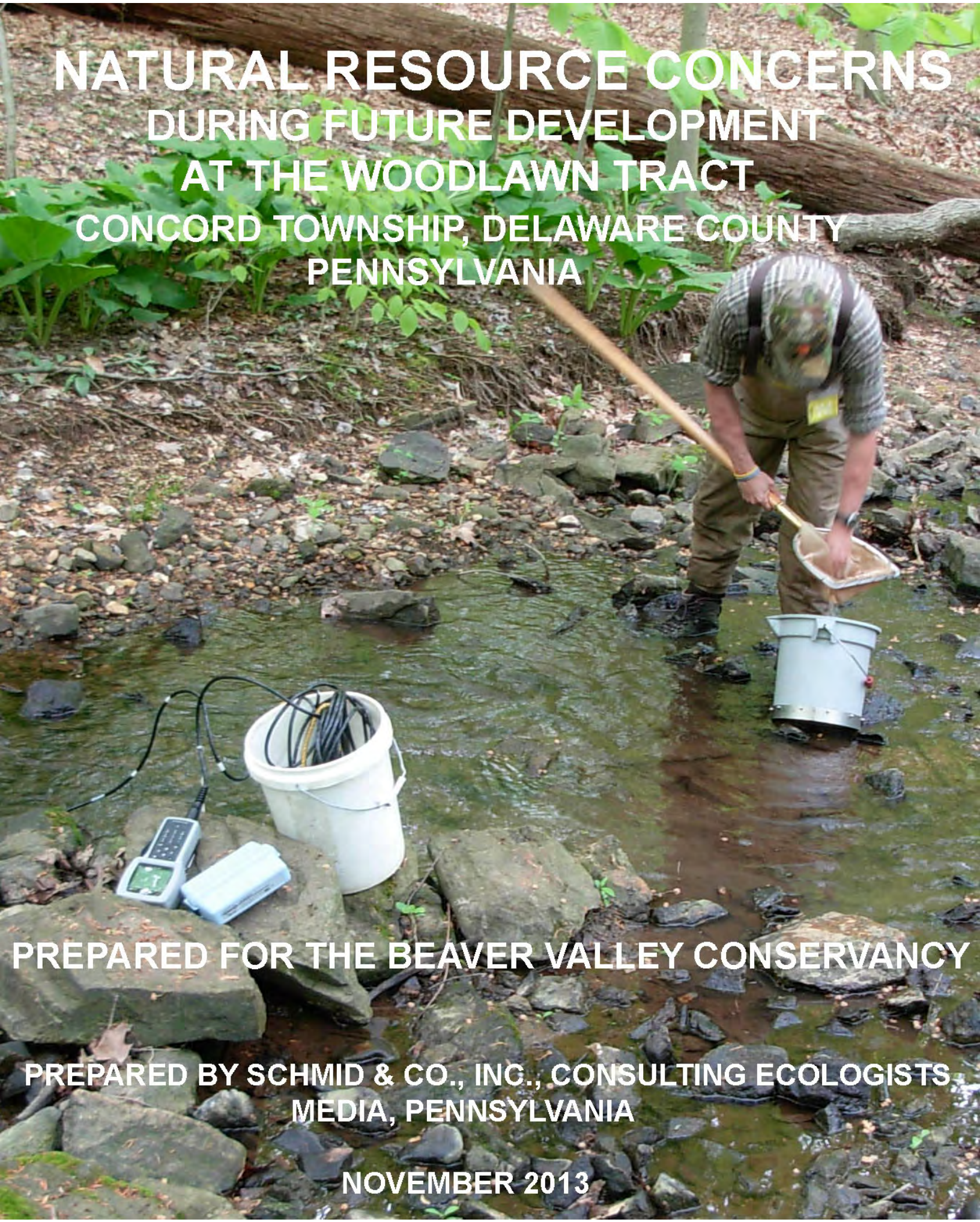

NATURAL RESOURCE CONCERNS
DURING FUTURE DEVELOPMENT
AT THE WOODLAWN TRACT
CONCORD TOWNSHIP, DELAWARE COUNTY
PENNSYLVANIA

PREPARED FOR THE BEAVER VALLEY CONSERVANCY

PREPARED BY SCHMID & CO., INC., CONSULTING ECOLOGISTS
MEDIA, PENNSYLVANIA

NOVEMBER 2013

Natural Resource Concerns
During Future Development at the Woodlawn Tract
Concord Township, Delaware County, Pennsylvania

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7 November 2013

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Introduction

Several developers have proposed rezoning, subdivision, and land development of a tract of about 323 acres long owned by the Woodlawn Trust in Concord Township, Delaware County, Pennsylvania. This report addresses natural resources on the subject property and potential impacts that must be considered carefully during project planning and during municipal review by Concord Township. It was prepared on behalf of the Beaver Valley Conservancy, based on information provided by site developers, supplemented by other information available from public sources and resulting from limited original field observations.

The Subject Property

The land addressed in this report extends westward from US Route 202 to the western limit of Concord Township north of the Delaware state line and south of Smithbridge Road (Figure 1). It is approximately bisected northeast-southwest by the northern section of Beaver Valley Road. It is shown on the Wilmington North 7.5-minute topographic quadrangle of the US Geological Survey (Figure 2).

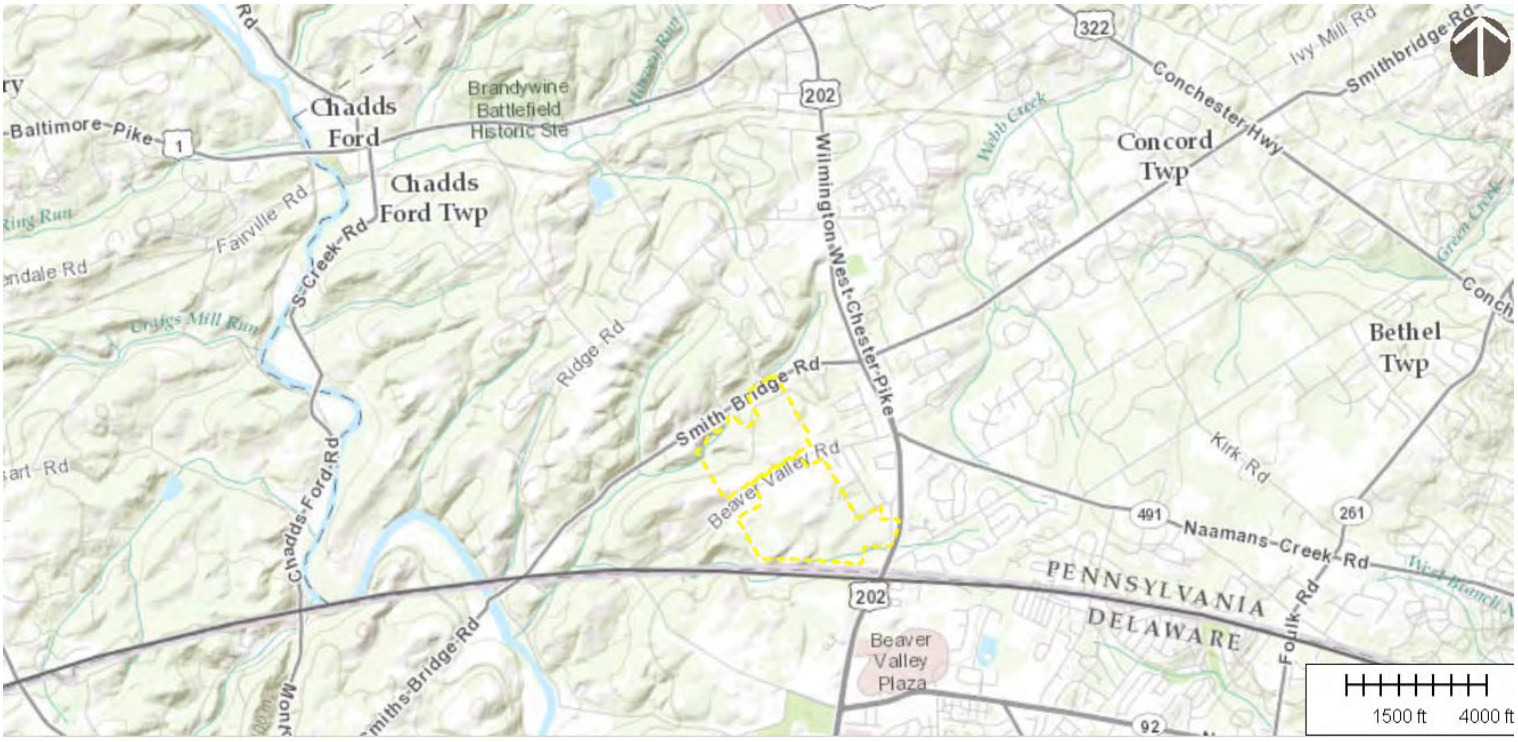

Figure 1. General location map of the subject property in Concord Township, Delaware County, Pennsylvania. The property is outlined in yellow and is bisected by Beaver Valley Road. Hill shading shows general slope southwestward from US Route 202 toward Brandywine Creek at left.

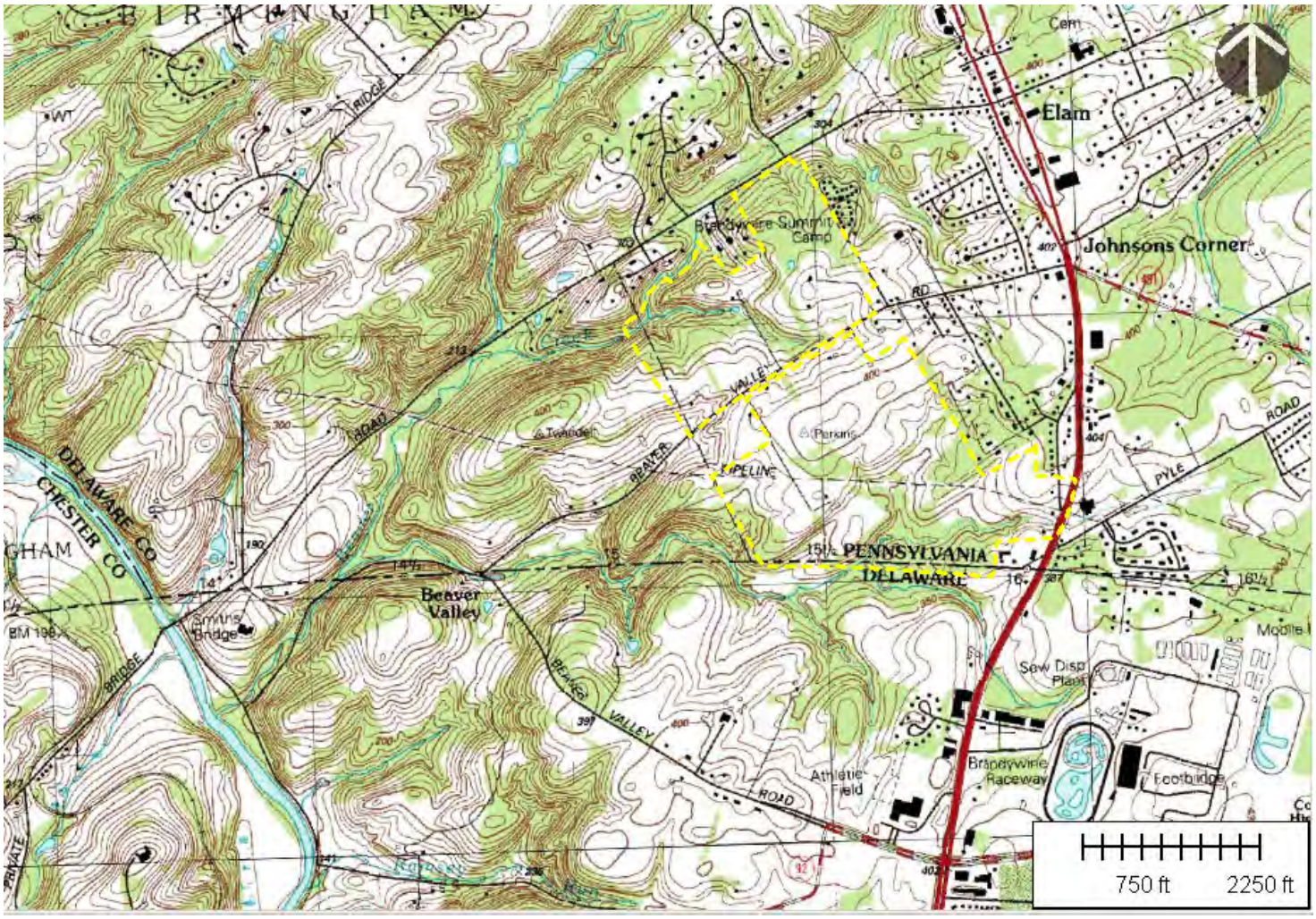

Figure 2. The subject property approximately outlined in yellow on the Wilmington North USGS 7.5-minute topographic quadrangle. Brandywine Creek at left forms the boundary between Chester County and Delaware County, Pennsylvania.

The site is in the piedmont physiographic province of southeastern Pennsylvania. It is drained by tributaries of Beaver Run (Beaver Creek), via which its runoff flows across the Delaware state line to Brandywine Creek, the Christina River, and ultimately the Delaware River estuary. Several tributaries rise onsite. Others flow across the site.

Land uses in the subject property are primarily agricultural---hayfields, pasture, and vineyards---and some single-family residences. Much of the land has regrown into mature deciduous forest (Figure 3). Many of the residences date back to the eighteenth and nineteenth centuries. The individual tracts were acquired by the Woodlawn Trust during the period 1935-1982.

A right-of-way for a 30-inch Colonial petroleum pipeline runs almost west-east through the subject property (Figure 2). The pipeline was installed in 1963-64.

The pipeline corridor is clear of trees and shrubs, and it appears as a pale line crossing the southern tract in Figure 3. Some of it contains palustrine emergent wetlands (Figure 15).

