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Powell River Project 1997

REPORT OF SURVEY FOR THREATENED AND ENDANGERED FISH AND MUSSELS IN THE POWELL RIVER BETWEEN RIVER KILOMETER 237.5 AND 242.2 LEE COUNTY, VIRGINIA

Lee County Regional Infrastructure

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1.0 INTRODUCTION

The Lee County Regional Infrastructure project consists of upgrading the Pennington Gap Water Treatment Plant from a 3.8 million liters per day (mld) capacity to 7.6 mld. In addition, a new wastewater treatment plant will be constructed in the Hickory Flats area of Lee County. The discharge from the new wastewater treatment plant will be to the Powell River. Construction of the new wastewater treatment plant will also involve placing a pipeline across Town Branch, a small, second-order tributary to the Powell River near Jonesville. Construction design and environmental permitting for the treatment plant is being handled by Anderson and Associates, Inc. Based on guidance given to personnel from Anderson and Associates, Inc. by the Virginia Department of Game and Inland Fisheries and the U. S. Fish and Wildlife Service (FWS), a survey for federally protected fish and mussel species is required in the Powell River in the general area of discharge from the new wastewater treatment plant, and in Town Branch in the vicinity of the pipeline for the new wastewater treatment plant. Federally listed species of fish that potentially occur in the vicinity of the proposed discharge are:

- yellowfin madtom (*Noturus flavipinnis* - **threatened**)
- slender chub (*Erimystax cahni* - **threatened**)

Federally protected mussels that potentially occur in the project vicinity are:

- shiny pigtoe (*Fusconia cor* - **endangered**)
- fine-rayed pigtoe (*Fusconia cuneolus* - **endangered**)
- cracking pearlymussel (*Hemistena lata* - **endangered**)
- birdwing pearlymussel (*Lemiox rimosus* - **endangered**)
- dromedary pearlymussel (*Dromus dromas* - **endangered**)
- Appalachian monkeyface (*Quadrula sparsa* - **endangered**)
- Cumberland monkeyface (*Quadrula intermedia* - **endangered**)

State listed species of fish that potentially occur in the project vicinity are:

- paddlefish (*Polyodon spathula* - **threatened**)
- emerald shiner (*Notropis atherinoides* - **threatened**)
- western sand darter (*Ammocrypta clara* - **threatened**)

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2.0 METHODS

Sampling for fish and mussels was conducted on 8 - 10 and 22 October 1996 at the locations indicated in Figures 1 - 5 (Appendix B) following the procedures described in the study plan. During the period 8 -10 October, conditions in the Powell River were excellent for an underwater survey using visual location: visibility was estimated at 1.5 - 2.0 m and the water temperature was 14^0 C. On 22 October, water temperature was 13^0 C and the underwater visibility was estimated at 2.5 - 2.7 m.

On 8 October, the survey team, consisting of 3 biologists from 3D/I and one biologist from Louis Berger and Associates, Inc. carefully searched the two shoals closest to the U. S. 58 bridge. These shoals are located approximately 150 m upstream of the bridge (Shoal no. 1) and approximately 450 m downstream of the bridge (Shoal no. 2). A third area, located approximately 30 m downstream from the mouth of Station Creek (approximately 210 m downstream of the bridge), was also examined. This area can be characterized as a short, deep run. A small island occurs along the northern shoreline creating a small shoal that, during low flow conditions, is approximately 3 m wide, 6 m long, and 15 - 30 cm deep. At least two passes were made through these areas using skin diving gear. In addition, fish were collected using a 1.2 X 3.0 m seine net (0.5 cm mesh). All fish collected with the seine net were carefully examined and identified in the net. Most individuals representing common and easily identifiable species were released alive. A few specimens of each species and all small minnows were preserved in 10% formalin for closer inspection at the laboratory. All live and relict mussels encountered were collected, examined, and identified to species. Total field time spent in the river on 8 October was approximately 40 man-hours (4 persons X 10 hours).

After dark that same day, the survey team returned to the study area, joined by another team member which arrived at the site late in the evening. This five person team, using skin diving gear (mask, snorkel, and wetsuit), and each armed with one or more powerful underwater lights, began at the U. S. 58 bridge and made a downstream pass through the survey area. At the upper end of Shoal No. 2 (approximately 450 m downstream of the U. S. 58 bridge) the team turned and slowly made their way back upstream to the bridge. During both passes, the survey team scanned the substrate for fish species (especially madtoms) and other taxa not collected or observed earlier during the daytime. Total time spent in the water during the nighttime survey was approximately 7.5 man-hours (5 persons X 1.5 hours).

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State listed species of mussels that potentially occur in the project vicinity are:

- elephant-ear (*Elliptio crassidens* - **endangered**)
- Cumberlandian combshell (*Epioblasma brevidens* - **endangered**)
- oyster mussel (*Epioblasma capsaeformis* - **endangered**)
- snuffbox (*Epioblasma triquetra* - **endangered**)
- slabside pearlymussel (*Lexingtonia dolabelloides* - **threatened**)
- black sandshell (*Ligumia recta* - **threatened**)
- sheepnose (*Plethobasus cyphyus* - **threatened**)
- pimpleback (*Quadrula pustulosa pustulosa* - **threatened**)
- rough rabbitsfoot (*Quadrula cylindrica strigillata* - **threatened**)
- deertoe (*Truncilla truncata* - **endangered**)

The FWS recommended the survey area should include Town Branch in the vicinity of the proposed pipeline crossing and 2440 to 4570 m (8000 to 15,000 ft) of the Powell River, downstream of the U.S. Route 58 bridge. The FWS also advised that the shoal area on the Powell River approximately 150 m upstream of the U. S. 58 bridge should be surveyed. On 23 August 1996, Anderson and Associates, Inc. contracted 3D/International, Environmental Group (3D/I) to survey Town Branch and Powell River for the federally protected species listed above. In the technical proposal submitted to Anderson and Associates, Inc., 3D/I developed a study plan for the survey, which was verbally approved by FWS on 2 July 1996. In the study plan (provided in Appendix A of this report), boundaries of the study area were defined as being between the U. S. Route 58 bridge and a point approximately 4600 m downstream. The first 460 m feet of this reach, beginning at the bridge, would be intensively examined for federally protected fish and mussels, i.e., all available habitats would be examined. In the remaining 4140 m feet of river, the search for threatened and endangered species would be habitat specific: only those habitats known to be preferred by the species listed above would be examined.

