Public Notice

U.S. Army Corps of Engineers

Baltimore District
PN# 17-20

In Reply to Application Number: CENAB-OPR-MN (MD SHA/BLOEDE DAM MITIGATION BANK) 2017-00320-M15

Comment Period: May 1, 2017 to May 30, 2017

Maryland Department of the Environment

THE PURPOSE OF THIS PUBLIC NOTICE IS TO SOLICIT COMMENTS FROM THE PUBLIC CONCERNING THE PROPOSED MARYLAND STATE HIGHWAY ADMINISTRATION THE PROSPCTUS FOR THE BLOEDE DAM MITIGATION BANKING INSTRUMENT AND THE POTENTIAL OF THE PROPOSED BLOEDE DAM MITIGATION BANK TO PROVIDE APPROPRIATE COMPENSATORY MITIGATION FOR ACTIVITIES AUTHORIZED BY DEPARTMENT OF THE ARMY PERMITS AND THE STATE OF MARYLAND DEPARTMENT OF THE ENVIRONMENT PERMITS.

At this time, no decision has been made as to whether or not the Bloede Dam Mitigation Bank Instrument will be approved. We are requesting comments to determine if approval should be granted for this proposed Mitigation Bank for the purpose of providing compensatory mitigation for unavoidable stream impacts authorized by the Department of the Army (DA) and the State of Maryland. Such impacts are expected to result from Maryland State Highway Administration (MD SHA) activities authorized under Section 404 of the Clean Water Act (CWA) and Titles 5 and 16 Environment Article Annotated Code of Maryland. Use of a Bank must meet all applicable requirements and be authorized by the appropriate authorities.

The U.S. Army Corps of Engineers, Baltimore District, (Corps) and the Maryland Department of the Environment (MDE) have received the MD SHA Prospectus for the Bloede Dam Mitigation Bank Site. The Bank Prospectus can be reviewed as part of this Public Notice at:

http://www.nab.usace.army.mil/Missions/Regulatory/Public-Notices/

This prospectus provides a summary of how the proposed mitigation banking site will be established, used, operated, and maintained and is in accordance with the Federal Final Rule on Compensatory Mitigation for the Losses of Aquatic Resources (33 CFR 325 and 332 and 40 CFR 230) and Code of Maryland Regulations (COMAR).

Documentation for the establishment and management of this proposed mitigation banking site will be reviewed by an Interagency Review Team (IRT), consisting of Federal and State agency representatives, and co-chaired by the Corps and MDE.

APPLICANT/BANK SPONSOR: Maryland State Highway Administration
Attn: Mr. Todd Nichols
707 North Calvert Street, C-306
Baltimore, Maryland 21202

LOCATION: Bloede Dam is located on the Patapsco River in the Maryland Department of Natural Resources (MD DNR) Patapsco River Valley Park near Ellicott City, Baltimore and Howard Counties, Maryland. Bloede Dam is located within the Gunpowder-Patapsco River Watershed (HUC #02060006).

BANK DESCRIPTION: The Bloede Dam removal will help restore historic diadromous species passage for approximately eight miles upstream (to Daniels Dam) on the Patapsco River and, in some cases, tributaries to the Patapsco River. In addition to restoring historic aquatic passage for American eel (*Anguilla rostrate*), river herring (*Alosa psuedoharengus*), hickory shad (*Alosa mediocris*), and American shad (*Alosa sapidissima*), the dam removal will also encourage re-introduction of freshwater mussels upstream of the site and help restore approximately 0.5 miles of stream currently impounded by the dam.

MD SHA is requesting 12,740 linear feet of stream mitigation credit for the Bloede Dam removal with credit releases triggered by documentation of functional uplift within the impoundment area and the presence of various fish species upstream of the Bloede Dam site. Consistent with the MD SHA Umbrella Bank Instrument (MD SHA UMBI), the proposed geographic service area for the bank is 8-digit HUC watershed where the bank is located. Bloede Dam is located within the Gunpowder-Patapsco River watershed (HUC #020600003). The Secondary Service Area is defined as the adjacent 8-digit HUC watersheds within the same river basin and physiographic province as the Primary Service Area. For the Bloede Dam Mitigation Bank Site the Secondary Service Area would be portions of the Patuxent River watershed (HUC #02060006) within the Upper Chesapeake Basin and the Piedmont Plateau.

The Bloede Dam site be monitored annually for a period of five years. The monitoring will generally mirror monitoring conducted for previous dam removals on the Patapsco River (e.g., Simkins Dam). The Bloede Dam site would remain under MD DNR control as a state park.

WORK REQUIRING DEPARTMENT OF THE ARMY AUTHORIZATION: Separate from this evaluation of the Bloede Dam Removal Mitigation Bank, the Corps initially proffered a DA permit to MD DNR to remove Bloede Dam.

The evaluation and approval of this mitigation banking site proposal will follow the Mitigation Banking Instrument modification procedures of the 2008 Mitigation Rule (33 CFR 332.8(g)(1)).

The purpose of this proposed mitigation bank is to provide compensatory mitigation for future unavoidable impacts to Waters of the U.S. as the result of MD SHA transportation improvements and repair/maintenance activities permitted under Section 404 of the Clean Water Act, and related State laws provided such use has met all applicable requirements and is authorized by the appropriate authority(s). The mitigation bank would be used to comply with special condition mitigation requirements of permitted projects by providing in-kind compensation for authorized stream losses. A mitigation bank may only be used for future projects after all appropriate and practicable steps to avoid and minimize adverse impacts to aquatic resources, including nontidal streams, have been taken. Remaining unavoidable impacts must be compensated to the extent appropriate and practicable. Per the 2008 Mitigation Rule, mitigation bank(s) will be the preferred mitigation option unless it is determined another option would be environmentally preferable.

Further, a mitigation bank does not provide ultimate DA and/or State authorization for specific future projects impacting Waters of the United States; exclude such future projects from any applicable statutory or regulatory requirements; or preauthorize the use of credits from the bank for any particular project. The Corps and the MDE provide no guarantee that any particular individual or general permit will be granted authorization to use approved mitigation banking sites under the MD SHA UMBI to compensate for unavoidable stream impacts associated with a proposed permit, even though compensatory mitigation may be available.

The decision whether to approve the Bloede Dam Mitigation Bank will be based on an evaluation of the probable impacts including cumulative impacts of the proposed bank on the public interest. As such, the decision to approve the Bloede Dam Mitigation Bank will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, and, in general, the needs and welfare of the people.

A preliminary review of this proposal indicates that the proposed work has not and will not affect listed species or their critical habitat pursuant to Section 7 of the Endangered Species Act as amended. As the evaluation of this proposal continues, additional information may become available which could modify this preliminary determination. The State Historic Preservation Officer (SHPO), Maryland Historical Trust (MHT), has determined that Bloede Dam is eligible for listing in the National Register of Historic Places under Criteria A, B, and C for its specialized engineering, innovative design, and association with early electrification and that the authorized dam removal would have an adverse effect on historic properties. As the lead federal agency in the dam removal, National Marine Fisheries Service has entered into a Memorandum of Agreement (MOA) among MD DNR, American Rivers, Delaware Tribe of Oklahoma, and the Maryland SHPO to address the adverse effect.

The applicant must obtain any State or local government permits which may be required.

Written comments concerning the activity described above must be submitted directly to the District Engineer, U.S. Army Corps of Engineers, Baltimore District, [ATTN: Mr. Jack Dinne, CENAB-OPR-MN], 10 South Howard Street, Baltimore, Maryland, 21201 and the Water Management Administration, Maryland Department of the Environment, 1800 Washington Boulevard, Suite 430, Baltimore, Maryland 21230-1708 [ATTN: Ms. Kelly Neff], within the comment period as specified above to receive consideration.

It is requested that you communicate the foregoing information concerning the proposed work to any persons known by you to be interested and not being known to this office, who did not receive a copy of this notice.

Prospectus
Bloede Dam Mitigation Bank

State Highway Administration
Environmental Programs Division
707 North Calvert Street
Baltimore, MD 21202

April 7, 2017

Table of Contents

1.0 INTRODUCTION

The State Highway Administration (SHA) (the Sponsor) proposes to establish the Bloede Dam Mitigation Bank to compensate for unavoidable and permitted impacts to nontidal waterways associated with future SHA projects. The purpose of the Bank is to provide off-site compensation for impacts authorized under Section 401 and 404 of the Clean Water Act, Maryland Nontidal Waterway Construction regulations, and associated Code of Maryland Regulations. Compensation will be provided where future SHA projects require mitigation for impacts within the Gunpowder-Patapsco River Watershed (HUC #02060003) and portions of the Patuxent River Watershed (HUC #02060006). The Bank will be established under the terms of SHA's Umbrella Mitigation Banking Instrument (UMBI).

Bloede Dam (39.246975, -76.761153) is located on the Patapsco River near Ellicott City, Maryland. The dam was constructed in 1907 to provide hydroelectric power. Large amounts of sediment carried by the Patapsco River frequently clogged the dam's intake pipes, and the dam was shut down in 1932 due to dysfunction. Since then, power generating equipment housed within the dam has been removed and large amounts of concrete have been added to support the structure. A fish ladder was constructed at the dam in 1992 to improve fish passage, but its overall effect has been marginal. Flooding of the Patapsco River has resulted in damage to the dam and ladder, and ongoing repair and maintenance is costly. Compliance with Maryland Dam Safety requirements could exceed $1 million if the dam remains in place. Also, the dam represents a safety hazard to park visitors. Although the Maryland Park Service patrols the area, and signs are posted to warn park visitors of danger, there have been at least 9 drowning deaths at the dam since the 1980s. Figure 1 provides a vicinity map of Bloede Dam and surroundings, including 0.5 mile of impounded area behind the dam.

