MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)

WYOMISSING CREEK WATERSHED TMDL

PREPARED FOR

THE WYOMISSING CREEK WATERSHED COALITION

21 O'NEIL STREET

MOHNTON, PA 19540

BRECKNOCK TOWNSHIP, CUMRU TOWNSHIP, MOHNTON BOROUGH, CITY OF READING, SHILLINGTON BOROUGH, SPRING TOWNSHIP, WEST READING BOROUGH, AND WYOMISSING BOROUGH, BERKS COUNTY, PENNSYLVANIA

JULY 25, 2017

PREPARED BY

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75 COMMERCE DRIVE

WYOMISSING, PA 19610

July 2017

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Regulatory Background

MS4 Program Development

The Municipal Separate Storm Sewer System (MS4) permit program has been in effect for Phase II Municipalities since 2003. The program was based in the Clean Water Act and is part of the Non-Point Discharge Elimination System Permitting, and requires an accounting of sources of pollution emanating from urbanized areas. The permits are administered in Pennsylvania by the PA DEP, and Commonwealth municipalities have various annual requirements to comply with the program, with scopes expanding during each subsequent five-year permit term. The program began as primarily a process of instituting non-structural Best Management Practices (BMPs) through a series of Minimum Control Measures (MCMs) to institute a "cultural" change in urbanized areas, through a series of protocols on public education and outreach, public involvement and participation, and an extensive program of construction-phase and post-construction stormwater management design criteria. Several other aspects of the program involved efforts by municipal public works departments relating to monitoring of illicit discharges (illegal pollution of stormwater) and the general adoption of good housekeeping practices. All of these programs were to be documented through annual and periodic reports in the first decade and a half of the permits.

One of the primary goals of the program is to address impaired stream segments to improve water quality and ultimately delist the stream. To serve this purpose, several TMDLs (Total Maximum Daily Loads) were developed by the PA DEP and other organization to identify the sources, causes, and extents of impairments to streams. The TMDLs also were developed to outline the healthy level of pollutant that the stream could experience and still attain, as well as to determine the total reduction necessary from both municipal and non-municipal non-point sources to bring the stream into attainment.

TMDLs can be for a variety of pollutants, ranging from synthetic organic compounds like PCBs, to various heavy metals, to the more common sources of impairment, sediment and nutrients. Sediment can be from accelerated erosion of land due to agriculture, or from scour due to intensified flows from increased urbanization and the impact of additional impervious cover in a watershed. Nutrient loading comes primarily from agricultural practices (fertilizer application or manure generation), but can also come from urban sources.

Wyomissing Creek Sediment TMDL

The Wyomissing Creek TMDL was completed and approved in 2004. This TMDL is for sediment loading in the Wyomissing Creek and its unnamed tributaries. The TMDL is a bulk allocation for the whole watershed with no delineation of the impact to individual tributaries or individual municipalities for MS4 wasteload allocations. The Wyomissing Creek watershed was compared to a baseline of the Big Hollow Watershed in Centre County, Pennsylvania, with the rationale of the reference watershed being a comparable size with comparable urbanization, land use, and geology. The results of the sediment TMDL are summarized in Figures 1 and 2 (below).

	Entire Watershed			Non MS4 Areas		MS4 Areas	
Source	Area (Ac)	Sed (lbs/yr)	Loading Rate (lbs/ac/yr)	Area (Ac)	Sed (lbs/yr)	Area (Ac)	Sed (lbs/yr)
HAY/PAST	751.20	163,200.00	217.25	364.72	79,236.29	386.48	83,963.71
CROPLAND	1,700.10	4,095,400.00	2,408.92	906.24	2,183,057.05	793.86	1,912,342.95
CONIF_FOR	464.60	16,600.00	35.73	280.66	10,027.89	183.94	6,572.11
MIXED_FOR	395.40	15,000.00	37.94	229.28	8,698.03	166.12	6,301.97
DECID_FOR	2,604.50	82,600.00	31.71	1,576.08	49,984.34	1,028.42	32,615.66
TRANSITION	133.40	1,523,000.00	11,416.79	62.49	713,435.31	70.91	809,564.69
LO_INT_DEV	2,985.00	306,600.00	102.71	660.94	67,887.51	2,324.06	238,712.49
HI_INT_DEV	953.80	108,800.00	114.07	160.79	18,341.32	793.01	90,458.68
Stream Bank	20.80	4,242,776.00	203,979.62	7.30	1,489,051.19	13.50	2,753,724.81
Total	**9,988.00**	**10,553,976.00**	**1,056.67**		**4,619,718.92**		**5,934,257.08**
				Reducable	4,551,008.67	Reducable	5,888,767.33
				LNR	68,710.25	LNR	45,489.75
				Total	4,619,718.92	Total	5,934,257.08

Figure 1 – Summary of TMDL Current Loading Totals (from Wyomissing Creek TMDL, PA DEP)

Component	Sediment (lbs./yr.)
TMDL (Total Maximum Daily Load)	6,329,495.48
MOS (Margin of Safety)	632,949.55
WLA (Wasteload Allocation)	3,747,238.13
LA (Load Allocation)	1,949,307.80

Figure 2 – Summary of Total Maximum Daily Load to Achieve Attainment (from Wyomissing Creek TMDL, PA DEP)

Based upon the information above, the total "current" (in 2004) loading from MS4-Permited Areas (likely Census-designated Urbanized Areas) was 5,934,257 pounds per year, and the allowable Wasteload Allocation (WLA) was 3,747,238 pounds per year. This means that to meet their regulatory allotment, the eight (8) Wyomissing Creek municipalities must collectively eliminate 37% of the existing pollutant loading from urbanized areas to achieve ultimate compliance. This original calculation was based upon old census-designated urbanized areas and outdated land-use data, so the original model must be updated as a component of the 2018 permit submission. Additionally, the Department's TMDL requirements for the 2018-2023 permit cycle will require a 10% reduction in the current loading. Municipalities are collectively responsible for the urbanized planning area.

Wyomissing Creek Watershed Coalition

History and Formation

Beginning in August of 2010, efforts were made between the eight (8) municipalities in the Wyomissing Creek watershed (and consequently subject to the TMDL) to begin assessing opportunities to jointly comply with the regulations. While most TMDL methodologies would provide a wasteload allocation (WLA) to each individual municipality, the Wyomissing Creek's WLA was applied to the entire watershed. As such, it was effectively impossible for an individual municipality to gauge an individual regulatory responsibility, so a joint effort was effectively the only option. As a TMDL Implementation Plan was a requirement of the upcoming September 2012 Individual Permit submission, it seemed pertinent to begin the planning process as soon as feasible. At the time, there was no guideline for measurable progress during a permit period, so the intent was to develop the most cost-effective BMP opportunities to generate a positive impact on the stream.

