Maidencreek Township, Berks County
POLLUTANT REDUCTION PLAN (PRP)
Willow Creek MS4

Prepared for

MAIDENCREEK TOWNSHIP
BOARD OF SUPERVISORS

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Blandon, PA 19510
Maidencreek Township, Berks County, PA

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SYSTEMS DESIGN ENGINEERING, INC
"A Passion for Engineering Excellence"
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1.0 Introduction

This MS4 Pollutant Reduction Plan (PRP) has been prepared by Systems Design Engineering, Inc. (SDE), for Maidencreek Township, Berks County, Pennsylvania (the Township), as part of the Township's obligations under its NPDES PAG-13 MS4 permit (Permit Number PAG-13-3521). Maidencreek Township has been operating under a permit since 2003.

The pollutant of concern in this PRP is "nutrients." A portion of the Township's MS4 discharges to a segment of Willow Creek that is impaired for nutrients, reportedly originating from an "industrial point source."

This plan will discuss implementation of best management practice (BMP) pollutant control measures within the storm sewersheds tributary to the impaired stream, with the intention of demonstrating a reduction in applicable pollutant loads as calculated using accepted methodologies.

2.0 Watershed/MS4 Characteristics

The MS4 area within Maidencreek Township is defined by the "Reading" Urbanized Area (UA) from the 2010 U.S. Census (see Figure 1). The UA is comprised mainly of residential developments, with some commercial development along the U.S. Route 222 and Park Road corridors, and more industry west of PA Route 73. No portion of Maidencreek Township is within the Chesapeake Bay watershed.

Maidencreek Township has two (2) impaired surface waters that need special plans, as they relate to regulated stormwater discharges: Lake Ontelaunee, which has a TMDL for nutrients and suspended sediment, and Willow Creek, a portion of which has an impairment for nutrients, as listed in the 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report [303(d) List]. There are other reaches of Willow Creek and its unnamed tributaries that have various impairments according to the Integrated Report, but they do not currently pertain to regulated stormwater discharges.

Figure 2 depicts Maidencreek Township and its UA, as well as the impaired surface waters pertaining to regulated stormwater discharges (red segments of Willow Creek needing a PRP and yellow Lake Ontelaunee needing a TMDL Plan). Note that only the downstream segment of Willow Creek is affected by the MS4, because the UA does not include the upper tributary to Willow Creek. The downstream segment is approximately 0.5 mile in length.

Maidencreek Township's MS4 has 56 regulated outfalls and seven (7) observation points. Three (3) outfalls discharge to Lake Ontelaunee and the remainder to Willow Creek and its unnamed tributaries.

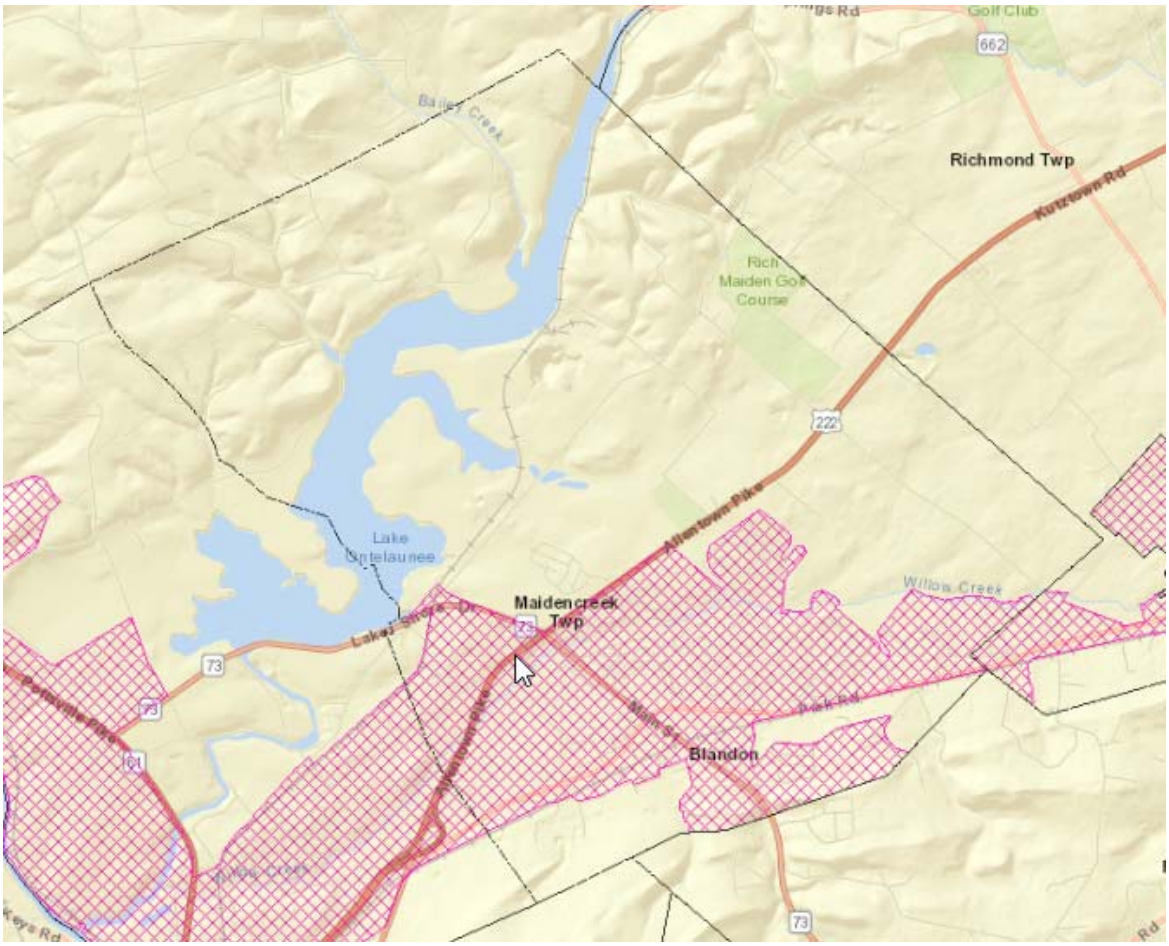


Figure 1. Maidencreek Township Urbanized Area (*from PA DEP's eMapPA online tool at http://www.depgis.state.pa.us/emappa/)*

2.1 303(d) Nutrient Listing Discussion

The 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report lists the specific impairment to the portion of Willow Creek in question is listed as *"Industrial Point Source – Nutrients."* The Assessment ID is 2327. The only nearby potential nutrient-yielding industrial point source a private corporation's wastewater treatment facility that discharges to the Willow Creek, over one-half mile *downstream* of the stream segment identified as having the industrial point source. It is unclear to what source the "industrial point source" is attributed for the stream segment identified, as the vast majority of the storm sewersheds tributary to the segment are comprised primarily of residential properties.

3.0 PRP Calculations

The pollutant of concern in this PRP is "nutrients." Nutrients typically refer to total nitrogen and total phosphorus. However, for non-Chesapeake Bay PRPs, "nutrients" refers to total phosphorus (TP). The goal of this PRP is therefore to reduce TP by five percent (5%) through BMP implementation. It can be presumed that a sediment reduction of at least 10 percent will accomplish the 5% TP reduction.

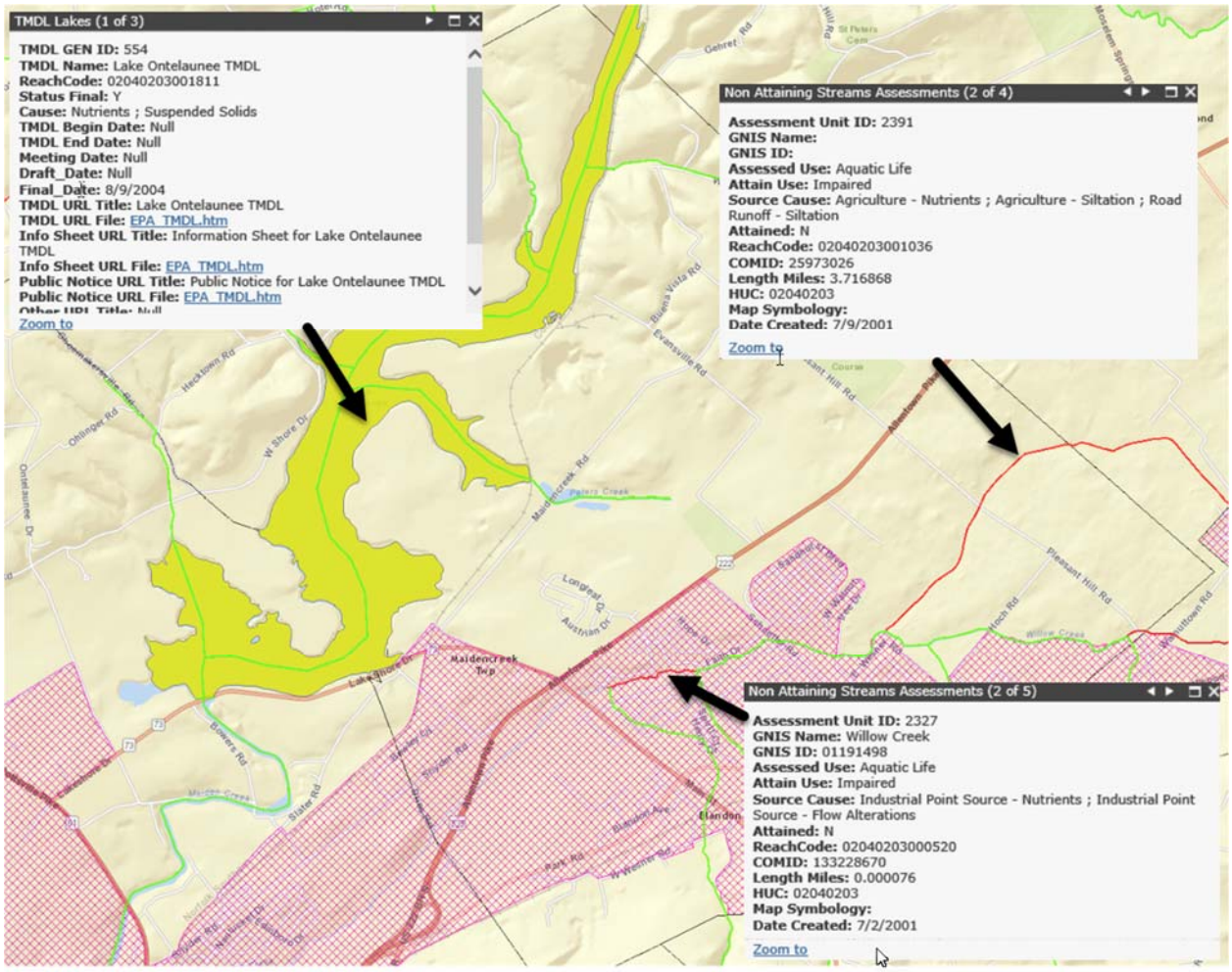


Figure 2. Maidencreek Township Impaired Surface Waters Pertaining to Stormwater Discharges (*from PA DEP's eMapPA online tool at http://www.depgis.state.pa.us/emappa/)*

3.1 Methodology

This PRP will establish existing pollutant loadings for TP. DEP's simplified method has been selected for the majority of the computations. According to Attachment B PA DEP's Pollutant Reduction Plan (PRP) Instructions (3800-PM-BCW0100k, rev. 3/20/17) in Appendix B, Berks County's loading rates for TP are 2.26 lbs/acre/yr and 0.98 lbs/acre/yr for impervious developed and pervious developed areas, respectively. For undeveloped areas outside of the UA, a loading rate of 0.33 lbs/acre/yr is to be used for TP. Loading rates derived from the Lake Ontelaunee TMDL document are used for two (2) specific storm sewersheds (O-015 and Willow Creek Riparian Buffer Area), where pervious areas needed to be evaluated for the actual existing and proposed covers (i.e., a more detailed analysis is needed than just a "pervious" classification, as is done in the simplified method).