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On 9 October, the survey team examined the remaining 4100 m of the study area. Using skin diving equipment, the survey team searched for mussels and the slender chub at each shoal indicated on Figure 5 (Appendix B). At several locations, a 1.2 X 3.0 m seine net (0.5 cm mesh) was used to obtain fish for a voucher collection. At Shoal Nos. 3 and 4, the survey team kept all relict shells encountered. Beginning at Shoal No. 5, each relict shell found by the survey team was examined closely and identified to species, but only those shells representing taxa other than mucket (*Actinonaias ligamentina*) or pheasantshell (*A. pectorosa*) were kept. Relict shells of mucket and pheasantshell were not kept because of the large number encountered, and because the time of death, location at death, and cause of death could not be determined with accuracy, Thus, quantitative data obtained from the relict shells would not have been pertinent. Total time spent surveying for fish and mussels on 9 October was approximately 32 man-hours (4 persons X 8 hours).

During the underwater work in the lower 4100 m of the study area in the Powell River, close attention was given to potential habitats for *Noturus flavipinnis*. As described in the sampling plan, the yellowfin madtom is a nocturnal species which inhabits pools and occasionally backwaters near riffles and runs (Dinkins and Shute 1996, Jenkins and Burkhead 1993). While this general type of habitat is common throughout the Powell River in the vicinity of the proposed plant discharge, only a short area located between river kilometer (Rkm) 239.7 to 240.1 (see Figure 1, Appendix B) possessed the specific physical features typically associated with the species in other locations where the species is extant. In Citico Creek, a medium-size tributary to the Little Tennessee River in eastern Tennessee. pools inhabited by the yellowfin madtom are two to four ft deep, have gravel, small and large flat cobbles, and boulders, and moderate to slow current. Most pools in the Powell River downstream of the U. S. 58 bridge are greater than six feet deep during normal flow conditions, and have a substrate comprised primarily of sand and boulders.

On 22 October, two members of the survey team returned to the Powell River and conducted a nighttime search for *N. flavipinnis* at Rkm 239.7 to 240.1. The survey team began at the downstream ford and worked upstream to the shoal just below the upstream ford (total distance approximately 305 m). Two passes were made through this area. The team began at 10:00 PM and finished at 11:30 PM (total search time = 3 man-hours).

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On 10 October the survey team surveyed Town Branch for fish and mussels in the vicinity of the proposed pipeline crossing. In this reach, Town Branch ranges from 15 cm to 0.6 m deep and 0.6 - 3.0 m wide. At the time of the survey, the stream was relatively clear; underwater visibility was estimated at two feet. Substrate is primarily chert stone and exposed bedrock. River snails (Pleuroceridae) were abundant and the stream appeared to be strongly spring-influenced. After a reconnaissance of the creek upstream and downstream of the U. S. 58 bridge, the survey team searched the channel and riparian areas for live and dead mussels. Next, the survey team, using a Coffelt backpack electrofisher, began approximately 120 m downstream of the U. S. 58 bridge and collected fish while traveling in an upstream direction, stopping just downstream of the bridge. The majority of fish captured were identified in the field, counted, and released alive.

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3.0 RESULTS

3.1 FISH

Table 3 - 1 provides a list of all fish species collected or observed during the survey of the Powell River. A list of fish species collected in Town Branch is provided in Table 3 - 2. Number of individuals collected, size range of preserved specimens, and catalogue number of specimen lots placed into the University of Tennessee Research Collection of Fishes is provided in Appendix C, Table C-1. Similar information is provided for fishes captured and released from Town Branch (Appendix C, Table C-2).

A total of 35 species of fish was collected or observed in the study area. No federal or state listed species were found. The fairly robust list of fish species produced from the field effort is somewhat misleading, in that the number of fish observed or collected was lower than expected. Especially surprising was the small number of larger fish observed, especially game species such as smallmouth bass and rockbass, during the nighttime snorkeling efforts.

Although conditions were optimal for conducting a survey that relied heavily on underwater observation, it appears that such conditions are not commonly present. On 4 September 1996, the survey team arrived at the river to initiate the survey. In the few weeks prior to this trip, conditions in the river had been marginal, based on daily observations provided by a local resident. As the survey team prepared to conduct the first nighttime search, a brief but intensive storm dropped about 3 cm of rain on the area. The following morning, the Powell River upstream of the U. S. 58 bridge was slightly less clear than the night before, but downstream of the mouth of Station Creek, located approximately 30 m below the bridge, the river was highly turbid as a result of the suspended sediment emanating from the creek. Subsequent observations of the river bottom throughout the study area revealed that sedimentation is widespread. Significant sources of sedimentation include impacted tributaries such as Station Creek, as well as eroding riparian areas along the main channel of the river where the vegetation has been reduced or denuded from cattle.

Anecdotal observations suggest that increased sedimentation is responsible for declining numbers of *N. flavipinnis* in Copper Creek, a tributary to the Clinch River in nearby Scott and Russell Counties, Virginia (Peggy Shute, pers. comm.) where the species was, until only a few years ago, fairly common. Until its discovery in Citico Creek by G. R. Dinkins in 1980 (Bauer, et al 1983), there were only two known extant populations, both near the project site: Copper Creek (lower 47 rkm) and the Powell

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Table 3-1

Fishes Collected or Observed in the Powell River Between River Kilometer 237.5 and 242.2, Lee County, Virginia (8-10, 22 October 1996)

Scientific Name	Common Name
Campostoma anomalum	central stoneroller
Cyprinella galactura	whitetail shiner
C. spilloptera	spotfin shiner
Erimystax dissimis	streamline chub
Hybopsis amblops	bigeye chub
Luxilus chrysocephalus	striped shiner
L. coccogenis	warpaint shiner
Lythrurus lirus	mountain shiner
Nocomis micropogon	river chub
Notropis sp.	sawfin shiner
N. ariommus	popeye shiner
N. leuciodus	Tennessee shiner
N. rubellus	rosyface shiner
N. telescopus	telescope shiner
N. volucellus	mimic shiner
Phenacobius uranops	stargazing minnow
Pimephales notatus	bluntnose minnow
Catostomus commersoni	white sucker
Hypentelium nigricans	northern hog sucker
Moxostoma erythrurum	golden redhorse
M. duquesnei	black redhorse
Cottus carolinae	banded sculping
Ambloplites rupestris	rockbass
Micropterus dolomieu	smallmouth bass
Lepomis macrochirus	bluegill
Etheostoma blennioides	greenside darter
E. rufilineatum	redline darter
E. simoterum	Tennessee snubnose darter
E. stigmaeum	speckled darter
E. vulneratum	wounded darter
E. zonale	banded darter
Percina aurantiaca	tangerine darter
P. copelandi	channel darter
P. evides	gilt darter
Stizostedion canadense	sauger

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Table 3-2

Fishes Collected from Town Branch in the Vicinity of U. S. 58, Lee County, Virginia (10 October 1996)

Scientific Name	Common Name
Campostoma anomalum	central stoneroller
Rhinichthys atratulus	blacknose dace
Hypentelium nigricans	northern hog sucker
Cottus carolinae	banded sculpin

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River at Rkm 160 and 172. The Powell River population is known from only three specimens collected over a span of 15 years (Feeman 1987). The number of yellowfin madtoms in Citico Creek has also declined, but sedimentation does not appear to be a contributing factor since the watershed is almost entirely forested and sediment loading is negligible.