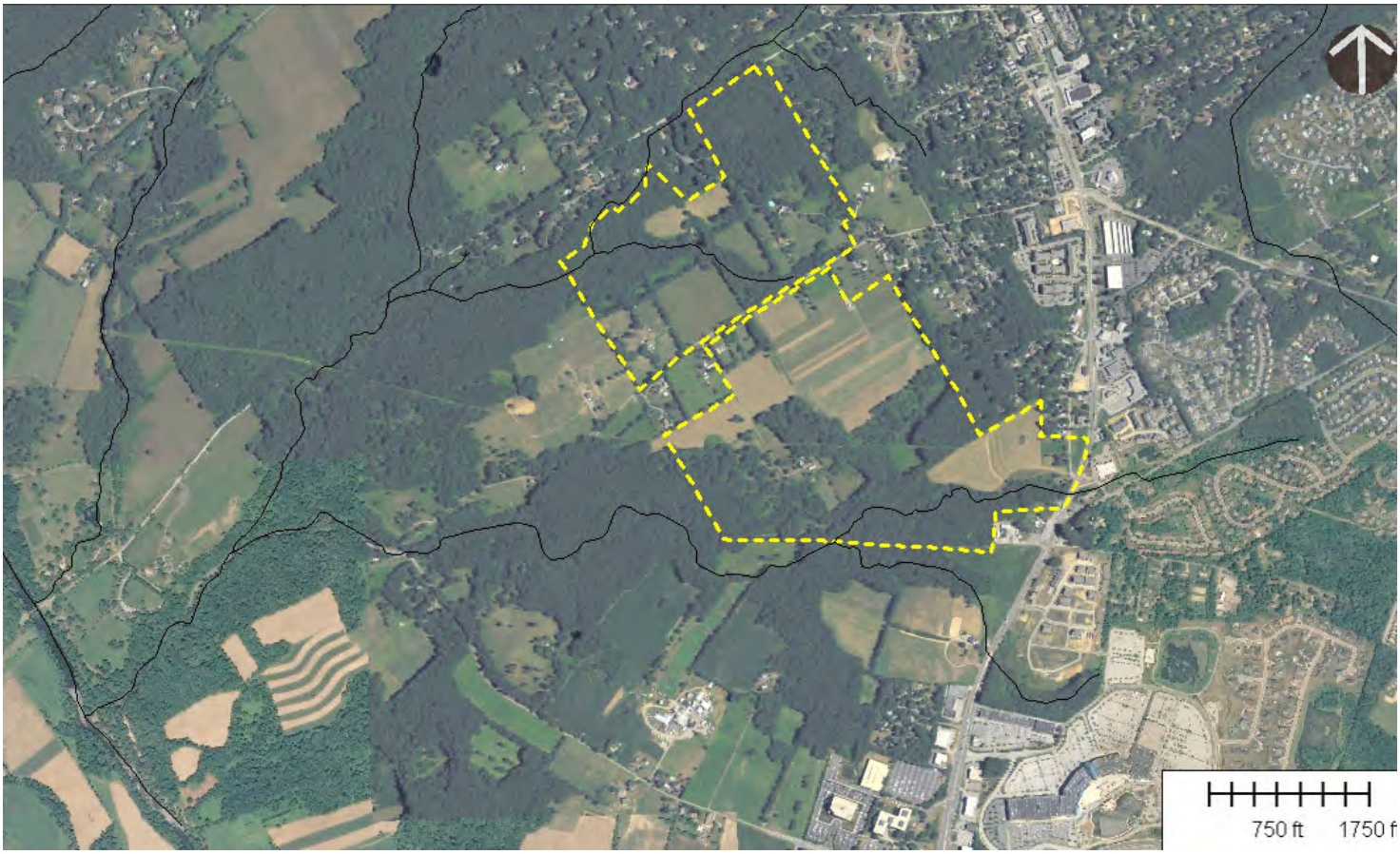

Figure 3. The subject property (yellow) in Concord Township, Delaware County, Pennsylvania. The subject property is less intensively developed than lands just to the east along US Route 202. Streams depicted on Pennsylvania Department of Environmental Protection eMapPA hydrographic maps are shown in black. Several unnamed tributaries are omitted from the state's map database.

Bedrock Geology

According to the Pennsylvania Geological Survey (1980), most bedrock beneath the subject property is Wissahickon schist of Lower Paleozoic age. Much younger rocks of the Triassic Bryn Mawr Formation extend as much as 180 feet into eastern edges of the south tract. A small intrusion of Lower Paleozoic pegmatite extends a few feet into the western side of the northern margin of the tract. The entire tract lies far south of the glacial boundary.

Physiographic Setting

The subject property is about 8 miles north of downtown Wilmington, Delaware, and about 4 miles northwest of the Delaware River at Marcus Hook, Pennsylvania, and Claymont, Delaware (Figure 4). It extends westward about 1 mile from the places known as Elam and Johnsons Corner (Figure 2) on US Route 202 to the eastern limit of Chadds Ford Township. Its north-south dimensions from Smithbridge Road to the northern edge of New Castle County, Delaware, also are about 1 mile.

The property is strongly rolling, dissected piedmont terrain near the edge of the Atlantic Coastal Plain. Elevations range from about 410 feet above sea level south of Beaver Valley Road to about 250 feet in the northwest corner along Beaver Creek. Slopes range from 0 to 3% along the valley fields to 25 to 40% along the sides of ridges (Kunkle 1963).

Figure 4. The subject property (white star) in the Brandywine and Christina River basins.

Soils

Soils on the subject property are classed by the county soil survey as belonging to the Glenelg-Manor-Chester association of shallow to deep, silty and channery soils on grayish-brown schist and gneiss bedrock (Kunkle 1963). This is the most extensive local soil association, and it covers about 393,000 acres in Chester and Delaware Counties. Chester soils are deep and well drained, with a dark brown silt loam surface layer and a strong brown light silty clay loam or silt loam subsoil. Glenelg soils are similar to the Chester series, but shallower above bedrock. Manor soils are shallow above partly weathered schist and are well drained. Brandywine soils are shallow and droughty. In lowlying areas and around stream heads are found poorly drained Worsham soils and moderately well drained Glenville soils. The area's soils early attracted farmers growing wheat, which was processed at local water-powered grist mills after Concord Township was organized in 1683.

Wetlands on and near the subject property most commonly are found associated with soils mapped as the hydric Worsham (WO) and Weehadkee (We) series and in unmapped Worsham inclusions within the Glenville map unit (Gn).

Vegetation

The subject property lies within the piedmont oak-chestnut forest region of the eastern deciduous forest (Braun 1950). Küchler (1964) classed the area as Appalachian oak forest, acknowledging the loss of American chestnut to a blight during the early twentieth century. The 1987 Omernik Level IV ecoregion is Northern Piedmont Uplands (USEPA 2012).

Forest composition is variable across the subject property. Tulip poplar is a prominent species. Some north-facing slopes are dominated by American beech. Other common species include northern red oak, white oak, red maple, green ash, and American sycamore. Some of the stands are large enough to offer interior forest conditions, with large, mature trees. Prominent shrubs include spicebush, witch hazel, and several introduced species such as honeysuckles, multiflora rose, and Japanese barberry. Herbaceous plants include a great variety of native and non-native species. Spring beauty, trout lily, and other spring ephemerals are characteristic beneath the forest cover. Much of the subject property has remained clear of forest in agricultural use such as pasture, hay, cropland, and vineyard. More detailed information is presented in Appendix 3.

Streams

The subject property lies west of the drainage limit of Chester Creek West Branch and drains to Brandywine Creek. Most of its watercourses are identified by the Pennsylvania Department of Environmental Protection (PADEP) in its online hydrography database (Figure 5). These include the mainstem of Beaver Run (Beaver Creek), which rises west of US Route 202 in southeastern Chadds Ford Township and crosses the northwest corner of the north tract. There is one

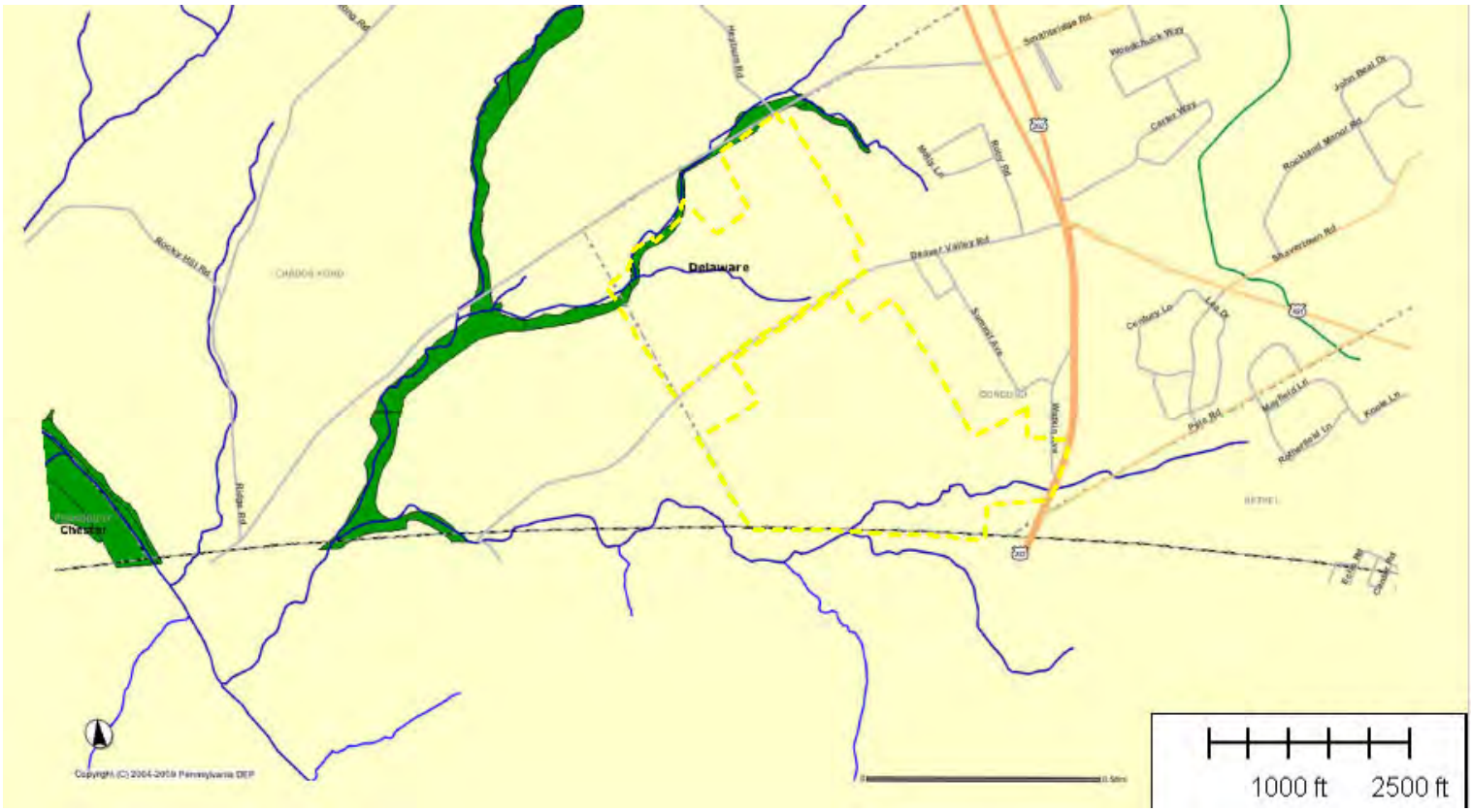

Figure 5. Streams (blue), streets (gray, orange, black), FEMA floodplains (green) and municipal boundaries (dot-dashed) on and near the subject property (yellow outline). Image from PADEP eMapPA. Brandywine Creek is at bottom left.

unnamed tributary on the right bank of the mainstem entirely within Chadds Ford Township. It, like the mainstem and the lowermost segment of the south branch, has a defined FEMA 100-year floodplain. All Pennsylvania streams not mapped by FEMA have a default floodway extending 50 feet horizontally from each bank. Unnamed tributaries joining the south branch of Beaver Run from Delaware are shown in Figure 5.

Unnamed tributary 00006 of Beaver Run essentially comprises a south branch of that stream (Figure 6). It rises east of US Route 202 and flows westward almost parallel to the Delaware boundary along the southern edge of the property. UNT 00006 joins the Beaver Run mainstem west of the subject property a short distance upstream from the confluence with Brandywine Creek. Another unnamed tributary (UNT X), not recorded by the National Hydrography database, rises onsite along the eastern margin of the south tract and flows south across the petroleum pipeline right-of-way to join Tributary 00006. Unnamed tributary 00009 rises onsite south of Beaver Valley Road and joins the mainstem at the northwest corner of the property after flowing westward across the north tract. All of these streams are listed by 25 *Pa. Code* Chapter 93 as having warm water fishery (WWF) as their designated use. The PADEP eMapPA database shows

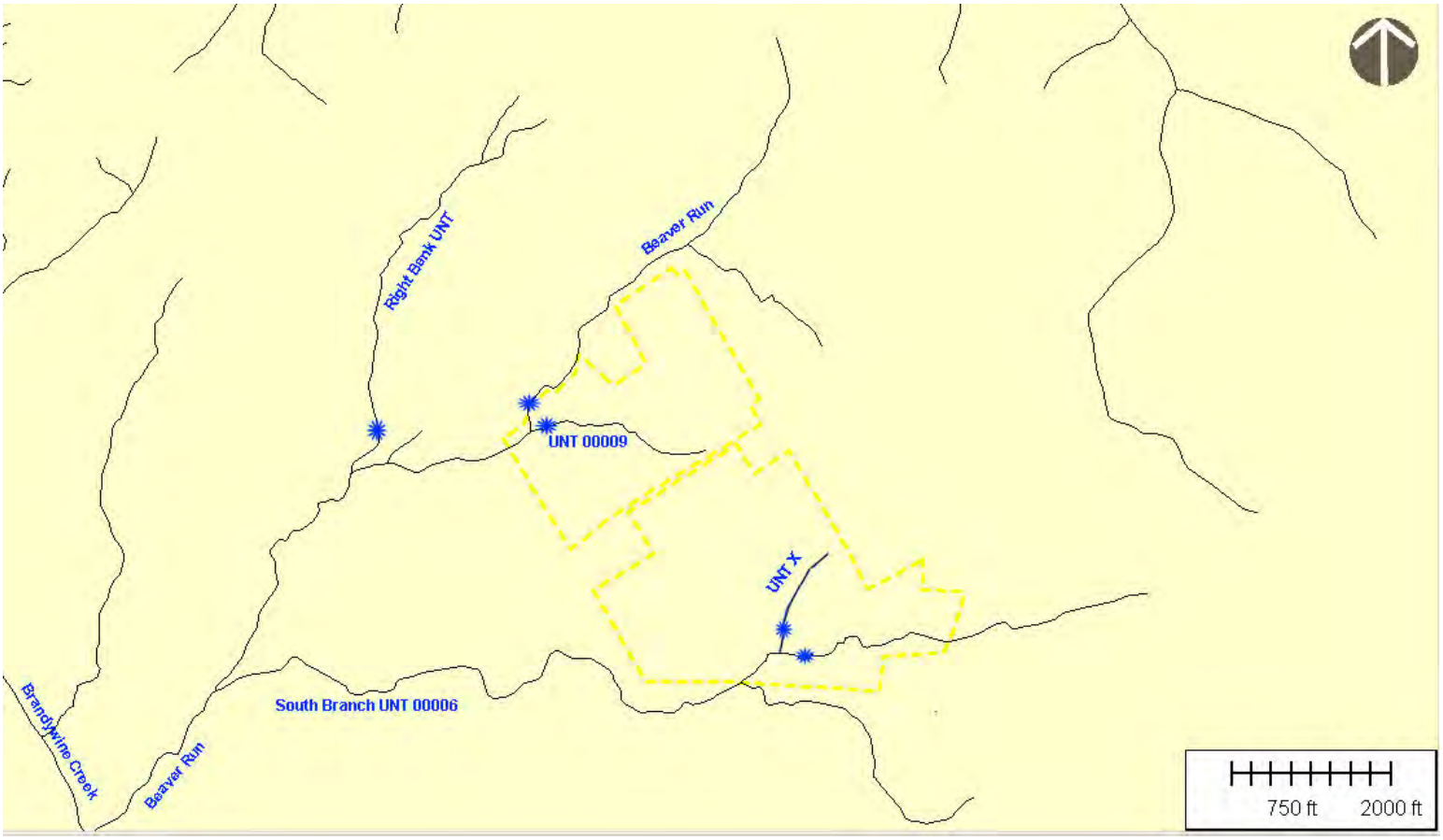

Figure 6. Streams (black) and May 2013 sampling stations (blue stars) at and near the subject property (yellow outline) in Concord Township, Delaware County, Pennsylvania. Features are from PADEP hydrographic maps, except for UNT X (added during 2013 field inspection). Some Delaware tributaries of Beaver Run are not shown on this drawing. Later figures show conditions at each sampling station on 7 May 2013.

