DOE/EA-1113/MAP-03

ANNUAL REPORT

CALENDAR YEAR 2003

IMPLEMENTATION OF MITIGATION ACTION PLAN FOR LEASE OF LAND PARCEL ED-1 ON THE OAK RIDGE RESERVATION OAK RIDGE, TENNESSEE

July 2004

U.S. Department of Energy
Oak Ridge Operations Office
Oak Ridge, Tennessee

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FIGURES

TABLES

LIST OF ACRONYMS

BI	Biotic Index
BMAP	Biological Monitoring and Abatement Program
CG	Collectors/gathers
CROET	Community Reuse Organization of East Tennessee
DOE	U.S. Department of Energy
EA	Environmental Assessment
EPT	Ephemeroptera – Plecoptera – Tricoptera
FC	Filter/Collectors
FFG	Functional Feeding Groups
FONSI	Finding of No Significant Impact
MAP	Mitigation Action Plan
NEPA	National Environmental Policy Act
ORNL	Oak Ridge National Laboratory
P	Predators
PI	Piercers
SC	Scrapers
SH	Shredders
TDEC	Tennessee Department of Environment and Conservation
TV	Tolerance Values
TWRA	Tennessee Wildlife Resources Agency

1. EXECUTIVE SUMMARY

In preparation for the transfer of Horizon Center, formerly Parcel ED-1, to the Community Reuse Organization of East Tennessee (CROET), an environmental review committee was established in 2002 to evaluate the Mitigation Action Plan and determine its effectiveness. The committee recommended an environmental investigation for 2003 that included monitoring of the Tennessee dace (*Phoxinus tennesseensis*), benthic macroinvertebrates at selected sites, birds, amphibians and reptiles, and inspection of sensitive sites. This report is in compliance with the committee's recommendations.

Fish surveys were restricted to Dace Branch where the state protected Tennessee dace has been monitored. While the population was low, it was equal to pre-lease conditions.

As in other years, some bird species were reported that had not been observed in previous years. Additionally, some species that were observed in previous surveys were not observed in this survey. The data suggests a healthy bird community during this sampling period. At least four bird species listed by state and federal agencies as being in need of protection were found to be using the Horizon Center.

Macroinvertebrate communities in East Fork Poplar Creek were surveyed at stations upstream and downstream from development activities. These communities were more diverse and more concentrated when compared with macroinvertebrate communities in baseline studies conducted in 1997 and in an offsite stream used as a control.

There were few changes in the ecology of sensitive areas. There were increases in numbers of Canadian yellow lilies (*Lilium canadense*) and golden seals (*Hydrastis canadensis*).

Two millstones were found in East Fork Poplar Creek at cultural resource site 40RE200 (939B).

2. INTRODUCTION

The U. S. Department of Energy (DOE) executed a lease for the 957.16 acre Parcel ED-1 of the Oak Ridge Reservation to the Community Reuse Organization of East Tennessee (CROET) for development of an industrial park (now known as Horizon Center) in January 1996. The lease subsequently became effective in April 1998. The lease was preceded by a National Environmental Policy Act (NEPA) Environmental Assessment (EA) (DOE 1996A) resulting in a mitigated Finding of No Significant Impact (FONSI) and the action was accompanied by a Mitigation Action Plan (MAP) (DOE 1996B).

The FONSI specified that mitigation measures be implemented to meet the objectives of preventing significant adverse impacts to ecological resources, floodplains, wetlands, water resources, and historic and archaeological resources. These measures were: (1) excluding areas of the Horizon Center from disturbance and development, and (2) conducting surveys and monitoring of industrial development areas prior to disturbance, during construction, and during facilities operations.

In December 1997, DOE published a report (DOE 1997) that documented baseline conditions from June 1996 through September 1997 and established monitoring sites. In December 1998, DOE published a report (DOE 1998) of progress toward meeting these objectives during the site master planning and early construction phases. Additionally, the DOE (1998) report addressed least environmentally damaging alternatives for development, pre-construction surveys, and monitoring during the first phase of construction of Horizon Center.

A plan was developed that would meet site development goals while adhering to the NEPA commitments. Master planning of the site relied heavily on several ecological studies and resulting recommendations for avoiding state or federally listed species and critical or unique habitats, and for minimizing impact to stream and floodplain crossings. The site master plan was accepted by DOE and subsequently implemented.

In preparation for the transfer of Horizon Center to CROET, DOE appointed a Peer Review Team to review and, if appropriate, revise the existing MAP (DOE 1997B). The recommended revisions were incorporated in an EA addendum (DOE 2003A) Mitigated FONSI (DOE 2003B) signed on April 2, 2002. These were reviewed in the 2002 Annual Report (DOE 2003).

The revised MAP (DOE 2003C) included the following requirements. Each of these was accomplished in 2002 as reported below.

- Inspection of sensitive areas within Natural Area (3 times per year during December-January; April-June; and September-October)
  - Perimeter boundary of the Natural Area
  - Cave

- Sinkholes
- Canebrakes
- Springs
- Wetlands
- Rare species locations
- East and west corridors
- Walnut plantations
- Beech-maple forest
- East Fork Poplar Creek and Dace Branch buffer zones

- Sensitive Areas Findings

  - General condition of the vegetation within each area, (major changes or perturbations should be recorded)
  - Observations of any wildlife
  - General condition of streams and springs

- Monitoring - Monitoring is to occur for at least three more years, with the first of those three years to include the 2002 data. The need for furthering monitoring (beyond the three years) will be evaluated using the available data.

  - Bird surveys
  - Amphibians (to be conducted during onsite inspections)
  - Benthic macroinvertebrates (spring samples at sampling locations EFK 6.3, EFK 2.3)
  - Fish (Dace Branch each spring)

- Mitigation – Follow requirements as defined in 40 CFR 1500-1508

- Cultural Resources - Continued stewardship and maintenance of the McKamey-Carmichael cemetery and sites 40RE195 and 40RE200

- Review of the Mitigation Action Plan (MAP) if there is a potential for direct or indirect significant impact of any sensitive resources found on the Horizon Center. This is to be coordinated with the responsible DOE Program office, and is to include, but not be limited to:

  - A new occupant constructing at the Horizon Center,
  - A change to an existing operation that has the potential to adversely impact any sensitive resources contained within the Natural Area,
  - A significant change to the habitat that is adjacent to the Horizon Center.

- Progress Annual Report

  The following monitoring requirements were accomplished in 2003 and findings are included in this report.

  Sensitive areas within Natural Area were inspected during December-January; April-June; and September-October periods. The objective was to report general condition of vegetation and wildlife observations in these areas and to report general conditions of streams and springs. Areas inspected included:

  - Perimeter boundary of the Natural Area
  - Cave
  - Sinkholes
  - Canebrakes
  - Springs
  - Wetlands
  - Rare species locations
  - East and west corridors
  - Walnut plantations
  - Beech-maple forest
  - East Fork Poplar Creek and Dace Branch buffer zones

  Bird surveys were conducted during April and June. The survey procedures and observation sites were the same as those used in previous years. Amphibian and reptiles were observed or heard during onsite inspections, aquatic surveys, and bird surveys.

  Benthic macroinvertebrates were sampled in April at EFK-63 and EFK-23 in East Fork Poplar Creek and at MIK-143 in Mitchell Branch. The quantitative and qualitative methods were those used in previous years. Fish were sampled in April at two locations in Dace Branch to determine the presence of the Tennessee Dace.

  Maintenance of the McKamey-Carmichael cemetery and sites 40RE195 and 40RE200 was monitored.

There were no new occupants or changes of existing operations that have the potential to adversely impact any sensitive resources contained within the Natural Area. Nor were they any significant changes to the habitat that is adjacent to the Horizon Center. Therefore no mitigation was required.

3. SITE ACTIVITIES

3.1 Construction

Construction of a 1,500-foot long roadway entering Development Area 2 east from Novus Drive was begun on June 03, 2003. Silt fences and straw bales were installed to control sediment. The roadbed was graded to finished contours along the entire length of the roadway. Approximately 750 feet were paved and curbs were installed.

Additionally, Phase 2 landscaping was implemented. This included seeding areas that were bare of vegetation and planting shrubs and trees along roads. The selection of plant types followed the principles of the Southeast Exotic Pest Plant Council of not introducing exotic species.

3.2 Public and Agency Involvement

To support title transfer, DOE performed a technical review of existing monitoring data and revised the MAP in 2002. In addition, an Addendum to the EA was prepared and both the Addendum and revised MAP were released on May 17, 2002 for a 30-day public comment period. Comments received were factored into revisions of the documents. A mitigated FONSI was signed on April 2, 2003.

Engineering was completed for a new roadway and adjacent utilities leading east from Novus Drive into Development Area 2. The Tennessee Department of Environment and Conservation (TDEC) approved the water and sewer engineering plans and the City of Oak Ridge issued applicable building permits. City staff and the Engineer of Record have conducted construction phase inspections of work subject of the building permits. No other formal public or agency involvement was required for the construction phase.

3.3 Mitigation Activities

Mitigation activities in 2003 consisted of seeding grass on cleared areas and landscape maintenance. These activities were in compliance with the existing FONSI and MAP which require use of natural species to accelerate succession and to landscape industrial site grounds, common areas, and infrastructure right-of-ways. In 1999, CROET and DOE adopted the principles of the Southeast Exotic Pest Plant Council to avoid introducing exotic species (DOE 1999). The Declaration of Covenants, Conditions, and Restrictions for Horizon Center mandate the use of native plants in all landscaping, and that development follow the recommendations of the Council's Landscaping with Native Plants.

