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CH2MHILL

April 9, 2004

John Baird
Ohio Department of Transportation
Office of Environmental Services
1980 West Broad Street
Columbus, OH 43223

Subject: Portsmouth Bypass Ecological Survey Report
SCI-823-0.00
PID 19415

Dear John:

Enclosed are two review copies of Volume 1 of the revised Ecological Survey Report for the Portsmouth Bypass. We've incorporated the various comments and guidance we've received, up to and including the two "tentative interchanges" in segments V3 and H3.

The total package contains three volumes:

Volume 1
Text, Tables and Figures

Volume 2
Appendices A through H – these are the same as the previous submissions

Volume 3
Appendices I through K – endangered species reports

The materials in Volume 2 are virtually unchanged. The materials in Volume 3 are copies of materials you've already reviewed. Thank you for your assistance with this task. Please call me at (614) 734-7144, ext. 20 if you have any questions or need further assistance.

Sincerely,

CH2M HILL

Rob Miller, AICP
Project Manager

Cc: Susan Swartz - TranSystems

Volume I: Text & Figures

Ecological Survey Report
Portsmouth Bypass Project
Scioto County, Ohio

SCI-823-0.00
PID 19415

Prepared for

Ohio Department of Transportation

March 2004

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Executive Summary

The Portsmouth Bypass project is a limited access, four-lane divided roadway proposed through central Scioto County. The project planning corridor extends generally east from US 23 near Lucasville toward Minford, and then turns south to meet US 52 in Wheelersburg. During the preliminary planning process, a number of possible alternatives were considered through the corridor. The area covered by these alternatives constitutes the study area for this ecological survey. The topography of the area varies from steep hilly terrain through much of the study area, to flat to gently rolling terrain along the floodplains and bottomlands adjacent to the Scioto and Little Scioto Rivers.

Field investigations were performed from October 30, 2001 through August 9, 2002 to identify and characterize wetlands, characterize the regulated streams in the project area, and to survey vegetation, wildlife, and aquatic biota across the study area.

Aquatic studies included mapping and evaluation of the network of ephemeral, intermittent and perennial streams. The stream network through the study area is typified by relatively steep ephemeral streams, leading to intermittent and small perennial streams with moderate to low gradient, to the larger streams (rivers) that are low gradient. Given their steepness, many streams appear to be subject to extremely low flow conditions during dry periods. Streams are typically well defined with cobble and gravel bottoms. Primary direct impacts to streams in the study area are cattle grazing, canopy removal, channelization (particularly near roadways) and debris accumulation. Sedimentation is most abundant in recently logged areas. Physical assessment of the larger streams using the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) indicate that many of the perennial streams in the study area would be able to support macroinvertabrates and fish communities typical of a Warm Water Habitat (WWH). QHEI scores for most of the lower intermittent streams were in the Modified Warm Water Habitat to Warm Water Habitat range. Smaller intermittent and ephemeral streams were rated using the Headwater Habitat Evaluation Index (HHEI). All but the uppermost, dry ephemeral stream reaches scored as Class II or III headwaters.

Water quality, fish and macroinvertebrate studies were conducted at 17 sites on the larger perennial streams in the study area, including the Little Scioto River, Long Run, Candy Run, Miller Run, and several other smaller perennial tributaries to the Little Scioto and Scioto Rivers. These studies found the Little Scioto River to have fairly good water quality and support the most diverse biotic communities. Long Run and Candy Run, two perennial streams that parallel Lucasville-Minford Road through the center of the study area, were also found to have good water quality and biotic communities. Long Run also supported a population of an Ohio Threatened species (rosyside dace) and the Little Scioto River supported a population of an Ohio Special Interest species (eastern sand darter). Two other larger perennial streams, Miller Run near US 23 and Wards Run just north of Wheelersburg, and a number of smaller streams were found to be polluted by domestic and/or agricultural sources. These streams were generally dominated by relatively disturbance-tolerant, headwater species.

There are 83 ponds totally or partially included in the study area, ranging in size from 0.02 acre to 4 acres, with a combined area of approximately 42.75 acres. Eleven ponds are greater than one acre in size, and 19 greater than one half acre. For the most part, the vast majority of the ponds are typical farm ponds.

Terrestrial studies found that standing forest comprises approximately 53 percent of the study area, and is distributed throughout. None of the forest in the study area can be considered "virgin" or "old growth" forest. Most if not all of the forest in the study area has been logged during the past century. Nevertheless, there are areas that are composed of canopy trees and understory species that were typical in the pre-settlement forest communities. The dominant canopy trees of the mature forests are sugar maple (*Acer saccharum*), yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), red oak (*Quercus rubra*), and chestnut oak (*Quercus prinus*). The former four species are widely distributed on more mesic sites (not floodplains). Chestnut oak is particularly more common on the drier upper slope positions. These forest communities are common in the unglaciated Appalachian Plateau on sites that were once cleared. Pines occur in scattered dense patches, mostly on steep slopes, but comprise less than one percent of the total woodlands in the study area. Narrow riparian woods along the larger streams are dominated by common floodplain species such as silver maple and American elm. The remainder of the terrestrial habitats that comprise the study area are recently logged forest (7%), active agricultural lands (9%), scrub-shrub (4%), inactive agricultural lands (10%), and urban/residential (17%). Most agricultural and urban land uses are located on the flatter terrain.

The field investigation identified 92 wetland areas in the study area with a combined area of approximately 30 acres. Approximately one third of the wetlands are driven by groundwater discharge or "seeps," half have formed along open drainageways or channelized natural streams, and the remainder occur in manmade or natural depressions. Most wetlands are palustrine emergent marsh, with a small percentage of scrub-shrub or forested wetlands. According to the Ohio Rapid Assessment Method (ORAM), 40 of the wetlands are Category 2 wetlands. All but seven of these are actually in the range of Modified Category 2 or in the Category 1 to Category 2 "gray zone." The other 52 wetlands are Category 1 (the lowest category). No Category 3 wetlands were found in the study area.

The Preliminary Development Process for the Portsmouth Bypass project included several steps. In 1999, a Portsmouth Transportation Study was published. This work studied the transportation and economic needs of the area and evaluated "Concepts" for achieving the critical elements of the project's Purpose and Need. The "Airport Bypass Concept" was selected for further consideration. Within the Airport Bypass area, "Conceptual Alternatives" were developed and evaluated. The most promising configurations were selected for further investigation. These configurations were identified as "Preliminary Alternatives". Because of the region's difficult topography, substantial engineering efforts were required to evaluate whether the Preliminary Alternatives could be considered "Feasible." Ultimately, seven (7) individual segments were developed that could be combined to form eight (8) Feasible Alternatives. The Segments are labeled H1, V1, HV2, H3, V3, H4, V4. Those segments which begin with an "H" denote segments that utilize the area's more rugged, undeveloped, and hilly terrain. Segments which begin with a "V",

denote segments that utilize the area's more level terrain, generally following Lucasville-Minford Road and the lands adjacent to the Little Scioto River. The Feasible Alternatives are thus identified by the segments that comprise them, for example, H1+HV2+H3+H4.

Specific surveys that focused on the eight Feasible Alternatives were conducted for four federally-listed rare species from April through August 2003: the endangered Indiana bat (*Myotis sodalis*), the threatened small whorled pogonia (*Isotria medeoloides*), the threatened Virginia spiraea (*Spiraea virginiana*), and the candidate species timber rattlesnake (*Crotalus horridus horridus*). To date, none of these species have been identified in the project area.

In general, the impacts associated with the eight Feasible Alternatives fall within a narrow range. Differences can be attributed to the segments. For example, stream impacts for the eight alternatives vary within a fairly narrow range. The highest impact occurs under Alternative V1+HV2+H3+H4 (47,600 linear feet), the minimum under H1+HV2+V3+V4 (37,900 linear feet). Generally, alternatives that incorporate segment H4 have greater impacts on ephemeral streams, and V4 have greater impacts on perennial streams. All cross the Little Scioto River at one location each, and they all cross Long Run at the same location. Impacts to wetlands are also relatively minor, as the wetlands are mostly small and widely distributed. The range of total wetland encroachments is from 4.36 acres (Alternative V1+HV2+V3+H4) to 1.8 acres. The impacts to terrestrial habitats are mostly to forest lands. Because of their landscape positions, Alternative H1+HV2+H3+H4 affects the largest proportion of woodland habitat, and Alternative V1+HV2+V3+V4 affects the largest proportion of agricultural lands. Urban and residential land uses are generally avoided.

Specific surveys that focused on the eight Feasible Alternatives were conducted for four federally-listed rare species from April through August 2003: the endangered Indiana bat (*Myotis sodalis*), the threatened small whorled pogonia (*Isotria medeoloides*), the threatened Virginia spiraea (*Spiraea virginiana*), and the candidate species timber rattlesnake (*Crotalus horridus horridus*). To date, none of these species have been identified in the project area.

Introduction

The Portsmouth Bypass project is a limited access roadway proposed through central Scioto County, linking US Route 23 near Lucasville with US Route 52 near Wheelersburg (see Figure 1). The project includes a four lane divided highway with grade-separated interchanges and overpasses at existing cross roads and railroads.

Several alternative corridors were developed during the planning stages of the project. These corridors constitute the study area for this ecological survey (see Figure 2).

This document is intended to describe the ecological conditions within the ecological survey study area and enumerate the impacts associated with each of the Feasible Alternatives.

Methods

Field investigations were performed from October 30, 2001 through August 9, 2002 to identify and characterize wetlands, characterize the regulated streams in the project area, and to survey vegetation, wildlife, and aquatic biota across the entire the study area. Investigations that were centered on the two Feasible Alternatives (mostly as part of threatened and endangered species surveys) were performed April through August 2003.

The weather was relatively mild during the late fall and winter months of 2001-2002. Snow was infrequent and light, seldom covering the ground. Snow dates were generally avoided. Spring months were mild, with frequent precipitation. Late spring and summer dates were typically warm and dry.

Aquatic Ecology

Jurisdictional streams were identified as those waters that had an ordinary high water mark, definable beds and banks, and evidence of stream flow. Any channel that parallels a roadway, was apparently created in a non-hydric soil, and does not represent a relocation of a natural channel was eliminated as jurisdictional. That is, these latter channels were considered "drainage ditches" or "ditches through uplands," which are generally not regulated as waters of the US under the Clean Water Act (Department of the Army, Corps of Engineers, 1999).

Each identified stream was labeled according to watershed number and a tributary alphanumeric code that includes an abbreviation for the named stream to which it drains and a tributary number. Stream segments were categorized as perennial, intermittent or ephemeral, as defined by the Corps of Engineers (Department of the Army, 2002b).

Streams with a drainage area of greater than one square mile were evaluated using the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI). The QHEI assessment examines a number of stream physical characteristics and yields a score ranging from 0 to 100. Based on the QHEI score, a provisional Aquatic Use Designation was assigned in accordance with Rankin (1989). A score of 60 typically indicates a stream has the physical characteristics needed to support diverse macro-invertebrate and fish populations and attain the Warm Water Habitat designation (WWH). Scores of 46 to 60 may be indicative of a Modified Warm Water Habitat (MWH), that is, a WWH that has been disturbed but could potentially recover. Scores less than 46 typically indicate a Limited Resource Water (LRW), that is, a stream that has been irretrievably altered. Scores greater than 75 indicate a possible Exceptional Warmwater Habitat (EWH).

Streams with drainage areas less than one square mile were evaluated using the OEPA draft Headwater Habitat Evaluation Index (HHEI) (Final Draft V2.0 April 2001), which is used to determine the status of smaller streams as one of three classes of Primary Headwater Habitats (PHWH). Class I streams offer limited aquatic habitat (namely, ephemeral streams), Class II offer appreciable but seasonal aquatic habitat (warm water adapted community), and Class III stream offer substantial invertebrate, fish and amphibian habitat (cool water adapted community). The method scores streams on a range of 0 to 80 based on physical characteristics. Scores less than 15 indicate a Class I PHWH, scores 15 to 30 indicate a Class II PHWH, scores 30 to 53 can be either Class II or Class III depending on their conditions, and Scores 53 or greater indicate a Class III PHWH.

Water chemistry, invertebrate community assessment, and fish community assessment surveys were performed at 17 perennial stream sites within the study area from June 18 to June 22, 2002 (Hoggarth, 2002). No significant precipitation fell in the survey area immediately prior to the field study, and no rainfall occurred during the five days of the study. All stream habitats were experiencing low water conditions and all streams in the study area were accessible by wading. Some streams (unnamed, intermittent streams) were dry at the time of this study.

The aquatic survey techniques discussed in the revised ODOT ecological manual (2001) were used. The following sites were surveyed:

- Site 1, Unnamed tributary of the Scioto River (Appendix G-Figure 2);
- Site 2, Unnamed tributary of the Scioto River (Appendix G-Figure 2);
- Site 3, Unnamed tributary of the Scioto River (Appendix G-Figure 2);
- Site 4, Little Scioto River (Appendix G-Figure 3);
- Site 5, Dan White Hollow Run (Appendix G-Figure 3);
- Site 6, Long Run (Appendix G-Figure 4);
- Site 7, Little Scioto River (Appendix G-Figure 5);
- Site 8, Long Run (Appendix G-Figure 4);
- Site 9, Harrison Furnace Creek (Appendix G-Figure 4);
- Site 10, Candy Run (Appendix G-Figure 6);
- Site 11, Candy Run (Appendix G-Figure 6);
- Site 12, Stout Hollow Run (Appendix G-Figure 5);

- Site 13, Shoumberg Hollow Run (Appendix G-Figure 5);
- Site 14, Mansfield Hollow Run (Appendix G-Figure 5);
- Site 15, Wards Run (Appendix G-Figure 5);
- Site 16, Miller Run (Appendix G-Figure 2); and
- Site 17, Unnamed Tributary of Scioto River (Appendix G-Figure 7).

Three intermittent tributaries of the Little Scioto River had insufficient water at the time of this survey (identified as "Dry" on Appendix G-Figure 3) and were not sampled.

Water chemistry parameters were determined in the field by using a HACH DREL/1c Colorimeter, appropriate meters, and a HACH digital titrator. Total ammonia, nitrite, nitrate, orthophosphate, chloride, iron, and sulfate were determined by using the colorimeter. Conductivity and total dissolved solids were measured by using a HACH Conductivity/TDS meter. pH of the water was found by using a HACH One pH meter, and turbidity was determined by using a HACH Turbidimeter (Model 16800). Temperature was determined with a standard thermometer. Air temperature was measured first followed by water temperature. Microtitration was used to determine the oxygen concentration of the water (Winkler Method), total alkalinity, and total hardness.

Fish and aquatic invertebrate surveys were performed within a 100-300 meter reach of stream at each sample site. The larger sample area was used wherever electroshock fishing was used (Little Scioto River and Miller Run) and the shorter sample area was used in all smaller streams. All individuals of fish and invertebrates encountered were collected, retained until identified, and then either released or kept for positive identification in the laboratory.

Invertebrates were collected by hand with a dip net, a hand sieve, and while seining for fish. Freshwater mussel surveys were performed concurrent with invertebrate sampling. Mussels were collected by hand using visual survey techniques. The invertebrate survey took approximately one to two hours at each site. At least one specimen of each taxon, other than mussels, were taken for positive identification in the laboratory. Invertebrates were identified after Merritt and Cummins (1995), Burch (1972, 1989), Klemm (1982), Jezerinac *et al.* (1995), and Thoma and Jezerinac (2000). Common names of molluscs follow Turgeon *et al.* (1988).

A Power Gard Electroshocking apparatus was used at three sites (two on the Little Scioto River and one site on Miller Run) for a distance of approximately 200 meters. Electroshock sampling was not employed in the small named streams and unnamed tributaries. At those sites, fish were sampled by using a six by ten feet seine for a distance of at least 100 meters. Fish were identified after Trautman (1981) with common names after Robins *et al.* (1991).

A Shannon-Weiner Diversity Index value was calculated for the invertebrate and fish communities at each site by using the formula below:

$$H' = (3.3219)(\log_{10}N - ((\Sigma n(\log_{10}n))/N)$$

where n = # of individuals of species n
N = total # of individuals of all species

The Shannon Index is a diversity index sensitive to species richness and evenness of distribution. An Index of Biotic Integrity (IBI) value was calculated for the fish community at the three electroshock sites. This index is not appropriate for fish data generated by seining techniques alone.

Terrestrial Ecology

The entirety of the study area was visited at least once during the study period. Running lists were kept of terrestrial wildlife encountered or whose signs (e.g., tracks, calls) were observed during the survey. Plant species were listed according to habitats in which they were found.

The forest canopy trees in mature, upland woodlands were inventoried using 0.10 acre (37.5 ft. radius) plots, located at random in selected woodland communities. In each plot, the diameter at breast height (dbh) was measured and recorded with the species for each canopy tree, that is, trees with greater than four inches (10 cm.) dbh. The data from the plots were tabulated and combined to describe the overall composition of the mature woodlands. "Frequency" was calculated as the number of trees of each species. "Basal area" was determined by calculating the area of each tree from its dbh and then summing the areas for each species. "Relative dominance" was calculated as the sum of the relative frequency (the number of trees of each species as a percentage of the total number of trees of all species) and the relative basal area (the basal area of each species as a percentage of the total basal area of all species).

Endangered Species

The potential for endangered species was first determined through contacting the Ohio Department of Natural Resources, Division of Natural Areas and Preserves regarding current and historic records of populations of state and federally listed species or other outstanding habitats, features, or preserves in the study area (see Agency Correspondence in Appendix C). The US Fish and Wildlife Service list of federally protected species was also checked to determine the species whose known ranges extend into Scioto County (http://midwest.fws.gov/Endangered/lists/ohio-cty.html). Species and habitat descriptions provided by these resource agencies, various field guides and other references were used during the field investigations to identify or eliminate potential specimens or habitats encountered.

Based on the historical records and the possibility of suitable habitats for three federally listed species and one species with a pre-listing conservation plan in the project area, an informal Section 7 consultation was initiated with the USFWS. Specific surveys were undertaken along the Feasible Alternatives to determine the presence/absence or potential

effect of the project on these species: the endangered Indiana bat (*Myotis sodalis*), the threatened small whorled pogonia (*Isotria medeoloides*), the threatened Virginia spiraea (*Spiraea virginiana*), and the timber rattlesnake (*Crotalus horridus horridus*), which is being given pre-listing consideration. The survey sites and methods were coordinated with the USFWS Reynoldsburg Field Office as sufficient to support a "not likely to adversely affect" determination if the species or important habitat were not found. (Copies of Survey reports are included in appendices I - L)

Indiana Bat

Indiana Bat surveys were conducted by Environmental Solutions and Innovations, Inc. of Cincinnati, Ohio in accordance with the USFWS guidelines (USFWS, 1999), from June 9, 2003 through August 6, 2003 (Appendix I and J). Twenty-one survey sites were selected throughout the project area in coordination with the USFWS, Reynoldsburg Field Office. At each site, two mist net sets were set up across likely migratory routes through woodlands (such as a stream corridor, logging road, or trail) and monitored continuously for a minimum of five hours per night, beginning at dusk. Each site was netted for two nights, for a total of four net-nights at each site. Each captured bat was identified to species and gender, measured, weighed, its reproductive status determined, and then released.

A cave/outcropping site was also identified and investigated during the latter part of the mist netting survey. The cave was located on a bluff face, and therefore could not be readily trapped or netted. On September 27, 2003, the cave was investigated using vertical caving equipment for evidence of bat habitation, including droppings, air movement, obstructions that might hinder use by bats, or indications that bats had not used the cave such as undisturbed spider webs. As confirmed with USFWS, this investigation was not subject to the seasonal restrictions of the mist netting.

Small Whorled Pogonia

Field studies for the Small Whorled Pogonia (SWP) (CH2M Hill, 2003,Appendix K) were conducted from June 20 to July 16. On June 27th, 2003, representatives of OES, USFWS and CH2M HILL visited the known Hocking County habitat of the SWP. During May 2003, two specimens of the SWP were present at that site in vegetative state as reported by the ODNR. These plants had senesced by June 27 and could not be found. Therefore, it was agreed by all parties that the Portsmouth Bypass study would continue through the remainder of June and early July 2003 to define those woodlands with potential habitat for the SWP. As agreed to by ODOT and USFWS, lower and middle slope positions were emphasized, as upper slopes are generally considered too dry for the species.

Areas of the Feasible Alternatives were selected for study based on the extent of acid soil types, as mapped in the Scioto County soil survey (McCleary *et al*, 1989) and successional, pine or mature woodlands as determined during previous fieldwork. This definition included approximately 90% of the 900 acres of woodlands (excluding active logging areas) along the Feasible Alternatives. In each identified area, a meandering search was conducted along the Feasible Alternative to search for the SWP or populations of associate species that might indicate a suitable habitat (Table 1). All of the associates were vegetatively identifiable throughout the survey period. Where a substantial population (that is, more than a few individuals) of associate species were found, a minimum one-quarter acre plot was established and recorded. Plots were expanded if the population of the associates

extended beyond the one-quarter acre. A list of species present in three strata (canopy - greater than 4-inch dbh, subcanopy - less than 4-inch dbh and greater than one meter high, and ground layer) was assembled for each plot. Also at each plot, the physical characteristics recorded included the slope position (upper, middle, lower), the slope aspect (north, northeast, east, southeast, south, southwest, west, northwest), slope angle, and soil characteristics in the upper 6 to 12 inches including color, texture, and depth of litter.

Based on this survey, the most likely habitats for the SWP along the Feasible Alternatives were identified for revisitation during peak flowering period (Spring 2004) to determine the presence or absence of the SWP.

TABLE 1
Target Associate Species, Small Whorled Pogonia Survey

SCIENTIFIC NAME	COMMON NAME
Acer rubrum (seedlings)	Red maple
Gaultheria procumbens	Wintergreen
Goodyera pubescens	Downy Rattlesnake plantain
Hamamelis virginiana	Witch hazel
Isotria verticillata	Large whorled pogonia
Lycopodium spp (except *L. complanatum)*	Clubmosses
Maianthemum canadense	Canada mayflower
Mitchella repens	Partridge berry
Medeola virginiana	Indian cucumber root
Thelypteris noveboracensis	New York fern
Vaccinium pallidum (vacillans)	Sweet lowbush blueberry

Virginia Spiraea

The survey for the Virginia spiraea was conducted June 30 through July 16, 2003 (Appendix K). The timing of the survey corresponded to the normal flowering period of this shrub species (late June through July). Perennial stream crossings along each Feasible Alternative were identified from previous field investigations. Each of these stream crossings was searched for the plant, a plant list was assembled, and the streambed, banks and canopy closure documented relative to the preferred habitat conditions of the Spiraea, as described in USFWS recovery plan (1999) and other publications.

Timber Rattlesnake

Timber rattlesnake surveys (Wynn, 2003, Appendix L) were conducted by Doug Wynn of Lewis Center, Ohio on 30 dates between March 24 and September 27, 2003. The studies focused on identifying and investigating potential den sites, as the chances of encountering a snake near a den site is greater than random survey throughout the area. Additionally,

local residents were surveyed to determine whether they had seen any Timber Rattlesnakes in the project area, and if so, how many and where. Timber Rattlesnakes typically utilize high, dry ridges through out the summer. Studies were not limited to the areas of the Feasible Alternatives but included adjacent areas that could serve as potential den sites. Maps were first examined to determine where suitable elevation (700 - 1200 feet) and aspect were present for den sites. In these areas, the Feasible Alternatives were surveyed for the snake and evaluations were made on the suitability of the habitat according to the following criteria:

1. The degree of human disturbances
2. Composition of plant communities
3. Structure of plant communities
4. Characteristics of the bedrock
5. Presence of exposed bedrock
6. Degree of relief and steepness
7. Proximity to nearest known locality
8. Sizes of suitable habitats within corridor
9. Sizes of suitable habitats within the average migratory distance of the species in Ohio
10. Isolation from humans
11. Inquiries with local residents and knowledgeable resources such as soil and water conservation personnel, wildlife officers, local naturalists, etc.

Wetlands

The wetlands were identified according to the *Corps of Engineers Wetland Delineation Manual* (Department of the Army, 1987) with subsequent guidance from the Corps of Engineers. In accordance with the manual, each wetland area was identified based on the occurrence of wetland vegetation, hydric soils, and wetland hydrology. Indicators of all three parameters are required to deduce that a regulated wetland is present.

Wetland vegetation was determined by making a visual estimate of the abundance of each species in each stratum. Starting with the most abundant, each species' relative abundance was tallied until the tally exceeded 50 percent; those species were considered dominant. Any species with a relative abundance of greater than 20 percent was also included as a dominant. The indicator status of each of the dominant species was determined using the US Fish and Wildlife Service's wetland indicator status for Ohio (Reed *et al*, 1988). If greater than 50 percent of all dominant species had an indicator status of Facultative (excluding Facultative -), Facultative-Wet or Obligate, then the community was assumed to be dominated by wetland vegetation. If 50 percent or less of the dominant species had these statuses, then the community was dominated by upland species.

Soils were sampled using a dutch (mud) auger or soil probe to a depth of 12 to 18 inches. The profile was characterized in accordance with the Corps manual, including assessing the colors of the soil by comparison to the Munsell Soil Color Chart. Other features of the soil, including redoximorphic characteristics, hydrogen sulfide production, and apparent

moisture regime were also noted. Soil texture was estimated by the tactile method. The profiles were compared to the typical soil profiles as provided in the *Soil Survey of Scioto County, Ohio* (McCleary *et al*, 1989).

Wetland hydrology was assessed using visual cues of inundation or saturation, such as actual surface water, saturation/standing water in the soil pit, sediment deposits, silt lines, debris lines, water marks, oxidized root channels, water-stained leaves, "FAC-neutral test," and local soil survey data.

The extent of each identified wetland was determined by a noticeable change in the vegetation toward an upland community and indicators of better drainage in the soils. These changes often corresponded to a topographic gradient. The boundaries were annotated on aerial photos and/or topographic maps in the field for later transcription into the project GIS.

The connectivity of each wetland to the tributary system (streams) of the study area was determined. Those wetlands that had indicators of at least annual surface water connection to a stream were considered "tributary," and those with no apparent surface water connection to a stream were considered "isolated." "Tributary" wetlands were typically located adjacent to or at the head of a channel, even though the channel was dry during the field investigation. Wetlands within the Federal Emergency Management Agency (FEMA) mapped 100-year floodplains of the Scioto, Little Scioto or Ohio Rivers were also considered "tributary" wetlands whether or not there was a direct channel connection with a stream. "Tributary" wetlands are regulated as waters of the US under the Clean Water Act. "Isolated" wetlands are not regulated under the Clean Water Act, but are regulated under the Ohio Isolated Wetlands Law.

Each of the identified wetlands was evaluated in accordance with the Ohio Rapid Assessment Method (version 5.0), developed by the Ohio EPA. The ORAM Field Forms for each wetland are included Appendix F. Categorization were done in accordance with the latest quantitative score calibration (Mack, 2000).

Literature Review

Background Geologic Information

The topography of the study area varies from flat to gently rolling terrain along floodplains and bottomlands adjacent to the major streams, to steep slopes beyond the floodplains (Figure 2). Both the Little Scioto and Scioto Rivers flow through the split valley of the pre-glacial Teays River.

The study area is located in an unglaciated portion of Ohio. Brockman (1998) places the site in the Shawnee-Mississippian portion of the unglaciated Allegheny Plateau. Bedrock is exposed in many of the stream valleys in the steeper portions of the study area. According to bedrock maps prepared by the ODNR, the bedrock is composed primarily of shale and sandstone deposited during the early part of the Mississippian Period (about 345 million years ago). The shale and sandstone represent mud and fine sand carried by ancient streams. The *Soil Survey of Scioto County, Ohio* (McCleary *et al*, 1989) describes the underlying bedrock in most of the county as composed of shale, sandstone, and conglomerate material. These components place this bedrock in the Waverly Group. This group shows extensive variation in both vertical and horizontal strata. The variations are the results of changes in ancient shorelines or climatic conditions that frequently altered the zone of deposition during that time. The thickness of the bedrock varies considerably as a direct result of the changing deposition zone. Recent geotechnical studies for the Portsmouth Bypass have found the Pennsylvanian-aged the Logan Formation (interbedded sandstone, siltstone and shale) is the dominant rock stratum (DLZ, Inc., 2002). The Breathitt Formation (largely sandstone and shale) caps the higher ridgelines. Mississippian Cuyahoga Formation (primarily shale with interbedded sandstone and siltstone) is prominent in the northwestern portion of the study area.

The Glacial Map of Ohio (ODNR, undated) shows the parent material above the bedrock primarily as Pre-Illinoinan (more than 300,000 years old) colluvium, with areas of lake deposits along the Little Scioto River and glacial outwash along the Scioto River.