all the streams as supporting migratory fish and as having aquatic life attaining the designated uses. The Pennsylvania Fish and Boat Commission does not list any streams in the Beaver Run watershed as wild trout streams and does not stock trout in them. Trout were observed only in the right bank UNT in Chadds Ford Township during the sampling on 7 May 2013. That Pennsylvania tributary is not a stocked stream.

The Delaware Department of Natural Resources and Environmental Control classifies Beaver Run as a designated trout stream and stocks its lower segments (Figure 7). The South Branch of Beaver Run (UNT 00006) appears as non-attaining on the Delaware 2010 Clean Water Act 303(d) list because of biological and habitat stressors. Delaware appears to have stricter standards for water quality and/or more accurate and current information than Pennsylvania regarding Beaver Valley streams.

The eMapPA database shows two ponds on the subject property. One is a 75,000-square foot pond in the eastern section of the southern tract. No such feature exists today. The other is a much smaller pond adjacent to a house north of Beaver Valley Road, which is mapped reasonably accurately.

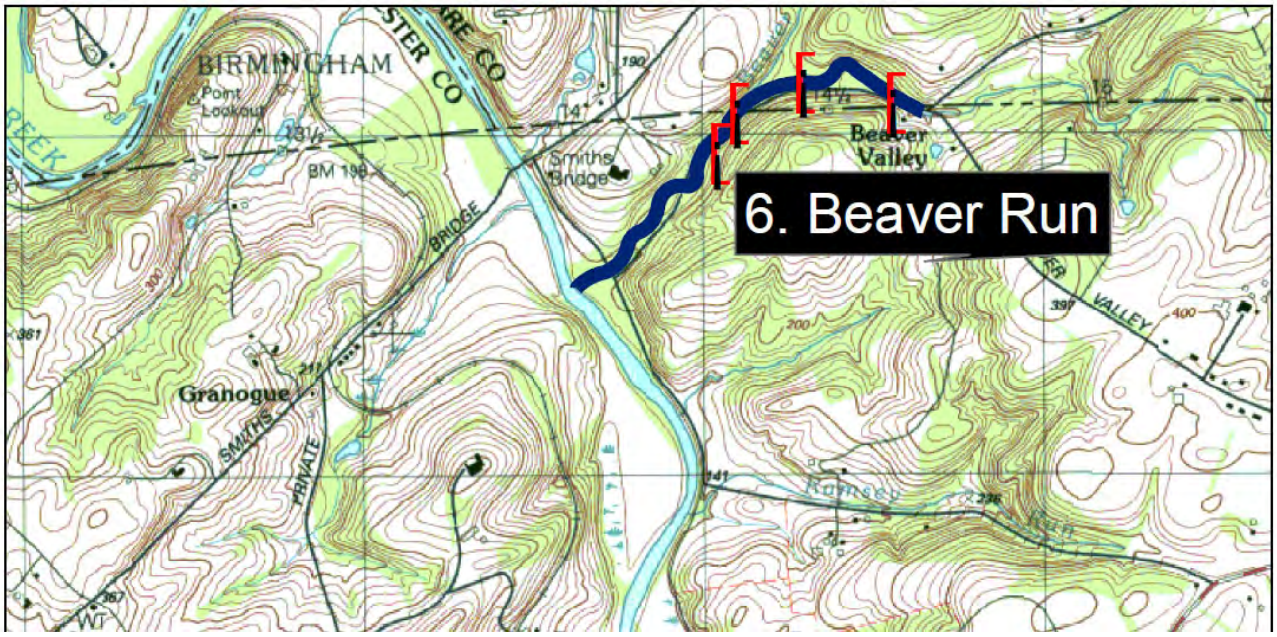

Figure 7. State trout stocking locations (red) on lower Beaver Run, New Castle County, Delaware. Basemap is excerpt from Wilmington North DE USGS 7.5-minute topographic quadrangle.

Water quality in the Brandywine Creek watershed is much affected by the extensive development which took place during the late twentieth century and continues at present. The Brandywine Creek is listed on the Delaware 2010 Clean Water Act Section 303(d) list of waters needing Total Maximum Daily Load allocation of pollutants among regulated dischargers because of its measured bacteria, nutrients, polychlorinated biphenyls (PCBs), and dioxin. Many of the stream segments of this basin are classed as impaired, and are not attaining their designated aquatic uses. Regular physical/chemical water quality sampling is performed on the Brandywine at Smith Bridge (STORET State Line Station 104051; Figure 6), and there are two biological sampling stations farther south of the Delaware state line. During the late twentieth century water quality in the Brandywine at the State Line Station was described as not swimmable (because of bacteria), worsening because of nitrate and dissolved oxygen levels, and having stable but high (>0.1 mg/L) phosphorus concentrations (DNREC 1997).

Given the sparse and questionable information currently available from PADEP for the streams of Beaver Valley and the conspicuous conflicts with data from DNREC, original field investigations were taken to identify macroinvertebrates and selected water quality parameters during May 2013. Macroinvertebrates were sampled at five stream riffles on 7 May 2013 (Figure 6). Two reference streams on

or near the subject property---the Beaver Run mainstem and its right bank UNT---were sampled at the same time as three onsite streams that drain areas proposed for development. These local reference streams currently are not expected to be affected by any onsite construction or discharges in the foreseeable future, and thus can provide a control for future measured changes in the streams affected by site development.

The stream samples reported here were collected and analyzed using the protocols of the Pennsylvania Department of Environmental Protection (2009) for comprehensive examination of stream quality and inclusion on Clean Water Act Section 303(d) lists of impaired streams. Six kicks covering 1 square meter each were composited using a 500 micron mesh D frame net (Figure 8). Flowing water habitat scores were recorded at each forested riffle using the 12 parameters specified by PADEP for freestone streams (2009). All of the recorded local habitat scores were considered excellent, ranging from 183 to 202 (Appendix 2). Habitat scores ranging from 192 to the theoretical maximum of 240 are optimal; 132 to 180, suboptimal. Tributary 00006 and offsite Right Bank Tributary were scored as optimal; the other three stations were in the suboptimal range.

Selected stream parameters also were measured (temperature, pH, specific conductance, dissolved oxygen, % dissolved oxygen, total dissolved solids, and total alkalinity, Appendix 2). A YSI Model 556 multimeter calibrated daily was used for most parameters. Alkalinity was determined by field titration using a Hach kit.

Figure 8. Sampling in South Branch Beaver Run (UNT 00006), 7 May 2013.

At the time of sampling water availability was deemed “normal” for the preceding six months, following a dry spring and summer in 2012 (Figure 9). The clear, cold water with discharges from springs supported a diverse population of aquatic macroinvertebrates in streams in and near the site of the proposed development at the time of field sampling on 7 May 2013. The number of kinds of macroinvertebrates identified ranged from 24 to 31 at each of the stations in samples of 212 to 240 individuals representing 16.4 to 25% of the total collected individuals. Sixty-five taxa (mostly genera) of macroinvertebrates were identified from the samples: 11 of mayflies, 10 of stoneflies, 12 of caddisflies, 11 of true flies, 3 of dragonflies, 10 of beetles, 2 kinds of crustaceans, 1 kind each of mollusc, acarid, flatworm, earthworm, hydra, and nematode (Appendix 1).

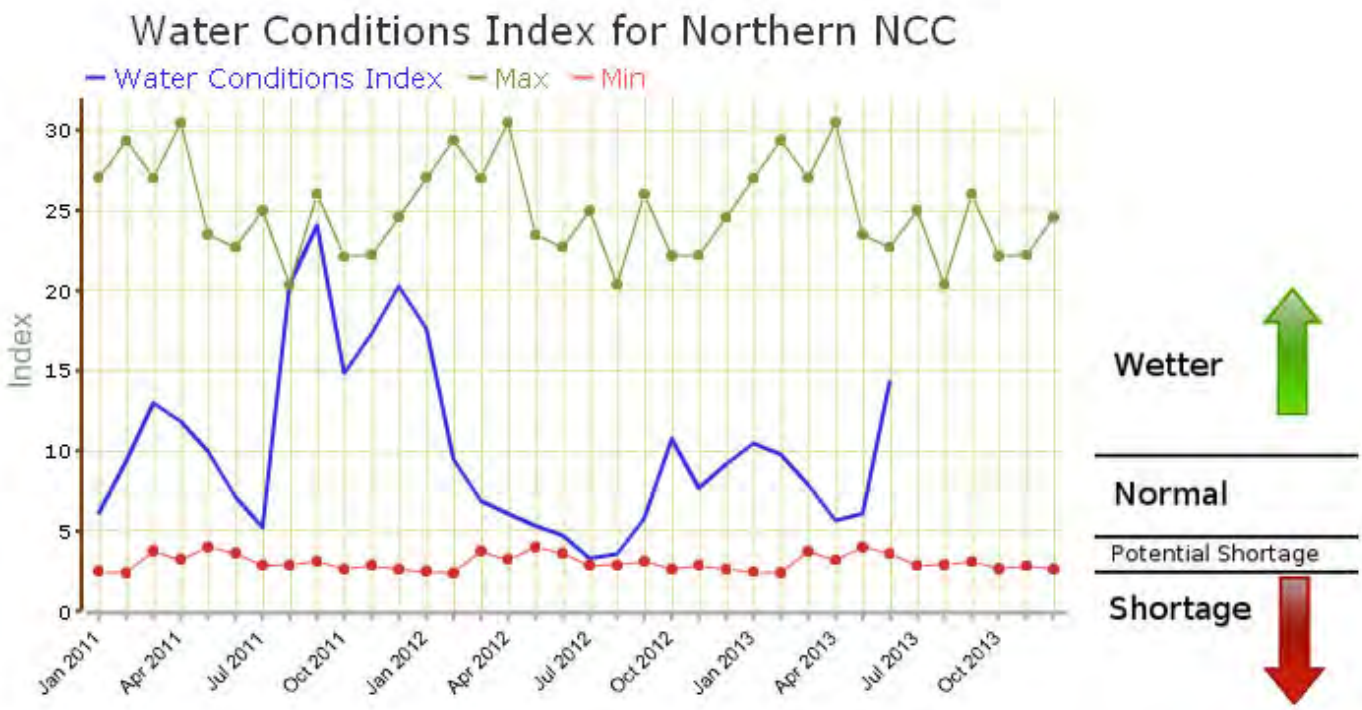

Figure 9. Water Conditions Index for northern New Castle County, Delaware, 2011-2013 (http://www.dgs.udel.edu/water-conditions-summary-index-new-castle-county). For May 2013 the actual index value (blue) was a "normal" 6.08; long-term recorded extremes for May range from 4 to 23.49. The index is based on cumulative precipitation for the preceding six months, the measured level in one groundwater observation well, the current monthly average flow in the Brandywine at Wilmington, and the year's population estimate for New Castle County (Jordan & Woodruff 1982).

Special attention attaches to the diversity of "EPT" taxa found in a stream, as these organisms are especially sensitive to pollution and constitute major food sources for trout and other fish. "E" stands for mayflies (Order Ephemeroptera); "P", for stoneflies (Order Plecoptera); and "T", for caddisflies (Order Trichoptera). The kinds of mayflies present at sampling stations ranged from 3 to 6; of stoneflies, from 3 to 6; and of caddisflies, from 1 to 8. Midges (Order Diptera) were abundant at most of the stations, reducing stream scores for all stations except Tributary 00009.

PADEP (2009) has adopted a complex protocol for analysis of the biological quality of riffles in freestone streams such as those on the subject property sampled during the March-November field season. The analysis yields an Index of Biotic Integrity (IBI) score. Attaining streams exhibit a score of 63 or greater; waters warranting special protection against degradation must score 80 or greater. IBI scores ranged from 48.8 to 83.7 across the five May 2013 samples (Appendix 1). With an IBI of 83.7, Tributary 00009 qualifies for one of the Special Protection attained use categories assigned to the best streams in Pennsylvania. UNT X and the offsite Right Bank tributary in Chadds Ford Township, with IBI scores of 66.0 and 70.7, respectively, currently are attaining their designated uses, but may warrant recognition of more stringent attained use than

mere warm water fisheries. The Beaver Run mainstem (51.8) and South Branch Tributary 00006 (48.8) are non-attaining, confirming the listing of the latter stream on the Delaware 2010 Clean Water Act Section 303(d) list. Photographs were taken to record conditions at each sampling station on 7 May 2013 (Figures 10-13, 16-21).

Figure 10. Sampling station at UNT X, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 11. View downstream toward confluence below sampling station on UNT X, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 12. View upstream at sampling station on South Branch UNT 00006, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 13. Seep flowing from springfed wetland into South Branch UNT 00006, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 14. UNT X flows left to right across pipeline right-of-way, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013. View east-southeast.

