

DEP Stream Code: 01986 PA FISH AND BOAT COMMISSION
COMMENTS AND RECOMMENDATIONS
February 16, 2012

Willow Creek

WATER: Willow Creek
Section 04; Section 03 (partial)
Lat/Lon 402537/755627

Berks County

EXAMINED: October 13 and 14, 2004

BY: Kaufmann and Chikotas

Bureau Director Action: _____ Date: _____

Division Chief Action: _____ Date: _____

WW Unit Leader Action: _____ Date: _____

CW Unit Leader Action: _____ Date: _____

=====
AREA COMMENTS:

Willow Creek is a 14.9 km (9.26 mi) long stream located in sub-subbasin 3B, Berks County. Section 04 is characterized as a limestone stream that extends from the mouth upstream for 1.5 km (0.97 mi.) to a spring located in the stream channel's substrate. The survey was conducted to re-inventory the stream's wild brook trout population, the biomass of which was classified in 1992 as being a low Class C (10.21 kg/ha) with an estimated abundance of 37 legal length (178 in.) trout per kilometer. No trout were present in 1981!

In 2004, Section 04 of Willow Creek supported a Class A wild brook trout population biomass estimated in excess of 58 kg/ha. This biomass exceeded the Class A minimum of 30 kg/ha by nearly two fold and was substantially higher than the 1992 estimate. The number of legal length brook trout that also exceeded 229 mm (9 in) was estimated to be 180 fish/km (288 fish/mile). In addition, an estimate of 60 trout per kilometer longer than 305 mm (12 in) indicated the exceptional quality of the brook trout population in 2004, ranking it among the best wild brook trout populations ever recorded in Pennsylvania.

AREA RECOMMENDATION:

1. The PFBC should continue to manage the wild brook trout population in Willow Creek under conventional statewide angling regulations. Other regulations would attract angling pressure that possibly could not be accommodated by the present parking and probable landowner sensitivities. Parking availability may improve as development progresses nearby. Alternative, more conservative, regulations should be discussed with riparian landowners in order to learn of their desires and concerns.

2. The PFBC should investigate the potential to remove the Reading Area Water Authority Dam located on Willow Creek upstream from its confluence with Maiden Creek to improve habitat for trout and open more of the stream up to American eel migration.
3. The PFBC should investigate Section 03 of Willow Creek for its potential to be managed with catchable trout in the statewide trout-stocking program since much of the riparian land is in public ownership.
4. The Department of Environmental Protection should upgrade Willow Creek's Chapter 93 Water Quality Standards from Cold Water Fishes (CWF) to High Quality Coldwater Fishes (HQ-CWF) based on the presence of an exceptional Class A wild brook trout population in the 1.5 km of stream extending upstream from the mouth. The CWF designation for Willow Creek basin upstream of Section 04's upper limit is appropriate based on the presence of wild brook trout at least seasonally in Section 03.
5. The Department of Environmental Protection should closely monitor the Maiden Creek Authority STP's discharge and its impact on aquatic macroinvertebrates due to the exceptional wild brook trout population located downstream.
6. The Department of Environmental Protection should carefully evaluate requests for NPDES permit temperature variances in order to protect the stream's temperature sensitive wild brook trout population.
7. In its evaluation of proposals for residential and commercial development in this drainage basin, the Department of Environmental Protection should require storm water management techniques that will minimize or prevent water temperature increases in Willow Creek due to runoff from development.
8. The Delaware River Basin Commission should take appropriate actions in its surface and groundwater withdrawal permitting process to protect existing spring flow to Willow Creek. The exceptional wild brook trout population is directly dependent upon maintenance of the existing flows. Previous permits have been issued to Fleetwood Borough and Muhlenburg Township Authority for withdrawals from this drainage basin.
9. The Berks County Conservation District should continue to closely evaluate and monitor the implementation of erosion and sedimentation control plans at construction sites in the Willow Creek basin.
10. If they have not done so already, Ontelaunee and Maiden Creek Townships should consider implementing zoning ordinances that will contribute to the protection of Willow Creek and its exceptional Class A wild brook trout population from water quality degradation,

DEP Stream Code: 01986 Stream Code: 01986 Willow Creek
Special habitat degradation (erosion, sedimentation, silt
damage), diminished flow, and increases in water temperature.

11. Organizations interested in improving conditions for wild trout should consider stream bank tree and shrub planting in unshaded segments of Section 03. Root systems will also help to stabilize stream banks.