According to the soil survey, 30 soil types in five soil associations occur within the study area (Table 2 and Figure 3). The majority of the soils in the area are in the Omulga-Monongahela-Haymond, Shelocta-Brownsville, and Shelocta-Wharton-Latham associations. These soil types are, for the most part, well-drained to moderately well drained. The well-drained Shelocta-Brownsville and Shelocta-Wharton-Latham associations are the dominant soils along the slopes, typically with slopes of 8-15% or greater. The Omulga-Monongahela-Haymond association occurs in most of the flatter areas of the study area, except the Scioto and Ohio River floodplains. Omulga soils, a moderately well drained soil, occurs most in the northern sections of the study area between Lucasville and Minford. Haymond, a well-drained soil, occurs along the Little Scioto River flood plain. The Scioto River floodplain is

TABLE 2
Soil Types in the Study Area
Portsmouth Bypass Project

Soil Series	Symbol(s)	Topography	Drainage Class [1]	Hydric or Hydric-Inclusion
Alford silt loam	AfD	10 – 25% slopes	WD	N/A
Casco loam	CaF	40 – 70% slopes	WD	N/A
Coolville-Rarden silt loams	CpC	8 - 15% slopes	MWD	N/A
Doles silt loam	DoA	0 - 3% slopes	SPD	Hydric-Inclusion
Elkinsville silt loam	EkB	1 - 8% slopes	WD	Hydric-Inclusion
Elkinsville-Urban land complex	EmB	1 - 8% slopes	WD	Hydric-Inclusion
Ernest silt loam	ErD	15 – 25% slopes	MWD	N/A
Genesee silt loam	Ge	Occasionally flooded	WD	N/A
Haymond silt loam	Ha	Occasionally flooded	WD	Hydric-Inclusion
Latham-Gilpin association	LgD	Hilly	MWD	N/A
Monongahela silt loam	MoB MoC2	1 - 8% slopes 8 - 15% slopes	MWD	N/A
Nolin silt loam	No	Occasionally flooded	WD	N/A
Ockley loam	OcB	1 - 8% slopes	WD	N/A
Omulga silt loam	OmB OmC	1 - 8% slopes 8 - 15% slopes	MWD	Hydric-Inclusion
Omulga Urban land complex	OpB OpC	1 - 8% slopes 8 - 15% slopes	MWD	N/A
Peoga silt loam	Pe	Rarely flooded	PD	Hydric
Gravel Pits	Ps	Gravel pit		
Sardinia silt loam	SaB	1 - 8% slopes	MWD	Hydric-Inclusion
Sciotoville silt loam	SacB	1 - 8% slopes	MWD	Hydric-Inclusion
Shelocta silt loam	SbB SbC SbD	3 - 8% slopes 8 - 15% slopes 15 – 25% slopes	WD	N/A
Shelocta-Brownsville association	ScE, ScF	Steep Very Steep	WD	N/A
Shelocta-Wharton-Latham association	SfE	Very Steep	WD	N/A
Skidmore silt loam	Sk	Occasionally flooded	WD	N/A
Stendal silt loam	St	Occasionally	SPD	Hydric-Inclusion

TABLE 2
Soil Types in the Study Area
Portsmouth Bypass Project

Soil Series	Symbol(s)	Topography	Drainage Class [1]	Hydric or Hydric-Inclusion
		flooded		
Tilsit-Coolville association	TcB	Undulating	MWD	Hydric-Inclusion
Tioga loam	To	Occasionally flooded	WD	N/A
Wharton silt loam	WfD	15 – 25% slopes	MWD	N/A
Wharton-Urban land complex	WkD	8 - 20% slopes	MWD	N/A
Wheeling silt loam	WmB	1 - 8% slopes	WD	N/A
Wyatt Silt Loam	WyC2	8 - 15% slopes	WD	N/A

[1] WD= Well drained; MWD = Moderately well drained; SPD = Somewhat poorly drained; PD = Poorly drained.

dominated by the well drained (although frequently flooded) Nolin-Genessee association, and the Ohio River floodplain by the Weinbach-Wheeling-Elkinsville association.

Of the 30 soil types, Peoga silt loam is the only soil considered hydric within the study area. This soil occurs in the southern-most tip of the study area, between US Route 52 and Ohio River Road in Wheelersburg just north of Lowe's Home Improvement. Nine other soils are considered hydric inclusion soils, that is, they may have small inclusions of hydric soils that are too small to be mapped as individual soil units (Table 2). These inclusion typically occur in depressions or along drainageways. The hydric soils referenced here are from the Scioto County hydric soils list and supplemental list of non-hydric soils with hydric inclusions (NRCS, 1991 and 1992).

Water Quality, Aquatic Macroinvertebrates, and Fish

The project is within two major watersheds: the Scioto River (USGS Hydrologic Cataloging Unit 05060002) and the Little Scioto River (USGS Hydrologic Cataloging Unit 05090103). These watersheds discharge directly into the Ohio River. Additionally, there are small intermittent streams, within the study area, that drain directly to the Ohio River. Table 3 presents a summary of the stream systems within the study area.

The Scioto River runs generally parallel to US Route 23 approximately 4000 feet from the northern termini of the study area. In this area, the Scioto River has a wide floodplain which is mostly used for agricultural row crops. Within the study area, there are four sub-watersheds of the Scioto River:

Miller Run – northern-most stream system within study area
Thomas Hollow – unnamed stream system that flows through Lucasville
Lake Margaret System – unnamed stream system that flows to Lake Margaret
Candy Run – largest of the Scioto River tributaries within the study area.

Approximately the western third of the study area drains to the Scioto River.

The Little Scioto River run northeast to southwest through the southern portion of the study area. The Ohio Water Quality Standards (WQS) includes the Little Scioto River in its "South East Ohio River Tribuaries" watershed. Within the study area, there are 8 sub-watersheds of the Little Scioto River:

Blue Run – Northern-most Little Scioto tributary, the Blue Run itself is not in the study area
Long Run – Large perennial stream which drains the Minford area
Shumway/Blake/Dan White Hollows – Steeply sloped and wooded system of hollows south of Minford
Slab Run – Small intermittent watershed immediately south of Dan White Hollow
Shoumberg Hollow – Perennial stream draining a steeply sloped and wooded area
Mansfield Hollow – Intermittent stream which joins the Little Scioto River at Tick Ridge Road
Stout Hollow – Small perennial stream in the vicinity of Highland Bend
Wards Run – Large perennial stream draining much of Porter Township, the southeast corner of the study area. The Oven Lick and the Shell Creek are large Ward Run tributaries.

The use designations per the WQS are shown on Table 3. The Little Scioto River is identified as a State Resource Water. Another State Resource Water in the vicinity of the study area is the Rocky Fork. While the Rocky Fork is not within the study area, a main tributary to Rocky Fork, namely Long Run, passes through the center of the study area, parallel to Lucasville-Minford Road.

All of the streams in the study area that are cited in the WQS have been given a Warmwater Habitat use designation, as well as designations that they are suitable as agricultural and industrial water supplies and for primary contact recreation.

According to the Ohio EPA website, no studies of either the Little Scioto River or the Scioto River in the study area have been published by Ohio EPA within the past 10 years.

TABLE 3
Summary of watershed structure used for Portsmouth Bypass including Ohio Water Quality Standard designations
Portsmouth Bypass Project

Stream Name	Ohio Water Quality Standards Aquatic Life Use Designation	Other Use Designations per Water Quality Standards[1]
Scioto River Basin		
Scioto River near Study Area	Warmwater Habitat	AWS, IWS, PCR
Miller Run	Warmwater Habitat	AWS, IWS, PCR
Thomas Hollow System	No designation	No designation
Lake Margaret System	No designation	No designation
Candy Run	Warmwater Habitat	AWS, IWS, PCR
Little Scioto River Basin		
Little Scioto River	Warmwater Habitat	State Resource Water, AWS, IWS, PCR
Blue Run	Warmwater Habitat	AWS, IWS, PCR
Long Run	Warmwater Habitat	AWS, IWS, PCR
Shumway/Blake/Dan White Hollows	No designation	No designation
Slab Run	No designation	No designation
Shoumberg Hollow	No designation	No designation
Mansfield Hollow	No designation	No designation
Stout Hollow	No designation	No designation
Wards Run (Plum Fork)	Warmwater Habitat	AWS, IWS, PCR
Small Ohio River Tributaries		
Stewart Hollow and 3 other small tributaries	No designation	No designation

[1] AWS = Agricultural Water Supply: IWS = Industrial Water Supply; PCR = Primary Contact Recreation

Terrestrial Plant and Animal Communities

The project is located at the western edge of the Mixed Mesophytic Forest community according to Braun (1950), and in the Mixed Oak and Bottomland Hardwood Communities according to Gordon (1969). These forest types are broadly defined by these authors based on the assessment of old growth stands and historical records, and represent the likely forest types that dominated the area before European settlement.

Braun generally characterized the original, Mixed Mesophytic forest community as dominated by a large variety of species, notably beech (*Fagus grandifolia*), tulip tree

(*Liriodendron tulipifera*), basswood (*Tilia heterophylla*), sugar maple (*Acer saccharum*), chestnut (*Castanea dentata*), Ohio buckeye (*Aesculus octandra*), red oak (*Quercus rubra*), white oak (*Q. alba*), and hemlock (*Tsuga canadensis*). Other common species included white ash (*Fraxinus americana*), red maple (*A. rubrum*), black cherry (*Prunus serotina*), sweet birch (*Betula lenta*), and cucumber tree (*Magnolia tripetala*). As common understory species she lists flowering dogwood (*Cornus florida*), ironwood (*Carpinus caroliniana*), hop-hornbeam (*Ostrya virginiana*), sourwood (*Oxydendrum arboreum*), several magnolias (*Magnolia* spp.), redbud (*Cercis canadensis*), striped maple (*Acer pensylvanicum*), holly (*Ilex opaca*), spicebush (*Lindera benzoin*), hydrangea (*Hydrangea arborescens*), pawpaw (*Asimina triloba*), and alternate dogwood (*Cornus alternifolia*). The composition and relative abundance of species varies from place to place with topographic position and other environmental factors.

Based upon trees cited in the original land survey records, Gordon's Mixed Oak Community of unglaciated Ohio is inclusive of two oak forest associations: the White Oak-Black Oak-Hickory association and the White Oak-Black Oak-Chestnut Association. Two subdivisions of these associations are also defined, the White Oak type and Chestnut Oak-Chestnut Type. In general, the oak forests are described as dominated by black oak (*Q. velutina*), white oak, shagbark hickory (*Carya ovata*), pignut hickory (*C. glabra*) and mockernut hickory (*C. tomentosa*). At some locations white oak was so common as to justify a specific white oak forest type. Other species associated with the oaks included black cherry, red maple, scarlet oak (*Q. coccinea*), white ash, tulip tree, and sour gum (*Nyssa sylvatica*). Common understory species includes those listed above by Braun, with the addition of sassafras (*Sassafras albidum*).

The oak-chestnut association was originally common on well drained hilltops with acidic sandy soils. Chestnut oak (*Quercus prinus*) was a key constituent in these forests with chestnut until the demise of chestnut by blight in the 1920s, at which time chestnut oak and other oaks became the dominants. The understory in these dry woodlands was commonly composed of blueberries and huckleberries (*Vaccinium vacillans, V. stamineum,* and *Gaylussacia baccata*), mountain laurel (*Kalmia latifolia*), and greenbriars (*Smilax glauca* and *S. bona-nox*).

Gordon describes Bottomland Hardwood communities as the original forest type along the Little Scioto and Scioto River bottoms. The composition varied with frequency of flooding, soil texture, and stand age. In general, he lists some of the common trees in the bottomlands as white ash, box elder (*Acer negundo*), Ohio buckeye, black cherry, American elm (*Ulmus americana*), honey locust (*Gleditsia triacanthos*), silver maple (*Acer saccharinum*), sugar maple, red maple, sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), black willow (*Salix nigra*), bitternut hickory (*Carya cordiformis*), and shagbark hickory. As an ancedote, Gordon mentions a giant sycamore, some 21 feet in diameter at breast height, that was recorded in Valley Township (near the study area) in the early nineteenth century.

Anderson (1982) classifies the existing forest communities in the unglaciated portion of the state as a number of specific communities, depending on the dominant species. The occurrence of each community depends on particular site conditions and forest disturbance history. Anderson's communities include mixed mesophytic, beech-sugar maple, oak-hickory, oak-maple, oak-maple-tuliptree, oak-pine, and Appalachian oak forests. In

bottomlands, Anderson identifies three floodplain forest community types: maple-cottonwood-sycamore, river birch-maple, and mixed floodplain forests. The latter is inclusive of the species listed in the other two communities, but occurs in transitional areas that are somewhat less frequently flooded and therefore includes species that typically occur in the adjacent uplands, such as tulip tree.

Endangered Species

The Ohio Department of Natural Resources, Division of Natural Areas and Preserves was contacted regarding records of rare species in the study area (see Agency Correspondence in the Appendix C). According to their records, there are several species that are considered potentially threatened, threatened or endangered in the state and that are known to occur in or near the study area. These species are listed in Table 4. Additionally, the Ohio Champion sourwood (*Oxydendrum arboreum*) is reported to be located at the edge of the study area near the Southern Ohio Correctional Facility. The location data from the Natural Heritage Database is shown on Figure 7.

TABLE 4
Natural Heritage Database – Occurrences within Study Area
Portsmouth Bypass Project

Scientific Name	Common Name	State Status	Federal Status	Year of most Recent Record
Oxydendrum arboreum	Sourwood	Ohio Champion Tree	---	---
Panicum laxiflorum	Pale-green Panic Grass	Potentially Threatened	---	1993
Phacelia bipinnatifida	Fern-leaf Scorpion Weed	Potentially Threatened	---	1990
Quercus falcata	Spanish Oak	Threatened	---	1961
Simpsonaias ambigua	Salamander Mussel	Special Interest	---	
Stenanthium gramineum	Feather-bells	Threatened	---	1989
Viola pedata	Bird-foot Violet	Threatened	---	1989

The US Fish and Wildlife Service maintains a list of federally listed threatened and endangered species in Ohio by county (http://midwest.fws.gov/Endangered/lists/ohio.html). According to that list, Scioto County is included in the range of three federally listed species, namely the endangered Indiana bat (*Myotis sodalis*) , the threatened Virginia spiraea, (*Spiraea virginiana*), and the threatened small whorled pogonia (*Isotria medeoloides*). The timber

rattlesnake (*Crotalus horridus horridus*) is not federally listed but it is declining and is receiving pre-listing consideration.

According to the USFWS, Indiana bats hibernate during winter in caves and abandoned mines, often along with many other species of bats. Areas in caves that are suitable for hibernation are draft free and have a constant winter temperature. After hibernation, Indiana bats migrate to their summer habitats. Based on recent trap and release studies, suitable summer (roosting and brood-rearing) habitat for the Indiana bat is living or standing dead trees or snags with exfoliating, peeling or loose bark, split trunks and/or branches, or cavities. There appears to be no tree size threshold, and both lowland and upland locations may be utilized.

Habitat for the small whorled pogonia consists of middle-aged, dry hardwood or mixed pine-hardwood forests with an open canopy, open understory and sparsely covered ground surface. Preferred habitat is near long-term canopy gaps such as streams, vine gaps and old roads. This species has only been confirmed in Hocking County, approximately 50 miles north of the study area.

Habitat for the Virginia spirea is usually rocky, flood scoured banks of high-energy (high gradient) streams or rivers. Flood scouring may be important to this species by preventing canopy closure and creating river wash deposits, thereby decreasing competition from larger trees and providing an appropriate rooting medium. This species is only known in Scioto County along Scioto Brush Creek, west of the Scioto River.

The timber rattlesnake occupies a variety of habitats depending on the time of year. Summer ranges include heavily forested areas, rocky hillsides, and fields bordered by forests. The nearest known populations of the timber rattlesnake are in Shawnee State Forest, 4-5 miles west of the Scioto River.

Wetlands

The National Wetland Inventory map shows a number of wetlands within the study area (see Figure 4). The majority of the wetlands identified on the NWI maps are manmade ponds, labeled as PUBG (palustrine, unconsolidated bottom, diked or excavated). A number of these ponds correspond to ponds shown on the USGS quadrangle maps. There are only four other wetlands shown. One small palustrine emergent marsh is shown near the western end of the study area between US 23 and Fairground Road, and two scrub-shrub wetlands and one emergent marsh are shown south of the Little Scioto River. One of the scrub-shrub wetlands corresponds to an old oxbow area north of Highland Bend Road. The study area passes over the southern end of this wetland. The emergent marsh is located in the area between US 52 and the Ohio River, and the other scrub-shrub wetland is located between US 52 and Ohio River Road near Wheelersburg.

The Ohio Wetlands Inventory (ODNR, 2001) shows numerous potential wetlands within the study area, mostly smaller than one half acre. Like the NWI, many are open water areas, that is, farm ponds (see Figure 5). The rest are small scrub-shrub and emergent wetlands scattered through the study area. No wooded wetlands are identified.

As described above in the "Background Geologic Information" section, Peoga loam, which is typically poorly drained and is the only hydric soil type in the study area, occurs in a single unit at the southern end of the project area, between US 52 and Ohio River Road north of Wheelersburg. Nine other soils are considered hydric inclusion soils, that is, units of these other soils may contain small unmapped areas of hydric soil. These other soils are distributed throughout the study area, mostly along the flatter areas adjacent to streams and floodplains.

Land Use

Recent (1999) aerial photography of the area shows mainly forest, agricultural and residential land uses throughout the majority of the study area. Most of the steep slopes that dominate the study area are forested or used for cattle grazing. Residential, commercial and institutional land uses are concentrated in the flatter portions of the study area along the main roadways. The most expansive developed lands occur in and east of Lucasville, in and around Minford, and in Wheelersburg. The Southern Ohio Correctional Facility is located along the south side of Lucasville-Minford Pike approximately 1.6 miles east of US 23. Railroads pass north and south through the study area adjacent to US 23 near Lucasville and parallel to SR 335. High-tension electric lines also pass north to south through the center of the study area, and east to west through the southern part of the study area. The extreme northwestern corner of the study area includes a portion of the Scioto County Fairgrounds, the Lucasville library, and the Scioto County Engineer's facility.

Agriculture in the study area is primarily livestock production, mostly cattle but also horses, because of the steep topography. Grasslands that are not grazed are likely harvested for hay. Some limited portions of the study area are used for row cropping and orchards.

A notable ongoing activity in the study area is timber harvesting, in select areas north of Lucasville-Minford Road and in the center of the study area south of Minford. Obviously, this activity directly transforms the habitat from a closed canopy forest community to open field or scrub-shrub habitats, depending on the time since and intensity of the harvesting. The creation of forest roads and the removal of vegetation may also directly affect aquatic habitats (mostly ephemeral and small intermittent streams, and possibly wetlands) directly or through increased runoff and/or sedimentation. There is also ongoing land development (primarily residential), mostly along Lucasville-Minford Road in the area of the correctional facility.

Aquatic Ecology

Streams

Physical Characterization

The stream network through the study area is typified by relatively steep ephemeral streams, leading to intermittent and small perennial streams with moderate to low gradient, to the larger streams (rivers) that are low gradient. Many of the ephemeral, intermittent and smaller perennial streams typically have substrates comprised of cobble, gravel, and bedrock (sandstone and shale). Sand and boulders are lesser components of the stream substrates. Except for the rivers, the steepness of the adjacent topography and the stream gradients provide high velocity flow conditions that minimize the accumulation of silt. Although embeddedness is locally present (typically from sand accumulation instead of silt), it is also somewhat controlled by the higher velocity flows in these streams. Given their steepness, many streams appear to be subject to extremely low flow conditions during dry periods.

Primary direct impacts to streams in the study area are cattle grazing, canopy removal, channelization (particularly near roadways) and debris accumulation. Land development and topography may also contribute to the "flashiness" of some streams, which leads to greater bank destabilization and greater flow variation. The greatest impact to streams from sedimentation occurs in recently logged areas.

The HHEI and QHEI stream habitat evaluations were performed selectively throughout the study area to characterize the streams in each watershed. Many of the smallest ephemeral streams were not evaluated, simply because they contained no water, and therefore almost invariably score in the Class I (lowest) headwater habitat range. Table 5 summarizes the QHEI/HHEI scores by watershed. The data forms are presented in Appendix G. Both scoring methods were designed for low flow periods, and the scores are influenced by the average and maximum water depths. Thus, forms completed during wet periods may rate some streams slightly higher. On the other hand, the scores are also largely dependent on parameters that remain consistent throughout the year, such as the abundance of coarser substrates (gravel and cobble) and other physical characteristics. The scores reflect generally good physical characteristics in the majority of the streams in the study area.

The intermittent streams in the study area were typically evaluated using the HHEI forms. For those streams where both a QHEI and a HHEI form were completed, the HHEI was completed for the upper reach of the stream, and QHEI on the lower reach. The HHEI scores ranged from 11 to 73. All but one intermittent stream scored in the Class II to Class III headwater habitat range (16 or greater). QHEI scores for most of the lower intermittent streams were in the Modified Warm Water Habitat to Warm Water Habitat range 46 or

greater). One intermittent tributary of the Long Run scored as a Limited Resource Water, mainly because of cattle grazing in and around the stream, leaving almost no stream bank vegetation and a nearly ubiquitous bedrock substrate and vertical banks. The small Ohio River tributaries also scored low because of heavy (several feet thick) sediment accumulation along the river floodplain (compromising the stream banks and substrate diversity) and the impacts of adjacent development.

TABLE 5
Summary of QHEI / HHEI Data
Portsmouth Bypass

Basin/watershed	**QHEI**	**HHEI**
Scioto River Basin		
Miller Run Watershed	45 – 61.5	-
Thomas Hollow Watershed	52.5 - 66	11 - 52
Lake Margaret Watershed	62	16 - 27
Candy Run Watershed	54 - 62	26 -61
Little Scioto River Basin		
Little Scioto River & direct tributaries	65 – 70	12 – 25
Blue Run Watershed	-	16 - 34
Long Run Watershed	45.5 – 68.5	35 – 60
Dan White/Shumway/Blake Hollows	66.5	60
Slab Run Watershed	70.5	36 – 42
Shoumberg Hollow	53	30 – 41
Mansfield Hollow	-	44
Stout Hollow	66	55 – 57
Wards Run Watershed	69 – 74.5	21
Ohio River Basin		
Small tributaries to Ohio River	19 -54	30 - 73

The QHEI scores for the perennial streams ranged from 52.5 to 74.5. These scores generally indicate that many of the perennial streams in the study area would be able to support macroinvertabrates and fish communities typical of a Warm Water Habitat (WWH) rating. One exception, the upper portions of the Thomas Hollow, had a Modified Warm Water Habitat (MWH) score of 52.5 because of impacts of adjacent developments.

Aquatic Biota Survey Site Descriptions

Site 1 (Unnamed tributary of Scioto River): Site 1 was located at Fairgrounds Road near Lucasville at 38°53'11"N 82°59'36"W (Appendix G-Figure 2). The small stream ran over a cobble and gravel substrate with abundant vegetation downstream of U.S. Route 23 (where it was open) (Photographs 1 & 2).

Site 2 (Unnamed tributary of Scioto River): Site 2 was located off of Thomas Hollow Road at 38°53'15"N 82°59'36"W (Appendix G-Figure 2). This was the same stream as Site 1, only this was farther upstream. There was very little flow at this site and aquatic sampling occurred at the bridge (culvert) pool (Photograph 3).

Site 3 (Unnamed tributary of Scioto River): Site 3 was located at the culvert at Minford Road at 38°53'06"N 82°59'32"W (Appendix G-Figure 2). The stream was located in a woodlot at this site (Photographs 4 & 5) and flowed over a substrate of mostly cobble and boulders.

Site 4 (Little Scioto River): Site 4 was located at the mouth of Dan White Hollow Run at 38°48'59"N 82°51'08"W (Appendix G-Figure 3). The Little Scioto River at this site alternated between short, shallow riffles over sand and gravel (Photograph 7) to pool and run habitats over gravel, sand and silt (Photograph 6). This reach provides habitat for many species of animals including mudpuppies (*Necturus maculosus*) with both adults and egg-masses found in this reach, and freshwater mussels, such as the specimen of *Lampsilis cardium* shown in Appendix G-Figure 8 with extended mantle flaps. Specimens of the eastern sand darter (*Ammocrypta pellucida*) were collected here as well.

Site 5 (Dan White Hollow Run): Site 5 is a small tributary of the Little Scioto River at 38°49"01"N 82°51'28"W (Appendix G-Figure 3). The stream forms the roadbed for much of its length (Photographs 10 & 11). This reach of the stream is extremely modified and intermittent. Upstream, outside of this area, it widens out and forms a natural channel (Photograph 9).

Site 6 (Long Run): Long Run at Site 6 was composed of shallow pools and long shallow riffles (Photographs 12 & 13). The stream at this site runs over a substrate of cobble and gravel. It is located at 38°51'15"N 82°52'53"W (Appendix G-Figure 4).

Site 7 (Little Scioto River): The Little Scioto River at Site 7 was composed of more pool habitats and fewer riffles and runs (Appendix G-Figures 14 & 15). There were large flat boulders throughout much of this reach and again the reach supported a very large population of mudpuppies (with many egg-masses found under the flat stones as well as many individuals of the salamander mussel, *Simpsonaias ambigua*). This site was located near the railroad bridge (Photograph 15) at 38°46'25"N 82°51'55"W (Appendix G-Figure 5).

Site 8 (Long Run): Site 8 was very similar to Site 6. Long Run at this site was mostly composed of shallow pools and riffle habitats (Photographs 16 & 17). This site was located upstream of Site 6 at 38°51'03"N 82°54'11"W (Appendix G-Figure 4). Specimens of the rosyside dace (*Clinostomus funduloides*) were collected from this site.

Site 9 (Harrison Furnace Creek): Site 9 was located at 38°50'57"N 82°53'34"W (Appendix G-Figure 4). The stream flowed over a substrate composed mostly of bedrock at this site (Photographs 18 & 19).
Site 10 (Candy Run): Site 10 was located at 38°51'53"N 82°56'13"W (Appendix G-Figure 6). This small, headwater stream was composed of short, shallow pools separated by long, shallow riffles (Photographs 20 & 21). Of interest here, however, was the collection of an unnamed species of crayfish (*Cambarus* sp. formerly known as *Cambarus bartonii cavatus*).

Site 11 (Candy Run): Site 11 was located downstream of Site 10 at 38°52'14"N 82°56'51"W (Appendix G-Figure 6). The creek at this site was composed of long shallow riffles (Photographs 22 & 23). Very few pools were found at this site, however, where shallow pools were found with slab boulders, the same unnamed species of crayfish (*Cambarus* sp.) was found as well as one specimen of the parasitic leech (*Placobdella parasitica*).

Site 12 (Stout Hollow Run): Site 12 was located in Camp Bennett at 38°46'31"N 82°51'35"W (Appendix G-Figure 5). Stout Hollow Run at this site is intermittent (Photographs 24 & 25) with essentially no flow at the time of this study.

Site 13 (Shoumberg Hollow Run): This stream was composed of shallow pools separated by shallow riffles (Photographs 26 & 27). The stream was sampled between the railroad tracks and SR 335 at 38°47'43"N 82°51'00"W (Appendix G-Figure 5).

Site 14 (Mansfield Hollow Run): Mansfield Hollow Run was composed of a series of pools separated by reaches of interstitial flow (Photographs 28 & 29). This sampling site was located near the Little Scioto River at 38°47'05"N 82°51'04"W (Appendix G-Figure 5).

Site 15 (Wards Run): This site is located in the town of Slocum at 38°46'03"N 82°50'34"W (Appendix G-Figure 5). This stream is composed of a fairly long, deep pool at the Dixon Mill Road Bridge (Photograph 30) to shallow pools separated by shallow riffles throughout the remainder of the study area (Photographs 31 & 32). The streambed was composed of gravel and sand with scattered cobble.

Site 16 (Miller Run): Miller Run at this site was located between the Scioto County Fairgrounds to the south (Photograph 33) and a farm and auto salvage lot to the north (Photograph 34). There was a long pool at the bridge with boulders and silt substrate. Otherwise, the stream alternated between shallow riffles and shallow pool habitats. This site was located at the Fairgrounds Road bridge at 38°54'19"N 83°00'13"W (Appendix G-Figure 2).

Site 17 (Unnamed tributary of Scioto River): This stream was composed of bisected pools separated by shallow riffles, some of which had interstitial flow at the time of this study (Photographs 35 & 36). This site was located adjacent to Lucasville Prison at 38°52'42"N 82°58'17"W upstream of Lake Margaret (Appendix G-Figure 7).

Water Chemistry

Appendix G-Table 1 lists the water chemistry data collected at the time of this survey. These data are fairly uniform throughout the study area. In general they depict streams with relatively low total hardness and alkalinities. These streams are found in unglaciated Ohio, running mostly through bedrock composed of sandstone. The pH of the water running through these streams ranged from 7.44 to 6.50 or circumneutral. Chloride levels were very low indicating that none of these streams currently is used for sewage discharge. All but the Little Scioto River were too small for adequate elimination of sewage from the generating source. The water in each stream was fairly clear (turbidity ranging from a low of 1.4 NTU to a high of 14.4 NTU) and water temperature fluctuated more or less linearly with air temperature (most of the streams were so small and open that they warmed up and cooled down rapidly - the only exception was the Little Scioto River, which maintained a fairly constant temperature throughout this study). Other water chemistry parameters varied with the stream.

Unnamed tributary of Scioto River (Sites 1 & 2): This stream has an unusually higher conductivity than expected. Compared to other streams in the area, this stream had conductivity readings similar to Stouts Hollow Run (Site 12) which formed the base of a road through much of its length, Miller Run (Site 16) which skirted a dump and active cattle farm upstream of the study area, and the Unnamed tributary of the Scioto River at correctional facility. The only noticeably elevated water quality parameters of this stream were sulfate levels (99 mg/l) and slightly elevated nitrate levels (1.50 - 1.51 mg/l). The fact that the Total Dissolved Solids (TDS) were 250 mg/l indicates that other substances were dissolved in the water but that these other metals/ions were not otherwise detected by the water chemistry analysis.

Unnamed tributary of Scioto River (Site 3): This stream is impacted by agricultural and/or suburban development. Phosphate levels were the highest of any stream sampled during this study (2.59 mg/l) and both nitrate (1.90 mg/l) and ammonia (0.50 mg/l) were fairly high as well. The eutrophic nature of the water was not evident as an overabundance of aquatic vegetation, but most of the reach sampled during this study was heavily wooded which might have shaded the water enough to inhibit algal growth, such as *Cladophora*. The source of this pollution was not determined.

Little Scioto River (Sites 4 & 7): Water quality of the Little Scioto River was very good within the study area. The river in this reach is fairly low gradient with long shallow to deep pools and short riffles. Ammonia (0.46 & 0.45 mg/l) and phosphate (0.42 & 0.52 mg/l) were slightly elevated, but all other parameters tested were within expected ranges. Oxygen levels (7.9 & 4.6 mg/l) were unexpectedly different between the two sites; oxygen levels were probably somewhere between these two values. The relatively large number of invertebrates and fish taken at both sites indicates that oxygen concentrations do not limit these animals in this river (according to Ohio EPA an oxygen concentration of 5 mg/l or more is required for a healthy aquatic community).

Dan White Hollow Run (Site 5): The road to Dan White Hollow follows the course of this stream. The stream is the roadbed throughout much of its length and this has undoubtedly

affected the quality of the water in this stream. In fact, the water quality depicted by the data collected during this study is very unusual. This stream had the lowest total hardness (66 mg/l), alkalinity (13 mg/l) and TDS (86 mg/l) of any stream in the corridor, but had the highest values for nitrate (3.20 mg/l) and turbidity (1.4 NTU).

