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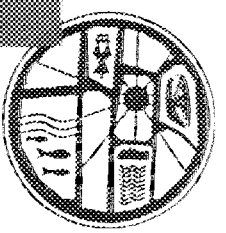
Wetland Survey of Selected Areas in the K-25 Site Area of Responsibility

B. A. Rosensteel
D. J. Awl

Environmental Sciences Division
Publication No. 4429



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MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Environmental Sciences Division

WETLAND SURVEY OF SELECTED AREAS IN THE K-25 SITE AREA OF RESPONSIBILITY

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Environmental Sciences Division
Publication No. 4429

Date Published: July 1995

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6286
managed by
LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

CONTENTS

CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AVLIS	Atomic Vapor Laser Isotope Separation
DOE	Department of Energy
ESD	Environmental Sciences Division
FAC	facultative
FACW	facultative wetland
GIS	geographic information system
HGM	Hydrogeomorphic Approach
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
OBL	obligate wetland
ORR	Oak Ridge Reservation
OU	Operable Unit
PEM1	palustrine emergent persistent wetland
PFO1	palustrine forested broad-leaved deciduous wetland
PSS1	palustrine scrub–shrub broad-leaved deciduous wetland
ROW	right-of-way
SR	State Route
TDEC	Tennessee Department of Environment and Conservation
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
WET	Wetland Evaluation Technique

ACKNOWLEDGMENTS

The authors thank Kym Campbell and Linda Mann for providing critical reviews of this document and for their excellent suggestions for improvements to the original. We also appreciate the work of the Oak Ridge K-25 site Engineering GeoData Group, which originally digitized the wetland areas and converted the data to a MapInfo format for our use. We also thank Mac Post for permission to use the Environmental Sciences Division (ESD) boats to conduct the wetland survey of Poplar Creek.

This report was prepared by the Natural Resource Analysis Group, Environmental Sciences Division, Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee, 37831, managed by Lockheed Martin Energy Systems, Inc., under contract DE-AC05-84OR21400 with the U.S. Department of Energy. Funding for this work was provided by the Water, Air, and Environmental Department of the Oak Ridge K-25 site Environmental Management Division and by the K-25 Environmental Restoration Regulatory Integration Program. Publication No. 4429, ESD, ORNL.

EXECUTIVE SUMMARY

Executive Orders 11990, Protection of Wetlands, and 11988, Floodplain Management, dated May 24, 1977, require federal agencies to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains and the destruction and modification of wetlands, and to avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative. In accordance with U.S. Department of Energy Regulations for Compliance with Floodplains/Wetlands Environmental Review Requirements (Subpart B, 10 CFR 1022.11), surveys to identify wetlands were conducted in the summer of 1994 in selected areas of the Oak Ridge K-25 site Area of Responsibility, located within the Oak Ridge Reservation. The survey area includes the main plant area of the K-25 site, the Mitchell Branch watershed, Poplar Creek, the Powerhouse area, Duct Island, the K-901 Operable Unit, the former proposed site for the Atomic Vapor Laser Isotope Separation (also known as AVLIS) facility, the K-25 South Site, and an area named, for the purposes of this report, the K-25 South Corner.

Wetlands occur in all of the areas surveyed except Duct Island and the main plant area of the K-25 site. A total of 44 wetland areas that range in size from approximately 0.13 to 4.32 ha were identified in the surveys. These wetlands occur in association with springs and seeps along stream bottomlands, in areas of seasonally high groundwater tables and surface water levels on the alluvial islands and floodplains of Poplar Creek and the Clinch River, in association with a beaver dam, and in and adjacent to areas of human impact (including utility line rights-of-way and channelized streams).

In all of the wetlands identified during the field survey, more than 50% of the vegetation species are classified as obligate wetland, facultative wetland, or facultative species. Hydrologic indicators in the wetlands include the presence of springs and seeps, free water in the soil borings at or within 25.6 cm (10 in.) of the surface, saturated soils, silted and water-stained leaf litter, and scour marks and drift lines from flooding. With the exception of two atypical wetlands located adjacent to Poplar Creek, the soils display hydric characteristics including chroma colors of 1 or 2, mottles, oxidized root channels, and manganese concretions.

The functions performed by wetlands can include floodflow alteration, sediment stabilization, sediment and toxicant reduction, nutrient transformation, production export, aquatic habitat, and wildlife diversity and abundance. Individual K-25 area wetlands probably perform some of these functions to varying degrees. However, to properly assess wetland functions, additional literature review, field investigations, and application of wetland evaluation methodologies will be necessary.

1. INTRODUCTION

Executive Orders 11990, Protection of Wetlands, and 11988, Floodplain Management, dated May 24, 1977 require federal agencies to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains and the destruction and modification of wetlands and to avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative. In accordance with U. S. Department of Energy (DOE) Regulations for Compliance with Floodplains/Wetlands Environmental Review Requirements (Subpart B, 10 CFR 1022.11), a survey was conducted during the summer of 1994 to identify wetlands in selected areas of the Oak Ridge K-25 Site Area of Responsibility, located within the Oak Ridge Reservation (ORR) (Fig. 1). The K-25 Site Area of Responsibility is that geographical area for which K-25 Site management has stewardship responsibility (Resource Management Organization 1995). As shown in Fig. 2, the surveyed areas are

1. the Mitchell Branch watershed;
2. the riparian and floodplain zone of Poplar Creek from the powerline corridor east of the Tennessee Valley Authority (TVA) Roane Substation downstream to the Clinch River confluence;
3 the Powerhouse area;
4. the K-770 Operable Unit;
5. the Duct Island interior;
6. the K-25 South Corner—The area bounded by the K-720 coal ashpile to the north, the Clinch River to the west, South First Avenue/Bear Creek Road to the east, and the TVA property boundary to the south; and
7. the K-1007-P1 Pond.

The main plant area of the K-25 site, the K-901 Operable Unit, the former proposed site for the Atomic Vapor Laser Isotope Separation (AVLIS) facility, and the K-25 South Site have had wetland surveys or wetland boundary delineations performed within the past 3 years. The findings of these surveys are also reported in this document.

A thorough assessment of wetland functions is outside of the scope of this project. However, important wetland functions are briefly discussed and a description of two wetland functional assessment methodologies is provided.

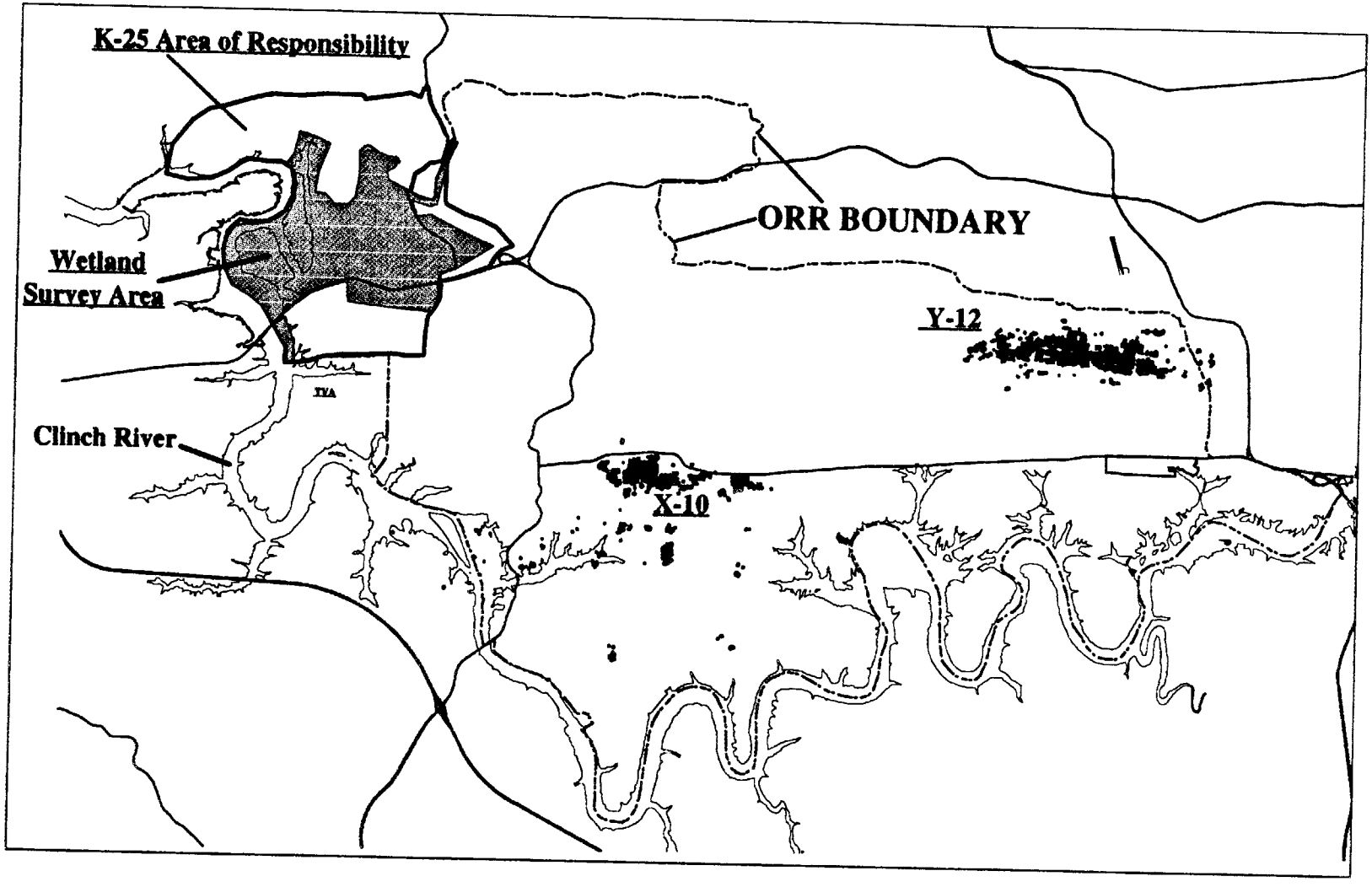


Fig. 1. Boundaries of the Oak Ridge Reservation (ORR), the K-25 Area of Responsibility, and the wetland survey area.

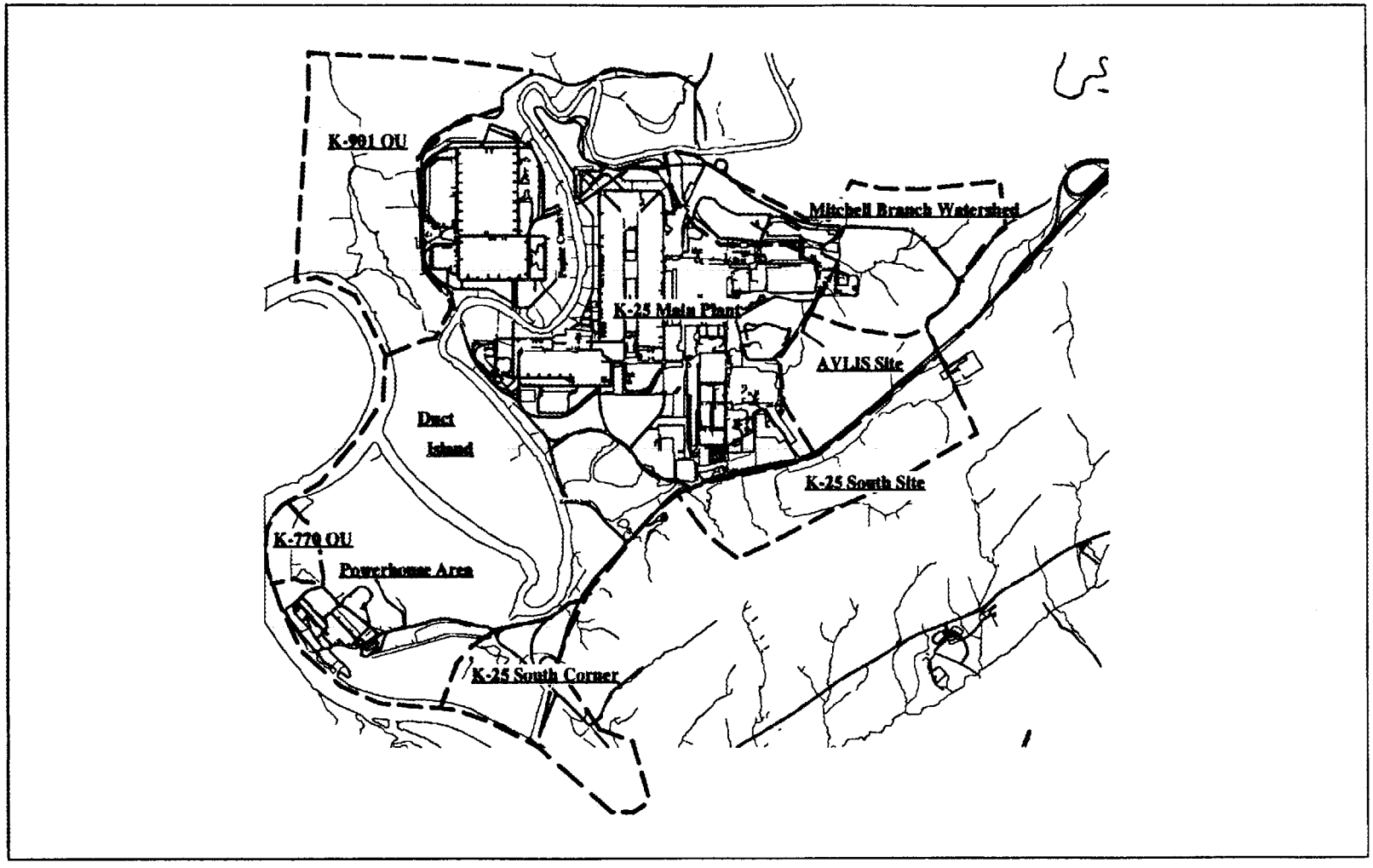


Fig. 2. Wetland survey areas in the K-25 Area of Responsibility.