Greene, T. PFBC, Coldwater Unit Leader

Arway, J. PFBC Chief, Environmental Services

Young, L. PFBC Environmental Services

Bridi, J. PFBC, Southeast Regional Law Enforcement Manager

Carney, S. PFBC

Schott, B. DEP

Embeck, M. DEP

Barron, T. DEP

Frey, B. DEP

Collier, C, Delaware River Basin Commission
carol.collier@drbc.state.nj.us

Ravert, J. Berks County Conservation District
jravert@countyofberks.com

Ontelaunee Township Supervisors
P.O. Box 746
Leesport, PA 19533

Maiden Creek Township Supervisors
Quarry Road
P.O. Box 319
Blandon, PA 19510

Burkert, E. Maiden Creek Township Water Authority
STP Manager
Box 289
Blandon, PA 19510

Muhlenberg Township Authority
muhltwpauth@comcast.net

Mr. Kermit Goda (Landowner)
142 Willow Creek Road
Reading, PA 19605

Ron Schmehl (Landowner)
5745 Leesport Ave
Reading, PA 19605

**Pennsylvania Fish & Boat Commission
Bureau of Fisheries
Fisheries Management Division**

Willow Creek (603B)
Section 04; Section 03 (partial)
Management Report

Prepared by:
B.A. Chikotas and M.L. Kaufmann

Fisheries Management Database Name: Willow Ck.
Lat/Lon: 40253755627

Date Sampled: October 13 and 14 Date Prepared: October 2004

Introduction

Willow Creek is a 14.9 km (9.26 mi.) long tributary to Maiden Creek located in sub-subbasin 3B, Berks County. The Pennsylvania Fish and Boat Commission (PFBC) currently manages Willow Creek as four separate sections, but this report is concerned with Section 04 and the results from electrofishing in Section 03 following the survey of Section 04. Section 04 of Willow Creek was surveyed to re-inventory the wild brook trout population, which in 1992 was classified as having a low Class C biomass (10.21 kg/ha) and an estimated abundance of 37 legal length trout per kilometer. No trout were present in 1981. Further electrofishing was conducted at three locations in Section 03 to determine if wild trout were present upstream of the stream bottom upwelling spring that marked Section 04's upper limit.

Section 04 extends from a point 375 meters upstream from the T-707 Bridge downstream to the mouth and supports a wild trout fishery managed by the PFBC for natural yield with conventional, statewide angling regulations. Those regulations include a 7-inch minimum size limit (MSL) and five fish daily creel limit from the opening day of the regular trout season in April through Labor Day. Wnuk and Kaufmann (1992) presented historical information and results from surveys conducted in 1992 and 1981 on Willow Creek. Physical and social information for Section 04 are presented in Table 1.

Section 03 extends for a distance 4.3 km from an unnamed tributary located 914 m upstream from SR73 downstream to a point 375 m upstream from the T-707 Bridge, Willow Creek Road. Prior to 2004 this section was believed to support only a warm water fish community.

The entire Willow Creek basin is classified as Coldwater Fishes (CWF) in the Pennsylvania Department of Environmental Protection's (DEP) Chapter 93 Water Quality Standards. The CWF designation requires that permitted discharges to the stream meet water quality criteria designed to protect a reproducing trout population. There are four permitted discharges to Willow Creek. They include the Fleetwood Borough Authority Sewage Treatment Plant (STP), the Giorgio Foods wastewater treatment plant, the Excelsior Brass Works discharge, and the Maiden Creek Township Authority Sewage Treatment Plant (STP). All four permitted discharges enter the stream upstream from Section 04. In addition, storm water runoff from the development of Willow Glen, a 272-unit housing development located along and north of T-707 (Willow Creek Road), enters directly into Willow Creek at three different locations within the section.

Fleetwood uses Willow Creek's headwaters as a potable water source. A pass-by flow is required by the Delaware River Basin Commission (DRBC) to provide continuous flow. Nevertheless the stream is subject to sinking and resurfacing during droughts at locations between Fleetwood and the vicinity of SR222, the location of the Giorgio Foods discharge, or the Maiden Creek Township Authority Sewage Treatment Plant, a maximum 1.0 mgd facility located 2.4 km downstream from SR222. During droughts the Maiden Creek Township Authority STP has been the sole source of flow in the portion of Willow Creek between the discharge and the first spring downstream.

Methods

One historic site, Station 0401, was sampled in Section 04 on October 13 and 14, 2004 (Table 2 and Figure 1). This site was also sampled in 1992 and in 1981, with the 1981 sampling having occurred just prior to operation of the then newly constructed Maiden Creek Township Authority STP.

