COAL MINING IN TENNESSEE
MINIMUM GUIDELINES FOR THE DEVELOPMENT OF PROTECTION AND ENHANCEMENT PLANS FOR BLACKSIDE DACE (*PHOXINUS CUMBERLANDENSIS*)

Developed by
U.S. Fish and Wildlife Service
and U.S. Office of Surface Mining

in Cooperation with
U.S. Army Corps of Engineers,
Tennessee Department of Environment and Conservation,
and Tennessee Wildlife Resources Agency

March 20, 2009

To: SMCRA Applicants, Operators, Consultants, and Other Interested Parties

In follow up of the implementation of the 1996 Biological Opinion between the U.S. Fish and Wildlife Service (FWS) and the Office of Surface Mining (OSM), the FWS and OSM, in cooperation with the U.S. Army Corps of Engineers, Tennessee Department of Environment and Conservation, and Tennessee Wildlife Resources Agency developed the attached guidelines for the preparation of protection and enhancement plans for the blackside dace in Tennessee's surface coal mine permit application process.

These guidelines are intended to aid applicants for coal mine permits in Tennessee in understanding the options and protocols associated with conducting surface coal mining operations in areas containing known or potential blackside dace habitat. This document was developed using the most current scientific research regarding the blackside dace, its habitat and biology. As new research expands knowledge of this species, revisions to this document may be necessary.

A copy of the guidelines is enclosed for your use and information. We look forward to the use of these guidelines and are available to assist you with their implementation.

Sincerely,

Earl Bandy, Director
Knoxville Field Office

Lee A. Barclay, Field Supervisor
Fish and Wildlife Service

INTRODUCTION

The blackside dace (*Phoxinus cumberlandensis*) is a minnow species designated as federally threatened in accordance with the Endangered Species Act (ESA). The species principally occupies first-, second-, and third-order streams, but may be found in other waters, particularly during seasonal movements between winter and summer habitats. The blackside dace requires relatively silt-free streams with substantial shading. Pollution inputs to streams (e.g., silt, toxicants, and organic materials), removal of canopy from riparian (i.e., streamside) areas, disruption of fish movement, introduction of predatory fish, and alteration of stream flow patterns are impediments to the species' existence and overall recovery. The health of blackside dace populations appears to be correlated with other sensitive aquatic invertebrate communities, exhibiting similar intolerance to water quality impairment and habitat perturbations.

These guidelines have been prepared to comply with the September 24, 1996, Formal Section 7 Biological Opinion (BO) and Conference Report on Surface Coal Mining and Reclamation Operations under the Surface Mining Control and Reclamation Act (SMCRA) of 1977. In accordance with the BO, it has been determined that species-specific measures are appropriate to minimize surface coal mining impacts to the blackside dace.

The objective of any species specific protective measures implemented under the BO is to minimize the potential take (i.e., a take that is in excess of the level authorized by the BO and

accompanying Incidental Take Statement) of particular species during otherwise lawful mining activity. The measures set forth below are designed to meet this objective under an adaptive management approach while effectively minimizing the uncertainty associated with the permitting and review process. These guidelines are intended as a description of the minimum level of effort necessary to minimize adverse impacts and support recovery of the blackside dace.

The applicant is not bound to implement these measures in all circumstances. Rather, other measures that are tailored to the size, location, and other characteristics of the project area may be developed. If the applicant elects to propose alternative measures, then personnel of the Fish and Wildlife Service (FWS) and Office of Surface Mining (OSM) will review the applicant's proposal to ensure that it provides adequate protection and is consistent with the underlying objectives of the BO, SMCRA, the ESA, and other State or Federal fish and wildlife protection laws and regulations. It is important to understand that the review of proposed alternative species specific protective measures may result in a delay in the processing of a particular permit application.

BACKGROUND

The blackside dace is thought to have been widely distributed in headwater stream systems throughout the upper Cumberland River drainage in Kentucky and Tennessee. Most extant blackside dace populations occupy tributaries upstream of Cumberland Falls, but the species persists in several tributaries below the falls. The first range-wide surveys revealed that the

species was present in 26 of 168 streams (Starnes, 1981) and 30 of 193 streams (O'Bara, 1985) sampled within the upper Cumberland River basin. The species is currently known to persist in approximately 105 streams across eight Kentucky counties (Bell, Harlan, Knox, Laurel, Letcher, McCreary, Pulaski, and Whitley) and three Tennessee counties (Campbell, Claiborne, and Scott) (Fish and Wildlife Service, 2007).

The blackside dace is generally restricted to eastern Kentucky and Tennessee. However, an isolated population was discovered in the upper Tennessee River system of Virginia in 2002 and is likely the result of inadvertent human relocation of the species (Strange and Skelton, 2003). Based on the blackside dace's historic and current distribution, the Tennessee portion of the species' range includes 15 or more distinct historic and extant populations. The species is found in approximately one to three new streams within its entire range each year as a result of expanded sampling efforts in Kentucky. Additional populations may be identified as a result of additional surveying in Tennessee.

Adverse impacts from mining and other human related disturbances have reduced and degraded blackside dace habitats. Water turbidity, conductivity, temperature, and predatory fish were shown to have significant negative correlations with the presence of blackside dace (Jones, 2005). O'Bara (1985) indicated that coal mining was a probable primary contributor to the loss of the species from six previously reported locations.

A recent study (Detar, 2004) demonstrated the species' ability to move more than two stream miles in less than four months. Based on this information, individual blackside dace that are located four stream miles or less from each other are considered to be part of the same population. Tennessee's known populations (including historic distribution) are located, by county, in the following streams (See also Appendix A for maps.):

Scott County:

1) Gum Fork - Jellico Creek system

Scott and Campbell Counties:

2) Capuchin Creek/Baird Creek/Hatfield Creek - Jellico Creek system

3) Straight Fork Creek - New River system

Campbell County:

4) Fall Branch - tributary of Elk Fork Creek

5) Crooked Creek - tributary of Elk Fork Creek

6) Little Elk Creek – tributary of Elk Fork Creek

7) Lick Fork/Elk Fork Creek/Coontail Branch/Terry Creek - Elk Fork Creek system

8) No Business Branch - tributary of Hickory Creek - Note that the species appears to be extirpated from this stream.

9) Louse Creek - Hickory Creek system

10) Sandlick Branch/Davis Creek - Hickory Creek system

Campbell and Claiborne Counties: 11) Little Tackett Creek - tributary of Tackett Creek

Claiborne County: 12) Buffalo Creek - tributary of Clear Fork

13) Straight Creek - Clear Fork system

14) Bennetts Fork - Yellow Creek system

15) Little Yellow Creek - Yellow Creek system

It should be noted that No Business Branch is within the Hickory Creek watershed, which the blackside dace is known to occupy. Recent efforts to restore the species to No Business Branch were monitored and have apparently failed. Therefore, this stream's population will not be considered extant for the purpose of these protection and enhancement plan (PEP) guidelines unless additional survey effort demonstrates presence of the species in that area.

Protection of stream habitats and water quality in the region historically occupied by the blackside dace is crucial for its recovery to a level at which the species can be expected to remain stable into the foreseeable future. Any individual or entity that may adversely affect the blackside dace is required by the ESA to provide for protection of the species and its habitat. Additionally, protection is required for activities that are conducted or authorized by the Federal government. SMCRA and its implementing regulations require a protection and enhancement plan describing how disturbances and adverse impacts to fish and wildlife resources will be minimized. Further, the SMCRA coordination procedures require compliance with the ESA

during surface coal mining and reclamation operations, including enhancement of these resources where practicable.