Long Run (Sites 6 & 8): The quality of the water in Long Run is affected by suburban development. Nitrate (1.50 & 2.20 mg/l) and phosphate (2.21 and 1.34 mg/l) are elevated, probably as a result of lawn fertilizers. Other than these nutrients, the stream has fairly good water quality.

Harrison Furnace Creek (Site 9): No obvious impairment to water quality was found at this site (all water quality parameters tested were very low and/or were within expected limits). However, there was a thick coat of algae on the rocks during this study (the stream lacked a wooded riparian corridor along much of its length), and the owner of the property at this site mentioned that the creek often appears polluted (odors and foam). The stream is probably affected by discharge from septic systems upstream.

Candy Run (Sites 10 & 11): Like Long Run, Candy Run appears to be impacted by suburban development with elevated nitrate (2.20 mg/l) and phosphate (0.82 mg/l) levels. Other than this, the stream has good water quality.

Tributaries of the Little Scioto River (Sites 12 - 15): Four small streams that flow into the Little Scioto River (Stout Hollow Run - Site 12, Shoumberg Hollow Run - Site 13, Mansfield Hollow Run - Site 14, and Wards Run - Site 15) were sampled. All but Stout Hollow Run and Wards Run had fairly good water quality. The other two sites (13 & 14) had relatively low phosphate levels (0.11 & 0.56 mg/l) and nitrate levels that ranged from 1.27 mg/l (Shoumberg Hollow Run) to 2.90 mg/l (Mansfield Hollow Run). Other parameters were within expected values. Stout Hollow Run (Site 12) had very low nutrient values but a very high conductivity (0.499 µS/cm) and low oxygen (1.7 mg/l). The obvious odor of raw sewage was apparent throughout much of its length. This stream is polluted by ineffective septic systems. Wards Run (Site 15) is also being impacted by septic systems, with lower than expected oxygen levels (4.4 mg/l) and higher than expected nitrate (2.80 mg/l) and phosphate (4.55 mg/l) concentrations.

Miller Run (Site 16): Miller Run had fairly good water quality at the time of this study, but it was obvious by the high conductivity (0.485 µS/cm) and the slipperiness of rocks (probably a result of algae or diatoms) that the stream receives nutrient enrichment. The fact that cattle were walking in the stream, upstream of the study area, also was a good indication that untreated wastes pollute the run. The higher than expected sulfate level (98 mg/l) and high conductivity may be the result of leakage from automobiles stored in the adjacent auto-salvage facility located at this site as well.

Unnamed tributary of Scioto River (Lake Margaret tributary) (Site 17): This small stream had the highest conductivity (0.551 µS/cm) of any of the streams sampled, but only the nitrate level (4.75 mg/l) was also elevated. The stream runs through an upscale housing development within the study area. Fertilizer application to lawns likely contributes to the

high nitrate levels. The high nitrate levels helps to explain the higher than expected conductivity, but other, untested ions and/or metals may contribute to this level as well.

In summary, several of the larger streams in this area (Little Scioto River, Long Run and Candy Run) with the exception of Miller Run and Wards Run had fairly good water quality. They should be able to support a wide variety of aquatic species. Miller Run and Wards Run, on the other hand, were polluted by domestic and/or agricultural sources. The smaller streams (Scioto River tributaries and Little Scioto River tributaries) were polluted by domestic and/or suburban development (including Dan White Hollow Run being used as a roadbed). Due to their relatively small size, they were unable to process (through plant growth) the nutrients available and these nutrients and other pollutants were delivered to the two major drainage basins in the study area. In general, these water quality data suggest that the named streams (other than Miller Run and Wards Run) should support adequate aquatic diversity and the smaller stream (unnamed tributaries) should not. However, it is expected that the smaller streams would have supported less diversity than the named streams anyway, due to the differences in size and permanency of flow conditions.

Invertebrate Community Structure

Table 6 summarizes the results of the aquatic biota survey performed for perennial streams in the study area. Appendix G-Table 2 provides more detailed invertebrate community structure data.

Sixty-five taxa of invertebrates were collected during this study. Arthropods and molluscs represented the majority of the invertebrate fauna collected during this study. The taxa that were most abundant throughout the study area were flatworms (Dugesiidae), mayfly (*Stenonema* sp.), water strider (*Aquarius* sp.), caddisfly (*Hydropsyche* sp.), and midge larvae (Chironomidae). Other common species were the spiny crayfish (*Orconectes spinosus*) and the pouch snail (*Physella integra*). Seven phyla, namely Porifera (sponges), Platyhelminthes (flatworms), Nematomorpha (gordian worms), Ectoprocta (bryozoans) and Annelida (a leech in this case) were each represented by a single taxon.

Site 1 (Unnamed tributary of Scioto River): Ninety individuals of 13 invertebrate taxa were collected at this site. Planaria, *O. spinosus*, and *Aquarius* sp. dominated the fauna. One specimen of a stonefly (*Perlinella* sp.) and one water-penny beetle larvae (*Psephenus herricki*) were collected at this site. Otherwise, no other invertebrate species of note were taken from this unnamed tributary.

Site 2 (Unnamed tributary of Scioto River): Eighty-three individual of ten invertebrate taxa were collected at this site (same unnamed tributary as Site 1). The same species dominated the invertebrate community with the exception that the pouch snail moved from second tier to first tier in abundance. No particular rare and/or sensitive species of invertebrates were collected at this site.

Site 3 (Unnamed tributary of Scioto River): Thirty-one individuals of ten invertebrate taxa were collected here. No taxa were abundant (perhaps as a result of domestic pollution

entering this stream), however one specimen of a stonefly (*Parapela* sp.) was collected here as well as two species of water strider (*Aquarius* sp. and *Trepobates* sp.) and one damselfly larvae (*Calopteryx* sp.).

TABLE 6
Summary of Aquatic Survey Results
Portsmouth Bypass

Sample Site Number	Stream	# Macro-inverts collected	# Macro-invert taxa	Macro-invert H' *	# Fish collected	# Fish species	Fish H' *	IBI
Scioto River Basin								
16	Miller Run (@ Fairground Road)	89	14	2.82	289	25	3.85	36
1	Thomas Hollow (East - Lower Section)	90	13	3.26	326	11	1.43	---
2	Thomas Hollow (East - Upper Section)	83	10	2.99	122	3	0.96	---
3	Thomas Hollow (West)	31	10	2.62	451	7	1.40	---
17	Lake Margaret System	49	12	3.36	154	6	2.29	---
10	Candy Run (Upper)	85	14	3.16	290	8	1.40	---
11	Candy Run (Lower)	87	12	2.26	424	12	2.42	---
Little Scioto River Basin								
4	Little Scioto River (Upper Section)	191	25	4.05	590	29	3.39	48
7	Little Scioto River (Lower Section)	157	18	3.22	203	23	3.26	44
8	Long Run (Upper Section)	68	15	3.26	973	18	2.62	---
6	Long Run (Lower Section)	104	14	2.92	1081	14	2.49	---
9	Long Run (@Harrison Furnace)	64	9	2.49	906	13	2.13	---
5	Dan White Hollow	49	4	1.46	63	4	0.13	---
13	Shoumberg Hollow	109	11	3.19	144	4	1.53	---
14	Mansfield Hollow	86	8	2.76	49	3	0.76	---
12	Stout Hollow	29	12	3.02	181	13	2.92	---
15	Wards Run	33	6	2.09	394	18	2.66	---

* H' = Shannon-Weiner Diversity Index

Site 4 (Little Scioto River): The invertebrate community of the Little Scioto River at Site 4 was dominated by planaria, caddisflies, midge larvae (Chironomidae), and freshwater mussels (nine species). One of the mussels collected alive at this site is an Ohio Special Interest species (the salamander mussel, *S. ambigua*), while the others demonstrate the fairly diverse mussel community at this site. Of note are the large number of plain pocketbooks (*L. cardium*, including many gravid females attempting to attract hosts for their young as

shown in Photograph 8), abundant Wabash pigtoes (*Fusconaia flava*) and abundant mapleleaf mussels (*Quadrula quadrula*).

Site 5 (Dan White Hollow Run): Dan White Hollow Run supported the least diverse invertebrate community encountered during this study. Only four taxa were collected and none of these are particularly sensitive to stream degradation. Both habitat structure (a roadbed) and water quality (see above) are poor at this site and the invertebrate community has been severely impacted as a result.

Site 6 (Long Run): Fourteen taxa and 104 individuals were collected at this site. Of note here are the large number of spiny crayfish (*O. spinosus*), water striders (*Aquarius* sp.), and caddisfly larvae. No particular pollution sensitive species were collected at this site, but the community as a whole is quite diverse.

Site 7 (Little Scioto River): The invertebrate community at this site was less diverse than at Site 4, but habitats were less diverse here as well. This site was composed of longer pools with mostly sand as the substrate. Still, there were some extensive riffle habitats in the downstream reach of the study area which did produce a large number of freshwater mussels (5 species) including 12 living individuals of the salamander mussel (*S. ambigua*). The mapleleaf (*Q. quadrula*) was the most abundant mussel found. One specimen of the pimpleback (*Quadrula pustulosa*) also was collected. This is the first record of *Q. pustulosa* for the Little Scioto River (OSUM records; Watters, 1988). Other organisms of note here were one specimen of sponge (Spongilidae), whirlygig beetles (*Dinutus* sp. and *Gyrinus* sp.), and a pea clam (*Pisidium compressum*).

Site 8 (Long Run): Sixty-eight specimens representing 15 taxa of invertebrates were collected from this site on Long Run. Of interest here were a single specimen of an adult gordian worm (Nematomorpha), a variety of dragonfly larvae (*Stylogomphus* sp. & *Macromia* sp.), and a couple of beetles (*Laccophilus* sp. & *P. herricki*).

Site 9 (Harrison Furnace Creek): This stream produced fewer than ten taxa of invertebrates and none was particularly abundant other than caddisflies, which accounted for over half of the diversity at this site. The lack of diversity at this site may be a result of water quality and habitat quality problems discussed above.

Site 10 (Candy Run): Of interest in Candy Run is the presence of an unnamed species of crayfish (*Cambarus* sp.). This crayfish has been described and was formerly known as *Cambarus bartonii cavatus*, but that name has been restricted to another species (Thoma and Jezerinac, 2000). Both sites on Candy Run supported this species. In addition, this site was dominated by bryozoans (Plumatellidae), isopods (*Asellus* sp.), mayflies (*Stenonema* sp., *Callibaetis* sp. & *Leptophelebia* sp.), and water-penny beetles (*P. herricki*).

Site 11 (Candy Run): This site on Candy Run had a similar invertebrate community structure as Site 10. Here again, the unnamed species of crayfish was found along with bryozoans (Plumatellidae), and isopods (*Asellus* sp.). Other taxa that were common here included the spiny crayfish, mayflies (*Stenonema* sp.), water striders, and caddisflies.

Site 12 (Stout Hollow Run): Very few specimens were collected from Stout Hollow Run, but quite a few taxa were found (hence the higher than expected H'=3.02 value). Planaria (Dugesiidae), isopods, amphipods (*Gammarus* sp.), spiny crayfish, and pouch snails were more or less equally abundant (from 2-3 individuals collected except pouch snails which accounted for 10 of the 29 specimens collected from this stream). All of these species are tolerant of habitat and water quality degradation (with the exception of the spiny crayfish, which is moderately tolerant) and so the community might best be described as a diverse, tolerant community.

Site 13 (Shoumberg Hollow Run): Shoumberg Hollow Run supports a surprisingly diverse community for its relatively small size. One hundred and nine specimens of 11 taxa were collected at this site. No unusual taxa were collected at this site, but those that were collected demonstrate the fairly high quality habitat and water quality of this stream.

Site 14 (Mansfield Hollow Run): A similar level of diversity was found at Mansfield Hollow Run. Here 86 specimens from 8 taxa were collected. Again, the taxa that were collected were expected for the stream, but they do depict a fairly good quality stream with good water quality and good habitat quality within the reach sampled.

Site 15 (Wards Run): For its size, Wards Run supported one of the least diverse invertebrate communities sampled during this study. Only 33 individuals of 6 taxa were collected. This community was dominated by midge larvae (Chironomidae) and caddisfly larvae (*Hydropsyche* sp.).

Site 16 (Miller Run): At first glance, Miller Run appears to support a good diversity of invertebrate species (12 taxa and an H' = 3.36), but all of the dominant species are pollution tolerant or pollution generalist species (planarians, *O. spinosus*, and midge larvae). Also found at this site were three species of snails (*Amnicola limosa*, *P. integra* and *Helisoma anceps*).

Site 17 (Unnamed tributary of Scioto River): For its size, this unnamed tributary of the Scioto River had a very good diversity of invertebrates. This diversity may be due to the large aquatic vegetation zone present near the existing road (and ultimately due to the nutrients entering this stream from the surrounding housing development). Of interest here was the large number of odonates collected at this site (*Calopteryx* sp., *Argia* sp., *Enallagma* sp., *Aeshna* sp. and *Boyeria* sp.), and the two molluscs (*P. integra* and *P. compressum*).

The most diverse invertebrate communities, based on Shannon Diversity Index values (H'), were found at the Little Scioto River at Site 4 (H' = 4.05), at Site 17 in the Lake Margaret system (H' = 3.36), at Site 8 on Long Run (H' = 3.26), and on Thomas Hollow at Site 1 (H' = 3.26). Site 7 on the Little Scioto River also had a fairly diverse community as measured by Shannon Diversity Index (H'=3.22). However, except for the two Little Scioto River sites, all other high Shannon Index values can be explained on the basis of evenness of distribution of invertebrates rather than number of taxa. Fewer than 100 individual invertebrates were collected from sites 1, 8 and 17. The Shannon Diversity Index is less sensitive to number of taxa compared to evenness of distribution. Therefore, the most diverse invertebrate communities were at the two Little Scioto River sites, followed by the Long Run sites (6 &

8). These sites along with the Candy Run sites (10 & 11), and to a lesser extent, the Miller Run site (Site 16) showed the highest species richness.

Fish Community Structure

Fifty-two species of fish were collected. The distribution and relative numbers of each species at each site are provided in Appendix G, Tables 3 and 4. This lists includes one Ohio Threatened species (rosyside dace - *Clinostomus funduloides*) and one Ohio Special Interest species (eastern sand darter - *Ammocrypta pellucida*). Three sites were electroshocked (due to their size) and these three sites yielded the most fish: the Little Scioto River at Site 4 (29 species), the Little Scioto River at Site 7 (23 species), and Miller Run (25 species). These sites had the highest Shannon Values (H' = 3.39, 3.26 and 3.85, respectively) (Table 6); however the IBI scores more accurately depict the fish community structure at these three sites (IBI = 48, 44 and 36, respectively). With all sites considered, southern redbelly dace (*Phoxinus erythrogaster*) dominated the fish fauna with stonerollers (*Campostoma anomalum*) taking a close second. Also common in the study area were blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), silverjaw minnow (*Notropis buccata*), and bluntnose minnow (*Pimephales notatus*). Unexpected fish captured during the current study were specimens of skipjack herring (*Alosa chrysochloris* - an Ohio River species), the mosquito fish (*Gambusia affinis* - an introduced species), and the eastern sand darter (*A. pellucida* - a fairly rare species in the Little Scioto River system) (Rice and Barnes, 1983; Rice *et al.*, 1991).

Site 1 (Unnamed tributary of Scioto River): Three hundred and twenty six fish of 11 species were collected from this small stream. This community was dominated by creek chubs (68.7%), but also had large numbers of redbelly dace and stonerollers. The stream had a Shannon Diversity Index value of H' = 1.43 which depicts its relative low diversity of species and numbers. Two species of darters were found here (johnny darter - *Etheostoma nigrum*, and fantail darter - *Etheostoma flabellare*) but neither was a dominant member of the fish fauna at this site.

Site 2 (Unnamed tributary of Scioto River): Only 122 specimens of 3 species of fish were collected at this site. Redbelly dace (77.9%) accounted for most of the fish taken at this site, with smaller numbers of creek chubs (15.6%) and blacknose dace (6.6%). This site had a very low Shannon Diversity Index value (H' = 0.96).

Site 3 (Unnamed tributary of Scioto River): This site yielded 451 fish of seven species. Again, redbelly dace dominated the fish community at this site (69.0%) with essentially the same percentages of creek chubs and blacknose dace as at Site 2 (19.5 and 6.0 %, respectively). One species of darter, orangethroat darter (*Etheostoma spectabile*), and one hybrid redbelly dace x creek chub was found at this site. This site also had a very low Shannon Diversity Index value (H' = 1.40).

Site 4 (Little Scioto River): This site had the highest species diversity of any site sampled during this study. A total of 590 individuals of 29 species and one hybrid were collected from this site. Included in this number were eight species of darters (including eastern sand darters), five species of suckers (including three species of redhorse suckers - *Moxostoma* spp.), and ten species of shiners and minnows (family Cyprinidae). This community had

the highest IBI score found in the study area (IBI = 48), which is sufficient for Exceptional Warm Water Habitat designation by the Ohio EPA (although this stream is officially designated as a Warm Water Habitat). Other species of fish collected by Rice *et al.* (1991) for this reach included longnose gar (*Lepisosteus osseus*), quillback carpsucker (*Carpiodes cyprinus* - collected at Site 7), river chub (*Nocomis micropogon*), white bass (*Morone chrysops*), and variegate dater (*Etheostoma variatum*).

Site 5 (Dan White Hollow Run): This reach of stream supported few fish and only four species. Creek chubs and blacknose dace accounted for 96.8% of the total fish community. No rare or pollution sensitive species were collected from this site. This site had the lowest Shannon Diversity Index value (H′ = 0.13) calculated for the entire study area.

Site 6 (Long Run): A remarkable 1081 individual fish were collected from this site with more than half of that number being silverjaw minnows (50.6%). Three species of darters were collected here, and nine species of shiners and minnows. This site had an intermediate Shannon Diversity Index value (H′ = 2.49) with 14 species of fish collected.

Site 7 (Little Scioto River): This site yielded fewer fish and fewer species than the other Little Scioto River site (Site 4). However, this site yielded species not found at the other site including two species of catfish (channel catfish - *Ictalurus punctatus*, and brindled madtom - *Noturus miurus*), a sauger (*Stizostedion canadense*) and a skipjack herring. These species were not collected by Rice, *et al.* (1991) during an earlier survey of the lower Little Scioto River. However, they collected other species not found in this study, including logperch darter and greenside darter. This site had a good Shannon Diversity Index value (H′ = 3.26), and its IBI score (IBI = 44) met the Warm Water Habitat standard.

Site 8 (Long Run): A total of 973 specimens of 18 species was collected at this site. Long Run obviously supports a diverse and abundant fish community. This community was dominated by stonerollers, with large numbers of bluntnose minnows, creek chubs, and striped shiners (*Luxilus chrysocephalus*). This site had a Shannon Diversity Index value similar to the other Long Run site, Site 6 (H′ = 2.62). The Ohio Threatened species, rosyside dace (*C. funduloides*) was collected at this site.

Site 9 (Harrison Furnace Creek): Harrison Furnace Creek yielded an impressive number of fish given its relatively limited habitat structure (see Photographs 18 & 19). Only 13 species were collected with blacknose dace (40.9%) and silverjaw minnows (27.8%) accounting for most of the 906 fish collected. This site had a Shannon Diversity Index value slightly lower than both sites on Long Run (H′ = 2.13).

Site 10 (Candy Run): The fish community in Candy Run was less diverse than its invertebrate community. Only 290 fish of eight species were collected at this site. The fish community was dominated by redbelly dace (74.1%) with stonerollers (10.0%) coming in a distant second. The absence of habitat diversity at this site may be responsible for the fish community structure at this site. The Shannon Diversity Index value at this site was lower than at the other Candy Run site (H′ = 1.40).

Site 11 (Candy Run): At first glance this site appeared to have low habitat diversity and poorer water quality (much of the site was downstream of a small sewage outfall and ran through a church camp), but farther downstream the creek flows through wooded corridors and has good habitat development. A total of 424 fish of 12 species was collected from this site. Again the fish community was dominated by redbelly dace (47.2%) with stonerollers coming in second (29.5%) . Three species of darters were found here (johnny darters, orangethroat darter, and rainbow darter - *Etheostoma caeruleum*) and this site had a Shannon Diversity Index value of H′ = 2.42.

Site 12 (Stout Hollow Run): A very large number of species of fish were collected here although very few individuals were taken. Only creek chubs dominated the fish fauna (32.0%) while all other species were fairly evenly distributed (and fairly rare). This evenness of distribution provided a fairly high Shannon Diversity Index value (H′ = 2.92).

Site 13 (Shoumberg Hollow Run): Only four species of fish were collected from this stream. Southern redbelly dace accounted for the majority of fish taken at this site (70.8%) with fewer numbers of blacknose dace, creek chubs, and stonerollers also collected here. This stream had a very low Shannon Diversity Index value (H′ = 1.53).

Site 14 (Mansfield Hollow Run): This small tributary to the Little Scioto River had similar fish community development as Site 13. Here again, very few individuals were collected and only three species were taken. This stream had a very low Shannon Diversity Index value (H′ = 0.76). Fish were collected from plunge pools between the Little Scioto River and a long culverted reach of the stream.

Site 15 (Wards Run): The large pool underneath the bridge at this site supported a large number of fish including most of the 18 species collected from this stream. Only one species of darter (orangethroat darter) was collected here, although large numbers of striped shiners (39.1%) and bluntnose minnows (20.3%) were taken at this site. This site had a fairly good Shannon Diversity Index value (H′ = 2.66), but not as high as might be expected for a stream of this size (in the 3.00 or greater range).

Site 16 (Miller Run): This stream supported a fairly good species diversity (25 species) and good fish numbers (289 individuals collected). The stream had a very high Shannon Diversity Index value (H′ = 3.85) but its IBI score did not meet Warm Water Habitat standards for the Western Allegheny Plateau Ecoregion (IBI = 36). Although all fish theoretically contribute to the Shannon Diversity Index equally (based solely on number of individuals), the IBI is based on trophic composition, tolerance, and fish condition. The community at this site was dominated by pollution tolerant species and by lower rather than higher trophic levels. These two conditions reduced the IBI score for this site even though the number of taxa and number of individuals was good. This community was dominated by bluntnose minnows (22.1%) with all other species relatively equal in number.

Site 17 (Unnamed tributary of Scioto River): This stream supported six species of fish with 154 individuals collected. Blacknose dace (30.5%), creek chubs (30.0), redbelly dace (20.8%), and stonerollers (14.3%) contributed more or less equally to the community with resulted in a fairly high Shannon Diversity Index value (H′ = 2.29).

In summary, just as with invertebrates, three streams that stand out as the most diverse and supporting the largest and most species rich fish communities: the Little Scioto River, Long Run, and Candy Run. Long Run supported a population of an Ohio Threatened species (rosyside dace) and the Little Scioto River supported a population of an Ohio Special Interest species (eastern sand darter). Miller Run had a fairly high Shannon Diversity Index value, but the fish community at this site was dominated by tolerant species from low trophic levels, which resulted in a low IBI score for this stream. The remainder of the streams sampled during this study were dominated by redbelly dace, creek chubs, stonerollers, and silverjaw minnows. These species are typically found in headwater streams.

Ponds

There are 83 ponds totally or partially included in the study area, ranging in size from 0.02 acre to 4 acres (see Figure 6). Total area of ponds in the study area is approximately 42.75 acres. Eleven ponds are greater than one acre in size, and 19 greater than one half acre. One of the largest (four acres) is located west of US 23, and may be an old borrow pit for the construction of US Route 23 (Figure 6a). Only its eastern edge is included in the study area. One other large pond (also four acres) is a commercial fishing lake north of the Little Scioto River and west of SR 335, near Stout Hollow (Figure 6d). Two large ponds adjacent to one another are located along SR 335, north of Batterson Cemetery Road (Figure 6d). These ponds were apparently used for agriculture at one time. Their current status is unknown, although one supports seasonal submerged aquatic vegetation.

One of the other larger ponds, located north of Lucasville-Minford Road and west of Blue Run Road, was created within the last five years for aesthetics and casual recreation according to the owner (Figure 6b). A similar pond was created within the last year north of Thomas Hollow Road about 4000 feet east of US 23. Another (1.75 acres) south of Lucasville-Minford Road was apparently created as an aesthetic feature but was recently drawn down by a failure of the embankment. Other larger ponds include the retention basin at the Lowe's Home Improvement store in Wheelersburg (Figure 6e), and larger livestock farm ponds.

For the most part, the vast majority of the ponds are typical farm ponds. Some have senesced and have an appreciable amount of hydrophytes along their perimeters. Some are used for stock watering and are apparently subject to the consequent nutrient loadings, as indicated by algal growth. Turtles and fish were common in the ponds, and occasionally beavers. No direct sampling of the fish was performed in any of the ponds. It is assumed that they would contain typical stock fish populations of sunfishes and minnows. A number of the smaller ponds are bordered to the west by plantings of pines or other evergreens as windbreaks. A few ponds are entirely surrounded by forest. The adjacent woodland vegetation may promote wildlife usage of these ponds.

Terrestrial Ecology

Table 7 and Figure 7 provide an overview of the terrestrial habitats within the study area. About 17% of the study area is urban/residential. Another 9% is active agricultural lands (active pasture, orchard, and row crop). Appendix A contains a list of plant species observed in the study area.

Standing forest comprises approximately 53 percent of the study area, and is distributed throughout. None of the forest in the study area can be considered "virgin" or "old growth" forest. Most likely, most if not all of the forest in the study area has been logged during the past century. Nevertheless, there are areas that are composed of larger, slower growing canopy trees that were typical in the pre-settlement forests described by Braun (1950) and Gordon (1969), and which have understory and ground layer vegetation that also reflects relatively undisturbed conditions. Riparian woodlands occur as very small proportions of the study area, owing to the fact that most of the valleys along streams are narrow and steep, and most of the larger floodplains have been clearcut for agriculture and/or development with only narrow woodland corridors along the banks. Therefore, the riparian woodlands have been included in the habitat mapping under the other forest types.

TABLE 7
Summary of Terrestrial Habitats in the Study Area
Portsmouth Bypass Project

Land Use Type	Total Area (acres)	Percent of Total
Mature Upland Forest	1791	16.8
Immature Forest	3813	35.7
Pine Forest	54	0.5
Recently Logged Forest	747	7.0
Scrub-Shrub	369	3.5
Non-active Pasture	954	8.9
Old Field	138	1.3
Urban/Residential	1829	17.1
Agricultural Lands:		
Active Pasture	284	2.7
Row Crop	597	5.6
Orchard	52	0.5
Open Water	44	0.4
Total	10672	100.0

For display purposes, Figure 7 depicts a condensed version of the terrestrial habitat data in Table 7. "Composite Forest" is a GIS conflation of the mature, immature and pine forest types. "Passive Agriculture" is a conflation of non-active pasture and old field. "Active Agriculture" is the conflation of active pasture, row crop and orchard. Scrub-shrub and recently logged areas are also depicted together.

Based on the select samples of trees in mature stands, the canopy of the mature forests in the study area are dominated by five species: sugar maple (*Acer saccharum*), yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), red oak (*Quercus rubra*), and chestnut oak (*Quercus prinus*) (Table 8). The former four species are widely distributed on more mesic sites (not floodplains). The mesic community matches well with the "Oak-Maple-Tuliptree" community as described by Anderson (1982). By his description, this community is common in the unglaciated Appalachian Plateau on sites that were once cleared. Chestnut oak is particularly more common on the drier upper slope positions. The drier sites also contained scarlet oak, black gum (*Nyssa sylvatica*), black oak (*Quercus velutina*), and sourwood (*Oxydendrum arboreum*), resembling Anderson's "Appalachian Oak" community. Both of these communities are considered common in the state, and according to Anderson no old growth stands of either community are known to remain. The largest diameter tree measured in the mature woodland plots was a 27.6-inch yellow poplar. A notable, uncommon component of the mature woodlands was persimmon (*Diospyros virginiana*).

TABLE 8
Summary of Canopy Tree Samples in Mature Upland Woodlands
Portsmouth Bypass Project

Species	Density (trees/ acre)	Average diameter (in)	Maximum diameter (in)	Relative Density (%)	Total Basal Area (ft^2/acre)	Relative Basal Area (%)	Relative Dominance
Acer saccharum	31	8.8	20.9	29.1	14.9	13.6	42.6
Carya ovata	2	12.8	13.8	2.3	2.2	2.0	4.3
Carya sp.	1	15.0	15.0	1.2	1.5	1.4	2.5
Fagus grandifolia	2	21.6	23.8	2.3	6.3	5.8	8.1
Liriodendron tulipifera	18	17.6	27.6	17.4	34.2	31.1	48.5
Nyssa sylvatica	2	4.5	5.6	2.4	0.3	0.3	2.7
Oxydendrum arboreum	1	14.4	14.4	1.2	1.4	1.3	2.4
Quercus alba	12	16.1	21.5	11.6	18.0	16.3	28.0
Quercus coccinea	1	11.9	11.9	1.2	1.0	0.9	2.0
Quercus velutina	2	16.8	18.5	2.3	3.8	3.5	5.8
Quercus prinus	11	16.4	20.6	10.5	16.6	15.1	25.5
Quercus rubra	11	11.3	13.8	10.5	7.9	7.2	17.6
Ulmus americana	1	4.0	4.0	1.2	0.1	0.1	1.3
Ulmus rubra	2	10.7	13.8	2.3	1.7	1.5	3.8
Total	101	13.1	27.6	100.0	109.7	100.0	200.0

The understory in each woodland contained components of the overstory, as well as other tree and shrub species. Common understory components included pawpaw (*Asimina triloba*), spicebush (*Lindera benzoin*), ironwood (*Carpinus caroliniana*), black gum, redbud (*Cercis canadensis*) and flowering dogwood (*Cornus florida*). Where the understory was less abundant, a variety of ground layer species could be found including greenbriars (*Smilax* spp.), wild ginger (*Asarum canadense*), bloodroot (*Sanguinaria canadensis*), trillium (*Trillium* spp.), black snakeroot (*Cimicifuga racemosa*), bedstraw (*Galium* spp.), mayapple (*Podophyllum peltatum*), Christmas fern (*Polystichum acrostichoides*), hayscented fern (*Dennstaedtia punctilobula*), puttyroot (*Aplectrum hyemale*), cranefly orchis (*Tipularia discolor*), and waterleaf (*Hydrophyllum* sp.).