In order to apply the existing pollutant loading rates throughout the MS4, storm sewersheds were delineated for the 56 outfalls and seven (7) observation points tributary to Willow Creek. Each storm sewershed was then divided into portions that are developed impervious and developed pervious, as well as undeveloped areas outside the UA. This data was entered into a spreadsheet which calculates total loading for each storm sewershed, as well as total gross loading overall. Again, storm sewersheds

O-015 and Willow Creek Riparian Buffer Area are the exceptions wherein actual agricultural, pasture/meadow and forest loading rates were used for existing and proposed conditions evaluations.

Several of the storm sewersheds also have existing BMPs (for example, dry extended detention basins, vegetated swales, forest buffers). Areas tributary to these BMPs are further evaluated for pollutant reductions and the cumulative result of these reductions is applied to the gross loading to determine a net loading that is used as the baseline for the required reduction. Refer to Appendix A for the spreadsheet tables utilized to compute existing and proposed loading.

3.2 Gross TP Loading

Gross TP loading is computed for each of the storm sewersheds using the methodology discussed above. Loading rates for each outfall's individual storm sewershed are then summed to arrive at the total gross loading. Gross loading does not take into account any existing BMPs within the storm sewersheds. Total gross TP loading for the storm sewersheds tributary to Willow Creek's nutrient-impaired segment is 1,905 pounds per year. Refer to Table 1 in Appendix A.

3.3 Net TP Loading

Net TP loading is computed by taking the gross TP loading values for each outfall's storm sewershed and applying reductions as appropriate for existing BMPs with the storm sewersheds. Not all storm sewersheds have existing BMPs, and some of the existing BMPs are ineligible to be counted for reductions to loading. Existing BMPs eligible for use in this PRP include Dry Extended Detention Basins, Forest Buffers, and Vegetated Open Channels. Each of these have specific effectiveness values, as provided in DEP's BMP Effectiveness Values table (3800-PM-BCW0100m, 5/2016), Appendix B.

Storm sewersheds are subdivided into areas that are tributary to the particular BMP for reduction, and areas that by-pass the BMP. Reductions, if available, are summed for each storm sewershed and are subtracted from gross TP loadings, to arrive at net TP loading for each storm sewershed. Individual net storm sewershed loadings are then summed to arrive at total net TP loading. Total net TP loading for the storm sewersheds tributary to Willow Creek's nutrient-impaired segment is 1,678 pounds per year. This is the baseline value to which the required five percent (5%) TP reduction is applied.

3.4 TP Reductions and BMP Effectiveness

With a net TP loading of 1,678 pounds per year, the required TP reduction at five percent (5%) is about 84 pounds. Proposed BMPs must be implemented over the five-year permit duration to achieve this minimum reduction. Proposed BMPs are described below (refer also to Tables 3 and 4 in Appendix A).

3.4.1 "CONVERT" – Ag Field Retirement/Conversion to Meadow

Storm sewershed 0-015 contains a farm field that has been purchased by Maidencreek Township for development of a community well. This farm field will be retired and left to return to meadow, with no chemical applications, due to wellhead protection requirements.

This BMP reduces sediment and nutrient pollution generically from "pervious" areas within the O-015 storm sewershed, but DEP's simplified method does not break down pervious areas into the specific cropland and meadow rates that need to be evaluated for BMP effectiveness in this case. Therefore,

loading rates for this storm sewershed were computed using representative source data from the Lake Ontelaunee TMDL document, because those sources are nearby and include cropland (which is the existing use for the farm field in O-015) and hay/pasture (which is the proposed use of the farm field, as converted).

Table ES-2 from the TMDL document is reproduced in the Table 4 data in Appendix A. Sources that are common between the Lake Ontelaunee watershed and the O-015 storm sewershed are listed in Table 4.a. Data from Table ES-2 are used in Table 4.a. to develop loading rates (lb/yr/ac) for each source. In Table 4.b., the actual areal extents of the common sources within the O-015 storm sewershed are multiplied by the loading rates computed in Table 4.a., to arrive at loadings in pounds per year for each O-015 source, in the existing (agricultural cropland) condition. The sum of the individual sources' loading masses (lb/yr) is used in Table 1 (Appendix A – TP gross overall), for O-015.

In Table 2, there are no existing BMPs in O-015 being used to reduce TP; therefore, net TP is the same as gross TP. The loading value is transferred to Table 3.

Table 3 depicts the effect of the proposed conversion of a portion of the O-015 storm sewershed from cropland to hay/pasture (i.e., the "CONVERT" BMP). The TP after reduction listed in Table 3 is based on computations in Table 4.c.

Table 4.c. is a variation of Table 4.b., wherein the "Cropland" source is reduced to an area of "zero," and the area formerly cropland is added to the hay/pasture source. This simulates the conversion BMP. As in Table 4.b., individual sources' loading masses (lb/yr) are totaled to arrive at a proposed load. This value is entered in Table 3 for O-015, as the "TP After BMP Reduction."

3.4.2 "CONVERT" – Riparian Buffer Area/Conversion from Meadow to Forest

The Willow Creek Riparian Buffer Area consists of approximately 34 Maidencreek Township-owned, contiguous acres between Schaeffer Road and PA Route 73, along the Willow Creek. Prior to its conversion to a forested riparian buffer, the land was primarily pasture and meadow. See BMP 3.4.3 below for a complete description of the buffer's origin and value.

The conversion of the 34 acres of this formerly pasture and meadow area to deciduous forest is a BMP that has nutrient-reducing capability. However, as in the "Cropland" conversion BMP, DEP's simplified method is insufficient to adequately quantify nutrient loading. Therefore, as above, loading rates for this storm sewershed were computed using representative source data from the Lake Ontelaunee TMDL document, because those sources are nearby and include hay/pasture (which is the pre-existing use for the riparian buffer area) and deciduous forest (which is the proposed use of the buffer area, as converted).

Table ES-2 from the TMDL document is reproduced in the Table 4 data in Appendix A. Sources that are common between the Lake Ontelaunee watershed and the Willow Creek Riparian Buffer Area are listed in Table 4.a. Data from Table ES-2 are used in Table 4.a. to develop loading rates (lb/yr/ac) for each source. In Table 4.d., the actual areal extents of the common sources within the Willow Creek Riparian Buffer Area are multiplied by the loading rates computed in Table 4.a., to arrive at loadings in pounds per year for each buffer area, in the existing (hay/pasture) condition. The sum of the individual sources' loading masses (lb/yr) is used in Table 1 (Appendix A – TP gross overall), for Willow Creek Riparian Area.

In Table 2, there are no existing BMPs in Willow Creek Riparian Area being used to reduce TP; therefore, net TP is the same as gross TP. The loading value is transferred to Table 3.

Table 3 depicts the effect of the proposed conversion of the Willow Creek Riparian Area from hay/pasture to deciduous forest. The TP after reduction listed in Table 3 is based on computations in Table 4.e.

Table 4.e. is a variation of Table 4.d., wherein the "Hay/Pasture" source is reduced to an area of "zero," and the area formerly hay/pasture is added to the deciduous forest source. This simulates the conversion BMP. As in Table 4.d., individual sources' loading masses (lb/yr) are totaled to arrive at a proposed load. This value is entered in Table 3 for Willow Creek Riparian Area, as the "TP After BMP Reduction."

3.4.3 "FOREST BUFFER" – Riparian Forest Buffer Along Willow Creek

Maidencreek Township, with nearly a dozen partners, is revegetating the approximately 34-acre riparian buffer along Willow Creek, between Schaeffer Road and PA Route 73. Since 2011, 1,735 trees have been planted throughout the buffer, in an effort to convert open meadow areas to a forest buffer. In-stream fish habitat enhancements, stream bank stabilization, educational signage and invasive species removal have also been implemented.

This is an ongoing, "living" BMP project that is a flagship example of community involvement and public education for a riparian improvement within an MS4. See Appendix C for a full report on the project.

It is acknowledged that DEP's PRP instructions restrict the use of previously installed BMPs as credit toward the proposed percentage reductions required for the particular pollutant of concern. However, this riparian buffer project is not a static BMP. It is an ongoing, constantly evolving managed "forest buffer" BMP, the benefits of which will continue to improve over the coming five (5) year permit period and beyond. Therefore, it is believed that the use of a "forest buffer" for a "proposed" BMP is justified.

The project began in 2011, however, no credit is sought for the buffer as an existing BMP. This is evident in Table 2. As a proposed Forest Buffer BMP, a 50 percent effectiveness value for TP reduction is used in Table 3.

Recent Chesapeake Bay guidelines place limitations upon the amount of area claimed for credit in treatment provided by riparian buffers. For phosphorus, the subject of this PRP, the area credit is two times the area of the riparian buffer. The Willow Creek Riparian Buffer Area is 34 acres; therefore, pollutant loading from 68 acres of tributary storm sewershed area can be credited with the 50 percent reduction specified in DEP's BMP effectiveness tables. Accordingly, Table 3 computes TP loading reductions for storm sewersheds O-007, O-008, O-010, O-012, O-016, O-023 and O-024 (these sewersheds total is 68 acres). Remaining sewersheds tributary to the riparian buffer receive no reduction credit in Table 3 (denoted as "FP[1]" in Table 3).

4.0 Pollutant Loading Reductions

As indicated above, the pollutant of concern in this PRP is Total Phosphorus (TP), based on nutrients from an "industrial point source." The preceding calculations depict the use of DEP's simplified method to compute existing loading, with existing BMP effectiveness netted out of the baseline. The calculations also demonstrate the effectiveness of the proposed BMPs on reducing TP loading.

Results of the analyses are tabulated below:

Existing Gross Loading lb/yr (Table 1)	Existing Net Loading lb/yr (Table 2)	Proposed Loading lb/yr	Reduction in Loading
1,904.59	1,678.43	1,588.43	5.36%

5.0 Plan Implementation

Maidencreek Township and/or its designee(s) will implement the PRP in the following manner:

Ag Field Conversion

Over the five-year permit term, allow natural meadow to return to cover former agricultural field. Do not apply chemicals, fertilizers, pesticides or herbicides. Maintain field in natural state. Mowing is acceptable as needed.

Forest Buffer

Over the five-year permit term, maintain established vegetation within the Willow Creek corridor. Maintain educational signage as needed. Refer to Appendix D for a full maintenance schedule.

6.0 Funding Mechanisms

Funding for the Ag Field Conversion and Forest Buffer BMPs will be as follows:

Ag Field Conversion

Funding for current and proposed operation and maintenance of the converted field is via the Township's General Fund. Given the passive, low-maintenance nature of this BMP, funding needs are expected to be minimal.

Forest Buffer

Funding for the Forest Buffer is as specified in Appendix C, which is the Project Description for the riparian project. Current and proposed funding for operation and maintenance of the BMPs is via the Township's General Fund.

7.0 Operation and Maintenance

Maidencreek Township owns each property upon which BMPs are proposed under this PRP. Accordingly, the Township will operate and maintain the BMPs.

