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Executive Order 12898 (Environmental Justice).
 - e. Other Public Interest Considerations. There was no significant opposition to the PAA by resource agencies, project stakeholders, or the general public. Comments received during the public review period were included in the FEA. There are no unresolved issues regarding the implementation of the proposed action.
5. I find the deviation to the Bluestone Lake Water Control Manual has been planned in accordance with the current authorization as described in the FEA. The PAA is consistent with national policy, statutes, and administrative directives. This determination is based on thorough analysis and evaluation of the PAA and NAA. In conclusion, I find the proposed Bluestone Lake Water Control Manual Initial Deviation will have no significant, adverse impacts on the quality of the natural and human environments as compared to the NAA. As a result, the preparation of an Environmental Impact Statement (EIS) is not necessary.

Date

Phillip M. Secrist
Colonel, Corps of Engineers
District Engineer

ABSTRACT

Bluestone Dam is located on the New River within the mountainous region of southern West Virginia in Summers County. Due to hydrologic and structural deficiencies, construction efforts are currently underway to improve the overall stability of Bluestone Dam. However, recent structural computations indicate dam failure may occur below the designed maximum flood control pool (FCP) of 1520 feet. Until the project can be safely operated to the designed maximum FCP, procedures for interim operation need to be established using sound professional judgment in order to reduce the risk of dam failure, loss of life, and catastrophic damage while minimizing the impacts of downstream flooding.

The Proposed Action Alternative (PAA) implements a major deviation to the Bluestone Lake Water Control Manual which establishes a threshold pool and threshold discharge rate at a target elevation and target flow. This will only serve as a guide triggering the need for dam safety actions until a full consequence analysis determining the threshold pool and threshold discharge is completed. The full consequence analysis is scheduled to be completed before the end of 2016. The full consequence analysis would be subject to public and policy review and once approved, would be in place until the designed maximum FCP is restored following the completion of the Phase 4 anchoring contract in 2019. Based on probabilistic structural analysis of the Dam's current conditions, the threshold pool is currently estimated to be an elevation of 1510 feet and the threshold discharge is estimated to be 140,000 cubic feet per second (cfs). Operating Bluestone Dam using structural computations and evaluations used to establish the threshold pool and threshold flow in conjunction with observed field conditions reduces the likelihood of dam failure.

The PAA and No Action Alternative (NAA) are the only two alternatives carried forward for detailed evaluation. Given the potential consequences associated with dam failure and the U.S. Army Corps of Engineers responsibility to ensure public safety, the PAA and NAA are very similar measures. However, the PAA provides the benefit of a more formalized plan to help facilitate risk informed decisions regarding project operations when downstream flood control stages are exceeded. Overall, no significant, adverse impacts to the natural or human environment associated with this deviation to the existing Water Control Manual under the PAA, as compared to the NAA, are anticipated.

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1.0 PROJECT DESCRIPTION

1.1 PROJECT BACKGROUND

Bluestone Dam is located on the New River within the mountainous region of southern West Virginia in Summers County, approximately one and a half miles upstream of the City of Hinton and a half mile upstream of the confluence of the New and Greenbrier Rivers. The project began operations in 1949 and controls an approximate 4,600 square mile drainage area upstream of the dam (See Figure 1).

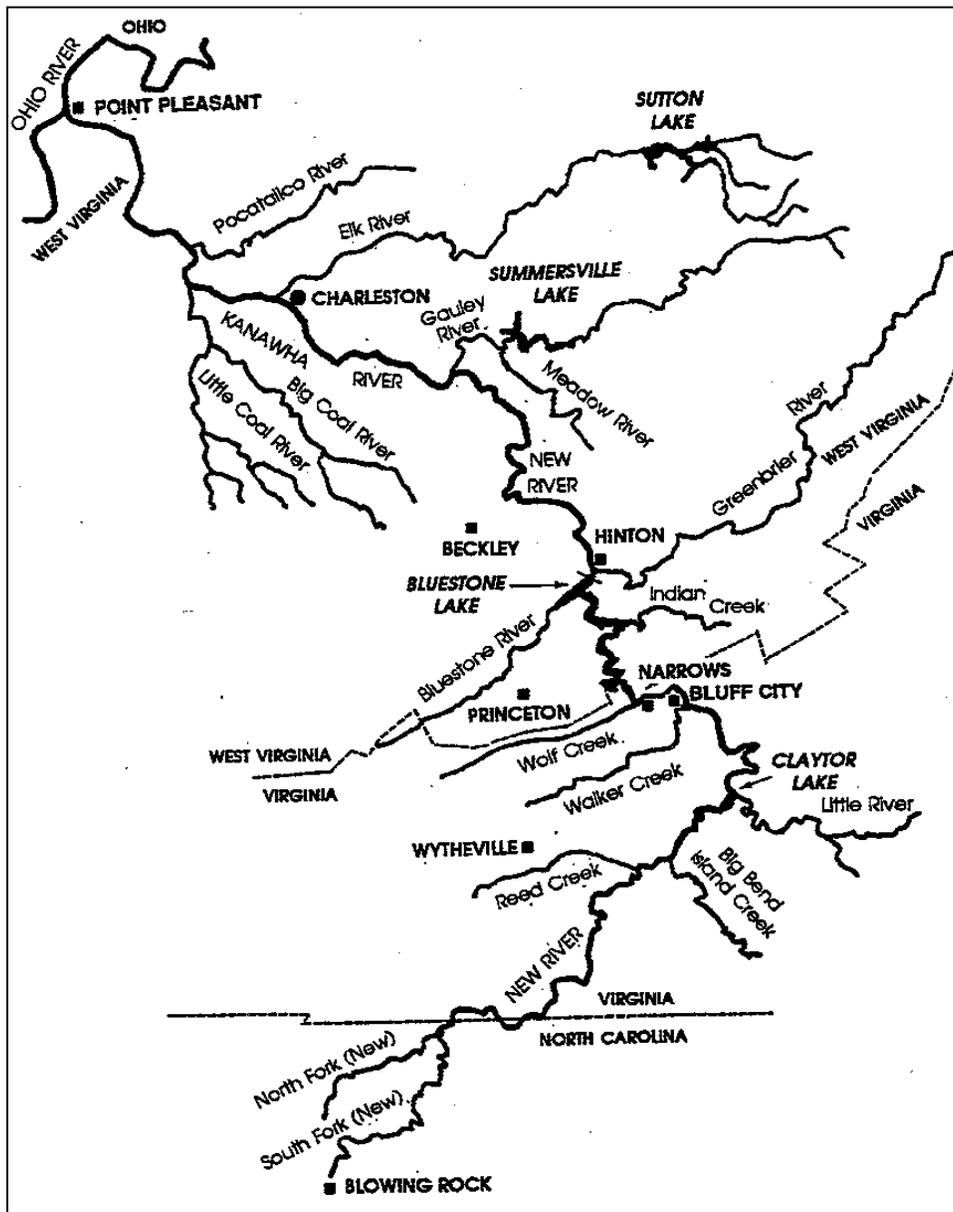


Figure 1: Kanawha River Basin with Bluestone Dam Drainage Area

As seen in Figure 2, Bluestone Dam is a straight, concrete gravity structure with an overall length of 2,060 feet and a maximum height of 165 feet above the streambed. The top of dam elevation is 1535 feet. Discharge capacity of the existing structure is accomplished through gated sluices and a gated auxiliary spillway. The spillway section is 790 feet long with a crest elevation of 1490 feet. Spillway flow is controlled by 21 crest gates. The total design discharge capacity of the dam is 430,000 cubic feet per second (cfs). Normal operation of the reservoir is by 16 gated sluices with a maximum total discharge capacity of 72,000 cfs.



Figure 2: Bluestone Dam

Construction of Bluestone Dam started in January 1942 and continued until March 1944. In 1944, the War Production Board suspended project construction for the duration of World War II. Construction later resumed in January 1946 and was completed in December 1948. While the original plans and authority for Bluestone Dam called for hydropower development, extensive electric power development during wartime resulted in a decision to defer hydropower development at the project and use all available storage for flood control. This lowered the elevation of the lake 80 feet from 1490 feet to 1410 feet, with additional drawdown to 1406 feet for winter pool.

