United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241

September 27, 2013

Ms. Ginger Mullins, Chief, Regulatory Division
U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070

Re: West Virginia American Water, Pratt Waterline, Kanawha County, West Virginia

Dear Ms. Mullins:

The U.S. Fish and Wildlife Service (Service) has reviewed the project plans and Biological Assessment (BA) for West Virginia American Water's (WVAW) proposed Pratt Waterline located in Kanawha County, West Virginia. The proposed project requires permits from the U.S. Army Corps of Engineers (USACE) under section 404 of the Clean Water Act (33 U.S.C. 1344) and section 10 of the Rivers and Harbors Act (33 U.S.C. 403). Your letter, dated September 26, 2013, requested we initiate formal consultation pursuant to section 7 of the Endangered Species Act (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). The Service concurs with your determination that proposed activity may affect and is likely to adversely affect four federally endangered mussel species, the pink mucket (*Lampsilis abrupta*), fanshell (*Cyprogenia stegaria*), spectaclecase (*Cumberlandia monodonta*), and sheepnose (*Plethobasus cyphyus*). This document represents the Service's biological opinion (BO) on the effects of the proposed action on those species.

CONSULTATION HISTORY

Service biologists met with representatives from the WVAW, the USACE, and the West Virginia Division of Natural Resources (WVDNR) numerous times either in person or by phone to discuss conceptual project designs, mussel survey activities, and the consultation planning process. The BA for the proposed action was received on September 26, 2013. Additional key events in the consultation history are as follows:

Event	Date(s)
Mussel survey plan submitted to WVDNR and the Service	5/3/2013
WVDNR concurred with survey plan	5/8/2013
Service concurred with survey plan	5/20/2013
Mussel survey conducted and endangered species found	6/3/2013 – 6/8/2013
WVAW submits permit application to USACE	7/12/2013
Meeting with Service, WVDNR, WVAW and consultants to discuss project alternatives	7/19/2013
Mussel survey plan for revised downstream alternative alignment submitted to Service and WVDNR for concurrence	7/21/2013
WVDNR concurred with revised survey plan	7/22/2013
Service concurred with revised survey plan	7/24/2013
Mussel survey conducted at revised location and endangered species found	8/2/2013 – 8/4/2013
Meeting with WVAW and USACE to discuss permit process	8/19/2013
Meeting with Service, WVDNR, WVAW and consultants to discuss the section 7 consultation process, timelines, alternative analysis, and conservation measures	8/27/2013

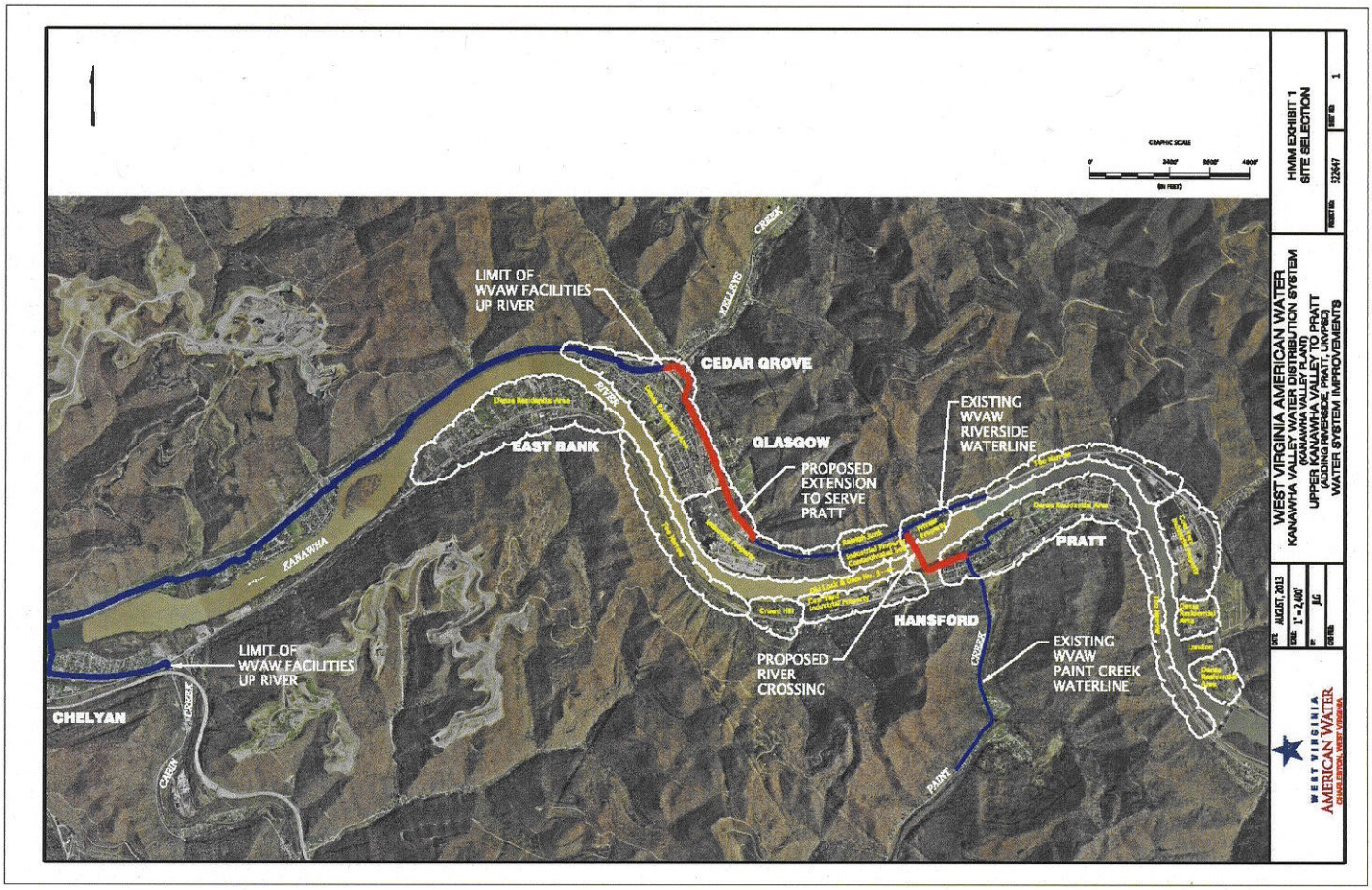
BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The purpose of the proposed action is to provide the Town of Pratt, West Virginia with a safe and reliable source of drinking water. Pratt owns and operates a small municipal water system in southeastern Kanawha County, on the south bank of the Kanawha River. This existing water supply has experienced operational, regulatory and financial challenges over the past few years. For example, Pratt's customers have been put on notice that their drinking water may present an increased risk of causing cancer due to the town's inability to produce drinking water that meets state and federal standards. The Pratt water treatment plant also direct discharges filter backwash water to the Kanawha River, causing significant pollutants to enter into an environmentally sensitive freshwater mussel habitat. In order to address these deficiencies and provide a new clean, reliable source of drinking water, WVAW proposes to construct 6,600 feet of new 16-inch water line (sized to serve the additional communities of Smithers and Montgomery in the future) starting from the existing 16-inch water line located in Cedar Grove and ending at the existing Riverside Booster Station. In addition, a new 8-inch water line will also be installed across the Kanawha River starting from the Riverside water line and interconnecting with the existing water line in Pratt. A total of 2,500 feet of new 8-inch water line will be installed consisting of 1,600 feet on land and 900 feet across the Kanawha River. The estimated cost of this project is $1,825,000. Permits from the USACE must be obtained before construction of the 8-inch water line across the Kanawha River can be initiated.

The proposed crossing of the Kanawha River is located near river mile (RM) 79.84 from the community of Riverside (hereinafter referred to as right descending or north bank) [latitude 38.20679695, longitude -81.402885285] to the community of Hansford (hereinafter referred to as left descending or south bank) [latitude 38.204682817, longitude -81.401285111]. The crossing is located in the Marmet Pool, approximately 10 miles downstream from the end of the navigable portion of the Kanawha River and about 14 miles downstream from Kanawha Falls. The location of the proposed project and the components described above are shown in Figure 1.

Figure 1: Overview of the action area and proposed project components.



WVAW is proposing to install the 8-inch water line across the Kanawha River using restrained ball and socket ductile iron pipe that has been specifically designed for river crossing applications and has been successfully used in similar applications for many years. This pipe would be installed under the river bottom by the open cut and cover method of construction. The river at this location is 900 feet wide and varies in depth from 14 feet in the navigation channel (which is 450 feet wide) to less than 3 feet along the left descending bank, with an average depth of 10 feet (as measured on August 3, 2013; gage height 5.75feet at Kanawha Falls). The water

line will be installed in a trench excavated in the river bottom using a conventional crane operated clamshell mounted on a barge. The trench will vary from 4 feet wide at the bottom to 20 feet wide at the top (assuming the line will be buried 4 feet below the river bottom). The material excavated from 700 linear feet of the trench will be temporarily placed in a barge, rather than side cast into the river, to minimize bottom disturbance and sedimentation. The remaining 200 linear feet, in shallow water on the south bank, will be excavated by a hydraulic excavator working from a much smaller barge that will draft approximately 2 feet. The use of a smaller barge will avoid the need to extensively excavate river bottom to get the larger barge closer to shore (the large crane barge drafts approximately 4.5 to 5 feet). The excavated material from this 200-foot section of the trench will be side cast to the downstream side of the excavation. An approximately 20 feet-wide section of river bottom will be covered by the material side cast into this temporary disposal area in the remaining 200 feet of trench. The substrate from this shallow portion of the river will be excavated last and backfilled first in order to minimize sedimentation and downstream transport of the side cast material. No equipment will be used directly in the stream.

In order to ensure that the trench is constructed to these specifications and within the limits of construction as described above, the contractor will be required to have a professional surveyor on-site to establish and maintain line and grade of the trench. In addition, a diver will be used to verify line and grade of the trench excavation. Immediately after placement of the water line in the trench, the excavated river bottom material will be placed back over the trench area to nearly meet the existing river bottom elevation. The water line is to be installed at a minimum depth of 3 feet below the existing river bottom. The USACE has approved a maximum pipe depth of 15 feet below normal pool. This will minimize excavation depth and width through the navigation channel (i.e., where the current water depths below normal pool are 13 to 14 feet, the excavation will only be 1 to 2 feet deep)

Installation of the 900 feet of water line across the Kanawha River is expected to be completed in 10 days and will be constructed in the following order. The trench will be excavated from shore to shore; a diver will inspect the trench excavation to verify the depth of cover or maximum depth immediately preceding the pipe installation. The ball and socket river crossing pipe will be bolted together in 3 joint segments on a separate barge and transported to the site (minimizing installation time at the site). The pipe segments will be bolted together and lowered into the excavated trench. A diver will verify that the pipe is in the established trench. The pipe will be pressure tested to verify the pipe and joint integrity, and then the trench will be backfilled.

Geotechnical borings and mussel survey habitat data confirm that the expected composition of excavated substrate material is relatively loose and consistent in the top four feet. Minimizing the excavation depth in the 700 linear feet of deep water makes that consistency of substrate composition even more likely. Native material from the river will be used to backfill the trench and compaction will not be attempted. The clamshell and excavator will take care to release fill material as close as safely possible to the pipe to minimize downstream turbidity. The backfill

will be slightly mounded to allow for initial settlement. EnviroScience Inc. divers will be used to evaluate the initial backfill substrate to ensure that it is suitable substrate for mussels. If not, adjustments can be made to the process. Rock riprap or other foreign material will not be used to backfill or stabilize the trench.

Construction of the water line crossing will require the clearing of a 20-foot-wide area of riparian habitat on both banks of the river. Prior to the start of any construction, silt barriers will be installed on the river banks and these will be continuously maintained until the trench is stabilized and the project is completed. Once construction is complete, the river banks will be restored to their preconstruction contour. The steep north bank will be stabilized with rock riprap to the normal high water mark. The south bank rises gradually to follow the grade of the boat launching ramp and will not need rock riprap. The riparian zone habitat on both banks will be restored to preconstruction condition by seeding, mulching, and the planting of native woody materials.

Construction is scheduled to take place during the period from October 15 to November 15, 2013. The mussel translocation is scheduled to take place immediately preceding construction. This time of year is typically ideal flow conditions for working in the Kanawha River based on previous years' flow data.

