MULTI-PROJECT

ENVIRONMENTAL ASSESSMENT

FOR HYDROPOWER LICENSE

Opekiska Lock and Dam Hydroelectric Project, FERC Project No. 13753-002

Morgantown Lock and Dam Hydroelectric Project, FERC Project No. 13762-002

West Virginia

Point Marion Lock and Dam Hydroelectric Project, FERC Project No. 13771-002

Grays Landing Lock and Dam Hydroelectric Project, FERC Project No. 13763-002

Maxwell Locks and Dam Hydroelectric Project, FERC Project No. 13766-002

Monongahela Locks and Dam 4 Hydroelectric Project, FERC Project No. 13767-002

Pennsylvania

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
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ACRONYMS AND ABBREVIATIONS

Advisory Council	Advisory Council on Historic Preservation
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
BMP	best management practices
°C	degrees Celsius
certification	water quality certification
CFR	Code of Federal Regulations
cfs	cubic feet per second
Charleroi Project	Monongahela Locks and Dam 4 Hydroelectric Project
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
DO	dissolved oxygen
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ºF	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FFP Missouri 13	FFP Missouri 13, LLC
FFP Missouri 15	FFP Missouri 15, LLC
FFP Missouri 16	FFP Missouri 16, LLC
FPA	Federal Power Act
fps	feet per second
FWS	U.S. Fish and Wildlife Service
Grays Landing Project	Grays Landing Lock and Dam Hydroelectric Project
HPMP	historic properties management plan
Interior	U.S. Department of the Interior
kV	kilovolt
Maxwell Project	Maxwell Locks and Dam Hydroelectric Project
mg/L	milligrams per liter
MOA	memorandum of agreement
Mon River Trails Conservancy	Monongahela River Trails Conservancy Ltd.
Morgantown Project	Morgantown Lock and Dam Hydroelectric Project
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NGVD 29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NTU	Nephelometric Turbidity Units
Opekiska Project	Opekiska Lock and Dam Hydroelectric Project

ORSANCO	Ohio River Valley Water Sanitation Commission
PA	Programmatic Agreement
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
Pennsylvania DCNR	Pennsylvania Department of Conservation and Natural Resources
Pennsylvania DEP	Pennsylvania Department of Environmental Protection
Pennsylvania FBC	Pennsylvania Fish and Boat Commission
Pennsylvania SHPO	Pennsylvania Bureau for Historic Preservation
PJM	PJM Interconnection LLC
PM&E	protection, mitigation, and enhancement
PNDI	Pennsylvania Natural Diversity Index
REA	Ready for Environmental Analysis
RM	river mile
ROW	right-of-way
Solia 4 Hydroelectric	Solia 4 Hydroelectric, LLC
Solia 5 Hydroelectric	Solia 5 Hydroelectric, LLC
Solia 8 Hydroelectric	Solia 8 Hydroelectric, LLC
USGS	U.S. Geological Survey
West Virginia DEP	West Virginia Department of Environmental Protection
West Virginia DNR	West Virginia Division of Natural Resources
WUA	weighted useable area

EXECUTIVE SUMMARY

Proposed Action

On February 27, 2014, applications were filed with the Federal Energy Regulatory Commission (Commission or FERC) for the construction and operation of the following six hydropower projects to be located at the U.S. Army Corps of Engineers' (Corps') dams on the Monongahela River:

- FFP Missouri 16, LLC's (FFP Missouri 16's) proposed 6-megawatt (MW) Opekiska Lock and Dam Hydroelectric Project No. 13753 (Opekiska Project) would be located at river mile (RM) 115.4 on the Monongahela River in Monongalia County, West Virginia. The project would occupy 4.31 acres of federal land owned by the Corps.

- FFP Missouri 15, LLC's (FFP Missouri 15's) proposed 5-MW Morgantown Lock and Dam Hydroelectric Project No. 13762 (Morgantown Project) would be located at RM 102.0 on the Monongahela River in Monongalia County, West Virginia. The project would occupy 0.99 acre of federal land owned by the Corps.

- Solia 8 Hydroelectric, LLC's (Solia 8 Hydroelectric's) proposed 5-MW Point Marion Lock and Dam Hydroelectric Project No. 13771 (Point Marion Project) would be located at RM 90.8 on the Monongahela River in Fayette County, Pennsylvania. The project would occupy 1.44 acres of federal land owned by the Corps.

- FFP Missouri 13, LLC's (FFP Missouri 13's) proposed 12-MW Grays Landing Lock and Dam Hydroelectric Project No. 13763 (Grays Landing Project) would be located at RM 82.0 on the Monongahela River in Greene and Fayette Counties, Pennsylvania. The project would occupy 10.46 acres of federal land owned by the Corps.

- Solia 5 Hydroelectric, LLC's (Solia 5 Hydroelectric's) proposed 13-MW Maxwell Locks and Dam Hydroelectric Project No. 13766 (Maxwell Project) would be located at RM 61.2 on the Monongahela River in Washington County, Pennsylvania. The project would occupy 2.02 acres of federal land owned by the Corps.

- Solia 4 Hydroelectric, LLC's (Solia 4 Hydroelectric's) proposed 12-MW Monongahela Locks and Dam 4 Hydroelectric Project No. 13767 (Charleroi Project)[1] would be located at RM 41.5 on the Monongahela River in Washington County, Pennsylvania. The project would occupy 0.68 acre of federal land owned by the Corps.

Existing Corps Facilities

The Monongahela and Allegheny Rivers join to form the Ohio River in Pittsburgh, Pennsylvania. The Corps owns 38 locks and dams on these rivers—9 locks and dams on the Monongahela River, 8 on the Allegheny River, and 21 on the Ohio River. The Corps operates these locks and dams for commercial and recreational navigation.

The proposed projects would be located at six existing locks and dams on the Monongahela River: Opekiska Lock and Dam; Morgantown Lock and Dam; Point Marion Lock and Dam; Grays Landing Lock and Dam; Maxwell Locks and Dam; and Monongahela Locks and Dam 4 (also known as Charleroi Locks and Dam). These six projects are referred to collectively herein as the Monongahela River Projects.

Opekiska Lock and Dam consists of a 336-foot-long, 24-foot-high concrete dam with a full length spillway equipped with four 84-foot-wide, 24-foot-high Tainter gates and a 600-foot-long, 84-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 857 feet National Geodetic Vertical Datum of 1929.[2]

Morgantown Lock and Dam consists of a 410-foot-long, 20-foot-high concrete dam with a full length spillway equipped with six 60-foot-wide, 20-foot-high Tainter gates and a 600-foot-long, 84-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 814 feet.

Point Marion Lock and Dam consists of a 560-foot-long, 20-foot-high concrete dam with a full length spillway equipped with six 60-foot-wide, 8.5-foot-high Tainter gates; a 65-foot-wide fixed-crest weir on the right (east) side; a 110-foot-long fixed-crest weir on the left side between the gated spillway and the lock; and a 720-foot-long, 84-

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[1] In this environmental assessment, we refer to the proposed Monongahela Locks and Dam 4 Hydroelectric Project as the Charleroi Project because that is the common project name used by the applicant and many stakeholders.

[2] All elevations are provided in National Geodetic Vertical Datum of 1929 unless otherwise noted.

foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 797 feet.

Grays Landing Lock and Dam consists of a 576-foot-long, 37-foot-high fixed-crest concrete dam and a 720-foot-long, 84-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 778 feet.

Maxwell Locks and Dam consists of a 460-foot-long, 56-foot-high concrete dam with a full length spillway equipped with five 84-foot-wide, 27.5-foot-high Tainter gates and two 720-foot-long, 84-foot-wide navigation locks. The normal water surface elevation of the upper pool is at elevation 763 feet.

Monongahela Locks and Dam 4 (Charleroi Locks and Dam) consists of a 463-foot-long, 40-foot-high concrete dam with a full length spillway equipped with five 84-foot-wide, 21-foot-high Tainter gates; a 720-foot-long, 56-foot-wide land-side navigation lock; and a 360-foot-long, 56-foot-wide river-side navigation lock. The normal water surface elevation of the upper pool is at elevation 743.5 feet.

Proposed Hydropower Facilities

The Opekiska Project would consist of a new 180-foot-long, 95-foot-wide intake channel excavated into the riverbed leading to a 30-foot-long, 70-foot-wide, 50-foot-high reinforced concrete intake structure that would convey flow past a trash rack with 3-inch clear bar spacing to a new 120-foot-long, 70-foot-wide, 60-foot-high reinforced concrete powerhouse on the west bank of the river, housing two equally sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 6 MW. Flows would exit the powerhouse into a 280-foot-long, 64-foot-wide tailrace excavated into the riverbed. Project power would be transmitted from the powerhouse to a new project substation with a 175-foot-long, medium-voltage, buried cable, and from there to an existing distribution line with a 3,111-foot-long,[3] 12.5-kilovolt (kV), overhead transmission line. The project would also include a 110-foot-long, 24-foot-wide access road with a parking area and the following new recreational facilities on the west bank (listed upstream to downstream): a canoe portage with stairs to the river, beginning approximately 350 feet upstream of the dam structure and ending approximately 450 feet downstream of the existing dam; recreation-designated parking adjacent to the proposed powerhouse; a portable accessible restroom near the proposed parking area; and an

[3] The final license application identified a transmission line of 3,511 feet; however, staff determined the distance from the proposed substation to the proposed interconnection point is approximately 400 feet less than described.

accessible shoreline fishing access trail and platform downstream of the proposed tailrace.

The Morgantown Project would consist of a new 100-foot-long, 64-foot-wide intake channel excavated into the riverbed immediately downstream of spillway gate 6 on the east side of the river and lead to a 30-foot-long, 64-foot-wide, 50-foot-high reinforced concrete intake structure. The intake structure would convey flow past a trash rack with 3-inch clear bar spacing to a new 120-foot-long, 70-foot-wide, 60-foot-high reinforced concrete powerhouse housing two equally sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 5 MW. Flows would exit the powerhouse into a 170-foot-long, 90-foot-wide tailrace excavated into the riverbed. Two 30-foot-wide spill gates would be constructed within the intake channel to pass the equivalent of the amount of flow through the Corps' spillway gate 6. Project power would be transmitted from the powerhouse to a new project substation with a 420-foot-long, medium-voltage, buried cable, and from there to an existing distribution line with a 2,162-foot-long, 12.5-kV, overhead transmission line. The project would also include a 425-foot-long, 15-foot-wide access road with a parking area and the following new recreational facilities on the east bank (listed upstream to downstream): an upper pool shoreline angler path with 4-foot-wide steel stairs from the Caperton Trail to the river, recreation-designated parking adjacent to the proposed powerhouse, and a tailrace shoreline angler path with 4-foot-wide steel stairs connecting the Caperton Trail to the river.

The Point Marion Project would consist of a new 280-foot-long, 70-foot-wide intake channel, which would be excavated into the riverbed and lead to a 30-foot-long, 70-foot-wide, 50-foot-high, reinforced concrete intake structure. The intake structure would convey flows past a trash rack with 3-inch clear bar spacing to a new 120-foot-long, 70-foot-wide, 60-foot-high reinforced concrete powerhouse on the east bank of the river. The powerhouse would house two equally sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 5 MW. Flows would exit the powerhouse into a 215-foot-long, 84-foot-wide tailrace excavated into the riverbed. Project power would be transmitted from the powerhouse to a new project substation with a 325-foot-long, medium-voltage, buried cable, and from there to an existing substation with a 4,051-foot-long, 69-kV, overhead transmission line. The project would also include a 1,210-foot-long, 18-foot-wide access road with a parking area and a new tailrace recreational facility on the east bank consisting of a 5-foot-wide wooden shoreline angler path with 4-foot-wide steel stairs connecting the wooden path to the river.

The Grays Landing Project would consist of a new 300-foot-long, 130-foot-wide intake channel excavated into the riverbed leading to a 100-foot-long, 84-foot-wide reinforced concrete intake structure that would convey flows past a trash rack with 3-inch clear bar spacing to a new 150-foot-long, 90-foot-wide, 75-foot-high reinforced concrete powerhouse housing two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 12 MW. Flows would exit the powerhouse into a 250-foot-long, 84-foot-wide tailrace excavated into the riverbed. A 2.5-foot-high adjustable crest gate[4] would be constructed across the entire length of the existing dam crest to control the water surface elevation to ensure sufficient depth for navigation in the upstream pool. Project power would be transmitted from the powerhouse to a new project substation with a 155-foot-long, medium-voltage, buried cable, and from there to an existing distribution line with a 9,965-foot-long, 69-kV, overhead transmission line. The project would also include a 585-foot-long, 24-foot-wide access road with a parking area. No recreational facilities are proposed.

The Maxwell Project would consist of a new 130-foot-long, 85-foot-wide intake channel excavated into the riverbed immediately downstream of the Corps' spillway gate 5 on the east side of the river and lead to a 100-foot-long, 85-foot-wide, 70-foot-high reinforced concrete intake structure. The intake structure would convey flows past a trash rack with 3-inch clear bar spacing to a new 150-foot-long, 90-foot-wide, 70-foot-high reinforced concrete powerhouse housing two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 13 MW. Flows would exit the powerhouse into a 160-foot-long, 120-foot-wide tailrace excavated into the riverbed. Two 42-foot-wide spill gates would be constructed within the intake channel to pass the equivalent of the amount of flow through the Corps' spillway gate 5. Project power would be transmitted from the powerhouse to a new project substation with a 2,800-foot-long, medium-voltage, buried cable, and from there to an existing distribution line with a 350-foot-long, 69/138-kV, overhead transmission line. The project would include a 5,060-foot-long, 24-foot-wide access road with a parking area. No recreational facilities are proposed.

The Charleroi Project would consist of a new 140-foot-long, 90-foot-wide intake channel excavated into the riverbed immediately downstream of the Corps' spillway gate 5 on the west side of the river leading to a 100-foot-long, 90-foot-wide, 65-foot-high reinforced concrete intake structure that would convey flows past a trash rack with 3-inch clear bar spacing to a new 150-foot-long, 90-foot-wide, 70-foot-high reinforced concrete powerhouse housing two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 12 MW. Flows would exit the powerhouse into a 210-foot-long, 130-foot-wide tailrace excavated into the riverbed. Two 42-foot-wide spill gates would be constructed within the intake channel to pass the equivalent of the amount of flow through the Corps' spillway gate 5. Project power would be transmitted from the

[4] Information provided in the license application indicates that the crest gate would consist of a single section as opposed to a series of sections separated by piers.

powerhouse to a new project substation with a 130-foot-long, medium-voltage, buried cable, and from there to an existing distribution line with a 45-foot-long, 69-kV, overhead transmission line. The project would also include a 30-foot-long, 15-foot-wide access road with a parking area. No recreational facilities are proposed.

Project Operation

The projects would operate in a run-of-release mode, using flows made available by the Corps that would normally be released over the dams through the Corps' gates or spillways.[5] The applicants also propose to maintain the water surface elevations of each pool upstream of the dams in accordance with the Corps' current management practice of providing adequate water depth for navigation. As a result, the water surface elevations of each upstream pool, with the exception of Grays Landing, would match existing water surface elevations. At Grays Landing, which currently has an uncontrolled spillway, a crest gate would be installed to control the water surface elevation to ensure sufficient depth for navigation. More specifically, when river flows are less than 9,000 cubic feet per second (cfs), the proposed crest gate would be in the full up position, holding the upstream pool elevation at 780.5 feet, which is up to 2.5 feet higher than existing conditions. When river flows are between 9,000 and 11,000 cfs, the proposed crest gate would be in the full up position, and the upstream pool elevation would increase from 780.5 to 781.5 feet, which is about 1 foot higher than existing conditions. When river flows are between 11,000 and 23,700 cfs, the crest gate would be incrementally lowered to achieve an elevation of 781.5 feet, which would result in an upstream pool elevation up to 0.5 foot higher than existing conditions when river flow is between 11,000 and 14,000 cfs and up to 1.5 foot lower than existing conditions when river flow is between 14,000 and 23,700 cfs. At river flows exceeding 23,700 cfs, the crest gate would be fully lowered. When river flows are between 23,700 and 65,000 cfs, the upstream pool elevation would be approximately 1 foot lower than existing conditions. When river flows exceed approximately 65,000 cfs, the turbines would shut down, and the upstream pool elevation would be equal to existing conditions.

For all of the projects, when river flow is less than the minimum hydraulic capacity required to operate one unit, or when high river flows reduce the available head below the minimum required to operate the turbines (9 feet at Maxwell and Charleroi; 11 feet at Morgantown, Point Marion, and Grays Landing; and 16 feet at Opekiska),

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[5] Although the applicants refer to their proposed operating mode as run-of-river, it is more accurate to refer to it as run-of-release because the projects would generate from flows as "released" (i.e., made available) to the projects by the Corps. Under a run-of-river mode, a project diverts and generates from available flows in the river.

generation would cease, and all flows would be passed in accordance with existing Corps practices.

The applicants propose to release the following bypass flows[6]: Opekiska, Morgantown, and Point Marion—300 cfs from July 1 through July 31; Grays Landing—500 cfs from July 1 through July 31, and 50 cfs during August through June; and Maxwell and Charleroi—500 cfs from July 1 through July 31.

The Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Projects would produce an annual average of 25,606 megawatt-hours (MWh); 19,130 MWh; 16,701 MWh; 47,958 MWh; 57,106 MWh; and 48,894 MWh, respectively.

Proposed Environmental Measures

The applicants propose to construct and operate the projects with environmental protection, mitigation, and enhancement (PM&E) measures as described below. All of the following PM&E measures apply to all six projects unless otherwise noted.

Geology and Soil Resources

- Develop an erosion and sedimentation control plan in consultation with the Corps and either the Pennsylvania Department of Environmental Protection or West Virginia Department of Natural Resources, as appropriate, that includes procedures and best management practices to reduce runoff and sedimentation during construction and final stabilization.

Aquatic Resources

- Operate in a run-of-release mode to avoid project-related impacts on the Corps' operation of its facilities.

- Ensure that at least the following flows pass through the Corps' gates or over the spillways during project operations to enhance aeration and protect water quality downstream of the projects: 300 cfs during the month of July at Morgantown, Opekiska, and Point Marion; 500 cfs during the month of July

[6] Bypass flow in this context refers to water that would normally be available to the proposed hydroelectric projects for generation, but is instead allowed to pass over the spillway, through the Corps' gates, or through the applicants' proposed spill gates.

at Maxwell and Charleroi; and 500 cfs in July plus 50 cfs during the rest of the year at Grays Landing.

- Conduct 3 years of post-construction water quality monitoring from June through September to monitor for project effects on water quality.

- Install a trash rack with 3-inch clear bar spacing, and provide approach velocities of less than 2 feet per second to mitigate for the entrainment and impingement of fish.

- When warranted and to the extent feasible, coordinate the timing of any construction-related hydraulic changes, such as changes in flow direction, to minimize potential effects on spawning fish and other aquatic organisms downstream of the project.

Terrestrial Resources

- At Grays Landing, protect sensitive plants by: providing 50-foot protection buffers around mapped locations of toothcup, scarlet ammannia, and hooded arrowhead and restricting the use of herbicides and construction activities in these areas; mapping and avoiding disturbance to populations of sourwood; fencing buffered habitat during construction; making sure personnel are aware of the locations of sensitive plants; consulting with Pennsylvania Department of Conservation and Natural Resources if protection buffers less than 50 feet are needed; and filing a map depicting the locations of buffer areas and limits of disturbance.

- Develop an avian protection plan consistent with Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service (FWS) guidelines that includes provisions for protecting bald eagles and other raptors from project-related effects.

- Develop a transmission line corridor management plan that includes provisions for protecting botanical resources from project-related effects and controlling invasive species along the transmission line rights-of-way.

Threatened and Endangered Species

- Follow all agency-recommended avoidance measures for federally listed bat species at the Charleroi, Maxwell, Grays Landing, and Point Marion Projects, including conducting tree cutting, tree inundation, and prescribed burning only between November 15 and March 31, and where possible, implementing the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.

Recreation and Land Use

- Implement a recreation resource management plan at the Opekiska Project with provisions for installing an accessible tailrace fishing platform; eight recreation-designated parking spaces; an accessible canoe portage trail with stairs that lead to the river at the end of the downstream trail; and a portable, accessible restroom.

- Implement a recreation resource management plan at the Morgantown Project with provisions for installing two shoreline angler paths (90 feet upstream and 450 feet downstream of the dam) consisting of 4-foot-wide steel stairs extending from the Caperton Trail towards the river, and parking facilities.

- Implement a recreation resource management plan at the Point Marion Project with provisions for installing a shoreline angler path 450 feet downstream of the dam consisting of a 5-foot-wide wooden trail and 4-foot-wide steel stairs connecting the wooden trail to the river.

Aesthetics

- Restore areas temporarily affected by construction activities to protect the sites' aesthetics.

- Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.

Cultural Resources

- Prepare a historic properties management plan (HPMP) in accordance with an anticipated Programmatic Agreement between the Commission and the West Virginia Division of Culture and History or the Pennsylvania Bureau for Historic Preservation, as appropriate.

Public Involvement

Before filing license applications, the applicants conducted pre-filing consultation under the traditional licensing process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission.

After the applications were filed, we conducted scoping to determine what issues and alternatives should be addressed. We issued a scoping document for the

Monongahela River Projects on September 2, 2014; conducted environmental site reviews on October 7 and 8, 2014; and conducted scoping meetings on October 7, 8, and 10, 2014. Based on discussions during the site visits and scoping meetings and written comments received during the comment period, we issued a revised scoping document on December 17, 2015. On the same date, we issued notice that the applications were ready for environmental analysis and requested terms and conditions, comments, and recommendations for each project.

Alternatives Considered

This multi-project environmental assessment (EA) analyzes the effects of the proposed action and recommends conditions for any original licenses that may be issued for the six projects. This EA considers the following alternatives for each project: (1) the applicant's proposal, as outlined above; (2) the applicant's proposal with staff modifications (staff alternative); and (3) no-action or license denial, meaning the project would not be constructed, and there would be no change to the existing environment.

Staff Alternative

Under the staff alternative, the projects would be constructed, operated, and maintained as proposed by the applicants with the exception of the proposal to ensure certain minimum flows pass over the dam at each project, and with the following modifications and additional staff-recommended measures. Unless otherwise noted, the following measures apply to all six projects.

- A contaminated sediment testing and disposal plan including provisions for testing sediment from the riverbed to ensure sediment is handled and disposed of in a manner that is consistent with current state standards and to ensure minimal impacts of contaminated sediment on aquatic species and their habitat.

- An operation compliance monitoring plan to document compliance with the operating requirements of any licenses issued for the projects.

- A stand-alone spill prevention, containment, and countermeasures plan to guide the handling of hazardous substances and protect water quality and aquatic biota during project construction and operation. A water quality monitoring plan that includes a provision to monitor water quality for 3 years post-construction, for the period of June 1 through October 15, and an additional provision to monitor water quality during construction

- A vegetation management plan that would apply the measures included in the applicants' transmission line corridor management plan to all project lands. At Grays Landing, the vegetation management plan would also include the applicant's proposed measures to protect sensitive plants during construction activities, extend these measures to also apply to project maintenance activities requiring ground disturbance, and include measures to protect sensitive plants from project operation.

- A revised recreation resource management plan for the Morgantown Project that includes the applicant-proposed measures and an accessible fishing platform and angler path at the tailrace.

- A revised recreation resource management plan for the Point Marion Project that includes the applicant-proposed measures and a fishing platform at the end of the proposed angler path near the tailrace.

- A construction access plan for the Morgantown and Point Marion Projects that includes construction safety guidelines, a schedule, signage, and specific mitigation measures that reduce construction impacts on public use of the Caperton and Sheepskin Trails.

- An access improvement plan for the Grays Landing, Maxwell, and Charleroi Projects that provides shoreline angler access at each facility.

- A debris management plan that includes the applicants' proposed measures to remove and dispose of trash that accumulates upstream of the proposed projects' trash racks, as well as procedures that describe how debris would be sorted, stored, and disposed of to minimize the effect of floating debris on local recreation and aesthetics.

- Implementation of a signed Programmatic Agreement that requires revision of the draft HPMP to address the management of historic properties and unevaluated cultural resources.

Environmental Impacts and Measures of the Staff Alternative

The primary issues associated with licensing the proposed projects are the potential effects of the projects on soils and sedimentation; dissolved oxygen (DO) concentrations and aquatic habitat downstream of the proposed projects; fish entrainment; vegetation and wildlife disturbance; and recreation, aesthetic, and cultural resources. The environmental effects of the staff alternative are described below.

Geology and Soil Resources

Ground-disturbing activities associated with constructing the proposed projects would involve excavation of the riverbed, shorelines, and nearby upland areas, and installation/removal of cofferdams, which could cause erosion and a temporary increase in suspended sediment and turbidity in the Monongahela River. The staff-recommended erosion and sedimentation control plan that includes provisions for the placement of turbidity curtains upstream and downstream of cofferdams, silt fencing, stabilization of temporarily disturbed soils, and final site stabilization would minimize soil erosion and sedimentation and protect water quality.

Aquatic Resources

Contaminant levels measured in river sediment samples collected by the applicants exceeded U.S. Environmental Protection Agency screening criteria for polycyclic aromatic hydrocarbons at all six project sites, heavy metals at four of the six project sites (Opekiska, Grays Landing, Maxwell, and Charleroi), and polychlorinated biphenyls at one project site (Morgantown). The staff-recommended contaminated sediment testing and disposal plans would specify sampling methodologies, locations, and frequency of testing; identify approved disposal sites; and describe how to remove, handle, and dispose of any contaminated sediments within the construction areas. At the Point Marion Project, the geographic scope of the plan would include a brownfield site[7] located along the proposed access road. These measures would ensure excavated sediment is tested, stored, and disposed of appropriately, ensuring that aquatic resources and human health are protected during project construction.

Construction of the proposed projects would require the use of an assortment of heavy equipment. This equipment would require gasoline or diesel fuel, motor oil, hydraulic fluid, and other lubricants. On-site fuel storage facilities for projects of these types commonly are in the range of several hundred to several thousand gallons of fuel. The staff-recommended spill prevention, containment, and countermeasures plans would protect freshwater organisms as well as mammals, insects, microorganisms, and vegetation susceptible to the effects of spilled fuels and other hydrocarbons.

Construction activities may also affect flow patterns downstream of the dams, suspend sediment, or cause erosion that could increase turbidity and affect aquatic habitat. Under the staff alternative, coordination of construction timing to avoid the spring fish spawning season would protect spawning habitat downstream of the dams from construction-related effects.

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[7] A brownfield is a property where expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (EPA, 2015).

Under the staff alternative, operating the projects in a run-of-release mode would limit effects on the Corps' current management of pool elevations and the timing or quantity of flow releases, which should protect fish and mussel habitat upstream and downstream of the dams. Installation and operation of a crest gate at Grays Landing would maintain safe navigation depths, which otherwise would be jeopardized by project operation. Operation of the crest gate to stabilize water levels in the upstream pool would improve aquatic habitat suitability for mussels and some fish relative to existing conditions, where water levels are uncontrolled and change as river flow changes. Developing operation compliance monitoring plans, as recommended by staff, would provide a means to verify compliance with the operational requirements of any licenses issued for the projects.

During project operations, river flows that currently flow over the existing dams and become aerated in the process would instead be diverted through the proposed turbines, potentially resulting in lowered DO concentrations downstream of the projects. The staff-recommended water quality monitoring plans that include provisions for turbidity, temperature, and DO monitoring during construction, and water temperature and DO monitoring from June 1 to October 15 during the first 3 years of operation, would provide information to make adjustments to construction and project operations, if needed, to protect water quality, fish, and other aquatic organisms.

Operation of the projects would also result in some unavoidable fish impingement on the trash racks or entrainment through the turbines, both of which could cause injury and mortality of fish. However, limiting intake velocities at the project trash racks to under 2 feet per second and installing trash racks with 3-inch clear bar spacing would allow most adults and juveniles of nearly all species to avoid both impingement and entrainment. Verifying intake velocities at the trash racks, as part of the staff-recommended operation and compliance monitoring plan, would ensure that intake velocities are sufficiently low to prevent or minimize involuntary fish impingement and entrainment.

Terrestrial Resources

Construction of the projects' generation facilities, access roads, parking areas, and transmission lines would disturb a total of 14.6 acres of upland habitat, predominantly deciduous riparian forest, in the proposed project boundaries and could lead to the spread of invasive plants. The staff-recommended vegetation management plans would incorporate the applicants' proposed revegetation and invasive species control measures for the transmission line corridors, but would expand the scope of these measures to all lands within the project boundaries to protect botanical resources in all areas affected by construction. The vegetation management plans would also include monitoring to ensure the success of revegetation and invasive species control measures. Additionally, the staff-recommended vegetation management plan for Grays Landing would incorporate the applicant's proposed measures to protect sensitive plants during construction activities and extend the measures to apply to project maintenance activities requiring ground disturbance. Finally, operation of the proposed Grays Landing crest gate would increase the water surface elevation up to 2.5 feet in the pool upstream of the dam, likely inundating a small fringe wetland at the southern edge of the project boundary. Three state-listed sensitive species—scarlet ammannia, hooded arrowhead, and tooth-cup—occur in this wetland and would likely be lost as a result of raising the pool elevation.

Construction of the projects may also disturb or eliminate habitat for bald eagles and other raptors if trees are removed. In addition, raptors may be electrocuted by the projects' transmission line or other electrical equipment. Development of avian protection plans in accordance with Avian Power Line Interaction Committee and FWS guidelines would protect raptors from electrocution and habitat disturbance.

Threatened and Endangered Species

Two federally listed freshwater mussel species (clubshell and snuffbox) and two federally listed terrestrial species (Indiana bat and northern long-eared bat) have historically occurred or may occur in the counties in which the projects would be located.

The Pennsylvania Natural Diversity Index (PNDI) reports and related correspondence with FWS did not identify any listed mussels that could be affected by the proposed projects. No listed species of mussels were identified in the vicinity of the proposed projects during the applicants' surveys, nor were any identified in Hart's comprehensive 2012 survey of 31 locations in the Monongahela River within Pennsylvania. Based on these results, it is unlikely that any listed mussel species occur within the proposed construction footprints or other areas potentially affected by the proposed projects. Therefore, we conclude that construction and operation of the projects would have no effect on the snuffbox or clubshell mussels.

FWS' Species Search website indicates that Indiana and northern long-eared bats are known to occur in the counties where the projects would be located. However, neither bat species was observed during general habitat surveys at any of the six project locations.

PNDI reports and related correspondence with FWS for the Charleroi Project indicate that construction and operation of the project is not likely to adversely affect bats if the following avoidance measure is considered: conduct tree cutting, tree inundation, and prescribed burns between November 15 and March 31 to avoid injuring or killing endangered bats. In its July 11, 2016, filing, the applicant agreed to implement these measures at the Charleroi Project. Although the proposed Charleroi Project would only disturb 0.07 acre of limited quality riparian forest, all of which would be associated with shoreline stabilization measures in a previously disturbed and inundated area, correspondence with FWS indicates that the proposed project is located within 10 miles of a known hibernaculum and therefore falls within a protection buffer zone for the Indiana bat.[8] As a result, bats using the hibernaculum may occur within the buffer zone. However, because of the small project footprint, minimal availability of suitable habitat, and the applicant's proposal to adhere to FWS' recommended avoidance measures, construction and operation of the proposed Charleroi Project would not likely adversely affect bats or their habitat.

PNDI report correspondence from FWS for the Maxwell, Grays Landing, and Point Marion Projects indicates that no known effects on bats are anticipated, and no further coordination is required for those projects. In addition, in its July 11, 2016, filing, the applicants agreed to implement the Charleroi Project avoidance measures at the Maxwell, Grays Landing, and Point Marion Projects to ensure adequate protection of bats in the region. Based on the lack of both habitat and known occurrences in the area, plus the added protection of the avoidance measures, construction and operation of the proposed Maxwell, Grays Landing, and Point Marion Projects would have no effect on either bat species.

Prior correspondence from FWS[9] indicated that no federally listed bats are known to occur within the vicinity of the Opekiska and Morgantown Projects, and, therefore, construction and operation of the projects would have no effect on listed bats. However, in a February 11, 2016, filing, FWS states that Indiana bat and northern long-eared bat could use the Opekiska Project area for foraging and roosting. Further correspondence with FWS indicates that Indiana bat and northern long-eared bat may also use the Morgantown Project area for foraging and roosting, and tree removal for the proposed transmission line may affect bat habitat.[10] Nevertheless, given the small project footprints and minimal availability of suitable habitat, construction and operation of the proposed Opekiska and Morgantown Projects would not likely adversely affect the bats or their habitat.

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[8] *See* memo filed August 19, 2016, FERC accession no. 20160819-4027.

[9] *See* appendix A of the *Rare, Threatened, and Endangered Species Report* from the final license application, volume II, Appendix C-4, FERC accession no. 20140227-5260.

[10] *See* memo filed August 19, 2016, FERC accession no. 20160819-4027.

Recreation

Construction and operation of the Grays Landing, Maxwell, and Charleroi Projects would result in minor and temporary impacts on limited recreational resources at these sites. Construction and operation of the Opekiska, Morgantown, and Point Marion Projects, however, would have permanent effects on shoreline angling access because much of the shoreline area used by anglers is within the footprint of the proposed powerhouse/tailrace areas. At the Morgantown and Point Marion Projects, construction and operation would also affect public access to the Caperton and Sheepskin Trails.

The staff alternative includes the following applicant-proposed recreation amenities: an accessible fishing platform, an accessible canoe portage trail, accessible restroom facilities, and parking facilities at Opekiska; two shoreline angler paths, stairs leading to the river, and parking facilities at Morgantown; and a shoreline angler path with stairs leading to the river at the Point Marion Project. In addition, the staff-recommended recreation plans for the Morgantown and Point Marion Projects include the applicants' proposed measures and provisions for an accessible fishing platform and angler path at the Morgantown Project tailrace, and a fishing platform at the end of the proposed angler path at the Point Marion Project. The staff recommendation includes a construction access plan for the Morgantown and Point Marion Projects and an access improvement plan with provisions for shoreline angler access at the Grays Landing, Maxwell, and Charleroi Projects. The fishing platforms would mitigate for the loss of informal fishing areas caused by construction of the Opekiska, Morgantown, and Point Marion Projects; the canoe portage trail and angler paths would increase access to the Opekiska, Morgantown, and Point Marion sites for boaters and anglers; the addition of parking facilities and a restroom would encourage recreational use of the Opekiska site; a construction access plan for the Morgantown and Point Marion Projects would mitigate construction effects that might hinder public use of the Caperton and Sheepskin Trails; and the access improvement plan would ensure increased angler access is provided at Grays Landing, Maxwell, and Charleroi.

Land Use and Aesthetics

Construction activity could cause a temporary, localized disruption of existing land use in the immediate vicinity of the projects. Short-term, unavoidable effects during construction would include increased levels of traffic, noise, and activity. The disturbances would be localized, with the surrounding residential areas along the riverfront being most affected. The staff-recommended construction access plan would include measures to avoid transmission line and access road-related impacts that might affect land use at the Morgantown and Point Marion Projects. The staff alternative includes the applicants' proposals to restore areas after construction by clearing construction debris and revegetating the landscape to protect existing aesthetics and historic properties at each site. The staff-recommended HPMPs also include a provision to visually blend the powerhouses with the locks and dams, which would ensure that new project facilities are not obtrusive to viewers.

Debris and trash, which can affect the visual character of the river, accumulates behind the existing dams and would concentrate upstream of the projects' trash racks during operations. The staff-recommended debris management plans would include the applicants' proposals to remove trash from the trash racks as well as procedures that describe how trash and other debris would be sorted, stored, and disposed of.

Cultural Resources

Construction of the proposed projects has the potential to affect historic properties associated with five of the existing Corps' locks and dams and also the Monongahela River Navigation System, all of which are eligible for listing on the National Register of Historic Places (National Register). The Grays Landing Lock and Dam is not considered to be a historic property, because it does not yet meet the 50-year threshold for National Register eligibility. The proposed projects could also adversely affect other cultural resources located within each project's area of potential effects. However, revision of the filed HPMPs to include additional staff-recommended measures (listed in section 3.3.7.2, *Cultural Resources, Environmental Effects, Effects on Historic Properties*), such as implementing specific management measures to resolve project-related adverse effects in consultation with the Corps and either the West Virginia Division of Culture and History or the Pennsylvania Bureau for Historic Preservation, would avoid or mitigate any adverse effects on historic properties.

No-action Alternative

Under the no-action alternative for each project, no license would be issued, and the proposed project would therefore not be constructed. Environmental conditions would remain the same at each site that is not licensed.

Conclusions

Based on our analysis, we recommend licensing all of the projects under the staff alternative.

In section 4.2, *Comparison of Alternatives*, we estimate the likely cost of alternative power for each of the three alternatives identified above. For the Opekiska Project, our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $874,680, or $34.16/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $889,100, or $34.72/MWh, more than the likely alternative cost of power.

For the Morgantown Project, our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $965,390, or $50.47/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $983,110, or $51.39/MWh, more than the likely alternative cost of power.

For the Point Marion Project, our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $1,026,750, or $61.48/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $1,043,620, or $62.49/MWh, more than the likely alternative cost of power.

For the Grays Landing Project, our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $1,303,800, or $27.19/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $1,318,560, or $27.49/MWh, more than the likely alternative cost of power.

For the Maxwell Project, our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $1,412,460, or $24.73/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $1,427,230, or $24.99/MWh, more than the likely alternative cost of power.

For the Charleroi Project, our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $1,282,820, or $26.24/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $1,297,590, or $26.54/MWh, more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative for each project because: (1) the projects would provide a dependable source of electrical energy for the region (215,395 MWh annually); (2) the combined 53 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by the applicants, as modified by staff, would adequately protect and enhance environmental resources affected by the projects. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

We conclude that issuing original licenses for the projects with the environmental measures we recommend would not be a major federal action significantly affecting the quality of the human environment.

MULTI-PROJECT

ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Opekiska Lock and Dam Hydroelectric Project, FERC Project No. 13753-002
Morgantown Lock and Dam Hydroelectric Project, FERC Project No. 13762-002

West Virginia

Point Marion Lock and Dam Hydroelectric Project, FERC Project No. 13771-002
Grays Landing Lock and Dam Hydroelectric Project, FERC Project No. 13763-002
Maxwell Locks and Dam Hydroelectric Project, FERC Project No. 13766-002
Monongahela Locks and Dam 4 Hydroelectric Project, FERC Project No. 13767-002

Pennsylvania

1.0 INTRODUCTION

1.1 APPLICATIONS

On February 27, 2014, applications were filed with the Federal Energy Regulatory Commission (Commission or FERC) for construction and operation of six hydropower projects to be located at the U.S. Army Corps of Engineers' (Corps') dams on the Monongahela River. These projects are collectively referred to as the Monongahela River Projects and described in more detail below. All six applicants are subsidiary companies of FFP New Hydro, LLC. Rye Development, LLC, is acting as agent on behalf of FFP New Hydro, LLC and its subsidiary companies for the Monongahela River Projects. This environmental assessment (EA) addresses project-specific environmental effects of licensing the proposed Monongahela River Projects (projects) and the potential cumulative effects of these projects and FFP New Hydro LLC's other proposed hydropower projects on the nearby Allegheny and Ohio Rivers (figure 1-1).[11]

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[11] The three projects on the Ohio River (P-13757, P-13761, and P-13768) are referred to as the Ohio River Projects, and the single project on the Allegheny River (P-13755) is referred to as the Allegheny Project. The EAs for the Ohio River Projects and the Allegheny Project were issued on June 3 and June 30, 2016, respectively.

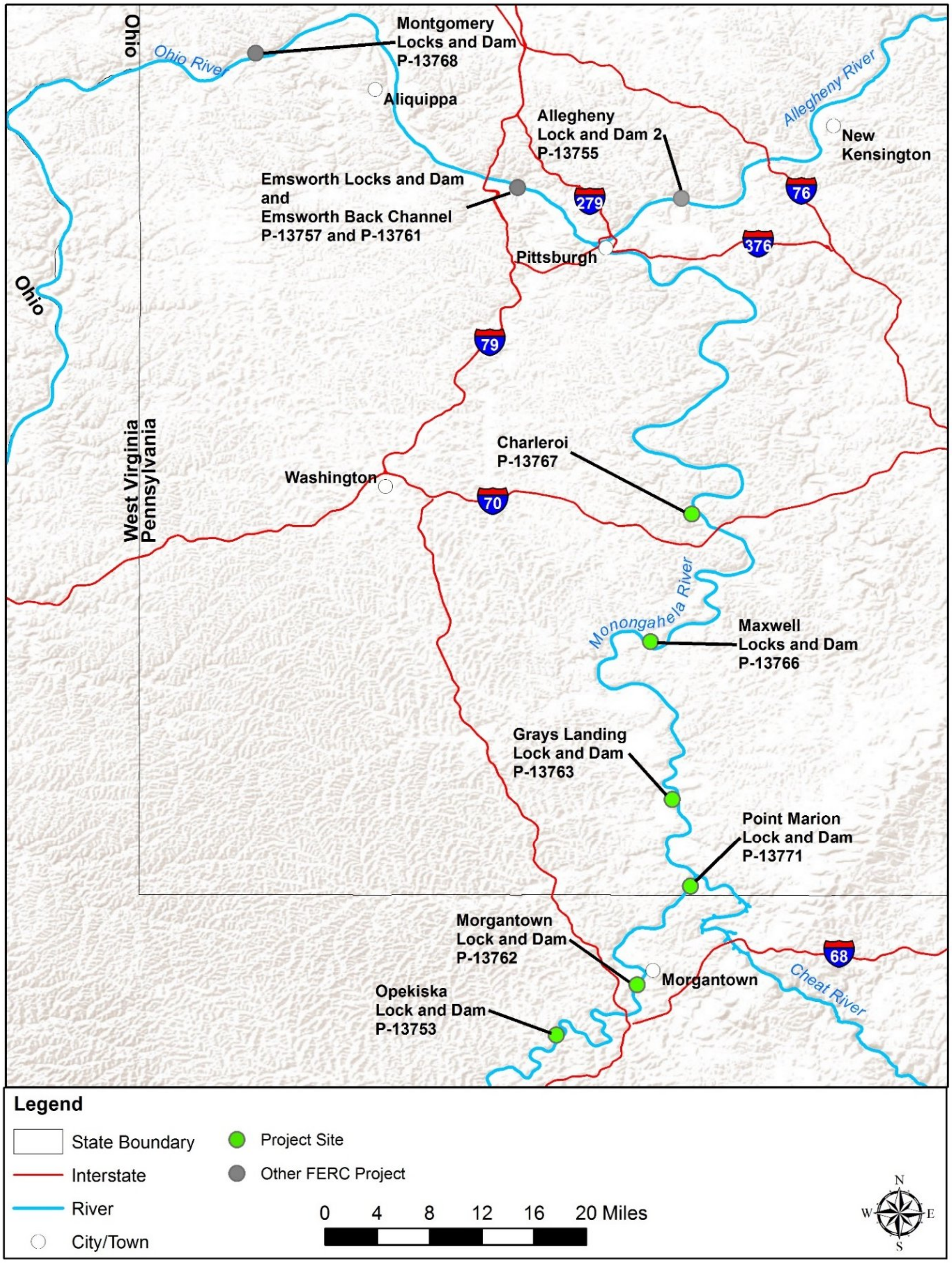

Figure 1-1. Location map of the Monongahela River Projects, Allegheny Project, and Ohio River Projects (Source: staff).

Opekiska Lock and Dam Hydroelectric Project

On February 27, 2014, FFP Missouri 16, LLC (FFP Missouri 16), filed an application for an original license with the Commission to construct and operate its proposed Opekiska Lock and Dam Hydroelectric Project No. 13753 (Opekiska Project). The project would be located on the Monongahela River at river mile (RM) 115.4 in Monongalia County, West Virginia, at the existing Opekiska Lock and Dam owned and operated by the Corps (figures 1-1 and 1-2). The proposed project would consist of constructing an intake, powerhouse, tailrace, substation, and transmission line. The project would have an installed capacity of 6 megawatts (MW) and an estimated annual generation of 25,300 megawatt-hours (MWh). The project would occupy 4.31 acres of federal land owned by the Corps.

Morgantown Lock and Dam Hydroelectric Project

On February 27, 2014, FFP Missouri 15, LLC (FFP Missouri 15), filed an application for an original license with the Commission to construct and operate its proposed Morgantown Lock and Dam Hydroelectric Project No. 13762 (Morgantown Project). On July 25, 2014, FFP Missouri 15 filed an update to its application regarding the proposed location of the powerhouse and other project facilities. The project would be located on the Monongahela River at RM 102.0 in Monongalia County, West Virginia, at the existing Morgantown Lock and Dam owned and operated by the Corps (figures 1-1 and 1-3). The proposed project would consist of constructing an intake, spill gates, powerhouse, tailrace, substation, and transmission line. The project would have an installed capacity of 5 MW and an estimated annual generation of 18,900 MWh. The project would occupy 0.99 acre of federal land owned by the Corps.

Point Marion Lock and Dam Hydroelectric Project

On February 27, 2014, Solia 8 Hydroelectric, LLC (Solia 8 Hydroelectric), filed an application for an original license with the Commission to construct and operate its proposed Point Marion Lock and Dam Hydroelectric Project No. 13771 (Point Marion Project). On July 25, 2014, Solia 8 Hydroelectric filed an update to its application regarding the proposed location of the access road and other project facilities. The project would be located on the Monongahela River at RM 90.8 in Fayette County, Pennsylvania, at the existing Point Marion Lock and Dam owned and operated by the Corps (figures 1-1 and 1-4). The proposed project would consist of constructing an intake, powerhouse, tailrace, substation, and transmission line. A portion of the existing fixed-crest spillway on the east end of the dam would be removed to accommodate the proposed project. The project would have an installed capacity of 5 MW and an estimated annual generation of 16,500 MWh. The project would occupy 1.44 acres of federal land owned by the Corps.

Grays Landing Lock and Dam Hydroelectric Project

On February 27, 2014, FFP Missouri 13, LLC (FFP Missouri 13), filed an application for an original license with the Commission to construct and operate its proposed Grays Landing Lock and Dam Hydroelectric Project No. 13763 (Grays Landing Project). The project would be located on the Monongahela River at RM 82.0 in Greene and Fayette Counties, Pennsylvania, at the existing Grays Landing Lock and Dam owned and operated by the Corps (figures 1-1 and 1-5). The project would consist of constructing an intake, crest gate, powerhouse, tailrace, substation, and transmission line, and it would have an installed capacity of 12 MW and an estimated annual generation of 47,300 MWh. The project would occupy 10.46 acres of federal land owned by the Corps.

Maxwell Locks and Dam Hydroelectric Project

On February 27, 2014, Solia 5 Hydroelectric, LLC (Solia 5 Hydroelectric), filed an application for an original license with the Commission to construct and operate its proposed Maxwell Locks and Dam Hydroelectric Project No. 13766 (Maxwell Project). The project would be located on the Monongahela River at RM 61.2 in Washington County, Pennsylvania, at the existing Maxwell Locks and Dam owned and operated by the Corps (figures 1-1 and 1-6). The project would consist of constructing an intake, spill gates, powerhouse, tailrace, substation, and transmission line, and it would have an installed capacity of 13 MW and an estimated annual generation of 56,800 MWh. The project would occupy 2.02 acres of federal land owned by the Corps.

Monongahela Locks and Dam 4 Hydroelectric Project

On February 27, 2014, Solia 4 Hydroelectric, LLC (Solia 4 Hydroelectric), filed an application for an original license with the Commission to construct and operate its proposed Monongahela Locks and Dam 4 Hydroelectric Project No. 13767 (referred to as the Charleroi Project).[12] The project would be located on the Monongahela River at RM 41.5 in Washington County, Pennsylvania, at the existing Monongahela Locks and Dam 4 (also known as Charleroi Locks and Dam) owned and operated by the Corps (figures 1-1 and 1-7). The project would consist of constructing an intake, spill gates, powerhouse, tailrace, substation, and transmission line, and it would have an installed capacity of 12 MW and an estimated annual generation of 48,500 MWh. The project would occupy 0.68 acre of federal land owned by the Corps.

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[12] Although the applicant refers to its project as the Monongahela Locks and Dam 4 Hydroelectric Project, in this EA, we refer to it as the Charleroi Project because that is the common project name used by the applicant and many stakeholders.

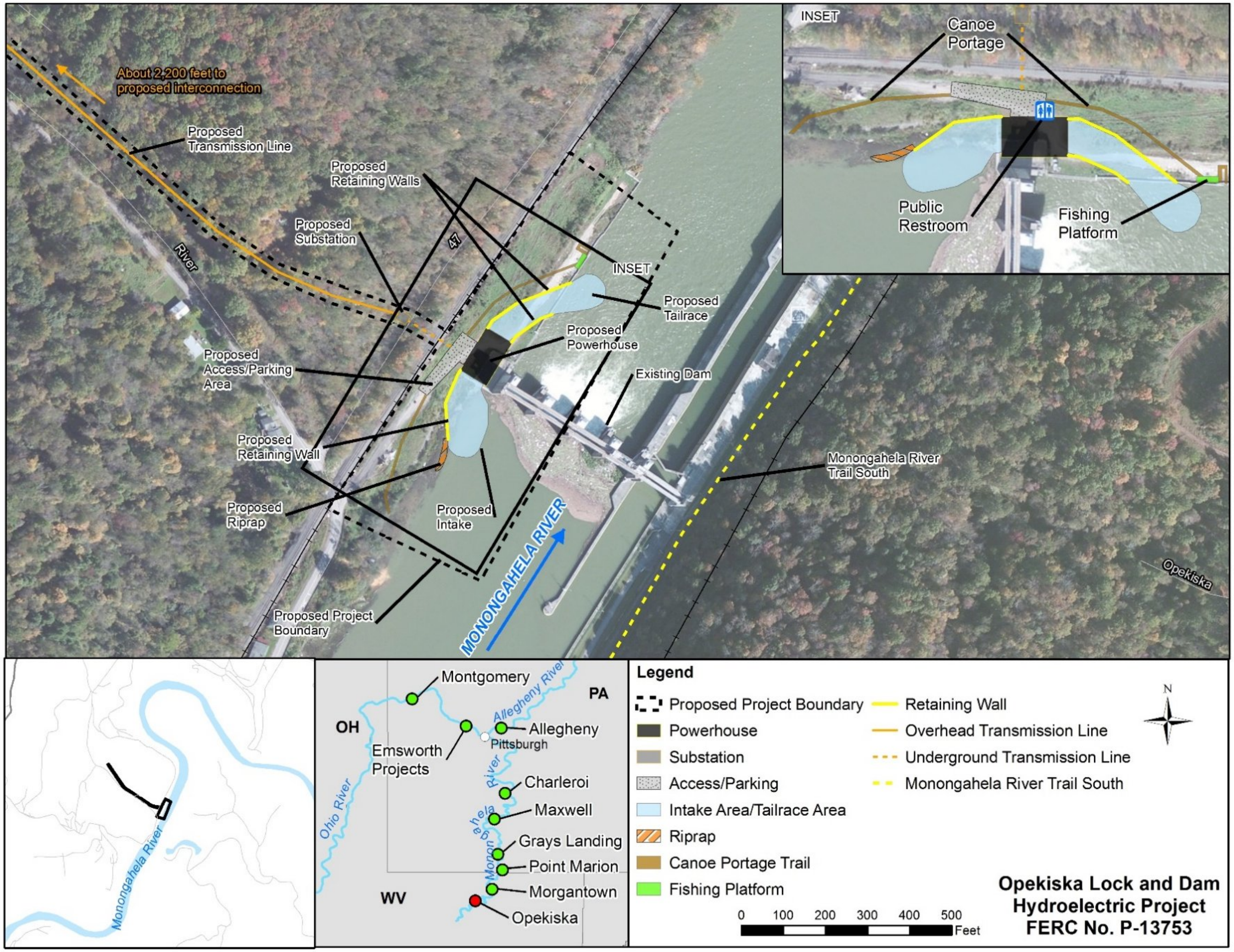

Figure 1-2. Location map of the Opekiska Project (Source: staff).

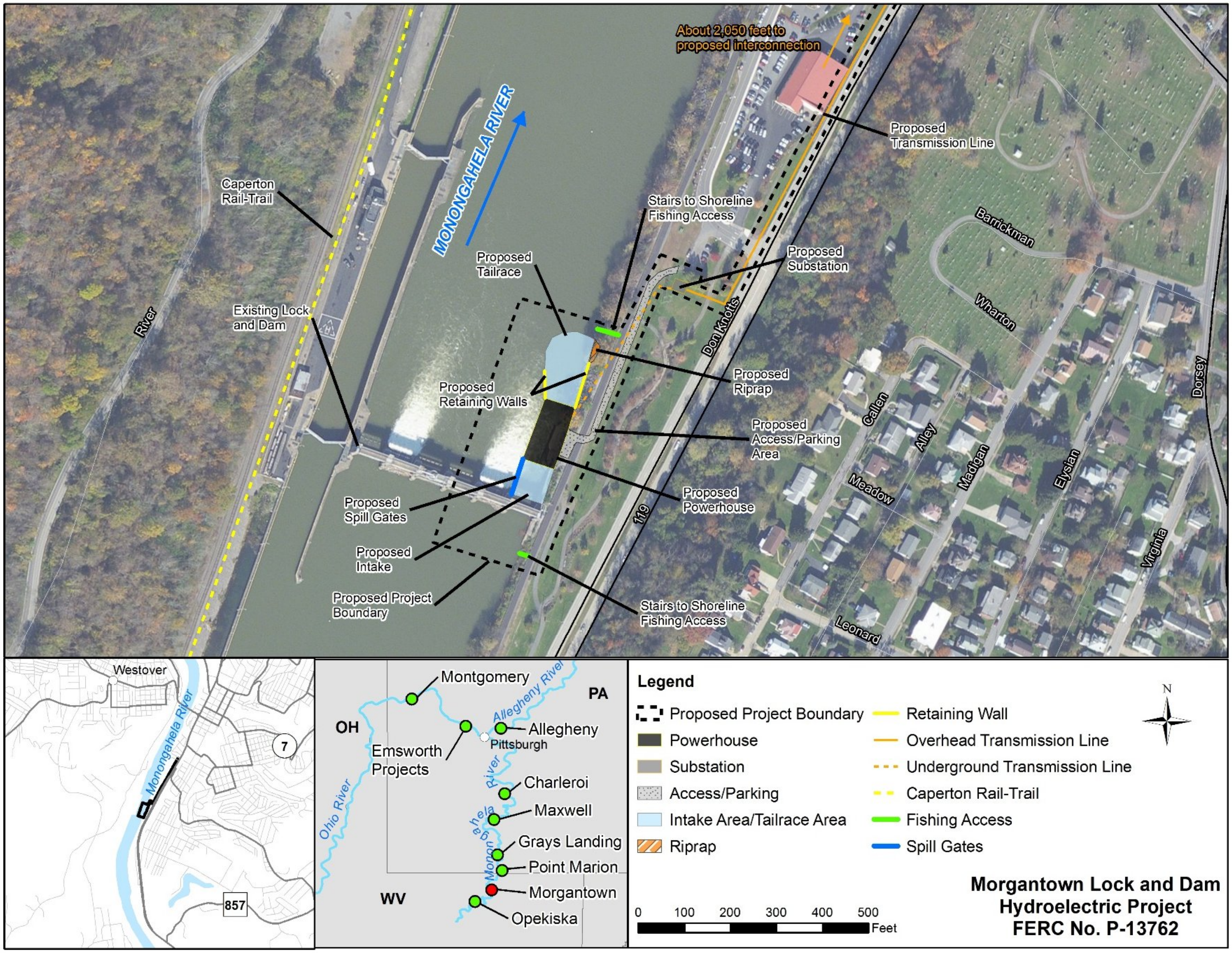

Figure 1-3. Location map of the Morgantown Project (Source: staff).

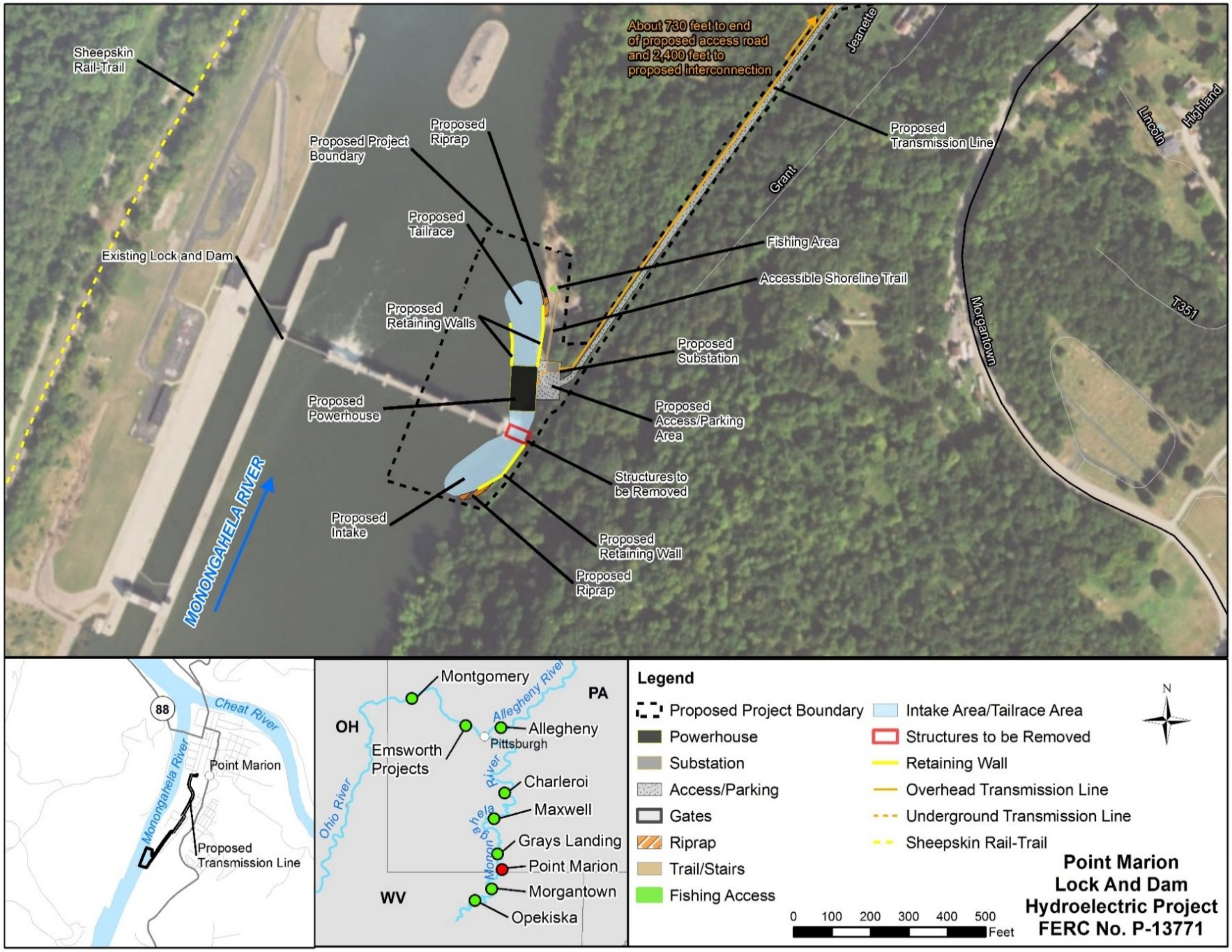

Figure 1-4. Location map of the Point Marion Project (Source: staff).

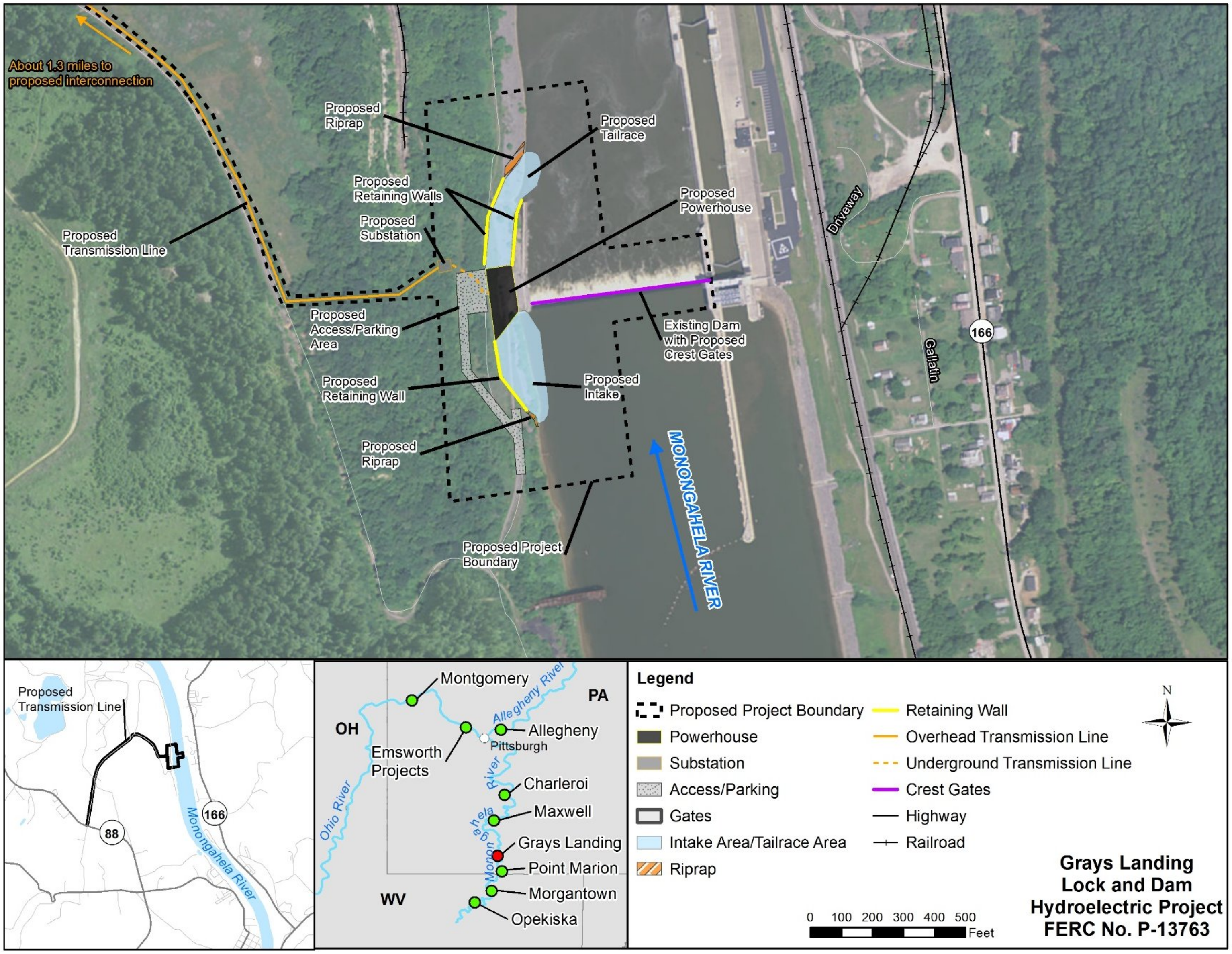

Figure 1-5. Location map of the Grays Landing Project (Source: staff).

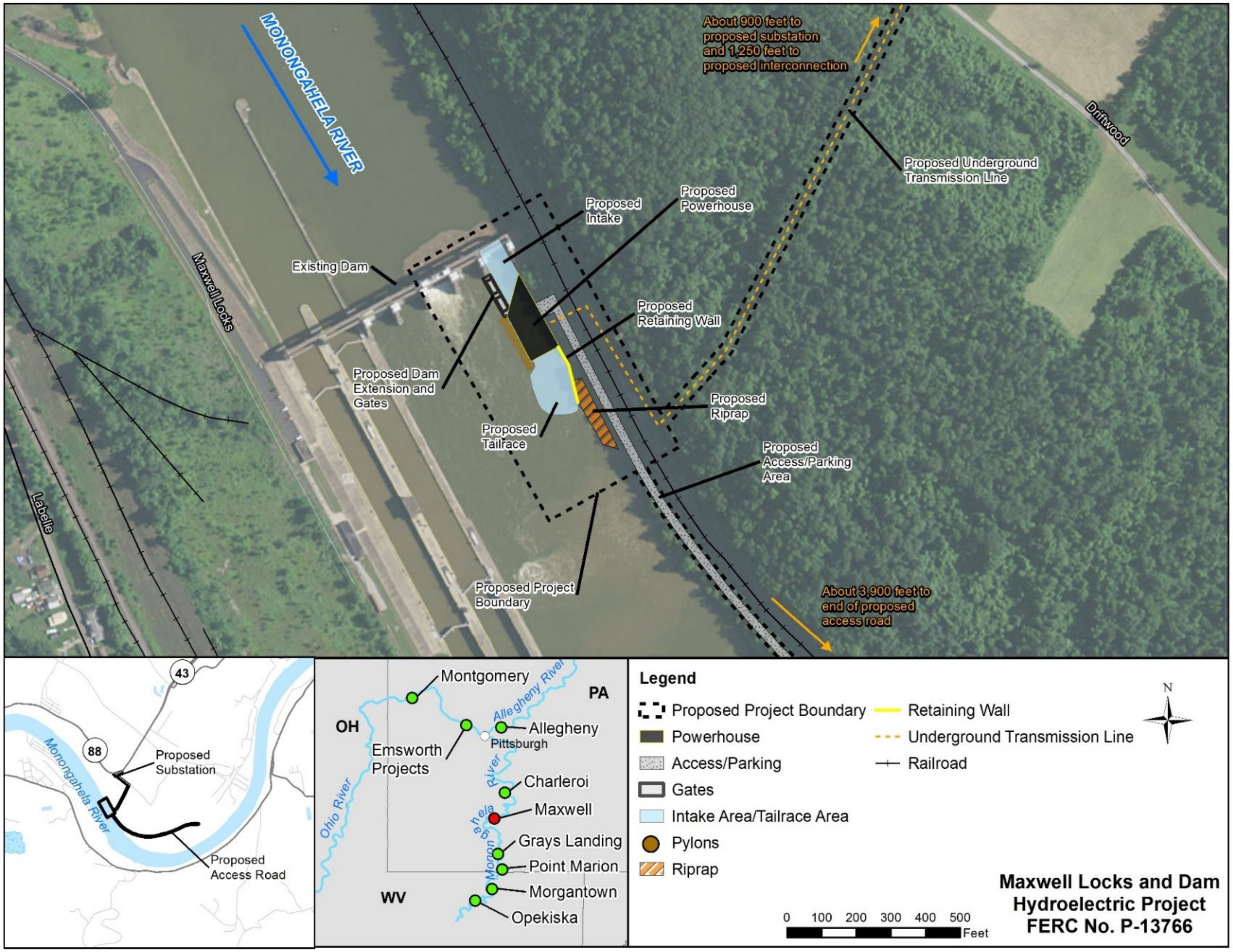

Figure 1-6. Location map of the Maxwell Project (Source: staff).

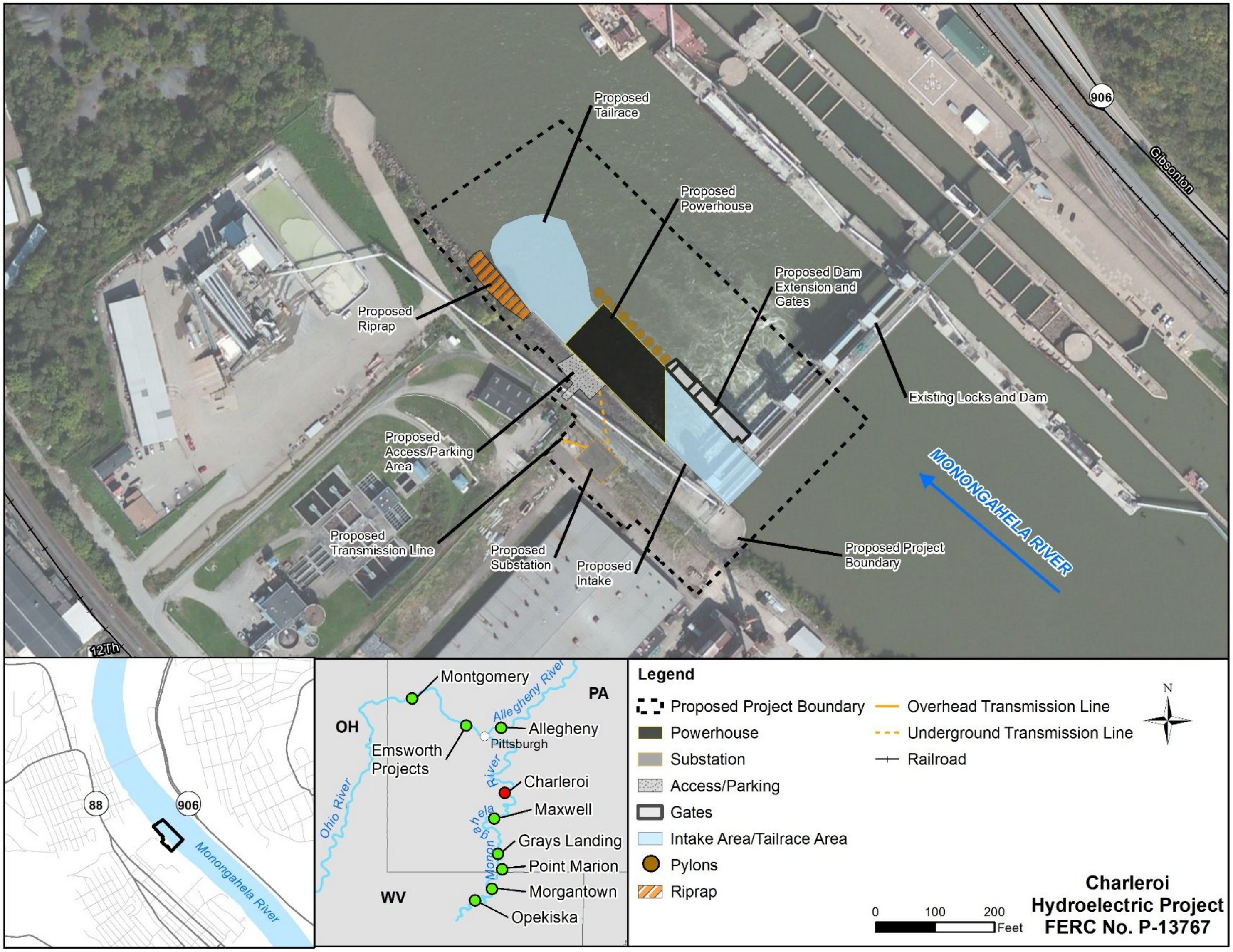

Figure 1-7. Location map of the Charleroi Project (Source: staff).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed Monongahela River Projects is to provide new sources of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue licenses to FFP Missouri 13, FFP Missouri 15, FFP Missouri 16, Solia 4 Hydroelectric, Solia 5 Hydroelectric, and Solia 8 Hydroelectric (the applicants) for the projects and what conditions should be placed on any licenses issued. In deciding whether to issue a license for any 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 (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing licenses for the proposed Monongahela River Projects would allow the applicants to generate electricity for the term of each license, making electric power from a renewable resource available to their customers.