These guidelines have been developed to provide permit applicants with a consistent framework around which PEP's for the blackside dace can be developed. The guidelines will be evaluated periodically and revised as new information about the species becomes available. It should be noted that these guidelines apply only to proposed mining activities in Tennessee. Similar but separate PEP guidelines are expected to be developed in association with proposed mining projects in Kentucky.

The protective measures proposed herein will be reviewed as part of a permit application to conduct surface coal mining operations. The level of protection required of the applicant will be based on factors including, but not limited to, distance of the proposed mine site from a blackside dace population, types of activity associated with the mining operation, extent and duration of surface disturbance, composition of exposed materials, and the location of proposed activities relative to streams and drainage corridors. While protection of aquatic resources is required for all streams, strengthening protective measures is especially important for areas that support healthy blackside dace populations.

The Tennessee Department of Environment and Conservation (TDEC) provides a fundamental regulatory role regarding stream impacts in Tennessee. Mining applicants should be familiar with the Tennessee Water Quality Control Act and its implementing regulations as specified by

the Rules of TDEC's Water Quality Control Board, Division of Water Pollution Control. Chapter 1200-4-3 describes water quality criteria and contains Tennessee's Anti-degradation Policy. Chapter 1200-4-4 establishes stream use classifications and lists specific streams and their identified uses. Regulations enforced by TDEC specify that discharges and disturbances of physical habitat shall not result in impairment to designated stream uses. Discharge limitations and monitoring requirements for individual permits are located in the TDEC issued National Pollutant Discharge Elimination System (NPDES) permit.[1] Chapter 1200-4-7 describes the Aquatic Resource Alteration Permit (ARAP) regulations, including stream mitigation guidelines for stream disturbance. On-site stream restoration is required to minimize impacts, and additional mitigation may be required as prescribed by the Tennessee Stream Mitigation Guidelines (TDEC, 2004).

STREAM SURVEY REQUIREMENTS

For the purpose of implementing blackside dace specific protection and enhancement measures, stream habitats that require protection have been identified in the Background section and Appendix A. These habitats will be referred to as "protection zones" throughout this document.

When a surface coal mining operation drains to a protection zone or the footprint plus an angle of draw of an underground mine underlies a protection zone, a baseline survey of the local fish

[1] For example, the NPDES permit authorizes the permittee to discharge treated wastewater from all point sources associated with mining and related areas within the approved permit boundary. Discharge limitations for Total Suspended Solids (TSS) is 35.0mg/l on a monthly average and 70.0 mg/l maximum for any one day. The NPDES permit allows a rainfall exemption from the TSS standard for precipitation events that exceed certain threshold criteria outlined in the TDEC Regulations and requested by the operator.

community, benthic macroinvertebrate community, stream/riparian habitat (including in-stream flow), and water column physical/chemical parameters will be necessary.

The applicant is to coordinate with OSM, FWS, and TDEC personnel to develop survey protocols for fish and habitat surveys; both the baseline surveys conducted prior to permit issuance and the monitoring surveys conducted during mining and reclamation activities. The baseline surveys will help direct and define site-specific protection measures for aquatic habitats containing blackside dace. Reports containing all survey results are to be provided to OSM and FWS, who will periodically review the reports to determine if changes to permit-specific PEP's need to be made. As required by their scientific collection permits, the results of fish surveys must also be provided to TWRA. The regulation of mining activities under the adaptive management approach may also necessitate that project-specific improvements to protection and enhancement measures be enacted in cases where survey results demonstrate inadequate responses to existing protection efforts.

Baseline surveys for suitable habitat and fish are required when a permit applicant proposes to conduct surface coal mining and reclamation operations in a watershed that drains to streams within a blackside dace protection zone, including underground mining operations that propose to undermine a protection zone. However, future survey requirements may be delayed until permit renewal, in cases where recent data (i.e., generally collected during the previous year) suggest no suitable blackside dace habitat is present or in-stream water quality would preclude blackside dace presence. In addition, assessments of potential suitable blackside dace habitat

and subsequent fish surveys may be required for streams that are located within the Tennessee portion of the species' range but are not found in Appendix A.

Important: One or more members of any crew that is surveying for blackside dace must have in their possession valid endangered species/scientific collection permits issued by the FWS and Tennessee Wildlife Resources Agency (TWRA).

In situations where baseline surveys indicate suitable habitat and the presence of blackside dace, fish surveys shall be initiated at least two years prior to the proposed permit issuance and occur once per calendar year, as outlined below. Benthic macroinvertebrate and water quality surveys[2] shall be initiated at least four seasons prior to the proposed permit issuance and occur two times per year thereafter. All surveys should reflect the location and season referenced in the TDEC's current Standard Operating Procedures Manual for Macroinvertebrate Stream Surveys. Fish, benthic macroinvertebrate, and water quality surveys shall continue until approval of Phase II of the bond release; unless Phase II bond release is disapproved for reasons other than vegetation or hydrology. Under certain circumstances and on a case by case basis, OSM may require these surveys to continue after Phase II bond release. The information gathered from the surveys will be used to document trends in blackside dace populations and to discern possible impacts to the species, thus providing the basis for any necessary adaptive revisions of protective measures for specific mining operations.

[2] The water quality survey referred to in this statement is not the water quality monitoring required under other provisions of the permit (i.e., NPDES, Surface Water Monitoring, etc.)

Discussion of the results, including a description of ongoing watershed activities that may affect stream quality, will be provided to OSM, FWS and TDEC via quarterly reports from the coal mine operator. To simplify reporting requirements, this information should be submitted in conjunction with the quarterly discharge monitoring reports (DMR).

Generally, sampling should be conducted as follows. Exceptions include situations where baseline surveys confirm suitable habitat, but blackside dace aren't captured during the fish surveys. In these cases, additional fish surveys will be delayed until permit renewal, but other sampling, macroinvertebrate and water quality, should proceed as follows. Before declaring a stream reach as unsuitable habitat, the applicant must provide documentation to OSM for review and approval. Consultation with OSM is required before any survey is excluded. The following table outlines the baseline and monitoring survey intervals for blackside dace, habitat, macroinvertebrate, and water quality.

Situation	BSD/Macro Baseline Survey	BSD Monitoring Surveys	Macro Invert	Water Quality	Stream Habitat
Unsuitable Habitat / No BSD	1 yr	1 / 5 yrs	1 / 5yrs	1 / 5 yrs	1 / 2.5 yrs
Suitable Habitat / No BSD	2 yrs	1 / yr	1 / yr	4 / yr	1 / yr
Suitable Habitat / BSD	2 yrs	1 / yr	2 / yr	4 / yr	2 / yr

If blackside dace habitat is present:

1) Fish surveys shall be conducted annually between September 15 and April 1. This time

frame is necessary to avoid placing undue stress on the blackside dace during the spawning season and to avoid periods of lower dissolved oxygen levels associated with warmer water temperature. Fish surveys should be conducted during average flow conditions, avoiding extreme low or high flows. Electro-shocking is generally considered the preferred sampling method, but seining may be appropriate in some situations. The survey will include all stream segments that support suitable, wadeable habitat for blackside dace within the proposed permit area and the first two miles of stream habitat adjacent to (i.e., upstream and downstream of the permit area. On a case by case basis, if known blackside dace populations exist just outside of the two mile radius, the survey may be expanded to include those areas where the dace had been identified in previous surveys. Streams shall be partitioned into segments that are 100 to 300 meters in length for blackside dace population sampling. A segment length that is thirty times the stream width is a useful guide. These segments shall be identified at the site by flagging or other appropriate means in order to establish benchmark stream reaches for duplication during future sampling efforts. Enumeration of blackside dace by size classes (total length) and general description of health/condition of individuals at each sample site shall be included in the assessment. The numbers of individuals for all other fish species shall also be reported. Data shall be recorded and included with the survey report.