During the planning of Bluestone Dam, a hypothetical flood was created by shifting the center of the July 1916 hurricane storm to the New River drainage basin. This hypothetical flood, which served as the basis for the Spillway Design Flood, had an estimated peak inflow of 430,000 cfs. Current hydrologic analysis indicates that the peak inflow that the dam would have to pass based on current design criteria is significantly higher than the original Spillways design flood. Preliminary estimates show a peak inflow greater than 1,000,000 cfs. In order to address this hydrologic deficiency, a combined Dam Safety Assurance (DSA) Evaluation Report and Environmental Impact Statement (EIS) was prepared and later approved in 1998.

The plan approved under the 1998 decision document was originally formulated to modify Bluestone Dam to safely pass flows of the Probable Maximum Flood (PMF). Primary features of the approved plan include: modification of the six hydropower penstocks to supplement discharge capacity; parapet wall on top of the dam; an additional gravity monolith on the east abutment; a floodgate closure across State Route 20 on the west abutment; removable closures at each end of the spillway; high-strength, multi-strand anchors; mass concrete thrust blocks against the downstream face of the dam; and scour protection downstream of the penstocks. Construction of the approved plan is currently underway and was initiated in September 2000.

In June 2005, a Screening Portfolio Risk Assessment (SPRA) was completed on Bluestone Dam. As a result of this assessment, Bluestone Dam was later classified as a Dam Safety Action Class (DSAC) II project in December 2008. Engineering Regulation (ER) 1110-2-1156 defines a Class II project with “HIGH URGENCY” and characterizes this class as “FAILURE INITIATION FORSEEN” or “VERY HIGH INCREMENTAL RISK”. Class II is assigned to dams where failure could begin during normal operations or be initiated by the consequence of an event.

While construction efforts completed to date, as described below in Section 1.1.1, have improved the structural stability of the dam, confidence in operating to the designed maximum FCP of 1520 feet will not be achieved until the completion of the Phase 4 anchoring contract – dictating the need to operate the dam differently than the existing Water Control Manual in order to reduce the likelihood of dam failure, loss of life, and catastrophic damage.

1.1.1 CONSTRUCTION PHASES

Construction of these structural features identified in the approved 1998 decision document was divided into manageable phases to comply with contracting requirements and annual funding constraints. Construction phases are briefly described as follows:

Phase 1 - Phase 1 of the modification project was awarded in 2000 and completed in 2004. Phase 1 included an access bridge over the stilling basin, a mass concrete thrust block, extension of six penstocks and installation of three penstock bulkheads.

Phase 2 - Phase 2A was awarded in 2004 and completed in 2007. Phase 2A consisted of a highway swing gate closure, an upgraded access road, a fishing pier for mitigation, a right abutment gravity wall and utility line relocation.

Phase 2B was awarded in 2005 and completed in 2011. Phase 2B installed 150 anchors and 3 remaining penstock bulkheads. American Recovery & Reinvestment Act (ARRA) funding helped to install gallery drains and 66 additional anchors.

Phase 3 - Phase 3 was awarded in 2010 and is expected to be complete in 2016. Phase 3 completes an auxiliary stilling basin for the penstocks.

Phase 4 - Phase 4 was awarded in 2012 and is anticipated to be complete in 2019. Phase 4 work included installation of 278 high strength steel strand anchors in the spillway and non-overflow monoliths. The remaining features approved by the 1998 DSA may or may not be implemented depending on the outcome of the Dam Safety Modification Study (DSMS). The DSMS is updating a risk assessment based on new hydrological data and is beginning to formulate alternatives to address failure modes.

1.1.2 PROJECT OPERATION

Bluestone Dam is part of the flood control system for the entire Ohio River Basin as well as of the New and Kanawha River Basins. Regulation of operation procedures for the project are correlated with the operation of the other lakes in the Kanawha River Basin and other Ohio River tributaries to the fullest extent possible while giving due consideration to local concerns and requirements.

During normal operations, flow is controlled through 16 gated sluices in the outlet works of the dam. Outflow is regulated to maintain a summer pool of 1410 feet for recreation and fish and wildlife conservation between the beginning of April and the optimum date to begin drawdown. In the fall, the pool is drawn down to 1406 feet for additional flood control storage. In order to sustain downstream aquatic populations, a minimum discharge of 610 cfs is maintained.

When downstream water levels are projected to increase above established control stages, the project, which is operated in conjunction with Summersville and Sutton Dams, reduces outflow and begins to store flood flows. Operation for Ohio River control is based on retention of flows that would add to crest stages in excess of 45 feet at Point Pleasant, West Virginia. The maximum flows (or stages) that can be maintained at points along the channel below the dam are called control flows (or stages) or regulation channel capacities. Although the project is operated to a defined control flow, the project is officially operated based on downstream control stages as the relationship between stages and corresponding flow rates vary slightly year to year. The control stage below Bluestone Lake is 10.7 feet (89,400 cfs) on the U.S. Geological Survey (USGS) gage at Hinton, West Virginia. The control stage at Kanawha Falls is 22.0 feet (146,000 cfs), and the control stage at Charleston is 36.0 feet (150,000 cfs).

As designed, the project is operated to store flood flows until the forecasted inflow based on rainfall on the ground would result in a pool elevation greater than the designed maximum FCP of 1520 feet. When the FCP is expected to be exceeded, the project is operated to release the projected excess storage above the FCP in a manner that will minimize downstream flooding. Twenty one crest gates are used to make these releases if the sluice gates do not have enough discharge capacity. The maximum design release for the sluice and crest gates is 480,000 cfs at FCP.

1.2 PURPOSE AND NEED

The primary purpose of the proposed action is to formalize a modification to project operations which would reduce risk of failure while permanent rehabilitation of the dam is ongoing. The proposed action would result in a major deviation from the existing Water Control Manual for Bluestone Lake. A Major Deviation is defined as a change to the Water Control Manual which lasts for more than five days or results in a change in the lake elevation by more than two feet. Water Control Manuals provide general guidelines for project operations at U.S. Army Corps of Engineers (Corps) dams and reservoirs.

The need for the deviation to the Water Control Manual stems from hydrologic and structural deficiencies identified during previous studies and investigations in support of the Bluestone DSA Evaluation Report and Environmental Impact Statement (EIS) completed in 1998 as well as more recent analysis. While construction efforts currently underway have improved the overall structural stability of the dam, current structural computations and evaluations indicate dam failure may occur below the designed maximum flood control pool (FCP). Until the project can be safely operated to the designed maximum FCP, deviation to the Bluestone Lake Water Control Manual needs to be established using sound professional judgment in order to reduce the risk of dam failure, loss of life, and catastrophic damage while minimizing the impacts of downstream flooding.

1.3 PROJECT AUTHORITY

Bluestone Dam and Reservoir was authorized by Executive Order 7183 in September 1935 and the Flood Control Acts of 1936 and 1938 for the purposes of flood control, low flow augmentation, and power development. The stated purposes were later expanded to include recreation activities under the Flood Control Act of 1944 and fish and wildlife enhancement under the Fish and Wildlife Coordination Act of 1958. More recently, Section 102(ff) of the Water Resource Development Act (WRDA) of 1992, as amended by Section 357 of WRDA 1996, further modified the original project authorization to address the accumulation and disposal of drift and debris at the project.

2.0 ALTERNATIVE PLAN FORMULATION

The need for a deviation of operations at the Bluestone Dam is based on structural computations and evaluations using guidance provided in Engineering Manual (EM) 1110-2-2100, *Stability Analysis of Concrete Structures*. Based on calculations performed following the completion of the Phase 2B anchoring contract, the Imminent Failure Flood (IFF) – the flood which places the dam at imminent danger of failing – corresponds to an elevation of 1514 feet. The IFF is based on a factor of safety for sliding of 1.0 and represents the elevation at which the loading on the dam causing instability is equal to the strength of materials along potential failure planes resisting instability. Given the designed maximum FCP for Bluestone Dam exceeds the calculated IFF, deviations to the project's Water Control Manual are necessary to reduce the risk associated with dam failure. Consequences associated with dam failure most

notably include loss of life, health and human safety concerns, and catastrophic flood damages – impacting not only physical properties and public infrastructure, but also productive aquatic and terrestrial habitats. The two alternatives considered for implementation are detailed in the following sections.