Conservation Measures

Conservation Measures are those actions taken to benefit or promote the recovery of the species and that are included as an integral portion of the proposed action. These actions will be taken by the Federal agency or the applicant and serve to minimize or compensate for project effects on the species under review. The USACE and WVAW have committed to completing the following conservation measures, as more fully detailed on pages 13-19 of the BA:

1. The project will be sited at a location that best minimizes the effects to mussels and mussel habitats.

2. The width of trenching and in-stream impacts will be minimized by conducting construction from appropriately-sized barges rather than using causeways in the river.

3. The installation below-grade depth requirement of the waterline was reduced by the USACE which greatly minimized the amount of in-stream excavation required.

4. Mussels will be relocated from the areas where the most acute adverse effects are anticipated to occur. Relocations will be conducted in accordance with a mussel salvage plan that will be reviewed and approved by the Service and the WVDNR prior to implementation. Measures will be used to minimize stress and mortality to mussels that

are being relocated as outlined in the BA, and supplemented by a final Mussel Salvage Plan and Habitat Monitoring Plan dated September 24, 2013.

5. The area of the riverbed directly affected by the project and the amount of sedimentation that will occur during in-water construction in deeper project sections will be minimized by temporarily storing excavated material in a barge rather than side-casting the material. In shallow project sections, sedimentation will be minimized by side-casting material downstream from the barge where it will be somewhat protected from river flows until settled. Both the excavator and clamshell will release fill material as close as safely practical to the stream bottom to minimize downstream transport and sedimentation.

6. Stream bank disturbance will be minimized to an approximately 20-foot-wide corridor. Measures will be used to minimize sedimentation from stream bank disturbance and the disturbed area will be restored, regraded, seeded, mulched and replanted as outlined in the BA, and supplemented by a final Erosion and Sediment Control and Sediment Monitoring Plan and Seeding and Planting Plan dated September 18, 2013.

7. The water line will be placed deep enough and the disturbed habitat will be restored to ensure no lingering hydraulic effects from exposed pipe sections. Inspections will be conducted periodically during the project to ensure proper construction. Additional coordination with the Service will occur if problems are identified and project modifications or repairs are needed.

8. In-stream fill will use native stream materials and bank fill will use native and clean fill.

9. A spill prevention plan will be prepared prior to construction and will be available on-site. Fueling of all equipment will occur on land in designated staging areas whenever possible. Measures will be implemented to ensure no spills/contamination will occur during construction including designated staging areas, spill control kits, and an on-site environmental monitor. The spill prevention plan will be reviewed and approved by the Service prior to implementation. A draft outline of this plan is included in the BA. Further details of the plans are provided in the the Environmental Policy Procedures and Emergency Response Procedures for Amherst Madison provided by emails dated September 18 and 19, 2013; and the Groundwater Protection Plan for Rover Construction, Inc. provided by email dated September 19, 2013.

10. A qualified malacologist or other qualified individual will be on-site during construction as a consultant to ensure all sediment and construction methods meet the terms and conditions of the BO.

11. Sedimentation monitoring will be conducted upstream and downstream during the construction operation using methods such as in-situ turbidity meters or artificial

substrate samplers as outlined in the BA, and supplemented by a final Erosion and Sediment Control and Sediment Monitoring Plan and Seeding and Planting Plan dated September 18, 2013.

12. To improve the recovery of endangered mussel species within the Kanawha River, WVAW will financially support mussel monitoring or propagation efforts at the Kanawha Falls mussel monitoring site. WVAW will provide $10,000 to support these or similar efforts to enhance Kanawha River mussel populations and habitat as outlined in the BA, and supplemented by a final Mussel Salvage Plan and Habitat Monitoring Plan dated September 24, 2013.

13. Post-construction monitoring will be conducted 1-year and 3-years post construction to ensure that the anticipated level of take is not exceeded and that restoration and recovery of mussel populations within the affected area occurs. Monitoring will be conducted in accordance with a habitat and mussel monitoring plan as outlined in the BA and supplemented by the final Mussel Salvage Plan and Habitat Monitoring Plan dated September 24, 2013.

Alternatives Evaluated

WVAW evaluated a number of potential alternatives to avoid and minimize adverse effects to federally endangered mussels. Horizontal directional drilling (HDD), a process that would drill a pipeline corridor under the surface of the river and would avoid direct disturbance to the stream bottom, was evaluated as the first option. However, based on factors such as topography, geometry, geology, and geotechnical findings, including elevations of the river bank and river bottom, it was determined that the HDD construction method carried a significantly high risk of failure and should not be attempted.

Two open cut alternatives were then evaluated. The first alignment considered was located approximately 140 feet upstream of the Pratt public boat launch. After an initial mussel survey conducted in June, 2013 identified significant mussel populations and federally endangered species within the area of direct impact, another alternative alignment (Alternative 2B) was developed. Alternative 2B is located approximately 60 feet downstream from the Pratt public boat launch. Another mussel survey conducted in August, 2013 also identified mussel populations and federally endangered species within this proposed alignment, but the mussel population was somewhat less dense than the populations identified in the first alignment.

Finally, WVAW evaluated whether the pipeline could be constructed within the same proposed alignment as Alternative 2B but could be placed on the river bottom without excavation. This would have minimized direct disturbance to the stream bed and reduced sedimentation. However, the USACE determined that this was not feasible because an unburied pipeline could pose a hazard to navigation and could cause a scour effect across the stream.

WVAW is constrained from developing additional alignment alternatives upstream or downstream due to the presence of dense residential development, industrial facilities with contaminated soil, and railroad lines located in close proximity to the riverbank, all of which precluded construction of new water lines in these areas. Constraints that precluded the development of additional alternative alignments are identified in Figure 1.

As a result of this evaluation, WVAW proposes to construct the pipeline using the open cut method at the alignment downstream of the Pratt public boat launch (Alternative 2B). The Service concurs that alternatives that will avoid adverse effects to federally listed species are not practicable, and that WVAW has selected the least damaging practicable alternative.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action, including all interrelated and interdependent effects and not merely the immediate area involved in the action. Therefore, for the purposes of this BO, the action area includes all areas affected by construction of the proposed action including the 16-inch water line installed starting at Cedar Grove (approximately RM 78.5) and continuing upstream to connection of the 8-inch waterline crossing the Kanawha River and connecting to the water system in Pratt (approximately RM 80.5). The action area thus encompasses approximately 2 miles of river and adjacent terrestrial areas extending up to 2,400 feet from the riverbank as shown in Figure 1.

Terrestrial areas within the action area are dominated by a mix of residential and industrial/commercial development. At the location of the proposed river crossing on the south side of the river (Pratt), CSX Transportation (CSXT) owns property that is currently used as baseball fields and a boat launching ramp and is essentially public use property. Immediately downstream of the CSXT property was the site of the old U.S. Lock and Dam No. 3, at RM 79.7. The majority of this structure in the river has been removed so that it is not impairing navigation, but foundations of this structure remain 12 feet below river pool elevation. On the north side of the river, opposite CSXT and upstream of the old lock and dam, is private residential property.

Within the action area commercial tow and barge traffic in the area is relatively light, as is recreational boat traffic. The site and surrounding areas support a healthy fishery and the boat launch located within the project area provides local access to the river. The currently active USACE London Lock and Dam is located just upstream of the action area at RM 82.8. Because the action area is located in the upper end of the Marmet navigation pool, river flows and substrates in this area are relatively less impacted by impoundment than the lower end of the navigation pool.

STATUS OF THE SPECIES

Species Descriptions and Listing Histories

The pink mucket is a freshwater mussel that was listed as federally endangered in June, 1976 (41 Federal Register [FR] 24062). At the time of listing, it was officially called *Lampsilis orbiculata*, but that name has been changed to *L. abrupta* (Turgeon *et al.* 1998). The pink mucket is a member of the mussel family Unionidae and is a medium-sized mussel, growing to a length of approximately 4.5 to 5 inches. The shells are subquadrate or circular in shape and become thick and heavy in mature individuals. Anterior edges of the shells are rounded, with slightly curved dorsal and ventral margins. The posterior margins of the shells in females are slightly rounded to straight; shells of the males are rounded or bluntly pointed. A well-defined posterior ridge is present in the males. Color of the outer shell surface (periostracum) varies from light yellow or yellowish-brown to dark brown, occasionally marked with broken fine to fairly wide dark green rays. The color of the inner shell surface (nacre) varies from white to pink to salmon in color, with the posterior margin being iridescent (Parmalee and Bogan 1998). The pink mucket is shown in Image 1. Critical habitat has not been designated for the pink mucket.

The fanshell was listed as federally endangered in June, 1990 (55 FR 25591). The fanshell is a member of the mussel family Unionidae and is a medium-sized mussel, seldom exceeding 3.2 inches in length. The shell of the species is subcircular in shape. The ventral margin of the shell is broadly rounded, and the posterior margin is slightly truncated. The posterior ridge is well developed with a sharp posterior slope. The periostracum, is light green or yellowish in color with green rays and mottling. The posterior two-thirds of the shell is covered with numerous rounded pustules and irregular knobs. The nacre is silvery white (Service 1991, Parmalee and Bogan 1998). The fanshell is shown in Image 2. Critical habitat has not been designated for the fanshell.

The spectaclecase was listed as a federally endangered in April, 2012 (77 FR 14914). The spectaclecase is a member of the mussel family Margaritiferidae and is a large mussel that reaches at least 9.25 inches in length (Oesch 1984, Parmalee and Bogan1998). The shape of the shell is greatly elongated, sometimes arcuate (bowed or curved), and moderately inflated, with the valves being solid and moderately thick. Both anterior and posterior ends of the shell are rounded with a shallow depression near the center of the valve. The anterior end is higher than the posterior end. The posterior ridge is low and broadly rounded. Year one specimens have heavy ridges running parallel with the growth rests. The periostracum (external shell surface) is somewhat smooth, rayless, and light yellow, greenish-tan, to brown in young specimens becoming rough and dark brown to black in old shells. The shell will commonly crack posteriorly when dried (Watters *et al.* 2009). The fanshell is shown in Image 3. Critical habitat has not been designated for the spectaclecase.

The sheepnose was listed as a federally endangered in April, 2012 (77 FR 14914). The sheepnose is a member of the mussel family Unionidae and is a medium-sized mussel that reaches nearly 5 inches in length (Oesch 1984, Parmalee and Bogan 1998). The shell is elongate ovate in shape, moderately inflated, with thick, solid valves. The anterior end of the shell is rounded, but the posterior end is somewhat bluntly pointed to truncate. The dorsal margin of the shell is nearly straight, while the ventral margin is uniformly rounded or slightly convex. The posterior ridge is gently rounded, becoming flattened ventrally and somewhat biangular. There is a row of large, broad tubercular swellings on the center of the shell extending from the beak to the ventral margin. A broad, shallow sulcus (depression on the furrow on the outside surface of the shell) lies between the posterior ridge and central row. Beaks are elevated, high, and placed near the anterior margin. Juvenile beak sculpture consists of a few concentric ridges at the tip of the beaks. The periostracum is generally smooth, shiny, rayless, and light yellow to a dull yellowish brown. Concentric ridges resulting from growth arrests are usually darker (Watters *et al.* 2009). The sheepnose is shown in Image 4. Critical habitat has not been designated for the sheepnose.

Image 1: Female Pink Mucket

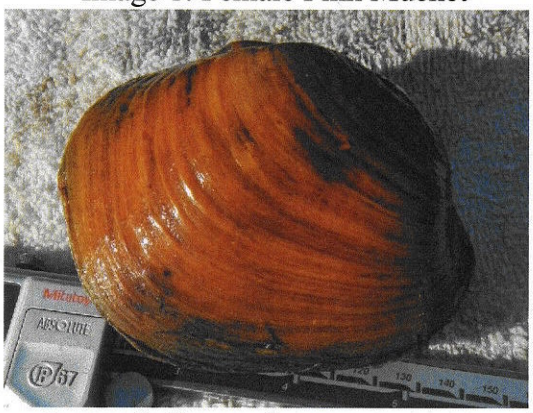


Image 2: Fanshell

Image 3: Spectaclecase

Image 4: Juvenile Sheepnose

All images provided by EnviroScience, Inc.

Life History

The general biology of the pink mucket, fanshell, spectaclecase, and sheepnose is similar to other freshwater mussels. Adults are suspension feeders, using their gills to remove suspended particles in the water column. The diet is believed to include detritus, phytoplankton, zooplankton, diatoms, bacteria, and other microorganisms (Fuller 1974). The extent of selectivity exhibited by mussels feeding on each of these food groups and species within these food groups is poorly understood and is likely to vary by species. Evidence suggests that detritus and bacteria may be an important food source (Silverman *et al.* 1997, Nichols and Garling 2000). Even less is known of the feeding behaviors of juvenile mussels. Juvenile mussels are believed to employ foot (pedal) feeding to some degree for the first several months of their lives, feeding on depositional materials in interstitial water (water within the substrate), including bacteria, algae, and detritus (Yeager *et al.* 1994). Pedal feeding in juveniles is accomplished by movements of microscopic cilia lining the foot that carry food particles into the mantle cavity and into the mouth. Juveniles also use the foot in a sweeping motion to draw particles toward the mantle cavity (Reid *et al.* 1992).