Figure 15. View east across palustrine emergent wetland in pipeline ROW, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 16. Sampling near mouth of UNT 00009, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 17. View upstream from sampling station in UNT 00009, Beaver Run watershed, Concord Township, Delaware County PA, 7 May 2013.

Figure 18. Confluence of UNT 00009 (left distance) with mainstem Beaver Run, Concord Township, Delaware County PA, 7 May 2013. View downstream.

Figure 19. View upstream from sampling station, mainstem Beaver Run, Concord Township, Delaware County PA, 7 May 2013.

Figure 20. Sampling station on right bank mainstem tributary to Beaver Run, Chadds Ford Township, Delaware County PA, 7 May 2013.

Figure 21. View downstream from sampling station toward old mill pond (left background) on right bank tributary to Beaver Run, Chadds Ford Township, Delaware County PA, 7 May 2013. Trout were observed here.

Beaver Valley is situated close to the southern limit of low-elevation trout-supporting streams in the piedmont. The proposed development of the Woodlawn Trust lands would involve construction of numerous stormwater detention basins to reduce peak runoff from the large areas of proposed impervious surfaces. As a result, the temperature of runoff entering onsite streams is likely to increase. Detention basins are recognized as problematic stormwater management practices in Pennsylvania watersheds such as this, where attained uses are highly sensitive to increasing water temperature. No analyses of water quality or stream impacts have been prepared by the developers.

The preservation of existing high water quality against degradation is important here, not merely to comply with State and Federal law and to preserve onsite water quality, but also to protect water quality in the trout waters and protected parklands just downstream from the proposed development site. Streams with attained uses in the Special Protection categories are not eligible for certain general permits and may require extended review by PADEP if proposed for impact by construction activity or discharges of stormwater. Development “as usual” can be expected to lead to unacceptable degradation of the forested onsite streams here, as elsewhere in the surrounding watershed, particularly if discharge water temperature increases as a result of added impervious surfaces and runoff detention basins exposed to sunshine.

The PADEP must make an attained-use investigation of each stream where stormwater runoff or other pollutants are to be discharged, in accordance with 25 *Pa. Code* 93.4a. The results of Beaver Valley Conservancy's inventory of these streams on 7 May 2013 should be transmitted to PADEP with a request for examination of currently attained uses pursuant to the Department's Aquatic Life Special Water Quality Protection Survey protocol specifically designed for antidegradation evaluations. Similarly, those streams currently not attaining their designated uses should be entered upon the Clean Water Act Section 303(d) list, and Total Maximum Daily Load allocations prepared.

Endangered and Threatened Species

Most of the subject property has long been posted by the Woodlawn Trust as a wildlife refuge, and it is closed to hunting. The Pennsylvania Natural Diversity Inventory (PNDI) maintains a historic database of native plants and animals of concern because of their rarity in Pennsylvania. For the subject property at least seven species of plants of concern to the Pennsylvania Bureau of Forestry have been recorded in its historic database from the subject property or its close vicinity. Similarly, animals of concern to the US Fish and Wildlife Service and to the Pennsylvania Fish and Boat Commission are listed for the property.

The 1992 Delaware County Natural Resources Inventory, updated by the Western Pennsylvania Conservancy in 1998, commented as follows regarding the lands along the pipeline that crosses the subject property (Figure 22):

> SP535, SP536, SP537, SP539, SP540 -NEW- (Bethel and Concord Twps) "Beaver Valley Road Pipeline Site" Five new plant species of concern were found in the Beaver Creek Valley. SP535 and SP536 both occur in a moist, open area of a powerline cut, dominated by sedges, rushes, goldenrods, milkweed, and mountain-mint. SP537 occurs in similar habitat north of the pipeline cut at the top of a southeast-facing slope. Encroachment by shrubs and vines such as oriental bittersweet and japanese honeysuckle are threats to SP537. A good-quality population of a PA-Endangered plant species, SP540 , is found in a low wet meadow in partial light. Associated plant species include red maple (Acer rubrum), winterberry (Ilex verticillata), marsh fern (Thelypteris palustris), cinnamon fern (Osmunda cinnamomea), stilt grass (Microstegium vimineum), heal-all (Prunella vulgaris), sedges (Carex spp.), and violets (Viola spp.). Finally, a good-quality population of SP539 is found in a wet, lower-slope meadow on the pipeline R.O.W., associated with goldenrod (Solidago spp.), aster (Aster spp.), heal-all, hyssop skullcap (Scutellaria integrifolia), little bluestem (Schizachirium scoparium), stilt grass, and field beadgrass (Tofieldia glutinosa).

> The species of concern at this site all require open conditions such as those found along the pipeline R.O.W. Maintaining the pipeline R.O.W. by annual, late season mowing, rather than summer mowing or herbicide use, will allow these species to persist (1998 update). [See Figure 15 above.]

The Western Pennsylvania Conservancy also commented on the undisturbed character of the riparian forest along the Brandywine Creek a short distance to the west of the Beaver Valley Road subject property.

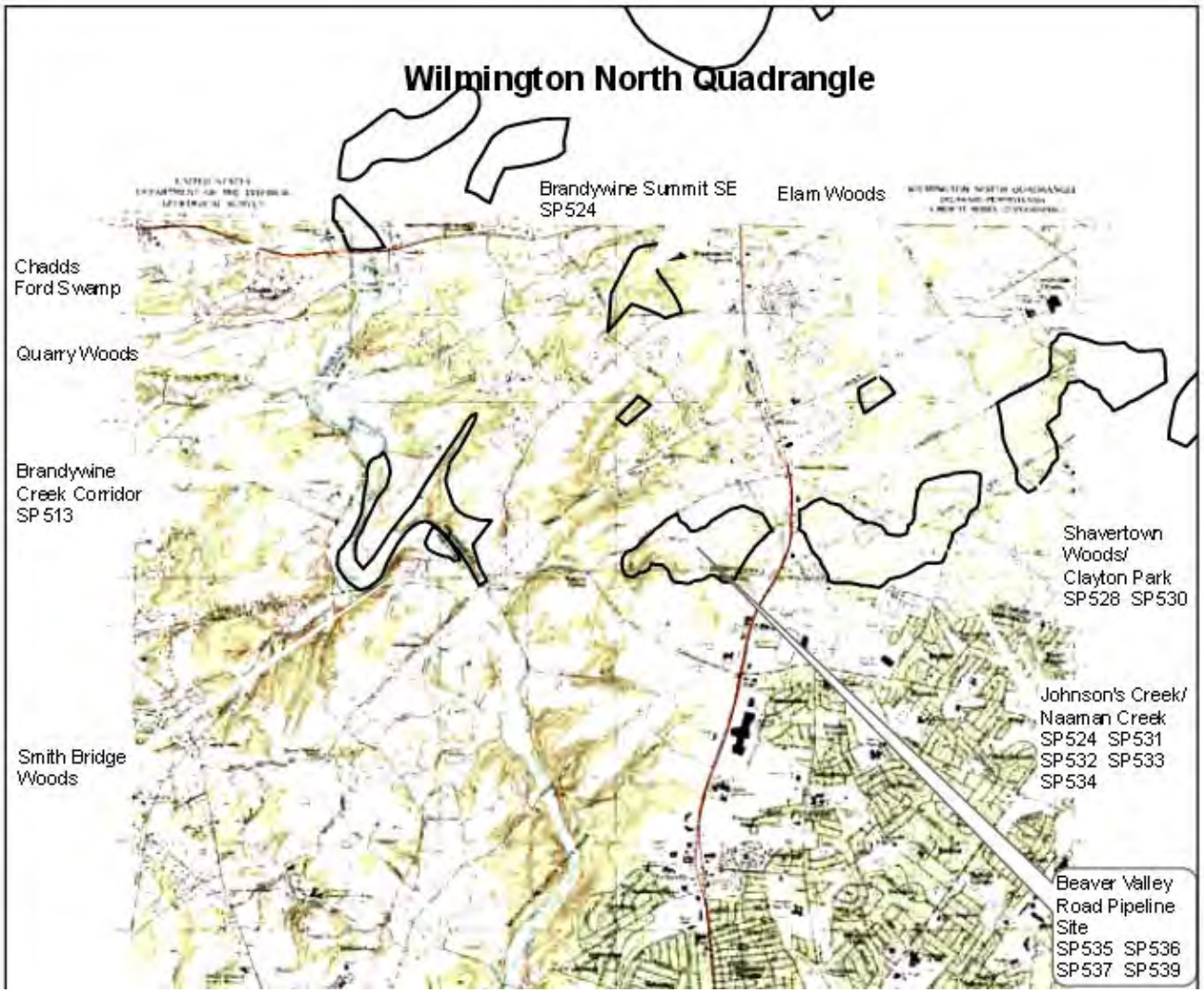

Figure 22. Excerpt from the Wilmington North USGS topographic quadrangle showing Delaware County areas supporting species of special concern (Davis *et al*. 1998). The present study area approximately corresponds to the "Beaver Valley Road Pipeline Site".

In 2011 the Delaware County natural resources inventory was updated (Figure 23). The core habitat for species of concern was expanded, interior and other forests were identified, and riparian buffers were outlined along streams. The expanded text for Beaver Valley in the 2011 heritage inventory is presented in full in Appendix 3.

Whether the developer has made a recent search of the PNDI is not known. PNDI records are no substitute for onsite field inventory searches for each target species. The results of investigations on behalf of Woodlawn Trust or the site developers have not been made public. Apparently, the resource agency concerns regarding the subject property have not been resolved. The resolution of potential impacts on listed species typically requires onsite field investigations by qualified biologists during the appropriate field season for each species.

The plant species known to be of concern to the Pennsylvania Bureau of Forestry and reported onsite or nearby are (PNDI 2013):

Name	**Current Class**	**Proposed Class**
Aletris farinosa (white colicroot)	Special Concern	Endangered
Dichanthelium scoparium (broom rosette-grass)	Endangered	Endangered
Juncus biflorus (bog rush)	Special Concern	Endangered
Lobelia puberula (downy lobelia)	Endangered	Endangered
Vernonia glauca (broadleaf ironweed)	Endangered	Endangered

Of these, the rosette-grass, rush, and lobelia are classified as facultative wetland (FACW) plants usually associated with wetlands. The white colicroot (facultative, FAC) is often found in wetlands. One additional species classed as Threatened in Pennsylvania, American holly (*Ilex opaca*, facultative upland, FACU) is sometimes found in wetlands. It is present onsite, where several individuals were observed during the spring of 2013, but apparently is not known to PNDI as occurring here. This is a coastal plain species here growing in the low piedmont. Two species of concern were observed in the Beaver Valley Woods during the 2010 update of the Delaware County natural heritage inventory (Appendix 3).

The known presence of Threatened or Endangered species of plants or animals in a wetland requires that such a wetland be classed as Exceptional Value (25 *Pa. Code* 105.17). Other criteria also can cause a wetland to be ranked as EV. Certain general permits are not available for use in Exceptional Value wetlands.

Rush-dominated wetlands appear to offer favorable habitat onsite for the Pennsylvania “Endangered” and Nationally “Threatened” bog turtle (*Glyptemys muhlenbergii,* Figure 15). Given the absence of a Corps-approved Jurisdictional Determination and the probable imposition of a 300-foot wide upland buffer free of construction outside the wetlands by the US Fish and Wildlife Service if bog turtles are present, resolution of the current uncertainty could impose major constraints on site planning for future development. The 2013 field season for bog turtle onsite investigations ended during June. Thus bog turtle questions at the subject property apparently cannot be settled prior to mid 2014 at the earliest. The Delaware County inventory recommends 238-foot wide (100 m) wooded buffers adjacent to stream floodplains, reduction of white-tailed deer numbers, and carefully targeted removal of autumn olive and other invasive plants from the Beaver Valley Woods.

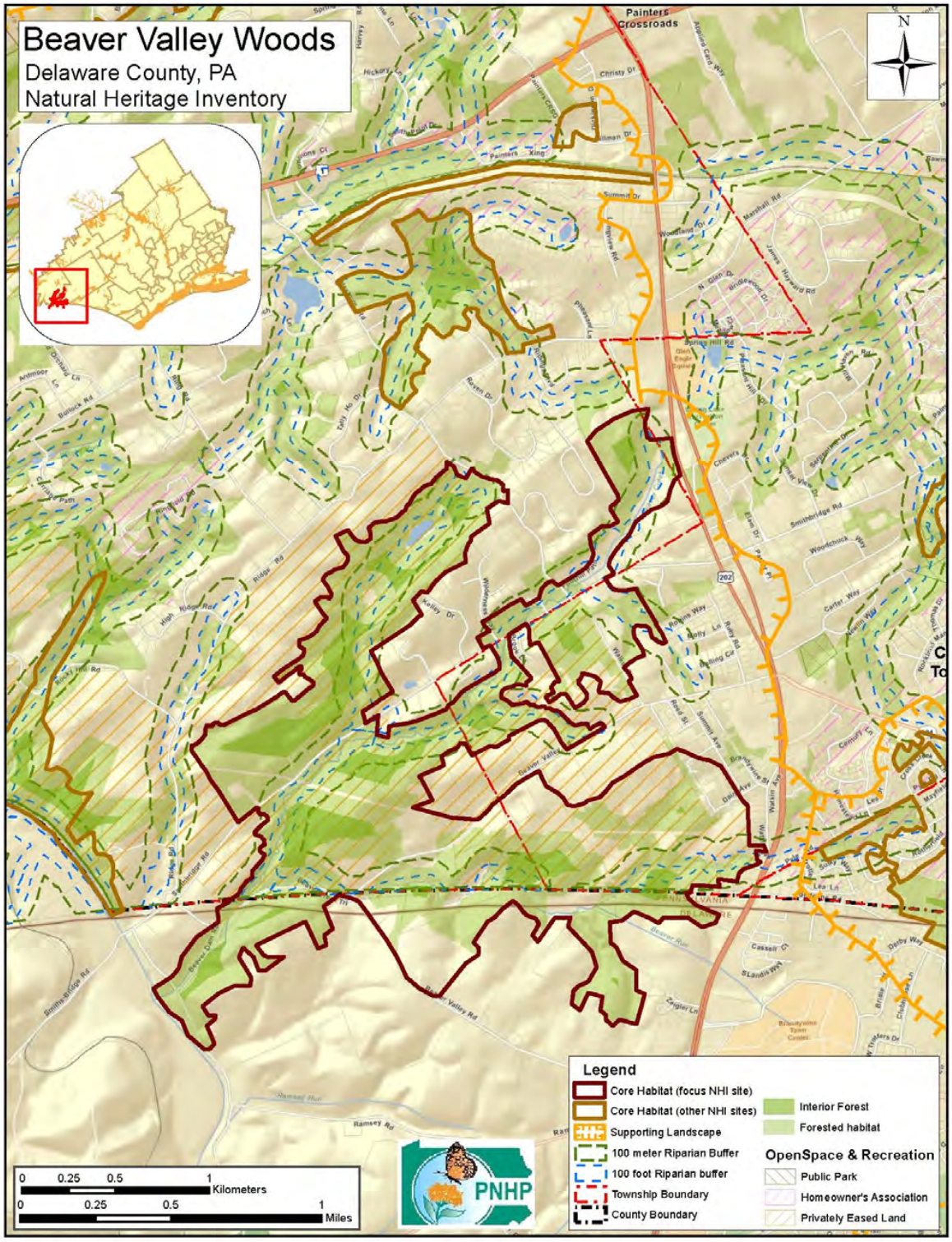

Figure 23. 2011 natural heritage program map of Delaware County showing the core focus area of Beaver Valley Woods (heavy black outline). The subject property occupies much of the eastern section of the woods in Concord Township. The full text that accompanies this map is presented in Appendix 3.