Successional or immature woodlands are those with a generally closed canopy, but typically comprised of trees with an average diameter less than 15 centimeters (6 inches). Dominant species in these areas included green and white ash, sugar maple, osage orange (*Maclura pomifera*), and black locust (*Robinia pseudoacacia*). Amur honeysuckle was a frequent component of these woods, in some locations to the near exclusion of other shrubs or herbaceous plants. Areas with more open canopy contained dense growths of greenbriars.

Pines occur in scattered dense patches, mostly on steep slopes, but comprise less than one percent of the total woodlands in the study area. Common pine species include eastern white pine (*Pinus strobus*), Virginia pine (*Pinus virginiana*), and shortleaf pine (*Pinus echinata*). A notable ground layer species observed in the pine woods is pink lady's slipper orchid (*Cyprepedium acaule*). In some locations, the pines are mixed with oaks, consistent with Anderson's Oak-Pine forest community.

The composition of the riparian forests varies from that of the adjacent upland forest. Dominant components of the riparian woods are silver maple and American elm. Other species that are also common include green ash, sycamore, eastern cottonwood, and occasional willows. The understory includes small silver maple, ash and elm trees; redbud; and Amur honeysuckle. The herbaceous layer includes poison ivy (*Toxicodendron radicans*), gill-over-the-ground (*Glechoma hederacea*), wingstem (*Verbesina alternifolia*), wild rye (*Elymus* spp.), and green-headed coneflower (*Rudbeckia laciniata*). The community resembles the "Maple-Cottonwood-Sycamore Floodplain Forest" described by Anderson as the major floodplain vegetation type throughout the state, particularly along larger rivers. In some areas, river birch (*Betula nigra*) was also common. Anderson describes areas where river birch comprises more than 20%, but which otherwise resembles the Maple-Cottonwood-Sycamore community, as the "River Birch-Maple Floodplain" community. In Ohio, this community is restricted to the unglaciated southeast. River birch has apparently expanded with the advent of acid mine drainage, and is common along streams throughout its range.

Scrub-shrub areas are transitional between open fields and successional woodlands. They generally do not have a closed canopy, but are typically dominated by shrubs and small trees, such as overhead power line easements. Much of the recently logged forest lands can also be considered scrub-shrub vegetation, given that they are becoming dominated by small trees and shrubs, with scattered remnant larger trees. Together, the scrub-shrub and logged forest cover types comprise about 11 percent of the study area. Common species include multiflora rose (*Rosa multiflora*), sumac (*Rhus* spp.), brambles (*Rubus* spp.), goldenrods (*Solidago* spp.), and asters (*Aster* spp.).

Pastures are dominated by a variety of grasses and herbs, with occasional shrubs. Some of the grasses appear to have been planted for forage, although some areas are not currently used for that purpose. Common grasses include fescue (*Festuca rubra*), brome (*Bromus* spp.), ryegrass (*Lolium* spp.), orchard grass (*Dactylis glomerata*), velvet grass (*Holcus lanatus*) and purpletop (*Tridens flavus*). Although not wetlands, some of the somewhat poorly drained pastures are dominated by reed canary grass (*Phalaris arunidinacea*). Blackberry (*Rubus* spp.), multiflora rose (*Rosa multiflora*) and poison ivy (*Toxicodendron radicans*) are common woody plants in some pastures.

A total of 76 bird species were observed through sight or call, including species that breed in the area as well as migrants. Some of the more common, year round residents (noted during the winter and summer months) included the northern cardinal (*Cardinalis cardinalis*), rufous-sided towhee (*Pipilo erythrophthalmus*), American crow (*Corvus brachyrhynchos*), red-tailed hawk, Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), killdeer (*Charadrius vociferus*), white breasted nuthatch (*Sitta carolinensis*), red-bellied woodpecker (*Melanerpes carolinus*), and pileated woodpecker (*Dryocopus pileatus*). Wild turkeys were sighted at a few locations. Eastern screech owl (*Otus asio*) and barred owl (*Strix varia*) were observed during the Indiana bat surveys. One resident reported widespread poaching of owls, particularly great horned owls. Notably, an albino red-tailed hawk was seen soaring near the intersection of Blue Run Road and Lucasville-Minford Road, at the center of the study area.

Ten reptile species were observed in the study area. These included the ringneck snake (*Diadophis punctatus*), northern water snake (*Nerodia sipedon*), black rat snake (*Elaphe obsoleta*), milk snake (*Lampropeltis doliata*), rough green snake (*Opheodrys aestivus*), Dekay's brown snake (*Storeria dekayi*), common garter snake (*Thamnophis sirtalis*), northern fence lizard (*Sceloporus undulatus hyacinthinus*), snapping turtles (*Chelydra serpentina*), and eastern box turtles (*Terrapene carolina*). Only a single or few animals of each species were seen, with the exception of the turtle populations, which were particularly abundant; a number of adult and juvenile turtles of each species were observed. Neither of the two poisonous snakes known from the region, the copperhead (*Agkistrodon contortrix mokeson*) and the timber rattlesnake (*Crotalus horridus horridus*), were sighted although they were reported by residents (see Endangered Species section).

Amphibian sightings were limited to relatively few species. Northern two-lined salamanders (*Eurycea bislineata*) and northern dusky salamanders (*Desmognathus fuscus*) were found along several ephemeral streams. Also rarely noted in ephemeral streams was the longtail salamander (*Eurycea longicauda*). Red-backed salamanders (*Plethodon cinereus*) occurred in mature forest. Fowler's toad (*Bufo woodhouseii fowleri*), American toad (*Bufo americanus*), gray tree frog (*Hyla versicolor*), spring peeper (*Pseudacris crucifer*), leopoard frog (*Rana pipiens*), and the American bullfrog (*Rana catesbeiana*) were found in or near open water bodies. The mud puppy (*Necturus maculosus*) was found in relatively large numbers during fish sampling along the lower reach of the Little Scioto River.

Twenty-two mammal species were identified within the study area by sight, sound, scat or tracks. Some of the more common species included eastern cottontail (*Sylvilagus floridanus*), white-tailed deer (*Odocoileus virginianus*), common vole (*Microtus arvalis*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), eastern gray squirrel (*Sciurus carolinensis*), and fox squirrel (*Sciurus niger*). All of these species are typical of this region of Ohio and throughout

the state. White-tailed deer tracks were common throughout the study area. Surveys for the endangered Indiana bat captured seven bat species (none rare) and one flying squirrel (*Glaucomys volans*); also, one red fox (*Vulpes fulva*) was seen and coyotes (*Canis latrans*) were heard during the bat surveys (see Endangered Species section). Uncommon mammals that were reported by residents in or near the study area but were not confirmed are black bear (*Ursus americanus*) and mountain lion (*Felis concolor*).

Refer to Appendix A for complete lists of the vertebrates observed in the study area.

Endangered Species

Surveys for federally listed threatened or endangered species known historically from Scioto County have produced no evidence of these species in the area of the Feasible Alternatives. The following is a summary of the results of these surveys.

Indiana Bat

The Indiana bat (*Myotis sodalis*) survey collected 83 bats of seven species from 21 sites located throughout the study area from June 9 through August 6, 2003 (Table 9, Figure 8a-8e). No Indiana bats were found. The majority of the bats captured were of three species which are commonly found in open/edge, developed areas: big brown bats (*Eptesicus fuscus)*, eastern red bats (*Lasiurus borealis*), and eastern pipistrelles (*Pipistrellus subflavus*). These species do not form maternity colonies in large trees as does the Indiana bat. The little brown bat (*Myotis lucifugus*) and northern bat (*Myotis septentrionalis*) were the only two species caught during this netting effort that form maternity colonies in trees and utilize habitat similar to that of the Indiana bat, although little brown bats often use man-made structures. Ten males and four females of little brown and northern bats were captured, which is significantly different than random. A low female capture rate may indicate poor reproductive habitat quality for these species and the similar Indiana bat.

Although there are some large trees with loose bark in woodlands throughout the study area that could be used for roosts, mainly shagbark hickory, sugar maple, and dead snags, the habitat within the project area at net sites appeared to be of relatively low value for the Indiana bat. In addition to man-made disturbances (such as logging), an ice storm during the previous spring destroyed the forest canopy in many areas. In these areas, understory clutter was usually high and unfavorable for bat activity. The storms also felled many snags that could have served as potential roost sites.

Low female capture rates for LBB + other Myotis sp.

Major ice-storms previous to surveys.

No IB captures
83 bats 7 species
21 sites

TABLE 9
Summary of Bat Survey Results

Species	Male	Female				Escape*	Total
		P*	L*	PL*	NR*		
Eptesicus fuscus	7	9	11	2	2	2	33
Pipistrellus subflavus	8	8	0	0	2	0	18
Myotis septentrionalis	7	1	0	0	0	0	8
Myotis lucifugus	3	0	2	1	0	0	6
Lasiurus borealis	0	4	2	2	4	2	14
Lasiurus cinereus	0	0	1	0	0	0	1
Lasionycteris noctivagans	3	0	0	0	0	0	3
Total	28	22	16	5	8	4	83

P=pregnant; L=lactating; PL=Post lactating; NR=non-reproductive; Escape=escaped from net before processing could be completed

Source: Environmental Solutions and Innovations, 2003

The cave/outcropping site found during the mist netting survey consisted of two narrow, side-by-side openings in the rock face, one approximately 30 feet deep and the other approximately 60-90 feet deep. No bats were found and no air movement was detected in either passage. Several (less than 10) fresh feces were found in the entrance of one opening, which were likely from one or two bats that had recently night-roosted within the entrance. Neither opening possessed the characteristics of bat hibernacula. The length and volume of the openings was unsuited for producing the conditions suitable for hibernation. There was no evidence that the Indiana bat would use the openings. (ESI, 2003b, Appendix J) (Figure 8e)

No additional surveys for this species in the project area appear to be warranted.

Small Whorled Pogonia

The small whorled pogonia (SWP) survey included re-inspection of most woodland habitats along the Feasible Alternatives, except those woodlands that were eliminated based on prior investigations (such as forests with dense understory or active logging areas). None of the study area closely matches the conditions of the known SWP site in Hocking County, namely a canopy dominated by Eastern hemlock in association with Indian cucumber root (*Medeola virginiana*) and partridge berry (*Mitchella repens*) at the ground layer. However, a total of 28 plots were documented where considerable populations of associates were found, or which otherwise appeared to be potential habitats based on previous studies, background information, or general forest aspect.

Ten sites were found that supported populations of the large whorled pogonia (*Isotria verticillata*), which the recovery plan (von Oettingen, 1992) reports has been found intermixed with the SWP at several locations, and/or one or more of the other associate

species (Table 1). The primary associates that were found in abundance at several locations were Indian cucumber root and rattlesnake plantain (*Goodyera pubescens*). Some of the listed associates were absent (namely *Gaultheria* and *Maianthemum*) or were fairly widespread and not so indicative of specific habitat conditions (such as *Vaccinium vacillans*). Partridge berry was found in abundance at only one site. Nine of the 10 sites are located in the northern half of the study area, along all alternatives. A single site, where Indian cucumber root was found in abundance, was located near the southern end of the study area along a segment common to all alternatives.

To complete this survey, the 10 sites where populations of associates were found to be particularly abundant will be revisited during the late spring (May to June 2004). The timing of this work will be coordinated with the ODNR personnel who are monitoring the known population of the SWP in Hocking County, so that the survey is completed when the SWP is at full development.

Virginia Spiraea

Each of the perennial streams that are crossed by each alternative were considered and reviewed for habitat for the Virginia spiraea. The conditions along the Little Scioto River at the proposed crossings do not appear suitable for the plant. In both locations, the river has a silt substrate and silt-laden banks and floodplain, and the river is subject to wide fluctuation in flood levels. There are none of the key habitat features of the Virginia spiraea as described in the recovery plan (Ogle, 1992), such as stable gravel bars and exposed bedrock banks, at these crossing locations. While several of the perennial streams appeared to have satisfactory habitat conditions for this shrub species, none of the plants were found. This survey was conducted during the peak flowering period. The lack of evidence of the plant during this study appears to be adequate documentation that this species is not present in the study area. No additional surveys for this species in the project area appear to be warranted.

Timber Rattlesnake

The surveys for the rattlesnake identified twenty-four potential den habitats in the study area. These sites and surrounding areas were investigated to determine if they contained habitat elements favorable for gestation, shedding, basking and cover. While the majority of the sites contained geological characteristics suitable for the rattlesnakes, none of these animals were found. Many of the sites had suitable elevations and gradients, but appear to be generally lower than most of the dens found in the Shawnee State Forest, and their northern and eastern aspects were less favorable. The degree of human activity (including logging and all-terrain-vehicle trails) near most sites and throughout the study area likely reduces the suitability of the area for the rattlesnake. With humans in such close proximity it would seem that if timber rattlesnakes were present, sightings would be more common and often reported. This was not found to be the case based on conversation with a number of local residents.

No additional surveys for this species in the project area appear to be warranted.

State Listed Species

One unusually large but unhealthy specimen of American chestnut (*Castanea dentata*) was found along a fenceline in an actively grazed pasture, between SR 335 and the Little Scioto River south of Batterson Cemetery Road. American chestnut is not federally listed but is listed as Potentially Threatened in Ohio. The tree was approximately 25 feet in height, which is about the maximum size before they are lost to the chestnut blight (http://www.dnr.state.oh.us/forestry/education/ohiotrees/chestnut.htm). Despite its degraded condition, the tree did bear fruit. Several chestnut saplings, likely suckers from remnant tree roots, were found at various locations in mature woods.

State -listed species encountered during the aquatic study were the Ohio threatened rosyside dace in Long Run, the Ohio special interest eastern sand darter and salamander mussel in the Little Scioto River. Sanders *et al.* (1999) state that rosyside dace are restricted to 34 stream systems in Ohio and that the species is found in small streams (mean drainage area = 9 square miles). This silt-sensitive species is known from first and second order tributaries of the Little Scioto River in Jackson, Pike, and Scioto Counties. Eastern sand darters are usually found in large streams (average drainage area = 3,978 square miles) and have been previously documented in the Little Scioto River. They are known from 14 other stream systems in Ohio (Rice and Barnes, 1983) . Watters (1988) found the salamander mussel at a few sites on the lower Little Scioto River, but not in the same numbers as at Site 7 in the current study.

The bobcat and black bear may occur in the study area but were not confirmed. Each of these species is considered Endangered in the state.

Wetlands

The field investigation identified 92 wetland areas in the study area with a combined area of approximately 30 acres (Table 10 and Figure 6). Wetlands are identified according to the watershed in which they occurred (W#), and a wetland number (WL#). As some potential wetlands were eliminated or fell outside of the study area, the wetlands are not numbered sequentially. Owing to the steep topography over most of the study area, only five wetlands are larger than one acre and only ten are larger than one-half acre.

Approximately one third of the wetlands are driven by groundwater discharge or "seeps." Groundwater frequently springs along the steep slopes in the study area. In some cases, the water is not quickly concentrated into a channel or streambed, and causes saturation of a substantial area of the soil, leading to the development of hydric soils and wetland vegetation. In many cases, the wetlands are drained by a channel at their lower ends, mostly manmade, and are therefore linked to the tributary system. In some locations, the groundwater percolates at the lower end of the wetland without entering a channel. These wetlands are thereby considered isolated. About six percent (by area) of the wetlands in the study area are isolated.

About half of the wetlands have formed along open drainageways that are channelized natural streams, remnant ditches from drainage attempts or in some cases may be eroded gullies. In each case, the channels are small. Many of these wetlands are driven by a combination of flow along the channels and groundwater seepage. All of these wetlands are connected to the tributary system.

One fifth of the wetlands formed in manmade or natural depressions, including the largest wetland in the study area (W21 WL5). A few of the Category 1 wetlands are located in small isolated depressions, that is, they have no apparent surface connection with the tributary system. Five wetlands are located in and around old farm ponds. Many of the farm ponds included some peripheral wetland vegetation. Those that are identified as wetlands are only those where the vegetation comprises more than half of the area of the pond, due to natural succession in the pond (gradual filling with sediment and organic matter), or due to a historical partial failure or drainage of the pond. In any case, the wetland condition appeared to be the "normal circumstance" of the area (i.e., permanent) and not a temporary condition that resulted from a recent change (such as a recent failure of an embankment that may be repaired) or that would foreseeably be corrected by maintenance dredging. Typically, the vegetation is dominated by cattails (*Typha* spp.), soft rush (*Juncus effusus*), and bulrushes (*Scirpus* spp.).

TABLE 10
Summary of Wetlands Within the Study Area
Portsmouth Bypass Project

WETLAND[1]	Total Area (acres)	Area within the Study Area (acres)	Cowardin Classification[2]	Hydrology	Isolated or tributary to surface waters	ORAM[3] score	Category[4]
W1 WL8	0.64	0.64	PEM	drainage	Tributary	20	C 1
W1 WL9	0.07	0.07	PEM	depression	Tributary	30	C 2
W1 WL10	0.68	0.68	PF01	oxbow	Tributary	39	C 2
W2 WL1	0.17	0.09	PEM	depression	Tributary	19	C 1
W2 WL2	2.98	1.40	PSS1	depression	Tributary	46	C 2
W2 WL3	2.15	2.15	PEM	drainage	Tributary	43	C 2
W2 WL4	1.93	0.14	PF01	depression	Tributary	42	C 2
W3 WL1	0.04	0.04	PF01	depression	Isolated	35	C 2
W3 WL3	0.03	0.03	PEM	seep	Tributary	25	C 1
W3 WL4	0.23	0.12	PSS1	seep/drainage	Tributary	30	C 2
W3 WL5	0.13	0.04	PEM	drainage	Tributary	26	C 1
W3 WL7	0.27	0.27	PEM	old pond	Isolated	19	C 1
W3 WL8	0.02	0.02	PEM	seep	Tributary	17	C 1
W3 WL13	1.15	1.15	PEM	old pond	Tributary	37	C 2
W4 WL1	0.27	0.27	PEM	drainage	Tributary	23	C 1
W4 WL2	0.03	0.03	PEM	seep	Isolated	20	C 1
W4 WL3	0.17	0.17	PEM	depression	Tributary	14	C 1
W4 WL6	0.30	0.30	PEM	seep	Tributary	26	C 1
W4 WL7	0.07	0.07	PEM	seep	Tributary	18	C 1
W4 WL8	0.39	0.39	PEM	seep	Tributary	22	C 1
W4 WL9	0.03	0.03	PSS1	drainage	Tributary	54	C 2
W5 WL1	0.11	0.11	PEM	seep	Tributary	32	C 2
W8 WL1	0.24	0.14	PEM	seep	Tributary	30	C 2
W8 WL2	0.20	0.20	PEM	old pond	Isolated	34	C 2
W8 WL5	0.01	0.01	PEM	drainage	Tributary	28	C 1
W8 WL6	0.07	0.03	PEM	seep	Isolated	29	C 1
W8 WL7	0.03	0.03	PEM	drainage	Tributary	26	C 1
W8 WL8	0.13	0.13	PEM	drainage	Tributary	28	C 1
W8 WL9	0.31	0.31	PEM	drainage	Tributary	30	C 2
W8 WL10	0.01	0.01	PEM	drainage	Tributary	26	C 1

TABLE 10
Summary of Wetlands Within the Study Area
Portsmouth Bypass Project

WETLAND[1]	Total Area (acres)	Area within the Study Area (acres)	Cowardin Classification[2]	Hydrology	Isolated or tributary to surface waters	ORAM[3] score	Category[4]
W8 WL11	0.18	0.18	PEM	seep	Tributary	30	C 2
W8 WL12	0.07	0.07	PSS1	seep	Tributary	36	C 2
W8 WL13	0.10	0.10	PEM	drainage	Tributary	27	C 1
W8 WL14	0.63	0.63	PEM	drainage	Tributary	43	C 2
W8 WL15	0.13	0.13	PEM	drainage	Tributary	26	C 1
W8 WL16	0.08	0.08	PEM	drainage	Tributary	24	C 1
W8 WL17	0.33	0.33	PSS1	drainage	Tributary	20	C 1
W8 WL18	0.11	0.11	PEM	old pond	Isolated	34	C 2
W8 WL19	0.16	0.16	PEM	drainage/seep	Tributary	35	C 2
W8 WL20	0.03	0.03	PEM	drainage	Isolated	27	C 1
W8 WL21	0.09	0.09	PEM	seep	Tributary	26	C 1
W8 WL22	0.08	0.08	PEM	drainage	Tributary	32	C 2
W8 WL23	0.06	0.06	PEM	seep	Isolated	27	C 1
W8 WL24	0.16	0.16	PEM	seep	Tributary	27	C 1
W8 WL25	0.13	0.13	PEM	drainage/seep	Tributary	28	C 1
W8 WL26	0.14	0.14	PEM	drainage	Tributary	20	C 1
W8 WL27	0.03	0.03	PEM	Drainage	Tributary	27	C 1
W8 WL28	0.11	0.11	PEM	Seep	Tributary	24	C 1
W8 WL29	0.10	0.10	PF01	depression	Tributary	24	C 1
W9 WL1	0.73	0.73	PSS1	depression/ drainage	Tributary	30	C 2
W9 WL2	0.12	0.12	PEM	drainage/seep	Tributary	32	C 2
W9 WL3	0.05	0.05	PEM	old pond	Isolated	47	C 2
W9 WL4	0.17	0.17	PEM	seep	Tributary	21	C 1
W9 WL5	0.39	0.39	PEM	depression	Isolated	24	C 1
W9 WL6	0.17	0.17	PEM	depression	Tributary	32	C 2
W12 WL 1	2.61	0.72	PEM	seep	Tributary	40	C 2
W12 WL2	0.42	0.42	PEM	seep	Tributary	51	C 2
W12 WL3	0.48	0.48	PEM/PSS1	depression	Tributary	37	C 2
W13 WL1	0.09	0.09	PEM	drainage	Tributary	24	C 1
W13 WL5	0.52	0.52	PEM	seep/drainage	Tributary	35	C 2

TABLE 10
Summary of Wetlands Within the Study Area
Portsmouth Bypass Project

WETLAND[1]	Total Area (acres)	Area within the Study Area (acres)	Cowardin Classification[2]	Hydrology	Isolated or tributary to surface waters	ORAM[3] score	Category[4]
W13 WL6	0.07	0.07	PF02	seep	Tributary	29	C 1
W14 WL1	0.02	0.02	PEM	drainage	Tributary	31	C 2
W14 WL2	0.03	0.03	PEM	drainage	Isolated	22	C 1
W14 WL6	0.21	0.05	PEM	seep/drainage	Tributary	21	C 1
W14 WL7	0.08	0.02	PEM	seep	Isolated	20	C 1
W14 WL10	0.16	0.16	PF01	Depression	Isolated	35	C 2
W14 WL11	0.05	0.05	PF01	Depression	Isolated	23	C 1
W14 WL12	0.36	0.36	PEM	seep/drainage	Tributary	30	C 2
W14 WL13	0.11	0.11	PEM	seep/drainage	Tributary	24	C 1
W14 WL14	0.04	0.04	PEM	seep/drainage	Tributary	20	C 1
W14 WL16	0.12	0.12	PEM	drainage	Tributary	23	C 1
W15 WL1	0.07	0.07	PEM	old pond	Isolated	22	C 1
W15 WL2	0.08	0.08	PEM	old pond	Isolated	26	C 1
W16 WL3	0.05	0.05	PF01	depression	Isolated	29	C 1
W21 WL1	3.69	3.69	PSS1	drainage	Tributary	50	C 2
W21 WL2	0.14	0.14	PEM	drainage	Tributary	34	C 2
W21 WL3	0.26	0.26	PEM	drainage	Tributary	24	C 1
W21 WL4	0.59	0.59	PF01	seep	Tributary	46	C 2
W21 WL5	12.35	3.92	PF01/PSS1	oxbow	Tributary	54	C 2
W21 WL6	0.74	0.74	PSS1	drainage	Tributary	39	C 2
W21 WL7	0.19	0.19	PSS1	drainage	Tributary	27	C 1
W21 WL13	0.63	0.63	PF01	seep/drainage	Tributary	28	C 1
W21 WL16	0.35	0.35	PSS1	depression	Isolated	42	C 2
W22 WL2	0.04	0.04	PSS1	drainage	Tributary	31	C 2
W23 WL1	0.41	0.41	PEM	depression	Tributary	29	C 1
W23 WL2	0.57	0.57	PF01	depression/ drainage	Tributary	32	C 2
W23 WL3	0.32	0.32	PEM	drainage	Tributary	35	C 2
W23 WL4	0.04	0.04	PEM	seep/drainage	Tributary	18	C 1
W23 WL10	0.01	0.01	PEM	drainage	Tributary	28	C 1
W24 WL4	1.55	1.55	PSS1	seep/storm	Tributary	34	C 2

TABLE 10
Summary of Wetlands Within the Study Area
Portsmouth Bypass Project

WETLAND[1]	Total Area (acres)	Area within the Study Area (acres)	Cowardin Classification[2]	Hydrology	Isolated or tributary to surface waters	ORAM[3] score	Category[4]
W24 WL5	0.17	0.16	PEM	basin drainage	Tributary	19	C 1
W24 WL6	0.24	0.24	PEM	drainage	Tributary	22	C 1
TOTAL	45.07	30.73					

[1] Wetlands are identified by watershed (W#) and a wetland number (WL#). As some potential wetlands were eliminated or fell outside the study area, the wetlands are not necessarily numbered sequentially.

[2] Cowardin classification: PEM=palustrine emergent marsh; PSS1 = palustrine scrub-shrub, deciduous; PF01 = palustrine forest, broad-leaf deciduous; PF02 = palustrine forest, needle-leaf deciduous.

[3] ORAM = Ohio Rapid Assessment Method for wetlands.

[4] Categorization according to the Ohio Wetland Water Quality Standards.

The majority of the wetlands are palustrine emergent marsh (PEM), dominated by common emergent species including cattails, fox sedge (*Carex vulpinoidea*), soft rush and rice cut-grass (*Leersia oryzoides*). A number are scrub-shrub (PSS1), dominated by shrubs such as buttonbush (*Cephalanthus occidentalis*), sandbar willow (*Salix exigua*) and elderberry (*Sambucus canadensis*). Twelve are considered forested or partially forested. Most of these are dominated by deciduous trees including silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), and green ash (*Fraxinus pennsylvanica*). One of the forested wetlands (W13 WL6) is dominated by bald cypress (*Taxodium distichum*).

The ORAM scores correlate less to size and more to the consistency of hydrology, the width of the buffer, and the intensity of surrounding land use. No Category 3 wetlands were identified in the study area. A total of 40 wetlands were assigned Category 2. Only seven of the wetlands identified clearly score in the range of Category 2 (45 or greater), as defined by Mack (2000). These wetlands range in size from 0.03 acre to 12.35 acre. Four of these seven wetlands are located in the Little Scioto and Scioto River floodplains. Fifteen of the Category 2 wetlands scored in the range of Modified Category 2 (35 to 44), and range in size from 0.04 to 0.74 acres. Eighteen of the Category 2 wetlands score in the Category 1 to 2 "gray zone" (30 to 34), ranging in size from 0.04 to 1.55 acres.

Category 2 Wetlands

W1 WL9

This wetland is a remnant wetland at the edge of new fill material. It retains some tree and shrub vegetation, as well as emergents. It is also located within the Scioto River floodplain adjacent to Miller Run. Its ORAM score of 30 makes it a marginal, gray-zone Category 2 wetland.

W1 WL 10

This wetland formed in the former stream channel of Miller Run, which was apparently rerouted during the construction of US 23. This isolated portion of the former channel is located in the Scioto River floodplain, averages 35 to 40 feet wide, and is surrounded by successional riparian woodland. The ORAM score for this wetland is 39, placing it in the Modified Category 2 range.

W2 WL2

At the western end of the study area, this wetland is dominated by scrub-shrub vegetation. The second largest wetland identified at 2.98 acres, it is only partially included in the study area. It apparently developed in an area formerly used for row cropping and is located adjacent to a stream channel. The ORAM score for this wetland is 46, because of its size, interspersion of wetland vegetation types, connection to a riparian corridor, and location within the Scioto River floodplain, placing it clearly in the Category 2 range.

W2 WL3

Adjacent to State Route 348 (west of the US-23/SR-348 intersection), this emergent wetland is approximately 2.15 acres in size. It lies adjacent to an existing "park and ride" lot. It apparently developed in an area formerly used for row cropping and is located adjacent to a stream channel. The ORAM score for this wetland is 43, because of its size, interspersion of wetland vegetation types, connection to a riparian corridor, and location within the Scioto River floodplain.

W2 WL4

Adjacent and partially including a borrow pond west of US 23, this wetland is partially dominated by early successional woodland vegetation and partially by emergent vegetation. Only a small part of it is included in the study area. The ORAM score for this wetland is 42, because of its size, interspersion of wetland vegetation types, and location within the Scioto River floodplain, placing it in the modified Category 2 range.

W3 WL1

This 0.38 acre wetland is located in a depression in a well drained, bottomland woods. It apparently developed in a small stream oxbow. The wetland is generally narrow and linear, and the hydrophytic herbaceous vegetation is relatively sparse, given the dense adjacent forested canopy. The ORAM score for this wetland is 35, placing it at the low end of Modified Category 2 range.

W3 WL4

This wetland developed in a residential area along a shallow swale. It is dominated by emergent vegetation. Because of its linkage to a small drainage, its ORAM score is 30, a marginal, gray-zone Category 2 wetland.

W3 WL13

This 1+ acre emergent wetland developed adjacent to Robert Lucas Road just above a culvert. Based on the presence of a water control structure, it was once used as a stock watering pond. Dominant plants include cattails and sweet flag. The wetland and surrounding area is still used for cattle grazing. An intermittent stream feeds into the wetland, possibly augmented by groundwater discharge. This wetland received an ORAM score of 34, in the "gray zone" between Categories 1 and 2. It was assigned Category 1 because it is in an area of active grazing, which compromises its water quality, general functionality and diversity.

W4 WL9

This small wetland (0.1 acre) is located in a forest area along a small stream corridor. It is fed by groundwater discharge. Although small, its large buffer, groundwater hydrology, lack of apparent disturbance, and location along a stream corridor led to a Category 2 ORAM score of 54.