Adult freshwater mussels spend their entire lives partially or completely buried in the stream bottom (Murray and Leonard 1962). The depth to which they bury themselves may depend on the species, season, and environmental conditions (Parmalee and Bogan 1998). The posterior margin of the shell is usually partially spread, and the siphons extended to facilitate feeding and respiration. During periods of activity, movement is accomplished by extending and contracting a single muscular foot between the valves. Extension of the foot also enables the mussel to wedge itself into the river bottom.

Reproduction

Freshwater mussels have an unusual and complex mode of reproduction, which includes a brief, obligatory parasitic stage on fish. Most species typically have separate sexes, and spawning occurs in the spring, summer, or early fall (depending on the species). First, females lay eggs and brood them in specialized chambers in the gills (marsupia). Then males release sperm into the water column and the sperm are then drawn into the female's incurrent siphon. Fertilization takes place internally within the marsupium. Within the marsupium, fertilized eggs develop into microscopic larvae (glochidia), which only have embryonic stages of a mouth, intestines, heart, and foot. The female may brood glochidia until the following year (long-term brooders) or release glochidia the same year it is fertilized (short-term brooders). Once glochidia are expelled by the female, they must quickly attach to the gills or the fins of an appropriate fish host to complete development. Glochidia that fail to attach to a suitable host will die. Host fish specificity varies among mussel species. While some mussel species appear to require a single host species, other species can transform their glochidia into juvenile mussels on several fish species. The glochidia parasitize a fish host for a variable length of time, likely depending upon water temperature, fish species, and other factors. Once attached to its host fish, the developing glochidia will disperse with the fish for a period of weeks while they must successfully transform

into juveniles, excyst from the host (drop off), and must then settle into suitable habitat to survive. Glochidia that do not drop off in suitable habitat will die. In addition, not all glochidia that attach to a suitable host successfully transform into juveniles. Transformation success on suitable host fish can vary widely and may be affected by the genetics and age of host fish as well as acquired immunity from previous parasitic infestations. Thus, there are several weak links in the life cycle that may prevent successful reproduction and recruitment of juveniles into existing populations (Butler 2002b). The successful transfer of mature glochidia to a suitable host constitutes one of the critical events in the life cycle of freshwater mussels, and various adaptations to facilitate this process have evolved. The method of host infection greatly varies among species.

Females pink muckets have an extension of the mantle tissue that strikingly resembles a small fish. This structure is displayed outside the shell from between the valves and is twitched repetitively to attract its predaceous fish host. The host is infested by the female mussel when the fish attempts to eat the lure (Kraemer 1970, Barnhart and Roberts 1997). This "lure" of glochidia increases the probability that a fish will come in contact with the mantle flap and release the glochidia when it approaches or attacks the lure. Based on laboratory host fish infections, potential fish hosts include the largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieui*), spotted bass (*M. punctulatus*), and walleye (*Stizostedion vitreum*) (Barnhart *et al.* 1997*a*). The use of large piscivorous fishes for hosts is consistent with the presence of a fish-like mantle lure in pink mucket (Barnhart *et al.* 1997). The pink mucket is a long-term brooder, becoming gravid in August and the females infect fish hosts the following spring (Ortman 1912, 1919).

The fanshell's glochidia are released into the water in the form of a unique spiral conglutinate. Conglutinates are small structures made up of gelatinous material that enclose large numbers of glochidia. These structures resemble prey items of the mussel's host fish, and the host fish are infested when they attempt to eat them (Chamberlain 1934, Barnhart and Roberts 1997). The worm-like shape of the fanshell's conglutinate suggests that a fish that visually searches for its food may be its host (Service 1991). Until recently, the species of host fish utilized by the fanshell was unknown. Jones and Neves (2002) induced 16 fish species with glochidia and determined that the fanshell has at least nine species of fish hosts. These fish species included mottled sculpin (*Cottus bairdi*), banded sculpin (*Cottus carolinae*), greenside darter (*Etheostoma blennioidesy*), snubnosed darter (*Etheostoma simoterumi*), banded logperch (*Etheostoma zonale*), tangerine darter (*Percina aurantiaca*), blotchside logperch (*Percina burtoni*), logperch (*Percina caprodes*), and Roanoke darter (*Percina roanoka*). The tangerine darter, blotchside logperch, Roanoke darter, and greenside darter proved to be the most suitable hosts for the fanshell because glochidia transformed to juvenile mussels on those species than on other fish species. The remaining five fish species, identified as hosts during the study, proved to be marginal hosts because few juvenile mussels transformed. Glochidia on all tested species of *Percina* transformed to juvenile mussels, so other species of *Percina* may be suitable hosts. The

fanshell is also a long-term breeder. Fertilization takes place in late summer/fall, and the glochidia overwinter in the female and are discharged into the water column in spring (Ortman 1919). Jones and Neves (2002) collected gravid female fanshells in the upper Clinch River in Virginia from late October to late May. March was the earliest conglutinates were expelled from the marsupium into the river. Some of the females collected in April and May had only one or two conglutinates remaining, suggesting that most females released conglutinates by late spring.

Spectaclecase glochidia are also released in the form of conglutinates. Spectaclecase conglutinates are flat and white, and some may be forked (Knudsen and Hove 1997, Baird 2000). Conglutinates typically contain not only glochidia, but embryos and undeveloped ova as well. Tens to hundreds of thousands of the hookless glochidia may occur in each conglutinate. Total fecundity (including glochidia and ova) in a Missouri study varied from 1.93-9.57 million per female (Baird 2000). The conglutinates are entrained along a transparent, sticky mucous strand up to several feet in length (Butler 2002a). Although several host studies have been done, the host(s) for the spectaclecase is not known (Butler 2002a). The fact that spectaclecase populations are oftentimes highly aggregated with apparently many even-aged individuals indicates that glochidia may simultaneously drop off from a host (Butler 2002a). The spectaclecase utilizes all four gills as marsupium for developing glochidia (Butler 2002a). The spectaclecase is apparently a short term brooder, with glochidial release occurring from early April through late May in Missouri streams (Baird 2000). Both Howard (1915) and Gordon & Smith (1990) inferred that the spectaclecase produces two broods each year (late spring/early summer and fall). Hermaphroditism (male and female characteristics in the same individual) may occur in the spectaclecase, although it was not reported in Baird's (2000) study (Butler 2002a).

Sheepnose glochidia are released in the form of conglutinates, which resemble small pink worms. Little is known regarding sheepnose host fishes or reproductive biology (Roberts and Bruenderman 2000). The sauger (*Stizostedion canadense*) and central stoneroller (*Campostoma anomalum*) are the only known natural hosts (Surber 1913, Wilson 1914, Watters *et al.* 2009). The sheepnose utilizes only the outer pair of gills as marsupium for its glochidia (Butler 2002b). The sheepnose is thought to be a short term brooder with most reproduction taking place in early summer, and glochidial release occurring presumably later in the summer.

Growth and Longevity

Many freshwater mussel species are long-lived and grow slowly. Individuals of many species live more than 10 years, and some have been reported to live over 100 years (Cummings and Mayer 1992). Freshwater mussels exhibit distinct lines on the surface of their shells that are hypothesized to form annually. Growth is rapid for the first few years, especially in males. In general, mussel growth slows considerably after the first few years, presumably when individuals become fully mature, with energy instead going towards gamete production and development (Baird 2000).

Qualitative age estimations from external shell growth ring counts from 36 individuals collected from Usage River, Missouri, suggests that the pink mucket can live up to 36 years (Neves and Moyer 1988, Ecological Specialists Inc. 2003). It is probable the species lives several years longer, considering that the growth ring method typically underestimates age compared to quantitative age determinations (thin sectioning shells) and that the older the specimen the greater the probability of underestimating its age (Neves and Moyer 1988). Unfortunately, no empirical age data exists from thin sectioning pink mucket shells. An experimental pond propagation study that took place in early 2006 using pink mucket stock from Pickwick Landing tailwaters (Tennessee River, Tennessee) shed light on aspects of its early life history. Host fish (largemouth bass) were infested with mature glochidia teased out of a gravid female pink mucket and contained in a small pond enclosure. By late summer 2006, six juvenile individuals that had survived post-metamorphosis were released into an enclosure in their parent tailwaters to monitor survival, growth, and sexual activity. After approximately 20 months, they had all survived and grown from approximately 0.9 inches length at the time of translocation to a range of 2.2 to 2.7 inches, and were beginning to develop sexual dimorphic shell characters (apparently four females and two males). A reassessment of the grow-out experiment in March 2009, when the mussels were approaching age 3, found 100 percent survival and that there were indeed four females and two males. The females all had charged gills (whether with eggs or glochidia was unknown) and had grown to a length range of 2.4 to 2.8 inches, while the males were larger at 3.1 and 3.2 inches (Butler 2010). From this age and growth data it appears that at least female pink muckets reach sexual maturity at age 2 or above.

Ages of fanshell collected from the Clinch River, Virginia ranged from 6 to 26 years with the mean age being younger than 8 to 10 years. Annual growth averaged 0.16 inches/year through age 10, and decreased approximately 0.03 inches/year thereafter. The smallest gravid females found in the Clinch River had a length of 1.1 to 1.3 inches, implying that most individuals are mature at 5 to 9 years. Individuals found in the Clinch River from 1998 to 2001 were small and in excellent condition, suggesting that the population was experiencing recruitment. The mean age at death of fanshell was determined to be approximately 12 to 13 years (Jones and Neves 2002).

Ages of spectaclecase collected in Missouri ranged from 1 to 56 years (Baird 2000). The Gasconade and Meramec River populations, both in Missouri, had mean estimated ages of 25 and 32 years, respectively. As expected, growth rate decreased with increasing individual size. Measured annual growth rates were variable, particularly in smaller individuals. Mean growth for tagged individuals that were recovered was 0.066 inches. Height increased by 0.044 inches and mass by 0.48 ounces (Baird 2000). Age at sexual maturity for spectaclecase was estimated at 4 to 5 years for males and 5 to 7 years for females (Baird 2000).

Very little literature exists regarding growth and longevity of the sheepnose. The sheepnose gradually slows in growth during its entire life. Specimens rarely reach more than 5.2 inches and longevity has been estimated to be 30 years (Watters *et al.* 2009). Age at sexual maturity is unknown, but given its estimated longevity, probably occurs after a few years.

Habitat

The pink mucket and fanshell occupy similar habitat. Both species occur in medium to large rivers (Bates and Dennis 1985; Service 1991, 1985). They are typically found in stable stream channels where a diversity of other mussel species are concentrated (i.e. a mussel bed). These areas of suitable habitat naturally occur in relatively small patches separated by longer reaches of unsuitable habitat (Vaughn and Pyron 1995). Both the pink mucket and fanshell can be found in a range of substrates and substrate mixtures including gravel, cobble, boulder, and occasionally mud or sand (Call 1900, Goodrich and Van der Schalie 1944, Cummings and Mayer 1992, Oesch 1995, Buchanan 1979, 1980, and 1994, Gordon 1991). However, they are most commonly reported from a gravel/sand mixture with various levels of cobble and silt (Buchanan 1980, Roberts and Bruenderman 2000, ESI 2003). While both species require flowing water and are considered typical riffle species, they can occupy a wide range of currents and water depths (Hickman 1937, Yokley 1972, Buchanan 1980, Clarke 1982, Oesch 1995, Roberts and Bruenderman 2000).

The spectaclecase generally inhabits large rivers, and is found in microhabitats sheltered from the main force of current. It occurs in substrates from mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with a slow to swift current (Baird 2000, Buchanan 1980, Parmalee and Bogan 1998). According to Stansbery (1967), this species is usually found in firm mud between large rocks in quiet water very near the interface with swift currents. Specimens have also been reported in tree stumps, in root masses, and in beds of rooted vegetation (Oesch 1984). Similar to other margaritiferids, spectaclecase occurrences throughout much of its range tend to be aggregated, particularly under slab boulders or bedrock shelves (Baird 2000, Buchanan 1980, Parmalee and Bogan 1998, Gordon and Layzer 1989), where they are protected from the current. Up to 200 specimens have been reported from under a single large slab in the Tennessee River at Muscle Shoals, Alabama (Hinkley 1906). Unlike most species that move about to some degree, the spectaclecase may seldom if ever move except to burrow deeper and may die from stranding during droughts (Oesch 1984). However, at least one recent study indicated that spectaclecase can be quite active because relocated individuals moved to more suitable habitat (Dunn *et al.* 1999).