4. ECOLOGICAL MONITORING

The sites used for ecological monitoring in 2003 were the same as those established in the 1997 baseline studies and used each year thereafter. In addition, the same monitoring techniques were employed. Data are presented in tables and figures herein.

4.1 Fish Census

Fish communities are indicators of ecological impacts, changes in water quality on habitat, and biological integrity. Annual surveys during site development and early construction phases indicate fish communities in 2000 were as good as, or better than, the baseline status. For these reasons the Peer Review Team did not recommend further monitoring of fish, except in Dace Branch where there is a population of the Tennessee dace.

The Tennessee dace has been deemed in-need-of management as determined by the State of Tennessee. The population of Tennessee dace at station DBK-0.3 in Dace Branch experienced increases from two in 1997 to 19 in 1998. However, it progressively declined to four in 1999 and none in 2000. Due to its status and decline in numbers, the Peer Review Team recommended Dace Branch continue to be surveyed for the Tennessee dace.

4.1.1 Fish Census Study Area and Methods

Dace Branch is a small perennial tributary of East Fork Poplar Creek. At the time Dace Branch was surveyed, it varied from two feet to three feet in width and ranged from one to six inches in depth. The substrate was sandy loam with gravel bars in some locations. Vegetation overhangs Dace Branch in many locations.

Block nets were placed across Dace Branch at DBK-0.3 to limit the movement of fish out of the area to be sampled. Three passes were made through the sample area using an electrofishing unit to stun fish. The fish were then netted and placed in plastic buckets filled with creek water for safekeeping until they were identified and counted upon completion of collection.

Biologists electrofished the pool near State Highway 95 (SR95) at the boundary of the Horizon Center that had Tennessee dace in previous years. At that location 40 square meters of stream was boxed in with netting and another depletion analysis was conducted.

4.1.2 Results and Discussion of Fish Census of Dace Branch

Tables 1 and 2 list the species and numbers of fish collected at DBK-0.3 and the pool at SR 95 on April 28, 2003. The Tennessee dace was not collected at DBK-0.3 where it had

been in the spring of years prior to 2000. However, it was collected from the pool where it had been found in the fall of 2000 (DOE 2000) and the spring of 2002 (DOE 2003).

The fish species present at DBK-0.3 were the same as in 2002 (DOE 2003). No species dominated the fish community in 2002; however, the saffron shiner (*Notropis rubricroceus*) was most numerous (22 fish). In 2003 the fish community had only 10 saffron shiners. Other species and concentrations collected at DBK-03 in 2003 were: 42 blacknose dace (*Rhinichthys atratulus*), 38 banded sculpin (*Cottus carolinae*), 26 central stonerollers (*Campostoma anomalum*), eight creek chub (*Semotilus atomaculatus*), and one bluegill (*Lepomis macrochirus*). These were similar to the concentrations collected there in years prior to 2002.

Likewise, in 2003 there was no dominant fish species at the pool near the highway (Table 2), whereas, in 2002 (DOE 2003) central stonerollers and creek chub dominated the fish community at the site. The lack of dominance in 2003 was due to a decrease in creek chub from 19 to 10 individuals and increases in blacknose dace from 5 to 15 individuals and banded sculpin from 5 to 18 individuals.

The sizes of the fish found at these two locations (Tables 1 and 2) were similar to those reported at these locations in previous years. The exception is the size distribution of banded sculpin in Dace branch in both 2002 and 2003. As in 2002, there were no young as indicated by no individuals smaller than 50 mm in length. There were, however, 6 banded sculpin larger than 75 mm in length in 2003.

One flame chub (*Hemitremia flammea*), a species deemed in-need-of management by the State of Tennessee, was collected in Dace Branch in the spring of 2002 (DOE 2003). It was not collected in 2003. The most recent record for flame chub before 2002 is reported in the 1997 Annual Report (DOE 1997) to be from a sample in the 1930's taken in Bear Creek. That report reviews literature that indicates biologists, who have access to extensive fish survey data, believe the flame chub was extirpated in the Bear Creek and East Fork Poplar Creek watershed due to upstream development.

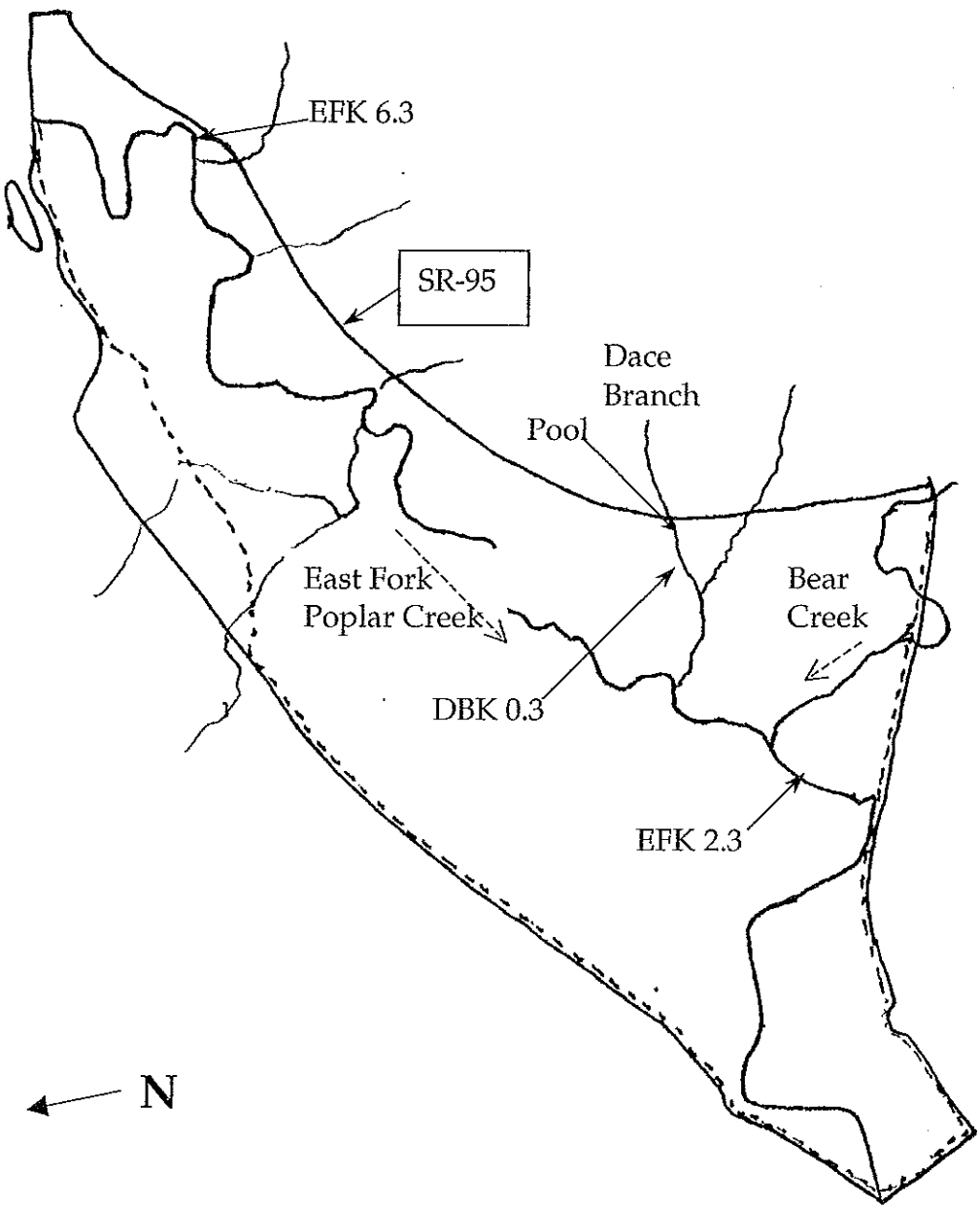

Figure 1. Macroinvertebrate and Fish Collection Stations on Horizon Center

Table 1. Number of fish collected on April 28, 2003, at Dace Branch (DBK 0.3) in millimeter (mm) size classes.

Species	Size Class (mm)	Number
Central stoneroller (*Campostoma anomalum*)	50-74 75-99 100-124 Total	12 8 6 26
Creek Chub (*Semotilus atomaculatus*)	75-99 100-124 125-149 Total	3 3 2 8
Blacknose dace (*Rhinichthys atratulus*)	50-74 75-99 100-124 Total	18 14 10 42
Banded Sculpin (*Cottus carolinae*)	50-74 75-99 Total	32 6 38
Saffron Shiner (*Notropis rubricroceus*)	1-24 25-49 50-74 Total	2 7 1 10
Bluegill (*Lepomis macrochirus*)	75-99	1

Table 2. Number of fish collected on April 28, 2003, in pool of Dace Branch at SR95 reported in millimeter (mm) size classes and density is in numbers per square meter.