W5 WL1

This emergent wetland developed from a seep in a formerly grazed field. Groundwater appears to maintain a consistent hydrology, and the wetland links to a small drainage. The ORAM score of 32 makes this wetland a gray-zone Category 2 wetland.

W8 WL1

This gray-zone wetland is located in a former cropland, now pasture land. The vegetation is dominated by annual emergent vegetation. It is likely mowed periodically. Fed by an intermittent groundwater source, this wetland is linked by a small drainage to Long Run.

W8 WL2

This wetland developed in a former farm pond. The embankment has been breached, such that the pond only retains shallow water, allowing for wetland vegetation to thrive. The wetland contains a diversity of wetland plants, and it is surrounded by inactive pasture. The ORAM score is 34, placing it in the higher range of the "gray zone." It was placed in Category 2 because of its plant diversity, size, and relatively undisturbed buffer area.

W8 WL9

This small wetland formed at the outfall of a livestock pond, and is located at the upstream end of a small drainage. It is grazed, and may have been subject to some soil disturbance. The vegetation is dominated by annual emergents. The ORAM score of 30 makes it a marginal, gray-zone Category 2 wetland.

W8 WL11

This wetland is comparable to W8 WL9. It also formed downstream of a small livestock watering pond, along a small drainage. It is likely grazed at times, and is dominated mostly by annual emergent plants with some grasses. It is a marginal, gray-zone Category 2 wetland according to its ORAM score of 30.

W8 WL12

This very small, 0.07 acre wetland is located at the upstream end of a small pond in a residential neighborhood. The ORAM score for this wetland is 36, in the Modified Category 2 range. Its ORAM score is supported by its location adjacent to a pond, medium buffers, and low intensity adjacent land use.

W8 WL 14

This wetland originates in a lawn and extends into an old farmstead, now grown over by scrub-shrub and young successional woodland. It is primarily fed by groundwater discharge and secondarily by surface drainage from Lucasville-Minford Pike. The portion in the lawn is periodically mowed and is dominated by grasses and spikerush. The remainder through the scrubby woodland is largely dominated by sweet flag (*Acorus calamus*). The ORAM score is 43, within the Modified Category 2 range.

W8 WL18

This wetland developed along the upper edge of a farm pond. It constitutes approximately 50% of the pond area. It has a dense buffer of pines and shrubs along the upland edge. The ORAM score is 34. It was placed in Category 2 because of its position in the landscape adjacent to a substantial upland scrub habitat and adjacency to open water.

W8 WL19

This sedge/soft rush/bulrush-dominated wetland is located at the edge of a residential area and adjacent to a forest, just downslope from a large pond embankment. It is also located at the origin of a small intermittent stream. It receives groundwater discharge that is likely seepage from the pond, as well as periodic overflow from the pond. The wetland's ORAM score is 35, which places it at the low end of the Modified Category 2 range, owing to its apparent regular hydrology, medium buffers, low intensity adjacent land uses, and fair vegetation development.

W8 WL22

This very small (0.08 acre) wetland formed along a small drainage into a recently constructed pond. It dominated by emergent vegetation, and may be mowed periodically. Its association with the small drainage and large open water body gives it a gray-zone ORAM score of 32.

W9 WL1

The scrub-shrub wetland developed in a depression that parallels an intermittent stream. It receives flow from a drainage ditch at its upper end. The wetland is not immediately adjacent to the stream, but does receive periodic overbank flow from the stream, which is not deeply entrenched. The wetland also receives flow near its center from a small culvert beneath SR 335. The ORAM score is 30, at the low end of the Category 1 and 2 "gray zone." It is assigned Category 2 because of its relatively large size (0.75 acre), its location along a stream, and adjacency to a forested area.

W9 WL2

Like several other wetlands mentioned above, this small emergent wetland is fed by groundwater, downstream of a pond and along a small drainage. The ORAM score for this wetland is therefore in the Category 1 to 2 gray zone at 32.

W9 WL3

This small (0.05 acre) wetland is an old farm pond that no longer retains deep water, but does retain enough water to sustain a reasonably well developed emergent marsh community. Semi- to permanent hydrology, medium buffers, and low intensity surrounding land use support an ORAM score of 47, at the low end of the Category 2 range.

W9 WL6

This narrow, scrub-shrub wetland formed along a drainage that mostly receives runoff from the nearby railroad easement/drainage ditches. It was likely disturbed during the construction of the railway, but is recovering. Its ORAM score is 32, making it a gray-zone Category 2 wetland.

W12 WL1

This wetland is primarily fed by groundwater. A small stream flows through the wetland, but is more likely fed by discharge from the wetland than vice versa. It is dominated by emergent marsh vegetation. Its total size is 2.6 acres, but only the upper 0.72 acre is included in the study area. Adjacent areas are lawn, old field, and active row cropland. Its ORAM score is 40, placing it in the Modified Category 2 range.

W12 WL2

This wetland is similar to W12 WL1, and is located upstream of it along the small stream. It is also fed by groundwater. It is dominated by emergent vegetation, but also contains an area of scrub-shrub vegetation. Its ORAM score is 51, somewhat higher than W12 WL1 because of the inclusion of the scrub-shrub vegetation.

W12 WL3

This wetland differs from wetlands W12 WL1 and WL2 in that it contains emergent and shrub vegetation throughout, and appears mostly driven by precipitation or only seasonal groundwater discharge. It is located within the floodplain of the Little Scioto River, although it is likely flooded infrequently. Surrounding land use is old field and row cropland on adjacent parcels. Its ORAM score is 37, placing it in the Modified Category 2 range.

W13 WL5

This wetland developed at the toe of a short, steep slope at a groundwater seep. It is primarily emergent, although large trees occur along the peripheral slope creating an incomplete canopy over portions of the wetland. Except for the peripheral slope, it is surrounded by active pasture land. The ORAM score is 35, placing it at the low end of the Modified Category 2 range.

W14 WL1

This narrow wetland formed along a sandbar in a small stream through a large active pasture. Its location along the stream provided an ORAM score of 31, making it a gray-zone Category 2 wetland.

W14 WL10

This is a small, forested wetland, located within a large woodlot surrounded by row cropland. Hydrology appears to be both groundwater and precipitation dependent. The area has undergone recent selective cutting of trees. The ORAM score is 35, at the low end of the Modified Category 2 range.

W14 WL12

This emergent wetland is located in active pasture, and supports mostly annual vegetation. It is driven by groundwater seep, and feeds into a small drainage. Its ORAM is 30, making it a marginal, Category 2 gray-zone wetland.

W21 WL1

This Category 2 wetland is located in an apparent old pasture or field, and was reportedly created by beavers that had dammed the culvert pipe beneath Highland Bend Road. The dam and the beavers have since been removed, and the beavers reportedly moved to the nearby oxbow (W21 WL5). Surface water or saturation to the surface remains in a majority of the wetland. Scrub-shrub and emergent vegetation predominates. Good habitat development, regular hydrology (groundwater discharge), and medium to large buffers with low intensity surrounding land use lead to an ORAM score of 50.

W21WL2

This scrub-shrub wetland formed along a small drainage along a roadside. It is bordered by a forest opposite the roadway that gives it, on average, a large buffer area. Its ORAM score of 34 makes it a gray-zone Category 2 wetland.

W21 WL4

This 0.59 acre, forested wetland is located along a steep valley, upstream of a large pond. It appears to be sustained by groundwater seepage as well as occasional flow along a small stream through the valley. The steep sided valley is generally wooded, although adjacent land use beyond the valley is primarily active pasture. A fence separates most of the wetland from the pasture. The ORAM score for this wetland is 46, placing it clearly in the Category 2 range.

W21 WL5

The largest wetland in the study area is an apparent oxbow of the Little Scioto River. Only the two ends of the oxbow are included in the study area, the majority of the wetland falling outside. A local resident reported that this wetland was formerly drained, but was dammed by beavers which restored permanent surface water. Evidence of an active beaver population is present. Standing dead trees in the southern half of the wetland indicate a

relatively recent change toward permanent flooding. The northern portion of the wetland is located beneath a high tension power line, such that the larger trees have been removed in this area and replaced by scrub-shrub vegetation, primarily buttonbush. These impacts limit the vegetative interspersion in the wetland and reduce the overall ORAM score somewhat. The ORAM for this wetland is 54, which places it in Category 2. Elements that contribute to this score include wetland size, medium to large buffers, low intensity of surrounding land use, persistent and diverse hydrologic regimes, and good habitat development.

W21 WL6

This convoluted wetland developed along small ephemeral streams that meet near Highland Bend Road. The wetland has been disturbed, but is generally succeeding to a forested wetland. Dominants include common species such as green ash, American elm, elderberry (*Sambucus canadensis*), wood reed (*Cinna arundinaria*), and impatiens (*Impatiens capensis*). Multiflora rose (*Rosa multiflora*) is also invading portions of the wetland. The wetland's ORAM score is 39, within the Modified Category 2 range.

W21WL16

This scrub-shrub wetland formed in a man-made depression along the toe of a steep forested slope. It appears that the depression may have served as a sedimentation basin during previous logging activities, or it was merely incidental to construction of a logging road. Other than a current dirt road that parallels the wetland to the north, it is surrounded by forest on all sides that provides a large buffer area. Its ORAM score of 42 makes it a modified Category 2 wetland.

W22 WL2

This very small (0.04 acre) wetland is located at the juncture of two small ephemeral streams. It has been disturbed by logging, and is therefore dominated by emergent vegetation. It retains a large buffer area. Its ORAM score of 31 makes it a marginal, gray-zone Category 2 wetland.

W23 WL2

The 0.57 acre wetland is located between US 52 and an elevated railroad bed, and was likely created by changes in drainage that accompanied the construction of the railroad. Woodland vegetation has developed since that time. The wetland receives flow through a channel from a culvert beneath US 52, and therefore is likely subject to flash flooding, perhaps with each substantial rainfall event. Although generally wooded, the wetland received an ORAM score of 32, in the Category 1 and 2 "gray zone."

W23 WL3

This emergent wetland, dominated by cattails, is approximately 0.32 acre in size and is located in a depression surrounded by scrub-shrub and early successional woodlands. Although stormwater outlets were not seen, it likely receives stormwater from the adjacent developments, as a channel directs flow from the wetland to a culvert beneath US 52. The ORAM score for this wetland is 35, placing it at the low end of Modified Category 2 range.

W24 WL4

This wetland adjacent to and partially surrounds a stormwater retention basin behind the Lowe's Home Improvement store located between Ohio River Road and US 52 in Wheelersburg. The greater, scrub-shrub dominated portion of the wetland occurs to the south of the basin, with a relatively narrow emergent band surrounding the deep water of the basin. The open water portion of the basin is excluded. The wetland and basin drain by a ditch that extends north through wetlands W24 WL6 and W24 WL5, and subsequently through a large culvert beneath US 52. This wetland has a very narrow buffer, and is almost completely surrounded by commercial and industrial land uses and highways.

The ORAM score is 30, which places it at the low end of the "gray zone" between Categories 1 and 2. It is considered a Category 2 wetland despite its apparent manipulation, low diversity, and the fact that the wetland primarily receives runoff from the parking lot, other industrial sites, and adjacent roadways, which affects the quality of the water in the wetland.

Category 1 Wetlands

Fifty-two wetlands were identified that are Category 1. They range in size from 0.01 to 0.64 acre, although only three are larger than 0.4 acre. Most have developed at groundwater seeps, along drainage swales, or in isolated depressions. The larger Category 1 wetlands are each compromised by some type of disturbance and generally have low dispersion of vegetation. Two have a substantial amount of invasive species.

The largest Category 1 wetlands are discussed below.

W1 WL8

This wetland formed along a drainage adjacent to US 23. Although it may have originated as a roadside ditch, its hydrology and shape appear to have been altered over the years, possibly as a result of farming (row cropping) and periodic siltation from flooding by the Scioto River. It is now along a very shallow swale, with a width of as much as 40 feet. It is dominated by cattails and other emergents. Given its narrow buffer and dominance by only a few species, its ORAM score is only 14.

W21 WL13

This wetland formed along a small stream above a livestock watering pond. While it is surrounded by a narrow width of woodland, it is otherwise surrounded by active pasture or residential area. It therefore has a small buffer. Its ORAM score is 28.

W23 WL1

This emergent wetland is located in a depression along the Ohio River floodplain and is shown as a pond on the USGS map. However, it appears that surface water occurs only during heavy rainfall and flooding. The sedge-dominated emergent vegetation is more indicative that the wetland hydrology is primarily soil saturation. It is possible that the hydrology has been altered over the years by subsurface drainage. The landowner has made recent attempts to restore a drainage pipe beneath the railroad and driveway to the north of

the wetland, which may also promote drainage in the wetland. The ORAM score for this wetland is 29, in the Category 1 range.

Impacts

Introduction

The Preliminary Development Process for the Portsmouth Bypass project included several steps. In 1999, a Portsmouth Transportation Study was published. This work studied the transportation and economic needs of the area and evaluated "Concepts" for achieving the critical elements of the project's Purpose and Need. The "Airport Bypass Concept" was selected for further consideration. This concept went north from Wheelerburg to Minford (where the Minford Regional Airport sits among some of the largest developable tracts of land in southern Ohio). From Minford, the Airport Bypass Concept went roughly east-west to US Route 23, in the vicinity of Lucasville. The ecological survey study area falls within the Airport Bypass Concept area.

The Airport Bypass Concept encompassed a very large area – in some places over three (3) miles wide. Within this area, "Conceptual Alternatives" were developed and evaluated. This evaluation utilized the project's GIS database to investigate the expected benefits and impacts of the various links and nodes that formed the Conceptual Alternatives. Using a network of 95 links and 9 nodes allowed for a tremendous number of possible configurations. The most promising configurations were selected for further investigation.

These configurations were identified as "Preliminary Alternatives." Because of the region's difficult topography, substantial engineering efforts were required to evaluate whether the Preliminary Alternatives could be considered "Feasible." During the engineering phase, the predicted costs associated with the Preliminary Alternatives led to the investigation of numerous variants. The study area for the Ecological Survey encompassed the entire extent of all Preliminary Alternatives. The ecological data was available to the project team during the evaluation of the Preliminary Alternatives. The environmental summaries used at this decision point are included in Appendix H.

Ultimately, seven (7) individual segments were developed that could be combined to form eight (8) Feasible Alternatives. The Segments are labeled H1, V1, HV2, H3, V3, H4, V4. Those segments, which begin with an "H", denote segments that utilize the area's more rugged, undeveloped, and hilly terrain (often referred to as the "hill alternatives"). Segments which begin with a "V", denote segments that utilize the area's more level terrain, generally following Lucasville-Minford Road and the lands adjacent to the Little Scioto River (the "valley alternatives"). The Feasible Alternatives are thus identified by the segments that comprise them, for example, H1+HV2+H3+H4. Figure 8 displays all 7 segments. An additional small segment, labeled "Crossover," includes the area where Segment H3 could connect to V4, or H4 could connect to V3. Segments H3 and V3 each incorporate the area of a tentative interchange at Lucasville-Minford Road or Glendale Road, respectively.

This section will discuss the impacts associated with the individual segments as well as with all of the possible combinations:

• Alternative H1+HV2+H3+H4 - All hill segments

• Alternative H1+HV2+V3+V4 - Valley segments north of the Minford Airport, hill segments south.

• Alternative H1+HV2+H3+V4 - Northern-most segment follows Lucasville-Minford Road, otherwise all hill segments.

•Alternative H1+HV2+V3+H4 - A single valley segment (between Lucasville-Minford Road and S.R 139).

•Alternative V1+HV2+V3+V4 - All valley segments

•Alternative V1+HV2+H3+H4 - Hill segments north of the Minford Airport, valley segments south.

•Alternative V1+HV2+H3+V4 – A single hill segment (north of Lucasville-Minford Road), otherwise valley segments.

•Alternative V1+HV2+V3+H4 - Northern-most segment along hills, otherwise all valley segments.

Aquatic and Wetland Habitats

All of the streams and wetlands that have a direct water connection to streams or other surface waters are regulated as waters of the United States pursuant to the Clean Water Act (CWA). Therefore, all crossings of these waters will require authorization from the Army Corps of Engineers under Section 404, and the Ohio EPA under Section 401 of this law. Some of the ponds are also regulated under the Clean Water Act, but many that have been created as stock watering ponds or aesthetic pools will not be, provided they were not created along a regulated stream. The impacts to all streams and tributary wetlands and ponds by the project will likely be considered as a whole under a single Individual Section 404/401 permit. Impacts to the Little Scioto River, as a State Resource Water, are prohibited from authorization under Nationwide Permits by the Ohio EPA.

Isolated wetlands do not have a surface water connection to a stream and are not regulated under the Clean Water Act. However, they are regulated under the Ohio Isolated Wetlands Law. Impacts to isolated wetlands up to one half acre are permissible under a General Permit with notification of the Ohio EPA.

Under both the Clean Water Act and the Ohio Isolated Wetlands Law, permits typically require mitigation for the wetland and stream impacts.

Streams and Ponds

Table 11 summarizes the impacts to aquatic habitats associated with the segments and Feasible Alternatives. For streams, the total number of crossings and the approximate total

linear feet of stream within the anticipated project right-of-way are presented. The precise length of stream affected may vary depending on the final roadway design. The total number of impacted ponds and their total area are also presented.

The impacts of the tentative interchanges at H3 and V3 are included in Segments H3 and V3 and all of the alternatives in Table 11. Each of the interchanges adds two stream crossings of ephemeral or intermittent streams to the total impact of the segments. The additional impacts of the H3 interchange amounts to 1000 feet of ephemeral streams, and 900 feet of intermittent streams. For the V3 interchange, the additional impacts to streams are 500 feet of ephemeral streams, and 1300 feet of intermittent streams. Each interchange would also affect additional ponds. The H3 interchange affects two ponds totalling 1 acre, and the V3 interchange affects one 0.4 acre pond. If these interchanges are not constructed, these additional impacts would be avoided, and the total impact of each alternative would be reduced proportionately.

At the alternative level, stream impacts for the eight alternatives vary within a fairly narrow range. The highest impact occurs under Alternative V1+HV2+V3+H4 (43,831 linear feet), the minimum under H1+HV2+V3+V4 (43,263 linear feet). In general, the differences in stream impacts vary by segment and stream size. Generally, alternatives that incorporate segment H4 have greater impacts on ephemeral streams, and V4 have greater impacts on perennial streams. Segment V1 generally has greater impact on both ephemeral and perennial streams compared to H1. There is less variation between segments for intermittent streams. Impacts to ponds between alternatives depends mostly on the inclusion of Segment H4, which crosses two larger ponds, versus V4, which crosses a single smaller pond.

TABLE 11
Summary of Aquatic Habitat Impacts
Portsmouth Bypass Project

	Segments: Number of Crossings/Approx. Length of Impact (feet)							
	Segment H1	**Segment V1**	**Segment HV2**	**Segment H3**	**Segment V3**	**Segment H4**	**Segment V4**	**Cross-over**
Ephemeral Streams	16/3,430	23/8,100	12/3,500	11/3,740	8/3,500	15/8,000	9/2,500	2/700
Intermittent Streams	11/7,520	9/6,400	9/5,300	7/4,020	7/3,000	6/2,800	5/2,000	2/800
Bridge crossings – Little Scioto/Long Run	1/660	1/440	0/0	1/390	1/400	0/0	0/0	0/0
Perennial Streams	1/370	2/1,400	2/1,500	0/0	1/700	2/160	3/3,600	0/0
Total Stream Impacts	**29/11,980**	**35/16,340**	**23/10,300**	**19/8,150**	**17/7,600**	**23/10,960**	**17/8,100**	**4/1,500**
Ponds (acres)	4/1.926	5/1.642	5/3.162	3/0.989	0/0	3/5.61	5/0.554	1/0.064

	Feasible Alternatives: Number of Crossings/Approx. Length of Impact (feet)							
	H1+HV2+ H3+H4	**H1+HV2+ V3+V4**	**H1+HV2+ V3+H4**	**H1+HV2+ H3+V4**	**V1+HV2+ V3+V4**	**V1+HV2+H3 +H4**	**V1+HV2+V 3+H4**	**V1+HV2+H 3+V4**
Ephemeral Streams	56/19,700	47/13,390	55/19,617	52/14,847	54/18,048	63/24,358	62/24,276	59/19,507
Intermittent Streams	33/20,524	32/19,047	35/20,616	34/20,439	30/17,913	31/19,391	33/19,483	32/19,305
Bridge crossings – Little Scioto/Long Run	2/1,047	2/1,047	2/1,047	2/1,047	2/823	2/823	2/823	2/823
Perennial Streams	5/1,992	7/6,071	6/2,647	6/5,414	8/7,045	6/2,966	7/3,622	7/6,389
Total Stream Impacts	**96/43,263**	**88/39,555**	**98/43,929**	**94/41,749**	**94/43,831**	**102/47,539**	**104/48,205**	**100/46,025**
Ponds (acres)	16/12 acres	15/6 acres	14/11.12 acres	19/6.9 acres	16/5.72 acres	17/11.6 acres	15/10.83 acres	20/6.6 acres

The largest and most diverse aquatic habitats in the study area are the Little Scioto River, Long Run and Candy Run. Depending on the specific stream crossing, the construction of road crossings over these streams could impact fairly diverse freshwater mussel communities and large fish communities. The Little Scioto River supports a diverse fish and invertebrate community throughout its length in the study area. Notably, the presence of large numbers of mudpuppies, salamander mussels and breeding plain pocketbook mussels, and the overall diversity of mussels in the river are regionally and nationally important. The occurrence of the Ohio Special Interest sand darter in the river also speaks to the importance of this reach of stream. In Long Run, the occurrence of the Ohio Threatened rosyside dace indicates the regional importance of the aquatic communities in this stream.

All Feasible Alternatives will require one crossing of the Little Scioto River and one crossing of Long Run. The Little Scioto River crossing will be a bridge, thereby minimizing impacts. The bridge would include concrete abutments stabilized with rock channel protection and possibly piers in the river. The impacts calculations include the entire length of the river within the anticipated right-of-way (650 feet for those alternatives which utilize the H1 segment, 400 feet for those which utilize the V1 segment).

The Long Run crossing is identical for all Feasible Alternatives (it occurs within the common segment HV2). This crossing is also expected to be a bridge. The crossing will occur at the point where State Route 139 parallels the main stem of the Long Run. The total impacted area for the bridge will be approximately 450 feet. The Feasible Alternatives will also cross several Long Run tributaries using standard culvert crossings.

Candy Run lies within a relatively narrow corridor surrounded by steep, wooded slopes. Lucasville-Minford Road runs through this corridor. The V3 and V4 segments will also utilize this corridor, crossing Candy Run once in its upper (intermittent) reaches. Because of its large watershed, all of the Feasible Alternatives will cross Candy Run tributaries. All of these stream crossings will likely be accomplished via standard culverts.

In addition to the larger systems (Little Scioto, Long Run and Candy Run), all Feasible Alternatives will encroach upon many of the other sub-watersheds within the study area. As shown on Figure 8, the H4 and H3 segments take an upland course between Lucasville and Minford, while the V4 and, to a lesser extent, V3 segments generally follow the Lucasville-Minford Road corridor. This results in a set of stream encroachments within different places of the same watersheds, the "H" Segments having crossings higher in the stream profile and the "V" Segments lower in the stream profile. Encroachments of this type occur in the Thomas Hollow and the Lake Margaret basins. All of these stream crossings will likely be accomplished via standard culverts.

South of Long Run, the Feasible Alternatives run identical courses (Segment HV2) for approximately 4 miles and would have comparable perpendicular crossings of the stream that parallels Swauger Valley Road, Shumway Hollow, Blake Hollow, Dan White Hollow, and Slab Run.

South of Slab Run, Segment H1 follows the hill country, while Segment V1 crosses through the Little Scioto River valley. From this point south to Sciotodale, the impacts for alternatives which use segment H1 versus V1 vary considerably. The Segment H1 encroaches upon the upper reaches of Shoumberg Hollow, Mansfield Hollow, and Stout Hollow, all west of the Little Scioto River. Conversely, Segment V1 encroaches upon the lower Shoumberg Hollow (prior to crossing the river) and the Wards Run system (including Shell Creek and Oven Lick) east of the river. Near Sciotodale, the H1 and V1 Segments vary slightly in their impacts to small Ohio River tributaries.

The numerous non-bridge crossings will include installation of culverts, concrete headwalls/aprons, stone stabilization at outlets of the culverts, and possibly channel relocations. Physical impacts to the streams will include loss of stream habitat, stream bank alterations, substrate alteration, and removal of riparian vegetation. The length of each stream affected depends on topography and the orientation of the highway alignment relative to the stream. The culverts will represent permanent loss of aquatic habitat. Areas of

stream realignment and stone stabilization at the outfalls will likely revert to viable habitat over time with the accumulation of bedload (sand, silt, gravel and cobbles), creating a more natural stream substrate. Removal of riparian vegetation will expose these aquatic habitats to increased illumination and temperature, possibly adversely affecting the aquatic animal populations during the summer months. This impact will eventually be lessened with regrowth along the banks. Such regrowth will take several years.

The impacts to aquatic communities associated with construction are well known and mostly short-lived. However, some long-term impacts can also be anticipated as a result of this project. Impacts to aquatic species within the primary impact zone will include the elimination of individuals of some species within the impact area, especially those that are sensitive to excessive siltation (lithophilic species) and the rare species if construction occurs within the reaches where these species occur. Given that these alterations will be localized, they are not expected to result in a permanent change in the diversity of the component species of any stream system. However, the loss of habitat could theoretically cause a proportional decrease in the populations.

Construction activities in the streams will also cause some sedimentation in downstream reaches. These streams currently do not have very high turbidities and any increase in turbidity levels could have significant impact on the fish and invertebrate communities. The extent of that impact will depend on the implementation of standard ODOT erosion control methods. The existing upstream and downstream reaches of each stream will provide refugia for the more mobile aquatic species during construction, which will lessen the impact to these species. Less mobile and more sensitive species, such as freshwater mussel populations, could be smothered if sedimentation, albeit temporary, is abundant. However, once the streambanks have become re-vegetated and the stream work has ceased, it is anticipated that silt loads will return to normal and these impacts would be eliminated. Over the long term, sediment will be flushed from the stream during rain events following completion of the construction. It is not anticipated that the smaller streams would be affected as greatly as the larger streams in this corridor as they currently do not support the same level of community development or diversity of habitats.

The new roadway will include a substantial increase in pavement area and possibly traffic volume. Therefore, it will likely lead to an increase in roadway runoff volumes and contaminants into the streams. The impact of this contamination will depend on the impact of current runoff contamination from current land uses, primarily cattle farming and existing roadways, and the implementation of standard ODOT stormwater quality controls. Smaller streams are already subject to some pollution, mostly an increase in nutrient loadings, which may impair the aquatic biota in these streams. Long Run and Candy Run are generally parallel to existing roadways, and these streams are presumably already subject to existing roadway runoff. Despite the adjacent roadways, current contamination appears to have only slight affect on Long Run and Candy Run, as well as the Little Scioto River, which sustain diverse populations of aquatic macroinvertebrates and fish, including pollution intolerant species. These streams benefit from dilution of contamination afforded by their higher flow volumes. Consequently, while the potential impact to aquatic diversity from runoff from the new roadway is greatest for these streams, they may also be buffered from the impacts by their sizes.

Each Feasible Alternative will also impact some ponds (Table 11). Each of the affected ponds would be partially or completely filled to accommodate the highway. Given that the water quality and habitat quality of many of the ponds are strongly influenced by human activities (such as agricultural uses of the ponds and adjacent lands and fish stocking), the impact on the local biotic populations from filling of some ponds is expected to be minimal.

Wetlands

2.61 4.44

In general, the wetlands within the study area are small and widely dispersed. Therefore, impacts to wetlands are relatively minor (Table 12). The minimum total wetland encroachment (Alternative H1+HV2+V3+V4) is 3.97 acres (14 wetlands). The maximum total wetland encroachment (Alternative V1+~~HV2+~~V3+H4) is 3.053acres (16 wetlands). These numbers include the entire area of each wetland, not just the area within the right-of-way. Segment V1 has slightly greater impacts to wetlands than Segment H1. Segment V4 affects a greater number of wetlands, but Segment H4 affects a larger area of wetlands.

The impacts of the tentative interchanges at H3 and V3 are included in Segments H3 and V3 and all of the alternatives in Table 12. The H3 interchange impacts two additional Category 1 wetlands and one additional Category 2 wetland, for a total additional impact of 0.1 acre. The V3 interchange impacts one additional Category 1 wetland with an area of 0.14 acre. If these interchanges are not constructed, these additional impacts would be avoided, and the total impact of each alternative would be reduced proportionately.

The habitat quality of the wetlands affected by the Feasible Alternatives is generally very similar, that is, the majority of the wetlands affected would be Category 1 or 2. No Category 3 wetlands are affected by the Feasible Alternatives. The alternatives do vary on the types of wetlands they affect. Approximately 80% of wetland area impacted by "H" segments are wooded wetlands (PF01 and PSS1), while 75% of the wetland area impacted by "V" segments are emergent (PEM).

