Pollutant Reduction Plan

For

RIDLEY TOWNSHIP

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DEFINITIONS AND ACRONYMS

BMP……...	Best management practice
DEP…….	Pennsylvania Department of Environmental Protection
DVRPC……...	Delaware Valley Regional Planning Commission
lb…….	Pound
MCM……...	Minimum Control Measures
MS4…….....	Small Municipal Separate Storm Sewer System
NPDES……	National Pollutant Discharge Elimination System
O&M……...	Operation and Maintenance
PRP…….	Pollutant Reduction Plan
TN……...	Total Nitrogen
Township……	Ridley Township
TP……	Total Phosphorous
TSS……..	Total Suspended Solids
USDA……...	United States Department of Agriculture
yr……...	Year

INTRODUCTION

This PRP is a component of the Township's NPDES Permit to discharge stormwater from Small Municipal Separate Storm Sewer Systems (MS4s). This PRP will outline the Township's 5-year plan to reduce sediment loading from the MS4. The Plan will also discuss the calculations and methodology used to determine storm sewershed boundaries, sediment loadings, sediment reductions, and BMP planning.

The Township is located within eight watersheds – Crum Creek, Little Crum Creek, Darby Creek, Muckinipattis Creek, Ridley Creek, Stony Creek, Shipley Run (aka Shipley Branch), and the Delaware River. All waterbodies are considered impaired according to DEP's *Integrated Water Quality Monitoring and Assessment Report*. All impairments are caused by siltation except for Darby Creek and the Delaware River. Therefore, the Township is required to reduce sediment discharging to Crum Creek, Little Crum Creek, Muckinipattis Creek, Ridley Creek, Stony Creek, and Shipley Run (aka Shipley Branch) by 10% within the next five years.

SECTION A – PUBLIC PARTICIPATION

There are 3 major components of the public participation process of the PRP – advertising, public comments, and response to public comments. A draft of this PRP was advertised in the Delaware County Daily Times on August 1, 2017. See Appendix 1 for the Proof of Publication. A copy of the draft PRP was made available to the public for the next 30 days. No comments were received.

The PRP was advertised a second time on December 14, 2018 since the list of proposed BMPs and sediment reduction values changed. A copy of the draft PRP was made available to the public for the next 30 days.

Appendix 2 contains the meeting minutes, agenda, and notes from the public meetings.

SECTION B – MAP

The entire storm sewer system for the Township was mapped and the storm sewersheds were delineated based on the stormwater flows going to each municipal inlet. See Appendix 3 and Appendix 4 for maps of the Township's storm sewer system and storm sewersheds. Please note that Appendix 3 shows municipal inlets and storm sewer systems as well as State and private inlets.

Two distinct areas have been parsed out of the municipal sewersheds - State roads and areas that do not drain to the MS4. This parsing has been done following DEP's Parsing Guidelines.

In this PRP, Observation Points are used to mark where water from municipal streets is going to end up before crossing into another municipality, parsed NPDES permit area, or State road. It is important to note that these points area used to conduct the MCM testing and are either located at manholes or inlets within the Township.

The various maps for this PRP (Storm Sewer Map, Storm Sewershed Map, Land Use Map, etc.) are listed in the Table of Contents on page 2 of this report.

SECTION C – POLLUTANTS OF CONCERN

This PRP has been developed for impaired waters and the pollutants are based on the impairment listing in DEP's MS4 Requirements Table. An excerpt from that Table is shown below. Since the impairment of the Township's streams are due to siltation, a requirement of 10% sediment reduction must be addressed.

Table 1. Excerpt from DEP's MS4 Requirements Table.

Impaired Downstream Waters or Applicable TMDL Name	**Requirement(s)**
Crum Creek	Appendix C-PCB (4a), Appendix E-Siltation (5)
*Darby Creek	Appendix C-PCB (5)
*Delaware River	Appendix C-PCB (4a)
Little Crum Creek	Appendix E-Siltation (5)
Muckinipattis Creek	Appendix C-PCB (5), Appendix E-Siltation (5)
Ridley Creek	Appendix E-Siltation (5)
Stony Creek	Appendix C-PCB (5), Appendix E-Siltation (5)
Shipley Run/ Shipley Branch	Appendix C-PCB (5), Appendix E-Siltation (5)
*No Township outfall discharges to indicated stream	