Species	Size Class (mm)	Number	Density
Central stoneroller (*Campostoma anomalum*)	50-74 75-99 100-124 Total	8 10 2 20	0.50
Creek Chub (*Semotilus atomaculatus*)	75-99 100-124 Total	5 5 10	0.25
Blacknose dace (Rhinichthys atratulus)	50-74 75-99 Total	11 4 15	0.33
Banded Sculpin (*Cottus carolinae*)	50-74 75-99 Total	12 6 18	0.38
Tennessee dace (*Phoxinus tennesseensis*)	75-99	2	0.05

4.2 Amphibian and Reptile Observations

The Revised MAP requires reporting of incidental observations of amphibians and reptiles during ecological monitoring activities. These monitoring activities included seasonal observation tours by biologists, avian surveys, fish collections, and macroinvertebrate collections.

Various species of frogs were seen or heard throughout the floodplains of East Fork Poplar Creek, Bear Creek, and Dace Branch, at wetlands associated with sinkholes, and at springs. Occasional calls were also heard in upland areas.

American toads (*Bufo americanus*) were heard wherever there are wet areas on the Horizon Center. Their breeding calls were heard beginning in March and extended through June. Egg masses were seen in shallow waters in wetlands and pools along roadways.

Spring peepers (*Hyla crucifer*) were heard from March into May. These small frogs were restricted to wet areas in the floodplains where rooted vegetation emerged from shallow standing water. In the earlier and later portions of their breeding season their calls were heard only at night. During the height of their breeding season they could be heard during the day as well.

Upland chorus frogs (*Pseudacris triseriata*) were heard in several locations along the East Fork Poplar Creek floodplain in April and early May (Figure 2). They were heard less frequently in uplands along the perimeter road north of the upper reaches of East Fork Poplar Creek and Upper Area 1 (Figure 2). During the last week in April, they were heard in developed areas along Renovare Boulevard adjacent to Dace Branch floodplain. This frog is well adapted to developed areas.

Cope's gray treefrogs (*Hyla versicolor*) were heard in many locations on the Horizon Center from April through June. Their calls were heard more frequently along the northern portion of the perimeter road from the East Fork Poplar Creek bridge to Upper Area 1. They were heard less frequently in the East Fork Poplar Creek and Dace Branch floodplains.

Green frogs (*Rana clamitans*) were heard from April through June in the East Fork Poplar Creek floodplain between its confluence with Dace Branch and the perimeter road bridge. They were occasionally heard in the wetlands associated with Upper Area 1.

Bullfrogs (*Rana catesbeiana*) were seen and heard in wetlands in the floodplain of the lower reaches of East Fork Poplar Creek. Several egg masses were seen in the shallow waters of the associated wetlands.

Leopard frogs (*Rana utricularia*) were seen around all areas of the Horizon Center where there was water. In addition, they were often seen on roads and trails after storms.

Numerous painted and slider turtles (*Chrysemys* spp.) were sighted in still or slow moving waters along the lower reaches of East Fork Poplar Creek. The highest concentrations were observed in the shallow flooded wetlands associated with the lower reaches of East Fork Poplar Creek where they basked on numerous emerged logs that received sunlight during much of the day. They were rarely seen along upstream reaches of East Fork Poplar Creek and never on Bear Creek.

One large snapping turtle (*Chelydra serpentina*) was seen submerged in East Fork Poplar Creek between Avian Route Sites 503 and 504 in June.

Eastern box turtles (*Terrapene carolina*) were seen along roads and trails throughout the Horizon Center during all seasons of the year.

Only three snakes were observed, a black racer (*Coluber constrictor*), a gray rat snake (*Elaphe obsoleta*), and a northern water snake (*Natrix sipedon*).

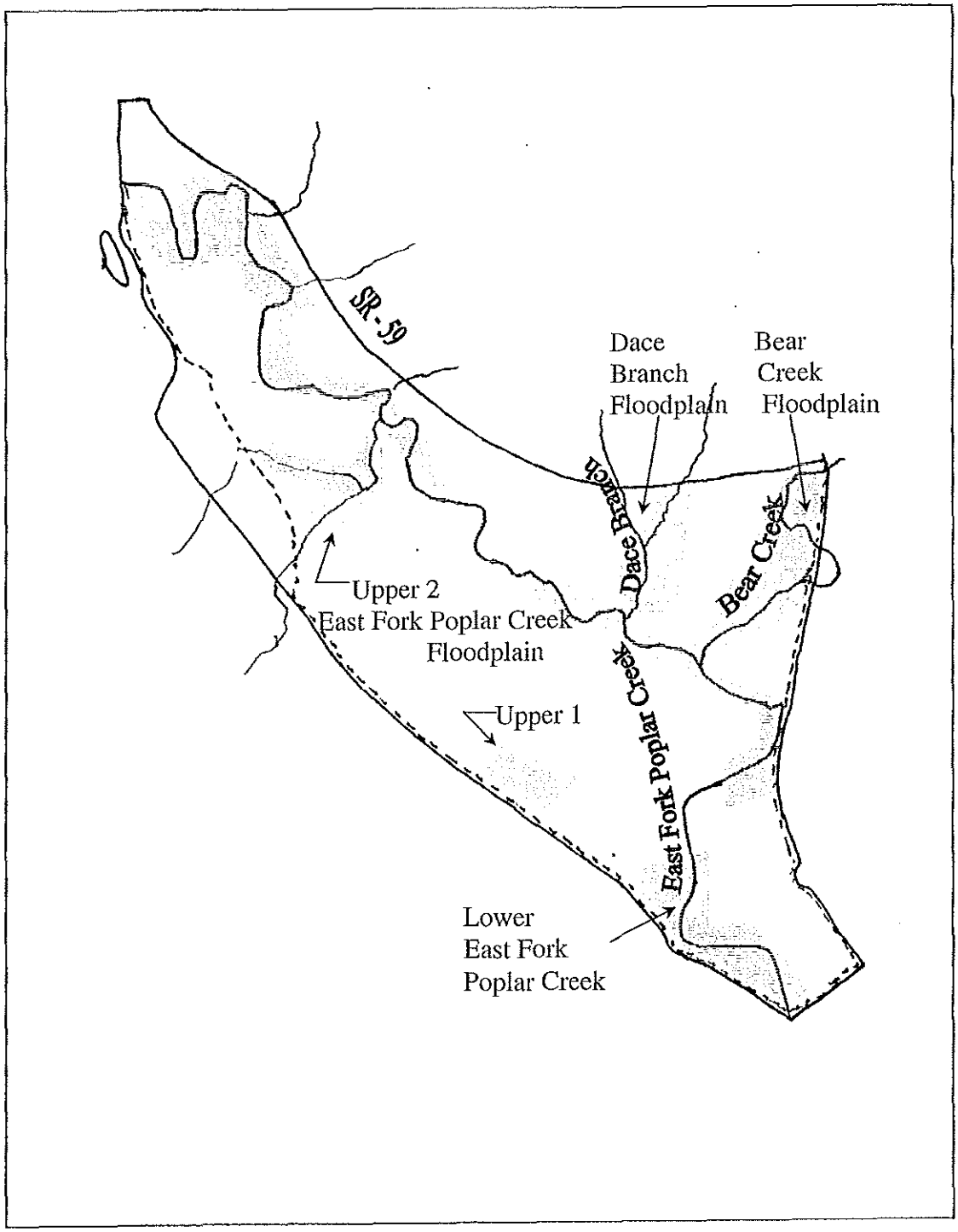

Figure 2. Areas Where Amphibians and Reptiles were Observed in 2003.

4.3 Avian Census

In order to establish baseline data for bird life throughout Horizon Center, a series of bird censuses were conducted prior to the onset of construction activities. Subsequent surveys have followed the same routes and stations.

4.3.1 Avian Census Area

Permanent 50-meter fixed-radius plots were established at 300-meter intervals along the Periphery Route and the Floodplain Route as bird monitoring sites (Figure 3). Each site has been permanently marked with an individual identification number on a 10-cm x 10-cm orange placard. The Periphery Route originally had 19 sites. Site 92 no longer exists due to extensive clearing of that part of the Horizon Center, leaving 18 sites on the Periphery Route.

The Periphery Route combined parts of two previously existing Partners-in-Flight routes. This route was adapted to include areas that, for the most part, skirt the upland portions of the Natural Area. This route was chosen to provide information on birds that: (1) use the edge of the Natural Area, (2) move across habitats (in and out of the Natural Area) during the breeding season, and (3) use this habitat during spring migration. Fifteen of the 18 monitoring posts were within or border the Natural Area. Although some areas covered during the survey of this route lie outside of the Natural Area, this route proved to be the most efficient and consistent way to sample birds along the edge of the zone. The Floodplain Route was established along the length of the protected floodplain entirely within the Natural Area. This route was selected to provide information on birds that breed exclusively in the Natural Area and to verify the validity of the Periphery Route. Both routes are approximately 6-km (4 miles) long.

The Periphery Route passes through several habitat types including areas of timber harvest, upland forest, and wetlands. It also borders large portions of the Natural Area. Timber was harvested in this area during the early 1990s. These areas were characterized by piled brush, log debris, snags, sparsely scattered hardwoods and standing dead pines. Dense ground vegetation was observed and included honeysuckle (*Lonicera* spp.), sourwood (*Oxydendrum arboreum*), sumac (*Rhus* spp.), and brambles (*Rubus* spp.). In 2002 these areas were in various stages of succession leading to hardwood forests. Young sapling and pole-sized hardwood trees were on several of the sites. Upland forests were well-drained areas with mixed deciduous trees. The three strata that were present in these upland forests were canopy, understory or shrub layer, and ground cover. Canopy trees included oaks (*Quercus* spp.), hickories (*Carya* spp.), maples (*Acer* spp.), tulip poplar (*Liriodendron tulipifera*) and American beech (*Fagus grandifolia*) in varying combinations depending on slope and aspect. The understory and shrub layers contained saplings and pole-sized trees including dogwood (*Cornus* spp.), oak, hickory, maple, and beech. The ground cover consisted of seedlings of canopy or understory species, ferns, and various herbaceous plants.