Wetlands

The subdivision plans submitted to Concord Township indicate the limits of what the developers believe are regulated streams and wetlands. The source of such information on the required natural features map, however, is not stated as required by Concord Township Ordinance [160-20.A(18)(d): "sources for any wetlands plotted shall be indicated". Who performed the delineation for Kelly & Close Engineers is not stated. No supporting documentation has been made available to Concord Township. The appearance of the plotted polygons suggests that wetlands were field delineated by someone and the flags were surveyed for transfer to site plans. Limited site inspection shows that not all obvious wetlands and streams have been plotted on the drawings as required by ordinance [160-20.A(18) and 160-23.B(14)]. No standard documentation of wetland conditions has been provided identifying the methodology used or the qualifications and experience of the delineator, and most flags were missing at the time of the 2013 field sampling.

According to Concord Township ordinance [160-49.F(2)], the definition and locational determination of wetlands by the Army Corps of Engineers is controlling for wetlands of concern to the Township. Yet the project sponsors have not requested a formal Jurisdictional Determination (JD) from the Philadelphia District. The delineation must be completed and a formal JD secured from the Corps following its field inspection of the property. For checking of the field delineation, the proposed wetland boundary should be provided at a scale of 1 inch = 50 feet, as required for Preliminary Plan submissions (160-23). Flag numbers should be clearly labeled, and the flags should be in place on the ground visibly for the Corps inspection. That inspection also will provide confirmation of the existence of suitable bog turtle habitat on the property. USFWS has a formal protocol for field investigation of any apparently suitable habitat for bog turtles, should a landowner believe that none is present (USFWS 2006). Should bog turtles be found on or adjacent to the property, USFWS normally requires that a 300-foot wide upland buffer be permanently kept free of disturbance.

The actual presence of any listed endangered or threatened species of plants or animals in the wetlands of the property will qualify onsite wetlands for classification by PADEP as having Exceptional Value. Similarly, wetlands in the floodplains of EV streams are themselves EV, as are wetlands that contribute to the quality of public or private water supplies. EV wetlands are by definition EV waters, render proposed activities in them ineligible for coverage by certain general permits, and thus require particular scrutiny by PADEP if any construction activities are proposed in them.

The project designers cannot properly plan proposed development on the subject property prior to having an approved Corps JD in hand. The Township ordinance [160-49.F(4)] requires that the Corps (as well as PADEP) be contacted if any wetlands are to be disturbed. There is no way for the designers to know where all regulated streams and wetlands are onsite, and thus whether any disturbance is

needed in these regulated areas, until they obtain a Corps JD. Wetland setbacks cannot be identified until bog turtle use of the site's wetlands has been determined.

No Township-regulated "wetland margin" has been identified. Thus it is not possible to tell whether the proposed development would exceed the ordinance limit of disturbance to a maximum 20% of the wetland margin [160-49.F(3)]. Such a margin and the extent of proposed development within it easily can be identified once a Corps JD is in hand, but not before then.

Salient Natural Features

Concord Township ordinance [148-7.B(1)(f)] requires that proposed development shall preserve salient natural features on each project site. The site analysis and natural features plan, however, does not show all features required by ordinance. The minimum scale for preliminary plans is 1" = 50 feet [160-23(14)]. The natural features map does not identify freestanding trees of 12-inch or greater caliper, and it does not show all resources out to a distance of 200 feet from the limits of the subject property. There is no thorough inventory of forest resources to serve as a basis for calculating proposed tree loss and ordinance-required replacement [160-49.E(1)(a)].

Likewise, all springs within the property are not identified, so it is not possible to determine whether all of them are being protected as directed by ordinance (160-49.G(6)(A)[3]).

Clearly, the drawings submitted to the Township to date do not fulfill the site inventory requirements set forth by ordinance. This project appears to be far from complete in its site inventory and design, as well as quite unready for Township review. Proposed zoning changes affecting future land use cannot be evaluated rationally in the absence of resource information on the subject property.

Petroleum Pipeline

Safe development adjacent to existing petroleum pipelines is a responsibility of local government. The Township should carefully consider the size and maximum authorized operating pressure of the onsite hazardous liquids pipeline and follow current minimum setback recommendations to reduce the likelihood of future loss of life and property from pipeline rupture and explosion. The Municipal Research and Services Center has developed an entire website that covers these "planning near pipelines" issues. It can be found at: http://www.mrsc.org/Subjects/PubSafe/transpipes.aspx. Sample ordinances are provided by the Pipeline Safety Trust at: http://www.pstrust.org/pipeinfo/localgov.htm The minimum default distance from the pipeline for careful review of planned development is 660 feet. Emergency access and fireproof construction should be required within this area for any new development. No pipeline is shown on several of the development plans (such as Figure 24). Its location is highlighted on an airphoto base in Figure 25.

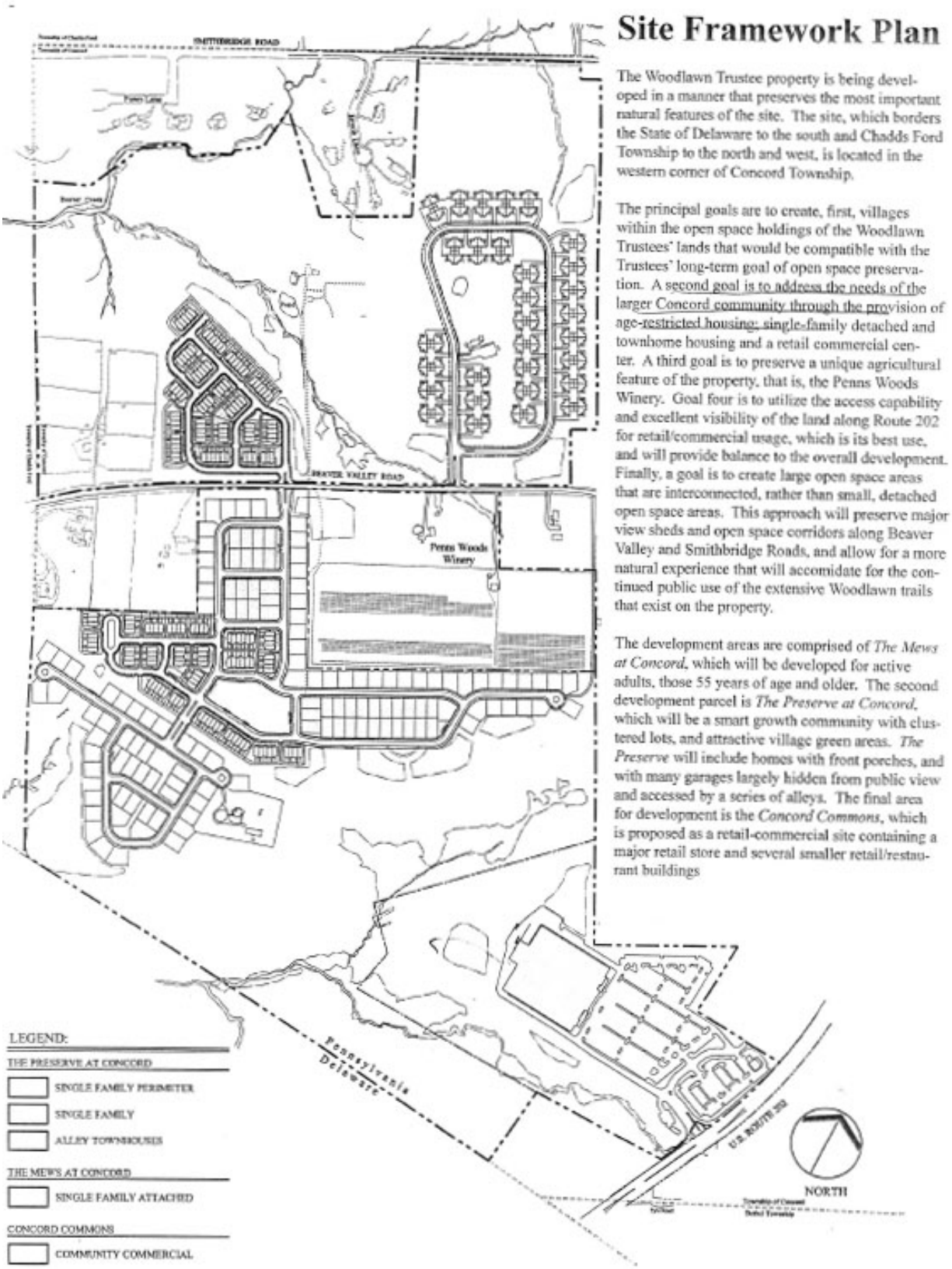

Figure 24. Conceptual plan and text for the subject property offered by developers in 2012. Tributary UNT X is shown, but not all of UNT 00009 or its wetlands are shown.

Figure 25. Developers' conceptual plan displayed against a 2011 Google aerial photograph. Existing pipeline right-of-way is highlighted in red.

Conclusions

The subject property has experienced human uses of relatively low intensity for many years. Consequently, it exhibits vegetation, animal communities, and streams of high quality, which are not common in the many densely developed sections of Concord Township or Delaware County. Its proposed conversion to higher intensity uses following a change in municipal zoning poses risks to (1) old-growth secondary deciduous forests, (2) populations of rare plants and animals, (3) at least one stream of very high present quality, and (4) future residents to be located adjacent to a large petroleum pipeline. The numerous public trails on the

site appear to receive significant recreational use by pedestrians and equestrians, who were encountered during every site inspection in 2013, both on weekends and during the week.

Existing environmental inventory information is incomplete, and is not adequate for site planning in compliance with existing municipal ordinances. The requisite coordination with State and federal resource agencies has not occurred. Developer plans filed to date omit some obvious wetlands and streams, as well as springs and trees required by Township ordinance. Hence the requisite documentation should be supplied, and a formal Jurisdictional Determination of the extent of regulated streams and wetlands secured from the Army Corps of Engineers after that agency's field inspection of the proposed delineation. The status of bog turtle populations in suitable habitats must be determined by onsite field investigation by qualified professionals during the appropriate field season, and setbacks from onsite wetlands adjusted as warranted by the resources at risk.

Concord Township should adopt appropriate ordinances concerning new construction in the vicinity of existing threats to human safety and the environment, such as pipelines that carry petroleum products and other hazardous liquids. Sample ordinances are available. Recent plans have proposed new homes immediately adjacent to a major petroleum pipeline without provision for emergency access. Proper setbacks should be observed, and fireproof construction mandated for all structures facing the pipeline.

Best management practices should be identified for use during and after construction to provide maximum protection from erosion, sedimentation, and water quality degradation, not only to onsite streams and other resources, but also to the environment of adjacent protected open spaces. Past intensification of land use in the surrounding region has entailed major damage to water quality (including both chemistry and temperature) and to biological resources. Such damage is avoidable and not necessary today when new uses are constructed, but certainly will occur unless thoughtful site planning and facility design precede rigorous municipal review of development on the subject property. Appropriate protective measures must be employed and monitored closely during the construction and long-term operation of any new uses.

Authorship and Acknowledgments

This report was prepared by James A. Schmid with the assistance of Stephen P. Kunz. Dr. Schmid and Mr. Kunz are certified as Senior Ecologists by the Ecological Society of America, as Professional Wetland Scientists by the Society of Wetland Scientists, and as Wetland Delineators by the Army Corps of Engineers. Both have many decades of experience in environmental inventory and assessment for clients that include the development community, environmental groups, and regulatory agencies.

Field sampling of macroinvertebrates and aquatic habitat assessment was performed by Michael D. Bilger, M.S., Senior Aquatic Biologist at Eco-Analysts, Inc., with the assistance of Dr. Schmid.

The assistance of longtime area resident Stephen Autman during field investigations was most helpful.

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Appendix 1. Invertebrates collected at each of five sampling stations in the Beaver Run watershed, 7 May 2013, and PADEP (2009) IBI metrics for the data.

Schmid & Co. Beaver Creek Trib. PAICE Benthos 2013
Data are not adjusted for subsampling

EcoAnalysts, Inc.

	Sample ID	UNT X	Trib 009	Trib 006	Beaver Run	Right Bank Trib
	Habitat	Riffle	Riffle	Riffle	Riffle	Riffle
	Device	D-Frame	D-Frame	D-Frame	D-Frame	D-Frame
	Collection Date	05-07-2013	05-07-2013	05-07-2013	05-07-2013	05-07-2013
	Percent Subsampled	16.41	25.00	25.00	20.83	23.96
	EcoAnalysts Sample ID	6501.1-1	6501.1-2	6501.1-3	6501.1-4	6501.1-5
Ephemeroptera	Acentrella sp.	0	0	0	1	0
	Ameletus sp.	2	0	0	0	0
	Baetis sp.	0	0	4	1	1
	Dannella sp.	0	1	0	4	0
	Diphetor hageni	0	1	0	0	0
	Ephemerella sp.	33	40	0	2	1
	Eurylophella sp.	2	1	5	0	0
	Leptophlebiidae	0	3	0	1	0
	Maccaffertium sp.	3	5	10	11	43
	Paraleptophlebia sp.	38	0	0	0	0
	Stenacron sp.	3	0	0	0	0
Plecoptera	Acroneuria sp.	0	7	0	1	12
	Amphinemura sp.	9	5	0	1	38
	Haploperla sp.	1	0	0	0	0
	Leuctra sp.	34	40	1	2	9
	Peltoperlidae	0	3	0	0	0
	Perlesta sp.	0	0	0	0	2
	Perlidae	1	0	2	0	0
	Perlodidae	0	6	0	0	0
	Remenus sp.	0	1	0	0	0
	Taeniopteryx sp.	0	0	2	20	1
Trichoptera	Agapetus sp.	0	0	0	0	1
	Cheumatopsyche sp.	0	0	1	2	2
	Chimarra sp.	0	0	3	1	0
	Diplectrona sp.	0	26	1	3	2
	Dolophilodes sp.	0	13	2	0	2
	Hydropsyche sp.	0	0	2	0	6
	Hydroptila sp.	0	0	0	2	0
	Lepidostoma sp.	2	3	0	0	0
	Neophylax sp.	0	1	1	2	4
	Polycentropodidae	0	0	0	0	1
	Polycentropus sp.	0	0	1	0	0
	Rhyacophila sp.	0	8	3	0	2

Schmid & Co. Beaver Creek Trib. PAICE Benthos 2013
Data are not adjusted for subsampling

EcoAnalysts, Inc.