Within the study area, suitable habitat was found in the long, shallow pool at Rkm 239.7, but all cobble of the size typically used as nesting cover or shelter by yellowfin madtoms in Citico Creek were imbedded in the substrate by a layer of silt. Numerous flat cobbles were lifted and their undersides examined for the presence of a cavity, but in every case the action produced a cloud of silt with no cavity structure apparent. Presumably, sealing off the cobble edges would preclude a crypto-benthic cavity-dweller such as *N. flavipinnis* from seeking shelter during the daylight hours. Its ability to locate and construct appropriate nesting cavities would be similarly affected. It is reasonable to believe that *N. flavipinnis* once occurred in the Powell River within the study area, but has been extirpated as a result of poor water quality and sediment loading. The most recent collection of the species in the Powell River occurred in 1983, over 13 years ago (Feeman 1987). The proximity of the upper location to the Virginia border - a distance of only 27 rkm, led Jenkins and Burkhead (1993) to believe that the species may occur in Virginia. If so, it is doubtful that it still exists in reaches where cobbles are imbedded within the substrate to the degree observed in the study area.

According to Jenkins and Burkhead (1993), the slender chub is a fish of the open, moderately to swiftly flowing, shallow flats and shoals of warm, usually clear, moderate-gradient, large streams and rivers (30 - 125 m wide). Frequently, the slender chub is taken as shallow as 0.3 m, rarely 0.1 m. They also reported that occasionally it inhabits slow runs, but was never found in a backwater or pool. Most importantly, the presence of major areas (greater than 25 m^2) of clean, small (pea-sized) to medium gravel is a specific habitat requirement. Infrequently, it occurs on sand-gravel mix and large gravel. In Virginia, it is known only from the Powell River at two locations in Lee County: Fletcher Ford and island at Fletcher Cliff (Rkm 188.7 and 189.7 [Feeman 1987]), despite intensive collecting efforts. Jenkins and Burkhead (1993) supposed that the prospects of *Erimystax cahni* establishing itself appreciably farther upriver in the Powell are low; ample beds of pea gravel may be absent or too far apart. Our observations of habitat in the study area, located 48 rkm upriver from the island at Fletcher Cliff, support this. No extensive pea gravel beds were found, at least none larger than 25 m^2.

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The fish community in Town Branch was typical of a small, spring-influenced stream of the Tennessee River system. The community was dominated by blacknose dace (*Rhinichthys atratulus*) and central stonerollers (*Campostoma anomalum*). Present in lesser numbers were northern hogsuckers (*Hypentelium nigricans*) and banded sculpins (*Cottus carolinae*).

3.2 Mussels

A total of 142 live mussels, representing 11 species, was found in the Powell River study area (Table 3-3). In the Powell River, an additional four species were recognized from relict shells (Appendix C, Table C-1). No mussels were found in the survey of Town Creek. In all, nine shoal areas on the Powell River were examined, including the long pool beginning at the U. S. 58 bridge (see Figure 4, Appendix B). The most common mussel was *Actinonaias ligamentina* (mucket), representing 49% of the specimens collected. Fairly equal in abundance were *A. pectorosa* (pheasentshell), *Elliptio dilitata* (spike), and *Fusconaia subrotunda* (long-solid), each representing 10 - 12% of the specimens collected. During the survey of Shoal Nos. 1 and 2 and the habitats in-between, all live mussels were removed from the substrate and brought to the shore for closer examination. Beginning at Shoal No. 3, the collectors removed from the substrate all mussels, but most of the *Actinonaias* were counted and then placed back into the substrate. Thus, the actual ratio of *A. ligamentina* to *A. pectorosa* may be inaccurately reported. This would explain the higher number of *A. pectorosa* among the relict shells, relative to *A. ligamentina*.

None of the species collected either as live or relict specimens are listed as federally threatened or endangered by the U. S. Fish and Wildlife Service. Based on casual observations of the range in shell sizes of live individuals, there appears to be little recruitment within the mussel community in the reach surveyed. Most of the live mussels collected and examined represented older individuals, were of a uniform size, and had a similar amount of shell wear. Further, most of the live specimens were similar in size to the relict shells, indicating a community comprised largely of individuals near the end of their natural life span.

Two of the species represented by relict shells, elephant-ear (*Elliptio crassidens*) and rough rabbitsfoot (*Quadrula cylindrica strigillata*), are listed by the state of Virginia as endangered and threatened, respectively. A single relict elephant-ear was found at Shoal No. 3. Two relict elephant-ear and one relict rough rabbitsfoot were found at Shoal No. 5.

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Table 3-3

Native Mussels Collected in the Powell River Between River Kilometer 237.5 and 242.2 Lee County, Virginia (8-10 October 1996)

Scientific Name	Common Name	Live	Relict
Actinonaias ligamentina	mucket	X	X
Actinonaias pectorosa	pheasantshell	X	X
Amblema plicata	threeridge	X	X
Elliptio crassidens	elephant-ear		X
Elliptio dilitata	spike	X	X
Fusconaia subrotunda	long-solid	X	X
Lampsilis cardium	plain pocketbook	X	X
Lampsilis fasciola	wavy-rayed lampmussel	X	X
Lampsilis ovata	pocketbook	X	X
Lasmigona costata	fluted-shell	X	
Potamilus alatus	pink heelsplitter		X
Ptychobranchus fasciolaris	kidneyshell	X	X
Quadrula cylindrica strigillata	rough rabbitsfoot		X
Villosa iris	rainbow	X	X
Villosa v. vanuxemensis	mountain creekshell		X

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Although the objective of the study was to document species of fish and mussels in the study area, the survey team was also alert to other aquatic organisms. Numerous live spiny river snails (*Io fluvialis*) were observed in several of the shoals. In the first shoal downstream of the U. S. 58 bridge (Shoal No. 2), they were fairly common along the river margin and in some of the more shallow areas. *Io fluvialis* is listed as threatened by the State of Virginia.