2. METHODOLOGY

2.1 WETLAND IDENTIFICATION METHODOLOGY

2.1.1 The U. S. Army Corps of Engineers Wetland Delineation Methodology

As required by the Energy and Water Development Appropriations Act of 1992, wetlands are identified using the criteria and methods set forth in the Wetlands Delineation Manual [U.S. Army Corps of Engineers (USACE) 1987]. USACE defines wetlands as: "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

The USACE lists three characteristics that are diagnostic of wetlands: (1.) The vegetation is characterized by a prevalence of macrophytes typically adapted to wetland soil and hydrological conditions; (2) the substrate is undrained hydric soil; and (3) the area is inundated either permanently or periodically at depths less than 2 m (6.6 ft.), or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.

2.1.1.1 Hydrophytic Vegetation

USACE (1987) defines hydrophytic vegetation as "the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present." The U.S. Fish and Wildlife Service (Reed 1988) has developed a classification system that assigns species to wetland indicator classes according to the frequency with which a species occurs in a wetland (Table 1). If more than 50% of the vegetation in each strata (i.e., canopy, sapling/shrub, vines, herbaceous) have an indicator status of obligate (OBL), facultative wetland (FACW), and/or facultative (FAC), the vegetation is classified as hydrophytic. A positive (+) or negative (-) sign following any of the facultative indicator categories indicates, respectively, a frequency toward the higher end of the category (more frequently found in wetlands) or the lower end of the category (less frequently found in wetlands).

2.1.1.2 Hydric Soils

Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in a major part of the root zone. The following indicators are used to determine whether a given nonsandy soil meets the definition and criteria for hydric soils:

1. Organic soils. An organic soil is one in which more than 50%, by volume, of the upper 82 cm (32 in.) of soil is composed of organic soil material. Organic soils are saturated for long periods and are commonly called peats or mucks.

2. Sulfidic material. The presence of a rotten egg odor is indicative of the presence of hydrogen sulfide, which is produced only in a reducing environment (e.g., saturated, waterlogged soils).

3. Aquic or peraquic moisture regime. An aquic moisture regime is one in which the soils virtually free of dissolved oxygen because of saturation by groundwater or water of the capillary fringe. Peraquic moisture regimes are characterized by the presence of groundwater always at or near the soil surface.

4. Iron and manganese concretions. These concretions are formed during the oxidation-reduction process. Concretions less than 2 mm in diameter occurring within 7.5 cm of the surface are evidence that the soil is saturated for long periods near the surface.

5. Soil colors. Soil colors are often the most diagnostic indicator of hydric soils. Mineral hydric soils either will be gleyed (bluish, greenish, or grayish colors resulting from chemical reduction under anaerobic conditions) or will have bright mottles (speckles of oxidized iron indicative of fluctuating water table and alternating anaerobic and aerobic conditions) and a low chroma matrix.

Table 1. Plant indicator classifications and frequency of occurrence in wetlands

Classification	Occurrence in Wetlands(%)
Obligate Wetland	> 99
Facultative Wetland	67–99
Facultative	34–66
Facultative Upland	1–33
Upland	< 1

Source: P. B. Reed. 1988. National List of Plant Species That Occur in Wetlands: Tennessee. USFWS Biological Report NERC-88/18.42. U.S. Fish and Wildlife Service, Washington, D.C.

Munsell Soil Color Charts (Kollmorgen Instrument Corp. 1992) were used to determine soil colors. The Munsell notation for color consists of separate notations for hue, value, and chroma. The hues are R (red), YR (yellow-red), and Y (yellow) and refer to the soil color in relation to the primary colors (red, yellow, and blue). The hues are further defined by the numbers 2.5, 5.0, 7.5, and 10 preceding the hue designation. The numbers indicate the gradation from red through yellow within each hue, with 2.5 being more red and 10 being more yellow. The value notation refers to the lightness of the hue, and ranges from 0 (absolute black) to 10 (absolute white). Chroma refers to the strength, or saturation, of the color, and ranges from 0 (neutral gray) to 8. In writing Munsell color notations, the sequence is always hue, value, and chroma. For instance, 10YR 5/2 indicates a soil on the yellow end of the yellow-red hue, with a value of 5 (mid-range) and a chroma of 2. Each Munsell notation corresponds to a color. For example, 10YR 5/2 is grayish-brown. Mineral hydric soils have one of the following features in the horizon immediately below the A-horizon, or between 0 and 25.6 cm (10 in.), whichever is shallower: 1) a matrix chroma of 2 or less in mottled soils or 2) a matrix chroma of 1 or less in unmottled soils.

Not all of the indicators listed above can be used in sandy soils because hydric features develop more slowly in sandy soils. Soil colors, in particular, should not be used as an indicator in most sandy soils. Hydric indicators for sandy soils include

1. high organic matter content in the surface horizon,
2. streaking of subsurface horizons by organic matter; and
3. organic pans which are accumulations of organic matter at the point representing the most commonly occurring depth to the water table.

In areas of sediment mixing and deposition, such as accreting sandbars and floodplains, indicators of hydric soil may not have time to develop within the upper 25.6 cm of the soil. For the purposes of wetland determinations, these sites are treated according to guidelines for atypical situations and problem areas described in Sect. 2.1.2.

2.1.1.3 Wetland Hydrology

Of the three technical criteria, wetland hydrology is generally the least exact. Field indicators are useful for confirming wetland presence but are unreliable for delineating precise wetland boundaries. Indicators of wetland hydrology include recorded data (e.g., aerial photographs, soil surveys, floodplain delineations) and field evidence such as drainage patterns (surface scouring, absence of leaf litter, eroded soil, and drift lines), sediment deposition, watermarks, visual observation of either inundation or saturated soils or both, and oxidized rhizospheres.

2.1.2 Atypical Situations and Problem Areas

The USACE Wetlands Delineation Manual (1987) addresses atypical situations and problem areas in which one or more positive indicators of wetland presence may be absent in a wetland and describes procedures for determining if the area in question is a wetland. Atypical situations are those in which positive indicators of either hydrophytic vegetation, hydric soils, or wetland hydrology are absent because of effects of recent human activities or natural events. Atypical situations include areas in which there are unauthorized discharges requiring enforcement actions; natural events such as changing river courses, beaver dams, mudslides, and earthquakes; and human-induced wetlands that have been purposely or incidentally created by human activities. Problem areas are those "wetland types in which wetland indicators of one or more parameters may be periodically lacking due to normal seasonal or annual variations in environment conditions that result from causes other than human activities or catastrophic natural events" (USACE 1987). Problem area wetlands include seasonal wetlands (in which wetland hydrology is absent during dry seasons), prairie potholes (in which wetland hydrology is absent during dry years), and vegetated flats (in which vegetation is absent during the nongrowing season).

2.2 WETLAND CLASSIFICATION

The wetlands identified in this survey were classified according to the system developed by Cowardin et al. (1979) for wetland and deepwater habitats of the United States. This hierarchical system describes wetlands and deepwater habitats by system, class, and subclass. Additional modifers are added for water regime, chemistry, soil, and disturbances. The systems are marine, estuarine, riverine, lacustrine, and palustrine. The marine and estuarine systems are oceanic and coastal and thus do not occur on ORR. The lacustrine and riverine systems encompass freshwater lakes and rivers/streams respectively. The palustrine system includes nontidal wetlands dominated by trees, shrubs, persistent emergents, and/or emergent mosses or lichens and includes vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and pond.

The palustrine system includes five classes which are vegetated, and are thus considered as wetlands under the USACE definition (1987): (1) aquatic bed (dominated by submerged or floating plants), (2) moss–lichen, (3) emergent (dominated by herbaceous plants that rise above the water surface), (4) scrub–shrub (dominated by shrubs and saplings), and (5) forested. Subclasses of the vegetated classes indicate differences in vegetative form, such as broad-leaved or needle-leaved, deciduous or evergreen, and persistent (species that normally remain standing at least until the beginning of the next growing season) or nonpersistent (plants that fall to the surface of the substrate or below the surface of the water at the end of the growing season).

2.3 IDENTIFICATION OF UNMAPPED STREAMS

Numerous streams on ORR have not been mapped. Many of these streams may have seasonal flow only and appear to be dry channels during the summer and early fall. Although these streams do not appear on the widely used S16-A map, in most cases, the topography indicates their possible presence. Like mapped blue-line streams, these unmapped streams are subject to regulation under the Tennessee Water Control Act of 1977 (TCA 69-3-101 et seq.).

Identification of streams was based on the State of Tennessee definition of streams and wet-weather conveyances (TCA Chap. 1200-4-3-04). According to these definitions, a stream is a watercourse that supports fish and aquatic life and has a channel below the groundwater table. This definition applies even if the groundwater connection is seasonal or intermittent. Unlike streams, wet-weather conveyances do not have a groundwater connection, flow only in direct response to precipitation, and do not support fish or other aquatic life.

In some areas, primarily the portions of watersheds in which wetlands were identified, the locations of any unmapped streams or unmapped portions of blue-line streams were noted during the field surveys for later mapping. Because identification of unmapped stream locations was incidental to the main task of wetland identification, those streams mapped as a result of this survey should not be thought to represent all of the unmapped streams that may exist in the K-25 Site survey area.

2.4 FIELD SURVEY

Existing maps, reports, and other information sources were consulted to determine potential and known wetland locations (i.e., stream bottoms, floodplains, topographic depressions, anthropogenic water features). To determine wetland presence or absence and to verify the areal extent of known wetlands, wetland field surveys were conducted on foot and by boat from June through September 1994. Hydrophytic vegetation communities and evidence of wetland hydrology provided the initial indications of possible wetland presence. If the vegetation community was dominated by facultative, facultative wetland, and/or obligate wetland species or if there was evidence of wetland hydrology, soil samples were collected throughout the area to a depth of 25 to 30 cm (10 to 12 in.) and were examined for hydric soil characteristics.

If the soils were hydric, soil samples from adjacent upland areas were examined for presence or absence of hydric characteristics. The approximate wetland boundary was considered to be at the interface between the hydric and nonhydric soils. If hydric soil indicators were not present because of an atypical situation, the boundary determination was based on changes in topography, vegetation community, and hydrologic indicators.

The wetland boundaries identified during this survey were not physically marked (i.e., with flagging or stakes) in the field and were not located by engineering (e.g., civil) survey or other ground location method (i.e., Global Positioning System). Therefore, except where otherwise noted, the wetland boundary locations and sizes are approximate.

The mapped wetlands are identified with codes of letters, numbers, or both. Each code refers to the watershed the wetland is in, the nearest body of water, or the given name for a particular project site. The codes are as follows:

- Mit: Mitchell Branch
- CR: Clinch River
- PC: Poplar Creek
- 770: K-770 Operable Unit
- P1: K-1007-P1 Pond
- 901: K-901 Operable Unit
- AV: AVLIS site

Wetlands are given a particular code designation and then sequentially numbered. For instance, the first wetland at the downstream end of Poplar Creek is PC-1, and a wetland in the catchment that drains to the K-1007-P1 Pond is designated as P1-2.

The naming of the streams referred to in this report follows no particular system because, to date, a stream-naming convention for ORR has not been fully developed or distributed. Therefore, each stream is referred to an abbreviation if the stream has a well-known name such as Mitchell Branch. The abbreviation is followed by a lower case letter if the stream is a tributary of a main stream (e.g., Mit-a) or simply by ST for unnamed Clinch River tributaries. This information can be updated in the future if a reservation-wide stream nomenclature system is developed.

3. WETLAND SURVEY FINDINGS

3.1 OVERVIEW

Forty-four separate wetland areas, ranging in approximate size from 0.13 to 4.23 ha, were identified in the selected areas of the K-25 Area of Responsibility. Wetlands were identified in all of the areas surveyed except the interior of Duct Island Peninsula and the main plant area of the K-25 Site. All of the areas identified as wetland support a hydrophytic vegetation community and have wetland hydrology. Hydrologic indicators include the presence of seeps and springs, saturated soil or free water or both in the soil borings at or within 25.6 cm (10 in.) of the surface, silted and water-stained leaf litter, scour marks, and drift lines. Characteristics of the soils found in the wetlands include matrix chromas of 1 and 2, mottles, oxidized root channels, and manganese concretions. Atypical situations or problem areas, in which the hydric soil criterion was absent, were identified in two locations in the Poplar Creek floodplain.

A system developed by Cowardin et al. (1979) was used to classify all wetlands identified during the field survey (Table 2). The wetlands identified were classified as palustrine emergent persistent (PEM1), palustrine scrub–shrub broad-leaved deciduous (PSS1), and palustrine forested broad-leaved deciduous (PFO1). Dominant and commonly occurring species identified in the wetlands are listed with their indicator classifications (Reed 1988) in Table 3.

3.2 MITCHELL BRANCH

3.2.1 General Findings

In the Mitchell Branch watershed, wetlands were identified in utility rights-of-way, on the margins of streams in disturbed or developed areas, at a spring near the 1407 Ponds, and in the forested areas in the Mitchell Branch headwater area (Fig. 3). The soils in the wetlands are gray and dark gray (10YR 6/1, 5/1, and 4/1, and 7.5YR 4/1), grayish brown (10YR 5/2), and dark grayish brown (10YR 4/2), and contain brown and yellowish-red mottles and manganese concretions. A dark gray to black, silty organic muck was found in one wetland area. The soils in the relatively undisturbed forested areas are silt loams, sandy silt loams, clay loams, and silty clays. In some developed and disturbed areas, the soil contains a higher percentage of clay and, where erosion from roadbanks and other filled areas has occurred, a larger proportion of gravel or other stone fragments than in undisturbed areas. Hydrologic evidence includes free water in the soil borings, flowing and ponded water, bare soils and scour marks (indicative of ponded water and flooding), silted leaves, and oxidized root channels. The following documentation of Mitchell

Table 2. Wetland Classification[a] for wetlands in the K-25 Area of Responsibility[b]

System	Subsystem	Class	Subclass
Palustrine	None	Emergent	1. Persistent 2. Nonpersistent
		Scrub–Shrub	1. Broad-leaved deciduous
		Forested	1. Broad-leaved deciduous

[a] This classification system is based on the Cowardin system. Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.