Ag Field Conversion

Limited maintenance will include occasional mowing as needed. Removal of invasive species will be done case-by-case. Ground cover is to remain vegetated or otherwise stabilized to prevent soil erosion. There is to be no application of any material that is contrary to regulations supporting public drinking water wellhead protection, including but not limited to herbicides, pesticides or fertilizers.

Forest Buffer

Refer to Appendix D for the Management Plan.

APPENDIX A

POLLUTANT LOADING CALCULATION SPREADSHEETS

TABLE 1.
WILLOW CREEK PRP - MAIDENCREEK TOWNSHIP
MS4 OUTFALL STORM SEWERSHEDS - EXISTING POLLUTANT LOADING (GROSS BEFORE EXISTING BMPS)
DECEMBER 2018

			IMPERVIOUS DEVELOPED AREA			PERVIOUS DEVELOPED AREA			UNDEVELOPED AREA (OUTSIDE MS4)			
OUTFALL OR OBSERVATION POINT	STORM SEWERSHED AREA (SF)	STORM SEWERSHED AREA (AC)	% IMPERV DEV	IMPERV DEVELOPED (AC)	TP IMPERV DEV (lbs/yr)	% PERV-IOUS DEV	PERVIOUS DEVELOPED (AC)	TP PERV DEV (lbs/yr)	% UNDEV	UNDEV (AC)	TP UNDEV (lbs/yr)	TP GROSS OVERALL (lbs/yr)
0-001	1,879,646	43.15	40%	17.26	39.01	60%	25.89	25.37	0%	0.00	0.00	64.38
0-002	107,786	2.47	65%	1.61	3.63	35%	0.87	0.85	0%	0.00	0.00	4.48
0-003	12,219,524	280.52	25%	70.13	158.49	50%	140.26	137.46	25%	70.13	23.14	319.09
0-004	225,522	5.18	1%	0.05	0.12	0%	0.00	0.00	99%	5.13	1.69	1.81
0-005	1,226,799	28.16	5%	1.41	3.18	95%	26.76	26.22	0%	0.00	0.00	29.40
0-006	649,428	14.91	5%	0.75	1.68	95%	14.16	13.88	0%	0.00	0.00	15.56
0-007	555,388	12.75	45%	5.74	12.97	55%	7.01	6.87	0%	0.00	0.00	19.84
0-008	1,347,374	30.93	45%	13.92	31.46	55%	17.01	16.67	0%	0.00	0.00	48.13
0-009	637,572	14.64	20%	2.93	6.62	80%	11.71	11.48	0%	0.00	0.00	18.09
0-010	84,764	1.95	20%	0.39	0.88	80%	1.56	1.53	0%	0.00	0.00	2.41
0-011	1,303,450	29.92	10%	2.99	6.76	50%	14.96	14.66	40%	11.97	3.95	25.37
0-012	390,789	8.97	50%	4.49	10.14	50%	4.49	4.40	0%	0.00	0.00	14.53
0-013	83,105	1.91	55%	1.05	2.37	45%	0.86	0.84	0%	0.00	0.00	3.21
0-014	226,750	5.21	40%	2.08	4.71	60%	3.12	3.06	0%	0.00	0.00	7.77
0-015	2,764,452	63.46	See Table 4.b. for computation of existing gross loading.									85.66
0-016	324,495	7.45	40%	2.98	6.73	60%	4.47	4.38	0%	0.00	0.00	11.11
0-017	183,712	4.22	40%	1.69	3.81	60%	2.53	2.48	0%	0.00	0.00	6.29
0-018	185,123	4.25	40%	1.70	3.84	60%	2.55	2.50	0%	0.00	0.00	6.34
0-019	633,685	14.55	40%	5.82	13.15	60%	8.73	8.55	0%	0.00	0.00	21.70
0-020	188,630	4.33	60%	2.60	5.87	40%	1.73	1.70	0%	0.00	0.00	7.57
0-021	4,479,194	102.83	30%	30.85	69.72	65%	66.84	65.50	5%	5.14	1.70	136.92
0-022	3,668,549	84.22	30%	25.27	57.10	50%	42.11	41.27	20%	16.84	5.56	103.93
0-023	112,530	2.58	55%	1.42	3.21	45%	1.16	1.14	0%	0.00	0.00	4.35
0-024	131,152	3.01	55%	1.66	3.74	45%	1.35	1.33	0%	0.00	0.00	5.07
0-025	4,453,721	102.24	40%	40.90	92.43	60%	61.35	60.12	0%	0.00	0.00	152.55
0-026	13,421	0.31	50%	0.15	0.35	50%	0.15	0.15	0%	0.00	0.00	0.50

			IMPERVIOUS DEVELOPED AREA			PERVIOUS DEVELOPED AREA			UNDEVELOPED AREA (OUTSIDE MS4)			
OUTFALL OR OBSERVATION POINT	STORM SEWERSHED AREA (SF)	STORM SEWERSHED AREA (AC)	% IMPERV DEV	IMPERV DEVELOPED (AC)	TP IMPERV DEV (lbs/yr)	% PERV-IOUS DEV	PERVIOUS DEVELOPED (AC)	TP PERV DEV (lbs/yr)	% UNDEV	UNDEV (AC)	TP UNDEV (lbs/yr)	TP GROSS OVERALL (lbs/yr)
0-027	727,003	16.69	45%	7.51	16.97	55%	9.18	9.00	0%	0.00	0.00	25.97
0-028	730,642	16.77	45%	7.55	17.06	55%	9.23	9.04	0%	0.00	0.00	26.10
0-029	306,197	7.03	15%	1.05	2.38	85%	5.97	5.86	0%	0.00	0.00	8.24
0-030	107,060	2.46	45%	1.11	2.50	55%	1.35	1.32	0%	0.00	0.00	3.82
0-031	171,221	3.93	45%	1.77	4.00	55%	2.16	2.12	0%	0.00	0.00	6.12
0-032	42,901	0.98	45%	0.44	1.00	55%	0.54	0.53	0%	0.00	0.00	1.53
0-033	210,681	4.84	45%	2.18	4.92	55%	2.66	2.61	0%	0.00	0.00	7.53
0-034	56,981	1.31	45%	0.59	1.33	55%	0.72	0.71	0%	0.00	0.00	2.04
0-035	251,100	5.76	35%	2.02	4.56	65%	3.75	3.67	0%	0.00	0.00	8.23
0-036	762,441	17.50	30%	5.25	11.87	70%	12.25	12.01	0%	0.00	0.00	23.87
0-037	475,826	10.92	40%	4.37	9.87	60%	6.55	6.42	0%	0.00	0.00	16.30
0-038	183,879	4.22	45%	1.90	4.29	55%	2.32	2.28	0%	0.00	0.00	6.57
0-039	16,819	0.39	50%	0.19	0.44	50%	0.19	0.19	0%	0.00	0.00	0.63
0-040	867,910	19.92	5%	1.00	2.25	10%	1.99	1.95	85%	16.94	5.59	9.79
0-041	112,177	2.58	20%	0.52	1.16	80%	2.06	2.02	0%	0.00	0.00	3.18
0-042	420,439	9.65	15%	1.45	3.27	85%	8.20	8.04	0%	0.00	0.00	11.31
0-043	129,651	2.98	10%	0.30	0.67	0%	0.00	0.00	90%	2.68	0.88	1.56
0-044	2,698,750	61.95	25%	15.49	35.00	75%	46.47	45.54	0%	0.00	0.00	80.54
0-045	541,264	12.43	40%	4.97	11.23	60%	7.46	7.31	0%	0.00	0.00	18.54
0-046	1,118,856	25.69	10%	2.57	5.80	20%	5.14	5.03	70%	17.98	5.93	16.77
0-047	1,528,761	35.10	25%	8.77	19.83	60%	21.06	20.64	15%	5.26	1.74	42.20
0-048	2,304,619	52.91	15%	7.94	17.94	50%	26.45	25.92	35%	18.52	6.11	49.97
0-052	2,064,702	47.40	15%	7.11	16.07	80%	37.92	37.16	5%	2.37	0.78	54.01
0-053	9,360,767	214.89	20%	42.98	97.13	25%	53.72	52.65	55%	118.19	39.00	188.78
0-054	776,505	17.83	25%	4.46	10.07	75%	13.37	13.10	0%	0.00	0.00	23.17
0-055	189,443	4.35	25%	1.09	2.46	75%	3.26	3.20	0%	0.00	0.00	5.65
0-056	358,489	8.23	25%	2.06	4.65	75%	6.17	6.05	0%	0.00	0.00	10.70
OP-001	1,301,975	29.89	15%	4.48	10.13	35%	10.46	10.25	50%	14.94	4.93	25.32
OP-002	865,824	19.88	5%	0.99	2.25	95%	18.88	18.51	0%	0.00	0.00	20.75

			IMPERVIOUS DEVELOPED AREA			PERVIOUS DEVELOPED AREA			UNDEVELOPED AREA (OUTSIDE MS4)			
OUTFALL OR OBSERVATION POINT	STORM SEWERSHED AREA (SF)	STORM SEWERSHED AREA (AC)	% IMPERV DEV	IMPERV DEVELOPED (AC)	TP IMPERV DEV (lbs/yr)	% PERV-IOUS DEV	PERVIOUS DEVELOPED (AC)	TP PERV DEV (lbs/yr)	% UNDEV	UNDEV (AC)	TP UNDEV (lbs/yr)	TP GROSS OVERALL (lbs/yr)
OP-003	918,501	21.09	20%	4.22	9.53	80%	16.87	16.53	0%	0.00	0.00	26.06
OP-004	200,545	4.60	25%	1.15	2.60	75%	3.45	3.38	0%	0.00	0.00	5.99
OP-005	818,595	18.79	10%	1.88	4.25	90%	16.91	16.57	0%	0.00	0.00	20.82
OP-006	281,500	6.46	25%	1.62	3.65	75%	4.85	4.75	0%	0.00	0.00	8.40
OP-007	581,625	13.35	10%	1.34	3.02	90%	12.02	11.78	0%	0.00	0.00	14.79
Willow Creek Riparian Area	1,484,094	34.07	See Table 4.d. for computation of existing gross loading.									13.25
	TOTALS:	1630.95			886.1			818.52			101.01	**1904.59**

TP LOADING RATES:	Impervious Developed Area:	2.26 lbs/acre/yr
	Pervious Developed Area:	0.98 lbs/acre/yr
	Undeveloped Area:	0.33 lbs/acre/yr

0-xxx: Outfall ID
OP-xxx: Observation Point ID

NOTE: Outfalls O-049, O-050 and O-051 are outside of the PRP planning area.