Note that, in order to facilitate the transition to these fish survey requirements, two years of surveys will not be required for mining operations associated with permits that are

issued prior to July 1, 2010. For operations associated with permits issued after June 30, 2009, and prior to July 1, 2010, one year of baseline fish inventory will be required. Survey requirements will be coordinated on a project-specific basis for permits issued prior to June 30, 2009.

2) Water quality survey sites should be established on the mainstem of streams between each tributary and at any other adjacent location where the blackside dace are found to be present and could be impacted by the proposed mining operations. These survey sites may be identical to the aquatic macroinvertebrate survey sites, and when possible, should coincide with surface water monitoring points used in the surface water monitoring plan. Control sites shall be established above all disturbances in the watershed, where possible, prior to initiating surface coal mining operations. These disturbances include the removal of trees associated with the construction of sedimentation ponds, development of material storage areas, and/or other mining-related activities.

The water quality survey sites shall be sampled quarterly to document seasonal variations. The in-stream parameters to be sampled will include flow (in cubic feet per second), dissolved oxygen, pH, temperature, conductivity, total dissolved solids, alkalinity, total settleable solids, total suspended solids, sulfate, total iron, and total manganese.

If possible, surveys should be coordinated with the existing or proposed water quality sampling requirements outlined in the approved permit or permit application. Any exceedance of approved permit conditions developed in accordance with the ARAP or the NPDES process shall be reported to OSM, FWS, and TDEC within 24 hours of awareness of the problem.

3) Surveys to assess trends in the aquatic macroinvertebrate community shall take place twice a year. A survey will be taken between January and June, and again between July and December. Survey dates are not to vary from year-to-year by more than two weeks from the initial survey date for any particular site, and a period of three or more months must separate each survey event. All invertebrate surveys and associated data assessment must follow TDEC's semi-quantitative riffle kick protocol (TDEC, 2006 – See Appendix B). Invertebrate densities for each survey event are to be reported for each sample site by taxa. The survey sites may be the same as those used to document water quality. On a case by case basis, biological survey stations may be required at tributary sites in portions of streams that contribute to blackside dace habitat. Implementation of additional water quality control measures (e.g., sediment retention structures) could be required if an invertebrate survey results in a biological index score below the acceptable level for the local TDEC delineated ecoregion.

A habitat assessment shall be conducted in conjunction with the invertebrate survey. This assessment is to include invertebrate substrate/available fish cover, channel

embeddedness, flow velocity/depth regime, sediment deposition, flow status (i.e., wetted channel perimeter), channel alteration, frequency of riffles, bank stability, vegetative protection, riparian vegetative zone width, and length of stream considered for the assessment. One pool site per habitat assessment area is to be marked in order to ensure consistency in subsequent observations of embeddedness and sediment deposition. A photograph of substrate conditions is to be submitted each time habitat is assessed.

In addition, any request to disturb land within 100 feet of a stream identified as a protection zone must be authorized by OSM, in coordination with the FWS, per the requirements of 30 CFR 816/817.57.

BASIC PROTECTION AND ENHANCEMENT MEASURES

An applicant for a SMCRA permit may select from the following suite of protection measures to develop the required protection and enhancement plan. At the discretion of OSM and FWS, other protection measures may be utilized to affect the desired impact on black side dace habitat or populations on a case by case basis. Be aware that PEP's should be strengthened in areas that support healthy blackside dace populations and that implementation of additional measures may be necessary in some cases.

1) In-stream facilities or devices (including temporary designs) cannot be located within perennial streams. At the discretion of OSM, in consultation with FWS, TDEC and the

U.S. Army Corps of Engineers (COE), exceptions may be granted. In-stream facilities and devices will not be allowed in intermittent streams except in atypical situations where feasible alternatives are not available. Most of these atypical situations in Tennessee involve re-mining scenarios in which ongoing water quality problems result from "pre-law" mining activities. An example of such a situation involves mining sites where sediment basins may be placed in the immediate vicinity of areas producing drainage from unstable spoil material, often very close to stream channels. Stream channel restoration is another mitigation technique routinely required to offset pre-law mining impacts in Tennessee. In both situations, mitigation measures may be required by TDEC in accordance with the "Stream Mitigation Guidelines for the State of Tennessee" (TDEC, 2004) or the COE pursuant to the Clean Water Act and Tennessee Water Quality Control Act. OSM must also approve all activities within stream buffer zones per the requirements at 30 CFR 816/817 for any and all fills associated with mitigation measures.

2) Wastewater limitations and monitoring requirements for all point source discharges are identified in the NPDES permit issued by TDEC. TDEC NPDES permits contain Best Management Practices (BMP) that incorporate Best Available Technology (BAT) and contain rainfall and storm event permit conditions that are applicable to all permitted sediment control structures. Increased sediment control measures may be required for haul and access roads to avoid or minimize impacts to blackside dace. Refer to TDEC publication "Tennessee Erosion & Sediment Control Handbook" (Price and Karesh, 2002) for specific BMP's and design specifications.

3) Riparian areas around sedimentation ponds to be retained as permanent structures, as well as other disturbed areas adjacent to streams that would benefit from reforestation (e.g., re-mining scenarios), are to be re-planted with riparian tree species native to the local area. Deviations from the native riparian species requirements may be granted only for stability reasons. Additionally, trees should not be planted on pond embankments. Three or more native hardwood species must be present at final bond release at a rate of 300 or more healthy stems per acre to establish 100-foot riparian zones on each side of intermittent and perennial streams. Wider riparian zones may be required in slide-prone areas and on sites that involve steep slopes.

Note that this measure is not associated with the 100-foot stream buffer zone requirement described in 30 CFR 816/817.57.

4) An appropriate combination of sediment control methods are to be used when disturbing streams during earth-moving activities (e.g., during construction of road crossings), including ephemeral channels. The "Tennessee Erosion and Sediment Control Handbook" referenced earlier, is a helpful resource and recommends:

A) A combination of these and other sediment retention structures should be used:

- silt fences

- straw bales
- dugout settling basins/sumps
- rock check dams
- additional sedimentation ponds

B) In-stream work should be performed in dry weather.

C) Disturbed areas are to be re-vegetated as early as possible with a ground cover that will appropriately control soil erosion and that will not impede establishment of woody species. Native species are to be used where possible, and mulch is to be applied as appropriate to enhance re-vegetation.

D) The use of bridges or open-bottom box culverts is encouraged, when and where possible, to completely span intermittent and perennial streams. Wide conduits generally require less maintenance, cause less flow constriction, enhance retention of natural substrate materials within the structure, and result in lower hydraulic gradients at the lower ends of stream crossings. When using metal culverts, it is critical they be placed in a manner that does not result in impoundment or restriction of water flow, create hydraulic drops, or act as an impediment to movement of aquatic life. Low water crossings will not be authorized on intermittent or

perennial streams. Crossings on ephemeral channels are to be lined with durable, non acid forming rock material.

E) Non-acid forming "clean" rock material is to be used to stabilize upper and lower ends of bridges and culverts. Clean rock is defined as rock of various type and size, depending on application, containing no fines, soils, wastes, or contaminants.

F) Bridges and culverts are to be kept free of woody debris for the duration of the mining operation.

5) Stream segments that are impacted during mining are to be restored in accordance with commonly-accepted natural channel design principles such as those described by Rosgen, (1996 and 2007). Restoration plans are to be coordinated with TDEC, COE, and FWS personnel.