[b] This table lists only those system, subsystems, classes, and subclasses for which vegetated wetland examples were identified in the K-25 Area of Responsibility. The palustrine system also includes nonvegetated classes that are not addressed by the wetland definition and identification methods used in this study. The Cowardin classification also includes marine, estuarine, riverine, and lacustrine systems.

Branch wetlands is divided into three sections: (1) the headwaters of Mitchell Branch and of a tributary stream, Mit-a; (2) all other tributary streams; and (3) Mitchell Branch from tributary stream Mit-e to the Poplar Creek confluence.

3.2.2 Mitchell Branch and Tributary Stream Mit-a

Wetland areas Mit-7 and Mit-a2 are located in the riparian zones of Mitchell Branch and Mitchell Branch tributary stream Mit-a in their respective headwater areas north and east of Blair Road (Fig. 3). The wetland areas include both PFO1 and PEM1 wetlands. The PFO1 wetlands encompass the headwater areas of both streams and extend downstream to a cleared utility line right-of-way, where they adjoin PEM1 wetlands that have developed in the right-of-way following tree removal. The dominant species in the PFO1 wetlands include red maple, sycamore, green ash, tulip poplar, alder, silky dogwood, poison ivy, microstegium, leafy bulrush, and fowl manna grass. Commonly occurring species in the PEM1 wetlands and parts of the PFO1 wetlands include black willow, buttonbush, seedbox, soft rush, sallow sedge, monkeyflower, bulrush, false nettle, bugleweed, fox sedge, grass-leaf rush, American potato-bean, and arrowleaf tearthumb.

Table 3. List of plant species and their wetland indicator classifications identifiedduring the wetland survey of selected areas in the K-25 Site Area of Responsibility, June–August 1994.

Common name	Scientific name	Regional Indicator[a]
American elm	*Ulmus americanus*	FACW
Bald cypress	*Taxodium distichum*	OBL
Black willow	*Salix nigra*	OBL
Box elder	*Acer negundo*	FACW
Cottonwood	*Populus deltoides*	FAC+
Green ash	*Fraxinus pennsylvanica*	FACW
Hackberry	*Celtis occidentalis*	FACU
Loblolly pine	*Pinus taeda*	FAC
Red maple	*Acer rubrum*	FAC
Slippery elm	*Ulmus rubra*	FAC
Swamp white oak	*Quercus bicolor*	FACW+
Sweetgum	*Liquidambar styriciflua*	FAC
Sycamore	*Platanus occidentalis*	FACW-
Tulip poplar	*Liriodendron tulipifera*	FAC
Winged elm	*Ulmus alata*	FACU+
Buttonbush	*Cephalanthus occidentalis*	OBL
Elderberry	*Sambucus canadensis*	FACW-
False indigobush	*Amorpha fruticosa*	FACW
Privet	*Ligustrum vulgare*	not listed
Silky dogwood	*Cornus amomum*	FACW+
Smooth alder	*Alnus serrulata*	FACW+
American potato-bean	*Apios americana*	FACW
Hog peanut	*Amphicarpaea bracteata*	FAC
Japanese honeysuckle	*Lonicera japonica*	FAC-
Poison ivy	*Toxicodendron radicans*	FAC
Sensitive fern	*Onoclea sensibilis*	FACW
Fowl manna grass	*Glyceria striata*	OBL
Indian sea-oats	*Chasmanthium latifolium*	FAC-
Microstegium	*Eulalia viminea*	FAC+
Rice cutgrass	*Leersia oryzoides*	OBL
Virginia wild rye	*Elymus virginicus*	FAC
Grass-leaf rush	*Juncus marginatus*	FACW

Table 3 (continued)

Common name	Scientific name	Regional indicator[a]
Soft rush	*Juncus effusus*	FACW+
Green bulrush	*Scirpus atrovirens*	OBL
Leafy bulrush	*Scirpus polyphyllus*	OBL
Woolgrass	*Scirpus cyperinus*	OBL
Blunt broomsedge	*Carex tribuloides*	FACW+
Fox sedge	*Carex vulpinoidea*	OBL
Frank's sedge	*Carex frankii*	OBL
Fringed sedge	*Carex crinita*	OBL
Sallow sedge	*Carex lurida*	OBL
Smooth sheath sedge	*Carex laevivaginata*	OBL
Stalk-grain sedge	*Carex stipata*	OBL
Many-flower flatsedge	*Cyperus lancastriensis*	FAC
Straw-color flatsedge	*Cyperus strigosa*	FACW
Yellow flatsedge	*Cyperus flavescens*	OBL
Blunt spikerush	*Eleocharis obtusa*	OBL
Creeping spikerush	*Eleocharis palustris*	OBL
American germander	*Teucrium canadense*	FACW-
Arrowleaf tearthumb	*Polygonum sagittatum*	OBL
Broad-leaf arrowhead	*Sagittaria latifolia*	OBL
Bugleweed	*Lycopus virginicus*	OBL
Bushy St. John's-wort	*Hypericum densiflorum*	FACW-
Canada wood-nettle	*Laportea canadensis*	FACW
Cardinal flower	*Lobelia cardinalis*	OBL
Cattail	*Typha latifolia*	OBL
Creeping jennie	*Lysimachia nummularia*	FACW+
Curly dock	*Rumex crispus*	FAC
Cut-leaved water horehound	*Lycopus americanus*	OBL
Dotted smartweed	*Polygonum punctatum*	FACW+
Dotted St. John's-wort	*Hypericum punctatum*	FAC
False nettle	*Boehmeria cylindrica*	FACW+
Goldenglow	*Rudbeckia laciniata*	FACW
Green dragon	*Arisaema dracontium*	FACW
Halberd-leaved rosemallow	*Hibiscus laevis*	OBL
Honewort	*Cryptotaenia canadensis*	FAC+

Table 3 (continued)

Common name	Scientific name	Regional Indicator[a]
Ironweed	*Vernonia noveboracensis*	FAC+
Jewelweed	*Impatiens capensis*	FACW
Lance leaf frog-fruit	*Phyla lanceolata*	FACW+
Lance-leaf loosestrife	*Lysimachia lanceolata*	FAC
Late-flowering thoroughwort	*Eupatorium serotinum*	FAC
Marsh bedstraw	*Galium tinctorium*	FACW
Mistflower	*Conoclinium coelestinum*	FAC
Seedbox	*Ludwigia sp.*	OBL
Slender St. John's-wort	*Hypericum mutilum*	FACW
Smooth hedge-nettle	*Stachys tenuifolia*	FACW-
Spotted joe-pye weed	*Eupatoriadelphus maculatus*	FACW-
Spotted water hemlock	*Cicuta maculata*	OBL
Spreading dayflower	*Commelina diffusa*	FACW
Square-stemmed monkeyflower	*Mimulus ringens*	OBL
Swamp milkweed	*Asclepias incarnata*	OBL
Swamp smartweed	*Polygonum hydropiperoides*	OBL
Swamp rosemallow	*Hibiscus moscheutos*	OBL
Three-lobe beggar-ticks	*Bidens tripartita*	OBL
Virginia knotweed	*Polygonum virginianum*	FAC
Water pimpernel	*Samolus parviflorus*	OBL
White avens	*Geum canadense*	FAC
Wingstem	*Verbesina alternifolia*	FAC

[a] Regional indicators are from Reed, P. B. 1988. National list of plant species that occur in wetlands: Tennessee. USFWS Biological Report NERC-88/18.42. U.S Fish and Wildlife Service, Washington, D.C. The indicator classification is based on the frequency with which a species occurs in a wetland habitat. A positive (+) or negative (-) sign following any of the facultative indicator categories indicates, respectively, a frequency toward the higher end of the category (more frequently found in wetlands) or the lower end of the category (less frequently found in wetlands).

Classification	Occurrence in wetlands (%)
Obligate (OBL)	>99
Facultative wetland (FACW)	67–99
Facultative (FAC)	34–66
Facultative Upland (FACU)	1–33
Upland (UPL)	<1

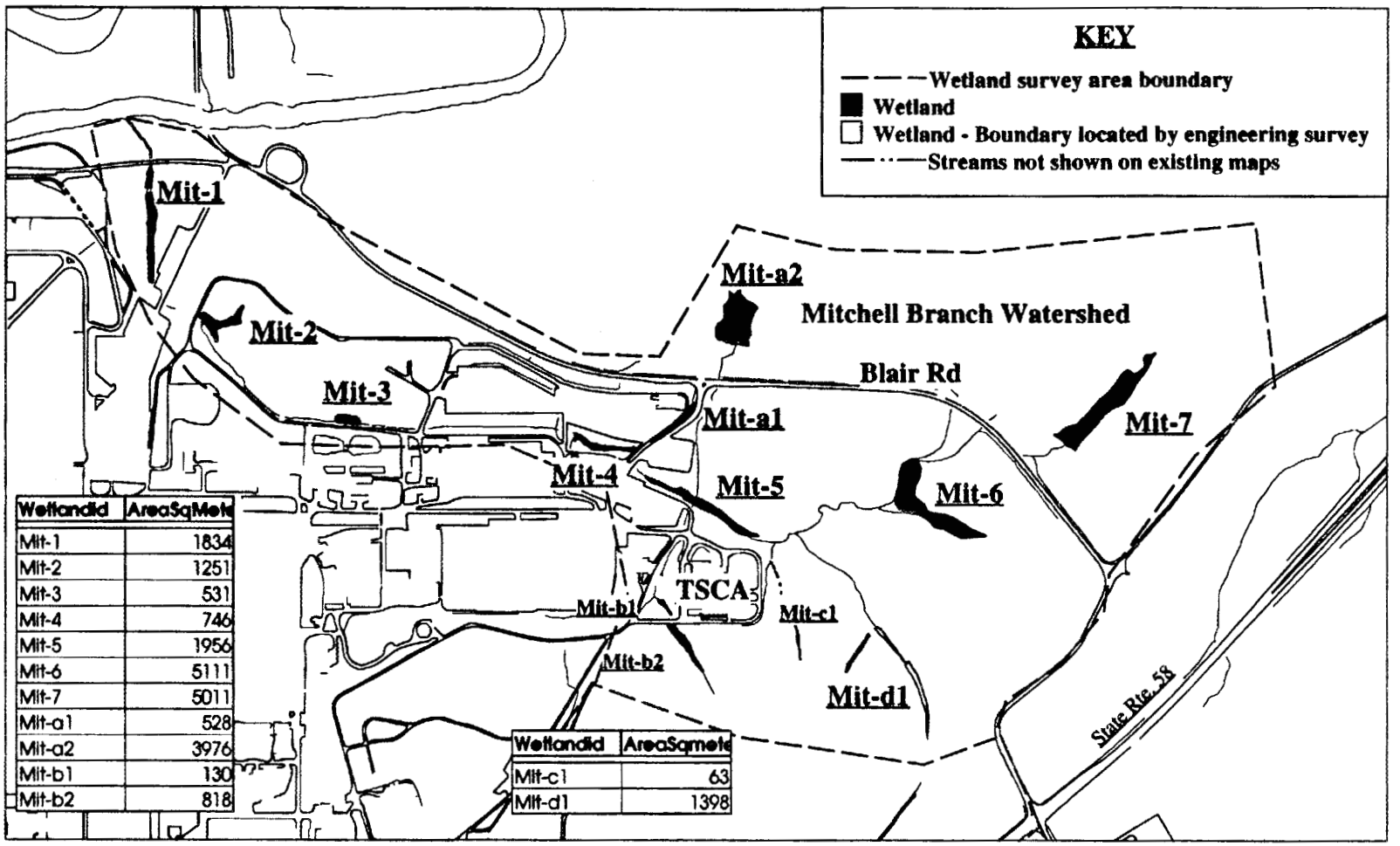


Fig. 3. Wetlands in the Mitchell Branch watershed.

(Wetland field surveys were conducted from June through September 1994.)

3.2.3 Tributaries of Mitchell Branch from Blair Road to the Portal 5 access road

3.2.3.1 Tributary Mit-a

Downstream of the Blair Road culvert, tributary Mit-a is immediately diverted through a culvert under the Portal 5 access road. Between the Portal 5 access road culvert and Mitchell Branch, Mit-a has been altered owing to surrounding development and is currently a shallow channel that flows through a narrow (2 to 5 m) sward between the Portal 5 access road and a chain-link fence that surrounds a developed area. This reach of the stream supports a PEM1 wetland, Mit-a1. The soil in and adjacent to the stream channel was saturated in mid-summer (the normal dry season) when the survey was conducted. The presence of flowing water during the normally dry season indicates that the stream is perennial and thus has the potential to support obligate and facultative wetland vegetation species. The area is planted in grass and had been mowed before the field survey was conducted; therefore, identification of other plant species was not possible. Mit-a1 is an atypical situation wetland due to the human-induced absence (routine mowing) of hydrophytic vegetation.

3.2.3.2 Tributaries Mit-b, Mit-c, Mit-d, and Mit-e

Between Blair Road and the Toxic Substances Control Act (TSCA) incinerator facility, Mitchell Branch flows through recently logged loblolly pine areas and immature pine and hardwood forest. Four tributary streams enter Mitchell Branch from the south.