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4.0 REFERENCES

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APPENDIX A

STUDY PLAN

STUDY PLAN FOR THE SURVEY OF YELLOWFIN MADTOM, SLENDER CHUB, AND ENDANGERED MUSSELS (revised)

1.1 PROJECT DESCRIPTION

The Lee County Regional Infrastructure project consists of upgrading the Pennington Gap Water Treatment Plant from a 1 million gallon per day (mgd) capacity to 2 mgd. In addition, a new wastewater treatment plant will be constructed in the Hickory Flats area of Lee County. The discharge from the new wastewater treatment plant will be to the Powell River. Construction of the new wastewater treatment plant will also involve placing a pipeline across Town Branch, a small, second-order tributary to the Powell River near Jonesville. Based on discussions with personnel from the Virginia Department of Game and Inland Fisheries and the U. S. Fish and Wildlife Service (FWS), surveys for endangered fish and mussel species will be required in the Powell River in the general area of discharge from the new wastewater treatment plant, and in Town Branch in the vicinity of the pipeline for the new wastewater treatment plant. Federally protected fish that potentially occur in the vicinity of the discharge to the Powell River are:

- yellowfin madtom (*Noturus flavipinnis*)
- slender chub (*Erimystax cahni*)

Federally protected mussels that potentially occur in the project vicinity are:

- shiny pigtoe (*Fusconia cor*)
- fine-rayed pigtoe (*Fusconia cuneolus*)
- cracking pearlymussel (*Hemistena lata*)
- birdwing pearlymussel (*Lemiox rimosus*)
- dromedary pearlymussel (*Dromus dromas*)
- Appalachian monkeyface (*Quadrula sparsa*)
- Cumberland monkeyface (*Quadrula intermedia*)

The FWS recommended the study area should include 8000 to 15,000 feet of the Powell River, downstream of the U.S. Route 58 bridge. For this study plan, the boundaries of the study area boundaries are defined as being between the U. S. Route 58 bridge and a point approximately 15,000 feet downstream. The first 1,500 feet of this reach, beginning at the bridge, will be intensively examined for federally protected fish and mussels, i.e., all available habitats will be examined. In the remaining 13,500 feet of river, the search for threatened and endangered species will be habitat specific: only those habitats known to be preferred by the species listed above will be examined.

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1.2 FISH

The yellowfin madtom, listed as a federally threatened species on 9 September 1977, is an inhabitant of pools and backwaters. In Citico Creek (Cherokee National Forest, eastern Tennessee) where it has been intensively studied, the yellowfin madtom is strictly a nocturnal fish. Except for the brief nesting period which extends from late May to early July, the species is particularly elusive during the daylight hours. Populations of this species in Tennessee and Virginia appear to be fairly localized; studies in Citico Creek indicate individuals have a limited home range (Dinkins and Shute, in press). Much less is known about the ecology of the yellowfin madtom in the Powell River, but qualitative observations of a population in Copper Creek (tributary to the Clinch River, Scott County, Virginia), indicate the Citico and Copper Creek populations have similar habitat and food preferences. It is reasonable to presume individuals in the Powell River have similar habits to those in Citico and Copper Creeks.

According to Jenkins and Burkhead (1993), the slender chub is a fish of the open, moderately to swiftly flowing, shallow flats and shoals of warm, usually clear, moderate-gradient, large streams and rivers. Frequently, the slender chub is taken as shallow as 0.3 meter, rarely 0.1 meter. Usually the chub is found on pea gravel, infrequently on sand-gravel mix and large gravel. The slender chub was listed as a federally threatened species on September 9, 1977.

To determine if the yellowfin madtom occurs in the study area, the survey team will conduct a nighttime, underwater search of the river bottom using skin diving gear and/or SCUBA, powerful underwater lights, and handnets. The survey team, beginning at the U. S. Route 58 bridge, will spread out in a straight line across the channel, and slowly work downstream while carefully searching the bottom with underwater lights. Depending upon conditions, the team may make another pass through this reach, either by again floating downstream from the bridge, or by working back upstream. All madtoms captured will be placed in a live bucket containing site water for subsequent streamside examination. Captured specimens will be identified to species, measured, sexed (if possible), photographed, and returned unharmed to the reach and habitat where they were captured.

The survey for slender chubs will be conducted during the daytime using a 10 ft by 4 ft seine net (3/16 in mesh). Jenkins and Burkhead (1993) reported the slender chub appears to require major areas (greater than 25 m^2) of clean, small (pea-sized) to medium gravel. Given that the species inhabits shallow water with moderate to swift current, seining efforts will be concentrated in shoal areas having these characteristics. The survey team will carry a live bucket containing site water, and any *Erimystax* that cannot be identified to species at the time of capture, will be kept for closer examination. These individuals will be then be more closely examined at streamside, measured, identified to species, photographed and released unharmed to the shoal area where they were captured. A voucher collection of all non-protected fish species

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may be kept for permanent record. All fish specimens wi l be catalogued at the University of Tennessee Research Collection of Fishes in Knoxville, Tennessee.

The survey for federally protected fishes in Town Branch will mirror that used in the search for slender chubs in the Powell River, except that all habitats will be seined, not just riffles and shoals. The survey team will begin approximately 300 feet upstream of the proposed pipeline crossing, and sample in a downstream direction to a point approximately 300 feet downstream of the proposed crossing. All available habitats will be sampled, e.g., pools, runs, undercut banks, etc. A separate voucher collection will be kept for Town Branch, and any federally protected species will be photographed and released unharmed at the point of capture.

A verbal report of the fish survey results will be provided to Anderson and Associates within three (3) days after completion of fieldwork, and a written report will be submitted within two (2) weeks after completion of fieldwork. The report will contain a description of the survey effort, including number of hours spent searching for the yellowfin madtom and slender chub, list of species captured (including relative abundance), description of habitats surveyed and methods used in each, map of the study area and capture location for any federally listed fish species, and photographs of captured specimens.

1.3 MUSSELS

Six of the seven mussel species described above were listed as federally endangered on 14 June 1976. The cracking pearlymussel was listed as endangered on 28 September 1989. These species require clear, clean, fast-flowing rivers and streams with stable substrates. In the Powell River, these seven species generally inhabit mixed sand and gravel areas in shoals where the depth during normal flow averages less than 1 m.