This multi-project EA has been prepared in compliance with the National Environmental Policy Act of 1969 to assess the environmental and economic effects associated with construction and operation of the Monongahela River Projects and alternatives to the proposed projects, and makes recommendations to the Commission on whether to issue a license for each project, and if so, recommends terms and conditions to become a part of any license issued for each project.

In this EA, we assess the environmental and economic effects of constructing, operating, and maintaining the Monongahela River Projects: (1) as proposed by the applicants (proposed action); and (2) with our recommended measures (staff alternative). We also consider the effects of the no-action alternative for each project. Important issues that are addressed include the potential effects of project construction and operation on soils and sedimentation; dissolved oxygen (DO) concentrations; aquatic species and their habitat downstream of the Corps' dams; fish entrainment; vegetation and wildlife; recreation, aesthetics, and cultural resources.

1.2.2 Need for Power

The six Monongahela River Projects would provide hydroelectric generation to meet part of West Virginia's and Pennsylvania's power requirements, resource diversity, and capacity needs. The projects would have a combined installed capacity of 53 MW, and over the term of the licenses would generate an average of about 213,300 MWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Monongahela River Projects are located within the jurisdiction of the PJM Interconnection LLC (PJM), a subregion of the Reliability First Corporation, a region of the NERC. PJM is a regional transmission organization that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia. According to NERC's most recent (2015) forecast, the total internal demand is expected to grow at a compound annual rate of 0.93 percent in summer and 0.82 percent in winter over the next 10 years (NERC, 2015).

We conclude that power from the Monongahela River Projects would help meet a need for power in the PJM subregion in both the short and long term. The projects would provide power that could displace non-renewable, fossil-fired generation and contribute to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions and create an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Licenses for the proposed projects are subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described in the following sections.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce or the U.S. Department of the Interior (Interior). Interior, by letter filed on February 11, 2016, requests a reservation of authority to prescribe fishways for the projects under section 18.

1.3.1.2 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the projects. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Interior timely filed, on February 11, 2016, recommendations under section 10(j), as summarized in table 5-1, in section 5.3, *Fish and Wildlife Agency Recommendations.* In section 5.3, we also discuss how we address agency recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401(a)(1) of the Clean Water Act, a license applicant must obtain either water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the Clean Water Act, or a waiver of certification by the appropriate state agency. The failure to act on a request for certification within a reasonable period of time, not to exceed one year, after receipt of such request constitutes a waiver.

On February 11, 2016, FFP Missouri 16 and FFP Missouri 15 mailed their applications to the West Virginia Department of Environmental Protection (West Virginia DEP) for a section 401 certification for licensing both the Opekiska and Morgantown Projects. West Virginia DEP received the applications on February 12, 2016.[13] West Virginia DEP has not yet acted on the certification requests. The certifications are due by February 12, 2017.

On February 11 and 15, 2016, Solia 8 Hydroelectric mailed its application in two parts to the Pennsylvania Department of Environmental Protection (Pennsylvania DEP) for a section 401 certification for licensing the Point Marion Project. Pennsylvania DEP received a part of the application on February 12, 2016, and the remaining portion of the application on February 16, 2016.[14] Pennsylvania DEP has not yet acted on the certification request.[15] The certification is due by February 16, 2017.

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[13] The applicants filed a copy of the certification requests and receipts of delivery to West Virginia DEP on February 16, 2016.

[14] The applicant filed a copy of the certification request and receipt of delivery to Pennsylvania DEP on February 16, 2016.

[15] In a letter filed on September 21, 2016, Pennsylvania DEP determined that the application for the Point Marion Project is incomplete and requested that the applicant submit additional information.

On February 9, 2016, FFP Missouri 13 mailed its application to Pennsylvania DEP for a section 401 certification for licensing the Grays Landing Project. Pennsylvania DEP received the application on February 10, 2016.[14] Pennsylvania DEP has not yet acted on the certification request.[16] The certification is due by February 10, 2017.

On February 4, 2016, Solia 5 Hydroelectric mailed its application to Pennsylvania DEP for a section 401 certification for licensing the Maxwell Project. Pennsylvania DEP received the application on February 5, 2016.[14] Pennsylvania DEP has not yet acted on the certification request.[17] The certification is due by February 5, 2017.

On January 20, 2016, Solia 4 Hydroelectric mailed its application to Pennsylvania DEP for a section 401 certification for licensing the Charleroi Project. Pennsylvania DEP received the application on January 21, 2016.[14] Pennsylvania DEP has not yet acted on the certification request. The certification is due by January 21, 2017.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species.

Based on staff's review of information available through the U.S. Fish and Wildlife Service (FWS) records, Pennsylvania Natural Heritage Program, and correspondence with the West Virginia Division of Natural Resources (West Virginia DNR), two federally listed freshwater mussel species (clubshell and snuffbox) and two federally listed terrestrial species (Indiana bat and northern long-eared bat) have historically occurred or may occur in the counties in which the projects would be located. No designated or proposed critical habitat for these species is presently found within the proposed project boundaries. Our analysis of project impacts on threatened and endangered species is presented in section 3.3.4, *Threatened and Endangered Species,*

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[16] In a letter filed on August 1, 2016, Pennsylvania DEP determined that the application for the Grays Landing Project is incomplete and requested that the applicant submit additional information.

[17] In a letter filed on August 11, 2016, Pennsylvania DEP determined that the application for the Maxwell Project is incomplete and requested that the applicant submit additional information.

and our recommendations are in section 5.1, *Comprehensive Development and Recommended Alternative*.

No federally listed mussel species were documented at any of the proposed project vicinities during the applicants' 2013 mussel surveys, or during Hart's comprehensive (2012) surveys on the Pennsylvania section of the Monongahela River. Pennsylvania Natural Diversity Index (PNDI) report correspondence with the Pennsylvania Fish and Boat Commission (Pennsylvania FBC) and FWS, filed by the applicants on February 27, 2014, July 8, 2015, September 24, 2015, and July 11, 2016, indicated no known impacts on aquatic species, and no further review was required. Therefore, construction and operation of all six of the projects would have no effect on the clubshell and snuffbox mussels.

FWS' Species Search website indicates that Indiana bats and northern long-eared bats are known to occur in the counties where the projects would be located. However, neither bat species was observed during general habitat surveys at any of the six project locations.

For the Charleroi Project, PNDI report correspondence from FWS, updated by the applicant on July 11, 2016, indicates that construction and operation of the project is not likely to adversely affect bats if the following avoidance measure is implemented: conduct tree cutting, tree inundation, and prescribed burns only between November 15 and March 31 to avoid injuring or killing endangered bats. While the proposed Charleroi Project would only disturb 0.07 acre of limited quality riparian forest, all of which would be associated with shoreline stabilization measures in a previously disturbed and inundated area, correspondence with FWS indicates that the proposed Charleroi Project is located within 10 miles of a known hibernaculum and therefore falls within a protection buffer zone for the Indiana bat.[18] As a result, bats using the hibernaculum may occur within the buffer zone; however, because of the small project footprint, minimal availability of suitable habitat, and the applicant's adherence to FWS' recommended avoidance measures, construction and operation of the proposed Charleroi Project would not likely adversely affect bats or their habitat.

For the Maxwell, Grays Landing, and Point Marion Projects, PNDI report correspondence from FWS, updated by the applicants on July 11, 2016, indicates that no federally listed bats are known to occur within the vicinity of the projects, and no further consultation is necessary. Overall, each project would disturb less than 4 acres of limited quality riparian forest, which, considering the developed and previously disturbed

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[18] *See* memo filed August 19, 2016, FERC accession no. 20160819-4027.

condition of the project areas, is not likely to support either bat species. Although not specifically recommended by FWS, the applicant states in its July 11, 2016, filing that it is also proposing to implement the same FWS avoidance measures from Charleroi at the Maxwell, Grays Landing, and Point Marion Projects to ensure adequate protection of bats in the region. Given the nature of the existing habitat (both small project size and minimal suitable habitat), plus the added protection of the avoidance measures, construction and operation of the Maxwell, Grays Landing, and Point Marion Projects would have no effect on bats or their habitat. Therefore, no further coordination with FWS would be needed for bats at the Maxwell, Grays Landing, and Point Marion Projects.

Prior correspondence from FWS[19] indicated that no federally listed bats are known to occur within the vicinity of the Opekiska and Morgantown Projects and, therefore, construction and operation of the projects would have no effect on listed bats. However, in Interior's February 11, 2016, letter, FWS states that Indiana bat and northern long-eared bat could potentially use the Opekiska Project area for foraging and roosting. Further correspondence with FWS indicates that Indiana bat and northern long-eared bat could also use the Morgantown Project area for foraging and roosting, and tree removal for the proposed transmission line may affect bat habitat.[20] Nevertheless, given the small project footprints and minimal availability of suitable habitat, construction and operation of the Opekiska and Morgantown Projects would not likely adversely affect the bats or their habitat.

We are requesting FWS concurrence with our finding for the Indiana bat and northern long-eared bat for the Charleroi, Opekiska, and Morgantown Projects.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code (U.S.C.) § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program,

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[19] *See* appendix A of the Rare, Threatened, and Endangered Species Report from the final license application, volume II, Appendix C-4, FERC accession no. 20140227-5260.

[20] *See* February 11, 2016, letter from FWS and memo filed August 19, 2016, FERC accession no. 20160819-4027.

or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

Pennsylvania DEP, in letters filed June 22, 2011 (Point Marion Lock and Dam and Maxwell Locks and Dam), and December 16, 2011 (Grays Landing Lock and Dam, Charleroi Locks and Dam), indicates that the proposed Monongahela River Projects would be located outside of Pennsylvania's designated coastal zone. Therefore, the projects are not subject to the Pennsylvania coastal zone program review, and no consistency certifications are needed for the actions.

West Virginia does not have a Coastal Zone Management Program, and no consistency certifications are needed for the actions.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA)[21] requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

On January 5, 2012, the Commission designated the applicants as its non-federal representatives for the purposes of conducting section 106 consultation under the NHPA. Pursuant to section 106, and as the Commission's designated non-federal representatives, the applicants consulted with the West Virginia Division of Culture and History (West Virginia SHPO) and the Pennsylvania Bureau for Historic Preservation (Pennsylvania SHPO) to identify historic properties, determine National Register eligibility, and assess potential adverse effects on historic properties within the projects' areas of potential effects (APEs). These consultations and other investigations concluded that the projects would adversely affect five of the Corps' existing locks and dams, which are contributing elements of the historic Monongahela River Navigation System. The dams individually and the Monongahela River Navigation System are eligible for inclusion in the National Register. The Grays Landing Project does not yet meet the 50-year threshold for National Register eligibility. The West Virginia SHPO and Pennsylvania SHPO have not commented on potential effects on other cultural resources that were identified within the projects' APEs.

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[21] 54 U.S.C. § 306108 (2014).

To meet the requirements of section 106 of the NHPA, we intend to execute Programmatic Agreements (PAs) with the West Virginia SHPO and the Pennsylvania SHPO for the protection of historic properties from the effects of construction, operation, and maintenance of the Monongahela River Projects. The terms of the PAs would ensure that the applicants address and treat all historic properties identified within the projects' APEs through the finalization and implementation of the proposed historic properties management plans (HPMPs).

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], section 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping for all six projects to determine what issues and alternatives should be addressed. A scoping document for the Monongahela River Projects was distributed to interested agencies and others on September 2, 2014. The document was noticed in the Federal Register on September 30, 2014. Environmental site reviews at each of the Monongahela River Projects were held on October 7 and 8, 2014. Scoping meetings were held on October 7, 2014, in Morgantown, West Virginia; on October 8, 2014, in Uniontown, Pennsylvania; and on October 10, 2014, in Pittsburgh, Pennsylvania, to request oral comments on the projects. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the projects. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	**Date Filed**
West Virginia Division of Natural Resources	October 30, 2014
U. S. Army Corps of Engineers, Pittsburgh District	November 6, 2014
Pennsylvania Fish and Boat Commission	November 10, 2014
John Stephen	November 10, 2014
National Park Service	November 10, 2014
City of Morgantown	November, 10, 2014
Monongahela River Trails Conservancy Ltd.	November 10, 2014
Sera Zegre	November 10, 2014
Point Marion Borough Council	November 12, 2014
John Lichter	November 12, 2014

In addition to the scoping comments, the following entities filed comments after scoping concluded:

Commenting Entity	**Date Filed**
Monongalia County Commission	December 9, 2014
Monongahela River Trails Conservancy Ltd.	August 3, 2015
Pennsylvania Environmental Council	August 7, 2015
Upper Monongahela River Association, Inc.	August 17, 2015
National Park Service	August 17, 2015
Mon River Town Program	August 24, 2015
Borough of Charleroi	August 31, 2015
West Virginia Division of Natural Resources	September 21, 2015
U.S. Army Corps of Engineers, Pittsburgh District	October 5, 2015

A revised scoping document was issued on December 17, 2015.

1.4.2 Interventions

On July 18, 2014, the Commission issued a notice accepting the applications. The notice set September 16, 2014, as the deadline for filing motions to intervene and protests and requests for cooperating agency status. On August 29, 2014, West Virginia DNR intervened in the licensing proceedings for the Opekiska and Morgantown Projects.

In addition, several parties filed late interventions. On January 29, 2016, Interior filed a late intervention for all six of the Monongahela River Projects. On February 5, 2016, Springhill Township and Point Marion Borough filed late interventions for the Point Marion Project. On February 12, 2016, the National Road Heritage Corridor filed a late intervention for the Point Marion Project, the Maxwell Project, and the Charleroi Project. On February 16, 2016, the Monongahela River Trails Conservancy Ltd. (Mon River Trails Conservancy) filed a late intervention for all six of the Monongahela River Projects. On February 17, 2016, the City of Morgantown, West Virginia, filed a late intervention for the Morgantown Project.

On February 16, 2016, the Commission granted late intervention to Interior. On June 9, 2016, the Commission granted late intervention to Springhill Township, the National Road Heritage Corridor, and the Mon River Trails Conservancy. On August 3, 2016, the Commission granted late intervention to the City of Morgantown. On August 19, 2016, the Commission granted late intervention to Point Marion Borough.

1.4.3 Comments on the License Applications

The Commission issued a Ready for Environmental Analysis (REA) notice for the six Monongahela River Projects on December 17, 2015, and requested comments, recommendations, terms and conditions, and fishway prescriptions. The following entities filed comments, terms and conditions, recommendations, or prescriptions:

Commenting Agency and Other Entity	Date Filed
Rosanne Rodgers	January 7, 2016
Daniel Miller	January 11, 2016
U.S. Department of the Interior	February 11, 2016
National Road Heritage Corridor	February 12, 2016
Ecosophic Strategies, LLC	February 16, 2016
Upper Monongahela River Association	February 16, 2016
West Virginia Division of Natural Resources	February 16, 2016
Monongahela River Trails Conservancy Ltd.	February 16, 2016
Point Marion Borough	February 16, 2016

Commenting Agency and Other Entity	**Date Filed**
Pennsylvania Fish and Boat Commission	February 19, 2016
U.S. Army Corps of Engineers, Pittsburgh District	March 4, 2016

1.4.4 U.S. Army Corps of Engineers – Terms and Conditions

Pursuant to the Memorandum of Understanding between the Commission and the Department of the Army,[22] licensed hydropower facilities that would be an integral part of or that could affect the structural integrity or operation of Corps' projects shall be designed and constructed in consultation with and subject to the review and approval of the appropriate Corps' District Engineer. Consistent with the Memorandum of Understanding, the Commission routinely includes special license articles which do the following:

- require the licensee to submit final plans and specifications for cofferdams and deep excavations to the Corps and the Commission;

- require the licensee to enter into a comprehensive agreement with the Corps within 90 days after a license is issued to coordinate its plans for access to and site activities on lands and property administered by the Corps, so that the authorized purposes, including operation of the federal facilities, are protected;

- authorize the Corps to (a) inspect the construction, operation, and maintenance of any licensed facilities that may affect the structural integrity or operation of the Corps' project, and (b) order the licensee to stop any activity that may endanger the structural integrity or safety of the Corps' project;

- require the licensee to submit a regulating (or operating) plan to the Corps for approval at least 60 days prior to the start of construction, and to enter into an operating Memorandum of Agreement (MOA) with the Corps describing the detailed operation of the power facilities acceptable to the Corps;

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[22] See Memorandum of Understanding between the United States Army Corps of Engineers and the Federal Energy Regulatory Commission on Non-federal Hydropower Projects, July 2016. Available at: http://www.ferc.gov/legal/mou/2016/07-21-16.pdf.

- provide that the licensee shall have no claim under the license against the United States arising from the effect of any changes made in the operation or reservoir levels of the Corps' project; and

- require the licensee to provide the Commission's Regional Director two copies of all correspondence between the licensee and the Corps and provide that the Commission's Regional Director shall not authorize construction until the Corps provides final written approval of the project.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative for each project, no license would be issued, and the proposed project would therefore not be constructed. Environmental conditions would remain the same at each site that is not licensed.

2.2 APPLICANTS' PROPOSALS

2.2.1 Existing Corps Facilities

The Monongahela and Allegheny Rivers join to form the Ohio River in Pittsburgh, Pennsylvania. The Corps owns a total of 38 locks and dams on these rivers, including 9 on the Monongahela River, 8 on the Allegheny River, and 21 on the Ohio River. The Corps operates the locks and dams for commercial and recreational navigation.

The proposed projects would be located at six existing locks and dams on the Monongahela River: Opekiska Lock and Dam; Morgantown Lock and Dam; Point Marion Lock and Dam; Grays Landing Lock and Dam; Maxwell Locks and Dam; and Charleroi Locks and Dam.

2.2.1.1 Opekiska Lock and Dam

Opekiska Lock and Dam is located at RM 115.4 on the Monongahela River near Fairmont, West Virginia. The lock and dam consists of a 336-foot-long, 24-foot-high, concrete dam with a full length spillway equipped with four 84-foot-wide, 24-foot-high Tainter gates and a 600-foot-long, 84-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 857 feet National Geodetic Vertical Datum of 1929 (NGVD 29).[23] At that elevation, the upper pool has a surface area of 800 acres and a volume of 14,400 acre-feet.

2.2.1.2 Morgantown Lock and Dam

Morgantown Lock and Dam is located at RM 102.0 on the Monongahela River near Morgantown, West Virginia. The lock and dam consists of a 410-foot-long, 20-foot-high, concrete dam with a full length spillway equipped with six 60-foot-wide, 20-foot-high Tainter gates and a 600-foot-long, 84-foot-wide navigation lock. The normal water

[23] All elevations are provided in NGVD 29 datum unless otherwise noted.

surface elevation of the upper pool is at elevation 814 feet. At that elevation, the upper pool has a surface area of 365 acres and a volume of 6,200 acre-feet.

2.2.1.3 Point Marion Lock and Dam

Point Marion Lock and Dam is located at RM 90.8 on the Monongahela River near Point Marion, Pennsylvania. The lock and dam consists of a 560-foot-long, 20-foot-high, concrete dam with a full length spillway equipped with six 60-foot-wide, 8.5-foot-high Tainter gates; a 65-foot-wide fixed-crest weir on the right (east) side; a 110-foot-long, fixed-crest weir on the left side between the gated spillway and the lock; and a 720-foot-long, 84-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 797 feet. At that elevation, the upper pool has a surface area of 710 acres and a volume of 11,500 acre-feet.

2.2.1.4 Grays Landing Lock and Dam

Grays Landing Lock and Dam is located at RM 82.0 on the Monongahela River in Grays Landing, Pennsylvania. The lock and dam consists of a 576-foot-long, 37-foot-high, fixed-crest concrete dam and a 720-foot-long, 84-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 778 feet. At that elevation, the upper pool has a surface area of 620 acres and a volume of 10,100 acre-feet.[24]

2.2.1.5 Maxwell Locks and Dam

Maxwell Locks and Dam is located at RM 61.2 on the Monongahela River near Brownsville, Pennsylvania. The locks and dam consists of a 460-foot-long, 56-foot-high, concrete dam with a full length spillway equipped with five 84-foot-wide, 27.5-foot-high Tainter gates, and two 720-foot-long, 84-foot-wide navigation locks. The normal water surface elevation of the upper pool is at elevation 763 feet. At that elevation, the upper pool has a surface area of 1,750 acres and a volume of 26,700 acre-feet.

2.2.1.6 Monongahela Locks and Dam 4 (Charleroi)

Charleroi Locks and Dam is located at RM 41.5 on the Monongahela River in Charleroi, Pennsylvania. The locks and dam consists of a 420-foot-long, 40-foot-high, concrete dam with a full length spillway equipped with five 84-foot-wide, 21-foot-high

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[24] Surface area and volume of the Grays Landing pool were provided by the Corps in its comments on the draft license applications in a letter dated January 8, 2014, filed on February 3, 2014.

Tainter gates; a 720-foot-long, 56-foot-wide navigation lock; and a 360-foot-long, 56-foot-wide navigation lock. The normal water surface elevation of the upper pool is at elevation 743.5 feet. At that elevation, the upper pool has a surface area of 1,660 acres and a volume of 25,100 acre-feet.

2.2.2 Existing Corps Operations

The Corps' operation of the Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi dams is integrated with its operation of the other locks and dams on the river to maintain the navigation channel. At each dam, gates are repositioned on a daily basis to regulate discharge and maintain the desired pool elevation and corresponding navigation channel depth (a minimum depth of 9 feet). Although the Corps uses established gate schedules to guide gate selection and position, other factors can influence daily operations. Factors that influence gate selection and position include controlling detrimental scour and shoaling, avoiding adverse effects on navigation, and managing debris passage.

2.2.3 Proposed Project Facilities

Each of the proposed hydroelectric facilities would include an intake channel, intake structure, powerhouse, tailrace, substation, transmission lines, and access roads. Most of the projects would involve modifications to, or removal of, a portion of the Corps' existing spillway and one or more spillway gates at each dam. In addition, half of the projects would include recreational facilities. The transmission lines would connect to existing substations or distribution lines of nearby local utilities. The proposed project boundaries, shown in figures 1-2 through 1-6, would enclose the facilities described below, including transmission line rights-of-way (ROWs).

2.2.3.1 Opekiska Project

The proposed Opekiska Project would be located adjacent to the west end of Opekiska Lock and Dam and would consist of the following new facilities: (1) a 180-foot-long, 95-foot-wide intake channel excavated into the riverbed directing flow to a 30-foot-long, 70-foot-wide, 50-foot-high reinforced concrete intake structure and trash rack with 3-inch clear bar spacing; (2) a 120-foot-long, 70-foot-wide, 60-foot-high reinforced concrete powerhouse on the west bank of the river; (3) two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 6 MW; (4) a 280-foot-long, 64-foot-wide tailrace excavated into the riverbed to discharge water from the powerhouse; (5) a 175-foot-long, medium-voltage, buried cable from the powerhouse to the substation; (6) a 40-foot-long by 40-foot-wide substation; (7) an approximately 3,111-foot-long, 12.5-kilovolt (kV), overhead transmission line to connect the project substation to an existing distribution line; (8) a 110-foot-long, 24-foot-wide access road with a 60-foot-long by 50-foot-wide parking area; and (9) appurtenant facilities.

The project would also include the following recreational facilities: a shoreline fishing access trail and canoe portage, an accessible tailrace fishing platform, stairs leading to the river, designated parking, and a portable accessible restroom. The overhead transmission line would be located within a 35-foot-wide ROW, and the buried cable would require clearing an area approximately 15 feet wide[25] during installation. The proposed project boundary would include the new hydroelectric and recreational facilities listed above, some Corps' gates and other structures, and a portion of the river upstream and downstream of the project.[26]

2.2.3.2 Morgantown Project

The proposed Morgantown Project would be located downstream of spillway gate 6 at Morgantown Lock and Dam and would consist of the following new facilities: (1) a 100-foot-long, 64-foot-wide intake channel excavated into the riverbed immediately downstream of spillway gate 6 on the east side of the river; (2) two 30-foot-wide spill gates located within the intake channel to pass the equivalent of the amount of flow through the Corps' spillway gate 6; (3) a 30-foot-long, 64-foot-wide, 50-foot-high, reinforced concrete intake structure and trash rack with 3-inch clear bar spacing; (4) a 120-foot-long, 70-foot-wide, 60-foot-high, reinforced concrete powerhouse; (5) two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 5 MW; (6) a 170-foot-long, 90-foot-wide tailrace excavated into the riverbed to discharge water from the powerhouse; (7) an approximately 420-foot-long, medium-voltage, buried cable from the powerhouse to the substation; (8) a 40-foot-long by 40-foot-wide substation; (9) a 2,162-foot-long, 12.5-kV, overhead transmission line to connect the project substation to an existing distribution line; (10) a 425-foot-long, 15-foot-wide access road with a 60-foot-long by 25-foot-wide parking area; and (11) appurtenant facilities.

The project would also include the following recreational facilities: two shoreline angler paths (90 feet upstream and 450 feet downstream of the dam), consisting of 4-foot-

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[25] Staff estimated the width of the buried cable corridor for all projects.

[26] In section 3.3.5.2, *Recreation and Land Use, Environmental Effects*, we discuss potential modifications to the proposed project boundary for all proposed projects.

wide steel stairs extending from the Caperton Trail[27] towards the river, and designated parking. The transmission line would be located within a 35-foot-wide ROW, and the buried cable would require clearing an area approximately 15-feet wide during installation. The proposed project boundary would include the new hydroelectric and recreational facilities listed above, some Corps gates and other structures, and a portion of the river upstream and downstream of the project.

2.2.3.3 Point Marion Project

The proposed Point Marion Project would be located downstream of the eastern fixed-crest section of Point Marion Lock and Dam and would consist of the following new facilities: (1) a 280-foot-long, 70-foot-wide intake channel excavated into the riverbed directing flow to a 30-foot-long, 70-foot-wide, 50-foot-high, reinforced concrete intake structure and trash rack with 3-inch clear bar spacing; (2) a 120-foot-long, 70-foot-wide, 60-foot-high, reinforced concrete powerhouse on the east bank of the river; (3) two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 5 MW; (4) a 215-foot-long, 84-foot-wide tailrace excavated into the riverbed to discharge water from the powerhouse; (5) an approximately 325-foot-long, medium-voltage, buried cable from the powerhouse to the substation; (6) a 40-foot-long by 40-foot-wide substation; (7) a 4,051-foot-long, 69-kV, overhead transmission line to connect the project substation to an existing substation; (8) a 1,210-foot-long, 18-foot-wide access road with a parking area; and (9) appurtenant facilities.

The project also would include tailrace shoreline fishing access near the Sheepskin Trail[28] via a 5-foot-wide wooden trail and 4-foot-wide steel stairs connecting the wooden trail to the river. The transmission line would be located within a 35-foot-wide ROW, and the buried cable would require clearing an area approximately 15-feet wide during installation. The proposed project boundary would include the new hydroelectric and

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[27] The Caperton Trail is part of the 48-mile-long Monongahela River-Caperton-Deckers Creek Trails. The trail stretches 6 miles from Star City, West Virginia, to Morgantown, West Virginia (Rails-to-Trails Conservancy, 2016). Interior designated this trail in 2006 as a component of the National Recreation Trail System. *See* Interior's filing of February 11, 2016.

[28] The Sheepskin Trail is part of the 32-mile-long Rails-to-Trails system connecting the State of West Virginia and the Commonwealth of Pennsylvania. The 1.4-mile-long segment from the West Virginia State line through Point Marion Borough, Pennsylvania, is expected to be completed in 2016. *See* Point Marion Borough, Pennsylvania, filing of February 16, 2016.

recreational facilities listed above, some Corps gates and other structures, and a portion of the river upstream and downstream of the project.

2.2.3.4 Grays Landing Project

The proposed Grays Landing Project would be located adjacent to the west end of Grays Landing Lock and Dam and would consist of the following new facilities: (1) a 576-foot-long, 2.5-foot-high, adjustable crest gate[29] on top of the existing dam crest; (2) a 300-foot-long, 130-foot-wide intake channel excavated into the riverbed directing flow to a 100-foot-long, 84-foot-wide, reinforced concrete intake structure and trash rack with 3-inch clear bar spacing; (3) a 150-foot-long, 90-foot-wide, 75-foot-high, reinforced concrete powerhouse; (4) two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 12 MW; (5) a 250-foot-long, 84-foot-wide tailrace excavated into the riverbed to discharge water from the powerhouse; (6) a 155-foot-long, medium-voltage, buried cable from the powerhouse to the substation; (7) a 40-foot-long by 40-foot-wide substation; (8) a 9,965-foot-long, 69-kV, overhead transmission line to connect the project substation to an existing distribution line; (9) a 585-foot-long, 24-foot-wide access road with a parking area; and (10) appurtenant facilities.

The proposed project would not include recreational facilities. The transmission line would be located within a 35-foot-wide ROW, and the buried cable would require clearing an area approximately 15-feet wide during installation. The proposed project boundary would include the new hydroelectric and recreational facilities listed above, the entire length of the Corps' dam, and a portion of the river upstream and downstream of the project. In section 3.3.5.2, *Recreation and Land Use, Environmental Effects*, we discuss potential modifications to the proposed project boundary.

2.2.3.5 Maxwell Project

The proposed Maxwell Project would be located downstream of spillway gate 5 at Maxwell Locks and Dam and would consist of the following new facilities: (1) a 130-foot-long, 85-foot-wide intake channel excavated into the riverbed immediately downstream of the Corps' spillway gate 5 on the east side of the river; (2) two 42-foot-wide spill gates located within the proposed intake channel to pass the equivalent of the amount of flow through the Corps' spillway gate 5; (3) a 100-foot-long, 85-foot-wide, 70-foot-high, reinforced concrete intake structure and trash rack with 3-inch clear bar

[29] Based on the information provided in the license application, we assume the crest gate would consist of a single section as opposed to a series of sections separated by piers.

spacing; (4) a 150-foot-long, 90-foot-wide, 70-foot-high, reinforced concrete powerhouse; (5) two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 13 MW; (6) a 160-foot-long, 120-foot-wide tailrace excavated into the riverbed to discharge water from the powerhouse; (7) a 2,748-foot-long, medium-voltage, buried cable from the powerhouse to the substation; (8) a 40-foot-long by 40-foot-wide substation; (9) a 350-foot-long, 69/138-kV, overhead transmission line to connect the project substation to an existing distribution line; (10) a 5,060-foot-long, 24-foot-wide access road with a parking area; and (11) appurtenant facilities.

The proposed project would not include recreational facilities. The transmission line would be located within a 35-foot-wide ROW, and the buried cable would require clearing an area approximately 15 feet wide during installation. The proposed project boundary would include the new hydroelectric and recreational facilities listed above, some Corps gates and other structures, and a portion of the river upstream and downstream of the project.

2.2.3.6 Charleroi Project

The proposed Charleroi Project would be located downstream of spillway gate 5 at Monongahela Locks and Dam 4 and would consist of the following new facilities: (1) a 140-foot-long, 90-foot-wide intake channel excavated into the riverbed immediately downstream of the Corps' spillway gate 5 on the west side of the river; (2) two 42-foot-wide spill gates located within the proposed intake channel to pass the equivalent of the amount of flow through the Corps' spillway gate 5; (3) a 100-foot-long, 90-foot-wide, 65-foot-high, reinforced concrete intake structure and trash rack with 3-inch clear bar spacing; (4) a 150-foot-long, 90-foot-wide, 70-foot-high, reinforced concrete powerhouse; (5) two equally-sized horizontal pit Kaplan-type turbine-generator units with a combined capacity of 12 MW; (6) a 210-foot-long, 130-foot-wide tailrace excavated into the riverbed to discharge water from the powerhouse; (7) a 130-foot-long, medium-voltage, buried cable from the powerhouse to the substation; (8) a 40-foot-long by 40-foot-wide substation; (9) a 45-foot-long, 69-kV, overhead transmission line to connect the project substation to an existing distribution line; (10) a 30-foot-long, 15-foot-wide access road with a parking area; and (11) appurtenant facilities.

The proposed project would not include recreational facilities. The transmission line would be located within a 35-foot-wide ROW, and the buried cable would require clearing an area approximately 15 feet wide during installation. The proposed project boundary would include the new hydroelectric and recreational facilities listed above, some Corps gates and other structures, and a portion of the river upstream and downstream of the project.

2.2.4 Project Safety

Under original hydropower licenses, the proposed projects would be subject to the Commission's project safety requirements. As part of the licensing process, Commission staff would evaluate the adequacy of the proposed facilities, and special articles would be included in any licenses issued, as appropriate. Before the projects are constructed, engineers from the Commission's New York Regional Office would review the designs, plans, and specifications of proposed generating structures. During construction, Commission engineers would frequently inspect the projects to ensure adherence to approved plans and specifications; special license articles relating to construction, operation, and maintenance; and accepted engineering practices and procedures. Once construction is complete and the projects enter the operation phase, Commission engineers would inspect them on a regular basis. Because the Corps maintains and operates the locks and dams, the Commission would coordinate with the Corps to fulfill its obligation to ensure that project safety requirements are met for each project.

2.2.5 Proposed Project Operation

Table 2-1 presents the hydraulic characteristics of each hydroelectric project, lock, and dam spillway. The projects would operate in a run-of-release mode, using only the flows made available by the Corps that would normally be released through the Corps' gates or spillways.[30] When river flow is less than the minimum hydraulic capacity required to operate a single unit at each project, all flow would be passed via the Corps' gates or spillways in accordance with existing Corps practices. When river flows available after lockage requirements are between minimum and maximum hydraulic capacity of the powerhouse, all flows not used for lockage would pass through the project powerhouse. When river flows available after lockage requirements exceed the hydraulic capacity of the project powerhouse additional flow would be released via the Corps' spillway and/or the projects' spill gates.[31] During very high flow conditions, there would not be sufficient head to operate the turbines,[32] the powerhouse would be shut down, and

[30] Although the applicants refer to their proposed operating mode as run-of-river, it is more accurate to refer to it as run-of-release, because the projects would generate from flows as "released" (i.e., made available) to the projects by the Corps. Under a run-of-river mode, a project diverts and generates from available flows in the river.

[31] Only the Morgantown, Maxwell, and Charleroi Projects include new spill gates.

[32] The minimum head required to operate the turbines would be about 9 feet at Maxwell and Charleroi; 11 feet at Morgantown, Point Marion, and Grays Landing; and 16 feet at Opekiska.

all flows would be passed in accordance with the Corps' management practices. The Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Projects would produce an annual average of 25,300 MWh, 18,900 MWh, 16,500 MWh, 47,300 MWh, 56,800 MWh, and 48,500 MWh of electricity, respectively.

Table 2-1. Hydraulic characteristics of the proposed projects and the Corps' locks and spillways (Source: FFP Missouri 13, 2014; FFP Missouri 15, 2014; FFP Missouri 16, 2014; Solia 4 Hydroelectric, 2014; Solia 5 Hydroelectric, 2014; Solia 8 Hydroelectric, 2014).

Project	Minimum Discharge (cubic feet per second [cfs], one unit)	Maximum Discharge (cubic feet per second [cfs], one unit)	Number of Units	Maximum Discharge (cfs, total all units)	Average Lockage Flow (cfs)[a]	Existing Spillway Capacity (cfs, total)
Opekiska	195	1,950	2	3,900	230	117,000
Morgantown	195	1,950	2	3,900	230	64,200
Point Marion	195	1,950	2	3,900	240[b]	24,190
Grays Landing	450	4,500	2	9,000	190	NA
Maxwell	450	4,500	2	9,000	580	92,400
Charleroi	450	4,500	2	9,000	540	71,900

[a] This value is the amount of lockage losses or continuous flow through lock chambers when the locks are closed.

[b] The license application provides conflicting numbers: the water quality, hydraulics, and aquatic habitat report in appendix C-1 uses 240 cfs, while Exhibit A uses 440 cfs.

The applicants propose to release the following bypass flows[33]: Opekiska, Morgantown, and Point Marion–300 cubic feet per second (cfs) from July 1 through July 31; Grays Landing–500 cfs from July 1 through July 31, and 50 cfs during August through June; and Maxwell and Charleroi–500 cfs from July 1 through July 31.

The applicants also propose to maintain the water surface elevations of each pool upstream of the dams in accordance with the Corps' current management practice of

[33] Bypass flow in this context refers to water that would normally be available to the proposed hydroelectric projects for generation, but is instead allowed to pass over the spillway, through the Corps' gates, or through the applicants' proposed spill gates.

providing adequate water depth for navigation. As a result, the water surface elevations of each upstream pool, with the exception of Grays Landing, would match existing water surface elevations. At Grays Landing, which currently has an uncontrolled spillway, a crest gate would be installed to control the water surface elevation to ensure sufficient depth for navigation. Figure 2-1 shows the applicant's headwater rating curve for normal operation in the existing and proposed conditions at the proposed Grays Landing Project.

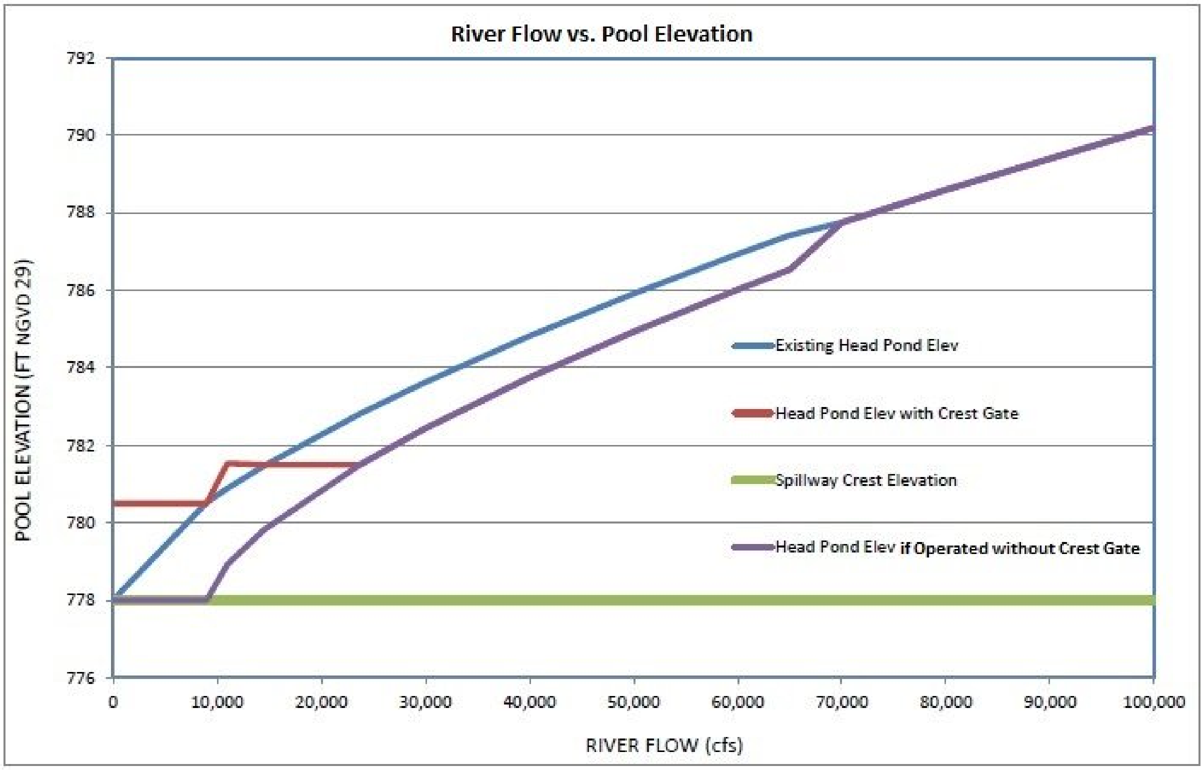

Figure 2-1. Grays Landing Project headwater rating curve for normal operation (Source: FFP Missouri 13, 2014).

When river flows are less than 9,000 cfs, the proposed crest gate would be in the full up position, holding the upstream pool elevation at 780.5 feet, which is up to 2.5 feet higher than existing conditions. When river flows are between 9,000 and 11,000 cfs, the proposed crest gate would be in the full up position, and the upstream pool elevation would increase from 780.5 to 781.5 feet, which is about 1 foot higher than existing conditions. When river flows are between 11,000 and 23,700 cfs, the crest gate would be incrementally lowered to achieve an elevation of 781.5 feet, which would result in an upstream pool elevation up to 0.5 foot higher than existing conditions when river flow is between 11,000 and 14,000 cfs and up to 1.5 foot lower than existing conditions when river flow is between 14,000 and 23,700 cfs. At river flows exceeding 23,700 cfs, the crest gate would be fully lowered. When river flows are between 23,700 and 65,000 cfs, the upstream pool elevation would be approximately 1 foot lower than existing conditions. When river flows exceed approximately 65,000 cfs, the turbines would shut down, and the upstream pool elevation would be equal to existing conditions.

2.2.6 Proposed Environmental Measures

In addition to the project design and operational measures described in the previous section, the applicant for each project proposes the following protection, mitigation, and enhancement (PM&E) measures to protect or enhance environmental resources and improve recreational opportunities. Unless otherwise noted, each PM&E measure applies to all six projects.

Geology and Soil Resources

- Develop an erosion and sedimentation control plan in consultation with the Corps and either the Pennsylvania DEP or West Virginia DNR, as appropriate, that includes procedures and best management practices (BMPs) to reduce runoff and sedimentation during construction and final stabilization.

Aquatic Resources

- Operate in a run-of-release mode to avoid project-related impacts on the Corps' operation of its facilities.

- Ensure that at least the following flows pass through the Corps' gates or over the spillways during project operation to enhance aeration and protect water quality downstream of the projects: 300 cfs during the month of July at Morgantown, Opekiska, and Point Marion; 500 cfs during the month of July at Maxwell and Charleroi; and 500 cfs in July plus 50 cfs during the rest of the year at Grays Landing.

- Conduct 3 years of post-construction water quality monitoring from June through September to monitor for project effects on water quality.

- Install a trash rack with 3-inch clear bar spacing, and provide approach velocities of less than 2 feet per second (fps) to mitigate for the entrainment and impingement of fish.

- When warranted and to the extent feasible, coordinate the timing of any construction-related hydraulic changes, such as changes in flow direction, to minimize potential effects on spawning fish and other aquatic organisms downstream of the projects.

Terrestrial Resources

- At Grays Landing, protect sensitive plants by: providing 50-foot protection buffers around mapped locations of toothcup, scarlet ammannia, and hooded arrowhead and restricting the use of herbicides and construction activities in these areas; mapping and avoiding disturbance to populations of sourwood; fencing buffered habitat during construction; making sure personnel are aware of the locations of sensitive plants; consulting with Pennsylvania Department of Conservation and Natural Resources (Pennsylvania DCNR) if protection buffers less than 50 feet are needed; and filing a map depicting the locations of buffer areas and limits of disturbance.

- Develop an avian protection plan consistent with Avian Power Line Interaction Committee (APLIC) and FWS guidelines that includes provisions for protecting bald eagles and other raptors from project-related effects.

- Develop a transmission line corridor management plan that includes provisions for protecting botanical resources from project-related effects and controlling invasive species along the transmission line ROWs.

Threatened and Endangered Species

- Follow all agency-recommended avoidance measures for federally listed bat species documented at the Charleroi, Maxwell, Grays Landing, and Point Marion Projects, including conducting tree cutting, tree inundation, and prescribed burning only between November 15 and March 31; and where possible, implementing the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.

Recreation and Land Use

- Implement a recreation resource management plan at the Opekiska Project with provisions for installing an accessible tailrace fishing platform; eight recreation-designated parking spaces; an accessible canoe portage trail with stairs that lead to the river at the end of the downstream trail; and a portable, accessible restroom.

- Implement a recreation resource management plan at the Morgantown Project with provisions for installing two shoreline angler paths (90 feet upstream and 450 feet downstream of the dam), consisting of 4-foot-wide steel stairs extending from the Caperton Trail towards the river, and parking facilities.

- Implement a recreation resource management plan at the Point Marion Project with provisions for installing a shoreline angler path 450 feet downstream of the dam consisting of a 5-foot-wide wooden trail and 4-foot-wide steel stairs connecting the wooden trail to the river.

Aesthetics

- Restore areas temporarily affected by construction activities to protect the sites' aesthetics.

- Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.

Cultural Resources

- Prepare an HPMP in accordance with an anticipated PA between the Commission and the West Virginia SHPO or the Pennsylvania SHPO, as appropriate.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the projects would be constructed, operated, and maintained as proposed by the applicants with the exception of the proposal to ensure certain minimum flows pass over the dam at each project, and with the following modifications and additional staff-recommended measures. Unless otherwise noted, the following measures apply to all six projects.

- A contaminated sediment testing and disposal plan including provisions for testing sediment from the riverbed to ensure sediment is handled and disposed of in a manner that is consistent with current state standards and to ensure minimal impacts of contaminated sediment on aquatic species and their habitat.

- An operation compliance monitoring plan to document compliance with the operating requirements of any licenses issued for the projects.

- A stand-alone spill prevention, containment, and countermeasures plan to guide the handling of hazardous substances and protect water quality and aquatic biota during project construction and operation. A water quality monitoring plan that includes a provision to monitor water quality for 3 years post-construction, for the period of June 1 through October 15, and an additional provision to monitor water quality during construction

- A vegetation management plan that would apply the measures included in the applicant's transmission line corridor management plan to all project lands. At Grays Landing, the vegetation management plan would also include proposed measures to protect sensitive plants during construction activities, extend these measures to also apply to project maintenance activities requiring ground disturbance, and measures to protect sensitive plants from project operation.

- A revised recreation resource management plan for the Morgantown Project that includes the applicant-proposed measures and an accessible fishing platform and angler path at the tailrace.

- A revised recreation resource management plan for the Point Marion Project that includes the applicant-proposed measures and a fishing platform at the end of the proposed angler path near the tailrace.

- A construction access plan for the Morgantown and Point Marion Projects that includes construction safety guidelines, a schedule, signage, and specific mitigation measures that reduce construction impacts on public use of the Caperton and Sheepskin Trails.

- An access improvement plan for the Grays Landing, Maxwell, and Charleroi Projects that provides shoreline access at each facility.

- A debris management plan that includes the applicants' proposed measures to remove and dispose of trash that accumulates upstream of the proposed projects' trash racks, as well as procedures that describe how debris would be sorted, stored, and disposed to minimize the effect of floating debris on local recreation and aesthetics.

- Implementation of a signed PA that requires revision of the draft HPMP to address the management of historic properties and unevaluated cultural resources.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

In the final license applications, the applicants evaluated several alternatives at each dam, including: (1) placement of turbines in lock chambers and (2) the use of a single large turbine unit. Placement of turbines in the lock chambers was eliminated from further consideration because of potentially substantial and unavoidable impacts on navigation and recreation. The use of a single large turbine was eliminated because of the depth of excavation that would be required near the dam and spillway, and because a single turbine unit configuration would offer less operational and maintenance flexibility than multiple unit configurations.

In addition, the Corps indicates that developing all 10 of the proposed projects in the Monongahela, Ohio, and Allegheny Rivers may not be "environmentally sustainable."[34] In its March 4, 2016, letter, the Corps recommends that the Commission prioritize a subset of the 10 proposed projects that would be considered in the alternatives analyses. Specifically, the Corps recommends that projects that support unique biological resources, provide greater aeration benefits (fixed-crest dams), and require substantial alteration of the Corps' facilities (i.e., projects that require in-river powerhouses and/or crest gates) should be prioritized for exclusion.

At least one or more Corps' exclusion criteria would apply to some degree at most of the Monongahela River Projects and other proposed projects on the Allegheny and Ohio Rivers. However, based on the license applications, scoping comments, and comments on the license applications, we have not identified any environmental issues that would cause us to eliminate any of the proposed projects from detailed analysis. Therefore, we consider the proposed action, the staff alternative, and the no-action alternative (license denial) for each of the Monongahela River Projects in section 3.0, *Environmental Analysis,* of this document.

[34] Rye Development's other related projects in the Upper Ohio River Basin include Allegheny Lock and Dam 2 (P-13755) on the Allegheny River and Emsworth Locks and Dam (P-13757), Emsworth Back Channel Dam (P-13761), and Montgomery Locks and Dam (P-13768) on the Ohio River.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinities; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historic and existing conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed PM&E measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*, of this EA.[35]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The proposed Monongahela River Projects would be located on the Monongahela River in northern West Virginia and southwestern Pennsylvania. The Monongahela River Basin has a total drainage area of 7,384 square miles. The Monongahela River joins the Allegheny River in Pittsburgh, Pennsylvania, forming the Ohio River.

The Monongahela, Allegheny, and Ohio Rivers flow into the Pittsburgh Low Plateau sections of the Appalachian Plateau province. Flood events are common in the rivers of the Appalachian Plateau because of the region's extreme dissection, high local relief, precipitous slopes, and narrow and discontinuous floodplains. This physiographic region is known as mostly unglaciated uplands with many streams forming a dendritic pattern (Pennsylvania FBC, 2011).

The dominant land use in the Monongahela River Basin is forest cover (Pennsylvania FBC, 2011). Most of the forest area comprises deciduous trees, though evergreen trees are present. Agriculture, including both pasture and row crops, is the second highest land use, followed by residential and commercial development. Most of the developed areas, and areas with more impervious surfaces, are concentrated in communities situated where the three rivers converge in Pittsburgh, Pennsylvania. The greater Pittsburgh metropolitan area has a history of extractive mining; mining of coal,

[35] Unless otherwise indicated, our information is taken from the applications for license for these projects (FFP Missouri 13, 2014; FFP Missouri 15, 2014; FFP Missouri 16, 2014; Solia 4 Hydroelectric, 2014; Solia 5 Hydroelectric, 2014; and Solia 8 Hydroelectric, 2014) and additional information filed by the applicants as noted in section 7.0, *Literature Cited*.

sand, and limestone and extraction of oil and natural gas are major industries, evidence of which can be seen along the river valleys (Pennsylvania FBC, 2011).

The Monongahela River Basin maintains a temperate climate pattern with a mean average temperature of 52 degrees Fahrenheit (°F), with average maximum temperatures ranging from 82.9°F in July to 17.3°F in February. Precipitation averages 38.2 inches per year, with most rain falling in the late spring and early summer. Snowfall in the area averages 35.2 inches per year, with the highest amount of snow falling in December and January.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 CFR § 1508.7), a cumulative effect is the impact on the environment that 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 effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Based on our review of the license applications and agency and public comments, we identified aquatic (water quality, habitat, and aquatic species) and recreation resources as having the potential to be cumulatively affected by the proposed projects, in combination with other past, present, and foreseeable future activities. Aquatic resources were selected because construction of the projects may affect water quality, especially DO concentrations, within and downstream of the project areas, and may affect aquatic species such as mussels, fish, and their habitat downstream, within, and upstream of the project areas. Other activities, in combination with the proposed actions, such as additional hydropower development, water withdrawals, wastewater discharge, and existing management of flows and water levels in the three rivers (Monongahela, Allegheny, and Ohio) and adjacent waterways, may collectively affect aquatic resources in a portion of the Upper Ohio River Basin. Recreation was selected because the proposed projects may affect recreation near the Monongahela River Projects including access to the Caperton and Sheepskin Trails and fishing opportunities immediately downstream of the dams. The proposed projects, in combination with each other, and other non-project activities such as expansion of the rail-trail and operation of the Corps' locks for recreation may affect recreational use and the quality of recreation opportunities.

3.2.1 Geographic Scope

Our geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of the proposed actions' effect on the resources, and contributing effects from other hydropower and non-hydropower activities within the Upper Ohio River Basin.

The geographic scope for aquatic resources (water quality and aquatic species) includes a portion of the Upper Ohio River Basin; specifically, the most upstream 33 miles of the Ohio River, the most downstream 17 miles of the Allegheny River, and the entire 128 miles of the Monongahela River. We chose this geographic scope because effects of the proposed projects in combination with other activities including proposed hydropower development in the basin would be limited to these areas. Any project-related effects on aquatic resources would not be discernable upstream or downstream of the defined geographic scope because potential effects would attenuate with increasing distance from the existing dams and any contribution to cumulative effects would be immeasurable. The geographic scope for recreation resources includes the Monongahela River corridor. We chose this geographic scope because the proposed projects may affect recreation near the projects including access to the river/shoreline area and fishing opportunities immediately downstream of the dams; and the proposed projects, in combination with each other, and other non-project activities such as expansion of the trails and operation of the Corps' locks for recreation may affect recreational use and the quality of recreation opportunities.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis in the EA will include a discussion of past, present, and reasonably foreseeable future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of original licenses issued at federal dams, the temporal scope will look 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the site-specific and cumulative environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative.*

3.3.1 Geology and Soil Resources

3.3.1.1 Affected Environment

Geology

The Monongahela River flows through the Appalachian Plateau Physiographic Province, a region that stretches from Alabama to New York. The Monongahela River Projects would be located in the unglaciated regions of West Virginia and Pennsylvania. The two southernmost projects, Opekiska and Morgantown, would be located in the Allegheny Mountain Section of the province. This section is characterized by steep hillsides and valleys. The Maxwell and Charleroi Projects would be located in the Waynesburg Hills Section of the province, and the remaining two projects, Point Marion and Grays Landing, would be located in the Pittsburgh Low Plateau Section of the province. Both the Waynesburg Hills and Pittsburgh Low Plateau Sections are characterized by smooth hills and steep-sloped, narrow valleys.

Bedrock in the project areas consists of Upper Paleozoic (Pennsylvanian and Permian) sedimentary rocks (sandstone, siltstone, shale, claystone, and limestone). Sedimentary beds deposited during the Pennsylvanian age contain large bituminous coal seams in the western half of Pennsylvania, which includes the project areas. Limited coal mining exists throughout the area, with facilities to process and transport coal nearby. Rock and gravel are also mined in the area.

The seismic hazard in the area is very low, with a peak horizontal ground acceleration of 2 percent g (percent of gravitational acceleration with a 10 percent probability of exceedance in 50 years).

Soils

Surface soils at all six project sites consist of silt loams and urban lands (table 3-1). The urban land soils are highly disturbed from past industrial practices including mining, agriculture, and commercial industry. The surface soils are underlain predominantly by colluvium of Holocene and late and middle Pleistocene age. In addition, there are limited channel and floodplain alluvium and pre-Illinoian age deposits bordering the Monongahela River. In general, soils in the vicinity of the projects are moderately to well-drained, but are susceptible to erosion and exhibit a high incidence of landslides. However, the riverbanks in most areas are protected by riprap and varying amounts of vegetation. Bank steepness varies among projects, slopes range from 0 to 65 percent. In a letter filed November 12, 2014, Point Marion Borough Council stated that the Point Marion Project site has brownfield-designated soils located along the existing Sheepskin Trail.

Table 3-1. Primary soil types found at each proposed project (Source: CDM Smith, 2014a).

Soil Type	Opekiska	Morgantown	Point Marion	Grays Landing	Maxwell	Charleroi	Soil Description
	Project Name						
Culleoka-Westmoreland Silt Loam	X	X					Moderately deep, well drained, 35 to 65% slopes.
Dormont-Culleoka Silt Loam			X	X	X		Moderately deep to very deep, well drained, 25 to 50% slopes.
Gilpin-Culleoka-Upshur Silt Loam	X						Well drained, deep, 35 to 65% slopes.
Gilpin-Weikert Channery Silt Loam			X				Shallow, well drained, 25 to 60% slopes.
Monongahela Silt Loam			X				Moderately deep, well drained, 2 to 6% slopes.
Udorthents, cut and fill	X						Moderately well drained to excessively drained.
Urban Land		X	X		X	X	Well drained, 0 to 8% slopes
Urban Land-Monongahela Complex				X		X	Very deep, moderately well drained, 0 to 8% slopes

Sediment

Instream sediments vary depending on streambed location. Main channel instream sediments are predominantly poorly graded gravel with sand, poorly graded gravel with silt and sand, and well graded gravel with sand. Scour and deposition occur immediately upstream and downstream of project dams during intermittent peak flow events.

In its January 9, 2014, comments on the draft license applications, the Corps states that fine-grained sediments upstream and downstream of project dams are likely to contain heavy metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds. The applicants collected and analyzed sediment core samples in 2013 from proposed construction locations upstream and downstream of the existing dams at each project site. Instream sediments in the vicinity of the proposed intake channel, powerhouse, and tailrace predominantly consist of gravel mixed with fine sediments (clay and silt) (table 3-2). Samples at all six project sites contained PAHs at a concentration above U.S. Environmental Protection Agency (EPA) sediment screening criteria (table 3-3). Samples taken at Opekiska, Grays Landing, Maxwell, and Charleroi also contained heavy metals at concentrations above the EPA screening criteria, and sediments from Morgantown contained PCBs at a concentration above the EPA screening criteria.[36]

Table 3-2. Grain size of instream sediments from core samples at proposed project sites (Source: CDM Smith, 2014a).

		Grain Size (in percent)							
	Loca-tion	Gravel		Sand			Fines		
Project		**Coarse**	**Fine**	**Coarse**	**Medium**	**Sand**	**Silt**	**Clay**	**Total**
Opekiska[a]		-	-	-	-	-	-	-	-
Morgantown	US	0.0	4.1	2.4	8.8	24.5	34.2	26.0	100
	DS	0.0	13.3	8.6	12.2	10.6	24.7	30.6	100
Point Marion	US	31.2	13.9	0.9	2.4	20.2	20.4	11.0	100
	DS	0.0	13.3	8.6	12.2	10.6	24.7	30.6	100
Grays Landing	US	0.0	0.0	0.0	0.9	15.3	55.1	28.7	100
	DS	40.4	14.8	6.8	8.1	11.5	11.7	6.7	100
Maxwell[a]	US	0.0	1.9	2.2	2.7	19.6	44.7	28.9	100
	DS	-	-	-	-	-	-	-	-
Charleroi	US	24.3	23.5	3.7	8.0	24.0	11.4	5.1	100
	DS	30.5	48.7	12.9	5.0	2.1	0.8		100

Notes: US—upstream of Corps dam; DS—downstream of Corps dam

[a] Grain size data from samples collected at Opekiska and downstream at Maxwell were not provided in the source report.

[36] *See* pages 3-1 to 3-14 of the Sediment Quality Survey study report (Appendix C-7, final license application volume—II) filed on February 3, 2014, which presents laboratory test data for the geotechnical tests and environmental analyses. It also documents specific contaminant levels and compares analytical test results with EPA sediment screening criteria.

Table 3-3. Contaminants in sediments in exceedance of EPA screening criteria (Source: CDM Smith, 2014a).

Project	Contaminants in Exceedance of EPA Screening Criteria
Opekiska	PAHs: Phenanthrene
	Heavy metals: Nickel, zinc
Morgantown	PAHs: Acenaphthene, fluoranthene, phenanthrene
	PCBs
Point Marion	PAHs: Fluoranthene, phenanthrene
Grays Landing	PAHs: Phenanthrene
	Heavy metals: Zinc
Maxwell	PAHs: Phenanthrene
	Heavy metals: Nickel, zinc
Charleroi	PAHs: Fluoranthene, phenanthrene
	Heavy metals: Nickel, arsenic, chromium

3.3.1.2 Environmental Effects

Construction Effects on Geology and Soils

Construction activities at each of the six Monongahela River Projects would generally consist of constructing an intake channel, powerhouse, tailrace, substation, access road/parking lot, and transmission line. Construction of the projects would require excavation of instream sediment and upland soils and would likely cause localized soil erosion, sedimentation, and streambed material transport. Sediment from the river bottom and upland construction sites could adversely affect water quality, resident aquatic species, and instream habitats and is discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Construction Effects on Water Quality* and *Construction Effects on Aquatic Organisms and Habitat*.

To reduce potential erosion and sedimentation impacts, the applicants propose to develop an erosion and sedimentation control plan for each project, in consultation with the Corps, and either Pennsylvania DEP or West Virginia DNR, as appropriate, that includes procedures and BMPs to address sediment and erosion control during construction and final site stabilization. The plan would include placement of turbidity curtains upstream and downstream of cofferdams, silt fencing, protection of temporarily disturbed ground, final site stabilization, and measures to address the prevention and cleanup of spills of hazardous substances.

Our Analysis

Table 3-4 shows the estimated volume of material that would be excavated during construction of the intake channel and structure, powerhouse, and tailrace at each of the Monongahela River Projects. Excavation of the riverbed, shorelines and nearby upland areas, and installation/removal of cofferdams would likely cause erosion, resulting in a temporary increase in suspended sediment and turbidity in the Monongahela River. High-flow events during construction could result in additional scour and suspended sediment in and downstream of the construction areas. In addition, construction of the parking lots, access roads, substations, and transmission lines would disturb upland areas and potentially lead to erosion and additional sediment inputs to the river. Potential effects of suspended sediment and turbidity on aquatic resources and measures to address the prevention and cleanup of spills of hazardous substances are discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Construction Effects on Water Quality*.

Table 3-4. Volume of excavated material at proposed project features (Source: applications; staff).

	Volume of Excavated Material Required for Proposed Project Facilities (estimate) (cubic yards)		
Project	**Intake Channel/ Structure**	**Powerhouse**	**Tailrace**
Opekiska	4,110	3,650	4,150
Morgantown	1,230	4,920	520
Point Marion	3,300	3,880	7,270
Grays Landing	17,950	9,450	6,620
Maxwell	5,570	5,560	3,560
Charleroi	10,270	9,450	8,600

Installation of cofferdams and turbidity curtains would greatly reduce turbidity and sediment transport, including the transport of any contaminated sediment, caused by in-river and upland area excavation activities. These structures would isolate the construction area from the river and minimize sediment and turbidity impacts throughout the construction phase. In upland areas, the applicants' proposed project designs incorporate the use of existing access road and transmission line corridors to the extent possible. As described previously, much of the area that would be affected by construction consists of previously disturbed areas with urban soil types. However, some land-clearing and disturbance of upland soils would occur during construction of the parking lots, access roads, substations, and transmission line corridors. Developing an erosion and sedimentation control plan for each project in consultation with the Corps, Pennsylvania DEP, and West Virginia DNR, as the applicants propose, would minimize erosion and sedimentation during in-water and upland construction activities.

Operational Effects on Geology and Soils

Under existing conditions, the inflow to each of the Corps' facilities is released over the dam or through the locks. Flows over the dams, except for the Grays Landing Project, are controlled by spillway gates that are repositioned on a daily basis to regulate discharge and maintain the desired pool elevation and corresponding navigation channel depth. In general, flow is released through gates in the center of the river first with additional gate openings as river flow increases, in accordance with the Corps' operating schedule at each dam. Under the proposed operation at each project, water would be diverted through the powerhouse located downstream of the dam at the end opposite the existing locks.[37] These proposed project operations would modify discharge patterns and hydrodynamics of the Monongahela River upstream and downstream of each dam. Operation of the proposed projects could cause scour in the streambed immediately upstream of the intake and downstream from the proposed tailrace, change existing sediment patterns by redistributing lateral water velocities both upstream and downstream of the dam, and redistribute streambed materials to new locations.

Our Analysis

Based on data developed from the applicant's hydraulic modeling (CDM Smith, 2015) and channel substrate surveys (CDM Smith, 2014a), project operation would result in increased water velocities within the immediate vicinities of the project intakes and tailraces, potentially increasing bed scour in these areas. The greatest change in water velocities, relative to existing conditions, would occur when most or all river flow is discharged through the powerhouses (i.e., when river flow matches the hydraulic capacity of the projects). This effect would be attenuated as river flow increases beyond the hydraulic capacities of the projects as more flow would be released through the Corps' gates, and discharge patterns similar to existing conditions would be restored. Overall, scour in the tailraces would occur primarily during initial operation of the powerhouses, and would diminish after the powerhouses have operated at their maximum hydraulic capacity for a short period.

With the exception of the Opekiska and Grays Landing Projects (where the powerhouses would be constructed adjacent to the river), bed scour could also increase in

[37] A detailed description of each project's proposed operation is provided in section 2.2.5, *Proposed Project Operation*.

the main channel during peak flow events because the proposed projects (i.e., powerhouses constructed in the river channel) would reduce channel width. Channel width would decrease by about 20 percent (70 feet) at the Morgantown Project, 13 percent (70 feet) at the Point Marion Project, 20 percent (90 feet) at the Maxwell Project, and 21 percent (90 feet) at the Charleroi Project immediately downstream of each dam, not considering the channel width for the locks at the respective projects. The proposed spill gates at each project would be designed to pass flow equal to the capacity of any obstructed Corps' gates, but scour could increase because of the decreased channel width, which would increase flow velocity, especially downstream of the gates that are immediately adjacent to the proposed spillway gates. The maximum scour of the existing streambed sediments would occur during the largest peak flow event. Once the riverbed has equilibrated to the new flow regime, scour of existing sediment would no longer occur, although scoured areas may temporarily fill in again with sediment during low-flow periods. Therefore, the effect of resuspended sediment on turbidity levels in the river would be minor and short in duration.

Overall, changes to the existing scour and deposition patterns associated with operation of the projects would be minor. Sediments scoured in the immediate vicinities of the project intakes and tailraces, and in the main channel during a peak flow event, are not expected to be transported for long distances in the river considering that the existing river bottom consists primarily of gravel with larger substrate (cobble and boulder) near the dams as described in section 3.3.2.1, *Aquatic Resources, Affected Environment*.

Sediments near all projects contained one or more contaminants such as metals, PCBs, and PAHs at concentrations slightly above EPA sediment screening criteria. Potential impacts of project operation on the river sediment quality, however, are expected to be minimal because: (1) the river is expected to contain similar contaminants throughout its bed given the long industrial history of the area, (2) scoured sediment would generally be expected to resettle rapidly as described above, and (3) scour of existing sediments would be limited to the startup phase of a project (intake and tailrace scour) or to a peak flow event (main channel scour).

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

The Monongahela River begins at the confluence of the West Fork River and Tygart Valley River at Fairmont, West Virginia. It flows north for 128 miles to its confluence with the Allegheny River in Pittsburgh, Pennsylvania, forming the Ohio River. The river has a drainage area of 7,384 square miles, encompassing portions of northern West Virginia, western Maryland, and southwestern Pennsylvania. The river's entire length is controlled and maintained for navigation by a series of nine locks and dams owned and operated by the Corps.

Table 3-5 shows the locations of the existing locks and dams at or adjacent to the proposed projects on the Monongahela River.

Table 3-5. Existing locks and dams at or adjacent to the proposed Monongahela River Projects (Source: staff).

Name	River	River Mile
Opekiska Lock and Dam	Monongahela	115.4
Hildebrand Lock and Dam	Monongahela	108.0
Morgantown Lock and Dam	Monongahela	102.0
Point Marion Lock and Dam	Monongahela	90.8
Grays Landing Lock and Dam	Monongahela	82.0
Maxwell Locks and Dam	Monongahela	61.2
Charleroi Locks and Dam	Monongahela	41.5
Locks and Dam 3	Monongahela	23.8
Braddock Locks and Dam	Monongahela	11.2

Table 3-6 shows the drainage area and daily flow (minimum, mean, and maximum) at each of the proposed project sites; table 3-7 shows 10-, 50-, and 90-percentile flows for the proposed project locations; and table 3-8 shows the monthly flow (mean) for each proposed project. Flow data are prorated based on drainage areas and data obtained from nearby U.S. Geological Survey (USGS) stream gages.

Table 3-6. Drainage area and estimated minimum, mean, maximum daily flow at each of the proposed projects based on prorated stream gages (Source: FFP Missouri 13, 2014; FFP Missouri 15, 2014; FFP Missouri 16, 2014; Solia 4 Hydroelectric, 2014; Solia 5 Hydroelectric, 2014; and Solia 8 Hydroelectric, 2014).

Project	Drainage Area (square miles)	Lowest Daily Mean Flow (cfs)	Mean Daily Flow (cfs)	Highest Daily Mean Flow (cfs)	Period of Record
Opekiska[a]	2,523	160	4,142	74,875	(1970–2011)
Morgantown[a]	2,579	168	4,335	78,367	(1970–

Project	Drainage Area (square miles)	Lowest Daily Mean Flow (cfs)	Mean Daily Flow (cfs)	Highest Daily Mean Flow (cfs)	Period of Record
					2011)
Point Marion[a]	2,715	172	4,444	80,350	(1970 2011)
Grays Landing[b]	4,440	177	8,450	154,000	(1970 2011)
Maxwell[b]	4,961	198	9,857	172,071	(1970 2011)
Charleroi[c]	5,214	208	10,418	180,846	(1970 2011)

[a] Flow data developed using USGS gages 03057000, Tygart Valley River at Colfax, WV (RM 6.0), and 03061000, West Fork River at Enterprise, WV (RM 12.1), and prorated based on drainage area difference between the projects and USGS gages.

[b] Flow data developed using USGS gage 03072655, Monongahela River near Masontown, PA (RM 81.9), and prorated based upon drainage area difference between the projects and USGS gage.

[c] Flow data developed using Corps outflow data.

Table 3-7. 10-, 50-, and 90-percentile flows (cfs) at each of the proposed projects (Source: CDM Smith, 2015).

Project Location	10-Percentile	50-Percentile	90-Percentile
Opekiska	487	1,864	7,774
Morgantown	509	1,950	8,136
Point Marion	497	1,731	7,583
Grays Landing	1,230	5,600	21,500
Maxwell	1,480	6,257	24,023
Charleroi	1,890	6,576	25,248

Note: The percentile flows are defined as follows: (1) 10-percentile flow (low flow—the flow that is equaled or exceeded 90 percent of the time); (2) 50-percentile flow (moderate flow—the flow that is equaled or exceeded 50 percent of the time); and (3) 90-percentile flow (high flow—the flow that is equaled or exceeded 10 percent of the time).

Table 3-8. Mean monthly flow data (cfs) at the Monongahela River Projects based on prorated stream gage data (Source: FFP Missouri 13, 2014; FFP Missouri 15, 2014; FFP Missouri 16, 2014; Solia 4 Hydroelectric, 2014; Solia 5 Hydroelectric, 2014; and Solia 8 Hydroelectric, 2014).

Project	**Period of Record**	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**August**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Opekiska	(1995□ 2011)	4,918	5,248	5,689	4,255	4,479	2,721	1,819	1,254	1,129	1,219	2,362	3,787
Morgantown	(1995□ 2010)	5,148	5,493	5,954	4,453	4,687	2,848	1,904	1,313	1,182	1,275	2,472	3,963
Point Marion	(1998□ 2010)	4,940	5,120	5,474	4,894	3,743	2,982	2,033	1,161	1,079	1,282	2,358	4,085
Grays Landing	(1995□ 2010)	13,062	12,821	15,073	11,574	11,965	6,939	4,706	3,542	3,354	3,661	7,189	10,659
Maxwell	(1995□ 2011)	14,595	14,325	16,841	12,932	13,368	7,754	5,258	3,958	3,747	4,090	8,032	11,910
Charleroi	(1995□ 2011)	15,339	15,056	17,700	13,591	14,050	8,149	5,527	4,160	3,938	4,299	8,442	12,517

The Corps' operation of the Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Dams is integrated with its operation of the other locks and dams on the river to maintain a minimum navigation channel depth of 9 feet. At each dam, except for Grays Landing which has a fixed-crest concrete dam with no spillway gates, gates are repositioned on a daily basis to regulate discharge and maintain the desired pool elevation and corresponding navigation channel depth. Factors that influence gate selection include controlling detrimental scour and shoaling, avoiding adverse effects on navigation, and managing debris passage. Under existing conditions, the inflow to each of the Corps' facilities is released over the dam or through the locks. In general, flow is released through gates in the center of the river first with additional gate openings as river flow increases in accordance with the Corps' operating schedule at each dam. Information describing lock flows is described in section 2.2.5, *Proposed Project Operation* (see table 2-1). Table 3-9 summarizes the existing median water surface elevation, surface area, and volume of the pools upstream of the Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Dams. Based on the Corps' rating curve and maximum flow events listed in table 3-6, water depth in the upstream pools can vary by 10 feet or more as a result of changes in river flow.[38]

Water Quality

By the early 1900s, the Upper Ohio River Basin was experiencing widespread habitat devastation and water quality degradation. Up until the 1970s, the convenience of using the Monongahela, Allegheny, and Ohio Rivers as a sink for decades of municipal and industrial wastes trumped requirements for potable water in western Pennsylvania and northern West Virginia. The Monongahela River was devoid of fish and was too acidic for people to swim in, even dissolving steel gates at some of its lock and dam structures. Mining has been identified as having the single greatest impact on surface water quality of any single land use in the Monongahela River (Anderson et al., 2000; Pennsylvania FBC, 2011). Concerted state and federal efforts since the 1970s, including reductions in industrial discharge, improvements in wastewater treatment, and improvements in mine drainage treatment and low-flow augmentation, eventually led to a tremendous improvement in river water quality (Anderson et al., 2000). Improved river water quality culminated in recoveries of fisheries, expressed as range expansions of native species, increases in fish population abundances, and a revival of angling opportunities within historically affected river reaches (Pennsylvania FBC, 2011).