TABLE 12
Summary of Wetland Impacts
Portsmouth Bypass Project

	Segments: Number of Wetlands/Total Area within ROW (acres)							
	Segment H1	**Segment V1**	**Segment HV2**	**Segment H3**	**Segment V3**	**Segment H4**	**Segment V4**	**Cross-over**
Category 1 (Isolated)	0/0	1/0.075	0/0	0/0	0/0	0/0	2/0.297	0/0
Category 1 (Tributary)	1/0.037	2/0.162	1/0.171	2/0.17	1/0.098	1/0.091	2/0.362	0/0
Category 2 (Isolated)	1/0.351	0/0	0/0	0/0	0/0	0/0	1/0.032	0/0
Category 2 (Tributary)	2/0.883	3/1.474	1/0.179	0/0	1/0.138	2/1.973	0/0	0/0
TOTAL	**4//1.271**	**6/1.711**	**2/0.35**	**2/0.17**	**2/0.236**	**3/2.064**	**5/0.691**	**0/0**

	Feasible Alternatives: Number of Wetlands/Total Area within ROW (acres)							
	H1+HV2+ H3+H4	**H1+HV2+ V3+V4**	**H1+HV2+ V3+H4**	**H1+HV2+ H3+V4**	**V1+HV2+ V3+V4**	**V1+HV2+H3 +H4**	**V1+HV2+V 3+H4**	**V1+HV2+ H3+V4**
Category 1 (Isolated)	1/0.03	2/0.30	0/0	3/0.33	3/0.37	2/0.11	1/0.08	4/0.4
Category 1 (Tributary)	6/0.50	6/0.81	5/0.535	7/0.77	7/0.93	7/0.63	6/0.66	8/0.89
Category 2 (Isolated)	2/0.40	2/0.38	1/0.35	3/0.44	1/0.03	1/0.05	0/0	2/0.09
Category 2 (Tributary)	5/3.04	4/1.13	6/3.1	3/1.06	5/1.72	6/3.63	7/3.7	4/1.65
TOTAL (isolated)	**3/0.43**	**4/0.68**	**1/0.35**	**6/0.77**	**4/0.4**	**3/0.16**	**1/0.08**	**6/0.49**
TOTAL (tributary)	**11/3.54**	**10/1.94**	**11/3.64**	**10/1.8**	**12/2.65**	**13/4.26**	**13/4.36**	**12/2.54**
TOTAL	**14/3.97**	**14/2.61**	**11/3.92**	**7/2.57**	**16/3.05**	**16/4.42**	**14/4.44**	**15/3.03**

Terrestrial Habitats

There will be moderate losses and fragmentation of terrestrial habitats as a consequence of this action (Table 13). Depending on which alternative is used, the total terrestrial habitat loss is estimated to be between 903 and 1,040 acres. The total impact reflects the footprint area of the segments. Segment V1 has a greater area than H1, while H4 has a considerably greater area of impact than V4. Thus, the V1+HV2+H3+H4 alternative has the greatest total impact area, and the H1+HV2+V3+V4 alternative exhibits the least area of impact.

The majority of the terrestrial impacts will be to forest lands. Impacts to other habitat types are generally proportional to their relative abundance. Urban/residential land uses are generally avoided. As discussed previously, those alternatives which utilize the "H" segments take alignments along the hills north of Lucasville and west of the Little Scioto River valley. This area is primarily wooded. In particular, those alternatives that include segment H4 generally have greater impact to forest and scrub-shrub lands than those that

include segment V4. The alternatives which utilize the "V" segments take alignments through the valleys, affecting proportionately larger agricultural areas.

The impacts of the tentative interchanges at H3 and V3 are included in Segments H3 and V3 and all of the alternatives in Table 13. The H3 interchange adds about 48 acres of total impact area: 22 acres woodland, 3 acres scrub, 1 acre active agriculture, 14 acres passive agriculture, and 8 acres of urban land. The V3 interchange adds about 40 acres of total impact area: 15 acres woodland, 4 acres active agriculture, 12 acres passive agriculture, and 9 acres of urban land. If these interchanges are not constructed, these additional impacts would be avoided, and the total impact of each alternative would be reduced proportionately.

Given their composition and history of disturbance, none of the affected forested habitats are considered to be regionally significant. However, several wood lots within the study area are good examples of mature deciduous woodlands. The loss of mature woodlands constitutes the greatest impact to terrestrial habitats, including terrestrial flora and fauna and timber resources. The impact of the roadway on mature woodlands is somewhat tempered by the fact that some of these woodlands are currently being logged by the landowners.

The losses of terrestrial habitats could proportionately reduce the vertebrate wildlife populations. There may be a relocation of some wildlife to nearby alternative habitats, as the mobility of the species and the carrying capacity of those habitats allow, which could reduce the impact somewhat. The project will not likely affect the overall diversity of mammal and bird populations in the area, as most of the observed species are adapted to urban settings. It is expected that other vertebrate populations would be similarly affected by the project.

The project will cause segmentation of some forest habitats, and may create barriers to wildlife migration in some locations. However, some segmentation and barriers are posed by the existing network of roadways and other development. Wide ranging species (such as coyote) already cross the existing roadways in the study area. Therefore, the project is not expected to substantially limit the accessibility of habitats to those species that occupy the study area.

TABLE 13
Summary of Terrestrial Habitat Impacts
Portsmouth Bypass Project

	Segments: Total Area within ROW (acres)/Percent of Total Impact Area							
	Segment H1	**Segment V1**	**Segment HV2**	**Segment H3**	**Segment V3**	**Segment H4**	**Segment V4**	**Cross-over**
Composite Forest	109/38%	133/43%	87/40%	114/68%	125/77%	183/67%	41/21%	38/100%
Scrub-Shrub/Logged Forest	54/19%	16/5%	54/25%	27/16%	3/2%	15/6%	7/3%	0/0
Active Agriculture (row crops/ active pasture/ orchard)	7/3%	59/19%	20/9%	2/1%	3/2%	26/10%	40/21%	0/0
Passive Agriculture (old field / passive pasture)	53/18%	45/14%	45/21%	16/10%	23/14%	5/2%	52/26%	0/0
Urban/Residential	63/22%	59/19%	11/5%	9/5%	8/5%	42/15%	58/29%	0/0
TOTAL	**286/100%**	**312/100%**	**217/100%**	**168/100%**	**162/100%**	**271/100%**	**198/100%**	**38/100%**

	Feasible Alternatives: Total Area within ROW (acres)/Percent of Total Impact Area							
	H1+HV2+ H3+H4	**H1+HV2+ V3+V4**	**H1+HV2+V 3+H4**	**H1+HV2+ H3+V4**	**V1+HV2+ V3+V4**	**V1+HV2+H 3+H4**	**V1+HV2+V 3+H4**	**V1+HV2+ H3+V4**
Composite Forest	514/52%	376/42%	556/56%	410/43%	400/43%	538/53%	581/56%	434/44%
Scrub-Shrub/Logged Forest	153/16%	119/14%	127/13%	145/15.5%	80/9%	114/11.5%	88/9%	106/11%
Active Agriculture (row crops/ active pasture/ orchard)	57/6%	75/8%	60/5%	71/8%	126/14%	108/11%	112/11%	122/13%
Passive Agriculture (old field / passive pasture)	132/13%	184/20%	137/13%	179/18%	176/19%	124/11.5%	129/12%	171/17%
Urban/Residential	133/13%	148/16%	132/13%	148/15.5%	144/16%	129/13%	129/12%	145/15%
TOTAL	**989/100%**	**903/100%**	**1014/100%**	**954/100%**	**928/100%**	**1015/100%**	**1040/100%**	**980/100%**

encountered
Rosyside Dace
E. Sand darter
Salamander mussel

W/in 10 miles of 2 Hib. records within 10 miles of several captures

360-560 ac impact roosting - 2-300 ac foraging

Endangered Species

Determination of Effects and Rationale for Federal Species

A **"No Effect"** determination is appropriate when the action will not affect the species (USFWS and NMFS, 1998). A **"May Affect"** is the appropriate conclusion when a proposed action may have any effects on the species. An **"Is Not Likely to Adversely Affect"** determination is appropriate when effects on the species are expected to be insignificant, discountable, or beneficial. Beneficial Effects are contemporaneous positive effects without any adverse effects. Insignificant effects relate to the size of the impact and never reach the scale of a take. Discountable effects are those extremely unlikely to occur. An **"Is Likely to Adversely Affect"** determination is appropriate if any adverse effect may occur to the listed species as a direct or indirect result of the proposed action or its interrelated or interdependent actions.

None of the federally-listed species have been identified within the project area.

Indiana Bat

The Feasible Alternatives would impact upland and riparian forest habitats that may contain suitable roosting trees/habitats for the Indiana bat. However, surveys found no individuals or evidence of the species, and generally found the habitat to be of low quality for this species. Mist netting sites, selected in cooperation with the USFWS, were found to have low roost site potential due to lack of canopy structure and cluttered understories.

Nevertheless, non-reproductive bats have been recorded during the summer in Scioto and adjacent Pike Counties, and summer maternity occurrences have been recorded in adjacent Lawrence County. To minimize possible impacts to the Indiana Bat, potential summer roost trees will be cleared within the project construction limits and ancillary work areas only between 15 September and 15 April of each year. Although there will be a loss of 360 - 560 acres of potential roosting (forest) habitat and 200 to 300 acres of potential foraging (open field) habitat from the project (Table 13), this is small in proportion to available habitat, both within the action area and at a landscape scale, and roosting and foraging habitat will remain plentiful.

There are no known hibernacula within the action area, the nearest being recorded in Adams County some 20+ miles west of the project area, so impacts to bats during winter is not anticipated.

Impacts from noise and contaminants will be negligible. Roads have not been proven to be a barrier to movement by bats, nor is there plausible evidence that the open road habitat makes bats more susceptible to predation by owls and other nocturnal sighted predators.

Therefore, a **"May Affect, Not Likely To Adversely Affect"** determination is appropriate for the Indiana bat during construction, operation, and maintenance activities of this new highway.

Small Whorled Pogonia

Surveys for the small whorled pogonia have covered all of the alternatives, but a second season survey is planned. To date, no populations of the small whorled pogonia have been identified in the project area. The survey will be completed during the peak flowering period in May to June 2004.

While habitat conditions that resemble the known habitat in Hocking County (that is, a canopy of eastern hemlock with associate ground layer species) were not found in the project area, a number of sites were found to contain populations of the large whorled pogonia and other associate plant species. These areas may represent unoccupied, potentially suitable habitats. The project is approximately 50 mi (80.5 km) from the closest known populations in Hocking County, Ohio, and dispersal over that distance is unlikely. However, the plant may lie dormant for several years. Therefore, there is a possibility for effects to potential unoccupied habitat and dormant individuals. Consequently, a **"May Affect, Not Likely to Adversely Affect"** determination is made for construction along all alternatives. If the species is found during the final surveys, then this determination will be re-examined.

Virginia Spiraea

Surveys of the project area during the peak seasons found neither individuals of this species nor any evidence of them. However, streambank habitats which may represent unoccupied, suitable habitats exist in the project area. Segment V1 provides the greatest amount of suitable streambank habitat of any segment.

The project is approximately 10 mi (16 km) east of the closest known population on the Scioto Brush Creek, and dispersal over that distance is unlikely. However, due to the presence of suitable habitat for the species, there is a potential for effects to unoccupied habitat. Therefore, a **"May Affect, Not Likely to Adversely Affect"** determination is appropriate for construction along all alternatives.

Timber Rattlesnake

Habitats which appear suitable for the timber rattlesnake exist in the project area. Segment H4 is generally the least developed/disturbed and appears to be the most suitable. Surveys of these habitats during the peak seasons found no individuals of this species nor any evidence of it. Given the influence of human activities in the area, and the distance to the nearest known population (some five miles west of the Scioto River), migration of this species to these habitats seems unlikely in the foreseeable future. Therefore, it appears the project would not likely affect this species, although it may adversely modify potentially suitable habitats.

As this species is not listed, a determination of effect is not required pursuant to the Endangered Species Act.

State Species

The American chestnut sighted during the field investigation is located some 200 feet east of Segment V1 and would not be directly affected by any alternative (Figure 8d). However, it is

close enough that it will be clearly identified prior to construction to avoid inadvertent impacts.

At least two fish species listed as rare in the state were found in study area streams, the rosyside dace in Long Run and the eastern sand darter in the Little Scioto River. All alternatives will cross these streams, potentially affected these species, primarily from siltation during construction. It is expected that the project impacts will be localized, and will not have a permanent impact on the populations of these species.

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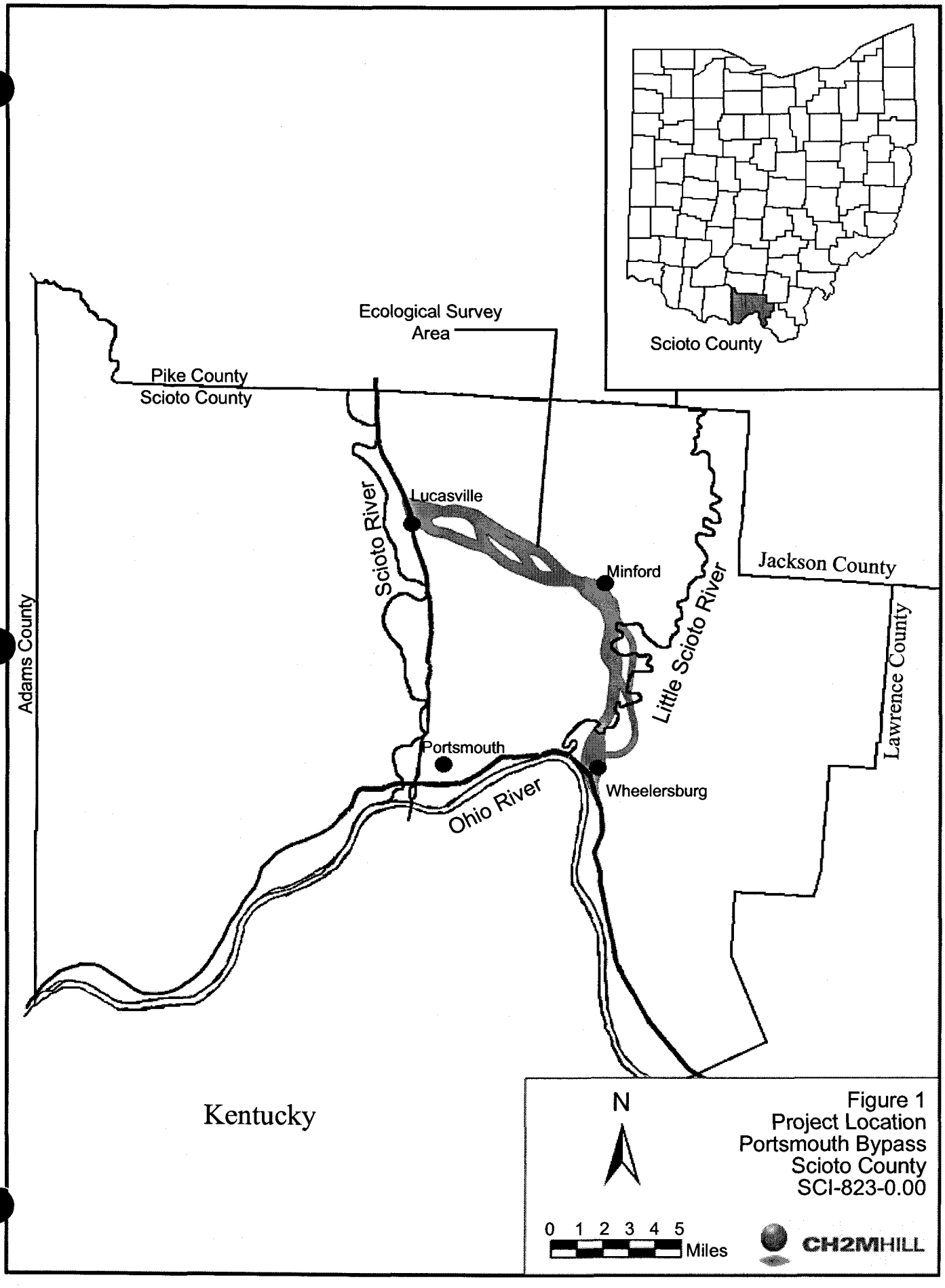

Figure 1
Project Location
Portsmouth Bypass
Scioto County
SCI-823-0.00

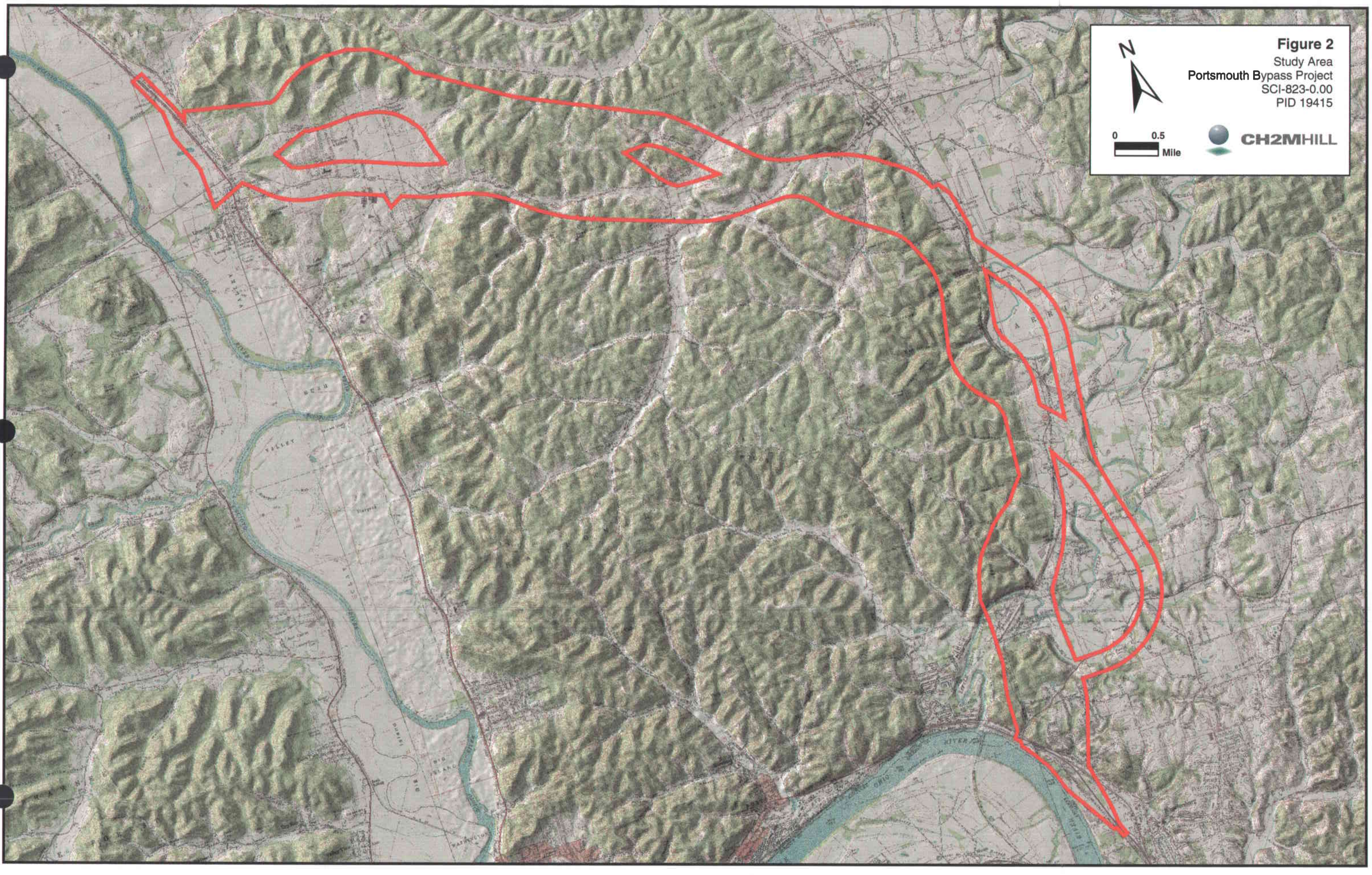
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Figure 2
Study Area
Portsmouth Bypass Project
SCI-823-0.00
PID 19415
0
0.5
Mile
CH2MHILL

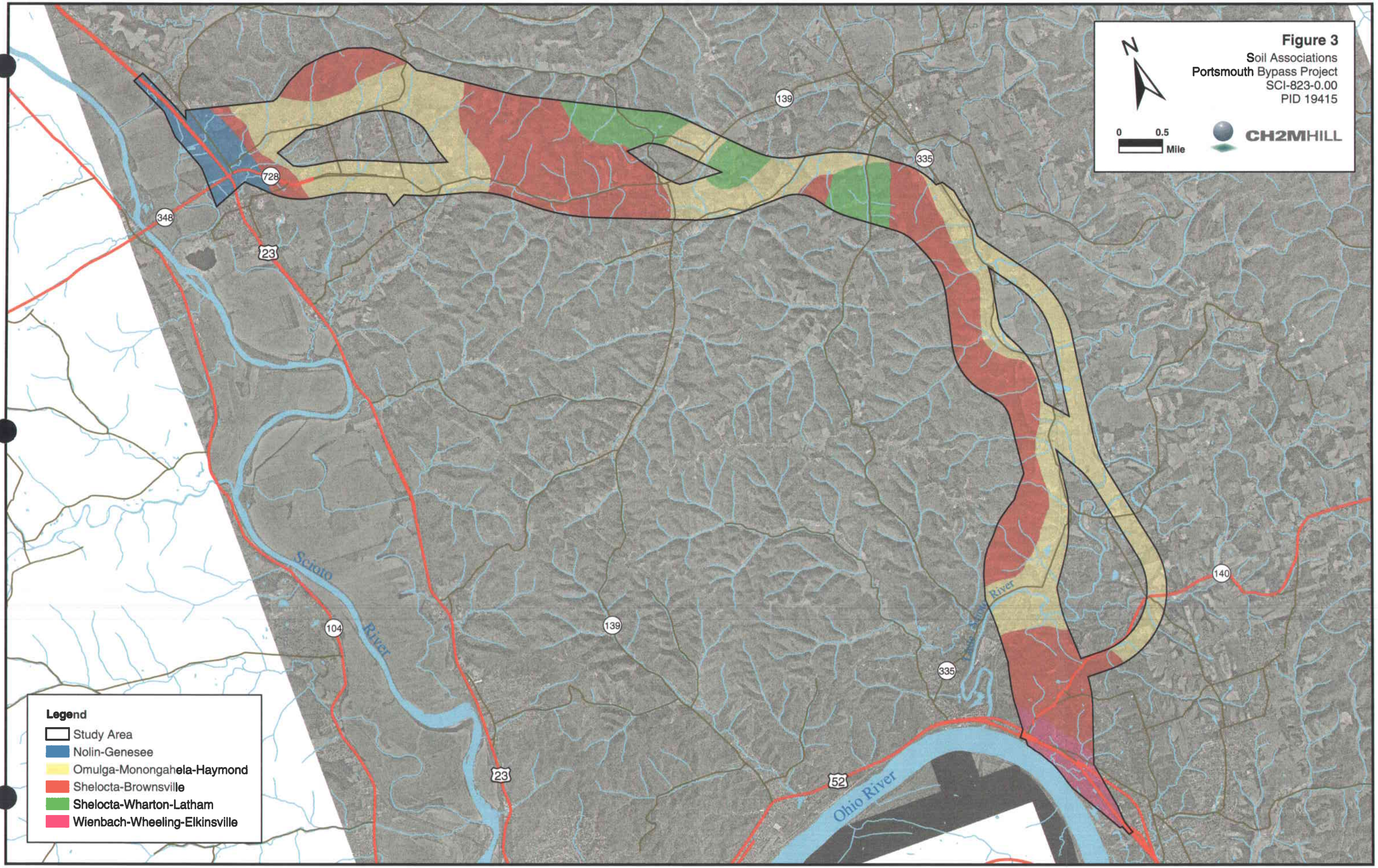
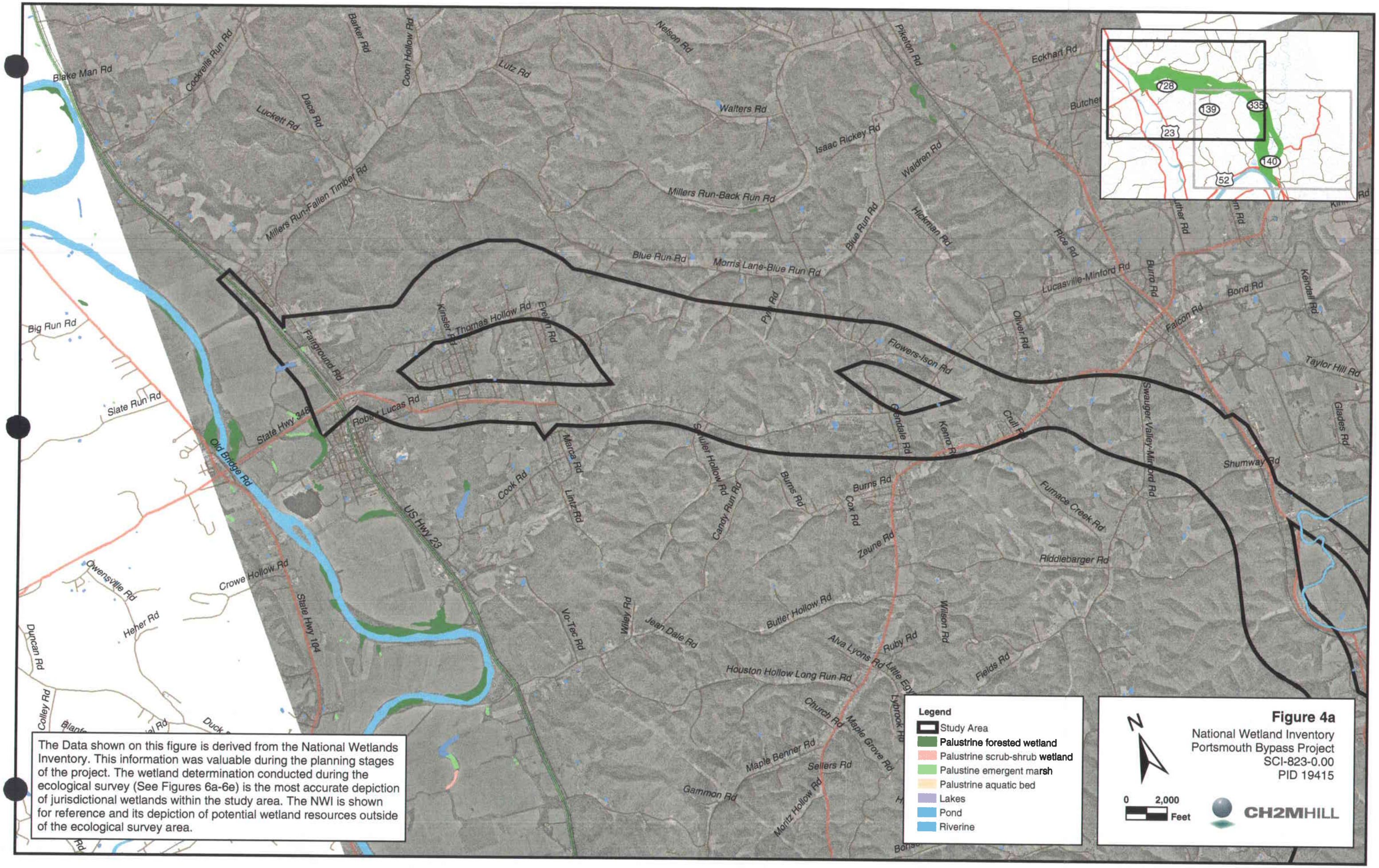


Figure 3
Soil Associations
Portsmouth Bypass Project
SCI-823-0.00
PID 19415
N
0
0.5
Mile
CH2MHILL
Legend
Study Area
Nolin-Genesee
Omulga-Monongahela-Haymond
Shelocta-Brownsville
Shelocta-Wharton-Latham
Wienbach-Wheeling-Elkinsville
139
335
728
348
23
104
140
52
Scioto River
Ohio River
Little Scioto River



The Data shown on this figure is derived from the National Wetlands Inventory. This information was valuable during the planning stages of the project. The wetland determination conducted during the ecological survey (See Figures 6a-6e) is the most accurate depiction of jurisdictional wetlands within the study area. The NWI is shown for reference and its depiction of potential wetland resources outside of the ecological survey area.

The Data shown on this figure is derived from the National Wetlands Inventory. This information was valuable during the planning stages of the project. The wetland determination conducted during the ecological survey (See Figures 6a-6e) is the most accurate depiction of jurisdictional wetlands within the study area. The NWI is shown for reference and its depiction of potential wetland resources outside of the ecological survey area.

Legend
- Study Area
- Palustrine forested wetland
- Palustrine scrub-shrub wetland
- Palustine emergent marsh
- Palustrine aquatic bed
- Lakes
- Pond
- Riverine

N

0 2,000 Feet

CH2MHILL

Figure 4b
National Wetland Inventory
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

The Data shown on this figure is derived from the Ohio Wetlands Inventory. This information was valuable during the planning stages of the project. The wetland determination conducted during the ecological survey (See Figures 6a-6e) is the most accurate depiction of jurisdictional wetlands within the study area. The OWI is shown for reference and its depiction of potential wetland resources outside of the ecological survey area.

Legend

- Study Area
- Woods on Hydric Soil
- Shallow Marsh
- Shrub/Scrub Wetland
- Wet Meadow
- Open Water

N

0 2,000 Feet

Figure 5a
Ohio Wetlands Inventory
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

CH2MHILL

The Data shown on this figure is derived from the Ohio Wetlands Inventory. This information was valuable during the planning stages of the project. The wetland determination conducted during the ecological survey (See Figures 6a-6e) is the most accurate depiction of jurisdictional wetlands within the study area. The OWI is shown for reference and its depiction of potential wetland resources outside of the ecological survey area.