	Sample ID	UNT X	Trib 009	Trib 006	Beaver Run	Right Bank Trib
	Habitat	Riffle	Riffle	Riffle	Riffle	Riffle
	Device	D-Frame	D-Frame	D-Frame	D-Frame	D-Frame
	Collection Date	05-07-2013	05-07-2013	05-07-2013	05-07-2013	05-07-2013
	Percent Subsampled	16.41	25.00	25.00	20.83	23.96
	EcoAnalysts Sample ID	6501.1-1	6501.1-2	6501.1-3	6501.1-4	6501.1-5
Odonata	Cordulegaster sp.	1	1	0	0	0
	Gomphidae	0	1	0	2	0
	Stylogomphus sp.	0	0	0	0	3
Coleoptera	Anchytarsus bicolor	1	2	0	1	0
	Dubiraphia sp.	0	0	1	1	0
	Ectopria sp.	0	1	0	0	0
	Helichus sp.	0	0	0	0	1
	Hydroporinae	0	0	2	0	0
	Macronychus glabratus	0	0	0	0	3
	Optioservus sp.	14	11	16	1	3
	Oulimnius sp.	8	0	5	1	0
	Psephenus sp.	1	0	5	0	0
	Stenelmis sp.	0	0	2	0	0
Diptera-Chironomidae	Chironomidae	63	14	144	138	81
Diptera	Antocha sp.	0	0	0	1	1
	Bezzia/Palpomyia sp.	0	0	0	1	0
	Chelifera/Metachela sp.	0	0	0	0	1
	Clinocera sp.	0	0	3	0	0
	Dixa sp.	0	1	0	0	0
	Empididae	0	0	0	1	2
	Hemerodromia sp.	0	0	0	0	4
	Neoplasta sp.	0	0	0	0	1
	Simulium sp.	1	0	1	1	1
	Tipula sp.	7	13	1	0	0
Annelida-Oligochaeta	Oligochaeta	7	3	18	15	5
Mollusca-Bivalvia	Sphaeriidae	0	0	0	0	1
Crustacea-Amphipoda	Hyalella sp.	0	0	0	1	0
Crustacea-Decapoda	Cambarus sp.	0	0	1	0	1
Acari	Acari	1	1	0	2	1
Turbellaria	Turbellaria	3	0	0	0	0
Cnidaria	Hydra sp.	1	0	0	0	0
Other Organisms	Nematoda	1	0	3	0	0
	TOTAL	**237**	**212**	**240**	**220**	**236**

Schmid & Co. Beaver Creek Trib. PAICE Benthos 2013
Data are not adjusted for subsampling

EcoAnalysts, Inc.

Sample ID	UNT X	Trib 009	Trib 006	Beaver Run	Right Bank Trib
Habitat	Riffle	Riffle	Riffle	Riffle	Riffle
Device	D-Frame	D-Frame	D-Frame	D-Frame	D-Frame
Collection Date	05-07-2013	05-07-2013	05-07-2013	05-07-2013	05-07-2013
Percent Subsampled	16.41	25.00	25.00	20.83	23.96
EcoAnalysts Sample ID	6501.1-1	6501.1-2	6501.1-3	6501.1-4	6501.1-5
2009 PA riffle freestone metrics					
Taxa Richness	24	27	27	28	31
EPT Richness (0-4)	11	15	10	11	12
Beck's Index, version 3	15	23	12	12	21
HBI	3.24	1.73	5.69	5.44	4.11
Shannon Diversity	2.31	2.61	1.79	1.64	2.27
% Intolerant Ind. (0-3)	52.32	75.47	9.17	19.55	50.42
Metric Scores					
Taxa Richness	0.727	0.818	0.818	0.848	0.939
EPT Richness	0.579	0.789	0.526	0.579	0.632
Beck's Index, version 3	0.395	0.605	0.316	0.316	0.553
HBI	0.833	1.000	0.532	0.562	0.726
Shannon Diversity	0.807	0.914	0.625	0.574	0.794
% Intolerant Ind. (0-3)	0.619	0.893	0.108	0.231	0.597
PA Freestone IBI	**66.0**	**83.7**	**48.8**	**51.8**	**70.7**

Appendix 2. Flowing Waterbody Field Data Forms and Water Quality Network Habitat Assessment for five sampling stations in the Beaver Run watershed, 7 May 2013.

For each station there are four pages of data.

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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20130507 - 1130 - MDB (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
Secondary Station ID	Big Box Site UNTX	Surveyed by: MDB		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach. **SWP Watershed**

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat] ✓

Location 39.84056 N / 75.555974 W

County: Delaware **Municipality:** Concord **Topo Quad:**

Location Description: Big Box Trib 300' w/ 1006 dns pipeline

Land Use

Residential:	%	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	100 %	Other:	%		

Land Use Comments: Heavily forested area Pipeline 100m upstream

Canopy cover: open partly shaded (mostly shaded) fully shaded

Water Quality

	Collector-sequence #	Temp (°C)	DO (mg/L)	pH	Cond. (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		12.45	10.70	5.46	128	40	%DO 100.2
2.							
3.							TDS 0.083

Water Appearance/Odor Comments: (* see bottom of back for common descriptors)

Findings

Not Impaired ☐	Impaired biology? ☐	Impaired habitat? ☐	Is impact localized? ☐	Reevaluate designated use? ☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score: **Total Habitat Score:** 183

Macroinvertebrate sampling

Sampling method: Std. kick screen: ☐ D-frame: ☒ Surber: ☐ Other: ☐ method?: ____

Comments/Abundance Notes:
Perlids, ptilodactylids, ephemerellids, leptophlebiids, heptogeniids; gomphids, midges, elmids

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	28
#9 Condition of Banks + #10 Bank Vegetation = 24 or less *(20 or less for warm water, low gradient streams*	29
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	183

Habitat Comments:
Width 1m
depth <0.1m
skunk cabbage
Good riffle/run sequence cobble dominant.
Fish present.

Special Condition

Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.

*Common descriptors: **Water Odors** - none normal sewage petroleum chemical other; **Water Surface Oils** - none slick sheen globs flecks; **Turbidity** - clear slight turbid opaque; **NPS Pollution** - no evidence some potential obvious; **Sediment Odors** - none normal sewage petroleum chemical anaerobic; **Sediment Oils** - absent slight moderate profuse; **Deposits** - none sludge sawdust paper fiber sand relict shells other.
Are the undersides of stones deeply embedded black? Yes

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WATER QUALITY NETWORK
HABITAT ASSESSMENT

WATERBODY NAME Big Box Trib UNT X STR CODE/RMI _____

STATION NUMBER _____ LOCATION ~300' U/S of SR 0006

DATE 5/7/13 TIME 1130

AQUATIC ECOREGION _____ COUNTY Delaware

INVESTIGATORS MTB

FORM COMPLETED BY MTB 39.840 N/-75.5°1597W **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish)	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Epifaunal Substrate	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
4. Velocity/Depth Regimes	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Total Side 1 71				

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RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1
10. Bank Vegetative Protection	More than 90% of the streambank surface covered by vegetation.	70-90% of the stream-bank surface covered by vegetation.	50-70% of the stream-bank surfaces covered by vegetation.	Less than 50% of the streambank surface covered by vegetation.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
11. Grazing or Other Disruptive Pressure	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
12. Riparian Vegetative Zone Width	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Total Side 2 112				
Total Score 183				

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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20130507 - 1030 - MDB (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
Secondary Station ID	00006 South Branch	Surveyed by: MDB		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach. **SWP Watershed**

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat] — 4

Location 39.84032N / -75.545884

County:	Delaware	Municipality:	Concord	Topo Quad:	

Location Description: ~50m ups Big Box Trib confluence

Land Use

Residential:	%	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	100 %	Other:	%		

Land Use Comments: Heavily forested in mixed hardwoods.

Canopy cover: open partly shaded mostly shaded fully shaded

Water Quality

	Collector-sequence #	Temp (°C)	DO (mg/L)	pH	Cond. (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		14.31	10.53	7.01	409	100	%DO 103.5
2.							TDS =0.266
3.							

Water Appearance/Odor Comments: (* see bottom of back for common descriptors)

Findings

Not Impaired	☐	Impaired biology?	☐	Impaired habitat?	☐	Is impact localized?	☐	Reevaluate designated use?	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:		Total Habitat Score:	202

B

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Macroinvertebrate sampling
Sampling method: Std. kick screen: ☐ D-frame: ☑ Surber: ☐ Other: ☐ method?: _____
Comments/Abundance Notes: Hydropsychids, Cambarus, heptageniids, philopotamids, water pennies, elmids, Amphipod

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less ***(20 or less for warm water, low gradient streams)***	32
#9 Condition of Banks + #10 Bank Vegetation = 24 or less ***(20 or less for warm water, low gradient streams***	31
Total habitat score 140 or less for forested, cold water, high gradient streams ***(120 or less for warm water, low gradient streams)***	202

Habitat Comments:
Good riffle/run sequence. Some algae on rocks.
Width - 3M
Depth - 0.1M
Green frog.

Special Condition
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.

Common descriptors: Water Odors - none normal sewage petroleum chemical other; **Water Surface Oils** - none slick sheen globs flecks; **Turbidity** clear slight turbid opaque; **NRS Pollution** - no evidence some potential obvious; **Sediment Odors** - none normal sewage petroleum chemical anaerobic; **Sediment Oils** absent slight moderate profuse; **Deposits** - none sludge sawdust paper fiber sand relict shells other.
Are the undersides of stones deeply embedded black? Yes

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BUREAU OF WATER STANDARDS AND FACILITY REGULATION

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WATER QUALITY NETWORK
HABITAT ASSESSMENT

WATERBODY NAME UNT Beaver Creek STR CODE/RMI ______

STATION NUMBER 00006 South Branch LOCATION Sn ups Big Box Trib confl.

DATE 5/7/13 TIME 1230

AQUATIC ECOREGION ______ COUNTY Delaware

INVESTIGATORS MTD B

FORM COMPLETED BY MTD 39.8?0372N -75.59588

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category: Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish)	Greater than 50% mix of boulder, cobble, sub-merged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat avail-ability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Epifaunal Substrate	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common.	Run area may be lack-ing; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bed-rock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Velocity/Depth Regimes	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Total Side 1 86

D

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RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1
10. Bank Vegetative Protection	More than 90% of the streambank surface covered by vegetation.	70-90% of the stream-bank surface covered by vegetation.	50-70% of the stream-bank surfaces covered by vegetation.	Less than 50% of the streambank surface covered by vegetation.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
11. Grazing or Other Disruptive Pressure	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
12. Riparian Vegetative Zone Width	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Total Side 2 116				
Total Score 202				

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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20130507 - 1330 - MDB (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
Secondary Station ID	0009	Surveyed by: MDB		

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed: 4

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]

Location 39.841614 N / -75.556556 W

County:	Delaware	Municipality:	Concord	Topo Quad:	

Location Description:
0009 beech forest ~ 10m above conf. [illegible] PIRSH

Land Use

Residential:	%	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	100 %	Other:	%		

Land Use Comments:
Beech forest. Some residential upstream

Canopy cover: open partly shaded (mostly shaded — circled) fully shaded

Water Quality

	Collector-sequence #	Temp (°C)	DO (mg/L)	pH	Cond. (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		14.48	9.78	6.4	131	40	%DO = 95.9
2.							TDS 0.085
3.							

Water Appearance/Odor Comments: (* see bottom of back for common descriptors)

Findings

Not Impaired: ☐	Impaired biology? ☐	Impaired habitat? ☐	Is impact localized? ☐	Reevaluate designated use? ☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score:		Total Habitat Score:	188

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Macroinvertebrate sampling

Sampling method: Std. kick screen: ☐ D-frame: ☒ Surber: ☐ Other: ☐ method?: _____

Comments/Abundance Notes:

Caenbaetis, perlids, heptageniids, beetles, ephemerellids, midges, beetles, hydropsychids

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less *(20 or less for warm water, low gradient streams)*	28
#9 Condition of Banks + #10 Bank Vegetation = 24 or less *(20 or less for warm water, low gradient streams*	34
Total habitat score 140 or less for forested, cold water, high gradient streams *(120 or less for warm water, low gradient streams)*	188

Habitat Comments:

width 1M forested. Good riffle from community.

Depth 0.1M

2 - lined juvenile salamander

Special Condition

Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.

Common descriptors: Water Odors: (none) normal sewage petroleum chemical other; Water Surface Oils: (none) slick sheen globs flecks; Turbidity: (clear) slight turbid opaque; NPS Pollution: no evidence some potential obvious; Sediment Odors: (none) normal sewage petroleum chemical anaerobic; Sediment Oils: (absent) slight moderate profuse; Deposits: none sludge sawdust paper fiber sand relict shells other;
Are the undersides of stones deeply embedded black? Yes

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WATER QUALITY NETWORK
HABITAT ASSESSMENT

WATERBODY NAME UNT Beaver Creek STR CODE/RMI ____________

STATION NUMBER 00009 LOCATION ~10 M ups Conf Beaver Creek

DATE 5/7/13 TIME 1330

AQUATIC ECOREGION ____________ COUNTY Delaware

INVESTIGATORS MDB

FORM COMPLETED BY MDB 39.84614N/-75.5508

RIFFLE/RUN PREVALENCE

Habitat Parameter	Category: Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish)	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Epifaunal Substrate	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Velocity/Depth Regimes	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Total Side 1 72

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RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE 14	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE 16	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE 14	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE 15	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE 19	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the stream-bank surface covered by vegetation. 15 14 13 12 11	50-70% of the stream-bank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE 19	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE 19	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 116				
Total Score 188				

D

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FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20130507 - 1400 - MDB (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
Secondary Station ID	Beaver Creek wps 00009 t.b	Surveyed by:	MDB	

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach. SWP Watershed

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat] — 4

Location 39.44834N | -75.55704W

County: Delaware | Municipality: Concord | Topo Quad:

Location Description:
Beech grove. ~10M above confluence UNT 00009. PICS # 2440 2441 d/s.