The Floodplain Route passes through a mixed deciduous forest in the valley bottom on East Fork Poplar Creek with poorly drained soils. The bottomland forest has at least three strata with varied flora, including canopy, understory or shrub layer, and ground cover. Canopy species included sweetgum *(Liquidambar styraciflua)*, American sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), elms (*Ulmus* spp.), ash (*Fraxinus* spp.), black willow (*Salix nigra*) and, infrequently oak and pine (*Pinus* spp.). The understory and shrub layer contained saplings and pole-sized trees of the canopy species, ironwood (*Carpinus caroliniana*), hop hornbeam (*Ostrya virginiana*), and red maple (*Acer rubrum*). The ground cover was dense in most areas and contains grasses, vines, and canes. Steep and low exposed banks of bare soil and small rock cliffs and ledges were common.

4.3.2 Avian Census Methods

In April 2003, five surveys were conducted along the Periphery Route and one survey was conducted along the Floodplain Route. In June 2003, two surveys were conducted along the Periphery Route and two surveys were conducted along the Floodplain Route. All birds seen or heard inside or outside the 50-m radius were noted as an addendum. Birds flushed by researchers entering or leaving the 50-m radius and fly-over birds were also noted. Five minute's observations at each site were divided into two periods, the first three minutes and the last two minutes. Sex and maturity were designated when known. Time, temperature, and weather conditions were noted at the beginning of each route and at each site.

Listening posts were established along roads throughout the Horizon Center for birds calling at pre-dawn and dusk. In addition, birds sighted or heard while investigators conducted other investigations were recorded as incidental.

4.3.3 Results and Discussion of Avian Census

Table 3 summarizes birds observed on the Floodplain and Peripheral Routes at the Horizon Center during April and June of 2003. Many of the birds observed in April are considered to be migrants, whereas, those observed in June are considered to be breeding residents.

While there were six species of birds observed in 2003 that were not observed in 2002, there were 19 species that were recorded in 2002 that were not recorded in 2003. The diversity and distribution in bird fauna for 2003 was similar to previous years.

Clearing land and constructing bridges and buildings has provided new types of habitat for birds on the Horizon Center. Swallows, Chimney Swifts, Least Flycatcher, and House Wren use construction components (e.g. bridges and buildings) for nesting and perches. The Least Flycatcher, Swallows, and House Wren were found nesting under bridges crossing East Fork Poplar Creek in the late spring and summer of 2003. The Chimney Swifts frequently fed over cleared areas from mid-afternoon to near dark.

Killdeer, Spotted Sandpiper, Common Grackle, and European Starling also used cleared areas for feeding.

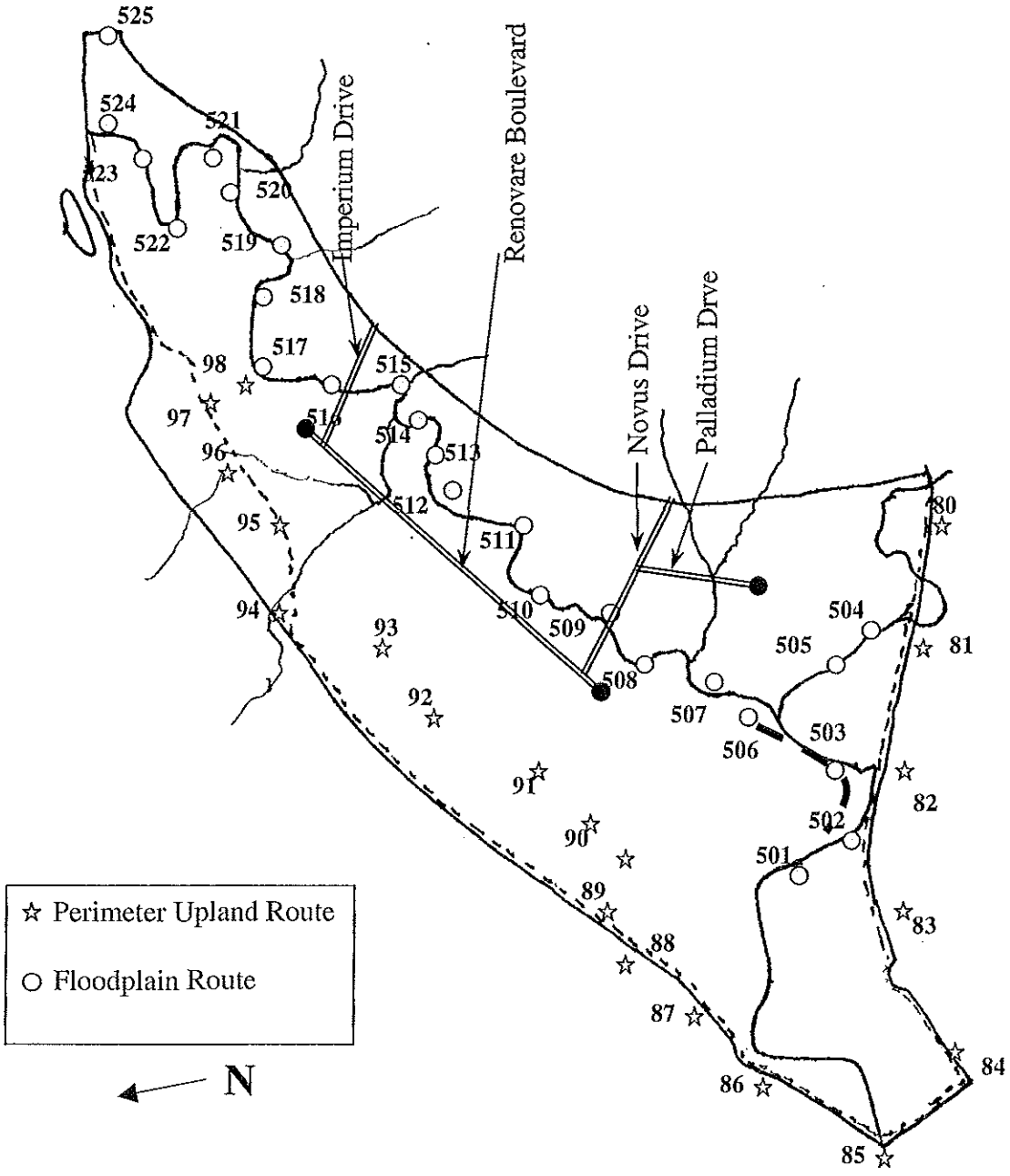

Figure 3. Bird Survey Locations along Perimeter Upland Route and Floodplain Route.

Table 3. Birds Observed on the Horizon Center along Peripheral Route, Floodplain Route, and Night.

Species	Periphery		Floodplain		Night
	April	June	April	June	April
Double-crested Cormorant	X	X			
Great Blue Heron	X	X	X	X	X
Green Heron			X		
Wood Duck	X		X		
Canada Goose	X	X	X		
Cooper's Hawk	X				
Broad-winged Hawk	X	X	X	X	
Sharp-shinned Hawk	X	X			
Red-shouldered Hawk	X	X	X	X	
Red-tailed Hawk			X		
Black Vulture	X		X		
Turkey Vulture	X	X	X		
Northern Bobwhite	X				
Wild Turkey	X	X	X		
Killdeer	X		X	X	X
Mourning Dove	X	X	X	X	
Black-billed Cuckoo			X		
Yellow-billed Cuckoo		X		X	
Barred Owl	X				
Chuck-will's-widow					X
Whip-poor-will			X		X
Ruby-throated Hummingbird	X	X	X	X	
Chimney Swift		X	X	X	
Belted Kingfisher	X		X		
Northern Flicker	X	X	X	X	
Downy Woodpecker	X	X	X	X	
Hairy Woodpecker	X	X			
Pileated Woodpecker	X	X	X	X	
Red-bellied Woodpecker	X	X	X	X	
Acadian Flycatcher	X	X	X	X	
Great Crested Flycatcher	X				
Eastern Kingbird	X		X		
Eastern Phoebe	X	X	X	X	
Eastern Wood-Pewee				X	
Northern Rough-winged Swallow	X		X		
American Crow	X	X	X	X	

