West Virginia Field Office
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Elkins, West Virginia 26241

July 7, l993

Colonel Earle C. Richardson
District Engineer
Huntington District, Corps of Engineers
502 Eighth Street
Huntington, West Virginia 2570l

Dear Colonel Richardson:

This responds to your December l2, l989 request for consultation under the Endangered Species Act (ESA) of l973 (87 Stat. 884, as amended, l6 U.S.C. 1531 et seq.) on proposed work at an authorized coal loading facility on the left descending bank (LDB) of the Kanawha River, mile 90.4, at Montgomery Heights, Fayette County, West Virginia (Public Notice 87-29, dated February 23, l987). This represents the Biological Opinion of the U.S. Fish and Wildlife Service (Service) in accordance with Section 7 of the ESA on the Fayette Dock project as it relates to a population of the pink mucket pearly mussel, Lampsilis abrupta (Say) (=orbiculata), (Hildreth). The scientific community (Turgeon et al. l988) now accepts L. abrupta as the scientific name of the pink mucket; it was officially listed as L. orbiculata in l975 (Federal Register, Volume 41, 24062-24067). For the purposes of this opinion, Lampsilis orbiculata will be used.

Project and Consultation Chronology

February 23, l987	U.S. Army Corps of Engineers (Corps), Huntington District, issues Public Notice ORHOP-F No. 87-29, detailing a proposal by Fayette Dock, Inc., to construct and operate a coal loading facility at mile 90.4 (LDB) of the Kanawha River.
March 24, l987	The Service, in accordance with Section 7 of the ESA, informs the Corps that a population of the endangered species, L. orbiculata, may exist at the project site and that the site should be surveyed for freshwater mussels.
April 27, l987	Corps informs the applicant of the need to conduct a mussel survey at the proposed site.
July 3, l987	Applicant's consultant, Arthur Clarke, submits a report of a mussel survey conducted at the project site to the Corps. While no endangered species were collected, Clarke reports "several **productive** mussel

	beds" at the site.
July l6, l987	Clarke's report transmitted to the Service.
August 18, l987	Service submits Fish and Wildlife Coordination Act (FWCA) report recommending denial of the permit.
December 2, l987	West Virginia Department of Natural Resources (WVDNR) denies Section 40l State Certification.
March l6, l988	WVDNR, upon appeal, grants 40l Certification with extensive conditions (including moving mussels).
June 3, l988	Corps initiates informal consultation under the l985 Memorandum of Agreement (MOA).
August 3, l988	Corps issues Record of Decision and Notice of Intent to Issue permit.
August 29, l988	Service informs Corps of its intention not to appeal District Engineer's decision under the l985 MOA. Service also puts Corps on notice that they must initiate formal Section 7 Consultation should they find endangered species when the mussels are moved.
September 2, l988	Corps issues permit.
July l7, l989	Corps informs Service of plans to transplant and tag mussels.
July l9, l989	Service responds restating the need for Section 7 Consultation should endangered species be found.
August l4, l989	Corps approves mussel plan relocation; WVDNR to perform the work.
September l2-l3, l989	WVDNR finds endangered species while moving mussels. Notifies Service and Corps by telephone.
September l3, l989	Service informs Corps, by telephone, of need for preparation of a Biological Assessment.
September l5, l989	WVDNR informs Corps, by letter, of the discovery of five specimens of the endangered species, L. orbiculata.
September 29, l989	Corps hosts meeting to discuss the discovery of an endangered species and procedures required by the ESA.
October 4, l989	Corps formally requests listing information.
October l3, l989	Service responds to Corps' l0/4/89 letter.
November 7, l989	Service provides direction for the preparation of a

	Biological Assessment.
November l3, l989	Permittee, Corps, and WVDNR meet to discuss mitigation for project impacts on endangered species.
December l2, l989	Corps sends cover letter stating that a Biological Assessment has been prepared.
December 21, l989	Service receives Biological Assessment.
December 29, 1989	Service receives Dr. Clarke's reasonable and prudent alternative measure advocating the recovery, relocation, and concentration of L. orbiculata specimens away from the proposed coal loading facility (see Appendix 1).
March 21, l990	The 90-day formal consultation period concludes. Service initiates preparation of Biological Opinion.
April 26, 1990	Service provides opportunity to the Corps and applicant to review and comment on the Draft Jeopardy Opinion.
July l9, l990	An interagency meeting is held to discuss Draft Jeopardy Opinion. Applicant submitted critique of Draft Jeopardy Opinion.
August 7, l990	Service distributed the Draft Jeopardy Opinion, critique, and other pertinent information to scientists around the United States with familiarity with the species.
September 10, 1991	Service receives Dr. Clarke's report entitled, "A survey of the endangered mussel, L. abrupta (Say), and other unionid mollusks in the upper Kanawha River, W. Va., for the purpose of assessing recruitment, and as a basis for recommendations for preservation and recovery measures."
February 13, 1992	Service biologists meet with the applicant, their consultants, and Corps officials to discuss the Draft Jeopardy Opinion and Dr. Clarke's report.
April 14, 1992	Applicant's consultant submits plans detailing changes in facility construction agreed to at the February 13, 1992 meeting.
June 16, 1992	Service transmits draft Biological Opinion reflecting new dock construction and operation proposal to applicant for their comment and review.
August 13, 1992	Service receives comments from the applicant's consultants.