SECTION D – DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

In this PRP, DEP's Simplified Method was used to calculate the existing sediment loading for each storm sewershed without BMPs. The storm sewersheds were mapped using AutoCAD® and analyzed in ArcMap®. To calculate the existing loading rates, pervious and impervious areas within each storm sewershed needed to be determined. The "DVRPC 2015 Impervious Surface - Delaware County, PA" shapefile from the Delaware Valley Regional Planning Commission was used and overlaid on top of the storm sewershed layer. According to the DVRPC website, "This dataset contains impervious landbase features updated using digital orthoimagery acquired in 2015 by the Delaware Valley Regional Planning Commission (DVRPC) and its partners." Figure 1 shows the "DVRPC 2015 Impervious Surface - Delaware County, PA" shapefile within the Township boundaries.

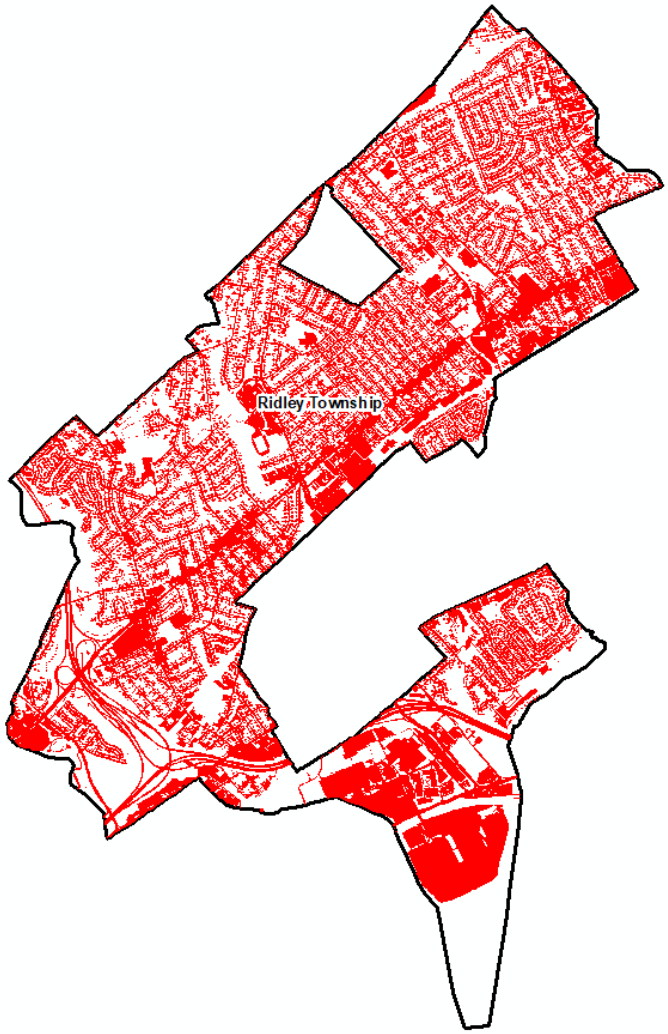

Figure 1. The "DVRPC 2015 Impervious Surface - Delaware County, PA" shapefile shown in red.

To calculate the impervious area within each storm sewershed, the impervious shapefile was clipped to the individual storm sewershed boundaries. For an example of this, please see Figure 2. The impervious area within each storm sewershed was calculated in ArcMap®.

To calculate the pervious area within each storm sewershed, the impervious area and the total storm sewershed area were used. It was assumed that any area outside of the impervious area within a storm sewershed was pervious. See Equation 1 below:

$$Total\ Sewershed\ Area - Impervious\ Area = Pervious\ Area$$

Figure 2. The "DVRPC 2015 Impervious Surface - Delaware County, PA" shapefile (shown in red) has been clipped to the Sewershed CRC-1/2 boundary.

Appendix 7 shows these area totals for each storm sewershed. To calculate the total sediment loading from each storm sewershed, the TSS (Sediment) loading rate from DEP's PRP Instructions was used. The loading rates are shown in Figure 3 on the following page. Please note that Delaware County is not listed as a separate entity in this table; the loading rates used in this PRP come from the "All Other Counties" column.