Due to the costs associated with the TMDL Implementation Plan, it became apparent that the municipalities would need to develop a cost-sharing agreement. Initially, it was determined that a $5,000 membership fee would be provided for the initial year, with a comparable cost expected annually. The actual membership fee would be based upon anticipated expenditures for the upcoming year, with the ultimate plan of revisiting the agreement once the members began undertaking substantial capital improvements. It was at this time that the Wyomissing Creek Watershed Coalition (WCWC) was formally created, with the seven initial member municipalities adopting ordinances and becoming members. Ultimately, the eighth municipality within the watershed also joined the Coalition. Meetings have been generally held monthly since that time, with cancellations due to inclement weather or lack of action items. The member municipalities are as follows (alphabetically listed): Brecknock Township, Cumru Township, Mohnton Borough, the City of Reading, Shillington Borough, Spring Township, West Reading Borough, and Wyomissing Borough.

Initial Studies

The first step undertaken by the WCWC was to commission an updated assessment of the watershed, as the initial impairment that facilitated the development of the TMDL occurred in 1998. The last sampling on record was from 2002, nearly a decade before the Implementation Plan was to be developed. As such, the Members felt it was appropriate to reassess the stream to determine if conditions had changed so that BMP implementation could be better prioritized. Eco-Analysts were commissioned to complete a study with support from Berks County Conservation District personnel. DEP's ICE protocol was followed, and the sample sites were located as closely to the original sampling sites as possible.

The results of the study confirmed the DEP's previous determination of which reaches of the Wyomissing Creek and its tributaries were attaining and which were impaired; however, some supplemental discoveries were made over the course of the study. It became apparent that while it was still impaired, conditions in the "Northridge" subshed (UNT # 01840) were extremely favorable due to attaining chemistry and habitat. Only a lack of macrobiota were a cause for impairment, leading the WCWC to prioritize this area for BMP implementation. The thought was that a modest number of BMP retrofits or installations might be sufficient to bring this segment into attaining, thus providing an early success for the group.

Additionally, the results of the study and the assessment of stream conditions led to the conclusion that the watershed was not impaired because of sediment loading from urbanized areas in most instances, but rather the scouring effects of concentrated stormwater flows were destroying the habitat of aquatic life and disturbing the streambed during significant precipitation events. As such, BMPs for water quality and sediment mitigation, while still beneficial, would not be as effective in bringing the stream to meet its designated use. BMPs such as streambank restoration, riparian buffers, and habitat improvements would likewise have limited effectiveness, because concentrated stormwater would potentially destroy the BMPs installed. As a result of these findings, the WCWC made a goal to initially address the effective management of stormwater runoff with future streambank restoration efforts at a later time. This core methodology would allow the Coalition to first "treat the disease and then treat lingering symptoms", rather than continue to treat the side effects only to have them chronically reoccur.

Coldwater Heritage Plan & BMP Prioritization Process

In addition to the updated Assessment of the Watershed, the Coalition commissioned a Coldwater Heritage Plan for development by the Berks County Conservation District. The intent of this plan was two-fold; first, it provided the Coalition with the opportunity to pursue Coldwater Heritage Grants to offset the costs of BMP implementation, and secondly, it began the process of identifying prospective BMPs. The CWHP was completed in 2014.

While this initial list of prospective BMPs was being developed, the Members developed a ranking system for the prioritization of BMPs. First, a list of parameters was developed and narrowed down to five core parameters. Then, through a value-engineering process of each member assigning a value to each parameter and a weighted average of the values being applied, each parameter was ranked and a scale of 1-5 "points" was developed for each parameter. The parameters, in order of importance were as follows: (1) Initial Capital Cost (with greater scores for less expensive projects or projects with grants availability), (2) Long-term Cost (Operations and Maintenance requirements, with facilities that would be maintained by non-municipal personnel taking precedence), (3) Impact/Assessability (Projects with the largest impact and most easily assessed impact taking precedence), (4) Location (visible projects with high educational and outreach value would rank higher), and (5) Timeframe (Projects that could be implemented more expediently or without extensive permitting requirements would rank higher).

The process of ranking the prospective BMPs identified in the Coldwater Heritage Plan began at this time. Most of the BMPs were structural in nature, or rather, would be constructed or reconstructed stormwater management infrastructure facilities; however, a handful of prospective BMPs were non-structural in nature. These included Education and Outreach efforts, the potential for SALDO and Zoning revisions to better protect the sensitive areas of the watershed, among other options.

Initial TMDL Strategy Plan Submission

In accordance with the 2012 permit requirements, the TMDL Implementation Plan was submitted by each of the eight Member Municipalities in the WCWC. A copy was sent by each municipality individually, but was considered a joint submission for this requirement. Although the WCWC municipalities are in the service area of the DEP's South-central Regional Office (SCRO), the submission at this time was sent to the South-east Regional Office (SERO) per DEP's directions. The individual permits for the eight constituent municipalities appeared in the PA Bulletin, but an engineer of one of the municipalities received email correspondence from SERO DEP stating that the permits were advertised mistakenly and that the DEP had comments and concerns regarding the TMDL. As such, the WCWC met with the DEP SCRO's permit reviewer and enforcement personnel to discuss the scope of the TMDL Implementation Plan. After a request for minor revisions and a copy of the Eco-Analysts Stream Assessment Report, we received correspondence that the DEP did not have any further comments on the document.

Since this time, the Member Municipalities have continued to operate under the original 2003 MS4 individual permitting requirements. No formal approval of the new MS4 permits or the TMDL Implementation Plan as a whole have been received, and permit administration has returned under the jurisdiction of DEP SCRO. The WCWC has proceeded with efforts to implement BMPs throughout the watershed, including assessing other opportunities and pursuing other grants.

A major component of good-faith compliance with the TMDL Implementation Plan has been a partnership with the Center for Watershed Protection (CWP). Through Altria grant funding that the CWP has received, and in coordination with the Berks County MS4 Steering Committee (BCMS4SC), the CWP offered training sessions to municipal staff and engineering consultants regarding BMP alternative selection and design, with the Pennwyn Playground in Cumru Township (located next to the Wyomissing Creek's main branch) as the focus of the training. Subsequent to the training, an actual BMP was selected. This was funded through another Altria Grant, with design by the CWP and competitive quote acquisition through Cumru Township. The BMP was then constructed, consisting of a rain barrel with an overflow into an infiltration trench for the purposes of storing or infiltrating all runoff from a pavilion in the park. Additionally, an educational sign discussing the project was installed for public education and outreach purposes.