Standard PFBC stream survey techniques described by Marcinko et al (1986) were used to measure physical, chemical, and biological parameters at Station 0401 (Tables 3-6). Aquatic macroinvertebrates were collected with a kick screen and by hand gleaning rocks. Aquatic macroinvertebrates were generally identified to the familial level. Unidentified aquatic macroinvertebrates were preserved in isopropyl alcohol for later identification. Pollution tolerance index values were assigned to invertebrates according to a combination of those developed by or through Illinois EPA (1989); EA Mid-Atlantic Regional Operations Engineering, Science and Technology, Inc. (1990); Klemm et al. (1990); RMC Environmental Services, Inc. (1991); and field experience of examiners. Fish were sampled with a towed boat electrofishing unit. The towboat electrofishing unit was equipped with a 250-volt straight D.C. T&J generator set at

225 volts of direct current. Two individuals worked the stream with one person towing the boat while the other electrofished. Fish species other than trout were assigned a subjective abundance index based on the number of individuals counted in 300 meters of electrofished stream. The brook trout population was quantified with a Chapman modified Petersen population estimate (Ricker 1975).

Fish were sampled at the three stations in Section 03 on October 26 and November 1, 2004 (Table 2 and Figures 1 and 2). Sampling was conducted with a backpack electrofishing unit, which consisted of a TAS generator and a Coffelt BP-1C variable voltage electrofisher set at alternating current voltages (VAC) ranging from 50 to 75 volts. Fish species occurrence was determined at each of the three stations and is presented in (Table 7).

Results and Discussion

Section 04 of Willow Creek supported a Class A wild brook trout population biomass estimated in excess of 58 kg/ha in 2004. This estimate was more than five times higher than the 1992 Class C biomass of 10.21 kg/ha. No trout were present in 1981. Brook trout ranged from between 100 and 374 mm in total lengths with the majority of the catch comprised of fish exceeding the seven-inch MSL. A high number of brook trout greater than 300 mm (11.8 in.) and some individuals exceeding 350 mm (13.8 in.) were present. The estimated number of legal length trout (7.0 in) was 180 fish/km (288 fish/mile) and the number greater than 300 mm was 60 fish/km (96 fish/mile).

Comparing brook trout biomass estimates from 1992 and 2004 revealed that the population had expanded from a low Class C to a high Class A biomass. This increase occurred while the stream was being managed under the conventional statewide regulations consisting of a 7-inch MSL, 8 fish daily creel limit from 1992 to 1999, and a 7-inch MSL and 5 fish daily creel limit from 2000 to the present. The estimated abundance of legal length trout increased from 37 fish/km in 1992 to 180 fish/km in 2004. Noteworthy was the substantial increase in the number of trout exceeding 300 mm in total length from none in 1992 to 60 fish/km in 2004.

The increase in the number of brook trout strongly suggested that conditions related to bottom substrate quality had improved considerably since the 1981 survey. In 1981 the Maiden Creek Authority STP's construction was nearly complete at the time of the survey. As part of the construction a few hundred meters of Willow Creek upstream from the plant had been relocated into a permanent man-made channel, complete with habitat improvement devices, in order to make room for a wastewater transmission line. Undoubtedly, the construction and channel relocation had

stream substrate turbidity initially and prevented sedimentation problems downstream for a period of years after construction. This degradation of the stream had likely prevented much successful brook trout reproduction from occurring and may have reduced the population to a remnant that likely survived in the adjacent springs, as no brook trout were collected at Station 0401 in 1981. Brook trout had been present in Willow Creek downstream from the limestone springs prior to 1981 (Biello, 1957).

Pennsylvania Fish and Boat Commission surveys from 1981 to 2004 documented a positive change in substrate composition as it pertained to suitability for brook trout reproduction. Substrate composition at Station 0401 in 1981 was primarily silt and sand, with gravel being present in higher velocity areas. In 1992 substrate composition was recorded as being rubble, gravel, and sand, with silt along the stream margins. In 2004 the substrate was rubble, gravel and sand, with little or no silt being present. This gradual reduction in the amount of silt from 1981 to 1992 and from 1992 to 2004 corresponded with the increase in the abundance of brook trout over the twenty-three year period. Willow Creek's low gradient and susceptibility to low flow likely prevented the silt load from being flushed through the section at a quicker rate.