The search for the seven endangered mussels listed above will be conducted using view boxes and skin diving equipment. Appropriate substrate in the study area will be carefully searched for live and dead shells. In conjunction with the search of the river substrate, the shoreline will be examined for dead shells. All live mussels will be carefully removed from the substrate, placed in a mesh bag, and kept in flowing water until processed. During the search of a shoal area, the survey team will stop periodically (approximately every 30 minutes) and process live mussels so that they may be returned expeditiously to the location where found. Each live mussel will be closely examined and identified to species. General shell condition and length will be noted, and photographs will be taken of representative specimens. All live mussels, including those that do not have state or federal protection, will be returned unharmed to the substrate in the general area where they were collected.

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APPENDIX B

MAPS

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The search for federally protected mussel species in Town Branch will be conducted using skin diving gear (mask and snorkel) and view boxes. The survey team will also grub with their hands the stream bottom in search for live mussels which are not siphoning at the substrate surface. In conjunction with the search for live mussels within the stream channel, the riparian area will be examined for dead shells. All mussels collected in Town Branch will be identified to species and counted. Any live specimen representing a federally protected species will be photographed and returned unharmed to the habitat where collected.

A verbal report of the mussel survey effort will be provided to Anderson and Associates within three (3) days after completion of fieldwork, and a written report will be submitted within two (2) weeks after completion of fieldwork. The report will contain a description of the survey effort, including number of hours spent in search of mussels, species list indicating the number of live, dead, and relict specimens found in the river and number of freshly dead and relict shells found along the river bank, description of habitats surveyed and the methods used, map of the study area and location of capture for any federally listed mussel species, and photographs of representative specimens.

1.4 REFERENCES

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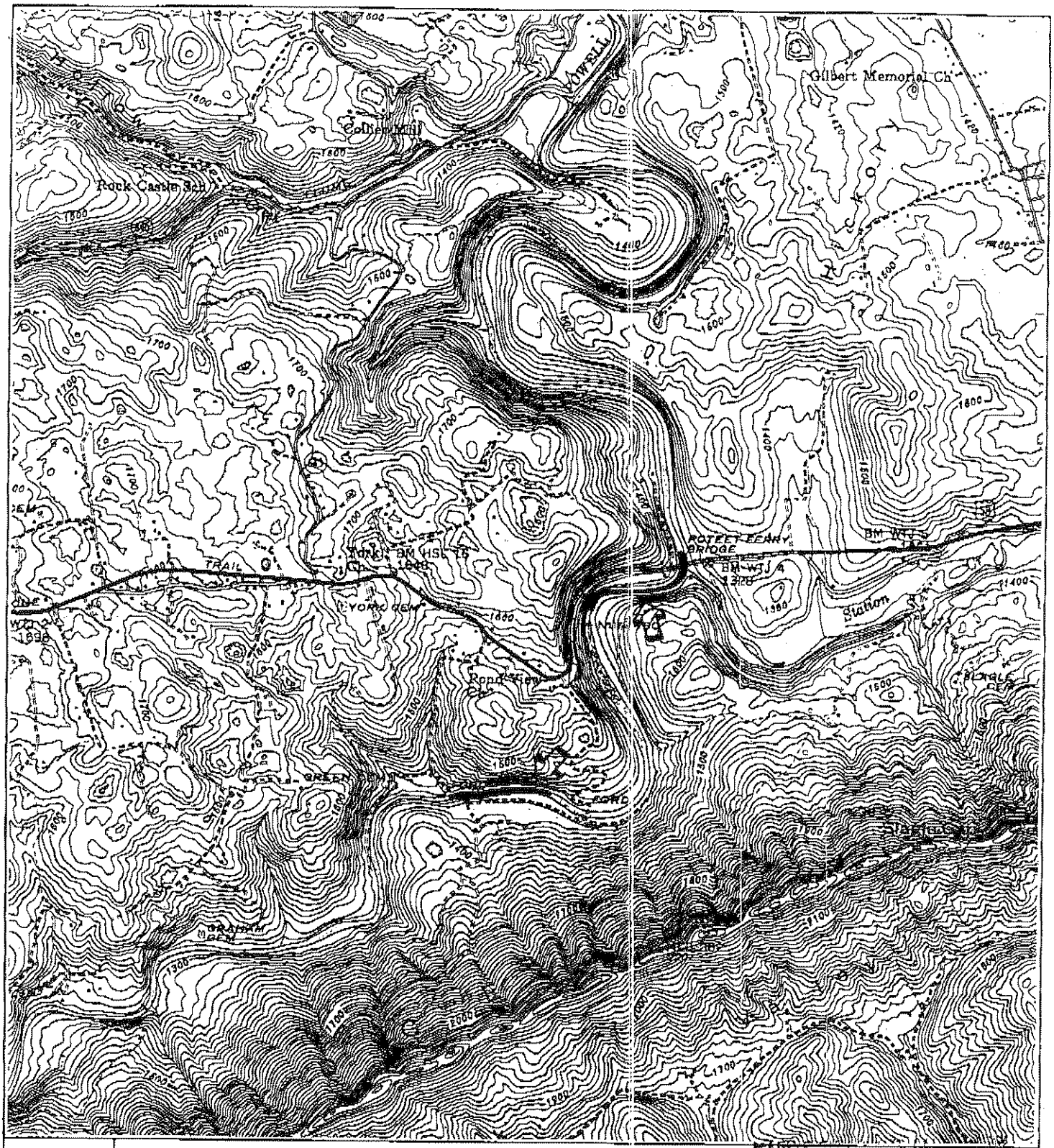

Figure 1. Areas surveyed for Noturus flavipinnis: Powell River, Lee County, Virginia; 9, 22 October 1996.

Source: Ben Hur, Virginia USGS 7.5 minute topgraphic quadrangle.