[38] The Corps' published rating curves for the upstream pools are available in the applicants' final license applications, as well as in appendix J to CDM Smith (2015).

Table 3-9. Monongahela River Projects upstream pool characteristics (Source: FFP Missouri 13, 2014; FFP Missouri 15, 2014; FFP Missouri 16, 2014; Solia 4 Hydroelectric, 2014; Solia 5 Hydroelectric, 2014; and Solia 8 Hydroelectric, 2014).

Project	**Existing Normal Water Surface Elevation (feet NGVD 29)**	**Surface Area of Upstream Pool at Normal Elevation (acres)**	**Volume of Upstream Pool at Normal Elevation (acre-feet)**
Opekiska	857	800	14,400
Morgantown	814	365	6,200
Point Marion	797	710	11,500
Grays Landing	778	620	10,100
Maxwell	763	1,750	26,700
Charleroi	743.5	1,660	25,100

Tables 3-10 and 3-11 present the states' water quality standards and maximum allowable water temperature standards for the project areas. Table 3-12 lists the West Virginia-designated beneficial uses for the Monongahela River near the proposed Opekiska and Morgantown Projects, and table 3-13 lists the Pennsylvania-designated uses for the proposed Point Marion, Grays Landing, Maxwell, and Charleroi Projects.

Table 3-10. West Virginia and Pennsylvania water quality standards applicable to the waters within the vicinity of the Monongahela River Projects (Source: West Virginia DEP, 2015; Commonwealth of Pennsylvania, 2013).

	Criteria	
Parameter	**West Virginia**	**Pennsylvania**
Water Temperature	Temperature rise shall be limited to no more than 5 degrees Fahrenheit (°F) above natural temperature, not to exceed 87 °F (31 degrees Celsius [°C]) at any time during the month of May through November and not to exceed 73 °F (23 °C) at any time during the months of December through April.	See table 3-11
Dissolved Oxygen	Minimum 5 milligrams per liter (mg/L) at all times.	7-day average 5.5 mg/L; minimum 5.0 mg/L
Suspended solids and floating debris	Suspended matter shall not cause turbidity increases in excess of 10 Nephelometric Turbidity Units (NTU) above background levels when the background is 50 NTU or less, or have more than a 10 percent increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTU.	Floating materials and substances that produce turbidity should be controlled
pH	No values lower than 6.0 or higher than 9.0 unless because of photosynthetic activity.	From 6.0 to 9.0 inclusive

Table 3-11. Pennsylvania maximum allowable water temperature standards applicable to project waters (Source: Commonwealth of Pennsylvania, 2013).

	Maximum Allowable Temperature			**Maximum Allowable Temperature**	
Period	**°F**	**°C**	**Period**	**°F**	**°C**
January 1□31	40	4.4	Aug 1-15	87	30.5
February 1□29	40	4.4	Aug 16-31	87	30.5
March 1□31	46	7.8	Sept 1-15	84	28.9
April 1□15	52	11.1	Sept 16-30	78	25.6
April 16□30	58	14.4	Oct 1-15	72	22.2
May 1□15	64	17.8	Oct 16-31	66	18.9
May 16□31	72	22.2	Nov 1-15	58	14.4
June 1□15	80	26.7	Nov 16-30	50	10.0
June 16□30	84	28.9	Dec 1-31	42	5.6
July 1□31	87	30.5			

Table 3-12. Beneficial uses designated for the Monongahela River near the Opekiska and Morgantown Locks and Dams, West Virginia (Source: West Virginia DEP, 2015).

Use Subcategory	**Use Category**	**Description**
Public water	Human health	Waters, which after conventional treatment, are used for human consumption.
Warm water fishery	Aquatic life	Propagation and maintenance of fish and other aquatic life in streams or stream segments that contain populations composed of all warm aquatic life.
Water contact recreation	Human health	Swimming, fishing, water skiing, and certain types of pleasure boating such as sailing in very small craft and outboard motor boats.

Table 3-13. Beneficial uses designated for the Point Marion, Grays Landing, Maxwell, and Charleroi Projects in Pennsylvania (Source: Commonwealth of Pennsylvania, 2000).

Category	Use Designation
Aquatic Life	Warmwater fishes
Water Supply	Potable water supply, industrial water supply, livestock water supply, wildlife water supply, irrigation
Recreation and Fish Consumption	Boating, fishing, water contact sports, aesthetics
Other	Navigation

West Virginia DEP lists the Monongahela River from its headwaters at the confluence of the West Fork River and Tygart Valley River in Fairmont, West Virginia, to the Pennsylvania border as impaired because of elevated fecal coliform concentrations (West Virginia DEP, 2014). The Lower Monongahela River, from the Pennsylvania-West Virginia state line downstream to Pittsburgh, is listed as impaired for potable water supply because of pathogens and for fish consumption because of PCBs (Pennsylvania DEP, 2014). West Virginia DEP and Pennsylvania DEP both have water quality non-degradation policies, under West Virginia Code §60.5 and 25 Pennsylvania Code § 93.4, that require water quality to be sufficient to maintain and protect the existing uses of all surface waters (West Virginia DEP, 2008; Commonwealth of Pennsylvania, 2000).

The applicants conducted a water quality monitoring study[39] that included collection of continuous temperature, DO concentration, and conductivity data at constant depths in the pools and tailwaters and in an upstream background site from May to October 2013. The background site was located about 5 miles upstream of the proposed Opekiska Project. In each pool, continuous meters were deployed at shallow (about 5 to 12 feet deep) and deep (about 15 to 27 feet deep) locations. The applicants collected monthly nutrient samples at the water surface in the pools and tailwaters at each lock and dam and at the river background site from April to October 2013.

In addition to continuous water quality monitoring, the applicants collected depth profile data (temperature, DO concentration and percent saturation, and specific

[39] The updated *Water Quality, Hydraulics, and Aquatic Habitat Study Report* for the Monongahela River Projects was filed on October 15, 2015.

conductivity) biweekly in the Corps' upstream pools of each proposed project, and biweekly instantaneous water quality monitoring (temperature, DO concentration and percent saturation, pH, specific conductivity, and turbidity) immediately upstream and downstream of each dam, throughout the study season.

The applicants also modeled water quality (temperature and DO concentration) upstream and downstream of each dam with and without operation of the proposed projects for three different water years based on analysis of USGS flow data from 1939 to 2013: (1) dry year (1999); (2) average year (2009), and (3) wet year (2013). The modeling effort examined the proposed projects' effects on water quality, including cumulative effects, and the effects of various bypass flows on DO concentration downstream of each dam.

Dissolved Oxygen

Average DO concentrations at the Monongahela River Projects usually ranged from about 8.1 to 9.7 milligrams per liter (mg/L) during the monitoring study. However, DO concentrations in the lower water column in the Opekiska and Morgantown pools, as well as the DO concentrations in the lower and upper water column of the Point Marion pool, occasionally were below 5.0 mg/L. The lowest DO concentration recorded at any pool during the study was 1.8 mg/L in the Opekiska pool from June 4 to June 5, 2013. DO concentrations were also occasionally below 5.0 mg/L at the Monongahela background monitoring location, about 5 miles upstream of Opekiska Dam, from August 5 through August 8, 2013. DO was at concentrations above those specified by state standards at all proposed projects downstream of the Point Marion Lock and Dam.

The 2013 water quality monitoring also showed an aeration effect downstream of the dams. However, the aeration magnitude and duration was more apparent downstream of some of the dams, than others. For example, downstream average DO concentrations were 0.7 to 1.4 mg/L higher than upstream average DO concentrations at the Point Marion, Grays Landing, and Charleroi Dams. While at the Opekiska, Morgantown, and Maxwell Dams, however, an aeration effect was only occasionally observed, and average DO concentrations were often higher upstream of the dams than downstream. Downstream DO concentrations at most of the dams on the Monongahela River also displayed a minor diel pattern from June through September 2013, with higher DO levels during the day and lower DO levels at night, typically fluctuating about 0.5 to 1 mg/L. A diel pattern was not observed downstream at the proposed Maxwell Project. Downstream of the Grays Landing and Charleroi Dams, a typical DO seasonal pattern was observed in 2013, with higher concentrations in the spring and late-fall and lower concentrations in the summer months. The other Monongahela River Projects showed more variation in DO across months and only displayed a weak seasonal pattern.

DO data collected by Pennsylvania DEP from October 2010 to March 2015 at locations near the proposed Point Marion and Charleroi Projects are available in the EPA STORET database (EPA, 2016). Samples were collected about 200 feet upstream of the Point Marion Dam along the right descending bank[40] and about 2,400 feet downstream of the Charleroi Dam in the middle of the river channel. DO concentrations measured at these locations were almost always above 5.0 mg/L. The exception was at the monitoring location downstream of the Charleroi Project, where a DO concentration of 4.8 mg/L was measured 0.5 mile downstream of the dam in July 2012.

USGS measured daily DO concentrations during summer through fall in the pool of the Hildebrand Lock and Dam[41] (USGS gage 03062245) from 2009 through 2012, and in the pool of the Monongahela Locks and Dam 3 (USGS gage 03075070) from 2005 through 2012 (USGS, 2016). Minimum daily DO concentrations were less than 5.0 mg/L in about 12 percent of daily samples and briefly decreased to less than 2.0 mg/L in mid-September 2012 in the Hildebrand pool. In the Monongahela Locks and Dam 3 pool, minimum daily DO concentrations were rarely less than 5.0 mg/L (less than 1 percent of samples). USGS (2016) also measured year-round continuous DO concentrations from October 2013 through October 2015 in the pool of the Grays Landing Lock and Dam (USGS gage 03072655), and immediately downstream of the Braddock Locks and Dam (USGS gage 03085002). DO concentrations at both locations were always greater than 5.0 mg/L during the monitoring periods, and typically higher than 8 mg/L from October through May, with peak concentrations around 14 mg/L during the winter months.

The applicants' water quality modeling, discussed in more detail in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Operational Effects on Water Quality*, reflected the previously described field collection results. The modeled existing hydrologic conditions showed DO concentrations below those specified by state standards at the Monongahela River Projects. DO concentrations were typically lower in the average flow year than in the wet year and lowest in the dry flow year.

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[40] The right descending bank refers to the river bank on the right side of the river channel when looking downstream. Similarly, the left descending bank refers to the river bank on the left side of the river channel when looking downstream.

[41] The Hildebrand Lock and Dam is the next lock and dam downstream of the Opekiska Lock and Dam. Similarly the Monongahela Locks and Dam 3 is the next lock and dam downstream of Charleroi Locks and Dam.

Water Temperature

Water temperatures at the monitoring locations on the Monongahela River typically were at levels less than those specified in tables 3-10 and 3-11, with the exception of a few values that exceeded the maximum allowable water temperature standards for Pennsylvania.

Reservoir Stratification

The pools of the Opekiska, Morgantown, Maxwell, and Charleroi Locks and Dams were occasionally stratified for temperature and DO during the summer of 2013. The greatest stratification was observed in the Opekiska pool, where surface water temperatures were up to 5 degrees Celsius (°C) warmer than bottom temperatures. The maximum difference in DO levels between surface and bottom waters was 5 mg/L in the Opekiska pool. However, DO in the hypolimnion[42] at all project reservoirs remained at concentrations above those specified by the state standards.

Nutrients

In general, nitrate+nitrite concentrations ranged from 0.21 to 0.65 mg/L. Total Kjeldahl nitrogen concentrations ranged from below the detection limit of 0.42 mg/L to 0.75 mg/L. Total phosphorus concentrations typically ranged between the detection limit of 0.014 to 0.420 mg/L. Chlorophyll-*a* concentrations overall were low in the spring and increased throughout the summer, ranging between 0.5 to 21 micrograms per liter.

Total suspended solids concentrations were highest in July, typically ranging between the detection limit of 4 mg/L and 50 mg/L. Turbidity levels at all proposed Monongahela River Projects, based on biweekly field measurements, were typically less than 20 Nephelometric Turbidity Units (NTU), with the exception of occasional elevated levels above 50 NTU during the summer, conceivably a result of rainfall events.

pH

The pH values measured near the proposed projects were always within specified state standards during 2013 monitoring, ranging from 6.2 to 8.8 during biweekly field measurements. Pennsylvania DEP measured similar values (range of 6.1 to 8.6) near the Point Marion and Charleroi Locks and Dams between 1998 and 2015 (EPA, 2016).

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[42] The hypolimnion is the lower or bottom layer of water in a stratified lake or reservoir, typically cooler than the water above and relatively stagnant, with no mixing with warmer surface waters.

Aquatic Habitat

The Monongahela River in the vicinity of the proposed projects is a low-gradient river impounded by a series of locks and dams. Short stretches of fast-moving water occur immediately below the dam spillways and near obstructions such as channel islands. Shallow water habitats include river shorelines, tributary mouths, and embayments, typically containing sand, gravel, and some cobble substrates. In addition to the locks and dams, other manmade structures in the rivers include bridges, piers, and other hardened shoreline features (e.g., riprap). Substrate composition in the vicinity of the proposed projects is variable within and across the sites. Table 3-14 lists the predominant substrates upstream and downstream of the Monongahela River dams.

Table 3-14. Predominant substrates, listed in order of abundance, upstream and downstream of the proposed project dams on the Monongahela River (Source: Ecological Specialists, Inc., 2015).

Project	Upstream	Downstream
Opekiska	Clay, silt, sand; cobble, bedrock near mid-channel	Silt, sand, gravel, boulder, bedrock, woody debris
Morgantown	Silt, gravel, trash	Boulder, cobble, gravel, bedrock, debris
Point Marion	Sand, silt	Boulder, cobble, gravel, sand
Grays Landing	Boulder, cobble, gravel, silt, clay	Boulder, cobble, gravel
Maxwell	Bedrock, cobble, sand	Boulder, cobble, sand
Charleroi	Clay, bedrock, cobble, gravel, sand	Cobble, gravel, sand

Substrate and fish habitat farther downstream of the Corps' dams is more uniform relative to tailwater habitat[43] at the dams. The Corps' gate operations affect where water is released, thus water velocity and the location of suitable fish habitat in and near the

[43] Tailwater habitat refers to the reach and full width of the river immediately downstream of a dam, and not the more defined hydroelectric term of "tailrace," which refers to the channel (usually excavated) that receives discharges from the powerhouse.

tailwaters change with gate adjustments. Aquatic habitats in the vicinity of the proposed Monongahela River Projects are generally deep-fast in the main channel, deep-slow adjacent to the main channel, and shallow-slow along the shorelines.[44] Shallow-fast habitat is primarily located immediately below the dams, but fish may avoid areas with excessive turbulence and high velocities, making some areas below the dams less suitable for fish. However, riverine fish are generally attracted to the reaches below the dams, because much of the areas still contain suitable velocities and depths for these species. Therefore, many fish species, including important game fish such as walleye and smallmouth bass, often use the deep-water habitat near the proposed projects.

Fish Community

Substantial water quality improvement over the past 50 years has improved aquatic community composition such that the Monongahela River now supports a diverse fish community. Lock chamber and nighttime pool electrofishing surveys, other fishery sampling conducted by Pennsylvania FBC, and available data in the Ohio River Valley Water Sanitation Commission (ORSANCO)[45] database from 1967 to 2010 show a steady recovery of fish assemblages (ORSANCO, 2016a; Pennsylvania FBC, 2011).

The Monongahela River in Pennsylvania currently supports at least 76 species of fish. Numerically dominant species (more than 5 percent of total site abundance) include gizzard shad, channel shiner, emerald shiner, ghost shiner, mimic shiner, golden redhorse, smallmouth bass, rock bass, and bluegill. The assemblage includes five Pennsylvania protected species, including three state-listed as endangered (river shiner, ghost shiner, and warmouth), one state-listed as threatened (bluebreast darter), and one state-listed as candidate (bowfin) (Pennsylvania FBC, 2011). In West Virginia, ghost shiner, river carpsucker, warmouth, and brown bullhead are listed as species of concern. The applicants compiled data on fish abundance in the proposed project areas using West Virginia DNR, Pennsylvania FBC, and ORSANCO databases, as part of the fish entrainment and passage study (HDR, 2013a) at project locations on the Monongahela

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[44] Shallow habitat refers to water depths less than 9 feet, while slow habitat refers to water velocities less than 1 foot per second. Similarly, deep habitat refers to water depths greater than 9 feet, and fast habitat refers to water velocities at or greater than 1 foot per second.

[45] The State of West Virginia and the Commonwealth of Pennsylvania are members of ORSANCO, which is an interstate council that was congressionally established in 1948 to coordinate the control and abatement of pollution in the Upper Ohio River Basin.

River. Compiled data include database records from 1990 to 2013. Sixty-four species have been collected near the Monongahela River Projects, including state-listed species such as ghost shiner, warmouth, and brown bullhead, and 17 remarkable species[46] (longnose gar, mooneye, skipjack herring, ghost shiner, mimic shiner, silver chub, river carpsucker, smallmouth buffalo, smallmouth redhorse, brook silverside, largemouth bass, smallmouth bass, spotted bass, sauger, walleye, logperch, and channel darter). Ghost shiner was most abundant near the Opekiska, Morgantown, and Maxwell Locks and Dams, and brown bullhead was only collected near the Opekiska Lock and Dam. Ghost shiner has also been reported from the Grays Landing pool (Argent et al., 2007), and warmouth has been reported from the Opekiska and Morgantown pools.

Pennsylvania FBC and West Virginia DNR manage the popular sport fishery in the Upper Ohio River Basin, which includes targeted fish species such as smallmouth bass, walleye, and catfish. Pennsylvania FBC stocks hybrid striped bass, tiger muskellunge and muskellunge, and paddlefish in the basin. West Virginia DNR additionally stocks catfish and trout in the basin. Diadromous species are typically not found in the Upper Ohio River Basin, likely because of the many locks and dams on the Ohio and Mississippi Rivers, making successful migration of adult and juvenile fish from and to the Gulf of Mexico highly unlikely. However, the catadromous[47] American eel has occasionally been found in the upper basin. ORSANCO's fish survey database reports the collection of 13 eels in the Upper Ohio and Allegheny Rivers in Pennsylvania since 1957 (ORSANCO, 2016a). Eels, however, have not been documented in the Monongahela River in the last several decades. Skipjack herring may be anadromous[48] in waters with access to the Gulf of Mexico, but they may also reside entirely in freshwater in the Mississippi River Basin, where they may migrate between pools throughout the upper basin for spawning. While skipjack herring are much more abundant than the American eel (approximately 1,500 skipjack herring have been collected in the Upper Ohio River Basin since 1957 [ORSANCO, 2016a; HDR, 2013a; HDR, 2013b]), they

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[46] Pennsylvania FBC considers remarkable species to be fish species that are: (1) previously or currently protected under 58 Pennsylvania Code Chapter 75; (2) sport fish maintained by natural reproduction; (3) classified as pollution intolerant by ORSANCO; or (4) collected for the first time in Pennsylvania or not typically collected with any regularity (Pennsylvania FBC, 2011).

[47] Catadromous species spend most of their lives in freshwater but enter saltwater to spawn.

[48] Anadromous species spend most of their lives in saltwater but enter freshwater to spawn.

generally have not been collected in large numbers during surveys in the upper basin. Some resident freshwater fish may also migrate between pools and between the river and tributaries or pools for spawning, foraging, or overwintering. Movement of fish is partially restricted by the lock and dam structures on the Monongahela River, but fish movement between pools can occur via the locks and gate releases.

Mussels

Mussels, like fish species, have historically suffered from degraded water quality and habitat in the Monongahela River. In the early 1900s, freshwater mussels were rare or absent, and these conditions persisted up to the 1960s, with some improvements in the 1970s and 1980s, and significant improvements over the past two decades (Anderson et al., 2000).

Historically, 28 species of mussels were known to be present within the Monongahela River (Ecological Specialists, Inc., 2015). Hart (2012) conducted a comprehensive field survey for mussels in the Monongahela River in 2008, covering 31 locations over 91 river miles. Hart (2012) conducted surveys in the pools of the following locks and dams: Emsworth, Braddock, Lock and Dam 3, Lock and Dam 4 (Charleroi Project area), Maxwell, and Grays Landing. The surveyed area in the Emsworth pool included the first 7.5 miles of the Monongahela River, upstream from its confluence with the Allegheny River in Pittsburgh. Hart collected a total of 148 mussels representing seven species: pink heelsplitter (135), fluted shell (1), fragile papershell (1), giant floater (1), maple leaf (2), fatmucket (7), and threeridge (1). Tributaries to the Monongahela River such as Dunkard Creek, which flows into the Monongahela River about 2 miles downstream of Point Marion, Pennsylvania, traditionally harbored up to 17 mussel species, including the federally endangered snuffbox mussel. However, a large fish and mussel kill occurred in this creek in August-September 2009 as a result of high concentrations of chloride and total dissolved solids in the discharge from Blacksville Number 2 mine in West Virginia, which created brackish water conditions favorable for a bloom of toxic golden algae. An estimated 25,000 mussels died in the West Virginia portion of Dunkard Creek as a result of this toxic event (Clayton and Everhart, 2015).

Since 2006, West Virginia DNR has restocked mussels throughout the state. In 2012, West Virginia DNR began stocking Dunkard Creek with bluegill inoculated with fatmucket, giant floater, and creeper glochidia and freshwater drum inoculated with pink heelsplitter glochidia (Clayton, 2013). Inoculated bluegill and freshwater drum were stocked again in 2013 and 2014, in addition to direct stocking of adult mussels. As of January 2015 nearly 2,800 mussels of 17 common species had been translocated to Dunkard Creek (Clayton and Everhart, 2015). Beginning 1 mile downstream of the Opekiska Lock and Dam along the left descending bank, mussels were stocked in 2006, 2007 (Clayton, 2012, as cited by Ecological Specialists, Inc., 2015) and 2013 (Ecological

Specialists, Inc., 2015). Up to 11 species have been stocked at this location since 2006, none of which were federally listed species (Lock+ Hydro Friends Fund XLVI, 2012).

The applicants conducted mussel surveys in the summer of 2013 upstream and downstream of the proposed projects (Ecological Specialist, Inc., 2015). Specifically, biologists conducted surveys by scuba diving along transects in a sampling area, about 2,500 feet upstream and downstream of the Opekiska, Maxwell, and Charleroi Dams and about 800 feet upstream and 2,500 feet downstream of the Morgantown, Point Marion, and Grays Landing Dams. Upstream, two 100-meter-long transects were placed perpendicular to the bank where each hydropower project is planned. At the Opekiska, Maxwell, and Charleroi Locks and Dams, investigators placed five additional transects upstream every 100 meters. Downstream, investigators placed seven transects perpendicular to the bank at about 100-meter intervals starting as close to the dam as safe diving allowed (which was typically about 100 meters downstream of the dam).

Table 3-15 shows the abundance of live mussel species collected during these surveys. Sites in the Monongahela River appeared to harbor sparse mussel communities with few species. In general, species abundance and diversity was higher downstream of the locks and dams than upstream. An exception was seen at the Opekiska Lock and Dam, where no mussels were collected downstream of the dam. The invasive zebra mussel was observed at every site. No federally or Pennsylvania state-listed species were collected. However, in West Virginia, all freshwater mussels are considered protected species pursuant to West Virginia Code § 20-2-4 and Code of State Rule 58-60-5.11. These codes prohibit the harvesting and possession of mussels or any parts thereof. Federally listed mussel species are discussed in section 3.3.4, *Threatened and Endangered Species*.

Table 3-15. Mussel species collected in the vicinity of the proposed Monongahela River Projects during mussel surveys conducted in 2013 (Source: Ecological Specialists, Inc., 2015, as modified by staff).

Species	**Opekiska**	**Morgantown**	**Point Marion**	**Grays Landing**	**Maxwell**	**Charleroi**
Lampsilinae						
Pink papershell	1	-	-	-	-	-
Pink heelsplitter	-	28	19	1	4	25
Pocketbook	-	1	-	-	-	-
Fatmucket	-	2	5	-	1	3
Fragile papershell	-	3	1	-	-	-
Plain pocketbook	-	-	2	-	-	-

Species	Opekiska	Morgantown	Point Marion	Grays Landing	Maxwell	Charleroi
Threehorn wartyback	-	-	-	-	-	2
Ambleminae						
Mapleleaf	-	-	-	-	-	2
Total abundance	1	34	27	1	5	32
Total species	1	4	4	1	2	4
No. per 10 square meters[a]	0.01	0.24	0.23	0.01	0.03	-
Percent ≥ 5 years old	0	3	3	0	1	6

[a] Not calculated for Charleroi sample.

Macroinvertebrates

Benthic macroinvertebrates are a diverse and typically abundant group of organisms with specific habitat preferences. Many species are sensitive to environmental conditions and stresses and intolerant of specific pollution sources. Therefore, benthic communities are excellent indicators of both water quality and biological integrity.

ORSANCO (2016b) collected macroinvertebrate samples from the Maxwell and Grays Landing pools, 5 to 6 RM upstream of each dam, in 2003 using Hester-Dendy samplers attached to cinderblocks.[49] Seventeen species were collected. *Gammarus* amphipods and *Amnicola* snails were the most dominant taxa in the Maxwell pool. In the Grays Landing pool, *Gammarus* accounted for 93 percent of the total abundance. *Gammarus* species are important species in aquatic systems because they fulfill various functional niches (prey, predators, herbivores, detritivores, and shredders) and are sensitive to pollutants, temperature, and DO concentrations. High *Gammarus* abundance is typically indicative of a healthy aquatic system (Kunz et al., 2010). Pennsylvania DEP and EPA collected macroinvertebrate samples in 2008 and 2009 in the Monongahela

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[49] A Hester-Dendy sampler consists of several thin (typically 1/8-inch thick) square or round plates secured onto an eyebolt by a wingnut and individually separated by spacers. Multiple samplers are secured to a weighted block and deployed in the water to provide a substrate for colonization by resident macroinvertebrates.

River from the Point Marion Project downstream to Pittsburgh, Pennsylvania. In addition to representing baseline surveys, the data are intended to also aid Pennsylvania DEP in developing an index to assess water quality conditions in large rivers (Pennsylvania DEP, 2010). Although the applicants requested a copy of the collection data from Pennsylvania DEP, the data are not yet available (Rye Development, 2015a).

3.3.2.2 Environmental Effects

Water Quantity

Construction Effects on Water Quantity

At the Opekiska and Point Marion Projects, construction would involve the temporary placement of cofferdams near the intake channel area upstream of the dam and the tailrace area downstream of the dam. To facilitate installation and removal of the cofferdams, operation of the Corps' gate immediately adjacent to the proposed project would be restricted. Other gates would require larger openings to pass river flows during cofferdam installation and removal. During construction of the intake, powerhouse, and tailrace, all Corps gates would be available to pass flows, but the temporary cofferdams could affect hydraulic conditions (e.g., discharge location, water surface elevation, and flow velocity and direction) upstream and downstream of each dam. In addition, flow over the uncontrolled spillway on the east side of the Point Marion Dam would be restricted during construction because this section would be permanently removed to facilitate construction and operation of the proposed powerhouse.

An upstream cofferdam would not be required at the Morgantown, Maxwell, and Charleroi Projects, where all of the proposed facilities including the intake channel would be located downstream of existing spillway gates. At each of these projects, construction would involve temporary placement of cofferdams downstream of the dam, surrounding the intake channel, powerhouse, and tailrace construction areas. Cofferdams would obstruct discharges from some Corps' gates and temporarily alter hydraulic conditions upstream and downstream of the dams. Specifically, operation and flow through the Corps' gates immediately adjacent to and upstream of the proposed intake channel and the proposed projects' new spill gates would be restricted during construction, and other, unobstructed, gates would require larger openings to pass river flows. During construction of the powerhouses, all of the Corps' spillway gates and the projects' new spill gates would be available to pass flows.

At the Grays Landing Project, construction would also involve temporary placement of cofferdams around the intake channel area upstream of the dam and around the tailrace area downstream of the dam. In addition, the applicant proposes to install a 2.5-foot-high crest gate on top of the dam crest. The applicant did not indicate whether cofferdams would be required during installation of the crest gate.

The applicants propose to sequence construction times to minimize construction-related hydraulic effects during seasons when spawning fish and other aquatic resources may be particularly sensitive. In addition, at the scoping meeting on October 10, 2014, Rye Development indicated that the applicants would defer to the Corps regarding gate operation during project construction.

The Corps, in its November 6, 2014 scoping comments, indicates that gate schedules during construction would be site specific, and suggests that flows could be directed through the center of the remaining unobstructed gates. The Corps also states that all gates may be opened to pass high flows and that the applicants' construction plans should consider forecasted river conditions.

Our Analysis

At each proposed project, under all flow conditions, except Point Marion and Grays Landing, the gate closest to the existing lock would typically be opened last.[50] Use of the gate(s) farthest from the locks would be restricted during construction, increasing the flow volume passing through the remaining spillway gates and likely shifting flow towards the middle of the river and the lock side of the Corps' facility. The use of fewer gates would cause the average water velocities upstream and downstream of the unobstructed portion of each dam to increase slightly, relative to existing flow releases, and would alter fish habitat and river conditions for navigation (i.e., velocities near the locks). The slight increase in velocity, however, would only occur near the Corps' gates and would quickly dissipate downstream. Therefore, velocity near the locks and throughout a majority of the dams' tailwaters would not likely exceed existing conditions (0 to 5 fps depending on river flow and gate openings) currently experienced by aquatic species, barges, or recreational vessels. Table 3-16 shows the proposed gate restrictions during construction at the dams.

[50] At the Point Marion Project, the gate closest to the lock is typically opened first, and the Grays Landing Project has a fixed-crest concrete dam with no spill gates.

Table 3-16. Spillway gate schedules and discharge capacities at Opekiska, Morgantown, Point Marion, Maxwell, and Charleroi Dams under existing conditions and during the project construction period when cofferdams are in place (Source: staff).

Project	Existing Gate Schedule[a]	Maximum Existing Gate Discharge Capacity	Proposed Gate Restriction during Construction[b]	Gate Discharge Capacity during Construction (cfs)
Opekiska	2, 3, 4, 1	117,000	4	87,750
Morgantown	4, 3, 5, 2, 6, 1	64,200	6	53,500
Point Marion	1, 2, 3, 4, 5, 6	24,190	6	20,158
Maxwell	3, 4, 2, 5, 1	92,400	4, 5	55,440
Charleroi	3, 4, 2, 5, 1	71,900	4, 5	43,140

[a] Gate numbering starts adjacent to lock, and gates are opened in the order shown.
[b] Gate restriction would occur during cofferdam installation, intake channel and spill gate construction, and cofferdam removal.

At the Grays Landing Project, we expect that a series of temporary cofferdams would be required to install the crest gate. The cofferdams would divert flow to other portions of the Corps' spillway while a section of the crest gate is installed. This would slightly raise water surface elevation in the pool and direct flow towards unobstructed portions of the spillway. This would result in localized and temporary changes in discharge patterns and water velocity upstream and downstream of the dam, but would ensure that pool elevation is maintained for navigation during crest gate installation.

Proposed gate restrictions and obstructions caused by cofferdams during project construction could reduce spillway capacity at the Opekiska, Morgantown, Point Marion, Maxwell, and Charleroi Projects. A reduction in spillway capacity would raise pool elevations when flows exceed the gate discharge capacity during construction (see table 3-16). River flows would rarely approach spillway capacity at the dams, however, even if some gates were completely obstructed and unavailable during construction (table 3-17). At these five projects, river flows approaching the available spillway capacity would have no more than a 1-percent chance of occurring from June through October. Therefore, completing construction activities that require cofferdams during this time period would minimize potential effects on water levels. Ultimately, the Corps would determine both the timing of construction and gate schedules during construction of the proposed projects.

Table 3-17. Percent of time by month that river flow equals or exceeds the maximum spillway capacity that would be available during construction of the proposed Monongahela River Projects when cofferdams are in place (Source: staff).

	Percent of Time Restricted Flow Capacity is Equaled or Exceeded				
Month	**Opekiska**	**Morgantown**	**Point Marion**	**Maxwell**	**Charleroi**
January	< 1	< 1	2	1	3
February	< 1	< 1	3	2	4
March	< 1	< 1	3	2	5
April	< 1	< 1	< 1	< 1	2
May	< 1	< 1	1	< 1	2
June	< 1	< 1	1	< 1	1
July	< 1	< 1	< 1	< 1	< 1
August	< 1	< 1	< 1	< 1	< 1
September	< 1	< 1	< 1	< 1	< 1
October	< 1	< 1	< 1	< 1	< 1
November	< 1	< 1	1	1	1
December	< 1	< 1	2	1	3

Operational Effects on Water Quantity

In general, operation of the projects in run-of-release mode[51] as proposed, would minimize effects on the Corps' management of water levels and the quantity or timing of flows that pass each dam. However, project operation would alter hydraulic conditions (e.g., flow distribution, water surface elevation, and flow velocity and direction) in some areas close to the dams. To maintain the existing hydraulic capacity at the Morgantown, Maxwell, and Charleroi Projects, the applicants propose to install spill gates in the intake

[51] Although the applicants refer to their proposed operating mode as run-of-river, it is more accurate to refer to it as run-of-release, because the projects would generate from flows as "released" (i.e., made available) to the projects by the Corps.

channel (forebay) of each proposed powerhouse. These gates would discharge flow at a perpendicular angle to the shoreline. The gates would be designed to pass the full hydraulic capacity of any gates obstructed by the proposed powerhouse. When river flow is less than the minimum hydraulic capacity required to operate one unit or when high water levels preclude project operation, the powerhouse would be shut down, and all flows would be passed through the Corps' gates and the proposed spill gates, as directed by the Corps.[52] Spill gates would not be needed to maintain existing spill capacity at the Opekiska, Point Marion, and Grays Landing Projects.

At the Grays Landing Project, which currently has an uncontrolled spillway, the applicant proposes to install a 2.5-foot-high adjustable crest gate on the dam crest to control the water surface elevation to ensure sufficient depth for navigation in the upstream pool. When river flow is less than the minimum hydraulic capacity required to operate one unit, or when high water levels preclude project operation, the powerhouse would be shut down, and all flows would be passed over the new crest gate on the dam, as directed by the Corps.

During operation, the applicants propose to curtail generation and allow minimum bypass flows to pass over the Corps' spillway, the project spill gates, or as otherwise directed by the Corps, at each of the proposed projects. Table 3-18 presents the proposed minimum bypass flow schedule proposed for each project.

Table 3-18. Minimum bypass flow schedules for proposed Monongahela River Projects (Source: FFP Missouri 13, FFP Missouri 15, Solia 4 Hydroelectric, Solia 5 Hydroelectric, and Solia 8 Hydroelectric, 2014).

Project	**Minimum Bypass Flow (cfs)**	**Period of Flow**
Opekiska	300	July 1–July 31
Morgantown	300	July 1–July 31
Point Marion	300	July 1–July 31
Grays Landing	500; 50	July 1–July 31; August–June
Maxwell	500	July 1–July 31
Charleroi	500	July 1–July 31

[52] A detailed description of each project's proposed operation is provided in section 2.2.5, *Proposed Project Operation*.

In its comments filed on March 4, 2016, the Corps states that the proposed project operation must not impact the navigation channel, pool elevations, or operation of the locks and dams. In addition, Interior (10(j) recommendation (1) recommends that the projects operate in a run-of-river mode, and provide minimum bypass flows through the dam gates or over dam spillways during all months of the year. In its comments filed on February 16, 2016, West Virginia DNR also recommends that minimum flows should be required during all months of the year. Pennsylvania FBC recommends the proposed projects operate in run-of-river mode to avoid impacts on water levels and protect fish and wildlife habitat.

Our Analysis

At the Opekiska, Morgantown, Maxwell, and Charleroi Locks and Dams, under existing low- and moderate-flow conditions (table 3-7 defines low-, moderate-, and high-flow conditions for each dam), the Corps generally releases most flow from a gate on the opposite side of the river from the locks and distributes flow releases more evenly across the width of the spillways under high-flow conditions. At the Point Marion Lock and Dam, the Corps releases the most flow from a gate adjacent to the lock and distributes flow releases more evenly across the width of the spillway under higher-flow conditions. Under the proposed operation, when river flows are within the hydraulic capacity of the proposed projects (195 to 3,900 cfs at the Opekiska, Morgantown, and Point Marion Projects; 450 to 9,000 cfs at the Maxwell and Charleroi Projects), most or all of the flow would typically pass through the powerhouses, all of which would be located on the opposite side of the river from the locks. The powerhouse tailraces at the Opekiska and Point Marion Projects would discharge flow at a slight angle from the shoreline. The powerhouse tailraces at the Morgantown, Maxwell, and Charleroi Projects would discharge flow approximately parallel to the shoreline. When the spill gates installed in the project intake channels at the Morgantown, Maxwell, and Charleroi Projects are in use, they would discharge flow towards the center of the river.

At the Grays Landing Lock and Dam, under existing low- and moderate-flow conditions (table 3-7), flows passing the dam that are not used for lock operation are distributed evenly across the width of the dam crest. When river flows are within the hydraulic capacity of the proposed project (450 to 9,000 cfs) under the proposed operation, most or all of the flow would typically pass through the powerhouse, all of which would be discharged on the opposite side of the river from the lock. The proposed powerhouse tailrace would discharge flow at a slight angle from the shoreline.

Two-dimensional hydraulic modeling software, ADH,[53] which was developed by the Corps' Coastal and Hydraulics Laboratory, was used to simulate the effects of project operation on the velocity distribution upstream and downstream of the dams (CDM Smith, 2015). Under existing conditions, water velocities upstream of each dam typically range between 0.5 and 1.0 fps, with higher velocities up to 4.0 fps in localized areas near the open gates. Existing velocities are between 0.5 and 3.0 fps downstream of the dams, with higher velocities up to 6.0 fps immediately downstream of the open gates. When the proposed projects are operating, areas of localized high velocities would form upstream of the proposed intakes, in and downstream of the proposed tailraces, and downstream of the proposed spill gates. Velocities in these areas are predicted to increase by 2.0 to 5.0 fps during moderate- to high-flow conditions (1,864 to 7,774 cfs at Opekiska, 1,950 to 8,136 cfs at Morgantown, 1,731 to 7,583 cfs at Point Marion, 5,600 to 21,500 cfs at Grays Landing, 6,257 to 24,023 cfs at Maxwell, and 6,576 to 25,248 cfs at Charleroi). Model results indicate that velocity changes in excess of 0.1 fps caused by project operation would extend no more than 1,500 feet upstream of the dams and no more than 6,550 feet downstream of the dams. In addition, velocities in the vicinities of the locks at all proposed projects would remain similar to existing conditions or decrease under all flow conditions whether or not the projects are operating. Therefore, commercial navigation and recreational boat traffic should not be affected by the operation of the proposed projects. Effects of the proposed projects' operations on aquatic organisms and habitat are discussed below in *Operational Effects on Aquatic Organisms and Habitat*.

The applicants state that project operations would not alter water levels upstream of the Opekiska, Morgantown, and Point Marion Dams, but could alter water levels upstream of the Maxwell, Charleroi, and Grays Landing Dams. The applicants' hydraulic modeling (CDM Smith, 2015) indicates that the maximum hydraulic capacity of the Maxwell and Charleroi Dams would be slightly lowered (by 4,240 cfs and 3,980 cfs, respectively) by the current design of the proposed spill gates,[54] which could have an

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[53] ADH is a state-of-the-art adaptive hydraulic modeling system capable of handling both saturated and unsaturated groundwater, overland flow, and two- or three-dimensional shallow water problems. ADH uses adaptive numerical meshes that can be employed to improve model accuracy without sacrificing efficiency.

[54] *See* pages 4-80 to 4-84 (Maxwell Locks and Dam) and pages 4-108 to 4-113 (Charleroi Locks and Dam) of the water quality, hydraulics, and aquatic habitat study report (appendix c-1 of the final license application – volume II) filed on March 14, 2014. The results indicate that the proposed Maxwell Project would reduce capacity of Maxwell Dam from 92,400 to 88,160 cfs and that the proposed Charleroi Project would reduce the capacity of Charleroi Dam from 71,900 to 67,920 cfs.

effect on upstream water levels when flow exceeds the maximum capacity of the dams and proposed projects (88,160 cfs at Maxwell and 67,920 at Charleroi). The applicants' hydraulic modeling also showed that project operation could result in small increases in water surface elevations downstream of the Corps' gate closest to the proposed powerhouse at both dams. For example, under maximum-flow conditions (90-percentile flows), the increases in water surface elevation could be up to 2.4 feet below Maxwell Dam and 1.8 feet below Charleroi Dam. However, any changes in water surface elevation downstream of the dams would be limited to an area immediately downstream of the dam. Table 3-19 presents modeled upstream and downstream pool elevations for existing and proposed conditions under maximum-flow conditions.

Table 3-19. Modeled upstream and downstream pool elevations for existing and proposed conditions at Maxwell and Charleroi Dams under maximum (90-percentile) flows (Source: CDM Smith, 2014b, as modified by staff).

	Pool Elevation (feet)	
Condition	**Maxwell**	**Charleroi**
Upstream for existing condition	764	744.6
Upstream for proposed condition	764	744.6
Downstream for existing condition	762.3	742.9
Downstream for proposed condition-turbines on	763.7	744.0
Downstream for proposed condition-turbines off	764.7	744.7

At the Maxwell and Charleroi Projects, modeling indicates that the existing configuration of the proposed spill gates may increase upstream water surface elevations when flows exceed 88,160 cfs and 67,920 cfs, respectively. The applicants' hydraulic modeling study suggests that the proposed spill gates may need to be resized to ensure that the Corps' capacity and upstream water surface elevations would not be affected. In addition, the modeling suggests the proposed spill gates would impede the hydraulic capacity of the Corps' adjacent gate (i.e., gate 4 next to the proposed spill gates). Extending the proposed length of the intake channel, therefore, could minimize effects on the maximum hydraulic capacity of the Maxwell and Charleroi Dams.

At Grays Landing, when river flows are less than 9,000 cfs, the proposed crest gate would be in the full up position, holding the upstream pool elevation at 780.5 feet, which is up to 2.5 feet higher than existing conditions. When river flows are between 9,000 and 11,000 cfs, the proposed crest gate would be in the full up position, and the upstream pool elevation would increase from 780.5 to 781.5 feet, which is about 1 foot higher than existing conditions. When river flows are between 11,000 and 23,700 cfs, the crest gate would be incrementally lowered to achieve an elevation of 781.5 feet, which would result in an upstream pool elevation up to 0.5 foot higher than existing conditions when river flow is between 11,000 and 14,000 cfs and up to 1.5 foot lower than existing conditions when river flow is between 14,000 and 23,700 cfs. At river flows exceeding 23,700 cfs, the crest gate would be fully lowered. When river flows are between 23,700 and 65,000 cfs, the upstream pool elevation would be about 1 foot lower than existing conditions. When river flows exceed approximately 65,000 cfs, the turbines would shut down, and the upstream pool elevation would be equal to existing conditions.

Generally, Commission licenses for non-federal projects at Corps dams require the licensees' to develop an operating plan and MOA with the Corps. Such an operating plan would describe the mode of hydropower operation, pool and flow regulation requirements for the Corps' projects, and integration of operation of the hydroelectric facilities into the Corps' emergency action plans. The MOA would describe the detailed operation of the project acceptable to the Corps and any restrictions needed to protect the purposes of the Corps' project for navigation. Development of an operation compliance monitoring plan would incorporate this MOA, include provisions for documenting compliance with any Corps' operating requirements, and establish a schedule for reporting project compliance/non-compliance during normal operation and emergencies. Operation of the Monongahela River Projects in accordance with MOAs between the applicants and the Corps and developing operation compliance monitoring plans would ensure run-of-release operation and minimize impacts on pool elevations, navigation, water quality, and aquatic resources.

Water Quality

<u>Construction Effects on Water Quality</u>

Proposed project facilities would require in-water construction (cofferdam installation and removal, the placement of fill or other materials, and excavation of intake channels and tailraces) for powerhouse construction within the river channel, installation of a 2.5-foot-high crest gate on top of the existing Grays Landing Dam, and some upland excavation (construction of the project access roads, parking lots, substations, and transmission lines). The Opekiska and Grays Landing Projects would be located mostly on land, adjacent to the dams and primarily involve upland area excavation. Both in-water and ground (near-water) construction may increase turbidity levels near the proposed projects, depending on the effectiveness of proposed erosion control measures.

Installation and removal of temporary cofferdams and dredging activities at each of the proposed projects could result in disturbance of contaminated sediment, including suspending sediment and redistributing contaminants to downstream locations. River sediment samples collected by the applicants in the vicinity of the proposed projects contained PAHs at concentrations that exceeded EPA sediment screening criteria.[55] Therefore, construction activities may result in redistribution of contaminated river sediment during cofferdam installation, excavation, or spoil disposal.

Construction of the proposed projects would also require the use of an assortment of heavy equipment (e.g., bulldozers, dump trucks, and tractors). This equipment would require fuel (diesel and gasoline), motor oil, hydraulic fluid, and other lubricants. The construction contractor(s) may also wish to store fuels and other hydrocarbons on site and may elect to perform some routine maintenance in the general project areas. On-site fuel storage facilities for projects of this type are commonly in the range of several hundred to several thousand gallons of fuel, along with lesser amounts of motor oil, hydraulic fluid, and lubricants. The presence of these materials would create a risk of accidental release of hydrocarbons, with the potential for contamination of area waterways. In addition, the turbine units and transformers used at the projects may contain petroleum-based oils or other substances that could be released into the river in the event of catastrophic equipment failure. All types of freshwater organisms as well as mammals, insects, microorganisms, and vegetation are susceptible to the effects of spilled hydrocarbons. In addition, the effects of spilled hydrocarbons on freshwater microorganisms, invertebrates, and algae tend to move up the food chain and affect other organisms.

The applicants propose several measures as part of an erosion and sedimentation control plan at each project to be developed in consultation with the Corps, Pennsylvania DEP, and West Virginia DEP that includes procedures and BMPs to prevent pollution, minimize erosion, contain sediment, minimize the potential for spills of hazardous substances, and stabilize soils after construction is complete, as well as to provide for adequate storage of potential pollutants (e.g., gasoline, oil) on the construction site.

In its comments filed on March 4, 2016, the Corps states that it would require continuously recorded water quality monitoring downstream and possibly upstream of each hydropower project during construction and operation. The Corps also states that all water quality monitoring data would be required to be available in real-time on the same website and web server, to ensure continual, real-time compliance with non-degradation criteria.

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[55] Table 3-3, section 3.3.1.1, *Geology and Soil Resources, Affected Environment*.

Our Analysis

During project construction, all river flow would continue to be passed through the existing gates of each dam, or over the ungated spillway at the Grays Landing Project. Although some gate use would be restricted during construction, the volume or depth of withdrawal of flows released over each dam would not change. Some changes in aeration and the location of aerated flow releases could change because of the use of fewer gates, which could affect DO concentrations downstream of the project sites.

Construction would likely temporarily increase turbidity because of cofferdam installation and removal. These effects, however, would be minimized by the use of turbidity curtains, and would be minor and limited to the period and areas of construction. Disturbance to adjacent lands along the shorelines, including road and parking lot construction, could also result in increased runoff and sedimentation. The use of BMPs and measures such as silt fencing and final site stabilization, as proposed in the applicants' erosion and sedimentation control plans, would minimize these effects. Project construction at the Morgantown and Point Marion Projects would also require barges to maneuver construction equipment and deliver project components. This could temporarily increase turbidity because of propeller-induced sediment mobilization where water depths can range from 2 feet (shoreline) to 18 feet (mid-channel) at the projects. However, substrate immediately downstream of these two locks and dams is mostly bedrock and boulder, with some cobble a little farther downstream of the Morgantown Lock and Dam. Therefore, the potential for sedimentation from barge movement would be limited. If barges are used during construction at other projects, sediment could be disturbed and suspended. Existing barge traffic through the Corps' locks routinely causes sediment resuspension and temporary increases in turbidity, so Monongahela River aquatic resources near the locks and dams would be accustomed to these short-term effects.

As described in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects, Construction Effects on Geology and Soils*, implementation of an erosion and sedimentation control plan at each project, developed in consultation with the agencies, as the applicants propose, would minimize construction-related effects on water quality. In addition, implementing a water quality monitoring plan during construction would allow for immediate identification of water quality effects caused by construction activities, and would inform any actions needed to minimize such effects on water quality. Appropriate parameters to monitor would include turbidity, water temperature, and DO.

Construction and operation of the proposed projects could result in the release of lubricants or other toxic substances into the Monongahela River, adversely affecting water quality and aquatic and terrestrial resources. The use of commonly accepted and approved BMPs during construction would likely minimize these adverse effects. For example, these BMPs could include: (1) intercepting and controlling accidental oil, gas, or electrical component releases through daily inspections and placing barriers around all mechanical and electrical equipment when not mobile; (2) removing and disposing of any spilled material in accordance with appropriate regulations; (3) storing fuel and other hydrocarbons in areas away from waterways; (4) appropriate primary and secondary containment for all fuel and hydrocarbons stored on site to reduce the likelihood of accidental releases that would directly or indirectly contaminate drainage ways; (5) treatment and infiltration of construction-associated wastewater back into the Monongahela River only if adequate pretreatment results in water quality consistent with existing state water quality standards; and (6) provisions for emergency response, agency notification procedures, and the availability of onsite equipment to contain spills.

While there still would be some risk for accidental introduction of hydrocarbons into the Monongahela River during the construction and operation of the proposed projects, the potential adverse effects that spills could have on water quality would be greatly reduced by implementing an appropriate plan for handling hazardous substances. The plan could also serve as a reference for procedures to be followed in the event of a hazardous materials spill, further minimizing the effects on water quality.

Construction of the proposed projects could result in the release of contaminated sediment into the Monongahela River during excavation for the proposed intakes, powerhouses, and tailraces. Construction of the proposed access road for the Point Marion Project could also disturb brownfield-designated soils located along the existing Sheepskin Trail, which, if not properly managed, could enter the river channel. Developing a contaminated sediment testing and disposal plan for each project, in consultation with the Corps, Pennsylvania DEP, and West Virginia DEP, which includes a requirement for testing sediment from the riverbed and disposal of contaminated sediment at an approved disposal site, would ensure proper handling and disposal of contaminated excavated materials. A suitable contaminated sediment testing and soil disposal plan would include: (1) a description of proposed sampling sites and sampling frequency; (2) a description of sampling methodologies and the types of contaminants to be tested for; (3) a description of the measures to be implemented to minimize suspension of contaminated sediments; (4) identification of an approved disposal site and a description of the process for removing, handling, and disposing of contaminated soils/sediments; (5) a provision to provide all testing results to Pennsylvania DEP and West Virginia DEP; and (6) an implementation schedule. At the Point Marion Project, the plan could also include a requirement to consult with Pennsylvania DEP to determine appropriate tests and protective measures for potential brownfield-designated soils along the proposed access road. All other sediment testing would be representative of the excavation area,[56] excavation depth, and contaminants observed in the watershed during sampling for the projects' final license applications.

Operational Effects on Water Quality

The applicants propose to divert a portion of the river flow currently passing over the spillways of the project dams through the proposed powerhouses. Current spillage provides some aeration, and redirecting flow into the powerhouses would reduce the amount of aeration that occurs at each dam, potentially reducing downstream DO concentrations. Decreased DO concentrations could, in turn, adversely affect aquatic species, including fish and freshwater mussels (e.g., mortality, reduced growth and spawning success).

To reduce effects on downstream water quality, the applicants propose seasonal bypass flows[57] to provide some aeration benefits during project operation and for aesthetics. In addition, the applicants would develop post-construction water quality monitoring plans to assess project effects on water quality. Monitoring is proposed for June through September for 3 years after project operation begins.

The Corps states that continuously recorded water quality monitoring would be required downstream and possibly upstream of each hydropower project during construction and operation. The Corps states that it would require monitoring throughout the term of the licenses, year-round during the first 3 years of operation and possibly reduced to a May through November monitoring period afterwards, based on monitoring results. The Corps also states that it would require all water quality monitoring data to be available in real-time and presented on the same website and web server, to ensure continual, real-time compliance with non-degradation criteria. Finally, the Corps states that an adaptive management approach to maintaining existing water quality and aquatic life conditions would be required, which would include compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.

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[56] For the quantity of excavated soil during construction of the proposed projects, see pages 75 and 40-42 of the applicants' letters in response to the Commission's request for additional information filed on October 20, 2014, and July 8, 2015, respectively.

[57] The proposed bypass flows would be as follows: Opekiska, Morgantown, and Point Marion–300 cfs from July 1 through July 31; Grays Landing–500 cfs from July 1 through July 31and 50 cfs during August through June; and Maxwell and Charleroi–500 cfs from July 1 through July 31.

Interior (10(j) recommendation 1) recommends year-round bypass flows to protect fish and wildlife habitat. In addition, Interior recommends post-construction water quality monitoring, but does not specify how many years the monitoring should be performed. West Virginia DNR recommends year-round bypass flows at the Opekiska and Morgantown Projects. Pennsylvania FBC also recommends water quality monitoring at all projects and that the projects adhere to a non-degradation standard determined by the Corps. Pennsylvania FBC also states that if the DO standard recommended by the Corps is not met, measures to increase DO (such as increasing bypass flows) must be implemented immediately. Ecosophic Strategies, LLC, recommends a DO non-degradation standard of 6.5 mg/L or higher if the agencies recommend a higher standard. The Upper Monongahela River Association, Inc., recommends continuous water quality monitoring and a non-degradation water quality standard for the Opekiska Project.

Our Analysis

To evaluate the effects of the proposed Monongahela River Projects on water quality downstream of the project dams, the applicants conducted water quality modeling as part of their *Water Quality, Hydraulics, and Aquatic Habitat Study* (CDM Smith, 2015). The study used a two-dimensional (longitudinal-vertical) CE-QUAL-W2 model[58] to simulate DO concentrations downstream of each proposed project from March 1 to October 31, with focus on the June 15 to October 15 period, during a wet year (2013), average year (2009), and dry year (1999). The model did not include the period from November through February because DO concentrations are typically near saturation in rivers of temperate climates during this period. The results indicate that proposed project operations would decrease minimum DO levels downstream of all the Monongahela River Projects by 1.08 to 2.94 mg/L in a wet year, 0.81 to 2.4 mg/L in an average year, and 0.66 to 2.67 mg/L in a dry year, relative to simulated baseline conditions (table 3-20).[59] While these results indicate that the reduction in DO would be greater in a wet year, the modeled DO concentrations are generally high and at levels above those specified by state standards. Except for a 1-hour period when modeled DO concentration

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[58] The Corps, EPA, and USGS commonly use the CE-QUAL-W2 model to simulate hydrodynamics, water temperature, and water quality constituents including DO, nutrients, organic matter and suspended solids in rivers, lakes, reservoirs, estuaries, and combinations thereof.

[59] The Corps expressed concern regarding the applicants' water quality model results and indicated that it would conduct a separate study to describe potential effects of hydropower operation on DO concentrations in the Monongahela River. However, to date, the Corps has not provided its water quality modeling results.

downstream of the proposed Point Marion Project decreased to 4.82 mg/L, modeled DO concentrations were always above those specified by the state standard at the other Monongahela River Projects, and at all other times at the Point Marion Project in a wet year.

Because modeling indicated that DO levels would remain relatively high and generally not be an issue during wet years, we focus our analysis on average and dry years. The frequency at which DO concentrations would fall below those concentrations specified by state standards would range from 1.6 percent of the time at the Maxwell Project to 20.7 percent of the time at the Opekiska Project in an average year, and from 4.3 percent of the time at Morgantown and Grays Landing Projects to 18.7 percent of the time at the Opekiska Project in a dry year (table 3-20). Modeling shows that the percent occurrence of DO concentrations less than those specified by the state standards would decrease to close to zero at all projects with the passage of bypass flows, except at the Opekiska and Charleroi Projects (4.0 and 2.1 percent of the time, respectively) in a dry year. Monitoring results indicate that the pools of the Opekiska, Morgantown, Maxwell, and Charleroi Locks and Dams were occasionally stratified during the summer of 2013, showing both cooler water temperatures and lower DO levels at depths of about 10 to 15 feet. Lower DO waters could be discharged through the proposed powerhouses, although the proposed full-depth powerhouse intakes should act to pull water from the full water column resulting in well-mixed discharges.

To monitor for project effects on water quality, the applicants would develop water quality monitoring plans that include provisions for monitoring from June through September for 3 years after project operations begin. The applicants do not provide any details about what parameters would be monitored, or the locations where monitoring data would be collected. Developing water quality monitoring plans in consultation with the Corps, FWS, Pennsylvania FBC, and Pennsylvania DEP or West Virginia DEP and for Commission review and approval would help to ensure that the plans identify appropriate monitoring locations, sampling frequency and duration, and reporting requirements needed to verify whether or not the applicants are achieving compliance with the water quality requirements of any licenses issued for the projects. Also, making real-time monitoring data available on a website would provide stakeholders with a means to access and review the data.

Table 3-20. Modeled DO concentrations (mg/L) downstream of the proposed Monongahela River Projects for a wet year (2013), average year (2009), and dry year (1999) under pre- and post-project operating conditions, with and without bypass flows,[a] from June 15 to October 15 (Source: Rye Development, 2014, 2015a, as modified by staff).

		Minimum Instantaneous DO Concentration (mg/L)			**Percent Frequency of DO Concentrations < 5.0 mg/L[b]**		
Hydrology	**Project**	**Pre-Project**	**Post-Project without Bypass Flow**	**Post-Project with Bypass Flow**	**Pre-Project**	**Post-Project Without Bypass Flow**	**Post-Project with Bypass Flow**
Wet Year (2013)	Opekiska	6.70	5.07	5.43	0.0	0.0	0.0
	Morgantown	7.09	6.01	6.12	0.0	0.0	0.0
	Point Marion	7.25	4.82	5.85	0.0	0.5	0.0
	Grays Landing	8.28	5.34	5.59	0.0	0.0	0.0
	Maxwell	7.91	6.10	6.44	0.0	0.0	0.0
	Charleroi	7.72	6.48	6.61	0.0	0.0	0.0
Average Year (2009)	Opekiska	4.98	3.40	4.96	0.1	20.7	0.1
	Morgantown	5.31	4.29	5.08	0.0	3.8	0.0
	Point Marion	5.21	3.63	5.15	0.0	20.1	0.0
	Grays Landing	6.52	4.12	5.87	0.0	2.3	0.0
	Maxwell	6.14	4.04	5.58	0.0	1.6	0.0
	Charleroi	5.26	4.45	4.82	0.0	1.8	0.4
Dry Year (1999)	Opekiska	3.93	2.98	3.94	2.4	18.7	4.0
	Morgantown	5.69	4.06	5.18	0.0	4.3	0.0

		Minimum Instantaneous DO Concentration (mg/L)			Percent Frequency of DO Concentrations < 5.0 mg/L[b]		
Hydrology	**Project**	**Pre-Project**	**Post-Project without Bypass Flow**	**Post-Project with Bypass Flow**	**Pre-Project**	**Post-Project Without Bypass Flow**	**Post-Project with Bypass Flow**
	Point Marion	4.81	3.37	4.87	0.3	12.8	0.4
	Grays Landing	6.52	3.85	6.20	0.0	4.3	0.0
	Maxwell	5.32	3.70	5.01	0.0	4.6	0.0
	Charleroi	4.34	3.68	4.21	1.5	10.0	2.1

[a] Bypass flow rates used in this analysis are as follows: Opekiska, Morgantown, Point Marion—300 cfs; Grays Landing, Maxwell, and Charleroi—500 cfs.

[b] Based on modeled continuous data in 3-hour intervals from June 15 to October 15.

The applicants' modeling results indicate that, when the projects are operating, DO concentrations downstream of the dams may fall to levels below those stipulated by state standards between late-June and mid-October during both average and dry water years (see figures 3-1 through 3-6). Monitoring data from USGS (2016) also showed lower DO concentrations persisting well into September for some of the Monongahela River navigation pools. The applicants' 2013 monitoring study (CDM Smith, 2015) and modeling results also indicate that diel DO patterns can occur at the proposed projects, resulting in lower DO concentrations at night. The applicants' proposed water quality monitoring plans include DO monitoring from June through September, which would encompass most of the period when DO concentrations downstream of each dam may be low. However, both existing monitoring data and the applicants' modeling show that DO concentrations less than 5.0 mg/L may occur into early-October, particularly at the Opekiska and Point Marion Projects. In addition, modeled DO concentrations typically approached the state standard (about 5 to 6 mg/L) at all the projects into early-October. Failing to monitor water quality into early-October would likely miss some days when water quality would be poor, but monitoring until at least mid-October would provide the data necessary to ensure that water quality downstream of the projects is maintained consistent with the water quality requirements of any licenses issued for the projects.

The applicants' monitoring plans would cover a period of 3 years after project operation begins. This duration should be sufficient to capture the normal range of climatological and hydrologic variation in the Monongahela River Basin. Including provisions in the plans for filing annual reports of the monitoring results for Commission approval at the end of each monitoring period would provide the means for the Commission to consider the need for further monitoring and mitigation measures.

The applicants propose bypass flows at the Opekiska, Morgantown, Point Marion, Maxwell, and Charleroi Projects during July, and year-round bypass flows at the Grays Landing Project, with the primary purpose of providing aeration to maintain downstream DO concentrations. However, the results of the applicants' modeling indicate that DO concentrations less than 5.0 mg/L could occur downstream of the dams from late-June through mid-October under proposed operations, not only in the month of July. The modeling also indicates there would be some aeration benefits from bypass flows (figures 3-1 through 3-6). Developing and implementing a water quality monitoring plan for each project, as described previously, however, would help identify any adverse water quality effects and inform any necessary actions that could be needed to protect water quality. Although implementing year-round bypass flows as recommended by Interior and West Virginia DNR would reduce effects of project operation on water quality, DO concentrations from November to May would be much higher than 5.0 mg/L and would fully support aquatic biota, indicating that year-round bypass flows would not be needed for the protection of water quality.

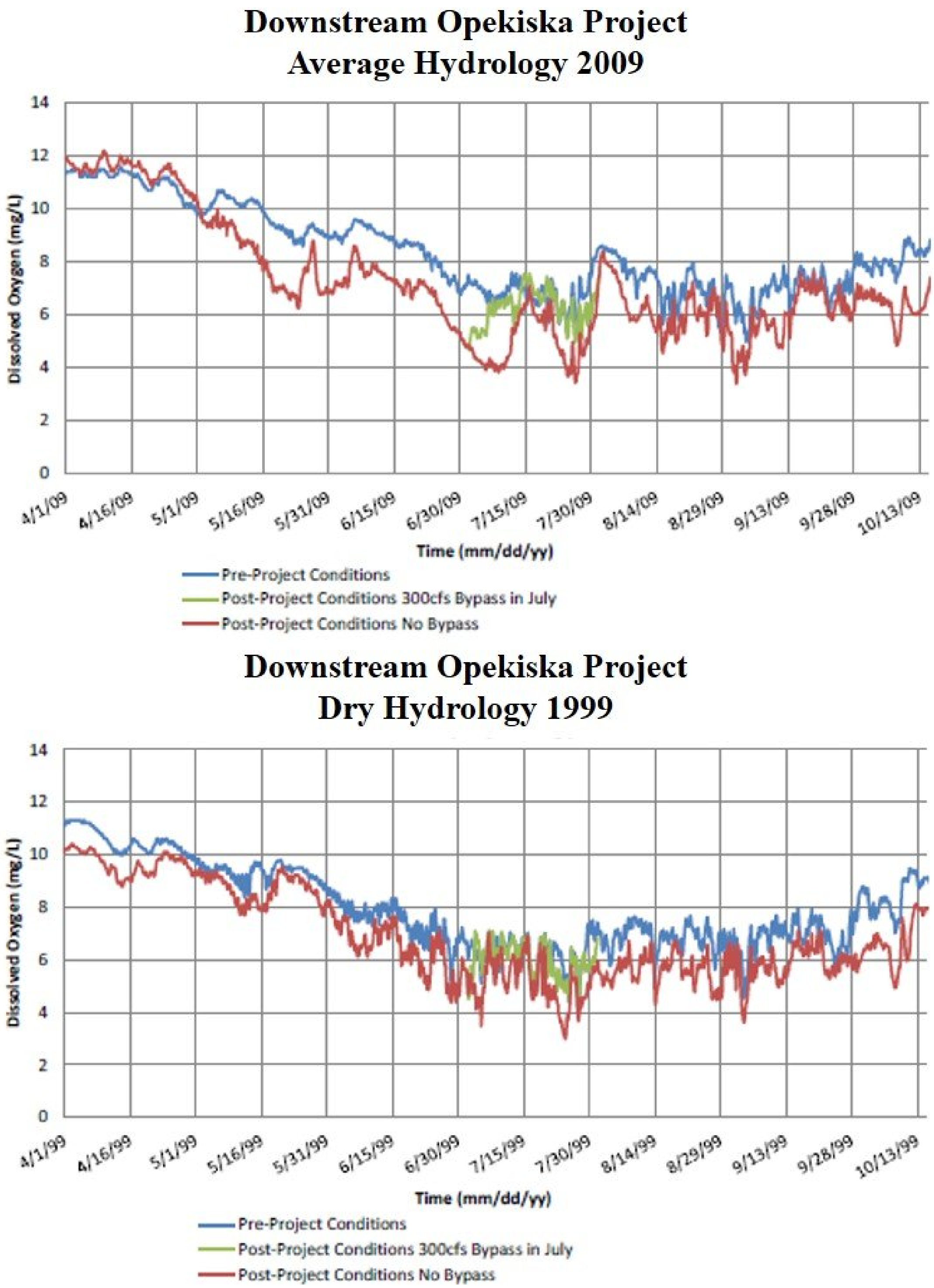
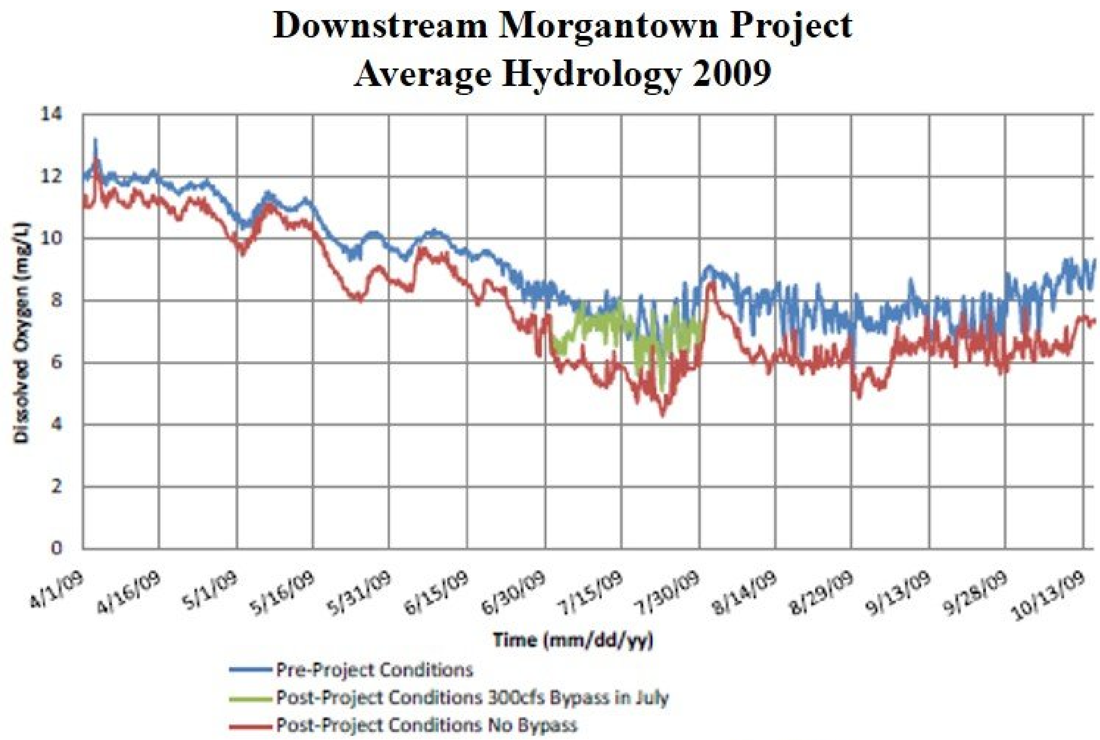


Figure 3-1. Modeled DO concentrations downstream of the Opekiska Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2015).