Three tributary streams (Mit-b, Mit-c, and Mit-d) start at springs in steep-sided, forested ravines on the former AVLIS site. The upper reaches of all three of the tributaries are located in relatively undisturbed forested areas. The downstream reach of stream Mit-b is located within the TSCA facility fence. Downstream of the TSCA facility, Mit-b is piped to Mitchell Branch. The downstream reaches of Mit-c and Mit-d flow through areas logged in late 1993 and enter Mitchell Branch upstream of the TSCA incinerator facility.

Along Mit-b is a PEM1 wetland in a small area inside the TSCA facility fence. The streamside area has been planted with grass and is routinely mowed; however, the wetland also supports the growth of sedges (Cyperus spp.; OBL or FACW) and spikerush (Eleocharis sp.; OBL).

The forested, upstream reaches of Mit-b, Mit-c, and Mit-d support PFO1 wetlands Mit-b2, Mit-c1, and Mit-d1, respectively (Fig. 3). The PFO1 wetlands are dominated by red maple, sweetgum, green ash, silky dogwood, ironwood, microstegium, and sedges. The PFO1 wetland grades into a PSS1 wetland in the upstream reach of Mit-d. The dominant species in the PSS1 wetland include sweetgum and red maple saplings, jewelweed, curly dock, rushes, fowl manna grass, false nettle, hog peanut, leafy bulrush, and several species of sedge. There are no wetlands along the downstream (logged area) reaches of Mit-c or

Mit-d. The Mit-c and Mit-d wetlands were delineated and located by civil survey during an earlier wetland survey project thus, the actual wetland boundaries and areal size are shown for these wetlands.

As shown in Fig. 3, three separate areas in the Mit-d drainage have been designated as as a single wetland area, Mit-d1. Two of the wetland areas are located in the Mit-d bottomland and are separated by a portion of an old railroad bed that was cut through the stream area and hillside many years ago. The upstream wetland is within the cut banks of the railroad bed and is fed by numerous seeps that discharge from the base of the banks. The downstream wetland is located in a portion of the stream bottom that was not directly disturbed by the railroad construction. The third wetland area is located along a small tributary of Mit-d. The area around the tributary confluence with Mit-d was disturbed by logging activities, including complete vegetation clearing and a logging road, in 1993. Because these three areas may have been one contiguous wetland prior to land disturbance, they are considered in this survey as a single wetland area, although no connections have been ascertained as yet due primarily to the extent of the logging disturbance. To determine a precise wetland boundary and connections between the three wetland areas would require following the delineation procedures for atypical situation wetlands (USACE 1987).

A short distance downstream from Blair Road, Mitchell Branch is joined by intermittent tributary stream Mit-e. Tributary Mit-e is a shallow, intermittent, heavily silted channel that is fed by springs and seeps. Within a narrow area surrounding Mit-e and a portion of the Mitchell Branch floodplain and riparian zone is wetland Mit-6. The dominant species include elm, red maple, green ash, alder, elderberry, silky dogwood, microstegium, false nettle, bugleweed, poison ivy, soft rush, and sedges. Wetland classification and a wetland boundary determination in this wetland was difficult because the vegetation communities and soils had been disturbed by logging in 1993–94. The approximate boundary of the wetland area has been mapped, based primarily on existing vegetation, a small number of soil samples, and site topography. However, the delineation of a precise wetland boundary would require the procedures for atypical situation wetlands because of the human-induced disturbances of vegetation and soils. Logging slash is in part of the area, and logging vehicles had crossed through an area of saturated soils in the upstream end of the wetland. Direct impacts to the wetland and Mit-e include soil compaction and minor alteration of surface flow patterns. Indirect impacts incurred at the time of logging may have included an increase in soil erosion to Mitchell Branch.

3.2.4 Mitchell Branch from Tributary Mit-e to Poplar Creek

Between Mit-e and the TSCA facility, Mitchell Branch flows through a wooded area that has been altered in the past by activities including planting pine plantations, logging, and depositing fill soils to accommodate development of adjacent land. Mitchell Branch, from the TSCA facility area downstream to the Poplar Creek confluence, flows through a

developed portion of the K-25 Site. Five wetland areas (Mit-1 to Mit-5) were identified adjacent to the mainstem of Mitchell Branch in this reach.

Mit-5, a PSS1 wetland, is located in a forested area along Mitchell Branch adjacent to the TSCA facility. The wetland occurs on low-elevation alluvial shelves and seep areas along the stream channel, which is shallower in this reach than it is in adjacent upstream and downstream reaches. The maximum width of the Mit-5 wetland is approximately 8 m. The dominant or commonly occurring species include red maple and green ash saplings, smooth alder, silky dogwood, ironwood, hog peanut, fowl manna grass, leafy bulrush, and microstegium.

Mit-4, a PEM1 wetland, is located on the banks of Mitchell Branch between the Portal 6 access road and an internal K-25 Site plant road (between stormwater outfalls 152 and 150). The Mit-4 wetland is from one to several meters wide and occurs on level areas immediately adjacent to the stream. Species include black willow saplings, smooth alder, soft rush, jewelweed, ironweed, cattail, and bulrush. The soil, which has been disturbed in the past, consists of a light gray or white (10YR 8/1) heavy clay. In the vicinity of stormwater outfall 150, there is a very dark grayish-brown (10YR 3/2) silt layer over stone riprap.

Mit-3, which is also a PEM1 wetland, has formed at a new spring located between Mitchell Branch and the K-1407 ponds. This is a new spring first observed in the fall of 1993. The area around the spring is saturated or inundated and supports numerous hydrophytic plant species, including black willow, bulrush, jewelweed, cattail, horsetail, ironweed, fox sedge, soft rush, and peppermint.

Mit-2, a PSS1 wetland, is located at the bottom of a steep bank adjacent to the 1417 Area Patrol Road downslope of stormwater outfalls 192 and 194. Mit-2 is surrounded by road fills and other highly disturbed fill areas. The surface of the wetland was inundated when it was observed on several dates in the spring and early summer of 1994. The primary source of water is groundwater seeps. Vegetation species in the wetland include black willow, green ash (some of which initially appeared to be dead but were producing new leaves on some branches), silky dogwood, rice cutgrass, and smartweeds. The flooded soils were a very dark gray or black silty organic muck.

Another PSS1 wetland, Mit-1, occurs on the narrow banks of Mitchell Branch in the reach between the Portal 5 access road and the K1700 sampling station. In this reach, the stream is flanked by low, steep sideslopes. The wetland area occurs in the narrow margin between the bottom of the sideslopes and the stream channel. Within the area mapped as a wetland, an area in which the stream channel bank and sideslopes are steep includes nonwetland patches; however, these patches were too small (approximately 3–4 m) to exclude from the wetland area at the map scale used. The wetland vegetation includes box elder, green ash, and black willow saplings, smooth alder, sallow sedge, and cattail.

3.3 POPLAR CREEK

3.3.1 General Findings

During initial field reconnaissance in the Poplar Creek area, surveyors determined that the upper boundaries of the wetlands were approximately delimited by the 744-ft elevation contour. The wetland survey was conducted by boat. Narrow, shallow areas that were mostly or entirely visible from the water were scanned from the boat. If a boat landing was possible, the areas that could not be adequately observed and described from the boat were groundchecked at several points to identify vegetation and hydrologic evidence and to sample soils. Two wetland areas were not fully accessible by boat (because of shallow water) or on foot (because of dense vegetation). The approximate boundary of these wetlands was estimated to occur along the 744-ft elevation contour.

Wetlands along Poplar Creek include PFO1 wetlands on the Poplar Creek floodplain, terraces, and alluvial islands. They also include PSS1 and PEM1 wetlands on alluvial islands, in creek backwater areas, and in powerline rights-of-way along tributary streams (Figs. 4 and 5). Wetland hydrology is provided by groundwater springs and seeps, by streambank overflow, and by inundation caused by the fluctuating water levels of Watts Bar Lake. The Poplar Creek wetlands support numerous plant species, including black willow, box elder, sycamore, green ash, American elm, buttonbush, silky dogwood, alder, false nettle, smartweeds, St. John's-worts, goldenglow, loosestrifes, and numerous sedges. Most of the soils in the wetlands appear to be alluvial in origin, and most contain a high percentage of sand. Soil textures include sandy loam, very sandy silt loam, and silt loam. With the exception of two areas that include atypical situations (described in Sect. 3.3.2), the wetlands have soil chromas of 1 and 2 with varying percentages of mottling.

3.3.2 Downstream Section of Poplar Creek

The downstream section of Poplar Creek in the K-25 Area includes the floodplain and riparian zone from the Clinch River upstream to the K-1250-3 bridge. Eight wetland areas (PC1–PC8) were identified in this section (Fig. 4).

On the downstream end of a small, wooded island in the Clinch River at the Poplar Creek confluence, a PSS1 wetland, PC-1, is located. The downstream end of the island is at a lower elevation than the upstream end and may be inundated at certain times of the year. Vegetation species include sycamore, red maple, black willow, smooth alder, and silky dogwood.

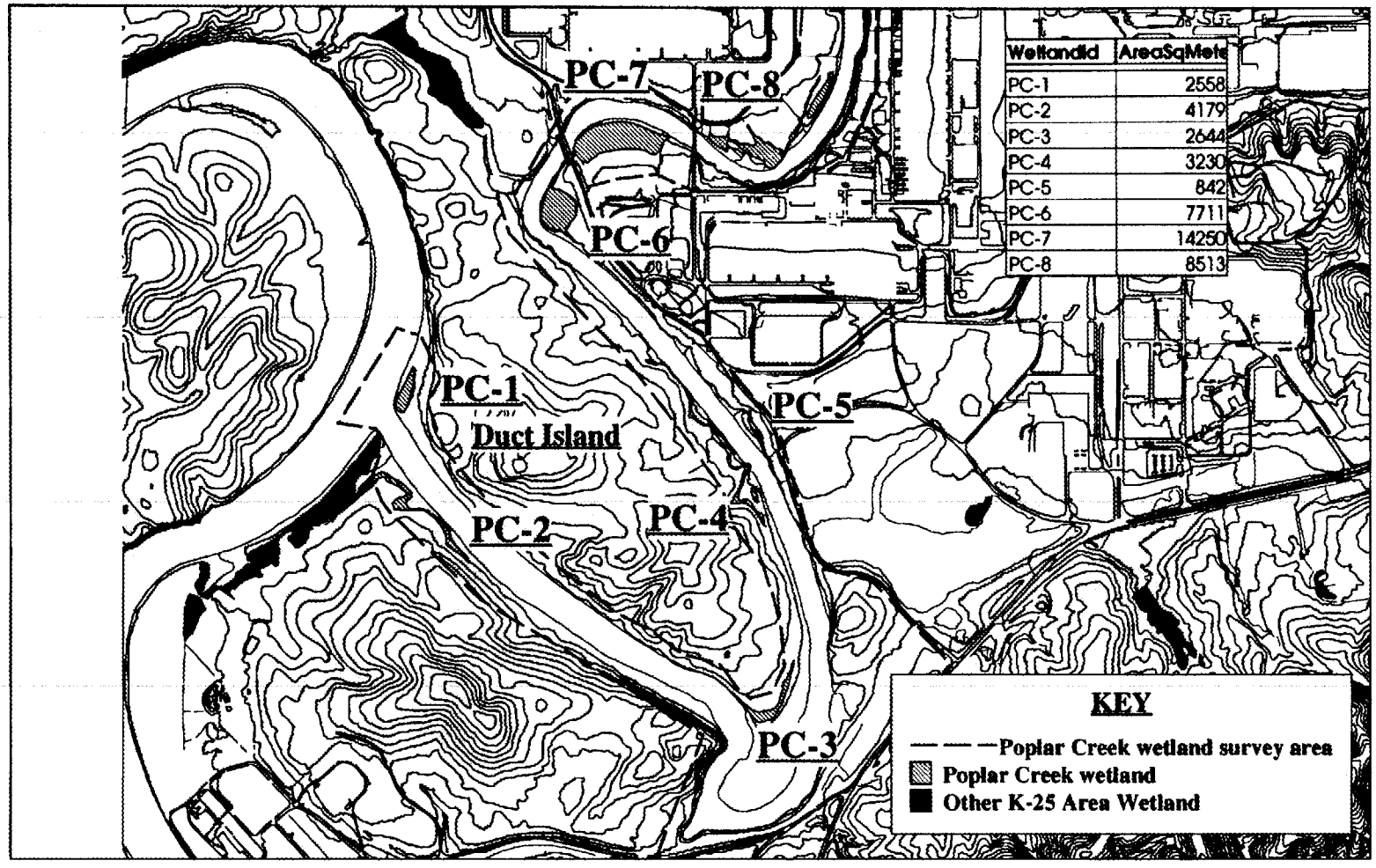


Fig. 4. Wetlands in the downstream section of the Poplar Creek floodplain and riparian zone in the K-25 Area of Responsibility.

(Wetland field surveys were conducted from June through September 1994.)