While additional alternative measures, such as eliminating the seasonal pool (recreation pool) in concert with establishing a pool restriction, for interim operation exist, a more detailed risk-informed analysis evaluating the trade-offs between the potential loss of authorized project benefits and incremental risk reduction is currently being performed. Until this more detailed risk-informed analysis is completed, sound professional judgment was utilized to develop and evaluate alternatives in a timely manner in order to efficiently reduce risk. Once this more detailed, risk-informed full consequence analysis is completed, another deviation to the water control manual will be evaluated including the full array of alternatives and corresponding consequences. The full consequence analysis is currently being conducted and is scheduled to be completed within the next year.

2.1 PROPOSED ACTION ALTERNATIVE (PAA)

The proposed action alternative (PAA) includes an initial deviation to the Water Control Manual while a more detailed, risk-informed consequence analysis is completed. The initial deviation would establish a threshold pool and a threshold discharge rate for flows released from the dam until the project can be safely operated at the designed maximum FCP of 1520 feet. Based on a probabilistic structural analysis of the Dam's current conditions, a threshold pool at an elevation of 1510 feet and the threshold discharge at a flow of 140,000 cubic feet per second (cfs) are proposed.

During normal operations, the project would continue using the 16 gated sluices. A seasonal pool would be maintained at 1410 feet with drawdown to 1406 feet during the winter. When downstream stages are projected to increase above established control stages, the project would be operated to store flood flows until the forecasted inflow would result in a pool elevation greater than 1510 feet. Rainfall on the ground within the drainage area above the dam would serve as the basis for inflow and pool elevation forecasting.

When pool elevations greater than 1510 feet were forecast, the project would likely be operated to release projected excess storage above the 1510 elevation in a manner minimizing downstream flooding. Project releases at these elevations would most likely be controlled by a combination of sluice gates and crest gates. The threshold elevation of 1510 feet is a target elevation and would only serve as a guide triggering the need to initiate dam safety actions. Utilization of storage above this threshold may occur, but would be based on the observed instrumentation readings and performance of the dam as pools approach the threshold elevation. The project would continue to be operated in a manner taking into account all downstream control points discussed in Section 2.2.

The proposed major deviation to the Water Control Manual would be attached as an addendum to the existing Water Control Manual until the detailed, risk-informed, full consequence analysis is completed and that threshold elevation and discharge is evaluated. This initial deviation to the Water Control Manual would remain in place until the full consequence analysis is completed at which time another deviation would be evaluated. The full consequence deviation would remain in place until deficiencies at the dam are corrected and the Water Control Manual is revised accordingly to return to operations as originally designed. The proposed Water Control Manual deviation is subject to policy compliance review and approval by higher Corps authority. Should comments received during policy compliance review require substantial modification to the proposed deviation, the revised document will be re-circulated for public review and comment prior to approval and implementation.

2.2 NO ACTION ALTERNATIVE (NAA)

The No Action Alternative (NAA) does not vary significantly from the PAA considering the Corps responsibility to ensure public safety and the requirement under the National Environmental Policy Act (NEPA) for all alternatives to be reasonable. A reasonable NAA must consider stability of the dam and operations striving to protect human life, infrastructure, and downstream resources. Operating Bluestone Dam as originally designed is not a reasonable alternative given the risks associated with dam failure. As a result, operating the project consistent with the existing Water Control Manual would not be considered the NAA due to known life safety issues.

Under the existing Water Control Manual, deviations to project operations are allowed for emergency situations. While the Water Control Manual may not be updated under the NAA, structural computations, and probabilistic structural computations, would likely guide decisions during flooding conditions. Overall, the NAA assumes the existing Water Control Manual would remain intact, but emergency actions would be taken as necessary to reduce risk associated with dam failure and loss of life. Under both the PAA and NAA, the District has the responsibility to ensure public safety and the District Commander has the ability to determine the best course of action for operating the project in an emergency situation. In short, the primary difference between the NAA and PAA is the PAA provides the benefit of having a formalized approach to more seamlessly guide decisions during flooding conditions.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Bluestone Dam has been in operation for nearly 65 years and has prevented over two billion dollars in flood damages according to the LRH Fiscal Year 2012 Annual Flood Situation Report, which is based upon real dollars. The current pool of record occurred in April 1960 when flood waters reached an elevation of 1506 feet. During this event, crest gates were operated to help pass drift and debris and the maximum outflow of the project was recorded at 66,000 cfs. Based upon the Draft Bluestone Dam Baseline Risk Assessment dated August 2013, the pool of record was equivalent to a 98-year event (0.0102 annual exceedence probability).

Under both the PAA and NAA, structural computations are anticipated to guide decisions regarding project operations during high water events. Project releases at these elevations would most likely be controlled by a combination of sluice and crest gates. The maximum outflow of the 16 sluice gates collectively is approximately 72,000 cfs. The maximum combined flow out of the sluice and crest gates would be restricted to 140,000 cfs.

Releases above 90,000 cfs will result in overbank flow and flooding to downstream communities. In the event conditions at Bluestone Dam warrant high volume releases when a sizable, uncontrolled tributary such as the Greenbrier, New, Gauley, or Kanawha Rivers downstream of the dam is at a high stage, the likelihood of flooding impacts increases. Should downstream control stages be exceeded, localized flood damage would begin to occur. To date, control stages downstream of Bluestone Dam have only been exceeded due to uncontrolled runoff.

The following graph reflects the percent of days a given pool elevation has been exceeded since the project has been in operation. As seen in Figure 3, the duration the pool at Bluestone Dam has exceeded the seasonal pool of 1410 is less than 10 percent.