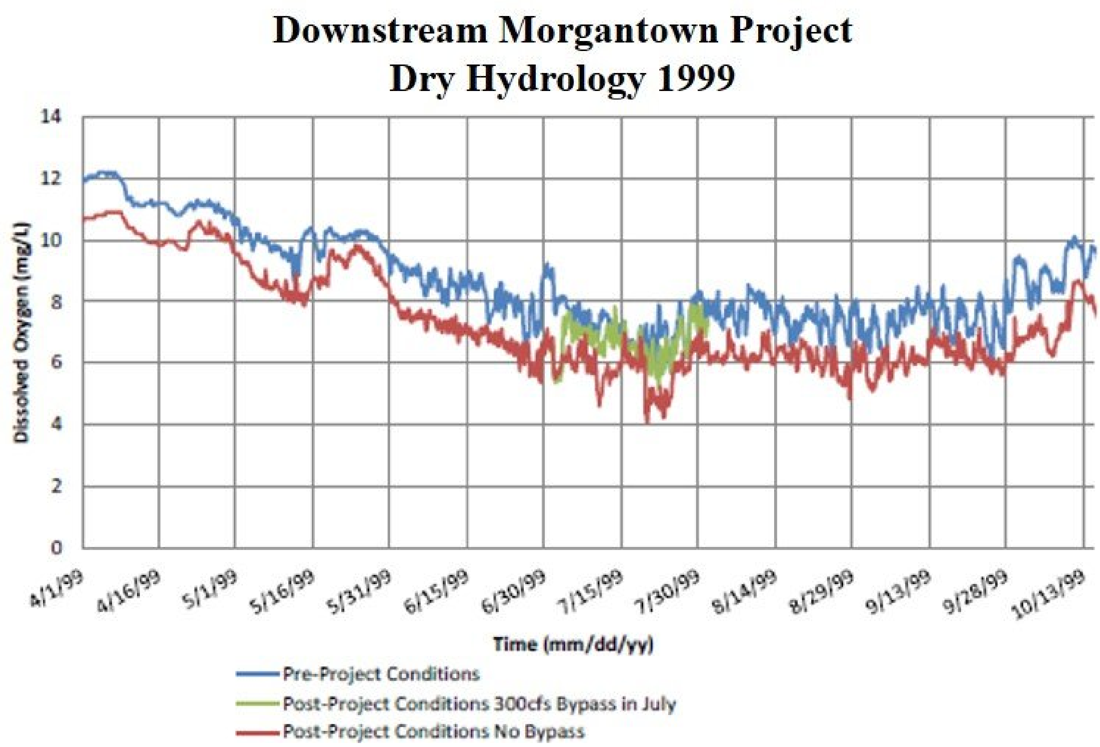
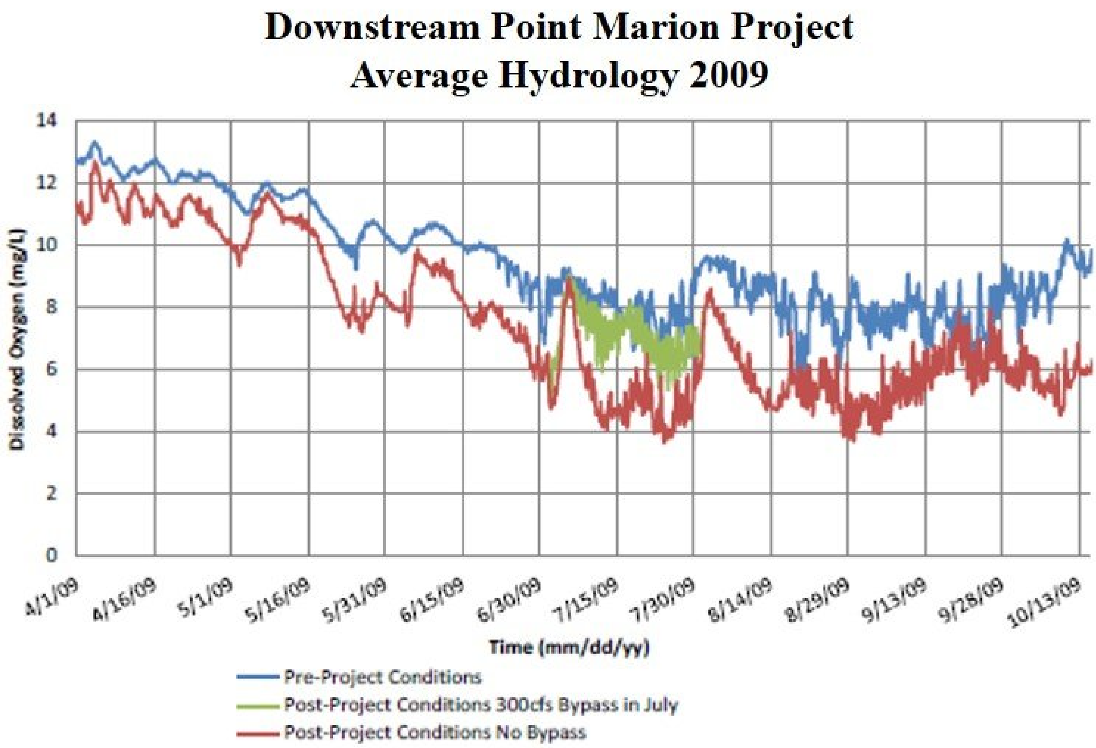


Figure 3-2. Modeled DO concentrations downstream of the Morgantown Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2015).



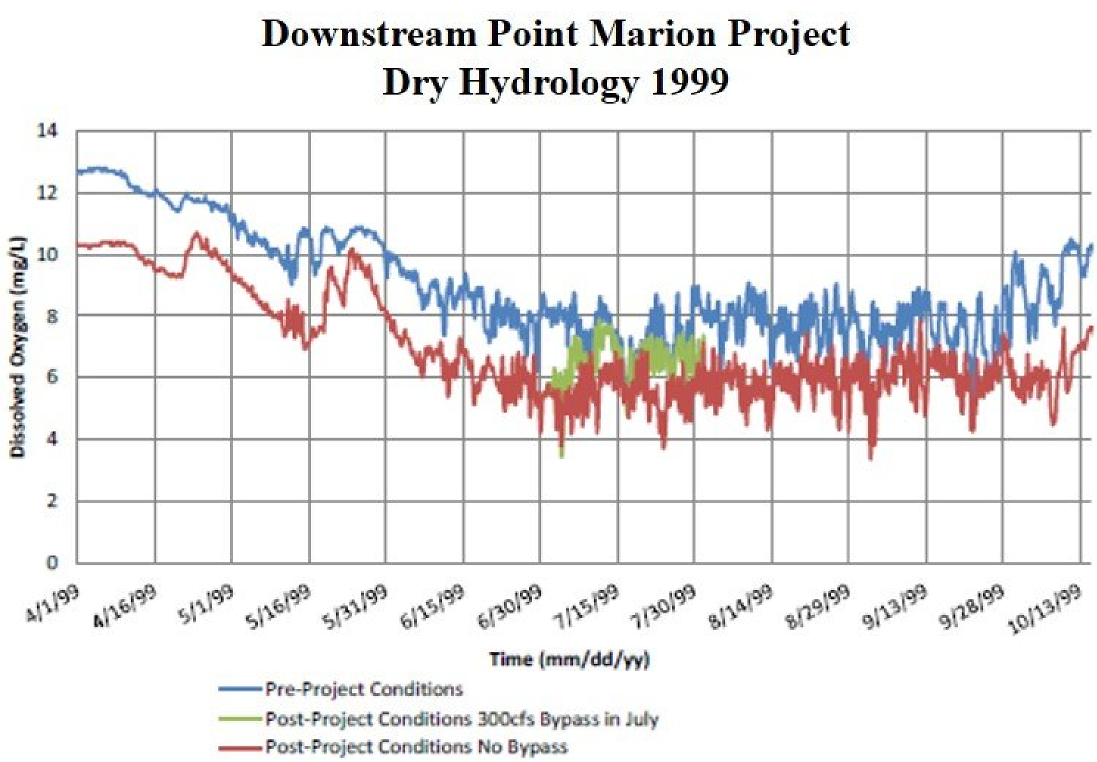
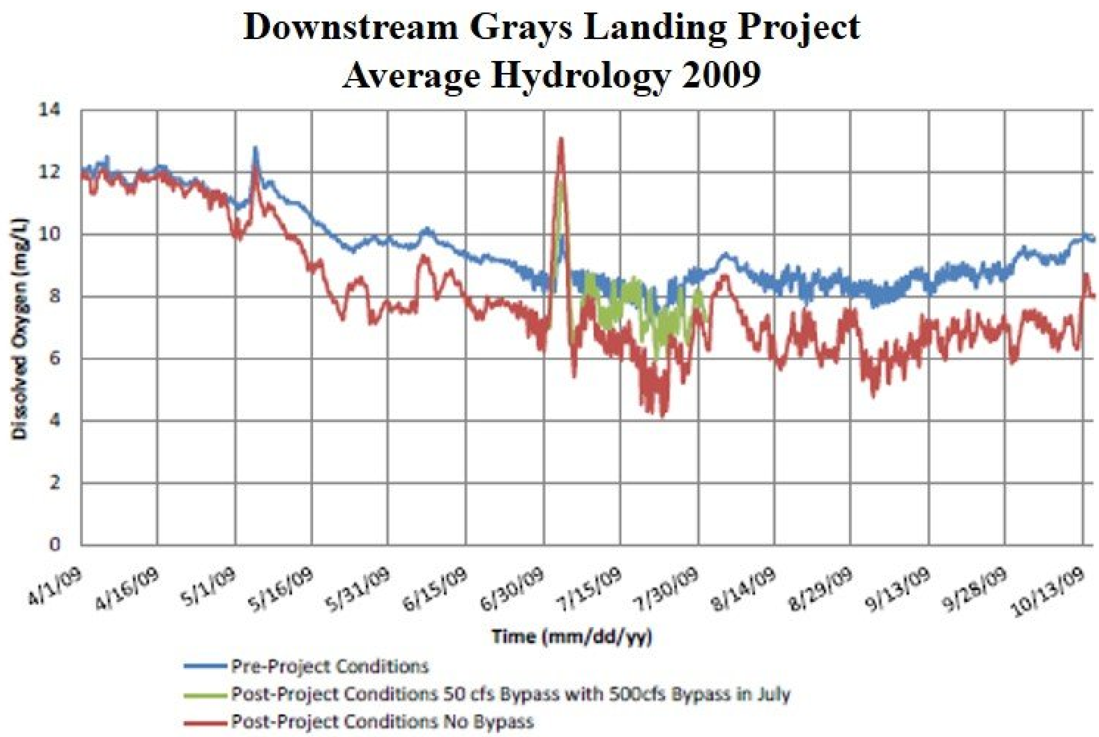


Figure 3-3. Modeled DO concentrations downstream of the Point Marion Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2015).



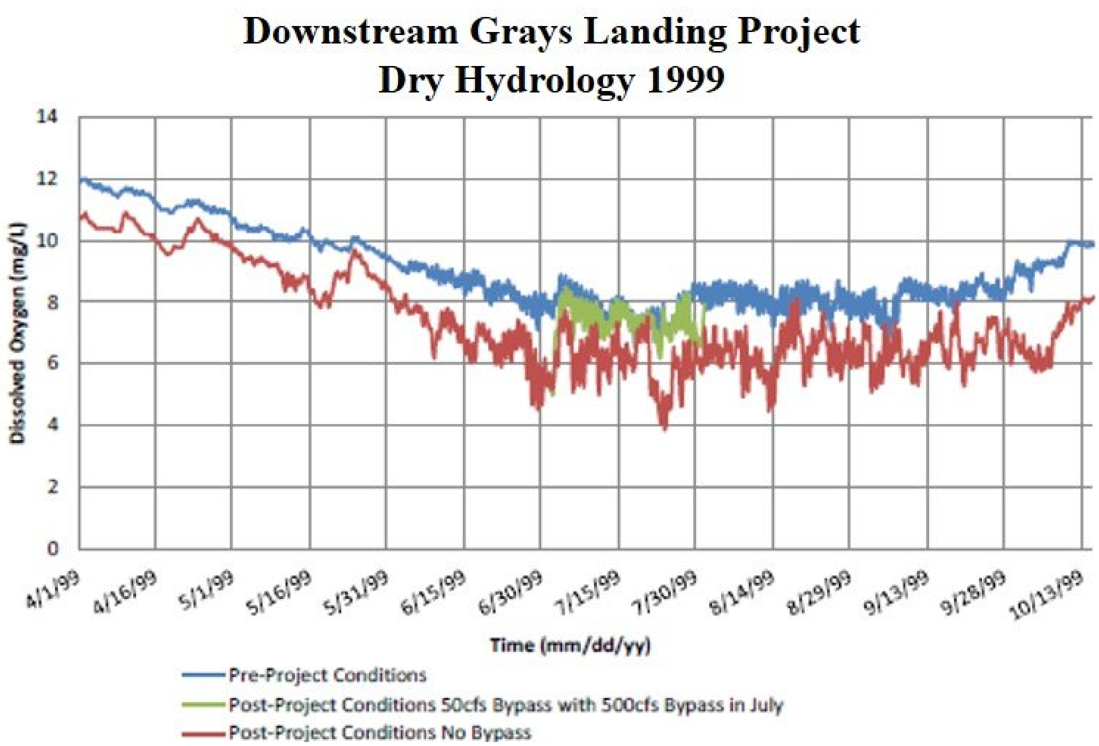
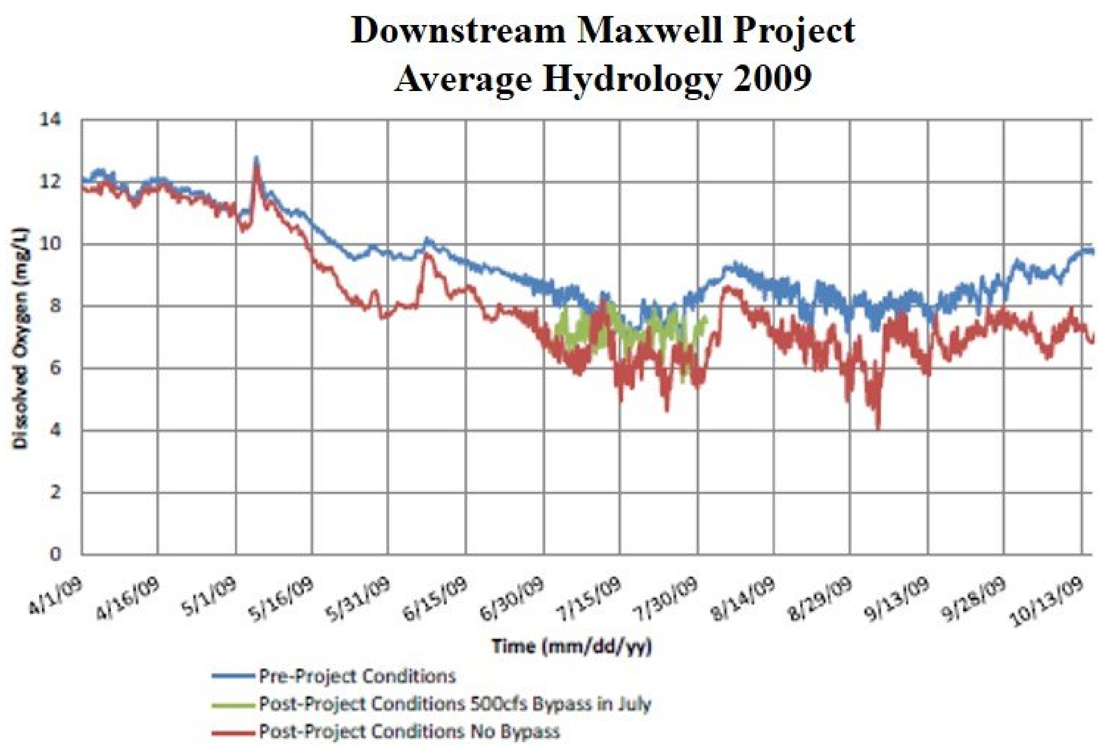


Figure 3-4. Modeled DO concentrations downstream of the Grays Landing Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2015).



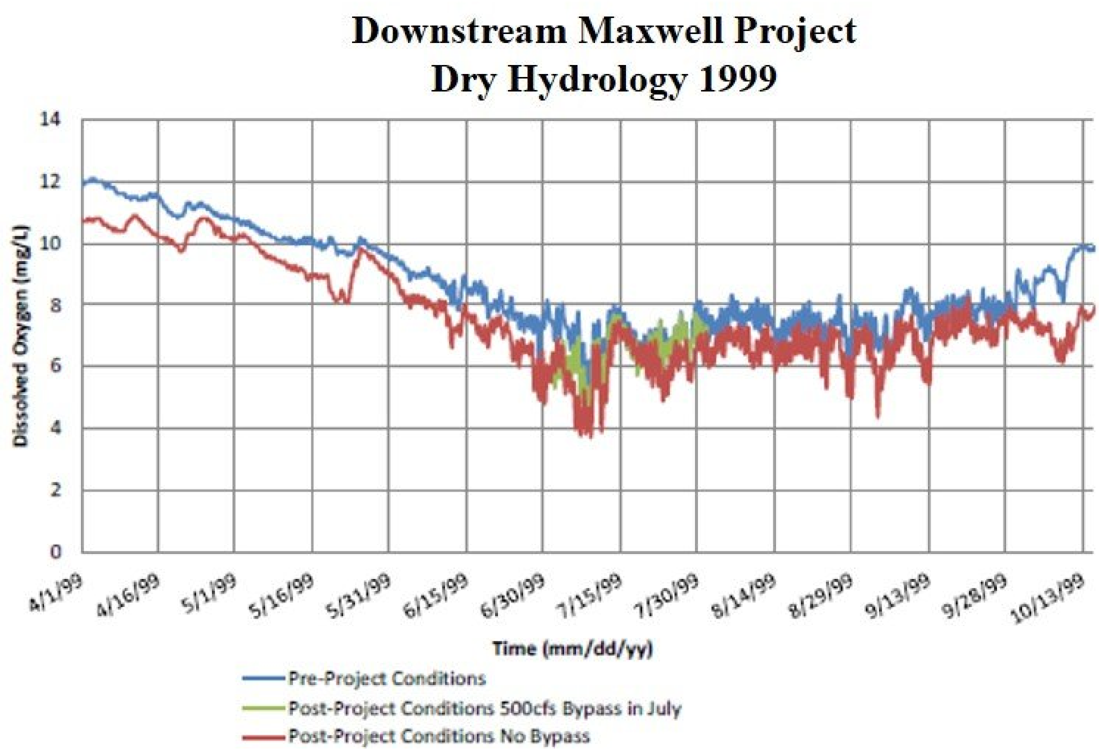


Figure 3-5. Modeled DO concentrations downstream of the Maxwell Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2015).

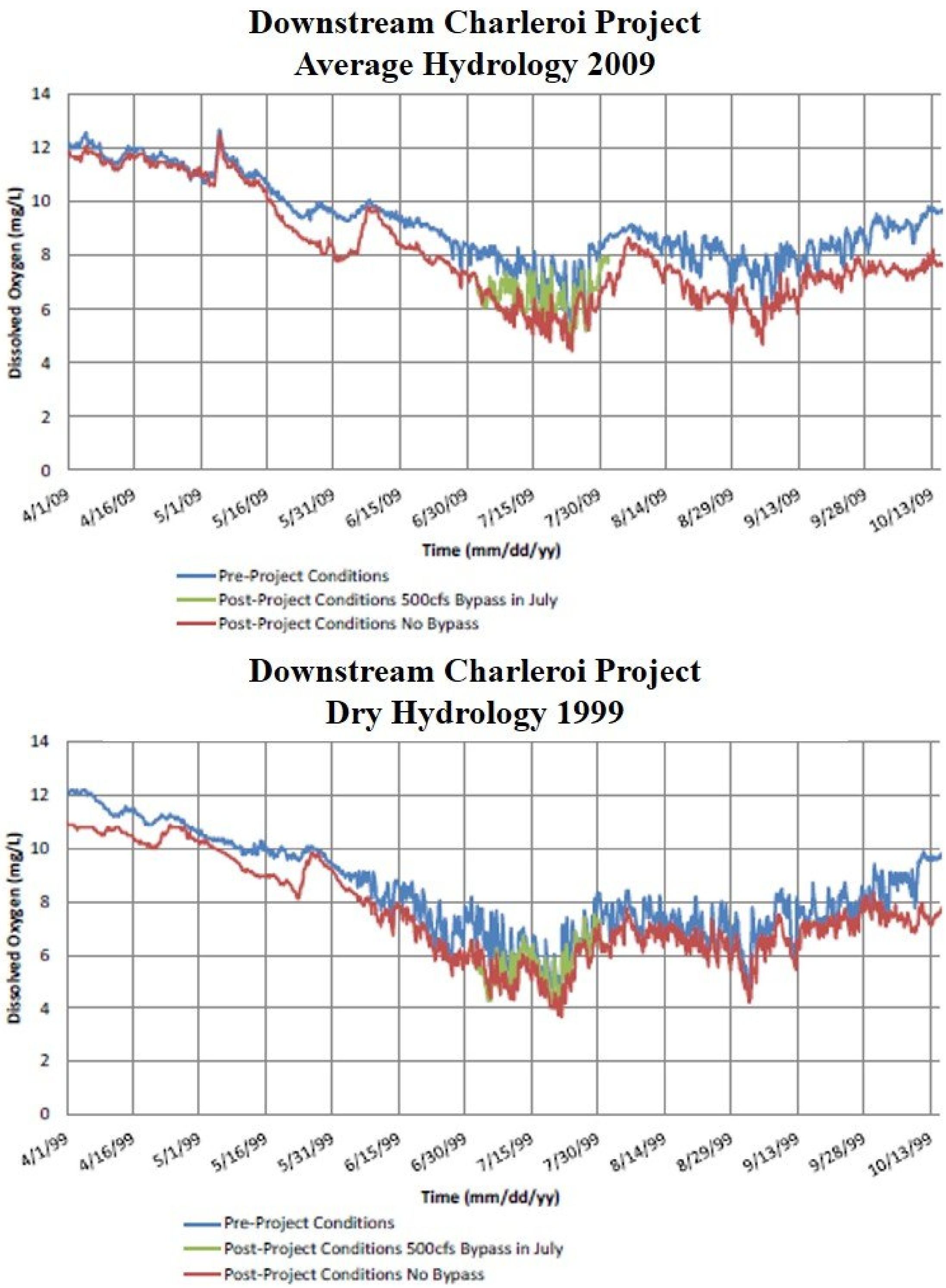


Figure 3-6. Modeled DO concentrations downstream of the Charleroi Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2015).

The Corps, Pennsylvania FBC, the Upper Monongahela River Association, and Ecosophic Strategies recommend that the projects meet a "non-degradation standard" for DO to support riverine water quality and the aquatic community. The Corps, Pennsylvania FBC and the Upper Monongahela River Association do not specify a standard, and Ecosophic Strategies suggests a standard of 6.5 mg/L. However, under baseline conditions in part of the year (summer), some existing dams already have DO concentrations less than 6.5 mg/L upstream and downstream of the dams, so it is unclear why such a higher DO concentration is needed. As we discuss above, maintaining DO concentrations of at least 5.0 mg/L would adequately protect fish and wildlife species, particularly the warmwater fish community in the Monongahela River. In addition, the operation compliance monitoring plan, described above, would include provisions to monitor compliance with the operational requirements of any license issued for the projects, and would provide information to adapt operations as needed.

Construction Effects on Aquatic Organisms and Habitat

Cofferdam Construction and Excavation

Construction activities could adversely affect resident fish, mussel, and macroinvertebrate populations through temporary displacement and mortality associated with cofferdam construction and dewatering, excavation and dredging in the river channel, and erosion and runoff from adjacent disturbed areas. Increases in suspended sediment could reduce aquatic habitat suitability downstream of the construction area, bury juvenile mussels and fish eggs, and clog the gills of freshwater mussels and macroinvertebrates.

As described in detail in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects, Construction Effects on Geology and Soils*, the applicants propose to develop an erosion and sedimentation control plan for each proposed project to minimize effects of in-water excavation and runoff from adjacent lands. Cofferdams would isolate the sections of the river to be dewatered to facilitate excavation of the intakes and tailraces as well as construction of the powerhouses. Turbidity curtains would be installed around cofferdams to minimize potential effects of suspended sediment during construction. The applicants would construct instream powerhouses just downstream of the existing Morgantown, Point Marion, Maxwell, and Charleroi Dams.

Our Analysis

Based on the applicants' substrate data from the mussel survey (Ecological Specialists, Inc., 2015), substrate near the downstream construction footprints for the projects is almost entirely bedrock, boulder, and gravel. This suggests that existing flows through the Corps gates and over the dam crest at Grays Landing, scour away fine sediments, leaving larger, more stable substrate behind. Substrate upstream of the dams along the same bank as the proposed projects is mostly silt, with some clay substrate as well. Cofferdam installation and removal for the intake channel construction at the Opekiska, Point Marion, and Grays Landing Projects could lead to elevated turbidity levels at these projects. However, because the construction footprints would be close to the dams, and turbidity curtains would be placed upstream and downstream of the cofferdams, there is little potential for in-river construction to suspend and redistribute large amounts of sediment. Furthermore, the proposed erosion and sedimentation control plans would include procedures and BMPs to prevent pollution, minimize erosion, contain sediment, minimize the potential for spills of hazardous substances, and stabilize soils after construction is complete, and therefore minimize any effects of project construction on aquatic habitat. Finally, as discussed previously in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Construction Effects on Water Quality*, implementing a water quality monitoring plan for each project during construction would allow for immediate identification of any turbidity level increases within the immediate area, and implementation of any actions needed to minimize erosion and sedimentation impacts.

Fish species, including darters and minnows that are often found in the dam tailwaters and therefore could also be in the construction areas, may be displaced by cofferdam construction; boat and barge traffic associated with construction; and/or increased turbidity associated with cofferdam installation, dewatering of the construction area, and excavation of the riverbed. However, any displacement would be temporary and unlikely to have long-term effects on aquatic organisms. Some fish stranding and mortality within the cofferdam construction areas is possible, but would be minimal because most fish would likely avoid the affected areas during cofferdam installation because of noise and vibrations associated with in-water construction activities. Additionally, the presence of large substrate (boulder and cobble) near but outside the construction footprints could offer cover and serve as refuges for fish, including darters and minnows, temporarily displaced during the proposed construction.

The applicants did not collect many mussels during the 2013 mussel surveys near the proposed projects. Surveys at the Morgantown, Point Marion, and Maxwell Locks and Dams included transects that were just downstream of the proposed construction area footprint, and no mussels were found at these transects. Similarly, no mussels were found at transects close to the construction footprints at the Opekiska and Charleroi Locks and Dams. Only one mussel was found at the Grays Landing Lock and Dam, but it did occur near the proposed Grays Landing tailrace construction area. This mussel was a common species, pink heelsplitter, which, if affected during construction, would not result in a major adverse impact on any local pink heelsplitter population(s). In general, mussels require habitats that remain suitable under all flow conditions. Under existing conditions, variation in flow and bed scouring from changes in gate operation and high flows would likely preclude most mussels from surviving directly below the dams where most construction activities would occur. The mussel survey results indicate that there is minimal potential for cofferdam placement and excavation to adversely affect mussel populations at the proposed Monongahela River Projects because only one mussel was collected within or near the construction footprints across all proposed projects.

Some macroinvertebrate habitat would be permanently lost within the construction footprint, but, given the small amount of area and the availability of similar substrate outside of the construction footprint, it is unlikely that this small loss of macroinvertebrate habitat would adversely affect the macroinvertebrate community.

Overall, the applicants' proposed construction activities would only affect a few individual fish, mussels, and macroinvertebrates, and would not adversely affect local populations. The applicants would use cofferdams and turbidity curtains to minimize effects of sediment suspension and redistribution during construction. In addition, implementing water quality monitoring plans, as described previously, would further ensure waters remain suitable for aquatic biota during construction. If monitoring identifies potential adverse effects on water quality, construction activities could be stopped or adjusted to ensure the protection of aquatic resources. Therefore, the use of turbidity curtains and monitoring water quality during project construction should provide adequate protection to the local aquatic community.

Flow Distribution during Construction

Installation of cofferdams and restrictions on the use of some Corps' gates would cause some hydraulic changes downstream of the dams, including a change in flow patterns and increases in velocity because of the possible use of fewer gates. Restricting the flow to fewer gates would cause higher flow velocities relative to the same quantity of discharge passed under existing conditions. Additionally, the applicant for the Grays Landing Project proposes to install a 2.5-foot-high adjustable crest gate on the existing Grays Landing Dam, and that installation may require the use of upstream cofferdams. As discussed above, the applicants propose to coordinate the timing of construction to avoid impacts on spawning fish and other aquatic organisms to the extent practical. The applicants also stated, during the scoping meeting on October 10, 2014, that they would defer to the Corps regarding gate schedules during construction. The Corps, in its November 6, 2014, scoping comments, indicates that gate schedules during construction would be site specific and suggests that flows could be directed through the center of the remaining unobstructed gates, to the extent feasible.

Our Analysis

In the hydraulics study report (CDM Smith, 2015), the applicants estimate that, during construction at the Monongahela River Projects, water depths near the construction footprints could fluctuate up to 0.3 foot, and downstream velocities could increase 3 to 4 fps in isolated areas at the Maxwell and Charleroi Projects. Depths and velocities would not change appreciably at the other Monongahela River Projects. Upstream of the dams, velocities would increase slightly relative to existing conditions as described previously in *Construction Effects on Water Quantity*. Potential depth and velocity changes estimated for the projects are based on maximum gate flow during construction (see table 3-16 in *Construction Effects on Water Quantity*) which is a "worst-case" scenario hydraulically. Actual hydraulic changes during construction would likely be less pronounced because a maximum gate flow would be rare, with no more than a 1-percent chance of occurrence during the June through October construction season. Additionally, any temporary changes in flow patterns and velocities immediately upstream and downstream of the dams would not be unusual; current flow patterns at each project dam change depending on the sequence of Corps gate operations and river hydrology. Furthermore, the applicants' hydraulic modeling suggests that any changes in velocities and flow patterns would rapidly attenuate downstream. Project operational modeling found that hydraulic effects would return to pre-project conditions within 6,550 feet downstream of the dams.[60] Construction-related hydraulic effects, however, would likely be less significant than operational effects because all flow releases during construction would remain through the Corps' gates or over the spillway at Grays Landing, similar to existing conditions. Operational flows would normally be concentrated immediately downstream of the proposed powerhouses, except under high-flow conditions when flows would also be discharged through the Corps' gates.

While hydraulic changes during construction could reduce the suitability of habitat for certain life stages of some fish in some locations, most fish would be able to move to more preferred habitat. Fish habitat conditions below the dams are dynamic under current gate operation conditions, so temporary changes in hydraulic conditions should not affect fish populations. If fish spawning habitat occurs downstream of the proposed cofferdams, spawning adults or incubating eggs could be disturbed by a reduction in flow velocity. If the applicants commence construction after the spring spawning and incubation period is complete for most species, this would minimize effects on any spawning habitat that is currently present downstream of the dams.

Mussels would likely not be affected by the small depth changes (no more than 0.3 foot) during construction of the proposed Monongahela River Projects. While velocity increases of 3 to 4 fps would be more of a concern, increases of this magnitude are only predicted to occur in limited areas close to the Maxwell and Charleroi Dams, where mussels were generally absent from collections within 1,500 feet of the locks and dams. Although some changes in velocity could occur within 6,550 feet downstream of the

[60] Project operational modeling found that flow velocities would return to within 0.1 fps of the existing flow velocities at the following distances downstream of each dam: Opekiska—1,620 feet; Morgantown—5,750 feet; Point Marion—6,550 feet; Grays Landing—5,100 feet; Maxwell—5,100 feet; and Charleroi—5,900 feet.

dams during operations, construction-related hydraulic effects would be less. The greatest change in velocity during construction would occur near the dams, and these effects would attenuate within short distances upstream and downstream of the dams. Therefore, few if any mussels at the Maxwell and Charleroi Projects would be adversely affected by changes in flows during construction. Velocity increases during construction of the other proposed Monongahela River Projects would be less than those predicted for the Maxwell and Charleroi Projects, and mussel densities are low. With the exception of a single mussel collected near the construction footprint of the Grays Landing Project, mussels were not collected near the Opekiska, Morgantown, and Point Marion Dams in 2013. Therefore, few mussels in the vicinity of these projects would be affected by changes in flows during construction.

Any mussels present downstream of the proposed cofferdams could be affected by changes in flow. Low velocities in these areas may lead to unsuitable conditions for mussels downstream of cofferdams because sediment may settle out of suspension, smothering any mussels that are present. In addition, success of spawning or release of glochidia could be affected by decreases in velocity and increases in sedimentation. However, these effects would likely be limited to a small area, directly downstream of the cofferdams, and would attenuate downstream as flow patterns normalize. Only a single mussel was collected near the proposed Grays Landing construction footprint, and none were collected near the other project footprints, so few mussels would be affected by sedimentation related to cofferdam hydraulic effects.

Although some macroinvertebrate habitat outside of the construction footprints could be affected by increased velocities during project construction, affected areas would likely be relatively small and similar macroinvertebrate habitat would not be affected in other locations. Therefore, hydraulic changes during project construction are not likely to cause a measurable effect on the overall macroinvertebrate populations.

In summary, expected hydraulic changes because of changes in gate operation during construction and flow obstructions by cofferdams would likely have a minor and temporary effect on individual fish and mussels, but would not likely have a discernable effect on species composition or abundance. Coordinating the timing of construction to minimize impacts on spawning fish and other organisms, as the applicants propose, would likely provide some benefit to aquatic species.

Operational Effects on Aquatic Organisms and Habitat

Modification of river flows by hydropower operations can positively or negatively affect aquatic organisms and their habitats. Diverting water through the project powerhouses, instead of through the Corps' gates or over the Grays Landing Dam crest, would alter existing discharge patterns and hydrodynamics upstream and downstream of each dam. These changes may affect existing aquatic habitat by changing existing hydraulic conditions, associated scour and deposition patterns, and DO concentrations.

Fish Habitat

To minimize impacts on water levels in the pools and maintain existing river flows, the applicants propose run-of-release operation at all projects, and to install a crest gate at the Grays Landing Project. In addition, the applicants propose seasonal bypass flows at all proposed projects to provide aeration and protect water quality and fish habitat downstream of the dams.

The Corps expresses concerns regarding operational impacts on tailwater habitat because these areas provide riverine habitat features that tend to support higher productivity and greater diversity than other habitats in the Monongahela River, and the potential effects of an increase in pool elevation at the Grays Landing Project as a result of proposed crest gate operation. Interior (10(j) recommendation 1) recommends that the projects operate in run-of-river mode and provide minimum bypass flows through dam gates or over dam spillways during all months of the year at all projects to protect and enhance fish and wildlife habitat. Pennsylvania FBC also recommends run-of-river operation to prevent undesirable river fluctuations and protect fish and wildlife habitat. West Virginia DNR recommends year-round minimum bypass flows at the Opekiska and Morgantown Projects to avoid impacts on DO and aquatic life downstream of the dams.

Our Analysis

Under the applicants' proposals to operate in a run-of-release mode, there would be no changes to upstream or downstream water surface elevations at the proposed projects, except in the pool upstream of Grays Landing Dam where there would be an increase of up to about 2.5 feet or a decrease of up to 1.5 feet relative to existing conditions, depending on flow (see figure 2-1). The volume of downstream flow releases would not change because the projects would operate in a run-of-release mode. However, project operations would cause flow patterns to change immediately downstream of the dams because more flow would be discharged through the proposed powerhouses instead of through the Corps' gates, or over the dam crest.

The applicants assessed the effects of operation of the proposed Monongahela River Projects on fish habitat suitability in the upstream and downstream potentially affected areas by modeling and comparing the weighted useable area (WUA)[61] for multiple life stages of target species under existing and proposed conditions during

[61] WUA is an index that describes overall habitat suitability within a study area.

different flow regimes (CDM Smith, 2015). This quantitative modeling was conducted for the Opekiska, Grays Landing, Maxwell, and Charleroi Projects. The applicants used quantitative modeling at these sites and site-specific habitat information to conduct qualitative analyses of operational effects on fish habitat suitability at the Morgantown and Point Marion Projects because of similarities in project designs and environmental conditions.

Each project's potentially affected area was defined through the applicants' hydraulics study,[62] as the area where the change in simulated river velocities resulting from turbine operations would be greater than 0.1 fps. The target species were gizzard shad and white bass (to represent deep-slow habitat), smallmouth bass and walleye (to represent deep-fast habitat), and white sucker and channel catfish (to represent shallow-slow habitat). These species were selected based on their abundance in the project areas, availability of habitat suitability index curves, ecological importance (act as fish hosts for mussels), and recreational importance (game species). The applicants elected not to include a species representative of shallow-fast habitat because such habitat is less common near the proposed projects, and, if present, would only occur in a portion of the dams' tailwaters. These areas are turbulent, and while they may present temporary foraging opportunities and habitat for some species, they are largely unsuitable for the most common fish species occurring in the project vicinities. Changes in velocity, depth, and substrate that would be caused by project operation were considered in the assessment. The three flow regimes used in this assessment included low (10-percentile), moderate (50-percentile), and high (90-percentile) flows as described above in table 3-7.

In general, results from the quantitative habitat suitability analyses using WUA found that relatively small decreases (less than 14 percent) in WUA would occur for most fish species and life stages under all flow conditions. In general, most of the decreases in WUA would occur within and immediately downstream of the tailraces, because these areas would be exposed to higher velocities than under current conditions. However, WUA typically would remain the same outside the tailrace flow trajectory, and increase immediately downstream of the dam under some flow conditions. The WUA analysis indicated that species that prefer lower flow velocities would have increased habitat suitability, compared to existing conditions, in other areas upstream of the dams and near the existing locks.

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[62] The hydraulics study is a component of the *Water Quality, Hydraulics, and Aquatic Habitat Study Report* (CDM Smith, 2015).

Table 3-21 summarizes the modeled changes in WUA for walleye, an important game species in the Upper Ohio River Basin. Effects of project operations on walleye could also affect local recreational opportunities (fishing) at the proposed projects. During all modeled flows at the Opekiska Project, adult walleye WUA showed little change (about 1 percent or less), while WUA for juvenile walleye decreased about 4 percent at all modeled flows, likely because of increased velocities within the proposed intake and tailrace areas. Modeling at the Grays Landing Project showed a decrease in adult walleye WUA ranging from 0.7 to 3.1 percent across all flows modeled and an increase in juvenile walleye WUA ranging from 1.2 to 6 percent. These changes would be concentrated in the mid-channel about 0.5 mile upstream and downstream of the dam. At the Maxwell Project, predicted WUA changes would range from an increase of 0.5 percent to a decrease of 1 percent for adult walleye and a decrease of 0.4 to 2.3 percent for juvenile walleye. These changes would be concentrated within the first 0.25 mile downstream of the dam. At the Charleroi Project, adult walleye WUA would decrease from 0.6 to 2.5 percent over the range of modeled flows, and juvenile walleye WUA would decrease by 0.1 to 3.7 percent, primarily in the first 1,000 feet downstream of the dam. Overall, the WUA modeling indicated that habitat suitability for both adult and juvenile walleye would not change substantially with operation of the four projects modeled.

Although the applicants did not model the proposed operation of the Morgantown and Point Marion Projects, they did provide qualitative information on predicted flow changes in the vicinity of the projects and potential effects on habitat for fish. This information indicates there would be a slight reduction in adult walleye habitat suitability upstream of the dams because of velocity changes near the turbine intake channels. Downstream of these dams, a small decrease in habitat suitability for adult and juvenile walleye would likely occur under low-flow conditions because of lower water velocities in the mid-channel. Similar to the four projects modeled, these changes in habitat suitability would not be substantial.

For the other target species, the analysis similarly shows both increases and decreases in WUA depending on the location and river flow, but overall changes would be minor, indicating that habitat suitability would remain essentially the same as current conditions. The greatest decrease in smallmouth bass WUA is about 14 percent for fry during high-flow periods at the Opekiska Project, but little existing high quality habitat for smallmouth bass fry occurs near the Opekiska Project, so the overall effect on fry habitat would be minor. Decreases in WUA for other life stages of smallmouth bass, and all other species and life stages evaluated are otherwise less than 9 percent at all projects. The greatest increase in WUA is for adult channel catfish (17 percent) at the Grays Landing Project. Other notable WUA increases are 6 percent for spawning gizzard shad at the Maxwell Project, and 3 percent for white bass fry at the Charleroi Project.

Table 3-21. Modeled change in WUA for juvenile and adult walleye at proposed Monongahela River Projects (Source: CDM Smith, 2015).

	Project	Life Stage	Existing WUA	Proposed WUA	Difference in WUA	Percent Change in WUA
High Flow	Opekiska	Juvenile	180,384	172,768	-7,616	-4.2%
		Adult	498,090	501,806	3,716	0.7%
	Grays Landing	Juvenile	1,058,954	1,122,594	63,639	6.0%
		Adult	5,822,408	5,738,808	-83,601	-1.4%
	Maxwell	Juvenile	775,414	772,691	-2,723	-0.4%
		Adult	1,884,657	1,866,638	-18,019	-1.0%
	Charleroi	Juvenile	819,293	788,741	-30,552	-3.7%
		Adult	2,391,764	2,337,925	-53,838	-2.3%
Moderate Flow	Opekiska	Juvenile	269,359	256,651	-12,708	-4.7%
		Adult	643,053	636,167	-6,886	-1.1%
	Grays Landing	Juvenile	1,813,771	1,876,704	62,933	3.5%
		Adult	7,563,900	7,326,085	-237,815	-3.1%
	Maxwell	Juvenile	1,608,250	1,571,534	-36,716	-2.3%
		Adult	3,045,116	3,061,714	16,598	0.5%
	Charleroi	Juvenile	1,878,341	1,844,279	-34,062	-1.8%
		Adult	3,720,756	3,628,990	-91,766	-2.5%
Low Flow	Opekiska	Juvenile	274,820	263,939	-10,881	-4.0%
		Adult	648,431	642,855	-5,576	-0.9%
	Grays Landing	Juvenile	1,993,573	2,017,743	24,171	1.2%
		Adult	7,600,208	7,550,066	-50,141	-0.7%
	Maxwell	Juvenile	1,896,046	1,879,917	-16,130	-0.9%
		Adult	3,373,421	3,338,648	-34,773	-1.0%
	Charleroi	Juvenile	2,263,360	2,261,719	-1,641	-0.1%
		Adult	3,791,861	3,770,208	-21,653	-0.6%

Changes in flow release patterns and velocities could also affect fish habitat through changes in benthic scour and depositional patterns. Based on hydraulic modeling during high-flow conditions (90-percentile flow) conducted by the applicants (CDM Smith, 2015), changes to the locations and total areas of potential streambed scouring would be minor when considering the existing scour and deposition patterns. Most bed scour would occur during high-flow periods, similar to existing conditions.

Some additional scouring could occur at the Charleroi Project under high flows at a small (approximately 1 acre) area about 0.5 mile downstream of the dam along the left descending bank.[63] This small area is predominately sand substrate and could offer localized habitat for some fish species. Additional habitat of similar size and substrate is found along the right descending bank, about the same distance downstream of the dam, and could offer suitable habitat for any displaced individuals, because no change in scour potential in this area is expected. In addition, while some areas at all projects would experience a reduction in scour, other areas, generally downstream of the proposed powerhouses would likely experience initial increases in scour when the projects begin operation. During extremely high flow events, flows that equal or exceed the Corps' spillway capacity, the projects would be shut down, and all flow would be directed through the Corps' gates and over the Grays Landing Dam crest. Under these conditions, where flow patterns are similar to existing conditions, we expect existing scour and deposition patterns to be maintained. Some deposition could occur immediately downstream of the powerhouses, but any sediments deposited there would be transported downstream once project operations resume.

Based on our analysis, some changes to scour, depositional patterns, and benthic fish habitat would occur because of project operations, but these changes would be minor. High flows (90-percentile or greater) would continue to have the largest effect on patterns of bed scour and deposition, which would help to maintain substrate and habitat distribution similar to existing conditions. Although changes in the velocity distribution downstream of the dam would alter the locations that provide optimal water depths and velocities for different species of fish, downstream habitat is variable under existing conditions because of changing river flows and variable Corps' gate operations. Considering that overall changes in fish habitat suitability would be limited, and that substantial additional scour is unlikely, the proposed run-of-release operations would only lead to minor changes in fish habitat downstream of the dams.

Although the overall quantity of water releases would remain the same as current operations, the proposed projects may influence water quality as described above in

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[63] *See* figure 4-46 in CDM Smith (2015).

Operational Effects on Water Quality. In general, reduced DO concentrations could occur downstream of the proposed projects because little or no aeration would occur when water is routed through the powerhouses, which may result in the episodic displacement of species that are sensitive to reduced DO concentrations. The applicants' water quality study (CDM Smith, 2015) indicates that operation of the proposed projects could result in occasional periods when DO concentrations are less than 5.0 mg/L, which is below the optimal growth range for target fish species such as channel catfish, smallmouth bass, and walleye (5 to 7 mg/L). These events would be most likely to occur in the summer months during low-flow periods in dry water years.

Interior's and West Virginia DNR's recommendations for year-round minimum bypass flows at the proposed projects would provide aeration that would help to limit project-related adverse effects on DO concentrations downstream of the dams. However, during the winter and spring months when DO concentrations are already high, bypass flows would likely be of no benefit to water quality. In addition, implementation of measures to protect water quality, including continuous water quality monitoring and reporting, as discussed previously in *Operational Effects on Water Quality*, would inform the need for any project-specific actions to protect fish downstream of the projects from any adverse effects of low DO concentrations. Bypass flows could help maintain habitat diversity because bypass flows would provide some turbulent and fast-moving water downstream of the Corps' gates during low and moderate river flows, similar to current conditions. However, the applicants' habitat modeling suggests that there would be ample habitat diversity, including areas of fast-moving water, under the proposed operating conditions.

At the Grays Landing Project, the applicant proposes to construct 2.5-foot-high crest gates to control the water surface elevation in the upstream pool to ensure sufficient depth for navigation, which would also benefit aquatic habitat by maintaining a more stable pool. At flows less than 9,000 cfs, the upstream pool elevation would be held relatively constant at 780.5 feet (up to 2.5 feet higher than existing conditions),which would stabilize shoreline habitat, increase the overall reproductive success of nest building fishes, and facilitate access to any tributaries.

At flows between 9,000 and 11,000 cfs, the pool elevation would increase to 781.5 feet and remain at this elevation at flows up to 23,700 cfs. These pool elevations would be stable relative to existing conditions and could yield similar benefits as described above. However, pool elevation would be up to 1.5 feet lower than existing conditions at flows from 14,000 to 65,000 cfs. A lower pool elevation at higher flows should not affect access to tributaries as the pool elevation would already be several feet higher compared to low flow conditions. Effects of a lower pool during higher flows on available habitat, fish nests, and cover would likely be inconsequential as the benefits of a stable pool during a majority of flow conditions (see mean monthly flows in table 3-8) would likely improve habitat conditions relative to higher, variable pool elevations.

Although some beneficial changes in upstream fish habitat would occur under the proposed crest gate operation, the Corps would ultimately determine appropriate crest gate operation and pool elevations in its operating plan and MOA with the applicant.

Overall, run-of-release operations as proposed by the applicants may alter fish habitat conditions through changes in velocity and scour patterns downstream of each dam, but only small changes in available habitat would occur for most species and life stages. Affected fish would likely move into remaining areas with suitable depths, velocities, and substrate during project operation. In addition, implementation of a water quality monitoring plan, discussed previously in *Operational Effects on Water Quality*, would inform the need for any project-specific actions to protect water quality and fish downstream of the dams.

Mussels and Macroinvertebrates

Similar to our previous discussion, mussels, macroinvertebrates, and their habitat may be affected by project-related changes in hydraulic conditions, scour and deposition patterns, and DO concentrations.

The Corps expresses concern about the potential effects of an increase in pool elevation on mussels as a result of the proposed crest gate operation at the Grays Landing Project. In its letter filed February 11, 2016, Interior recommends the applicants coordinate with FWS regarding potential impacts on species that are under review for potential listing under the ESA, including longsolid (*Fusconaia subrotunda*), pyramid pigtoe (*Pleurobema rubrum)*, and round hickorynut (*Obovaria subrotunda*). Interior also recommends that additional freshwater mussel surveys be performed in the section of the Monongahela River beginning 762 meters (2,500 feet) downstream of the Opekiska Lock and Dam and ending 1,200 meters (3,937 feet) downstream of the dam. West Virginia DNR expresses concern about the potential impacts of riverbed scour and sedimentation during project operations on mussels downstream of the proposed projects.

Our Analysis

During mussel surveys conducted near the proposed Monongahela River Projects (Ecological Specialists, Inc., 2015), mussels were collected from transects upstream and downstream of the dams. However, no more than four mussel species were collected at each of the six proposed project locations, and the species composition was typically dominated by pink heelsplitter (50 to 100 percent, depending on the project), with the exception of surveys at the Opekiska Lock and Dam where only a single pink papershell mussel was collected across all transects. At the Opekiska and Maxwell Locks and Dams, mussels were rarely collected (one to five mussels) and were mostly found at least 500 feet upstream of the dams along the left descending banks. Surveys at Grays Landing Lock and Dam similarly only collected one mussel, but near the center of the channel, about 300 feet downstream of the dam. Surveys at the Morgantown, Point

Marion, and Charleroi Locks and Dams collected between 27 and 34 mussels, which were found channel-wide, beginning about 1,000 to 1,700 feet downstream of the dams.

To evaluate potential operational effects on mussels, the applicants modeled the change in velocities between existing and proposed operational conditions at 50 percent exceedance (median) flows, and compared the hydraulic modeling results to the mussel distribution results from their surveys at the proposed Monongahela River Projects (CDM Smith, 2015; Ecological Specialists, Inc., 2015). During proposed project operations, velocities would increase within the intake and tailrace channels, and flow distribution patterns would change relative to existing conditions. However, surveys conducted by the applicants found that mussels were generally absent in areas near the dams, where project operations would have the greatest effect on the water velocity distribution.

As mentioned previously, substrate downstream of the dams, near the proposed tailrace locations, is almost entirely bedrock, boulder, and gravel, which is generally unsuitable for mussels. Substrate upstream of the dams along the same bank as the proposed projects is mostly silt, with some clay substrate as well. However, with the exception of two mussels collected upstream of the Maxwell Dam, along the same bank as the proposed powerhouse,[64] no mussels were collected from surveys within 1,500 feet upstream of the dams. Therefore the effects of any initial scouring upstream of the dams on mussels would be minimal.

Where mussels were more common, in downstream surveys at the Morgantown and Point Marion Locks and Dams, the fauna was dominated (70 to 80 percent) by pink heelsplitter, which is a common species in the Upper Ohio River Basin. The existing mussel fauna downstream of the dams is likely adapted to changing flow patterns and velocities under existing conditions, because these patterns and velocities are constantly changing depending on Corps' gate operations and river hydrology. Proposed operations would also not substantially increase stream bed scouring that could affect existing mussel beds.

Flow patterns downstream of all proposed powerhouses would likely be more stable than existing flow patterns, which are affected by variations in river flows and gate operations. Under proposed conditions, all water would be routed through the powerhouses during low and moderate flows, up to the capacity of each powerhouse, which should create areas where velocity is consistent under most flow conditions. Increased stability in velocity patterns downstream of the powerhouses would improve

[64] This powerhouse for the Maxwell Project is proposed to be constructed downstream of the dam, while the two mussels were collected upstream of the dam.

habitat conditions in those areas and benefit mussels that either currently occur in or that could colonize these areas. Downstream of the Corps' gates, or the spillway at Grays Landing, a decrease in velocity would occur under low and moderate flow conditions; however, these areas are currently unsuitable for mussels because of mostly bedrock, boulder, and cobble substrate. Overall, some mussel habitat may be lost while additional habitat is created, because of the change in flow patterns associated with the operation of the proposed projects. The most substantial changes in aquatic habitat would occur downstream of and close to the dams, where mussels were generally absent. Based on the 2013 mussel surveys near the proposed projects, pink heelsplitter typically accounted for 50 to 100 percent of the total abundance and is the most likely species to be affected. This species is common in the Upper Ohio River Basin, and any affected individuals would not likely cause a measurable effect on the local mussel population.

The proposed crest gate at the Grays Landing Project would maintain higher upstream pool elevations at flows less than 14,000 cfs, would ensure that depths are maintained for navigation during project operation, and would provide the Corps better control of upstream water levels. The proposed change in depth could affect suitable mussel habitat for some mussels, but very few mussels likely inhabit the Grays Landing pool. The applicant's survey (Ecological Specialists, Inc., 2015) did not collect any mussels upstream of the dam, and Hart (2012) only collected two mussels during surveys in the Grays Landing pool. Under existing conditions, mussels upstream of the dam can experience depth changes of 10 feet or more as flow conditions change. Under the proposed conditions, pool elevations would be more stabilized. Mussels and mussel habitat near the river margins upstream of the dam would be subjected to fewer reductions in water levels and stranding, because crest gate operation would maintain a higher pool elevation during low and moderate flow conditions. The proposed operation of the crest gate would raise the pool level, relative to existing conditions, when flow is less than 14,000 cfs, but would have little effect on water velocity upstream of the dam because the project would operate in run-of-release mode. Conditions downstream of the dam would be minimally affected by the proposed crest gate because any flows that are passed over the crest gate would be distributed along the downstream face of the dam, similar to existing conditions.

In Interior's letter filed February 11, 2016, FWS notes that dead shells of the longsolid mussel were found in the West Virginia portion of the Monongahela River and suggests that this species and the pyramid pigtoe and round hickorynut mussels may be present at the Opekiska Project. These species are under review for potential listing under the ESA, so FWS suggests the applicant coordinate with the agency because listing may occur in the near future. However, none of these three species of concern was found in the vicinity of the Opekiska or Morgantown Locks and Dams (Ecological Specialists, Inc., 2015). Therefore, it is unlikely that the longsolid, pyramid pigtoe, or round hickorynut are present within the potentially affected areas near the dam; therefore, it is not likely that any of these species would be affected by operation of the proposed project.

Interior expresses concerns about the potential for low DO concentrations at the Opekiska Project to reach a West Virginia DNR mussel stocking area, located about 5,250 feet downstream of Opekiska Dam, and, therefore, recommends additional mussel surveys downstream of the area surveyed by the applicant to an area surveyed by West Virginia DNR, about 3,937 feet downstream of Opekiska Dam. No mussels were found at the site surveyed by West Virginia DNR. We note that the applicant's mussel survey report states that the surveys generally occurred within 2,500 feet downstream of the dams; however, at Opekiska site, the survey was conducted between 975 to 3,450 feet downstream of the dam.[65] Ecological Specialists notes that habitat in this area was generally not suitable for mussels, and no mussels were observed in this survey area. Considering the poor quality of available habitat downstream of Opekiska Dam and survey results of West Virginia DNR and the applicant, it is unlikely there would be a significant population of mussels within the approximately 490-foot unsurveyed section of river between the end of the applicant's survey and West Virginia DNR's survey.

Despite a lack of observed mussels between Opekiska Dam and the West Virginia DNR mussel stocking location, potential project effects on mussels include lower DO concentrations downstream of the dam because of routing water through the powerhouse rather than through the Corps' gates, where some aeration occurs. The DO thresholds for mussels are not well known, but monitoring water quality and maintaining DO concentrations at or above 5.0 mg/L, as discussed previously in *Operational Effects on Water Quality,* would minimize potential effects of the proposed projects on DO concentrations and any associated effects on mussels. Therefore, additional surveys would not be necessary.

As discussed above for fish, seasonal bypass flows at all projects could maintain some of the current aeration and protect mussels from low DO conditions during critical summer periods of low river flows and high temperatures. However, year-round bypass flows, as Interior recommends, would not be needed because DO concentrations are typically high from mid-October through May. Seasonal bypass flows, as the applicants propose, would be more beneficial during the summer months, especially in dry years. Bypass flows would maintain areas of swift moving water immediately downstream of the dams, but this would not likely benefit mussels because they do not typically occur in these areas.

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[65] See figures 3-1 to 3-4 in Ecological Specialists, Inc. (2015) for exact transect locations.

Changes in velocity and scour patterns could also affect other benthic macroinvertebrates, which are important prey items for many fish species. Project operations would likely affect some macroinvertebrate habitat, especially near the proposed tailrace areas. For example, consistent discharge from the proposed powerhouses could increase habitat for certain species of mayflies, caddisflies, and other groups that are adapted to swift-water, while habitat for other species could decrease. Given the availability of habitat elsewhere in the project areas, it is unlikely that any loss of macroinvertebrate habitat would adversely affect the macroinvertebrate community. In addition, macroinvertebrates in the vicinity of the Grays Landing and Maxwell Locks and Dams generally consist of amphipods of the genus *Gammarus*, which are common in the Upper Ohio River Basin.

In summary, run-of-release operation, as the applicants propose may alter mussel and macroinvertebrate habitat conditions through changes in velocity and scour patterns downstream of the dams, but some habitat would be improved by the more stable flow releases from the powerhouses. The proposed crest gate at Grays Landing would maintain higher upstream pool elevations and increase the amount of wetted habitat along the shorelines during low-flow periods. In addition, the implementation of measures to protect water quality, discussed previously in *Operational Effects on Water Quality*, would inform the need for any project-specific actions to protect water quality and mussels downstream of the dams.

Fish Stranding Surveys

Interior recommends the applicants design and implement post-construction fish stranding surveys for the dam tailraces at all projects, extending downstream to the point where turbine discharges enter the river.

Our Analysis

Although project operations would change some flow and velocity patterns downstream of the dams, the projects would not dewater any aquatic habitat. On the Monongahela River, each Corps dam creates a pool that extends to the base of the next upstream dam. As pool levels fluctuate because of changes in flow or Corps' operations, only small strips of habitat along the river banks would be dewatered. The tailraces of the proposed projects would be excavated into the bed of the existing river channel and continuously submerged whether the projects are operating or not. Because fish stranding is unlikely, stranding surveys would not be necessary.

Fish Impingement, Entrainment, and Passage

Operation of the proposed projects has the potential to result in some fish injury and mortality from impingement on the proposed trash racks and entrainment through the proposed turbines. To minimize fish mortality related to project operations, the applicants propose to: (1) design the projects so that the intakes have maximum approach velocities of less than 2 fps; (2) install trash racks with 3-inch clear bar spacing; and (3) use "fish friendly" Kaplan turbines.

Pennsylvania FBC and Interior recommend that the applicants design and implement post-project construction fish impingement and entrainment studies at all projects. Based on the results of these studies, Interior may recommend consultation with the resource agencies to determine appropriate trash rack vertical bar spacing and approach velocities at all projects, and make project modifications where necessary to ensure protection of all fish species and life stages in project areas. In addition, Interior expresses concern about the upstream and downstream fish passage at the Opekiska and Morgantown Projects because of reduced lockages at these dams, and suggests fish passage options be considered. West Virginia DNR recommends the applicants for the Opekiska and Morgantown Projects develop appropriate studies to determine the appropriate level of compensation, pursuant to Title 47 Series 5A 6.2.1, which requires compensation for fish losses caused by impingement or entrainment at FERC-licensed hydro facilities. Pennsylvania FBC also recommends mitigation for fish impingement and entrainment losses.

Our Analysis

At the existing dams, fish can pass downstream through the Corps' gates, over the Grays Landing Dam crest, or through the lock chambers, and fish can pass upstream through the lock chambers only. Some downstream fish passage now occurring over the dam crest and through the Corps' gates would be diverted through the proposed powerhouses, and is the primary concern regarding downstream fish passage and potential entrainment and mortality. Diadromous species (includes both anadromous and catadromous species) typically do not occur in the Upper Ohio River Basin. As mentioned previously, the occurrence of the catadromous American eel is rare, and it has not been reported from the Monongahela River in many decades. Some resident species, such as skipjack herring, walleye, and gizzard shad, may exhibit some migratory characteristics during the spawning (move upstream to spawn) and post-spawning periods, but there is no information to indicate that sufficient spawning areas are not available between the dams.

Entrainment would occur when fish are unable to overcome the approach velocity at the trash racks and pass through the turbines during project operation, or volitionally pass downstream through the trash racks. The proposed 3-inch trash rack clear bar spacing would allow all but the largest fish to pass through the trash racks, which limits the potential for fish to become impinged on the trash racks. Table 3-22 summarizes the site-specific trash rack and turbine features.

Table 3-22. Trash rack and turbine characteristics at proposed hydroelectric projects on the Monongahela River (Source: HDR, 2013a).

	Trash Rack Characteristics		Turbine Characteristics			
Project	**Trash Rack Bar Spacing (inches)**	**Modeled Maximum Approach Velocity (fps)**	**Number of Units**	**Runner Diameter (feet)**	**Rated Speed (revolutions per minute)**	**Rated Head (feet)**
Opekiska	3	1.45	2	11.2	106.0	21.0
Morgantown	3	1.45	2	11.2	106.0	17.1
Point Marion	3	1.45	2	11.2	106.0	20.0
Grays Landing	3	1.50	2	15.8	81.8	18.0
Maxwell	3	1.50	2	15.8	81.8	20.0
Charleroi	3	1.50	2	15.8	81.8	18.0

To evaluate the effects of the proposed projects on downstream fish passage, the applicants conducted a desktop entrainment and turbine survival study (HDR, 2013a) to estimate the number of fish that would be entrained and suffer mortality during project operations. The calculated maximum intake velocity at the projects' trash racks would be about 1.5 fps. Burst swim speed data for seven of the target species and nine surrogate species[66] show that almost all species in their adult life stages and most in their juvenile life stages can swim faster than the maximum intake velocity, and could avoid being swept into the trash racks (table 3-23). Therefore, we expect that impingement of fish on the trash racks would only occur rarely.

[66] Surrogate species are species that are similar in body shape and size (may be of the same genus or family) to target species in the Monongahela River, and that have better data available than for the target species in the Monongahela River. Surrogate species are assumed to have the same swimming ability as the target species.

Table 3-23. Average burst swim speeds and fish sizes for representative species (Source: HDR, 2013a).

Species	Life Stage	Total Length (inches)[a]	Burst Swim Speed (feet per second)
American shad[b]	Juvenile	1.0□3.0	1.75□2.5
Emerald shiner	Adult	2.5	4
	Juvenile	2.01□2.13	1.84
Bluegill	Adult	3.94□5.91	2.44
	Adult	6.02	4.3
Blue sucker[b]	Adult	26.2	19.51
Herring[b]	Fry	0.4□0.8	0.0□1.0
	Juvenile/Adult	6.0□11.0	5.0-7.0
Hybrid catfish[b]	Juvenile	6.30□9.06	7.88
Ghost shiner[b]	Adult	1.39	2.93
Greenside darter[b]	Adult	4.0□6.8	1.02□2.64
	Fry	0.79□0.87	1.56□2.04
Largemouth bass[b]	Juvenile	2.05□5.04	1.84□3.28
	Juvenile	5.91□10.63	3.02□4.34
Longnose sucker[b]	Juvenile/Adult	3.9□16.0	4.0□8.0
Mimic shiner	Adult	1.39	2.86
Paddlefish	Juvenile	3.54	1.87□2.46
	Adult	47.2	32.8
Smallmouth bass	Fry	0.55□0.98	<1.78
	Juvenile	3.58□3.66	2.6□3.6
	Adult	10.3□14.9	3.2□7.8
Striped bass[b]	Fry	0.5□1.0	0.4□1.0
	Juvenile	2.0□5.0	1.0□5.0
Walleye[b]	Juvenile	3.15□6.30 (F)	2.48□6.02
	Adult	13.78□22.44 (F)	5.48□8.57
White crappie	Juvenile	3.03	0.36□1.04

[a] (F) equals fork length; otherwise, length measurements are total length.

[b] Surrogate species used to represent target species in the Monongahela River. Some target species such as walleye and largemouth bass, representative of sauger and spotted bass respectively, were also used as surrogate species.

The applicants estimated entrainment rates based on seasonal entrainment densities measured at 43 hydroelectric projects in the Electric Power Research Institute (EPRI) (1997) database, then adjusted rates for each species by their percent relative composition in the vicinity of the projects based on specific fish survey data from West Virginia DNR, Pennsylvania FBC, and ORSANCO databases. The estimated annual entrainment ranged from 20,000 fish at the Opekiska Project to 600,000 fish at the Grays Landing Project, with gizzard shad accounting for 85 percent of the total annual entrainment across all proposed projects. Emerald shiner, mimic shiner and bluegill account for an additional 12 percent (table 3-24). Seasonally, at the Opekiska and Morgantown Projects, the spring and fall periods were estimated to have the greatest entrainment, while the winter period was estimated to have the lowest entrainment. The summer/fall period was estimated to have the greatest entrainment, with the winter/spring period (December through May) having the lowest entrainment at the Point Marion, Grays Landing, Maxwell, and Charleroi Projects. The majority of entrained fish would be small fish less than 6 inches long, with gizzard shad, emerald shiner, and mimic shiner representing the majority of small fish entrainment at all the projects. Larger game species were a small percentage of the projected entrainment; both smallmouth bass and walleye entrainment was estimated at less than 0.1 percent of total annual entrainment at the Opekiska, Morgantown, Point Marion, Grays Landing, and Maxwell Projects, and less than 2 percent of the total annual entrainment at the Charleroi Project.

The applicants' desktop study (HDR, 2013a) also estimates the number of entrained fish that could be subject to direct mortality during turbine passage using the Franke et al. (1997) blade strike probability equation. Mortality estimates by species reflect the entrainment estimates, with gizzard shad comprising most of the fish killed. Larger fish were estimated to suffer the highest mortality, but few large fish were projected to be entrained. Average turbine passage survival rates estimated for the projects ranged from 93 to 95 percent. These are consistent estimates with the results of turbine passage survival tests conducted at other projects with similar types of turbines, as summarized in EPRI (1997). Slow-speed, large diameter Kaplan turbines, similar to those proposed by the applicants, also typically showed the highest survival rates.

Based on the results of the applicants' calculated intake velocities, trash rack bar spacing, and the desktop entrainment mortality study, potential effects of impingement and entrainment under the projects' proposed configurations would be minor (i.e., there would be no impingement mortality and only about a 5 percent entrainment mortality rate). Also, the relatively high fecundity of most warmwater fish species that would be entrained (e.g., gizzard shad, minnows, and sunfish species) would sufficiently offset the low amount of mortality so that the projects would not likely affect the composition of the existing fish community or the health of fish populations at the projects. Verifying intake velocities at a range of flows, as part of the operation compliance monitoring plans discussed previously in *Operational Effects on Water Quantity*, would ensure that intake velocities meet design objectives and are adequate to protect fish.

Table 3-24. Estimated number of fish that would be entrained annually at the Monongahela River Projects (Source: HDR, 2013a, as modified by staff).

	Project					
Species	Opekiska	Morgantown	Point Marion	Grays Landing	Maxwell	Charleroi
Bluegill	3,871	8,869	3,466	7,659	4,464	7,809
Brook silverside	3	6	5	13	37	52
Channel catfish	185	238	792	2,416	2,208	6,632
Channel darter	0	0	10	29	0	1,413
Emerald shiner	11,608	19,065	11,615	28,016	21,818	2,404
Flathead catfish	142	344	84	155	162	0
Freshwater drum	3	6	44	137	355	129
Ghost shiner	1,601	3,499	562	491	6,286	0
Gizzard shad	2,876	6,883	175,097	548,623	434,590	33,947
Logperch	47	12	8	5	32	0
Mimic shiner	24	0	284	870	1,128	37,062
Mooneye	0	0	16	49	14	0
Paddlefish	0	0	0	0	0	0
Rock bass	92	213	80	169	881	909
Silver chub	0	0	2	6	42	307
Skipjack herring	0	0	46	132	580	0
Smallmouth bass	0	0	6	20	137	1,790
Smallmouth redhorse	0	0	0	0	0	258

	Project					
Species	**Opekiska**	**Morgantown**	**Point Marion**	**Grays Landing**	**Maxwell**	**Charleroi**
Spotted bass	68	19	16	19	160	0
Walleye	7	0	6	15	36	685
White bass	56	126	61	136	606	0
Black crappie	39	10	9	12	9	860
Total	20,621	39,292	192,208	588,971	473,543	94,259

Interior suggests that existing upstream passage options may not be sufficient for fish to move freely between pools at the Opekiska and Morgantown Projects. While the proposed projects may affect downstream fish passage (e.g., entrainment mortality), upstream fish passage conditions would be maintained. Upstream fish passage may occur through the existing boat locks, which have been demonstrated to pass fish on other rivers. Although the number of lockages at Opekiska, Morgantown, and Hildebrand dams has decreased in recent years, this decrease has no relationship to the proposed projects. Construction and operation of the proposed powerhouses would have no effect on existing lock operations, so any existing fish passage through the locks would not be affected.

In conclusion, the applicants' desktop entrainment study (HDR, 2013a) and other published entrainment studies are sufficient to analyze the potential for fish injury and mortality due to entrainment and turbine mortality. Therefore, there is no basis for additional entrainment or turbine mortality studies. Because the applicants' proposed trash rack spacing, intake velocities, and turbine type would adequately protect fish passing downstream through the projects, and entrainment and turbine mortality would have no effect on project-area fish populations, there would be no basis for providing further protection or mitigation.[67]

<u>Special Status Fish and Mussels</u>

Aquatic state-listed and species of concern would be vulnerable to the same potential construction and operation-related effects as non-listed species discussed previously. Potential effects could change the habitat suitability for some state-listed species.

Our Analysis

The applicants' mussel survey did not yield any Pennsylvania-listed endangered or threatened mussel species near the proposed Monongahela River Projects. While mussels were collected at the Opekiska and Morgantown Locks and Dams in West Virginia, where all freshwater mussels are considered protected by West Virginia DNR, none were collected within the potentially affected area at the Opekiska Project, and none within the

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[67] On a related matter, compensatory mitigation for lost fish, as recommended by some of the agencies, would constitute a payment of damages. However, the Commission lacks the authority under the FPA to either adjudicate claims for or require compensation for damages. *See* City of Jackson, Ohio, and Certain Ohio Municipalities, 105 FERC ¶ 61,136, P 11 (2003).

first 1,100 feet downstream of Morgantown Dam. There would be no construction- or operation-related effects on any state-listed mussels at the Opekiska Project, and there would be no construction-related effects on state-listed mussels at the Morgantown Project. Operational effects such as altered flow patterns would be limited because flows would be laterally well mixed by 1,100 feet downstream of the Morgantown dam and powerhouse discharge.

Construction and operation could change the habitat suitability for some state-listed fish species reported from the project areas, which include brown bullhead, ghost shiner, warmouth, and paddlefish.[68] However, there would be limited loss of habitat for state-listed or other special status species near the proposed projects. Ghost shiner are a Pennsylvania state-listed species (58 PA Code § 75) and could be entrained during operation of the proposed projects. However, estimated survival rates for ghost shiner across all proposed projects are 99 to 100 percent. The small size and burst swim speed of the ghost shiner, along with the proposed intake and turbine characteristics, would allow for avoidance of the intake by ghost shiner, and if entrained, high survival rates across all proposed projects. Paddlefish are not a Pennsylvania state-listed species (58 PA Code § 75), but they were considered extirpated from Pennsylvania (Argent et al., (n.d.)). Since 1991, Pennsylvania FBC has stocked paddlefish in the lower 30 miles of the Allegheny River and the upper 40 miles of the Ohio River. In the Monongahela River, paddlefish are rare. Single specimens were collected from the Maxwell lock chamber in 2003 and from below the dam in 2009. Therefore, proposed construction and operation of the Monongahela River Projects would not likely affect paddlefish.

Aquatic Organism Monitoring

The Corps indicates that it would require, as part of its permitting for the projects, a variety of post-construction biotic monitoring at regular intervals to document any project-related changes to aquatic habitat and communities. Specifically, the Corps would require: (1) multi-method fish surveys to document any project-related changes in the fish community; (2) fish impingement, entrainment, and mortality surveys to assess impacts on all species and sizes of fish; (3) macroinvertebrate surveys; (4) mussel surveys; (5) an assessment of biological integrity for macroinvertebrate and fish assemblages, and (6) tracking of mussel bed and tailwater habitat during construction and

[68] Brown bullhead are listed as imperiled in West Virginia; ghost shiner are listed as vulnerable in West Virginia and endangered in Pennsylvania; warmouth are listed as critically imperiled in West Virginia and endangered in Pennsylvania; and paddlefish are listed as critically imperiled in West Virginia and were considered extirpated in Pennsylvania.

operation throughout the term of the license. In addition, the Corps specifically expresses concern regarding potential project effects on darters (small benthic-dwelling fish) and their habitat in the dam tailwaters as these fish can serve important ecological functions, such as serving as a host fish for mussels.

Our Analysis

As described above, construction and operation of the projects would have some effects on aquatic species and their habitats. In general, effects of construction could temporarily displace organisms or decrease habitat suitability near the construction areas. Once operation begins, some habitat would become less suitable for fish and other organisms, while other areas would see an increase in habitat suitability. Overall, a small reduction in suitable habitat for most aquatic species would occur at low and moderate flows while conditions at high flows would remain relatively unchanged. In addition, fish entrained through the project may suffer turbine-induced mortality, but the entrainment mortality rate would be low.