METERS 0 305 610 915
FEET 0 1000 2000 3000

PROJECT # C7656.11

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ENVIRONMENTAL GROUP

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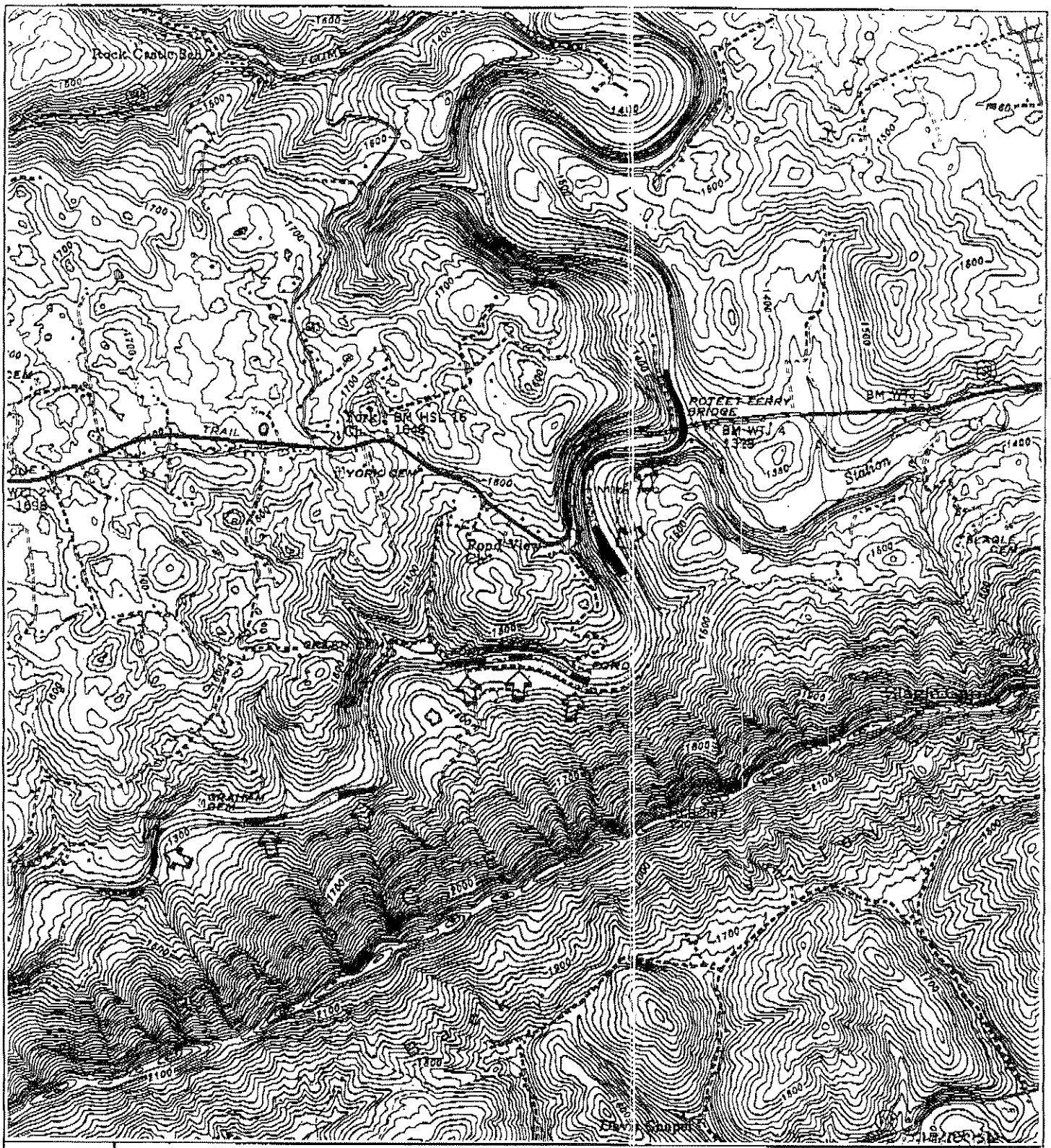

Figure 2. Areas visually surveyed for Erimystax cahni; Powell River, Lee County, Virginia; 9, 10, 22 October 1996.

Source: Ben Hur, Virginia USGS 7.5 minute topographic quadrangle.