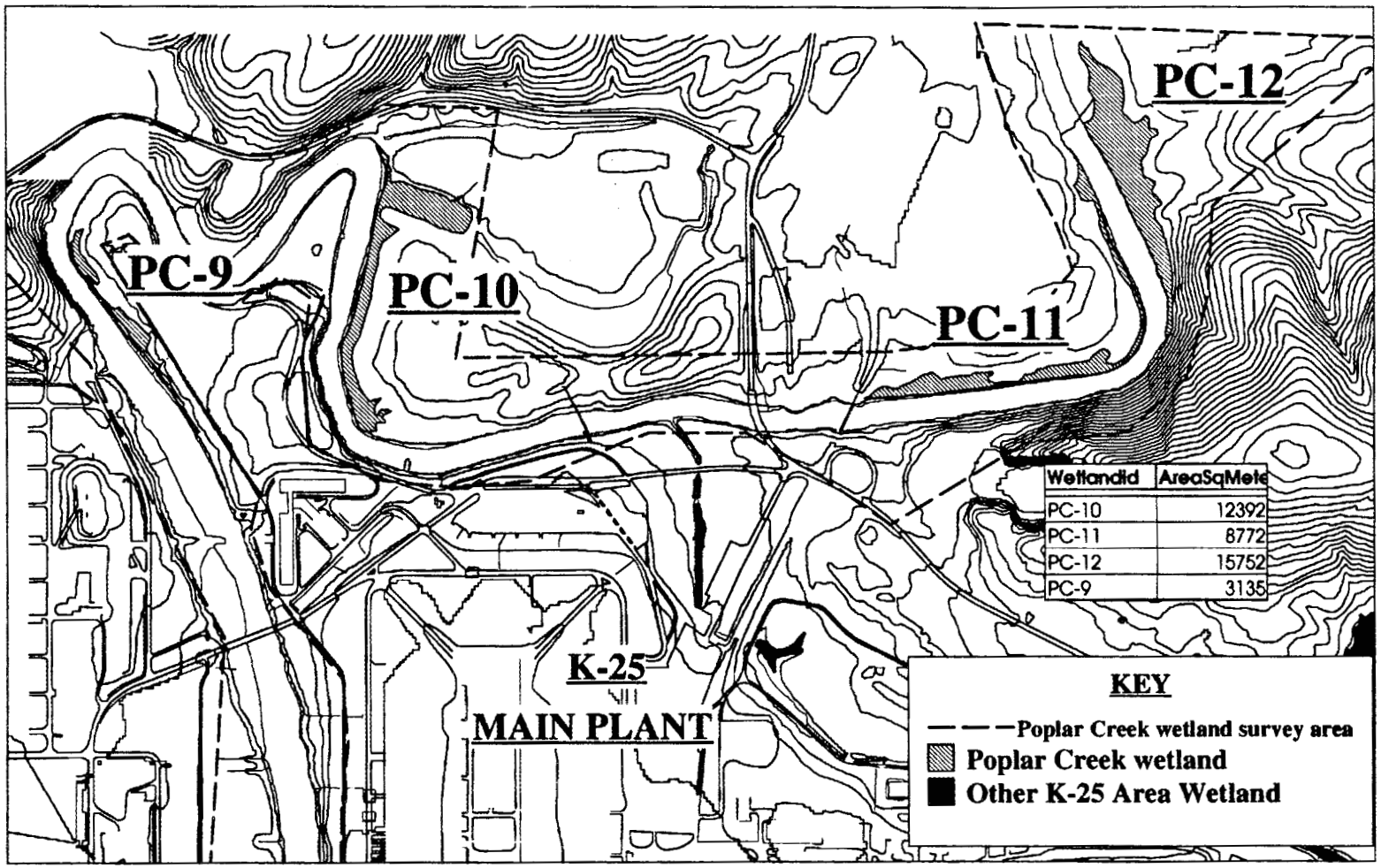


Fig. 5. Wetlands in the upstream section of the Poplar Creek floodplain and riparian zone in the K-25 Area of Responsibility

(Wetland field surveys were conducted from June through September 1994.)

PC-2 consists of a PSS1 wetland located on the shoreline of the creek at the base of a moderately steep, pine-dominated slope. The dominant vegetation species are silky dogwood and sedges. Wetlands that occur in narrow bands along the margins of a waterbody are sometimes referred to as "fringe" wetlands. The PC-2 fringe wetland is connected to a large wetland on the Clinch River floodplain that extends from Poplar Creek to the K-770 OU (Sect. 3.4).

PSS1 and PEM1 wetlands, PC-4 and PC-5, were identified in the vicinity of the West Perimeter Road boat ramp. Wetland PC-4 is on the margins of Duct Island and is within a powerline right-of-way. This wetland area includes PSS1 and PEM1 wetlands on an alluvial island and the seasonally flooded PEM1 that lies between this island and the Poplar Creek bank. Wetland PC-5 is a PEM1 wetland along the stream fringes of the north shoreline. Both wetlands are saturated or inundated in the growing season owing to water-level fluctuations of the Clinch River. The dominant species include black willow saplings, silky dogwood, ironweed, smartweeds, monkeyflower, spreading dayflower, and numerous species of sedge.

Wetland PC-6 is located between Poplar Creek and West Perimeter Road (downstream from the Perimeter Road bridge) on a tract of land shaped roughly like a half-circle. It consists of PSS1 and PEM1 wetlands in a backwater inlet. Dense herbaceous and shrubby vegetation grows in the shallow water of the inlet and on small alluvial islands. This area is saturated or inundated during the growing season. The dominant species include black willow, sycamore, box elder, green ash, woolgrass, false nettle, joepyeweed, and indian sea-oats.

The PC-7 wetland area is located between the Perimeter Road bridge and the Avenue S bridge on a floodplain that has been disturbed in the past. Vegetation species include cottonwood, sycamore, green ash, box elder, joepyeweed, false nettle, cardinal flower, Virginia wild-rye, greenbriar, mistflower, Frank's sedge, American potato-bean (this species is also known by the common name, groundnut), jewelweed, spreading dayflower, and several species of sedge. There are drainage patterns and water-stained leaves, both indicative of flowing or ponded water.

Two floodplain areas, PC-3 and PC-8, were identified as atypical situations. Atypical situations are ones in which positive indicators of the three wetland criteria cannot be found owing to effects of recent human activities or natural events (USACE 1987). PC-8 is located in the Poplar Creek floodplain near the water tower and PC-3 is located at the tip of the Duct Island Peninsula. Although these two floodplain areas display a dominance of hydrophytic vegetation and evidence of wetland hydrology (e.g., drainage patterns, drift lines, and bare soils), the soil lacks hydric characteristics. Vegetation species include box elder, green ash, American elm, hackberry, sycamore, wingstem, jewelweed, privet, green dragon, false nettle, smartweed, cardinal flower, and spotted water hemlock. The soils, however, are well-drained, very sandy silt loams that have not developed hydric soil

characteristics within the top 25.6 cm (10 in.) of the soil profile. In spite of favorable hydrology, hydric soil characteristics do not develop in some floodplain areas because of the pattern of deposition and soil movement in floodplains and the soil type and texture (i.e., the slower development of hydric soil characteristics in sandy soil). These two areas have been included in the wetlands mapping because their floodplain functions, which could include attenuation of storm runoff and removal of particulates and contaminants, place them in the category of "critical environmental areas" for which protection from disturbance or degradation is warranted.

In addition to the floodplain area described as an atypical situation in the preceding paragraph, PC-8 includes PSS1 and PEM1 wetlands on two alluvial islands within Poplar Creek and on the seasonally flooded mudflats that separate these islands from the mainland. The dominant vegetation species in this part of the PC-8 wetland include green ash, box elder, black willow, buttonbush, ironweed, false nettle, hog peanut, potato-bean, joepyeweed, cardinal flower, Virginia wild-rye, and creeping jennie.

3.3.3 Upstream Section of Poplar Creek

Four wetland areas, PC9–PC12, were identified in the upstream section of Poplar Creek, which includes the floodplain and riparian zone from the K-1250-3 bridge to the mouth of East Fork Poplar Creek (Fig. 5).

A backwater inlet, alluvial islands, and mudflats support PEM1 and PSS1 wetlands on the south side of the 1064 peninsula in wetland area PC-9. PEM1 and PSS1 wetlands are located along the shoreline, on alluvial islands, in the Poplar Creek floodplain, and in association with tributary streams in the PC-10 and PC-12 wetland areas. The PC-10 wetland area also includes PFO1 wetlands in the floodplain between loblolly pine plantations and the Poplar Creek shore. Those portions of the PC-10 and PC-12 wetlands associated with tributary streams are located within a wide powerline right-of-way. Visual observations were made from the boat; however, because access to these areas was limited by dense vegetation, shallow water, and/or time limitations, these areas were not entered to obtain soil samples or to describe the vegetation and hydrology. The wetland characterization is therefore taken from those areas closest to the shoreline. The PC-8, PC-10, and PC-12 wetland areas support numerous plant species, including sycamore, box elder, green ash, red maple, smooth alder, buttonbush, silky dogwood, jewelweed, rice cut-grass, bugleweed, potato-bean, spotted water hemlock, creeping jennie, smartweeds, late-flowering thoroughwort, joe-pye weed, spreading dayflower, and numerous sedges.

A PFO1 wetland, PC-11, was identified on a Poplar Creek terrace. The wetland area is several feet higher in elevation than that of Poplar Creek, and part of it is on a slight slope. This would suggest that the area would be a well- to moderately well-drained upland river terrace. However, there is a perched water table that has resulted in hydric soils and a dominant vegetation community that is classified as hydrophytic. Vegetation species

include green ash, box elder, silky dogwood, American elm, privet, goldenglow, creeping jennie, false nettle, potato-bean, and spreading dayflower. The soil in the A-horizon is a dark grayish-brown (10YR 4/2) silt loam with faint mottles. Hydrologic evidence includes areas of scoured soil, surface drainage patterns, and silted leaf litter.

3.4 POWERHOUSE AREA

The Powerhouse area is on a wide peninsula that is surrounded on three sides by the Clinch River and Poplar Creek (Fig. 2). The peninsula includes the old Powerhouse facilities, the K-720 area, the K-770 OU, and surrounding undeveloped areas. For the purposes of this survey, the K-720 coal ash pile was considered as the southeastern boundary of the Powerhouse area. The K-770 OU is addressed as a separate area in Sect. 3.5 of this report.

One wetland area, CR-1, was identified in the Powerhouse area (Fig. 6). CR-1 is located on the Clinch River floodplain on the northwestern tip of the peninsula. Preliminary observations from a distance (from a boat on the Clinch River and Poplar Creek) combined with the knowledge of the land elevation in the area suggested that wetlands might be present on the northwestern tip of the peninsula. However, because land access to this site was limited by several factors including the presence of fences, the density of the vegetation, and possible safety concerns, only a limited area was groundchecked. The ground check of an area between the top of the river bank [approximate elevation 740-ft National Geodetic Vertical Datum (NGVD)] and an elevation of approximately 744-ft NGVD (as estimated from 2-ft contour field maps) confirmed that PSS1 and PEM1 wetlands are present in this area. The soil is a grayish brown (10YR 5/2) and gray (10YR 6/1) sandy silt loam with mottles and manganese concretions. Common vegetation species include cottonwood, box elder, sycamore, alder, black willow, false indigobush, privet, lance-leaf loosestrife, dotted smartweed, false nettle, and sedges. Signs of recent beaver activity in this area included felled trees stripped of branches and bark and beaver trails leading from the river. Based on the findings of this ground check, the wetland boundary was estimated to coincide with the 744-ft elevation contour. This boundary includes all of the land along the river from the northwestern tip of the peninsula to and around the embayment that drains the K-770 OU. The embayment and the land adjacent to it were not field checked due to safety and access concerns.

3.5 K-770 OPERABLE UNIT

The K-770 OU is located on the western tip of the Powerhouse area peninsula (Figs. 2

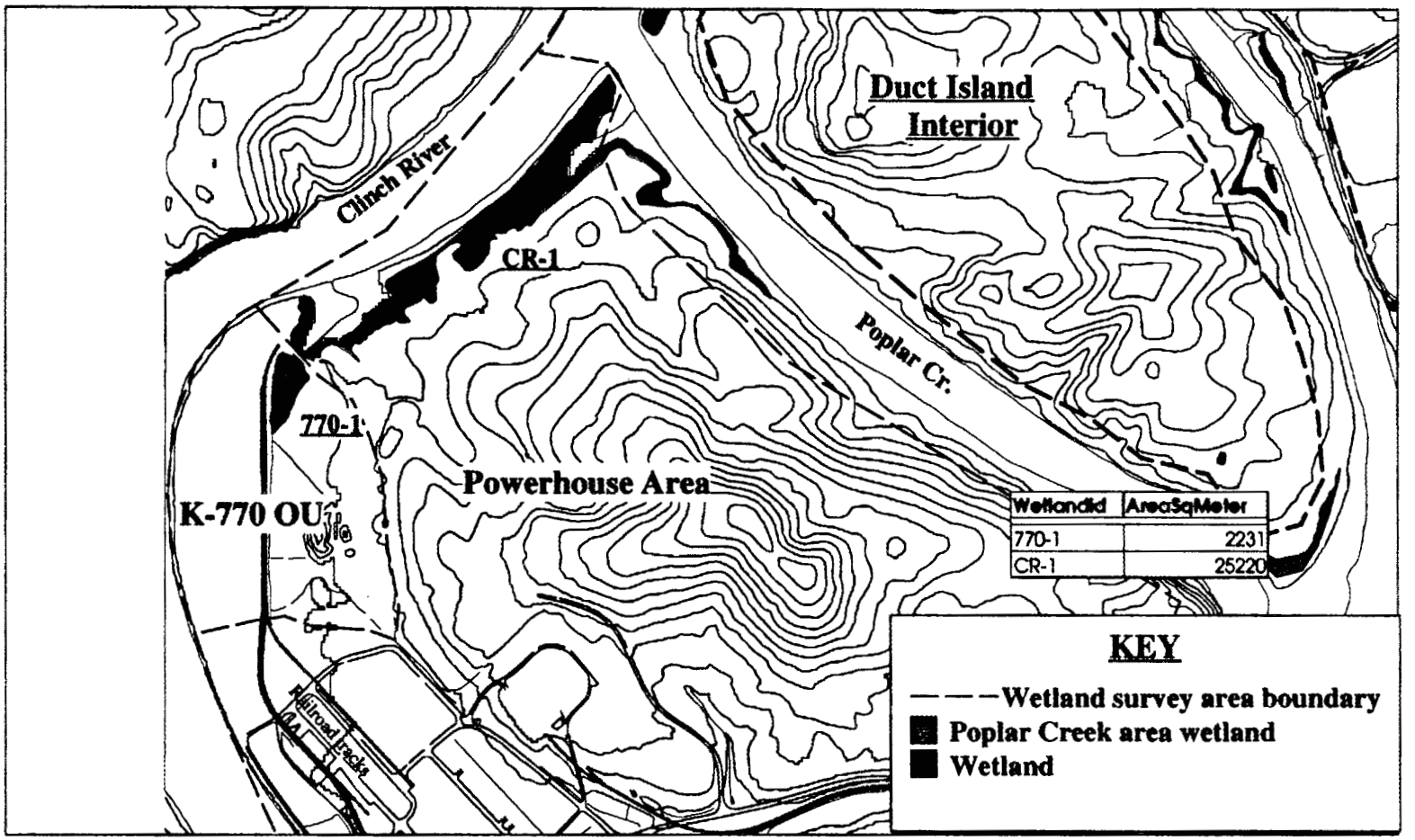


Fig. 6. Wetlands in the Powerhouse area and K-770 operable unit.