The Maryland Department of Natural Resources (DNR) is proposing to remove Bloede Dam with the goal of restoring historic migratory corridors of diadromous fish species to the Patapsco River. SHA proposes to fund $5 million towards removal of the dam, or approximately 31% of the project's total cost. The project will allow both diadromous and resident fish species to access 118 miles of upstream habitat. SHA's proposed funding would not be used as match to Federal funds; instead, SHA's funding is covering the majority of the cost of the dam removal, which is estimated at $6,600,000.

Figure 1: Bloede Dam Vicinity Map

2.0 GOALS AND OBJECTIVES

SHA's goal in funding the removal of Bloede Dam is to generate mitigation credits to compensate for unavoidable and permitted impacts to nontidal waterways associated with future SHA projects. Objectives of the proposed dam removal include:

- Restoration of the historic migratory corridors of diadromous species upstream of Bloede Dam within the Patapsco River and its tributaries. Important species include American eel (*Anguilla rostrata*), along with river herring (*Alosa pseudoharengus, Alosa aestivalis*), hickory shad (*Alosa mediocris*), and American shad (*Alosa sapidissima*). Table 1 provides Patapsco River mainstem and tributary miles that exist between Bloede Dam and the next documented upstream fish barrier (Daniels Dam and Bonnie Branch Dam) that will be reopened to migratory fish as a result of the dam removal.

Table 1: Important Species and Miles Reopened Upstream of Bloede Dam

Fish Species	Habitat Extents and Orders; upstream of Bloede Dam to downstream of Daniels Dam	Patapsco Mainstem Feet	Tributaries Feet	Total Feet	Total Miles
American Eel	All streams	47,198	577,664	624,862	118.3
River Herring	All 2nd order and higher streams	47,198	294,879	342,077	64.7
Hickory Shad	All 3rd order and higher streams	47,198	131,779	178,977	33.8
American Shad	All 4th order and higher streams	47,198	28,957	76,155	14.4

- Reopening of the historic migratory corridor will also provide opportunities for freshwater mussels to inhabit upstream reaches of the Patapsco River. Dams block the movement of host fish that mussels rely on to complete their life cycle.
- Restoration of spawning, foraging, and refuge habitat for all aquatic organisms inhabiting the watershed. More sustainable, robust populations of aquatic organisms are expected to result from dam removal over the long-term.
- Restoration of the 0.5 mile impoundment to a riverine system, and restoration of riverine processes, including a more natural sediment transport regime which increases habitat value. An estimated 312,000 cubic yards of sediment are impounded behind the dam. Removal of the dam will allow natural transport of river sediments, thereby improving habitat conditions.
- Restoration of Patapsco River water quality. Impounded water results in increased surface water temperatures, resulting in lower dissolved oxygen levels. Removal will support cooler surface water temperatures and higher dissolved oxygen levels.

3.0 ESTABLISHMENT AND OPERATION

SHA proposes this Bank as a Single Client Bank to be used by SHA to meet compensatory mitigation requirements of future projects. Because the Bank is proposed for single client use, no credits will be sold to entities outside of SHA. The Bank will only be used as compensation for unavoidable and permitted impacts to nontidal waterways. The Maryland DNR submitted a Joint Permit Application (JPA) for the removal of Bloede Dam in 2015. The following permits for the removal of Bloede Dam have been proffered by the U.S. Army Corps of Engineers (USACOE) and the Maryland Department of Environment (MDE).

- MDE Waterway Construction Permit #15-MR-0044
- MDE Water Quality Certification #15-NT-0021/201560068
- USACOE Permit #CENAB-OPR-M 2015-60068-M37

Additional information on the establishment and operation of the Bloede Dam Mitigation Bank is provided in the following sections.

3.1 Site Selection

Dam removal from the Patapsco River is a priority of numerous stakeholders. The Maryland DNR and others have successfully restored segments of the Patapsco through removal of two dams upstream from Bloede: the Union and Simkins Dams. In combination with these previous dam removal projects, the Bloede Dam removal has potential to provide substantial ecological uplift to the Patapsco River. Ecological gains provided by Bloede Dam removal are expected to include reestablishment of a natural flow regime, transformation from a reservoir to a river channel, improved water temperatures and oxygen levels, improved sediment release and transport, and enhanced migration opportunities for fish and other organisms. This expectation is supported by the success of the Union and Simkins Dam removal projects.

A post construction monitoring program was associated with the Simkins Dam removal that included biological monitoring. Monitoring was performed by Maryland DNR and was documented in a report that included the following findings:

- Dam removal and subsequent sediment mobilization did temporarily disturb downstream habitats and decrease local eel abundance, fish assemblages, and shifts of macroinvertebrate communities. However, biological communities quickly recovered following dam removal and disturbances were offset by the establishment of favorable habitat in the former Simkins impoundment.
- Bloede Dam is likely slowing the recolonization of American eels into upstream areas, including the former Simkins impoundment. Bloede Dam has a major impact on fish movement that overshadows the effect of the Simkins Dam removal upstream.

- A significant (relative to control sites) shift in macroinvertebrate community metrics was observed that was most pronounced in sites closest to the Simkins Dam. Communities shifted from lentic (lake) to lotic (swift water) types in accordance with the changes in habitat observed.

The report concluded with the following statement:

".....improvements to the ecological conditions of the Patapsco River will be greatly enhanced by the removal of Bloede Dam. Removing Bloede Dam would provide unimpeded passage for anadromous fish, improve habitat for resident fish and other riverine species, and allow sediment trapped behind it to move downstream and out of the non-tidal Patapsco River."

Based on this conclusion, the removal of Bloede Dam is considered an important component to the overall goal of restoring the Patapsco River and will serve to enhance the uplift provided by the previous removals of Union and Simkins Dam.

Daniels Dam, located upstream of Bloede Dam, will be the last remaining dam on the Patapsco River mainstem following the Bloede dam removal project. A fish ladder exists at the dam, but woody debris blockages compromise its ability to allow fish passage. Since the ladder often requires maintenance to remove woody debris, Daniels Dam represents at least a partial fish blockage. Additional dams within the watershed include Liberty Lake Dam and Piney Run Lake Dam (both upstream from Daniels Dam), and Bonnie Branch Dam (located on Bonnie Branch, upstream of Bloede Dam).

3.2 Site Protection Instrument

The Bloede Dam site has long-term protection based on its location within Patapsco Valley State Park. The Park is managed under Program Open Space, as administered by Maryland DNR's Land Acquisition and Planning Unit, in collaboration with the Office of the Attorney General. The open space program is intended to conserve natural resources and provide exceptional outdoor recreational opportunities for all citizens. Funding for the program is drawn from the collection of a 0.5% State property transfer tax, and federal grant funds for open space and recreation projects. The program has preserved over 324,000 acres to date, exceeding annual preservation goals set by Maryland DNR in every year since 2010.

Policies of Program Open Space are specified in the Natural Resources Article of the Annotated Code of Maryland. According to the Code, "Land acquired or developed under a State grant from Program Open Space may not be converted, without written approval of the Secretary, the Secretary of the Department of Budget and Management, and the Secretary of the Department of Planning from outdoor public recreation or open space to any other use. Any conversion in land use may be approved only after the local governing body replaces the land with land of a least equivalent area and of equal recreation or open space value." (§5-906)

In addition, the Patapsco Valley State Park Management Plan will be updated to reflect that this portion of the Patapsco River within the Park is an approved compensatory mitigation site.

The mainstem and tributary streams that extend outside of the Patapsco Valley State Park boundaries are afforded protection through Federal and State authorities through enforcement of the Clean Water Act and Maryland's wetlands and waterways protection regulations including COMAR 26.08.02 - Water Quality and COMAR 26.17.04 – Construction on Nontidal Waters and Floodplains.

3.3 Baseline Information

Data collection at the site has provided a characterization of sediment impounded at the dam, baseflow, and hydraulics. Monitoring surveys have identified impacts of the dam on fish species including diadromous species. Through modeling, future fish passage and sediment transport conditions following the dam removal have been projected. These findings were reported to the Maryland DNR in *The Bloede Dam 60% Design Report* (Inter-Fluve, Inc. et al., 2015), and are summarized as follows.

Impounded sediment volume has been estimated through subsurface investigations. Soil borings and volumetric calculations indicate that a total of 312,000 cubic yards of sediment is behind the dam. Sediment data analysis provides that deposits on the left bank upstream from the dam constitute a significant portion of the impounded sediment volume. It is believed that the original main river channel exists in this area. Soil borings show stratification in the impounded sediment, with high fractions of silt in lower layers and high fractions of sand in upper layers (due to changes in residence time behind the dam over the years).

Base flow at Bloede Dam has been estimated through gage-derived hydrologic modeling. Based on gage data recorded between 1944 to 2014, base flow at the dam is estimated to be 30 cubic feet per second (cfs). Specifically, this estimate is derived from the USGS stream gage at the Hollofield area of Patapsco Valley State Park, near Ellicott City, MD. Further details describing existing hydraulic conditions can be referenced in *Hydrology and Hydraulics Study: Bloede Dam Removal and Patapsco River Restoration* (McCormick Taylor, 2012).