3800-PM-BCW0100k 3/2017
PRP Instructions

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
McKean	impervious developed	38.7	20.93	3.21	1,843.27
	pervious developed	5.3	22.58	1.45	249.26
Mifflin	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Montour	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Northumberland	impervious developed	8,687.3	25.73	1.54	2,197.08
	pervious developed	25,168.3	24.63	0.54	367.84
Perry	impervious developed	5,041.1	26.77	1.32	2,314.7
	pervious developed	9,977	23.94	0.51	343.16
Potter	impervious developed	2,936.3	16.95	2.75	1,728.34
	pervious developed	2,699.3	17.11	1.09	265.2
Schuylkill	impervious developed	5,638.7	30.49	1.56	1,921.08
	pervious developed	14,797.2	29.41	0.57	264.04
Snyder	impervious developed	4,934.2	28.6	1.11	2,068.16
	pervious developed	14,718.1	24.35	0.4	301.5
Somerset	impervious developed	1,013.6	25.13	2.79	1,845.7
	pervious developed	851.2	25.71	1.14	293.42
Sullivan	impervious developed	3,031.7	19.08	2.85	2,013.9
	pervious developed	3,943.4	21.55	1.31	301.58
Susquehanna	impervious developed	7,042.1	19.29	2.86	1,405.73
	pervious developed	14,749.7	20.77	1.21	203.85
Tioga	impervious developed	7,966.9	12.37	2.09	1,767.75
	pervious developed	18,090.3	12.22	0.76	261.94
Union	impervious developed	4,382.6	22.98	2.04	2,393.55
	pervious developed	14,065.3	20.88	0.69	343.81
Wayne	impervious developed	320.5	18.69	2.89	1,002.58
	pervious developed	509	21.14	1.31	158.48
Wyoming	impervious developed	3,634.4	16.03	2.53	2,022.32
	pervious developed	10,792.9	13.75	0.7	238.26
York	impervious developed	10,330.7	29.69	1.18	1,614.15
	pervious developed	40,374.8	18.73	0.29	220.4
All Other Counties	impervious developed	-	23.06	2.28	1,839
	pervious developed	-	20.72	0.84	264.96

Figure 3. Section from Attachment B titled "Developed Land Loading Rates for PA Counties" from the DEP's PRP Instructions.

Sediment loading rates for each storm sewershed were calculated using Equation 2 below. The calculated existing sediment loading rates without BMPs are shown in Appendix 7.

$$Impervious\ Area\ (acres)\ x\ TSS\ (lbs/acre/yr) = Sediment\ Loading\ (lbs/yr)$$

$$+\quad Pervious\ Area\ (acres)\ x\ TSS\ (lbs/acre/yr) = Sediment\ Loading\ (lbs/yr)$$

$$= Total\ Sediment\ Loading\ (lbs/yr)$$

According to Section I.C of DEP's PRP Instructions, "If structural BMPs were implemented prior to development of the PRP and continue to be operated and maintained, the MS4 may claim pollutant reduction credit in the form of reduced existing loading." However, to claim credit for these BMPs, the BMPs must be currently installed and maintained in existing load estimates, i.e. sewersheds.

The Township contains many existing structural BMPs that were installed prior to this PRP. However, not all are within sewershed boundaries. The BMPs that are within the sewershed boundaries were accounted for in the existing sediment loading calculations. The map of these existing BMPs is Appendix 9 of this Report. The list of the BMPs that are within the sewershed boundaries is Appendix 11.

BMP sediment removal values were calculated using DEP's Simplified Method. The existing BMP calculations can be seen in Appendix 11. The Existing Sediment Loading for has been adjusted accordingly to take credit for these BMPs. The total existing sediment loading rates can be seen in Appendix 7 and Appendix 12.

The impairment for Crum Creek, Little Crum Creek, Muckinipattis Creek, Ridley Creek, Stony Creek, and Shipley Run (aka Shipley Branch) is based on siltation, therefore a minimum of 10% TSS reduction is required. The impairment for Darby Creek and the Delaware River is based on PCB so the 10% TSS reduction is not applicable. The final loading totals for each watershed subject to the sediment removal requirement were multiplied by 10% to determine the required reductions. Final sediment loading values and required reductions are shown in Appendix 12.

SECTION E – SELECT BMPS TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING

To meet the required sediment reductions within the 5-year period, various BMPs need to be constructed within the Township within this time period. Required reductions outlined in Section D need to be met by the end of the 5-year period. BMP pollutant load removal rates vary depending on the type of BMP. Therefore, careful planning was considered when choosing the correct BMPs to meet the required load reductions.