METERS 0 305 610 915

FEET 0 1000 2000 3000

PROJECT # C7656.11

3D/INTERNATIONAL ENVIRONMENTAL GROUP

ADDITIONAL INFO REVISION

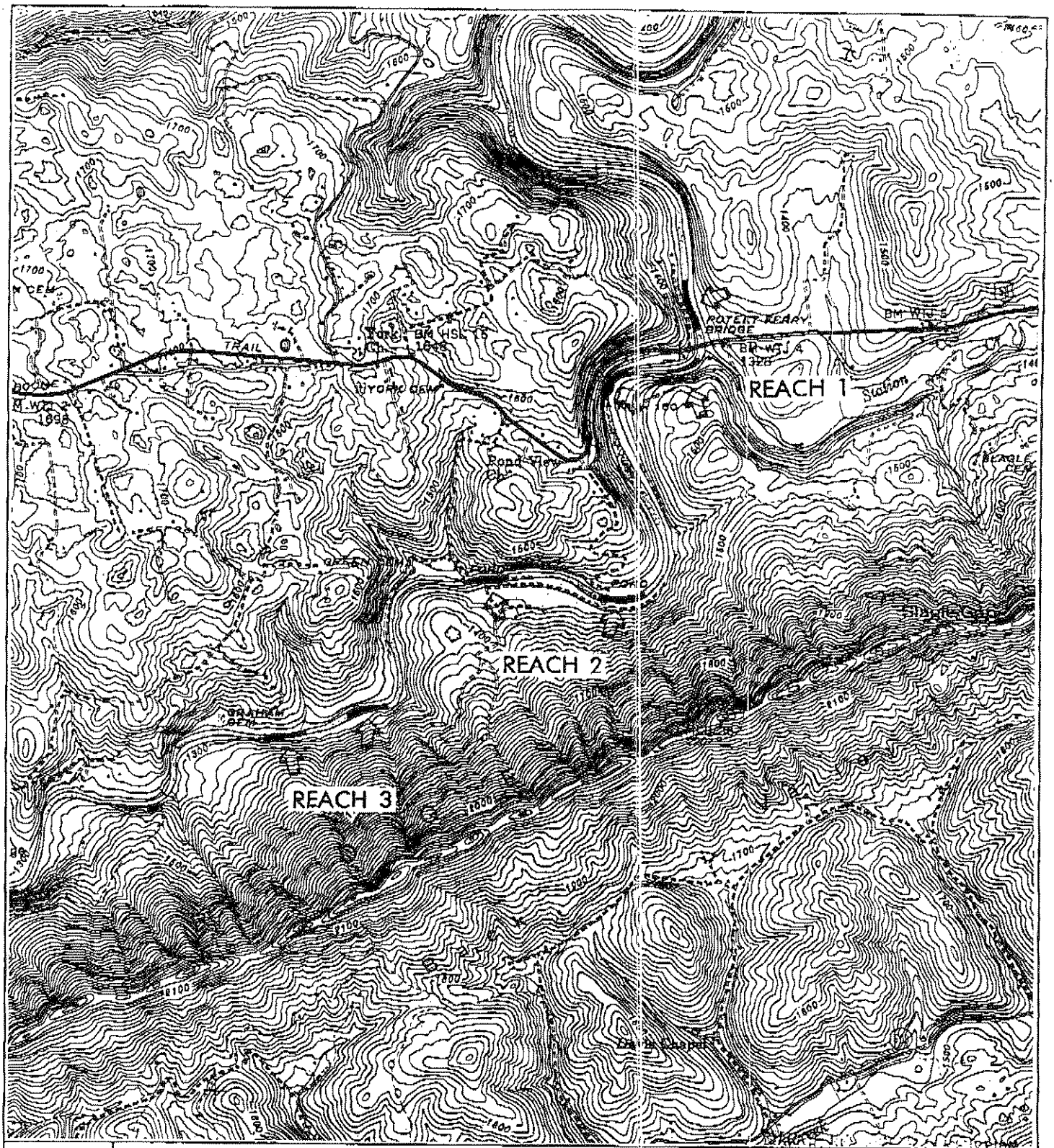

Figure 3. Areas where fish were collected and preserved, Powell River, Lee County, Virginia; 9, 10 October 1996.

Source: Ben Hur, Virginia USGS 7.5 minute topographic quadrangle.

METERS 0 305 610 915
FEET 0 1000 2000 3000

PROJECT # C7656.11

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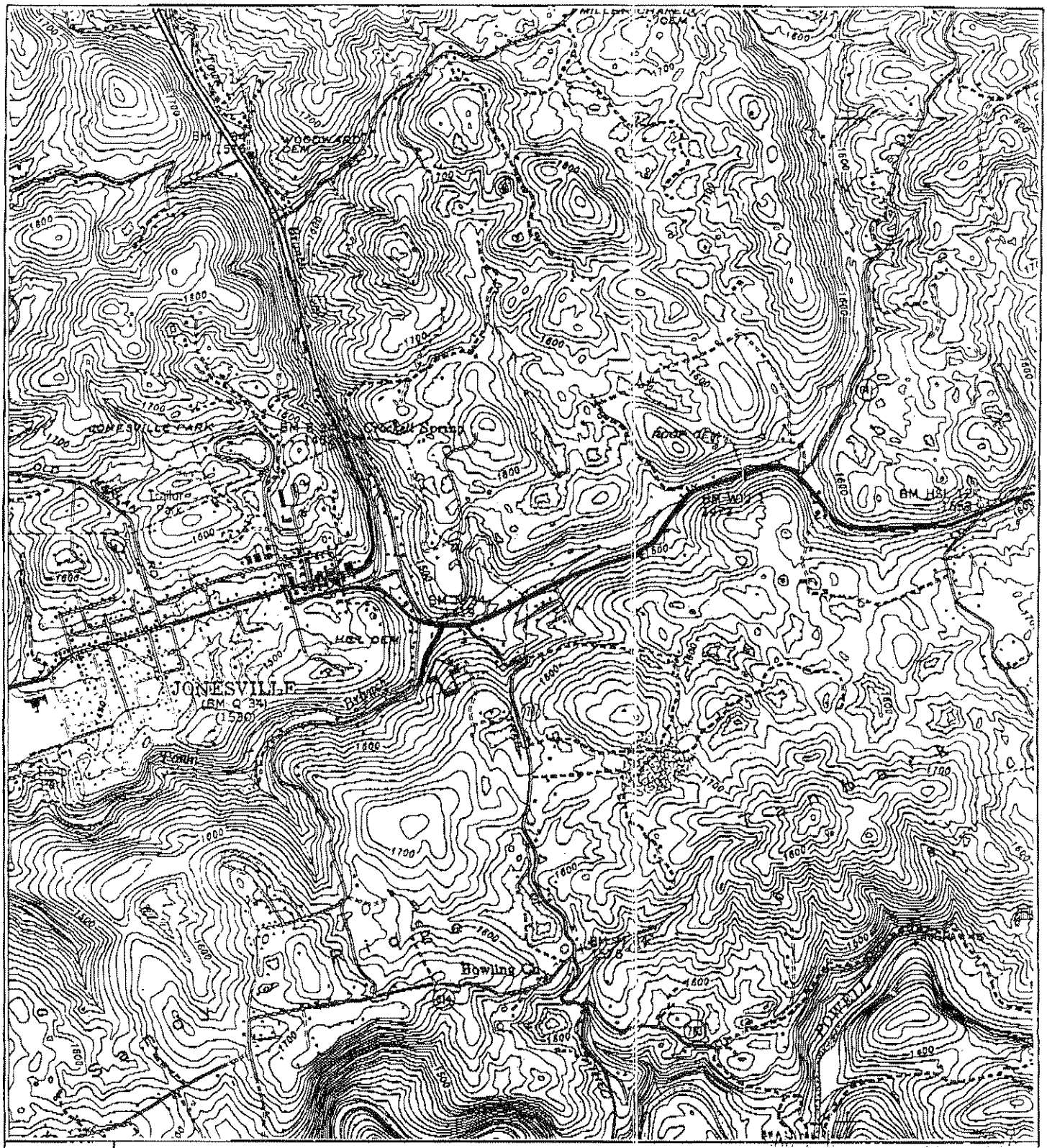

Figure 4. Area surveyed on Town Branch; Powell River; Lee County, Virginia; 10 October 1996.

Source: Ben Hur, Virginia USGS 7.5 minute topographic quadrangle.

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METERS 0 305 610 915

FEET 0 1000 2000 3000

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Figure 5. Areas surveyed for native mussels; Powell River, Lee County, Virginia; 9, 10 October 1996.

Source: Ben Hur, Virginia USGS 7.5 minute topographic quadrangle.

METERS 0 305 610 915
FEET 0 1000 2000 3000

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APPENDIX C

FISH SPECIES LISTS

ADDITIONAL INFO
REVISION

Table C-1

Fishes Collected or Observed in the Powell River Between River Kilometer 237.5 and 242.2, Lee County, Virginia (8, 9, 22 October 1996)