Bloede Dam has had a significant effect on aquatic communities in the Patapsco River. The reduction in habitat diversity behind the dam has resulted in a loss of species diversity and greater numbers of species that are tolerant of altered conditions. Most importantly, Bloede Dam is a major barrier to diadromous and resident fish passage. Monitoring surveys have identified the following diadromous species in the Patapsco River: American eel, blueback herring, hickory shad, sea lamprey, striped bass, white perch, yellow perch, and quillback. In general, these species are in decreased abundance or absent from waters above the dam. Resident species identified throughout the Patapsco River include bluegill, brown trout, channel catfish, common carp, fallfish, gizzard shad, northern hogsucker, rainbow trout, redbreast sunfish, rock bass, smallmouth bass, white catfish, and white sucker.

Using gage data and hydrologic modeling, future fish passage conditions following dam removal have been projected. During high flows, projected velocities are estimated at 6.68 feet per second (ft/s), and during low flows, velocities are estimated at 3.88 ft/s. Because there are varying flow velocities across a stream channel, these rates reflect the average velocity occurring within a channel cross section. Downstream from the dam plunge pool and outside of the project area, projected velocities vary from 11 to 15 ft/s. Thus, flow velocities in the former dam area are expected to be lower than flow velocities downstream. Because a fish's maneuvering ability increases with decreased velocity, fish are expected to be able to pass the former impoundment area. Also, cruising speeds associated with American eel (7 ft/s), American shad (8 ft/s), and blueback herring (5 ft/s) compare favorably with the projected fish passage flow velocities in the impoundment area. Variations in water depth, water velocity and stream grade would exist, but modeling indicates that full fish passage would be established.

3.4 Determination of Credits

The proposed mitigation credit approval and the subsequent release of credits for the Bloede Dam removal project, as discussed in this section, follows the achievement of specific goals and performance standards. SHA requests full credit (1:1) for the restoration of the 0.5 mile (2,716 linear feet) of impounded area above the dam. However, because the project will also provide out-of-kind mitigation (restoration of fish passage functions) for future authorized SHA impacts, mitigation credit for fish passage was calculated at a lower ratio as described below.

Credit calculation is based on direct restoration of the impounded area and fish passage restoration provided by the project, specifically the opening of the Patapsco River mainstem and second order (or higher) tributaries to diadromous species. The length of the mainstem and second order (or higher) tributaries included in the credit determination includes the stream system from Bloede Dam upstream to Daniels Dam, minus the 2,716 linear feet of direct restoration of the impoundment. Bonnie Branch is excluded due to the presence of the Bonnie Branch Dam. SHA requests mitigation credit at a ratio of 5:1 for the Patapsco River mainstem from Bloede Dam to Daniels Dam, and a ratio of 10:1 for second order (or higher) tributaries between Bloede Dam and Daniels Dam. The resulting credits are then factored by 31% to account for the amount of funding provided by SHA.

The credits will be available for future SHA projects with unavoidable and permitted impacts to nontidal waterways including all stream use classes and stream orders. SHA understands that the use of these credits for impacts to Use III streams may be at the discretion of the Interagency Review Team (IRT) and will be negotiated during project permitting. Table 2 summarizes how mitigation credit has been determined. A map showing the waterway extents reopened to diadromous fish species is provided in Figure 2.

Table 2: SHA Credit Determination for Bloede Dam Removal

Credit Type	Credit Ratio	Length (feet)	Total Credit (Feet)	Partial Credit based on Funding	SHA Mitigation Credit
Stream Restoration	1:1	2,716	2,716	31%	842
Fish Passage: Mainstem from Bloede to Daniels Dam	5:1	44,482	8,896	31%	2,757
Fish Passage: 2nd Order Tributaries and higher from Bloede to Daniels Dam	10:1	294,879	29,488	31%	9,141
				Total Credit requested by SHA	12,740

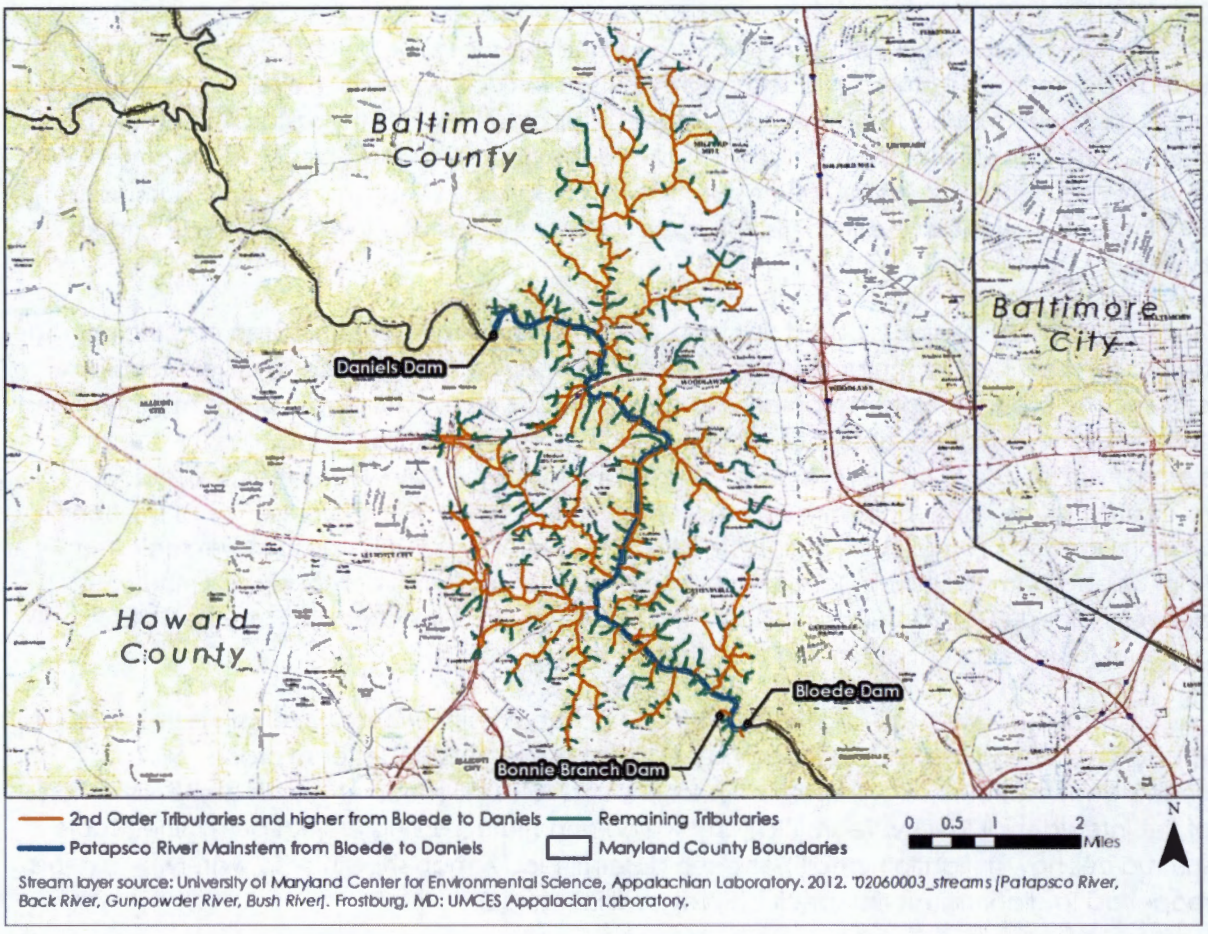


Figure 2: Patapsco River Mainstem and Second Order or Higher Tributaries Opened Through Removal of Bloede Dam

Release of mitigation bank credits to SHA will follow a schedule tied to the achievement of project milestones. The initial 15% of the available credit will be released to SHA upon approval of the mitigation bank. An additional 20% of the available credit will be released upon completion of the dam removal construction. Once the dam is removed, sediments previously impounded by the dam will vacate the area. An as-built survey will be performed to evaluate post-construction conditions including channel widths and depths required for migratory fish species to pass. Confirmation of the minimum widths and depths necessary for migratory fish passage will trigger the release of an additional 25% of available credit. Documentation of functional uplift of the 2,716 linear feet of direct restoration will result in the release of an additional 20% of the credit. Documentation of the presence of hickory shad or herring at the head of the former impounded area, defined as Ilchester Road, will result in the release of 10% of the credits. The remaining credits (10%) will be released upon documentation of an increase in eel populations upstream from the former Bloede Dam. Table 3 provides a summary of the credit release amounts and schedule.

Table 3: Credit Release Schedule

Mitigation Milestone	% Credits Released	Total Cumulative Credits Released
Final approval of Bloede Dam Mitigation Bank	15%	1,911
Removal of Bloede Dam	20%	4,459
As-built survey that documents sediment removal and minimum width/depth for fish passage	25%	7,644
Documented functional uplift of direct restoration of impounded area	20%	10,192
Documented presence of hickory shad or herring at head of impoundment (Ilchester Road)	10%	11,466
Documented increase in eel population upstream of Bloede dam	10%	12,740

3.5 Mitigation Work Plan

The removal of Bloede dam will follow the project design plans prepared by Interfluve, Inc. for the Maryland DNR as provided with the JPA (15-NT-0021/201560068). The project scope of work includes relocation of a 42" sanitary sewer line, dam demolition using a hydraulic hammer attached to a long-arm excavator, and removal of all concrete, rebar or other associated debris from the site. Once the dam is removed, impounded sediment will evacuate the area through passive sediment release. Disturbed land associated temporary construction access and staging areas will be stabilized and revegetated. Trees and shrubs are proposed to be planted within the former impoundment area, but not within the proposed channel.

The work plan includes breaching the dam and allowing natural transport of the impounded sediments. The passive sediment management approach is based on the sediment transport model data, regulatory and regional expert opinions regarding sediment release, and by comparison of channel response and sediment monitoring data collected as part of the post-removal evaluation of the Simkins removal.