Slimy sculpins apparently also benefited from reduced sediments in the stream's substrate. No slimy sculpins were found in 1981, but they were common to abundant in 1992 and 2004, respectively.

Aquatic macroinvertebrate diversity in 2004 indicated that water quality had improved since 1992. The improvement was probably associated with better wastewater treatment by the Maiden Creek Township Authority STP and/or the correction of its apparently chronic chlorine discharge problem noted by DEP in 1999 (Embeck, 1999). This corrective measure followed the discovery of poor macroinvertebrate diversity by the PFBC survey team downstream from the sewage treatment plant in 1992. At that time the aquatic macroinvertebrate community was comprised of only four pollution tolerant families, an indication of a substantial pollution problem.

The presence of a less diverse aquatic macroinvertebrate community in 2004 than in 1981, and the later disappearance of some transitional and warmwater fish species that were found in 1981, suggested that other changes in addition to Willow Creek's sedimentation problem may have occurred from 1981 to 2004. Although the three point in time PFBC water temperature records gave no indication of any change in the stream's temperature regime the increase in stream alkalinity combined with composition differences in the fish and aquatic macroinvertebrate communities between 1981 and 2004 reflected the fact that relative flows and, therefore, influences on water

stability from 1986 springs, the Maiden Creek Authority STP and Section 03 had changed over the 23-year period. The absence of warmwater fish species (banded killifish, and redbreast sunfish) and one transitional species (marginated madtom) indicated that the fish community consisted of fewer warmwater and transitional species in 2004 than in 1992 and 1981. Their presence in 1981 could have been transient, however, due to movement associated with low flow and habitat losses upstream from Section 04 during the 1981 drought. The greater diversity in aquatic macroinvertebrates since the 1992 low in diversity, however, was likely due to improved sewage treatment, but the poorer diversity in 2004 in comparison to 1981 was probably at least in part due to the absence of nearby STP discharge in 1981. Nevertheless, the improvement in Willow Creek's bottom substrate; the continued positive influence from presently reliable limestone springs, and limited negative impacts on stream biota from permitted discharges have resulted in the development of an exceptional Class A wild brook trout population. This brook trout population is comprised of enough legal length and larger individuals for the population to be considered among the best ever recorded in Pennsylvania.

Electrofishing at the three stations in Section 03, historically considered to be a transitional reach with a strong bias toward warm conditions, revealed a fairly diverse fish community comprised of coldwater, transitional, and warm water species. The presence of wild trout at all three stations indicated that Willow Creek Section 03 habitat was suitable for coldwater fish from fall through spring. The coldwater fish (trout) originated from Section 04 and from the unnamed tributary that formed the section's upper limit. The presence of at least nine warm water fish species indicated that seasonally elevated stream temperatures limited further expansion of the wild trout populations in Section 03. Additionally, the stream had a history of sinking in this reach during drought conditions and was completely dry in the vicinity of SR73 and immediately upstream from the Maiden Creek Authority STP discharge as recently as 2002, producing a substantial fish kill. The abundance of fish found in this reach in 2004 provided strong evidence that the stream's fish community had rapidly recovered from dewatered conditions, although fish density suggested that the community has not completely recovered by 2004.

- Biello, R.J. 1957. Willow Creek Stream Survey Work Sheet Report. PFBC files, Revere, PA
- EA Mid-Atlantic Regional Operations Engineering, Science, and Technology, Inc. 1990. Freshwater macroinvertebrate species list including tolerance values and functional feeding group designations for use in rapid bioassessment protocols. Prepared for the US EPA, Washington, DC.
- Embeck, M.S. 1999. Aquatic Biological Investigation Willow Creek (Maiden Creek Municipal Authority WWTP) Ontelaunee Township, Berks County. PA. Department of Environmental Protection. Stream Code: 01986 Stream File 1.15.6. PFBC Files, Revere PA.
- Illinois EPA. 1989. Biological stream characterization: a biological assessment of Illinois stream quality. Special Report # 13, Illinois State Water Plan Task Force, Division of Water Pollution Control. Springfield, IL.
- Klemm, D.J., P.A. Lewis, F. Fulk, and J.M. Lazorchak. 1990. Macroinvertebrate field and laboratory methods for evaluating the biological integrity of surface waters. US EPA, Cincinnati, OH.
- Marcinko, M., R. Lorson and R. Hoopes. 1986 Procedures for stream and river inventory information input. PFBC publication, Bellefonte, PA.
- RMC Environmental Services, Inc. 1991. Post-diversion aquatic biology assessment for 1990. Prepared for the Philadelphia Electric Company, Philadelphia, PA.
- Wnuk, R., and M. Kaufmann 1992. Willow Creek Fisheries Management Report. PFBC files, Bellefonte, PA.