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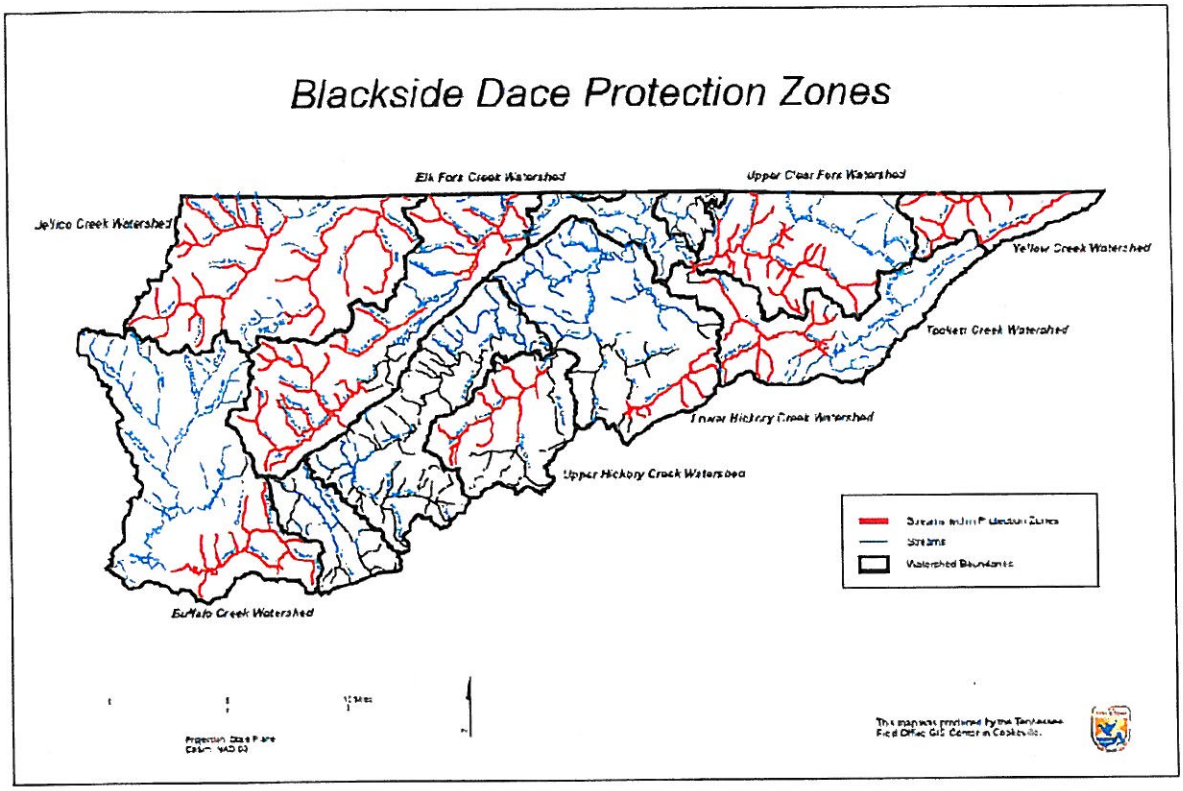
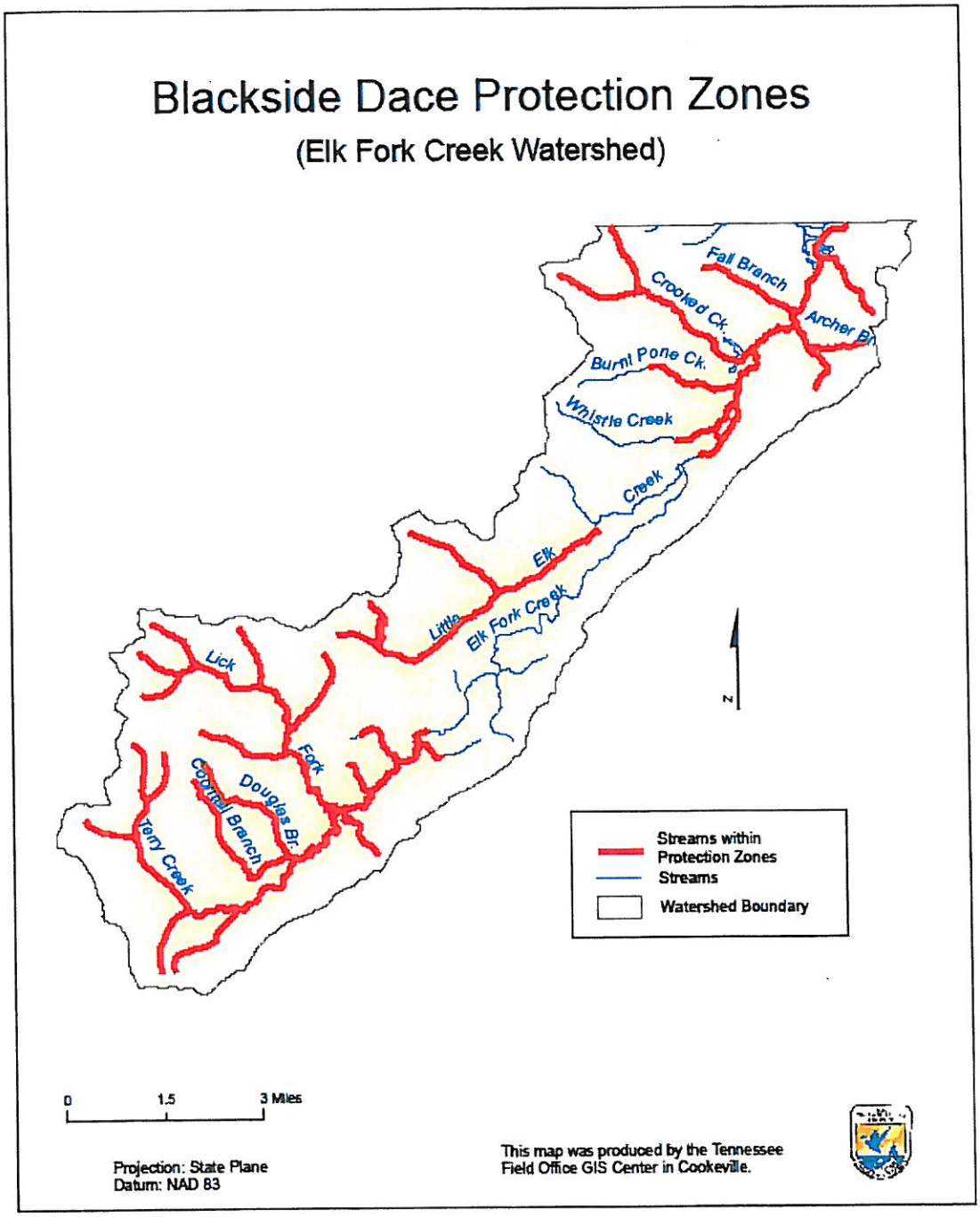
APPENDIX A – Protection Zones for Blackside Dace – Maps