Sediment transport simulations were conducted with the Dam Removal Express Assessment Models (DREAM-1). DREAM-1 concluded that the most likely outcome is that 250,000 CY of sand will be transported during wet and average hydrologic conditions following removal of Bloede Dam, and the pre-dam channel profile will be exhumed in 1 to 6.5 months, respectively.

3.6 Maintenance Plan

Dam removal is a self-sustaining activity that should require no maintenance outside of any provisions planned for in the Adaptive Management Plan (AMP). The proposed mitigation is a one-time removal of the Bloede Dam that will restore historic migratory corridors of American eel, river herring, hickory shad, and American shad. The AMP provides provisions for monitoring and maintenance of the site. The AMP is provided as Attachment A.

3.7 Performance Standards

The project goal is to reconnect historic migratory routes for American eel, along with river herring, hickory shad, and American shad by removing Bloede Dam and providing access to upstream spawning and rearing habitat. The performance standards are:

- documented removal of the dam to designed/permitted conditions;
- documented impounded sediment evacuation sufficient to establish a riverine system capable of providing fish passage;
- documentation of ecological lift within the former impoundment, defined as any one or more of the following: the creation of a more diverse geomorphic condition with increased bed form diversity and/or riffle-pool morphology, increased percent Ephemeroptera, Plecoptera, and Trichoptera (EPT taxa) macroinvertebrates, increased dissolved oxygen levels, and decreased water temperatures;
- documentation of the presence of hickory shad or herring (or their eggs) at or above the upstream head of the former impounded area, defined as Ilchester Road; and
- a documented increase in American eel populations (or their eggs) upstream of the former dam.

3.8 Monitoring Requirements

A monitoring framework for the Bloede Dam removal was developed with respect to the project's objectives and in consideration of monitoring activities that were conducted for the Simkins Dam removal. An outline of the monitoring framework for assessing stream conditions is included as Attachment B. Monitoring activities are expected to include:

- Cross sectional surveys
- Photo documentation
- Sediment budgeting
- Suspended sediment and discharge data collection
- Benthic macroinvertebrate sampling
- Fish sampling
- Water quality monitoring

Annual monitoring reports will be submitted to MDE and the USACOE for a period of ten years in accordance with the Bloede Dam permit conditions. If agreeable by MDE and the USACOE, monitoring may be considered complete after year five or any time thereafter if suitable monitoring data is available to justify project goals have been met. Additionally, quarterly observation reports will be submitted that consist of a description and photographs of any major findings or problem areas and any proposed remedial measures during the duration of the monitoring period. If agreed to by MDE and USACOE, the duration and frequently of the observation reports may be modified. If conditions are the same as the previous quarter, a report stating no major findings or problem areas have been observed will be sufficient.

3.9 Long-term Management Plan

Long-term management of the dam removal site will be conducted in accordance with the permit special conditions. Dam removal is expected to require minimal long-term management, and will follow the procedures outlined in the AMP. In areas where stream bank erosion, and/or streambed downcutting, due to removal of the dam results in more than minimal adverse impacts to the aquatic environment or fish passage as determined by the USACOE, the sponsor and/or permittee may be required to take corrective remedial actions (e.g., removal of sediment and disposal at an upland site) consistent with the AMP.

3.10 Adaptive Management Plan

An AMP has been prepared and submitted to the agencies with the JPA. The AMP identifies potential members of an adaptive management team that will be responsible for implementation of the plan and corrective actions. Potential issues that are recognized in the AMP include impacts associated with sediment transport and deposition, bank erosion, and localized areas of concern. Also, the AMP provides a decision-making flowchart and suggested management actions given a number of potential problems. Overall, the adaptive management team retains the flexibility to evaluate potential problems, determine whether problems are the result of the restoration project, and take remedial action. The AMP is included in this Prospectus as Attachment A.

3.11 Financial Assurances

The Sponsor, SHA, has dedicated funding through the Transportation Trust Fund to ensure timely payments to Maryland DNR, the project owner. As an agency of the Maryland Department of Transportation, supported with State and Federal funds, SHA's contribution of $5,000,000 towards removal of Bloede Dam is in place.

4.0 GEOGRAPHIC SERVICE AREA

The geographic service area for the Bloede Dam Mitigation Bank was determined in accordance with guidelines specified in SHA's UMBI. The UMBI defines the Primary Service Area as the 8-digit HUC watershed in which the bank site is located. Bloede Dam is located within the Gunpowder-Patapsco River Watershed (HUC #02060003). The Secondary Service Area is defined as the adjacent 8-digit HUC watersheds within the same river basin and within the same physiographic province as the Primary Service Area. For the Bloede Dam site, this includes portions of the Patuxent River Watershed (HUC #02060006) within the Upper Chesapeake Basin and within the Piedmont Plateau. Figure 3 shows the primary and secondary service areas for the mitigation project. Future SHA projects within the primary service area will receive mitigation credits at a 1:1 ratio, but the mitigation ratio for projects within the secondary service area may be at a higher ratio at the discretion of the IRT.

5.0 GENERAL NEED AND TECHNICAL FEASIBILITY

SHA designs and constructs transportation improvements to maintain existing roadways, increase capacity, and enhance roadway safety. Areas in need of improvement are identified through extensive planning and research. At times transportation improvements require unavoidable impacts to regulated resources. As such, SHA obtains all appropriate authorizations from regulatory agencies before any activities affecting resources are initiated. Mitigation credits as a result of the Bloede Dam removal will help SHA to meet its regulatory requirements for transportation improvement projects within the Gunpowder-Patapsco River Watershed (HUC #02060003) and portions of the Patuxent River Watershed (HUC #02060006).

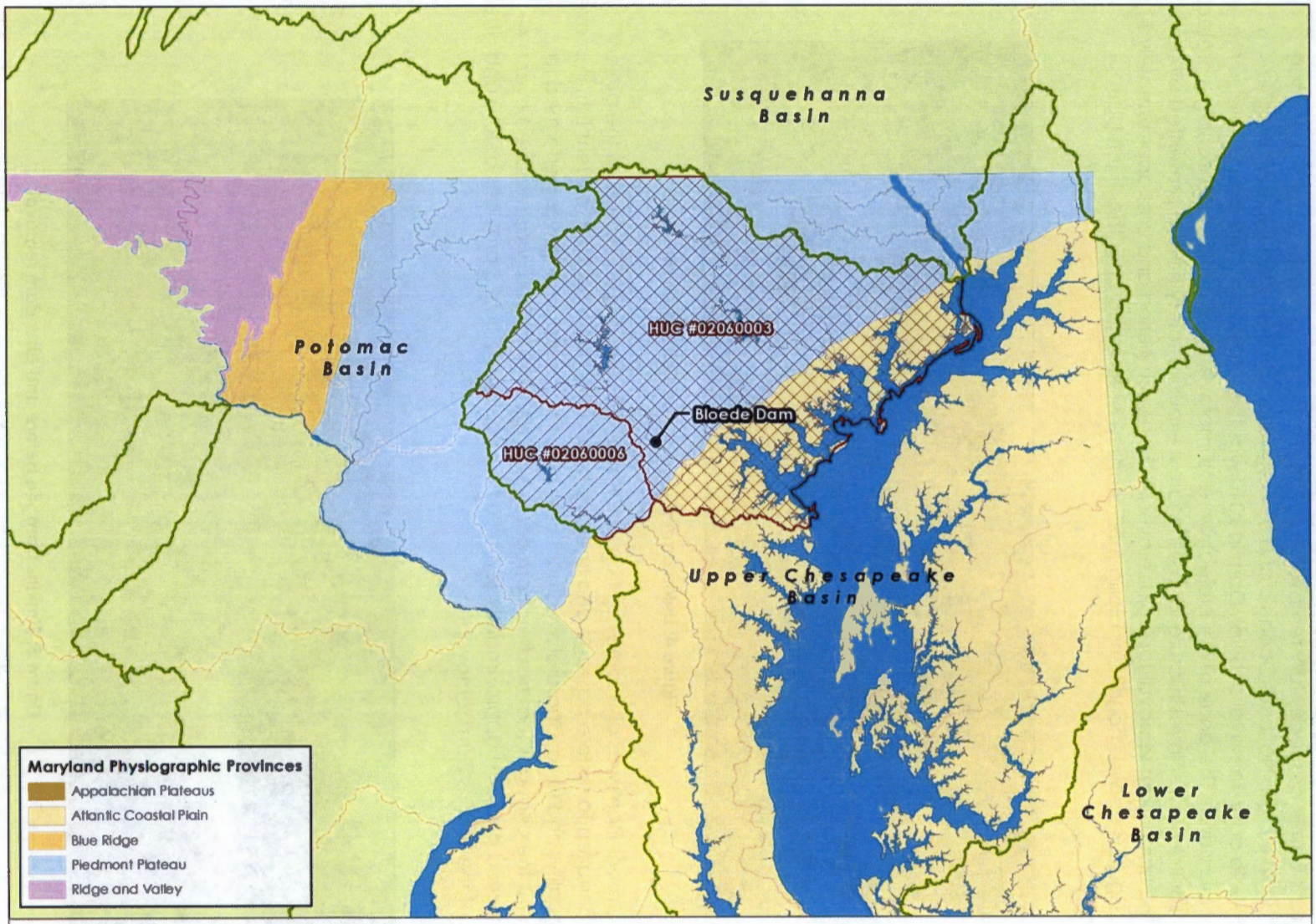


Figure 3: Primary and Secondary Service Areas for the Bloede Dam Mitigation Bank

Maryland DNR was successful in removing the Union Dam from the Patapsco River, and the Simkins Dam was successfully removed through a collaborative arrangement between American Rivers, the National Oceanic and Atmospheric Administration (NOAA), and Simkins Industries. To date, removal of Union Dam in 2010 was the largest dam removal project in the State of Maryland. The goals of the project were to improve river function and ecology, protect nearby sanitary sewer infrastructure, and eliminate the public safety hazard presented by the dam. The Union Dam removal took place over an 11-month period and cost approximately $1.5 million. Figure 4 depicts conditions along the Patapsco before and after the Union Dam removal.