(Wetland field surveys were conducted from June through September 1994.)

and 6). In the OU, wetland determination was based on vegetation and hydrology only. Soil samples were not collected because of the possibility of surface soil contamination.

Only one wetland, 770-1, was identified in the K-770 OU—in a man-made pond on the northern end of the site (Fig. 6). The pond has steep banks that are densely vegetated with both woody and herbaceous vegetation. The wetland is a PSS1 wetland located at the bottom of the banks on the margins of the pond. The pond drains to a small Clinch River embayment.

Unused railroad tracks bisect the site from north to south. West of the railroad tracks are level fields vegetated with planted lespedeza and pioneer, old-field species (i.e., species in the family Compositae). Most of this area has been mowed. The soil consists primarily of hard-packed, stony fill. The area east of the railroad tracks is level to moderately sloping. This part of the site contains piles of scrap metal and other discarded equipment that are surrounded by dirt and gravel temporary-access roads and work areas. Site remediation, including removal of the scrap material, was under way on the day of the survey.

A highly degraded stream flow through the eastern half of the site. The stream begins at a spring in the southeastern portion of the site near a small building and piles of old barrels and scrap metal. The stream flows to the man-made pond through a narrow channel located between piles of contaminated scrap and through the area in which site remedial activities were occurring. One section of the stream had been diverted through a culvert to provide vehicle access for site activities; however, a second vehicle crossing was located in a downstream section with neither a culvert nor soil stabilization or erosion control devices in place. This unstabilized crossing could contribute eroded soil and other particulates into the downstream channel and the pond. Black willows and sedges are present on the edge of the stream in the section located between two scrap metal piles. If hydric soil is present, this narrow fringe along the stream could be classified as wetland. However, it should be considered an atypical situation because of the extensive disturbance of the site. Determining if a wetland of any type occurred in this area before site disturbance would be very difficult, and perhaps impossible. It is highly probable that the wetland indicators now present would not exist had the site not been disturbed. Moreover, because of historic and ongoing site disturbance, the stream and adjacent areas have been severely degraded, and aquatic and/or wetland functions are probably occurring at a minimal level, if at all. The possible lack of wetland presence prior to site disturbance, the minimal level of wetland function, and the severely degraded status of the stream and riparian area resulted in a decision to not map the area as a wetland.

3.6 DUCT ISLAND PENINSULA

The Duct Island Peninsula consists of a low, wide ridge that slopes down at a moderate to steep grade on three sides to the Clinch River and Poplar Creek (Figs. 2 and 4). The

peninsula is mostly undeveloped and is forested in pine plantation and mixed hardwood and pine forest. A powerline corridor bisects the peninsula, and one gravel access road provides access to the powerline corridor. No wetlands were identified in the interior of the peninsula. A floodplain wetland area located at the tip of the peninsula andPSS1 and PEM1 wetlands along the Poplar Creek shoreline on the north side of the peninsula were discussed in Sect. 3.3 of this report.

3.7 K-25 SOUTH CORNER

The K-25 South Corner is a long, narrow parcel of land in the southern corner of the K-25 Area of Responsibility. It is bounded by the K-720 ash pile to the northwest, the Clinch River to the south, Bear Creek Road and Powerhouse Road to the northeast, and the Tennessee Valley Authority and DOE property boundary to the southeast (Figs. 1 and 2). Although this area is referred to as the K-25 South Corner for the purposes of this report, the area does not have a formal name or designation of which the authors are aware. The area is crossed by State Route (SR) 58, a powerline right-of-way, and two gravel access roads. On the northwest side of SR 58 is the Coal Yard access road which extends from South First Avenue to the Powerhouse. On the southeast side of SR 58 is a short gravel road that extends across the powerline corridor from Bear Creek Road to the riverbank.

The K-25 South Corner is crossed by three streams. Streams designated as ST-1 and ST-2 begin on Pine Ridge outside the boundary of the K-25 South Corner and enter the site through culverts under SR 58 (Fig. 7). ST-1, a tributary of Poplar Creek, flows into a deep, steep-sided pond before entering Poplar Creek through a culvert under Powerhouse Road. ST-2 flows through areas altered by past road construction activities before flowing through a culvert under South First Avenue. Downstream of the culvert, ST-2 flows through a PFO1 wetland, CR-5. The downstream reach of ST-2 has been channelized along the base of the SR 58 road bank. A third, unnamed stream is wholly located within a wetland. The stream begins with a channelized section in a loblolly pine plantation southeast of SR 58. The stream is diverted through a culvert under the gravel access road, continues southeast across the powerline right-of-way, and forms a small river embayment at its confluence with the Clinch River. The stream can be seen as a blue line on Fig. 7 within wetlands CR-9 and CR-10. Map information for the southeastern end of this area was not available; therefore, the downstream reach of the stream and the embayment are not shown.

Nine wetland areas, CR-2–CR-10, cover approximately half of the K-25 South Corner

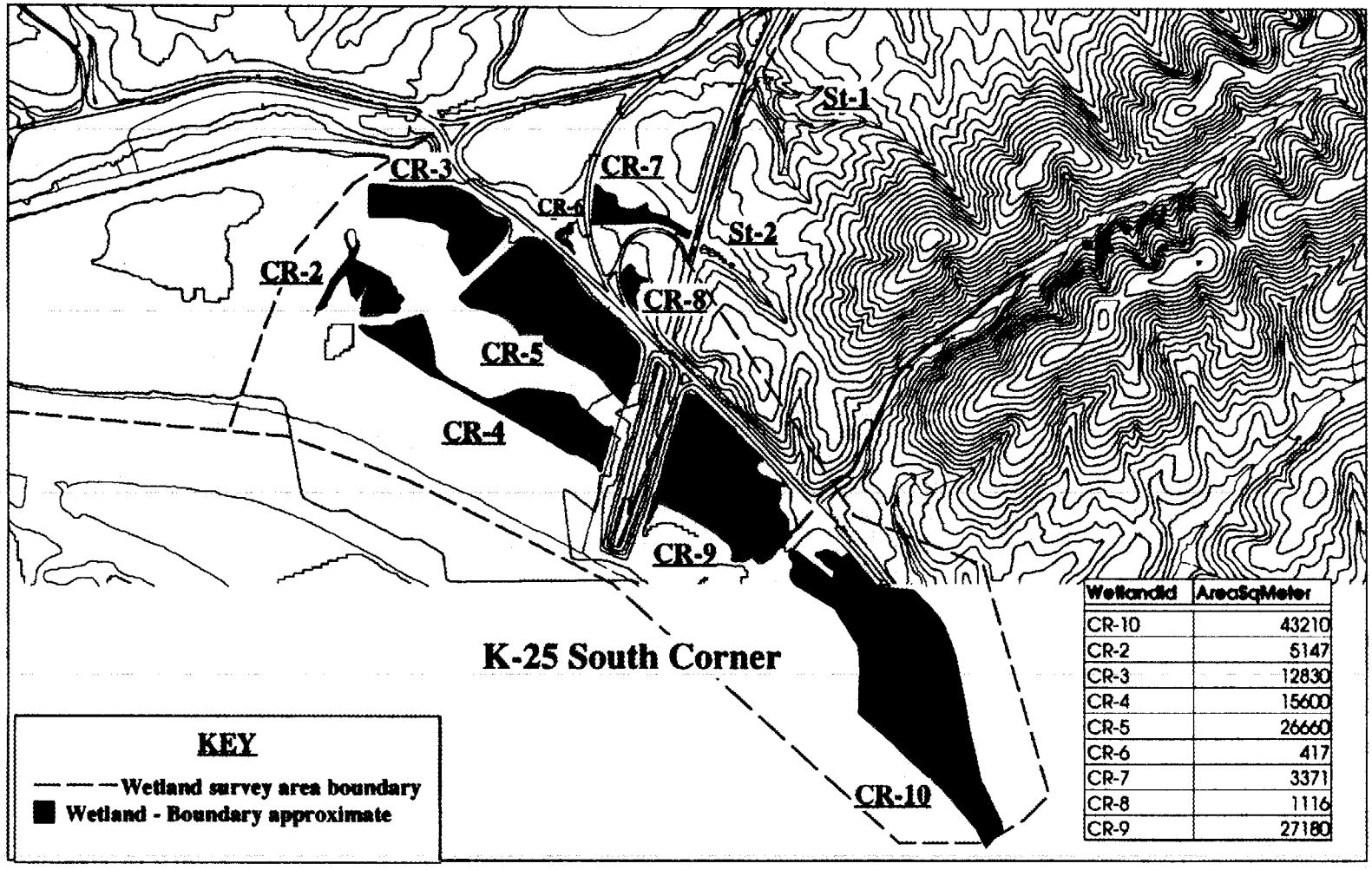


Fig. 7. Wetlands in the K-25 South Corner.

(Wetland field surveys were conducted from June through September 1994.)

(Fig. 7). Wetlands CR-2, CR-3, CR-4, CR-6, CR-7, CR-8, and portions of CR-9 and CR-10 are PSS1 wetlands. Wetlands CR-2, CR-4, CR-9, and CR-10 occur in areas disturbed by the initial construction and the continuing maintenance of the pwerline right-of-way. Wetlands CR-6, CR-7, and CR-8 occur in areas disturbed by the initial construction of and the continuing maintenance of roads. Wetland CR-3 consists of a beaver pond with a band of scrub–shrub vegetation in the wide, shallow areas around the margins and in the shallow upper half of the pond. The pond is connected, via a deep man-made channel that flows through a loblolly pine plantation, to the man-made channel on the northwest boundary of the site. Common species in thePSS1 and PEM1 wetlands include buttonbush, silky dogwood, black willow, rose, blackberry, arrowleaf tearthumb, American potato-bean, soft rush, goldenglow, monkeyflower, dotted smartweed, rice cutgrass, green bulrush, and several other species of sedge.

Wetland CR-5 and parts of wetlands CR-9 and CR-10 are PFO1 wetlands. Wetland CR-5 has developed along stream ST-2 in a forest stand that is primarily planted loblolly pine. The wetland has expanded into the pine plantation as a result of a beaver dam located at the base of the SR 58 roadbank. The beaver dam has caused the flooding of a majority of the loblolly pine stand between South First Avenue and the powerline corridor and has aided in the expansion of wetland CR-3 (via a culvert under Coal Yard Access Road). Dominant or commonly occurring species, in addition to loblolly pine, include black willow, green ash, silky dogwood, and jewelweed.

The CR-9 PFO1 wetland exists in a loblolly pine plantation between Bear Creek Road, the SR 58 exit ramp to Bear Creek Road, the powerline corridor, and the gravel access road. The PFO1 wetland portion of CR-10 is in the southeastern end of the area between the river and Bear Creek Road and consists of a hardwood stand that has not been disturbed by an recent activities. Common species in the PFO1 wetlands include loblolly pine, box elder, sweetgum, green ash, red maple, American elm, and poison ivy.

Naturally-occurring hydrologic sources for the wetlands in the K-25 South Corner include two stream systems, ST-2 and unnamed blue line stream (Fig. 7), with associated springs and seeps. ST-2 contributes to wetlands CR-3, CR-5, CR-6, and CR-7, and the unnamed blue-line stream contributes to CR-9 and CR-10. Groundwater seeps contribute to wetlands CR-2, CR-4, and CR-8. Man-induced hydrologic modifications, however, appear to have had an important role in the expansion and development of the forested, scrub–shrub, and emergent wetlands in the K-25 South Corner. A deep man-made channel extending inland from the river on the northwestern boundary of the area contributes water to PEM1 wetlands CR-2 and CR-4. The seasonal increase in river water level contributes water via existing stream channels to bottomland areas of wetlands CR-5, CR-9 and CR-10. Road fill and soil compaction from road development north of South First Avenue may have altered site drainage patterns contributing to the development and/or expansion of wetlands CR-7 and CR-8.

3.8 K-1007-P1 POND

The K-1007-PI Pond is located adjacent to the main plant area of the K-25 Site. It is in a rounded triangle of land formed by Route 58 and Contractors Road and Perimeter Road (Fig. 2). Along most of the pond perimeter, the banks are steep and the surface of the water is several meters below the top of the banks. The east, south, and west sides of the pond are bordered by railroad tracks and paved roads. The long, north shoreline is bordered by level fields dominated by lespedeza and grasses. Bald cypress, black willow, false indigobush, and other species tolerant of wet soils are growing on and at the top of the banks; however, the pond lacks a shallow littoral area in which emergent wetlands could develop. The soil on the top of the bank and for a short distance into the field consists of a very thin (3 cm or less), crumbly surface layer over a gravel layer from which it was not possible to extract a sample with the hand-held auger.