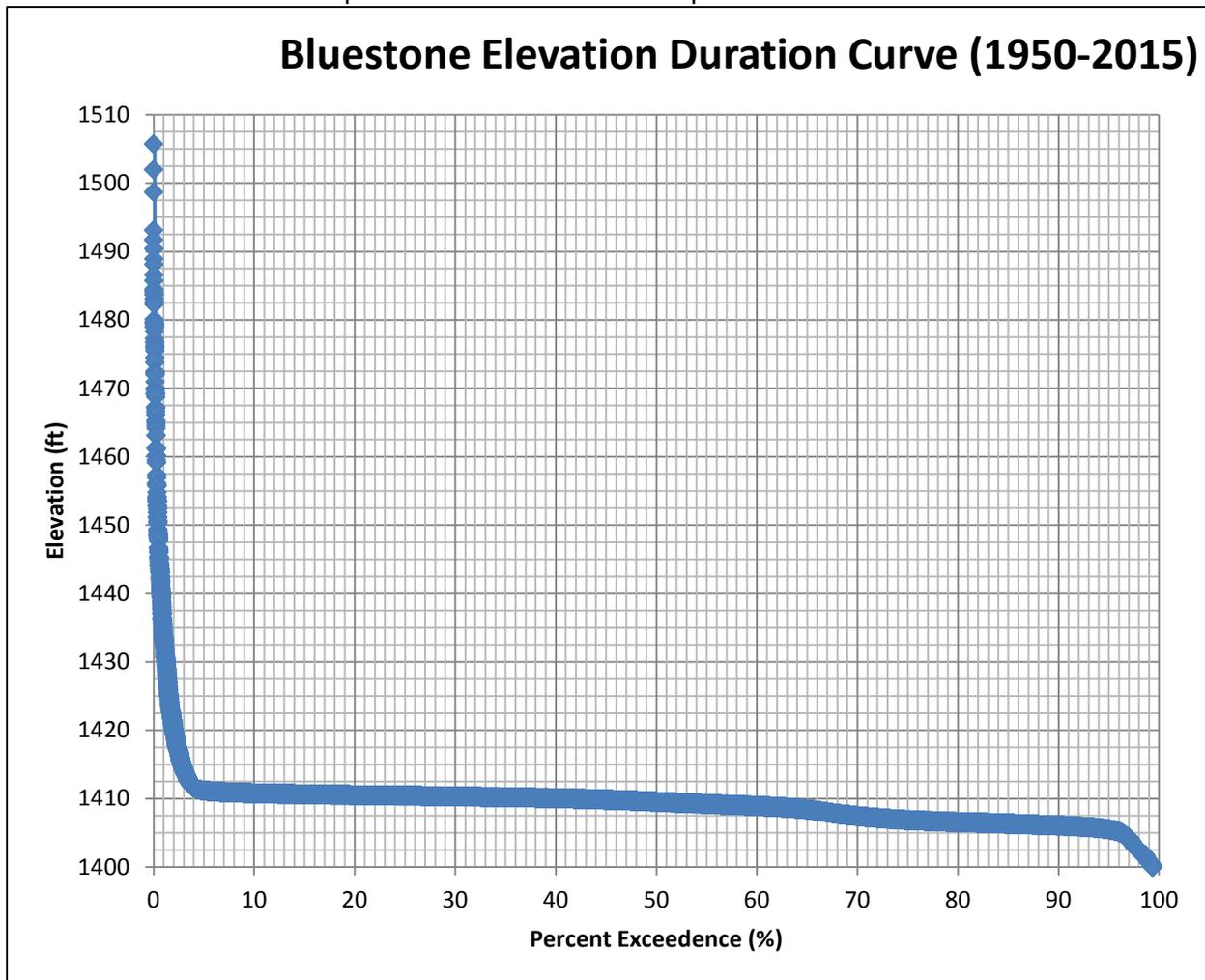


Figure 3: Bluestone Elevation Duration Curve

Modifications and deviations to the Water Control Manual as described under both the PAA and NAA respectively are temporary measures until the full consequence based deviation can be established. Even the full consequence based deviation would be temporary until construction is complete when the project can be safely operated to the designed maximum FCP. The designed maximum FCP is anticipated to be restored following the completion of the Phase 4 anchoring contract in 2020. The Bluestone Dam would continue to be operated in conjunction with Summersville and Sutton Dams to minimize flood damage while taking into account structural computations / evaluations and downstream flow conditions in order to reduce the risk of dam failure.

Dam failure presents a significant threat to public health and human safety – exposing a large population to risk associated with loss of life. In addition, dam failure has the potential to lead to catastrophic flooding of critical infrastructure including wastewater treatment plants throughout the basin and large industrial facilities manufacturing or utilizing hazardous substances along the Kanawha River near the City of Charleston. Both harmful gaseous emissions and widespread water contamination could result from catastrophic flooding. As a result, operating the dam to reduce the risk associated with dam failure is of upmost importance.

Overall, no significant environmental impacts associated with a deviation to the existing Water Control Manual under the PAA as compared to the NAA are anticipated. The following sections briefly describe affected resources and corresponding environmental consequences related to the PAA and NAA.

3.1 HEALTH AND HUMAN SAFETY

While flooding most notably results in physical damage to residential, commercial, and public structures, negative impacts on agricultural lands and crops, and destruction of property contents, flooding more importantly has the ability to threaten public health and human safety. Of primary concern is the probability of injury and risk associated with loss of life during the event and corresponding aftermath. Flood victims may also experience physical and mental stress due to temporary displacement, property damage and destruction, financial burdens, loss of loved ones, and injuries.

While major outbreaks of infectious diseases following flooding conditions are not typical in the United States, floodwaters are commonly contaminated by pollutants such as chemicals or untreated sewage. The most prevalent health impacts resulting from floods affect the gastrointestinal system and are caused by contact with contaminated sources and subsequent ingestion of contaminated food or water. Prolonged rainfall and floods also provide new breeding grounds for mosquitoes and can lead to an increase in the number of mosquito-borne diseases. There is also an increased risk for flood victims to contract upper respiratory diseases due to potential excessive exposure to mold and mildew.

As designed, discharges from Bluestone Dam contributing to potential downstream flooding would not occur until pool elevation 1520 (330-year event or 0.003 annual exceedence probability) when water is released through the crest gates. However, under the PAA and NAA, contributions to downstream flooding conditions have the potential to occur at the threshold pool, which is currently calculated at 1510 (125-year event or 0.008 annual exceedence probability). While localized flooding is anticipated should downstream control stages be exceeded, Bluestone Dam would continue to be operated in a manner to ensure public safety while minimizing flood damages. Therefore, overall impacts to public health and safety are anticipated to be minimal under the PAA as it provides the benefit of a more formalized plan to help facilitate risk informed decisions regarding project operations when downstream control stages are exceeded.

Under the NAA, there would be no formalized approach to help seamlessly guide decisions during flooding conditions which could impact health and safety. These impacts would be minor because it is the Corps responsibility to ensure public safety and determine the best course of action for operating a project in an emergency situation.

3.2 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Bluestone Dam is located within the mountainous region of southern West Virginia in Summers County – approximately one and a half miles upstream of the City of Hinton, which is the county seat. According to the U.S. Census Bureau, the City of Hinton had a predominantly Caucasian population of 2,643 in 2013. Minority populations are notably low throughout the State of West Virginia. In 2014, the State of West Virginia had a population of 1,850,326 with 93.7 percent of residents being Caucasian. Similarly, Summers County’s population of 13,417 was approximately 92.6 percent Caucasian while the population within the City of Hinton was approximately 95 percent Caucasian.

Based on the 2009-2013 American Community Survey, approximately 39 percent of individuals within the City of Hinton live below poverty levels compared to 17.5 percent in the State of West Virginia and 18 percent in Summers County. The median household income within the City of Hinton is \$24,488, which is substantially lower than the median household income of \$41,043 for the entire state and \$33,784 for Summers County.

Significant development along the river does not occur downstream of Hinton until the New and Gauley Rivers converge to form the Kanawha River approximately 65 miles downstream of Bluestone Dam. Several small communities are situated along the Kanawha River with more intensive development starting at the City of Marmet. This development continues to increase as the river approaches the City of Charleston, which is the state capital of West Virginia and the largest population center downstream of Bluestone Dam. The City of Charleston is located approximately 104 miles downstream of Bluestone Dam and 58 miles upstream of the Ohio River. According to the U.S. Census Bureau, the City of Charleston had a population of 50,404 in 2014 with approximately 78.4 percent of this population being Caucasian. The median household income in the City of Charleston is \$48,527 and approximately 18.4 percent of

residents live below poverty levels. A large concentration of industrial infrastructure exists within the Charleston metropolitan area. The chemical industry alone supports approximately 22,500 jobs in Kanawha and Putnam Counties, which represents almost 60 percent of manufacturing jobs in the greater Kanawha Valley. Downstream of the densely populated Charleston area, the Kanawha Valley is comprised mostly of residential and agricultural development until the Kanawha River empties into the Ohio River at Point Pleasant, West Virginia.

Executive Order 12898 directs Federal agencies to identify and address the disproportionately high and adverse human health or environmental effects on minority and low-income populations to the greatest extent practicable and permitted by law. Under both the PAA and NAA, the project would be operated in a manner to reduce risk associated with dam failure while minimizing flood damages. The demographic conditions within communities downstream of Bluestone Dam vary significantly – from large industrial plants in the Kanawha River Valley to low-income housing along the New River. Given the extent and variety of areas and communities downstream of Bluestone Dam that may be subjected to flooding on a more frequent basis, no disproportionate effects on minority or low-income populations are anticipated under either alternative. Therefore, the PAA and NAA meet the directive of EO 12898 by avoiding any disproportionately high adverse human health or environmental effects on minority or low income populations.

3.3 AQUATIC RESOURCES

The New River begins in the Blue Ridge Mountains of North Carolina and continues to flow northward carving the deepest and longest river gorge in the Appalachian Mountains. The New River, which is designated as an American Heritage River, is considered to be the oldest river in North America. The New River along with many streams and bodies of water in the Kanawha River Basin, such as the Bluestone River, a National Wild and Scenic River, contain an abundance of aquatic resources.

The tailwaters stemming from Bluestone Dam to Sandstone Falls are considered one of the most ecologically productive stretches of the New River. According to U.S. Fish and Wildlife Service (USFWS), portions of this stretch of river are classified as Resource Category 1 habitat. Habitats of this nature are considered of high value for evaluation species and are unique and irreplaceable on a national basis. The tailwater area downstream of Bluestone Dam has excellent in-stream and riparian cover with bottom substrate consisting of fractured bedrock, boulders, and cobble riffles. Much of the tailwater productivity is influenced by Bluestone Lake. The eutrophic nature of Bluestone Lake and high plankton concentration allow for the availability of a rich food source downstream of the dam. As a result, the highest concentration of benthic macroinvertebrates, mussels, and fish are located in this area. Diverse populations of fish are located within this area and include rock bass, smallmouth bass, largemouth bass, spotted bass, sunfish, shiners, bigmouth chub, logperch, northern hog sucker, central stoneroller, and darters.