Legend

- Study Area
- Woods on Hydric Soil
- Shallow Marsh
- Shrub/Scrub Wetland
- Wet Meadow
- Open Water

N

0 2,000 Feet

Figure 5b
Ohio Wetlands Inventory
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

CH2MHILL

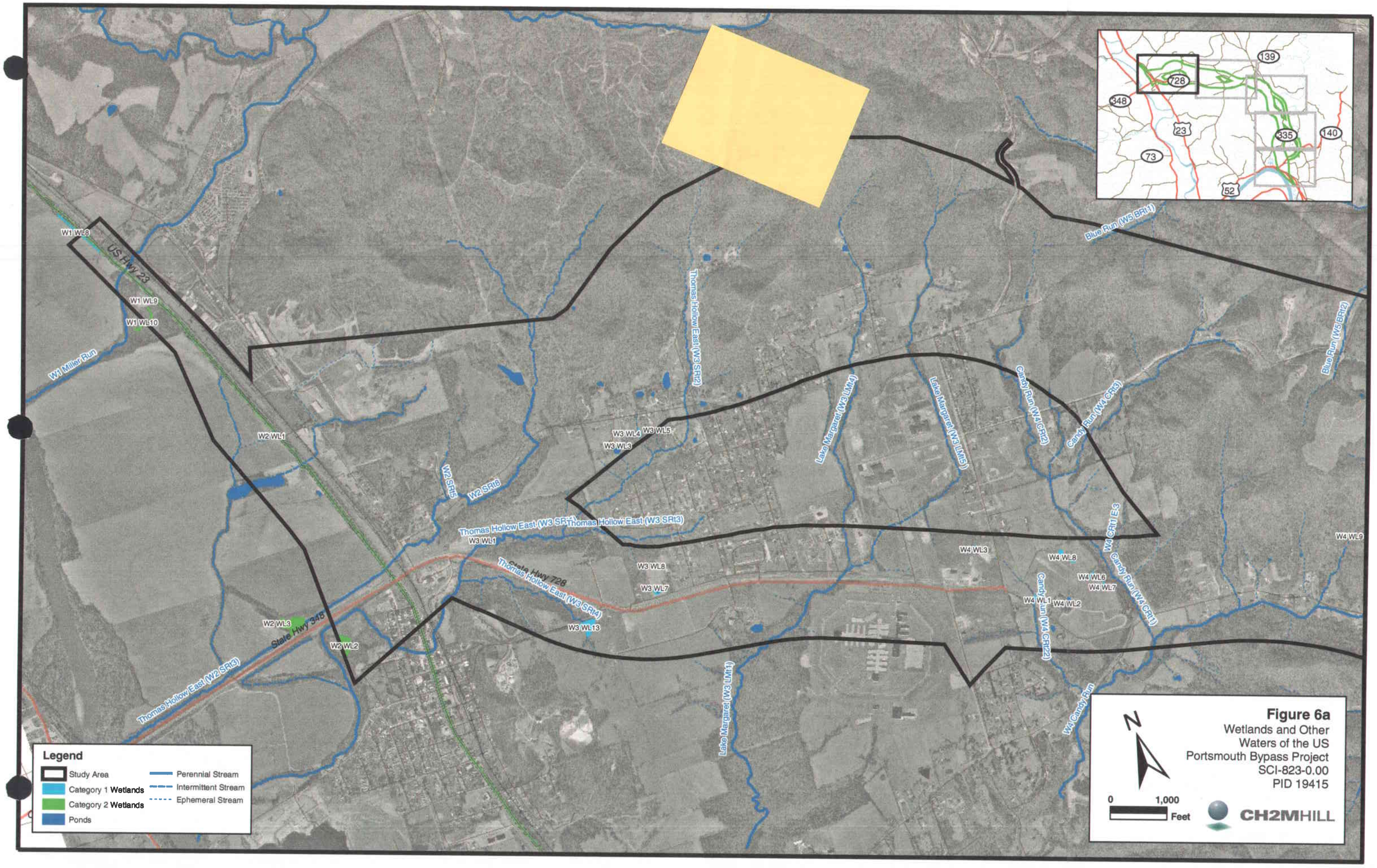


Figure 6a
Wetlands and Other Waters of the US
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

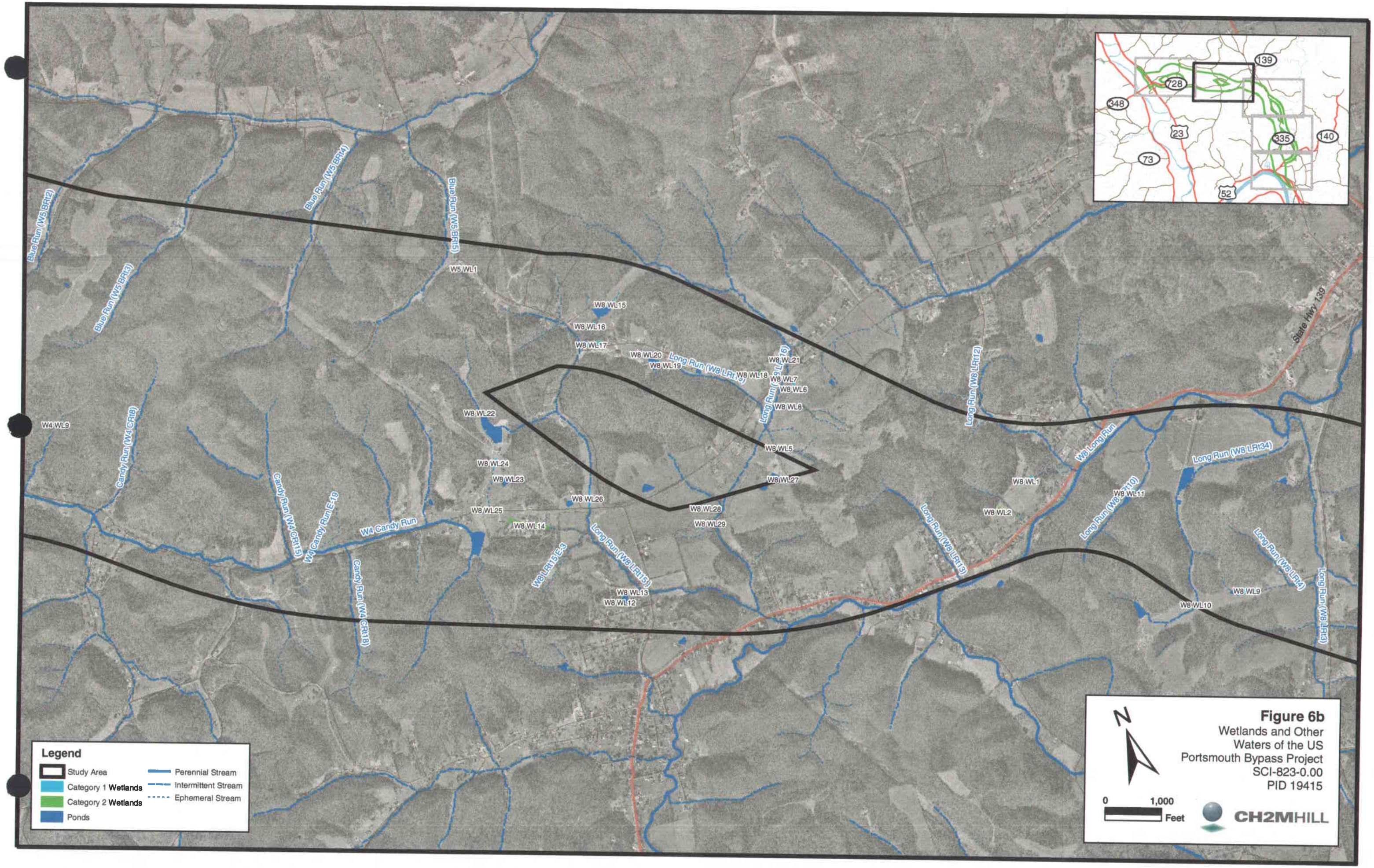


Figure 6b
Wetlands and Other Waters of the US
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

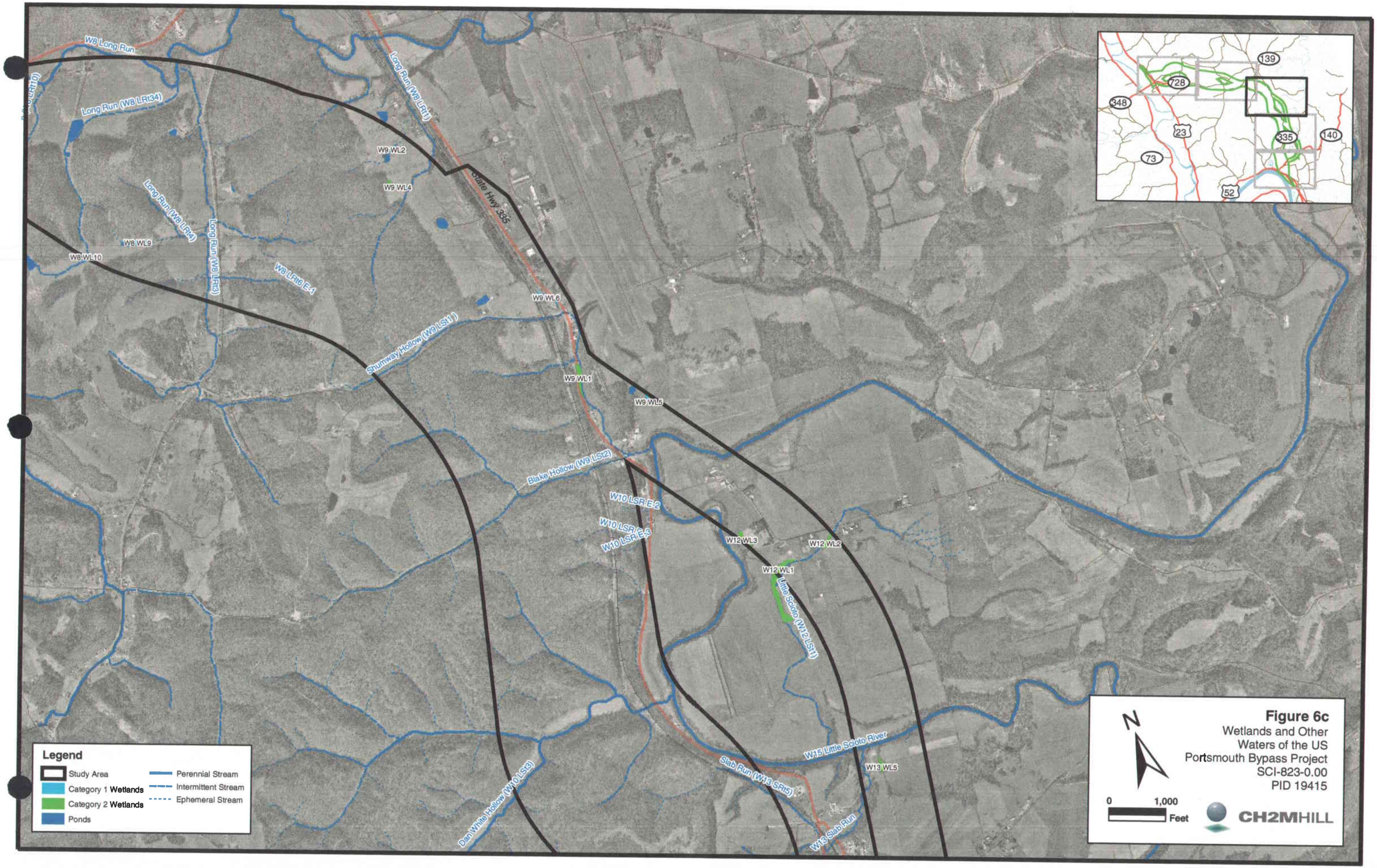
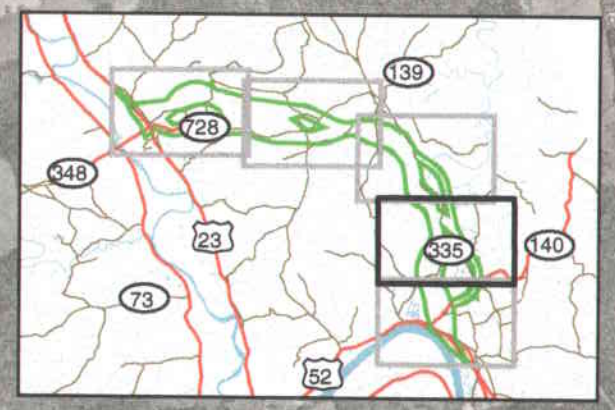


Figure 6c
Wetlands and Other Waters of the US
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

Dan White Hollow (W10 LSt3)
W13 WL6
W13 SR15
State Hwy 355
W13 WL1
Shoumberg Hollow (W14 LSt2)
W14 WL16
W15 Little Sobolo River
Shoumberg Hollow (W14 LSt3)
W14 WL12
W14 WL13
W14 WL14
W14 WL11
Fair Oaks
State Hwy 355
Shoumberg Hollow (W14 LSt1)
W14 WL10
Mansfield Hollow (W14 LSt8)
W14 WL2
W14 WL1
W14 WL6
W14 WL7
Stout Hollow (W16 LSt5)
Stout Hollow (W16 LSt2)
W15 WL2
W15 WL1
W16 WL3
Wards Run (W15)



Legend

- Study Area
- Category 1 Wetlands
- Category 2 Wetlands
- Ponds
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream

N

0 1,000 Feet

Figure 6d
Wetlands and Other Waters of the US
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

CH2MHILL

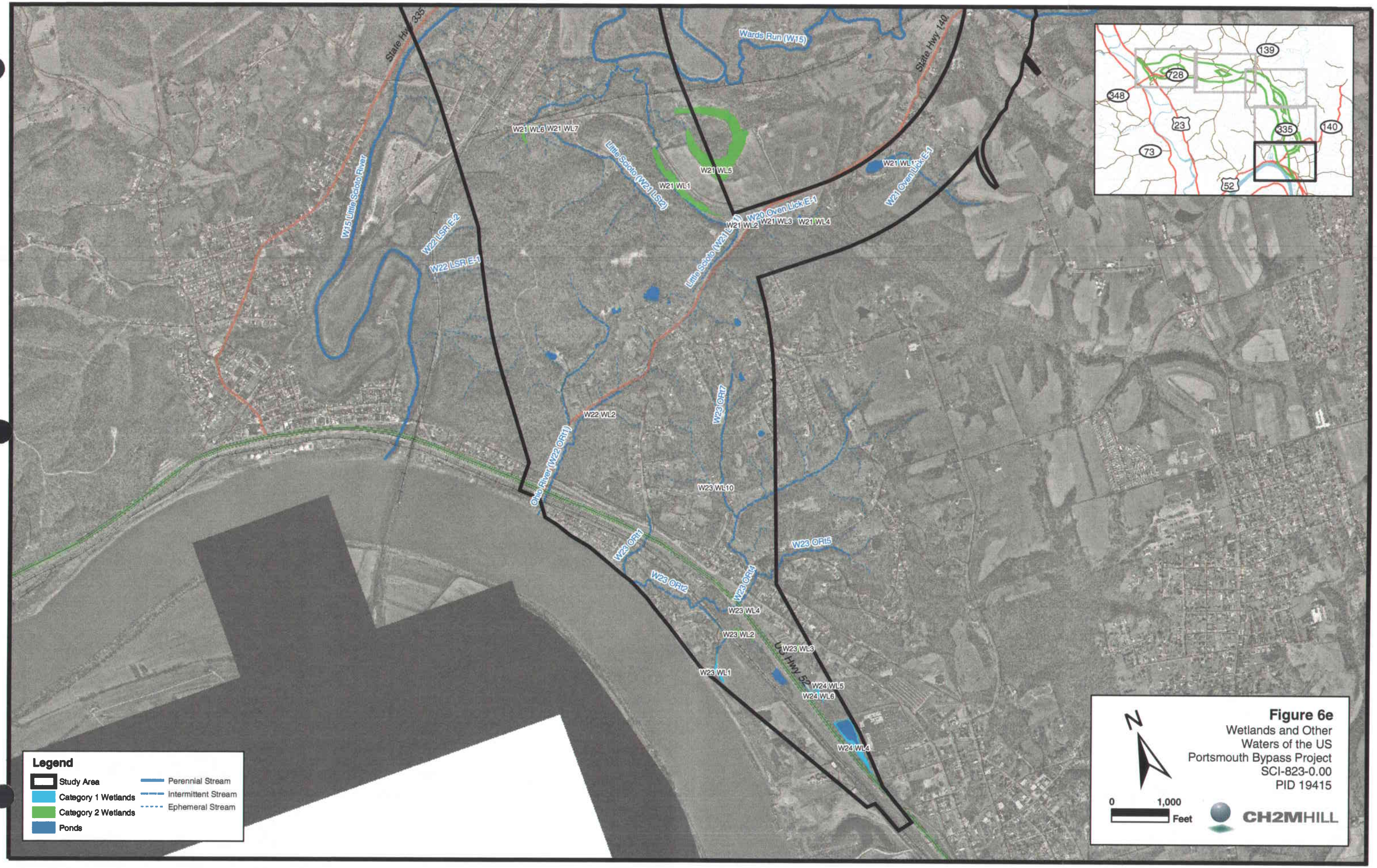
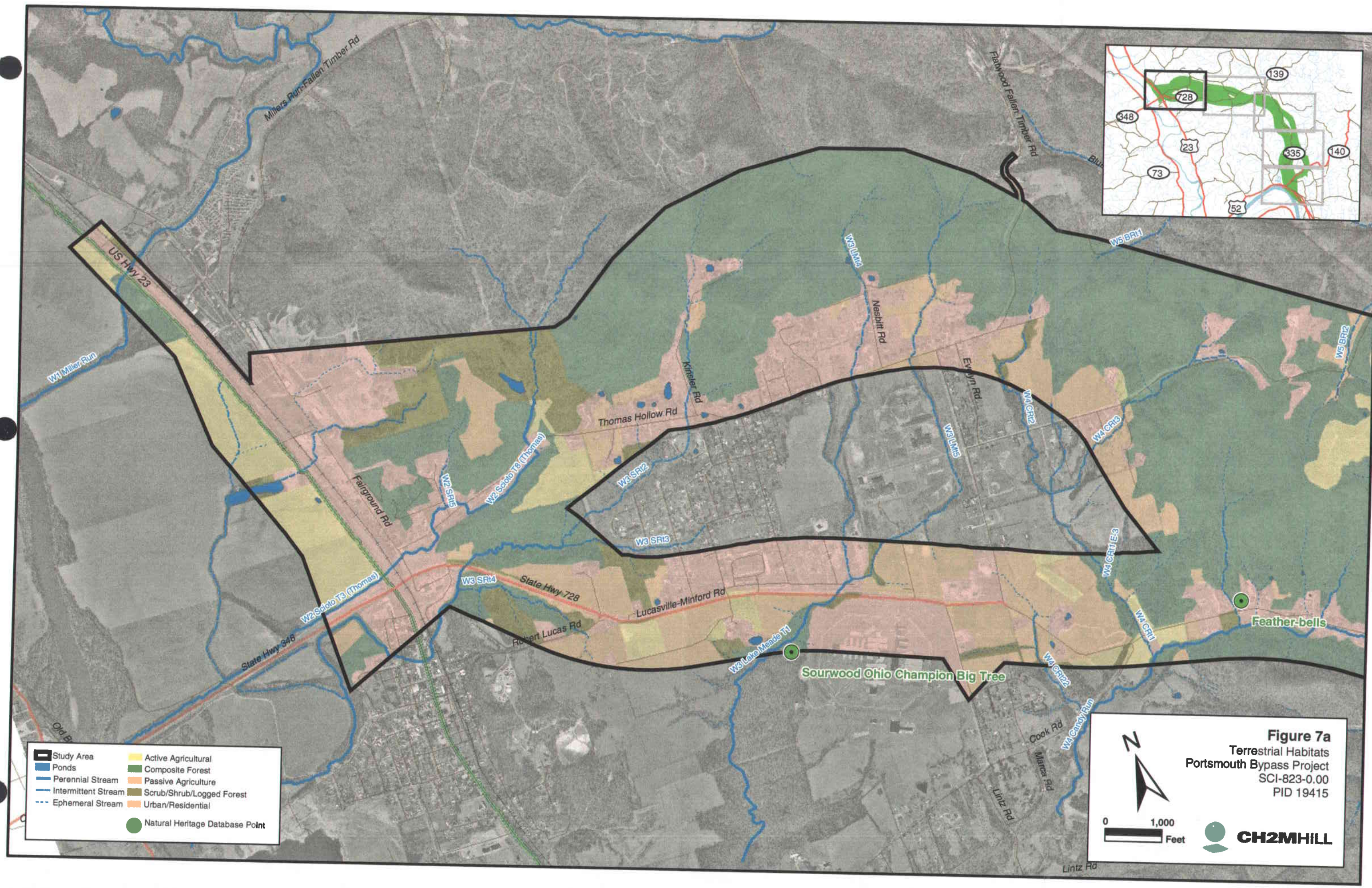
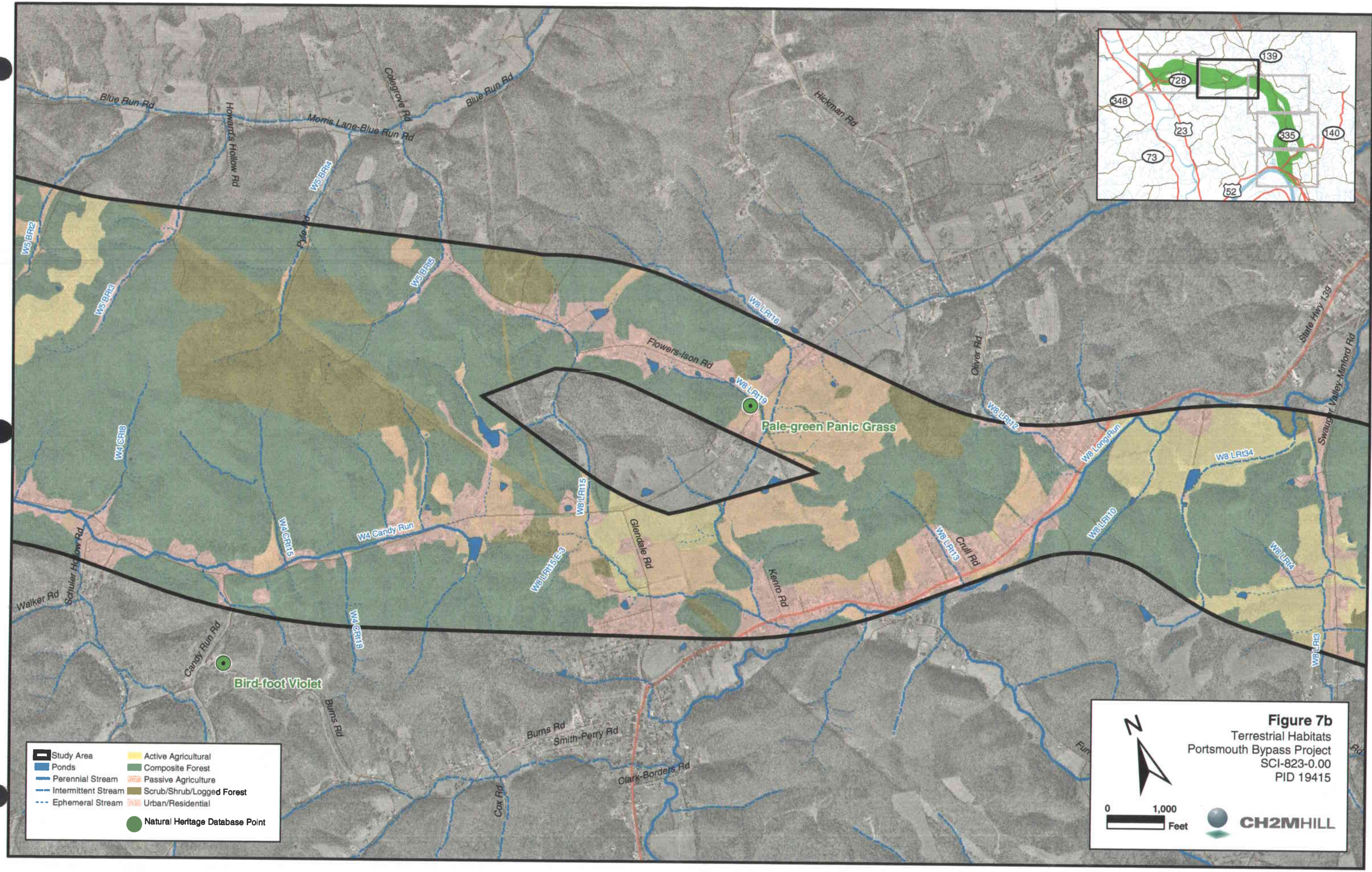


Figure 6e
Wetlands and Other Waters of the US
Portsmouth Bypass Project
SCI-823-0.00
PID 19415


Millers Run-Fallen Timber Rd
Flatwood Fallen Timber Rd
US Hwy 23
W1 Miller Run
Thomas Hollow Rd
Kinsler Rd
Nesbitt Rd
Evelyn Rd
W3 LM4
W3 LM5
W4 CR12
W4 CR13
W5 BR11
W5 BR12
W2 SR15
W2 Scioto T8 (Thomas)
W3 SR12
W3 SR13
W3 SR14
W2 Scioto T3 (Thomas)
State Hwy 728
Lucasville-Minford Rd
Fairground Rd
State Hwy 348
Robert Lucas Rd
W3 Lake Meade T1
Sourwood Ohio Champion Big Tree
Feather-bells
W4 CR11 E-3
W4 CR11
W4 CR22
W4 Candy Run
Cook Rd
Marcia Rd
Lintz Rd
Study Area
Ponds
Perennial Stream
Intermittent Stream
Ephemeral Stream
Active Agricultural
Composite Forest
Passive Agriculture
Scrub/Shrub/Logged Forest
Urban/Residential
Natural Heritage Database Point
N
0
1,000
Feet
Figure 7a
Terrestrial Habitats
Portsmouth Bypass Project
SCI-823-0.00
PID 19415
CH2MHILL


Blue Run Rd
Howard's Hollow Rd
Morris Lane-Blue Run Rd
Colegrove Rd
Blue Run Rd
Hickman Rd
W5 BRt2
W5 BRt3
W5 BRt4
Pyle Rd
W5 BRt5
W8 LRt16
Flowers-Ison Rd
W8 LRt19
Pale-green Panic Grass
Oliver Rd
W8 LRt12
W8 Long Run
W8 LRt34
State Hwy 139
Swauger Valley-Mimford Rd
W4 CRt8
W4 CRt15
W4 Candy Run
W8 LRt15
W8 LRt15 E-3
Glendale Rd
Kenro Rd
W8 LRt13
Crull Rd
W8 LRt10
W8 LRt4
W8 LRt3
Walker Rd
Schuler Hollow Rd
Candy Run Rd
W4 CRt18
Bird-foot Violet
Burns Rd
Smith-Perry Rd
Clark-Borders Rd
Cox Rd
Study Area
Ponds
Perennial Stream
Intermittent Stream
Ephemeral Stream
Active Agricultural
Composite Forest
Passive Agriculture
Scrub/Shrub/Logged Forest
Urban/Residential
Natural Heritage Database Point
139
728
348
23
335
140
73
52
N
0
1,000
Feet
Figure 7b
Terrestrial Habitats
Portsmouth Bypass Project
SCI-823-0.00
PID 19415
CH2MHILL