On the northeastern end of the pond, the banks are not steep, and the elevation of the land adjacent to the pond is the same or slightly higher than that of the pond surface. In this area, a PEM1 wetland, P1-1, was identified a short distance from the Contractors Road (Fig. 8). The wetland extends from the shoreline into a topographic depression in the field. The dominant species include black willow, false indigobush, silky dogwood, three-square, spikerush, bulrush, rose mallow, swamp milkweed, and frog-fruit. This area is also underlain with a hard, gravelly layer; however, unlike the thin, dry surface layer in other areas adjacent to the pond, the surface layer in the wetland is approximately 14 cm (6 in.) thick and consists of a 1-chroma silt underlain by a 1-chroma clay loam with mottles. Mapping the boundary of this wetland area was difficult because of the lack of topographic relief. Therefore, although the mapped location of the wetland is correct, the size and shape of the area are not precise.

3.9 ADDITIONAL AREAS

Wetland surveys or wetland boundary delineations have been performed in the following areas of K-25 within the last three years. The wetland areas identified on these sites are shown on Figures 8, 9, and 10. The findings are briefly discussed below.

3.9.1 Main Plant Area of the K-25 Site

The main plant area is the main developed and controlled area within the K-25 fence (Fig. 2). Most of the area is covered with buildings, pavement, and other structures, and there are few unlandscaped vegetated areas within its boundaries. This survey and discussion of the main plant area does not include the Mitchell Branch area, which has been addressed separately in this report. There are no wetlands in the main plant area.

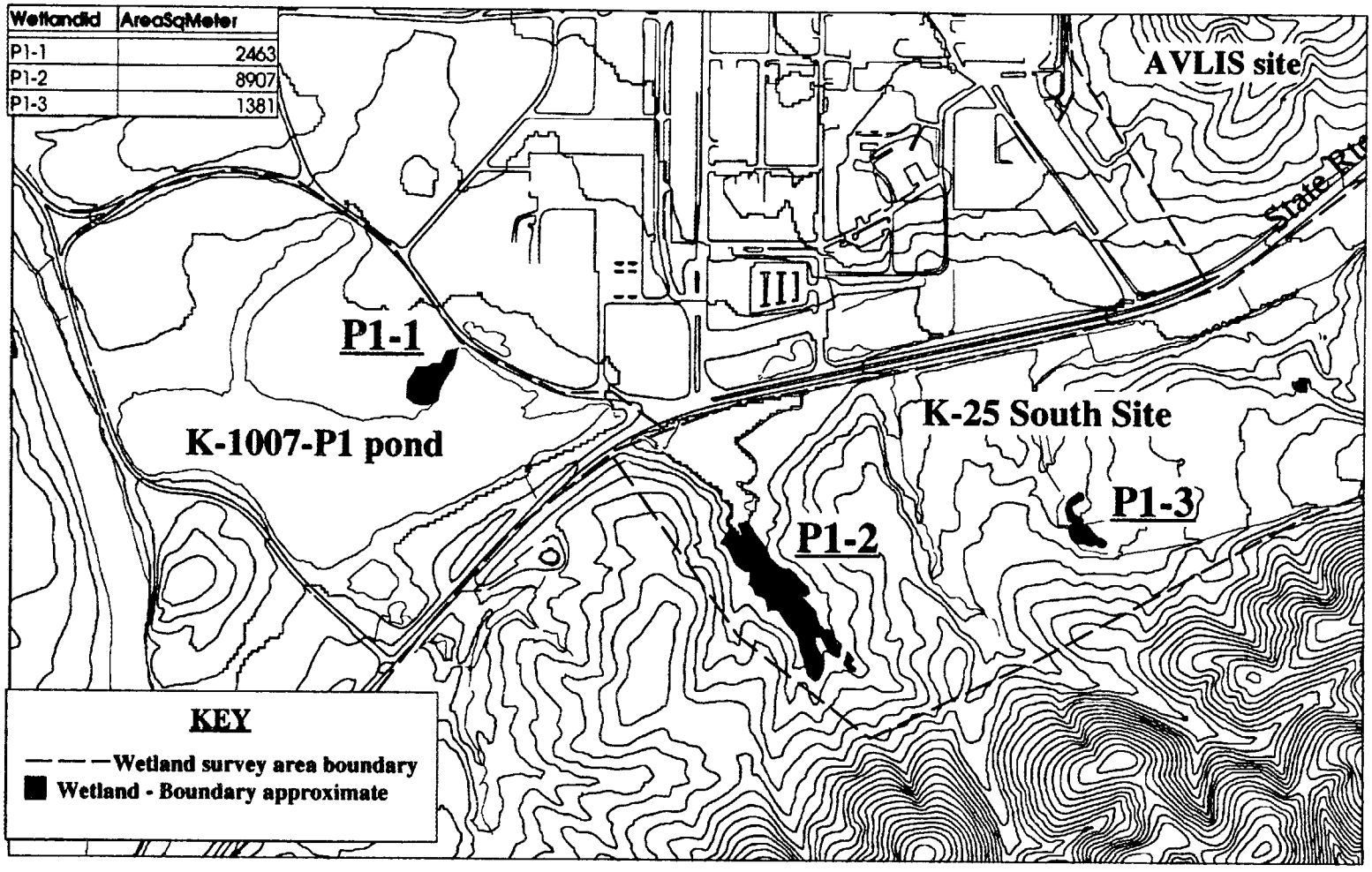


Fig. 8. Wetlands in the K-1007-P1 Pond Area and K-25 South Site.

(Wetland field surveys were conducted from June through September 1994.)

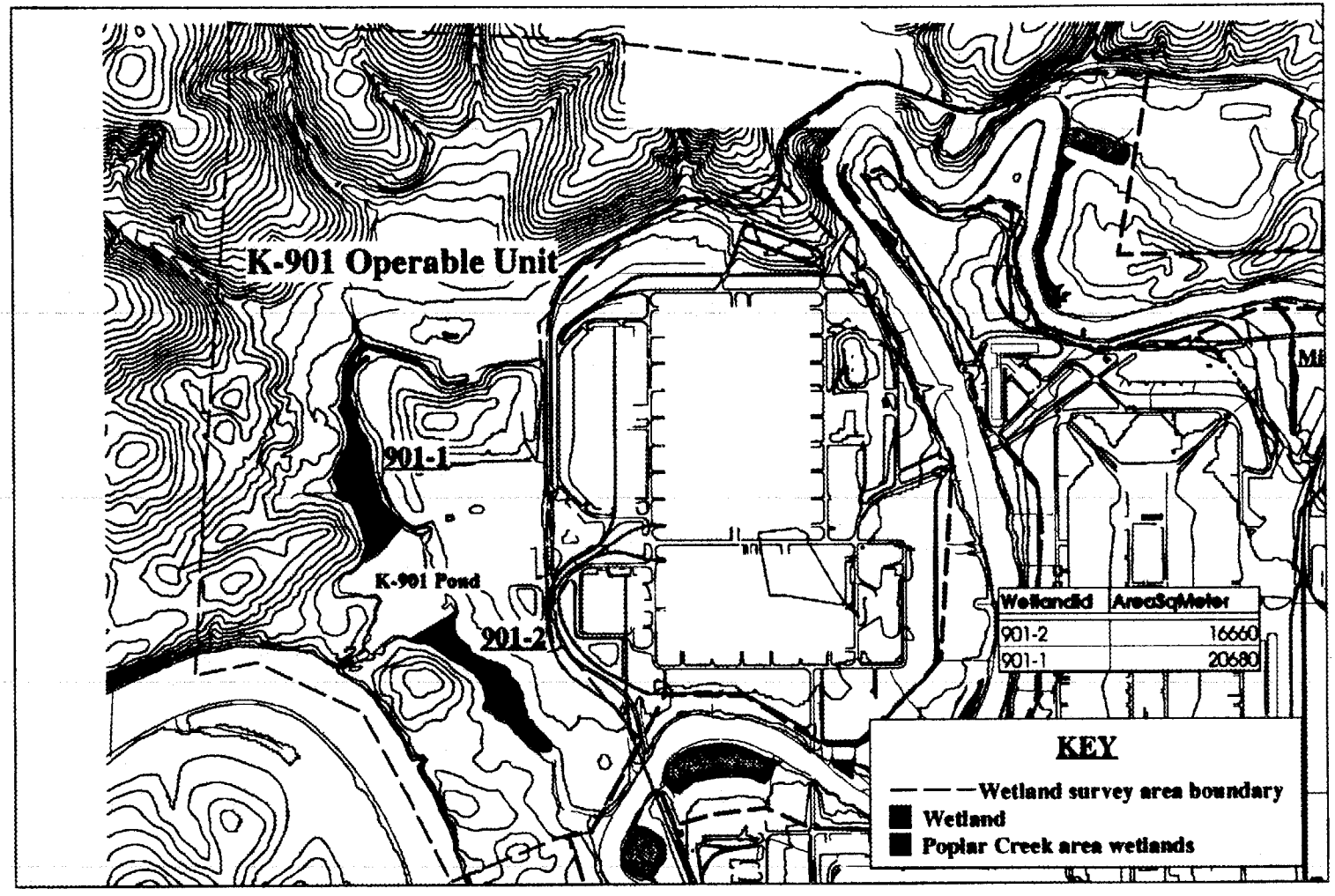
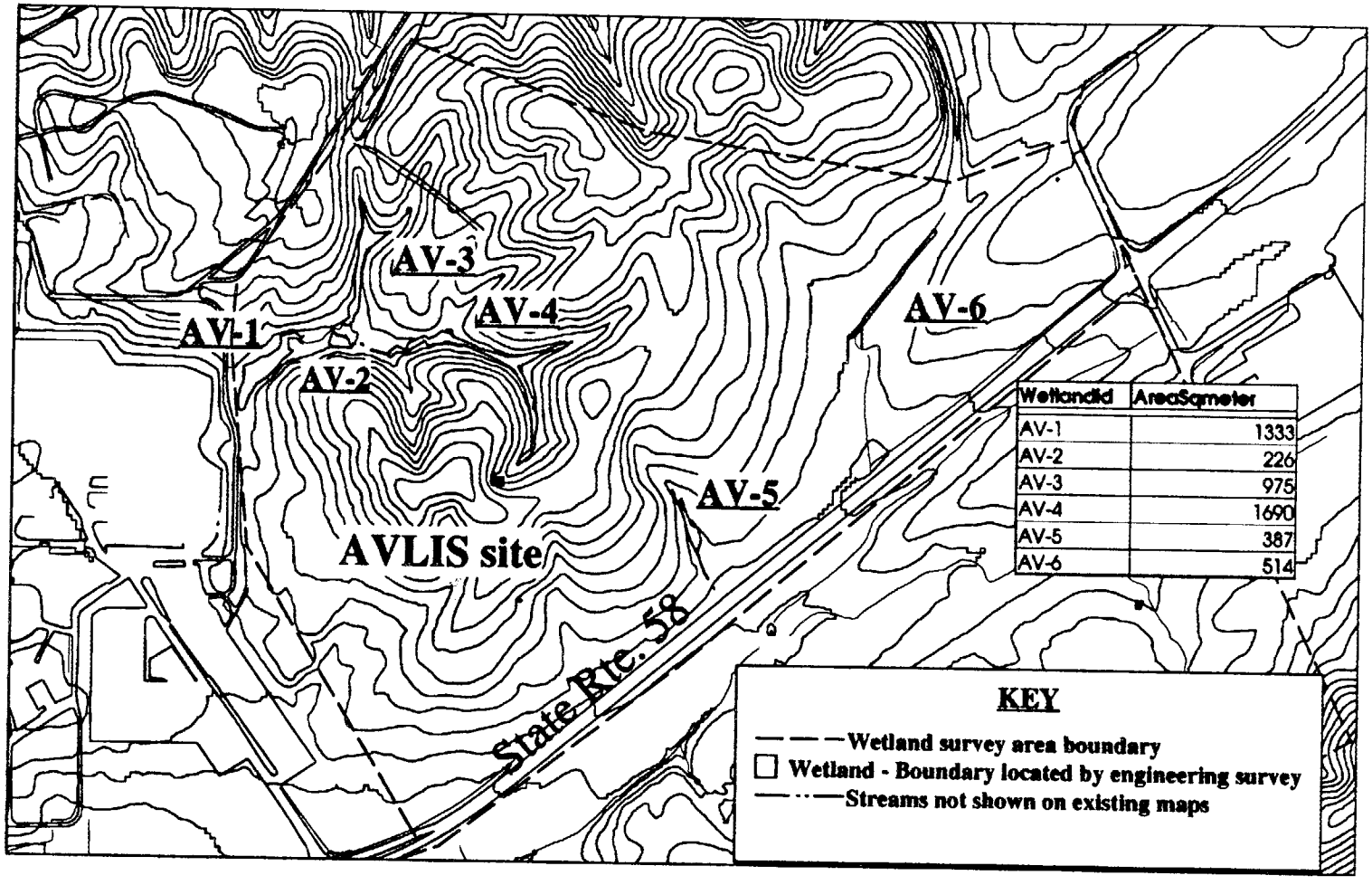


Fig. 9. Wetlands in the K-901 operable unit.

(Wetland field surveys were conducted from June through September 1994.)



WetlandId	AreaSqmeter
AV-1	1333
AV-2	226
AV-3	975
AV-4	1690
AV-5	387
AV-6	514

Fig. 10. Wetlands on the AVLIS site.

(Wetland delineation was conducted in January 1994.)