Federally listed mussels have been collected approximately 75 miles downstream of Bluestone Dam in the Kanawha and Elk Rivers. Federally listed mussel species have not been noted to occur on other tributaries to the Kanawha River, such as the New, Gauley, and Coal Rivers. Endangered mussel species in the Kanawha River Basin are briefly described in Table 1 and include the fanshell (*Cyprogenia stegaria*), pink mucket pearly mussel (*Lampsilis abrupta*), sheepnose (*Plethobasus cyphus*), spectaclecase (*Cumberlandia monodonta*), tubercled blossom pearly mussel (*Epioblasma tortulosa*), clubshell (*Pleurobema clava*), northern riffleshell (*Epioblasma torulosa rangiana*), rayed bean (*Villosa fabalis*), and snuffbox (*Epioblasma triquetra*). The diamond darter (*Crystallaria cincotta*), a freshwater fish, has also been observed on the Elk River.

Table 1 – USFWS Descriptions of Federally Listed Endangered Aquatic Species on the Kanawha and Elk Rivers

Fanshell	<i>Cyprogenia stegaria</i>	Medium-sized freshwater mussel with light green or yellow shell with green mottling or rays	Medium to large rivers; Primarily from relatively deep water in gravelly substrate with moderate current	Kanawha
Pink Mucket Pearly Mussel	<i>Lampsilis abrupta</i>	Medium-sized freshwater mussel with a smooth, yellow or yellowish green shell with faint green rays	Medium to large rivers with strong currents; Substrate preferences include sand, gravel, and pockets between rocky ledges in high velocity areas and mud and sand in slower moving waters	Kanawha and Elk
Sheepnose	<i>Plethobasus cyphus</i>	Medium-sized freshwater mussel with a thick, solid, smooth, and light yellow to a dull yellowish brown shell without lines or rays	Larger rivers and streams; Primarily in shallow areas with moderate to swift currents flowing over coarse sand and gravel	Kanawha
Spectaclecase	<i>Cumberlandia monodonta</i>	Large-sized freshwater mussel with an elongated, somewhat curved and somewhat inflated shell	Large rivers in areas sheltered from the main force of the river current; Often clusters in firm mud or sheltered areas, such as beneath rock slabs, between boulders and even under tree roots	Kanawha
Tuberled Blossom Pearly Mussel	<i>Epioblasma tortulosa tortulosa</i>	Medium-sized freshwater mussel, which vary in shape, with yellowish brown shell with green rays	Large rivers, in shallow sand and gravel shoals with rapid current	Kanawha
Clubshell	<i>Pleurobema clava</i>	Small to medium-sized freshwater mussel with a yellow to brown shell with bright green blotchy rays	Medium to small rivers and streams in clean, loose sand and gravel	Elk
Northern Riffleshell	<i>Epioblasma torulosa rangiana</i>	Small to medium-sized freshwater mussel with a brownish yellow to yellowish green shell with fine green rays	Large to small streams in firmly packed sand or gravel	Elk
Rayed bean	<i>Villosa fabalis</i>	Small-sized freshwater mussel with a smooth-textured and green, yellowish-green, or brown shell with numerous dark-green wavy lines shell	Smaller, headwater creeks, but also found in large rivers and wave-washed areas of glacial lakes; Prefers gravel or sand substrates, and is often found in and around roots of aquatic vegetation	Elk
Snuffbox	<i>Epioblasma triquetra</i>	Small to medium-sized freshwater mussel with a yellow, green, or brown shell interrupted with green rays, blotches, or chevron-shaped lines	Small to medium creeks with swift currents; Also found in Lake Erie and some larger rivers; Burrow deep in sand, gravel or cobble substrates	Elk
Diamond darter	<i>Crystallaria cincotta</i>	In the perch family; translucent with silver sides and white belly, yellow-tan on the back with four wide olive colored saddles	Inhabits medium to large warm water streams with moderate current and clean sand to gravel substrate	Elk

While areas downstream of Bluestone Dam may be subjected to flooding on a more frequent basis under both the PAA and NAA, controlled releases from the dam are not anticipated to significantly impact aquatic resources. Flooding is a natural occurrence and can be beneficial to mussel communities – providing a greater food supply and protection from predators. However, large floods can be detrimental and lead to extinction. During high flow events, mussel species can be dislodged and potentially redistributed downstream or buried in sediment. High flow events also have the ability to alter the nature of the river banks and bottom through scour and sediment deposition. Alterations to the river bottom would likely be temporary in nature as aquatic habitats tend to stabilize and gradually return to natural conditions over time. While changing, conditions could temporarily impact mussel beds and mussel reproduction, aquatic species that are mobile, such as fish, would seek areas more suitable to the changing conditions. The threshold discharge of 140,000 cfs would still be within the banks of the Kanawha River (i.e. Kanawha Falls and Charleston, West Virginia). Flows in this range at Hinton, West Virginia located immediately below the dam would exceed bank full conditions at Hinton, West Virginia and the New River would be out of bank by approximately three feet. It is likely some fish would be stranded by overbank flooding. However, floods occur naturally and it is expected the impacts to the aquatic communities would be temporary and be considered minimal.

Although the Elk River is hydrologically connected to the New River through its confluence with the Kanawha River in Charleston, West Virginia, impacts to endangered mussel species and the diamond darter on this stream are anticipated to be negligible. Flows on the Elk River are largely influenced by Sutton Dam, which would continue to be operated in conjunction with Bluestone and Summersville Dams to minimize flood damages. While controlled releases from Bluestone Dam have the potential to elevate water levels and flow velocities on the Kanawha River, consequential flooding along the Elk River would result from backwater. Without a high flow event on the Elk River, the stream composition and aquatic habitat associated with this resource is not anticipated to change significantly. Likewise, impacts to other aquatic species such as fish and the benthic community would be considered negligible.

Overall, no significant difference between the PAA and NAA is anticipated for aquatic species including Federally listed aquatic species. High flow events have the potential to impact aquatic species by temporarily disrupting their habitat and naturally occur in riverine systems. Therefore, the PAA and the NAA may affect, but are not likely to adversely affect the aquatic species due to disruptions during high flow events that are temporary in nature. In addition, the limited threshold discharge would maintain the majority of the downstream areas within the confines of the riverbanks (assuming other tributaries such as the Greenbrier River are not experiencing high flow events). Actions under the PAA would assist in further reducing the likelihood of dam failure which would result in significant impacts.

3.4 TERRESTRIAL RESOURCES

Carving through rugged, mountainous terrain to form deep river valleys, the New River helps create diverse terrestrial habitat supporting a variety of plants and offering refuge to

endangered mammals and rare birds and amphibians. Common mammals within the area include groundhogs, raccoons, opossums, gray and fox squirrels, chipmunks, white-tailed deer, and bats. Beaver, mink and river otter may be seen along the river banks. The area has a diverse bird population including warblers, vireos, thrushes, and hawks. Amphibians such as wood frogs, spring peepers, and red-spotted newts are common in the area. Reptiles within this area include fence lizards, five-lined skinks, black rat snakes, garter snakes, ring snakes, copperheads and eastern box turtles.

While operation of Bluestone Dam has the ability to influence the Kanawha River mainstem and portions of its tributaries, the largest area of impact on terrestrial resources lies along floodplains adjacent to the New and Kanawha Rivers. Counties downstream of Bluestone Dam encompassing portions of either the New or Kanawha Rivers include Summers, Raleigh, Fayette, Kanawha, Putnam, and Mason. According to USFWS, Federally listed plant species supported by terrestrial habit within these counties include running buffalo clover (*Trifolium stoloniferum*) and Virginia spiraea (*Spiraea virginiana*). The Virginia big-eared bat (*Corynorhinus townsendii virginianus*), Northern long-eared (*Myotis septentrionalis*) and Indiana bat (*Myotis sodalis*), Federally listed mammal species are also known to utilize abandoned mine portals and caves within the aforementioned counties. The riparian areas are also where they forage for food and temporary cover. During summer months, the bats generally migrate to wooded areas where they usually roost under loose tree bark on dead or dying trees. The riparian areas provide suitable roost trees during the summer. Table 2 briefly describes Federally listed terrestrial species located or known to potentially occur within Summers, Raleigh, Fayette, Kanawha, Putnam, and Mason Counties.