Since this time, the Coalition has continued to seek grant funding opportunities to better levy the WCWC's limited budget into more successful projects. Potential signage throughout the watershed to raise awareness of the Creek, other infiltration BMPs at public parks, and a prospective streambank restoration project were used for grant applications but not approved to date.

2018-2023 TMDL Implementation Plan

Calculation of Gross 5-year load Reductions

As previously outlined, the watershed-wide goal would be a 10% reduction of sediment loading to the stream from the collective portion attributed to the municipal regulated MS4 areas. This requires a series of steps:

1. Update the land use and streams data and urbanized area limits.
2. Develop a planning area for all flows which travel through municipally owned and/or operated facilities.
3. Process land-use and streams data in the MapShed/GWLF-E software which was used for the original TMDL modelling efforts to create an updated model with new sediment loading rates for each land use type.
4. Apply the land use loading rates generated by MapSheds and the associated GWLF-E software to the measured acreages of each land use in the planning area.
5. Calculate the total regulated MS4 loading rate and determine whether the WCWC Member Municipalities intend to meet the 10% minimum reduction or the 37% reduction required in the original TMDL model for ultimate compliance efforts.

For the results of steps 1, 2 and 4, see drawing 3017-003-E-101 (Overall Land Use & Urban Planning Area Map) in the permit package. Regarding step 3, the MapShed/GWLF-E program was prone to errors in model runs and failed to develop proper outputs, so the WCWC coordinated with Professor Barry Evans at Penn State University, the developer of the software to generate an updated model for the Coalition. The results of the modeling and GIS spatial analysis of the mapping (step 5 above) generated the following results summarized in Figure 3 below:

AREA (Acres)	LAND USE	Loading Rate (Average) tons/acre/yr	Load (Average) tons/year
211.894	**Low Density Mixed**	0.008	1.695
1167.547	**High Density Mixed**	0.038	44.367
118.606	**Hay/Pasture**	0.121	14.351
103.635	**Cropland**	1.434	148.613
9.878	**Wooded Wetland**	0.003	0.030
560.762	**Low Density Residential**	0.009	5.047
2910.997	**Medium Density Residential**	0.038	110.618
197.956	**High Density Residential**	0.038	7.522
583.870	**Medium Density Mixed**	0.038	22.187
764.897	**Open Land**	0.166	126.973
740.085	**Total Forest**	0.013	9.621
		Total - Average (tons)	491.02
		Total - Average (pounds)	982,047.37
		Loading Rate (lbs/ft)	
84600.00	**Stream Length (feet)**	34.00	2,876,400.00
		Grand Total	3,858,447.37
		10% reduction	**385,844.74**

Figure 3 – Summary of TMDL Current Loading Totals

A total existing loading of 3.86 million pounds per year is developed from the results of these efforts. The regulatory minimum requirement of 10% reduction means 385,844.74 pounds per year of reductions will be required over the course of five years to comply with DEP regulations. The Coalition intends to meet the five-year goal of 10% reduction instead of the ultimate goal of 37% sediment reduction due to budgetary and time constraints. Additional, the Coalition believes that initial efforts to eliminate pollutant loading to the streams, as well as to reduce the structural impacts of intense stormwater runoff, may yield results greater than expected by the model.

Tabulation of Existing BMP Reductions

There are a large number of existing BMPs located in the Wyomissing Creek Watershed's 10,000-plus acres due to the results of post-construction stormwater management efforts associated with recent regulations. Additionally, several municipalities developed flood-control basins in the aftermath of Hurricane Agnes, which had a lasting impact on the greater Reading Area. While most of these BMPs have either been developed to meet minimum regulatory requirements for new construction (so as not to further degrade water quality or increase peak stormwater runoff volume and rate) or were instituted solely for flood control and do not generally have an impact on water quality. With that in mind, there are several existing BMPs which do have a measurable impact on treatment of sediment loading which commensurately offset the regulatory requirements of the WCWC Member Municipalities.

The CWP, through funding from the 2017 Altria grant, assisted the WCWC in the development of a list of existing BMPs for prospective retrofits and an accounting of existing reductions that the GWLF-E model does not account for in its assumptions. A tabulation of existing BMP reductions appears below in Figure 4:

Existing BMP Name	Loading Rate (pounds/year)	Reduction to WCWC Member Municipalities (10%)
Kuser Dam Wetlands	68,365.90	6,836.59
222 PennDOT Basin 3	15,941.10	1,594.11
222 PennDOT Basin 4	5,086.10	508.61
222 PennDOT Basin 5	3,389.00	338.90
222 PennDOT Basin 6	2,467.60	246.76
222 PennDOT Basin 7	9,564.70	956.47
222 PennDOT Basin 8	20,411.20	2,041.12
Cumru - Impervious Removal	3,362.00	336.20
	Total	**12,858.76**

Figure 4 – Summary of Existing BMP Reductions

The impact of these existing BMPs reduces the WCWC's regulatory burden by 12,858.76 pounds per year, reducing the total five-year target to 372,985.98 pounds per year. See the attached BMP summary sheets in Appendix B for additional information.

<u>Tabulation of Proposed BMPs</u>

The Wyomissing Creek Watershed Coalition utilized the Coldwater Heritage Plan and the BMP Prioritization as the basis for the list of prospective BMPs for implementation purposes. Additionally, through funding from an Altria Grant, the Center for Watershed Protection coordinated with WCWC representatives to analyze the impact and scope of retrofit measures for the prospective BMPs. The selected BMPs and associated reductions are outlined below, with additional information in Appendix B:

Proposed BMP Name	Host Municipality	Proposed Sediment Loading Reduction
Stanford Avenue Dam Retrofit	Spring	80,583.44
Highbrook Channel	Mohnton	100,000.00
Burgis Northridge Basin Retrofit	Mohnton	2,000.00
Fairmont Avenue Streambank Restoration	Cumru	143,750.00
Berkshire Boulevard Basin Retrofit	Wyomissing	13,154.80
Ramp DB Basin Retrofit	Wyomissing	50,306.90
Rain Gardens at Municipal/School District Facilities	All	5,000.00
TOTAL		**394,795.14**

Figure 5 – Summary of Selected BMPs for Five-year Reductions

BMP Funding Measures

The current estimate (in 2017 dollars) of the costs associated with the proposed BMPs is **$1,522,600.00**. These estimates can be reviewed in more detail in Appendix C of the report. Estimates are based upon preliminary scopes of work and generally include (as appropriate) design engineering, permitting, land acquisition (either through purchase or through the securing of easements and access agreements), grading/excavation, fine grading/landscaping, and various structural improvements to the sites including installation of new or retrofit of existing outlet structures to attenuate and treat stormwater more extensively.