Table 3 Continued

Species	Periphery		Floodplain		Night
	April	June	April	June	April
Blue Jay	X	X	X	X	
Carolina Chickadee	X	X	X	X	
Tufted Titmouse	X	X	X	X	
White-breasted Nuthatch	X	X	X	X	
Carolina Wren	X	X	X	X	
Blue-gray Gnatcatcher	X	X	X	X	
Eastern Bluebird	X		X	X	
Hermit Thrush	X		X		
Wood Thrush	X	X	X	X	
Gray Catbird	X	X	X		
Northern Mockingbird		X	X	X	
Brown Thrasher	X		X		
European Starling	X				
Cedar Waxwing				X	
Red-eyed Vireo	X	X	X	X	
White-eyed Vireo	X	X	X	X	
Yellow-throated Vireo	X	X	X	X	
Yellow-breasted Chat	X	X	X	X	X
Ovenbird	X				
Northern Parula	X	X	X	X	
Black-and-white Warbler	X			X	
Black-throated Green Warbler	X				
Blue-winged Warbler	X	X	X	X	
Cerulean Warbler	X				
Hooded Warbler	X	X	X	X	
Kentucky Warbler	X	X	X	X	
Nashville Warbler	X				
Palm Warbler	X				
Pine Warbler	X	X	X		
Prairie Warbler	X	X	X	X	
Prothonotary Warbler		X			
Swainson's Warbler				X	
Tennessee Warbler	X				
Worm-eating Warbler	X				
Yellow-throated Warbler	X	X	X	X	
Yellow-rumped Warbler	X				
Louisiana Waterthrush	X		X	X	
Common Yellowthroat	X	X	X	X	

Table 3 Continued

Species	Periphery		Floodplain		Night
	April	June	April	June	April
Scarlet Tanager	X	X	X	X	
Summer Tanager	X	X		X	
Indigo Bunting	X	X	X	X	
Northern Cardinal	X	X	X	X	X
Chipping Sparrow	X	X	X	X	
Field Sparrow	X	X	X	X	
Song Sparrow	X		X		X
Lincoln's Sparrow			X		
White-throated Sparrow	X		X		
Eastern Towhee	X	X	X	X	
Red-winged Blackbird	X				
Brown-headed Cowbird	X	X	X	X	
Baltimore Oriole			X		
Orchard Oriole	X				
American Goldfinch	X	X	X	X	

Several Killdeer nests were observed in many locations throughout the spring and summer.

During planning stages of Horizon Center, there had been concern that bridge corridors would fragment the riverine bottomland forest and prevent neotropical song birds from migrating. The number of neotropical migratory species increased on both sides of the bridges in years following construction, suggesting that the roadways crossing the floodplain have not negatively impacted habitat continuity, an important factor in migration.

Cerulean Warblers are listed as "In Need of Management" by the State of Tennessee and of "Special Concern" by federal agencies. Only one was observed in an incidental sighting on April 18, 2003. It was seen along the perimeter road near site 94 and probably was passing through the region since they are rare neotropical migrants that primarily nest outside the Ridge and Valley provinces. They were previously reported on the Horizon Center in the spring of 1996 (DOE 1996) and 1999 (DOE 1999). They were not observed in 2000 (DOE 2000) or 2002 (DOE 2003).

Swainson's Warblers are listed as "In Need of Management" by the State of Tennessee. One was seen on June 16, 2003 in the East Fork Poplar Creek floodplain near site 515. A Swainson's Warbler was reported at this site in 2002. The area is vegetated in secondary growth that is type habitat preferred by the Swainson's Warbler. Several searches were made for this secretive bird during the remainder of the summer. It was not seen or heard again.

Sharp-shinned Hawks, listed as "In Need of Management" by the State of Tennessee, were sighted on the Horizon Center in 2003. Two sightings were made at sites 94 and 96. The latter was on June 15, 2003. A sighting at this time suggests the possibility of a nearby nest. The woodlands and woodland-open area borders that are abundant on the Horizon Center provide excellent habitat for this hawk. This hawk was also reported in 1997 (DOE 1997) and 2002 (DOE 2003).

Cooper's Hawk is a rare hawk deemed "In Need of Management" that was also observed in 2003. This was a single sighting as the hawk flew over the perimeter road in late April. Cooper's Hawks are dependent on a healthy pine forest for cover, feed, and nesting requirements. They were first reported on the Horizon Center in 1997 (DOE 1997). They were observed again in 1999 (DOE 1999) and at least one breeding pair was observed in 2000 (DOE 2000). They were not seen in 2002 (DOE 2003). Since 2000, the pine beetle has killed most of the pine trees on the Horizon Center depriving the Cooper's Hawk of preferred habitat.

Numerous Red-shouldered Hawks and Broad-winged Hawks were observed at various locations and times during 2003. Apparent breeding pairs of both were seen throughout the spring and reported in the formal surveys. Adult Broad-winged Hawks feeding a fledgling in a nest atop a tall oak near site 80 were observed on June 15, 2003. This is the first reported sighting of a Broad-winged Hawk nest on the Horizon Center. As the summer progressed, several incidental sightings of young Red-shouldered Hawks were made.

Double-crested Cormorants were seen on the Horizon Center for the first time in 2003. The first sighting was of three birds flying over site 80 on April 14. During the summer an immature Double-crested Cormorant was seen on the bridge crossing East Fork Poplar Creek between sites 85 and 86. This suggests a nest site was in the area.

Wood ducks were very active along East Fork Poplar Creek and Bear Creek during the winter, spring, and fall of 2003. None were sighted during the summer. Mallard ducks were sighted during the late spring in the lowlands near the end of East Fork Poplar Creek. No young were seen, as was the case in 2000. Mallard ducks were not reported as occurring on the Horizon Center in the baseline census (DOE 1997) or the first year following construction of the infrastructure (DOE 1999). In 2000 they had nested and reared young in the wetlands along East Fork Poplar Creek and had been observed on other occasions throughout the year (DOE 2000).

Canada Geese were observed in various locations on the Horizon Center throughout the year. A nesting pair was observed from the beginning of nest building through rearing of their young. The nest site was on a peninsula of high ground protruding into a wetland in the lower reaches of the East Fork Poplar Creek floodplain.

Incidental observations found two pair of ruffed grouse in the upland forests in 2002. These had not been reported at the Horizon Center in previous years although habitat

requirements are abundant at the Horizon Center and surrounding hillsides. Searches for ruffed grouse in 2003 yielded no sightings.

The concern was expressed during public meetings that there would be an invasion of European starlings and brown-headed cowbirds following completion of the first phase of construction. While these birds were present in 2003, the numbers were not greater than in previous years.

In summary, the habitat types in the floodplain corridor were diverse and supported a diverse community of breeding birds in 2003. In the spring, the Horizon Center was used as a migration corridor which is typical of unfragmented bottomland forests of the region. The crossing of road right-of-ways and bridges did not appear to adversely impact the migration of birds along the East Fork Poplar Creek corridor. The upland corridors, that connect the bottomland corridor along East Fork Poplar Creek and the uplands of the ridges, support diverse bird communities. The increase in diverse habitat types along the upland corridor following deforestation resulting from pine beetle infestation has contributed to increased bird diversity and numbers of individuals. The data show areas within the Horizon Center are being used as breeding territory for some state and federal species listed as being in need of management.

4.4 Benthic Macroinvertebrate Census

Benthic macroinvertebrates are small animals large enough to be seen with the unaided eye that live on or among the substrate particles in bodies of water. Their life span of several months make them ideal for use in following long-term ecological trends associated with impacts. However, the high variability of macroinvertebrate communities makes causes of short-term fluctuations difficult to identify.

The objectives of the stream benthic macroinvertebrate studies were to: (1) characterize the benthic macroinvertebrate communities of an upstream station (EFK-6.3) and a downstream station (EFK-2.3) within the Horizon Center; (2) compare community structures with those observed during the collection of baseline data in 1996 (DOE 1997) and with an offsite station (Mitchell Creek MIK-1.43); and (3) document the presence of any federal or state listed threatened, endangered, or in-need-of management species.

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPT). Taxa richness and concentrations of tolerant versus intolerant groups when used over a number of years are also indicators of well being of a habitat. Ratings can also be assigned with a Tolerance Value (TV) index that summarizes tolerance. No baseline or criteria for these TV indices have been established for streams in this region of Tennessee; thus, the indices are used here only to provide general indications of water quality.

4.4.1 Benthic Macroinvertebrate Census Methods

Figure 1 indicates the location of macroinvertebrate survey sites on the Horizon Center. An offsite station on Mitchell Branch at kilometer 1.43 (MIK-1.43) was originally used as a reference because it was similar to Dace Branch and had a long-term historical database available for comparisons. Even though Mitchell Branch is very different from East Fork Poplar Creek it continues to be used as an indicator of annual fluctuations of benthic communities in the area.

Surber samplers equipped with a 363-micrometer mesh net were used to collect quantitative samples in triplicate at each station. Kick nets were used to collect qualitative samples throughout each site. Samples were placed in jars and preserved with 95 percent ethyl alcohol and taken to the laboratory. To avoid sample decomposition caused by dilution of the original preservative, the ethanol was replaced with a permanent preservative. Organisms were picked from the debris in the samples, identified to the lowest practical taxon, and enumerated.

4.4.2 Results and Discussion of Benthic Macroinvertebrate Census

Table 4 is a composite checklist of the benthic macroinvertebrates collected by qualitative kick net and quantitative surber samples from the three stations in April of 2003. The reported number represents the total number of each type of organism in three samples of 0.1 square meters ($/m^2$) of stream bottom. Additional types of organisms observed in the qualitative samples are represented by an "X" in the tables. In addition, most taxa are annotated by Functional Feeding Groups (FFG) and a Tolerance Value (TV).

Mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Tricoptera) are generally intolerant to organic wastes and sediments, and are indicators of good water quality. Chironomids are generally tolerant to organic wastes, natural detritus, and sediments. Thus, taxa richness and percentage of individuals of chironomids and Ephemeropter+Plecoptera+Tricoptera (EPT) are reported for each site in Table 5. Table 6 shows the number of individuals in the three surber samples within each of the FFG.

EFK-6.3 – This upstream station on East Fork Poplar Creek was composed of alternating shallow pools and riffles at this site at the time it was sampled in 2003. The flow was slow to moderate. Substrate of the pools was predominantly coarse sand. The riffles were predominantly rough bedrock intermittently covered with small to medium cobble. Qualitative samples were taken throughout the site, while quantitative surber samples were only collected in the riffles.

There were 41 different types of organisms with a community density of 1264 individuals/0.1 m^2. Chironomids dominated (59.9 percent) the macroinvertebrate community at EFK-6.3 in the spring of 2003.

This is normal in April when there are high concentrations of small detritus particles moving along and through the streambed substrate. The ten EPT species represented 17.9 percent of the individuals at the site. This is much greater than the 2.5 percent in the spring of 1997 (DOE 1997). Macroinvertebrates other than EPT and chironomids made up 22.3 percent of the number of individuals. The richness of all taxa (37) and EPT (9.6) are near the numbers of taxa found in the respective categories and indicate an even distribution of taxa throughout the riffle.

Most of the macroinvertebrates at this site feed on natural organic detritus that has been broken into small pieces. Those that collect or gather small particles on or in the streambed comprise 68.5 percent of the macroinvertebrate community. Those that gather small particles from the water near the streambed or filter organic particles from the water column comprise 10.2 percent of the community. These are contrasted with less than one percent that shred large organic components such as leaves and herbaceous materials. Food for shredders was very limited in riffle areas where samples were taken. The current rapidly sweeps the larger materials away. However, numerous small organic particles move through the riffles in the water column and along the streambed.

The diversity and community structure are indicators of long-term good water quality where East Fork Poplar Creek enters the Horizon Center.

EFK-2.3 –This station is downstream from EFK-6.3 and development activities on the Horizon Center. Conditions at the station consisted of alternating shallow pools and riffles, and the flow was slow to moderate. Substrate of the pools was predominantly sandy with a small amount of gravel. The riffles were predominantly rough bedrock covered with small to medium cobble with a mixture of gravel and sand. Qualitative samples were taken throughout the site, while the quantitative surber samples were only taken in the riffle areas.

There were 43 types of macroinvertebrates found at EFK-2.3 in April 2003. While this was lower than the 79 taxa found there in the spring of 2002, it was higher than any other year since the monitoring began in 1996. The number of EPT species that are intolerant to organic wastes and sediments continue to be high and have increased in concentration from 5.6 in 2002 to 9.6 percent in 2003. This has also been accompanied by a slight increase in concentrations of macroinvertebrates other than EPT and chrionomids.

The percent of individuals in the community that belonged to the chironomids continued to be high (83.7 percent) although lower than in the spring of 2002 (90.1 percent). The percent of the community comprised of chironomids is similar to spring samples in each year since 1997. This reduction in percent concentration is not due to reductions in numbers of chironomids, but due to an increase in other macroinvertebrates.

Chironomids tolerate organic wastes and sediments and are often used as indicators of pollutants; however, they also utilize small organic particles in clean water. The abundance of organic leaf materials in East Fork Poplar Creek provided ideal habitat for chironomids from late fall through the spring.

As at site EFK-6.3, most of the macroinvertebrates at EFK-2.3 feed on natural organic detritus that has been broken into small pieces. Those that collect or gather small particles on or in the streambed comprise 76.5 percent of the macroinvertebrate community. Those that gather small particles from the water near the streambed or filter organic particles from the water column comprise 6.4 percent of the community. These are also contrasted with less than one percent that shred large organic components such as leaves and herbaceous materials.

Historical data indicates the macroinvertebrate community in this reach of East Fork Poplar Creek has been unstable. The relatively high diversity in the spring of 2002 and 2003 suggests an improved condition over the last few years.

MIK-1.43 – This station on Mitchell Creek was established as an offsite control for macroinvertebrate monitoring in the baseline studies in 1996 (DOE 1997). Mitchell Creek varies from two to three feet in width and ranges from three to 12 inches in depth. The year-round flow is over a sandy loam substrate with occasional gravel and sand bars. The flow rate is slow to moderate. The flood plain is vegetated with forbes and shrubs that often overhang the creek.

In the spring of 2002 the density of 355 individuals/0.1 m^2 of the macroinvertebrate community was lower than in any spring sample recorded. In the spring of 2003, the macroinvertebrate density of 558 individuals/0.1 m^2 had recovered to previous conditions. The 35 taxa recorded from the samples indicated a diverse community structure. However, the taxa richness of 26 indicated the community structure was not balanced within the collection site. This is due to the variability in substrate composition and presence of detritus.

At MIK-1.43 18.5 percent of the macroinvertebrates with reported FFG shred leaves and other detritus, whereas, only 4.9 percent are collectors and gathers (Table 6). This indicates the habitat has an abundance of relatively large organic materials to be used as a food source by these shredder herbivores. The shredders provide food for the predators that were abundant (25.7percent).

As at East Fork Poplar Creek stations, the total number of taxa was less than in 2002. Much of this reduction was in taxa other than chironomids and EPT. The individuals in those taxa comprised 25.2 percent of the community in 2002 and 16.6 percent in 2003. In 2003, chironomids were less than half (49.7 percent) of the macroinvertebrate community. There were 18 species of EPT that comprised 33.7 percent of the macroinvertebrates

4.4.3 Protected Aquatic Invertebrates

An extensive search for protected aquatic invertebrates was conducted in 2002 (DOE 2003). In 2003 searches for protected aquatic invertebrates was restricted to visual inspections of: (1) East Fork Poplar Creek at sites where macroinvertebrates were

collected, cultural resource sites, and sensitive species sites; (2) Dace Branch at fish sampling sites; (3) portions of Bear Creek; (4) wetlands, and (5) springs. No protected aquatic invertebrates were found in 2003.

Table 4. Composite of Quantitative and Qualitative Macroinvertebrate Benthos at each monitoring location in April 2003 and Functional Feeding Group (FFG) and North Carolina Tolerance Value (TV) designations of each taxon.

	Indices		Stations		
Taxa	TV	FFG	EFK 2.3	EFK 6.3	MIK 1.43
PLATYHELMINTHES					
Turbellaria					18
NEMATODA	6.02		1	2	
MOLLUSCA					
Bivalvia					
Veneroida					
Corbiculidae					
Corbicula fluminea	6.12	FC	14	18	
Pisidium sp.	6.48	FC		X	
Gastropoda					
Mesogastropoda					
Pleuroceridae					
Elimia clavaeformis	5	SC	30	115	
Basommatophora					
Ancylidae					
Ferrissia rivularis	6.55	SC	X	4	
Physidae					
ANNELIDA					
Oligochaeta	10	CG			44
Haplotaxida					
Lumbricidae		CG	10	29	
Naididae	8	CG	1	36	
Nais behningi	8.89	CG	13	19	
Nais bretscheri	8.88	CG	6	396	
Nais communis	8.81	CG	6		
Slavina appendiculata	7.06	CG	16	26	
Stylaria lacustris	9.38	CG	X	50	
Lumbriculida					
Lumbriculidae	7.03	CG	2	12	

Under Stations the numbers = number of individuals of respective taxon found in three surber samples and X = Representative of Taxa observed in the qualitative sample but was not observed in the Surber samples; Under TV numbers are indices; FFG = Functional Feeding Groups; CG = Collector/Gathers; FC = Filtering/Collectors; SC = Scrapers; SH = Shredders; P = Predators; PI = Piercers.

Table 4 Continued

	Indices		Stations		
Taxa	TV	FFG	EFK 2.3	EFK 6.3	MIK 1.43
ARTHROPODA					
Crustacea					
Isopoda					
Asellidae	8	SH			
Caecidotea sp.	9.11	CG	5	6	
Lirceus sp.	7.85	CG	10	2	31
Amphipoda					
Crangonyctidae					
Crangonyx sp.	7.87	CG			6
Decapoda					
Cambaridae					
Cambarus sp.	7.62	CG	X	4	
Arachnoidea					1
Insecta					
Ephemeroptera					
Baetidae	4	CG			
Acentrella ampla	3.61	CG	9		
Acerpenna pygmaea					1
Baetis sp.	4	CG	25	120	
Diphetor hageni					157
Ephemerellidae	1	SC			
Ephemera sp.					2
Ephemerella sp.	2	SC	3		
Eurylophella sp.	4.34	SC	X	6	
Heptageniidae	4	SC			
Stenacron interpunctatum	6.87	SC	8	55	
Stenonema sp.	4	SC	5		
Stenonema mediopunctatum	3.77	SC	60	160	
Leptophlebiidae	2	CG			
Habrophlebiodes sp.					57
Odonata					
Gomphidae	1	P			
Hagenius brevistylus	3.99	P		2	
Stylogomphus albistylus	4.72	P			9
Plecoptera					
Capniidae					
Allocapnia sp.			6		35