Table 2 – USFWS Descriptions of Federally Listed Terrestrial Species within Summers, Raleigh, Fayette, Kanawha, Putnam, and Mason Counties

Running Buffalo Clover	<i>Trifolium stoloniferum</i>	Endangered	Perennial species with leaves divided into three leaflets; Produces runners extending from the base of erect stems to the ground; Flower heads are about one-inch wide, white, and grow on stems two to eight inches long; Each flower head has two large opposite leaves below it on the flowering stem; Blooms from late spring to early summer	Partially shaded woodlots, mowed areas, and along streams and trails; Requires periodic disturbance and a somewhat open habitat to successfully flourish; Cannot tolerate full-sun, full-shade, or severe disturbance	Fayette
Virginia spiraea	<i>Spiraea virginiana</i>	Threatened	Perennial shrub with many branches reaching a height of three to ten feet; Young stems are greenish-yellow to dark brown and mature stems are dark gray; Produces yellowish green to pale white flowers; Blooms from May through early June, but flower production is sparse and does not begin until after the first year of establishment	Virginia spiraea occurs along rivers and streams and relies on periodic disturbances, such as high velocity scouring floods, which eliminate competition from trees and other woody vegetation	Summers, Raleigh, and Fayette
Virginia big-eared bat	<i>Corynorhinus townsendii virginianus</i>	Endangered	Medium-sized bat with large ears connecting across the forehead; Weighs less than half of an ounce and is four inches in length from head to toe; Long brown fur with pale brown under parts	Caves at elevations greater than 1,500 feet above sea level	Fayette, Kanawha, Raleigh, and Summers
Northern Long-eared bat	<i>Myotis septentrionalis</i>	Threatened	Medium-sized bat with a body length of 3 to 3.7 inches but a wingspan of 9 to 10 inches; medium to dark brown fur; identified by its long ears	During the winter they hibernate in caves and mines; summer months they roost singly or in colonies underneath bark of both live trees or snags	Summers, Raleigh, Fayette, Kanawha, Putnam, and Mason
Indiana bat	<i>Myotis sodalis</i>	Endangered	Small bat weighing only a quarter of an ounce with a wingspan of 9-11 inches, Closely resembles the little brown bat, but differs in coloration; Fur is dark brown to black	During winter months, hibernates in caves or abandoned mine portals with cool, but stable temperatures; During summer months, migrates to wooded areas where they usually roost under loose tree bark on dead or dying trees	Summers, Raleigh, Fayette, Kanawha, Putnam, and Mason

While areas downstream of Bluestone Dam may be subjected to flooding on a more frequent basis under both the PAA and NAA, under the PAA there would be operational methods formally established for the operation of the dam to reduce the risk of dam failure. The PAA would further assist in the operation of the dam to reduce the risk of dam failure. Flows greater than 90,000 cfs would cause out of bank flooding within the areas immediately below the dam. Out of bank flooding reduces and ultimately diminishes further downstream below the dam. During flooding conditions, species (mammals, amphibians, reptiles, etc.) located within areas of inundation with the ability to relocate may be temporarily displaced. Similarly, certain species impacted by flooding may seek refuge within the areas of inundation. Reactions to flooding conditions are contingent on the type of species and corresponding habitat preferences and adaptive traits. Although the bats prefer forging along the riparian corridor and roosting in loose tree bark in dead or dying trees during the summer months, sufficient habitat exists throughout the basin should temporary relocation be necessary. The riparian areas may sustain minor impact but the discharge threshold of 140,000 cfs is not anticipated to up-root trees. Given the mobility of the Virginia big-eared bat, Northern long-eared bat and Indiana bat combined with an abundance of terrestrial habitat, implementation of the PAA or NAA may affect, but are not likely to adversely affect these Federally protected species. However, actions under the PAA would assist in further reducing the likelihood of dam failure which would result in significant impacts.

While running buffalo clover is most frequently found in habitats with filtered sunlight and recent disturbance such as trails, logging roads, grazed ravines, and mowed paths, Virginia spiraea thrives along rocky, flood scoured banks of high-energy streams and rivers. Although increased outflow from Bluestone Dam has the potential to scour streambanks and damage riparian habitat, both running buffalo clover and Virginia spiraea are resilient to disturbance. As a result, implementation of the PAA or NAA may affect, but not adversely affect the Federally protected plant species and no significant difference between the PAA and NAA is anticipated.

Overall impacts to the terrestrial species and terrestrial habitat are expected to be temporary and minor in nature. As indicated above, out of bank flooding would be minimal for the terrestrial species (such as birds, mammal, amphibians, reptiles) and their associated habitat. In addition, many of the species are mobile and would likely seek shelter away from flooding or temporarily inundated areas.

3.5 CULTURAL RESOURCES

The Corps Huntington District is mandated through numerous federal laws and regulations to consider how Federal actions impact historic properties. The largest area of known cultural resources lies along floodplains adjacent to the New and Kanawha Rivers. There are approximately 127 known archeological sites within Huntington District boundaries within Bluestone Reservoir, most of which have been documented within riverine environments. There would be no significant difference between implementation of the PAA or NAA from a cultural resource perspective. It is expected there would be no potential affect to historic properties or cultural resources.

3.6 WATER QUALITY

Public awareness and a desire to control water pollution led to the passage of the Clean Water Act in 1972. The goal of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Under Section 303(d) of the Clean Water Act, states are required to identify impaired waters, which violate water quality standards and do not fully support designated uses. In order to comply with the requirements of the Clean Water Act, the West Virginia Department of Environmental Protection (WVDEP) regularly monitors and assesses the quality of water resources throughout the state. Waterbodies identified as impaired are included on the state's Section 303(d) list, which is submitted biannually to the U.S. Environmental Protection Agency (USEPA) for review and approval. All impaired waterways on the approved Section 303(d) list require the development of a Total Maximum Daily Load (TMDL). The Section 303(d) list for the State of West Virginia was updated in 2012 and is currently awaiting approval from USEPA.

The Section 303(d) list for the State of West Virginia is organized by hydrologic unit codes (HUC) established by USGS. While the entire length of the Kanawha River remains listed as impaired due to fish consumption advisories related to elevated concentrations of Polychlorinated Biphenyls (PCBs), the lower portion of the Kanawha River – extending from the mouth of the Elk River to its confluence with the Ohio River in Point Pleasant – is also listed as impaired for fecal coliform. Water quality impairments along the mainstem of the Kanawha River affect contact recreation and public water supply uses. Bluestone Lake and the New River are not currently listed as impaired. While Bluestone Lake was previously listed for elevated concentrations of PCB, recently collected fish tissue does not support an impaired listing.

Increased exposure during flooding conditions to point and nonpoint pollutant sources may also negatively impact water quality. Examples of point sources include inundated municipal and industrial sites such as wastewater treatment plants or direct chemical spills. A common nonpoint pollutant stems from runoff from agricultural practices. Should point and nonpoint pollutant sources be inundated during flooding conditions, increases in nutrient and fecal coliform bacteria levels would likely occur. While elevated water levels and flow velocities do not necessarily cause such increases, these conditions allow for pollutants to be transported and distributed throughout the basin. Although widespread flooding during a large storm event would temporarily increase pollutant loads to the New and Kanawha Rivers, no significant difference between the PAA and NAA is anticipated with respect to water quality.

Under both the PAA and NAA, a minimum discharge of 610 cfs would be maintained to help sustain aquatic resources during normal operating conditions. While areas downstream of Bluestone Dam may be subjected to flooding on a more frequent basis under both alternatives, controlled releases from the dam are not anticipated to significantly impact water quality. During flooding conditions, the potential for streambank erosion and increased sediment loading exists. Although excessive turbidity and siltation negatively impact water quality and disrupt the stream environment, flooding and streambank erosion are natural occurrences in

river systems. As a result, implementation of the PAA and NAA would not have significant impacts to water quality.

3.7 RECREATION

Bluestone Dam spans the New River forming Bluestone Lake, which is the third largest lake in West Virginia. At summer pool, Bluestone Lake covers a 2,040 acre surface area allowing for a wide variety of recreational activities including fishing, boating, and water skiing. The State of West Virginia operates Bluestone State Park encompassing over 2,100 acres of rugged, heavily forested, mountainous terrain. The state park along with the adjacent state-operated wildlife management area offers additional opportunities for fishing, boating, hiking, camping, sightseeing, swimming, and picnicking. Hunting and horseback riding are also permitted at the Bluestone Lake Wildlife Management Area. Recreation immediately downstream of the dam predominately includes fishing, sightseeing, canoeing, and picnicking. Whitewater boating is also offered further downstream.