1. The PFBC should continue to manage the wild brook trout population in Willow Creek under conventional statewide angling regulations. Other regulations would attract angling pressure that possibly could not be accommodated by the present parking and probable landowner sensitivities. Parking availability may improve as development progresses nearby. Alternative, more conservative, regulations should be discussed with riparian landowners in order to learn of their desires and concerns.
2. The PFBC should investigate the potential to remove the Reading Area Water Authority Dam located on Willow Creek upstream from its confluence with Maiden Creek to improve habitat for trout and open more of the stream up to American eel migration.
3. The PFBC should investigate Section 03 of Willow Creek for its potential to be managed with catchable trout in the statewide trout-stocking program since much of the riparian land is in public ownership.
4. The Department of Environmental Protection should upgrade Willow Creek's Chapter 93 Water Quality Standards from Cold Water Fishes (CWF) to High Quality Coldwater Fishes (HQ-CWF) based on the presence of an exceptional Class A wild brook trout population in the 1.5 km of stream extending upstream from the mouth. The CWF designation for Willow Creek basin upstream of Section 04's upper limit is appropriate based on the presence of wild brook trout at least seasonally in Section 03.
5. The Department of Environmental Protection should closely monitor the Maiden Creek Authority STP's discharge and its impact on aquatic macroinvertebrates due to the exceptional wild brook trout population located downstream.
6. The Department of Environmental Protection should carefully evaluate requests for NPDES permit temperature variances in order to protect the stream's temperature sensitive wild brook trout population.
7. In its evaluation of proposals for residential and commercial development in this drainage basin, the Department of Environmental Protection should require storm water management techniques that will minimize or prevent water temperature increases in Willow Creek due to runoff from development.
8. The Delaware River Basin Commission should take appropriate actions in its surface and groundwater withdrawal permitting

protect existing spring flow to Willow Creek. The exceptional wild brook trout population is directly dependent upon maintenance of the existing flows. Previous permits have been issued to Fleetwood Borough and Muhlenburg Township Authority for withdrawals from this drainage basin.

9. The Berks County Conservation District should continue to closely evaluate and monitor the implementation of erosion and sedimentation control plans at construction sites in the Willow Creek basin.
10. If they have not done so already, Ontelaunee and Maiden Creek Townships should consider implementing zoning ordinances that will contribute to the protection of Willow Creek and its exceptional Class A wild brook trout population from water quality degradation, physical habitat degradation (erosion, sedimentation, storm water damage), diminished flow, and increases in water temperature.
11. Organizations interested in improving conditions for wild trout should consider stream bank tree and shrub planting in unshaded segments of Section 03. Root systems will also help to stabilize stream banks.

DEP Stream Code: 01986 and social characteristics for Section Willow Creek
 Willow Creek (603B) Berks.

Characteristic	Section 04
USGS Quadrangle	Temple (O38)
Section Limits: From a point 375 meters upstream from the T-707 Bridge downstream to the mouth.	
Total length (km)	1.5
Mean width (m)	6.92
Area (ha)	1.04
Gradient (m/km)	5.4
DEP Classification	CWF
Ownership (Assessed 2004)	
% Public (closed)	10
% Private (open)	90
Road Access:	
% Within 100 m	94
% Within 300 m	100
% Within 500 m	100
Human population density 2000 census (#people/km ²)	55

* = Cold Water Fishes

DEP Stream Code: 01986
 Table 2. Station location, length electrofished, average width and river mile surveyed October 13, 14, 26, and November 1, 2004. Willow Creek

Station	Downstream limit description	Length (m)	Ave. Width (m)	RM
0301	46 meters upstream SR73 Bridge	497	5.2	3.18
0302	Maiden Ck. Township Authority STP discharge pipe	388	6.3	1.13
0303	245 meters downstream Maiden Ck. Township STP discharge pipe	245	6.6	0.98
0401	37 meters upstream SR1004 Bridge	334	9.8	0.43

Table 3. Comparison of physicochemical parameters measured at Station 0401 of Willow Creek (603B) Berks County in October 2004, August 1992, and September 1981.