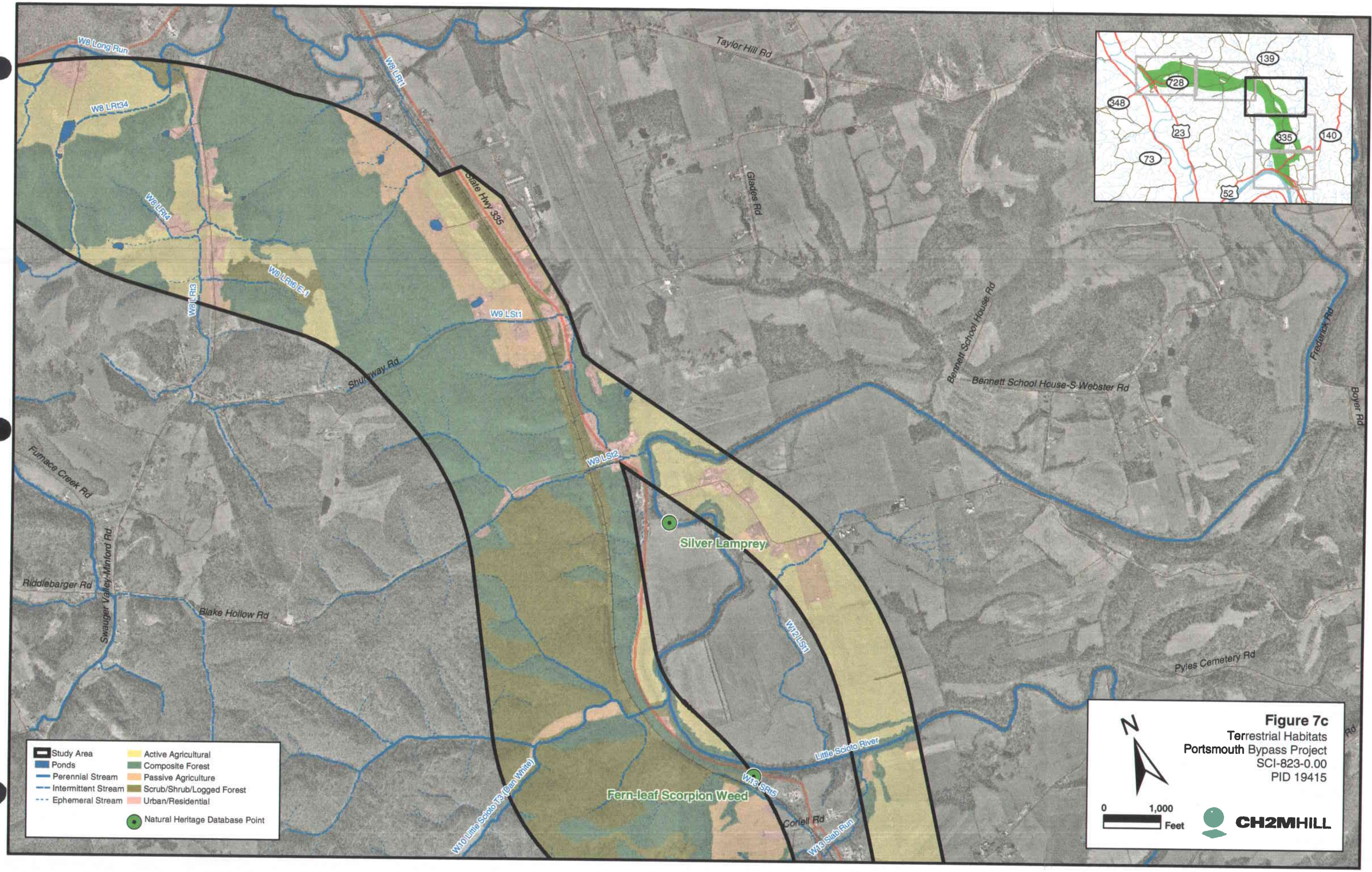
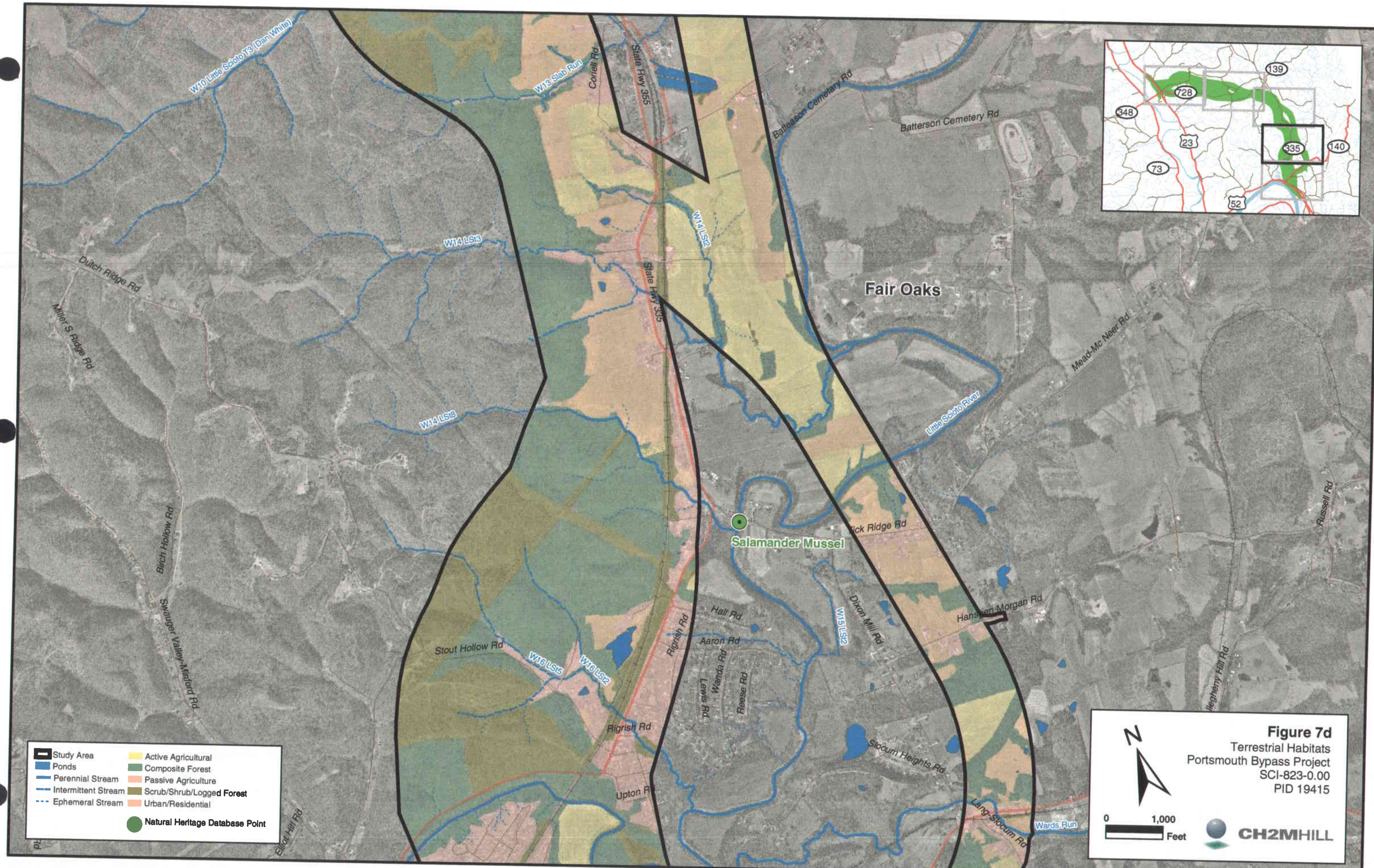
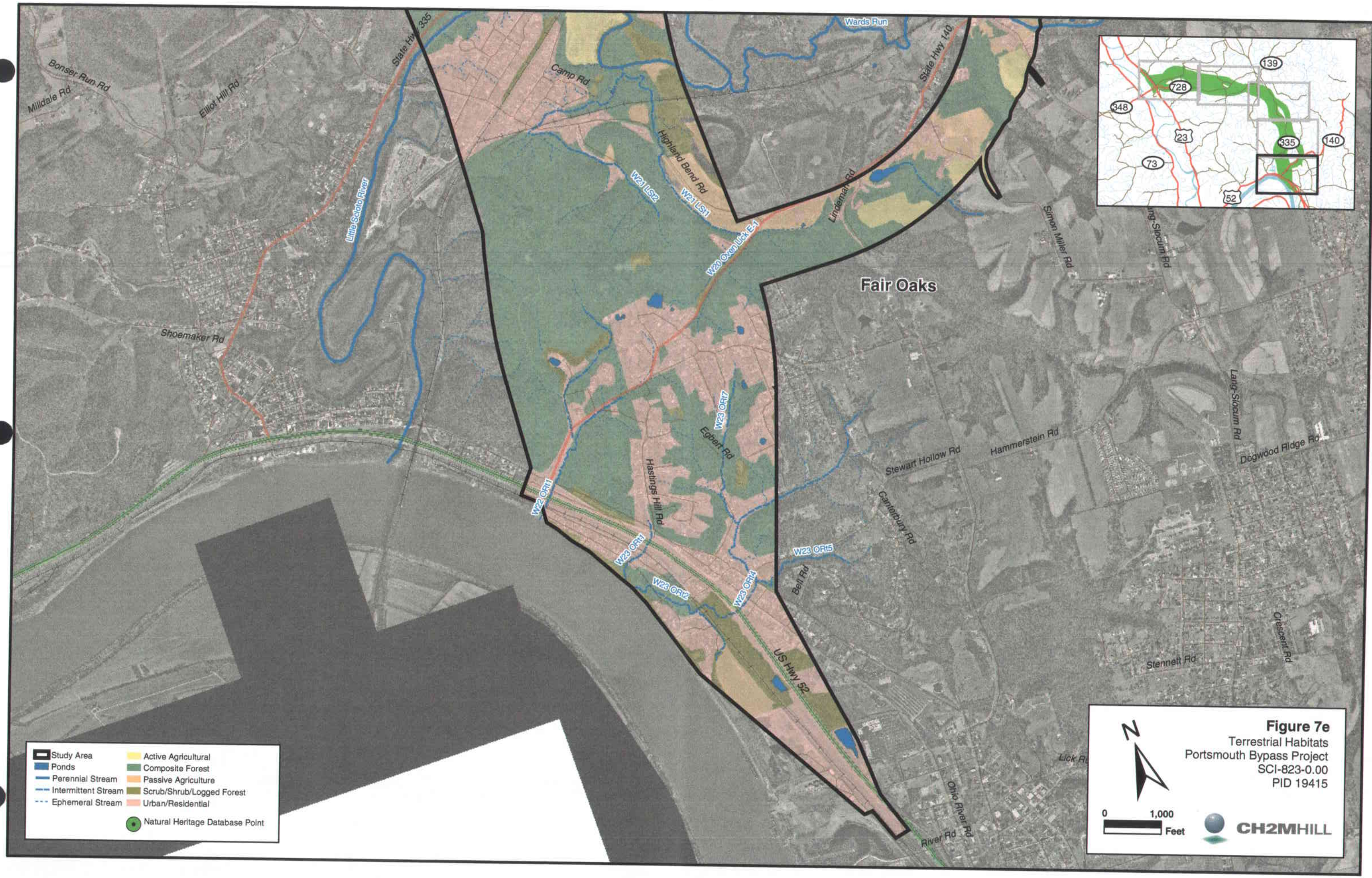


Figure 7c
Terrestrial Habitats
Portsmouth Bypass Project
SCI-823-0.00
PID 19415


W10 Little Scioto T3 (Dan White)
W13 Slab Run
Correll Rd
State Hwy 355
Batteason Cemetery Rd
Batterson Cemetery Rd
W14 LS13
W14 LS12
Dutch Ridge Rd
Miller S Ridge Rd
State Hwy 335
Fair Oaks
Mead-Mc Neer Rd
Little Scioto River
W14 LS8
Salamander Mussel
Birch Hollow Rd
Swauger Valley-Mitford Rd
Stout Hollow Rd
W16 LS15
W18 LS2
Rigrish Rd
Hall Rd
Aaron Rd
Wanda Rd
Lewis Rd
Reese Rd
W15 LS2
Dixon Mill Rd
Hanstein Morgan Rd
Slocum Heights Rd
Lang-Slocum Rd
Wards Run
Russell Rd
Elliot Hill Rd
Study Area
Ponds
Perennial Stream
Intermittent Stream
Ephemeral Stream
Active Agricultural
Composite Forest
Passive Agriculture
Scrub/Shrub/Logged Forest
Urban/Residential
Natural Heritage Database Point
N
0
1,000
Feet
Figure 7d
Terrestrial Habitats
Portsmouth Bypass Project
SCI-823-0.00
PID 19415
CH2MHILL


Bonser Run Rd
Millidale Rd
Elliot Hill Rd
State Hwy 335
Little Scioto River
Shoemaker Rd
Camp Rd
Highland Bend Rd
W21 LS2
W21 LS1
W20 Owl Lick E-1
Wards Run
State Hwy 140
Lindemann Rd
Simon Miller Rd
Fair Oaks
Lang-Slocum Rd
Stewart Hollow Rd
Hammerstein Rd
Dogwood Ridge Rd
W23 ORt7
Egbert Rd
Hastings Hill Rd
W22 ORt1
W23 ORt3
W23 ORt2
W23 ORt4
W23 ORt5
Bell Rd
Canterbury Rd
US Hwy 52
Stennett Rd
Crescent Rd
Ohio River Rd
River Rd
Study Area
Ponds
Perennial Stream
Intermittent Stream
Ephemeral Stream
Active Agricultural
Composite Forest
Passive Agriculture
Scrub/Shrub/Logged Forest
Urban/Residential
Natural Heritage Database Point
N
0
1,000
Feet
CH2MHILL
Figure 7e
Terrestrial Habitats
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

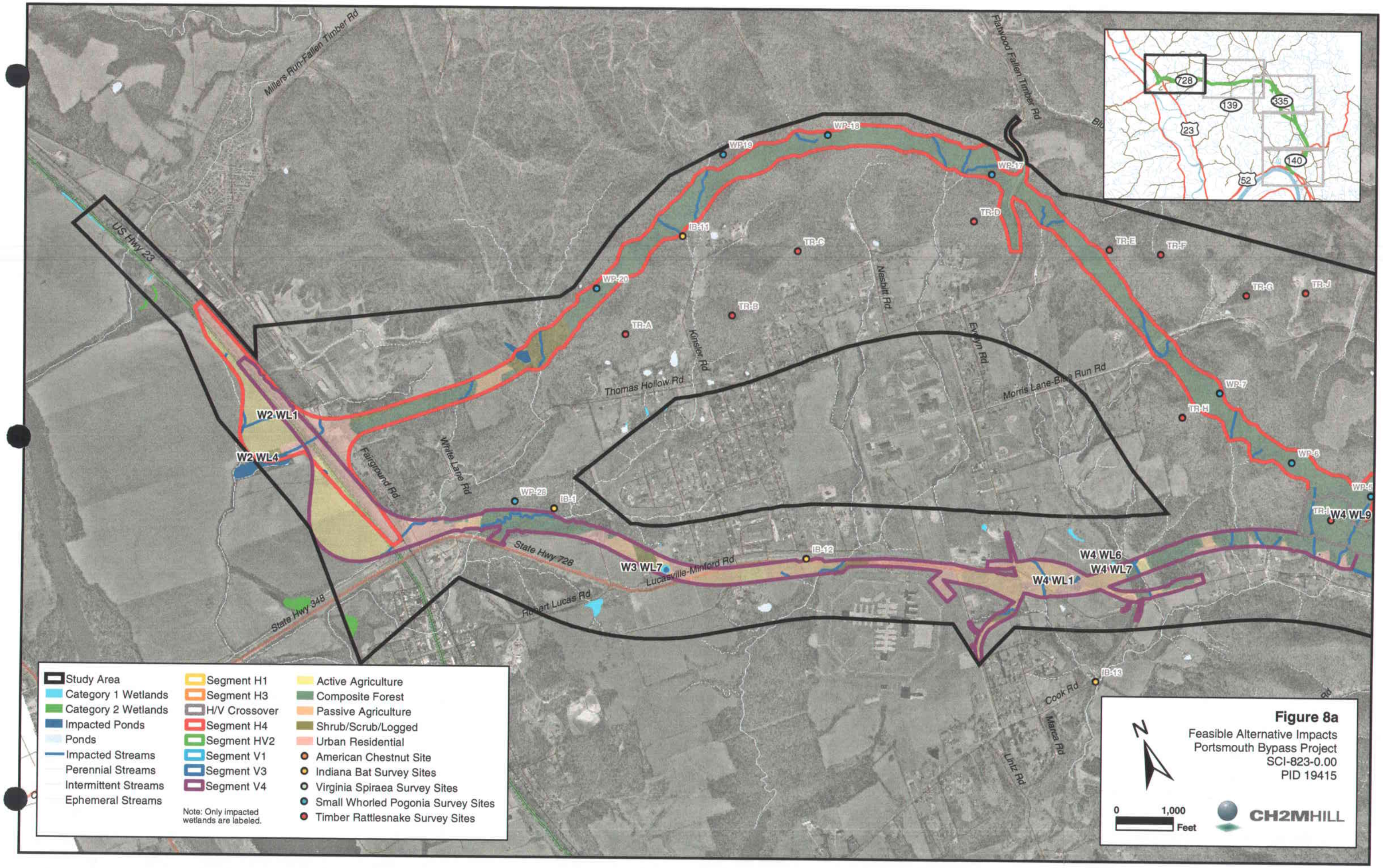


Figure 8a
Feasible Alternative Impacts
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

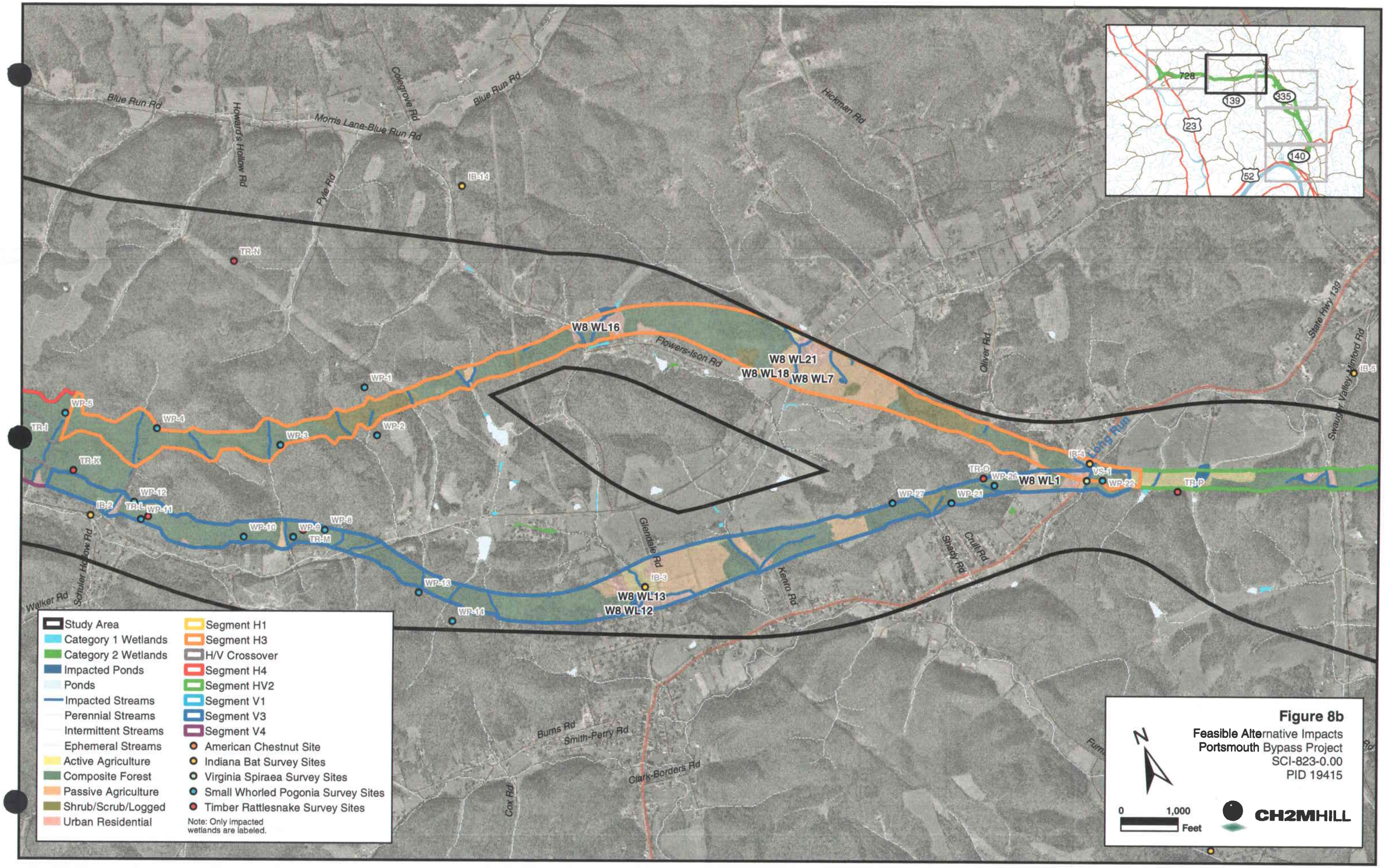


Figure 8b
Feasible Alternative Impacts
Portsmouth Bypass Project
SCI-823-0.00
PID 19415

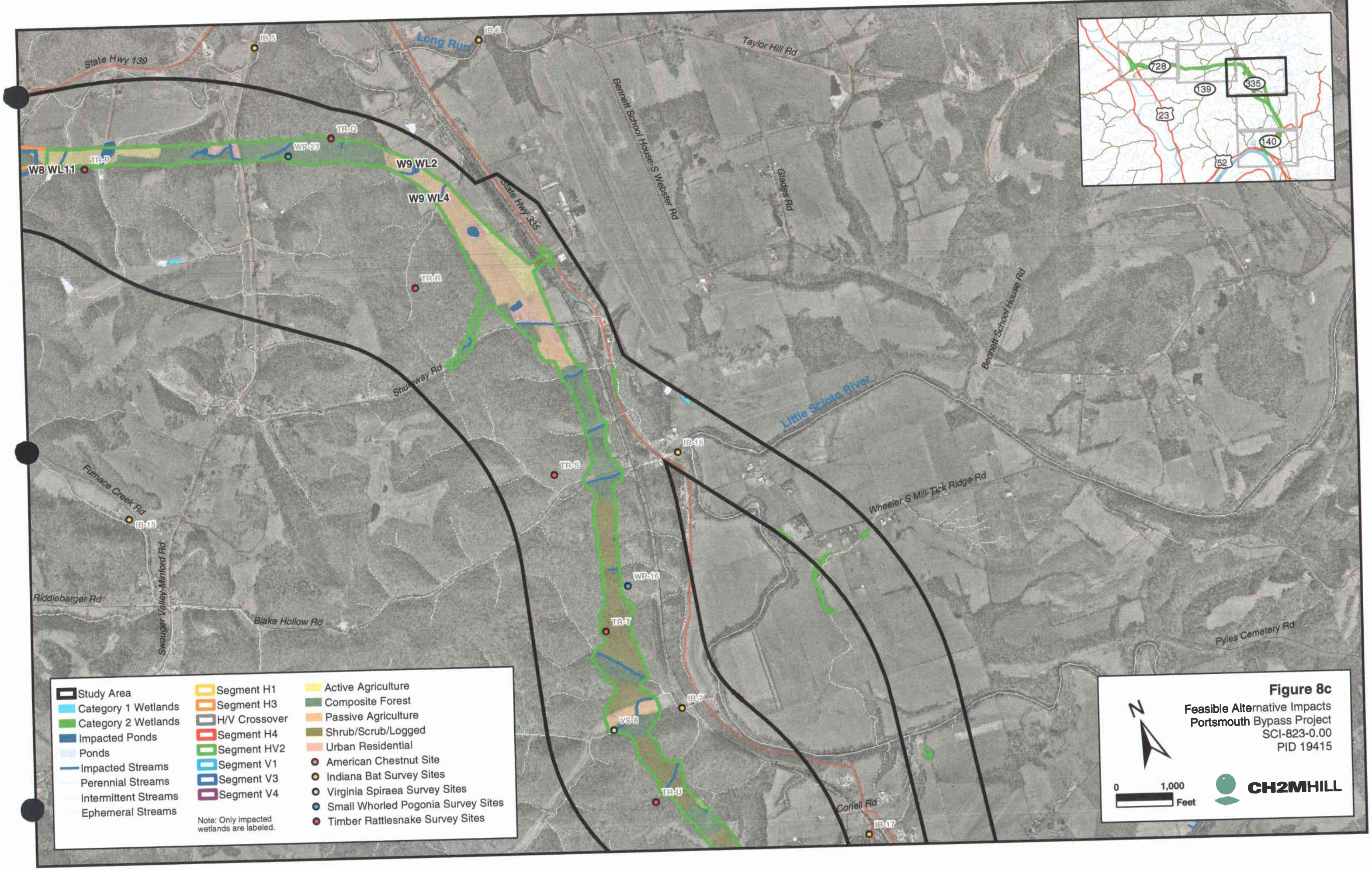
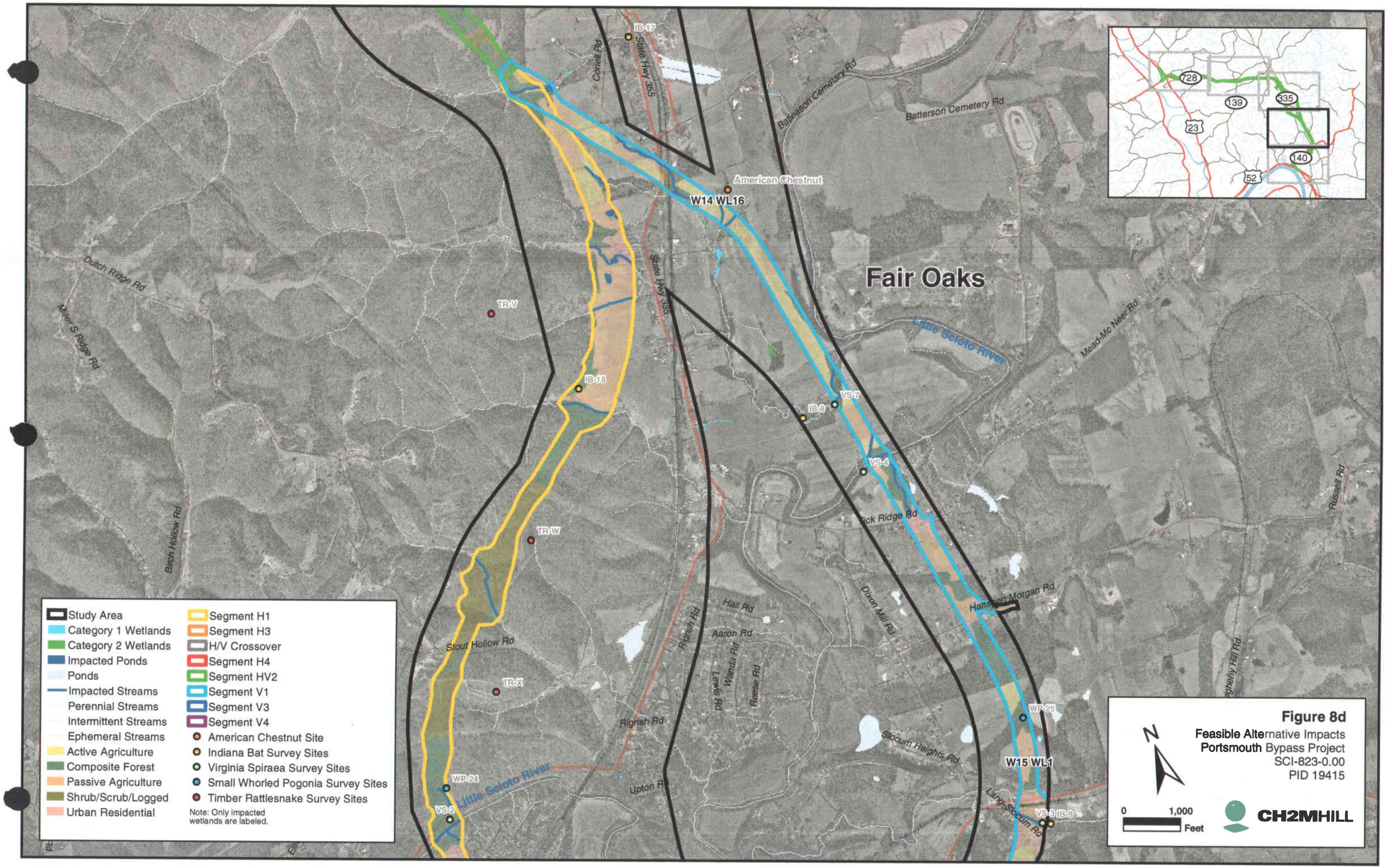


Figure 8c
Feasible Alternative Impacts
Portsmouth Bypass Project
SCI-823-0.00
PID 19415


IB-17
State Hwy 355
Coriell Rd
Balleason Cemetery Rd
Batterson Cemetery Rd
American Chestnut
W14 WL16
Fair Oaks
Dutch Ridge Rd
Miller S Ridge Rd
TR-V
IB-18
State Hwy 355
Little Scioto River
Mead-Mc Neer Rd
VS-7
IB-3
VS-4
Birch Hollow Rd
TR-W
Stout Hollow Rd
TR-X
Rigrish Rd
Hall Rd
Aaron Rd
Lewis Rd
Wanda Rd
Reese Rd
Dixon Mill Rd
Hanstgen Morgan Rd
Russell Rd
WP-25
Slocum Heights Rd
W15 WL1
WP-24
VS-2
Upton Rd
Lang Slocum Rd
VS-3 IB-9
728
139
335
23
140
52
Study Area
Category 1 Wetlands
Category 2 Wetlands
Impacted Ponds
Ponds
Impacted Streams
Perennial Streams
Intermittent Streams
Ephemeral Streams
Active Agriculture
Composite Forest
Passive Agriculture
Shrub/Scrub/Logged
Urban Residential
Segment H1
Segment H3
H/V Crossover
Segment H4
Segment HV2
Segment V1
Segment V3
Segment V4
American Chestnut Site
Indiana Bat Survey Sites
Virginia Spiraea Survey Sites
Small Whorled Pogonia Survey Sites
Timber Rattlesnake Survey Sites
Note: Only impacted wetlands are labeled.
N
0
1,000
Feet
Figure 8d
Feasible Alternative Impacts
Portsmouth Bypass Project
SCI-823-0.00
PID 19415
CH2MHILL

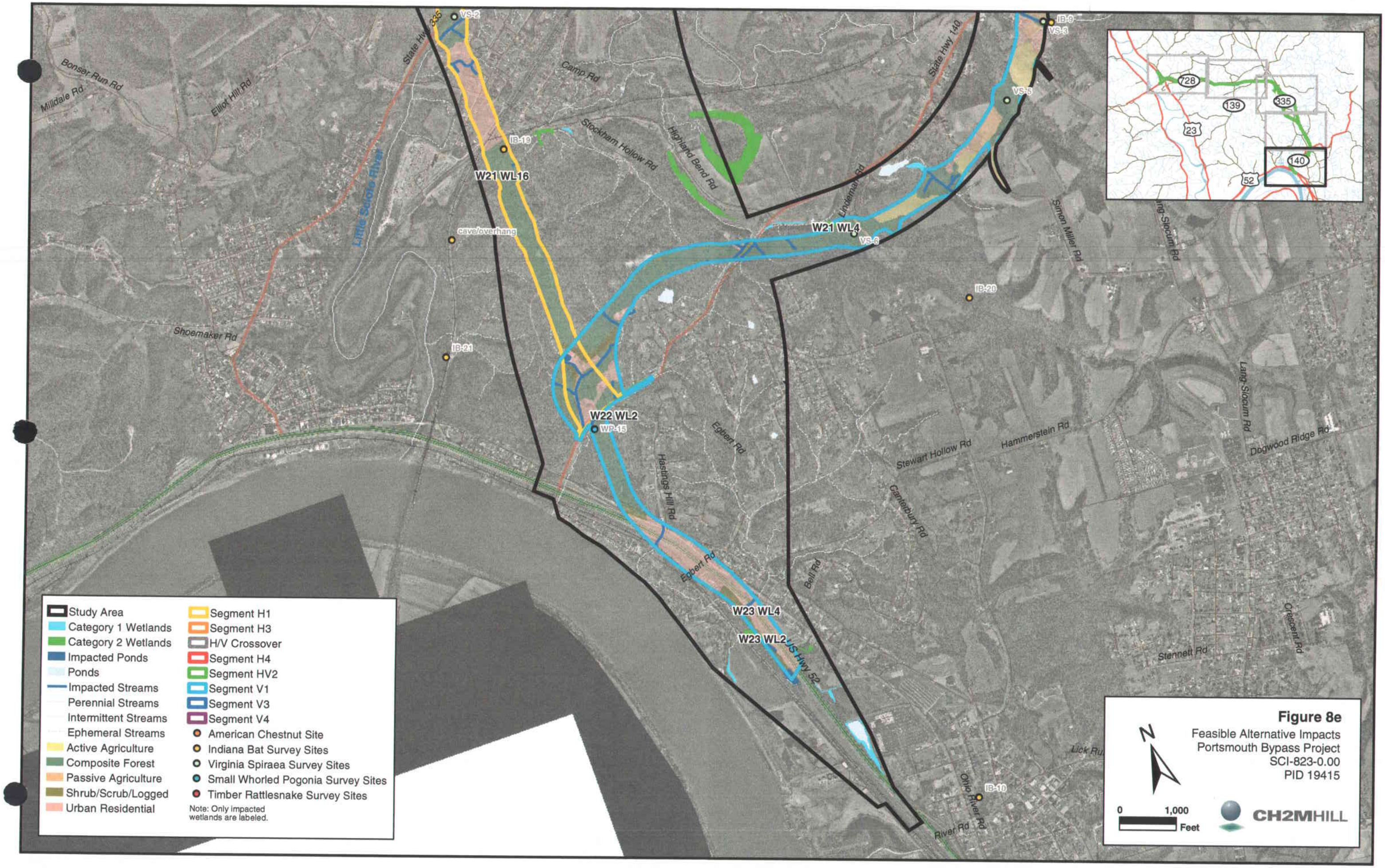


Figure 8e
Feasible Alternative Impacts
Portsmouth Bypass Project
SCI-823-0.00
PID 19415