Figure 4: Union Dam site before and after dam removal

Simkins Dam was also removed from the Patapsco River in 2010. Primarily, the project was undertaken to restore passage and improve habitat for migratory and resident fish, improve water quality, and restore natural river functions. Large scale monitoring was performed to document the changes that resulted from dam removal. Simkins Dam was removed over a 4-month period and cost approximately $872,000 to complete. Figure 5 provides before and after photos of the Simkins Dam removal.

Figure 5: Simkins Dam site before and after dam removal

Based on the success of these projects, and the knowledge gained from project implementation and monitoring, SHA expects the Bloede Dam removal project to meet its stated goals and objectives. Also, the Maryland DNR has been collecting data at Bloede Dam since 2009 (see Section 3.3, Baseline Information). Assessment of the site has included topographic surveys of the areas around the dam, coring of the sediment behind the dam to determine its physical and chemical properties, investigation of existing infrastructure to determine potential risks, and electrofishing of the areas around the dam to gather data on fish species and abundance. The design for removal of Bloede Dam is similar to the design for Simkins Dam; passive sediment release will be employed to evacuate impounded sediment. Stakeholders have selected this design plan based on the following recent technical analyses:

- Regional experts attended the "Bloede Dam Sediment Management Workshop" in January 2014 to reach consensus on the preferred method of sediment management for the project.
- A technical memorandum entitled "Sediment Transport in the Patapsco River, Maryland after the Bloede Dam Removal" (Stillwater Sciences) was compiled to summarize expected impacts to downstream waters resulting from dam removal.
- A technical memorandum entitled "Bloede Dam Biogeochemical Impacts – An Analysis Based on Patapsco River Nutrient Balances" was completed to examine the effects of dam removal on nutrient concentrations in the lower Patapsco and Chesapeake Bay.

The overall results of technical investigations and analyses indicate that the long-term benefits of dam removal will outweigh any temporary impacts following construction. As a result, SHA believes that ecological uplift of the Patapsco through removal of Bloede Dam is feasible and has a high probability of success.

6.0 OWNERSHIP AND LONG-TERM MANAGEMENT STRATEGY

The Bloede Dam is located within the Patapsco Valley State Park, which is managed by Maryland DNR under Program Open Space. Maryland DNR will continue to maintain Patapsco Valley State Park in perpetuity following completion of the project. Provisions for long-term management will be specified in the permit special conditions. Any additional long-term management actions will be determined by the USACOE and MDE in consultation with the IRT.

SHA is the Bank Sponsor. The contact information of the Sponsor is:

State Highway Administration
707 North Calvert Street
Baltimore, MD 21202
Attn: Mr. Todd Nichols, Chief
Environmental Programs Division
tnichols@sha.state.md.us

7.0 QUALIFICATIONS OF THE SPONSOR

The Sponsor, SHA, has dedicated funding through the Transportation Trust Fund to ensure timely payments to Maryland DNR, the project owner.

8.0 ECOLOGICAL SUSTAINABILITY

Bloede Dam blocks the Patapsco River, resulting in altered fluctuations in flow. In general, altered flow results in aquatic communities that consist of generalist species who can tolerate variable flow conditions. Studies indicate that when natural flow is restored through dam removal, biodiversity and population of native aquatic organisms increases. Restoration of natural flow also fosters growth of aquatic vegetation that improves spawning habitat for fish. The Bloede Dam site provides an ideal opportunity to reestablish natural flow to the Patapsco River. Following the short-term impacts of dam removal, a more natural flow regime will be allowed to develop. More natural habitat formations are also expected to result from natural flow restoration.

Behind the Bloede Dam, the Patapsco River has been transformed into a lacustrine habitat. Water moves slowly and has a larger surface area behind the dam than in the natural reaches of the channel. These waterbody characteristics favor slow-moving generalist species over those that are adapted to riverine habitats. Removal of Bloede Dam will restore the pre-dam, riverine habitat that species native to the Patapsco depend on. Studies show that dam removal replaces warm-water species and promotes the recovery of native fish populations that require colder, riverine waters.

The increase in water surface area and decrease in flow velocity behind Bloede Dam results in stratification. Warm layers of water sit at the top of the impounded area, and cooler, denser waters sink to the bottom. At the top, the warm layers can mix with the atmosphere and are well oxygenated, but there is a lack of dissolved oxygen in the lower layers. Stratified conditions behind dams can be harmful to native fish species. Warming of the water due to the presence of a dam can affect downstream species composition and population densities. Removal of Bloede Dam is expected to improve Patapsco River water quality by reducing stratification within the stream. Following a short-term period of self-adjustment, water depths, surface areas, and velocities at the site will resemble pre-dam conditions more closely. Subsequently, water temperatures and dissolved oxygen ranges will become more suitable for native fish populations.

Bloede Dam restricts the amount and type of sediment transported by the Patapsco River. Based on an estimate of the pre-dam riverbed elevation and location, Bloede Dam impounds approximately 312,000 cubic yards of sediment. The dam reduces the overall amount of sediment that can be transported through the stream system, resulting in degraded habitat conditions. Streambank erosion and channel incision occur because downstream channel flow lacks sediment. Also, large particles such as cobbles and boulders are unable to pass the dam, which limits the available instream habitat throughout the stream. Following removal of Bloede Dam, natural sediment distribution will be restored. Similar projects have increased the amount of rocky substrate in formerly impounded areas, and have reintroduced larger and coarser

sediments to degraded reaches. Enhanced sediment transport provides new colonization habitat for aquatic insects and restored spawning habitat for fish.

Lower reaches of the Patapsco River are a tidal estuary inlet of the Chesapeake Bay. Historically, the river supported spawning runs for diadromous fish, but Bloede Dam blocks the fish from their traditional spawning grounds. Bloede Dam is the lowermost dam on the river. Removal of the dam will provide diadromous species with greater access to the Patapsco River and its tributaries. Figures 6 through 9 provide the historic range of diadromous species in the Patapsco River. In addition, removal of the dam is expected to provide native freshwater mussels with greater access to regions of the Patapsco River. Mussels rely on host fish to carry young to new habitats, and dams inhibit the movement of host fish. A USGS study of freshwater mussels in the Delaware River determined that the river provides habitat for over 2.2 million mussels per mile. Ninety-eight percent (98%) of the mussels were identified as eastern elliptio (*Elliptio complanata*), which relies solely on the American eel to complete its life cycle. It was concluded that dams such as the Conowingo Dam have restricted upstream movements of American eels and that mussel populations have been adversely impacted as a result.