August 14, 1992 — Service distributes the rough draft and the consultants comments to Service scientists around the United States with knowledge of the species and the project for their input and comments.

Proposed Project

The Project, as described in the Corps permit, issued September 2, l988, proposed the construction of a commercial coal loading facility at mile 90.4 of the Kanawha River. The facility was to consist of five mooring cells, 24 feet in diameter; nine mooring cells, six feet square; and seven mooring cells, l6 feet in diameter. The cells were to be constructed of steel sheetpiling filled with sand and gravel and capped with concrete. The applicant modified the project proposal by deleting all mooring cells and now proposes to construct the in-river portion of the facility with a series of nine floating barges held offshore with spar poles. The dock would extend along the shoreline for about l,800 feet and be capable of mooring l7 barges - eight loaded and nine unloaded.

The modified plan and operational procedures for the facility should avoid many of the impacts anticipated with the original project proposal. The applicant proposed to limit traffic over the mussel beds to the movement of approximately five empty barges every two to three days (at maximum production). At this rate there should be minimal impact to the aquatic fauna. The Service, however, would consider an increase in the number of barges or number of days barges are brought in to the dock to be a significant change in facility operation. Similarly, the Service would consider a proposal to install sheetpile cells a significant project modification.

Review of Endangered Species Information

The Service has reviewed the Corps' December l2, l989 Biological Assessment on the proposed project. A conclusion was reached that construction of the coal loading facility "could potentially adversely affect or destroy individuals of the endangered mussel species located at the project site." The Service has also reviewed the available literature (Clarke 1991 and l982; Schmidt et al. l988; Stansbery l980; Tolin et al. l987; U.S. Fish and Wildlife Service l985; Zeto l989) on the local and national distribution of L. orbiculata and consulted with authorities with knowledge on this species' range and population dynamics. In addition, literature on the effects of barge fleeting was reviewed.

Pink Mucket Pearly Mussel, Lampsilis orbiculata

Distribution

Historical records of L. orbiculata indicate it is predominantly an Ohio River basin species, found mainly in the Tennessee, Cumberland, and Ohio River drainages with occasional records from the Mississippi River (Illinois and Iowa). L. orbiculata was widespread, occurring in 25 river systems; it was never collected in large numbers from any site (U.S. Fish and Wildlife Service 1985).

Presently, L. orbiculata is known from isolated reaches in l6 river systems

(U.S. Fish and Wildlife Service l985), representing three major geographic locations. These populations are isolated by water pollution, impoundments, and associated problems (siltation, sublethal effects, etc.). The largest known populations are reported from the Tennessee River (Alabama, Tennessee, and Kentucky), Cumberland River (Kentucky and Tennessee), Osage River (Missouri), and the Meramac River (Missouri). The population of L. orbiculata in the Kanawha River extends from Kanawha Falls through the project site (U.S. Fish and Wildlife Service l985). Another population was discovered in 1991 near Blue Creek, WV, on the Elk River.

Several populations of L. orbiculata also occur in the White River System (White, Black, Current, and Ouachita Rivers) in Arkansas. However, several researchers (Clarke l990, and Stansbery, Ohio State Museum of Zoology, pers. comm. l990) believe these populations may represent a different species.

Ecology and Life History

L. orbiculata inhabits medium to large rivers in substrates ranging from silt to boulders. The preferred habitat is a mixture of sand, gravel, and cobble substrate swept by moderate to fast currents in depths up to 26 feet. L. orbiculata requires well aerated water having high dissolved oxygen and low carbon dioxide concentrations. Habitat at the Kanawha River project site is typical for the species.

The life history of L. orbiculata is thought to be similar to other native mussels (U.S. Fish and Wildlife Service l985). Males produce sperm which is discharged into the water column and dispersed by currents. Females downstream intake the sperm during feeding and respiration. Fertilization occurs within the posterior section of the outer gills which are modified as brood pouches. L. orbiculata is a long-term breeder, i.e., eggs are fertilized in late summer to early fall and the embryos (glochidia) develop over winter and are discharged into the water column in late spring to early summer. The glochidia then attach (encyst) to the gill filaments or fins of a fish host where they develop into juvenile mussels. The sauger (Stizostedion canadense) is thought to be the host species. The genus Lampsilis has evolved a mantle flap on the incurrent syphon which resembles a small fish or aquatic invertebrate, complete with eyespot. When extended into the current, this flap attracts fish, increasing the opportunity for glochidia to come in contact with the host fish (U.S. Fish and Wildlife Service l985).

Reasons for Decline and Continued Threats

Possibly the most important factor contributing to the decline of L. orbiculata and freshwater mussels in general is the alteration and destruction of habitat by: canalization for navigation, hydropower development, recreational development, and flood control impoundments. Certain mussels are affected by their inability to adapt to habitat component changes, such as reduced flows, altered temperature regimes, and anoxic conditions.