Under existing conditions, changes in gate operations alter flow distribution and habitat suitability downstream of the spillways on a regular basis, and water elevations and depths in the Monongahela River pools varies by approximately 10 feet or more with normal variations in river flow. Therefore, the existing aquatic community is adapted to variation in flows and habitat suitability within and near the dam tailwaters. Some entrainment mortality would occur, but it would not likely have an effect on the existing fish communities. Therefore, additional fish, mussel, and macroinvertebrate surveys, entrainment surveys, and habitat surveys are not needed to document project effects.

As for darters, these species are small benthic-dwelling species with short home ranges that are often found in tailwater habitats. The swift current and cobble substrate found in tailwaters can provide protection for darter species because most predatory fish generally do not tolerate this habitat (Pennsylvania FBC, 2016). During construction, as discussed above, some darters may be displaced from within or near the construction footprint, but would likely seek out adjacent suitable habitat within the tailwaters. Darters would likely avoid construction areas because of noise or vibrations and would not likely be affected by dewatering within the cofferdams. Because they typically use tailwater habitat and do not exhibit migratory behavior, darters would not be at high risk of entrainment. Of those very low numbers that might be entrained, few would be killed, because they are small enough to avoid striking from the turbine runner. Furthermore, as described previously for other species, the availability of suitable habitat for darters is unlikely to change significantly, and darters would seek out suitable habitat in the tailwaters with or without operation of the proposed projects.

3.3.2.3 Cumulative Effects on Water and Aquatic Resources

Water Quality

By the early 1900s, the Upper Ohio River Basin was experiencing widespread habitat devastation and water quality degradation. Up until the 1970s, the convenience of using the Monongahela, Allegheny, and Ohio Rivers as a sink for decades of municipal and industrial wastes trumped requirements for potable water in western Pennsylvania and northern West Virginia. Mining has been identified as having the single greatest impact on surface water quality of any single land use in the Monongahela, Allegheny, and Ohio Rivers (Pennsylvania FBC, 2011; Anderson et al., 2000). Concerted state and federal efforts since the 1970s, including reductions in industrial discharge, improvements in wastewater treatment, improvements in mine drainage treatment and low-flow augmentation, eventually led to tremendous improvement in river water quality (Anderson et al., 2000).

Construction and operation of the proposed projects on the Monongahela, Allegheny, and Upper Ohio Rivers could cumulatively affect water quality throughout the Upper Ohio River Basin,[69] both in the short-term (construction effects) and long-term (operational effects). Construction of the proposed projects on each river may disturb and suspend sediments, potentially resulting in temporarily increased turbidity levels within the affected reaches of each river. However, most disturbed sediment would likely settle out in the downstream pools. Developing and implementing an erosion and sedimentation control plan at each project, along with monitoring water quality during construction would limit the projects' construction contribution to cumulative effects on turbidity levels in the Upper Ohio River Basin. During operation, reduced DO levels downstream from each project could contribute to cumulative effects on DO levels in the Upper Ohio River Basin because the three rivers are already affected by urban and industrial development, navigation, and other uses and have experienced low DO concentrations, particularly during the summer and early fall when flows are generally low.

On the Monongahela River, operation of the proposed projects could reduce DO concentrations downstream of each project, compared to existing conditions. The

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[69] Rye Development's other related projects that could contribute to cumulative effects throughout the Upper Ohio River Basin include, Allegheny Lock and Dam 2 (P-13755) on the Allegheny River; and Emsworth Locks and Dam (P-13757), Emsworth Back Channel (P-13761), and Montgomery Locks and Dam (P-13768) on the Ohio River.

applicants analyzed the cumulative effect of operating multiple sequential hydropower facilities on DO concentrations on the Monongahela River under different flows.

Figures 3-7 and 3-8 show the modeled minimum DO concentrations along the Monongahela River from June 15 to September 30 during average and dry water years during project operations (without bypass flows). During these operations, modeling predicts that DO concentrations would be lower immediately below each dam than above the dam, likely because (1) less water is spilled over the dam as more water is drawn through the turbines, so less aeration occurs at the dam, and (2) the powerhouses withdraw water from the entire upstream water column, including deeper water that may contain lower DO concentrations because of pool stratification in the summer. However, DO concentrations are predicted to recover relatively quickly below each dam and return to higher levels. In addition, DO concentrations in the lower river are predicted to generally increase to levels well above those stipulated by state standards at the confluence with the Youghiogheny River, upstream of the Braddock Locks and Dam, and at the confluence with the Allegheny River. This modeling was conducted at worst-case conditions (without any bypass flows). Other modeling conducted by the applicants showed that implementing bypass flows[70] at the projects could improve DO concentrations below each dam during operation relative to operation without bypass flows. Although modeling predicts some reductions in DO concentrations at worst-case conditions below some of the dams, overall cumulative effects on DO concentrations in the Monongahela River would be minimal if the Corps continued to release flows from its facilities at the dams.

The Braddock Project (FERC Project No. 13739-002) is approximately 30 RMs downstream of the Charleroi Locks and Dam and approximately 11 RMs upstream of the confluence of the Monongahela and Allegheny Rivers in Pittsburgh, Pennsylvania. The recently licensed Braddock Project will operate in a run-of-release mode similar to the currently proposed projects on the Monongahela River (FERC, 2014). DO concentrations entering the Braddock pool during operation of all proposed Monongahela River Projects are predicted to be similar to existing conditions regardless of the water year. Operation of the Braddock Project was predicted to result in only small decreases

[70] Because the projects would only be able to operate with flows made available to them by the Corps (run-of-release), any flows released through dam gates or newly constructed spill gates (bypass flows) would be at the sole discretion of the Corps. The Commission has no authority to require the release of these flows.

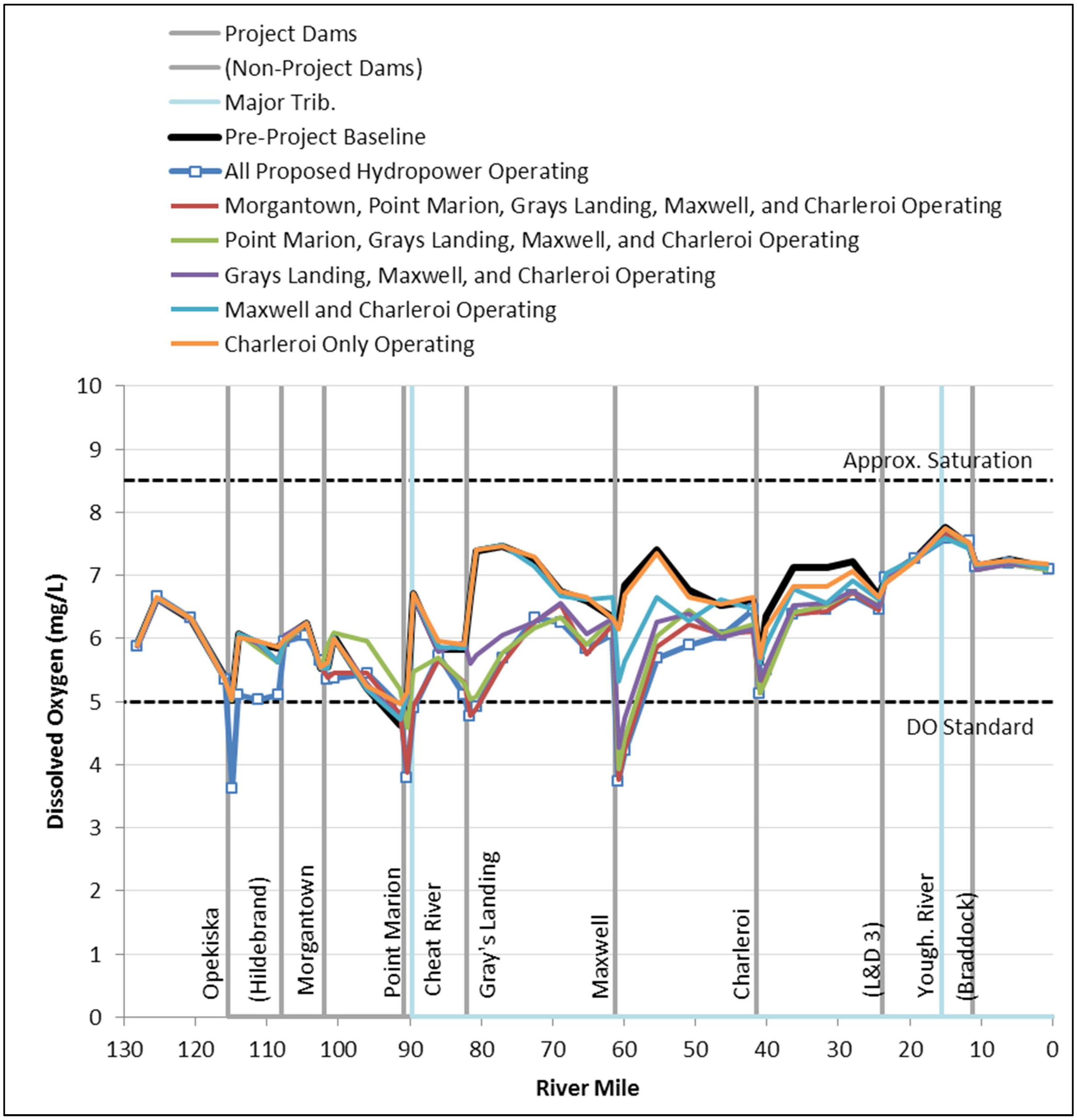

Figure 3-7. Modeled minimum DO concentrations along the Monongahela River between June 15 to September 30, 2009 (average year) (Source: Rye Development, 2014).

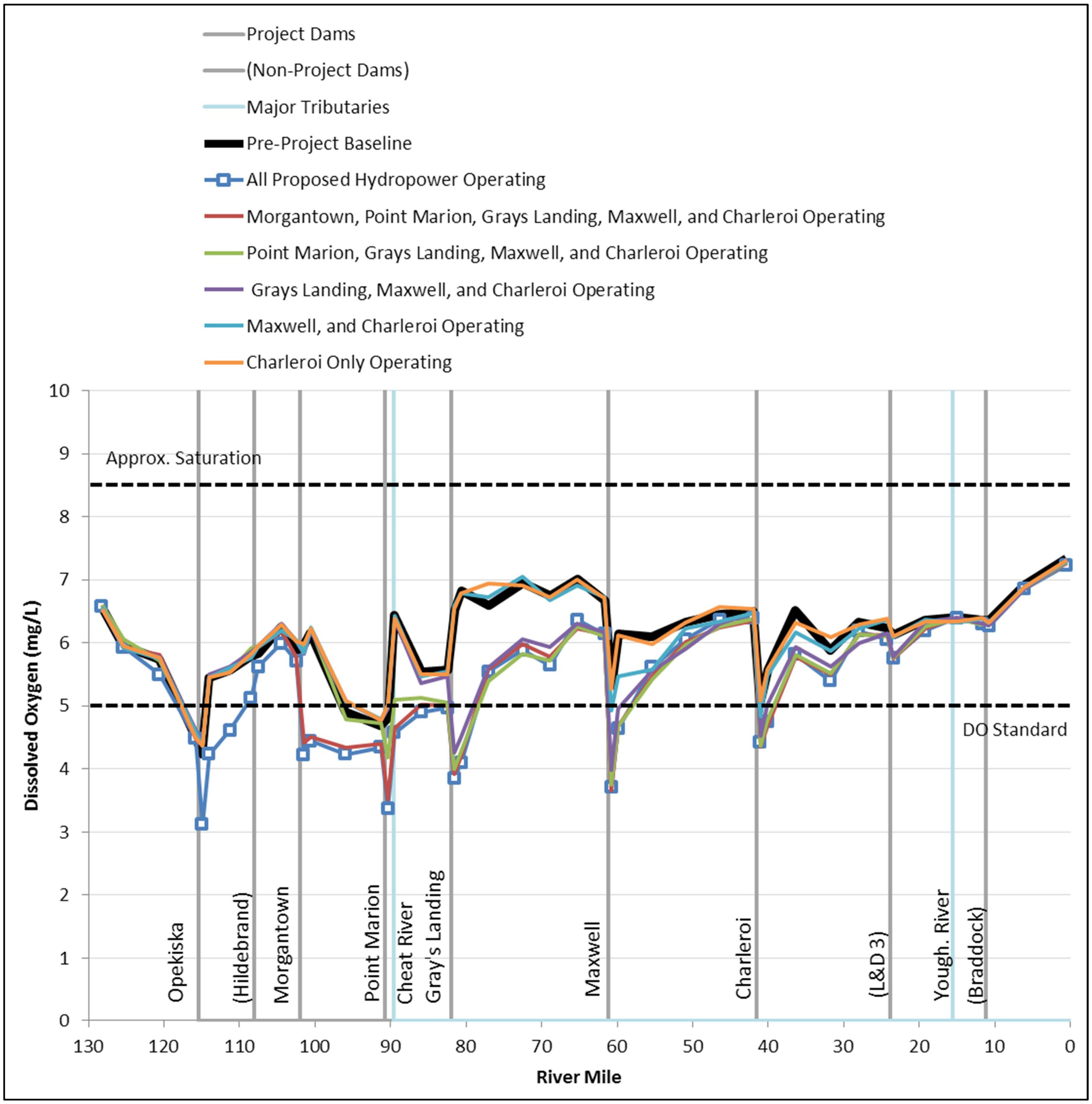

Figure 3-8. Modeled minimum DO concentrations along the Monongahela River between June 15 to September 30, 1999 (dry year) (Source: Rye Development, 2014).

in DO concentrations below the environmental gate[71] (0.07 to 0.32 mg/L) and in the turbine discharge (0.14 to 0.35 mg/L) relative to simulated baseline conditions, based on hydrodynamic and water quality models (FERC, 2014). Therefore, cumulative effects on DO concentrations on the Monongahela River as a result of the proposed projects, in conjunction with the recently licensed Braddock Project, would be minimal.

The Allegheny Project would be the downstream-most hydroelectric facility on the Allegheny River, only 6.7 RM upstream of the river's confluence with the Monongahela River. Therefore, any effects of the proposed project on water quality could affect the downstream facilities on the Ohio River, but would not affect DO concentrations in the Monongahela River. However, the applicant's DO modeling indicated that DO concentrations within 1,600 feet upstream and 4,700 feet downstream of the proposed Allegheny Project are not predicted to decrease below 7.74 mg/L at any time. Thus, DO concentrations should remain sufficiently protective of water quality in the lower Allegheny River to its confluence with the Monongahela River.

The applicants for the three Ohio River Projects (Emsworth Locks and Dam, Emsworth Back Channel Dam, and Montgomery Locks and Dam) modeled the potential cumulative effects of operations of the six proposed projects on the Monongahela River and the Allegheny Project on DO concentrations in the Upper Ohio River and found that those effects would be minimal (CDM Smith, 2014b). Figure 3-9 shows the predicted differences in DO concentrations in the Ohio River upstream of the Ohio River Projects for different water years, with and without the operation of the proposed Monongahela and Allegheny Projects. The maximum decrease in DO concentration with all seven projects operating was predicted to be 0.6 mg/L during a dry year, with most predicted decreases generally between 0.0 and 0.4 mg/L. Modeling results also indicated that operation of the three proposed Ohio River Projects would have only minor effects on DO, causing no more than a 0.92 mg/L decrease in DO concentrations downstream of any of the dams, and DO concentrations would remain at levels well above those established by state standards. Furthermore, figure 3-10 shows the modeled DO concentrations downstream of the Montgomery Project during an average and dry year. In developing the modeled data shown in figure 3-10, the applicants incorporated the impacts of the other upstream projects currently being proposed. Therefore, when all proposed hydropower facilities are operating, simulated DO concentrations did not decrease below 8 mg/L even during a dry (low flow) year. Overall, cumulative effects on DO concentrations in the Upper Ohio River Basin would be minimal.

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[71] The environmental gate (also referred to as Gate No. 1 or the water quality gate in the Braddock Project proceedings) is where the Corps has been directing flows to maximize DO levels in the river, particularly during the warm, low-flow season.

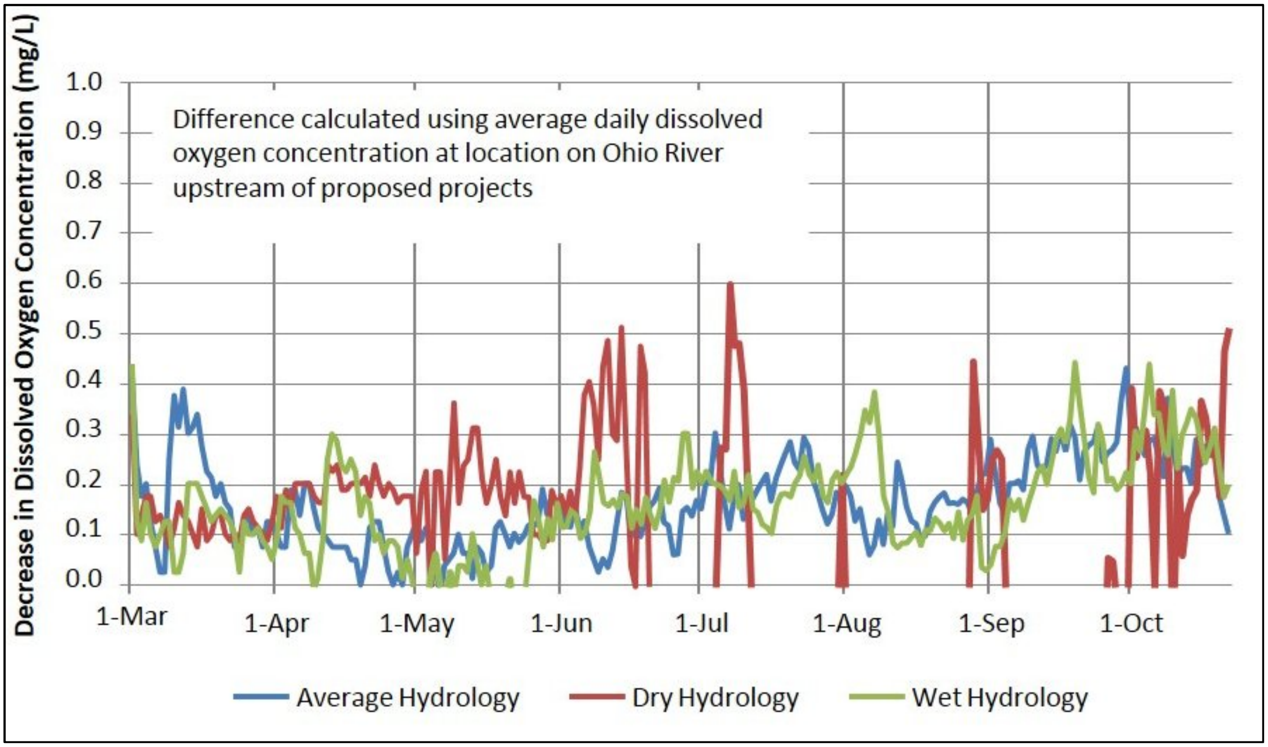

Figure 3-9. Difference in DO concentrations upstream of the Ohio River Projects, with and without the Monongahela and Allegheny River Projects (Source: CDM Smith, 2014b).

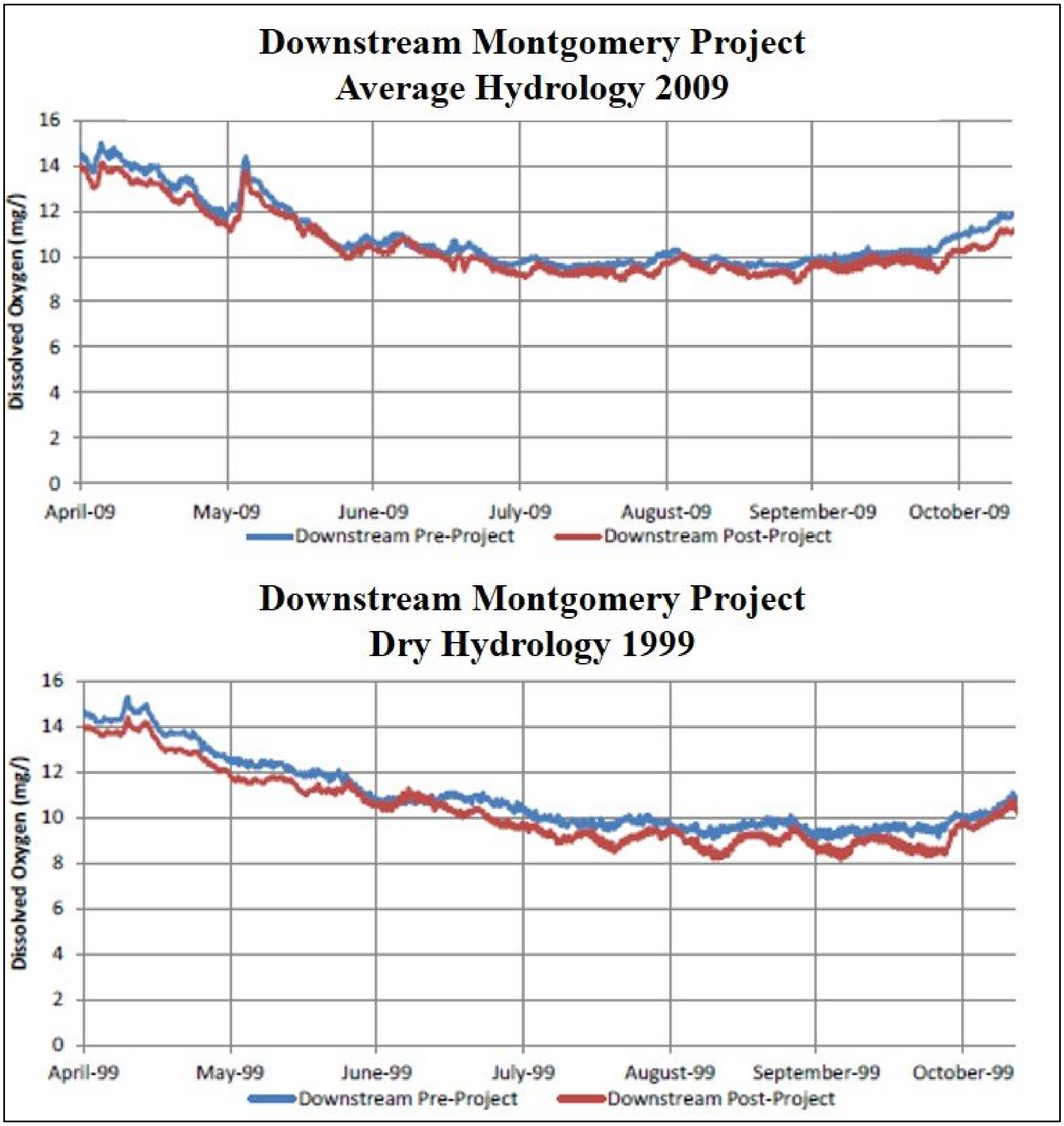

Figure 3-10. Modeled DO concentrations downstream of the Montgomery Project during an average year (2009) and dry year (1999) (Source: CDM Smith, 2014b).

Fisheries

The flow distribution in aquatic habitat downstream of the proposed projects would be altered by project operation, and some decreases in habitat suitability could contribute to cumulative effects on fishery resources. However, under existing conditions the flow pattern downstream of each gated dam can change dramatically when gate openings are adjusted with changes in river flow, or when the Corps uses different gates to pass flows. Therefore, aquatic organisms are likely adapted to changes in hydraulic conditions downstream of the project dams, and other Corps' dams on the Monongahela, Allegheny, and Ohio Rivers, and any effects of project-related modified flow patterns would be limited. Although some fish species may lose some suitable habitat in certain areas of the proposed projects, losses would be relatively small, and the majority of suitable habitat would still be available. Because the proposed projects would have minimal effects on fish passage in the Monongahela River, resident fish populations would maintain their current distribution, with some upstream passage available through the locks, and downstream passage available via spillage over the dams, through the locks, through the Corps' Tainter gates and the applicants proposed spill gates, or through the proposed project turbines. Freshwater mussels would still have fish hosts available to complete their life cycle. Additionally, the projects would have minimal effects on mussel habitat, because mussel distribution is limited in many of the project areas, and any effects of project-related flow pattern changes would also be limited. Any individual mussels that may be affected by habitat modifications would not likely contribute to a cumulative adverse effect on the Monongahela River mussel population.

Turbine-related injuries and mortality associated with operation of the proposed projects could contribute to cumulative effects on fishery resources. While some fish entrainment would occur, most fish entrained would be juvenile or smaller fish of the most common species that occur in the Upper Ohio River Basin. In addition, because of the "fish-friendly" characteristics of the proposed turbines (large, low-speed Kaplan turbines with low head), entrainment-related mortality rates at the projects would be relatively low. The high fecundities of most of the warmwater fish species that would be subject to entrainment would compensate for any mortality, reducing the potential for any population-level effects on resident species. The applicants' proposals to install trash racks with 3-inch clear bar spacing at the Monongahela River Projects and 5-inch clear bar spacing at the Allegheny and Ohio River Projects, with intake approach velocities of less than 2.0 fps, would also limit impingement on project trash racks and entrainment through the trash racks. Most fish would be able to avoid being involuntarily drawn into the trash racks, and those that are drawn in would likely pass through the racks and would have high survival rates through the turbines.

Cumulative effects of impingement and entrainment may be of greatest concern for any migratory species that must pass multiple dams to complete their life history. Although the catadromous American eel has been documented in the Upper Ohio and Allegheny Rivers, those reports are of rare occurrences and typically only individuals. Sustained migrations of American eel to the Gulf of Mexico do not occur in the Upper Ohio River Basin because of the large number of locks and dams on the lower Ohio River and Mississippi River. Skipjack herring, which are resident species, may migrate between pools through the upper basin but do not require such behavior to complete their life cycle. Table 3-24 shows that relatively few skipjack herring would likely be entrained (from 0 to 580 fish) at the Monongahela River Projects. Furthermore, the survival rate of any entrained skipjack herring at each Monongahela River Project would likely exceed the average survival rate of 95 percent estimated by the applicants because of their relatively small size and an associated reduced probability of blade strike. No skipjack herring were estimated to be entrained at the proposed Allegheny Project because few skipjack have been reported in the Allegheny River. Skipjack herring entrainment was estimated to be higher at the proposed Ohio River Projects (from 1,313 to 27,625 fish per project), but survival was also estimated to be high (approximately 99 percent). In addition, there is no information to indicate that skipjack herring in the Monongahela and Ohio Rivers require passage over multiple dams in these rivers to complete their life cycles. Even if multiple dam passage was required, the expected high survival at each dam would ensure that major adverse effects would not occur. Thus, overall effects of any impingement and entrainment of skipjack herring and other resident fishes would not contribute to cumulative adverse effects on the Upper Ohio River Basin fish populations.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Botanical Resources

The Monongahela River Basin supports a mixed mesophytic forest complex with high species diversity and a low occurrence of dominant species. Beech, sweet buckeye, black cherry, tulip tree, oaks, cucumber tree, basswood, hemlock, white ash, sugar maple, birches, red maple, chestnut, sour gum, hickories, and black walnut all occur in such forests. The present forest assemblage represents regrowth subsequent to past land-clearing activities, including agriculture, timber harvesting, and mining. No large tracts of virgin forest are known to exist in the Monongahela River Basin.

<u>Opekiska Project</u>

Much of the proposed Opekiska Project area was previously disturbed during construction of the railroad adjacent to the proposed project. Three primary terrestrial habitats dominate the project area: field, deciduous forest, and wetland. The shoreline at both the upstream and downstream limits of disturbance consists of a grass and shrub field. The terrestrial limit of the field habitat is defined by an active railroad line followed by deciduous forest. Opportunistic upland species, including Japanese knotweed and staghorn sumac, are common and dominate the disturbed areas along the railroad. Dominant trees include oak and maple.

<u>Morgantown Project</u>

Vegetation is dominated by a maintained park, consisting of mowed grass, a paved path, and some trees. An active railroad separates the park from the river. The shoreline of the Morgantown Lock and Dam is about 30 feet wide and is a northwest-facing rocky slope supporting deciduous trees and shrubs.

Point Marion Project

The proposed project is located between deciduous forest land to the east and mixed forest land to the west. The lock (east) side of the river is surrounded by deciduous forest land. The west side of the river is bordered by larger swaths of mixed forest land. The shoreline in the immediate area of the proposed powerhouse is deciduous forest land to either side of the project site. Stands of elm, maple, and oak species dominate the forest structure on the project site.

Grays Landing Project

The area adjacent to the proposed project is heavily disturbed from construction of the dam and consists of imported rock and ballast material used to create the river bank protection. Forest structure on the project site is dominated by stands of elm, maple, and oak species. Opportunistic upland species, including Japanese knotweed and staghorn sumac, dominate open trail spaces. Both of these species are common to road and rail ROWs, and open spaces (i.e., fields, stream/river banks) in the project vicinity.

Maxwell Project

The area adjacent to the proposed project has been heavily disturbed and consists of imported rock and ballast material that were used to create the river bank protection. The upland bank consists of a heavily wooded area on a steep incline. Dominant trees in this area are typical of the surrounding forests and include elm, maple, and oak species. Some small pockets of goldenrod exist on the site.

Charleroi Project

The proposed project area is surrounded by existing development, and industrial land use and vegetation resources are limited. Opportunistic upland species, including Japanese knotweed and staghorn sumac, are dominant species in the proposed project boundary.

Invasive Species

The applicants consulted the U.S. Department of Agriculture plant database map of recorded occurrences of invasive species. Additionally, site visits for biological studies in 2013 noted occurrences of invasive species in the vicinity of the proposed projects to identify species with potential to colonize disturbed areas. Table 3-25 lists the invasive species either encountered during these surveys, or known to occur in the vicinity, and the projects where potential colonization could occur.

Table 3-25. Invasive species occurring in the vicinity of the proposed Monongahela River Projects (Source: Rye Development, 2015b,c).

Project	Invasive Species
Opekiska	Garlic-mustard, Japanese knotweed, kudzu, multiflora rose, purple loosestrife, tree-of-heaven, and yellow iris
Morgantown	Garlic-mustard, Japanese knotweed, kudzu, multiflora rose, purple loosestrife, tree-of-heaven, and yellow iris
Point Marion	Autumn olive, Canada thistle, creeping myrtle, dame's rocket, garlic-mustard, Japanese barberry, Japanese honeysuckle, Japanese knotweed, Japanese stiltgrass, lesser celandine, Morrow's honeysuckle, multiflora rose, Norway maple, Oriental bittersweet, purple loosestrife, star-of-Bethlehem, tree-of-heaven, wild parsnip, and wineberry
Grays Landing	Autumn olive, Canada thistle, common reed, dame's rocket, garlic-mustard, giant hogweed, Japanese barberry, Japanese honeysuckle, lesser celandine, Oriental bittersweet, purple loosestrife, star-of-Bethlehem, tree-of-heaven, wild parsnip, and wineberry
Maxwell	Canada thistle, common buckthorn, dame's rocket, garlic-mustard, glossy buckthorn, Japanese honeysuckle, Japanese knotweed, Norway maple, Oriental bittersweet, purple loosestrife, Russian olive, star-of-Bethlehem, tatarian honeysuckle, tree-of-heaven, wild parsnip, and wineberry
Charleroi	Amur honeysuckle, autumn olive, Canada thistle, cheatgrass, common buckthorn, common privet, common reed, dame's rocket, garlic-mustard, glossy buckthorn, Guelder rose, Japanese barberry, Japanese honeysuckle, Japanese knotweed, Morrow's honeysuckle, multiflora rose, Norway maple, Oriental bittersweet, Russian olive, tatarian honeysuckle, tree-of-heaven, and wineberry

Wetlands

The applicants conducted wetland delineations covering each of the proposed project boundaries in July 2013. Delineation identified one floodplain palustrine emergent wetland (0.05 acre) on the upstream shoreline adjacent to the Opekiska Project. Cattails and rush species dominate this wetland. Wetland delineators confirmed no wetlands at the other projects. Staff also reviewed the National Wetlands Inventory (NWI) data (FWS, 2015) within 1 mile upstream and downstream of the Grays Landing

Project. NWI does not identify any wetlands in this area. The botanical survey report for Grays Landing (S&ME, 2015) identifies several rare plants in a fringe riparian wetland upstream of the dam; however, this is outside the wetland determination study area.

Sensitive Plant Species and Communities

The applicants consulted the PNDI Environmental Review tool and West Virginia DNR to identify sensitive species potentially occurring in the project areas. In Pennsylvania, sensitive species are managed by several agencies. The Pennsylvania Game Commission manages state-listed birds and mammals; Pennsylvania FBC manages state-listed fish and aquatic organisms (discussed in section 3.3.2, *Aquatic Resources*), reptiles, and amphibians; Pennsylvania DCNR manages state-listed plants, natural communities, and terrestrial invertebrates; and FWS manages federally listed species (discussed in section 3.3.4, *Threatened and Endangered Species*).

The PNDI system coordinates the review of these agencies for specific projects and identifies species that could be affected. As part of the review process, each agency determines whether further review or species-specific surveys are warranted. The PNDI results indicated potential for sensitive plant species habitat at Grays Landing and Point Marion and no habitat for sensitive plants at Maxwell or Charleroi. At Grays Landing, Pennsylvania DCNR requested surveys for leaf-cup (*Smallanthus uvedalius*), Nuttall's hedge-nettle (*Stachys cordata*), October ladies'-tresses (*Spiranthes ovalis*), and yellow passion flower (*Passiflora lutea*). At Point Marion, Pennsylvania DCNR requested surveys for wild oats (*Chasmanthium latifolium*). Table 3-26 presents the results of the applicants' surveys. West Virginia DNR did not identify any terrestrial sensitive species that could be affected by the proposed Opekiska or Morgantown Projects.

Table 3-26. Sensitive plant species and communities with potential to occur in the Monongahela River Projects vicinity (Source: Rye Development, 2015b,c).

Common Name	Scientific Name	Status[a]	Habitat	Project Specific Survey Results
Hooded arrowhead[b]	*Sagittaria calycina var. calycina*	PAPE	Prefers mud flats, mucky backwaters or lakes and rivers	The applicant encountered about 24 plants growing within the proposed project boundary while conducting surveys for other species at the Grays Landing Project in September 2015.

Common Name	Scientific Name	Status[a]	Habitat	Project Specific Survey Results
Leaf-cup	*Smallanthus uvedalius*	PAPR	Occurs locally, documented in roadside openings, early successional forest, and a power line ROW; prefers ravines, thickets, and river or stream banks	The applicant surveyed the Grays Landing Project in September 2015 and found suitable habitat but no occurrences.
Nuttall's hedge-nettle	*Stachys cordata*	PAE	Locally documented in moist rich wooded lower slopes and bottomlands; prefers wooded mountain slopes	The applicant surveyed the Grays Landing Project in September 2015 and found suitable habitat but no occurrences.
October ladies'-tresses	*Spiranthes ovalis*	PAE	Occurs locally on a dry rocky limestone wooded slope; prefers damp humus rich forest	The applicant surveyed the Grays Landing Project in September 2015 and found suitable habitat but no occurrences.
Scarlet ammannia[b]	*Ammannia coccinea*	PAR	Prefers shorelines of rivers, streams, and ponds	The applicant encountered about 30 plants growing within the proposed project boundary while conducting surveys for other species at the Grays Landing Project in September 2015.
Toothcup[b]	*Rotala ramosior*	PAR	Prefers exposed shorelines, stream margins, streambed outcrops, other damp, open places	The applicant surveyed the Grays Landing Project in September 2015 and found about 12 plants growing within the proposed project boundary.

Common Name	Scientific Name	Status[a]	Habitat	Project Specific Survey Results
Sourwood[b]	*Oxydendrum arboreum*	PPAR	Occurs in Piedmont region along streams on well-drained lowland areas not subject to ordinary flooding	The applicant encountered a few plants growing within the proposed project boundary while conducting surveys for other species at the Grays Landing Project in September 2015.
Wild oats	*Chasmanthium latifolium*	PASCS	Found on river and stream banks and in moist woodlands	The applicant surveyed the Point Marion Project for this species and found suitable habitat but no occurrences.
Yellow passion flower	*Passiflora lutea*	PAE	Locally documented on a wooded bluff; prefers moist stream bank thickets, roadsides, and wooded slopes	The applicant surveyed the Grays Landing Project in September 2015 and found suitable habitat but no occurrences.

[a] Species Status:

PAE—Pennsylvania state-endangered; PAT—Pennsylvania state-threatened; PAR—Pennsylvania Rare; PPAR—Proposed Pennsylvania Rare; PASCS—Pennsylvania special concern species; PASCR—Pennsylvania special concern resource; PAPE—Pennsylvania Proposed Endangered; PAPR—Pennsylvania proposed rare.

[b] Species observed within proposed project boundaries.

Wildlife and Species of Special Concern

Birds within the project areas are characteristic of deciduous forests of the south central and eastern region of the United States. The proposed project sites provide nesting and feeding habitat for avian species including the American robin, mourning dove, northern mockingbird, red-winged blackbird, northern cardinal, tufted titmouse, warblers, eastern towhee, sparrows, Carolina and black-capped chickadee, vireo, flycatchers, and swallows. Waterfowl and shorebirds common to the project areas include American black duck, mallard duck, green-winged teal, merganser, grebe, heron, gulls, and pipers. Birds of prey such as owls, turkey vultures, kestrel, hawks (e.g., buteos, accipiters, and harriers), and bald eagle may also be present.

Other wildlife species expected to use the edge habitat available within the immediate project areas would be those tolerant of human development and activity (e.g., common raccoon, Virginia opossum, eastern gray squirrel, eastern chipmunk, and small rodents) and those that would use aquatic habitat within the rivers (e.g., muskrat, beaver, reptiles, and amphibians). Larger mammals such as red fox, coyote, striped skunk, and white-tailed deer may also occur in the project areas.

Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) were removed from the federal list of threatened and endangered species in 2007. This species, however, is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which prohibit the "take" of bald eagle eggs, nests, and offspring, except as permitted by regulation. Bald eagles migrate throughout North America and nest near large open bodies of water where tall trees and cliffs are available. The diet of bald eagles consists of dying or dead fish, birds, and mammal carcasses, including large herbivores such as livestock and deer. Bald eagles will also scavenge food from other fish-eating birds such as osprey, mergansers, herons, or other eagles.

In Pennsylvania, the bald eagle is generally a year-round resident, although immature birds may migrate in the spring and fall. Typically, these eagles stop over and forage along reservoirs and rivers, especially where shallow water is present. The status of Pennsylvania bald eagles is unknown because the population is not marked by leg bands or other markings. It is assumed that most pairs remain close to their nesting territories throughout the year. In Pennsylvania, nesting and fledging activities occur from December through August (FWS, 2007). Some immature bald eagles can be nomadic for several years while others demonstrate natal fidelity in their second year (Buehler, 2000).

Bald eagles are rare in West Virginia in all seasons. Occasional summer residents are sighted, usually in the vicinity of the Potomac River. During fall migration, bald eagles may be seen all across the state, but most observations come from the mountains where birds follow the ridges southward. The first recorded West Virginia bald eagle nest was discovered in 1981 along the south branch of the Potomac River. Since then, it is estimated that the state my hold as many as 100 to 200 nesting pairs (McCoy, 2015). In West Virginia, nesting and fledging activities occur from December through August (FWS, 2007).

Bald eagles have been observed around the project areas in both Pennsylvania and West Virginia (eBird, 2015). While no bald eagle nests have been observed at the projects, potential nesting habitat is likely available in trees located near open water in the project vicinities.

Osprey

The osprey (*Pandion haliaetus*), is federally protected under the Migratory Bird Treaty Act of 1918. The osprey tolerates a wide variety of habitats, nesting in any location near a body of water, coastal or inland, that provides an adequate food supply. Fish are the primary prey for osprey, although they also feed on small waterfowl, mammals, and carrion. Ospreys typically inhabit salt marshes, large inland rivers, lakes, ponds, and wetlands bordered by mature trees. Nests are usually built near water in large, often dead, trees but nests have also been found on channel markers, telephone and transmission line poles, chimneys, and artificial platforms built specifically for birds' use. Preferred foraging habitat of local osprey populations was reported to be shallow water with low turbidity. Osprey pairs typically return in late March to early April to nest and depart by the end of September.

Osprey is listed as a threatened species in Pennsylvania. The population of nesting osprey within the state has seen a population rise over recent years, attributed to successful reintroduction programs across the state. Additionally, the success of growing populations in the Delaware and Chesapeake Bays has contributed to the increase of osprey populations within the state (Gross, 2014).

Osprey is listed as a rare species in West Virginia. Populations in the state were historically low given the lack of habitat; however, with the increase of artificial lakes, there has been an increase in nests documented throughout the state including nests in Berkeley, Jefferson, Lewis, Mason, Tyler, and Wood counties. A translocation project during the 1980s and 1990s also increased the number of nesting pairs (West Virginia DNR, 2005).

3.3.3.2 Environmental Effects

Effects of Project Construction and Operation on Wetlands

As discussed in section 3.3.1, *Geology and Soil Resources*, construction of the projects could cause erosion, sedimentation, and streambed material transport. Construction of project facilities, including access roads and transmission lines, may disturb vegetation and expose surface soils to erosive elements. Soil eroded from construction sites and disturbance of the riverbed could have negative impacts on water quality and wetland habitats.

At the Grays Landing Project, the applicant would install an adjustable crest gate to control the upper pool elevation, as described in section 2.2.5, *Proposed Project*

Operation. The Corps comments that changes in upper pool levels and flow velocities could affect wetlands upstream and downstream of the project.

Our Analysis

As described previously, applicants would operate the projects in run-of-release mode, which would not affect downstream water elevations. Therefore, any wetland or riparian habitat downstream of the dams would not be affected by the projects. With the exception of the Grays Landing Project, proposed project operations would maintain the existing water surface elevations of each pool upstream of the dams in accordance with the Corps' management practices. At Grays Landing, the upstream pool elevation would increase, inundating a 0.09-acre fringe wetland about 550 feet upstream from the dam. This wetland provides habitat for several state-sensitive plants, discussed below in *Effects of Project Construction, Operation, and Maintenance on Sensitive Plant Species.*

Effects of Project Construction, Operation, and Maintenance on Terrestrial Vegetation

The areas surrounding the proposed powerhouses, substations, and transmission lines would be temporarily disturbed by staging materials and equipment, as well as from construction activities such as excavation and road construction. Construction activities would involve removal of existing vegetation, which could allow invasive plant species to spread or become introduced in disturbed areas. Project operation and maintenance would include mowing and trimming of tree branches to keep vegetation clear from the transmission lines.

To mitigate effects on existing plant communities, the applicants propose to develop transmission line corridor management plans that would: (1) include a protocol for trimming and removing vegetation in accordance with timing restrictions to protect sensitive wildlife species; (2) establish practices to prevent the establishment and spread of noxious or invasive weeds; (3) establish guidelines for revegetation activities in temporarily disturbed areas using native seeds; and (4) develop a protocol to train utility personnel about potential avian, terrestrial, and sensitive wildlife issues. The applicants propose to develop these plans after construction of the transmission lines are complete.

Our Analysis

<u>Opekiska</u>

Construction of generation facilities (access road, parking area, riprap, substation, and powerhouse) at the Opekiska Project would disturb 0.37 acre of land composed largely of maintained grass or previously disturbed land. Construction of the transmission line would occur adjacent to an existing electric line and require clearing of 2.53 acres of deciduous riparian forest for the new ROW. Construction of proposed recreation facilities would disturb 0.1 acre of land composed largely of maintained grass or previously disturbed land. Table 3-27 summarizes the dimensions of proposed facilities and the area of expected vegetation disturbance.

Table 3-27. Areas of vegetation disturbance in acres at Opekiska Lock and Dam (Source: Rye Development, 2015d, staff).

		Acres of Disturbance by Vegetation Type			
Facility	**Total Acres of Disturbance (length x width)**	**Riparian Forest**	**Grass**	**Disturbed**	**Water**
Transmission line	2.55 acres (3,111 feet x 35 feet overhead line, plus 175 feet x 15 feet for buried cable)	2.53	0.02	0.01	0.00
Access road	0.06 acre (110 feet x 24 feet)	0.00	0.03	0.03	0.00
Parking area	0.07	0.00	0.06	0.01	0.00
Riprap	0.02	0.00	0.00	0.02	0.00
Substation	0.02	0.02	0.00	0.00	0.00
Powerhouse	0.20	0.00	0.06	0.14	0.00
Recreation facilities	0.10	0.01	0.05	0.04	0.00
Total	3.33	2.56	0.22	0.25	0.00

Morgantown

Construction of generation facilities at the Morgantown Project would disturb 0.44 acre of land composed largely of disturbed areas or mowed grass. Construction of the transmission line would parallel an existing road through developed areas and maintained grass. Construction of proposed recreation facilities would disturb 0.01 acre of deciduous riparian forest. Table 3-28 summarizes the dimensions of proposed facilities and the area of expected vegetation disturbance.

Table 3-28. Areas of vegetation disturbance at Morgantown Lock and Dam (Source: Rye Development, 2015d, staff).

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type			
		Riparian Forest	Grass	Disturbed	Water
Transmission line	1.90 acres (2,162 feet x 35 feet for overhead line, plus 476 feet x 15 feet for buried cable)	0.00	0.00	1.90	0.00
Access road	0.15 acre (425 feet x 15 feet)	0.00	0.15	0.00	0.00
Parking area	0.03	0.03	0.00	0.00	0.00
Riprap	0.01	0.01	0.00	0.00	0.00
Substation	0.02	0.02	0.00	0.00	0.00
Powerhouse	0.23	0.03	0.00	0.06	0.14
Recreation facilities	0.01	0.01	0.00	0.00	0.00
Total	2.35	0.10	0.15	1.96	0.14

Point Marion

Construction of generation facilities at the Point Marion Project would disturb 0.55 acre of deciduous riparian forest. Construction of the transmission line would require 1.30 acres of new ROW in deciduous forest and 1.95 acres of ROW in disturbed lands adjacent to an existing road. Construction of proposed recreation facilities would disturb 0.03 acre of deciduous riparian forest. Table 3-29 summarizes the dimensions of proposed facilities and area of expected vegetation disturbance.

Table 3-29. Areas of vegetation disturbance at Point Marion Lock and Dam (Source: Rye Development, 2015d, staff).

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type: Riparian Forest	Grass	Disturbed	Water
Transmission[72] line	3.25 acres (4,051 feet x 35 feet)	1.30	0.00	1.95	0.00
Access road	0.50 acre (1,210 feet x 18 feet)	0.50	0.00	0.00	0.00
Parking area	0.07	0.03	0.00	0.00	0.04
Riprap	0.01	0.00	0.00	0.00	0.01
Substation	0.02	0.02	0.00	0.00	0.00
Powerhouse	0.18	0.00	0.00	0.00	0.18
Recreation facilities	0.03	0.03	0.00	0.00	0.00
Total	4.06	1.88	0.00	1.95	0.23

Grays Landing

Construction of generation facilities at the Grays Landing Project would disturb 1.01 acres of land composed largely of deciduous riparian forest, maintained grass, and previously disturbed land. The transmission line would require 0.45 acre of new ROW through deciduous forest, but would then follow an existing road with a maintained grass shoulder. In total, the project would disturb 9.07 acres of land, most of which is grass, or previously disturbed land. Table 3-30 summarizes the dimensions of proposed facilities and the area of expected vegetation disturbance.

[72] The project also includes a buried transmission line from the powerhouse to the substation, but the effects of this section of line are included in the effects of the parking area.

Table 3-30. Areas of vegetation disturbance at Grays Landing Lock and Dam (Source: Rye Development, 2015d, staff).

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type			
		Riparian Forest	Grass	Disturbed	Water
Transmission line	8.06 acres (9,965 feet x 35 feet for overhead line, plus 155 feet x 15 feet for buried cable)	0.45	3.78	3.83	0.00
Access road	0.32 acre (585 feet x 24 feet)	0.21	0.11	0.00	0.00
Parking area	0.26	0.26	0.00	0.00	0.00
Riprap	0.01	0.00	0.00	0.01	0.00
Substation	0.04	0.04	0.00	0.00	0.00
Powerhouse	0.38	0.00	0.18	0.20	0.00
Total	9.07	0.96	4.07	4.04	0.00

Maxwell

Construction of generation facilities at the Grays Landing Project would disturb 2.88 acres of land composed largely of deciduous riparian forest and maintained grass. Construction of the transmission line would disturb about 1.23 acres of land, composed of deciduous riparian forest and maintained grass. Table 3-31 summarizes the dimensions of proposed facilities and the area of expected vegetation disturbance.

Table 3-31. Areas of vegetation disturbance at Maxwell Locks and Dam (Source: Rye Development, 2015d, staff).

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type			
		Riparian Forest	Grass	Disturbed	Water
Transmission line	1.23 acres (350 feet x 35 feet for overhead line, plus 2,748 feet x 15 feet for buried cable)	0.76	0.47	0.00	0.00

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type			
		Riparian Forest	Grass	Disturbed	Water
Access road	2.79 acre (5,060 feet x 24 feet)	2.79	0.00	0.00	0.00
Parking area	0.06	0.03	0.00	0.00	0.03
Riprap	0.01	0.00	0.00	0.01	0.00
Substation	0.05	0.00	0.05	0.00	0.00
Powerhouse	0.40	0.00	0.00	0.00	0.40
Total	4.54	3.58	0.52	0.01	0.43

Charleroi

Construction of generation facilities at the Charleroi Project would disturb 0.21 acre of land composed largely of deciduous riparian forest and previously disturbed land. The proposed 45-foot-long transmission line and associated 35-foot-wide ROW would be sited in a developed industrial area with minimal vegetation and disturb 0.08 acre of previously disturbed land. Table 3-32 summarizes the dimensions of proposed facilities and the area of expected vegetation disturbance.

Table 3-32. Areas of vegetation disturbance at Charleroi Locks and Dam (Source: Rye Development, 2015d, staff).

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type			
		Riparian Forest	Grass	Disturbed	Water
Transmission line	0.08 acre (45 feet x 35 feet for overhead line, plus 130 feet x 15 feet for buried cable)	0.00	0.00	0.08	0.00
Access road	0.01 acre (30 feet x 15 feet)	0.00	0.00	0.01	0.00
Parking area	0.06	0.00	0.00	0.06	0.00
Riprap	0.09	0.07	0.00	0.00	0.02
Substation	0.07	0.00	0.03	0.04	0.00

Facility	Total Acres of Disturbance (length x width)	Acres of Disturbance by Vegetation Type			
		Riparian Forest	Grass	Disturbed	Water
Powerhouse	0.40	0.00	0.00	0.00	0.40
Total	0.71	0.07	0.03	0.19	0.42

The establishment of early successional native vegetation, as part of the applicants' proposed transmission line corridor management plans, would aid in the reintroduction of native herbaceous forage and cover. Additionally, the applicants' proposal to incorporate BMPs to prevent the spread of invasive species into the transmission line corridor management plans would reduce effects of invasive plants in the corridors.

However, the areas surrounding the proposed powerhouses, substations, and access roads would also be temporarily disturbed by the staging of materials and equipment, as well as from construction activities such as excavation and road construction. Vegetation removal could allow invasive or noxious plant species to become established in all areas where construction activities occur. The applicants' plans would be more effective at minimizing impacts on botanical resources if they were expanded to include the entire project areas rather than just the transmission line corridors. Additionally, development of the plans prior to construction of the projects would allow implementation of preventive measures to reduce impacts on botanical resources.

The applicants' proposals do not include a mechanism to monitor the effectiveness of the plans, or what actions to take if the plans are not successful. Further, the applicants' proposals do not include a schedule for reporting monitoring results to West Virginia DNR, Pennsylvania DCNR, Pennsylvania Game Commission, FWS, the Corps, and the Commission, or a schedule for implementing the plans. To further reduce potential effects on botanical resources, effective plans should include a monitoring program to evaluate the success of revegetation and invasive plant control efforts, including criteria that define when the measures are successful; a reporting schedule for filing monitoring results and progress reports with West Virginia DNR, Pennsylvania DCNR, Pennsylvania Game Commission, FWS, the Corps, and the Commission; and an implementation schedule.

The applicants' proposed measures to revegetate the transmission line corridors and control invasive plants, expanded into project-wide vegetation management plans, developed prior to construction of the projects, with the inclusion of a monitoring program to evaluate the success of revegetation and invasive plant control efforts, including criteria that define when the measures are successful and a reporting and implementation schedule, would reduce impacts on botanical resources, including the spread or introduction of invasive plants.

Effects of Project Construction, Operation, and Maintenance on Sensitive Plant Species

Agency consultation and surveys indicate there are no sensitive plants at Opekiska, Morgantown, Point Marion, Maxwell, or Charleroi, so these projects would not affect sensitive plants. At the proposed Grays Landing Project, the applicant's surveys identified four sensitive plant species (toothcup, scarlet ammannia, hooded arrowhead, and sourwood) growing within the proposed project boundary. Construction and maintenance activities that include soil disruption or material storage could affect these species if suitable protection measures are not implemented.

On October 14, 2015, the applicant filed its *Botanical Survey Report for Grays Landing* (S&ME, 2015). The report included mapped locations of toothcup, scarlet ammannia, hooded arrowhead, and sourwood and proposed measures for avoiding construction-related impacts on these locations. These measures included providing 50-foot protection buffers around mapped populations and avoiding construction activities in these areas. If avoidance is not possible, the report recommended salvaging topsoil to restore the seedbank following construction. The report also noted that because the species are annuals, relocation of individuals to a similar undisturbed habitat would not be a viable option. On December 7, 2015, the applicant filed correspondence with Pennsylvania DCNR (Rye Development, 2015e) responding to agency questions and describing proposed protection measures to minimize potential disturbance to these species. In response to the Pennsylvania DCNR's question about effects of pool elevations on sensitive plants, the applicant stated that although the project includes a proposed adjustable crest gate, the project would operate in run-of-release mode and the upper pool would not be fluctuated for reasons other than natural runoff causes.

Pennsylvania DCNR recommends specific measures, consistent with the applicant's proposed measures, to protect sensitive plants at Grays Landing during construction. These measures include: (1) providing a 50-foot protective buffer around mapped locations of toothcup, scarlet ammannia, and hooded arrowhead and restrict the use of herbicides and construction activities in these areas; (2) mapping locations of sourwood and avoiding direct disturbance to sourwood populations; (3) installing temporary protective fencing around all buffered habitat; (4) ensuring all personnel are aware of the locations of sensitive plant populations in the project boundary; (5) consulting with Pennsylvania DCNR to develop additional mitigation measures such as topsoil segregation to preserve potential seed bank, in the event that a setback of less than 50 feet is required; and (6) once project plans are finalized, filing a map depicting the species locations and buffer distances in relation to the project limit-of-disturbance.

Pennsylvania DCNR notes that, with implementation of these measures, no impacts are anticipated.

Our Analysis

Construction activities could affect sensitive species if soil disturbance occurs close to established plants or construction vehicles, stored materials, or personnel crush, trample, break, or otherwise cause direct harm. Implementing the applicant's proposed measures, which are consistent with Pennsylvania DCNR's recommendations, would ensure existing populations and associated protection buffers are clearly identified to personnel at the project. These measures would minimize potential for deliberate or accidental damage to existing populations and minimize potential for effects. Further, project maintenance activities, including maintenance of the transmission line, could require future activities in locations where these sensitive species are located. Extending implementation of the proposed measures throughout the term of any license issued for the Grays Landing Project would further protect these species by ensuring protection buffers are restored and maintenance activities including herbicide application or transmission line conductor maintenance do not disturb sensitive plants.

Regarding effects of crest gate operation on sensitive plant species occurring in the fringe wetland, it is not clear whether the proposed addition of an adjustable crest gate was incorporated into the applicant's effects analysis or discussed during consultation with Pennsylvania DCNR. The applicant's filing (FFP Missouri 13, 2014) indicates that the addition of the crest gate would increase the upper pool elevation by 2.5 feet under low-flow conditions (figure 2-1). Field data sheets from the botanical survey show fringe wetland containing toothcup, scarlet ammannia, and hooded arrowhead at elevation 778 feet. The proposed crest gate would increase the upper pool to 780.5 feet, submerging this wetland and likely eliminating these populations. Potential mitigation could include transporting topsoil from the affected area to similar habitat in an attempt to introduce seed bank for these annual species to a new site. However, the extent to which similar habitat may occur in the project vicinity is unknown, and such efforts may not result in generation of new populations. Further consultation with Pennsylvania DCNR could identify mitigation measures that would reduce operation effects on these species.

Effects of Project Construction, Operation, and Maintenance on Wildlife and Species of Special Concern

Construction of the proposed project facilities would primarily occur in previously disturbed areas, thereby limiting construction-related effects on terrestrial habitat. Land uses close to the proposed projects, including the transmission lines, are medium-density urban residential and industrial, and the proposed powerhouses would be established on lands managed and maintained by the Corps, as discussed in section 3.3.5, *Recreation and Land Use Resources*.

Our Analysis

The applicants would use heavy machinery to clear existing vegetation in preparation for construction of the powerhouses and other project-related facilities. Construction would also result in increased human presence within the projects' boundaries, as well as increased levels of noise and artificial lighting. The increase of activity in each project area could disturb local wildlife, resulting in an increased risk of nest and den abandonment for birds and small mammals, depending on the season, and interference with foraging. However, most of the habitat in the project areas has previously been disturbed or is currently developed, and much of the existing wildlife is tolerant of disturbance. Further, disturbance to most terrestrial habitats during operation of the proposed projects would likely be minimal.

Avian Protection Plan

There are currently no known bald eagle nests in the proposed construction areas; however, there are suitable trees for bald eagles or osprey to use while foraging or roosting at all six Monongahela River Projects. The proposed projects would require some clearing of riparian trees along the Monongahela River, which could impact bald eagle habitat. Additionally, bald eagle and other raptors can come into contact with transmission lines and associated electrical structures during flight, foraging, roosting, and nesting. Mortality because of interaction with transmission lines and electrical structures has been noted since the 1900s. Raptors and other large-bodied birds may be at higher risk for collision or electrocution because of their large size, hunting strategies, and nesting preferences (APLIC, 2006).

To protect raptors from electrocution and collision with project power lines, the applicants propose to develop avian protection plans in consultation with the Pennsylvania Game Commission, West Virginia DNR, and FWS. Specifically, the applicants' proposed plans would be developed in accordance with APLIC and FWS guidelines.[73] Measures to address future transmission facility maintenance activities would also be addressed in the plan. The avian protection plans would include the following provisions: (1) if a bald eagle or other target species is discovered within the project boundary, the applicants would notify the Pennsylvania Game Commission, West Virginia DNR, and FWS within 30 days of discovery; and (2) prior to any tree clearing within the project boundary or areas immediately adjacent to the project boundary, the area to be cleared would be surveyed for target species nests by project staff. If any such

[73] Staff assumes that the applicants are referring to the FWS' *National Bald Eagle Management Guidelines* (FWS, 2007).

nests are discovered, the Pennsylvania Game Commission, West Virginia DNR, and FWS would be consulted prior to tree-clearing activities.

Our Analysis

The applicants' proposals to develop avian protection plans following APLIC and FWS' National Bald Eagle Management guidelines would reduce potential effects on species of special concern such as bald eagles and other raptors during construction and operation of the proposed projects.

Preparing the plans in accordance with the guidelines would also help to protect raptors from switchyard equipment interactions by providing for adequate separation of energized conductors, ground wires, and other metal hardware and adequate insulation. In accordance with the guidelines, the plans would include a mechanism to monitor the effectiveness of the plans, or what actions to take if the plans are not successful; a schedule for reporting monitoring results to the Pennsylvania Game Commission, West Virginia DNR, FWS, the Corps, and the Commission; and a schedule for implementing the plans.

Implementation of the proposed avian protection plans would ensure that adverse effects on bald eagles and other raptors would be avoided or minimized during construction, operation, and maintenance of the projects.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Aquatic Resources

Mussel surveys in the vicinity of each of the six proposed projects did not document any threatened or endangered species (Ecological Specialists, Inc., 2015). In addition, no federally listed mussel species were collected during Hart's (2012) surveys on the Monongahela River. Furthermore, consultations with Pennsylvania FBC and FWS indicate that, given the nature of the existing habitat, no federally listed species occur in the vicinity of the proposed projects. However, two endangered species, clubshell (*Pleurobema clava*) and snuffbox (*Epioblasma triquetra*) have historically occurred or may occur in the Monongahela River and its tributaries (FWS, 2016a). In Interior's letter filed on February 11, 2016, FWS reports that weathered dead shells from clubshell mussels were observed by West Virginia DNR, but there is no information to suggest any federally listed mussels currently inhabit the Monongahela River. Although no listed species likely occur in the vicinity of the projects, we provide information on listed species (including their habitat and occurrence) that have been reported from elsewhere in the Monongahela River Basin.

Clubshell

Clubshell was federally listed as endangered on January 22, 1993, and FWS finalized a recovery plan on September 21, 1994 (Watters, 1994). No critical habitat has been designated for this species. Habitat requirements include clean, coarse sand and gravel in runs, often just downstream of riffles. The species does not tolerate mud or slackwater and is very susceptible to siltation. Clubshell was historically common throughout the Ohio and Maumee River valleys, but now is reduced to 21 streams and 8 reproducing populations (FWS, 2008). Some clubshell mussels may still exist in Hackers Creek, a tributary to the West Fork River located about 70 miles upstream of Opekiska Lock and Dam; however, as of 2008 this population was confined to a 100-yard section of Hackers Creek, non-reproducing, and declining (FWS, 2008). Weathered dead shells of clubshell have been reported from the West Virginia portion of the Monongahela River (Clayton, 2012, as cited by Ecological Specialists, Inc., 2015, and noted by FWS). Host fish species include the central stoneroller, striped shiner, blackside darter, and logperch.

Snuffbox

Snuffbox was federally listed as endangered wherever found on March 15, 2012. No recovery plan has been finalized or critical habitat designated for this species. Snuffbox was historically distributed across 210 streams and lakes in 18 states and Ontario, Canada. Current distribution is reduced to 79 streams in 14 states and Ontario, Canada. The species occurs in swift currents of riffles and shoals and wave-washed shores of lakes over gravel and sand with occasional cobble and boulders (FWS, 2012). Snuffbox is thought to have occurred in Dunkard Creek, a tributary of the Monongahela River, prior to a large chemical spill in 2009 that killed an estimated 25,000 mussels (Clayton and Everhart, 2015). Mussel restoration efforts have occurred in Dunkard Creek since 2012, but have not included stocking of snuffbox. Juvenile snuffbox have successfully transformed on logperch, blackside darter, rainbow darter, Iowa darter, blackspotted topminnow, mottled sculpin, banded sculpin, Ozark sculpin, largemouth bass, and brook stickleback in laboratory tests (FWS, 2012).

Terrestrial Species

FWS' Species Search website indicates that Indiana bats (*Myotis sodalis*) and northern long-eared bats (*Myotis septentrionalis*) are known to occur in the counties where the projects would be located. Neither bat species was observed during general habitat surveys at the project locations.

Indiana Bat

The Indiana bat is a migratory species found throughout much of the Midwestern United States, hibernating colonially in caves, mines, and other underground areas (hibernacula) through the winter. The non-hibernation season (April 1 through November 15) includes spring emergence and migration, summer reproduction in maternity roosts, and fall migration, swarming, and mating. Summer foraging habitats are generally defined as riparian, bottomland or upland forest, old fields or pastures with scattered trees, and small ponds or streams. Roosting/maternity habitat consists primarily of live or dead hardwood tree species which have exfoliating bark that provides space for bats to roost between the bark and the bole of the tree. Tree cavities, crevices, splits, or hollow portions of tree boles and limbs also provide roost sites for this species. In West Virginia, FWS considers all forested habitat containing trees greater than or equal to 5 inches in diameter at breast height to be potentially suitable as summer roosting and foraging habitat for the Indiana bat.

The Indiana bat was listed as federally endangered in 1967. Threats to Indiana bats include human disturbance of hibernacula, gates, or other structures that impede entry of bats to caves and mines and summer habitat loss and degradation (FWS, 2013). FWS designated critical habitat for the Indiana bat on September 24, 1976, consisting of 11 caves and 2 mines in 6 states: Illinois, Indiana, Kentucky, Missouri, Tennessee, and West Virginia. There is no designated critical habitat for the Indiana bat in Pennsylvania.

Northern Long-eared Bat

The northern long-eared bat was listed as federally threatened on April 2, 2015. It is distinguished by its long ears, is a medium-sized nocturnal bat ranging from 3 to 3.7 inches in length, and possesses shades of brown fur. Traditional ranges include most of the central and eastern United States, as well as the southern and central provinces of Canada, coinciding with the greatest abundance of forested areas. Similar to the Indiana bat, northern long-eared bat foraging habitat includes forested hillsides and ridges and small ponds or streams, and it typically feeds on moths, flies, and other insects. Northern long-eared bats are typically associated with large tracts of mature, upland forests with more canopy cover than is preferred by Indiana bats. Northern long-eared bat seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices, and this species is known to use a wider variety of roost types than the Indiana bat. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat has also occasionally been found roosting in structures like barns and sheds.

As with Indiana bats, northern long-eared bats use caves or mine portals for winter hibernation between November 15 and March 31. These species also use the hibernacula and the areas around them for fall-swarming and spring-staging (August 15 to November 14 and April 1 to May 14, respectively). Some males have been known to stay close to the hibernacula during the summer and may use the hibernacula as summer roosts. There may be other landscape features bats use during the winter that have yet to be documented. No critical habitat has been designated for the northern long-eared bat.

The northern long-eared bat incurs a process of delayed fertilization. Reproduction is limited to one pup a year in late-spring, so bat populations can be slow to rebound from anthropogenic and naturally occurring mortality events. Historically, some bat populations have been negatively affected by degradation or loss of habitat, and exclusion from caves and related human disturbance affecting hibernacula. More recently, white-nose syndrome has caused the dramatic decline of the northern long-eared bat population with death rates for infected bats reaching 90 to 100 percent (FWS, 2016b, 2014).[74]

White-nose syndrome was first observed in New York in 2006 and has since spread throughout the Northeast to the Midwest. Within the past several years, federal and state wildlife agencies have taken measures to protect hibernacula through signage and other means. FWS most recently finalized 4(d) rules for this species in January 2016, focusing on preventing effects on bats in hibernacula associated with the spread of white-nose syndrome and effects of tree removal on roosting bats or maternity colonies (FWS, 2016b). In the recent rule, FWS concludes that take incidental to certain activities conducted in accordance with the following habitat conservation measures, as applicable, would not be prohibited (i.e., excepted from the take prohibitions): (1) occurs more than 0.25 mile (0.4 kilometer) from a known, occupied hibernacula; (2) avoids cutting or destroying known, occupied maternity roost trees during the pup season (June 1–July 31); and (3) avoids clearcuts within 0.25 mile (0.4 kilometer) of known, occupied maternity roost trees during the pup season (June 1–July 31).

3.3.4.2 Environmental Effects

Freshwater Mussels

Currently, no populations of listed mussel species are known to occur in any of the project areas. As with the non-listed mussels, potential construction-related effects include direct mortality during cofferdam placement and excavation, elevated turbidity from erosion and sedimentation, and disturbances to substrate from the construction of new discharge points for project tailraces. Potential operational effects include changes to the cross-sectional flow patterns, which could redistribute substrate and decrease habitat suitability. Also, diverting flow that now passes through the Corps' gates and over the Grays Landing Dam crest to the turbines could reduce DO concentrations immediately downstream of each project during operations.

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[74] White-nose syndrome is a fungal infection that agitates hibernating bats, causing them to rouse prematurely and burn fat supplies. Mortality results from starvation or, in some cases, exposure.

The applicants do not propose any specific measure to mitigate potential effects on federally listed mussel species.

The Corps states that, prior to any construction or drawdown activities, the footprint of the powerhouses and any dewatered areas in the cofferdam footprints should be surveyed to determine the presence/absence of federally listed species. The Corps also states contingency plans to either relocate or avoid federally listed mussel species would be necessary to avoid impacts if any are identified. Interior recommends consultation regarding potential impacts on federally listed threatened and/or endangered freshwater mussel species at any of the proposed projects where such species are documented as occurring within the project's potentially affected area.

Our Analysis

No federally listed mussel species were encountered at the proposed projects during the applicants' 2013 mussel surveys (Ecological Specialists, Inc., 2015) conducted in the immediate vicinity of the proposed construction footprints, or during Hart's (2012) comprehensive 2012 survey, which extended over the entire length of the Pennsylvania section of the river. Hart's survey used scuba techniques to survey an average of 418 square meters at each of 31 locations. In addition, the applicants' 2013 surveys of the project areas indicate that unsuitable substrate dominates the riverbed in the vicinity of most of the proposed projects.

The applicants' PNDI reports and agency consultation records (dated August 23 and 28, 2013, March 4 and 5, 2015, and July 1, 2016, and filed by the applicants on February 27, 2014 [Opekiska and Morgantown Projects], July 8, 2015 [Point Marion Project), September 24, 2015 [Grays Landing and Maxwell Projects], and July 11, 2016 [Charleroi Project]), show that no impacts from the proposed projects are expected for threatened or endangered species, and no further coordination with the agencies would be required. However, as described previously, weathered dead shells of clubshell were recently found in the West Virginia portion of the Monongahela River, although the exact location, quantity or age of the shells is unknown. Typically, a weathered dead shell indicates that the animal was dead for more than one year. The snuffbox mussel may have occurred in Dunkard Creek, which empties into the Monongahela River upstream of Grays Landing Lock and Dam, but there are no recent records of this species from the Monongahela River.

Given that no listed species of mussels were identified in the vicinity of the proposed projects during the applicants' surveys, or in Hart's 2012 surveys, it is unlikely that any listed mussel species occur within the construction footprints or adjacent potentially affected areas. In addition, habitat within the construction footprints is often scoured during high flows and provides poor, if any, habitat for listed and other mussel species. Accordingly, conducting additional mussel surveys or preparing contingency plans to relocate mussels, as recommended by the Corps, would not likely result in a benefit for mussels because no mussels likely occur in these areas. Based on the above, we conclude that construction and operation of the projects would have no effect on the clubshell or snuffbox mussels.

Indiana Bat and Northern Long-Eared Bat

Project construction and operation could affect the Indiana and northern long-eared bats if the authorized actions resulted in the removal of suitable roosting and foraging habitat or the disturbance of bat hibernacula.

At the Charleroi Project, FWS recommends the applicant follow avoidance measures that include conducting tree cutting, tree inundation, and prescribed burning between November 15 and March 31 to avoid injuring or killing endangered bats. In its July 11, 2016, filing, the applicants agreed to implement the above avoidance measures at Charleroi, Maxwell, Grays Landing, and Point Marion Projects to ensure adequate protection of bats in the region. No measures were recommended for the Opekiska and Morgantown Projects.

Our Analysis

FWS' Species Search website indicates that Indiana bats and northern long-eared bats are known to occur in the counties where the projects are located, but neither bat species was observed during general habitat surveys at the projects.

While the proposed Charleroi Project would only disturb 0.07 acre of limited quality riparian forest, of which all disturbance would be associated with shoreline stabilization measures in a previously disturbed and inundated area, correspondence from FWS indicates that the proposed Charleroi Project is located within 10 miles of a known hibernaculum and therefore falls within a protection buffer zone for the Indiana bat.[75] Given the location of the Charleroi Project to known hibernaculum and within the buffer zone for the Indiana bat, the proposed project may affect bats should they expand their range to the project area in the future. However, because of the small project footprint, minimal availability of suitable habitat, and the applicant's adherence to FWS avoidance measures, construction and operation of the proposed Charleroi Project would not likely adversely affect bats or their habitat.