Land Use

Residential	10%	Commercial	%	Industrial	%	Cropland	%	Pasture	%
Abd. Mining	%	Old Fields	%	Forest	90 %	Other	%		

Land Use Comments:
Lots of beech in area. Some low density residential WPS

Canopy cover: open partly shaded (mostly shaded) fully shaded

Water Quality

	Collector sequence #	Field Meter Readings: Temp (°C)	DO (mg/L)	pH	Cond. (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		15.21	9.68	7.29	420	100	%DO: 96.4
2.							TDS: 0.273
3.							

Water Appearance/Odor Comments: (* see bottom of back for common descriptors)

Findings

Not Impaired	Impaired biology?	Impaired habitat?	Is impact localized?	Reevaluate designated use?
☐	☐	☐	☐	☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score: | Total Habitat Score: 189

D

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Macroinvertebrate sampling
Sampling method: Std. kick screen: ☐ D-frame: ☒ Surber: ☐ Other: ☐ method?: _____
Comments/Abundance Notes: perlids, hydropsychids, heptageniids, ephemerellids

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less ***(20 or less for warm water, low gradient streams)***	23
#9 Condition of Banks + #10 Bank Vegetation = 24 or less ***(20 or less for warm water, low gradient streams***	31
Total habitat score 140 or less for forested, cold water, high gradient streams ***(120 or less for warm water, low gradient streams)***	189

Habitat Comments:

Beech grove
width ≈ 3M
Depth ~ 0.1M
Fair riffle run sequence some noticeable silt deposits on bottom.

Special Condition
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.

*Common descriptors: **Water Odors** - none normal sewage petroleum chemical other; **Water Surface Oils** - none slick sheen globs flecks; **Turbidity** - clear slight turbid opaque; **NPS Pollution** - no evidence some potential obvious; **Sediment Odors** - none normal sewage petroleum chemical anaerobic; **Sediment Oils** - absent slight moderate profuse; **Deposits** - none sludge sawdust paper fiber sand relict shells other. **Are the undersides of stones deeply embedded black?**

D

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WATER QUALITY NETWORK
HABITAT ASSESSMENT

WATERBODY NAME Beaver Creek Mainstem STR CODE/RMI _____

STATION NUMBER _____ LOCATION US 10th Unt 0009

DATE 5/7/13 TIME 1400

AQUATIC ECOREGION _____ COUNTY Delaware

INVESTIGATORS MDB

FORM COMPLETED BY MDB 39.84839N / -75.55704W **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish)	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Epifaunal Substrate	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
SCORE 16	20 19 18 17 (16)	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1
4. Velocity/Depth Regimes	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Total Side 1 78				

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RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition SCORE 12	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition. 20 19 18 17 16	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools. 15 14 13 12 11	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1
7. Frequency of Riffles SCORE 16	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat. 20 19 18 17 16	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15. 15 14 13 12 11	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. 10 9 8 7 6	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25. 5 4 3 2 1
8. Channel Flow Status SCORE 14	Water reaches base of both lower banks and minimal amount of channel substrate is exposed. 20 19 18 17 16	Water fills > 75% of the available channel; or <25% of channel substrate is exposed. 15 14 13 12 11	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed. 10 9 8 7 6	Very little water in channel and mostly present as standing pools. 5 4 3 2 1
9. Condition of Banks SCORE 13	Banks stable; no evidence of erosion or bank failure. 20 19 18 17 16	Moderately stable; infrequent, small areas of erosion mostly healed over. 15 14 13 12 11	Moderately unstable; up to 60% of banks in reach have areas of erosion. 10 9 8 7 6	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars. 5 4 3 2 1
10. Bank Vegetative Protection SCORE 18	More than 90% of the streambank surface covered by vegetation. 20 19 18 17 16	70-90% of the stream-bank surface covered by vegetation. 15 14 13 12 11	50-70% of the stream-bank surfaces covered by vegetation. 10 9 8 7 6	Less than 50% of the streambank surface covered by vegetation. 5 4 3 2 1
11. Grazing or Other Disruptive Pressure SCORE 19	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally. 20 19 18 17 16	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 15 14 13 12 11	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 10 9 8 7 6	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height. 5 4 3 2 1
12. Riparian Vegetative Zone Width SCORE 19	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. 20 19 18 17 16	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 15 14 13 12 11	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. 10 9 8 7 6	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. 5 4 3 2 1
Total Side 2 111				
Total Score 189				

E

3800-FM-WSFR0086 Rev. 12/2008

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER STANDARDS AND FACILITY REGULATION

FLOWING WATERBODY FIELD DATA FORM

(Information and comments for fields boxed in double lines are required database entries. Other fields are optional for personal use.)

Date-Time-Initials* Example 20040212-0312-XYZ	20130507 - 1545 - MDB (Date / Time / Initials)	Watershed Code (HUC)	Stream Code	Ch. 93 Use
Secondary Station ID	Right Bank Trib	Surveyed by:	MDB	

*Date as YYYYMMDD, time as military time, and your initials uniquely identify the stream reach.

SWP Watershed:

Survey Type

(1) Basin Survey, (2) Cause / Effect, (3) Fish Tissue, (4) Instream Comprehensive Evaluation [ICE], (5) Point-of-First-Use, (6) SERA, (7) Antidegradation [Special Protection], (8) Toxics, (10) Use Attainability, (11) WQN, (12) Limestone, (13) Low-gradient [Multihabitat]: 4

Location 40.84425N / -75.56427W

County: Delaware Municipality: Chadds Ford Topo Quad:

Location Description:
off development site.
pics # 2243 ups
22 44 dns

Land Use

Residential:	25 %	Commercial:	%	Industrial:	%	Cropland:	%	Pasture:	%
Abd. Mining:	%	Old Fields:	%	Forest:	75 %	Other:	%		

Land Use Comments:
mostly forested, some light residential.

Canopy cover: open partly shaded (mostly shaded) fully shaded

Water Quality

	Collector-sequence #	Temp (°C)	DO (mg/L)	pH	Cond. (umhos)	Alkalinity mg/l	Bottle Notes (N-normal, MNF-metals non-filtered, MF-metals filtered, B-bac't, Others: indicate)
1.		15.98	9.44	7.20	274	100	TDS=0.178
2.							%DO=95.7
3.							

Water Appearance/Odor Comments: (* see bottom of back for common descriptors)

Findings

Not Impaired: ☐ Impaired biology? ☐ Impaired habitat? ☐ Is impact localized? ☐ Reevaluate designated use? ☐

Decision comments. Describe the rationale for your "Not Impaired" or "Impaired" decision; reach locations for use designation reevaluations; special condition comments; etc.:

IBI Score: Total Habitat Score: 196

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Macroinvertebrate sampling
Sampling method: Std. kick screen: ☐ D-frame: ☑ Surber: ☐ Other: ☐ method?: _____
Comments/Abundance Notes: Perlids, heptageneids, elmids, crayfish, ephemerellids. Thought a trout was seen

Habitat Impairment Thresholds	Metric Score
#3 Riff/Run: embeddedness *or* #3 Glide/Pool: substrate character + #6 Sediment Deposition = 24 or less ***(20 or less for warm water, low gradient streams)***	30
#9 Condition of Banks + #10 Bank Vegetation = 24 or less ***(20 or less for warm water, low gradient streams***	30
Total habitat score 140 or less for forested, cold water, high gradient streams ***(120 or less for warm water, low gradient streams)***	196

Habitat Comments: Nice riffle/run. Good gradient.
Width 2m
Depth 0.1m

Special Condition
Use this block to describe conditions that justify attainment/impairment of stations with IBI score <63 and >53.

***Common descriptors: Water Odors** - none normal sewage petroleum chemical other; **Water Surface Oils** - none slick sheen globs flecks; **Turbidity** - clear slight turbid opaque; **NPS Pollution** - no evidence some potential obvious; **Sediment Odors** - none normal sewage petroleum chemical anaerobic; **Sediment Oils** - absent slight moderate profuse; **Deposits** – none sludge sawdust paper fiber sand relict shells other. **Are the undersides of stones deeply embedded black?** Yes

3800-FM-WSFR0402 Rev. 10/2008

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER STANDARDS AND FACILITY REGULATION

WATER QUALITY NETWORK
HABITAT ASSESSMENT

WATERBODY NAME Right Bank Trib STR CODE/RMI _____

STATION NUMBER _____ LOCATION off site

DATE 5/7/13 TIME 1545

AQUATIC ECOREGION _____ COUNTY Delaware

INVESTIGATORS MDB

FORM COMPLETED BY MDB 40.84635 x -75.569 **RIFFLE/RUN PREVALENCE**

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (Fish)	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Epifaunal Substrate	Well developed riffle and run, riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than two times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than two times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Velocity/Depth Regimes	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score lower than if missing other regimes).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored gabion or cement; over 80% of the stream reach channelized and disrupted.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Total Side 1 85				

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RIFFLE/RUN PREVALENCE

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
6. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstruction, constriction, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
10. Bank Vegetative Protection	More than 90% of the streambank surface covered by vegetation.	70-90% of the stream-bank surface covered by vegetation.	50-70% of the stream-bank surfaces covered by vegetation.	Less than 50% of the streambank surface covered by vegetation.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
11. Grazing or Other Disruptive Pressure	Vegetative disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
12. Riparian Vegetative Zone Width	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Total Side 2 111				
Total Score 196				

Appendix 3. 2011 comments from Delaware County natural heritage inventory concerning Beaver Valley Woods, pages 104-110 (Pennsylvania Natural Heritage Program 2011).


Beaver Valley Woods
Delaware County, PA
Natural Heritage Inventory
Painters Crossroads
N
Legend
Core Habitat (focus NHI site)
Core Habitat (other NHI sites)
Supporting Landscape
100 meter Riparian Buffer
100 foot Riparian buffer
Township Boundary
County Boundary
Interior Forest
Forested habitat
OpenSpace & Recreation
Public Park
Homeowner's Association
Privately Eased Land
0 0.25 0.5 1 Kilometers
0 0.25 0.5 1 Miles
PNHP

Beaver Valley Woods – *High significance*

Species of Concern:	Taxa[1]	PNDI Rank[2] Global	PNDI Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
Velvety panic-grass (*Dichanthelium scoparium*)	P	G5	S1	PE (PE)	2010	C
Soapwort gentian (*Gentiana saponaria*)	P	G5	S1S2	TU (PE)	2010	C
Grass-leaved rush (*Juncus biflorus*)	P	G5	S2	TU (PT)	1995	B
Downy lobelia (*Lobelia puberula*)	P	G5	S1	PE (PE)	2010	C
Tawny ironweed (*Vernonia glauca*)	P	G5	S1	PE (PE)	2010	C
Sensitive species of concern[3]	---	---	---	---	2010	C
Sensitive species of concern[3]	---	---	---	---	2010	E

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionoid (Mussel)
[2] Please refer to Appendix III for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency overseeing its protection

Location: This large area includes adjoining habitats along Beaver Creek and its tributaries roughly bounded on the east by Route 202, on the south by the Delaware State Line, and on the west and north by Ridge Road.

- Municipalities:
  - Chadds Ford Township
  - Concord Township
  - New Castle County, State of Delaware
- USGS Quadrangles:
  - Wilmington North Quadrangle
- Watersheds:
  - Brandywine Creek
- 1992 Delaware County Natural Areas Inventory reference:
  - "SP525" (Wilmington North Quadrangle)
  - "Quarry Woods" (Wilmington North Quadrangle)
- 1998 Delaware County Natural Areas Inventory Update reference:
  - "SP535, SP536, SP537, SP539, SP540 - Beaver Valley Road Pipeline Site"- (West Chester Quadrangle)

Description: A mosaic of upland forest, forested wetlands, open wetlands, spring seeps, successional old fields and pipeline rights-of-way are set within an agricultural and residential context. Forested habitats include several significant patches of interior forest, which is forested habitat at least 100 meters away from any canopy fragmenting feature such as roads, powerlines, residences or open fields. Interior forest is critical nesting habitat for many of Pennsylvania's neotropical migrant songbirds. This area combines two sites from the original 1992 CNHI report "SP525" and "Quarry Woods" and the subsequent 1998 update: "Beaver Valley Road Pipeline Site" into this enlarged area that hosts a wide variety of habitats and scattered populations of several species of concern.

Species of Concern Considerations:

- Five plant species of concern, velvety panic-grass, soapwort gentian, grass-leaved rush, downy lobelia and tawny ironweed are plants that typically grow in damp to seasonally wet clearings, abandoned fields, woods borders, thickets, marshes, and disturbed ground. Active management, such as periodic mowing or prescribed fire, may be needed to create the proper successional stage and ecological conditions for these species to thrive. Vegetation maintenance along agricultural field edges and the pipeline at this location helps to reduce competition from woody and aggressive species and keep the habitat in a state of early succession. Habitat loss, deer browse and the indiscriminate spraying of herbicides are threats to these species in some locations.
- A sensitive species of concern, which is not named at the request of the jurisdictional agency overseeing its protection, occurs in several locations within this forested area. Its preferred habitat is moist deciduous forests and stream banks. These high quality woodlands may be altered by encroachment of invasive species, over-browsing by deer, and fragmentation. Fragmentation can have a drying effect on the habitat and promote invasive species growth. Creating buffers around fragmented habitat and removal of invasive species will help to maintain populations and encourage new population growth.
- An additional sensitive species of concern, which is not named at the request of the jurisdictional agency overseeing its protection, occurs in several locations within this forested area. Its preferred habitat is moist deciduous forests requires specific plant communities within a matrix of open canopied habitats. Restoration of the marshy habitats historically associated with the Beaver Creek floodplain will help to provide expanded habitat opportunities for this species of concern.

Forest Cover / Natural Communities: The plant community types depicted are approximations delineated from 2005 aerial photography interpretation and were followed up with minimal selective ground-truthing. Community types follow "Terrestrial & Palustrine Plant Communities of Pennsylvania" (Fike 1999) where appropriate, and otherwise describe general land cover types (*).