TABLE 2.
WILLOW CREEK PRP - MAIDENCREEK TOWNSHIP
MS4 OUTFALL STORM SEWERSHEDS - EXISTING POLLUTANT LOADING (NET AFTER EXISTING BMPS)
DECEMBER 2018

OUTFALL	TP GROSS OVERALL (lbs/yr)	EX BMP TYPE	% STORM SEWERSHED TO BMP	TP GROSS TO BMP (lbs/yr)	BMP EFFECTIVE TREATMENT %	TP AFTER BMP TREATMENT (lbs/yr)	TP NOT TO ANY BMP (lbs/yr)	TP NET OVERALL (lbs/yr)
0-001	64.38	VOC-B	95.0%	61.16	45%	33.64	3.22	36.86
0-002	4.48	n/a	0.0%	0.00	0%	0.00	4.48	4.48
0-003	319.09	DED	65.0%	207.41	20%	165.93	111.68	277.61
0-004	1.81	VOC-B	50.0%	0.90	45%	0.50	0.90	1.40
0-005	29.40	n/a	0.0%	0.00	0%	0.00	29.40	29.40
0-006	15.56	n/a	0.0%	0.00	0%	0.00	15.56	15.56
0-007	19.84	n/a	0.0%	0.00	0%	0.00	19.84	19.84
0-008	48.13	n/a	0.0%	0.00	0%	0.00	48.13	48.13
0-009	18.09	n/a	0.0%	0.00	0%	0.00	18.09	18.09
0-010	2.41	n/a	0.0%	0.00	0%	0.00	2.41	2.41
0-011	25.37	n/a	0.0%	0.00	0%	0.00	25.37	25.37
0-012	14.53	n/a	0.0%	0.00	0%	0.00	14.53	14.53
0-013	3.21	DED	90.0%	2.89	20%	2.31	0.32	2.63
0-014	7.77	n/a	0.0%	0.00	0%	0.00	7.77	7.77
0-015	85.66	n/a	0.0%	0.00	0%	0.00	85.66	85.66
0-016	11.11	n/a	0.0%	0.00	0%	0.00	11.11	11.11
0-017	6.29	n/a	0.0%	0.00	0%	0.00	6.29	6.29
0-018	6.34	n/a	0.0%	0.00	0%	0.00	6.34	6.34
0-019	21.70	n/a	0.0%	0.00	0%	0.00	21.70	21.70
0-020	7.57	FB	100.0%	7.57	50%	3.78	0.00	3.78
0-021	136.92	DED	100.0%	136.92	20%	109.53	0.00	109.53
0-022	103.93	n/a	0.0%	0.00	0%	0.00	103.93	103.93
0-023	4.35	n/a	0.0%	0.00	0%	0.00	4.35	4.35
0-024	5.07	n/a	0.0%	0.00	0%	0.00	5.07	5.07
0-025	152.55	DED	90.0%	137.29	20%	109.83	15.25	125.09
0-026	0.50	n/a	0.0%	0.00	0%	0.00	0.50	0.50
0-027	25.97	FB	100.0%	25.97	50%	12.98	0.00	12.98
0-028	26.10	FB	100.0%	26.10	50%	13.05	0.00	13.05
0-029	8.24	FB	100.0%	8.24	50%	4.12	0.00	4.12
0-030	3.82	FB	100.0%	3.82	50%	1.91	0.00	1.91
0-031	6.12	FB	100.0%	6.12	50%	3.06	0.00	3.06
0-032	1.53	FB	100.0%	1.53	50%	0.77	0.00	0.77

OUTFALL	TP GROSS OVERALL (lbs/yr)	EX BMP TYPE	% STORM SEWERSHED TO BMP	TP GROSS TO BMP (lbs/yr)	BMP EFFECTIVE TREATMENT %	TP AFTER BMP TREATMENT (lbs/yr)	TP NOT TO ANY BMP (lbs/yr)	TP NET OVERALL (lbs/yr)
0-033	7.53	FB	100.0%	7.53	50%	3.76	0.00	3.76
0-034	2.04	FB	100.0%	2.04	50%	1.02	0.00	1.02
0-035	8.23	FB	100.0%	8.23	50%	4.12	0.00	4.12
0-036	23.87	DED	15.0%	3.58	20%	2.86	20.29	23.16
0-037	16.30	DED	100.0%	16.30	20%	13.04	0.00	13.04
0-038	6.57	n/a	0.0%	0.00	0%	0.00	6.57	6.57
0-039	0.63	n/a	0.0%	0.00	0%	0.00	0.63	0.63
0-040	9.79	n/a	0.0%	0.00	0%	0.00	9.79	9.79
0-041	3.18	DED	100.0%	3.18	20%	2.55	0.00	2.55
0-042	11.31	n/a	0.0%	0.00	0%	0.00	11.31	11.31
0-043	1.56	n/a	0.0%	0.00	0%	0.00	1.56	1.56
0-044	80.54	DED	80.0%	64.43	20%	51.55	16.11	67.65
0-045	18.54	n/a	0.0%	0.00	0%	0.00	18.54	18.54
0-046	16.77	DED	45.0%	7.55	20%	6.04	9.22	15.26
0-047	42.20	VOC-B	100.0%	42.20	45%	23.21	0.00	23.21
0-048	49.97	n/a	0.0%	0.00	0%	0.00	49.97	49.97
0-052	54.01	DED	75.0%	40.51	20%	32.41	13.50	45.91
0-053	188.78	n/a	0.0%	0.00	0%	0.00	188.78	188.78
0-054	23.17	n/a	0.0%	0.00	0%	0.00	23.17	23.17
0-055	5.65	n/a	0.0%	0.00	0%	0.00	5.65	5.65
0-056	10.70	n/a	0.0%	0.00	0%	0.00	10.70	10.70
OP-001	25.32	n/a	0.0%	0.00	0%	0.00	25.32	25.32
OP-002	20.75	n/a	0.0%	0.00	0%	0.00	20.75	20.75
OP-003	26.06	n/a	0.0%	0.00	0%	0.00	26.06	26.06
OP-004	5.99	n/a	0.0%	0.00	0%	0.00	5.99	5.99
OP-005	20.82	n/a	0.0%	0.00	0%	0.00	20.82	20.82
OP-006	8.40	n/a	0.0%	0.00	0%	0.00	8.40	8.40
OP-007	14.79	VOC-B	100.0%	14.79	45%	8.14	0.00	8.14
Willow Creek Riparian Area	13.25	n/a	0.0%	0.00	0%	0.00	13.25	13.25
	1904.59					**NET TP (lbs/yr) =**		**1678.43**

ABBREV.:
DED - Dry Extended Detention Basin
FB - Forest Buffer
VOC-B - Vegetated Open Channel - B Soils

TABLE 3.
WILLOW CREEK PRP - MAIDENCREEK TOWNSHIP
PROPOSED POLLUTANT LOADING (WITH PROPOSED BMPS)
DECEMBER 2018

OUTFALL	STORM SEWERSHED AREA (AC)	TP NET OVERALL (lbs/yr)	PROPOSED BMP TYPE	PROPOSED BMP EFFECTIVE-NESS	TP AFTER BMP REDUCTION (lbs/yr)
0-001	43.15	36.86	--	0%	36.86
0-002	2.47	4.48	--	0%	4.48
0-003	280.52	277.61	--	0%	277.61
0-004	5.18	1.40	FB[1]	0%	1.40
0-005	28.16	29.40	FB[1]	0%	29.40
0-006	14.91	15.56	FB[1]	0%	15.56
0-007	12.75	19.84	FB	50%	9.92
0-008	30.93	48.13	FB	50%	24.06
0-009	14.64	18.09	FB[1]	0%	18.09
0-010	1.95	2.41	FB	50%	1.20
0-011	29.92	25.37	FB[1]	0%	25.37
0-012	8.97	14.53	FB	50%	7.27
0-013	1.91	2.63	--	0%	2.63
0-014	5.21	7.77	FB[1]	0%	7.77
0-015	63.46	85.66	CONVERT[1] (see Table 4.c.)		58.82
0-016	7.45	11.11	FB	50%	5.56
0-017	4.22	6.29	FB[1]	0%	6.29
0-018	4.25	6.34	FB[1]	0%	6.34
0-019	14.55	21.70	FB[1]	0%	21.70
0-020	4.33	3.78	--	0%	3.78
0-021	102.83	109.53	--	0%	109.53
0-022	84.22	103.93	FB[1]	0%	103.93
0-023	2.58	4.35	FB	50%	2.18
0-024	3.01	5.07	FB	50%	2.54
0-025	102.24	125.09	--	0%	125.09
0-026	0.31	0.50	--	0%	0.50
0-027	16.69	12.98	--	0%	12.98
0-028	16.77	13.05	--	0%	13.05
0-029	7.03	4.12	--	0%	4.12
0-030	2.46	1.91	--	0%	1.91
0-031	3.93	3.06	--	0%	3.06
0-032	0.98	0.77	--	0%	0.77
0-033	4.84	3.76	--	0%	3.76
0-034	1.31	1.02	--	0%	1.02

0-035	5.76	4.12	--	0%	4.12
0-036	17.50	23.16	--	0%	23.16
0-037	10.92	13.04	--	0%	13.04
0-038	4.22	6.57	--	0%	6.57
0-039	0.39	0.63	--	0%	0.63
0-040	19.92	9.79	--	0%	9.79
0-041	2.58	2.55	--	0%	2.55
0-042	9.65	11.31	--	0%	11.31
0-043	2.98	1.56	--	0%	1.56
0-044	61.95	67.65	--	0%	67.65
0-045	12.43	18.54	--	0%	18.54
0-046	25.69	15.26	--	0%	15.26
0-047	35.10	23.21	--	0%	23.21
0-048	52.91	49.97	--	0%	49.97
0-052	47.40	45.91	--	0%	45.91
0-053	214.89	188.78	--	0%	188.78
0-054	17.83	23.17	--	0%	23.17
0-055	4.35	5.65	--	0%	5.65
0-056	8.23	10.70	--	0%	10.70
OP-001	29.89	25.32	--	0%	25.32
OP-002	19.88	20.75	--	0%	20.75
OP-003	21.09	26.06	--	0%	26.06
OP-004	4.60	5.99	--	0%	5.99
OP-005	18.79	20.82	--	0%	20.82
OP-006	6.46	8.40	--	0%	8.40
OP-007	13.35	8.14	--	0%	8.14
Willow Creek Riparian Area	34.07	13.25	CONVERT[2] (see Table 4.e.)		2.81
		1678.43			1588.43

Table Summary:

Net Overall TP:	1678.43	lbs/yr
TP Reduction Required (5%):	83.92	lbs/yr
TP After BMP Reduction:	1588.43	lbs/yr
TP Reduction Actual:	90.00	lbs/yr
% TP Reduction Actual:	**5.36%**	

Notes/Abbreviations:

CONVERT[1]	Ag Field Retirement/Conversion from Ag to Meadow (See Tables 4.a., 4.d., and 4.e.)
CONVERT[2]	Riparian Forest Buffer/Conversion from Meadow to Forest (See Tables 4.a., 4.d., and 4.e.)
FB	Forest Buffer - sewersheds counted for 50% reduction (approx. 68 acres - see note below)
FB[1]	Forest Buffer - sewershed is tributary to FB but no reduction applied (see note below)
Note:	Chesapeake Bay guidelines limit the credited area tributary to a riparian forest buffer to two times the buffer area when considering phosphorus reductions. Proposed riparian buffer area is 34 acres; therefore, 68 acres is the limit for tributary sewershed treatment credit. The sewersheds with "FB" denoted above total 68 acres; the sewersheds with "FB[1]" denoted are not credited.

TABLE 4.
WILLOW CREEK PRP - MAIDENCREEK TOWNSHIP
"CONVERT" BMP REDUCTION - STORMSHEDS O-015 & WILLOW CREEK RIPARIAN BUFFER
DECEMBER 2018

Table 4.a. Use Lake Ontelaunee TMDL Source Allocation to Estimate TP Loading Rate

Source[1]	TMDL Area ha	TMDL Ex. TP Load t/yr	TP Load Rate t/yr/ha	TP Load Rate lb/yr/ac
Hay/Pasture	9,061	3.95	0.00044	0.39
Cropland	19,994	46.93	0.00235	2.09
Deciduous Forest	14,481	1.34	0.00009	0.08
High Intensity	242	0.35	0.00145	1.29
Low Intensity	646	0.07	0.00011	0.10
MS4	54	0.13	0.00241	2.15

Notes:

1. Sources taken from the Lake Ontelaunee TMDL, Table ES-2. and are those that are in common with sources in O-015 and the Willow Creek Riparian Buffer (see below).
2. Loading Rates are computed to apply to specific O-015 sources in Table 4.b.
3. Loading Rates are computed to apply to specific Willow Creek Riparian Buffer sources in Table 4.d.
4. "t" is metric ton.