Siltation has also severely affected freshwater mussels. The greatest diversity and abundance of mussels are associated with clean-swept sand and gravel substrates. Chronic increases in turbidity and suspended sediments decrease the depth and amount of light penetration, affect primary productivity, increase water temperature, irritate or cause clogging of gills,

and result in a blanket of silt on the substrate. Siltation affects mussels by affecting the fish host populations, by smothering fish eggs or larvae, and by reducing food availability. Siltation also fills interstitial spaces eliminating spawning and habitat critical to the survival of young fish. Mussels may be directly affected by siltation through smothering.

Pollution from municipal, agricultural, and industrial waste discharges have decreased or eliminated mussel populations directly and indirectly through elimination of significant species of fish hosts resulting in reproductive failures.

All of the aforementioned impacts, especially those aggravated by river impoundments, have contributed to the decline of mussels, such as L. orbiculata, which prefer unpolluted waters with clean-swept sand, gravel, and cobble substrates (U.S. Fish and Wildlife Service l985).

Effects of Barge Fleeting on Mussels

Despite design and operational changes made, increased (number and frequency) barge traffic could adversely impact the L. orbiculata population at the dock site. The following discusses these potential impacts and the Service's concerns:

Sparks and Blodgett (l988) reported on the effects of barge fleeting on mussels in the Illinois River. They placed up to 25 mussels in each of 25 one-meter square frames at two fleeted areas (one - barges ground; one - barges tied to pilings) and two unfleeted control areas. The degree of disturbance was termed severe at three of the four areas. At one fleeting area, deep (2.0 meters) scour holes were observed. The frames were broken or lost either in the water or washed on to the shore at the site where the barges were grounded. At the other fleeting site the degree of disturbance was categorized as moderate; frames were bent and buried beneath 20 centimeters of mud and woody debris. At one unfleeted control, no disturbance was evident. At the other, disturbance was severe and attributed to pleasure boats. Sparks and Blodgett (l988) also reported reduced growth rates for most species at the fleeted sites. Miller [U.S. Army Corps of Engineers, Waterways Experiment Station (WES), Vicksburg, Mississippi, pers. comm. l990] reported over 50 percent of shells examined in a turning basin of the Mississippi River were damaged by barges during his work in July l990 at McGregor, Iowa. Water depths at that site were approximately ten feet. Ahlstedt (pers. comm. l990) reported water depths at Fayette Dock site to be nine to ten feet deep, 25 yards off shore. Clarke (1987) reported depths ranging from ten to twelve feet in the project vicinity.

Miller and Payne (1989) discussed the impacts of barge traffic on mussels in the barge turning basin at Prairie du Chien. At the level of traffic (518 commercial tow passages) during the study period, no detrimental effect on recruitment were observed. Miller and Payne (1991) concluded "that changes in velocity and suspended solids due to (barge) traffic were minor and unlikely to have immediate measurable effects on the mussel community at the study sites."

The detrimental effects of siltation and increased turbidity have been well documented, including abrasion and clogging of gills (Ellis l936), actual

smothering of organisms (Parmalee l967), and reduction of food organisms and host fishes. The degree of exposure is important and may best explain the differences between natural events, such as floods (acute exposures) to which mussels have adapted, and human-induced events (chronic exposures), such as the constant stirring of the bottom from propeller wash or bank erosion from wave wash. Mussels grow and reproduce at a location based on site-specific conditions (current direction, diurnal light conditions, etc.). Barge fleeting and approaches and departures could cause subtle, sublethal effects that reduce or impair reproduction, feeding, etc., as mussels tend to close when ambient conditions change suddenly (Sparks, pers. comm. l990). Barge activity at the Fayette Dock site could produce similar effects if it increases significantly above the current operational plan.

Chronic exposures to siltation may interfere with feeding efficiency, growth, and reproduction of mussels (Stansbery l970). Loosanoff and Engle (l947) found that mussels close and stop filtering for long periods when harmful substances or large concentrations of suspended material are present in water. Ellis (l936) found that mussels were closed 75 to 95 percent of the time in muddy water, as compared to 50 percent of the time in clear water and Loosanoff and Tommers (l948) observed a 94 percent decrease in pumping where water had concentrations of three to four grams per liter of silt.

Laboratory experiments on the impacts of suspended sediment were conducted by the Corps' Waterways Experiment Station in Vicksburg, Mississippi (Payne et al. l987). Two species of freshwater mussels, Quadrula pustulosa and Fusconaia flava, were exposed to a resuspension of inorganic solids for a duration of seven minutes. This was performed every three hours for three days to simulate a moderate passage rate of commercial vessels in a heavily trafficked portion of waterway. The food clearance rates were then determined and compared to those of a control. The Quadrula had food clearance rates averaging 57 percent of that of the controls and the Fusconaia had food clearance rates averaging 55 percent, indicating that periodic resuspension of bottom sediments can impair feeding activity of freshwater mussels.