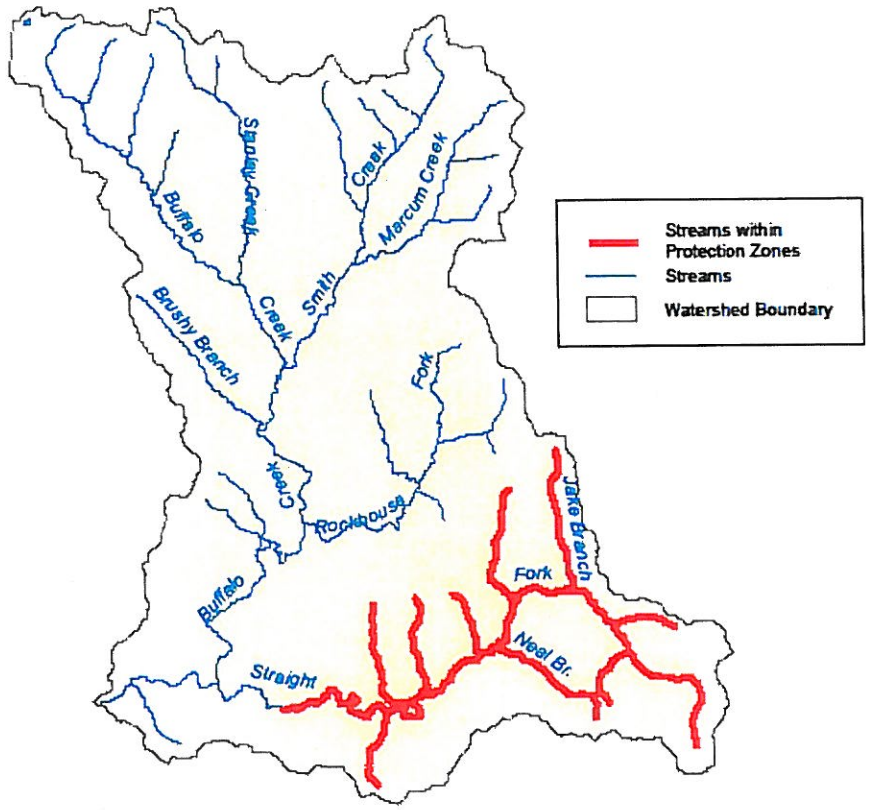
See successive pages.


Blackside Dace Protection Zones
Elk Fork Creek Watershed
Upper Clear Fork Watershed
Jellico Creek Watershed
Yellow Creek Watershed
Tackett Creek Watershed
Lower Hickory Creek Watershed
Upper Hickory Creek Watershed
Buffalo Creek Watershed
Streams
Watershed Boundaries


Blackside Dace Protection Zones
(Elk Fork Creek Watershed)
Fall Branch
Crooked Ck.
Archer Br.
Burnt Pone Ck.
Whistle Creek
Creek
Elk
Little
Elk Fork Creek