Table 4.b. Apply Loading Rate from Table 4.a. to Areas of Actual Existing Sources in O-015

Source	TP Load Rate lb/yr/ac	O-015 Area sf	O-015 Area ac	O-015 Ex. TP Load lb/yr	
Hay/Pasture	0.39	288,932	6.63	2.58	
Cropland[1]	2.09	685,697	15.74	32.96	
High Intensity	1.29	1,100,000	25.25	32.58	
Low Intensity	0.10	350,000	8.03	0.78	
MS4	2.15	339,823	7.80	16.76	
	Totals	2,764,452	63.46	85.66	*See this value in Tables 1 & 2*

Table 4.c. Compute Proposed Loading with All Cropland as Hay/Pasture in O-015

Source	TP Load Rate lb/yr/ac	O-015 Area sf	O-015 Area ac	O-015 Prop. TP Load lb/yr	
Hay/Pasture	0.39	974,629	22.37	8.70	
Cropland[1]	2.09	-	-	0.00	
High Intensity	1.29	1,100,000	25.25	32.58	
Low Intensity	0.10	350,000	8.03	0.78	
MS4	2.15	339,823	7.80	16.76	
	Totals	2,764,452	63.46	58.82	*See this value in Table 3*

Notes:

1. Cropland area is "zeroed out" and added to Hay/Pasture to simulate cropland conversion to meadow.

Table 4.d. Apply Loading Rate from Table 4.a. to Areas of Actual Existing Sources in the Willow Creek Riparian Buffer

Source	TP Load Rate lb/yr/ac	Riparian Buffer Area sf	Riparian Buffer Area ac	Rip. Buffer Ex. TP Load lb/yr	
Hay/Pasture	0.39	1,484,094	34.07	13.25	
Deciduous Forest	0.08	-	-	0.00	
	Totals	1,484,094	34.07	13.25	*See this value in Tables 1 & 2*

Table 4.e. Compute Proposed Loading with All Deciduous Forest in the Willow Creek Riparian Buffer

Source	TP Load Rate lb/yr/ac	Riparian Buffer Area sf	Riparian Buffer Area ac	Rip. Buffer Ex. TP Load lb/yr	
Hay/Pasture[1]	0.39	-	-	0.00	
Deciduous Forest	0.08	1,484,094	34.07	2.81	
	Totals	1,484,094	34.07	2.81	*See this value in Table 3*

Notes:

1. Hay/Pasture area is "zeroed out" and added to Deciduous Forest to simulate Hay/Pasture conversion to the riparian buffer.

Table ES-1. Lake Ontelaunee Phosphorus TMDL Table (metric tons per year) (from EPA TMDL Lake Ontelaunee, Berks and Lehigh Counties, PA)

Source	Area (ha)	Existing Load (t/yr)	% of Total Existing Load	Existing UAL (t/yr*ha)	Allocated Load (t/yr)	% of Total Allocated Load	Allocated UAL (t/yr*ha)	Percent reduction (%)
Hay/Pasture	9,061	3.95	4.8	0.00044	1.00	9.9	0.00011	75
Cropland	19,994	46.93	57.0	0.00235	2.35	23.2	0.00012	95
Coniferous	1,135	0.02	0.0	0.00002	0.02	0.2	0.00002	0
Mixed Forest	948	0.09	0.1	0.00009	0.09	0.9	0.00010	0
Deciduous Forest	14,481	1.34	1.6	0.00009	1.34	13.2	0.00009	0
Unpaved Roads	44	0.37	0.4	0.00841	0.02	0.2	0.00042	95
Quarry	16	0.06	0.1	0.00375	0.00	0.0	0.00022	93
Transitional	1,490	16.27	19.8	0.01092	0.81	8.0	0.00054	95
Low Intensity	646	0.07	0.1	0.00011	0.07	0.7	0.00011	0
High Intensity	242	0.35	0.4	0.00145	0.05	0.5	0.00022	85
MS4	54	0.13	0.2	0.00232	0.01	0.1	0.00015	94
Point Source	--	3.65	4.4	--	2.76	27.2	--	24
Groundwater	--	6.06	7.4	--	1.52	15.0	--	75
Septic Systems	--	3.03	3.7	--	0.09	0.9	--	97
Total	48,111	82.31	100.0	0.00171	10.13	100.0	0.00021	88

TABLE 5.
WILLOW CREEK PRP - MAIDENCREEK TOWNSHIP
EXISTING BMP DATA
DECEMBER 2018

OUTFALL SHED AREA	EX BMP TYPE	LAT	LONG	PERMIT #	DATE INSTALLED	O&M REQUIREMENTS (T=TWP.; P=PRIVATE)
0-001	VOC-B	40-26-53.91	-75-51-41.11	None	1991	Mow, clean, repair as needed (T)
0-003	DED(1)	40-26-45.76	-75-52-10.68	PA-R-10-C449	2007	Maintain amended soils; manage vegetation (P)
0-003	DED(2)	40-26-38.01	-75-52-06.43	PA-R-10-C449	2007	Mow, clean, repair as needed (P)
0-003	DED(3)	40-26-30.93	-75-52-01.68	None	1985	"
0-003	DED(4)	40-26-42.21	-75-51-47.41	None	1992	Clean, repair as needed, manage vegetation (P)
0-004	VOC-B	40-27-07.72	-75-52-43.62	PA-S-10-C051	2003	Mow, clean, repair as needed (P)
0-013	DED	40-26-54.07	-75-53-55.23	None	2000	"
0-015	DED	40-26-35.27	-75-53-25.64	None	1991	"
0-020	FB	40-26-51.99	-75-53-05.43	None	1990	Manage woodland (T)
0-021	DED	40-27-08.39	-75-52-37.79	PA-S-10-C051	2003	Mow, clean, repair as needed (P)
0-025	DED(1)	40-26-49.10	-75-52-40.29	None	2000	Mow, clean, repair as needed (T)
0-025	DED(2)	40-27-01.35	-75-52-38.48	None	1998	Mow, clean, repair as needed (P)
0-025	DED(3)	40-26-41.63	-75-52-23.66	PAG2000607022	2004	Maintain amended soils; manage vegetation (P)
0-027	FB	40-26-48.90	-75-53-03.74	None	1995	Manage woodland (T)
0-028	FB	40-26-39.28	-75-52-55.40	None	1995	"
0-029	FB	40-26-48.08	-75-53-04.85	None	1995	"
0-030	FB	40-26-47.30	-75-53-03.31	None	1995	"
0-031	FB	40-26-45.08	-75-53-02.19	None	1995	"
0-032	FB	40-26-43.05	-75-53-00.76	None	1995	"
0-033	FB	40-26-40.10	-75-52-58.40	None	1995	"
0-034	FB	40-26-37.95	-75-52-57.18	None	1995	"
0-035	FB	40-26-35.02	-75-52-55.71	None	1995	"
0-036	DED	40-26-31.68	-75-52-38.19	None	1990	Mow, clean, repair as needed (P)
0-037	DED	40-26-30.19	-75-53-01.24	None	1988	"
0-041	DED	40-26-22.61	-75-52-43.47	None	1992	"
0-044	DED	40-26-17.06	-75-52-24.66	None	1994	Clean, repair as needed, manage vegetation (P)
0-046	DED(1)	40-26-45.28	-75-51-12.62	None	1999	Mow, clean, repair as needed (P)
0-046	DED(2)	40-26-45.77	-75-51-06.46	None	1995	"
0-047	VOC-B	40-27-01.49	-75-52-22.28	None	1990	Clean, repair as needed, manage vegetation (P)
0-052	DED	40-26-24.62	-75-51-41.26	PA-R-10-C309R	2003	Mow, clean, repair as needed (P)
OP-007	VOC-B	40-26-50.49	-75-51-38.50	None	2007	Mow, clean, repair as needed (T)

ABBREV.: DED - Dry Extended Detention Basin
FB - Forest Buffer
VOC-B - Vegetated Open Channel - B Soils

NOTE: All BMPs used for existing credit are functioning as designed.

APPENDIX B

DEP DOCUMENTATION

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Berks County						
HEREFORD TWP		Yes	SP	Swabia Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Perkiomen Creek	Appendix E-Nutrients, Siltation (5)	Thermal Modifications (5)
				Green Lane Reservoir	Appendix E-Organic Enrichment/Low D.O. (4a)	
				Little Lehigh Creek	Appendix E-Siltation (5)	
KENHORST BORO	PAG133515	No		Schuylkill River	Appendix C-PCB (4a)	
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
LAURELDALE BORO	PAG133518	No		Laurel Run	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Schuylkill River	Appendix C-PCB (4a)	
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
				Bernhart Creek TMDL	Appendix A-Metals (4a)	TDS (4a)
LEESPORT BORO	PAG133527	No		Schuylkill River	Appendix C-PCB (4a)	
				Unnamed Tributaries to Schuylkill River		Water/Flow Variability (4c)
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
LONGSWAMP TWP	PAI133512*	Yes	SP, W-I	Little Lehigh Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	
				Unnamed Tributaries to Little Lehigh Creek	Appendix E-Organic Enrichment/Low D.O. (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Swabia Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Other Habitat Alterations (4c)
LOWER ALSACE TWP	PAG133519	No		Antietam Creek	Appendix B-Pathogens (5)	
				Schuylkill River PCB TMDL	Appendix C-PCB (4a)	
				Unnamed Tributaries to Schuylkill River		Other Habitat Alterations (4c)
				Schuylkill River	Appendix C-PCB (4a)	
LOWER HEIDELBERG TWP	PAG133520	No		Blue Marsh Lake	Appendix B-Pathogens (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5)	
				Manor Creek	Appendix E-Nutrients, Siltation (4a)	
				Schuylkill River	Appendix C-PCB (4a)	
				Spring Creek	Appendix E-Nutrients, Siltation (5)	
				Tulpehocken Creek	Appendix E-Nutrients (5)	
				Cacoosing Creek	Appendix B-Pathogens (5), Appendix E-Nutrients, Siltation (5)	
				Little Cacoosing Creek	Appendix E-Nutrients, Siltation (4a)	
MAIDENCREEK TWP	PAG133521	No		Willow Creek	Appendix B-Pathogens (5), Appendix E-Nutrients (5)	Flow Alterations (4c)
				Lake Ontelaunee TMDL	TMDL Plan-Nutrients, Suspended Solids (4a)	
				Maiden Creek	Appendix B-Pathogens (5)	Other Habitat Alterations (4c)
				Schuylkill River	Appendix C-PCB (4a)	
				Unnamed Tributaries to Willow Creek	Appendix B-Pathogens (5)	

ATTACHMENT B

DEVELOPED LAND LOADING RATES FOR PA COUNTIES[1,2,3]

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
Adams	impervious developed	10,373.2	33.43	2.1	1,398.77
	pervious developed	44,028.6	22.99	0.8	207.67
Bedford	impervious developed	9,815.2	19.42	1.9	2,034.34
	pervious developed	19,425	17.97	0.68	301.22
Berks	impervious developed	1,292.4	36.81	2.26	1,925.79
	pervious developed	5,178.8	34.02	0.98	264.29
Blair	impervious developed	3,587.9	20.88	1.73	1,813.55
	pervious developed	9,177.5	18.9	0.62	267.34
Bradford	impervious developed	10,423	14.82	2.37	1,880.87
	pervious developed	23,709.7	13.05	0.85	272.25

For land area outside of the urbanized area, undeveloped land loading rates may be used where appropriate. When using the simplified method, DEP recommends the following loading rates (for any county) for undeveloped land:

- TN – 10 lbs/acre/yr
- TP – 0.33 lbs/acre/yr
- TSS (Sediment) – 234.6 lbs/acre/yr

These values were derived by using the existing loads for each pollutant, according to the 2014 Chesapeake Bay Progress Run, and dividing by the number of acres for the unregulated stormwater subsector.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.