The effects of turbidity and sedimentation vary according to age of the mussel. Juvenile mussels seem more susceptible to environmental disturbances and may have more stringent habitat requirements than adults. D'Eliscu (l972) believes juveniles and adults may occupy completely different habitats. Silt deposits near dams may not affect older mussels, but young mussels may sink below the surface and suffocate. Williams and Schuster (l983) reported a heavy covering of silt in mussel beds in deep water close to dams on the Ohio and Green Rivers. Adult mussels in these beds appeared healthy and in good condition, and exhibited little adverse effect. They noted that in impoundments on the Tennessee River, little if any recruitment takes place in heavily silted areas, and under these conditions mussel beds are usually extirpated.

There are several aspects of freshwater mussel life histories which make them quite susceptible to environmental perturbations. First, they are long-lived and reach sexual maturity in two to eight years. Some mussels collected by Williams and Schuster (l983) were about 40 years old. Because these mussels are long-lived, it may take considerable time for adverse effects to manifest. Second, they are slow-moving and bury themselves in the substrate during periods of adverse natural conditions, such as in winter and during floods

(Tolin, U.S. Fish and Wildlife Service, Elkins, WV, pers. comm. 1990). They are less able to physically avoid disturbances, such as being dislocated by propeller wash and are susceptible to increased turbidity and harmful substances. Third, mussels are filter-feeders, removing plankton and detritus from the water. Fourth, during one life stage they are obligate parasites on fishes which makes them susceptible to adverse impacts on host fishes. Yokley (l976) notes that many of the fish that serve as glochidial hosts are not tolerant of silt. The sauger, the suspected host fish for the pink mucket pearly mussel, is a sight feeder and occurs in larger, deeper rivers of rather low gradient in the Ohio River drainage basin. Turbidities, such as those associated with fleeting activities, may adversely affect fish species by abrading and clogging gills, thus hindering respiration and decreasing chances of infection (Allen and Hardy l980). This study also found that high turbidities may reduce the ability of fish to navigate and decrease the survival of eggs. In a like manner, increased turbidities and propeller wash may destroy important spawning habitat.

Not only can mussel beds be adversely affected by fleeting and loading activities, but they can be destroyed by attendant activities, such as barge-cleaning. Spills of materials and release of fuels, lubricants, cleaners and other contaminants, and the sinking and grounding of barges, may degrade or destroy mussel beds. These effects may be persistent and preclude mussel recolonization if the material remains in the sediments.

Upland activities can also be detrimental to mussel resources. Should runoff from coal storage areas occur due to poor housekeeping or an accident, then runoff would have an adverse effect on water quality and aquatic life. Coal can produce acid drainage with associated low pH and high concentrations of metals, sulfates, and iron-hydroxide precipitates.

Current Status of the Pink Mucket Pearly Mussel

L. orbiculata is considered widely but sparsely distributed throughout its range (Stansbery, pers. comm. l990). There are two to three times as many populations of L. orbiculata documented now than when it was first listed in 1976, but, with rare exception, these populations are in decline (Stansbery, pers. comm. l990). The exceptions are the Meramac River, Gasconade River, and Osage River systems where Buchanan (Missouri Department of Conservation, Columbia, MO., pers. comm. l990) feels that L. orbiculata populations are stable. However, he noted no strong evidence of reproduction of the species in any Missouri River System river.

L. orbiculata populations in the Meramac, Tennessee, and Cumberland Rivers were considered viable in l985 (U.S. Fish and Wildlife Service). However, based on a survey of the regional and national malacological experts, populations of L. orbiculata in the Cumberland are now considered sporadic and not reproducing (Biggins, U.S. Fish and Wildlife Service, Asheville, NC., pers. comm. l990). Most experts believe the unionid mussel populations are doing poorly in the Cumberland River (Koch, Missouri Department of Conservation, Columbia, MO., pers. comm. l990; Widlak, U.S. Fish and Wildlife Service, Cookeville, Tennessee Field Office, pers. comm. l990; Biggins, pers. comm. l990). Two populations of L. orbiculata in the Tennessee River have historically (as late as the early 1980's) been considered healthy and reproducing. One population is located below Pickwick Dam and the other below

Kentucky Dam on the Tennessee River (Koch, pers. comm. l990). Koch (pers. comm. l990) felt populations below the Pickwick Dam were doing well and reproducing in l982. Recently, however, Ahlstedt (pers. comm. l990) reported finding no specimens of L. orbiculata below Pickwick Dam.

Sickel (Murray State University, Murray, KY, pers. comm. l990) recently found only one specimen (a gravid female) of L. orbiculata out of l0,000 mussels collected below Kentucky Dam. Cicerello (Kentucky Nature Preserves Commission, Frankfort, KY., pers. comm. l990) reports that L. orbiculata is rare below Kentucky Dam with a few scattered records of the species. Cicerello also reports finding only a few fresh dead specimens on the Green and Barron Rivers in Kentucky.

In the Ohio River, L. orbiculata occurs in the lower portion of the river at a few scattered locations near Paducah, Kentucky (Cicerello, pers. comm. l990). Recently, one specimen was discovered near Moscow, Ohio, at the Zimmer Power Plant (Cicerello, pers. comm. l990). Tolin et al., (l987) discovered a new population in the Ohio River near Greenbottom, West Virginia. Dunn and Watters discovered a new population of L. orbiculata in the Elk River of West Virginia in 1991.