Lick
Fork
Douglas Br.
Cornfall Branch
Tony Creek
N
Streams within Protection Zones
Streams
Watershed Boundary
0
1.5
3 Miles
Projection: State Plane
Datum: NAD 83
This map was produced by the Tennessee Field Office GIS Center in Cookeville.

Blackside Dace Protection Zones

(Buffalo Creek Watershed)



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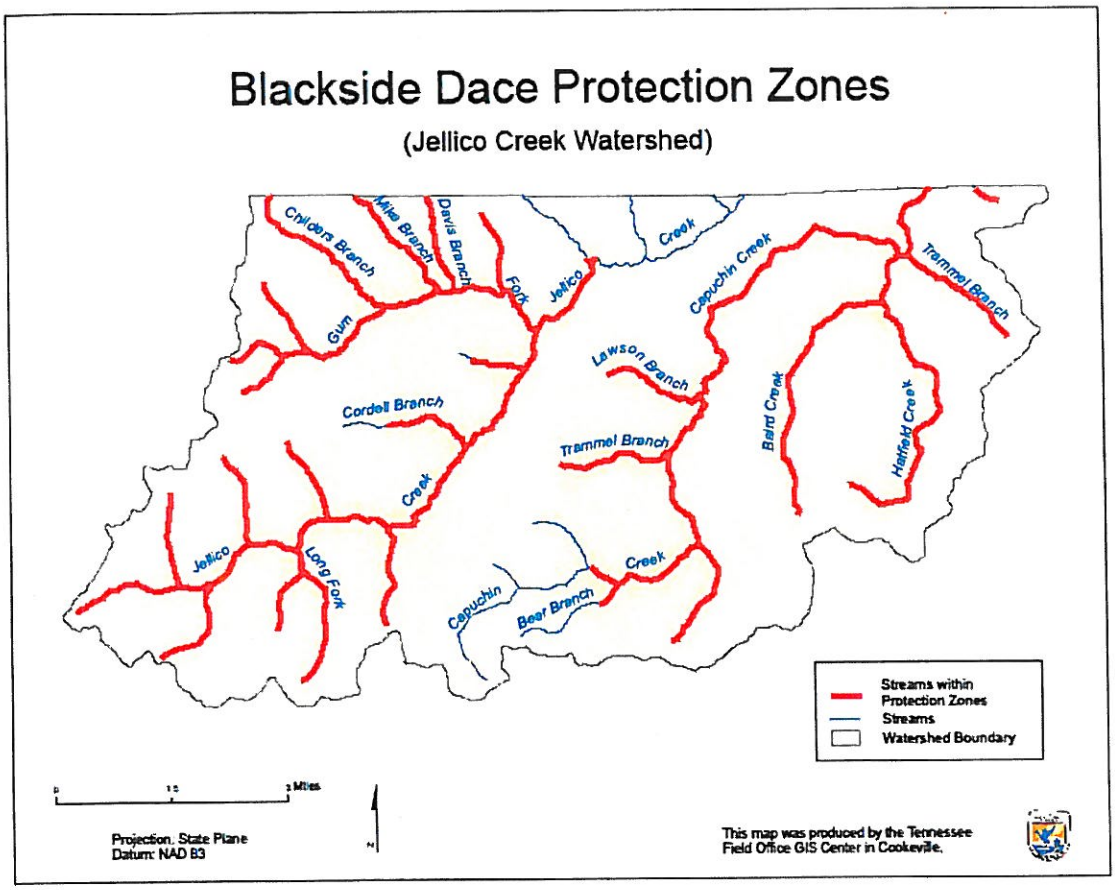
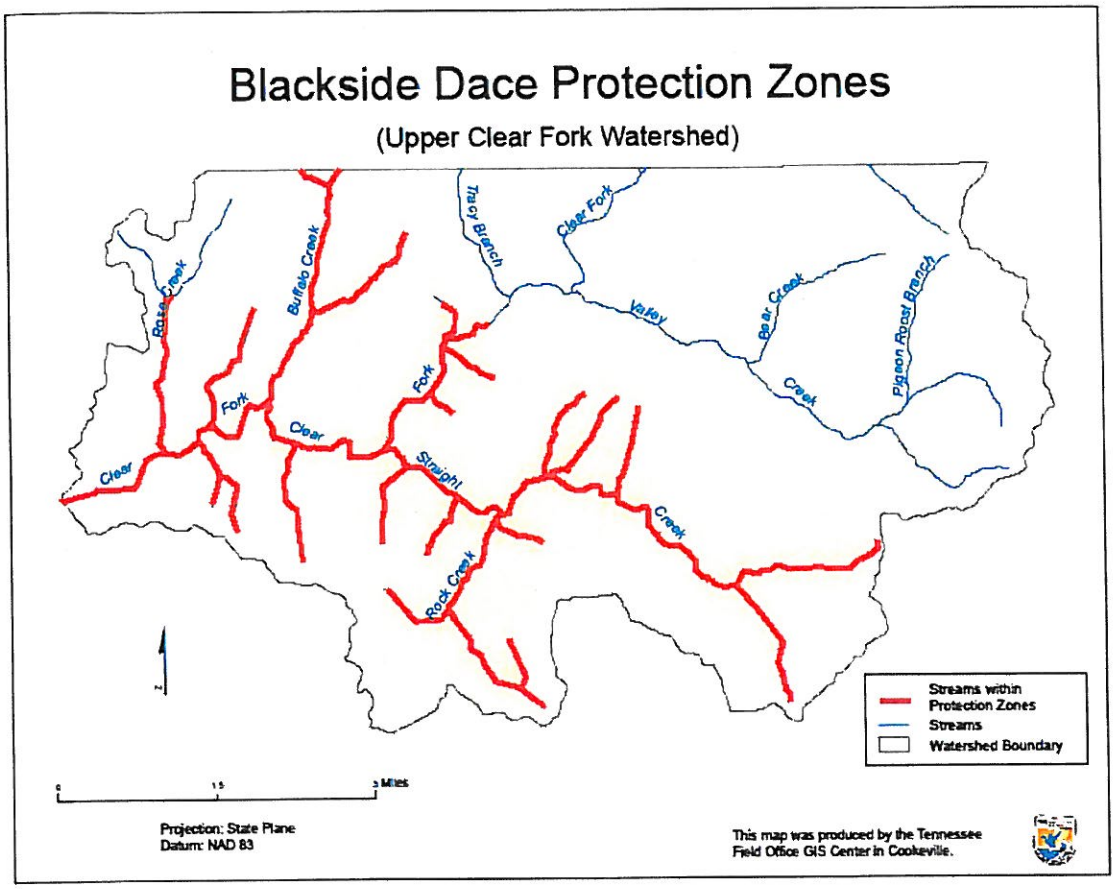
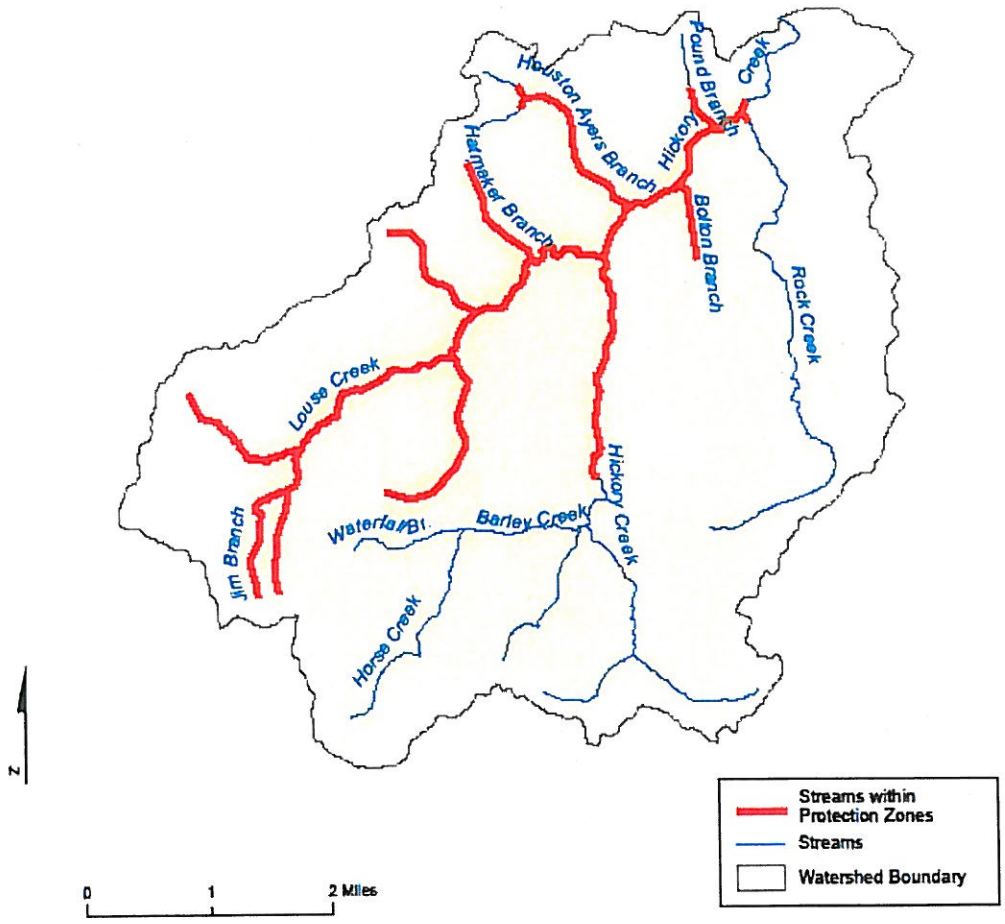