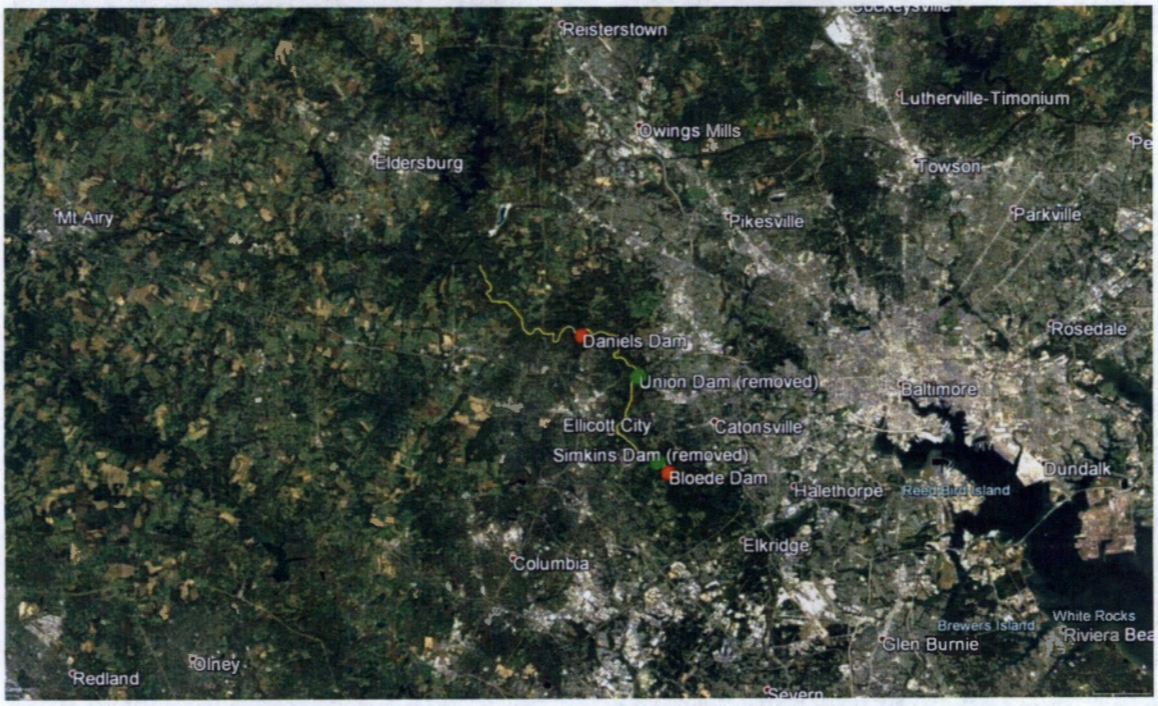


Figure 6: Historic Range of American Shad

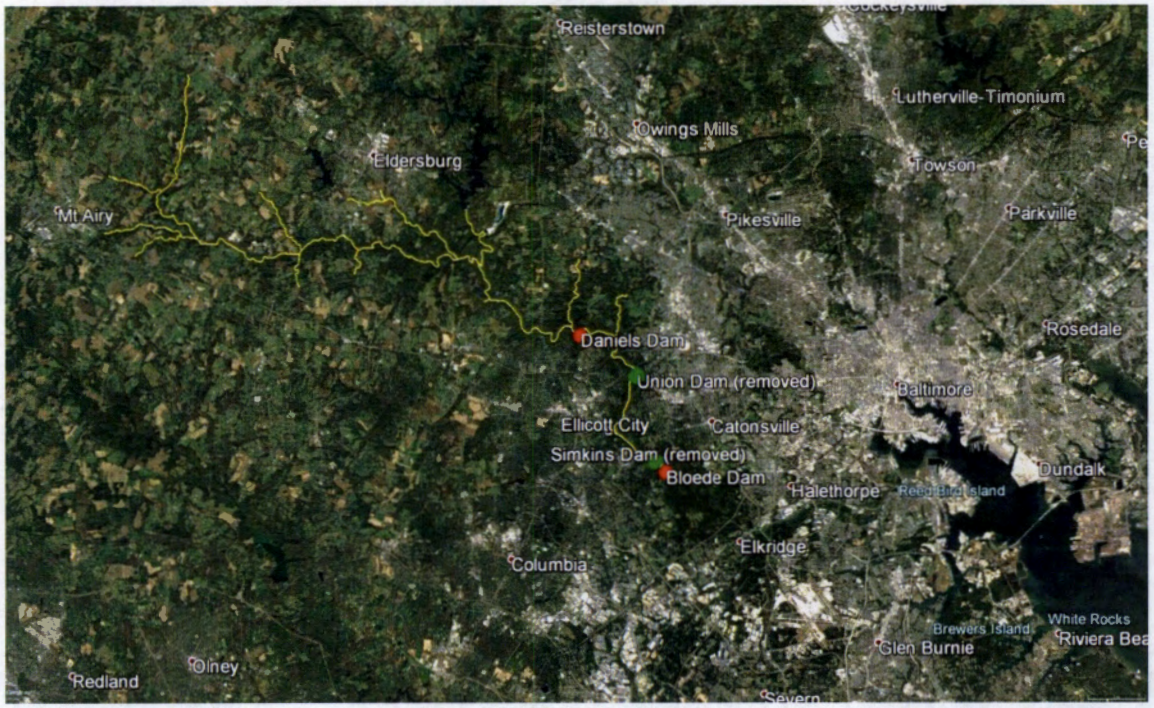


Figure 7: Historic Range of Hickory Shad

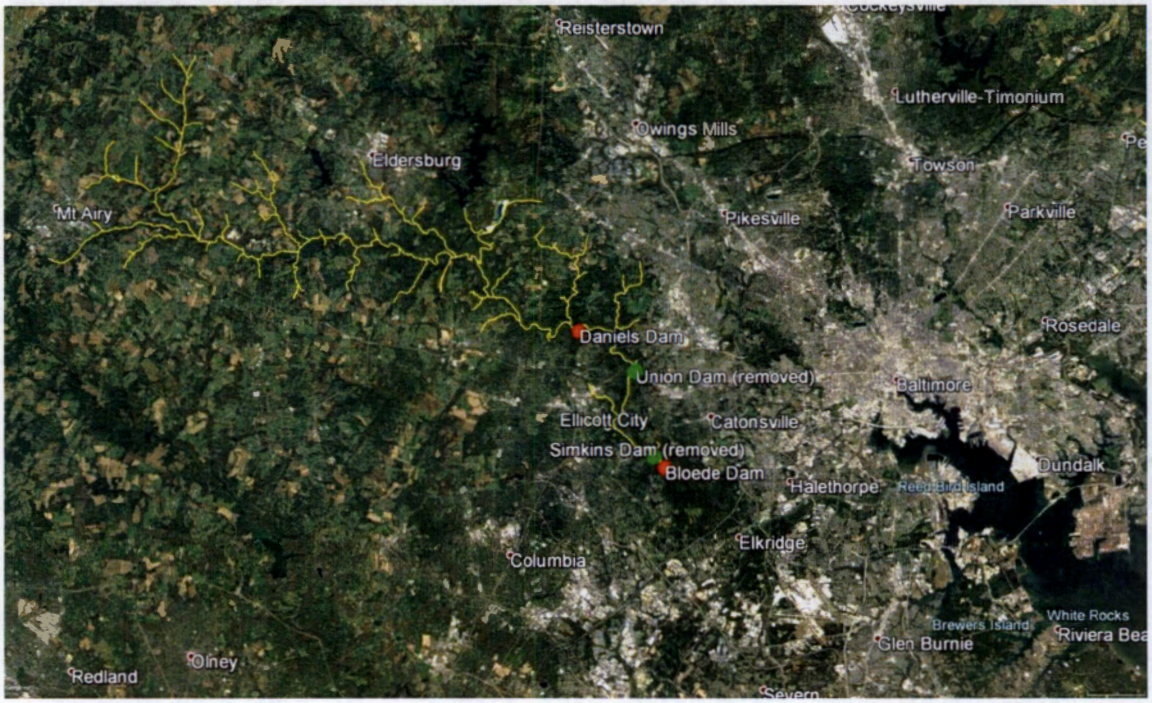


Figure 8: Historic Range of River Herring

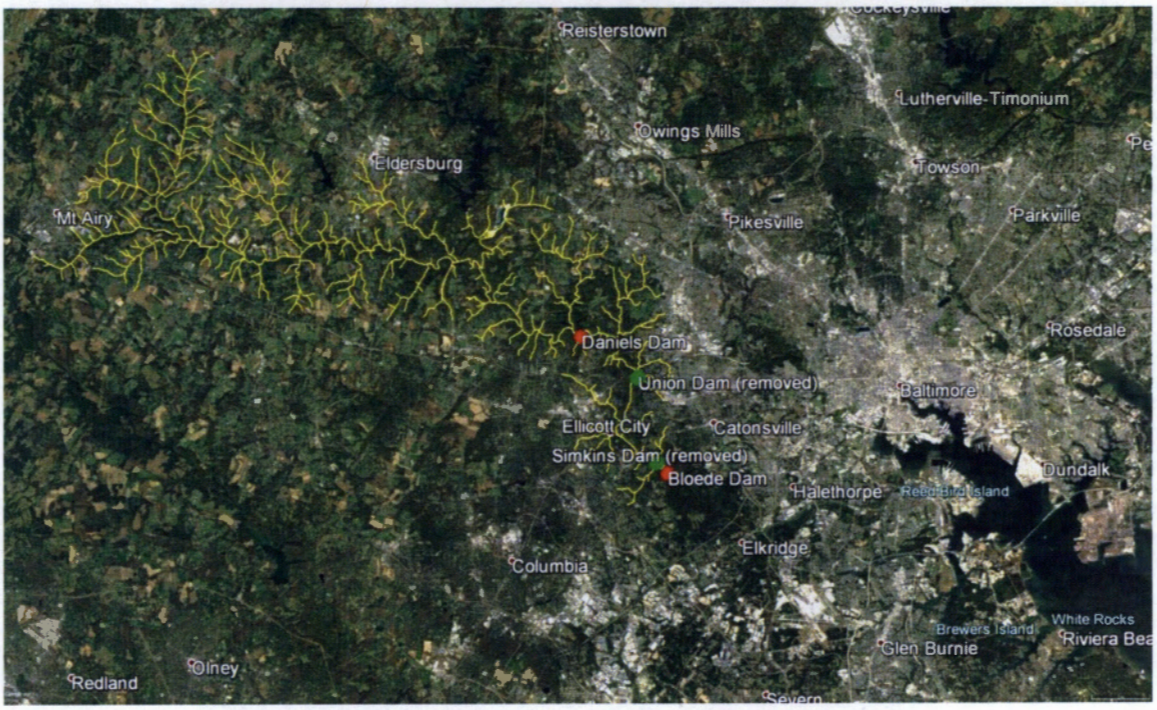


Figure 9: Historic Range of American Eel

9.0 ASSURANCE OF WATER RIGHTS

The total watershed area above Bloede Dam is approximately 303 square miles. Surface water and groundwater are the primary sources of hydrology to the river, in addition to overland flow and stormwater inputs. Even during drought conditions, flow is likely to persist in the channel. The dam removal is expected to restore more natural flow patterns to the Patapsco River. Pre-dam conditions are expected to develop over time after removal of the dam is complete.

ATTACHMENT A

ADAPTIVE MANAGEMENT PLAN

PATAPSCO RIVER RESTORATION ADAPTIVE MANAGEMENT PLAN
Bloede Dam Update

American Rivers and its partners—including NOAA, Maryland Department of Natural Resources and many others—are working to reconnect historic diadramous fish routes with the long-term goal of helping rebuild populations of target species, such as Alewife, Blueback Herring, American and Hickory Shad and American Eel. This work has included the removal of the Simkins and Union dams with post-removal activities directed by the original Patapsco River adaptive management plan, effective October 2010 through October 2014. During this period, our team has effectively managed a robust monitoring program and has overseen work to fix a damaged rock ramp at Thistle Creek. With the successful completion of these projects, we are currently focused on removal of Bloede Dam, the lowermost dam on the Patapsco. This Adaptive Management Plan (AMP) has been updated to reflect conditions anticipated following the removal of the Bloede Dam and provides the framework for managing project goals within the context of allowing the natural geomorphic processes of the Patapsco River an opportunity to restore riverine habitat features over time.