Scientific Name	Common Name	U. of TN Cat. No.	Reach 1	Reach 2	Reach 3
Campostoma anomalum	central stoneroller	44.7220		1(53)	
Cyprinella galactura	whitetail shiner				8(24-78)
C. spiloptera	spotfin shiner	44.7222	3(40-47)	1(45)	1(47)
Erimystax dissimis	streamline chub		observed	observed	1(45)
Hybopsis amblops	bigeye chub	44.7224	11(30-53)	observed	3(31-45)
Luxilus chrysocephalus	striped shiner	44.7225	41(28-54)	13(29-59)	11(33-78)
L. coccogenis	warpaint shiner	44.7226	14(32-44)	5(40-45)	19(35-74)
Lythrurus lirus	mountain shiner	44.7227	1(44)		2(22-43)
Nocomis micropogon	river chub	44.7228		1(46)	
Notropis sp.	sawfin shiner	44.7234	45(23-45)	9(37-47)	39(28-43)
N. ariommus	popeye shiner	44.7229	1(37)		
N. leuciodus	Tennessee shiner	44.7230	9(32-44)	32(29-56)	60(30-55)
N. rubellus	rosyface shiner	44.7231	29(22-48)	19(26-55)	11(22-58)
N. telescopus	telescope shiner	44.7232	42(29-41)	23(30-54)	72(31-57)
N. volucellus	mimic shiner	44.7233	2(18-27)	1(41)	2(41-44)
Phenacobius uranops	stargazing minnow	44.7235	2(45-46)	2(44)	observed
Pimephales notatus	bluntnose minnow	44.7236	3(26-28)		3(30-32)
Catostomus commersoni	white sucker		observed	observed	observed
Hypentelium nigricans	northern hog sucker	45.1369	1(62)	observed	observed
Moxostoma erythrurum	golden redhorse	45.1371	1(41)	observed	observed
M. duquesnei	black redhorse	45.1370	1(51)	observed	observed
Cottus carolinae	banded sculping	129.597	observed	5(39-88)	observed
Ambloplites rupestris	rockbass		observed	observed	observed
Micropterus dolomieu	smallmouth bass		observed	observed	observed
L. macrochirus	bluegill		observed	observed	observed
Etheostoma blennioides	greenside darter		observed	observed	1(44)
E. rufilineatum	redline darter	91.5030	observed	6(29-38)	2(28-29)
E. simoterum	Tennessee snubnose darter	91.5031	observed	observed	1(33)
E. stigmaeum	speckled darter	91.5032	1(31)		observed
E. vulneratum	wounded darter		observed		
E. zonale	banded darter	91.5033	1(31)	2(38-48)	2(35-36)
Percina aurantiaca	tangerine darter		observed	observed	observed
P. copelandi	channel darter			observed	observed
P. evides	gilt darter		observed	3(35-36)	observed
Stizostedion canadense	sauger				observed

Number of individuals is followed by the range in standard lengths (mm) in parenthesis.

ADDITIONAL INFO
REVISION

TABLE C - 2

Fishes Collected in Town Branch in the Vicinity of U. S. 58 Lee County, Virginia (10 October 1996)

Scientific Name	Common Name	No. Released	No. Retained	Size Range (mm SL)	Univ. of Tenn. Cat. No.
Campostoma anomalum	central stoneroller	25	9	40-140	44.7238
Rhinichthys atratulus	blacknose dace	140	60	27-71	44.7239
Hypentelium nigricans	northern hog sucker	6	1	135	45.1372
Cottus carolinae	banded sculpin	10	13	34-87	129.598

APPENDIX D

MUSSEL SPECIES LISTS

Table D - 1

Live and Relict Mussels Collected from Nine Shoals in Powell River Between River Kilometer 237.5 and 242.2, Lee County, Virginia (8 - 9 October 1996)

Scientific Name	Common Name	Live	Dead
Actinonaias ligamentina	mucket	Yes	Yes
Actinonaias pectorosa	pheasentshell	Yes	Yes
Amblema plicata	threeridge	Yes	Yes
Elliptio crassidens	elephant-ear	No	Yes
Elliptio dilatata	spike	Yes	Yes
Fusconaia subrotunda	long-solid	Yes	Yes
Lampsilis cardium	plain pocketbook	Yes	Yes
Lampsilis fasciola	wavy-rayed lampmussel	Yes	Yes
Lampsilis ovata	pocketbook	Yes	Yes
Lasmigona costata	fluted-shell	Yes	No
Potamilus alatus	pink heelsplitter	No	Yes
Ptychobranchus fasciolaris	kidneyshell	Yes	Yes
Quadrula cylindrica strigillata	rough rabbitsfoot	No	Yes
Villosa iris	rainbow	Yes	Yes
Villosa v. vanuxemensis	mountain creekshell	No	Yes
	Total:	**11**	**14**

ADDITIONAL INFO
REVISION

ADDITIONAL INFO REVISION

Table D - 2

Live Mussels Collected from Nine Shoals in Powell River Between River Kilometer 237.5 and 242.2, Lee County, Virginia (8 - 9 October 1996)

Scientific Name	Common Name	Shoal									No. of Individuals	
		1	2	3	4	5	6	7	8	9		
Actinonaias ligamentina	mucket	6		6	28	30					70	49%
Actinonaias pectorosa	pheasentshell	2	1	2	5	5					15	11%
Amblema plicata	threeridge	1		1	1						3	2%
Elliptio dilatata	spike	2	1	1	9	4					17	12%
Fusconaia subrotunda	long-solid	9			2	3					14	10%
Lampsilis cardium	plain pocketbook			1							1	1%
Lampsilis fasciola	wavy-rayed lampmussel			3						1	4	3%
Lampsilis ovata	pocketbook	1									1	1%
Lasmigona costata	fluted-shell	1		1	1						3	2%
Ptychobranchus fasciolaris	kidneyshell	1			5	7					13	9%
Villosa iris	rainbow			1							1	1%
											142	

TABLE D - 3

Relative Abundance of Relict Mussel Specimens From Nine Shoals in the Powell River Between River Kilometer 237.5 and 242.2 Lee County, Virginia (8, 9 October 1996)

		Shoal								
Scientific Name	**Common Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Actinonaias ligamentina	mucket	F	F	R		R				R
Actinonaias pectorosa	pheasentshell	C	C	C	C	C			C	C
Amblema plicata	threeridge		R							
Elliptio crassidens	elephant-ear			R		F				
Elliptio dilatata	spike	F	F	C	C	C			R	R
Fusconaia subrotunda	long-solid	F	C	C	F	F				
Lampsilis cardium	plain pocketbook			R		R				
Lampsilis fasciola	wavy-rayed lampmussel		F	F	F					R
Lampsilis ovata	southern pocketbook								R	
Potamilus alatus	pink heelsplitter		R	R						
Ptychobranchus fasciolaris	kidneyshell	R		F	R	F				
Quadrula cylindrica strigillata	rough rabbitsfoot				R					R
Villosa iris	rainbow	R			R			R	F	
Villosa v. vanuxemensis	mountain creekshell	R	R		F			R		

R = Rare (1 individual), F = Frequent (2 to 3 individuals), Common (Greater than 3 individuals).

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