Blackside Dace Protection Zones
(Jellico Creek Watershed)
Childers Branch
Mike Branch
Davis Branch
Fork
Jellico
Creek
Capuchin Creek
Trammel Branch
Gum
Lawson Branch
Cordell Branch
Trammel Branch
Baird Creek
Hatfield Creek
Creek
Jellico
Long Fork
Capuchin
Bear Branch
Creek
Streams within Protection Zones
Streams
Watershed Boundary
Miles
Projection: State Plane
Datum: NAD 83
This map was produced by the Tennessee Field Office GIS Center in Cookeville.


Blackside Dace Protection Zones
(Upper Clear Fork Watershed)
Rose Creek
Buffalo Creek
Tracy Branch
Clear Fork
Valley
Bear Creek
Pigeon Roost Branch
Creek
Fork
Clear
Fork
Clear
Straight
Creek
Rock Creek
Streams within Protection Zones
Streams
Watershed Boundary
Miles
Projection: State Plane
Datum: NAD 83
This map was produced by the Tennessee Field Office GIS Center in Cookeville.

Blackside Dace Protection Zones

(Upper Hickory Creek Watershed)



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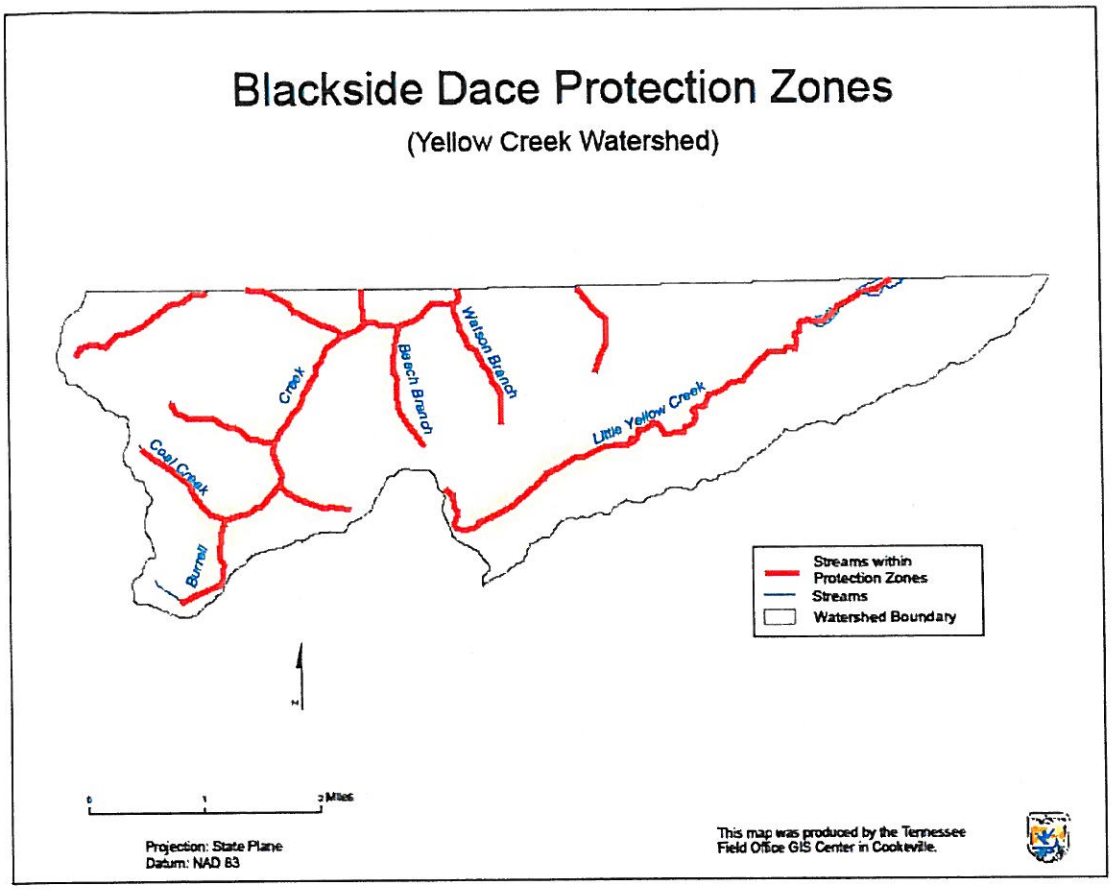
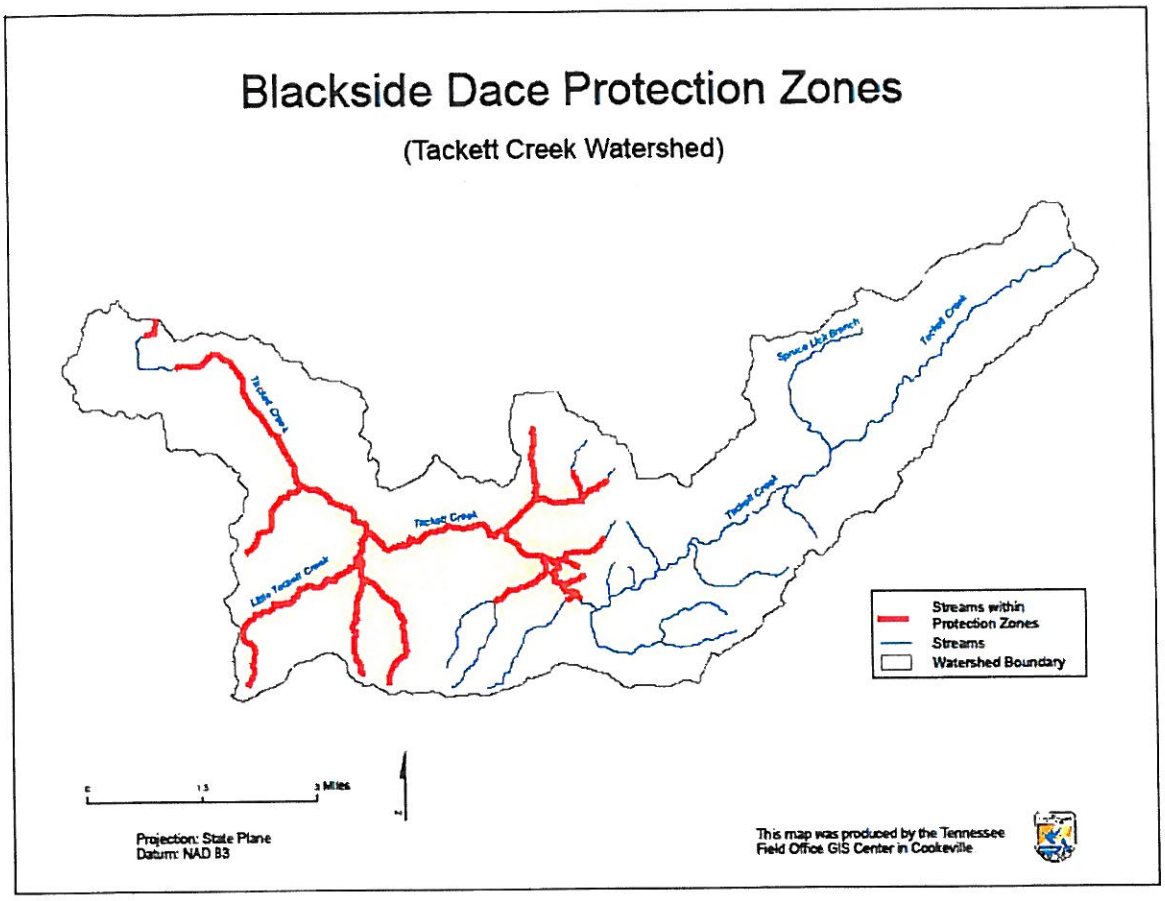
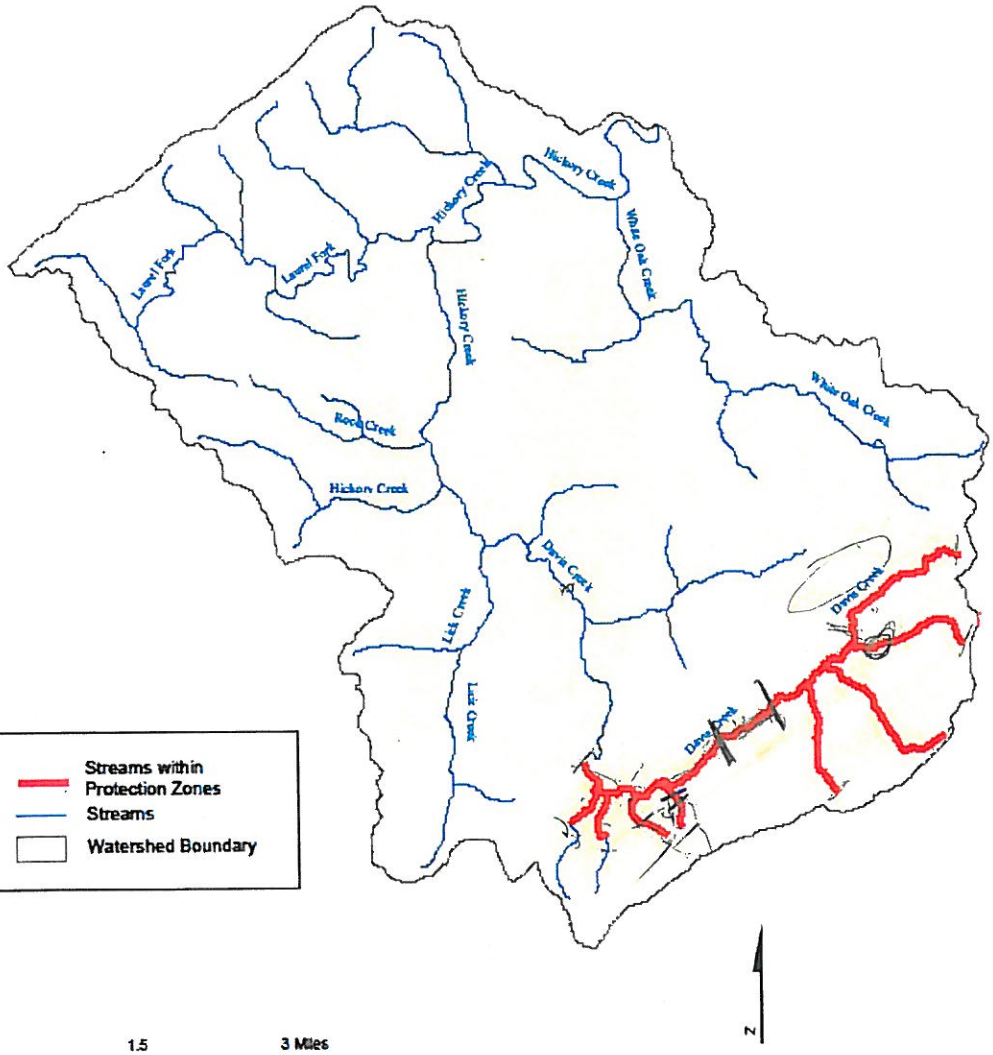

Blackside Dace Protection Zones
(Yellow Creek Watershed)
Creek
Beech Branch
Watson Branch
Little Yellow Creek
Coal Creek
Burnett
Streams within Protection Zones
Streams
Watershed Boundary
Miles
Projection: State Plane
Datum: NAD 83
This map was produced by the Tennessee Field Office GIS Center in Cookeville.