Adaptive management is a dynamic process of setting a management plan, periodically reviewing the plan and monitoring information, and revising the plan and corrective actions, if necessary, to reflect actual experience gained in the implementation. Adaptive management is particularly appropriate for river restoration projects because initial project expectations often prove unrealistic in actual implementation or because it may not be possible to define specific corrective actions/management needs (such as the need to dredge deposited sediment) at the initiation of the project.

Work completed during the planning and design phase established the foundation for the adaptive management data collection and analysis in an effort to identify and address potential areas of concern that may arise as a result of the restoration action. The goal of this guidance is to develop an approach—based on monitoring, applied studies, and modeling—for providing the information that the adaptive management team (AMT) will need for decision-making. This adaptive management plan is organized in three main sections: (1) Establishing an adaptive management framework and corrective actions; (2) Monitoring and dissemination of results; and (3) Decision-making and implementation of corrective actions.

(1) Establishing an adaptive management framework and corrective actions

A key component in being able to swiftly identify and respond to any needs that arise is to establish a core team[1] responsible for developing the AMP framework and associated corrective actions, and making management decisions based on monitoring and field observations in accordance with that plan. Below is a list of individuals/organizations that we recommend comprise the adaptive management team (AMT).

[1] Though not explicitly listed, the organizations conducting monitoring for this project will also play an integral role in this work.

Mary Andrews, NOAA
Serena McClain, American Rivers
Rob Dyke, Maryland Park Service
Michele Hurt, Maryland DNR
Jon Romeo, USACE
Phatta Thapa or Bill Seiger, Maryland Department of the Environment

Members of the AMT will meet on an annual basis for updates regarding ongoing monitoring efforts. These meetings will give members an opportunity to assess whether the AMP is addressing project needs and ensure lines of communication remain open. Additional information below outlines the process if urgent corrective action is necessary.

Targeted Areas of Concern

Through the design process, several areas of potential concern were identified, including three areas that have been monitored since the removal of the Simkins Dam. These include: (1) increased sedimentation on Grist Mill Trail and Grist Mill Trail Extension; (2) sediment deposition at the Gunn Road Crossing; and (3) increased bank retreat at Station 39+700 in the area of the school bus facility. The other possibly affected areas identified include: (4) increased sediment deposition on park roads near the Thomas Viaduct and the Patapsco Valley State Park entrance facility at Avalon and (5) tractive force increases in the area of the Bloede impoundment. Although additional problem areas have not been identified to date, other areas of concern may be identified by the AMT throughout the adaptive management process.

Table 1 (pg. 8) provides a summary of the potential problem areas, monitoring methods, management triggers and potential management actions.

Sediment Transport and Potential Depositional Impacts

Sediment transport simulations were conducted with the Dam Removal Express Assessment Models (DREAM-1), developed by Stillwater Sciences in collaboration with scientists from the University of Minnesota, University of California Berkeley and the National Marine Fisheries Service (NMFS). DREAM-1 is a peer-reviewed sediment transport model that has been examined extensively with both flume and field data. This model and previous versions have been used successfully in dam removal evaluations and other related sediment transport applications, including in the Simkins Dam removal. For the Bloede Dam removal model scenarios, Stillwater used the refined active channel width as well as cross-sectional survey data, LiDAR data, and a hindcast HEC-RAS transport model developed by Johns Hopkins University for model input, and developed a numerically simulated quasi-equilibrium longitudinal profile based on the refined profile. In addition, the DREAM-1 model assumes that all of the sediment eroded from the Simkins impoundment following the Simkins Dam removal will be evacuated out of the system prior to the removal of Bloede Dam, and that the river will regain its quasi-equilibrium condition by the time the Bloede Dam is removed. To examine the effect of different hydrologic conditions on sediment transport, flow hydrographs for three water year types (a wet, an average and a dry year) were selected and different combinations were used for model input.

DREAM-1 concluded that the most likely outcome is that 250,000 CY of sand will be transported during wet and average hydrologic conditions following removal of Bloede Dam, and the pre-dam channel profile will be exhumed in 1 to 6.5 months, respectively. Suspended sediment concentrations are anticipated to peak up to 6,000 to 7,000 mg/l, with elevated concentrations (>1000 mg/l) persisting for approximately 11 weeks with average hydrologic condition and less than 3 weeks with wet hydrologic conditions (Stillwater, 2014). Channel aggradation may be up to 7 feet high immediately downstream of the dam, and channel aggradation of 3 to 4 feet high may persist for up to 5 years as sediments migrate downstream. The primary depositional area downstream of Bloede Dam is located between River Stations (distance measured from the river mouth) 30,000 and 45,000 ft (RM 5.7 – 8.5). Although there is approximately twice the sand in the Bloede impoundment than was within the Simkins impoundment, the higher volume of sediment does not result in twice the depositional depths downstream.

The AMT proposes to use the information gathered through the sediment transport model to develop criteria for decision-making on sediment deposition in the Patapsco River. Since the amount of sand and gravel deposition in the channel will vary both spatially and temporally post dam removal, developing a set number (such as 1 or 2 feet of deposition) is not a realistic or informative management trigger for action. For example, a deposition of up to 7 feet could be found immediately downstream of the dam post removal. However, according to the sediment transport model, this deposition is temporary and will largely be transported downstream within 126 days post removal. The AMT proposes the periodic review of the monitoring information, including the repeated cross sections, to determine whether a management trigger for the adaptive management plan has been tripped. If the repeated cross sections exceed the predicted sediment deposition in the channel as defined in the sediment transport model, the AMT will meet and discuss if management actions are needed. Possible management actions would include: no action – the team recommends no management action is necessary; partial excavation of deposited sediments in the area to provide fish passage; or complete excavation of all deposited sediment in the specified area.

In addition, fisheries biologists will monitor the stream using Maryland Biological Stream Survey (MBSS) protocols. If a site is encountered in which fish passage is significantly impacted through sediment deposition, the AMT will be notified to convene a meeting and/or site visit to assess the situation and discuss if any corrective actions are needed.

Bank Retreat and Potential Erosive Impacts

Erosion is expected to occur within the Bloede impoundment as a result of utilizing a passive sediment approach and given the likely re-establishment of the historical channel elevation. From information collected during the design process, no excessive bank retreat beyond impounded sediment is expected upstream of the dam. However, the project partners will monitor upstream bank condition and upstream infrastructure. Looking downstream, the partners do not predict excessive bank retreat in any location along the length of the Patapsco River. One area was identified as a potential hot spot for bank retreat located at Station 39+700 in the area of

the school bus facility. This is a pre-existing erosive area, first identified by the project team in 2009, and has continued to experience severe erosion (most recently following Tropical Storm Lee in 2011) unrelated to the dam removal projects. As part of due diligence of this removal, the project team is committed to monitoring the Bloede impoundment and Station 39+700 as part of the monitoring effort and have included management triggers in Table 1.

The partners cannot assume responsibility for bank retreat along the entire length of the Patapsco River downstream of the dam removal. Bank retreat can be the result of numerous other stressors on the river system including hurricanes and storm event damage, localized stream impacts such as removal of the riparian buffer or dying/falling trees, erosion due to illegal bike paths in the park system, and a number of other factors. However, the AMT proposes the use of the adaptive management plan to assist in the identification of any potential issues related to the dam removal over the first 24 months of removal.

The AMT will review repeat cross sections, photo documentation and visual reports to determine if bank erosion has exceeded two feet from the pre-removal conditions along the established cross sections. Possible management actions would include: no action – the team agrees no management action is necessary and/or the retreat cannot be attributed to the dam removal; possible grading of the bank; or stabilization of the bank.

(2) Monitoring and dissemination of results

Biotic and abiotic monitoring will be conducted to: (1) assess progress toward restoration goals, and (2) ensure short-term impacts do not exceed acceptable allowances set by the AMT. Abiotic monitoring will evaluate the physical response of the Patapsco River following removal of Bloede Dam using techniques such as cross-sectional surveys, suspended-sediment loads and photo stations. Biotic monitoring will examine changes to benthic macroinvertebrate and fish communities. A more detailed review of the project's monitoring goals can be found in Tab 7.