Parameter	Station 0401		
	10/13/04	8/13/92	9/1/81
Date	10/13/04	8/13/92	9/1/81
Time (24 hour)	1134	1100	0958
Air temperature (°C)	15.0	26	22.0
Water temperature (°C)	11.0	14.0	11.5
pH (standard units)	8.0	7.9	7.8
Specific conductance (umhos)	340	474	274
Total alkalinity (mg/l)	194	148	128
Total hardness (mg/l)	242	188	171

Table 4. Comparison of aquatic macroinvertebrate taxa collected at Station 0401 of Willow Creek (603B) Berks County in October 2004, August 1992, and September 1981.

Taxon	2004	1992	1981	PTI
Ephemeroptera				
Baetidae	X		X	7
Ephemerellidae			X	2
Tricorythidae			*	5
Coleoptera				
Elmidae			X	8
Hydrophilidae			X	8
Trichoptera				
Hydropsychidae	X		X	4-8
Hydroptilidae			X	8
Philopotamidae	X			6
Psychomyiidae			X	2
Diptera				
Chironomidae			X	0-10
Other Chironomids	X			0-10
Empididae			X	6
Simuliidae			X	1-10
Tipulidae	X		X	4
Hemiptera				
Corixidae			X	NA
Gerridae	X		X	NA
Veliidae	X			NA
Decapoda				
Cambaridae	X		X	6
Amphipoda				
Gammaridae	*	X	*	2-8
Isopoda				
Asellidae	X		X	8
Hydracarina			X	NA
Tricladida				
Planariidae	X	X	X	10
Class Oligochaeta				10
Opisthopora			X	10
Plesiopora		X	X	10
Class Hirudinea		X	X	10
Total taxa	11	4	22	

X = Present at Station; * = Abundant at Station.

PTI = Pollution Tolerance Index. PTI ranges from 0 (very intolerant of pollution) to 10 (very tolerant of pollution). NA = not available.

DEP Stream Code: 01986

Willow Creek

Table 5. Comparison of fish species occurrence for Station 0401 of Willow Creek (603B), Berks County, surveyed October 2004, August 1992, and September 1981.

Scientific name	Common name	2004	1992*	1981*
<i>Salvelinus fontinalis</i>	Brook trout	A	C	
<i>Rhinichthys atratulus</i>	Blacknose dace	P	R	X
<i>Rhinichthys cataractae</i>	Longnose dace	A	P	X
<i>Semotilus atromaculatus</i>	Creek chub	P		X
<i>Catostomus commersoni</i>	White sucker	C	C	X
<i>Noturus insignis</i>	Margined madtom			X
<i>Anguilla rostrata</i>	American eel		P	X
<i>Fundulus diaphanus</i>	Banded killifish		P	X
<i>Lepomis auritus</i>	Red breast sunfish			X
<i>Lepomis cyanellus</i>	Green sunfish		P	
<i>Etheostoma olmstedi</i>	Tessellated darter			X
<i>Cottus cognatus</i>	Slimy sculpin	A	C	
Total species		6	8	9

Subjective Abundance Index (based on a 300 m long station)

- A = Abundant (> 100)
 C = Common (26 - 100)
 P = Present (3 - 25)
 R = Rare (< 3)
 X = Present (not enumerated)

* = Historically Station 0302 same as 2004 Station 0401

Table 6. Time series abundance data from WILLOW CK at site rivermile 0.43 with Site Latitude 402538 Longitude 755600. This site is currently located within Section Number 4 within sub-subbasin 03B. Species selected: brook trout

SizeGroup (mm)	Kg/Ha 10/13/04	Num/Km 10/13/04	Num/Mi 10/13/04	Kg/Ha 08/13/92	Num/Km 08/13/92	Num/Mi 08/13/92
75				0.65	50	80
100	0.98	60	96	2.29	126	202
125	7.79	293	469			
150	1.59	39	62	0.16	3	5
175				0.94	9	14
200				0.98	6	10
225	2.78	18	29	3.31	16	26
250	8.37	42	67	1.88	6	10
275	15.52	60	96			
300	15.89	48	77			
325	3.64	9	14			
350	1.56	3	5			
Totals:	58.12	572	915	10.21	216	347

Table 7. Comparison of fish species occurrence for Stations 0202, 0302, and 0303 of Willow Creek (603B) Berks County, surveyed in October and November 2004.