Table 4 Continued

	Indices		Stations		
Taxa	TV	FFG	EFK 2.3	EFK 6.3	MIK 1.43
Leuctridae	0	SH			
Leuctra sp.	0.67	SH	10	15	75
Nemouridae	2	SH			
Amphinemura sp.	3.33	SH	5	X	104
Perlidae	1	P	24	12	177
Perlodidae					
Isoperia bilineata					1
Taeniopterygidae	2	SH			
Taeniopteryx sp.	5.37	SH	4	X	
Trichoptera					
Glossosomatidae	0	SC			
Agapetus sp.	0	SC		X	1
Hydropsychidae	4	FC	99	67	
Cheumatopsyche sp.	6.22	FC	27	144	
Diplectrona modesta	2.21	FC	17	X	4
Hydropsyche sp.	5	FC	X	96	
Hydroptilidae					
Ochrotrichia sp.					3
Hydroptila sp.	6.22	PI	2	3	
Rhyacophilidae	0	P			
Rhyacophila sp.	1	P			1
Uenoidae					
Neophylax sp.	2.2	SC	7	X	3
Coleoptera					
Dytiscidae					
Hydroporus sp.			X		3
Elmidae	5	CG			
Ancyronyx variegata	6.49	SC	X	2	
Dubiraphia sp.	5.93	SC		1	
Optioservus sp.	2.36	SC	5	8	11
Stenelmis sp.	5.1	SC	21	18	79
Psephenidae	4	SC			
Psephenus herricki	2.35	SC	3		
Ptilodactylidae		SH			
Anchytarsus bicolor	3.64	SH			1
Diptera	5	P			
Ceratopogonidae	6.86	P			11
Chironomidae			226	183	67

Table 4 Continued

	Indices		Stations		
Taxa	TV	FFG	EFK 2.3	EFK 6.3	MIK 1.43
ORTHOCLADIINAE	5.8	SH			129
Cricotopus sp.	2.84	CG	941	650	
Eukiefferiella devonica	7.07	CG	204	206	
Orthocladius sp.	5.4	CG	209	79	
Parakiefferiella sp.	3.65	CG	380	346	
Parametriocnemus lundbecki	7.28	CG	179	200	
Rheocricotopus robacki	4.36	CG	96	64	
Synorthocladius semivirens	5.86	CG	104	97	
Thienemanniella xena	3.61	CG	243	222	
CHIRONOMINI	6.38	P			230
Rheotanytarsus sp.	6.52		135	222	
PODONOMINAE					15
TANYTARSINI					271
TANYPODINAE					120
Dixidae		CG			
Dixa sp.	2.55	CG			1
Simuliidae	8.4				
Simulium sp.	4	FC	52	63	3
Tipulidae	3	SH			
Antocha sp.	4.25	CG	24	32	
Hexatoma sp.	4.31	P			3
Pseudolimnophila sp.	7.22	CG			1

Table 5. Summary of Benthic Macroinvertebrates from Three Surber Samples for Streams on Horizon Center, April 2003.

Site	Total Number of Taxa (Richness)	Total Number of Individual Organisms	Total Number of EPT Taxa (Richness)	% EPT	% Chironomidae	% Other Taxa	Density /0.1 m^2
EFK 2.3	43 (38)	3247	16 (14)	9.6%	83.7%	6.7%	1082
EFK 6.3	41 (37)	3792	10 (9.6)	17. 9%	59. 8%	22.3%	1264
MIK 1.43	35 (26)	1675	14 (10)	33.7%	49.7%	16.6%	558

Totals represent numbers in all three samples. Richness is the average number of taxa in the three samples taken at that site. Percents are based on number of individuals in the group compared to the total number of individuals. Density is in individuals/0.1 m^2.

Table 6. Number and Percent of Macroinvertebrate Individuals in each of the Functional Feeding Groups in Three Surber Samples at Sites EFK-2.3, EFK-6.3, and MIK-1.43.

Functional Feeding Groups	EFK-2.3	EFK-6.3	MIK-1.43
Collector/Gathers (Percent of total)	2483(76.5%)	2596(68.5%)	83(4.9%)
Filtering/Collectors (Percent of total)	209(6.4%)	388(10.2%)	7(0.4%)
Scrapers (Percent of total)	142(4.4%)	369(9.7%)	94(5.6%)
Shredders (Percent of total)	19(0.6%)	15(0.4%)	309(18.5%)
Predators (Percent of total)	159(4.9%)	236(6.2%)	431(25.7%)
Piercers (Percent of total)	2(0.06%)	3(0.08%)	0
Unknown (Percent of total)	233(7.2%)	185(4.9%)	751(44.8%)

The numbers are based on composites of three Surber samples at each site.

4.5 General Vegetation Surveys

The EA and MAP required detailed evaluation of plant communities on a five-year schedule. In 2002 that evaluation was conducted and reported in the annual report (DOE 2003). The Revised MAP requires spring, fall, and winter observations of plant communities throughout the Horizon Center by a botanist. These were conducted accordingly during the 2003 monitoring.

Most of the pine forests have succumbed to the pine beetle infestation and have been replaced by early succession. Young tree species include: tulip poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), and an assortment of maples (*Acer* spp.). In 2003, the vegetation communities in most of these areas were dominated by Japanese honeysuckle (*Lonicera japonica*) and blackberry (*Rubus* sp.).

As in other years almost all plant communities at the Horizon Center had some exotic plants in 2003. Most of the forest floor on the floodplain was dominated by aggressive exotic invaders. These included microstegium (*Eulalia viminea*), privet (*Ligustrum sineses* and *L. vulgare*), and Oriental bittersweet (*Celastrus orbiculatus*). The successional stages of upland forests were dominated by honeysuckle, autumn olive (*Elaeagnus umbellata*), and multiflora rose (*Rosa multiflora*).

4.6 Sensitive Community Surveys

DOE found five types of sensitive plant communities on the property prior to leasing it to CROET (DOE, 1997). These were inspected during each of the three seasons.

4.6.1 Beech-Maple Forest

The area designated as the beech-maple forest at the Horizon Center is unusual for the ridge and valley province and is not known to occur elsewhere on the Oak Ridge Reservation (DOE, 1996A). Aerial photographs taken in 1943 show the Beach-Maple

Forest area to be intact, although it was completely surrounded by agriculture at the time. The area has not been disturbed since. Due to its longevity and to the vegetation composition, it is considered to be approaching the status of a climax forest. In the Midwest, forests of this type have been ranked critically imperiled because of extreme rarity (Grossman et al. 1994).

There were no observable changes in this area since the 2002 annual report (DOE 2003).

4.6.2 Limestone Cliffs

The limestone cliffs identified in the Environmental Assessment (DOE 1996A) are along the left-bank-descending of East Fork Poplar Creek. The cliffs are not high and are intermittent. They are dry. The soils on these limestone cliffs are deeper than those found on most limestone cliffs in the region. Aerial photographs taken in 1943 show the surrounding areas to be cultivated at that time. After the government acquired the land, natural succession vegetated farmland surrounding the upper banks of the limestone cliffs. In latter years the government planted hardwood and pine plantations in the previously farmed lands adjacent to these limestone cliffs. Thus, the makeup of mature vegetation on these limestone cliffs in 2002 was found to be similar to the surrounding forests. No observable changes occurred during 2003.

A similar region of limestone outcrops is on the right-bank-descending of East Fork Poplar Creek. The cliffs along this zone are very intermittent and short. They too are dry. The soils on the upper banks are deep. The 1943 aerial photograph indicates the surrounding area was mature forest in 1943. Here too, the vegetation community of the upper banks was similar to the surrounding forest. There are no indications of this area being disturbed since the government acquired the property. No observable changes occurred during 2003.

Another limestone cliff was described in the baseline report (DOE 1997) as being in a steep curve along the right-bank-descending of East Fork Poplar Creek. Portions of this area were in cultivation to the upper margin of the cliff prior to 1943. Much of this cliff face was wet from seeps and periodic flooding of East Fork Poplar Creek. However, there is a gradation of moisture saturation and sunlight intensity from bottom to top. This has resulted in several strata of plant community types. These have resulted in an ecocline progression from high concentrations of moss, lichen, and algae on the bare rock surfaces near the bottom to oak-maple forest at the top. No development has occurred along East Fork Poplar Creek upstream of, or in the vicinity of this cliff. No observable changes have occurred in the plant communities along this limestone cliff since the baseline studies were conducted in 1996.

4.6.3 Limestone Barrens

The baseline study (DOE 1997) described a single limestone barren from observations made in 1996. A second area designated as a limestone barren was referenced in the Environmental Assessment (DOE 1996A). Conditions for both are probably man-

induced due to previous farming and logging practices. In the summer of 2003 the boundaries of both were difficult to delineate because there was a gradual change in soil thickness and underlying geology accompanied by an irregular progression of changes in vegetation.

No observable changes occurred during 2003.

4.6.4 Canebrakes

Canebrake communities are composed of understory and forest floor vegetation within the bottomland forest community throughout the foothills of Appalachia. These canebrakes have been reduced by 95 percent, largely due to free-range livestock, drainage, conversion to agriculture, and fire suppression (Grossman et al. 1994). The Environmental Assessment (DOE 1996A) stated the canebrake communities along East Fork Poplar Creek were the most extensive on the Oak Ridge Reservation at that time.