APPENDIX C

RIPARIAN BUFFER – HABITAT RESTORATION REPORT

WILLOW CREEK HABITAT RESTORATION PROJECT

Sponsor: Fish & Wilflife Service Office: Northeast Fisheries Center

Project Partners: Pennsylvania Fish & Boat Commission, Eastern Brook Trout Joint Venture, Berks Conservancy, Fleetwood High School Outdoor Club, Fleetwood Middle School, Maidencreek Township Parks and Recreation Board, Maidencreek Watershed Association, Reading Area Community College, Reading Area Water Authority, Schuylkill River National and State Heritage Area, Trout Unlimited (Tulpehocken Chapter), Maidencreek Township Authority, Boy Scouts of America Troop 183

Project Costs:

Total Cost - $121,800 - projected $161,246.36 - actual
Non Federal Amount - $71,800 – projected
$74,031.70 – in kind service and actual paid by Twp.
$37,214.66 – additional expenses covered by other grants
Federal Amount - $0

Funding Sources:

Partner	Activity	Cash Match	In Kind	Totals
PA Fish Commission	Materials for fish habitat, project oversight & design	7,214.66 (CHIP Grant)	32,500.95	39,715.61
Maidencreek Township	Materials, labor, equipment	16,919.38	12,703.17	29,622.55
Schuylkill River Heritage	Equipment Rental, riparian planting, materials	30,000.00 (SRGA Grant)		30,000.00
PA EBTJV	Equipment Rental, riparian planting, materials, signs	50,000.00		50,000.00
Berks County Conservancy	Riparian Planting		982.56	982.56

	design & oversight, trees and shrubs			
Maidencreek Watershed Association/Kutztown University	Volunteer hours for buffer planting	0	427.20	427.20
Trout Unlimited	Volunteer hours for buffer planting	0	1,110.72	1,110.72
Fleetwood High School/Outdoor Club	Volunteer hours for buffer planting	0	4,902.12	4,902.12
Fleetwood Middle School	Volunteer hours for buffer planting	0	2,221.44	2,221.44
Reading Area Community College	Volunteer hours for buffer planting	0	875.76	875.76
Reading Area Water Authority	Volunteer hours for invasive species removal	0	1,388.40	1,388.40
		104,134.04	57,112.32	161,246.36

Action Strategy Implemented In the Project:

Improve fish habitat and stabilize stream bank to narrow and deepen the channel which will encourage macroinvertebrate habitation and reproduction.

Plant a riparian buffer to provide shade so temperatures stay at trout suitable levels all year. Promote diversity and overall abundance of flora and fauna.

Educate and inform the public of the project

Provide angling opportunities.

Priority Score of the Sub-Watershed: Gray

State Wildlife Action Plan Listed Habitat Conservation Goal Supported by the Project: The restoration actions will help restore the Willow Creek, a high priority lotic and riparian habitat and improve water quality in the Schuylkill River Watershed.

Methods Used: Used volunteers and Maidencreek Township Road Crew to re-vegetate the riparian buffer and install fish habitats. PA Fish Commission provided project oversite for the habitat installation and Berks Conservancy provided project oversite for the riparian buffer design and installation. Educated the public through mailings, newspaper articles and informational kiosks in the project area.

Project Outcomes: Fish habitat and stream bank stabilization were addressed by Maidencreek Township Road Crew and the PA Fish Commission installing 16 mud sills, 100 random boulders and 65 deflectors along 1.2 miles of the Willow Creek. These devices will help narrow and deepen the channel which will encourage macroinvertebrate habitation and reproduction.

A riparian buffer (native trees and shrubs) was planted in six acres by Maidencreek Township Road Crew, the Berks Conservancy and volunteers. Vegetation was allowed to grow without cutting and invasive species were removed from plantings by volunteers. Once mature, the trees will provide shade so temperatures stay at trout suitable levels all year. Grass was cut to provide a twelve foot wide trail for access to the stream for fishing.

Pamphlets were distributed to everyone along the stream corridor via mail and several articles were published in the Township newsletters as well as local newspapers. This spurred additional interest in the project and two members of Boy Scout Troop 183 installed three bat boxes and fifteen birdhouses within the project area.

Informational signs were installed throughout the project area to commemorate the effort and educate trail users on the project.

PA Fish Commission will continue to monitor the site after completion. An Open Space Management Plan was created and adopted so future generations have a manual to follow.

Brook Trout Population Response to the Project Outcome: Sampling was taken in July 2014 and there has been no significant increase in trout population to date. However, stream bank erosion has stabilized and the riparian buffer is growing at a steady pace.

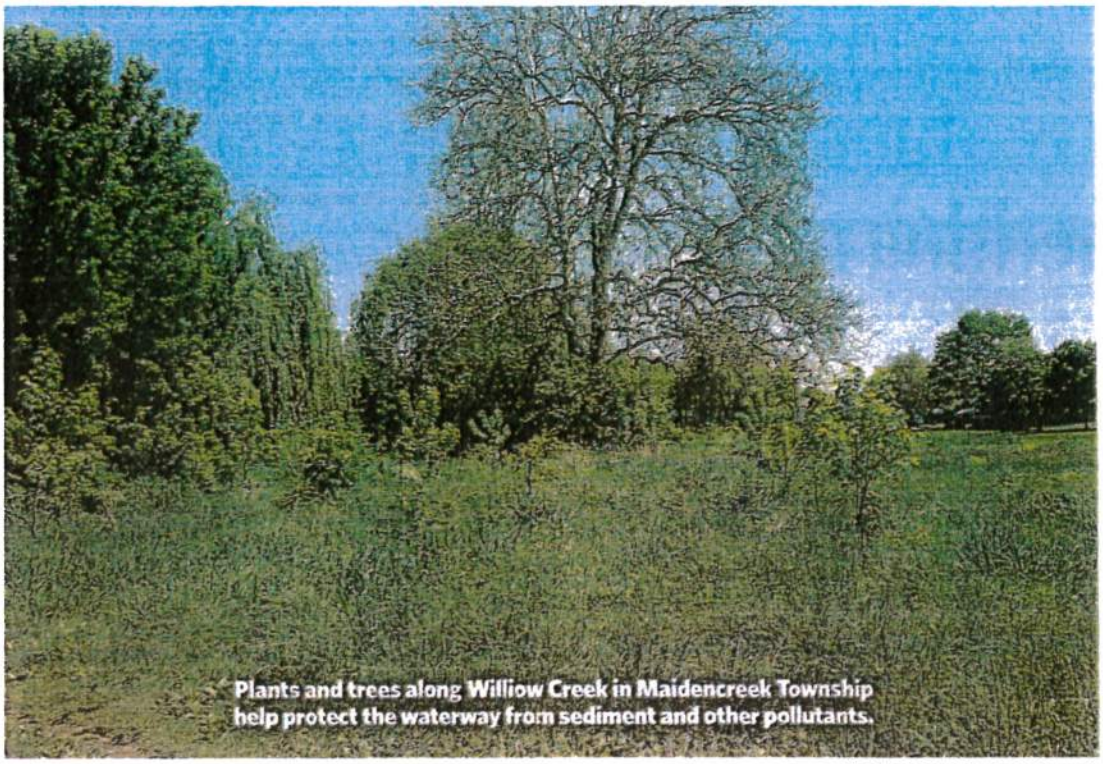
Number of Stream Miles: 1.2 miles

List of Accomplishments

- Larry Lloyd of the Berks Conservancy treated noxious weeds on June 10, September 12, 13, and 14, 2011 between Schaeffer Road to 150ft further downstream from the tributary at the playground on the South side of the creek. Weeds treated included poison hemlock, Canada thistle, crown vetch, mile a minute, teasel, bindweed, tree of heaven and Japanese knotweed. The Township Road Crew mowed along areas of the stream to prevent thistle from going to seed in untreated areas.
- A pamphlet was created by John Buzzar of PA Fish and Boat. The pamphlet titled, "Willow Creek Habitat Restoration Project – Improving Your Water Resources" and mailed by the Township staff to the ninety property owners along the stream corridor on June 22, 2011. It has also been posted on the Township website and put at the municipal building for residents and visitors to take.
- Fish habitats and stream bank stabilization were installed in the area from Schaeffer Road to the Cornerstone Drive Playground by PA Fish and Boat and Township Road Crew June 20 to June 29, 2011.
- John Buzzar of PA Fish and Boat attended the July 14, 2011 Maidencreek Township Board of Supervisors meeting to answer questions from the public.
- A riparian buffer was designed by Larry Lloyd of the Berks Conservancy.
- The Township ordered 450 trees and shrubs for the riparian buffer. The Township Road Crew dug holes and volunteers installed the plants on October 15, 2011 on the Cornerstone Drive side of the stream from Schaeffer Road to the Cornerstone Playground. Volunteer hours totaled 253.5 hours. Volunteers from the Fleetwood High School and Middle School (185.5 hours), Kutztown University (20 hours), and Trout Unlimited (48 hours) participated and were overseen by the Berks Conservancy and PA Fish and Boat.
- May 25, 2012 a walking trail was marked out by Keith Shuman of the Maidencreek Township Road Crew and Larry Lloyd and was mowed by the Township Road Crew.

- Larry Lloyd of the Berks Conservancy treated noxious weeds on June 8, and September 11-13, 2012. The June treatment was to remove vegetation that was growing around the plantings between Schaeffer Road to 150ft further downstream from the tributary at the playground on the South side of the creek, some of which was done chemically and some pulling by hand. The September treatment occurred between the playground at Cornerstone Drive and Route 73. Weeds treated included poison hemlock, Canada thistle, crown vetch, mile a minute, teasel, bindweed, tree of heaven and Japanese knotweed. This treatment was in preparation for fall planting of 600 trees and shrubs.
- The pamphlet created by John Buzzar of PA Fish and Boat titled, "Willow Creek Habitat Restoration Project – Improving Your Water Resources" is posted on the Township website and put at the municipal building for residents and visitors to take. All new homeowners receive this information upon moving into the Township and pamphlets were also distributed at Community Day.
- June 26 to 29, 2012 the Township Road Crew mowed the meadow along the stream.
- July 1 to 6, 2012 the Township Road Crew staged all materials in meadow for the fish habitat structures.
- Fish habitats and stream bank stabilization were installed in the area from the Cornerstone Drive Playground to Route 73 by PA Fish and Boat and Township Road Crew between July 9 and July 12, 2012.
- July 11 and 12, 2012 the stream bank was planted with a 50/50 mix of annual rye grass and stream bank rye grass under the direction of Larry Lloyd.
- The Township Road Crew dug the holes on October 1 to 4, 2012 and volunteers installed 600 trees and plants on October 13 and 20, 2012 on the Cornerstone Drive side of the stream from Cornerstone Drive Playground to Route 73.
- The Township Road Crew set boulders in the stream in February 2013. This completed the installation of all trout habitat structures.
- This project has drawn the attention of local Boy Scout Troops and in March, one leader, Geoffrey Price, constructed and installed three bat boxes in the project limits. The Township paid for all materials.