The sheepnose is a larger-stream species occurring primarily in shallow shoal habitats with moderate to swift currents over coarse sand and gravel (Oesch 1984). Habitats with sheepnose may also have mud, cobble, and boulders. Sheepnose in larger rivers may occur at depths exceeding 19.7 feet and may occur in deep runs (Parmalee and Bogan 1998). Strayer (1999) demonstrated in field trials that mussels in streams occur chiefly in flow refuges, or relatively

stable areas that displayed little movement of particles during flood events. Flow refuges conceivably allow relatively immobile mussels to remain in the same general location throughout their entire lives (Butler 2002b).

Many of the medium to large rivers occupied by all four of these species are now regulated rivers that have been modified by locks and dams. The species all appear to have adapted in various degrees to conditions in the upper reaches of some impoundments created by the locks and dams, as they are most are commonly found in portions of the rivers that still support good riverine-quality habitat (generally substrates that are swept free of excessive fine sediment deposits by adequate currents). Reservoir conditions, characterized by slackwater, low dissolved oxygen (DO), and heavy silt deposition, are not conducive for the survival and population sustainability of these species (Butler 2010).

Status and Distribution

The pink mucket was historically widespread throughout the Mississippi River basin, occurring in 48 rivers. It was known mainly from the Tennessee, Cumberland, and Ohio River drainages with occasional records from elsewhere within the Mississippi River drainage. While the species was widespread, it never was known to occur in large numbers from any one site, and, therefore, it has usually been considered rare (Service 1985). At the present time, only 29 populations are considered extant. These populations are known from the following rivers: Tennessee and Cumberland (Alabama, Tennessee, Kentucky); Meramec, Gasconade, Big, Black, Sac, and Osage (Missouri); Ohio (Kentucky, Ohio, West Virginia); Green (Kentucky); Clinch (Tennessee); White, Spring, Current, Black, Little Black, Eleven Point, Little, Little Missouri, Saline, and Ouachita (Arkansas); Kanawha and Elk (West Virginia); and the Paint Rock (Alabama). The largest and most significant populations are currently known to occur in the Tennessee, Saline, Cumberland, Osage, and Meramec Rivers. Of these extant populations, only a few have shown recent evidence of recruitment. With few exceptions the 29 extant populations are extremely small and occur in relatively short river reaches despite the extent of seemingly suitable habitat in many streams. Further, over one-third of its populations deemed extant are very sporadic in occurrence and known from only one or two individuals collected over approximately the past 25 years. Sixteen populations (55 percent) are restricted to 16 river miles. Accordingly, a majority of populations are essentially limited to discrete reaches making the species in these streams highly susceptible to elimination from catastrophic stochastic events (Butler 2010).

Historically, the fanshell was widely distributed in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries in Pennsylvania, Ohio, West Virginia, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Virginia (Service 1991). Currently, it is estimated that a total of 472 miles of rivers throughout the United States contain populations of fanshell, which represents less than ten percent of its historic range (Biggins, unpublished data). The best populations of the fanshell mussel occur in the Licking, Green, and Rolling Fork Rivers in Kentucky, and in the Clinch River in Tennessee and Virginia. These populations are considered

healthy with evidence of recruitment over several years or even decades, with multiple year classes present. The Rolling Fork River population adds one more known reproducing population since the recovery plan was written, but it is a relatively small population compared to the Licking, Green and Clinch River populations. Extant populations of the fanshell mussel also currently exist in portions of the following rivers: Muskingum (Ohio), Kanawha (West Virginia), Ohio (West Virginia, Ohio), Wabash (Illinois, Indiana), East Fork White (Indiana), Tippecanoe (Indiana), and Tennessee (Tennessee). Each of these populations is susceptible to single damaging events. This includes both natural stochastic events, such as floods, and anthropogenic threats, such as toxic spills (Butler 2010). A nonessential experimental population may be established by releasing the fanshell into the lower French Broad and lower Holston Rivers to further the recovery and conservation of the species (72 FR 52424).

The spectaclecase historically occurred in at least 44 streams in the Mississippi, Ohio, and Missouri River basins. Its distribution comprised portions of 14 States (Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Missouri, Ohio, Tennessee, Virginia, West Virginia, and Wisconsin). Based on historical and current data, the spectaclecase has declined significantly rangewide and is now known from only 20 of the 44 streams, representing a 55 percent decline. The species is presumed extirpated from thousands of river miles and from numerous reaches of habitat in which it occurred historically, including long reaches of upper Mississippi, Ohio, Cumberland, and Tennessee Rivers and many other streams and stream reaches. Of the 20 extant populations, 6 are represented by only one or two recent specimens each and are likely declining and some may be extirpated. Populations in Mississippi and Clinch Rivers have recently experienced significant population declines. Most surviving populations face significant threats and with few exceptions are highly fragmented and restricted to short stream reaches. The spectaclecase is considered extirpated from Indiana, Kansas, and Ohio. Reports of the spectaclecase from 1877 in the Blue and Elkhorn Rivers, Nebraska are not considered valid. The only relatively strong populations remaining are in the Meramec and Gasconade Rivers in Missouri and in the St. Croix River in Minnesota and Wisconsin (Butler 2002).

Historically, the sheepnose occurred in the Mississippi, Ohio, Cumberland, and Tennessee River systems and their tributaries, totaling at least 76 streams (including 1 canal) (Butler 2002a). Its distribution comprised portions of 14 States (Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin). Historically, the sheepnose was fairly widespread in many Mississippi River system streams, although rarely common. The sheepnose has been extirpated throughout much of its former range or reduced to isolated populations (Parmalee and Bogan 1998, Neves 1991). The only records known from some streams are archeological specimens (for example, Little Pigeon, Big Black, Yazoo, Saline Rivers). The sheepnose has been eliminated from two-thirds of the total number of streams from which it was historically known, and currently occupies only 25 streams. This species has also been eliminated from long reaches of former habitat including thousands of miles of the Mississippi, Wisconsin, Illinois, Ohio, Cumberland, and Tennessee

Rivers and dozens of other streams and stream reaches. Of the 25 sheepnose populations that are considered extant, 9 are thought to be stable and 8 are considered declining. Six other populations (Walhonding, Rock, Gasconade, Muskingum, Osage Fork, and Duck Rivers) are considered extant, but the status of these populations is unknown.

Reasons for Listing and Current Threats

The decline of the pink mucket, fanshell, spectaclecase, and sheepnose all parallel the general decline and elimination of freshwater mussels from many big river systems in the United States.

All four species were listed as endangered for similar reasons largely because of their extirpation from many river systems and reduction in range (Service 1985, 1991; 77 FR 14914). Habitat destruction and degradation as a result of physical, chemical, and biological alterations continues to threaten populations throughout their range. The major causes of such alterations are impoundments, water pollution, sedimentation, channelization, instream construction, sand and gravel mining, and dredging. Because mussels are sedentary, and annually have low juvenile survival rates, they are susceptible to both periodic and permanent environmental degradation. In addition, loss and alteration of habitat from the factors listed above has also resulted in changes in native fish populations and likely loss of glochidial hosts for these four mussel species.

Recent improvements in water quality in many rivers primarily as a result of promulgated regulations pursuant to the Clean Water Act requiring sewage and mine treatment facilities, and restrictions on industrial outfalls have allowed mussels and their fish hosts to return to some of their former range. More thorough analysis of the environmental impacts of activities such as commercial sand and gravel dredging and barge loading and mooring facilities have also helped to facilitate the reestablishment of mussel and fish resources by protecting valuable physical habitat.

High sedimentation levels are also a threat to mussel conservation and recovery. The greatest diversity and abundance of mussels are associated with clean-swept sand and gravel substrates. Chronic or severe acute increases in turbidity and suspended sediments decrease the depth and amount of light penetration, affect primary productivity, decrease oxygen levels, increase water temperature, irritate or cause clogging of gills, and result in a blanket of silt on the substrate. Siltation affects mussels by smothering eggs or larvae of the fish host populations and by reducing food availability. Siltation also fills interstitial spaces, eliminating spawning and foraging habitat important to the survival of young fish and juvenile mussels.

The exotic and prolific zebra mussel (*Dreissena polymorpha*), was accidentally introduced to North America in the mid-1980's through ship ballast water from interior European ports. This species poses a severe threat to all native mussel species because it competes for space and food, and attaches to the native mussels in numbers that impair the mussel's ability to travel, burrow, and open and close its shell. Zebra mussel densities have increased dramatically since the early

1990's, when they were first identified in the Upper Ohio River Basin, reaching up to 460 per square foot, a significant increase from the 20.6 per square foot found in 1997 at the same location. The 1998 survey also found that 90 percent of live native mussels were infested with zebra mussels. Zebra mussels are present within the Kanawha River as well.

Finally, habitat fragmentation and the small size and disjunct distribution of many remaining populations make these four species highly susceptible to localized extirpations. Many populations are: 1) invariably small (rarely are more than one or two individuals found per sample; 2) characteristically rare (having low relative abundance); 3) sporadically or occasionally distributed (despite the extent of seemingly suitable habitat), and; 4) generally limited in linear extent (most less than 30 RMs), and typically lacking evidence for recent recruitment. As a result, stochastic events such as droughts or chemical spills are a real concern, particularly reach-limited ones and those associated with navigation channels and other major transportation arteries (Butler 2010). For example, in the same general reach of the upper Ohio River, two major catastrophic events resulted in the destruction of an unknown number of pink mucket, fanshell, and numerous other mussel species within the past 15 years. A chemical release from an industrial facility in Ohio wiped out millions of mussels in a 20-mile reach in 2002. Four years later breakaway barges collided with Belleville Lock and Dam, resulting in partial dewatering of the pool and the stranding of hundreds of thousands of mussels. Without a nearby source population that is within migration distance of host fishes and that has no barriers to fish migration, it is unlikely that most extant populations could naturally recover from localized extirpations caused by these types of stochastic events. Furthermore, recruitment reduction or failure has been identified as a threat for many small spectaclecase and sheepnose populations rangewide, a condition exacerbated by reduced range and increasingly isolated populations (Butler 2002a, b). If current trends continue, further significant declines in total spectaclecase and sheepnose population size and consequent reduction in long-term viability may soon become apparent. Because the pink mucket, fanshell, spectaclecase, and sheepnose populations in the Kanawha River are all limited to less than 20 river miles, they are particularly susceptible to extirpation and loss of long-term viability in the remaining fragmented populations as a result of spills and other stochastic events that may cause high mortality or recruitment reduction or failure (Butler 2010).

Conservation Needs of the Species

Recovery criteria and conservation actions needed to achieve recovery of the pink mucket and fanshell are detailed in the recovery plans for these species completed in 1985 and 1991 respectively (Service 1985, Service 1991). The most recent draft 5-year review for the pink mucket and the Fanshell Mussel Recovery Action Plan provide updated lists of prioritized conservation actions for these species (Service 2009b, Butler 2010). Recovery plans or outlines for the spectaclecase and sheepnose have not yet been completed, but the 2002 status assessment reports for these species outline conservation and management actions needed to improve the status of these species (Butler 2002 a, b). The identified conservation needs for all four species

are generally similar and center on reducing existing threats, avoiding new threats, and implementing methods to expand existing or reestablish extirpated populations so that there is increased population viability and resiliency. The plans and documents cited above identify and prioritize the following types of actions to achieve these conservation goals:

- Surveying streams to determine population status, habitat condition, and determine the feasibility of population reintroductions or augmentations.

- Reducing existing threats by various methods including modifying dam operations, reducing water quality degradation and habitat alterations, implementing riparian and instream habitat restoration and protection measures, and establishing protective water quality criteria.

- Conducting host fish, life history, and population viability research.

- Refining and developing various propagation methodologies.

- Reintroducing, augmenting, or expanding populations within historical ranges of the species in stream reaches that have suitable habitat and water quality conditions.

- Establishing monitoring programs to track populations, threats, and water and habitat quality.

In all cases, the recovery planning and status assessment documents for these species have found that all existing populations must be both maintained and expanded, and that new populations must become established before the species can be recovered.