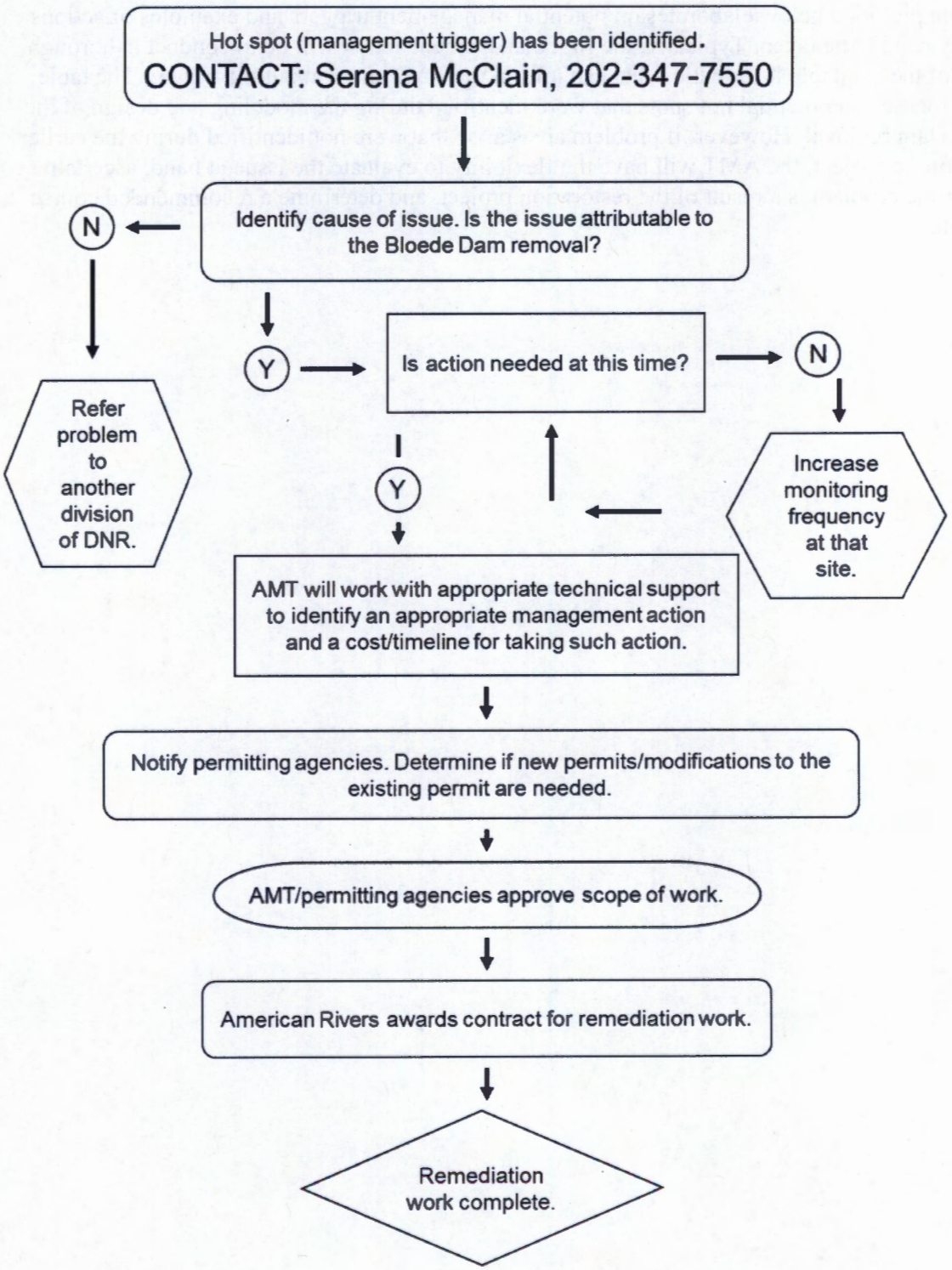
The AMT will be provided all data related to the physical and biological monitoring and will convene a yearly meeting to discuss the results and determine if management actions are necessary.

In the event of inclement weather (2-year storm event or greater), American Rivers will mobilize a team of volunteers or contractors to walk the Patapsco, providing photo documentation and field notes to the AMT, if necessary. Additional meetings can be scheduled if an issue becomes apparent that needs to be addressed by the AMT such as a significant storm event or flood flows, which may have impacted sediment deposition along the stream reach.

(3) Decision-making and implementation of corrective actions

While the restoration targets identify the desired outcomes, the management triggers identify the point at which technical analysts believe the system may not be performing as expected (i.e., potentially moving away from achieving a restoration target). At this point, the AMT should evaluate the identified problem, consider management actions and make a recommendation to

the regulatory agencies. The flow chart below further elaborates on the decision-making process once a problem has been identified.



The table provided below elaborates on potential management triggers and examples of actions that may need to be taken. Typically, the first management action will be to conduct a thorough review of the available information that can inform the AMT more about the trigger. The table largely focuses on potential hot spots that were identified during the modeling and design of the Bloede Dam removal. However, if problem areas arise that were not identified during the earlier phases of the project, the AMT will have the flexibility to evaluate the issue at hand, ascertain whether the problem is a result of the restoration project, and determine a recommended course of action.

Table 1. Management Triggers in Areas of Concern

Category	Monitoring Methods	Management Trigger	Expected Timeframe for Decision-making	Potential Management Action
Grist Mill Trail and Grist Mill Trail Extension	• Repeat photography/field observation • Coordination with Patapsco Valley Park staff	• Sand on trail following storm events	5 days	• No Action • Sweeping or excavation of sand from the path
Gunn Road Crossing	• Repeat cross sections will be surveyed yearly or after significant rain events	• Deposition in the channel exceeds results in the sediment transport model - approximately 4 feet • Overbank deposition of sediment in the adjacent park area	1 month	• No Action • The channel within 200 feet upstream of the bridge will be dredged to the pre-removal depth. •Dredging will be conducted using a standard track or wheel excavator based near the bridge or along the banks, or could involve suction dredging. Consideration will be given to disposing off of state property.
School Bus Facility (station 39700)	• Repeat cross sections will be surveyed yearly or after significant rain events	• Bank retreat exceeds 2 feet along this cross section with evidence of sediment deposition at location	2-4 months	• No Action • If the bank retreat at the bus facility exceeds the established criteria, we will conduct additional topographic surveying and produce a hydraulic model that calculates the hydraulic conditions encountered at the time of survey. • A stable rock toe will be installed, and the bank will be graded and stabilized. The exact design of the bank stabilization will depend on the conditions encountered at the time. The bank stabilization project will be designed to withstand the 100-year flood event.
Thomas Viaduct/ Avalon Park Entrance	• Field observation • Coordination with Patapsco Valley Park staff	• Sand on roads or in park kiosk following storm events	5 days	• No Action • Sweeping or excavation. Consideration will be given to disposing off of state property.
Bloede Impoundment	• Repeat cross sections will be surveyed yearly and after significant rain events • Field observations and coordination with Patapsco Valley Park staff	• Bank retreat exceeds 2 feet along this cross section, or it is demonstrated that bank retreat will potentially impact the stability of Grist Mill Trail, Ilchester swinging bridge or other upstream infrastructure	1 month	• No Action • If the bank retreat along the Grist Mill Trail jeopardizes the stability of the bank/trail, a stable rock toe (or suitable engineering treatment) will be installed, and the bank will be stabilized. The exact design of the bank stabilization will depend on the conditions encountered at the time.

ATTACHMENT B

OUTLINE OF MONITORING FRAMEWORK FOR ASSESSING STREAM CONDITIONS

Outline of Monitoring Framework for Assessing Stream Conditions Pre- and Post-removal of Bloede Dam, Patapsco River, Maryland

Project Goals:

1. Reconnect historic migratory routes for Alewife, Blueback Herring, American Eel and American and Hickory Shad by removing Bloede Dam and providing access to upstream spawning and rearing habitat.

2. Eliminate a documented safety hazard and attractive nuisance.

Monitoring Questions:

Monitoring and evaluation of the biotic and abiotic outcomes following removal of Bloede Dam will assess project effectiveness with respect to the stated goals, building on the monitoring that began in 2010 with the removal of the Simkins Dam. We have designed our monitoring plan to address the following questions:

- What are the magnitudes and spatial distribution of sediment accretions in reaches below the Bloede Dam site?
- At what rates do sediments released to downstream reaches, and temporarily stored there, remobilize?
- What are the timescales required to develop a quasi-stable channel in the former impoundment?
- How does the channel geometry and bed sediment grain size distribution change in former impoundments and downstream receiving reaches?
- What is the ecological response to sediment release following removal of Bloede Dam?
    - What are the changes in species composition, relative abundance and taxa richness change, both temporally and spatially, following removal of the dam?
- What is the biotic response to increased connectivity by migratory and other aquatic species?
    - What are the changes in species composition and relative abundance of migratory fish, both temporally and spatially, following removal of the dam?
    - What are the changes in resident fish communities both upstream and downstream of the dam following removal? How are these changes evolving over time?

Monitoring Methods:

Our effectiveness monitoring of the Patapsco River dam removals began in 2010 before the removal of the Simkins dam. Our methods to address the monitoring questions include the following parameters and analyses:

- Topographic surveys, facies mapping, and digital elevation models pre- and post-removal at representative cross-sections
- Repeat photography at representative cross-sections and additional fixed stations
- Sediment budgets for the project reach at multiple spatial scales
- Continuous suspended-sediment and discharge data collection at three sites: above the project reach, immediately below the Simkins site, and 5 km below Bloede Dam
- Benthic macroinvertebrates collected pre- and post-removal at representative sites
- Resident fish and American Eel surveys pre- and post-removal at macroinvertebrate sampling sites using electrofishing methods
- Anadromous fish surveys at representative sites via electrofishing and/or fyke net
- Monthly monitoring of water quality parameters at one long-term monitoring station downstream of Bloede Dam and another upstream of the project reach

To date, we have collected four years of data on the physical response of the lower Patapsco River to the Simkins Dam removal and sediment release, and have compared post-removal data with baseline data collected in 2009 and 2010[1]. Collection of this monitoring data has allowed for a dynamic adaptive management approach following the removal of Simkins Dam. We have been able to closely track the movement of sediment from the Simkins impoundment downstream. Future monitoring will play a similar role in the Bloede Dam removal Adaptive Management Plan (see Tab 6). Furthermore, with the removal of Bloede Dam, we will build upon the knowledge gained from post-Simkins monitoring.

[1] Collins, M.J., et al. 2014. Physical and Biological Responses to Simkins Dam Removal, Patapsco River, Maryland: Summary Results After Post-removal Monitoring, 2010-2013. Submitted report.