The Coalition was formed and is currently governed by an intermunicipal agreement which includes cost-sharing measures for planning-phase efforts. Under this founding IMA, the eight (8) constituent municipalities evenly share the budgeted costs; however, given the substantial increase in scope and scale of the projects and associated expenditures predicated by the new iteration of the permit regulations, the Member Muncipalities feel it is appropriate to reallocate costs related to actual impact to the watershed. The Members are in the process of adopting a new IMA where costs are allocated based upon a ratio of individual urbanized area to the total urbanized area of the watershed. The draft IMA can be examined in Appendix D.

The Coalition has developed a preliminary estimated budget of $2,000,000.00 for the next five-year permit cycle. This exceeds the total expected cost of the proposed BMPs, but is tentatively appropriate for a number of reasons: (1) it allows a factor of safety for inflationary effects over the next five years, (2) it allows for implementation of additional projects in the event that the final designs of the BMPs yield lower reductions than the preliminary estimates, and (3) it provides a round number for municipalities to begin budgeting their individual portions of the Coalition's joint funds. The municipalities are expected to hold their portion of the annual funds until a request is made to use them for one of the proposed joint projects. In the interim, efforts will be made to seek grant funding to offset the costs of the proposed projects.

The Coalition has historically had success receiving grant funding through Altria and the Coldwater Heritage Grant program, and hopes to receive additional funding from these sources in the future to offset the expected costs of projects. Additionally, the Coalition has sought funding from PA American Water Company's Environmental Education grant program and the Schuylkill River Restoration Fund, but has been unsuccessful to date. The Coalition will assess other opportunities to offset the costs of program implementation as they become available. Additionally, the WCWC intends to work with local volunteer groups for assistance on raingarden installations at local government facilities in the watershed.

Operations and Maintenance Requirements

Most of the existing facilities proposed are owned and operated by the local municipality or some other government agency, such as PennDOT. It is the Coalition's intention for each individual municipality to be responsible for the continued operations and maintenance of the retrofit facilities within their municipal boundaries and current responsibilities. For private facilities proposed for retrofits, the current intention is to require future operations and maintenance of the facilities to be the responsibility of the homeowners; however, if sufficient assurance cannot be secured that these ongoing duties will be met, it is possible that the municipality that the facility is located in would take on operations and maintenance of the facility. Regardless, the WCWC intends to provide a one-time stipend to any municipality which has an expanded or new maintenance requirement associated with their facilities. If the facility continues to be privately owned, maintained, and operated, the Coalition will assess on a case-by-case basis if a stipend will be provided to the municipality with the right to monitor ongoing operations and maintenance.

TMDL Long-Term Compliance

Regulatory Target Reductions

As previously stated, the original Wyomissing Creek TMDL required an ultimate reduction of 37% of the sediment loading from urbanized areas for ultimate compliance. The extents of the urbanized area have changed with a census update, the land use models have changed, and the requirement for urbanized planning area as opposed to just urbanized area has changed. Based upon the previous calculations, the total urbanized planning area loading rate is 3,858,447.37 pounds per year, so the ultimate reduction of 37% would require 1,427,625.53 pounds per year of reductions (less the existing BMP reductions listed in the previous section).

In the twenty-five (25) years following the 2018-2023 permit cycle, the Coalition will need to eliminate the remaining 1,000,000-plus pounds per year of excess sediment to remain in regulatory compliance; however, it is important to assess the ultimate goal of the MS4 and TMDL programs to consider the best course of action for these reductions. **The ultimate goal of the MS4 program is to eliminate pollution from the stream.** In the instance of the Wyomissing Creek Watershed, the stream is considered by DEP to be impaired due to excess sediment loading; however, previous studies commissioned by the WCWC have determined that sediment loading from urbanized areas is having a smaller impact than the scour and deposition effects of the accelerated and higher-volume stormwater flows associated with urbanized areas.

The WCWC intends to focus primarily upon the attenuation of existing stormwater flows through runoff reduction and peak flow attenuation practices first and foremost. Both the MapShed/GWLF-E modeling and actual observations of the watershed substantiate that erosion of the actual streambanks and scour of the streambed generates much greater sediment loading than loads delivered within the actual stormwater. It is believed that the implementation of habitat-reestablishing and erosion-mitigating practices such as streambank restoration would have limited impact without effective upstream stormwater management.

The WCWC intends to remain in compliance with the DEP regulations pertaining to load reductions during the various five-year MS4 permit terms; however, the Coalition has made it the primary goal to cost-effectively eliminate the impairment in the stream if at all feasible. First, the focus will be on the "Northridge" Unnamed Tributary. This stream segment was identified as nearly attaining during the Eco-Analysts study, so the Coalition hopes to have this segment delisted in the next decade as a pilot project for the goal of eliminating impairment in the watershed.

A variety of prospective BMPs has already been identified and is located in Appendix B of this report. Additionally, the WCWC will consider non-structural BMPs such as continued Education and Outreach efforts as well as zoning and subdivision and land development ordinance revisions for the purpose of reinforcing the goals of the program.

Executive Summary

Regulatory Requirements and Existing Loading

The eight (8) municipalities in the Wyomissing Creek Watershed are required to prepare a plan to eliminate 10% of the excess sediment loading to the Creek during the upcoming five-year permit period beginning in March of 2018 through March of 2023. This is to meet water quality improvement goals to eliminate sediment pollution in the stream which negatively effects aquatic life. The municipalities previously formed the Wyomissing Creek Watershed Coalition, which has been complying with these more stringent Municipal Separate Storm Sewer System (MS4) regulations for seven years.

The results of updated studies have determined that almost **375,000 pounds per year** of excess sediment will need to be eliminated through the implementation of stormwater management Best Management Practices (BMPs). These facilities slow runoff from municipal roads and storm sewer to prevent flooding, erosion of infrastructure, and improve water quality through removal of pollutants. While the proposed BMPs have substantial costs associated with them, it is important to note that most of the BMPs involved retrofit or reconstruction of existing infrastructure, which presents a cost savings compared to installing completely new infrastructure to comply with the sediment load reductions.

The proposed BMPs are expected to eliminate approximately **395,000 pounds per year** of sediment at a projected cost of **$1.52 million**. This cost would be shared among the municipalities as previously delineated in the First Revised Intermunicipal Agreement and Cost-sharing allocation. While the reductions technically exceed the minimum requirement, this was decided upon for a number of reasons: (1) the modelling required in the TMDL plan does not include extensive design engineering, which means the actual reductions yielded by a project can be higher or lower than the planning-phase assumptions, (2) one of the projects identified yields minimal "credit" for sediment reduction; however, it would mitigate excess stormwater which makes one of the necessary, "higher-credit" projects feasible.