- From March 21, 2013 through April 13, 2013, the Township purchased and planted another 600 trees in the riparian buffer area with the help of volunteers from Reading Area Community College.
- The Road Crew mowed and maintained the grass trail through the project in May, June and August of 2013.
- In June and September of 2013 Larry Lloyd of Berks Conservancy pulled invasive species from along the Willow Creek.
- The Township purchased 29 trees, each 12 feet in height, in September 2013 and were planted by the Township Road Crew in October 2013 along the stream.
- A local Boy Scout, Brandon Beshore, proposed an Eagle Scout Project to build 15 bird houses along the Willow Creek from Cornerstone Drive to Schaeffer Road. The Township Park and Recreation Board approved the project and Brandon Beshore completed the project in October 2013, with all materials purchased by the Township.
- The Road Crew mowed and maintained the grass trail through the project in May, June and August of 2014.
- In June and September of 2014 Larry Lloyd of Berks Conservancy, along with interns from Albright College and volunteers from the Reading Area Water Authority pulled invasive species from along the Willow Creek.
- September 15 and 16, 2014 Township Road Crew installed informative signs along the walking trail of the Willow Creek.
- Larry Lloyd of the Berks Conservancy will complete the riparian planting of 56 native trees in October 2014 to replace those lost to animal activity.



Plants and trees along Willow Creek in Maidencreek Township help protect the waterway from sediment and other pollutants.

COURTESY OF BERKS COUNTY CONSERVANCY

It takes a community to clean a stream



Larry Lloyd *is a senior ecologist with the Berks County Conservancy.*

BY LARRY LLOYD

It is puzzling how water, our most precious and essential natural resource, is at the same time our most taken-for-granted gift. With the human body composed of greater than 95 percent water and with all aspects of health and life on planet Earth dependent on water, it would stand to reason that clean, sustainable drinking water would be a top priority. Do you know where your drinking water comes from and how it got there?

Today, there are many stressors to water quality, and our lack of attention and lack of action to protect our water quality is negatively impacting the availability of clean water.

Water is a community value, because it takes respect and action by all members of our communities to ensure quality drinking water. What we drink is the result of positive and negative human behaviors on the land, and everyone is downstream from someone.

There are some local communities in Berks County that are taking their link in the chain of protecting our water seriously. Among those forward-thinking communities using best management practices to enhance drinking water quality, Maidencreek Township is a shining and instructive example.

The Willow Creek runs through Ruscombmanor Township, Fleetwood, and Maidencreek and Ontelaunee townships on its way to join the Maiden Creek near its confluence with the Schuylkill River. The Willow Creek has stream segments that support breeding native brook trout. Native, as opposed to stocked, trout are bio-indicators of good water quality. Their presence in a stream means the process of cleaning water is functioning. The Willow Creek, like many streams, is an impaired waterway, primarily because of storm runoff from residential, commercial, industrial and agricultural impervious surfaces.

Instead of feeling daunted by these many challenges, Maidencreek officials and the state Fish and Boat Commission procured grant funding to help improve the water quality of the Willow Creek by installing aquatic habitat structures to reduce erosion and the accumulation of sediment, and by planting native trees along the stream to shade and cool the water, stabilize soil and serve as a riparian buffer from surrounding residences.

The Berks Conservancy helped the Fish and Boat Commission and the township develop a plan to manage Maidencreek's milelong, 44 acre riparian buffer along the creek. Between fall 2011 and spring 2013, more than 1,900 5-foot-tall native trees were planted.

Participating in the tree planting were the Fish and Boat Commission; Maidencreek Township supervisors and management staff; the township Parks and Recreation Board; Conservancy staff and members; the Maiden Creek Watershed Association; students from Kutztown University, Albright College, Reading Area Community College and Exeter High School; Tulpehocken Trout Unlimited; and students from the Fleetwood School District's elementary school, middle school and high school, who participated in all four plantings from start to finish.

This extraordinary participation proved contagious and was the impetus for other positive actions for water quality to be undertaken in the watershed. An upstream dairy farmer installed agricultural best management practices to keep animal manures from mixing with storm water runoff and entering the stream, reducing the nutrient load in the stream.

Downstream, the Maidencreek Township Authority and its staff planted more than 85 native trees, averaging 12 feet tall, creating a riparian buffer on their portion of the creek. In addition, Giorgio Foods plans to plant native trees in the fall along its portion of the creek.

Congratulations to all the partners for participation in this Willow Creek water quality project and for demonstrating the importance of talking individual and collective responsibility for the water quality in their watershed. Everyone can play a part in and add value to the sustainability of clean drinking water. Catch the wave.

We welcome letters and commentary. Letters should be brief (about 200 words) and should respond to a news item published in *Berks Country* or address a specific topic of interest to the rural community. For verification purposes, include your full name, the municipality in which you reside, and phone number (day and evening). **Online:** Go to berkscountry.readingeagle.com, click on the "Submit News" tab, select "Letters to the Editor," email: country@readingeagle.

APPENDIX D

WILLOW CREEK PROJECT MANAGEMENT PLAN

MAIDENCREEK TOWNSHIP OWNED PROPERTIES

WILLOW CREEK PROJECT MANAGEMENT PLAN

I. Background, overview

A. Project and Property Summary - open space in multiple residential subdivisions- Blandon Meadows, Willow Gardens, Creekside Manor, Maiden Creek Estates, Georgetown Village

B. Donor wishes - open space in Maidencreek Township

II. Property Description

A. Location - Road Map

B. Size – 44.19 acres with ~ 5,250 linear feet of the main stem Willow Creek and ~ 2,500 linear feet of an unnamed tributary of the Willow Creek. ; see also, aerial map , tax parcel map , topo map, approved Subdivision Plan map

C. Watershed – Primary watershed – Schuylkill River; Secondary watershed - Maiden Creek ; Local watershed – Willow Creek, a Cold Water Fishery (CWF) ; see also the Maiden Creek Watershed map with the Willow Creek Project location

D. Historic Land use – Farm pasture

E. Current Land Use – open space in residential subdivisions

F. Species of concern - breeding brook trout

G. Site Specific Studies – Pennsylvania Fish and Boat Commission as basis for grant award to Maidencreek Township for Expanding Brook Trout within Willow Creek as per the NFHAP and PA ABTJV State Conservation Strategy

III Management Goals and Objectives

A. Real Estate Aspects

1. Agreements – 20 year Operations and Maintenance Agreement within grant award which is applicable to the main stem of the Willow Creek; see also the grant award agreement
2. Easements - Buckeye Pipeline and UGI; see also the Subdivision Plan map
3. Storm water outfalls – see MS4 Stormwater Management Plan
4. Liability/Structures - playground and court and floodplain
5. Neighbor Relations- No Homeowners Association. This Management Plan is being developed in part to present to all Township residents the Township's intended uses for this Township owned property
6. School District - Fleetwood

7. Property Taxes – N/A
8. Municipality- Maidencreek Township
9. Municipal Zoning- High Density Residential
10. Title Report - clear
11. Environmental Assessment, Phase I- not required
12. Insurance- Township coverage (PIRMA for Liability and EMC for Property)

B. Ecological Aspects

Zone 1 - Riparian area/buffer of unnamed tributary of the Willow Creek , between Cornerstone Drive and Park Rd. ; 6.91 acres

1. Resource Management objectives - manage as wooded riparian buffer with no public access
2. Resource Management considerations –
   a. Encroachment by neighboring residences; e.g. dumping of yard waste and failure to respect property boundaries
   b. Stormwater runoff from neighboring residences
3. Resource Management actions-
   a. Identify and mark property line boundaries
   b. Contact neighboring residences by mail to inform neighbors of the Township's desires for the Township property and include educational materials - " Caring for your streamside property" and " When it rains , it drains"

Zone 2 – playground and court area , north of Cornerstone Drive; 1.2 acres

1. Resource Management objectives- manage for playground activities and active recreation
2. Resource Management considerations - provide a safe environment with vegetation management suited to playground activities
3. Resource Management actions-
   a. Perform regular maintenance
   b. Marking of property boundaries
   c. Posting of Regulations

Zone 3 - ~ 10 foot wide mowed access trail; 3.34 acres

1. Resource Management objectives – manage as public access corridor/trail in vicinity of the property line boundary; in addition, establish a few trail spurs from the main corridor/trail to the stream to provide stream access

2. Resource Management considerations – encroachment by neighboring residences ; e.g. dumping of yard waste and failure to respect property boundaries
3. Resource Management actions
    a. Identify and mark property line boundaries
    b. Contact neighboring residences by mail to inform neighbors of Township's desires for the Township property and include educational materials – " Caring for your streamside property", " When it rains , it drains", "Willow Creek Habitat Restoration Project"
    c. Identify and mark mowing limits

Zone 4 – Riparian area/buffer of Willow Creek, mainstem between Schaeffer Rd and Main St.; 32.74 acres

1. Resource Management objectives - manage as riparian buffer, as per 20 year O&M Agreement through grant award. Provide a few trail spurs from the main public access corridor/trail to the stream to provide for stream access
2. Resource Management considerations
    a. In cooperation with Pa. Fish and Boat Commission, monitoring and maintenance of installed practices as part of Grant Agreement
    b. Establishment of riparian buffer with special attention to installed trees and shrubs and also invasive species which may negatively effect riparian buffer function
    c. Provide access to stream
3. Resource Management actions –
    a. Identify and mark mowing limits for trail spurs
    b. Monitor and maintain installed stream and streambank practices
    c. Monitor and maintain riparian buffer; develop program for dealing with alien invasive species and Pa. Noxious weeds.
    d. Monitor effects of increased usage and develop program for dealing with emerging issues. E.g. increased trash ; durability of trail surfaces

Zone 5 – Parking locations for access to project area (note , to date, no parking areas have been chosen ; TBD)

1. Resource Management objectives- manage for parking to provide public access
2. Resource Management considerations - floodplain proximity and stormwater runoff from impervious surfaces

3. Resource management actions - identify possible locations and analyze relative to floodplain ; consider pervious surfaces and stormwater retention for any parking lot

C. Programmatic Aspects

1. Public access - open to all residents in Zones 2,3,4,5
2. Permitted uses - fishing with valid Pa, Fish and Boat fishing license in Zone 4; no hunting and trapping throughout
3. Authorized users – pipeline maintenance
4. Signage - to be determined; make a note on sketch plan and with photo and photo map entry
5. Rules posting and site maps – playground regulations and Willow Creek riparian buffer regulations(to be determined) , make note on Sketch map and with photo and photo map entry
6. Education – participation in Willow Creek Project by the Fleetwood School District; project area could be made available for field trips by Fleetwood School District
7. Research - ongoing by Pa. Fish and Boat Commission
8. Surveillance /Security – none currently; any future installation should be noted on Sketch Map and with photo and photo map entry

IV Operations and Maintenance

1. Work Plan, 3-5 year
2. Management Fund and/or Annual Stipend- Park and Rec Board has annual budget
3. Work Plan Project budgets
4. Staff and Board(s) responsibilities