Analysis of the species/critical habitat likely to be affected

This BO will evaluate the effects of the proposed action on the pink mucket, fanshell, spectaclecase, and sheepnose. As described below, project-specific surveys have documented that both the pink mucket and the fanshell occur directly within the area of the proposed waterline crossing in the Kanawha River. In addition, as described in the Environmental Baseline section, previous surveys have documented that the spectaclecase occurs within the action area in the vicinity of the proposed waterline crossing, and that the sheepnose occurs within the Kanawha River in close proximity to the action area. Even though WVAW found no live spectaclecase or sheepnose during their surveys, the Service believes that these two mussels could potentially be present within the action area in low densities. The Service relies on current and past surveys to determine likely mussel presence.

Critical habitat has not been designated for the pink mucket, fanshell, spectaclecase, or sheepnose. Therefore, no critical habitat will be affected.

ENVIRONMENTAL BASELINE

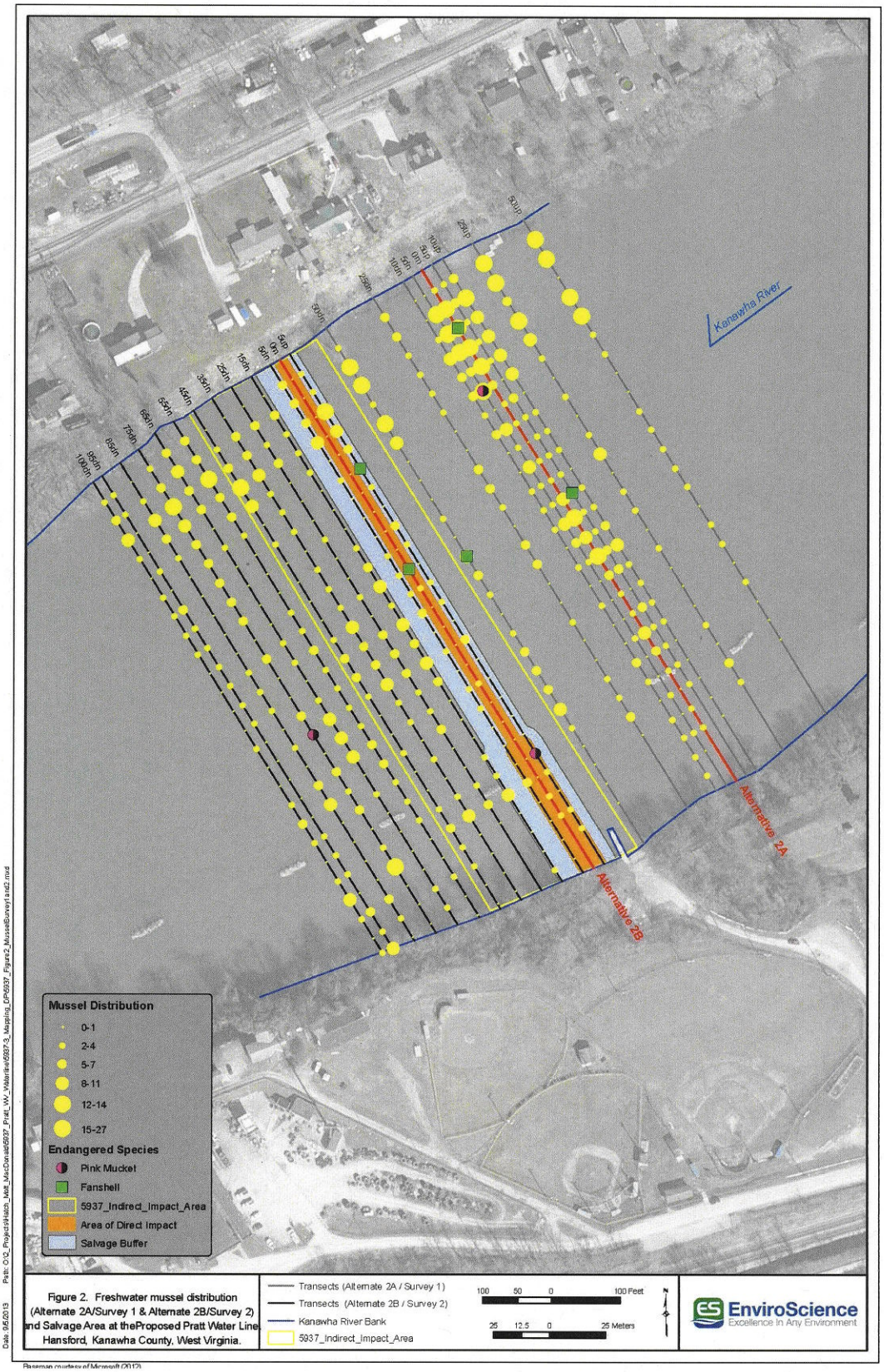
The environmental baseline describes the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation and the impact of State or private actions that are contemporaneous with the consultation in process.

Status of the Species in the Action Area

Surveys within the action area were conducted in June and August of 2013. These surveys covered a total length of approximately 740 feet and included a distance approximately 164 feet above the originally proposed crossing location and extending approximately 328 feet

downstream of the second and selected crossing location (Alternative 2B). Surveys were conducted consistent with the 2013 West Virginia Mussel Survey Protocols (Clayton *et al.* 2013). These surveys documented a total of over 1,000 individual mussels of 27 species, including 3 adult pink mucket and 5 adult fanshell. An overview of the results of these mussel surveys and the location of the two alternatives are shown in Figure 2.

Figure 2: Mussel distribution and abundance in relation to the two proposed crossing locations.



Surveys performed from June 3 to 8, 2013 covered the originally proposed crossing location and detected 996 individual mussels including 3 fanshell and 1 female pink mucket. Subsequent discussions with the Service and WVDNR identified a possible alternate route across the river approximately 246 feet downstream from the originally proposed location. Therefore, a second survey was performed at the second alternative location from August 2 to 4, 2013. A total of 1,061 mussels were found near the second and selected location (Alternative 2B) representing 27 species. No additional species were detected at the second alternative location with the exception of one fresh dead butterfly mussel (*Ellipsaria lineolata*). Two fanshell and 1 female and 1 male pink mucket were found within the second survey area.

The distribution of mussels within the study reach (both alternatives) was not evenly distributed and most mussels were concentrated along the right descending half of the river, with some additional veins of mussel concentrations mid-channel and also running along the south side of the engineered ice-disrupting dikes that are located to the left descending side of the navigation channel. Relatively fewer mussels occurred in the shallow water along the left descending bank where the bottom consisted primarily of fine sediments. The richest mussel concentration was identified along the right descending side of the Kanawha River from 33 feet from the bank to 197 feet riverward. Overall, mussel distribution appeared to be strongly influenced by navigation traffic rather than completely by habitat, as observed habitat and depths were somewhat consistent throughout the survey area.

The survey area is relatively shallow with gentle contours, except immediately near the banks. Measured water depths seldom exceeded 12 feet. The best mussel habitat occurred from 66 feet to 197 feet south of the right descending (north) bank where a nearly equal mix of stable sand, gravel, and cobble occurred. Further riverward, the river bed contained broad patches of shifting sand that nearly covered cobbles, sometimes accumulated to a foot deep or more, and was somewhat unstable and more embedded. At about 591 feet from the north bank, the channel shallowed steeply to the south bank's large point bar. Except for shallow water areas that contained dead leaves and sticks on the north bank, sediments appeared to be well-oxygenated. From the line of small engineered dike islands approximately 164 feet to 230 feet from the south shore, the water depth (about 4 feet) gradually became shallower and deep mud with detritus and woody material became the sole substrate material (poor mussel habitat).

Existing riparian habitat within the area of the proposed waterline crossing has been affected by previous disturbances. The north stream bank slopes steeply and has previously been stabilized by rip rap boulder and cobble. Dense vegetation (much of it invasive exotics) consisting of small trees, shrubs, and herbaceous vegetation has subsequently become established upon this slope over the years. The south bank is more gently sloping, much less armored, and covered by older vegetation consisting of large trees, shrubs, and herbaceous vegetation largely native to the area.

Full results of the mussel and habitat surveys conducted in the action area are provided in EnviroScience Inc.'s reports dated June and August, 2013, and are incorporated here by reference.

Kanawha River Populations

The pink mucket and fanshell individuals found within the project area are part of the overall Kanawha River populations that currently extend over an approximately 20 mile reach of river from Kanawha Falls (RM 95.5) downstream to Watson's Island (RM 75.5). Approximately 36 species are currently known to exist within this reach of the Kanawha River. This includes the pink mucket, fanshell, spectaclecase, and sheepnose. In addition, a freshly dead shell of the federally endangered tuberculed blossom (*Epioblasma torulosa torulosa*) was found downstream of Kanawha Falls in 1969. This is the last known location of this species anywhere throughout its range, and this species may now be extinct (Service 2011).

It is likely that pink mucket, fanshell, spectaclecase, and sheepnose populations historically occurred throughout the entire Kanawha River system, and were contiguous with populations in the Ohio River. Pink mucket, fanshell, and sheepnose shells were all found during archeological evaluations of Native American mussel middens along the Kanawha River near Buffalo (in the vicinity of RM 22) in Putnam County (Taylor 1983). However, the construction of locks and dams followed by the impoundment and dredging of the river, as well as historical water quality degradation, resulted in the extirpation of many species in the lower Kanawha River, and the restriction of most populations to the upper-most reaches of the river, particularly the 5 miles just below Kanawha Falls. This reach of river is relatively unaffected by impoundment and still retains many free-flowing characteristics including riffles and swift water. It is also above most historic point-sources of water quality degradation and is not affected by dredging, channel maintenance, or barge traffic. In 1983, Taylor noted that the lower 81 miles of the Kanawha River "should be considered devoid of native mussel life," while in contrast, he called the upper five miles of river "undoubtedly the richest single stream site in West Virginia."

The Kanawha River is currently serving as a recovery area for the pink mucket, fanshell, spectaclecase, and sheepnose, because the number and distribution of these two species, as well as other listed and more common species, has been increasing over time. At the time of listing, both species were only known to occur in the upper 5 miles of the Kanawha River. By 2000, mussel beds supporting the pink mucket and fanshell were known to extend down to around Wheeler Islands (RM 87.4). The documentation of the pink mucket at this proposed project site near RM 80 represents the furthest downstream location of this species in recent record. In 2006, surveys documented individual fanshell at two locations between RM 77.6 and 75.5. In 2002, the spectaclecase was found at RM 78.5 by EnviroScience Inc., representing the first historical or current record in the Kanawha River. In 2005/2006 live or weathered dead specimens were also found by the WVDNR at two locations between RM 78.5 and 75.5. Recent records for the sheepnose in the Kanawha River are still restricted to the upper 5 miles. However, WVDNR surveys have documented evidence of recent recruitment and young mussels less than 5 years old

within that area, suggesting that the sheepnose population may be able to expand in the future (WVDNR 2010). The expanding range of these species in the Kanawha River suggests that mussel populations in the river may be recovering given recent water quality improvements and limited direct habitat disturbances in the area. However, records within the Kanawha River outside of the upper 5 miles continue to be limited and typically consist of a few scattered individuals. In order for Kanawha River populations to continue to expand and become viable within the navigable portion of the river, water quality conditions must be maintained and improved, and habitat losses and degradation must be limited.

Other Factors Affecting the Species in the Action Area

The action area is currently affected by the majority of threats that affect the species overall including the construction and operation of dams, water quality degradation, sedimentation, channelization, sand and gravel mining, dredging, and invasive species. The Kanawha River has been impounded through a series of locks and dams for the purpose of navigation. The construction of the locks and dams has caused drastic alterations in river flow, morphology and function, which eliminated or degraded much of the habitat for these species, including reducing flow and increasing the amount of fines in the substrate. The area is also affected by the continued presence of barge traffic, which can scour the substrate and dislodge mussels particularly juveniles, and also increase the amount of suspended sediments in the water. The impoundment of the river and the presence of barge traffic also has allowed for the invasive zebra mussel to become established within the Kanawha River. Previous sand and gravel mining and dredging for coal fines in the river has eliminated or degraded substrates suitable for sustaining mussel populations. However, the Service has not seen any recent proposals to conduct these types of mining or dredging activities in the Kanawha River in the past few years. Water quality within the overall Kanawha River Basin has generally improved from about 1980 to1998 with respect to pH, total iron, total manganese, and sedimentation (Paybins *et al.* 2000). Although more recent water quality trend data in the Kanawha River basin have not been comprehensively compiled, some sources of water quality degradation continue and this portion of the Kanawha River is currently on the WVDEP's Section 303(d) list for the presence of PCB's. The Service has no site-specific information on previous direct disturbances that have occurred within the immediate action area. We do know, however, that direct habitat disturbance occasionally occurs within the Kanawha River within the general vicinity from the construction of barge loading facilities, water and pipeline crossings, or other structures in the river. Finally, as described above, the Kanawha River populations are currently small and restricted to an approximately 20 mile reach. They are thus susceptible to stochastic events and localized extirpation.