For the Maxwell, Grays Landing, and Point Marion Projects, the PNDI report correspondence from FWS indicates that no federally listed bats are known to occur within the project vicinities and that construction and operation of the projects would

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[75] *See* memo filed August 19, 2016, FERC accession no. 20160819-4027.

have no effect on bats or their habitat. The proposed Maxwell Project would disturb 3.58 acres of limited quality riparian forest. Of those acres, 3.55 acres of the disturbance would be associated primarily with construction of the transmission line and access road. The proposed Grays Landing Project would disturb 0.95 acre of limited quality riparian forest. Of that acreage, 0.91 acre of the disturbance would be associated primarily with construction of the transmission line, access road, and parking area. The proposed Point Marion Project would disturb 1.88 acres of limited quality riparian forest. Of those acres, 1.8 acres of the disturbance would be associated primarily with construction of the transmission line and access road. Overall, each project would disturb less than 4 acres of limited quality riparian forest.

Based on the applicants' description of existing habitats and a review of aerial photos of the project areas, only the transmission corridors would potentially contain any wooded habitats that could support bats. Considering the developed and previously disturbed condition of the project areas, these sites are not likely to support either bat species. The projects are also more than 10 miles from known hibernaculum and not near any known maternity roosts or summer detection sites. Given the nature of the existing habitat (both small project size and minimal suitable habitat), construction and operation of the Maxwell, Grays Landing, and Point Marion Projects would have no effect on bats or their habitat. Further, adhering to FWS avoidance measures, as proposed by the applicants, would ensure additional protection for bats in these project areas.

The proposed Opekiska Project would disturb 2.85 acres of limited quality riparian forest. Of those, 2.82 acres would be associated primarily with construction of the transmission line. The proposed Morgantown Project would disturb 0.1 acre of limited quality riparian forest, of which all would be associated with construction of the parking area, riprap, substation, powerhouse, and recreation facilities. As FWS indicates,[76] Indiana and northern long-eared bats may use the proposed project areas for roosting and foraging; however, FWS states that construction and operation of the projects would not likely adversely affect the Indiana bat or northern long-eared bat because the proposed footprint of the project area, including the powerhouse, parking lot, substation, transmission line corridor, and access road, would: (1) affect less than 17 acres of potential bat foraging or roosting habitat; (2) not be within any of the bat hibernacula or summer use buffers; and (3) not affect any potential caves or mines that could be used as hibernacula. Therefore, given the small project footprints and minimal availability of suitable habitat, the proposed Opekiska and Morgantown Projects may affect, but would not likely adversely affect, bats or their habitat.

[76] *See* letter from FWS filed on February 11, 2016, and memo filed on August 19, 2016, FERC accession no. 20160819-4027.

3.3.5 Recreation and Land Use Resources

3.3.5.1 Affected Environment

Regional Recreation

Recreational opportunities in the region include powered and non-powered boating, fishing, swimming, camping, hiking, biking, hunting, and wildlife watching. Tributaries and nearby lakes provide water-based opportunities similar to those available on the Monongahela River. Land-based opportunities exist at 15 state parks, 4 state forests, 5 State Game Lands, and 7 wildlife areas in the southwestern Pennsylvania/northern West Virginia region (Google Earth, 2015). The West Virginia Botanic Garden and Core Arboretum are also near the projects, located about 5 miles east and 2 miles northwest of the Morgantown Project, respectively.

Three water trails and six walking and biking trails surround the Monongahela River Basin (Pennsylvania FBC, 2011). Water trails include: Three Rivers Water Trail from Freeport, Pennsylvania, to Elizabeth, Pennsylvania; Youghiogheny River Water Trail from McKeesport, Pennsylvania, to Connellsville, Pennsylvania; and Upper Monongahela Water Trail from the Maxwell Locks and Dam to Fairmont, West Virginia. Multi-use trails include: Three Rivers Heritage Trail; Great Allegheny Passage Trail; Mon River Trail system, which includes the Sheepskin and Caperton Trails; Woodland Trail; and Green River Trail. Federal lands in the southwestern Pennsylvania/northern West Virginia region include Friendship Hill National Historic Site, just 3.5 miles north of the Point Marion Project; Canaan Valley National Wildlife Refuge, about 46 miles southeast of the Opekiska Project in West Virginia; Ohio River Islands National Wildlife Refuge, about 47 miles directly west of the Opekiska Project in West Virginia; and Wayne National Forest, about 73 miles southwest of the West Virginia projects.

The numerous locks and dams of the Monongahela River ensure navigability from Fairmont, West Virginia, to its confluence with the Ohio and Allegheny Rivers in Pittsburgh, Pennsylvania. Locks along the Monongahela River are designed and operated for year-round commercial navigation; recreational boaters also have access to many of its locks, although with some restrictions.

The Monongahela River provides opportunities for recreational boating without the horsepower restrictions that occur on sections of its tributaries (e.g., speed limits that limit opportunities such as water skiing). It is also recognized for its recreational fishing opportunities. West Virginia DNR lists the Monongahela among its "Favorite Fishing Waters" for musky, walleye, and white bass; it is also known for its saugeye and channel catfish fishery (Pennsylvania FBC, 2011). Fishing is most popular in the spring and summer when catfish, carp, and walleye are prevalent. The spillways downstream of the dams are typically the best locations to catch these fish.

Recreation at the Projects

Each of the six project sites feature one or more of the following recreational resources, either formally or informally, within the project vicinity: parking, hiking/walking trails, boat ramps and docks, fishing access points, camping, picnicking, and open space. Recreationists use these resources for their intended purpose and in support of boating and fishing activities. Peak use of these resources occurs from March through September. Although bank fishing is not permitted at any of the project sites, the applicants state that there are people who fish illegally from the lock structures.

The recreational resources available at each lock and dam site are described in detail below.

Opekiska Lock and Dam

The Opekiska Lock and Dam is located at RM 115.4 on the Monongahela River near Fairmont, West Virginia (see figure 1-2). The Corps operates the Opekiska lock on the east river bank. Currently, the Opekiska lock is available for commercial appointment lockage only.[77] There were about 136 total lockages in 2015.[78] Recreational use consists primarily of fishing activities. Formal fishing access on the lock side (east shore) of the river near the dam is restricted for security purposes, however, informal shoreline fishing has been observed on the east shore, near the Monongahela River Trail South, and on the west shore of the lock and dam, downstream of the project area. Boat fishing is also common, although the closest ramp is located almost 3 miles downstream at the Six & Plum Marina and Campground. Multiple hand-launch opportunities for watercraft, such as kayaks and canoes, exist in the project vicinity. Informal parking is available both on the western shore, off of River Road, and on the eastern shore, off of the Monongahela River Trail South. There are no picnicking facilities at this site.

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[77] The Corps' Monongahela River lock schedule is posted online at http://www.lrp.usace.army.mil/Missions/Navigation/Navigation-Notices/.

[78] *See* memo filed August 3, 2016, detailing email correspondence between Commission staff and Corps staff regarding lockage use numbers for the Opekiska, Morgantown, Grays Landing, Maxwell, Charleroi, and Point Marion Projects on the Monongahela River.

Morgantown Lock and Dam

The Morgantown Lock and Dam is located at RM 102.0 on the Monongahela River in Morgantown, West Virginia (see figure 1-3). The Corps operates the Morgantown lock on the west river bank. The lock operates daily, 7:00 A.M. to 3:00 P.M. There were about 381 total lockages in 2015. Recreation around the lock and dam consists primarily of non-fishing activities, including running/walking, canoeing/kayaking, and hiking/sight-seeing. Recreational use is highest in summer. Although fishing from the lock is not permitted, boat fishing occurs as well as informal shoreline fishing on the west bank just below the lock facilities and on the east bank about 2,100 feet below the dam. Fishing also occurs upstream and downstream of the dam at Mountaineer Heritage Park and around the Caperton Trail, located adjacent to the dam on the east shore. Here, a 95-foot-long concrete platform is located about 70 feet downstream from the base of the dam and provides shoreline fishing access to the tailwater (Google Earth, 2015). The platform could accommodate about 10 anglers simultaneously. Additional informal fishing areas exist farther downstream approximately 0.25 mile and 0.43 mile downstream of the dam near the Waterfront Hotel. The Caperton Trail is a National Recreation Trail located adjacent to the Morgantown Lock and Dam that provides multi-use recreational opportunities. The trail is managed by the Mon River Trails Conservancy. Informal parking is available on the west side of the Monongahela River at the entrance to the dam, and formal parking areas are located on the east side of the Monongahela River at Mountaineer Heritage Park. Neither campground nor picnicking facilities are near the project.

Point Marion Lock and Dam

The Point Marion Lock and Dam is located at RM 90.8 on the Monongahela River in Point Marion, Pennsylvania (see figure 1-4). The Corps operates the Point Marion lock on the west river bank. The lock operates 7 days a week, 24 hours a day. There were about 1,414 total lockages in 2015. Recreation around the lock and dam consists primarily of shoreline/dock fishing. Nearby recreational facilities include a public boat ramp and shoreline fishing 0.5 mile downstream at the Pennsylvania FBC boat ramp, and a private marina with boat ramp, dock, restaurant, and campground at Two Rivers Marina, located about 2 miles from the project. There are also two informal fishing sites accessible on the lock side of the project and across the river from the Pennsylvania FBC boat ramp and pier. The Sheepskin Trail, located adjacent to the project, serves as a hiking/walking trail and is popular with local residents. The trail is owned by Fayette County and is co-managed with the National Road Heritage Corridor. Parking facilities can be accessed informally off of Power Plant Road, or formally at either the Pennsylvania FBC Point Marion Access or the Point Marion Ballfield and Community Park, which includes accessible parking spaces. There are no picnicking facilities at this site.

Grays Landing Lock and Dam

The Grays Landing Lock and Dam is located at RM 82.0 on the Monongahela River in Masontown, Pennsylvania (see figure 1-5). The Corps operates the Grays Landing lock on the east river bank. Currently, the Corps maintains recreational boat travel 24 hours a day, 7 days a week. There were about 1,551 total lockages in 2015. Recreational use consists primarily of non-fishing activities such as jet skiing and riding ATVs. However, the Pennsylvania FBC Glassworks Boat Launch does provide formal fishing access about 1.75 miles upstream of the dam, and informal fishing occurs at both Coal Tipple Access and at the Lock and Dam Viewing Area. The New Geneva Boat Ramp, 1.7 miles upstream of the dam, also provides shoreline fishing access and a public boat ramp. There are no parking, picnicking, or camping facilities at this site.

Maxwell Locks and Dam

The Maxwell Locks and Dam is located at RM 61.2 on the Monongahela River near Brownsville, Pennsylvania (see figure 1-6). The Corps operates the two Maxwell locks on the west river bank. Recreational boaters may lock through year round, 24 hours a day, 7 days a week. There were about 3,690 total lockages in 2015. Recreational use consists primarily of fishing, with peak usage occurring in the summer months. Private recreational facilities are located both upstream and downstream of the site. Packrall's Bay Restaurant provides a restaurant with a private boat ramp, fishing pier, and dock about 3 miles upstream, and Dammieco Marina offers a private marina with launch ramp, dock, and shoreline fishing about 2.5 miles downstream. Informal fishing occurs at the following access points: Luzerne Township Fire Company Park/Maxwell Ballpark (upstream of the dam), Driftwood Road (opposite the lock), and at a private campsite (downstream of the dam). Informal parking exists off of 4th Street, along Narrow Road, and along Driftwood Road below the dam on the east side of the river. Public campground facilities and picnicking are not present in the project vicinity.

Charleroi Locks and Dam

The Charleroi Locks and Dam is located at RM 41.5 on the Monongahela River in Charleroi, Pennsylvania (see figure 1-7). The Corps operates the two Charleroi Locks on the east river bank. Recreational boaters may lock through year round, 24 hours a day, 7 days a week. There were about 5,914 total lockages in 2015. Recreational use consists primarily of shoreline fishing. Four informal fishing areas exist upstream and downstream of the dam. The Charleroi Community Park access is 1,500 feet upstream of the dam, and the 2nd Street access area is about 4,000 feet upstream of the dam. Downstream shoreline access is available at the public dock under the Vance Deicas Memorial Bridge (2,500 feet downstream) and at the intersection of 7th Street/River Road (1,750 feet downstream). The Pennsylvania FBC Speers Landing, 2 miles upstream, also offers shoreline fishing and a public boat ramp. Limited parking facilities are available in North Charleroi Borough at 7th Street and River Road, at the Charleroi Community Park (including accessible parking spaces), and at the 2nd Street river access. Although there are no campground facilities near the project, informal picnicking is allowed on the shore near the dam.

Regional Land Use

Land use in the Monongahela River Basin is predominantly forestland. Forests cover about 72 percent of the basin, and agriculture lands occupy about 15 percent. Developed land uses, including residential, commercial, industrial, mining, and infrastructure (roads, railroads, etc.), occupy about 11 percent of the basin (Homer et al., 2015). The dominant land use close to the project powerhouses, including the transmission lines, is a mixture of deciduous forests and small patches of low-intensity residential development. The proposed powerhouses would be established on lands managed and maintained by the Corps.

There are no lands in the immediate vicinity of the six proposed projects that are designated as wilderness lands; however, there are lands included in the national trails system at the Morgantown Project. The Caperton Trail is a National Recreation Trail located adjacent to the proposed powerhouse. Although the Monongahela River Basin is not included in the list of wild and scenic rivers, Interior named the Three Rivers Water Trail a National Recreation Trail in 2010.

3.3.5.2 Environmental Effects

Effects of Project Construction and Operation on Recreation

Construction and operation of the proposed projects would affect angling, boating, and recreational site access. The applicants propose PM&E measures with the intent of mitigating any adverse effects at projects with observed high recreational use.

<u>Opekiska Project</u>

Within the project boundary, anglers access the river on the western shore of the Monongahela River downstream of the dam. During project construction, angling access would be restricted at the site of the proposed powerhouse to ensure public safety, because the shoreline access lies within the footprint of the proposed powerhouse. Construction is expected to take up to 3 years and would eliminate tailwater angling opportunities from the shoreline during that time. Project construction activities would not directly impact existing shoreline angling along the east side of the river, because this area is outside of the project area of disturbance. Recreational boaters using the Upper Monongahela River Water Trail would not have any construction-related restrictions that would impact locking through the dam because construction would take place on the opposite shore.

After project construction, angling access would resume on the western shore below the powerhouse because construction-related restrictions to the tailwater would no longer be necessary. Project operation would likely change hydraulic flow patterns both upstream and downstream, most noticeably in the vicinity of the project, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quantity*. On the side of the river where the project would be constructed, water approaching the intake channel on the upstream side of the dam would increase in velocity. Downstream, the tailrace would create an area of turbulent, deep water that did not exist before. These changes in hydraulic conditions would change the locations that offer the most favorable fishing conditions.

To mitigate for these impacts on recreation, the applicant proposes to construct: (1) a 40-foot-long by 10-foot-wide accessible asphalt tailrace fishing platform on the west river bank; (2) eight recreation-designated parking spaces; (3) an accessible canoe portage/angler trail with 5-foot-wide concrete stairs leading to the river; and (4) a portable accessible restroom with a 10-foot-wide by 10-foot-long pad. The fishing platform would be accessed from the proposed parking area via the canoe portage trail. As figure 3-11 shows, the takeout for the portage would be located about 400 feet upstream of the dam and would follow an asphalt walkway to the parking area. The walkway would continue about 500 feet downstream of the dam to the put-in location.

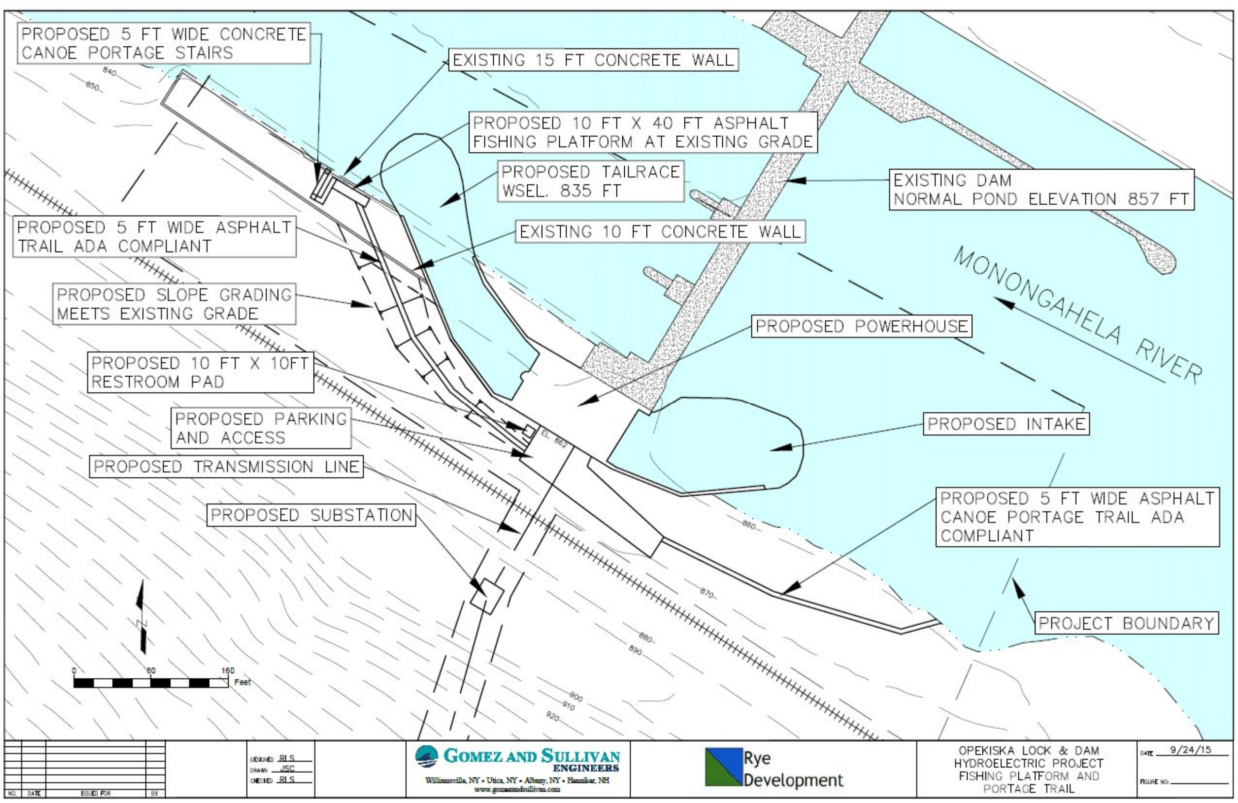

Figure 3-11. Recreation enhancement conceptual design plans, Opekiska (Source: Rye Development, 2015f).

In response to the REA notice issued by the Commission, several stakeholders provided comments and recommendations. The Corps requests that the applicant assess recreational effects and propose mitigation measures that include alternatives for boating, hiking, and fishing. Pennsylvania FBC recommends evaluation of angling limitations associated with project construction, operation, and maintenance. The Upper Monongahela River Association recommends developing angler walkways on the riverward sides of the powerhouse, an angler path along the shoreline, an accessible fishing pier at the end of the existing concrete wall, parking, accessible restrooms, submerged rock jetties, portage paths around the dam, and hand-carried boat access to the Hildebrand pool. The Mon River Trails Conservancy requests mitigation of construction impacts with a hand-carried boat/canoe portage, fishing amenities, public parking, and restroom facilities. In its comment letter filed prior to the REA notice, the Mon River Town Program requests the same recreation amenities as the Mon River Trails Conservancy.

Morgantown Project

Within the project boundary, anglers access the river on the eastern shore of the Monongahela River upstream and downstream of the dam. During project construction, angling access would be restricted to ensure safety, because the shoreline access lies within the footprint of the proposed powerhouse. Construction is expected to take up to 3 years and would permanently eliminate the existing tailwater angling access at the concrete platform below the dam. Project construction activities would not directly impact existing informal shoreline angling below the lock because this area is outside of the project area of disturbance. Recreational boaters using the Upper Monongahela River Water Trail would continue to have the same access to lock through the dam during project construction as they would during project operation, since construction would take place on the opposite shore. Construction impacts affecting public access to the Caperton Trail may include construction noise, the presence of construction equipment on or near the trail, and detours or traffic stops to allow construction vehicles to cross the trail to access the project site. In addition, transmission lines crossing the trail would be installed.

After project construction, angling access would resume on the eastern shore below the powerhouse because construction-related restrictions to the tailrace would no longer be necessary. Project operation would likely create a change in hydraulic flow patterns both upstream and downstream of the dam, most noticeably in the vicinity of the project, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quantity*. On the side of the river where the project would be constructed, water approaching the intake channel on the upstream side of the dam would increase in velocity; while downstream of the dam, the tailrace would create an area of turbulent, deep water that does not currently exist. These changes in hydraulic conditions would change the locations that offer the most favorable fishing conditions. Project operation would also directly impact existing public access to the Caperton Trail and Mountaineer Heritage Park, which contains a tree memorial. The tree memorial is located within the project area, and the applicant intends to continue consultation with stakeholders to ensure that the project is developed in a manner that fully considers the significance of the memorial. The applicant intends to continue consultation with the National Park Service, West Virginia DNR, City of Morgantown, Monongalia County Commission, Mon River Trails Conservancy, Upper Monongahela River Association, and other interested stakeholders regarding the compatibility of the Morgantown Project with the Caperton Trail.

To mitigate for these impacts on recreation, the applicant proposes to construct: (1) shoreline angler paths 90 feet upstream and 450 feet downstream of the dam consisting of 4-foot-wide steel stairs connecting the Caperton Trail to the river; and (2) parking facilities. Figure 3-12 shows the proposed location of the angler access and parking area, which would be located adjacent to the Caperton Trail and next to the proposed powerhouse.

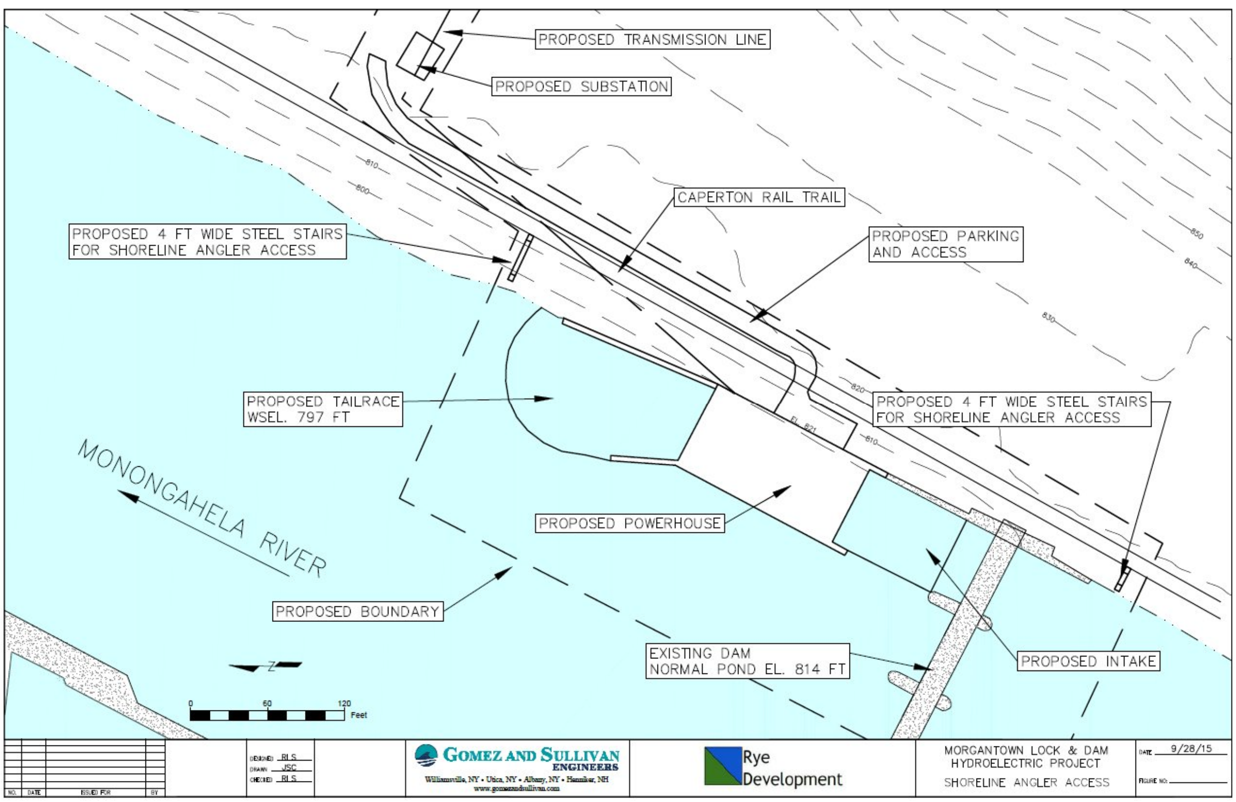

Figure 3-12. Recreation enhancement conceptual design plans, Morgantown (Source: Rye Development, 2015g).

In response to the REA notice issued by the Commission, several stakeholders provided comments and recommendations. The Corps requests that the applicant adequately assess recreational effects and propose sufficient mitigation measures that include alternatives for boating, hiking, and fishing. Pennsylvania FBC recommends evaluation of angling limitations associated with project construction, operation, and maintenance. The National Park Service, the National Road Heritage Corridor, and the Mon River Trails Conservancy request that the Caperton Trail not be used for construction access, stating it is not safe for that type of use, and request that the rail-trail remain in its existing location while providing family-safe detours. These same entities recommend developing and implementing a construction mitigation plan to minimize and mitigate for construction impacts. The Upper Monongahela River Association recommends developing angler walkways on the riverward sides of the powerhouse, an angler path along the shoreline to the Waterfront Hotel, and submerged rock jetties. The Mon River Trails Conservancy similarly recommends an angler walkway on the powerhouse and a shoreline fishing path as well as a canoe portage.

In its comment letter filed prior to the REA notice, the Mon River Town Program requests the same recreation amenities as the Mon River Trails Conservancy.

Point Marion Project

Within the project boundary, anglers access the river on the eastern shore of the Monongahela River downstream of the dam. During project construction, angling access would be restricted to ensure safety, because the shoreline access lies within the footprint of the proposed powerhouse. Construction is expected to take up to 3 years and would eliminate tailwater angling opportunities during that time. Project construction activities would not directly impact existing informal angling along the western shoreline near the lock, since this area is outside the project area of disturbance. Recreational boaters using the Upper Monongahela River Water Trail would continue to have the same access to lock through the dam during project construction as they would during project operation, since construction would take place on the opposite shore. Construction of the proposed access road would intersect the Sheepskin Trail, impeding access to a small portion of the trail.

After project construction, angling access would resume on the eastern shore below the powerhouse because construction-related restrictions to the tailrace would no longer be necessary. Project operation is likely to create a change in hydraulic flow patterns both upstream and downstream of the dam, most noticeably in the vicinity of the project, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quantity*. On the side of the river where the project would be constructed, water approaching the intake channel on the upstream side of the dam would increase in velocity. Downstream of the dam, the tailrace would create an area of turbulent, deep water that does not currently exist. These changes in hydraulic conditions would change the locations that offer the most favorable fishing conditions.

To mitigate for these impacts on recreation, the applicant proposes to construct: a 5-foot-wide wooden shoreline angler path, 450 feet downstream of the dam, leading to the project tailrace with 4-foot-wide steel stairs for angler access (figure 3-13).

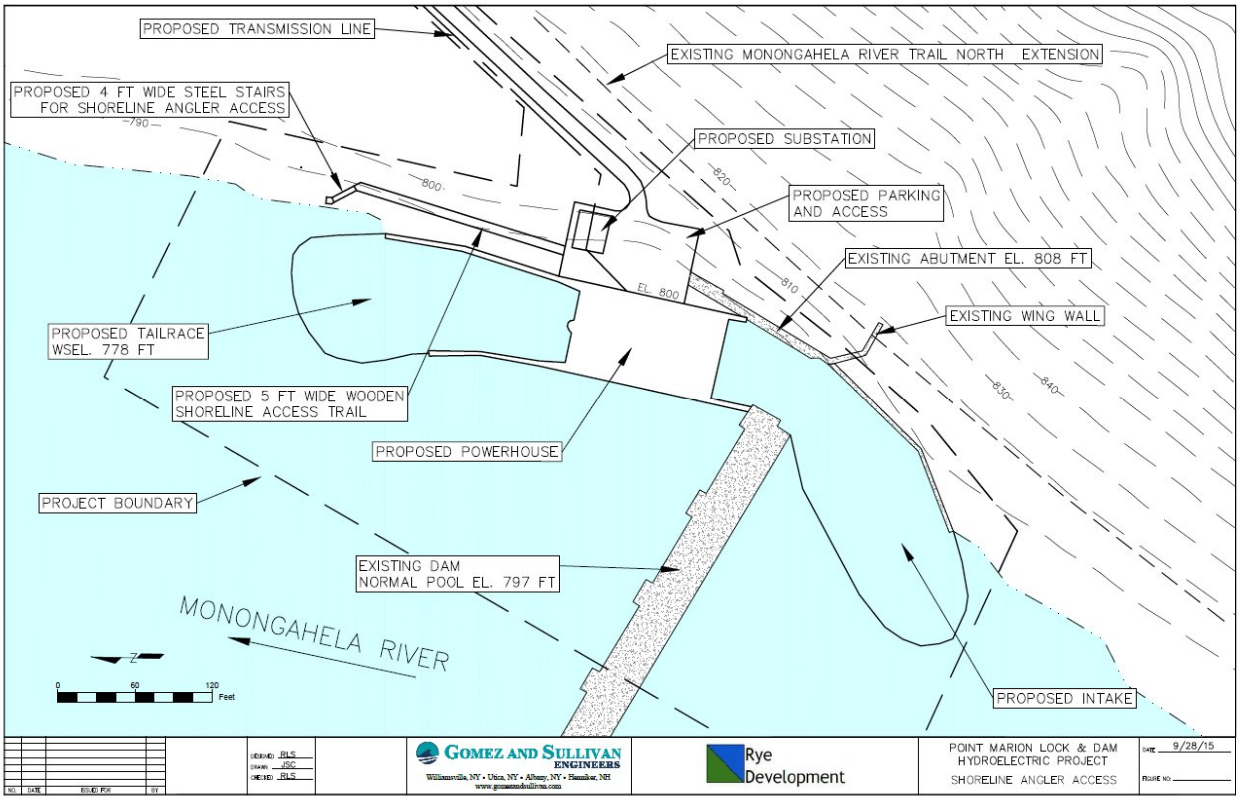

Figure 3-13. Recreation enhancement conceptual design plans, Point Marion (Source: Rye Development, 2015g).

In response to the REA notice issued by the Commission, several stakeholders provided comments and recommendations. The Corps requests that the applicant adequately assess recreational effects and propose mitigation measures that include alternatives for boating, hiking, and fishing. Interior, the National Road Heritage Corridor, the Mon River Trails Conservancy, and Point Marion Borough request that the Sheepskin Trail not be used for construction access, stating it is not safe for that type of use, and request keeping the rail-trail in its existing location, providing family-safe detours, and prohibiting facilities maintenance parking at the city park. Interior also requests that the applicant provide further details of construction and operation impacts along with how it intends to minimize and mitigate for those impacts, stating that it is not enough to develop a post-licensing construction mitigation plan. Pennsylvania FBC requests a study to identify potential loss of angler access and mitigation measures if angler loss occurs. The Mon River Trails Conservancy requests that the applicant install a canoe and kayak portage. Both the Mon River Trails Conservancy and the Point Marion Borough recommend providing a fishing platform at the dam with road access, parking, and restrooms to offset impacts at Point Marion Park. In its comment letter filed prior to the REA notice, the Mon River Town Program requests the same recreation amenities as the Mon River Trails Conservancy and Point Marion Borough.

Grays Landing Project

Within the project boundary, construction would facilitate the need to restrict recreational site access near the proposed powerhouse to ensure public safety. Access to the Pennsylvania FBC Glassworks boat launch would remain unchanged because it is located 1.75 miles upstream of construction activities. Fishing from boats would continue to be allowed, and boaters using the Upper Monongahela Water Trail would continue to have unrestricted access to lock through the dam during project construction. During project operation, restrictions would be lifted, and public access would be restored. Project operation is likely to create a change in hydraulic flow patterns both upstream and downstream of the dam, most noticeably in the vicinity of the project, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quantity*. On the side of the river where the project would be constructed, water approaching the intake channel on the upstream side of the dam would increase in velocity, while downstream of the dam; the tailrace would create an area of turbulent, deep water that does not currently exist. These changes in hydraulic conditions would change the locations that offer the most favorable fishing conditions. The applicant does not identify any existing recreation within the project boundaries, therefore no mitigation measures are proposed.

In response to the REA notice issued by the Commission, several stakeholders provided comments and recommendations. The Corps requests that the applicant adequately assess recreational effects and propose mitigation measures that include alternatives for boating, hiking, and fishing. Pennsylvania FBC requests a study of the potential loss of angler access and use, recommending mitigation if angler use is diminished, stating that this location is the premier smallmouth bass site in the region and would lose 100 percent of angler access on the west shoreline with powerhouse construction. The Mon River Trails Conservancy and the Mon River Town Program request that the applicant install a canoe and kayak portage.

Maxwell Project

Within the project boundary, construction would facilitate the need to restrict site access near the proposed powerhouse to ensure public safety. Access to the Luzerne Township Fire Company Park/Maxwell Ballpark and the adjacent private campsite would remain unchanged. In addition, boaters using the Upper Monongahela Water Trail would continue to have unrestricted access to lock through the dam during project construction, since construction would take place on the opposite shore. During project operation, restrictions would be lifted and public access would be restored. Project operation is likely to create a change in hydraulic flow patterns both upstream and downstream of the dam, most noticeably in the vicinity of the project, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quantity*. On the side of the river where the project would be constructed, water approaching the intake channel on the upstream side of the dam would increase in velocity, while downstream of the dam; the tailrace would create an area of turbulent, deep water that does not currently exist. These changes in hydraulic conditions would change the locations that offer the most favorable fishing conditions. The applicant does not identify any existing recreation within the project boundaries, therefore no mitigation measures are proposed.

In response to the REA notice issued by the Commission, several stakeholders provided comments and recommendations. The Corps requests that the applicant assess recreational effects and propose mitigation measures that include alternatives for boating, hiking, and fishing. Pennsylvania FBC states that this site is heavily used by anglers and requests a study of the potential loss of angler access and use, recommending mitigation if angler loss would occur. The Mon River Trails Conservancy and the Mon River Town Program requests that the applicant install a canoe and kayak portage.

Charleroi Project

Within the project boundary, construction would facilitate the need to restrict site access near the proposed powerhouse to ensure public safety. During project operation, restrictions would be lifted and public access would be restored. Project operation would likely create a change in hydraulic flow patterns both upstream and downstream of the dam, most noticeably in the vicinity of the project, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quantity*. On the side of the river where the project would be constructed, water approaching the intake channel on the upstream side of the dam would increase in velocity. Downstream of the dam, the tailrace would create an area of turbulent, deep water that does not currently exist. These changes in hydraulic conditions would change the locations that offer the most favorable fishing conditions. The applicant does not identify any existing recreation within the project boundaries, and therefore, proposes no mitigation measures.

Public access would remain available during project construction and operation at the Vance Deicas Memorial Bridge, the shoreline access near 7th Street/River Road, the Charleroi Community Park, and the 2nd Street access because these facilities are located outside of the proposed project boundary.

In response to the REA notice issued by the Commission, several stakeholders provided comments and recommendations. The Corps requests that the applicant assess recreational effects and propose mitigation measures that include alternatives for boating, hiking, and fishing. Pennsylvania FBC requests a study of the potential loss of angler access and use, recommending mitigation if angler use would be diminished and stating that access to the eastern shore would be significantly reduced with power development. The Mon River Trails Conservancy and the Mon River Town Program requests that the applicant install a canoe and kayak portage.

Our Analysis

In response to Commission staff's request for information on existing recreation use for each project to qualitatively characterize existing recreation use and demand patterns near the proposed projects in all seasons, various times of day, and various days of the week (including at least one holiday),[79] the applicants filed two recreation resource management plans.[80] The plans included recreation use data for the Monongahela Projects that rely on previously collected data and two 5-hour observations conducted by the applicants at each of the project sites in 2014. In addition, anecdotal information about seasonal and daily recreation use from local stakeholders was provided in the recreation plans. Multiple stakeholders have provided comments on recreation access and use throughout the licensing process. In addition, the Corps provided data on the number of lockages that occurred at the projects from 2010 to 2015. While formal evaluations of recreational use at the projects have not been completed, enough recreational use information was provided to support our analysis of project effects, the applicant's proposed PM&E measures, and stakeholder recommendations.

Opekiska Project

Project construction would temporarily displace shoreline angling opportunities on the west side of the Monongahela River below the dam and would permanently displace the primitive steps currently providing access to the water's edge. Within the construction area at and below the dam, the applicant would need to restrict public shoreline access to reduce potentially dangerous interactions while construction activities are occurring (i.e., recreationists encountering moving construction equipment). Restricting shoreline access during construction would benefit public safety.

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[79] *See* request for additional information issued June 12, 2014.

[80] The plan for Opekiska, Grays Landing, Maxwell, and Charleroi was filed on September 25, 2015; the plan for Morgantown and Point Marion was filed on September 29, 2015.

Project construction and operation would directly impact existing informal access to shoreline fishing because an existing access is located within the proposed powerhouse footprint. However, the applicant would construct a new access and fishing platform farther downstream to mitigate for the loss of the existing access. The Upper Monongahela River Association requests similar amenities as proposed by the applicant, but also suggests an angler walkway on the riverward side of the powerhouse for angling access. An angler walkway on the riverward side of the powerhouse may provide access to flows released from the Corps' gates. In its recreation plan, the applicant indicates it could not allow access on the powerhouse because of safety concerns. An angler walkway on the riverward side of the powerhouse may create safety issues for users, especially during high flows when maximum flow is released through the Corps gates. In addition, the Corps may or may not release flows through the gate adjacent to the powerhouse, and a walkway at the requested location may not provide consistent angling opportunities.

Operation of the powerhouse would create a change in hydraulic flow patterns that would likely produce turbulent flow from the tailrace downstream of the project. The change in hydraulic flow patterns would likely change the location of quality fishing below the dam. Currently, fish are attracted to the currents produced by water flowing through dam gates 2, 3, and 4. With the diversion of flows through the turbines, fish would likely be attracted to the project tailrace near the proposed fishing platform. Therefore, submerged rock jetties, as recommended by the Upper Monongahela River Association would not be needed to improve fish habitat or angling opportunities. Project operation would not have a significant impact on recreational boating immediately downstream of the dam because the downstream lock and dam holds the reservoir elevation stable for navigation. Although flow patterns immediately downstream of the dam and powerhouse would change, these changes would be modest enough that boaters would not likely experience changes in river depth.

The proposed accessible fishing platform and walkway at Opekiska would enhance recreation facilities and mitigate for the loss of recreation access while addressing the needs of visitors with disabilities. Parking facilities, accessible restrooms, and a canoe portage trail would contribute to the public's enjoyment of recreational resources. The canoe portage would especially enhance the boating experience because the Opekiska lock operates by commercial appointment only, and not for recreational boats. Considering the applicant's proposed recreation measures, no further study of angler access or recreation use, as requested by the Corps and Pennsylvania FBC, would be needed to mitigate project-related effects. However, stakeholders have consistently raised concerns for loss of angler access and use during construction; therefore, the development of a construction schedule to minimize construction-related effects on existing shoreline fishing access, should help mitigate effects on angler use and fishing at the project.

Morgantown Project

Project construction would temporarily displace informal shoreline angling opportunities on the eastern shore of the Monongahela River upstream of the dam and would permanently remove the existing concrete platform that provides angler access to the tailwater downstream of the dam. Within the construction area, the applicant would need to restrict public shoreline access to reduce potentially dangerous interactions while construction activities are occurring (i.e., recreationists encountering moving construction equipment). Restricting shoreline access during construction would benefit public safety; however, it would not address general public safety issues caused by the disruption of access and use of the Caperton Trail.

The applicant proposes to complete construction of the project via a floating plant and barge system from the waterway, which would decrease construction impacts in the immediate vicinity of the Caperton Trail, but would not prevent temporary obstruction of the trail. The proposed in-river design of the project powerhouse and related facilities would not likely protect the existing Caperton Trail and associated components from encroachment by construction of the proposed project facilities. The proposed access road would intersect the trail during construction, impeding access to a portion of the trail, causing significant disruption during the construction period. Construction of the project within the proposed footprint would necessitate either a temporary alternative route or detour around the construction area or creating a safe crossing area during project construction. Development of a construction access plan that provides measures for signage, timing, flaggers, detours, crosswalks, barriers, and safety issues at the site would help alleviate effects on the project site and the adjacent Caperton Trail during construction. Given the proposed alignment of the project access road, there would also be permanent impacts on public access to the Caperton Trail and Mountaineer Heritage Park caused by operation and maintenance activities.

Project construction and operation would directly impact existing tailwater fishing opportunities on the east shore because the existing access is located within the proposed powerhouse footprint. The applicant proposes to provide new access via angler paths with stairs leading to the river approximately 90 feet upstream of the dam and 450 feet downstream of the dam but would not replace the existing concrete platform that would be removed. Removal of the concrete platform would adversely affect fishing access in the project area; however, the effect could be mitigated by construction of an accessible path leading from the Caperton Trail to an accessible fishing platform at the tailrace. An accessible path and platform could provide access to the water's edge and tailwater similar to existing conditions and would also improve access for persons with disabilities.

The Upper Monongahela River Association requests an angler walkway on the riverward side of the powerhouse and a path along the shoreline that extends from the dam to the Waterfront Hotel, approximately 2,000 feet downstream. A 2,000-foot fishing path along the entire shoreline would improve access to the water, but would also impact a large area of shoreline. Further, according to the applicant's recreation plan, informal shoreline access already occurs along the shoreline in at least two areas near the Waterfront Hotel. As for a walkway on the riverward side of the powerhouse, there are similar public safety concerns and potential for inconsistent fishing opportunities related to the Corps' gate schedule as discussed above for the Opekiska Project. In addition, flow from the project's spill gates or trash rack cleaning may create other potential hazards for angler use on the riverward side of the powerhouse.

Operation of the powerhouse would change hydraulic flow patterns, which would likely produce turbulent flow from the tailrace below the project. The change in hydraulic flow patterns would likely change the location of quality fishing below the dam. During regular operation, a portion of the water that previously passed over the spillway would now pass through the project turbines. With the diversion of flows through the turbines, fish would likely be attracted to the project tailrace. As such, submerged rock jetties, as recommended by the Upper Monongahela River Association, would not be needed to improve fish habitat or angling opportunities.

The change in hydraulic flow patterns would not have a significant impact on recreational boating immediately downstream of the dam because the downstream lock and dam holds the reservoir elevation stable for navigation. Although flow patterns immediately downstream of the dam and powerhouse would change, these changes would be modest enough that boaters would not likely experience changes in river depth. In addition, the lock operates daily from 7:00 A.M. to 3:00 P.M. and is available for recreational boating lockages. Because the proposed project would not affect lock operation or boating, portages would not be needed to mitigate any project-related effects.

The proposed upstream and downstream shoreline angler paths with stairs at Morgantown would enhance recreation facilities and help mitigate the loss of recreation access, and the addition of parking facilities would contribute to the public's enjoyment of recreational resources. The current recreation resource management plan for the Morgantown Project (Rye Development, 2015g) does not sufficiently address how the applicant would mitigate and avoid disruption of the Caperton Trail during project construction. Stakeholders have consistently raised concerns for loss of trail access; therefore, further consultation with stakeholders (Mon River Trails Conservancy, Mon River Town Program, National Park Service, and National Road Heritage Corridor) to revise the final recreation resource management plan and develop a construction access plan, would help identify additional measures to minimize effects on the Caperton Trail during peak times and resolve stakeholder concerns for safe trail access and use. In addition, installing a downstream fishing platform and making the proposed downstream angler path accessible would restore and enhance angler access that would be lost because of construction of the powerhouse. Considering the recreation measures discussed previously, no further study of angler access or recreation use, as requested by the Corps and Pennsylvania FBC, would be needed to mitigate project-related effects.

Point Marion Project

Project construction would disrupt recreational activity at the Point Marion Project. Shoreline angling on the eastern shore of the Monongahela River downstream of the dam would be permanently displaced, because the area would be within the footprint of the proposed powerhouse and tailrace area. Within the construction area at and below the dam, the applicant would need to restrict public shoreline access to reduce potentially dangerous interactions while construction activities are occurring (i.e., recreationists encountering moving construction equipment). Restricting shoreline access during construction would benefit public safety; however, it would not address general public safety issues caused by the disruption to access and use of the Sheepskin Trail.

The applicant proposes to complete construction via a floating plant and barge system from the waterway, which would decrease construction impacts in the immediate vicinity of local residential roads and the Sheepskin Trail, but would not prevent temporary obstruction of the trail. The proposed in-river design of the project powerhouse and related facilities would not protect the existing Sheepskin Trail and associated components from encroachment by construction of the proposed project facilities. Given the alignment of the proposed access road and the limitations of the current topography, there would be a significant disruption to the trail during the construction period. Construction of the project within the proposed footprint would necessitate either creating a temporary alternative route or detour around the construction area or a safe crossing area during project construction. Development of a construction access plan that provides measures for signage, timing, flaggers, detours, crosswalks, barriers, and safety issues at the site would help alleviate construction effects on the project site and the adjacent Sheepskin Trail.

Project construction and operation would directly impact existing tailwater fishing opportunities on the east shore because the existing access is located within the proposed powerhouse footprint. The applicant proposes to provide a 5-foot wide wooden shoreline access trail with 4-foot wide steel stairs connecting the wooden trail to the river below the proposed project's tailrace. In addition, several stakeholders request an accessible fishing platform, parking, and restroom facilities at the dam to mitigate for the loss of the existing access. Considering the existing size of the informal access (about 500 feet of shoreline), its popularity among anglers as noted by multiple stakeholders, its proximity to a formal recreation site (Point Marion Park) and the town of Point Marion, a platform could enhance the existing informal access area.. Parking for recreational visitors and restroom facilities, however, may not be feasible given the limited area near the project's powerhouse suitable for development. In addition, parking and restroom facilities currently exist at the nearby Point Marion Park.

Operation of the powerhouse would change hydraulic flow patterns that would likely produce turbulent flow from the tailrace below the project. The change in hydraulic flow patterns would likely change the location of quality fishing below the dam. During regular operation, a portion of the water that previously passed over the spillway would now pass through the project turbines. With the diversion of flows through the turbines, fish would likely be attracted to the project tailrace after construction of the project.

The change in hydraulic flow patterns would not have a significant impact on recreational boating immediately downstream of the dam because the downstream lock and dam holds the reservoir elevation stable for navigation. Although flow patterns immediately downstream of the dam and powerhouse would change, these changes would be modest enough that boaters are not likely to experience changes in river depth. In addition, the lock operates daily and is available for recreational boating lockages 24 hours a day. Because the proposed project would not affect lock operation or boating, portages would not be needed to mitigate any project-related effects.

The proposed shoreline angler path at Point Marion would enhance recreation facilities and provide some mitigation for the loss of recreation access. The current recreation resource management plan for the Point Marion Project (Rye Development, 2015g), however, does not sufficiently address how the applicant would mitigate and avoid disruption of the Sheepskin Trail during project construction. Several stakeholders, including the Corps, Pennsylvania DCNR, Monongalia County Commission, Mon River Trails Conservancy, National Park Service, Upper Monongahela River Association, and Point Marion Borough, raised concerns about the compatibility of the project with the Sheepskin Trail. Revision of the final recreation resource management plan and development of a construction access plan in consultation with the stakeholders would help identify additional measures to minimize effects on the Sheepskin Trail and resolve stakeholder concerns for safe trail access and use. In addition, installing a fishing platform at the end of the proposed angler path would minimize the loss of angler access and enhance shoreline access below the dam. Considering the recreation measures discussed above, no further study of angler access or recreation use, as requested by the Corps and Pennsylvania FBC, would be needed to mitigate project-related effects.

Grays Landing, Maxwell, and Charleroi Projects

Downstream of the Point Marion Project, the Grays Landing, Maxwell, and Charleroi Projects span nearly 50 river miles before the next Corps dam is encountered. The fishery at Grays Landing has been described by Pennsylvania FBC as underutilized but also as a premier smallmouth bass site in the region. The Maxwell fishery is described as heavily utilized and becoming increasingly complex and diverse. Recreational use at Charleroi is not characterized by Pennsylvania FBC but the fishery contains several different species. Currently, there are no formal recreation facilities associated with these three Corps' locks and dams yet there is evidence of informal angling access and regular public use. The presence of construction-related equipment, vehicles, and employees is expected to have temporary impacts on angler access. Fishing near the dams, opposite the locks, would be restricted for a period of time to reduce potentially dangerous interactions while construction activities are occurring (i.e., recreationists encountering moving construction equipment). Restricting shoreline access during construction would benefit public safety.

At the Grays Landing, Maxwell, and Charleroi Projects, project operation would not have an impact on the existing public or informal fishing access points located outside the project boundary. Within the project boundaries, relatively good angler access exists but may be lost once the projects are completed. Operation of the powerhouses would create a change in hydraulic flow patterns that would likely produce turbulent flow in the tailwaters below the projects, which could attract a greater number and variety of fish. Since fish tend to be attracted to fast-moving water, the diversion of flows through the powerhouses would likely attract more fish to the project tailwaters than are currently there under existing conditions. Project operations would not have a significant impact on recreational boating immediately below the dams because each downstream lock and dam holds its respective reservoir elevation stable for navigation. Although flow patterns immediately downstream of the dams and powerhouses would change, these changes would be modest enough that boaters are not likely to experience changes in river depth. Operation of the Grays Landing Project's proposed crest gate would raise water levels in the pool upstream of the dam up to 2.5 feet relative to existing conditions when river flow is less than 9,000 cfs. As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, changes in the upper pool water levels could affect wetlands upstream of the dam; however, this change would not affect recreational boating or fishing near the dam.

Stakeholders have consistently requested that the applicant propose mitigation measures for the loss of access at all six projects; however, the applicant has not proposed recreation measures for the Grays Landing, Maxwell, or Charleroi Projects. Although the current level of recreation use has not been described in detail for any of these three projects, comments provided by local and regional stakeholders indicate that the public is aware of and uses these resources recreationally. Because access to tailwater fisheries is limited over the 50-mile reach of river encompassing these three project locations, some degree of angler access improvements would provide a benefit to anglers recreating in this reach. To improve angling at the Grays Landing, Maxwell, and Charleroi tailraces, an access improvement plan developed in consultation with the Corps, Pennsylvania FBC, and Pennsylvania DCNR would provide formal shoreline access to anglers that could include, at a minimum, formal parking, signage, trails, stairs and/or fishing platforms. Any plan developed should include provisions for regular consultation meetings, identification of access issues, and criteria for selecting appropriate mitigation measures to ensure angler access is available at or near each project during construction and operation within the stretch of river encompassed by the Grays Landing, Maxwell, and Charleroi Projects.

As demonstrated in the recreation resource management plans, demand for non-motorized boating is insufficient to warrant installing canoe and kayak portages at each of the three sites, as recommended by stakeholders. According to the Mon River Town Program, there is only one canoe/kayak rental operation for the whole Upper and Middle Monongahela River (Mon River Town Program, 2014). In addition, canoeists and kayakers may use the locks at the Grays Landing, Maxwell, and Charleroi Projects as they are available for recreational lockages. The access improvement plans would likely provide enhanced angler access at Grays Landing, Maxwell, and Charleroi; therefore, additional studies on the loss of angler access or recreation, as recommended by the Corps and Pennsylvania FBC, would not be needed.

Land Use

Each project would require construction of a new powerhouse and transmission line that connects the proposed substations to the local utility distribution lines. Construction could temporarily disrupt existing land use in the immediate vicinity of the projects. At the Point Marion Project, residential roads in the town of Point Marion could be affected during project construction because heavy equipment would utilize local roads to connect from the project to the main thoroughfare. This could impact the local road surfaces if the pavement is not able to withstand the weight of construction vehicles and equipment. Properties adjacent to the local roads could also be affected if the width of the roads is not conducive to large construction vehicles and equipment.

The applicants propose to incorporate measures to minimize disruptions to existing land use into their final construction plans, but have not specifically described any PM&E measures related to land use.

Point Marion Borough states that Jeannette Street, as specified by the applicant to be used for construction access, is not suited for construction equipment and that sections of Jeannette Street have never been opened or dedicated as a Borough street. Point Marion Borough requests that the applicant find an alternative access for construction and long-term maintenance.

Our Analysis

With the exception of the Charleroi and Morgantown Projects, which are located adjacent to an industrial lot and a medium-intensity residential area, respectively, the remaining four projects are located within non-urban land use areas. Because of the presence of the locks and dams, the proposed powerhouses would likely blend in with the Corps' existing structures and would not constitute a significant change in land use at each location.

Heavy machinery and materials could block access to recreational resources in the immediate area of the dams. Access to shoreline fishing locations near the dams would require temporary closure or restriction during specific phases of project construction. Although recreational features such as nature observation and fishing from shore would likely be disrupted during project construction, these impacts would be temporary if recreation PM&E measures, discussed in the previous section, were implemented.

While moving construction equipment to the Point Marion Project, we expect that the applicant would obey local traffic laws and ordinances for the use of public roads in the project area, including following maximum vehicle height, weight, and noise restrictions. We also expect that, if the applicant requires variances from local laws and ordinances, it would apply for appropriate permits from local governing entities. Therefore, movement of construction equipment through the town would not be likely to hinder residential access, affect property bordering the locally used streets (including Jeannette Street), or decrease the integrity of the road surfaces.

New powerhouses and transmission lines, along with new recreation amenities, would be designed to integrate into the existing dam facilities to minimize changes to the upstream and downstream shoreline conditions. Once complete, operation of the powerhouses would not result in any noticeable changes to land uses adjacent to the project boundaries at the projects. At the Morgantown and Point Marion Projects, however, the proposed transmission lines and access roads would be located adjacent to the Caperton and Sheepskin Trails and could affect recreational use of the trails, as discussed in section 3.3.5.2, *Recreation and Land Use Resources, Environmental Effects*. These two trails are significant recreation and land use resources to users locally and throughout the state. In their comments on the license applications, stakeholders have insisted that these trails remain intact with minimal disruption during construction. Including measures in the construction access plan for avoiding transmission line and access road-related effects on the Caperton and Sheepskin Trails would mitigate these effects at the Morgantown and Point Marion Projects.

The project boundaries shown in the Exhibit G drawings filed with the license applications incorporate more land and Corps' facilities, including portions of the shorelines and adjacent Corps' gates, than needed to operate and maintain the projects, thereby potentially affecting land use in an area that is larger than necessary. The Exhibit G drawings should include only the principal project works necessary for operation and maintenance of each project, including any recreational facilities.

3.3.5.3 Cumulative Impacts

The Monongahela River provides many recreational opportunities and has been recognized by the West Virginia DNR as a "Favorite Fishing Water" for musky, walleye, and white bass (West Virginia DNR, 2003). Popular recreation activities along the river and adjacent shoreline lands include boating, fishing, cycling, hiking, and wildlife observation. We determined that recreation resources may be cumulatively affected by project construction and operation of the six proposed projects, including the effects of project operations on river flows, associated recreational opportunities, and public access.

Construction of project facilities may have direct cumulative effects on cyclists, hikers, and anglers along the Monongahela River Trail. The Monongahela River Trail is a trail system that runs parallel and adjacent to the Monongahela River. Segments of this trail exist at both Morgantown and Point Marion Projects, known as the Caperton Trail and Sheepskin Trail, respectively. The presence of construction vehicles and construction activity at the Morgantown and Point Marion Projects could restrict public access to these connected trails, thereby creating a cumulative effect on public recreation access. Specifically, multiple construction sites along the trail may result in a loss of public recreational use during the construction period because of noise, dust, or access issues associated with construction activity. The Mon River Trails Conservancy comments that any closure of the rail-to-trail would result in an economic impact of the loss of trail tourism dollars, economic development, and property tax.[81] These trails are used by cyclists both as a means of recreation and of commuting; cyclists sometimes make several trips a day. Closing trail segments during project construction could shift cyclists to nearby major roads where conditions are less safe, putting cyclists at risk of vehicular collision. Developing a construction access plan at the Morgantown and Point Marion Projects would allow trail use to continue during construction and minimize any cumulative effects on trail use or trail-related tourism. At all projects, construction activity would restrict shoreline access for anglers near the proposed powerhouses. However, access restrictions would be temporary, and shoreline angler access would be restored once construction is complete.

During project operations, trail users at Morgantown and Point Marion would encounter occasional restricted access to the trails during maintenance when vehicles would need to cross the trails to access hydropower facilities for short periods of time over the term of the license. New recreational facilities, as described in the staff alternative, would improve angling access at the project sites along the Monongahela River. Additionally, many of the recreation facilities would be developed with accessible features to increase access for persons with disabilities. The lack of accessible facilities that currently exist at the Corps' Opekiska, Morgantown, and Point Marion facilities make it difficult for persons with disabilities to participate in recreational activities. The recreation enhancements would expand these types of amenities while creating additional capacity to accommodate increased recreation. The southern Pennsylvania and northern West Virginia region would likely see an increase in recreational fishing because the

[81] *See* Mon River Trails Conservancy filing of August 3, 2015.

quality of fishing below each dam's tailrace would likely improve because of turbulent water caused by the operation of the hydropower facilities. No effects on boating resources are anticipated because the downstream locks and dams hold the river elevation stable, which would provide boaters with similar access and flow conditions as currently exist. Therefore, the overall cumulative effects of construction and operation of all projects, in combination with the PM&E measures described under the staff alternative, would be beneficial for recreation users along the Monongahela River.

3.3.6 Aesthetic Resources

3.3.6.1 Affected Environment

The proposed projects would be constructed on lands owned and maintained by the Corps. The dams are located on the Monongahela River within mostly undeveloped areas. The main aesthetic features of the six proposed projects are the existing locks and dams and the surrounding quiet forested views. The visual landscape in the vicinity of the project areas is defined by the deciduous forests and agricultural pastures that line most of the river basin. Many of the projects are surrounded by local parks, trails, and farmland which enhance the aesthetic environment of the Monongahela River Basin.

Because of the residential and recreational land uses adjacent to the Monongahela River, some trash enters the river along with typical organic debris such as dead trees. This debris can build up behind the Corps' dams but is eventually passed downstream in accordance with the Corps' existing management practices.

3.3.6.2 Environmental Effects

Following project construction, the facilities, including the powerhouses and transmission conveyance systems, would be visible to recreational boaters and shore-based recreationists, as well as to residents of adjacent neighborhoods. The applicants propose to conduct post-construction site restoration at each project site to restore the existing aesthetics at those areas temporarily affected by construction.

Both man-made trash and organic debris would continue to pass through the Corps' dams during construction. However, when the proposed projects are operating, water would be drawn through the powerhouse, and debris would concentrate and build up against the trash racks. Therefore, the applicants propose to remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.

In its letter filed February 14, 2016, the Mon River Trails Conservancy expresses concern that floating trash accumulating behind the Morgantown Lock and Dam would have an adverse effect on neighboring aesthetics, during and after project construction. Similar to the applicant's proposal, the Mon River Trails Conservancy recommends developing and implementing mitigative measures that would remove accumulated trash from the site.

Our Analysis

Project construction would require the use of machinery and equipment and increase vehicular traffic at each site. Increased truck traffic and construction activities would produce dust that would create visible nuisances for people close to the sites. Proposed construction equipment would produce noise levels between 84 and 90 decibels within 50 feet. The noise associated with the construction of the powerhouses, transmission lines, and associated facilities would, therefore, increase noise levels at adjacent recreation areas. Construction activities would likely temporarily disrupt both audio and visual resources in the project vicinity, especially for visitors along the Sheepskin and Caperton Trails. Restoring the landscape after construction is complete, as the applicants propose, would ensure that the existing visual character is maintained and/or improved.

Operation of five out of six of the proposed projects would not meaningfully alter water levels as discussed above in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Operational Effects on Water Quantity*. Therefore, operations would not affect shoreline conditions or waterfront views in the area.

Aesthetics in the Grays Landing Project area would be slightly altered by diversion of flow through the powerhouse, which would reduce the volume of flow spilling over the dam, and by operation of the crest gate, which would increase the elevation of the upstream pool by up to 2.5 feet when river flows are less than about 14,000 cfs and reduce upstream pool levels by up to 1.5 feet when flows are between 14,000 and 65,000 cfs (figure 2-1). The greatest change in the upstream pool elevation would occur at flows less than 11,000 cfs, when the 2.5-foot-high crest gate would be in the full upright position. The increased pool elevation would cause the upstream river to appear fuller (with less river bank exposed), especially at flows less than 11,000 cfs when the crest gate is in the full up position.

When the powerhouse is operating, the volume of flow passing over the dam would be reduced by up to 9,000 cfs, which is the maximum flow that would be diverted through the powerhouse. The applicant's proposal to provide year-round bypass flows would maintain a veil of water passing over the crest gate, which would minimize any adverse effects on aesthetics for people viewing the dam from downstream. If no bypass flows are provided, no water would pass over the crest gate when flows are less than the hydraulic capacity of the powerhouse. These conditions would typically occur during the month of July. The lack of flow over the dam would eliminate the visual appeal of having a veil of water passing over the dam, which would cause the dam and crest gate to be visible from locations downstream of the dam. Because this effect would occur only one month out of the year, visual effects are minimal and would not disrupt the scenic enjoyment of the area. Any flows that are "bypassed" through the spill gates or over the dam crest would be at the sole discretion of the Corps.

In their HPMPs, the applicants propose to design project facilities with low profiles and to blend any new facilities with their surroundings to the extent possible (as discussed in the following section); however, the applicants have not provided details on how this would be accomplished. Revising the HPMPs, in consultation with the Corps and the Pennsylvania and the West Virginia SHPOs, as the applicants propose, would likely minimize effects on the surrounding landscape and reduce the visual effect of project facilities on aesthetic values. Consulting with the Pennsylvania and West Virginia SHPOs would ensure the powerhouses and additional structures would have a compatible appearance, to the greatest extent possible, with the existing landscape and dam features and ensure that native species are used for any vegetative screening. Also, constructing the proposed powerhouses and other project facilities with materials that blend with the existing architecture and colors would make the project structures less visually and aesthetically disruptive to viewers. Furthermore, the applicants' proposal to restore the landscape after construction would minimize effects on aesthetics and historic properties and could be included in the HPMPs.

The presence of trash and other debris, especially when concentrated behind dams, can affect the visual character of the river. Disposing of trash collected during trash rack cleaning would improve the existing visual conditions. However, it is unclear what specific kinds of debris would be passed downstream or removed from the river, whether the applicants intend to temporarily store trash on-site, or how often debris would be removed from the projects. Therefore, development of a debris management plan, in consultation with the Corps, Pennsylvania FBC, and West Virginia DNR, which includes the applicants' proposed measure to separate and remove trash from the river, would ensure that debris is sorted, stored, and disposed of appropriately. A debris management plan could include, but not necessarily be limited to, the following provisions: (1) procedures for separation of organic and inorganic trash; (2) procedures for any storage and off-site disposal of inorganic material; (3) procedures for reintroducing organic debris collected on the trash rack to the Monongahela River downstream of the dam, as appropriate; and (4) an implementation schedule.

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Section 106 of the NHPA requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register prior to an undertaking. In this case, the undertaking is the issuance of original licenses for each of the proposed projects. Project-related effects could be associated with the construction, operation, and maintenance of the proposed projects.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. Traditional cultural properties are a type of historic property eligible for the National Register because of their association with cultural practices or beliefs of a living community that are: (1) rooted in that community's history or (2) important in maintaining the continuing cultural identity of the community. In this EA, we also use the term cultural resources to include properties that have not been evaluated for eligibility for listing in the National Register. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register.

Section 106 also requires that the Commission seek concurrence with the West Virginia SHPO or the Pennsylvania SHPO as appropriate on any finding involving effects or no effects on historic properties and allow the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, section 106 requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

On January 5, 2012, the Commission designated the applicants as the non-federal representatives for carrying out day-to-day consultation regarding the licensing efforts pursuant to section 106 of the NHPA. However, the Commission remains largely responsible for all findings and determinations regarding the effects of the proposed projects on any historic property, pursuant to section 106.

Areas of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by the issuance of licenses for the proposed Monongahela River Projects within each project's APE. According to the Advisory Council's regulations, an APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 CFR § 800.16(d)) (2014).

The APE for each project includes: (1) all lands within the proposed project boundary (as described in section 2.2.3, *Proposed Project Facilities*, and depicted in figures 1-2 through 1-7); and (2) lands outside the project boundary where project construction and/or operation may affect historic properties. Each of the HPMPs filed on October 8, 2015, contains a brief description and map of the project APE. In each description, two APEs are identified: one for above-ground structures and one for archaeological resources where project-related ground disturbance would occur. In all of the HPMPs, the APE for above-ground structures extends beyond the proposed project boundary while the APE for archaeological resources is described or depicted as contained within the project boundary. In a letter attached to the Opekiska and

Morgantown HPMPs[82] the West Virginia SHPO concurs with the definitions of the APEs for these two projects. However, the West Virginia SHPO comments that, if changes to the height or materials of the proposed transmission line at the Opekiska Project become necessary, additional review of the APE for this project would be required because of the project's proximity to the adjacent Chancery Hill Historic District. In a letter attached to the remaining HPMPs,[83] the Pennsylvania SHPO concurs with the definition of the APEs for the Point Marion, Grays Landing, Maxwell, and Charleroi Projects.

Cultural History Overview

The following discussion of the cultural context of the projects is adapted from the HPMPs for the six proposed projects (Barrett et al., 2015a,b,c,d,e,f).

Prehistoric occupation of the Upper Ohio River Basin is generally divided into four temporal periods: (1) the Paleoindian period (prior to 8,000 B.C.); (2) the Archaic period (8,000-1,000 B.C.); (3) the Woodland period (1,000-1,600 A.D.); and the Protohistoric period (1,600-contact). The Archaic and Woodland periods are commonly subdivided into early, middle, and late periods. The Paleoindian period is characterized by highly mobile bands of hunter-gatherers traversing the landscape in search of food and high-quality stone tool material. Paleoindian archaeological sites are often identified by the presence of distinctive fluted projectile points, called Clovis points. In the Upper Ohio Valley, the Paleoindian period begins with Clovis points, but projectile points change over the period. Archaeological sites from this period are generally rare because of their age and ephemeral nature. The Meadowcroft Rockshelter, in Washington County, Pennsylvania, not only dates to the Paleoindian period but may be the earliest documented occupation of North America.

The Archaic period is characterized by a change in subsistence strategy as people began relying on smaller game and increased their reliance on plant materials. This shift is often considered a response to changes in climate and environmental conditions. Changes in subsistence sources required different tool technologies; projectile points became smaller and tools associated with plant collection and processing begin appearing in the archaeological record. Although the Archaic period is not well understood in this region, archaeological sites dating to this period have been found in the Upper Ohio

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[82] The May 4, 2015, correspondence was included in the HPMPs filed on October 8, 2015.

[83] The May 18, 2015 correspondence was included in the HPMPs filed on October 8, 2015.

River Basin. Archaeological evidence indicates that population increased as people moved to exploit different resources.

The shift to the Woodland period is commonly marked by the development of horticulture and appearance of ceramics. Woodland peoples used uplands and smaller streams more frequently than their Archaic ancestors, and their habitation sites, commonly located along floodplains, tended to be more permanent. Increasing sedentism went hand in hand with the adoption of horticulture, which required people to tend their growing plants. However, hunting and gathering subsistence activities continued, and in some areas may have increased. By the end of the Woodland period, people were predominantly relying on agriculture, including maize cultivation, supplemented by hunting and gathering. Changes in burial patterns, the construction of mounds, and material culture suggest changes in ceremonialism and social complexity during this period.

Little is known about the Protohistoric period (seventeenth century) in either West Virginia or Pennsylvania. Captain Henry Fleet commanded an expedition to the headwaters of the Potomac and encountered indigenous settlements, but the expedition did not enter the area of the proposed projects. Archaeological evidence indicates that much of the area was abandoned during this century, and it appears that the indigenous peoples who remained in the area, the Monongahela culture, retracted to what is now Greene and Monongalia County. Glass trade beads have been recovered from Monongahela villages, indicating that these communities persisted into the seventeenth century and had contact, probably indirectly, with Europeans. However, by the late seventeenth century this group had left the region.

The French and British began to settle along the rivers west of the Allegheny Mountains around 1730. This settlement led to increased tension among the British, French, and Native Americans as they sought control over land and economic opportunities. The tensions in the Ohio River area and northeastern North American in general led to the French and Indian War in the 1750s (Barrett and Burr, 2015). The British gained control of the Monongahela and Allegheny Rivers in the 1763 Treaty of Paris, and permanent settlements were established. The Ohio River and its tributaries were again a pivotal battle location during the Revolutionary War as the Americans held this position and used it to launch an offensive against the British and their Native American allies for control of the western extent of the Ohio River (Barrett et al., 2015g).

After the Revolutionary War, settlement increased in western Pennsylvania and northwestern West Virginia. The Monongahela River was integral to transporting resources throughout the area. Although coal was the most common resource transported along the rivers, other commercial products were moved along the rivers. These included coke, iron, steel, and other extractive and agricultural products. Railroads were constructed along the river during the nineteenth century, but the river continued to be important for transporting commercial products.

Problems such as snag and sandbars created some difficulties in navigating these rivers, and, beginning in the nineteenth century, Congress appropriated funds to address safe navigation along the Ohio River. By the mid-nineteenth century, the Corps decided to construct a lock and dam on the Ohio River to aid navigation. Davis Island Lock and Dam was a success and led to the construction of additional locks and dams along the river. Increased river traffic in the early twentieth century led the Corps to complete a series of improvements to the locks and dams along the Ohio River. The construction of dams along the Monongahela River followed a similar trajectory as those along the Ohio River. The recent reduction in coal production in the area has impacted the amount of traffic on all three rivers. Table 3-33 details the history of construction and modification of the locks and dams considered in this EA.

Table 3-33. Corps dams and locks: Construction/alteration history (Source: staff)

Project	Period(s) of Construction/Alterations
Monongahela River	
Opekiska Lock and Dam	Initial construction 1961□1967
Morgantown Lock and Dam	Initial construction 1948□1950
Point Marion Lock and Dam	Initial construction 1923□1926
	1958□1959: changed to a gated dam
	1989□1994: new lock constructed
Grays Landing Lock and Dam	Initial construction 1988□1995
Maxwell Locks and Dam	Initial construction 1960□1965
Charleroi (Monongahela Locks and Dam No. 4)	Initial construction1931□1933 1964□1967: reconstructed

Prehistoric and Historic Resources

The applicants completed Phase I cultural resource surveys in 2013 for each of the proposed projects located in West Virginia. The surveys consisted of background research and a terrestrial survey of the two APEs and included auger testing to identify subsurface deposits. The resulting report concluded that there are no archaeological sites located within the APEs for the proposed Opekiska and Morgantown Projects (Smoker Schumer et al., 2013).