The Wyomissing Creek Watershed TMDL Implementation plan will be made available at all eight municipality's designated offices for public review. The document contains extensive calculations and narratives to more thoroughly support the information in this Summary. The WCWC will solicit comments from the individual boards of elected officials as well as the public at large for a 30-day period as required by the DEP.

Appendix A – System Maps

Wyomissing Creek Watershed
Stanford Avenue Basin BMP Map

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Legend

- Storm Inlet
- Storm Junction Box
- Storm Manhole
- Storm Outlet
- Storm Observation Point
- Storm Outfall
- Storm Sewer
- Drainage Swale
- Detention Basin
- Roads
- State Roads
- Streams
- 100 ft Contours
- 20 ft Contours
- Municipalities
- Urban Area

BMP Shed

- Stanford Ave Dam

1 inch = 1,000 feet

1,000 500 0 1,000 Feet

WYOMISSING CREEK WATERSHED
STANFORD AVENUE BASIN BMP MAP
BERKS COUNTY PENNSYLVANIA

GVC
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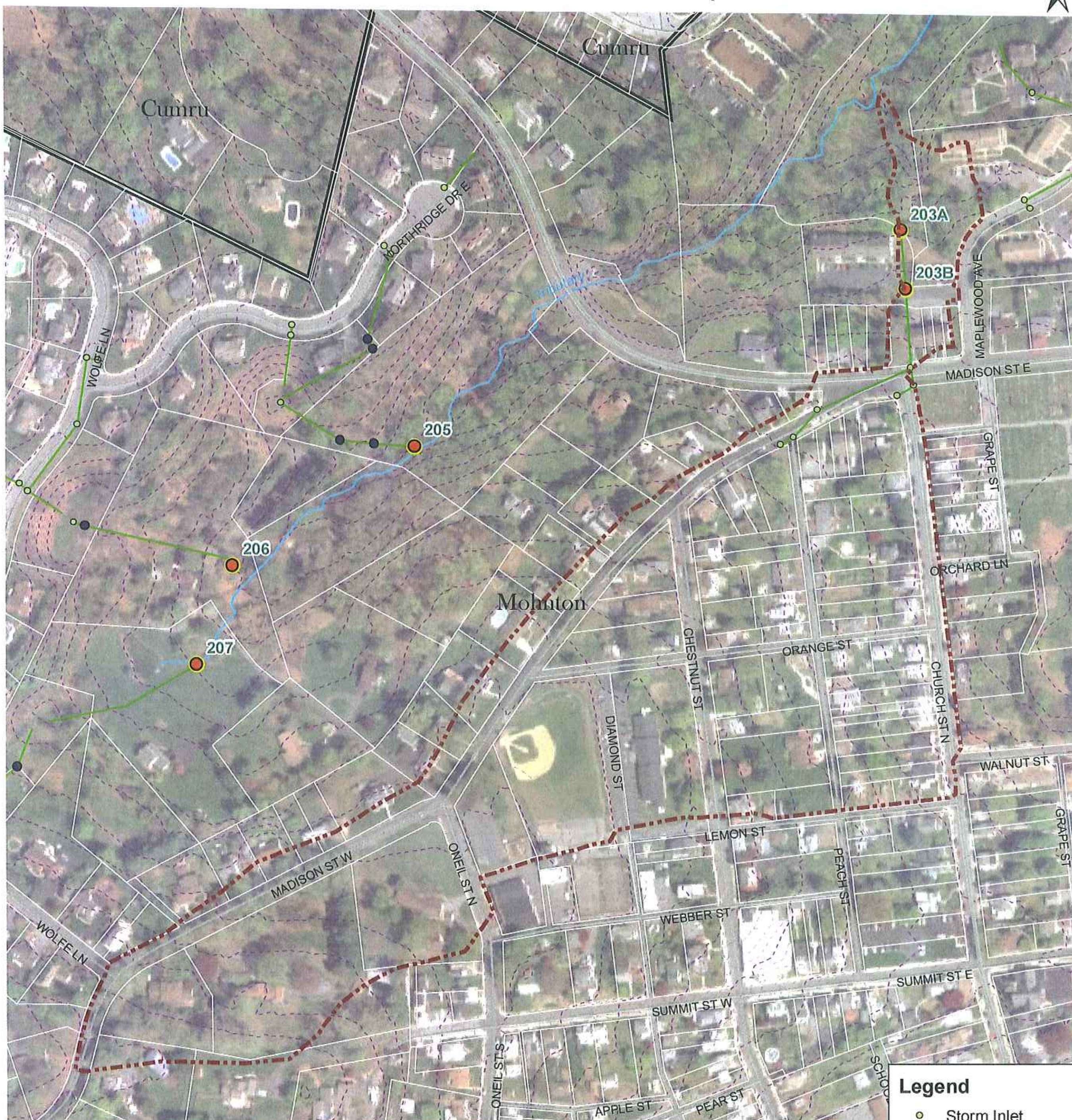
DRAFTED BY: J. MILLER	SCALE: 1" = 1,000'
CHECKED BY: N. JOHNSON	DATE: 6/26/2017
PROJECTION: NAD83 STATE PLANE	DRAWING NUMBER: 3017-003-A-102

Wyomissing Creek Watershed
Highbrook Channel BMP Map

N



WYOMISSING CREEK WATERSHED
HIGHBROOK CHANNEL BMP MAP
BERKS COUNTY — PENNSYLVANIA

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DRAFTED BY: J. MILLER	SCALE: 1" = 300'
CHECKED BY: N. JOHNSON	DATE: 6/28/2017
PROJECTION: NAD83 STATE PLANE	DRAWING NUMBER: 3017-003-A-103

NOTE:
The entire watershed is within urban area.