Pipestem Resort State Park and Sandstone Falls are additional recreational resources in the area offering beautiful scenic overlooks. Pipestem Resort State Park, which is considered the crown jewel of West Virginia State Parks, lies approximately 10 miles south or upstream of Bluestone Dam. Pipestem Resort State Park offers not only numerous recreational opportunities including golfing, hiking, and biking, but also lodging, cottage rentals, dining, and conference facilities. Sandstone Falls is located approximately 10 miles downstream of Bluestone Dam and is the largest waterfall on the New River. Sandstone Falls is part of the New River Gorge area, which is categorized as a National River and covered by the National Park Service.

Under both the PAA and NAA, a seasonal pool of 1410 feet would be maintained during the summer. As a result, no impacts to recreational resources during normal operating conditions are anticipated under either alternative. During high water events, recreational activities are extremely limited due to weather, flow conditions, and general safety concerns. Given floods associated with the calculated threshold pool elevation of 1510 correspond to relatively low reoccurrence events, little to no impacts to recreational resources are anticipated under the PAA or NAA. Releasing water prior to the designed maximum FCP may result in additional clean-up efforts and delays to recreational activities, particularly in areas immediately downstream of the dam. However, clean-up and access delays are common following high water events regardless of project operation.

3.8 TRANSPORTATION AND PUBLIC INFRASTRUCTURE

The transportation network within the Kanawha River Basin is extensive and includes state and Federal highways, navigable waterways, railway systems, and airports. Bluestone Dam is easily accessible from Interstates 64 and 77 using State Route 20, which is a major north-south highway connecting New Martinsville to Bluewell. Immediately below Bluestone Dam, State

Routes 3 and 107 navigate through the City of Hinton. While State Route 107 is confined entirely within the city limits, State Route 3 runs east to west throughout the state connecting Sweet Springs to West Hamlin.

Approximately 100 miles downstream of Bluestone Dam, Interstates 64, 77, and 79 intersect in downtown Charleston. Interstate 64 travels east to west and connects Chesapeake, Virginia with Wentzville, Missouri through cities such as Richmond, Virginia; Huntington, West Virginia; Lexington and Louisville, Kentucky; and St. Louis, Missouri. Interstate 77 is an important north-south corridor traversing diverse terrain from the Appalachian Mountains to the rolling farmlands of Ohio. Interstate 77 connects Cleveland, Ohio to Columbia, South Carolina while Interstate 79 also runs north to south and links Charleston, West Virginia with Erie, Pennsylvania. Other highways of importance throughout the Kanawha River Basin include U.S. Highways 19, 33, 35, 60, and 119.

The predominate source of commercial navigation within the Kanawha River Basin is along a 91-mile stretch of the Kanawha River, which converges with the Ohio River at Point Pleasant, West Virginia. The navigation channel on the Kanawha River is maintained by a series of three Corps of Engineers lock and dam projects – Winfield, Marmet, and London. In addition to barge traffic traveling along the Kanawha River, commodities are often shipped along the CSX and Norfolk Southern railways. A portion of these railways is also used by the Amtrak line transporting passengers between Chicago, Illinois and Washington DC.

The Kanawha River Basin is further supported by a widespread system of public infrastructure including hospitals, emergency medical services, fire and law enforcement stations, educational facilities, and utility companies such as power, water treatment, and wastewater treatment plants. Within five miles downstream of Bluestone Dam, critical resources include the Summers County Appalachian Regional Hospital, Summers County Emergency Medical Services, Summers County Volunteer Fire Department, Hinton Fire Department, Summers County Sheriff Department, Hinton Police Department, Hinton Area Elementary School, Summers Middle School, and Summers County High School, and Human Resource Development and Employment (HRDE) – Stanley Technical Institute.

Under both the PAA and NAA, Bluestone Dam would be operated in conjunction with Summersville and Sutton Dams in a manner to reduce risk associated with dam failure while minimizing flood damages. The maximum flood storage of the dam would be reduced until the completion of the Phase 4 anchoring contract and releases have the potential to occur more frequently. If downstream control stages are exceeded, localized flood damage could begin to occur and critical infrastructure may become inundated. Given flooding is a natural occurrence and flood control projects within the Kanawha River Basin would continue to be operated as a system to minimize flood damages, impacts to critical infrastructure downstream of Bluestone Dam are anticipated to be minimal under the PAA as compared to the NAA.

3.9 CLIMATE CHANGE

Executive Order (E.O.) 13653 requires federal agencies to address climate change. For the purposes of defining climate-induced changes to temperature, stream flow and rainfall intensity, the watershed of Bluestone Dam (4,565 m²) extending into Virginia and North Carolina and the downstream New River/Kanawha River system to the Kanawha River stream gage just downstream of Charleston, WV is identified as the affected area.

The affected area's mid-latitude position combined with the seasonal undulations of the northern jet stream makes this region susceptible to highly variable weather throughout the year. The watershed's climate is greatly influenced by oceanic and atmospheric interactions. Rhythmic fluctuations in El Niño and La Niña Pacific currents combined with variable North Atlantic Oscillation patterns also affect seasonal weather in the project region. According to the Köppen climate classification system, the affected area is in a continental location that is fairly moist, and can experience both warm and cool summers depending upon site elevation. There are significant variations in topography and surface elevation within the New River watershed (i.e. Boone, NC at el. 3,333 msl. and Hinton, WV at el. 1,463 msl.) that drive differences in seasonal temperatures by several degrees. The New River watershed experiences seasonal weather patterns with climatic conditions typical of all four seasons for the Mid-Atlantic and Southeast Regions of the United States. Variability in weather tends to be greater during the late winter, spring, and fall seasons within the watershed. Long-term predictions of weather in such a dynamic system are uncertain at best and model projections of future global climate change further exacerbate those uncertainties.

Downscaled model projections from current climate change studies indicate increased air temperatures within the affected area of at least 0.5° F per decade between 2011 and 2040. It is likely that increases in air temperature will begin to slightly raise water temperatures both within Bluestone Lake and downstream New River as well as some free-flowing tributary streams. Some attenuation of rising New River water temperatures downstream of the dam may be affected through releases of deeper, cooler water from the dam. Downscaled model projections for the 2011 through 2040 time frame indicate increases in precipitation in the basin and resulting higher flows in the New River and other major tributaries. Projected increases in stream flow at the Charleston gage indicate that the Bluestone Lake project could experience future mean annual inflow increases from 15% to 25% higher during the period between 2011 and 2040 than recorded during the base years (1952-2001). In addition, various climate change studies have shown a trend in heavier downpours over the last 30 years for the affected area. These trends show considerable variation between the upper and lower reaches of the affected area. Future projections indicate the potential for more intense rainfall events in the 1 in 20 year event range leading to possible flash flooding on small tributary streams in the affected area, but the sources investigated did not indicate that longer-duration rainfall would be significantly affected by these changes.

Based upon current planning/design/construction schedules, the proposed restrictions on flood control pool elevation and discharge (PPA) would be lifted by 2020. This ending date generally occurs before the projected onset of 15% to 25% increases in mean annual precipitation in the watershed and resulting inflow into Bluestone Lake are likely to occur and prior to any significant increases in the mean annual air temperature (0.6° F increase by 2020) that could affect water temperatures in the lake or downstream. Therefore it is unlikely that the PPA implementing restrictions on the maximum flood control pool elevation and maximum discharge volume would face conditions associated with climate change that would endanger the dam or its modified operations for flood risk reduction during the period covered by the deviation or result in any significant adverse impacts downstream.

The PAA and NAA would not involve any activity that could affect the environment in regard to climate change; therefore, no impacts with respect to climate change would occur as a result of the PAA or NAA.

3.10 OTHER ENVIRONMENTAL RESOURCES

The following environmental resources are commonly considered by the Corps of Engineers while assessing potential impacts resulting from proposed Federal actions – floodplain resources; air quality; noise; hazardous, toxic, and radioactive waste; and aesthetics. Given the nature of the proposed and no action alternatives, no adverse impacts associated with the aforementioned resources are anticipated. According to the Council on Environmental Quality (CEQ), agencies shall reduce unnecessary paperwork while implementing NEPA by discussing impacts in “proportion to their significance” (40 CFR 1502.2(b)). Consequently, the aforementioned environmental resources were not evaluated in detail.