Current Status of the Pink Mucket Pearly Mussel at the Project Site

Stansbery (pers. comm. 1990) described the population in the Kanawha River as a prime population of L. orbiculata based on the collection of five specimens at the Fayette Dock site during the short-lived WVDNR transplant efforts. The freshwater mussel assemblage at the proposed coal dock site is considered to be a healthy and diverse reproducing population (Clarke l987; Zeto l989). Clarke (l987) estimated the total mussel population (all species) to be approximately l0,000 individuals in the vicinity of the proposed coal dock. During WVDNR's mussel transplant efforts in l989, L. orbiculata accounted for greater than one percent of the mussels collected (five of 468). Based on Clarke's estimation and WVDNR results, the assemblage of L. orbiculata could be estimated to number approximately l00.

Three recent sampling efforts [Clarke (l987), Schmidt et al., (l988), and Zeto (l989)] revealed that at least 22 species (Table l) inhabit the immediate vicinity. With increased sampling effort one could expect to find additional species at the Fayette Dock site. Twenty-nine species, including the recently listed fan shell, Cyprogenia stegaria, have been reported from the five-mile reach of the Kanawha River between the proposed facility and Kanawha Falls. In West Virginia, only the large mussel populations of the Greenup and Belleville pools of the Ohio River contain more species (32 species) than the upper Kanawha River. According to Ahlstedt (pers. comm. l990) few sites remain in the Tennessee River that compare in diversity with the upper Kanawha.

Clarke (l989) questioned the likelihood of this population of L. orbiculata surviving due to the apparent lack of recruitment at the site. Clarke partially attributed the lack of recruitment to interference by Corbicula (ingesting unionid sperm) (see Appendix 1).

While no juvenile specimens of L. orbiculata were found during WVDNR's transplant efforts, Zeto (l989) did report collecting juveniles of several

species. Ahlstedt (pers. comm. l990) found evidence of recent reproduction (individuals approximately four to five years old) of common species during the WVDNR transplant efforts.

Clarke (1991) again questioned the likelihood of recruitment as his efforts failed to turn up specimens age 14 or younger while other, more common, species appeared to be reproducing and recruiting normally. Of note, two of the six living female L. orbiculata collected by Clarke (1991) were gravid.

Neves stated during the February 13, 1992 meeting, that the results of the Ecosearch survey during mid-December 1990 and April/May 1991, provided useful information, but that the effective sample size (15) was statistically too small. An additional 15 qualitative samples were also taken. Neves (pers. comm. 1992) felt that their significance was limited to indicating the deme of pink muckets at this site to be large relative to other known populations.

Neves pointed out that the lower third of the cohorts are not readily sampled. He also considered their recruitment success to be consistent with that of other rare species. Long-lived animals (30-40 years) such as L. orbiculata may only need to reproduce themselves once or twice in their lifetime. The lack of young specimens of L. orbiculata is typical as the species is a rare component (one percent) of the mussel population and juveniles are difficult to detect. Neves (pers. comm. 1992) considers reproduction to be low but not non-existent.

Neves pointed out during the February 13th meeting that gravid females may have been overlooked when water temperatures were too low. He also pointed out that the number of transects taken would have to be greater to increase the odds of finding rare species.

Miller and Payne (l988) recommend that accurate determinations of recruitment require that quantitative samples of bottom material be collected and sieved for all live mussels regardless of age. Neves and Widlak (l987) believe that specific collecting techniques are required to locate juveniles. With the exception of Clarke (1991) the three most recent investigators did not employ special techniques to enhance their ability to locate juveniles. Clarke (1991) also employed visual sampling techniques in an attempt to collect additional specimens. Neves (pers. comm. 1992) believed the absence of younger mussels (7+ years) was not surprising considering the rarity of L. orbiculata in the upper Kanawha River.

In addition to the difficulty of finding juvenile mussels, gaps between age classes often exist because mussel's reproductive requirements are subject to numerous biotic (fish hosts, fertilization, etc.) and abiotic (water quality, substrate requirements, etc.) variables. Miller and Payne (l988) found recruitment success varied with species and spatially within Ohio River mussel beds. Sparks and Blodgett (l988) reported recruitment in mussels in the Illinois and upper Mississippi Rivers to be low and infrequent. In one case, Miller and Payne (l988) found a single year class of Fusconaia ebena accounted for nearly 70 percent of all individuals collected. They also found gaps between cohorts. Miller (pers. comm. l990) has observed this missing cohort phenomenon on numerous occasions. He has observed Amblema plicata reproducing only one time in ten years in large rivers.

Clarke (l990, 1991) raised the concern over the age and reproductive capability of the specimens of L. orbiculata collected. Ahlstedt reported (pers. comm. l990) that he has observed gravid, flapping 40 + year old specimens of a sister species, Lampsilis ovata. Zeto (l989) reported two distinct year classes of approximately 20 years and 27 years. Taylor (l983) reported finding ten specimens of L. orbiculata from muskrat middens or fresh dead in shallow water in the Kanawha River from mile 91.0 (LDB) to mile 94.3 (LDB). These specimens represented at least five cohorts ranging in age from seven to l3 (Taylor, Marshall University, Huntington, West Virginia, pers. comm. l990). Members of these cohorts should have been l4 to 20 years old during the l989 WVDNR transplant efforts.