1 inch = 300 feet

300 150 0 300 Feet

Legend

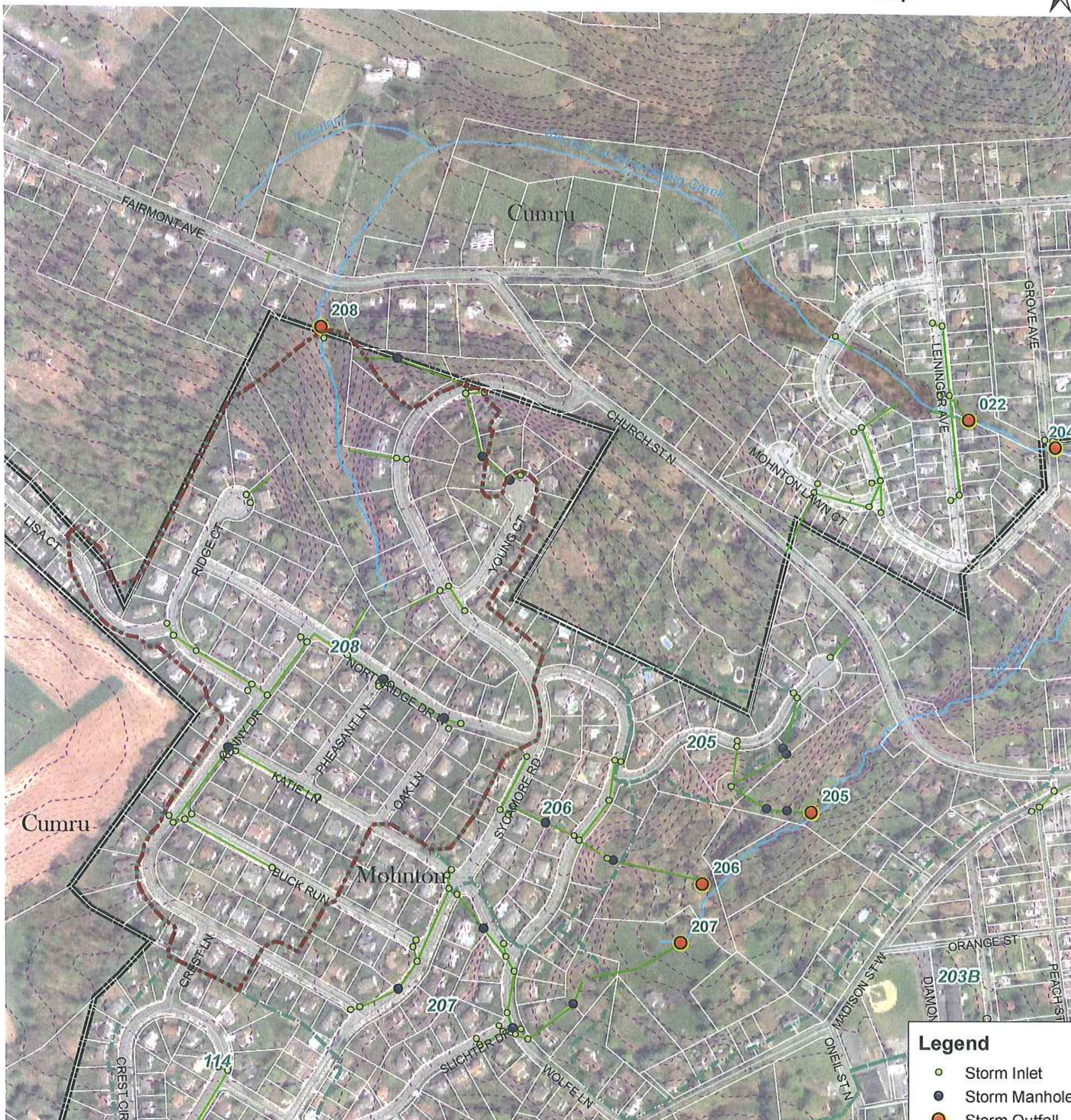
- Storm Inlet
- Storm Manhole
- Storm Outfall
- Storm Sewer
- Roads
- State Roads
- Streams
- 10' Contours
- 2' Contours
- Municipalities

BMP Shed

- Highbrook Channel

Wyomissing Creek Watershed
Northridge Basin & Fairmont Avenue Streambank BMP Map

N



WYOMISSING CREEK WATERSHED
NORTHRIDGE BASIN & FAIRMONTAVE.
STREAMBANK BMP MAP

BERKS COUNTY PENNSYLVANIA

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DRAFTED BY: J. MILLER	SCALE: 1" = 500'
CHECKED BY: N. JOHNSON	DATE: 6/28/2017
PROJECTION: NAD83 STATE PLANE	DRAWING NUMBER: 3017-003-A-104

NOTE:
The entire watershed is within urban area.

1 inch = 500 feet

500 250 0 500 Feet

Legend
- Storm Inlet
- Storm Manhole
- Storm Outfall
- Storm Sewer
- Drainage Swale
- Detention Basin
- Roads
- State Roads
- Streams
- 10' Contours
- 2' Contours
- Municipalities

BMP Shed
- Northridge Basin

Wyomissing Creek Watershed
Berkshire Boulevard Basin BMP Map

Legend

- Storm Inlet
- Storm Outfall
- Storm Sewer
- Detention Basin
- Roads
- State Roads
- Streams
- 10' Contours
- 2' Contours
- Municipalities

BMP Shed

- Berkshire Blvd. Basin

NOTE:
The entire watershed is within urban area.

WGWC

1 inch = 200 feet

200 100 0 200 Feet

WYOMISSING CREEK WATERSHED
BERKSHIRE BOULEVARD BASIN BMP MAP

WYOMISSING BOROUGH BERKS COUNTY PENNSYLVANIA

GVC
GREAT VALLEY CONSULTANTS
75 COMMERCE DRIVE, WYOMISSING, PA 19610-1038

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DRAFTED BY: J. MILLER	SCALE: 1" = 200'
CHECKED BY: N. JOHNSON	DATE: 7/27/2017
PROJECTION: NAD83 STATE PLANE	DRAWING NUMBER: 3017-003-A-105

Wyomissing Creek Watershed
Berkshire Boulevard Basin BMP Map

WYOMISSING CREEK WATERSHED
PENNDOT RAMP DB BASIN BMP MAP

WYOMISSING BOROUGH | BERKS COUNTY | PENNSYLVANIA

GVC
GREAT VALLEY CONSULTANTS
75 COMMERCE DRIVE, WYOMISSING, PA 19610-1038

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DRAFTED BY: J. MILLER	SCALE: 1" = 800'
CHECKED BY: N. JOHNSON	DATE: 7/27/2017
PROJECTION: NAD83 STATE PLANE	DRAWING NUMBER: 3017-003-A-106

NOTE:
The entire watershed is within urban area.