3.11 CUMULATIVE EFFECTS

The cumulative effects of the proposed project on the environment as stipulated in NEPA must be considered. As defined by the CEQ, cumulative effects are “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions.” Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR Part 1508.7).

The cumulative effects analysis qualitatively presented below is based on the potential effects of the proposed project when added to similar impacts from other projects in the region. An inherent part of the cumulative effects analysis is the uncertainty surrounding actions that have not yet been fully developed. The CEQ regulations provide for the inclusion of uncertainties in the analysis and states that “when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment....and there is incomplete or unavailable

information, the agency shall always make clear that such information is lacking” (40 CFR 1502.22).

Under the PAA and NAA, Bluestone Dam would be operated in a manner to reduce risk associated with dam failure while minimizing flood damage and corresponding impacts. Considering the significance of consequences potentially resulting from dam failure, cumulative effects associated with the described deviations from the existing Water Control Manual are considered negligible. While areas downstream of Bluestone may be subjected to flooding on a more frequent basis, corresponding impacts would be limited to an interim period until the full consequence based analysis is completed and approved (which is scheduled for the end of 2016).

Section 3.0 documents the existing environment and potential environmental effects of the PAA and NAA with respect to the existing conditions. The effects of the PAA, as discussed above are minor. In scoping cumulative effects issues, no resources were identified as having a potential to be significantly affected. Only minor impacts to ecological resources would be sustained with the implementation of the PAA. There is an overall benefit to reduce the likelihood of dam failure, loss of life, and catastrophic damage. Given the overall beneficial effect from implementation of the PAA, there is expected to be a positive, though small, cumulative effect on safety based on past, present, and reasonably foreseeable actions.

4.0 STATUS OF ENVIRONMENTAL COMPLIANCE

The PAA is in compliance with all state and federal requirements as well as Executive Orders. This compliance is summarized in Table 3 below.

Statute/Executive Order	Full	Partial	N/A
National Environmental Policy Act (considered partial until the FONSI is signed)		X	
Fish and Wildlife Coordination Act*		X	
Endangered Species Act*		X	
Clean Water Act	X		
Wild and Scenic Rivers Act	X		
Clean Air Act	X		
National Historic Preservation Act	X		
Archeological Resources Protection Act			N/A
Comprehensive, Environmental Response, Compensation and Liability Act	X		
Resource Conservation and Recovery Act	X		
Toxic Substances Control Act	X		
Quiet Communities Act	X		
Farmland Protection Act			N/A
Executive Order 11988 Floodplain Management	X		
Executive Order 11990 Protection of Wetlands	X		
Executive Order 12898 Environmental Justice in Minority Populations and Low-Income Populations	X		

*Considered partial until public review and prior to signing of the FONSI.

5.0 AGENCY AND PUBLIC COORDINATION

The draft Environmental Assessment (EA) for the Bluestone Lake Water Control Manual Initial Deviation will be made available to Federal and state environmental resource agencies, project stakeholders, and the general public for a period of 30 days as required by NEPA. The Water

Control Manual for Bluestone Lake will also be made available upon request. A copy of the mailing distribution list is available in Appendix A. A Notice of Availability (NOA) will be published in *The Hinton News*, *The Charleston Gazette*, *The Charleston Daily Mail*, and *The Register-Herald (Beckley, West Virginia)*

apprising the public of the opportunity to review and comment on the draft EA. The draft EA will also be made available online at www.lrh.usace.army.mil/Missions/PublicReview and placed at the main branches of the Summers County Library, Kanawha County Library, and Raleigh County Library for additional access. All comments received during the review period will be taken into consideration in the development of the final EA.

In addition, a series of public meetings in Summers, Raleigh, Fayette, Kanawha, Putnam, and Mason Counties were held in 2009 to highlight ongoing construction efforts and communicate the risk associated with dam failure and the need to modify normal project operations in order to ensure public safety. During these meetings, the public was informed flooding could occur on a more frequent basis as a result of necessary changes to operations due to the stability issues associated with the dam. Emergency management personnel throughout each of these counties were also actively engaged. Subsequent meetings have occurred annually in the City of Hinton and state officials within West Virginia and Ohio have been kept apprised of all operational changes.

6.0 CONCLUSION

Construction efforts currently underway have undoubtedly improved the overall stability of Bluestone Dam. However, recent structural computations indicate dam failure may occur below the designed maximum FCP. Until the project can be safely operated to the designed maximum FCP, procedures for formal operation need to be established using sound professional judgment to reduce the risk of dam failure, loss of life, and catastrophic damage. While the existing Water Control Manual allows for deviations during emergency situations, formally deviating from the Water Control Manual facilitates informed decisions regarding project operations when downstream flood control stages are exceeded. Operating Bluestone Dam using structural analysis and evaluations used to establish the threshold pool and threshold discharge in conjunction with observed field conditions reduces the likelihood of dam failure.

Deviations to the Water Control Manual as described under both the PAA and NAA respectively are anticipated to be temporary measures until the project can be safely operated to the designed maximum FCP. The designed maximum FCP is anticipated to be restored following the completion of the Phase 4 anchoring contract in 2019. The Bluestone Dam would continue to be operated in conjunction with Summersville and Sutton Dams to minimize flood damage while taking into account structural computations / evaluations and downstream flow conditions. Overall, no significant, adverse impacts to the natural or human environment under the PAA, as compared to the NAA, are anticipated.

Given the potential consequences associated with dam failure and the Corps' responsibility to ensure public safety, the PAA and NAA are very similar. Under both alternatives, modifications or deviations to the Water Control Manual would occur. However, the PAA provides the benefit of having a formalized approach to more seamlessly guide decisions during flooding conditions. As a result, the PAA is recommended for implementation.

Works Cited

- The 3rd National Climate Assessment (2014) for the continental United States which is based upon the IPCC's 5th Assessment Report (CMIP5)
- Climate Change and Hydrology Literature Synthesis for the US Army Corps of Engineers Missions in the United States (2015)
- Ohio River Basin Climate Change Impacts and Adaptation Draft Pilot Study (July 2015) sponsored by the USACE Institute for Water Resources (IWR).
- West Virginia 2012 Draft Section 303(d) List
- United States Census Bureau, <http://quickfacts.census.gov>

Appendix A: Mailing Distribution List

**BLUESTONE LAKE WATER CONTROL MANUAL INITIAL DEVIATION DRAFT ENVIRONMENTAL ASSESSMENT –
MAILING DISTRIBUTION LIST**

Federal Agencies and Officials

The Honorable Joe Manchin
United States Senate
900 Pennsylvania Avenue, Suite 629
Charleston, West Virginia 25302

The Honorable Shelley Moore Capito
United States Senate
220 North Kanawha Street
Suite 1
Beckley, WV 25801-4514

The Honorable Evan Jenkins
United States House of Representatives
223 Prince St.
Beckley, WV 25801

U.S. Environmental Protection Agency
Region III
1060 Chapline Street
Wheeling, West Virginia 26003

Mr. Jared Beard
USDA Natural Resources Conservation
Service
1550 Earl Core Road, Suite 200
Morgantown, WV 26505

U.S. Department of Agriculture
Natural Resources Conservation Service
Beckley-South Area Office
465 Ragland Road
Beckley, WV 25801

Mr. John Schmidt
Field Supervisor
U.S. Fish and Wildlife Service
West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

Ms. Patricia Kicklighter
Park Superintendent
U.S. Department of Interior
National Park Service
New River Gorge
P.O. Box 246
Glen Jean, West Virginia 25846

State Agencies and Officials

The Honorable Earl Ray Tomblin
Governor of West Virginia
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305

Mr. Randy Huffman
Cabinet Secretary
West Virginia Department of Environmental
Protection
601 57th Street, Southeast
Charleston, West Virginia 25304

Ms. Janet Clayton, Wildlife Diversity
Biologist
West Virginia Division of Natural Resources
P.O. Box 67
Elkins, West Virginia 26241

Ms. Barbara Sargent, Environmental
Resource Specialist
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**BLUESTONE LAKE WATER CONTROL MANUAL INITIAL DEVIATION DRAFT ENVIRONMENTAL ASSESSMENT –
MAILING DISTRIBUTION LIST**

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