Blackside Dace Protection Zones
(Tackett Creek Watershed)
Tackett Creek
Little Tackett Creek
Tackett Creek
Spruce Lick Branch
Tackett Creek
Tackett Creek
Streams within Protection Zones
Streams
Watershed Boundary
0
1.5
3 Miles
N
Projection: State Plane
Datum: NAD 83
This map was produced by the Tennessee Field Office GIS Center in Cookeville

Blackside Dace Protection Zones

(Lower Hickory Creek Watershed)



Projection: State Plane
Datum: NAD 83

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APPENDIX B – Field Collection Techniques for Semi-Quantitative Single Habitat Sample (SQKICK or SQBANK))

Biologist or Environmental Specialist
Collect a semi-quantitative single habitat sample (SQKICK or SQBANK) when a quantifiable assessment of the benthic community is needed. This method is directly comparable to the Division's proposed numeric biocriteria. This is a more defensible and sensitive method than the biorecon. When both sample types have been collected, semi-quantitative sample results will always take precedence over biorecon results.

The semi-quantitative single habitat sample will generally be used for:

a. 303(d) list removal or addition (a biorecon can be used if it shows the site clearly supporting or non-supporting)
b. TMDLs
c. Permit compliance and enforcement
d. Any study that has the potential of being used by the Water Quality Control Board.

In order for the data to be compared to the reference database:

a. Samples must be collected in the exact manner outlined in this section.
b. The upstream watershed must be 80% within the bioregion.
c. The stream size must be comparable to those in the reference database for that bioregion (Appendix A).

There are three methods of semi-quantitative sample collection:

a. SQKICK (Riffle streams larger than 1 meter wide)
b. Modified SQKICK (Riffle streams less than 1 meter wide)
c. SQBANK (Non-riffle streams)

The type of sample collected will depend on the stream type and/or ecological subregion. Information on ecoregion boundaries can be found in *Tennessee Ecoregion Project* (Arnwine et al, 2000) and in *Development of Regionally-Based Numeric Interpretations of Tennessee's Narrative Biological Integrity Criterion* (Arnwine and Denton, 2001). Ecoregions can also be determined for specific stream segments by using Tennessee's Online Water Quality Assessment Database (www.state.tn.us/environment/water). Each Environmental Assistance Center should have copies of ecoregion maps for their area. Contact the Planning and Standards section if there is uncertainty about what ecoregion a stream is located in.

a. Semi-quantitative Riffle Kick (SQKICK)

Collect a semi-quantitative riffle kick (SQKICK) in ecological subregions 65j, 66d, 66e, 66f, 66g, 67f, 67g, 67h, 67i, 68a, 68b, 68c, 69d, 71e, 71f, 71g, 71h, 74a, and riffle streams in 71i.

If a riffle is not present, a semi-quantitative bank sample can be collected, but will not be directly comparable to the reference criteria. Therefore, an upstream or off-site reference SQBANK will also need to be collected (this can be a bank sample collected at one or more of the established ecoregion reference sites). If riffles have been compromised by sedimentation or are embedded, they should still be sampled since impacts are being measured.

1. Use a (two-person) one square meter kick net with a 500-micron mesh to sample the riffle. If necessary, use rocks to weight the bottom edge to prevent the flow of water beneath the net. At each site, collect two kicks: one from an area of fast current velocity and one from an area of slower current velocity. Always collect the downstream sample first to avoid organism drift. Avoid areas with large leaf packs caught on the rocks if possible. If the stream is too small to do two riffle kicks in a single riffle, sample two separate riffles. (In extremely small streams, less than 1 meter wide, sample 4 riffles using the modified SQKICK for small streams – method b.)

2. One biologist holds the net at an angle that allows the current to flow into it, making sure the bottom is in contact with the substrate and the top of the net is above the surface of the water. The second biologist disturbs the substrate for approximately one-meter distance and the width of the net (one meter) upstream of the net by kicking and shuffling the substrate. This causes organisms and debris to flow into the net. Larger rocks may be lifted and rubbed with the hands to remove clinging organisms.

3. Once the kick is completed, allow time for the lighter debris to finish floating into the net. The biologist who performed the kick then grabs the two pole ends at the bottom of the net and carefully lifts the net out of the water while the other biologist continues to hold the upper end making sure the top of the net does not dip below the water surface, thereby allowing organisms to escape. If the top of the net dips under the water and debris flows out, discard the sample and collect another kick. Carry the net horizontally to the bank for processing.

4. Composite the debris from both kicks. Using forceps, remove all organisms clinging to the net and add them to the sample. Thoroughly rinse the sample using sieved water to remove fine sediment. Large rocks or organic material such as whole leaves or twigs are discarded after rinsing and removing clinging organisms. If upon cursory examination of the debris, it does not appear that a minimum of 200 organisms have been collected after 2 kicks, perform additional kicks in the same reach until at least 200 organisms are assured. Document the number and location of kicks on the field survey form and write the number of kicks on the sample tag.

5. Place the composited debris in a wide mouth plastic container and preserve with 80% ethanol. Include an internal tag (written in pencil on water-proof paper) with the station number, date, sampler's initials and sample type inside the container with the debris (Figure 2). Attach an external sample tag to the outside of the container. Standard

external tags for both biological and chemical samples are obtained from the state lab (Figure 3). Instead of an external tag, the site information can be printed in indelible ink (i.e. Sharpie) on the sample lid. The external tag information must include the Station ID, Stream name, location, sampler's initials, date sampled time sampled and sample type (Figure 5). If samples are going to be sent to the central lab for analysis, a biological sample request form including chain of custody must be completed (Appendix B).

Figure 5: Example of external tag information (on sample lid)

DAVIS012.5CL
DAVIS CREEK
100 YDS U/S DAIRY
COL. JEB/DRM
3/6/02
1200
SQKICK

b. Modified SQKICK (small streams)

1. In extremely small streams, where riffles are less than one meter wide, collect a one person stationary kick using an 18-inch single handle rectangular net with a 500-micron mesh.

2. Sample four separate riffles. Starting with a downstream riffle, hold the net perpendicular to the flow making certain the bottom of the net is in contact with the substrate at all time. Disturb the substrate upstream of the net for an area approximately 18 inches long and the width of the net. Do not allow the net to move during the kick as it might cause organisms to drift under the net. Once the kick is complete, allow time for all debris to finish flowing into the net.

3. Composite the debris from all four kicks. Use forceps, to remove all organisms clinging to the net and add them to the debris. Thoroughly rinse the sample using sieved water to remove fine sediment. Large rocks or organic material such as whole leaves or twigs are discarded after rinsing and removing clinging organisms. If upon cursory examination of the debris, it does not appear that 200 organisms are in the composited sample, collect additional kicks and add them to the composite. Document the total number of kicks on the sample tag and on the field survey form.

4. Place the composited debris in a wide mouth plastic container and preserve with 80% ethanol. Include an internal tag with the station number, date, sampler's initials and sample type inside the container with the debris (Figure 2). Attach an external sample tag to the outside of the container. Standard external tags for both biological and chemical samples are obtained from the state lab (Figure 3). Instead of an external tag, the site information can be written in indelible ink (i.e. Sharpie) on the sample lid. The external tag information must include the Station ID, Stream name, location, sampler's initials, date sampled time sampled and sample type (Figure 5). If samples are going to be sent to the central lab for analysis, a biological sample request form including chain of custody must be completed (Appendix B).