Scientific name	Common name	0202	0302	0303
<i>Salvelinus fontinalis</i>	Brook trout	X	X	X
<i>Salmo trutta</i>	Brown trout			X
<i>Notemigonus crysoleucas</i>	Golden shiner		X	
<i>Luxilus cornutus</i>	Common shiner		X	
<i>Notropis hudsonius</i>	Spottail shiner	X		
<i>Pimephales notatus</i>	Bluntnose minnow		X	X
<i>Pimephales promelas</i>	Fathead minnow	X	X	X
<i>Rhinichthys atratulus</i>	Blacknose dace	X	X	X
<i>Rhinichthys cataractae</i>	Longnose dace	X	X	X
<i>Semotilus atromaculatus</i>	Creek chub	X	X	X
<i>Catostomus commersoni</i>	White sucker	X	X	X
<i>Ameiurus nebulosus</i>	Brown bullhead		X	
<i>Fundulus diaphanus</i>	Banded killifish	X	X	X
<i>Lepomis auritus</i>	Red breast sunfish	X	X	
<i>Lepomis cyanellus</i>	Green sunfish	X		X
<i>Lepomis gibbosus</i>	Pumpkinseed sunfish	X		
<i>Etheostoma olmstedi</i>	Tessellated darter	X	X	X
<i>Cottus cognatus</i>	Slimy sculpin			X
Total species		12	13	12

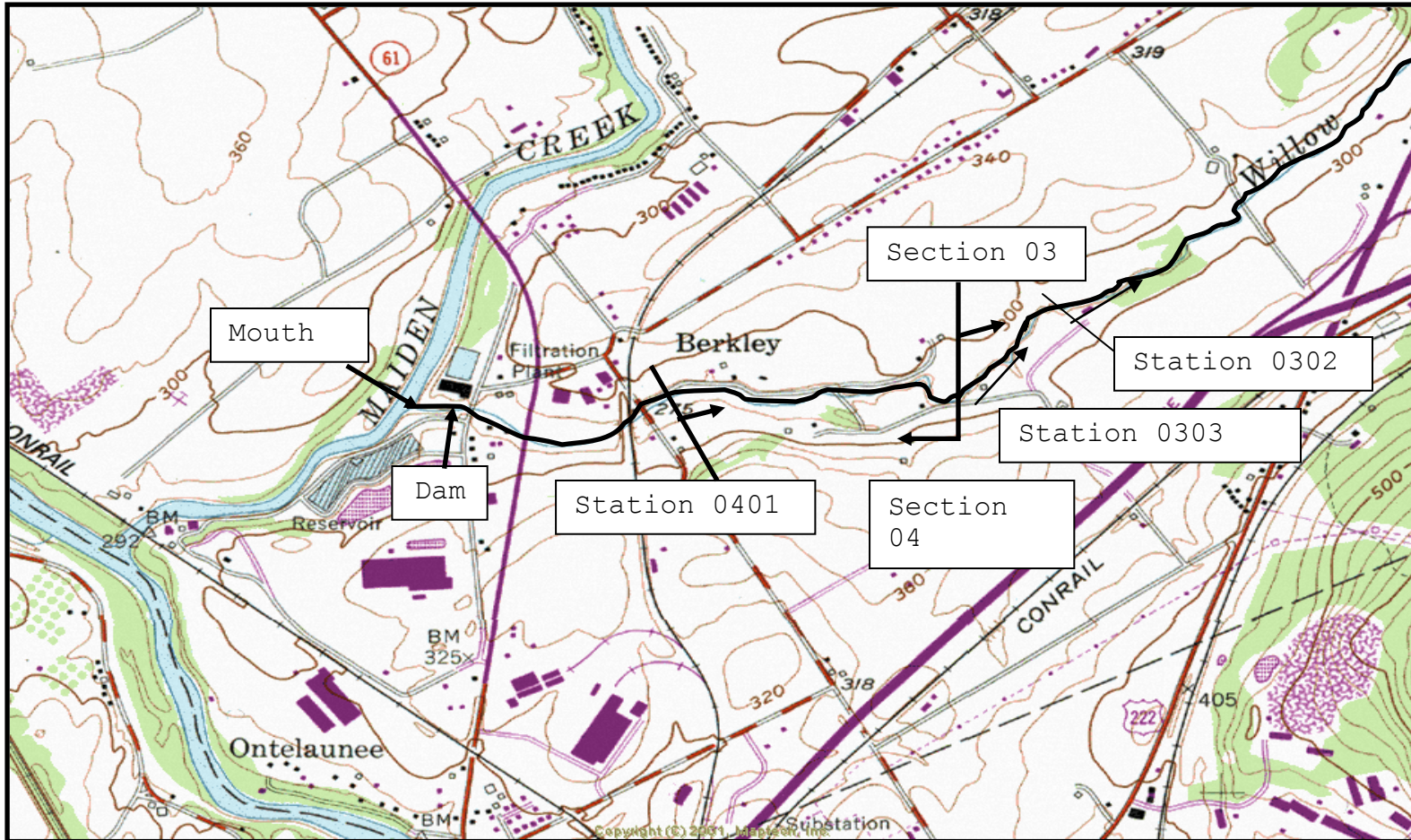


Figure 1. Map location for Willow Creek (603B) Section 04 in Berks County.