In a letter attached to the Opekiska and Morgantown HPMPs[84] the West Virginia SHPO agreed that no further consultation regarding archaeological resources is needed for these two projects. The applicants also completed Phase I cultural resource surveys in 2013 for the four proposed projects in Pennsylvania. The surveys for archaeological resources were initiated with a background search to identify previously documented resources within the APEs. Additionally, a pedestrian field reconnaissance of the portion of each APE that could be impacted by direct ground disturbance was then completed to confirm areas of prior disturbance and to identify any additional archaeological resources. Portions of the Point Marion and Maxwell APEs that would not be subject to project-related ground disturbance were not surveyed. All surveys were documented on a Pennsylvania Phase I negative survey form (Schumer and Gundy, 2014a) or record of disturbance form (Smoker Schumer et al., 2013; Schumer and Gundy 2014b, c, d,). In its May 18, 2015 letter, the Pennsylvania SHPO also commented that no further archaeological fieldwork was required for the proposed Grays Landing and Charleroi Projects in Pennsylvania.

A survey of above-ground resources was also completed for each proposed project in West Virginia and Pennsylvania (Ricketts and Kuncio, 2014; Kuncio and Ricketts 2014a,b,c,d). These surveys documented all of the architectural structures located within the APE for each project, regardless of the age of the structure. A portion of the APE for the proposed Maxwell Project was not surveyed for architectural resources for unknown reasons. In its May 18, 2015, letter, the Pennsylvania SHPO stated that no specific comments on the above-ground studies were provided by the West Virginia SHPO.

The Monongahela River Navigation System has been documented as a multiple property, National Register-eligible resource. The Monongahela River served as an important transportation corridor during the early settlement of the region. In 1836, the state of Pennsylvania hired a private company to construct locks and dams along the river. Between 1844 and 1856 six locks and dams were in operation along the river (Barrett et al., 2015a). The Corps constructed an additional three locks and dams along the upper stretch of the river between 1879 and 1889. The Monongahela River Navigation System consists of multiple National-Register-eligible properties and was determined eligible under Criterion A for its contribution to maritime history, inland navigation, and industrial development and under Criterion C for notable engineering features and twentieth century lock and dam technology (Barrett et al., 2015a). All of the Corps' existing locks and dams on the Monongahela River, with the exception of Grays Landing have been determined eligible for listing on the National Register. These locks

[84] The November 25, 2012, correspondence was included in the HPMPs filed on October 6, 2015.

and dams are eligible under Criteria A and C for their contribution to maritime history and for their engineering features and all are contributing elements to the Monongahela River Navigation System. Grays Landing does not yet meet the 50-year threshold for eligibility.

In addition to the Monongahela River Navigation System and the existing locks and dams, 21 additional cultural resources were identified within the APEs for the proposed Monongahela River Projects. Nine of these resources were previously recorded structures, including two additional locks and dams, a historic wharf/warehouse historic district, four railroad segments, and glass works, all of which have been determined eligible for the National Register. Additionally, a single prehistoric site (36FA362) had been previously recorded on the Monongahela River within the Grays Landing APE. FFP Missouri 13's report for the Grays Landing Project (Schumer and Gundy, 2014b) states that this resource was previously determined to be ineligible for listing in the National Register, but no documentation of this determination has been filed.

The remaining resources identified in the six Monongahela River APEs include five additional historic railroad segments (two recommended eligible), an industrial glasswork complex (recommended not eligible), three historic houses (all recommended eligible), one potential historic district (recommended not eligible), the Community of Lowsville (recommended not eligible), and a mine (recommended not eligible). The West Virginia SHPO and the Pennsylvania SHPO have not yet concurred with these recommendations. Table 3-34 lists all known cultural resources identified at the Monongahela River Projects.

Table 3-34. Monongahela River cultural resources (Source: Barrett et al., 2015a,b,c,d,e,f).

Resource Name	National Register Eligibility	Project-Related Effects	Determination/ Recommendation
Monongahela River Navigation System	Eligible (1996)	Construction of the proposed projects on the Monongahela River would alter character defining features of the Monongahela River Navigation System that contribute to its National Register eligibility	Direct adverse effect; mitigation proposed

Resource Name	National Register Eligibility	Project-Related Effects	Determination/ Recommendation
Opekiska Lock and Dam			
Opekiska Lock and Dam	Eligible (2014)	Alteration of the historic lock and dam and its environment. Potential inadvertent damage during construction.	Recommended direct adverse effect; mitigation proposed
Corps Lock and Dam No. 14	Eligible (1999)	Partial removal of the surviving esplanade and land wall	Recommended direct adverse effect; mitigation proposed
Italianate House	Recommended eligible	Undetermined	Undetermined; consult with the West Virginia SHPO regarding eligibility and effects
Monongahela Railway at Lowsville	Recommended eligible	Undetermined	Undetermined; consult with the West Virginia SHPO regarding eligibility and effects
Former Fairmont, Morgantown and Pittsburgh branch of the B&O Railroad	Recommended not eligible	Undetermined	Undetermined; consult with the West Virginia SHPO regarding eligibility and effects
Community of Lowsville	Recommended not eligible	Undetermined	Undetermined; consult with the West Virginia SHPO regarding eligibility and effects
Morgantown Lock and Dam			
Morgantown Lock and Dam	Eligible (1999)	Alteration of the historic lock and dam and its environment. Potential inadvertent damage during construction.	Recommended direct adverse effect; mitigation proposed

Resource Name	National Register Eligibility	Project-Related Effects	Determination/ Recommendation
Corps Lock and Dam No. 10	Eligible (1999)	Limited visual impacts	Recommended no adverse effect; consult with the West Virginia SHPO if there are changes that would result in other effects
Morgantown Wharf and Warehouse Historic District	Listed (1998)	Limited visual impacts	Recommended no adverse effect; consult with the West Virginia SHPO if there are changes that would result in other effects
Former Morgantown Railway at Morgantown	Recommended eligible	Limited visual impacts	Recommended no adverse effect; consult with the West Virginia SHPO if there are changes that would result in other effects
Former Fairmont, Morgantown, and Pittsburg branch of the B&O Railroad	Recommended not eligible	Undetermined	Undetermined; consult with the West Virginia SHPO regarding eligibility and effects
Point Marion Lock and Dam			
Point Marion Lock and Dam	Eligible (2010)	Alteration of the historic lock and dam and its environment. Removal of the fixed-crest dam. Potential inadvertent damage during construction.	Direct adverse effect; mitigation proposed
Monongahela Railroad (Brownsville Junction to West Virginia State Line	Eligible (2002)	Limited visual impacts	Recommended no adverse effect; consult with the Pennsylvania SHPO if there are changes that would result in other effects

Resource Name	National Register Eligibility	Project-Related Effects	Determination/ Recommendation
Fairmont, Morgantown and Pittsburg Railroad (Greene Junction to West Virginia State Line)	Recommended not eligible (2002)[a]	The rail trail will be affected by the proposed access road but it will not compromise the National Register eligibility of the resource.	Recommended no adverse effect; consult with the Pennsylvania SHPO to minimize effects or if there are changes that would result in other effects
Point Marion/L.J. Houze Convex Glass Company Historic District[b]	*Recommended not eligible*	*Undetermined*	*Undetermined; no measures proposed*
L.J. Houze House[b]	*Recommended eligible*	*Undetermined*	*Undetermined; no measures proposed*
Grays Landing Lock and Dam			
Monongahela Railroad (West Virginia State Line to Brownsville Junction)	Eligible (2002)	Limited visual impacts	Recommended no adverse effect; consult with the Pennsylvania SHPO if there are changes that would result in other effects
Robena Mine #1	Recommended not eligible	Undetermined	Undetermined; consult with the Pennsylvania SHPO regarding eligibility and effects
Gallatin Historic District[b]	*Recommended not eligible*	*Recommended no effect*	*Recommended no effect; no measures proposed*
36FA362[b] *(prehistoric habitation)*	*Not eligible*[c]	*No effects (site not eligible)*	*No effects; no measures proposed*

Resource Name	National Register Eligibility	Project-Related Effects	Determination/ Recommendation
Maxwell Locks and Dam			
Maxwell Locks and Dam	Eligible (2015)	Alteration of the historic locks and dam and its environment. Potential inadvertent damage during construction.	Direct adverse effect; mitigation proposed
Monongahela Railroad (West Virginia State Line to Brownsville Junction)[b]	*Eligible (2002)*	*Undetermined*	*Undetermined; no measures proposed*
Hormell House/Worthington Farmhouse[b]	*Recommended Eligible*	*Undetermined*	*Undetermined; no measures proposed*
Charleroi Locks and Dam			
Corps New Locks and Dam No. 4 (aka Charleroi Locks and Dam)	Eligible (2011)	Alteration of the historic locks and dam and its environment. Potential inadvertent damage during construction.	Direct adverse effect; mitigation proposed
Pittsburg and Lake Erie Railroad	Eligible (2001; 2012)	Limited visual impacts	Recommended no adverse effect; consult with the Pennsylvania SHPO if there are changes that would result in other effects
Macbeth-Evans Charleroi Glass Works/World Kitchen, LLCX	Eligible (2014)	Limited visual impacts.	Recommended no adverse effect; consult with the SHPO if there are changes that would result in other effects

[a] Resources identified in italics are those that are identified in the applicants' cultural resource reports as located within a project's APE but are not discussed within the same project's HPMP.

[b] The tracks, ties, and ballast in the vicinity of the proposed project have been removed, and the railroad has been converted to a multi-use trail. This portion of the railway has been recommended as not eligible for listing on the National Register, but concurrence from the Pennsylvania SHPO has not been received.

[c] Documentation not provided.

Traditional Cultural Properties

By two letters issued November 29, 2011, the Commission initiated consultation with the Absentee-Shawnee Tribe of Indians of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Delaware Nation, Cherokee Nation, United Keetoowah Band of Cherokee Indians in Oklahoma, Easter Band of Cherokee Indians, Seneca-Cayuga Tribe of Oklahoma, Catawba Indian Nation, Tuscarora Nation of New York, Saint Regis Mohawk Tribe, Oneida Nation of New York, Tonawanda Band of Seneca Indians of New York, and Seneca Nation of New York on the proposed Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Projects.

No responses to these letters were received and no consulted tribes have reported any known traditional cultural properties within the proposed projects' APEs.

3.3.7.2 Environmental Effects

Effects on Historic Properties

Construction, operation, and maintenance of the proposed Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Monongahela (Charleroi) Projects would adversely affect the historic locks and dams and the Monongahela River Navigation System. Project maintenance, use, and maintenance of project roads, recreation, vandalism, and mitigation measures associated with other project resources could also affect other cultural resources located within the APEs. Project effects are adverse when an activity directly or indirectly alters the characteristics of a historic property that qualifies it for inclusion in the National Register. If adverse effects are found, they would be resolved in consultation with the West Virginia SHPO or the Pennsylvania SHPO and other parties.

Identified effects for the proposed projects located on the Monongahela River are summarized in table 3-25. In HPMPs filed on October 8, 2015, for the proposed Opekiska and Morgantown Projects in West Virginia, the applicants recommend a finding that construction of these two projects would have direct adverse effects on the Monongahela River Navigation System and on the Corps' Opekiska and Morgantown Locks and Dams. The applicants have not filed documentation of the West Virginia SHPO concurrence with these recommendations with the Commission.

In letters dated January 27, 2014,[85] the Pennsylvania SHPO determined that construction of the proposed projects would have an adverse effect on the Monongahela River Navigation System by adding features to the property that are not related to river navigation thereby affecting the historic qualities of the system that make it eligible for listing in the National Register. Additionally, the applicants recommend a finding that the construction of the proposed projects would adversely affect the Point Marion, Maxwell, and Charleroi Locks and Dams, all of which are individually eligible for listing in the National Register. FFP Missouri 13 recommends a finding that the Grays Landing Lock and Dam would not be adversely affected because the facility does not yet meet the 50-year age threshold for National Register eligibility.

In its HPMPs for the proposed projects (Barrett et al., 2015a,b,c,d,e,f), The applicants identified other direct impacts on cultural resources that would result from construction of the proposed projects on the Monongahela River. In its HPMP filed for the proposed Opekiska Project (Barrett et al., 2015a), FFP Missouri 16 recommends a finding that construction of the project would result in a direct adverse effect on the National Register-eligible Corps' Lock and Dam No. 14. Solia 8 Hydroelectric also recommends a finding that construction of the proposed Point Marion Project would directly impact the Fairmont, Morgantown, and Pittsburg Railroad (Greene Junction to West Virginia; currently a rail trail), but that these impacts would not be adverse because the structure is recommended as ineligible for listing on the National Register (Barrett et al., 2015c).

In its HPMPs for the proposed Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Projects (Barrett et al., 2015b,c,d,e,f), the applicants recommend a finding that construction of these projects would have visual effects on historic properties. These include the Corps' Lock and Dam No. 10, Morgantown Wharf and Warehouse Historic District, former Morgantown Railway, two sections of the Monongahela Railroad (Brownsville-West Virginia), the Pittsburg and Lake Erie Railroad, and the Macbeth-Evans Charleroi Glass Works. While these structures are all listed, eligible, or recommended eligible for listing on the National Register, in its HPMPs, the applicants recommend a finding that visual effects on these resources would not be adverse. The West Virginia SHPO and the Pennsylvania SHPO have not yet concurred with any of the applicants' effect assessments and recommendations for other resources found within the APEs of the proposed Monongahela River Projects.

[85] The January 27, 2014, correspondences were included in the HPMPs filed by the applicant on October 8, 2015.

Assessments of effect were not provided for several other resources. These include two resources at the Opekiska Project (Italianate House, Monongahela Railway at Lowsville, a segment of the former Fairmont Morgantown and Pittsburgh Branch of the B&O Railroad, Community of Lowsville), and one resource at the Grays Landing Project (Robena Mine #1) have not yet been completed, and the applicants propose to consult with the appropriate SHPOs in this regard.

Assessments of effect were also not provided for several other resources. These include two structures at the proposed Point Marion Project (Point Marion/L.J. Houze Convex Glass Company Historic District, L.J. Houze House), two resources at the proposed Grays Landing Project (Gallatin Historic District, prehistoric archaeological site 36FA362), and two resources at the proposed Maxwell Project (a third segment of the Monongahela Railroad [Brownsville-West Virginia], the Hormell House/Worthington Farmhouse). While all of these resources were identified in the applicants' survey reports, they were not identified in the projects' HPMPs.

Management of Historic Properties

To address project-related effects, the applicants propose to implement an HPMP for each project. The applicants' filed draft HPMPs on October 8, 2015 that were developed in accordance with the *Guidelines for the Development of Historic Property Management Plans for FERC Hydroelectric Projects* (Advisory Council and FERC, 2002). The HPMPs contain procedures and requirements for: (1) designation of a Cultural Resources Coordinator;[86] (2) biennial training of personnel; (3) consultation requirements; (4) an internal decision-making process; (5) procedures for emergency situations; (6) a plan for public interpretation; (7) an unanticipated discoveries plan; (8) procedures for the discovery of human remains; (9) a plan for the curation of any recovered cultural materials; (10) annual reporting; (11) a plan for review and revisions to the HPMP; and (12) dispute resolution.

In addition to the proposed general procedures and requirements identified above, the HPMPs provide specific procedures and requirements to resolve adverse effects on several eligible properties located within the projects' APEs. For direct adverse effects on the eligible Monongahela River Navigation System and affected locks and dams (including Lock and Dam No. 14), the applicants propose to: (1) document the lock and

[86] The Cultural Resources Coordinator would ensure compliance with the expected PAs and implementation of the HPMPs, including review of project activities, consultation with the Pennsylvania SHPO, coordination of personnel training, maintenance of cultural resources records, and public outreach.

dam structures using the Secretary of the Interior's standards for documenting historic engineering resources; (2) design new facilities with low profiles to blend with the surrounding area to the greatest extent practicable; (3) consult with the appropriate SHPO and the Corps on any changes or modifications to the projects; and (4) install interpretive signage.

The HPMPs also call for further consultation with the West Virginia SHPO or the Pennsylvania SHPO regarding: (1) eligibility recommendations for resources where project effects have not been determined; and (2) properties identified with non-adverse visual effects where potential changes in project activities could result in a change to an "adverse" effect recommendation.

In a letter filed November 10, 2015, the Pennsylvania SHPO provides comments on the HPMPs for the proposed Point Marion, Grays Landing, Maxwell, and Charleroi Projects. The Pennsylvania SHPO states that, in general, it was in agreement with the proposed management and mitigation measures provided in the HPMPs for above-ground structures at these projects (Monongahela River Navigation System and existing locks and dams). However, the Pennsylvania SHPO requests a number of revisions to the HPMPs. Although many of these revisions are editorial, additional information on the eligibility of each identified property, including applicable National Register criteria, and additional discussion of project-related effects were requested. Because the comments were filed subsequent to the filing of the HPMPs, these comments have not yet been addressed by the applicants. Comments from the West Virginia SHPO on the proposed Opekiska and Morgantown HPMPs have not yet been filed with the Commission.

On June 1, 2016, Commission staff initiated a conference call with Rye Development, the Corps, the West Virginia SHPO and the Pennsylvania SHPO to discuss issues related to the proposed projects. Several topics were discussed, including but not limited to: (1) the projects' APEs; (2) tribal consultation, and (3) additional consultation with the Pennsylvania SHPO regarding project effects on historic properties and the resolution of those effects. These issues are discussed in detail in the following section. In the call, Rye Development agreed to revise the HPMPs to satisfy the Commission's comments. Meeting notes for the call were submitted to all participants for review and were filed on June 28, 2016.

Our Analysis

The applicants' HPMPs provide measures that are consistent with the Advisory Council and Commission's 2002 guidelines. However, the final HPMPs should include more detail as explained below. Continued consultation with the West Virginia SHPO, the Pennsylvania SHPO, and Corps is needed to finalize the documents.

Each of the HPMPs contains a brief description and map of the project APE. In each description, two APEs are identified: one for above-ground structures and one for archaeological resources where project-related ground disturbance would occur. In each HPMP, the APE for above-ground structures extends beyond the proposed project boundary while the APE for archaeological resources is contained within the project boundary. Licensing of a hydroelectric project is a single section 106 undertaking, and Commission staff recognizes a single APE that would encompass land both directly and indirectly affected by the project. For each project, this APE would coincide with the larger APE that the applicants identified for structures that extends beyond the proposed project boundary. However, while each HPMP refers to additional information related to the determination of the APE,[87] no detailed discussion of exactly how the APE was defined for each project was provided (e.g., distance from project boundary, extent of viewshed). Additionally, the APE and resource location maps in each of the HPMPs do not depict the proposed project boundary in relation to the APE. Inclusion in the HPMPs of: (1) a detailed discussion related to how the APE beyond the project boundary for each project was defined; and (2) a revised APE and resource location maps that include the proposed project boundary, would provide clarity regarding the location of resources and project effects, both within and outside of the project boundary.

The HPMPs do not include plans for cultural resources monitoring during construction. To protect prehistoric sites that have been identified at the Grays Landing Project as well as any unknown sites which may be discovered during construction, the HPMPs must include provisions for monitoring cultural resources during ground-disturbing construction activities. Additionally, the Pennsylvania SHPO has stated that unsurveyed portions of the Point Marion and Maxwell APEs contain a high potential for archaeological resources. The Pennsylvania SHPO comments that, if ground disturbance becomes necessary in these areas, additional surveys would be required. If these surveys identify new resources, cultural resources monitoring in the vicinity of these areas by either the Cultural Resources Coordinator or a qualified cultural resources professional would ensure that these resources are protected.

In accordance with the Advisory Council and Commission's 2002 guidelines, HPMPs for hydroelectric projects must contain a list of activities that are exempt from further section 106 consultation. In its HPMPs, the applicants' state that a PA with the appropriate SHPO would be established that would specify the types of activities that would be exempt from SHPO review. Including a list of exempted activities in the HPMPs would comply with the Advisory Council and Commission guidelines and would ensure that the listed activities are considered during project planning.

[87] *See* Chapter II, Section D, subsection 2 of each draft HPMP.

As mentioned in section 3.3.7.1, *Cultural Resources, Affected Environment*, the Commission initiated consultation with a number of Native American tribes regarding the proposed projects. No tribal organizations responded to the Commission's invitation to consult regarding the proposed projects. In the HPMPs for the proposed Opekiska and Morgantown Projects in West Virginia, the applicants' state that a search of the Native American Consultation Database did not identify any Tribes with potential interests in the project. However, it is not clear if FFP Missouri 16 or FFP Missouri 15 considered the list of 16 tribes identified in the Commission's section 106 consultation invitation letter dated November 29, 2011, regarding the two projects. Further, in the Opekiska and Morgantown HPMPs, descriptions of procedures to be followed in the event that Native American human remains are identified at these two projects state that the appropriate Tribal Historic Preservation Officer and "lineal descendants" would be consulted, but no specific tribes are specified. In the HPMPs for the proposed projects in Pennsylvania, the applicants' state that any tribal correspondence should be directed to the Seneca Nation and the Tonawanda Band of Seneca. In the initial consultation letters for the proposed projects in Pennsylvania, 16 tribes were identified by the Commission; it is not clear why only two of these tribes are identified by the applicants for the purposes of consultation. Therefore, the HPMPs for each of the proposed projects should include a description of Native American consultation efforts undertaken by the applicants to date, a justification for the selection of tribes to be consulted for each project, and the inclusion of appropriate Tribes as consulting parties with regard to prehistoric archaeological resources and human remains. These measures would ensure that Native American concerns are appropriately considered in accordance with section 106, the Native American Graves Protection and Repatriation Act, the Advisory Council's Policy Statement Regarding Treatment of Human Remains and Grave Goods.

We also note that the applicants' HPMPs for the proposed projects only identify the Commission and the West Virginia SHPO or the Pennsylvania SHPO as consulting parties. Given that the proposed facilities would be located on existing Corps structures, the applicants should include the Corps as a consulting party in the HPMPs. The HPMPs should delineate the roles and responsibilities of each party.

In accordance with section 106 and its implementing regulations found at 36 CFR 800, the West Virginia SHPO and the Pennsylvania SHPO must be consulted regarding any recommendations of National Register eligibility, the assessment of effects, and the resolution of adverse effects. The Pennsylvania SHPO has determined that the Monongahela River Navigation System associated with the proposed projects and three of the four Corps locks and dams in Pennsylvania are eligible for listing. The proposed construction would have an adverse effect on these historic resources. Neither SHPO has concurred with the applicant's effect recommendations for other resources identified within the projects' APEs. In its HPMPs, the applicants only propose to consult with the appropriate SHPO in the future if there are changes in project activities that could result in new effects, other than visual effects, to properties that have been recommended as eligible for listing in the National Register. Further, three of the applicants' cultural resource reports (Point Marion, Grays Landing, Maxwell) identify specific properties that are located within a project's APE, but these resources are not discussed within the same project's HPMP. These resources are identified in italics in the tables provided in section 3.3.7.1, *Cultural Resources, Affected Environment*. The applicants have recommended that most, but not all, of these resources are not eligible for listing in the National Register. All cultural resources identified within a project's APE must be included in the project's HPMP regardless of eligibility. Therefore, additional information regarding the applicants' recommendations of National Register eligibility should be provided in the HPMPs. Further consultation with the Pennsylvania SHPO regarding these recommendations, any recommendations of effect, and the ultimate resolution of effects found to be adverse is needed to complete section 106 consultation.

Finally, inclusion in the HPMPs of a detailed schedule for completion of the activities required under the HPMPs (e.g., further consultation regarding National Register eligibility of identified resources, assessment of effects, and implementation of mitigation measures) would ensure that these activities are completed in a timely manner.

Revision of the HPMPs in consultation with the West Virginia SHPO, the Pennsylvania SHPO, and the Corps to include the following measures would ensure that the HPMPs are compliant with section 106 and consistent with the Advisory Council and Commission's 2002 guidelines: (1) a detailed discussion regarding how the APE for each project was defined and revised APE and resource location maps that delineate both the APE and the project boundary; (2) cultural resources monitoring of ground disturbance conducted at the Maxwell, Point Marion, and Grays Landing projects in the vicinity of known archaeological resources, to be conducted by either the Cultural Resources Coordinator or by a qualified cultural resources professional; at the Opekiska, Morgantown, and Charleroi Projects, include a discussion on the circumstances under which cultural resources monitoring, by either the Cultural Resources Coordinator or by a qualified cultural resources professional, would be required; (3) a list of activities that are exempt from further section 106 consultation; (4) a description of Native American consultation efforts undertaken by the applicants to date, justification for the selection of tribes to be consulted for each project, and the inclusion of appropriate Tribes as consulting parties regarding prehistoric archaeological resources and human remains; (5) inclusion of the Corps as a consulting party in the HPMPs; (6) a discussion of all cultural resources identified within the APEs of the proposed projects, their National Register eligibility, project-related effects, and specific management measures to resolve project-related adverse effects (all to be completed in consultation with the appropriate SHPO); and (7) inclusion in the consultation appendix of all correspondences and comments related to the HPMP and a discussion of how those comments are addressed in the HPMP. Revision of the HPMPs to include these requirements in consultation with the West Virginia SHPO or the Pennsylvania SHPO and the Corps, and submittal to consulting parties (for a minimum of 30 days), for their review and comments, would ensure that project effects on historic properties within each project's APE are appropriately addressed.

To meet the section 106 requirements, the Commission intends to execute PAs with the West Virginia SHPO or the Pennsylvania SHPO as appropriate for each proposed project for the protection of historic properties that would be affected by the construction and operation of the projects. The terms of each PA would require the applicants to address all historic properties identified within the projects' APEs through the revision of the existing HPMPs.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative for each project, no license would be issued, and the proposed project would not be constructed. Environmental conditions would remain the same at each site that is not licensed. The power needs that would have been satisfied by the projects' hydropower generation would have to be satisfied by other renewable resources or nonrenewable fuels.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at each project's use of the river for hydropower purposes to see what effect various environmental measures would have on the projects' costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[88] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECTS

Table 4-1 summarizes some of the assumptions and economic information we use in our analysis. The table contains information that pertains to all six projects. Tables 4-2 through 4-7 summarize additional project-specific assumptions and economic information we use in our analysis.

The values provided by the applicants are reasonable for the purposes of our analyses. For each project, cost items common to all alternatives except the no-action

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[88] *See* Mead Corporation, Publishing Paper Division, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

alternative include: taxes and insurance costs, estimated future capital investment required to maintain and extend the life of plant equipment and facilities, costs to prepare the license application, normal operation and maintenance cost, and Commission fees. The no-action alternative only includes the cost to prepare the license application. All dollars are year 2016, unless specified otherwise.

Table 4-1. Parameters for the economic analysis common to all of the Monongahela River Projects (Source: FFP Missouri 13, FFP Missouri 15, FFP Missouri 16, Solia 4 Hydroelectric, Solia 5 Hydroelectric, Solia 8 Hydroelectric, and staff).

Economic Parameter	**Value**	**Source**
Period of economic analysis	30 years	Staff
Term of financing	20 years	Staff
Cost of capital (long-term interest rate)	9 percent[a]	Applicants
Short-term interest rate (during construction)	9 percent[b]	Staff
Discount rate	8 percent	Staff
Federal tax rate	35 percent	Staff
Local tax rate	3 percent	Staff
Energy rate	\$37.83/MWh[c]	Staff
Capacity rate	\$190/kW-year[d]	Staff

[a] All applicants, license applications, page D-2.

[b] Staff assumed the applicants' short-term interest rate was the same as its long-term interest rate.

[c] The applicants provided a 2012 energy rate of \$40.86/MWh. Staff used values from the *2015 PJM State of the Market Report* (Monitoring Analytics, 2016): on-peak rate of \$41.50/MWh for 16 hours, off-peak rate of \$30.48/MWh for 8 hours, and average rate of \$37.83/MWh.

[d] kW–kilowatt. The capacity rate is based on the Energy Information Administration's 2016 Annual Energy Outlook (EIA, 2016).

Table 4-2. Parameters for the economic analysis for FFP Missouri 16's Opekiska Project (Source: FFP Missouri 16 and staff).

Economic Parameter	Value	Source
Proposed capacity	6.0 MW[a]	FFP Missouri 16
Proposed average annual generation	25,606 MWh[b]	FFP Missouri 16
Construction cost	$15,501,510[c]	FFP Missouri 16
Annual operation and maintenance cost	$298,820/year[d]	FFP Missouri 16
Cost to prepare license application	$491,080[e]	FFP Missouri 16
Insurance	$26,070	FFP Missouri 16
Dependable capacity	1.03 MW[f]	FFP Missouri 16

[a] FFP Missouri 16, February 2014 license application, pages A-5 and B-8.

[b] Although the applicant proposed a minimum bypass flow, with an associated loss of 306 MWh in potential annual generation, only the Corps can require bypass flows, so we revised the annual generation to reflect no annual bypass flow and no associated energy loss.

[c] FFP Missouri 16, February 2014 license application, page D-2, table D.3-1, escalated to 2016 dollars.

[d] FFP Missouri 16, February 2014 license application, page D-2, table D.4-1. This value includes operation and maintenance expenses, transmission charges, Corps electric bill, land lease fees, and headwater benefits fees, escalated to 2016 dollars.

[e] FFP Missouri 16, February 2014 license application, page D-4, escalated to 2016 dollars. Includes $10,000 in 2013 dollars for development of the recreation resource management plan.

[f] FFP Missouri 16, February 2014 license application, page B-8.

Table 4-3. Parameters for the economic analysis for FFP Missouri 15's Morgantown Project (Source: FFP Missouri 15 and staff).

Economic Parameter	Value	Source
Proposed capacity	5.0 MW[a]	FFP Missouri 15
Proposed average annual generation	18,900 MWh[b]	FFP Missouri 15
Construction cost	$14,882,340[c]	FFP Missouri 15
Annual operation and maintenance cost	$259,140/year[d]	FFP Missouri 15

Economic Parameter	Value	Source
Cost to prepare license application	$430,540[e]	FFP Missouri 15
Insurance	$22,110	FFP Missouri 15
Dependable capacity	0.78 MW[f]	FFP Missouri 15

[a] FFP Missouri 15, February 2014 license application, page A-29.

[b] Although the applicant proposed a minimum bypass flow, with an associated loss of 230 MWh in potential annual generation, only the Corps can require bypass flows, so we revised the annual generation to reflect no annual bypass flow and no associated energy loss.

[c] FFP Missouri 15, February 2014 license application, page A-24, table A.1.10-1, escalated to 2016 dollars.

[d] FFP Missouri 15, February 2014 license application, pages A-24 to A-25, table A.1.11-1. This value includes operation and maintenance expenses, transmission charges, Corps electric bill, land lease fees, and headwater benefits fees, escalated to 2016 dollars.

[e] FFP Missouri 15, February 2014 license application, page A-28, escalated to 2016 dollars. Includes $10,000 in 2013 dollars for development of the recreation resource management plan.

[f] FFP Missouri 15, February 2014 license application, page A-30.

Table 4-4. Parameters for the economic analysis for Solia 8 Hydroelectric's Point Marion Project (Source: Solia 8 Hydroelectric and staff).

Economic Parameter	Value	Source
Proposed capacity	5.0 MW[a]	Solia 8 Hydroelectric
Proposed average annual generation	16,500 MWh[b]	Solia 8 Hydroelectric
Construction cost	$14,882,340[c]	Solia 8 Hydroelectric
Annual operation and maintenance cost	$235,790/year[d]	Solia 8 Hydroelectric
Cost to prepare license application	$72,100[e]	Solia 8 Hydroelectric
Insurance	$19,040	Solia 8 Hydroelectric
Dependable capacity	0.578 MW[f]	Solia 8 Hydroelectric

[a] Solia 8 Hydroelectric, February 2014 license application, page A-30.

[b] Although the applicant proposed a minimum bypass flow, with an associated loss of 201 MWh in potential annual generation, only the Corps can require bypass flows, so

we revised the annual generation to reflect no annual bypass flow and no associated energy loss.

[c] Solia 8 Hydroelectric, February 2014 license application, page A-24, table A.1.10-1, escalated to 2016 dollars.

[d] Solia 8 Hydroelectric, February 2014 license application, page A-24-25, table A.1.11-1. This value includes operation and maintenance expenses, transmission charges, Corps electric bill, land lease fees, and headwater benefits fees, escalated to 2016 dollars.

[e] Solia 8 Hydroelectric, February 2014 license application, page A-29, escalated to 2016 dollars. Includes $10,000 in 2013 dollars for development of the recreation resource management plan.

[f] Solia 8 Hydroelectric, February 2014 license application, page A-2, table A.1.1-1.

Table 4-5. Parameters for the economic analysis for FFP Missouri 13's Grays Landing Project (Source: FFP Missouri 13 and staff).

Economic Parameter	**Value**	**Source**
Proposed capacity	12.0 MW[a]	FFP Missouri 13
Proposed average annual generation	47,300 MWh[b]	FFP Missouri 13
Construction cost	$25,482,180[c]	FFP Missouri 13
Annual operation and maintenance cost	$623,860/year[d]	FFP Missouri 13
Cost to prepare license application	$1,057,560[e]	FFP Missouri 13
Insurance	$55,090	FFP Missouri 13
Dependable capacity	2.4 MW[f]	FFP Missouri 13

[a] FFP Missouri 13, February 2014 license application, pages A-5 and B-11.

[b] Although the applicant proposed a minimum bypass flow, with an associated loss of 658 MWh in potential annual generation, only the Corps can require bypass flows, so we revised the annual generation to reflect no annual bypass flow and no associated energy loss.

[c] FFP Missouri 13, February 2014 license application, page D-2, table D.3-1, escalated to 2016 dollars.

[d] FFP Missouri 13, February 2014 license application, page D-2, table D.4-1. This value includes operation and maintenance expenses, transmission charges, Corps electric bill, land lease fees, and headwater benefits fees, escalated to 2016 dollars.

[e] FFP Missouri 13, February 2014 license application, page D-4, escalated to 2016 dollars. Includes $10,000 in 2013 dollars for development of the recreation resource management plan.

[f] FFP Missouri 13, February 2014 license application, page B-11.

Table 4-6. Parameters for the economic analysis for Solia 5 Hydroelectric's Maxwell Project (Source: Solia 5 Hydroelectric and staff).

Economic Parameter	Value	Source
Proposed capacity	13.0 MW[a]	Solia 5 Hydroelectric
Proposed average annual generation	56,800 MWh[b]	Solia 5 Hydroelectric
Construction cost	$28,773,600[c]	Solia 5 Hydroelectric
Annual operation and maintenance cost	$732,250/year[d]	Solia 5 Hydroelectric
Cost to prepare license application	$1,281,920[e]	Solia 5 Hydroelectric
Insurance	$65,290	Solia 5 Hydroelectric
Dependable capacity	2.86 MW[f]	Solia 5 Hydroelectric

[a] Solia 5 Hydroelectric, February 2014 license application, pages A-4 and B-7.

[b] Although the applicant proposed a minimum bypass flow, with an associated loss of 406 MWh in potential annual generation, only the Corps can require bypass flows, so we revised the annual generation to reflect no annual bypass flow and no associated energy loss.

[c] Solia 5 Hydroelectric, February 2014 license application, page D-2, table D.3-1, escalated to 2016 dollars.

[d] Solia 5 Hydroelectric, February 2014 license application, page D-2, table D.4-1. This value includes operation and maintenance expenses, transmission charges, Corps electric bill, land lease fees, and headwater benefits fees, escalated to 2016 dollars.

[e] Solia 5 Hydroelectric, February 2014 license application, page D-4, escalated to 2016 dollars. Includes $10,000 in 2013 dollars for development of the recreation resource management plan.

[f] Solia 5 Hydroelectric, February 2014 license application, page B-8.

Table 4-7. Parameters for the economic analysis for Solia 4 Hydroelectric's Monongahela Locks and Dam 4 Project (Source: Solia 4 Hydroelectric and staff).

Economic Parameter	Value	Source
Proposed capacity	12.0 MW[a]	Solia 4 Hydroelectric
Proposed average annual generation	48,500 MWh[b]	Solia 4 Hydroelectric
Construction cost	$25,333,210[c]	Solia 4 Hydroelectric
Annual operation and maintenance cost	$616,310/year[d]	Solia 4 Hydroelectric
Cost to prepare license application	$1,003,520[e]	Solia 4 Hydroelectric
Insurance	$52,250	Solia 4 Hydroelectric
Dependable capacity	2.19 MW[f]	Solia 4 Hydroelectric

[a] Solia 4 Hydroelectric, February 2014 license application, pages A-5 and B-7.

[b] Although the applicant proposed a minimum bypass flow, with an associated loss of 394 MWh in potential annual generation, only the Corps can require bypass flows, so we revised the annual generation to reflect no annual bypass flow and no associated energy loss.

[c] Solia 4 Hydroelectric, February 2014 license application, page D-2, table D.3-1, escalated to 2016 dollars.

[d] Solia 4 Hydroelectric, February 2014 license application, page D-2, table D.4-1. This value includes operation and maintenance expenses, transmission charges, Corps electric bill, land lease fees, and headwater benefits fees, escalated to 2016 dollars.

[e] Solia 4 Hydroelectric, February 2014 license application, page D-4, escalated to 2016 dollars. Includes $10,000 in 2013 dollars for development of the recreation resource management plan.

[f] Solia 4 Hydroelectric, February 2014 license application, page B-9.

4.2 COMPARISON OF ALTERNATIVES

Tables 4-8 through 4-13 compare the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each applicant's proposal and staff alternative. In these tables, a number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the project cost is greater than the cost of alternative power.

Table 4-8. Summary of the annual cost of alternative power and annual project costs for alternatives for the Opekiska Project (Source: staff).

	FFP Missouri 16's Proposal[a]	Staff Alternative
Installed capacity (MW)	6	6
Annual generation (MWh)	25,606	25,606
Annual cost of alternative power	$1,164,300	$1,164,300
($/MWh)	45.47	45.47
Annual project cost	$2,038,980	$2,053,400
($/MWh)	79.63	80.19
Difference between cost of alternative power and project cost	($874,680)	($889,100)
($/MWh)	(34.16)	(34.72)

[a] A number in parentheses indicates that the annual project cost is greater than the cost of alternative power.

Table 4-9. Summary of the annual cost of alternative power and annual project costs for alternatives for the Morgantown Project (Source: staff).

	FFP Missouri 15's Proposal[a]	Staff Alternative
Installed capacity (MW)	5	5
Annual generation (MWh)	19,130	19,130
Annual cost of alternative power	$871,950	$871,950
($/MWh)	45.58	45.58
Annual project cost	$1,837,340	$1,855,060
($/MWh)	96.05	96.97
Difference between cost of alternative power and project cost	($965,390)	($983,110)
($/MWh)	(50.47)	(51.39)

[a] A number in parentheses indicates that the annual project cost is greater than the cost of alternative power.

Table 4-10. Summary of the annual cost of alternative power and annual project costs for alternatives for the Point Marion Project (Source: staff).

	Solia 8 Hydroelectric's Proposal[a]	Staff Alternative
Installed capacity (MW)	5	5
Annual generation (MWh)	16,701	16,701
Annual cost of alternative power	$741,690	$741,690
($/MWh)	44.41	44.41
Annual project cost	$1,768,440	$1,785,310
($/MWh)	105.89	106.90
Difference between cost of alternative power and project cost	($1,026,750)	($1,043,620)
($/MWh)	(61.48)	(62.49)

[a] A number in parentheses indicates that the annual project cost is greater than the cost of alternative power.

Table 4-11. Summary of the annual cost of alternative power and annual project costs for alternatives for the Grays Landing Project (Source: staff).

	FFP Missouri 13's Proposal[a]	Staff Alternative
Installed capacity (MW)	12	12
Annual generation (MWh)	47,958	47,958
Annual cost of alternative power	$2,270,330	$2,270,330
($/MWh)	47.34	47.34
Annual project cost	$3,574,130	$3,588,890
($/MWh)	74.53	74.83
Difference between cost of alternative power and project cost	($1,303,800)	($1,318,560)
($/MWh)	(27.19)	(27.49)

[a] A number in parentheses indicates that the annual project cost is greater than the cost of alternative power.

Table 4-12. Summary of the annual cost of alternative power and annual project costs for alternatives for the Maxwell Project (Source: staff).

	Solia 5 Hydroelectric's Proposal[a]	Staff Alternative
Installed capacity (MW)	13	13
Annual generation (MWh)	57,106	57,106
Annual cost of alternative power	$2,703,970	$2,703,970
($/MWh)	47.35	47.35
Annual project cost	$4,116,430	$4,131,200
($/MWh)	72.08	72.34
Difference between cost of alternative power and project cost ($/MWh)	($1,412,460) (24.73)	($1,427,230) (24.99)

[a] A number in parentheses indicates that the annual project cost is greater than the cost of alternative power.

Table 4-13. Summary of the annual cost of alternative power and annual project costs for alternatives for the Charleroi Project (Source: staff).

	Solia 4 Hydroelectric's Proposal[a]	Staff Alternative
Installed capacity (MW)	12	12
Annual generation (MWh)	48,894	48,894
Annual cost of alternative power	$2,265,750	$2,265,750
($/MWh)	46.34	46.34
Annual project cost	$3,548,570	$3,563,340
($/MWh)	72.58	72.88
Difference between cost of alternative power and project cost ($/MWh)	($1,282,820) (26.24)	$1,297,590 (26.54)

[a] A number in parentheses indicates that the annual project cost is greater than the cost of alternative power.

4.2.1 No-action Alternative

Under the no-action alternative, no license(s) would be issued for one or more of the projects, and the proposed project(s) would not be constructed and would not produce any electricity. Under the no-action alternative, the six projects would not be constructed and would not produce any electricity. None of the environmental enhancements would be implemented at each site that is not licensed. The only cost associated with this alternative would be the cost to prepare the license application.

4.2.2 Applicants' Proposals

Opekiska Project

Under FFP Missouri 16's proposal, the Opekiska Project would have an installed capacity of 6 MW and generate an average of 25,606 MWh of electricity annually. The average annual cost of alternative power would be $1,164,300, or $45.47/MWh. In total, the average annual project cost would be $2,038,980, or about $79.63/MWh. Overall, the project would produce power at a cost that is $874,680, or $34.16/MWh, more than the cost of alternative power.

Morgantown Project

Under FFP Missouri 15's proposal, the Morgantown Project would have an installed capacity of 5 MW and generate an average of 19,130 MWh of electricity annually. The average annual cost of alternative power would be $871,950, or $45.58/MWh. In total, the average annual project cost would be $1,837,340, or about $96.05/MWh. Overall, the project would produce power at a cost that is $965,390, or $50.47/MWh, more than the cost of alternative power.

Point Marion Project

Under Solia 8 Hydroelectric's proposal, the Point Marion Project would have an installed capacity of 5 MW and generate an average of 16,701 MWh of electricity annually. The average annual cost of alternative power would be $741,690, or $44.41/MWh. In total, the average annual project cost would be $1,768,440, or about $105.89/MWh. Overall, the project would produce power at a cost that is $1,026,750, or $61.48/MWh, more than the cost of alternative power.

Grays Landing Project

Under FFP Missouri 13's proposal, the Grays Landing Project would have an installed capacity of 12 MW and generate an average of 47,958 MWh of electricity annually. The average annual cost of alternative power would be $2,270,330, or $47.34/MWh. In total, the average annual project cost would be $3,574,130, or about

$74.53/MWh. Overall, the project would produce power at a cost that is $1,303,800, or $27.19/MWh, more than the cost of alternative power.

Maxwell Project

Under Solia 5 Hydroelectric's proposal, the Maxwell Project would have an installed capacity of 13 MW and generate an average of 57,106 MWh of electricity annually. The average annual cost of alternative power would be $2,703,970, or $47.35/MWh. In total, the average annual project cost would be $4,116,430, or about $72.08/MWh. Overall, the project would produce power at a cost that is $1,412,460, or $24.73/MWh, more than the cost of alternative power.

Charleroi Project

Under Solia 4 Hydroelectric's proposal, the Charleroi Project would have an installed capacity of 12 MW and generate an average of 48,894 MWh of electricity annually. The average annual cost of alternative power would be $2,265,750, or $46.34/MWh. In total, the average annual project cost would be $3,548,570, or about $72.58/MWh. Overall, the project would produce power at a cost that is $1,282,820, or $26.24/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative includes the same power generating features as the applicants' proposals and, therefore, would have the same capacity and energy values described above. Tables 4-14 through 4-19 show the respective staff-recommended additions, deletions, and modifications to each applicant's proposed environmental protection and enhancement measures and the estimated cost of each.

Opekiska Project

Under the staff alternative for the Opekiska Project, based on the same capacity and energy attributes as the proposed project, the cost of alternative power would be $1,164,300, or $45.47/MWh. The average annual project cost would be $2,053,400 or about $80.19/MWh. Overall, the project would produce power at a cost which is $889,100 or $34.72/MWh, more than the cost of alternative power.

Morgantown Project

Under the staff alternative for the Morgantown Project, based on the same capacity and energy attributes as the proposed project, the cost of alternative power would be $871,950, or $45.58/MWh. The average annual project cost would be $1,855,060 or about $96.97/MWh. Overall, the project would produce power at a cost which is $983,110 or $51.39/MWh, more than the cost of alternative power.

Point Marion Project

Under the staff alternative for the Point Marion Project, based on the same capacity and energy attributes as the proposed project, the cost of alternative power would be $741,690, or $44.41/MWh. The average annual project cost would be $1,785,310 or about $106.90/MWh. Overall, the project would produce power at a cost which is $1,043,620 or $62.49/MWh, more than the cost of alternative power.

Grays Landing Project

Under the staff alternative for the Grays Landing Project, based on the same capacity and energy attributes as the proposed project, the cost of alternative power would be $2,270,330, or $47.34/MWh. The average annual project cost would be $3,588,890 or about $74.83/MWh. Overall, the project would produce power at a cost which is $1,318,560 or $27.49/MWh, more than the cost of alternative power.

Maxwell Project

Under the staff alternative for the Maxwell Project, based on the same capacity and energy attributes as the proposed project, the cost of alternative power would be $2,703,970, or $47.35/MWh. The average annual project cost would be $4,131,200 or about $72.34/MWh. Overall, the project would produce power at a cost which is $1,427,230 or $24.99/MWh, more than the cost of alternative power.

Charleroi Project

Under the staff alternative for the Charleroi Project, based on the same capacity and energy attributes as the proposed project, the cost of alternative power would be $2,265,750, or $46.34/MWh. The average annual project cost would be $3,563,340 or about $72.88/MWh. Overall, the project would produce power at a cost which is $1,297,590 or $26.54/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Tables 4-14 through 4-19 give the cost of each of the PM&E measures for each of the six projects considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost. All costs are from the applicants unless otherwise noted. All costs are presented in 2016 dollars.

Table 4-14. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Opekiska Project (Source: Staff and FFP Missouri 16).

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Geologic and Soil Resources				
1. Develop and implement an erosion and sedimentation control plan.	Applicant, Staff	$10,130[d]	$1,050[d]	$1,550
Aquatic Resources				
2. Develop and implement a contaminated sediment testing and disposal plan.	Staff	$30,000[e]	$0	$2,550
3. Operate the project in a run-of-release mode.	Applicant, Staff	$0	$0[f]	$0
4. Develop and implement an operation compliance monitoring plan.	Staff	$10,000[g]	$5,000[g]	$4,100
5. Develop and implement a spill prevention, containment, and countermeasures plan independent of the erosion and sedimentation control plan in measure 1 above.	Staff	$10,000[h]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
6. Conduct water quality monitoring during the months of June through September for 3 years after the commencement of project operations.	Applicant	$0	$1,620[i]	$1,050
7. Develop and implement a detailed water quality monitoring plan in consultation with the Corps and West Virginia DEP that includes water quality monitoring during construction and for 3 years of operation during June 1 to October 15.	Staff	$10,000[j]	$9,060[j]	$6,740
8. Conduct post-project construction DO monitoring.	Upper Monongahela River Association, Interior	$0	$18,890[k]	$12,280
9. Conduct continuous water quality monitoring during construction and operation, for the life of the project.	Corps	$0	$25,190[l]	$16,380
10. Provide a minimum bypass flow of 300 cfs during July.	Applicant	$0	$0[m]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
11. Operate the project in a run-of-river mode and provide minimum bypass flows through dam gates or over the dam spillway during all months of the year to protect fish and wildlife habitat.	Interior	$0	$0[m]	$0
12. Provide minimum flows during all months of the year to avoid impacts on DO	West Virginia DNR	$0	$0[m]	$0
13. Comply with the Corps' non-degradation standard for DO and implement measures, such as increasing bypass flow, if the standard is not met.	Upper Monongahela River Association, Ecosophic Strategies	$0	$0[m]	$0
14. Provide an adaptive management approach to maintain existing water quality and aquatic life, including compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.	Corps	$0	$0[m]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
15. Coordinate the timing of construction-related hydraulic changes to minimize potential effects on spawning fish and other aquatic organisms.	Applicant, Staff	$0[n]	$0	$0
16. Install trash racks with a 3-inch clear bar spacing and provide approach velocities of less than 2 fps to reduce impingement or entrainment of fish.	Applicant, Staff	$0[o]	$0	$0
17. Develop appropriate studies to determine the appropriate level of compensation as pursuant to Title 47 Series 5A 6.2.1, which requires compensation for loss of fish caused by impingement or entrainment at FERC-licensed hydro facilities.	West Virginia DNR	$250,000[p]	$0	$21,270
18. Design and implement post-construction fish impingement and entrainment studies, including turbine mortality studies, and if necessary modify the trash rack spacing and approach velocities based on the results.	Interior	$250,000[p]	$0	$21,270

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
19. Design and implement post-construction fish stranding studies for the dam tailrace, extending downstream to the point where the turbine discharge enters the river.	Interior	$10,000[q]	$0	$850
20. Conduct additional freshwater mussel surveys in the section of the Monongahela River beginning 762 meters downstream of the Opekiska Lock and Dam and ending 1.2 kilometers downstream of the lock and dam.	Interior	$40,000[r]	$0	$3,400
21. Conduct biotic monitoring at regular intervals to document local and cumulative effects on aquatic habitats and communities.	Corps	$10,000[s]	$108,730[s]	$71,530
Terrestrial Resources				
22. Develop and implement an avian protection plan consistent with APLIC and FWS guidelines to protect bald eagle and other raptors.	Applicant, Staff	$5,070	$5,070	$3,730

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
23. Develop and implement a transmission line corridor management plan to protect botanical resources along the transmission line.	Applicant	$5,070	$5,070	$3,730
24. Develop a vegetation management plan, which incorporates the applicant's measures from item 23 above to reestablish native vegetation at disturbed sites and manage noxious and invasive plants, expanded to cover all project lands.	Staff	$10,000[t]	$5,000[t]	$4,100
Threatened and Endangered Species				
25. Survey for federally listed mussels in the construction footprint and relocate any listed mussels that are found.	Corps	$10,000[u]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Recreation Resources				
26. Implement the measures described in the recreation resource management plan, including provisions for installing an accessible tailrace fishing platform; eight recreation-designated parking spaces; an accessible canoe portage trail with stairs that lead to the river at the end of the downstream trail; and a portable, accessible restroom.	Applicant, Mon River Town Program, Mon River Trails Conservancy, Upper Monongahela River Association, Staff	$144,000[v]	$3,000[v]	$14,200
27. Develop angler walkways on the riverward sides of the powerhouse, an accessible fishing pier at the end of the existing concrete wall, hand carried boat access to the Hildebrand pool, and submerged rock jetties.	Upper Monongahela River Association	$275,000[w]	$2,000	$24,700

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Land Use and Aesthetic Resources				
28. Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.	Applicant	$0	$0[x]	$0
29. Develop and implement a debris management plan in consultation with the Corps and West Virginia DNR that includes the applicants' proposal in measure 28 above and adds provisions to ensure that trash is sorted, stored, and disposed of appropriately.	Staff	$5,000[y]	$0	$430
Cultural Resources				
30. Prepare an HPMP in accordance with the anticipated PA between the Commission and the West Virginia SHPO.	Applicant, West Virginia SHPO	$15,130	$0	$1,290
31. Implement a PA that requires revision of the draft HPMP to address management of historic properties and unevaluated cultural resources including staff recommendations described in the EA.	Staff	$20,130[z]	$0	$1,710

[a] Costs provided by the applicant unless otherwise noted.

[b] Capital costs typically includes equipment, construction, and licensing and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

[d] Proposed cost includes $10,000 (2013 dollars) for plan development and $5,000 (2013 dollars) per year during three years of project construction. Cost was escalated to 2016 dollars by Staff.

[e] Staff estimated $5,000 for development of the plan and $25,000 for testing.

[f] There is no cost for "run-of-river operation" because the project is designed to operate in this manner. Although the applicant and Interior used the term "run-of-river", we interpret their use of run-of-river to mean "run-of-release." In other words, the project would operate from flows made available (i.e., released) by the Corps.

[g] Staff estimated $10,000 for development of the plan and $5,000 per year for implementation of the plan.

[h] Staff estimated $10,000 for development of the plan.

[i] Cost provided by applicant; $10,000 per year for three years in 2013 dollars. Cost was escalated to 2016 dollars by Staff.

[j] Cost includes $10,000 for plan development, $35,000 per year during 3 years of construction, including turbidity monitoring, and $10,000 per year (2013 dollars) for monitoring June 1 to October 15 during operations for 3 years. Cost was escalated to 2016 dollars by Staff.

[k] Cost prorated to year-round water quality monitoring based on the cost of the applicant's proposed monitoring.

[l] Cost assumes year-round water quality monitoring during construction (3 years) and operation. Cost prorated based on the cost of the applicant's proposed monitoring.

[m] Staff does not assign a cost to a bypass flow regardless of the magnitude because the release or spill of any quantity of water prior to it being made available to the project for generation (run-of-release) would be at the sole discretion of the Corps, and therefore, could not be imposed on the Corps by a license.

[n] Staff estimates that the cost would be negligible.

[o] Cost included in the overall construction cost.

[p] Staff estimated $250,000 to conduct the studies.

[q] Staff estimated $10,000 to conduct the studies.

[r] Staff estimated $40,000 to conduct the surveys.

[s] Staff estimated $10,000 for plan development and $300,000 in year 1 and every 3 years thereafter to conduct the studies.

[t] Staff estimated $10,000 to develop the plan and $5,000 per year to implement the plan.

[u] Staff estimated $10,000 to conduct the survey.

[v] The applicant estimates $144,000 to construct the proposed recreational facilities and $3,000 per year for routine maintenance.

[w] Staff estimated $275,000 to construct the facilities and $2,000 per year for routine maintenance.

[x] Cost would be part of routine operation and maintenance costs.

[y] Staff estimated $5,000 to develop the plan.

[z] Staff estimated that our recommendations would increase the cost of the proposed plan by $5,000. The plan would also include the applicant's proposal to restore areas temporarily affected by construction to preserve resources. Staff assumes the cost for restoring areas after construction is included in the overall construction cost.

Table 4-15. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Morgantown Project (Source: Staff and FFP Missouri 15).

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Geologic and Soil Resources				
1. Develop and implement an erosion and sedimentation control plan.	Applicant, Staff	$10,130[d]	$1,050[d]	$1,550
Aquatic Resources				
2. Develop and implement a contaminated sediment testing and disposal plan.	Staff	$30,000[e]	$0	$2,550
3. Operate the project in a run-of-release mode.	Applicant, Staff	$0	$0[f]	$0
4. Develop and implement an operation compliance monitoring plan.	Staff	$10,000[g]	$5,000[g]	$4,100
5. Develop and implement a spill prevention, containment, and countermeasures plan independent of the erosion and sedimentation control plan in measure 1 above.	Staff	$10,000[h]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
6. Conduct water quality monitoring during the months of June through September for 3 years after the commencement of project operations.	Applicant	$0	$1,620[i]	$1,050
7. Develop and implement a detailed water quality monitoring plan in consultation with the Corps and West Virginia DEP that includes water quality monitoring during construction and for 3 years of operation during June 1 through October 15.	Staff	$10,000[j]	$9,060[j]	$6,740
8. Conduct post-project construction DO monitoring.	Interior	$0	$18,890[k]	$12,280
9. Conduct continuous water quality monitoring during construction and operation for the life of the project.	Corps	$0	$25,190[l]	$16,380
10. Provide a minimum bypass flow of 300 cfs during the month of July.	Applicant	$0	$0[m]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
11. Operate the project in a run-of-river mode and provide minimum bypass flows through dam gates or over the dam spillway during all months of the year to protect fish and wildlife habitat.	Interior	$0	$0[m]	$0
12. Provide minimum flows during all months of the year to avoid impacts on DO	West Virginia DNR	$0	$0[m]	$0
13. Comply with the Corps' non-degradation standard for DO and implement measures, such as increasing bypass flow, if the standard is not met.	Ecosophic Strategies	$0	$0[m]	$0
14. Provide an adaptive management approach to maintain existing water quality and aquatic life, including compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.	Corps	$0	$0[m]	$0
15. Coordinate the timing of construction-related hydraulic changes to minimize potential effects on spawning fish and other aquatic organisms.	Applicant, Staff	$0[n]	$0	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
16. Install trash racks with a 3-inch clear bar spacing and provide approach velocities of less than 2 fps to reduce impingement or entrainment of fish.	Applicant, Staff	$0[o]	$0	$0
17. Develop appropriate studies to determine the appropriate level of compensation as pursuant to Title 47 Series 5A 6.2.1, which requires compensation for loss of fish caused by impingement or entrainment at FERC-licensed hydro facilities.	West Virginia DNR	$250,000[p]	$0	$21,270
18. Design and implement post-construction fish impingement and entrainment studies, including turbine mortality studies, and if necessary, modify the trash rack spacing and approach velocities based on the results of the studies.	Interior	$250,000[p]	$0	$21,270
19. Design and implement post-construction fish stranding studies for the dam tailrace, extending downstream to the point where the turbine discharge enters the river.	Interior	$10,000[q]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
20. Conduct biotic monitoring at regular intervals to document local and cumulative effects on aquatic habitats and communities.	Corps	$10,000[r]	$108,730[r]	$71,530
Terrestrial Resources				
21. Develop and implement an avian protection plan consistent with APLIC and FWS guidelines to protect bald eagle and other raptors.	Applicant, Staff	$5,070	$5,070	$3,730
22. Develop and implement a transmission line corridor management plan to protect botanical resources along the transmission line.	Applicant	$5,070	$5,070	$3,730
23. Develop a vegetation management plan which incorporates the applicant's measures from item 22 above to reestablish native vegetation at disturbed sites and manage noxious and invasive plants, expanded to cover all project lands.	Staff	$10,000[s]	$5,000[s]	$4,100

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Threatened and Endangered Species				
24. Survey for federally listed mussels in the construction footprint and relocate any listed mussels that are found.	Corps	$10,000[t]	$0	$850
Recreation Resources				
25. Implement the measures described in the recreation resource management plan, including constructing two shoreline angler paths (90 feet upstream and 450 feet downstream of the dam), consisting of 4-foot-wide steel stairs extending from the Caperton Trail towards the river, and parking facilities.	Applicant, Staff	$88,000[u]	$1,500[u]	$8,460
26. Develop a canoe and kayak portage.	Mon River Trails Conservancy, Mon River Town Program	$80,000[v]	$1,000[v]	$7,460

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
27. Develop angler walkways on the riverward sides of the powerhouse.	Upper Monongahela River Association, Mon River Trails Conservancy	$75,000[w]	$1,000[w]	$7,030
28. Develop an angler path along the shoreline downstream to the Waterfront Place Hotel, and install submerged rock jetties.	Upper Monongahela River Association	$210,000[x]	$2,000[x]	$19,170
29. Develop a construction mitigation plan for recreation access.	Interior, National Park Service, National Road Heritage Corridor, Mon River Trails Conservancy	$5,000[y]	$0	$430
30. Develop a construction access plan that provides specific construction mitigation measures that address effects on the Caperton Trail and includes a construction schedule.	Staff	$5,000[z]	$0	$430

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
31. An accessible fishing platform and angler path at the tailrace.	Staff	$30,000[aa]	$500[aa]	$2,880
Land Use and Aesthetic Resources				
32. Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.	Applicant, Mon River Trails Conservancy	$0	$0[bb]	$0
33. Develop and implement a debris management plan in consultation with the Corps and West Virginia DNR that includes the applicant's proposal in measure 33 above and adds provisions to ensure trash is sorted, stored, and disposed of appropriately.	Staff	$5,000[cc]	$0	$430
Cultural Resources				
34. Prepare an HPMP in accordance with the anticipated PA between the Commission and the West Virginia SHPO.	Applicant, West Virginia SHPO	$15,130	$0	$1,290

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
35. Implement a PA that requires revision of the HPMP to address the management of historic properties and unevaluated cultural resources including staff recommendations described in this EA.	Staff	$20,130[dd]	$0	$1,710

[a] Costs provided by the applicant unless otherwise noted.

[b] Capital costs typically includes equipment, construction, and licensing and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

[d] Proposed cost includes $10,000 (2013 dollars) for plan development and $5,000 (2013 dollars) per year during three years of project construction. Cost was escalated to 2016 dollars by staff.

[e] Cost of plan would be the same as for the proposed plan, which is included in the overall construction cost, but staff added $25,000 for specific testing requirements.

[f] There is no cost for "run-of-river operation", because the project is designed to operate in this manner. Although the applicant and Interior used the term "run-of-river", we interpret their use of run-of-river to mean "run-of-release." In other words, the project would operate from flows made available (i.e., released) by the Corps.

[g] Staff estimated $10,000 for development of the plan and $5,000 per year for implementation of the plan.

[h] Staff estimated $10,000 for development of the plan.

[i] Cost provided by applicant; $10,000 per year for three years in 2013 dollars. Cost was escalated to 2016 dollars by staff.

[j] Cost includes $10,000 for plan development, $35,000 per year during 3 years of construction, including turbidity monitoring, and $10,000 per year (2013 dollars) for monitoring June 1 to October 15 during operations for 3 years. Cost was escalated to 2016 dollars by staff.

[k] Cost prorated to year-round water quality monitoring based on the cost of the applicant's proposed monitoring.

[l] Cost assumes year-round water quality monitoring during construction (3 years) and operation. Cost prorated based on the cost of the applicant's proposed monitoring.

[m] Staff does not assign a cost to a bypass flow regardless of the magnitude because the release or spill of any quantity of water prior to it being made available to the project for generation (run-of-release) would be at the sole discretion of the Corps, and therefore, could not be imposed on the Corps by a license.

[n] Staff estimates that the cost would be negligible.

[o] Cost included in the overall construction cost.

[p] Staff estimated $250,000 to conduct the studies.

[q] Staff estimated $10,000 to conduct the studies.

[r] Staff estimated $10,000 for plan development and $300,000 in year 1 and every 3 years thereafter to conduct the studies.

[s] Staff estimated $10,000 to develop the plan and $5,000 per year to implement the plan.

[t] Staff estimated $10,000 to conduct the survey.

[u] The applicant estimates $144,000 to construct the proposed recreational facilities and $3,000 per year for routine maintenance.

[v] Staff estimated $80,000 to construct the facilities and $1,000 per year for routine maintenance.

[w] Staff estimated $75,000 to construct the facilities and $1,000 per year for routine maintenance.

[x] Staff estimated $210,000 to construct the facilities and $2,000 per year for routine maintenance.

[y] Staff estimated $5,000 to develop the plan.

[z] Staff estimated $5,000 to develop the plan.

[aa] Staff estimated $30,000 to construct the facilities and $500 per year for routine maintenance. Additional land acquisition costs may be required.

[bb] Cost would be part of routine operation and maintenance cost.

[cc] Staff estimated $5,000 to develop the plan.

[dd] Staff estimated that our recommendations would increase the cost of the proposed plan by $5,000. The plan would also include the applicant's proposal to restore areas temporarily affected by construction to preserve resources. Staff assumes the cost for restoring areas after construction is included in the overall construction cost.

Table 4-16. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Point Marion Project (Source: Staff and Solia 8 Hydroelectric).

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Geologic and Soil Resources				
1. Develop and implement an erosion and sedimentation control plan.	Applicant, Staff	$10,130[d]	$1,050[d]	$1,550
Aquatic Resources				
2. Develop and implement a contaminated sediment testing and disposal plan.	Staff	$30,000[e]	$0	$2,550
3. Operate the project in a run-of-release mode.	Applicant, Interior, Pennsylvania FBC, Staff	$0	$0[f]	$0
4. Develop and implement an operation compliance monitoring plan.	Staff	$10,000[g]	$5,000[g]	$4,100

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
5. Develop and implement a spill prevention, containment, and countermeasures plan independent of the erosion and sedimentation control plan in measure 1 above.	Staff	$10,000[h]	$0	$850
6. Conduct water quality monitoring during the months of June through September for 3 years after the commencement of project operations.	Applicant	$0	$1,620[i]	$1,050
7. Develop and implement a detailed water quality monitoring plan in consultation with the Corps, Pennsylvania DEP, and Pennsylvania FBC that includes water quality monitoring during construction and for 3 years of operation during June 1 through October 15.	Staff	$10,000[j]	$9,060[j]	$7,370
8. Conduct post-project construction DO monitoring.	Pennsylvania FBC, Interior	$0	$18,890[k]	$12,280
9. Conduct continuous water quality monitoring during construction and operation, for the life of the project.	Corps	$0	$25,190[l]	$16,380

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
10. Provide a minimum bypass flow of 300 cfs during the month of July.	Applicant	$0	$0[m]	$0
11. Operate the project in a run-of-river mode and provide minimum bypass flows through dam gates or over the dam spillway during all months of the year to protect fish and wildlife habitat.	Interior	$0	$0[m]	$0
12. Comply with the Corps' non-degradation standard for DO and implement measures, such as increasing bypass flow, if the standard is not met.	Pennsylvania FBC, Ecosophic Strategies	$0	$0[m]	$0
13. Provide an adaptive management approach to maintain existing water quality and aquatic life, including compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.	Corps	$0	$0[m]	$0
14. Coordinate the timing of construction-related hydraulic changes to minimize potential effects on spawning fish and other aquatic organisms.	Applicant, Staff	$0[n]	$0	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
15. Install trash racks with a 3-inch clear bar spacing and provide approach velocities of less than 2 fps to reduce impingement or entrainment of fish.	Applicant, Staff	$0[o]	$0	$0
16. Design and implement post-construction fish impingement and entrainment studies, including turbine mortality studies, and if necessary, modify the trash rack spacing and approach velocities based on the results of the studies.	Interior, Pennsylvania FBC	$250,000[p]	$0	$21,270
17. Design and implement post-construction fish stranding studies for the dam tailrace, extending downstream to the point where the turbine discharge enters the river.	Interior	$10,000[q]	$0	$850
18. Conduct biotic monitoring at regular intervals to document local and cumulative effects on aquatic habitats and communities.	Corps	$10,000[r]	$108,730[r]	$71,530

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Terrestrial Resources				
19. Develop and implement an avian protection plan consistent with APLIC and FWS guidelines to protect bald eagle and other raptors.	Applicant, Staff	$5,070	$5,070	$3,730
20. Develop and implement a transmission line corridor management plan to protect botanical resources along the transmission line.	Applicant	$5,070	$5,070	$3,730
21. Develop a vegetation management plan, which incorporates the applicant's measures from item 20 above to reestablish native vegetation at disturbed sites and manage noxious and invasive plants, expanded to cover all project lands.	Staff	$10,000[s]	$5,000[s]	$4,100
Threatened and Endangered Species				
22. Survey for federally listed mussels in the construction footprint and relocate any listed mussels that are found.	Corps	$20,000[t]	$0	$1,700

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
23. Conduct tree cutting, tree inundation, and prescribed burning between November 15 and March 31 to avoid killing or injuring endangered bats; and where possible, implement the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.	Applicant, Staff	$0	$0[u]	$0
Recreation Resources				
24. Implement the measures described in the recreation resource management plan, including constructing a shoreline angler path 450 feet downstream of the dam consisting of a 5-foot-wide wooden trail and 4-foot-wide steel stairs connecting the wooden trail to the river.	Applicant, Staff	$112,000[v]	$1,000[v]	$10,180
25. Develop a construction access plan that provides specific construction mitigation measures that address effects to the Sheepskin Trail, and includes a construction schedule.	Staff	$5,000[w]	$0	$430

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
26. Provide an access road that would not use the recreation trail.	Point Marion Borough, National Road Heritage Corridor	$0[x]	$0	$0
27. Develop a canoe and kayak portage.	Mon River Trails Conservancy, Mon River Town Program	$80,000[y]	$1,000[y]	$7,460
28. Install a fishing platform at the end of the proposed angler path.	Staff	$20,000[z]	$500[z]	$2,030
29. Study the potential loss of angler access and use after the installation of power facilities and mitigate if a loss of angler use would occur.	Pennsylvania FBC	$10,000[aa]	$0	$850
30. Develop temporary fishing access that could be used during construction.	Mon River Trails Conservancy	$0[bb]	$0	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
31. Develop a mitigation plan that would include provisions for a fishing platform at the dam with road access, parking, and restrooms.	Pennsylvania FBC, Point Marion Borough, National Road Heritage Corridor, Mon River Town Program	$100,000[cc]	$1,500[bb]	$9,480
32. Provide recreational access for anglers that does not require crossing the construction access.	National Park Service, Mon River Trails Conservancy, Point Marion Borough	$0[dd]	$0	$0
33. Develop a construction mitigation plan for recreation access.	Interior, Point Marion Borough	$5,000[ee]	$0	$430
Land Use and Aesthetic Resources				
34. Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.	Applicant	$0	$0[ff]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
35. Develop and implement a debris management plan in consultation with the Corps and Pennsylvania FBC that includes the applicants' proposal in measure 33 above and adds provisions to ensure trash is sorted, stored, and disposed of appropriately.	Staff	$5,000[gg]	$0	$430
Cultural Resources				
36. Prepare an HPMP in accordance with the anticipated PA between the Commission and the Pennsylvania SHPO.	Applicant, Pennsylvania SHPO	$15,130	$0	$1,290
37. Implement a PA that requires revision of the draft HPMP to address the management of historic properties and unevaluated cultural resources including staff recommendations described in this EA.	Staff	$20,130[hh]	$0	$1,710

[a] Costs provided by the applicant unless otherwise noted.

[b] Capital costs typically includes equipment, construction, and licensing and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

[d] Proposed cost includes $10,000 (2013 dollars) for plan development and $5,000 (2013 dollars) per year during three years of project construction. Cost was escalated to 2016 dollars by staff.

[e] Cost of plan would be the same as for the proposed plan, which is included in the overall construction cost, but staff added $25,000 for specific testing requirements.

[f] There is no cost for "run-of-river operation", because the project is designed to operate in this manner. Although the applicant, Interior and Pennsylvania FBC used the term "run-of-river", we interpret their use of run-of-river to mean "run-of-release." In other words, the project would operate from flows made available (i.e., released) by the Corps.

[g] Staff estimated $10,000 for development of the plan and $5,000 per year for implementation of the plan.

[h] Staff estimated $10,000 for development of the plan.

[i] Cost provided by applicant; $10,000 per year for three years in 2013 dollars. Cost was escalated to 2016 dollars by staff.

[j] Cost includes $10,000 for plan development, $35,000 per year during 3 years of construction, including turbidity monitoring, and $10,000 per year (2013 dollars) for monitoring June 1 to October 15 during operations for 3 years. Cost was escalated to 2016 dollars by staff.

[k] Cost prorated to year-round water quality monitoring based on the cost of the applicant's proposed monitoring.

[l] Cost assumes year-round water quality monitoring during construction (3 years) and operation. Cost prorated based on the cost of the applicant's proposed monitoring.