WCWC

1 inch = 800 feet

800 400 0 800 Feet

Legend

- Storm Inlet
- Storm Outfall
- Storm Sewer
- Detention Basin
- Roads
- State Roads
- Streams
- 10' Contours
- 2' Contours
- Municipalities

BMP Shed

- PennDOT Ramp DB Basin

Appendix B – BMP Reports

Appendix B-1

Existing BMPs

Kuser Dam (EC_01)


Table 1. Background Information

BMP Type	Latitude	Longitude
Wetland	40.292661	-76.010633

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	27.49		
Pervious	141.97		
Total	169.46	635.14	107,634

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
1.719	0.75	63.5%	68,365.9

BMP Summary

The Kuser Dam appears to be a pass-through for Kline Creek (we believe), a high-quality stream among Pennsylvania's designated-use waterways. The low-elevation outlet at the dam structure likely got partially clogged by detritus some time ago, and additional plant matter has since accumulated behind it. This has fostered the development of a full and healthy wooded wetland environment. A wide variety of wetland taxa were observed, both flora and fauna. The depth at the outlet structure was measured at 57 inches. The effective depth used for volume calculations was one third of this, fitting the volume formula for a cone, or the average of the area-integral of parabolic cross sections of the basin. We feel this was relatively conservative.

There appears to be no threat of obstruction or damage to the existing overflow structure, which still has 27 inches of available elevation before being reached. There was observed "baseflow" through the low-elevation orifice at this structure, so water is still getting through, though the rate may or may not be sufficient to support the stream reach beneath it. However, the outlet of the Kuser Dam appears to lead directly into what is described within this report as PennDOT Lancaster 6 (RE_04), which subsequently flows into PennDOT Lancaster 5 (RE_03). From there it appears to cross under Lancaster Pike and to Wyomissing Creek, past the Summit Heights outfall plunge pool (NR_03). Fish and animal movement is likely not supported through this set of culverts and structures, but the baseflow rate from Kline Creek through Kuser Dam may require some modification to the outlet structure. It is likely at this point that the established wetland mass behind Kuser Dam precludes the normal "maintenance" procedures of removal of accumulated sediment, for example.

To be clear in our recommendations, we recommend not doing anything at Kuser except the bare minimum necessary to ensure there are no health or safety risks associated with the current condition. This appears to be a healthy, established wooded wetland which is providing significant ecosystem and water quality benefits. If possible, it should be left alone.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Note that the impervious cover percentage of this drainage area is believed to be at least slightly higher than is reflected by the numbers above, which would in turn affect the performance efficiency of the wetland.

PennDOT Lancaster 3 (RE_01)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.296498	-76.003048

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.76		
Pervious	78.86		
Total	81.62	365.99	29,872

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.119	0.52	53.4%	15,941.1

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.358	1.56	76.4%	22,827.3	6,886.2

BMP Summary

This basin likely has debris obstruction of the culvert outlet, causing a standing water condition. The result is water quality treatment provided by wooded wetland vegetation and a small wet pond for sediment settling. This unintentional wetland can be enhanced by adding an outlet structure designed to retain additional water, before a designed overflow allows water through the culvert. This would expand the wetland and increase the size of the wet pond.

PennDOT Lancaster 4 (RE_02)


Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.297177	-76.000846

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.39		
Pervious	3.39		
Total	7.78	799.68	6,225

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.558	1.52	81.7%	5,086.1

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.744	2.03	84.0%	5,229.1	143.0

BMP Summary

This basin, like many others, has a dedicated riprap-lined channel running from the inlets to the outlet. There is a large, flat area adjacent to this flume which can be leveraged for water quality treatment. The Soil Survey suggests B soils, though this is a heavily compacted area due to the adjacent highway construction. A wet swale, or potentially a dry swale, could be constructed along the flow path from the pipe inlets. Also, the basin at the bottom of the slope (near the outlet/culvert) could be used more effectively for water quality treatment if an outlet structure was added prior to the culvert. This basin appears to be the headwater location of an unnamed HQ-CWF tributary of Wyomissing Creek based on eMapPA and receives water from PennDOT Lancaster 3 (RE_01).

The low benefit associated with retrofit work here, no matter how cheap it is relative to other retrofit options, makes this a very low benefit:cost project. The mobilization cost associated with even small projects likely makes this impractical.

PennDOT Lancaster 5 (RE_03)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.293827	-76.007160

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.85		
Pervious	23.40		
Total	30.25	623.81	18,868

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.071	0.12	18.0%	3,389.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.855	1.50	76.0%	14,341.8	10,952.8

BMP Summary

This detention basin appears to be forming into a wooded wetland and has significant potential for greater water quality treatment. Adding an outlet structure before the culvert will retain additional water, allowing for infiltration, evapotranspiration, and eventually development of more wetland taxa. The basin receives flow from PennDOT Lancaster 6 (RE_04), which in turn receives flow from the Kuser Dam (EC_01), believed to lie along Kline Creek, a HQ-CWF tributary of Wyomissing Creek.

PennDOT Lancaster 6 (RE_04)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.292812	-76.009624

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.17		
Pervious	2.84		
Total	6.00	751.04	4,510

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.143	0.54	54.7%	2,467.6

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.861	2.5	78.8%	3,554.2	1,086.6

BMP Summary

This basin has a volunteer wetland with established wooded wetland taxa, and could be further leveraged for greater water quality treatment benefits. Adding an outlet structure – perhaps as simple as a weir wall – will retain additional water in the basin and provide greater sediment removal. The basin receives flow at the downstream end from the Kuser Dam (EC_01), and the outlet culvert leads to PennDOT Lancaster 5 (RE_03).

PennDOT Lancaster 7 (EC_02)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.287880	-76.013872

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.57		
Pervious	16.56		
Total	19.13	634.54	12,136

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.637	2.5	78.8%	9,564.7

BMP Summary

A wetland that was not part of the original BMP design appears to have developed in this basin adjacent to the highway barrier wall (opposite side of wall from roadway). The outlet structure is 48" from outlet invert to overflow grate. The water level in the wetland is currently 18" above the outlet invert, at the invert of the trapezoidal orifice (30" from overflow). This is most likely due to a buried and submerged low-flow orifice. The trapezoidal staged-flow orifice is not completely blocked, and the overflow is clear. It appears to receive flow from the outlet of PennDOT Lancaster 8 (EC_03). This unintentional wetland is providing water quality treatment and there are no recommendations for maintenance or retrofit.

PennDOT Lancaster 8 (EC_03)

Table 1. Background Information

BMP Type	Latitude	Longitude
Wet Pond	40.287103	-76.014868

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.96		
Pervious	47.08		
Total	54.04	505.64	27,326

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.781	1.35	74.7%	20,411.2

BMP Summary

This wet pond estimated to have been constructed in 2003-2004 looks to still be in good condition. Wet ponds provide water quality benefit through sediment settling, and biologic processes that remove nutrient loads. The outlet appears to lead to PennDOT Lancaster 7 (EC_02).