BMP planning has been separated by watershed. Each watershed needs to meet the 10% reduction requirement. Since the Township has limited municipal owned parks, recreation, and open areas, BMP planning was based on land ownership, land use, sediment reduction, and feasibility. To reach these goals, proposed BMPs have been determined. The BMPs selected include various infiltration basins, rain gardens, seepage beds, tree plantings, and streambank restoration. Calculations are shown in Appendix 13. The locations of the proposed BMPs are shown in Appendix 9.

To calculate the BMP sediment loading rates, DEP's Simplified Method was used. Equation 2 from Section D was used to calculate the sediment loading rate for each BMP. In this case, the area value used is how many acres are draining to and being treated by the proposed BMP.

BMPs are not 100% efficient, therefore, the sediment loading rates need to be multiplied by the BMP Effectiveness value (Appendix 8). Removal rates were calculated using Equation 3 below:

$$Sediment\ Loading\ Rate\ (lbs/yr)\ x\ Effectiveness\ Value = Removal\ Rate\ (lbs/yr)$$

Based on these removal rates for each proposed BMP, the Township will meet the 10% reduction goal.

Stream restoration, one of the BMPs selected, must meet qualifying criteria to be eligible for MS4 load reduction credits. DEP's "Considerations of Stream Restoration Projects in Pennsylvania for eligibility as an MS4 Best Management Practice" document outlines the relevant qualifying criteria. A copy of the document is in Appendix 14. The qualifying criteria and what the Township has done to meet the criteria are described in the Table below.

Table 2. Streambank restoration qualifying criteria and steps done to meet it.

Criteria	What has been done	Location in PRP
Permittee must document existing channel or streambank erosion and an actively enlarging or incising urban stream condition prior to restoration (an existing problem)	Pictures of the streambank were taken where restoration is planned to be competed	Appendix 14
Effectiveness is most readily demonstrated for projects in 1st -3rd order streams (small). Larger scale projects will require additional documentation	Stream order has been determined	Appendix 14
The project must address at least 100 linear feet of stream channel	This has been taken into account in the Planned BMP calculations	Appendix 13
Impervious areas upstream of the project must be sufficiently treated to address peak flows that may exceed engineering design thresholds or compromise channel form and function	This will be considered in the design	
The project must address both sides of the channel on sites where a need to do so is evident	This has been taken into account in the Planned BMP calculations	Appendix 13

SECTION F – FUNDING MECHANISM(S)

The Township is exploring funding opportunities to construct and maintain the planned BMPs. The number and types of BMPs were chosen to meet the required reduction rates, to minimize possible costs, and maximize the area draining to and treated by BMPs. The Township plans on funding the BMPs through the municipality's annual budget and/or applying for local, State, and/or Federal grants, as necessary. At this time, raising taxes or charging homeowners and industries does not sound feasible. Please note that the cost for each BMP has not been determined yet.

SECTION G – IDENTIFY RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE (O&M) OF BMPS

Once the planned BMPs are constructed and being used, O&M of these structures need to be implemented. The BMPs will be constructed on Township owned land so the Township will be responsible for the O&M.

Activities and frequency involved with O&M for each BMP is outlined in the table below. Please note that the same O&M for similar BMPs is assumed. In addition to using the Pennsylvania Stormwater Best Management Practices Manual, O&M information should also come from the Ridley Township Stormwater Management Ordinance.

Since Stream Bank Restoration is not listed in the BMP Manual, the Stormwater Best Management Practice Operations, Maintenance, and Inspection Agreement in the Ordinance should be followed. In the first couple of years following the construction of the stream bank restoration project, the banks should be inspected at least 2 – 4 times per year or after major storm events[1] to replace any plants and to make sure the bank continues to be stabilized.

[1] In the *Pennsylvania Stormwater Best Management Practices Manual, Section 3 Stormwater Management Principles, Goals, and a Management Model* under Section 3.2.1, the "smaller storms [are] typically the 2-year storm and under." Therefore, a larger/major storm can be anything above the 2-year storm.

Table 3. O&M Excerpts from Chapter 6 of the *Pennsylvania Stormwater Best Management Practices Manual*.