3.9.2 K-25 South Site

The K-25 South Site is an approximately 100-acre forested site located on the south side of SR 58 opposite the AVLIS site and the main plant area of the K-25 Site (Fig. 2). Although streams on the South Site are tributaries of Poplar Creek, they first drain to the K-1007-P1 Pond which empties into Poplar Creek. PFO1 wetland P1-3 (Fig. 8), which was delineated in November 1993 and subsequently located by civil survey, is located upslope of a utility right-of-way and gravel road (not shown on map) in a seep area adjacent to a stream. An additional area of PFO1 wetlands located upstream of the K-1007-P3 Pond was identified and mapped as part of the current survey. The boundary of this additional area was not located by civil survey. Common species in the wetlands include sweetgum, ironwood, red maple, green ash, sycamore, silky dogwood, microstegium, and sedges.

3.9.3 K-901 Operable Unit

The K-901 OU is located in the western corner of the K-25 wetland survey area (Fig. 2). A wetland survey of the entire OU was conducted in October 1993. PSS1 and PEM1 wetlands were identified in the north and south arms of the K-901 Pond. PSS1 wetland 901-1 in the northern arm (Fig. 9) is dominated by a willow and buttonbush thicket. Wetland 901-2 in the southern arm (Fig. 9) consists of interspersed open water and emergent wetland areas. Vegetation species include sycamore, black willow, false indigo-bush, cutgrass, and beggar-ticks.

3.9.4 AVLIS Site

The former proposed site of the AVLIS is a forested tract dissected by several, steep-sided stream catchments. It is located between Blair Road, SR 58, and the main plant area (Fig. 2). The site drains to Mitchell Branch and to Poplar Creek tributaries. Wetlands were delineated and located by civil survey on this site in January and February of 1993. Most of the wetlands are PFO1 wetlands in the riparian zones of the headwater streams that begin on the site. PFO1 wetlands AV-1, AV-2, AV-3, and AV-4 are all located in one headwater catchment but are physically separated from each other by short sections of nonwetland areas in the stream riparian zone (Fig. 10). Vegetation species include red maple, sweetgum, ironwood, elm, microstegium, and sedges.

Wetland AV-5 is a PSS1 wetland in a formerly disturbed area along a seasonal stream located adjacent to SR 58 and a natural gas line right-of-way (not shown on the map). AV-6 is also a PSS1 wetland. It has developed along the margins of a stream in an area that was disturbed when a portion of the stream was channelized to accommodate construction of a small road. The road, which is now overgrown with herbaceous vegetation, is immediately adjacent to the stream channel. The channel has low, steep sidebanks. Wetland AV-6 has developed in the narrow area of saturated soils between

the bottom of these banks and the edge of the normal flow stream channel. Common vegetation species in both scrub–shrub wetlands include sweetgum and red maple saplings, privet, silky dogwood, rose, microstegium, rush, and sedges.

Mit-c and Mit-d, two other wetland areas that were delineated during the AVLIS survey in 1993, are in the Mitchell Branch watershed (Fig. 3) and are therefore included in the Mitchell Branch section (Sect. 3.1) of this report.

4. WETLAND FUNCTIONS

A thorough assessment of wetland functions for the K-25 area wetlands is outside of the scope of this project. To properly assess wetland functions, additional literature review, field investigations, and application of wetland evaluation methodologies will be necessary. However, the following sections provide a brief overview of wetland functions and describe the wetland evaluation methodologies available for future assessment of those functions in the K-25 area wetlands.

4.1 DESCRIPTION

Wetland functions are physical, chemical, and biological processes or attributes of wetlands that are vital to the integrity of the wetland system (Adamus et al. 1991). Wetland functions include groundwater recharge and discharge, floodflow alteration, sediment stabilization, nutrient removal and transformation, sediment and toxicant retention, production export, and provision of wildlife and aquatic species habitat. Not all functions will be performed in every wetland. The factors that affect the performance of wetland functions are numerous and include geographic and topographic location; wetland position in the watershed; and physical, chemical, and biological characteristics of the wetland.

4.1.1 Groundwater Discharge

Groundwater discharge is the movement of groundwater to surface water, while groundwater recharge is the movement of surface water into the ground (Adamus et al. 1991). It is clear from the presence of numerous seeps and springs in the K-25 area wetlands that groundwater discharge occurs. In fact, in the headwater riparian wetlands, it is the primary source of water. However, it is not known to what extent groundwater recharge occurs.

4.1.2 Floodflow Alteration

Floodflow alteration is the process by which peak flows from runoff, surface flow, groundwater interflow and discharge, and precipitation enter a wetland and are stored or delayed from their downstream movement. In order to provide effective storage, a wetland must not be filled to capacity with surface water. However, in developed watersheds, in the lower reaches of watersheds, and in watersheds with little wetland acreage, many wetlands become quickly saturated and filled to capacity (Adamus et al. 1991). Because many of the K-25 area wetlands fit this description, the floodflow alteration function may not be effectively performed. However, additional study or application of wetland evaluation methodologies is necessary to estimate the floodflow

alteration function of these wetlands.

4.1.3 Sediment Stabilization

Sediment stabilization consists of shoreline anchoring (stabilization of soil at the water's edge) and dissipation of erosive forces (the lessening of energy associated with waves, currents, water-level fluctuations, and groundwater flow) (Adamus et al. 1991). This function is probably not present in most of the K-25 area wetlands that are located on first- and second-order streams. It is, however, likely to be present in the river embayment wetland, owing to the river's
water-level fluctuations. In this wetland, the vegetation may stabilize embayment soils that are affected by water-level fluctuations and may reduce sediment loads to the river by capturing eroded soil and other particulates washed in with upland and upstream storm runoff.

4.1.4 Nutrient Removal and Transformation

Nutrient removal and transformation includes the storage of nutrients (primarily nitrogen and phosphorus) within the sediment or plant substrate, the transformation of inorganic nutrients to their organic forms, and the transformation and removal of nitrogen (Adamus et al. 1991). The total loading of nitrogen and phosphorus to the various K-25 rea wetlands from point and nonpoint sources is not known. Potential anthropogenic sources of nitrogen and phosphorus include sewage treatment plant or septic system discharges; land application of fertilizers, sludges, or compost; and agricultural waste. The nitrogen and phosphorus loadings to the wetlands in headwater areas or areas upstream of human activities may be low; thus nutrient removal and transformation may be only minimally performed in these wetlands. Conversely, wetlands along Mitchell Branch and Poplar Creek may receive loadings of nitrogen and phosphorus from activities from the K-25 Site and from upstream off-site activities in the Poplar Creek watershed. The K-25 Site activities that could contribute nitrogen and phosphorus to aquatic areas include parking lot and road runoff, fertilizer applications to landscaped and reforestation areas, and discharges from the sewage treatment plant. Potential off-site sources of nitrogen and phosphorus include discharges from malfunctioning septic systems, residential and agricultural fertilizer use, and livestock.

4.1.5 Sediment and Toxicant Retention

Sediment and toxicant retention is the process by which suspended solids and adsorbed contaminants are retained and deposited in a wetland. Toxicants can include heavy metals, pesticides, and other toxic organics (i.e., solvents and polychlorinated biphenyls). Toxicant retention is associated with sediment retention because many toxicants adsorb to solids and thus will be removed from the water column when the solids settle out. In the wetland, the toxicants can be permanently or temporarily sequestered in the sediments and

in plant tissue, transferred to the atmosphere through volatilization, biochemically transformed to intermediate compounds that are less or more toxic than the parent compound, or completely mineralized to carbon dioxide and water. Sediments and associated toxicants can also be resuspended and exported from the wetland in subsequent flooding events (Adamus et al. 1991). Routes of contaminant entry into a wetland include groundwater and atmospheric inputs, and accidental spills. Wetlands in the floodplain and riparian zones of Poplar Creek and Mitchell Branch and in the contaminated areas (i.e., K-901 and K-770 OUs) may have the greatest opportunity to perform the sediment and toxicant retention function because of their general location, their position in the watersheds (downstream of point and non-point pollution sources), and their flooding occurrence. However, because toxicants can also enter through groundwater and the atmosphere and because many of the same physical characteristics (i.e., anoxic sediments, reducing conditions, oxidized rhizospheres) that control the biogeochemical processes responsible for toxicant retention, detoxification, assimilation, and transformation, are present in all of the wetlands identified in the K-25 Area of Responsibility, all probably have the ability to perform this function.

4.1.6 Production Export

Production export refers to the flushing of organic material from the wetland to downstream or adjacent waters. Another mechanism of production export is insect emergence and consumption by vertebrates that travel out of the wetland. The amount of production export depends on a variety of biotic and abiotic factors, including climate, acreage, size of watershed, wetland to watershed area ratio, gradient, wetland type, plant productivity, sheet or channel flow, water velocity, and duration of flooding (Adamus et al. 1991).

4.1.7 Aquatic Diversity

Aquatic diversity is defined as the support of a notably great on-site diversity and abundance of fish or invertebrates that are mainly confined to the water and saturated soils (Adamus et al. 1991). Although this function may be performed in some of the Poplar Creek wetlands and the river embayment wetlands, fish diversity and abundance is probably not a significant function in most of the K-25 area wetlands, because of the lack of long-term inundation of most of the wetland areas. The wetlands do, however, provide habitat for wetland-dependent invertebrates, such as crayfish and some insect species.

4.1.8 Wildlife Diversity

Wildlife diversity is defined as the support of a notably great on-site diversity and abundance of wetland-dependent birds (Adamus et al. 1991). However, the focus on birds should not imply that other wildlife species, such as many furbearers (e.g., mink and beaver), other mammals (e.g., shrews), most amphibians, and some reptiles (e.g., bog

turtles, water snakes), are any less important or dependent on wetlands. Therefore, wildlife diversity, for the purposes of our brief discussion, includes all wildlife species that are wetland-dependent or that may use wetlands on a daily, seasonal, or intermittent basis. Wildlife species present on the ORR that use or are dependent on wetlands include raccoons, mink, muskrat, beaver, deer, turtles, and numerous bird and amphibian species. A great blue heron rookery is located in and adjacent to a wetland area along Poplar Creek. These birds probably use the scrub–shrub and emergent wetland areas along the creek for hunting and foraging.

4.2 WETLAND EVALUATION METHODOLOGIES

Techniques for assessing wetland functions and values include the Wetland Evaluation Technique (WET) and the Hydrogeomorphic Approach (HGM). WET (Adamus et al. 1987; Adamus et al. 1991) is a widely used methodology for assessing wetland functions and values. Although other wetland evaluation techniques existed before the development of WET, none addressed all of the important wetland functions and wetland types or presented a single, unified procedure that could be employed rapidly, accurately, and consistently. WET is used to evaluate wetland functions and values in terms of Social Significance (societal value as evidenced by economic worth or official recognition), Opportunity (the chance a wetland has to perform a specific function), and Effectiveness (the capability of a wetland to perform a function because of its physical, chemical, or biological characteristics). Features of the wetland's watershed, topography, vegetation, and other parameters are used to determine probability ratings of high, medium, or low for each function and value. WET estimates the probability that a particular wetland performs specific functions and provides insight as to the significance of those functions but does not provide definitive answers to specific questions regarding wetland functions.

A new assessment methodology, HGM, is being developed by the USACE (Smith 1995). This method is based on the Hydrogeomorphic Classification system for wetlands developed by Brinson (1993). The HGM system classifies wetlands on the basis of geomorphic setting, water source, and hydrodynamics and identifies groups of wetlands that function similarly. The basic HGM classes are riverine, depressional, slope, flat, and fringe. The classes can be subdivided into subclasses on the basis of landscape and ecosystem scale factors. Assessment models are developed for each function that is likely to be performed in the wetland subclass and result in an index that reflects the ability of a wetland to perform a function relative to similar wetland in the region (Smith 1995). Model calibration should be based on data collected from reference wetlands that represent the range of conditions that exist in the region (Smith 1995). HGM is still in the early development stage for many regions of the United States. Assessment models and reference wetland sets have not yet been developed or established for the wetland classes in the Ridge and Valley Province of Tennessee in which ORR is located.

5. SUMMARY

In accordance with DOE Regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements (Subpart B, 10 CFR 1022.11), wetland surveys were conducted in selected areas within the K-25 Area of Responsibility during the summer of 1994. These areas are Mitchell Branch, Poplar Creek, the K-770 OU, Duct Island Peninsula, the Powerhouse area, and the K-25 South Corner. Previously surveyed areas included in this report are the main plant area of the K-25 Site, the K-901 OU, the AVLIS site, and the K-25 South Site. Wetland determinations were based on the USACE methodology (USACE 1987).

Forty-four separate wetland areas, ranging in size from 0.13 to 4.23 ha, were identified. Wetlands were identified in all of the areas surveyed with the exception of the interior of the Duct Island Peninsula and the main plant area of the K-25 Site. Wetlands on Duct Island Peninsula are located on the margins of the peninsula and are associated with Poplar Creek. Wetlands occur in relatively undisturbed forested areas in the Mitchell Branch watershed, in Poplar Creek floodplain and riparian zones, and on the K-25 South Site. Undisturbed PSS1 and PEM1 wetlands occur along Poplar Creek. Many of the wetlands occur in areas of past or present disturbance that include utility rights-of-way, loblolly pine plantations, channelized streams, and streams in developed areas. Two atypical situation wetlands (USACE 1987) in the Poplar Creek floodplain and riparian zone are included in the wetland mapping. These two wetlands lack hydric soil indicators, but have hydrophytic vegetation and evidence of wetland hydrology. They also share the ecological functions and values of wetlands and would qualify as critical environmental areas.

Wetlands perform functions such as floodflow alteration, sediment stabilization, sediment and toxicant retention, nutrient transformation, production export, and support of aquatic species and wildlife diversity and abundance. The forested, scrub–shrub, and emergent wetlands identified in the K-25 area perform some or all of these functions to varying degrees. Additional studies will be necessary to assess the functional capabilities of these wetlands.

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