- Terrestrial (upland) communities:
  - Red oak – mixed hardwood forest
  - Tuliptree – beech-maple forest
  - modified successional forest*
- Palustrine (wetland) communities:
  - Silver maple floodplain forest

- Some of the forest patches are in the long process of reverting from past agricultural uses, while other patches exhibit a much more undisturbed and pristine quality. Though the forest was likely selectively cut for fuel wood and timber several times since colonial times, much of the existing forest has apparently been standing for well over 100 years. Some of the trees were in the past likely considered less desirable for lumber and fuel or were less accessible due to steep slopes and were left in place. While this tract of forest can't be considered virgin timber, some individual trees in the area may be 200-300 years old or older. Although there is invasion of exotic plant species into the woods the overall quality of the woods is remarkably natural and aesthetically pleasing.
- The forest canopy is dominated by a mix of large tuliptrees (*Liriodendron tulipifera*), American beeches (*Fagus grandifolia*) and mixed oaks (*Quercus alba, Q. rubra, Q. palustris, Q. montana*). The shrub layer is dominated by invasive species in much of the area, though some areas have a relatively good representation of native shrub species. In other areas, the shrub layer is missing altogether, giving the forest an open, park-like look. This openness is likely due to excessive deer pressure on the reproductive success of understory vegetation including tree seedlings. The herbaceous layer is variable within the diversity of habitat types present.

Ownership:

- This large area is owned by two primary owners, but also includes several secondary property owners. The reduced number of landowners of this large piece of the green infrastructure of Delaware County can be tremendously helpful towards implementation of consistent conservation action across this significant piece of the landscape.

Habitat Disturbances:

- Historic:
  - Most of the original forest cover of the area had been removed and converted to agricultural or other uses over the past several centuries, leaving little of the original vegetation in place. Aerial photographs from 1937 show scattered forested woodlots within a landscape dominated by active agriculture. Though the forest was likely cut for fuel wood and timber several times since colonial times, the existing forest has likely been standing for over 100 years.
  - The gas pipeline right-of-way was cut east to west through the lower portion of the area. Though this was a disturbance to the integrity of the forested habitats, it established a narrow strip of vegetation that was maintained as early successional habitat up to the present day.
- Current:
  - Much of the area remains as it was at the time of the 1937 aerial photos, with scattered forested areas surrounded by open pastures and agricultural fields.
  - Rapid development has occurred outside of and on the periphery of the core habitat area, fragmenting the landscape with additional buildings, roads and infrastructure and increasing the amount of impervious surface and edge habitat in the immediate watershed.
  - Stormwater runoff from the highly developed surrounding communities flows into the creek system with little opportunity to be slowed or filtered. This results in increased downstream flooding and erosion and is a potentially significant non-point source of pollution. Runoff from these sources has significantly higher levels of sediment, nutrients, pesticides, herbicides and other pollutants than runoff filtered through natural vegetation.
  - Exotic Species – The edge habitat provided by reverting agricultural fields and residential development creates conditions favorable for many introduced species of plants. Some of the primary invasive species occurring in this location include:
    - Norway maple *(Acer platanoides)*
    - garlic-mustard *(Alliaria petiolata)*
    - Japanese barberry (*Berberis thunbergii*)
    - Asiatic bittersweet (*Celastrus orbiculatus*)
    - autumn olive (*Elaeagnus umbellata*)
    - wintercreeper (*Euonymus fortunei)*
    - Japanese honeysuckle *(Lonicera japonica)*
    - amur honeysuckle *(Lonicera maackii)*
    - Japanese stiltgrass *(Microstegium vimineum)*
    - mile-a-minute weed *(Persicaria perfoliata)*
    - common reed *(Phragmites australis)*
    - multiflora rose *(Rosa multiflora)*
    - wineberry (*Rubus phoenicolasius*)
    - linden viburnum (*Viburnum dilatatum*)
  - Control options for invasive plants range from mechanical to chemical. However, indiscriminate use of herbicides as rights-of-way defoliants is not acceptable. A smarter, more selective use of chemical controls is required in these areas that contain both invasive species and species of concern.
  - Invasive species management needs to be coordinated by individuals familiar with the rare species as well as the invasive species present.
  - High priority for invasive species control at this site should be targeted towards removing small populations of newly established invasive plants in the most weed-free portions of the Natural Heritage Area. Invasive species control efforts should try to maintain weed-free areas first, and then concentrate on removing invasive species in lightly infested areas, continually pushing back the line of invasion. Invasive species removal should be conducted in coordination with native species replacement to avoid

denuding the understory vegetation. This needs to be a continual and sustained process of monitoring and control efforts.

- The relatively low volume of understory herbs and shrubs noted in this forest may be attributable to an oversized deer herd. Over-browsing by white-tailed deer is a serious threat to the overall understory plant diversity. An overabundance of deer can create the effect of park-like forests in which the understory and vertical stratification is greatly reduced. Removal of understory species eliminates habitat for some nesting songbirds as well as increasing competition between deer and other wildlife due to reduced food sources. Deer have strong, species-specific feeding preferences. The most highly preferred species are the first to decline or disappear when deer numbers are high. Furthermore, deer have been shown to be prolific seed dispersers for many of the most invasive nonnative species. The result is greatly impoverished native species diversity, failure of native tree regeneration, and the rapid proliferation of invasive species. It is likely their selective feeding habits and effective seed dispersal make the spread of invasives much faster than would be the case without deer, even where herds are only moderately oversized.

Conservation Actions:

- Overall:
  - Allow the forested habitats to achieve and maintain old growth conditions.
  - Prevent the conversion of the surrounding agricultural lands to residential or industrial development.
  - Conserve and expand the forested riparian buffers of Beaver Creek and its tributaries. Establish at least a 100 meter (328 feet) buffer of woody vegetation along the creek to help reduce erosion, sedimentation, and pollution. Additionally, best management practices (BMPs) that focus on limiting the introduction of non-point sources of pollution into surface and groundwater should be applied to the surrounding area.
  - Beaver Creek, as indicated by its name, was likely heavily influenced by beaver activity in the historical past. Habitat modification by beavers could help to improve the integrity of this Natural Heritage Area, by reestablishing the matrix of open and canopied wetland complexes. Beaver numbers are on the rise in Pennsylvania, and it is very possible that they could be documented here in the future. If beavers expand into this system, they should be left to modify and restore some of the open habitats that previously existed at this site.
- Within the Core Habitat:
  - The Core Habitat for this location was drawn to exclude the most unnatural portions of the adjacent habitat, which are primarily active agricultural fields and residential areas.
  - Avoid fragmenting the existing forested areas with additional buildings or infrastructure. Avoid logging in this area except as it relates to invasive species removal. The forest cover should be allowed to achieve and maintain old-growth characteristics. Leave fallen trees in place to help provide habitat, soil nutrients, humus and tilth. Trees that have fallen over approved trails can be cut through as necessary.
  - Restore and protect the hydrology of the landscape. Avoid altering the hydrology of Beaver Creek, its tributaries, springs and wetlands. This may require that road crossings involve bridge systems that would preserve the wide sluggish waters associated with marshes and slow flowing waterways.
  - Forested and open wetlands each require special consideration to maintain their unique attributes. Existing wet meadows should not be modified (i.e. dammed, planted in trees or farmed), as this will deprive the open wetlands adapted species of suitable habitat. Light grazing with pastoral animals can be an effective tool to maintain these soggy meadows in their preferred condition. Once the open habitat within the historic floodplain has been restored, light grazing, often considered compatible with high financial yield organic meat and dairy production, could be an effective tool to maintaining the habitat for all wet meadow species.

- As existing farm ponds deteriorate and are in need of maintenance, the removal of such ponds should be explored, in order to recreate the natural hydrologic flows of the landscape.
- Because several of the species of concern noted from this site rely upon open canopied habitats, programs that support establishment of riparian buffers with trees, such as CREP, should be avoided in areas along the pipeline rights-of-way. In addition, removal of woody shrubs appears to be necessary to restore habitat for several of the open habitat adapted plant species as formerly open fallow fields have become dominated by the invasive woody shrub autumn olive (*Elaeagnus umbellata*). Autumn olive should be cut, stump treated with herbicide to avoid resprouting and the area mowed every other year in early spring to help maintain the early successional conditions favorable for these plant species of concern.
- The stormwater runoff from development and agriculture should be considered a potential source of significant contamination for the creek and its floodplain habitat. Runoff from these sources have significantly higher levels of sediment, nutrients, pesticides, herbicides and other pollutants than runoff filtered through a natural habitat. Stormwater management measures such as the creation of detention basins or vegetated swales should be implemented to decrease the unfiltered flow into the creek.
- Remove invasive species of plants (see below).
- Reduce the deer density in the area. Uncommon species of native plants are particularly susceptible to deer herbivory.

- Potential Restoration Activities:
  - Streams through forested areas should be considered high priority for conservation. The forested riparian corridor helps to regulate the temperature of the stream and creates streamside conditions that contribute to improved water quality and aquatic habitat. Streams through non-forested areas should be restored with native trees and shrubs appropriate to the habitat.
    - Careful determination is needed to avoid planting trees in floodplains that contain herbaceous wetland habitats. These habitats should be maintained in their current open condition, with tree plantings to occur at the periphery of natural wetland openings.
    - Riparian Buffers:
      - An ideal vegetated stream buffer should be at least 100 meters (328 feet) in width from the edge of the 100-year floodplain.
      - An intermediate vegetated stream buffer should be at least 100 feet in width from the edge of the 100-year floodplain.
      - A minimum vegetated buffer should be at least 35 feet in width from the edge of the 100-year floodplain.
  - Remove invasive species of plants. Invasive species management needs to be coordinated by individuals familiar with the rare species as well as the invasive species present.
  - Control options for invasive plants range from mechanical to chemical. However, indiscriminate use of herbicides as rights-of-way defoliants is not acceptable. A smarter, more selective use of chemical controls is required in these areas that contain both invasive species and species of concern.
  - High priority for invasive species control at this site should be targeted towards removing woody shrubs, especially autumn olive, from the successional old fields adjacent to the pipeline rights-of-way.
  - Invasive species control efforts should try to maintain weed-free areas first, and then concentrate on removing invasive species in lightly infested areas, continually pushing back the line of invasion. Invasive species removal should be conducted in coordination with native species replacement to avoid denuding the understory

vegetation. Control of invasive species in the area will require extensive and continual effort.

- Target pioneer populations of invasive plants for immediate and continued removal. It is much easier and more effective to keep a place invasive-free than to try and repair a heavily infested habitat.

Photo Source: Rocky Gleason (PNHP)

Large, older trees contribute to the canopy of the forested habitats in Beaver Valley.

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7 November 2013

Cosmo Servidio
Regional Director, Southeast Regional Office
PA Department of Environmental Protection
1 East Main Street
Norristown, Pennsylvania 19401

John A. Arway
Executive Director
PA Fish & Boat Commission
1601 Elmerton Avenue
Harrisburg, Pennsylvania 17110

In re: Attained Use Determination Needed --- Special Protection Trout Waters

Gentlemen:

On behalf of the Beaver Valley Conservancy, this letter transmits current information relevant to determinations that will have to be made regarding the attained uses of certain headwater streams in Concord Township, Delaware County, Pennsylvania, where discharge permits are expected to be sought for proposed development. It is the hope of the Conservancy that the Department will undertake its own analyses, in concert with the Commission, to confirm the regulatory status of the subject streams, so that permit decisions can be made timely based on accurate information.

In addition, the Department's findings on attained uses would be of value to Concord Township as it considers the requested major rezoning of lands kept for many years in conservation uses in order to accommodate proposed development. The information also will be useful to developers as they finalize their plans for new commercial and intensive residential construction. Most of the land proposed for development is part of the Beaver Valley Woods identified by the Western Pennsylvania Conservancy as a focus Natural Heritage Inventory site having core interior forest habitat of high significance and a posted wildlife refuge in Delaware County. The site's developers have not yet resolved any of the potential conflicts with records of numerous onsite species deemed Threatened or Endangered, as indicated by the Pennsylvania Natural Heritage Inventory database.

The land in question consists of about 323 acres in the southwestern corner of Concord Township. The land extends southeast from Smithbridge Road to the boundary of New Castle County and from US Route 202 west to the boundary of Chadds Ford (formerly Birmingham) Township, Delaware County. It is approximately bisected northeast-southwest by the northern section of Beaver Valley Road.

All streams here are part of the Beaver Run (Beaver Creek) watershed and drain to the Brandywine Creek en route to the Christina River and Delaware Bay. Some, but not all, of the onsite permanent streams are shown on the National Hydrography Dataset reproduced on the Department's eMapPA geographical information system database.

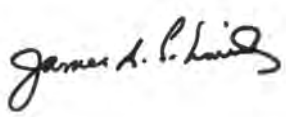
All of the onsite and nearby streams in Beaver Valley are currently designated by the Department for Warm Water Fishery use (25 *Pa. Code* Chapter 93), but some maintain naturally reproducing trout populations. The Department's database indicates that all of the streams also offer habitat for migratory fish and that all are listed as "attaining" streams supporting designated uses. Some of the onsite streams appear from our 2013 macroinvertebrate sampling to warrant recognition of Special Protection attained uses, according to numerical results from using the Department's 2009 Index of Biotic Integrity calculation. The Conservancy's work employing the Department's protocol included laboratory identification of macroinvertebrates to the genus level. Special Protection attained use status must be confirmed prior to issuance or registration of any permits affecting the Beaver Valley streams that have emerged as candidates for Special Protection, and proper steps taken to prevent their degradation (25 *Pa. Code* 93.4c). The lower section of Beaver Run just across the Delaware State line in New Castle County is a designated trout stream and is stocked with trout by the Delaware Department of Natural Resources and Environmental Control.

The "south branch" of Beaver Run (UNT 00006) also appears on Delaware's 2010 Clean Water Act Section 303(d) list of non-attaining streams as a result of biological and habitat stressors. Our 2013 macroinvertebrate sampling, reported here, confirmed the non-attaining status of some of the onsite streams using the Department's 2009 Index of Biotic Integrity. The Department should update its information on non-attainment status of Beaver Valley streams and prepare Total Maximum Daily Load allocations for streams that warrant such in order to maintain and improve their current water quality. Particular attention should be given to temperature effects from the numerous stormwater detention basins proposed to receive runoff from new impervious surfaces.

Widespread development in recent decades has led to impairment in many streams throughout the Brandywine Creek watershed. The Department needs to exercise particular vigilance here to prevent degradation of the streams of Beaver Valley. To that end we attach a copy of our recent report that provides the field and laboratory data from 2013 stream sampling in the context of available environmental information.

Kindly keep us informed of progress toward completing attained use determinations for the streams now at risk from proposed development in Beaver Valley.

Yours truly,



James A. Schmid, Ph. D.
President

Enclosure

cc: Beaver Valley Conservancy

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