There have been no previous formal consultations for any federally endangered mussel species within the direct action area. The only previous formal consultation for an endangered mussel species within the Kanawha River was completed in 1993 on the effects of a proposed barge loading facility near RM 90.5 on the pink mucket. That project was never constructed.

Conservation Needs of the Species in the Action Area

Similar to the rangewide conservation needs of the species, the conservation needs of the species within the action area center around reducing existing threats, avoiding new threats, and allowing the populations to continue to expand and recover so that they have increased viability and

resiliency. Within the action area this includes: allowing water quality to continue to improve by avoiding and minimizing new sources of water quality degradation from chemical discharges or increased sedimentation; limiting the amount, duration, and severity of direct disturbances; ensuring that suitable substrates are not degraded or lost from dredging or direct disturbances; minimizing the direct loss of existing individuals; ensuring that reproduction and recruitment are not impaired; conducting efforts to augment existing populations; and establishing monitoring programs to track population and habitat conditions. When evaluating the effects of the action, we will consider whether the proposed action has incorporated measures to address the conservation needs of the species in the action area.

EFFECTS OF THE ACTION

Regulations define effects of the action as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action that will be added to the environmental baseline. The Service anticipates that the following effects will occur as a result of the proposed action.

Direct Effects

Direct effects of the proposed action include direct mussel disturbance, direct habitat disturbance, sedimentation, streambank disturbance, and potential spills and toxic discharges. Each of these types of adverse effects is described in more detail below.

Direct Mussel Disturbance

Mussels present within the direct impact area, including those within 20-foot width of the trench, as well as mussels present in substrates adjacent to the trench that may fall or slump into the trench during construction, may be crushed, smothered, dislodged, or killed during construction. Those mussels not killed or injured during this process may still suffer death, injury, or increased predation risk if they are unable to right themselves and re-burrow into suitable habitat. Mussels may also be smothered and killed within an estimated 200-foot long and 20-foot wide area downstream of the trench where excavated material will be side-cast. Based on these dimensions, we estimate that all mussels within a 21,528 square feet area will affected by direct construction impacts.

WVAW has minimized the potential for directly crushing, smothering, or killing mussels by selecting the crossing alignment that had fewer mussels present, minimizing the width of

instream disturbance, surveying the area and relocating any mussels found prior to construction, having a qualified malacologist on-site during construction to ensure the water line is placed within the correct area, and conducting post-construction monitoring to ensure no unanticipated mussel mortality occurs. These measures combine to both reduce the potential number of mussels that will be exposed to project effects, and also reduce the severity of effects that will be experienced by the remaining individual mussels, since mortality associated with relocation is significantly less than mortality associated with direct crushing.

Relocations will be conducted by surveying the area that will be most significantly affected by project construction (including direct construction and sedimentation as described below) and relocating all individual mussels that are found into an upstream area of the Kanawha River that should not be affected by the project. The area that mussels will be relocated from is shown in Figure 2 and will include the 20 foot wide area to be directly impacted by the trench, plus buffer areas immediately upstream (16 feet) and downstream (33 feet). Therefore, the area from which mussels shall be relocated extends from 26 feet upstream to 43 feet downstream of the project centerline for a total width of 69 feet. In the shallow channel reach, where material will be side-cast, the width of the direct impacts will increase to 40 feet to account for side-casting and the same upstream and downstream buffers will be applied. Therefore, for this 200 foot reach of river, the relocation area will extend for a total width of 89 feet. The upstream and downstream buffer distances for mussel relocations are based on the recommendations in Clayton *et al.* (2013).

While we expect that the majority of mussels present within the direct impact area will be found during relocation surveys, some individuals may not be detected and would be crushed or killed by trenching or smothered by side-cast material. Based on previous experiences with relocation efforts in West Virginia, it is estimated that relocations may find approximately 60 percent of the mussels in an area (EnviroScience Inc. 2013, 2004, 2002, 2001; Clayton, J. WVDNR, personal comm.). Because they are small and difficult to locate, juvenile mussels are less likely to be located during surveys and thus may have an increased risk of being crushed, killed, or smothered. This could result in the disproportionate loss of younger individuals and could alter the age-class distribution of the population.

While relocation will result in the reduction of direct take, and will thus significantly minimize adverse effects, there can also be some adverse effects associated with relocations. When conducted properly, relocations can be an effective tool to minimize mussel mortality. Studies have documented survival of up to 99 percent of relocated mussels after one year (Cope *et al.* 2003). However, handling and relocation of mussels can also cause direct mortality, or stress to mussels resulting in reduced growth and reproduction (Cope and Waller 2006, Dunn *et al.* 1999; Strayer and Smith 2003). The rate of survival during relocations and handling is influenced by water and air temperatures, handling and transport methods, and substrate suitability in relocation area. Most relocation projects are conducted from July to September when reproductive stress is relatively low and metabolic rates are sufficient for active reburrowing in the substrate (Cope and

Waller 2006). Relocations conducted during active reproduction periods or during low temperatures when metabolic rates are low will likely result in increased mortality and reduced reproductive success. For example, one relocation project conducted during fall with rapidly declining temperatures resulted in greater than 30 percent mortality for most relocated species (Dunn *et al.* 1999).

WVAW is proposing to conduct relocation efforts in early October which is later than relocations are typically allowed in West Virginia because of the risk of low or rapidly declining temperatures and the related increase and associated stress and mortality to the mussels.

Metabolic rates of mussels begin to decline during this time period, and mussels may expend needed energy reserves to reburrow into substrates. In order to address this concern, WVAW has incorporated a number of measures to minimize the amount of mussel mortality or stress that will occur as a result of the relocation. These measures are outlined in the BA and further detailed in the Mussel Salvage Plan and Habitat Monitoring Plan dated September 24, 2013, and include using handling methods to minimize the amount of time that mussels are out of the water, hand placing all mussels back in the substrate in life position, and only conducting relocation efforts when air and water temperatures are above 55°F and are expected to stay above that temperature for the next 3 days. These measures are based on the recommendations of Dunn *et al.* (1999), Cope *et al.* (2003), and Cope and Waller (2006) for conducting effective mussel relocation efforts, as well as the personal experiences of the WVDNR State Malacologist.

Direct Habitat Disturbance

In addition to directly disturbing mussels within the action area, the project will disrupt and alter mussel habitat in the action area. As described above, habitat within the trenched area, as well as the area covered by side-cast material will be directly disturbed. In addition, the presence of barges within the river to support construction activities could scour the habitat underneath the barges and potentially result in local hydrologic modifications to the river bottom. Finally, the presence of the waterline within the substrate could create a hydraulic control that could scour and destabilize substrates downstream. These activities could change substrate composition or compaction in and around the construction area and make it less suitable for mussels to live and burrow in. As described above, a total of 64,583 square feet of habitat may be affected from these types of effects.

WVAW has incorporated a number of conservation measures into the project that should minimize the extent and significance of the direct habitat disturbance. These measures include limiting instream construction to 10 days, constructing the waterline from equipment floating on barges rather than having equipment directly on the substrate so that substrates should not be compacted, side-casting the material into barges rather than into the river for 700 out of 900 feet of crossing, using two sizes of barges and other equipment (large for deep channel and a smaller barge for the shallow reach) to limit scouring, installing the waterline deep enough so that there will be no lingering hydraulic effects, using the same material that was excavated from the trench

to refill the trench so substrate composition should be approximately the same pre and post construction, and conducting regular inspections of the waterline installation during construction and post-construction to identify and address any potential short-term or long-term hydraulic modifications. Post-construction monitoring will include a bathymetric profile and substrate characterization to help ensure that the area is restored to approximately the original depth and channel profile, and that substrate conditions post-construction are suitable for mussels. As a result of the incorporation of these conservation measures, we expect that duration and scope of habitat degradation as a result of direct disturbance will be limited, and that the directly disturbed portions of the site will likely provide some level of suitable mussel habitat post-construction.

Sedimentation

Mussels will also be affected by increased sedimentation generated during excavation and disturbance of the substrate from the trenching, side-casting and replacing the excavated material, and from disturbance of the riverbanks. Both deposited and suspended sediment can negatively affect the survival and fitness of freshwater mussels. Effects of sedimentation include mortality, reduced physiological function, and depressed rates of growth, reproduction, and recruitment (Henley *et al.* 2000).

High levels of suspended sediments cause mussels to reduce water filtration rates and have reduced dietary absorption efficiencies which can cause sub-lethal effects on growth and reproduction, or starvation with long-term exposure. Mussels will close their valves during periods of heavy siltation to avoid irritation and clogging of feeding structures (Loar *et al.* 1980). Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Mussels exposed to greater than 600 mg/l of suspended sediments for 9 days showed decreases in metabolic rates and feeding impairment (Aldridge *et al.* 1987). Studies have documented peak suspended sediment levels of 1,500 mg/l and 3,000 mg/l downstream of pipeline construction sites (Levesque and Dube 2007).

Excessive siltation also degrades water and substrate quality. High levels of suspended sediments will reduce dissolved oxygen levels in the water, while heavy sediment deposition will fill interstitial spaces in the substrates, both of which can suffocate mussels particularly if sufficient accumulation occurs (Ellis 1936, Marking and Bills 1980). Some mussel species showed significant mortality when exposed to less than 0.25 inches of deposited sediment (Ellis 1936, Henley *et al.* 2000). Young mussels who feed in interstitial waters and whose siphons cannot extend far above the substrate may be particularly susceptible to these types of effects. Finally, mussel shell erosion rates can increase significantly due to the scouring effect of increased suspended sand and larger size particles, and the displacement of larger substrates which serve as refugia from high flows.

It is difficult to determine how far downstream these types of effects will occur, what level of excess sedimentation will be generated by the project, or how long these effects will persist. Factors such as stream channel morphology, flow rates during and post-construction, the

composition of excavated sediments, and the effectiveness of sediment and erosion control measures, can affect the duration and severity of instream sedimentation. One recent effort used data on flows and substrate composition at locations in the Duck River (Tennessee), the Elk River (West Virginia), and the James River (Virginia) to model the distance downstream that mussels would be affected from sedimentation during construction of stream crossings for natural gas pipelines. That study estimated that sub-lethal effects from suspended sediments would extend between 2,640 and 3,700 feet downstream and that lethal levels of sediment deposition would extend between 70 and 1,060 feet downstream (ENSR 2008). In general, most studies have documented that increases in suspended sediments will peak during construction and will persist a few days post construction (Levesque and Dube 2007). Sediments deposited downstream of pipeline projects may persist for a few weeks to a few months post-construction until high flows wash them away (Levesque and Dube 2007).

WVAW has incorporated a number of conservation measures into the project that should minimize the extent and duration of sedimentation that will occur to distances below those cited above. These measures include: limiting the width and depth of the trench excavation; side-casting the excavated material into barges for the majority of the length of the trench (700 out of 900 feet), and backfilling the trench by releasing the fill material as close to the bottom as possible. All these measures should minimize the amount of material that will be mobilized, which will in turn reduce the level of suspended sediments and the rate of downstream sediment deposition. For example, during most pipeline construction projects excavated material is typically side-cast directly into the river where it is continually eroded and mobilized by river flows for the duration of project construction. Removing the excavated material from the river and temporarily holding it in a barge should significantly reduce the amount of material that is exposed to flows and will thus reduce the amount of sedimentation that occurs and the distance downstream that is affected by the deposition of suspended sediments. We expect that the majority of sedimentation will occur from this project will be generated from the area near the left descending bank where material will be side-cast directly into the river. Substrates in this area are predominately muds and other fine materials that are easily suspended and are likely to travel farther downstream than other larger particles like gravel or cobble would. Fortunately, most of the mussel concentrations downstream of this portion of the project area are limited compared to the concentrations found near the right descending bank and the center of the river.

Finally, the duration of increased suspended sedimentation should be short because instream activity will be limited to no more than 10 days. As noted above, we expect that suspended sediment levels will abate a few days post construction, but that the effects of sediment deposition may persist for a few weeks to a few months post-construction until high flows wash them away (Levesque and Dube 2007). During this time period, we expect that mussels downstream of the project will experience sub-lethal and potentially lethal levels of suspended and deposited sedimentation. Based on the description of the proposed project dimensions including the direct construction area and the area affected by barges and construction equipment, we estimate that the area within 66 feet upstream and 164 feet downstream of the

project centerline (a total of 193,750 square feet) will be most significantly affected by increased sedimentation (EnviroScience Inc. 2013). We are not able to quantify the maximum distance downstream that will be affected by lower levels of sedimentation due to uncertainties about the flows that will occur during and post-construction, and due to the lack of site-specific modeling that incorporates the known conditions in the Kanawha River as well as the potential effects of the conservation measures that have been employed, however, we expect that effects will extend significantly less than the maximum distances found in the modeled examples cited above (ENSR 2008).