Clarke (l990, 1991) expressed concern over water pollution threats to the mussel population. He noted, as did the Service in its l987 FWCA report, that a flyash landfill is situated adjacent to the mussel population. Fayette Dock, Inc., (pers. comm. l990) maintains it can further stabilize the flyash and prevent its entry into the water course if it constructs its facility. Zeto (WVDNR, Water Resources Section, Charleston, pers. comm. l990) expressed his concern that construction activities associated with the landward operations of the facility could destabilize the fill. The permit has been conditioned to require reinforcement of the flyash.

Zeto (pers. comm. l990) also contested Clarke's (l990) opinion that the Kanawha River is polluted, channelized, and unsuitable for mussels below the proposed coal dock site. Mussel habitat is degraded below this point, but mussels do inhabit the Kanawha River downstream of the proposed dock site. Schmidt et al., (l988) conducted a mussel survey of the entire navigable portion of the Kanawha River in l987. At Site 20 (Fayette Dock) they collected l4 species. At site l9 (Wheeler Island, mile 88.l) they collected l2 species. In fact, mussels were present, where suitable habitat existed, down to the Ohio River. Municipal and industrial wastewater treatment facilities discharge into the Kanawha River immediately below the proposed dock site. However, these permitted discharges have not been documented to

cause adverse impacts to the Kanawha River fauna. Zeto (pers. comm. l990) pointed out that adverse impacts from these discharges did not show up during the l988 drought.

While there is no evidence that L. orbiculata is reproducing at the Fayette Dock site, neither is there evidence that it is not (Neves, pers. comm. l990). Juvenile mussels are difficult to locate, occasional gaps between cohorts is normal, several cohorts have been reported from the population in recent years, and there is evidence of recruitment by other species occupying the same mussel bed. Best professional judgment would lead one to believe that L. orbiculata is reproducing at the site and elsewhere throughout the five mile reach it occupies in the Kanawha River.

Potential Effects of the Proposed Coal Loading/Fleeting Facility on Lampsilis orbiculata and the Associated Kanawha River Mussel Bed

The proposed re-designed facility's structure should not directly destroy portions of the mussel bed supporting the endangered species. However, indirect impacts from fleeting, shading, coal/fuel spillage, and tow boat approaches and departures could result in harm to mussels (stress, limited or no reproduction, etc.), loss or degradation of habitat, and physical disturbance to mussels. The extent of these depend upon the operation and cleanliness of the proposed facility. Anticipated adverse impacts from increased fleeting, approaches and departures, and shading include siltation, scouring, reduced feeding and reproductive success, and reduced light penetration. Coal/fuel spillage could result in direct and indirect (lethal and sublethal) adverse impacts to the freshwater mussel population.

Despite project modifications that are designed to minimize the potential for flyash to leach into the river, project construction and top of bank activities could cause flyash leaching. Flyash leachate could result in acute or sub-lethal toxic effects to the mussels in the adjacent river.

Operation of the facility was a major topic of discussion during the February 13, 1992 meeting with the permittee. The permittee's operational plan calls for bringing the empty barges in slowly to the upstream end of the fleeting area. The barges would then be guided into position, utilizing the current to move them downstream along the dock. Loaded barge tows would be pulled from the lower end of the dock and turned by the current to start them downstream. If this procedure is followed the level of impact should be negligible.

The Kanawha River is approximately 900 feet wide in the vicinity of the proposed facility. A complete five barge tow could be 975 feet long. As such, loaded barges will have to be removed in smaller groups or configured two barges wide to avoid adverse impacts to the Kanawha River shoreline and the onsite mussel fauna.

Ordinarily, the Service would object to the use of floating barge docks because they tend to accumulate sediment beneath them, often becoming grounded. However, in this case the river currents that keep the mussel bed swept clean should serve to keep sediment from accumulating beneath the barges and smothering the mussels.

Biological Opinion

The Biological Opinion of the Service is predicated on the preceding information, summarized below:

1. While the populations in the Meramac and the Gasconade Rivers are considered stable, no strong evidence of reproduction exists for those streams. Elsewhere throughout its range, L. orbiculata populations may be in decline.

2. The Kanawha River population of L. orbiculata is likely the healthiest population in the Ohio River drainage.

3. The species occurs from the project site upstream to Kanawha Falls. L. orbiculata at the project site are found at a density higher than other known populations and may be the seed source for upstream occurrences of the species.

4. The loss of individuals within the project area could result in the loss or substantial reduction of the Kanawha River populations over time. Rivers are dynamic ecosystems. Many aspects of river morphology are subject to change due to natural conditions or man-made influence. Therefore, the entire five mile reach inhabited by L. orbiculata is important to its survival.

5. The re-designed facility (floating dock structure) and the proposed method of operation should substantially reduce the potential for adverse impacts from sedimentation, scouring, etc., to L. orbiculata at the site.