[m] Staff does not assign a cost to a bypass flow regardless of the magnitude because the release or spill of any quantity of water prior to it being made available to the project for generation (run-of-release) would be at the sole discretion of the Corps, and therefore, could not be imposed on the Corps by a license.

[n] Staff estimates that the cost would be negligible.

[o] Cost included in the overall construction cost.

[p] Staff estimated $250,000 to conduct the studies.

[q] Staff estimated $10,000 to conduct the studies.

[r] Staff estimated $10,000 for plan development and $300,000 in year 1 and every 3 years thereafter to conduct the studies.

[s] Staff estimated $10,000 to develop the plan and $5,000 per year to implement the plan.

[t] Staff estimated $20,000 to conduct the survey.

[u] Staff estimates there would be no additional cost for this measure.

[v] The applicant estimates $112,000 to construct the proposed recreational facilities and $1,000 per year for routine maintenance.

[w] Staff estimated $5,000 to develop the plan.

[x] No specifics were provided upon which to estimate a cost.

[y] Staff estimated $80,000 to construct the facilities and $1,000 per year for routine maintenance.

[z] Staff estimated $20,000 to construct the facilities.

[aa] Staff estimated $10,000 to conduct the study.

[bb] No specifics were provided upon which to estimate a cost.

[cc] Staff estimated $100,000 to develop the plan and construct the facilities.

[dd] No specifics were provided upon which to estimate a cost.

[ee] Staff estimated $5,000 to develop the plan.

[ff] Cost would be part of routine operation and maintenance cost.

[gg] Staff estimated $5,000 to develop the plan.

[hh] Staff estimated that our recommendations would increase the cost of the proposed plan by $5,000. The plan would also include the applicant's proposal to restore areas temporarily affected by construction to preserve resources. Staff assumes the cost for restoring areas after construction is included in the overall construction cost.

Table 4-17. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Grays Landing Project (Source: Staff and FFP Missouri 13).

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Geologic and Soil Resources				
1. Develop and implement an erosion and sedimentation control plan.	Applicant, Staff	$10,130[d]	$1,050[d]	$1,550
Aquatic Resources				
2. Develop and implement a contaminated sediment testing and disposal plan.	Staff	$30,000[e]	$0	$2,550
3. Operate the project in a run-of-release mode.	Applicant, Pennsylvania FBC, Staff	$0	$0[f]	$0
4. Develop and implement an operation compliance monitoring plan.	Staff	$10,000[g]	$5,000[g]	$4,100
5. Develop and implement a spill prevention, containment, and countermeasures plan independent of the erosion and sedimentation control plan in measure 1 above.	Staff	$10,000[h]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
6. Conduct water quality monitoring during the months of June through September for 3 years after the commencement of project operations.	Applicant	$0	$1,620[i]	$1,050
7. Develop and implement a detailed water quality monitoring plan in consultation with the Corps, Pennsylvania DEP, and Pennsylvania FBC, that includes water quality monitoring during construction and for 3 years of operation during June 1 through October 15.	Staff	$10,000[j]	$9,060[j]	$6,740
8. Conduct post-project construction DO monitoring.	Pennsylvania FBC, Interior	$0	$18,890[k]	$12,280
9. Conduct continuous water quality monitoring during construction and operation, for the life of the project.	Corps	$0	$25,190[l]	$16,380
10. Provide a minimum bypass flow of 500 cfs during the month of July and 50 cfs in August through June.	Applicant	$0	$0[m]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
11. Operate the project in a run-of-river mode and provide minimum bypass flows through dam gates or over the dam spillway during all months of the year to protect fish and wildlife habitat.	Interior	$0	$0[m]	$0
12. Comply with the Corps' non-degradation standard for DO and implement measures, such as increasing bypass flow, if the standard is not met.	Pennsylvania FBC, Ecosophic Strategies	$0	$0[m]	$0
13. Provide an adaptive management approach to maintain existing water quality and aquatic life, including compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.	Corps	$0	$0[m]	$0
14. Coordinate the timing of construction-related hydraulic changes to minimize potential effects on spawning fish and other aquatic organisms.	Applicant, Staff	$0[n]	$0	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
15. Install trash racks with a 3-inch clear bar spacing and provide approach velocities of less than 2 fps to reduce impingement or entrainment of fish.	Applicant, Staff	$0[o]	$0	$0
16. Design and implement post-construction fish impingement and entrainment studies, including turbine mortality studies, and if necessary, modify the trash rack spacing and approach velocities based on the results.	Interior, Pennsylvania FBC	$250,000[p]	$0	$21,270
17. Design and implement post-construction fish stranding studies for the dam tailrace, extending downstream to the point where the turbine discharge enters the river.	Interior	$10,000[q]	$0	$850
18. Conduct biotic monitoring at regular intervals to document local and cumulative effects on aquatic habitats and communities.	Corps	$10,000[r]	$108,730[r]	$71,530

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Terrestrial Resources				
19. Develop and implement an avian protection plan consistent with APLIC and FWS guidelines to protect bald eagle and other raptors.	Applicant, Staff	$5,070	$5,070	$3,730
20. Develop and implement a transmission line corridor management plan to protect botanical resources along the transmission line.	Applicant	$5,070	$5,070	$3,730
21. Avoid directly impacting the mapped locations of toothcap, scarlet ammannia, hooded arrowhead by keeping a buffer of 50 feet or greater during construction.	Applicant, Pennsylvania DCNR	$0	$0[s]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
22. Develop a vegetation management plan, which incorporates the applicant's measures from item 20 and 21 above to reestablish native vegetation at disturbed sites and manage noxious and invasive plants and protect sensitive plants during construction. Extend measures from item 20 to cover all project lands and ground-disturbing maintenance activities, and include consultation with Pennsylvania DCNR to identify potential mitigation measures for effects of project operations directly affecting the mapped locations of toothcap, scarlet ammannia, and hooded arrowhead.	Staff	$10,000[t]	$5,000[t]	$4,100
Threatened and Endangered Species				
23. Survey for federally listed mussels in the construction footprint and relocate any listed mussels that are found.	Corps	$10,000[u]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
24. Conduct tree cutting, tree inundation, and prescribed burning between November 15 and March 31 to avoid killing or injuring endangered bats; and where possible, implement the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.	Applicant, Staff	$0	$0[v]	$0
Recreation Resources				
25. Develop a canoe and kayak portage.	Mon River Trails Conservancy, Mon River Town Program	$80,000[w]	$1,000[w]	$7,460
26. Study the potential loss of angler access and use after the installation of power facilities and mitigate if a loss of angler use would occur.	Pennsylvania FBC	$10,000[x]	$0	$850
27. Develop an access improvement plan for the Grays Landing Project that provides shoreline access downstream of the dam.	Staff	$4,000[y]	$0	$340

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Land Use and Aesthetic Resources				
28. Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.	Applicant	$0	$0[z]	$0
29. Develop and implement a debris management plan in consultation with the Corps and Pennsylvania FBC that includes the applicants' proposal in measure 28 above and adds provisions to ensure trash is sorted, stored, and disposed of appropriately.	Staff	$5,000[aa]	$0	$430
Cultural Resources				
30. Prepare an HPMP in accordance with the anticipated PA between the Commission and the Pennsylvania SHPO.	Applicant, Pennsylvania SHPO	$15,130	$0	$1,290

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
31. Implement a PA that requires revision of the draft HPMP to address the management of historic properties and unevaluated cultural resources including staff recommendations described in this EA.	Staff	$20,130[bb]	$0	$1,710

[a] Costs provided by the applicant unless otherwise noted.

[b] Capital costs typically includes equipment, construction, and licensing and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

[d] Proposed cost includes $10,000 (2013 dollars) for plan development and $5,000 (2013 dollars) per year during three years of project construction. Cost was escalated to 2016 dollars by staff.

[e] Cost of plan would be the same as for the proposed plan, which is included in the overall construction cost, but staff added $25,000 for specific testing requirements.

[f] There is no cost for “run-of-river operation”, because the project is designed to operate in this manner. Although the applicant, Interior and Pennsylvania FBC used the term “run-of-river”, we interpret their use of run-of-river to mean “run-of-release.” In other words, the project would operate from flows made available (i.e., released) by the Corps.

[g] Staff estimated $10,000 for development of the plan and $5,000 per year for implementation of the plan.

[h] Staff estimated $10,000 for development of the plan.

[i] Cost provided by applicant; $10,000 per year for three years in 2013 dollars. Cost was escalated to 2016 dollars by Staff.

[j] Cost includes $10,000 for plan development, $35,000 per year during 3 years of construction, including turbidity monitoring, and $10,000 per year (2013 dollars) for monitoring June 1 to October 15 during operations for 3 years. Cost was escalated to 2016 dollars by staff.

[k] Cost prorated to year-round water quality monitoring based on the cost of the applicant's proposed monitoring.

[l] Cost assumes year-round water quality monitoring during construction (3 years) and operation. Cost prorated based on the cost of the applicant's proposed monitoring.

[m] Staff does not assign a cost to a bypass flow regardless of the magnitude because the release or spill of any quantity of water prior to it being made available to the project for generation (run-of-release) would be at the sole discretion of the Corps, and therefore, could not be imposed on the Corps by a license.

[n] Staff estimated that the cost would be negligible.

[o] Cost included in the overall construction cost.

[p] Staff estimated $250,000 to conduct the studies.

[q] Staff estimated $10,000 to conduct the studies.

[r] Staff estimated $10,000 for plan development and $300,000 in year 1 and every 3 years thereafter to conduct the studies.

[s] Staff estimated $10,000 to develop the plan and $5,000 per year to implement the plan.

[t] There would be no costs associated with avoidance measures.

[u] Staff estimates there would be no additional cost for this measure.

[v] Staff estimated $10,000 to conduct the survey.

[w] Staff estimated $80,000 to construct the facilities and $1,000 per year for routine maintenance.

[x] Staff estimated $10,000 to conduct the study.

[y] Staff estimated $4,000 for the development of, and consultation for, the plan.

[z] Cost would be part of routine operation and maintenance cost.

[aa] Staff estimated $5,000 to develop the plan.

[bb] Staff estimated that our recommendations would increase the cost of the proposed plan by $5,000. The plan would also include the applicant's proposal to restore areas temporarily affected by construction to preserve resources. Staff assumes the cost for restoring areas after construction is included in the overall construction cost.

Table 4-18. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Maxwell Project (Source: Staff and Solia 5 Hydroelectric).

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Geologic and Soil Resources				
1. Develop and implement an erosion and sedimentation control plan.	Applicant, Staff	$10,130[d]	$1,050[d]	$1,550
Aquatic Resources				
2. Develop and implement a contaminated sediment testing and disposal plan.	Staff	$30,000[e]	$0	$2,550
3. Operate the project in a run-of-release mode.	Applicant, Pennsylvania FBC, Staff	$0	$0[f]	$0
4. Develop and implement an operation compliance monitoring plan.	Staff	$10,000[g]	$5,000[g]	$4,100
5. Develop and implement a spill prevention, containment, and countermeasures plan independent of the erosion and sedimentation control plan in measure 1 above.	Staff	$10,000[h]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
6. Conduct water quality monitoring during the months of June through September for 3 years after the commencement of project operations.	Applicant	$0	$1,620[i]	$1,050
7. Develop and implement a detailed water quality monitoring plan in consultation with the Corps, Pennsylvania DEP, and Pennsylvania FBC that includes water quality monitoring during construction and for 3 years of operation during June 1 through October 15.	Staff	$10,000[j]	$9,060[j]	$6,740
8. Conduct post-project construction DO monitoring.	Pennsylvania FBC, Interior	$0	$18,190[k]	$12,280
9. Conduct continuous water quality monitoring during construction and operation, for the life of the project.	Corps	$0	$25,190[l]	$16,380
10. Provide a minimum bypass flow of 500 cfs during the month of July.	Applicant	$0	$0[m]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
11. Operate the project in a run-of-river mode and provide minimum bypass flows through dam gates or over the dam spillway during all months of the year to protect fish and wildlife habitat.	Interior	$0	$0[m]	$0
12. Comply with the Corps' non-degradation standard for DO and implement measures, such as increasing bypass flow, if the standard is not met.	Pennsylvania FBC, Ecosophic Strategies, Corps	$0	$0[m]	$0
13. Provide an adaptive management approach to maintain existing water quality and aquatic life, including compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.	Corps	$0	$0[m]	$0
14. Coordinate the timing of construction-related hydraulic changes to minimize potential effects on spawning fish and other aquatic organisms.	Applicant, Staff	$0[n]	$0	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
15. Install trash racks with a 3-inch clear bar spacing and provide approach velocities of less than 2 fps to reduce impingement or entrainment of fish.	Applicant, Staff	$0[o]	$0	$0
16. Design and implement post-construction fish impingement and entrainment studies, including turbine mortality studies, and if necessary, modify the trash rack spacing and approach velocities based on the results.	Interior, Pennsylvania FBC	$250,000[p]	$0	$21,270
17. Design and implement post-construction fish stranding studies for the dam tailrace, extending downstream to the point where the turbine discharge enters the river.	Interior	$10,000[q]	$0	$850
18. Conduct biotic monitoring at regular intervals to document local and cumulative effects on aquatic habitats and communities.	Corps	$10,000[r]	$108,730[r]	$71,530

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Terrestrial Resources				
19. Develop and implement an avian protection plan consistent with APLIC and FWS guidelines to protect bald eagle and other raptors.	Applicant, Staff	$5,070	$5,070	$3,730
20. Develop and implement a transmission line corridor management plan to protect botanical resources along the transmission line.	Applicant	$5,070	$5,070	$3,730
21. Develop a vegetation management plan, which incorporates the applicant's measures from item 20 above to reestablish native vegetation at disturbed sites and manage noxious and invasive plants, expanded to cover all project lands.	Staff	$10,000[s]	$5,000[s]	$4,100
Threatened and Endangered Species				
22. Survey for federally listed mussels in the construction footprint and relocate any listed mussels that are found.	Corps	$15,000[t]	$0	$1,280

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
23. Conduct tree cutting, tree inundation, and prescribed burning between November 15 and March 31 to avoid killing or injuring endangered bats; and where possible, implement the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.	Applicant, Staff	$0	$0[u]	$0
Recreation Resources				
24. Develop a canoe and kayak portage.	Mon River Trails Conservancy, Mon River Town Program	$80,000[v]	$1,000[v]	$7,460
25. Study the potential loss of angler access and use after the installation of power facilities mitigate if a loss of angler use would occur.	Pennsylvania FBC	$10,000[w]	$0	$850
26. Develop an access improvement plan for the Maxwell Project that provides shoreline access downstream of the dam.	Staff	$4,000[x]	$0	$340

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Land Use and Aesthetic Resources				
27. Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.	Applicant	$0	$0[y]	$0
28. Develop and implement a debris management plan in consultation with the Corps and Pennsylvania FBC that includes the applicants' proposal in measure 25 above and adds provisions to ensure trash is sorted, stored, and disposed of appropriately.	Staff	$5,000[z]	$0	$430
Cultural Resources				
29. Prepare an HPMP in accordance with the anticipated PA between the Commission and the Pennsylvania SHPO.	Applicant, Pennsylvania SHPO	$15,130	$0	$1,290
30. Implement a PA that requires revision of the HPMP to address the management of historic properties and unevaluated cultural resources including staff recommendations described in this EA.	Staff	$20,130[aa]	$0	$1,710

[a] Costs provided by the applicant unless otherwise noted.

[b] Capital costs typically includes equipment, construction, and licensing and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

[d] Proposed cost includes $10,000 (2013 dollars) for plan development and $5,000 (2013 dollars) per year during three years of project construction. Cost was escalated to 2016 dollars by staff.

[e] Cost of plan would be the same as for the proposed plan, which is included in the overall construction cost, but staff added $25,000 for specific testing requirements.

[f] There is no cost for "run-of-river operation", because the project is designed to operate in this manner. Although the applicant, Interior and Pennsylvania FBC used the term "run-of-river", we interpret their use of run-of-river to mean "run-of-release." In other words, the project would operate from flows made available (i.e., released) by the Corps.

[g] Staff estimated $10,000 for development of the plan and $5,000 per year for implementation of the plan.

[h] Staff estimated $10,000 for development of the plan.

[i] Cost provided by applicant; $10,000 per year for three years in 2013 dollars. Cost was escalated to 2016 dollars by staff.

[j] Cost includes $10,000 for plan development, $35,000 per year during 3 years of construction, including turbidity monitoring, and $10,000 per year (2013 dollars) for monitoring June 1 to October 15 during operations for 3 years. Cost was escalated to 2016 dollars by staff.

[k] Cost prorated to year-round water quality monitoring based on the cost of the applicant's proposed monitoring.

[l] Cost assumes year-round water quality monitoring during construction (3 years) and operation. Cost prorated based on the cost of the applicant's proposed monitoring.

[m] Staff does not assign a cost to a bypass flow regardless of the magnitude because the release or spill of any quantity of water prior to it being made available to the project for generation (run-of-release) would be at the sole discretion of the Corps, and therefore, could not be imposed on the Corps by a license.

[n] Staff estimates that the cost would be negligible.

[o] Cost included in the overall construction cost.

[p] Staff estimated $250,000 to conduct the studies.

[q] Staff estimated $10,000 to conduct the studies.

[r] Staff estimated $10,000 for plan development and $300,000 in year 1 and every 3 years thereafter to conduct the studies.

[s] Staff estimated $10,000 to develop the plan and $5,000 per year to implement the plan.

[t] Staff estimated $15,000 to conduct the survey.

[u] Staff estimates there would be no additional cost for this measure.

[v] Staff estimated $80,000 to construct the facilities and $1,000 per year for routine maintenance.

[w] Staff estimated $10,000 to conduct the study.

[x] Staff estimated $4,000 for the development of, and consultation for, the plan.

[y] Cost would be part of routine operation and maintenance cost.

[z] Staff estimated $5,000 to develop the plan.

[aa] Staff estimated that our recommendations would increase the cost of the proposed plan by $5,000. The plan would also include the applicant's proposal to restore areas temporarily affected by construction to preserve resources. Staff assumes the cost for restoring areas after construction is included in the overall construction cost.

Table 4-19. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Charleroi Project (Source: Staff and Solia 4 Hydroelectric).

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Geologic and Soil Resources				
1. Develop and implement an erosion and sedimentation control plan.	Applicant, Staff	$10,130[d]	$1,050[d]	$1,550
Aquatic Resources				
2. Develop and implement a contaminated sediment testing and disposal plan.	Staff	$30,000[e]	$0	$2,550
3. Operate the project in a run-of-release mode.	Applicant, Pennsylvania FBC, Staff	$0	$0[f]	$0
4. Develop and implement an operation compliance monitoring plan.	Staff	$10,000[g]	$5,000[g]	$4,100
5. Develop and implement a spill prevention, containment, and countermeasures plan independent of the erosion and sedimentation control plan in measure 1 above.	Staff	$10,000[h]	$0	$850

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
6. Conduct water quality monitoring during the months of June through September for 3 years after the commencement of project operations.	Applicant	$0	$1,620[i]	$1,050
7. Develop and implement a detailed water quality monitoring plan in consultation with the Corps and West Virginia DEP that includes water quality monitoring during construction and for 3 years of operation during June 1 through October 15.	Staff	$10,000[j]	$9,060[j]	$6,740
8. Conduct post-project construction DO monitoring.	Pennsylvania FBC, Interior	$0	$18,890[k]	$12,280
9. Conduct continuous water quality monitoring during construction and operation, for the life of the project.	Corps	$0	$25,190[l]	$16,380
10. Provide a minimum bypass flow of 500 cfs during the month of July.	Applicant	$0	$0[m]	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
11. Operate the project in a run-of-river mode and provide minimum bypass flows through dam gates or over the dam spillway during all months of the year to protect fish and wildlife habitat.	Interior	$0	$0[m]	$0
12. Comply with the Corps' non-degradation standard for DO and implement measures, such as increasing bypass flow, if the standard is not met.	Pennsylvania FBC, Ecosophic Strategies, Corps	$0	$0[m]	$0
13. Provide an adaptive management approach to maintain existing water quality and aquatic life, including compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.	Corps	$0	$0[m]	$0
14. Coordinate the timing of construction-related hydraulic changes to minimize potential effects on spawning fish and other aquatic organisms.	Applicant, Staff	$0[n]	$0	$0

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
15. Install trash racks with a 3-inch clear bar spacing and provide approach velocities of less than 2 fps to reduce impingement or entrainment of fish.	Applicant, Staff	$0[o]	$0	$0
16. Design and implement post-construction fish impingement and entrainment studies, including turbine mortality studies, and if necessary, modify the trash rack spacing and approach velocities based on the results of the studies.	Interior, Pennsylvania FBC	$250,000[p]	$0	$21,270
17. Design and implement post-construction fish stranding studies for the dam tailrace, extending downstream to the point where the turbine discharge enters the river.	Interior	$10,000[q]	$0	$850
18. Conduct biotic monitoring at regular intervals to document local and cumulative effects on aquatic habitats and communities.	Corps	$10,000[r]	$108,730[r]	$71,530

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Terrestrial Resources				
19. Develop and implement an avian protection plan consistent with APLIC and FWS guidelines to protect bald eagle and other raptors.	Applicant, Staff	$5,070	$5,070	$3,730
20. Develop and implement a transmission line corridor management plan to protect botanical resources along the transmission line.	Applicant	$5,070	$5,070	$3,730
21. Develop a vegetation management plan, which incorporates the applicant's measures from item 21 above to reestablish native vegetation at disturbed sites and manage noxious and invasive plants, expanded to cover all project lands.	Staff	$10,000[s]	$5,000[s]	$4,100
Threatened and Endangered Species				
22. Survey for federally listed mussels in the construction footprint and relocate any listed mussels that are found.	Corps	$15,000[t]	$0	$1,280

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
23. Conduct tree cutting, tree inundation, and prescribed burning between November 15 and March 31 to avoid killing or injuring endangered bats; and where possible, implement the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.	Applicant, Interior, Staff	$0	$0[u]	$0
Recreation Resources				
24. Develop a canoe and kayak portage.	Mon River Trails Conservancy, Mon River Town Program	$80,000[v]	$1,000[v]	$7,460
25. Study the potential loss of angler access and use after the installation of power facilities and mitigate if a loss of angler use would occur.	Pennsylvania FBC	$10,000[w]	$0	$850
26. Develop an access improvement plan for the Charleroi Project that provides shoreline access downstream of the dam.	Staff	$4,000[x]	$0[x]	$340

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
Land Use and Aesthetic Resources				
27. Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.	Applicant	$0	$0[y]	$0
28. Develop and implement a debris management plan in consultation with the Corps and Pennsylvania FBC that includes the applicants' proposal in measure 27 above and adds provisions to ensure trash is sorted, stored, and disposed of appropriately.	Staff	$5,000[z]	$0	$430
Cultural Resources				
29. Prepare an HPMP in accordance with the anticipated PA between the Commission and the Pennsylvania SHPO.	Applicant, Pennsylvania SHPO	$15,130	$0	$1,290

Enhancement/Mitigation Measure	Entity	Capital Cost[a,b] (2016$)	Annual Cost[a,c] (2016$)	Levelized Annual Cost (2016$)
30. Implement a PA that requires revision of the draft HPMP to address the management of historic properties and unevaluated cultural resources including staff recommendations described in this EA.	Staff	$20,130[aa]	$0	$1,710

[a] Costs provided by the applicant unless otherwise noted.

[b] Capital costs typically includes equipment, construction, and licensing and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

[d] Proposed cost includes $10,000 (2013 dollars) for plan development and $5,000 (2013 dollars) per year during three years of project construction. Cost was escalated to 2016 dollars by staff.

[e] Cost of plan would be the same as for the proposed plan, which is included in the overall construction cost, but staff added $25,000 for specific testing requirements.

[f] There is no cost for "run-of-river operation," because the project is designed to operate in this manner. Although the applicant, Interior and Pennsylvania FBC used the term "run-of-river," we interpret their use of run-of-river to mean "run-of-release." In other words, the project would operate from flows made available (i.e., released) by the Corps.

[g] Staff estimated $10,000 for development of the plan and $5,000 per year for implementation of the plan.

[h] Staff estimated $10,000 for development of the plan.

[i] Cost provided by applicant; $10,000 per year for three years in 2013 dollars. Cost was escalated to 2016 dollars by staff.

[j] Cost includes $10,000 for plan development, $35,000 per year during 3 years of construction, including turbidity monitoring, and $10,000 per year (2013 dollars) for monitoring June 1 to October 15 during operations for 3 years. Cost was escalated to 2016 dollars by staff.

[k] Cost prorated to year-round water quality monitoring based on the cost of the applicant's proposed monitoring.

[l] Cost assumes year-round water quality monitoring during construction (3 years) and operation. Cost prorated based on the cost of the applicant's proposed monitoring.

[m] Staff does not assign a cost to a bypass flow regardless of the magnitude because the release or spill of any quantity of water prior to it being made available to the project for generation (run-of-release) would be at the sole discretion of the Corps, and therefore, could not be imposed on the Corps by a license.

[n] Staff estimates the cost would be negligible.

[o] Cost included in the overall construction cost.

[p] Staff estimated $250,000 to conduct the studies.

[q] Staff estimated $10,000 to conduct the studies.

[r] Staff estimated $10,000 for plan development and $300,000 in year 1 and every 3 years thereafter to conduct the studies.

[s] Staff estimated $10,000 to develop the plan and $5,000 per year to implement the plan.

[t] Staff estimated $15,000 to conduct the survey.

[u] Staff estimates there would be no additional cost for this measure.

[v] Staff estimated $80,000 to construct the facilities and $1,000 per year for routine maintenance.

[w] Staff estimated $10,000 to conduct the study.

[x] Staff estimated $4,000 for the development of, and consultation for, the plan.

[y] Cost would be part of routine operation and maintenance cost.

[z] Staff estimated $5,000 to develop the plan.

[aa] Staff estimated that our recommendations would increase the cost of the proposed plan by $5,000. The plan would also include the applicant's proposal to restore areas temporarily affected by construction to preserve resources. Staff assumes the cost for restoring areas after construction is included in the overall construction cost.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any licenses issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the six Monongahela River Projects. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on these projects and our review of the environmental and economic effects of the proposed projects and their alternatives, we selected the staff alternative as the preferred alternative for each of the Monongahela River Projects. The staff alternative includes elements of the applicants' proposals with some additional staff-recommended measures. We recommend this alternative because: (1) issuance of an original license for each project would allow the applicants to operate the projects as economically beneficial and dependable sources of electrical energy; (2) the combined 53 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative in all six cases would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance environmental resources affected by the proposed projects.

In the following section, we make recommendations for which environmental measures proposed by FFP Missouri 16, FFP Missouri 15, Solia 8 Hydroelectric, FFP Missouri 13, Solia 5 Hydroelectric, and Solia 4 Hydroelectric or recommended by agencies or other entities should be included in any licenses issued for the projects. In addition to the applicants' proposed environmental measures listed below, we recommend additional staff-recommended environmental measures to be included in any licenses issued for the projects.

5.1.1 Measures Proposed by the Applicants

Based on our environmental analysis of the applicants' proposals in section 3.0, *Environmental Effects*, and the costs presented in section 4.0, *Developmental Analysis*, we recommend the following environmental measures proposed by the applicants to protect and enhance environmental resources and believe these measures would be worth their cost. Unless otherwise noted, each measure applies to all six projects.

- Develop an erosion and sedimentation control plan in consultation with the Corps and either the Pennsylvania DEP or West Virginia DNR, as appropriate, that includes procedures and BMPs to reduce runoff and sedimentation during construction and final stabilization.

- Operate in a run-of-release mode to avoid project-related impacts on the Corps' operation of its facilities.

- Install a trash rack with 3-inch clear bar spacing, and provide approach velocities of less than 2 fps to mitigate for the entrainment and impingement of fish.

- When warranted and to the extent feasible, coordinate the timing of any construction-related hydraulic changes, such as changes in flow direction, to minimize potential effects on spawning fish and other aquatic organisms downstream of the project.

- At Grays Landing, protect sensitive plants by: providing 50-foot protection buffers around mapped locations of toothcup, scarlet ammannia, and hooded arrowhead and restricting the use of herbicides and construction activities in these areas; mapping and avoiding disturbance to populations of sourwood; fencing buffered habitat during construction; making sure personnel are aware of the locations of sensitive plants; consulting with Pennsylvania DCNR if protection buffers less than 50 feet are needed; and filing a map depicting the locations of buffer areas and limits of disturbance.

- Develop an avian protection plan consistent with APLIC and FWS guidelines that includes provisions for protecting bald eagles and other raptors from project-related effects.

- Develop a transmission line corridor management plan that includes provisions for protecting botanical resources from project-related effects and controlling invasive species along the transmission line ROWs.

- Follow all agency-recommended avoidance measures for federally listed bat species documented at the Charleroi, Maxwell, Grays Landing, and Point Marion Projects, including conducting tree cutting, tree inundation, and prescribed burning only between November 15 and March 31; and where possible, implementing the FWS Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting.

- Implement a recreation resource management plan at the Opekiska Project with provisions for installing an accessible tailrace fishing platform; eight recreation-designated parking spaces; an accessible canoe portage trail with stairs that lead to the river at the end of the downstream trail; and a portable, accessible restroom.

- Implement a recreation resource management plan at the Morgantown Project with provisions for installing two shoreline angler paths (90 feet upstream and 450 feet downstream of the dam), consisting of 4-foot-wide steel stairs extending from the Caperton Trail towards the river; and parking facilities.

- Implement a recreation resource management plan at the Point Marion Project with provisions for installing a shoreline angler path 450 feet downstream of the dam consisting of a 5-foot-wide wooden trail and 4-foot-wide steel stairs connecting the wooden trail to the river.

- Restore areas temporarily affected by construction activities to protect the sites' aesthetics.

- Remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.

- Prepare a HPMP in accordance with an anticipated PA between the Commission and the West Virginia SHPO or the Pennsylvania SHPO, as appropriate.

5.1.2 Additional Staff-recommended Measures

The additional staff-recommended measures are described below. As noted in section 5.1.1, *Measures Proposed by the Applicants*, unless otherwise noted, each measure applies to all six projects.

- A contaminated sediment testing and disposal plan including provisions for testing sediment from the riverbed to ensure sediment is handled and disposed of in a manner that is consistent with current state standards and to ensure minimal impacts of contaminated sediment on aquatic species and their habitat.

- An operation compliance monitoring plan to document compliance with the operating requirements of any licenses issued for the projects.

- A stand-alone spill prevention, containment, and countermeasures plan to guide the handling of hazardous substances and protect water quality and aquatic biota during project construction and operation.

- A water quality monitoring plan that includes a provision to monitor water quality for 3 years post-construction, for the period of June 1 through October 15, and an additional provision to monitor water quality during construction.

- A vegetation management plan that would apply the measures included in the applicant's transmission line corridor management plan to all project lands. At Grays Landing, the vegetation management plan would also include the applicant's proposed measures to protect sensitive plants during construction activities, extend these measures to also apply to project maintenance activities requiring ground disturbance, and include measures to protect sensitive plants from project operation.

- A revised recreation resource management plan for the Morgantown Project that includes the applicant-proposed measures and an accessible fishing platform and angler path at the tailrace.

- A revised recreation resource management plan for the Point Marion Project that includes the applicant-proposed measures and a fishing platform at the end of the proposed angler path near the tailrace.

- A construction access plan for the Morgantown and Point Marion Projects that includes construction safety guidelines, a schedule, signage, and specific mitigation measures that reduce construction impacts on public use of the Caperton and Sheepskin Trails.

- An access improvement plan for the Grays Landing, Maxwell, and Charleroi Projects that provides shoreline access at each facility.

- A debris management plan that includes the applicants' proposed measures to remove and dispose of trash that accumulates upstream of the proposed projects' trash racks, as well as procedures that describe how debris would be sorted, stored, and disposed to minimize the effect of floating debris on local recreation and aesthetics.

- Implementation of a signed PA that requires revision of the draft HPMP to address the management of historic properties and unevaluated cultural resources.

We discuss the rationale for the measures we are recommending or not recommending below.

Erosion and Sedimentation Control Plan

Construction of the proposed projects would require ground and riverbed disturbance, which could result in sediment (including potentially contaminated sediment) reaching or suspending within the Monongahela River. The applicants propose to develop and implement an erosion and sedimentation control plan for each project, in consultation with the Corps and either Pennsylvania DEP or West Virginia DEP, as appropriate, which would include placement of turbidity curtains; siltation fencing; stabilization of temporarily disturbed soil; final site stabilization; and, to the extent necessary, measures to prevent spills and guide cleanup of hazardous substances. Implementing erosion and sedimentation control measures would help to minimize erosion and sedimentation which would help protect water quality in the river and protect fish and other aquatic life, and we recommend these measures. We estimate that the levelized annual cost to develop an erosion and sedimentation control plan would be $1,550 for each project and conclude that the benefits of the measure would outweigh the costs.

Contaminated Soil Testing and Disposal Plan

In-water construction activities would include the construction of temporary cofferdams and localized dredging. These activities would disturb river sediments, potentially suspending contaminated sediments into the water column, which could lead to bioaccumulation of toxic substances in aquatic and terrestrial organisms. The applicants collected and analyzed sediment core samples in 2013 from the proposed construction locations upstream and downstream of the existing dams at each of the project sites. Samples taken at all six project sites contained PAHs at a concentration above the EPA sediment screening criteria. Samples taken at four of the six project sites (Opekiska, Grays Landing, Maxwell, and Charleroi) also contained heavy metals at concentrations above the EPA screening criteria, and samples from one project (Morgantown) contained PCBs at a concentration above the EPA screening criteria.

Depending on the type and level of contamination, soil disposal methods could vary. Therefore, some sediment sampling within the construction area prior to the start of construction would determine if measures are needed to ensure proper disposal of any contaminated sediment, and to minimize suspension and transport of contaminated sediments into the Monongahela River. To ensure that contaminated sediment is identified and handled properly, we recommend that the applicants develop a contaminated sediment testing and disposal plan for each proposed project, that includes a description of the specific locations and frequency for testing river-bottom sediments; a description of the sampling and testing methodologies; a description of measures that would minimize suspension of contaminated sediments; identification of approved disposal sites; a description of how any contaminated sediments would be removed, handled, and disposed of; and an implementation schedule. The plans should be developed in consultation with the Corps and either the Pennsylvania DEP or West Virginia DEP, as appropriate, to ensure appropriate measures are implemented to dispose of contaminated sediments. We estimate that the levelized annual cost of developing and implementing a contaminated sediment testing and disposal plan for each project would be $2,550 and conclude that the benefits of the measure outweigh the cost.

Spill Prevention, Containment, and Countermeasures Plan

As discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, construction, operation, and maintenance of the proposed Monongahela River Projects would require the use of equipment in and adjacent to the Monongahela River. Therefore, there is the potential for accidental spills of oil, gasoline, and other hazardous materials, which could degrade water quality and negatively affect aquatic resources in the project areas. The applicants state that their proposed erosion and sedimentation control plans would include measures “to the extent necessary” to address the prevention and cleanup of spills of hazardous substances. However, we recommend that the applicants develop and implement a separate spill prevention, containment, and countermeasures plan for each project.

Developing separate plans would facilitate plan review during development, and specifying emergency procedures in separate plans would simplify prompt access to the information needed to address any hazardous materials spills that may occur. To maximize the effectiveness of each spill prevention, containment, and countermeasures plan, we recommend that each plan be developed in consultation with the Corps and either the Pennsylvania DEP or West Virginia DEP, as appropriate, and contain, at a minimum: (1) a detailed description of the procedures for transporting, storing, handling and disposing of oil, fuels, lubricant products, and other hazardous liquid substances; (2) procedures that would be implemented in the event of a spill to ensure the containment and cleanup of any hazardous substances to minimize adverse effects on water quality and aquatic resources in the project areas; (3) a provision to provide immediate notification to the Commission, Corps, and either the Pennsylvania DEP or West Virginia DEP, as appropriate, upon discovering an accidental spill of hazardous substances; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure similar spills do not occur in the future.

We estimate that the levelized annual cost of developing a spill prevention, containment, and countermeasures plan for each project would be $850 and conclude that the benefits of the measure outweigh the cost.

Run-of-Release Operation

The applicants propose to operate the projects in a run-of-release mode,[89] meaning that the projects would operate using flows established by and made available by the Corps. In addition, the applicants propose to provide a minimum bypass flow of 300 cfs during the month of July at the Opekiska, Morgantown, and Point Marion Projects, 500 cfs during the month of July and 50 cfs the rest of the year at the Grays Landing Project, and 500 cfs during the month of July at the Maxwell and Charleroi Projects. Interior recommends that the applicants operate the projects in run-of-release mode and provide year-round minimum bypass flows through the Corps' gates or over the dam spillways. Pennsylvania FBC also recommends run-of-release operation for all projects, and West Virginia DNR also recommends year-round minimum bypass flows. In addition, the Corps notes that the projects must not impact the navigation channel, pool elevations, or operation of the locks and dams.

Operating the projects in a run-of-release mode would limit effects on the Corps' current management of pool elevations and the timing or quantity of flow releases which should protect fish and mussel habitat upstream and downstream of the dams. With the exception of Grays Landing, only small (0.5 foot change or less), localized effects on water surface elevations immediately upstream or downstream of the dams would likely occur with run-of-release operation. At the Grays Landing Project, the applicant proposes to construct 2.5-foot-high crest gates to maintain upstream pool elevations for navigation, which would also benefit aquatic habitat by maintaining a more stable pool. Compared to existing conditions, crest gate operations would cause upstream pool elevations to be increased by up to 2.5 feet when flows are less than 14,000 cfs, but would reduce elevations by up to 1.5 feet when flows are between 14,000 and 65,000 cfs. The higher minimum pool level that would be maintained during low-flow conditions would stabilize shoreline aquatic habitat for fish and other aquatic biota, facilitate access to any tributaries for fishes, increase the overall reproductive success of nest building fishes, and provide more foraging opportunity and cover for resident fishes. Very few mussels likely inhabit the Grays Landing pool, but the higher and more stable pool elevations during low flow conditions would protect mussel habitat and reduce the potential for any mussel stranding. However, increasing the upstream pool elevation during low-flow periods would also inundate an existing fringe wetland along the river bank. During late summer low flows, several state-protected plants flower and set seed in

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[89] Although the applicant, Interior, and Pennsylvania FBC used the term "run-of-river," we interpret their use of run-of-river to mean "run-of-release" because the Corps would determine how much flow to make available (release) to the proposed projects.

this area. Implementing a 2.5-foot increase in water elevation during this period would likely eliminate these populations.

The applicants' proposal to operate in run-of-release mode should not change total river flow passed at each project nor adversely affect navigation depths upstream or downstream of the proposed projects. Relative to existing conditions, there would be no cost associated with operating the projects in a run-of-release mode. Therefore, staff recommends run-of-release operation. Under this mode of operation, the projects would only be able to generate using flows made available to them by the Corps. Because any bypass flow releases over the dams or through the proposed spill gates would be at the sole discretion of the Corps, the applicants' proposed minimum flows over the dam could not be imposed on the applicants or the Corps through a license. For this reason, the staff alternative does not include the applicants' proposal to allow certain minimum flows to pass over the dams.

Operation Compliance Monitoring Plan

As described above, the applicants propose to operate the projects in run-of-release mode. The applicants' proposals, however, do not specify how they would document compliance with the run-of-release operation or how they would coordinate their operations with the Corps.

Generally, Commission licenses for non-federal projects at Corps' dams require the licensee to develop an operating plan and an MOA with the Corps.[90] The operating plan describes the mode of hydropower operation, pool flow diversion, regulation requirements for the Corps' project, and integration of operation of the hydroelectric facility in the Corps' emergency action plan. The MOA describes the detailed operation of the project acceptable to the Corps and any restrictions needed to protect the purposes of the Corps' project.

Therefore, we recommend that any licenses issued for the projects require the applicants to develop an operation compliance monitoring plan in consultation with the Corps, and enter into an operating MOA with the Corps for each project. The plans should include provisions for documenting compliance with the Corps' operating requirements and establish a schedule for reporting project compliance/non-compliance during normal operation and emergencies. The plans should also include provisions for measuring intake velocities at a range of flows to ensure that intake velocities are

[90] *See* Memorandum of Understanding between the Commission and the Corps of Engineers on Non-federal Hydropower Projects, dated March 2016.

sufficiently low to protect fish from impingement on the trash racks and to minimize fish entrainment. Operation compliance monitoring plans would also ensure run-of-release operation and minimization of impacts on aquatic resources that could otherwise occur because of changes in flow, pool elevations, or water quality caused by project operations. We estimate that the levelized annual cost of developing an operation compliance monitoring plan would be $4,100 for each project and conclude that the benefits of this measure outweigh the costs.

Water Quality Monitoring Plan

Project operations could alter existing DO concentrations in the Monongahela River downstream of each proposed project, because water that passes through the projects' turbines would not be subject to the turbulence and aeration that currently occurs when water passes over the existing dams. Also, construction of the proposed projects would likely result in moderate, short-term increases in turbidity levels within the Monongahela River.

The applicants propose to develop post-construction water quality monitoring plans to assess project-related effects on water quality. Monitoring is proposed for June through September for 3 years after project operation begins. However, the applicants do not provide specific details about what parameters would be monitored; the locations where monitoring data would be collected; or what parties, if any, would be consulted to develop a monitoring strategy.

The Corps states that real-time, continuously recorded, water quality monitoring would be required downstream and possibly upstream of each hydropower project during construction and operation. The Corps also states that it would require monitoring throughout the term of the licenses, year-round during the first 3 years of operation, with the potential to reduce the duration of monitoring to May through November after 3 years. In addition, the Corps states that an adaptive management approach to maintaining existing water quality and aquatic life conditions would be required, which would include compliance with non-degradation water quality and aquatic life criteria and higher bypass flows if/when criteria are not being met.

Interior recommends post-construction DO monitoring, but does not specify how many years or during which months the monitoring should be performed. Pennsylvania FBC recommends post-construction continuous DO monitoring at all projects, that the projects adhere to a non-degradation standard, and that measures be implemented to increase DO concentrations immediately if any DO standard recommended by the Corps is not met. West Virginia DNR expresses concern about reservoir stratification in the Opekiska and Morgantown pools and the potential impact on downstream DO concentrations when all flow is redirected through the proposed turbines during summer low-flow conditions. The Upper Monongahela River Association, Inc., recommends continuous water quality monitoring and a non-degradation water quality standard for the Opekiska Project. Ecosophic Strategies, LLC, recommends a DO non-degradation standard of 6.5 mg/L, or higher if the agencies recommend a higher standard.

The applicants' water quality modeling study and our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Operational Effects on Water Quality,* indicate that operation of the proposed projects could affect DO concentrations downstream of the dams. DO concentrations, the primary parameter of concern to Interior, the Corps, state agencies, the Upper Monongahela River Association, Inc., and Ecosophic Strategies, are typically higher from November through May (typically exceeding state standards) than during the summer months in temperate climates. Thus, year-round continuous monitoring would not be needed and not worth the levelized annual cost of $12,280. Furthermore, monitoring for the life of the licenses may not be necessary if monitoring during the first several years of project operation demonstrates that the projects are not affecting downstream DO concentrations. The applicants are proposing monitoring during the first 3 years of project operations, which should be sufficient to capture the normal range of climatological and hydrologic variation in the Monongahela River Basin. We also recommend monitoring water quality (turbidity, water temperature, and DO) during construction, as suggested by the Corps, and implementing any needed corrective measures to protect water quality during project construction.

The existing state minimum water quality standard (5.0 mg/L) was determined by Pennsylvania DEP and West Virginia DEP as adequate to protect aquatic life in the Monongahela River. At this time, it is unclear how adherence to a non-degradation standard would benefit aquatic resources relative to the state standard. Nevertheless, because the projects could only be licensed to operate with flows made available to them by the Corps, the Corps could impose a non-degradation standard for the projects and choose to spill any quantity of water it decides would be necessary to meet such standards. The projects could not be licensed to provide specific bypass flows because the decision to release flows downstream of the Corps' dams prior to being made available for generation at the project lies solely with the Corps. As for any adaptive management measures aimed at addressing the Corps' nondegradation requirements, we note that the Corps would enter into an operating plan and MOA with the applicant that would specify any restrictions needed to protect the primary purposes of the Corps' project, including water quality.

Overall, developing and implementing a water quality monitoring plan for each project would inform the Commission of the need for any project-specific actions to protect water quality and biota downstream of the dams. Accordingly, we recommend that the applicants develop, in consultation with the Corps, FWS, and either Pennsylvania FBC/Pennsylvania DEP or West Virginia DEP/West Virginia DNR, as appropriate, a water quality monitoring plan for each project that contains, at a minimum, the following provisions: (1) identifying the exact locations of monitoring sites; (2) the type of instruments that would be used to monitor water quality; (3) a schedule for monitoring turbidity levels, water temperature, and DO concentrations during project construction; (4) continuous, real-time monitoring of water temperature and DO concentration downstream of the projects from June 1 through October 15 each year for 3 years following the commencement of project operation; (5) the filing of annual summary reports for each year that monitoring is conducted; and (6) if monitoring indicates deviations from the water quality requirements of any licenses issued for the projects, filing a report with the Commission within 10 days describing the deviation and implementation of any corrective actions.

We estimate that development of a water quality monitoring plan with our recommended additions would have a levelized annual cost of $6,740 for each project and conclude that the benefits of this measure outweigh the costs.

Vegetation Management Plan

Construction and maintenance of the proposed projects would disturb some existing vegetation, potentially leading to the introduction or spread of invasive plants. Land surrounding the projects likely has numerous invasive plant species that could spread along the transmission line corridors and access roads and potentially to the construction sites. The applicants propose to develop transmission line corridor management plans, after construction of the transmission line, to limit impacts from project construction and maintenance on plant communities within the project transmission line ROWs. The proposed plans would include measures to revegetate disturbed areas and BMPs to prevent the spread of invasive species into the transmission line corridor.

However, the areas surrounding the proposed powerhouses, substations, and access roads would require vegetation removal that could allow invasive or noxious plant species to become established in all areas where construction activities occur. Therefore, staff recommends that the applicants prepare project-specific vegetation management plans that would incorporate the revegetation and invasive species control measures specified in the proposed transmission line corridor management plan, but apply the measures to the entire project areas rather than just the transmission line corridors. Additionally, development of the plans prior to construction of the project would allow implementation of preventive measures to reduce impacts on botanical resources. To further reduce potential effects on botanical resources, staff recommends that the plans include monitoring programs to evaluate the success of revegetation and invasive plant control efforts, including criteria that define when the measures are successful; a reporting schedule for filing monitoring results and progress reports with the Commission, FWS, the Corps, and West Virginia DNR or Pennsylvania DCNR and Pennsylvania Game Commission, as appropriate; and an implementation schedule.

Additionally, for Grays Landing, the applicant proposes measures to protect sensitive plants during construction, including: (1) providing a 50-foot protective buffer around mapped locations of toothcup, scarlet ammannia, and hooded arrowhead and restricting the use of herbicides and construction activities in these areas; (2) mapping locations of sourwood and avoiding direct disturbance to sourwood populations; (3) installing temporary protective fencing around all buffered habitat; (4) ensuring all personnel are aware of the locations of sensitive plant populations in the project boundary; (5) consulting with Pennsylvania DCNR to develop additional mitigation measures such as topsoil segregation to preserve potential seed bank, in the event that a setback of less than 50 feet is required; and (6) once project plans are finalized, filing a map depicting the species locations and buffer distances in relation to the project limit-of-disturbance. We recommend the vegetation management plan include these proposed measures to protect sensitive plants during construction, and extend these measures to apply to ground disturbing maintenance activities, which would also have potential to affect sensitive species.

Finally, because the proposed crest gate is likely to raise the upper pool level and inundate the fringe wetland containing sensitive plants, we recommend the Grays Landing vegetation management plan include consultation with Pennsylvania DCNR to help identify mitigation measures for effects of project operation on sensitive plants.

We estimate that development of a vegetation management plan, with our recommended measures, would result in a levelized annual cost of $4,100 for each project and conclude that the benefits of this measure outweigh the costs.

<u>Avian Protection Plan</u>

Bald eagles and other raptors may collide with and be electrocuted by transmission lines or other electrical equipment. Further, construction of the project transmission lines could disturb or remove bald eagle roosting or nesting habitat. To protect bald eagles and other raptors from potential habitat disturbance or electrocution and collision with project power lines, the applicants propose to develop avian protection plans in consultation with the Pennsylvania Game Commission, West Virginia DNR, and FWS. Specifically, the applicants' proposed plans would be developed in accordance with the APLIC and FWS' National Bald Eagle Management guidelines. Measures to address future transmission facility maintenance activities would also be addressed in the plan. The avian protection plan would include the following provisions: (1) if a bald eagle or other target species is discovered within the project boundary, the applicants would notify the Pennsylvania Game Commission, West Virginia DNR, and FWS within 30 days of discovery; and (2) prior to any tree clearing within the project boundary or areas immediately adjacent to the project boundary, project staff would survey the area to be cleared for target species nests. If any such nests are discovered, the Pennsylvania Game Commission, West Virginia DNR, FWS, and the Commission would be consulted prior to any tree-clearing activities.

Preparing the plans in accordance with the guidelines would also help to protect raptors from switchyard equipment interactions by ensuring: (1) adequate separation of energized conductors, ground wires, and other metal hardware; and (2) adequate insulation. In accordance with the guidelines, the plans would include a mechanism to monitor the effectiveness of the plans, or what actions to take if the plans are not successful; a schedule for reporting monitoring results to the Pennsylvania Game Commission, West Virginia DNR, FWS, the Corps, and the Commission; and a schedule for implementing the plans. Therefore, staff recommends the proposed avian protection plans.

We estimate that development of an avian protection plan in accordance with the above specified guidelines would have a levelized annual cost of $3,730 for each project and conclude that the benefits of this measure outweigh the costs.

Indiana Bat and Northern Long-eared Bat Protection

At the Charleroi Project, most of the habitat in the proposed project area has previously been disturbed, or is currently developed, so Indiana bat and northern long-eared bats would not be affected by construction of the powerhouse area. However, tree clearing for construction of the proposed transmission line and tree trimming for general ROW maintenance, could negatively affect potential bat habitat. Further, because both Indiana and northern long-eared bats use much of the same summer habitat (e.g., dead or live trees and snags with peeling or exfoliating bark), any activities at the proposed project that affect these types of habitat, such as tree clearing related to the construction or maintenance of the project transmission line, could negatively affect both of these bat species, if present. Because these bat species may use habitat in the Charleroi Project area, the applicant should avoid and protect potential bat roosting and maternity habitat if encountered.

Staff supports the applicant's proposal to implement FWS-recommended avoidance measures at Charleroi, Maxwell, Grays Landing, and Point Marion Projects which requires tree cutting, tree inundation, and prescribed burning to be performed between November 15 and March 31; and where possible, implement the FWS' Forest Management Guidelines for Indiana Bat Swarming Habitat when conducting timber harvesting. Specifically, the FWS guidelines recommend retaining shagbark hickory trees, dead and dying trees, and large-diameter trees (greater than 11 inches diameter at breast height) to serve as roost trees for bats; and retaining forested riparian corridors, forested wetlands, and all snags, where possible.

We recommend that avoidance and protection measures be established in accordance with FWS' Forest Management Guidelines for Indiana Bat Swarming Habitat and Range-wide Indiana Bat Protection and Enhancement Plan Guidelines 2009, or the most current edition of this document.

Furthermore, for northern long-eared bats, all projects are subject to adhering to the FWS final 4(d) rule, which states that incidental take of northern long-eared bats resulting from tree removal is prohibited if it: (1) occurs within a 0.25 mile radius of known northern long-eared bat hibernacula; or (2) cuts or destroys known occupied maternity roost trees, or any other trees within a 150-foot radius from the known maternity tree during the pup season (June 1 through July 31). These projects conform to the final 4(d) rule because activities involving bat and habitat disturbance would be conducted outside of pup season and in accordance with the recommended avoidance guidelines.

Following the FWS- and staff-recommended tree clearing and avoidance guidelines would ensure that potential adverse effects on Indiana bat and northern long-eared bat and their habitat would be avoided or minimized during construction, operation, and maintenance of the Charleroi, Maxwell, Grays Landing, and Point Marion Projects.

There would be no additional cost associated with these avoidance measures and any costs associated with future consultation between the applicant and the resource agencies would be negligible. We conclude that the benefits of these measures outweigh any future costs.

Recreation Amenities

The applicant filed two recreation resource management plans for all six projects that evaluate access and amenities during project construction and operation. As discussed in section 3.3.5.2, *Recreation and Land Use Resources, Environmental Effect*s, because of limited recreational use observed by the applicant at the Grays Landing, Maxwell, and Charleroi Projects, the recreation resource management plans only propose recreation measures for the Opekiska, Morgantown, and Point Marion Projects. The applicants propose to construct: an accessible tailrace fishing platform, an accessible canoe portage and trail, eight designated parking spaces, and a portable accessible restroom at the Opekiska Project; a shoreline angler path upstream and downstream of the dam and to provide parking facilities at the Morgantown Project; and a shoreline angler path downstream of the dam at the Point Marion Project.

Based on stakeholder comments, applicant-proposed measures, and staff-recommended measures (described in the following paragraph), a revised recreation resource management plan is needed for the Point Marion and Morgantown Projects to address significant construction effects on the Sheepskin and Caperton Trails. These effects include temporary closures of the trail for construction traffic and the risk of public interactions with construction equipment. Implementing the measures proposed at the Opekiska, Point Marion, and Morgantown Projects would contribute to the enhancement of recreation facilities and help mitigate for the loss of existing angler access to the tailwaters at each project. We recommend these proposed measures because they would enhance the existing recreation opportunities available at these projects.

Furthermore, we recommend installing a fishing platform at the end of the proposed angler path at the Point Marion Project to improve angler access to the tailrace; installing an accessible fishing platform and angler path at the Morgantown Project tailrace to improve angler access and safety; developing a construction access plan, as discussed in section 3.3.5.2, *Recreation and Land Use, Environmental Effects,* for the Morgantown and Point Marion Projects to further minimize construction effects on the Caperton and Sheepskin Trails; and access improvement plans, also discussed in section 3.3.5.2, for the Grays Landing, Maxwell, and Charleroi Projects that provide shoreline access at each facility. The applicant's proposed measures, in combination with these staff recommendations, would enhance recreational access and public safety at all six projects. Use of the recreational facilities would be monitored through reporting requirements of the FERC Form 80.

As discussed in section 3.3.5.2, many stakeholders, including the Corps, Interior, the National Park Service, Pennsylvania FBC, Mon River Trails Conservancy, Mon River Town Program, Upper Monongahela River Association, National Road Heritage Corridor, and Point Marion Borough, requested studies and provided recommendations for enhancing recreational fishing and boating opportunities at each of the six projects. Considering both the applicants' proposed recreation measures and the staff-recommended measures along with the availability of nearby recreation facilities, no further study of angler access or recreation use would be needed to mitigate project-related effects and we do not recommend these studies or additional mitigation.

We estimate that constructing, operating, and maintaining the applicants' proposed facilities at the Morgantown and Point Marion Projects would have a levelized annual cost of $8,460 and $10,180, respectively. Developing a construction access plan for the Morgantown and Point Marion Projects would have an estimated levelized annual cost of $430 for each project. Installing an accessible fishing platform and angler path at the Morgantown Project tailrace would have a levelized annual cost of $2,880. Installing a fishing platform at the end of the proposed angler path at the Point Marion Project would have an estimated levelized annual cost of $2,030. Developing an access improvement plan for the Grays Landing, Maxwell, and Charleroi Projects would have an estimated levelized cost of $340 for each project. We conclude that the benefits of these measures would justify the costs.

<u>Debris Management Plan</u>

The presence of trash and other debris, especially when concentrated behind dams, can affect the visual character of the river. The applicants propose to remove and properly dispose of any non-organic debris or trash that is collected during trash rack cleaning.

Disposing of trash collected during trash rack cleaning would improve the existing visual conditions. However, it is unclear what specific kinds of debris would be passed downstream or removed from the river, whether the applicants intend to temporarily store trash on-site, or how often debris would be removed from the projects. Therefore, we recommend the applicants develop debris management plans in consultation with the Corps, Pennsylvania FBC, and West Virginia DNR, which includes the applicants' proposed measure to separate and remove trash from the river and ensure that debris is sorted, stored, and disposed of appropriately. A debris management plan should include, but not necessarily be limited to, the following provisions: (1) procedures for separation of organic and inorganic trash; (2) procedures for any storage and off-site disposal of inorganic material; (3) procedures for reintroducing organic debris collected on the trash rack to the Monongahela River downstream of the dam, as appropriate; and (4) an implementation schedule. We estimate that the levelized annual cost of developing a debris management plan would be $430 for each project and conclude that the benefits of this measure outweigh the costs.

Historic Properties Management Plan

Construction of the proposed Opekiska, Morgantown, Point Marion, Grays Landing, Maxwell, and Charleroi Projects would result in adverse effects on the existing Corps' locks and dams and also the Monongahela River Navigation System, all of which are eligible for listing on the National Register. While the Corps' Grays Landing Lock and Dam is not eligible for listing on the National Register, construction of the proposed project at this location would result in adverse effects to the Monongahela River Navigation System. The proposed projects could also adversely affect other cultural resources located within each project's APE, including 10 resources that are eligible or have been recommended as eligible for listing on the National Register (Corps' Lock and Dam No. 14, the Italianate House, Corps Lock and Dam No. 10, Morgantown Wharf and Warehouse Historic District, four historic railways, Robena Mine #1, Macbeth-Evans Charleroi Glass Works/World Kitchen, LLCX) and five resources that have been recommended as ineligible for listing (four historic railroads and the Community of Lowsville), as well as the Point Marion/L.J. Houze Convex Glass Company Historic District, the Gallatin Historic District, one railroad, the Hormell House/Worthington Farmhouse, and one prehistoric site that are located within the APEs but have not been addressed in the HPMPs. Therefore, we recommend the applicants revise the HPMPs to contain additional staff-recommended measures, listed in section 3.3.7.2, *Cultural Resources, Environmental Effects*, in consultation with the West Virginia SHPO, the Pennsylvania SHPO, and the Corps to avoid, lessen, or mitigate the adverse effects on these historic properties. In addition, the HPMPs should include the applicants' proposals to conduct post-construction site restoration at each of the project sites to ensure the landscape is cleared of construction debris and restored to a managed landscape because these measures would protect aesthetics and historic properties.

To satisfy the requirements of section 106, Commission staff intends to execute PAs for each project that would include stipulations for the protection of historic resources, including revision of the HPMPs in consultation with the Corps and either the West Virginia SHPO or Pennsylvania SHPO, as appropriate. The revised HPMPs would describe the treatment measures necessary for managing properties included in, or eligible for inclusion in, the National Register that could be affected by issuance of a license for the proposed projects. Specifically, the revised HPMPs would include but not be limited to a discussion of all cultural resources identified within the APEs of the proposed projects, their National Register eligibility status, project-related effects, and specific management measures to resolve project-related adverse effects (all to be completed in consultation with the West Virginia SHPO or Pennsylvania SHPO). We conclude that the benefits are worth the levelized annual cost of $1,710 for each project to revise and implement final HPMPs.

5.1.3 Measures Not Recommended by Staff

Fish Stranding Surveys

Interior recommends the applicants design and implement post-construction fish stranding studies for the proposed tailraces, extending downstream to the point where the turbine discharge enters the river.

Although project operations could result in some changes in flow and velocity patterns downstream of the dams, project operations would not dewater any aquatic habitat. On the Monongahela River, each Corps dam creates a pool that extends to the base of the next upstream dam. Project operations should not strand fish in the project tailraces, or in any other area of the river, because the tailraces would be excavated into the bed of the existing river channel and would be continuously submerged whether the projects were operating or not, and any change in water levels downstream of the dams would be negligible. Therefore, we do not recommend fish stranding surveys and conclude that the levelized annual cost of $850 for each project is not justified.

Post-Construction Fish Impingement and Entrainment Studies

Project operation has the potential to result in some fish impingement on the project trash racks and entrainment-related mortality of fish that are entrained through the turbines. To minimize fish mortality related to project operations, the applicants propose to design the projects so that the intakes have maximum approach velocities of less than 2 fps and install trash racks with 3-inch clear bar spacing. Pennsylvania FBC and Interior recommend that the applicants design and implement post-project construction fish impingement and entrainment studies at the projects. Based on the results of the post-project construction studies, Interior may then recommend the applicants consult with the resource agencies to determine appropriate trash rack vertical bar spacing and approach velocities at all projects, and make project modifications where necessary to ensure protection of all fish species and life stages in project areas. Pennsylvania FBC recommends that fish impingement and entrainment losses should be mitigated, but does not specifically describe any mitigation measures. West Virginia DNR recommends the applicants for the Opekiska and Morgantown Projects develop appropriate studies to determine the appropriate level of compensation for fish losses caused by impingement or entrainment at FERC-licensed hydro facilities.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the applicants conducted a desktop entrainment and turbine survival study to evaluate the risk of impingement and to estimate the number and survival rates of fish that would be entrained through the project turbines during project operation. Analysis of burst swim speeds for representative species indicates that the low approach velocity and relatively wide bar spacing of the trash racks would pose a very low risk of impingement. The study also indicates that most entrained fish would be less than 6 inches in length, with gizzard shad, emerald shiner, and mimic shiner accounting for the majority of the total entrainment. Average survival rates for fish entrained through the turbines were estimated to be between 93 and 95 percent for the Monongahela River Projects. Staff concludes that there is little basis for recommending additional field entrainment and impingement studies because it is likely that any such studies would show results similar to the studies that have been conducted at other projects,[91] which have consistently shown that most of the fish entrained and killed during turbine passage are young fish of highly prolific species, whose populations can compensate for such losses. Accordingly, we do not recommend that the applicants be required to conduct post-construction fish impingement and entrainment studies, because the benefits would not justify the estimated levelized annual cost of $21,270 at each project.

Corps' Biotic Monitoring Requirements

As described in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, construction and operation of the projects would have some effects on aquatic species and their habitats. In general, construction activities could temporarily displace organisms or decrease habitat suitability near or within the construction areas. Once operation begins, some habitat would become less suitable for fish and other organisms, while other areas would see an increase in habitat suitability. Overall, a small reduction in suitable habitat for some aquatic species would occur at low and moderate flows, while conditions at high flows would remain relatively unchanged. In addition, fish entrained through the projects may suffer turbine-induced mortality, but the entrainment mortality rate would be low.

[91] Those studies form the basis for the applicants' desktop entrainment study.

The Corps indicates that it would require the applicants to conduct post-construction monitoring studies at regular intervals to document local and cumulative effects on aquatic habitats and communities. Specifically, the Corps indicates that it would require: (1) multi-method fish surveys to document any project-related changes in the fish community; (2) fish impingement, entrainment, and mortality surveys to address impacts on all species and sizes of fish; (3) macroinvertebrate surveys; (4) mussel surveys; (5) an assessment of biological integrity for macroinvertebrate and fish assemblages, and (6) tracking of mussel beds and tailwater habitat during construction and operation throughout the term of the license.

Under existing conditions, changes in river flow alter and shift aquatic habitat suitability on a regular basis (e.g., daily, weekly, or annually, depending on river flow and Corps gate operations). Based on the Corps' rating curves, water surface elevations in the Monongahela River pools can vary by more than 10 feet as a result of changes in river flow under existing conditions. Therefore, the existing aquatic community would be adapted to variation in the flows and habitat suitability within the pools and dam tailwaters, and project-related changes in habitat suitability would be minor. Some entrainment mortality would occur, but it would not likely have an effect on the existing fish community, and studies documenting entrainment mortality would serve no project-related purpose. Therefore, fish, mussel, and macroinvertebrate surveys, entrainment surveys, and habitat surveys are not needed to document project effects, and we do not recommend these surveys. We estimate that the biotic monitoring studies recommended by the Corps would have a levelized annual cost of $71,530 for each project, and conclude that the benefits of the studies would not justify the cost.

Pre-Construction Federally Listed Mussel Surveys

The Corps recommends that prior to any construction or drawdown activities, the footprint of the powerhouses and any dewatered areas in the cofferdam footprint at each project should be surveyed to determine the presence/absence of federally listed mussel species. The Corps also states that a contingency plan to either relocate or avoid federally listed mussels would be necessary to avoid impacts if such species are found.

Conducting surveys within the proposed dewatered areas, as recommended by the Corps, would provide further assurance on the presence/absence of federally listed mussels within the construction footprint of each project. However, no individuals or populations of listed mussels are known to currently occur in these areas. As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment*, the applicants' 2013 mussel survey did not document any federally listed species in the vicinity of the proposed projects. The applicants surveyed within the proposed construction footprints of the Point Marion and Grays Landing Projects, and within the immediate vicinity of the proposed construction footprints of the Opekiska, Morgantown, Maxwell, and Charleroi Projects. No federally listed species were documented by the applicants during these surveys. Similarly Hart (2012) did not collect any federally listed species in his comprehensive surveys on the Monongahela River. The 2013 surveys closest to the respective dams were generally absent of any mussels, with the exception of three individuals collected across all six proposed projects. The existing boulder and cobble substrate and changing hydraulic conditions downstream of the dams, as a result of the Corps gate operations, likely make the construction footprints at these projects unsuitable for mussels, which generally require stable hydraulic conditions and finer substrates. Therefore, it would not be necessary to conduct additional mussel surveys in areas within or just outside the construction footprints where surveys have already documented no federally listed mussel species.

Similarly, a contingency plan as recommended by the Corps, would not be necessary because additional mussel surveys would not be needed. Therefore, we do not recommend that the applicants conduct pre-construction surveys for federally listed mussel species, which we estimate would have levelized annual costs ranging from $850 to $1,700, depending on the project, because the benefits would not justify the costs.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Construction and initial operation of the six Monongahela River Projects may cause unavoidable short-term increases in erosion and sedimentation within the Monongahela River in locations immediately upstream and downstream of the respective projects. Construction of the proposed projects also has the potential to result in the resuspension and downstream distribution of contaminated sediments present within the Monongahela River. However, implementation of an erosion and sedimentation control plan at each project, as proposed by the applicants, would minimize the potential for negative effects, and no long-term effects from erosion are expected. Implementing a contaminated sediment testing and disposal plan at each project would minimize the potential for suspending and distributing contaminated sediments by ensuring proper procedures are in place during contaminated sediment removal and disposal activities. Lastly, implementing a spill prevention, containment and countermeasures plan at each project with staff-recommended measures would further protect water quality in the Monongahela River.

A temporary loss of aquatic habitat would occur within portions of the river enclosed by cofferdams. Construction activities such as cofferdam placement and removal, excavation, and boat traffic in the immediate project areas could displace aquatic organisms, representing a minor, short-term effect during construction. Any mussels currently present within or near the proposed construction footprints could be permanently impacted, but because only one mussel was found within the construction footprints, the overall effects of projects’ construction on the mussel community should be minor.

Operation of the proposed projects may result in lower DO concentrations downstream of the respective projects under some critical river flow conditions, compared to existing conditions. However, monitoring DO concentrations upstream and downstream of each proposed project from June through October 15 for the first 3 years of project operations would help to determine to what extent project operations are affecting DO concentrations downstream of the projects, and what adaptive measures, if any, would be needed.

Operation of the projects would result in some unavoidable fish entrainment-related mortality as fish pass through the turbines. However, the applicants' proposal to install trash racks at the powerhouse intakes with a 3-inch clear bar spacing and limit maximum intake velocity to no more than 2 fps would help to limit any entrainment- and impingement-related fish mortality. Most of the fish entrained by the projects would be juveniles with expected high survival rates during turbine passage, and any resulting mortality is not likely to result in any measurable impact on resident fish populations in the Monongahela River.

Construction of the proposed facilities would permanently disturb shoreline vegetation and some vegetation along transmission line corridors and access roads. Some trees that are potential summer roosting habitat for the northern long-eared and Indiana bat, and osprey nesting habitat would be cleared. Vegetation clearing may also reset plant succession, consequently removing saplings that may develop into the types of mature forest essential for these bat species. However, loss of vegetation would be mitigated by implementing the staff-recommended vegetation management plan at each project. Adhering to FWS' Final 4(d) rule for northern long-eared bat and state-specific guidelines for Indiana bat, including avoiding the removal or disturbance of identified Indiana bat roosting trees, whenever possible, and avoiding tree clearing during pup season (June 1 through July 31), would minimize construction-related effects to the Indiana and northern long-eared bat. Lastly, implementing the applicants' proposed avian protection plan with staff modifications would minimize project impacts on the avian community.

Construction of the proposed Monongahela River Projects would result in the temporary loss of public recreational fishing areas. Additionally, some debris would periodically accumulate near the projects during construction and operation. This debris could decrease the recreational value of the Monongahela River in the vicinity of the proposed projects. However, the applicant-proposed and staff-recommended recreation facilities and implementation of a debris management plan would minimize the effects on recreational use.

The construction of the Monongahela River Projects would result in a short-term degradation of the visual qualities and noise levels in the vicinity of the dams. The disturbances would be localized, with the surrounding commercial and residential areas being most affected by the visual effects of construction, along with noise and dust. The decreased visual quality and increased noise levels are unavoidable, but temporary, adverse effects of project construction.

Construction of the proposed Opekiska, Morgantown, Point Marion, Maxwell, and Charleroi Projects would result in adverse effects on the cultural aspects of the existing Corps' locks and dams and also the Ohio River Navigation System, all of which are eligible for listing on the National Register. The proposed projects could also adversely affect other cultural resources within each project's APE. Revision of the HPMPs to contain additional staff-recommended measures in consultation with the West Virginia SHPO or Pennsylvania SHPO and the Corps would avoid or mitigate adverse effects on these historic properties.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

In response to the Commission's Ready for Environmental Analysis notice, three fish and wildlife agencies submitted recommendations for the project: Interior (timely filed letter on February 11, 2016), West Virginia DNR (timely filed on February 16, 2016) and Pennsylvania FBC (untimely filed letter on February 19, 2016).[92] Table 5-1 lists Interior's recommendation and whether it is adopted under the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) are considered under section 10(a) and addressed in the specific resource sections of this document and the previous section.

[92] West Virginia DNR and Pennsylvania FBC filed recommendations but did not specify if the recommendations were submitted under section 10(a) or 10(j). Therefore, these recommendations are considered under 10(a) and are discussed by resource area in section 3.0, *Environmental Analysis*, of this EA.

The Commission staff makes a preliminary determination that one recommendation by Interior may be inconsistent with the purpose and requirements of the FPA or other applicable law.

Table 5-1. Fish and wildlife agency recommendation for the Monongahela River Projects (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
Operate the project in a run-of-river mode, and provide minimum bypass flows through dam gates or over dam spillways during all months of the year	Interior	No[a]	$0	Not Adopted.

[a] The measure is outside the scope of section 10(j) because it is not within the Commission's authority to enforce. The applicant would only be able to operate off of flows made available to it by the Corps. Flow releases over the dam or through the proposed spill gates are at the sole discretion of the Corps.

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 12 qualifying comprehensive plans that are applicable to the six Monongahela River Projects located in West Virginia and Pennsylvania. No inconsistencies were found.

The following is a list of qualifying comprehensive plans relevant to the Monongahela River Projects:

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6.0 FINDING OF NO SIGNIFICANT IMPACT

If the six Monongahela River Projects are licensed as proposed with the additional staff-recommended measures, the projects would operate while providing protective measures for aquatic, terrestrial, recreation, aesthetic, and cultural resources in the project areas.

Based on our independent analysis, issuance of licenses for the Monongahela River Projects, as proposed with additional staff-recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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