V. Reporting

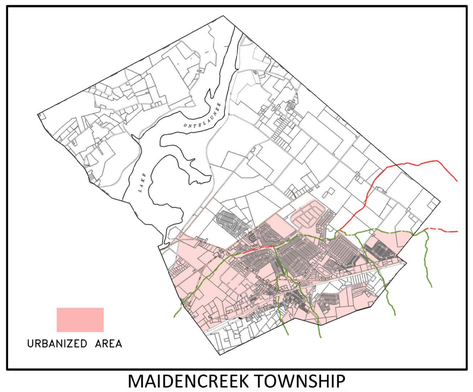
1. internal annual report form - playground form

   a. photo stations with photos annually; see also Photo stations map

2. owned property reports files

APPENDIX E

PRP MAPS – EXISTING & PROPOSED CONDITIONS

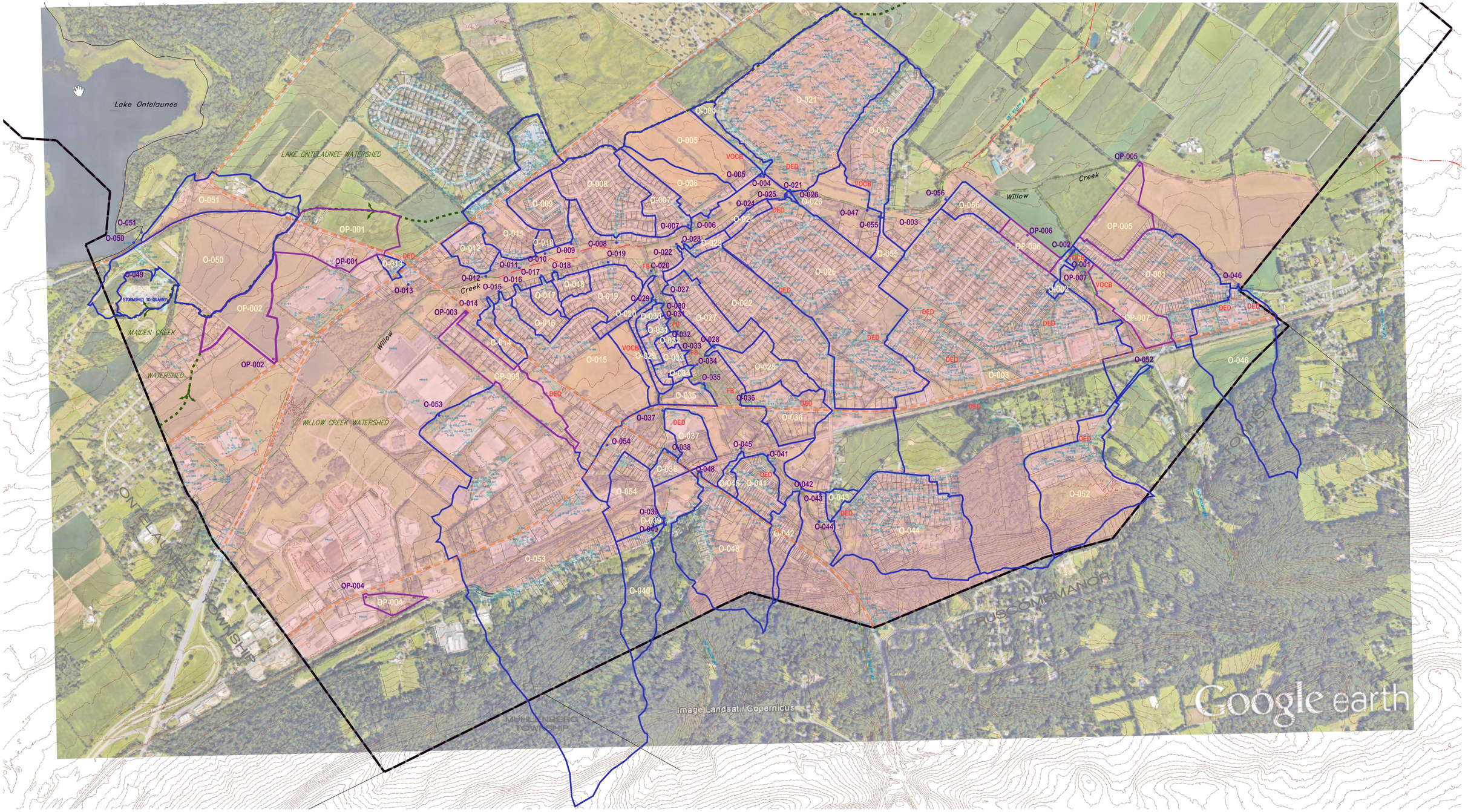


MAIDENCREEK TOWNSHIP

LEGEND

- O-001 MS4 OUTFALL & ID #
- OP-001 MS4 OBSERVATION POINT & ID #
- G-1 EXISTING STORMWATER COLLECTION SYSTEM
- EXISTING STORM PIPE AND FLOW DIRECTION
- EXISTING CHANNEL
- EXISTING STREAM (IMPAIRED-NUTRIENTS)
- EXISTING STREAM (IMPAIRED-PATHOGENS)
- TOWNSHIP ROAD
- STATE ROAD
- ACT 167 WATERSHED BOUNDARY
- STORM SEWERSHED (OUTFALL)
- STORM SEWERSHED (OBSERVATION POINT)
- 0-001 STORM SEWERSHED ID
- MUNICIPAL BOUNDARY
- "READING" URBANIZED AREA
- DED E-1 EXISTING DRY EXTENDED DETENTION BASIN
- VOCB VEGETATED OPEN CHANNEL – "B" SOILS
- FB FOREST BUFFER

MS4 REQUIREMENTS TABLE		
IMPAIRED DOWNSTREAM WATERS OR APPLICABLE TMDL NAME	REQUIREMENTS	OTHER CAUSE(S) OF IMPAIRMENT
UNNAMED TRIBUTARIES TO WILLOW CREEK	APPENDIX B–PATHOGENS (5)	NONE LISTED
SCHUYLKILL RIVER	APPENDIX C–PCB (4a)	NONE LISTED
MAIDEN CREEK	APPENDIX B–PATHOGENS (5)	OTHER HABITAT ALTERATIONS (4c)
LAKE ONTELAUNEE TMDL	TMDL PLAN–NUTRIENTS, SUSPENDED SOLIDS (4a)	OTHER HABITAT ALTERATIONS (4c)
WILLOW CREEK	APPENDIX B–PATHOGENS(5), APPENDIX E–NUTRIENTS (5)	FLOW ALTERATIONS (4c)



SDE SYSTEMS DESIGN ENGINEERING, INC

1032 JAMES DR. LEESPORT, PA 19533 PHONE: 610.916.8500 FAX: 610.916.8501

BOYERTOWN, PA 610.369.1319 SCHUYLKILL HAVEN, PA 570.385.5549

SDE Project No.: 17-0019-0191

500 0 250 500 1000

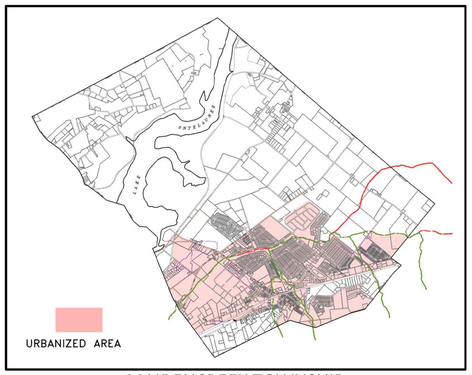
1" = 500'

PRP MAP - EXISTING CONDITIONS

MAIDENCREEK TOWNSHIP

BERKS CO., PA.

UPDATED 11/21/18
06/25/2017



MAIDENCREEK TOWNSHIP

LEGEND

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- "READING" URBANIZED AREA
- FB FOREST BUFFER
- AGC AGRICULTURAL CONVERSION BMP

MS4 REQUIREMENTS TABLE		
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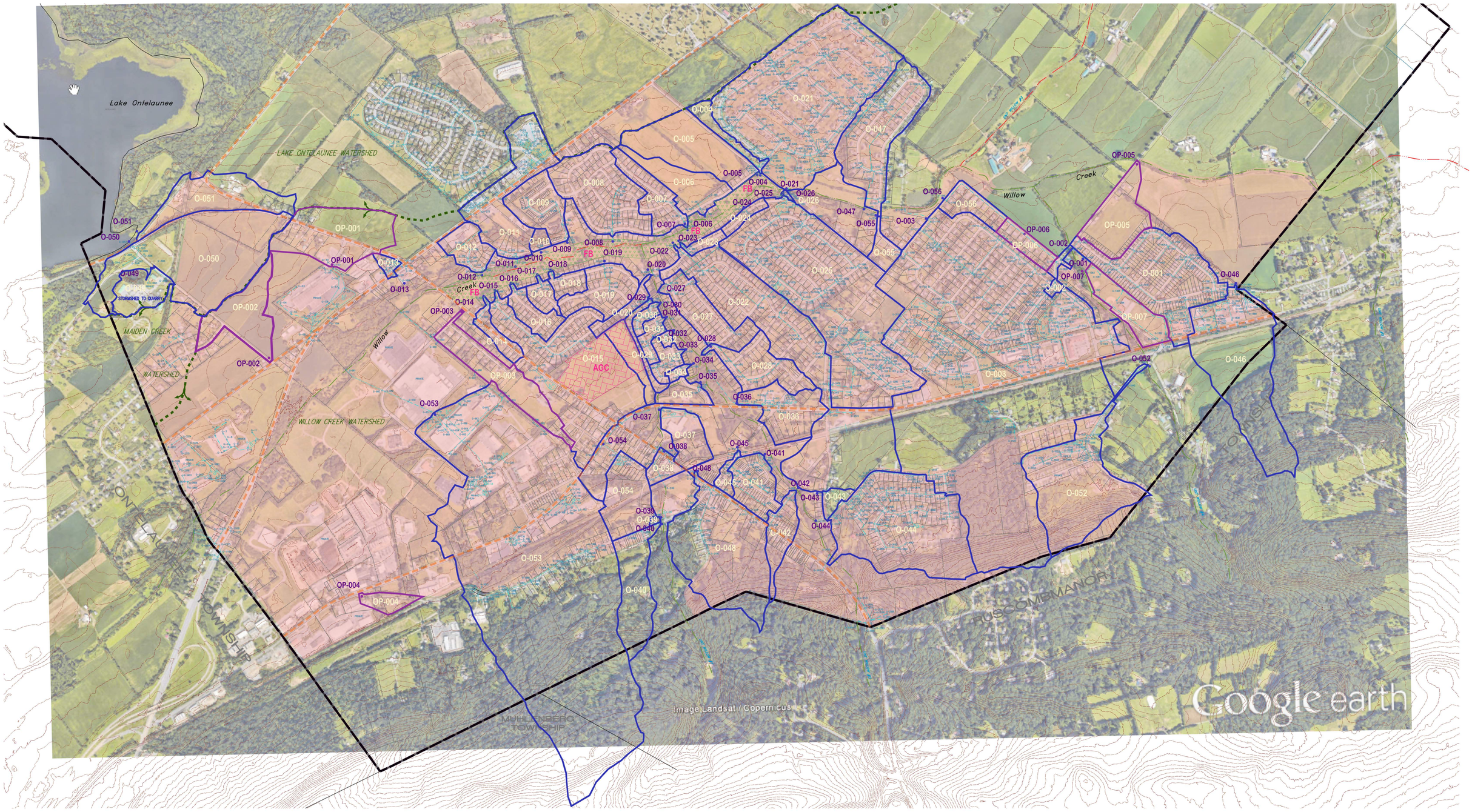

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PRP MAP - PROPOSED CONDITIONS

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