Streambank Disturbance

Streambank disturbance and loss of riparian vegetation can affect the physical and biological processes of streams (Pusey and Arthington 2003). Healthy, functioning, riparian areas are essential to maintaining water and habitat quality in streams, and streams are adversely affected when riparian vegetation is removed (Urgenson 2006). Loss of streambank vegetation can cause increased water temperatures and changes in light regimes, that can affect dissolved oxygen levels, and the health, fitness, and survival of benthic invertebrates like mussels, as well as their fish hosts (Urgenson 2006). Removal of riparian vegetation and disturbance to the streambanks can also increase streambank erosion, increase sedimentation in streams, and alter channel morphology.

The proposed action will result in the disturbance of approximately 20 feet of streambank on both sides of the river. Existing riparian vegetation in the areas proposed to be disturbed is minimal on the north bank and is dominated by riprap and invasive species. Riparian vegetation on the south bank is comparatively more intact and includes large trees and other native vegetation. WVAW has developed a Service-approved Erosion and Sediment Control and Sediment Monitoring Plan and Seeding and Planting Plan, dated September 18, 2013. This plan includes measures to ensure that streambank disturbance will be minimal, that erosion and sedimentation from streambank disturbances will be controlled and minimized, and that riparian habitat will be restored using native woody and herbaceous vegetation. As a result, of the small amount of streambank to be disturbed (20 feet or less), the degraded condition of the existing riparian vegetation, and the conservation measures included to reduce erosion and immediately restore the vegetation and grade of the streambanks post-construction, we anticipate overall project effects from the streambank disturbance and loss of existing riparian vegetation will be minor.

Spills and Toxic Discharges

There is a potential for spills or releases of oil, fuel, or other toxic contaminants to occur during project construction. These products could leak from construction equipment, broken fuel or hydraulic lines, storage tanks, or other items used on site. Petroleum and oil-based products can kill or impair adult or young mussels or their fish hosts, as well as adversely affect the reproduction of these species. Both the terrestrial and river-based contractors who will be conducting the work for WVAW have provided spill prevention and control plans detailing the

procedures that will be used to ensure that spills and discharges are unlikely to occur, and the measures that will be taken to immediately control and contain any spills that do occur. These plans were provided to the Service in one email dated September 18 and two emails dated September 19, 2013. Measures that will be used included storing fuels, oils, and other potentially toxic material away from the stream, conducting transfer of oil and fuel away from site; and monitoring to detect and stop spills quickly. As a result of the implementation of these plans, we anticipate that the potential for spills or chemical discharges should be insignificant. If significant spills or toxic discharges do occur, this shall constitute new information that was not considered in this BO.

Indirect Effects

Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. While some of the direct effects of project construction may be short-term and temporary, indirect adverse effects from disturbance of the mussels and their habitat, and increased sedimentation can occur or persist for some time post-construction. Indirect effects include effects on the reproduction of mussels in the area, and lost mussel density and abundance until such time that mussels recolonize the area.

Reproductive Effects

The proposed action could adversely affect mussel reproduction. Stress caused by mussels being displaced from their habitat or increased sedimentation could impact reproduction by causing mussels to abort their glochidia before they are mature (77 FR 14914). The proposed action could also affect the transport of sperm making them less viable, impair the rate that mussels siphon water and thus reduce their intake of sperm, cause host fish to avoid the area so that they are not present when mussels release their glochidia, or impair the ability of the fish host to detect lures and conglutinates that mimic prey items so that host fish are less likely to become infested with glochidia. The type and extent of these potential effects will depend on the timing of construction. For long-term brooders like the pink mucket and fanshell, construction in early spring when mussels are releasing mature glochidia could reduce the rate that glochidia successfully come in contact and encyst on fish hosts, while construction in late spring to summer could reduce the rate of sperm intake and the successful maturation of glochidia in adult female mussels. Construction in fall and winter could cause the mussels to abort glochidia or release them earlier than would normally occur. For short-term brooders like the spectaclecase and sheepnose, construction during in the spring and summer could reduce sperm intake, maturation of glochidia, and encystment of glochidia on fish hosts. Because so little is known about the timing and triggers for each stage of reproduction for these endangered mussels, these timeframes are only approximations based on currently available information. Flow rates and water temperatures may also affect the timing of reproduction each year.

WVAW proposes to conduct instream construction for 10 days between October 15 and November 15 when the pink mucket and fanshell should be holding glochidia overwinter for

release in the spring. As a result, disturbance during this time could cause the mussels to abort or prematurely release their glochidia. Mussels from all four species that are stressed from injury, handling during relocations, habitat disturbance, and sedimentation may also divert more of their resources towards physical recovery and away from reproduction, and these mussels would thus have reduced reproductive output the following year. These two factors could result in lost reproductive potential of the affected mussels for the next year, and a reduction in numbers of young mussels of that year-class present in the population of the action area.

These impacts to mussel reproduction may be partially and indirectly offset by WVAW's commitment to provide support to WVDNR's mussel recovery efforts. WVDNR is currently working with partners to develop and refine captive propagation techniques for federally listed mussels including the pink mucket, fanshell, and spectaclecase, and to augment populations of these species within their currently known and historic ranges, including within the Kanawha River watershed. The Service estimates that it takes between $10,000 and $20,000 for one facility to conduct one year of captive propagation for one species, and between $10,000 to $15,000 to conduct one year of genetic or fish host research for one species to support the development of effective and biologically appropriate propagation techniques. WVAW's contribution of $10,000 should therefore provide between one half to one year of effort to augment the reproduction of one species.

Mussel Recolonization and Recovery

Studies have found decreases in fish and benthic macroinvertebrate populations in stream reaches affected by pipeline stream crossings that persist for 1 to 3 years post-construction (Reid and Anderson 1999, Yount and Niemi 1999). However, Yount and Niemi (1999) cite an example of one study that made a preliminary determination of stream recovery within 1 year, but when the site was re-examined 6 years later, fish biomass, fish populations, macroinvertabrate densities, and species composition were still changing. It was suspected that shifts in sediment and nutrient inputs to the site as a result of construction in and around the stream contributed to the long-term lack of recovery. In another study, alterations in channel morphology, such as increased channel width and reduced water depth, were evident 2 to 4 years post-construction at sites that lacked an intact forest canopy in adjacent riparian areas (Reid and Anderson 1999).

Whether or how quickly a population recovers depends in part on the life history characteristics of the species (Yount and Niemi 1999). The rate of recovery for many benthic macroinvertebrates following a disturbance can be rapid due to their mobility and short generation times (Sietman *et al.* 2001). Conversely, freshwater mussels are long-lived and mainly sedentary, with a complex life cycle that is reliant on the presence of specific host fish. They also have long generation times and low overall population numbers. These characteristics make mussels highly susceptible to changes in habitat and can impede them from recolonizing an area (Sietman *et al.* 2001, Neves 1993).

It is not known how long it will take for endangered mussels to recolonize the area affected by this proposed action. In one experiment where mussels were removed from small areas of a mussel bed, mussels had recolonized the removal plots, although not to pre-removal density, within 2.5 years (Young and Williams 1983). Deposition of juvenile mussels by fish was found to be the most important mode of recolonization, whereas active movement and passive transfer were less important. This suggests that if suitable habitat conditions and fish hosts are present, and reproducing source populations are reasonably close, mussels can recolonize areas. However, in that study, mussels were only removed from small areas, habitat disturbance was limited (there was no large scale excavation of the substrate), and mussel mortality associated with instream construction did not occur. As a result, it will likely take more than 2.5 years for mussels to recolonize the action area to pre-construction densities.

Factors that may affect the rate and success of mussel recolonization include the presence and abundance of other reproducing source populations nearby, the presence of suitable substrates post-construction, how long it takes for host fish to begin reusing the area, whether water quality and flows are conducive to successful reproduction in the years subsequent to construction, and the abundance of zebra mussels in the area (which can affect the growth and survival of juvenile mussels).

In this case, conservation measures have been incorporated into the project to help increase the chances that mussels can recolonize the area. For example, the same material that was excavated from the trench will be used to refill the trench so substrate composition should be approximately the same pre and post construction. In addition because there will be no equipment traveling directly on the substrate, the substrates should not be compacted post-construction, which should allow mussels to burrow into the substrate. Post-construction monitoring will include a bathymetric profile and substrate characterization to help ensure that the area is restored to approximately the original depth and channel profile, and that substrate conditions post-construction are suitable for mussel recolonization. Another factor that increases the chances that recolonization will occur is the known presence of individual pink mucket and fanshell in the action area immediately upstream of the proposed crossing location that will not be affected by project construction. In addition, all mussels found during relocation efforts will be moved upstream to an area in close proximity to these existing unaffected individuals.

However, population numbers in the area are low, which reduces the overall amount of reproduction that may occur in the action area. In addition, as discussed above, reproduction and recruitment of juveniles into the population is likely to be reduced post-construction because 1) construction could affect the reproductive success of mussels remaining in and downstream of the pipeline crossing, 2) juvenile mussels are less likely to be found during relocation and are thus more likely to be crushed and killed during construction, and 3) young mussels are particularly susceptible to the effects of sedimentation. These factors could reduce the overall rate of recolonization in the area, and could have continuing effects on the age distribution of the mussel population in the action area resulting in a population with a larger percentage of older,

less reproductively-active individuals. WVAW's commitment to provide support to WVDNR's ongoing mussel recovery efforts in the Kanawha River watershed may partially offset these adverse effects as described above.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. While the Service is not aware of any specific proposed projects scheduled to occur in or near the action area, it is currently being affected by a variety of actions and activities as described in the "Other Factors Affecting the Species in the Action Area" section above. The Service has no specific information on any additional non-Federal actions that are reasonably certain to occur in the future.

Summary of Effects

The proposed action could have a number of types of adverse effects on individual pink mucket, fanshell, spectaclecase, and sheepnose mussels present in the action area. Direct effects of the proposed action include direct mussel disturbance, direct habitat disturbance, sedimentation, streambank disturbance, and potential spills and toxic discharges.

We estimate that a total of 64,583 square feet of habitat will be affected by trenching, side-casting, scouring, and other direct habitat disturbance during project construction. Mussels present within these areas may be crushed, smothered, dislodged, or killed during construction. Surveys will be conducted within this area prior to construction, and all mussels found will be relocated to an unaffected area upstream. However, relocations are not 100 percent effective and any individuals not detected and would still be crushed, killed, or smothered. Juvenile mussels are less likely to be located during surveys and thus may have an increased risk of being crushed, killed, or smothered. This could result in the disproportionate loss of younger individuals and could alter the age-class distribution of the population. Relocated mussels may experience some mortality or stress resulting in reduced growth and reproduction. However, measures have been developed to minimize mortality and stress from relocation. Relocation efforts should significantly reduce the number of mussels that will be exposed to project effects, and also reduce the severity of effects that will be experienced by the remaining individual mussels, since mortality associated with relocation is significantly less than mortality associated with direct crushing. Habitat within this same area will be degraded during project construction but, due to the conservation measures that have been employed, we expect that duration and scope of habitat degradation will be limited, and that the directly disturbed portions of the site will likely provide some level of suitable mussel habitat post-construction.

Mussels within the action area may also be adversely affected by sedimentation in the form of both increased suspended and deposited sediments. Effects of sedimentation include degraded water and substrate quality, mussel mortality, reduced physiological function, and depressed rates of growth, reproduction, and recruitment. Increases in suspended sediments will likely persist a few days post construction, whereas increased deposited sediments may persist for a few months post-construction until high flows wash them away. We estimate that mussels and habitat within a 193,750 square foot area (a total of 230 linear feet) will be most significantly affected by increased sedimentation. We are not able to quantify the maximum distance downstream that will be affected by lower levels of sedimentation due to uncertainties about the flows that will occur during and post-construction and the lack of site-specific modeling, but we expect that effects farther downstream will likely be sub-lethal.

As a result of the conservation measures incorporated into the project, we anticipate overall project effects from streambank disturbance and loss of existing riparian vegetation will be minor. We also anticipate that the potential for spills or chemical discharges should be insignificant. If significant spills or toxic discharges do occur, this shall constitute new information that was not considered in this BO.