Type of BMP	Maintenance Issues
Bioretention /Rain Garden	Properly designed and installed Bioretention areas require some regular maintenance. • While vegetation is being established, pruning and weeding may be required. • Detritus may also need to be removed every year. Perennial plantings may be cut down at the end of the growing season. • Mulch should be re-spread when erosion is evident and be replenished as needed. Once every 2 to 3 years the entire area may require mulch replacement. • Bioretention areas should be inspected at least two times per year for sediment buildup, erosion, vegetative conditions, etc. • During periods of extended drought, Bioretention areas may require watering. • Trees and shrubs should be inspected twice per year to evaluate health.
Infiltration Basin	• Catch Basins and Inlets (upgradient of infiltration basin) should be inspected and cleaned at least two times per year and after runoff events. • The vegetation along the surface of the Infiltration basin should be maintained in good condition, and any bare spots revegetated as soon as possible. • Vehicles should not be parked or driven on an Infiltration Basin, and care should be taken to avoid excessive compaction by mowers. • Inspect the basin after runoff events and make sure that runoff drains down within 72 hours. Mosquito's should not be a problem if the water drains in 72 hours. Mosquitoes require a considerably long breeding period with relatively static water levels. • Also inspect for accumulation of sediment, damage to outlet control structures, erosion control measures, signs of water contamination/spills, and slope stability in the berms. • Mow only as appropriate for vegetative cover species. • Remove accumulated sediment from basin as required. Restore original cross section and infiltration rate. Properly dispose of sediment.

Detention Basin	Maintenance is necessary to ensure proper functionality of the extended detention basin and should take place on a quarterly basis. A basin maintenance plan should be developed which includes the following measures: • All basin structures expected to receive and/or trap debris and sediment should be inspected for clogged and excessive debris and sediment accumulation at least four times per year, as well as after every storm greater than 1 inch. o Structures include basin bottoms, trash racks, outlets structures, riprap or gabion structures, and inlets. • Sediment removal should be conducted when the basin is completely dry. Sediment should be disposed of properly and once sediment is removed, disturbed areas need to be immediately stabilized and revegetated. • Mowing and/or trimming of vegetation should be performed as necessary to sustain the system, but all detritus should be removed from the basin. o Vegetated areas should be inspected annually for erosion. o Vegetated areas should be inspected annually for unwanted growth of exotic/invasive species. o Vegetative cover should be maintained at a minimum of 95 percent. If vegetative cover has been reduced by 10%, vegetation should be reestablished.
Subsurface Infiltration Bed	Subsurface Infiltration is generally less maintenance intensive than other practices of its type. Generally speaking, vegetation associated with Subsurface Infiltration practices is less substantial than practices such as Recharge Gardens and Vegetated Swales and therefore requires less maintenance. Maintenance activities required for the subsurface bed are similar to those of any infiltration system and focus on regular sediment and debris removal. The following represents the recommended maintenance efforts: • All Catch Basins and Inlets should be inspected and cleaned at least 2 times per year. • The overlying vegetation of Subsurface Infiltration features should be maintained in good condition, and any bare spots revegetated as soon as possible. • Vehicular access on Subsurface Infiltration areas should be prohibited, and care should be taken to avoid excessive compaction by

	mowers. If access is needed, use of permeable, turf reinforcement should be considered.
Infiltration Trench	• Catch Basins and Inlets should be inspected and cleaned at least 2 times per year. • The vegetation along the surface of the Infiltration Trench should be maintained in good condition, and any bare spots revegetated as soon as possible. • Vehicles should not be parked or driven on a vegetated Infiltration Trench, and care should be taken to avoid excessive compaction by mowers.
Bioswale	Maintenance activities to be done annually and within 48 hours after every major storm event (> 1 inch rainfall depth): • Inspect and correct erosion problems, damage to vegetation, and sediment and debris accumulation (address when > 3 inches at any spot or covering vegetation) • Inspect vegetation on side slopes for erosion and formation of rills or gullies, correct as needed • Inspect for pools of standing water; dewater and discharge to an approved location and restore to design grade • Mow and trim vegetation to ensure safety, aesthetics, proper swale operation, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility; mow only when swale is dry to avoid rutting • Inspect for litter; remove prior to mowing • Inspect for uniformity in cross-section and longitudinal slope, correct as needed • Inspect swale inlet (curb cuts, pipes, etc.) and outlet for signs of erosion or blockage, correct as needed Maintenance activities to be done as needed: • Plant alternative grass species in the event of unsuccessful establishment. • Reseed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming • Rototill and replant swale if draw down time is more than 48 hours • Inspect and correct check dams when signs of altered water flow (channelization, obstructions, erosion, etc.) are identified

	• Water during dry periods, fertilize, and apply pesticide only when absolutely necessary