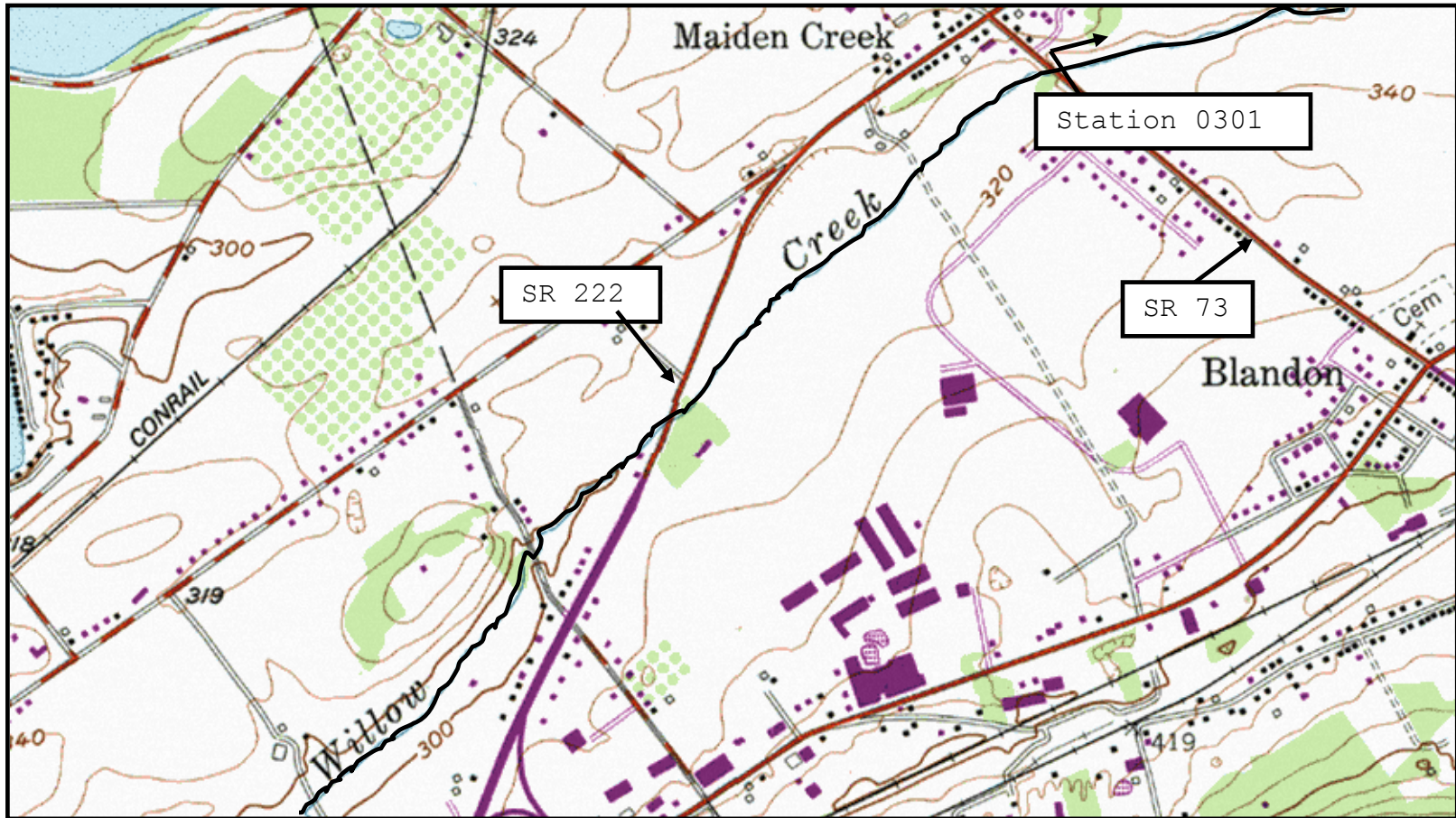


Figure 2. Map location for Willow Creek (603B) Section 03 in Berks County.