Forested canebrakes were reported in various locations along floodplains of East Fork Poplar Creek and its tributaries in the Environmental Assessment (DOE 1996A) and the baseline studies (DOE 1997). The canebrakes exist as discrete patches in a bottomland mosaic. In 2003, canebrakes were seen throughout the floodplains on the Horizon Center. Other than the two locations where bridges cross the East Fork Poplar Creek floodplain, there has been no direct disruption of canebrake habitat. Clearing of vegetation at those bridge crossings resulted in more light reaching the forest floor at the margin of the right-of-way. This has resulted in increased populations and vigor of local cane.

4.6.5 Walnut Plantations

Two walnut plantations were planted prior to 1977. Walnut Plantation 1 is located within the floodplain of East Fork Poplar Creek and Walnut Plantation 2 is upland and borders the North Perimeter Road. No changes occurred during 2003.

4.6.6 Threatened and Endangered Plant Species

The baseline study (DOE 1997) reported the presence of five plant species having state or federal protection on the Horizon Center. During the late spring and early summer of 2002, protection zones were established around each area where these were reported. Each site was evaluated during each scheduled visit.

4.6.7 Yellow Lily and Golden Seal Populations

Populations of yellow lily (*Lilium canadense*) and golden seal (*Hydrastis canadensis*) are located in hardwood dominated mesic forest on limestone slopes adjacent to Walnut Plantation 1. The slope has approximately 10-percent exposed limestone. There has been sufficient seepage to keep the soils moist in the earlier portion of the growing season. The area is bounded on the bottom of the slope by the floodplain of East Fork

Poplar Creek and on the top of the slope by a former pine plantation that is now in secondary succession.

Approximately 150 golden seal were observed and most were located on the lower half of the slope. In 2002 there were approximate 200 yellow lilies intermingled with the golden seal. In 2003, the population of yellow lilies had increased to approximately 500 plants. Most of these were in dense patches having approximately 5-foot radii. Others were more dispersed.

4.6.8 Additional Golden Seal Population

The slope that supports the golden seal and yellow lily continues to the northeast and provides habitat for a moderate population of golden seal. The 20-30 percent slope was too steep for agriculture; thus, it was wooded at the time of government acquisition.

The slope had a narrow hardwood dominated mesic forest bounded at the top by a red cedar-pine second growth forest and at the bottom by Walnut Plantation 1. The understory was sparse and is composed of sugar maple, American elm, and dogwood. The herbaceous layer was also sparse with such plants as wild ginger, Jacob's ladder, Virginia creeper, trillium, and poison ivy.

The slope had approximately 20-percent exposed limestone and thin soils over limestone. Portions of the slope had sufficient seepage to keep local soils moist in the earlier portion of the growing season. However, most of the slope dried quickly. The open canopy allowed filtered light on the forest floor during much of the day.

Approximately 25 small plants were observed over an area approximately 100 meters by 10 meters during 2002. The population was estimated to be double that in the spring of 2003. In addition, the distribution had spread up-slope where many flowering and fruiting plants were found in close proximity to rock outcrops and fallen timbers.

4.6.9 Pink Lady Slipper Population

A large population of pink lady slipper (*Cypripedium acaule*) was found on the left-bank-descending along the lower portion of East Fork Poplar Creek in June of 1996 (DOE 1997). The site was adjacent to a pine plantation that had been devastated by the pine beetle. As reported in 1997, many of the trees were dead and fallen with the early stages of succession underway. The probability for survival of the lady slipper was stated to be marginal.

The pine beetle infestation killed the surrounding pine forest over the last five years. The investigations in 2002 (DOE 2003) found secondary succession had produced a dense cover of low-lying invasive vegetation. Observations in 2003 indicated the primary succession had increased in density. The extent and density of this invasive vegetation has sufficiently altered habitat conditions such that survival of lady slipper is unlikely. No lady slippers were found in 2003.

4.6.10 Beak Rush Community

The beak rush (*Rhynchospora colorata*) community could not be located during the 2003 study.

4.6.11 Ginseng Population

The ginseng (*Panax quinquifolius*) community could not be located during the 2003 study.

4.6.12 Cave Entrances

The EA (DOE 1997A) and the baseline study (DOE 1997) reference a cave entrance along North Perimeter Road. In 2003, the entrance of the cave was open and not obstructed. The surrounding vegetation was primarily privet and Japanese honeysuckle.

4.6.13 Springs

The EA (DOE 1996A) and the MAP reference two springs in the lower reaches of the East Fork Poplar Creek floodplain. These, plus an additional spring, were located and marked in 2002. All of these produced large flows of clear water throughout the year. Each was in a protected cove with small surface watersheds; thus, their downstream flows were not impacted by surface conditions. Each had tracks of several unidentified types of wildlife around their perimeters. There were no observable changes in 2003.

4.6.14 Sinkholes

Several small sinkholes and one large one are on the Horizon Center. The only one of these inspected was the large sinkhole along the North Perimeter Road. In 2003 the area was in secondary succession. Privet, green ash, and box elder were the dominant vegetation. Other areas were more mature with box elder and green ash being the dominant trees.

4.6.15 Wetlands

All known wetlands are in protected Natural Areas. Several wetlands were observed for signs of stress or impact from external influences. All appear to be healthy and are being used by wildlife.

4.6.16 Buffer Zones

Buffer zones around the Horizon Center, Natural Areas, sensitive areas, and cultural resources were examined during each season of 2003. There were no encroachments or need of special maintenance found.

4.7 Game Species

Only casual observations of game species were made in 2003. Thus, no attempts were made to quantify populations of rabbits (*Sylvilagus floridanus* and *S. aquaticus*), white-tail deer (*Odocoileus virginiana*), wild turkey (*Meleagris gallopavo*), wood duck (*Aix sponsa*), mallard duck (*Anas platyrhynchos*), ruffed grouse (*Bonasa umbellus*), and northern bobwhite (*Colinus virginianus*).

Rabbit – The eastern cottontail *(S. floridanus)* appears to be increasing due to the increase of open land and succession. They, or their signs, have been sighted in all areas of the Horizon Center. Swamp rabbit (*Sylvilagus aquaticus*) was reported for the first time in 2002 (DOE 2003). The swamp rabbit was seen again in 2003.

White-tail Deer – In the baseline study (DOE 1997) the white-tail deer population was roughly estimated at one deer per 15 acres of land. The estimate was based on the hunting records for the Oak Ridge Reservation in general, and may have been low for the high carrying capacity at the Horizon Center. No deer hunting was permitted during the past six hunting seasons; therefore, no recent harvest records were available.

Observations indicated white-tail deer were common at the Horizon Center during 2003. Deer moved over most of the parcel. Tracks of buck, doe, and young were observed in roadways, clearings, and around water holes. Several doe with young were observed during the summer and fall months; thus, indicating a viable breeding herd of white-tail deer on the Horizon Center in 2003.

Wild Turkey – Wild turkey were re-introduced into the Oak Ridge Reservation in the mid-1980s. At that time, the Horizon Center provided prime habitat for turkey production and the population quickly expanded. The secondary succession resulting from pine beetle destruction of timber reduced prime habitat at the Horizon Center and construction of infrastructure further reduced the acres of range that support the birds. However, the increased open area for building sites and infrastructure and the increased edge along boundaries between secondary growth and mature forest increased the quality of the habitat available.

Wild turkey were seen throughout the Horizon Center in all months of the year. Several broods of young poults were observed during all seasons of 2003.

Wood Duck – Throughout the year single ducks and pairs were seen along Bear Creek and East Fork Poplar Creek. In the fall several wood ducks were observed feeding in the wetlands near the confluence of East Fork Poplar Creek with Poplar Creek. Thus, the East Fork Poplar Creek at the Horizon Center continues to provide suitable year-round habitat for wood ducks.

Mallard Duck –Breeding mallard ducks were reported in East Fork Poplar Creek in the summer of 2000 (DOE 2000). They were also heard and seen on other occasions in that summer, fall, and winter of that year. They were not seen in 2002 (DOE 2003). However, one pair of breeding mallard ducks was seen in 2003.

Northern Bobwhite – Northern bobwhite has been considered to be a declining species on the Oak Ridge Reservation (DOE 1997). There were none reported on the Horizon Center in the 1999 census, and the bobwhite population in 2000 was less than reported in the baseline study. While not common, northern bobwhite were observed in several locations on the Horizon Center in the spring and summer of 2002 and again in 2003. The increased open areas, edges, and areas in secondary succession provided habitat that supported a partial recovery of this game bird.

Ruffed Grouse – Ruffed grouse were first reported on the Horizon Center in 2002 (DOE 2003). Extensive searches were conducted for ruffed grouse during their breeding season in 2003. None were found.

5. CULTURAL RESOURCES

All known cultural resources at the Horizon Center continued to be protected. The 100-foot buffer placed around the McKamey-Carmichael and Silvey cemeteries has been maintained.

Mill sites 40RE195 (975C) and 40RE200 (939B) along East Fork Poplar Creek, including 100-foot buffers, were marked as a precaution to encroachment.

In 2003 two millstones were found in East Fork Poplar Creek at 40RE200 (939B).

6. ENVIRONMENTAL PERMITS

Lockwood Greene engineered a roadway and adjacent utility lines leading east from Novus Drive into Development Area 2. TDEC approved the water and sewer engineering plans and the City of Oak Ridge issued grading and construction permits.

7. REFERENCES

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DOE 2003A. Environmental Assessment Addendum for the Proposed Transfer of Parcel ED-1, April 2003, DOE/EA-1113-A.

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