On the basis of this information, we believe that construction and use of the proposed coal loading facility at mile 90.4 of the Kanawha River **should not** likely reduce the numbers, reproduction, and distribution of L. orbiculata and thereby reduce appreciably the likelihood of both the survival and recovery of this species. At this time the Service considers the upper Kanawha River population of L. orbiculata to be stable (not declining), the population extremely important to the continued welfare of the species, and the likelihood and magnitude of adverse impacts, while not non-existent, to be acceptable. Therefore, it is the Biological Opinion of the Service that the subject project is not likely to jeopardize the continued existence of L. orbiculata.

Incidental Take

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 a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed 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 normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. 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 a taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are nondiscretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in Section 7(o)(2) to apply.

Level of Take

Turbidity levels and sedimentation in the river may increase as a result of the construction and operation of this project. There is potential, therefore, for the project to adversely impact endangered mussels either directly (killing mussels) or indirectly (reducing/eliminating reproductive success).

Incidental take will be difficult to detect because L. orbiculata represents such a small percentage of the mussel community within the project area. Therefore, the expected level of take is defined in terms of changes in the project area's mussel community structure. The following level of take of this species can be anticipated by a decrease in the health of the mussel population within the project impact area as follows:

1. A continual decline in the density over a period of three years (five percent per year) of the five most abundant mussel species after establishing a "before project" baseline (Dr. Clarke's previous surveys may be used to determine a baseline). This should include adults and juveniles (juveniles being defined as less than 35 percent of maximum size encountered, measured as total length) other than Amblema p. plicata, which is a pollution-tolerant species;

2. Failure to collect L. orbiculata (collection is not expected to add to mortality) from the sampling site exposed to barge traffic. A minimum of two sites should be monitored; an upstream control between Kanawha Falls and the County Route 13 bridge and a site adjacent to the project.

3. A continual decrease in the live-to-recently dead ratio over the life of the project of all mussel species (i.e., more dead than alive each year over a three-year period). Recently dead is defined as those shells exhibiting some shininess of the nacre or dead less than one year;

4. A decline of $\leq$ 25 percent or more in the total number of species encountered per bed;

5. No evidence of recent recruitment (juvenile specimens less than five years of age) of the five dominant species other than A. p. plicata; **or**

6. A significant decline in the growth rate of two dominant species other than A. p. plicata by comparing annual random samples for cohort structure for post-project length frequency distributions to a pre-project random sample.

Reasonable and Prudent Measures to Minimize Impacts of the Taking

The following measures are required to reduce adverse impacts of the project:

1. All barge tow approaches and departures shall be done in a manner such that there is little or no disturbance to the riverbottom substrate. Corps personnel skilled in maneuvering barges shall initially monitor barge tow approaches and departures when the facility becomes operational to assist the fleet operators with determining the best mode of operation around the sensitive areas. A Service biologist shall participate in this review. The operational mode found to have the least amount of potential impact shall be implemented.

2. The area landward of the floating barge dock shall be kept clean of floating debris. Debris could sink and harm mussels at the site. The site shall be frequently and regularly inspected to assure that permit conditions designed to preclude flyash leaching are enforced.

3. Maintenance dredging is prohibited.

4. The facility shall be limited to receiving five barges every two days with no more than 15 per week. Loaded barges must be removed concurrently. No more than 20 barges are permitted to be moored at the facility.

5. A monitoring program shall be designed and implemented that adequately addresses the concerns listed in the Level of Take section. Monitoring and reporting shall continue annually for a period of ten years or until the Service is convinced that there are no significant adverse impacts to the endangered species from the operation of the facility. This monitoring shall be undertaken by a reputable, Service approved malacologist utilizing Service approved sampling methods. The investigator must notify the Service's West Virginia Field Office (WVFO), Endangered Species Specialist (ESS), prior to initiating annual sampling efforts so that the ESS can participate in monitoring efforts. An annual report must be submitted to the WVFO for approval and copies (2) sent to the Chief, Endangered Species, Region 5, Hadley, Massachusetts.

Terms and Conditions

1. A "before project" baseline of the species diversity and abundance must be established for the project area. This effort should continue annually until the project becomes operational. This would include determining age structure based on length measurements (juveniles defined as less than 35 percent of maximum size encountered, measured as total length);

2. Monitor and report annually the live-to-recently dead ratio of all mussel species;

3. Monitor and report mussel density and species diversity annually of all species;

4. Monitor and report recruitment success annually of the five dominant species other than A. p. plicata; and

5. Annually monitor and report growth rates of two dominant species other

than A. p. plicata by comparing cohort structure for post-project length frequency distributions to a pre-project random sample.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impacts of the incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service believes that the anticipated level of incidental take, as described above, will not be exceeded. However, if, during the course of the action, this level of take is exceeded, consultation with this office must be reinitiated.

Any dead specimens of endangered or surrogate mussel species should be reported to this office immediately, and to the Special Agent, U.S. Fish and Wildlife Service, P.O Box 928, Morgantown, West Virginia 26507. Other, non-listed, non-surrogate species or specimens found in muskrat middens need not be reported. Instructions for handling and disposal will be given by this office.

Conservation Recommendations

Section 7(a)(1) of the Act 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. The term conservation recommendations has been defined as Service suggestions regarding discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information.