Indirect effects include effects on the reproduction of mussels in the area, and lost mussel density and abundance until such time that mussels recolonize the area. We expect that there could be reduced reproductive output of mussels within the action area for at least one year post-construction, and a reduction in numbers of young mussels present in the population of the action area, resulting in a population with a larger percentage of older, less reproductively-active individuals. We further expect that while federally endangered mussels will recolonize the area eventually, it will likely take more than 2.5 years for mussels to recolonize the action area to pre-construction densities.

No cumulative effects are anticipated to occur.

Based on the effects analysis described above, we have determined that the proposed action has incorporated conservation measures into the project that address the following conservation needs of the species in the action area: minimizing new sources of water quality degradation from chemical discharges or increased sedimentation; limiting the amount, duration, and severity of direct disturbances; ensuring that suitable substrates are not degraded or lost from direct disturbances; minimizing the direct loss of existing individuals; conducting efforts to augment existing populations; and establishing monitoring programs to track population and habitat conditions. However, the project may result is some impairment of reproduction and recruitment within the action area.

CONCLUSION

After evaluating the effects of the action, we must then determine if the proposed action will jeopardize the continued existence of the species. Jeopardize means to engage in an action that reasonably would be expected, directly or indirectly, to appreciably reduce the likelihood of survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. This is evaluated first by determining the effects to individuals within the action area (in combination with baseline conditions), and then evaluating the significance of those individual effects in to the reproduction, numbers, and distribution of the population that they are a part of. If there is an appreciable effect to any one factor at the population-level, then the analysis is extended to determine whether there are appreciable effects range-wide, or to the recovery unit, if recovery units have been designated. Actions that have met or addressed the conservation needs of the species in the action area, and thus are not expected to appreciably reduce the reproduction, numbers, and distribution within the action area, are not likely to jeopardize the species.

Conservation measures have been incorporated into the proposed action that will substantially reduce the scope and significance of all the types of effects described in the Effects of the Action section above. As a result, the number of individual mussels of each species that will be affected is low, and the majority of mussels affected will be subjected to sub-lethal effects. An appreciable loss of numbers within the action area is not anticipated. There will be no permanent loss of available habitat, but there will be a loss of mussel density and abundance within the directly disturbed area. However, due to the presence of unaffected mussel populations in close proximity to the disturbed area, the relatively small length of habitat that will be affected, and the expected continued habitat suitability, it is expected that mussels will recolonize the area within a few years. There should therefore be no appreciable loss of distribution in the action area. Some reduction in reproduction and loss of young mussels within the action area is anticipated as a result of direct and indirect effects of the action. The loss in reproductive potential will only affect a limited number of individuals. Other individual pink mucket and fanshell mussels are known to occur within the action area that will not experience reduced reproductive potential. Conservation measures have been incorporated that will partially off-set these effects, and in the absence of additional disturbances, or habitat or water quality degradation in the future, the reduction in reproduction and recruitment should be temporary and relatively short-term when considering the reproductive life-span of the mussels.

After reviewing the current status of the pink mucket, fanshell, spectaclecase, and sheepnose, the environmental baseline of the action area, and the effects of the proposed water line crossing, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of these species because: 1) the proposed project footprint is small and affects only a small fraction of the species' populations within the Kanawha River and therefore, also the range of the species overall; 2) conservation measures have been incorporated into the proposed action

so that the scope and extent of each of the potential adverse effects have been significantly reduced, and as a result potential direct mortality would be limited to a few individuals, and most other effects would be temporary and of short duration. No critical habitat has been designated for these species therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without any exception. Harm is further defined to include significant habitat modification or degradation that results in death or injury to species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of the incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions of any funding, permits, contracts and/or approvals, as appropriate, issued to the applicant for the exception in section 7(o)(2) to apply. The USACE has the continuing duty to regulate the activity covered by this incidental take statement. If the USACE (1) fails to require the applicant and any contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, authorization, contract or funding document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE or the applicant/contractor must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.12 (I)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates that take in the form of killing, harm, and harassment (as defined in 50 CFR §17.3) will occur as a result of the proposed action. We anticipate that pink mucket, fanshell (and potentially the spectaclecase and sheepnose) will be taken during implementation of the Pratt Waterline Project through direct mortality, injury, and stress. Mussels within the footprint of the construction may be crushed, smothered, dislodged, or killed if not found and translocated during the pre-construction survey. Relocated mussels may experience some direct mortality and stress as a result of the translocation effort. Mussels located downstream of the footprint of construction may experience direct mortality, injury, stress, and reproductive

impairment as a result of instream sedimentation and disturbance of streambanks. These events could also result in harm to glocidal life stages of the mussels or to populations of host fish.

In order to estimate the potential level of take, EnviroScience Inc. used the results of the project-specific mussel surveys conducted in 2013 to estimate the total abundance of mussels in the area immediately surrounding the proposed action and also to calculate the relative abundance of each endangered species within the overall mussel population. Because the surveys were not expected to have detected all mussels present, they used data from previous survey and relocation efforts in West Virginia to estimate that initial surveys were only 40 percent efficient (i.e. they only found 40 percent of the mussels present within the survey area) (EnviroScience Inc. 2013, 2004, 2002, 2001; Clayton, J. WVDNR, personal comm.). Based on this analysis, it is estimated that approximately 4,570 freshwater mussels of all species may be present and that the pink mucket and fanshell will each comprise 0.2 percent of this total mussel population. Because the spectaclecase and sheepnose were not found during surveys, estimated relative abundance of these two species was based on best professional judgment and knowledge of previous documented occurrences in the Kanawha River. They further assumed that translocation efforts would be 60 percent efficient (because this effort is more intensive than previous survey efforts), resulting in an estimate of 2,742 mussels that are expected to be translocated. As a result of these calculations, which are more fully described on pages 36 to 38 of the BA, we estimate that the project will result in the following:

Species	Total Incidental Take	# Mussels Translocated
pink mucket	9	5
Fanshell	9	5
Spectaclecase	1	1
Sheepnose	3	2

The numerical take levels listed above are intended to provide estimates of the level of take due to effects within the area 66 feet upstream and 164 feet downstream of the project centerline only. This area comprises a total of 193,750 square feet and is the area expected to be most affected by project activities.

The Service is unable to quantify the expected levels of take to individual mussels outside these areas due to uncertainties regarding the extent of adverse effects further downstream (e.g., sedimentation), as described in the Effects of the Action section. Any take that may occur outside the area defined above is expected to be minimal and in the form of harm and harassment. Sedimentation levels are used as a surrogate to estimate incidental take farther downstream. As described in the Effects of the Action section, mussels have showed significant mortality when exposed to 0.25 inches of deposited sediment (Ellis 1936, Henley *et al.* 2010). We expect that less than 0.25 inches sediment will be deposited in areas farther downstream of

the project centerline. Monitoring as described in the Erosion and Sediment Control and Sediment Monitoring Plan and Seeding and Planting Plan, dated September 18, 2013 will be used to track this type of take.

These estimated levels of take are based on the proposed project design, assumptions regarding the effectiveness of erosion and sedimentation control and spill control plans, and full implementation of the conservation measures. We note that the actual level of incidental take will be difficult to detect and quantify for the following reasons: 1) as indicated by the results of the mussel surveys within the project action area, these species are present in small, and possibly undetectable numbers; 2) individuals (juveniles and adults) are typically buried in the substrate, making them difficult to locate; 3) finding dead or injured specimens is unlikely; and 4) sub-lethal effects such as stress, reduced fitness, and decreased reproductive success are difficult to measure and detect in the field.

However, implementation of the terms and conditions associated with the reasonable and prudent measures will reduce the potential for incidental take. If, during the course of the action, this estimated level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The USACE must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

REASONABLE AND PRUDENT MEASURES
and
TERMS AND CONDITIONS

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize incidental take of the pink mucket, fanshell, spectaclecase, and sheepnose. In order to be exempt from the prohibitions of section 9 of the ESA, the USACE, and the applicant, WVAW, and any contractors acting under the action agency or the applicant must comply with the following terms and conditions which implement the RPMs and outline the reporting/monitoring requirements. These terms and conditions are non-discretionary. Each RPM is listed in italics, followed by numbered terms and conditions that implement each RPM.

RPM 1: Implement measures to avoid and minimize adverse effects of project construction, including reducing the project footprint, minimizing direct mortality and adverse reproductive effects, reducing sedimentation and streambank disturbance, and avoiding spills and discharges of toxic chemicals.

1.1 The project shall be implemented and constructed consistent with all details provided in the Project Description section of the Biological Assessment (pages 8 through 19) including all associated conservation measures, and consistent will all details provided by the following supplemental project-specific plans:

- the Mussel Salvage Plan and Habitat Monitoring Plan, including mussel conservation measures dated September 24, 2013;
- the Erosion and Sediment Control and Sediment Monitoring Plan and Seeding and Planting Plan, dated September 18, 2013; and
- the Environmental Policy Procedures and Emergency Response Procedures for Amherst Madison provided by emails dated September 18 and 19, 2013; and the Groundwater Protection Plan for Rover Construction, Inc. provided by email dated September 19, 2013.

RPM 2: Implement measures to ensure that the project is constructed as planned and that incidental take is not exceeded.

2.1 WVAW shall notify all project personnel and contractors of the presence of federally endangered species in the project area and the special provisions necessary to protect them, including the reasonable and prudent measures and terms and conditions listed in this document. The project personnel and contractors shall be instructed on the importance of the natural resources in the project area and the need to ensure proper implementation of the required measures. They shall also be informed that there is a risk of unauthorized take (ESA section 9 violation) if the terms and conditions of the Service's BO are not closely followed.

2.2 WVAW must notify the Service's West Virginia Field Office and the USACE at least 48 hours prior to the start of any instream activities. The Service shall be allowed to access the site to ensure that all required measures are being conducted[1].

2.3 Immediate corrective action shall be taken if any spills or discharges of potentially toxic materials occur. The Service's West Virginia Field Office shall be contacted immediately if any spills or discharges occur.

2.4 WVAW and the USACE shall monitor and report the direct mortality of mussels resulting from the implementation of this project. They shall notify the Service's West Virginia Field Office and Division of Law Enforcement in Elkins, WV within 24 hours should any endangered species be found dead or injured as a direct or indirect result of the implementation of this project. This notification shall include the date, time, and location of the carcass, and any other pertinent information. Federally endangered mussels that are accidentally killed, or that are moribund or freshly-dead and contain soft tissues, shall be preserved according to standard museum practices, properly identified or

1 The Service shall comply with all safety requirements or instructions while present on-site.

indexed (date of collection, complete scientific and common name, latitude and longitude of collection site, description of collection site), and shall be submitted for deposition at a recognized museum or scientific repository after coordination with the Service.

RPM 3: Implement a monitoring program to track incidental take associated with the project.

3.1 WVAW and the USACE shall conduct monitoring to track incidental take as described in the project-specific Mussel Salvage Plan and Habitat Monitoring Plan dated September 24, 2013, and the Erosion and Sediment Control and Sediment Monitoring Plan dated September 18, 2013.

3.2 The Service's West Virginia Field Office shall be immediately notified if monitoring suggests that the authorized level of incidental take as described above will be exceeded, or that excessive or unanticipated mussel mortality or habitat degradation as a result of project-related activities is likely to occur.

3.3 A report of project related efforts shall be furnished to the Service, the USACE, and the WVDNR no later than 90 days following the completion of the field work conducted each monitoring year, including in 2013, 2014, and 2016. This report shall include: 1) a description of all activities implemented in accordance with the RPMs and terms and conditions during that year; and 2) a description of the methods, results, and associated data analysis of all monitoring as described in 3.1 above.

CONSERVATION RECOMMENDATIONS

Section 7(a) (1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service does not have any additional conservation recommendations at this time.

REINITIATION OF FORMAL CONSULTATION

This concludes formal consultation on the action outlined in the USACE request. You may ask the Service to confirm this draft BO as a final BO on the prospective action. The request must be in writing. If the Service confirms this as the final BO on the project, no further section 7 consultation will be necessary except if any reinitiation criteria are met. As required by 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered

in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease pending reinitiation.

We sincerely appreciate the efforts of the USACE, WVAW, and their contractors towards cooperatively developing effective conservation measures for this project during this consultation process. If you have any questions regarding this consultation, please contact Barbara Douglas of my staff at (304) 636-6586, Ext. 19, or barbara_douglas@fws.gov, or at the letterhead address.

Sincerely,

Barbara Douglas
for

John Schmidt
Field Supervisor

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cc:
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Project File
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