The Service recommends the following work to assist in conservation of L. orbiculata:

Initiate and fund a life history study of L. orbiculata in the Kanawha River. The study should, at a minimum, identify and/or assess the reproductive cycle, fish hosts, age and growth, cohort structure, and habitat use of L. orbiculata in the upper Kanawha River.

In addition to the outlined monitoring program the permittee should undertake a study to identify and monitor threats to the pink mucket population so that adverse impacts to the population can be properly assessed. This study should include water quality monitoring at the upstream and dock sites, an inventory of point and non-point source discharges upstream of the dock, conducting bioassays with glochidia of Lampsilis sp. and river water collected from below suspected problem areas, and assessing suitability of the river for the pink mucket.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

This concludes formal consultation on the action outlined in the request. As required by 50 CFR Section 402.16, reinitiation of formal consultation is required 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 agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was 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 that are causing such take must be stopped in the interim period between the initiation and completion of the new consultation if any additional taking is likely to occur.

The Service appreciates the Corps' efforts to meet its responsibilities under the ESA. If you desire further information or assistance, please contact John Schmidt of this office at (304) 636-6586.

Sincerely,

Christopher M. Clower
Supervisor

cc:
WVDNR - Miles
Pelurie
McCoy
EPA - Forren
ARD/ES, Hadley
PAFO - Kulp
Project File
Reader File
ES:WVFO:JESchmidt:wjc:7/7/93
File Name:\CORPS\FAY-DOC2.JES

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APPENDIX I

Significant information regarding the population status and reproduction of L. orbiculata has come to light in the last five years. The L. orbiculata Recovery Plan may need updating as pointed out by Clarke (l990) in his critique of this Draft Biological Opinion. However, Clarke's proposed strategy for recovery, relocating, and concentrating mussels into reproductive aggregates, is unlikely to be adopted. Neves (U.S. Fish and Wildlife Service, Virginia Tech., Virginia Cooperative Fish and Wildlife Research Unit, pers. comm. l990) felt that while Clarke's technique may work, the technique is an "unproven protocol for enhancing the reproductive success of rare unionids." The recent data on translocation would argue against these activities. Neves (pers. comm. l990) reports recent efforts to translocate the endangered birdwing pearly mussel (Lemiox rimosus) by the Tennessee Valley Authority have not resulted in adequate survival or documented reproduction (presence of juveniles) after eight years. Similarly, a recent relocation of mussels was conducted by Dunn (l990) on the Ohio River. A two year assessment of over 5,000 mussels that were moved out of a fleeting area resulted in annual survival rates of only 35 to 50 percent (Neves, pers. comm. l990). Of note, the researchers were unable to locate 30 specimens of the rare Truncilla truncata that were transplanted. The preliminary data indicate that some species appear to be less adaptive to relocations than others. It is not known how L. orbiculata would fare in a translocation effort.

Clarke (l989) felt L. orbiculata was not reproducing in the Kanawha due to interference by Corbicula. However, in l988 (Clarke) felt that Corbicula did not "threaten the existence of unionid species in the Ohio-Mississippi drainage river systems, with the exception of Elliptio crassidens." Of note, E. crassidens ranked third and fourth in abundance at the Fayette Dock site according to Zeto (l989) and Clarke (l987), respectively. Clarke (l988) and Neves (l987) both suspected the Asian clam, Corbicula, of negatively impacting native freshwater mussels. However, Neves (pers. comm. l990) indicated that evidence of competitive interactions is lacking. The Asian clam represents only one of numerous variables that could contribute to faunal declines. Miller et al., (l990) could find no correlation, positive or negative, between densities of freshwater mussels in river and densities of Asian clams in those mussel beds. Ahlstedt (Tennessee Valley Authority, Norris, Tennessee, pers. comm. l990) reports the endangered species, Lemiox rimosus, reproducing in the Duck River despite "abundant" Corbicula.

Transplanting and aggregating mussels make the aggregates more vulnerable to catastrophic events, such as toxic spills, disease, predation, scouring, and other episodic events that are usually site-specific rather than river-specific (Neves, pers. comm. l990; Moser, U.S. Fish and Wildlife Service, Annapolis, Maryland, Field Office, pers. comm. l990). Before translocation is attempted on the massive scale recommended by Clarke, better quantitative information on the density of L. orbiculata and recruitment rates for each population would be necessary. The technique using surrogate species must be proven prior to attempting it with endangered species. It must be assured that significant habitats from which mussels are to be transplanted will be preserved. Otherwise, viable habitat and populations of endangered species would be destroyed by water resource development projects if translocation efforts are unsuccessful.

If reproduction recruitment was not evident, we should first attempt to determine whether fertilization success is the problem with this population (i.e., low percentage of glochidia versus the percentage of available eggs). If this were the case, one could argue that the sexes may be too far apart to achieve successful fertilization. However Kitchell (Virginia Department of Game and Inland Fisheries, pers. comm. l990) found that concentrating adults 30 per 3.3 feet^2 to improve fertilization of Fusconaia edgariana was not successful. If low or no recruitment is due to other reasons, moving adult mussels may even further limit population survival (Neves, pers. comm. l990).