Appendix B-2

Proposed BMPs

Berkshire Boulevard – Walmart Basin (RP_01)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.340567	-75.979014

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	18.06		
Pervious	5.51		
Total	23.57	857.15	20,206

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
1.205	0.80	65.1%	13,154.8	13,154.8

BMP Summary

The dry detention basin at Berkshire Square is a functioning detention basin, but provides little rate control, and no discernable water quality treatment. Two of the four pipe inlets completely or significantly short-circuit the basin to the outlet, and the perforated standpipe has enough perforation area that it likely does not function to provide extended detention.

Options for retrofitting include, but are not limited to:

- With a small amount of excavation and in-situ soils being used to construct low berms, the flow paths from the northern inlet pipes can be extended, and some extended detention can be provided by forming pools
- Pretreatment in the form of stilling basins or full forebays can be installed beneath the inlets to slow the flow velocity, and collect some of the sediment load
- Due to the available head at each of the inlet pipes, even a stilling basin or a flow splitter, connected to surface sand filters, can provide significant filtration to complement the extended detention option below
- Change low-elevation outlet at northern end of basin to a better staged discharge arrangement, providing 24-hour detention of the design storm
- Plant native vegetation to add some evapotranspiration and possibly a little infiltration due to root-formed macropores to the basin's hydrologic function

All of these possible retrofits will require some maintenance, though the berms, extended detention, and forebays will require little or no more than the current maintenance requirements. The sand filter option, and native vegetation will require relatively little maintenance.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Note that the impervious cover percentage of this drainage area is believed to be at least slightly higher than is reflected by the numbers above, which would in turn affect the performance efficiency of the BMP.

PennDOT Ramp DB Basin (RP_18)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.337037	-75.967779

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	66.07		
Pervious	195.91		
Total	261.98	648.80	169,973

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
1.177	0.21	30.8%	52,306.9	52,306.9

BMP Summary

This basin, like PennDOT Ramp DC Basin (RP_19), was designed to provide some quantity control in extreme storm events. There is a concrete or stone-lined channel around the edge of the basin allowing runoff from the inlets to completely bypass the basin floor, which is between 6 inches and two feet higher than these channels. The basin outlet has a perforated metal plate to attenuate flow in some larger storm events, but this structure appears to be broken.

Recommendations are to remove the channels from inlets to outlet, excavate within the basin floor, spoil excavated soil on site in compacted and vegetated mounds, or berms to force long flow paths from the inlets. Lowering the basin floor to, or below, the inlet inverts will allow for detention and some infiltration of smaller storms and reduce runoff. The drainage areas for these basins are very large, and the potential sediment removal benefit quite high for a simple on-site earth-moving project. A more robust outlet structure to detain the 1- to 2-year storm for 24 hours, but allow high-rate flows to pass, would offer significant cost effectiveness in retrofitting. This may involve simply rebuilding the existing, damaged outlet structure. Shallow grades within the basin, including over the berms, and simple turfgrass (highway mix) vegetation won't require additional maintenance beyond that for the existing basin, but will achieve significant water quality benefits.

The Wyomissing Hills Elementary School (RP_24) is within the greater drainage area delineated for this basin. The drainage area calculations for this basin exclude those for the school. If the school's effluent does in fact drain to this basin, it may be necessary to account for the pollutant concentration effects of any BMPs implemented there to get precise pollutant removal effects of this proposed BMP.

Stanford Avenue Dam (RP_21)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.317315	-75.994822

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	99.60		
Pervious	387.89		
Total	487.49	525.99	256,414

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
3.444	0.41	50.1%	128,407.7	128,407.7

BMP Summary

The Stanford Avenue Dam basin receives runoff from nearly 500 acres of drainage area, approximately 100 of which are impervious. The ample space affords many retrofit opportunities for water quality treatment. The inlet channel leads directly through the basin along a concrete-lined channel to the outlet structure. The low-elevation orifice of this structure is 36 inches in diameter and provides very little rate control or detention, except in extreme storm events.

Qualifiers, caveats, and concerns:
Karst topography is present in this area and any infiltration practices will need to account for safety hazards and property damage risk due to sinkholes. A thorough geotechnical analysis is recommended with multiple borings or other subterranean imaging, given the adjacency of large commercial development to the south, the dam structure at and culvert under Lancaster Pike (Route 222), and the cost associated with repairing large sinkholes. Retrofitting is only recommended provided there is little or no risk of significant sinkholes or similar issues in this basin.

Options for retrofit:

A. Change the outlet structure to at least temporarily detain small storm flows; it is our understanding that the stage-storage-discharge of this basin has room for adjustment to utilize the bottom couple feet of elevation.
B. Create a water quality swale in the basin: remove the flume/lined channel and grade a sinuous, vegetated channel through the basin with check dams to slow runoff and allow infiltration and evapotranspiration to reduce runoff.
C. Option A, and: Excavate within basin, use soil to form berms to retain water, allowing infiltration. The basin should be able to accomodate at least an average of one foot of ponding without any significant effect on the dam's ability to mitigate flood risks during major storm events. This is a low-cost, high-benefit option.

Other options are possible, but if geotechnical investigation confirms feasibility, Option C is an incredibly cost-effective retrofit for this basin. Pollutant removal calculations provided assume Option C as the retrofit implemented. If another option is chosen, there is still a remarkable benefit:cost ratio given the drainage area to this basin. A minimum of 30,000 pounds per year is achievable with even very modest retrofit options.

Appendix B-3

Other BMPs

Grove/Leininger Dam (STR_01)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.293949	-75.988927

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
200	44.88	8,976

BMP Summary

An unnamed high-quality tributary of Wyomissing Creek crosses under a set of "dams" at Grove Avenue and Leininger Avenue in the Cumru Township immediately north of Mohnton. Information gleaned from eMapPA is below:

- Designated Use Gen ID: 58088
- ReachCode: 02040203003397
- COMID: 25992954
- Map Symbology: HQ
- Designated Use: 6
- DES Use ID: 4
- Use Description: HQ-CWF (HIGH QUALITY-COLD WATER FISHES)
- Migratory_Fish: Y
- HUC: 02040203

Approximately 200 feet upstream (NW) of the western section of Grove Avenue, the stream shifts from a shallow pair of channels in a relatively stable wetland section to a steeply descending pair of stream channels, eroding a significant deposit of legacy sediment. At this location, it would be beneficial to remove the accumulated legacy sediment, install in-stream grade control structures for the channels such as cross vanes and sills, and potentially merge the split channel. Bank treatments such as cribbing and mudsills, and perhaps some rock or log diversions, are recommended to protect the banks from further erosion and the adjacent residential properties from incursion. It is also possible that after a natural resources survey, extending the stream restoration upstream through the wetland will also be recommended.

There is also channel erosion on the downstream sides of the dams at Grove and Leininger. These areas are not as severe as the last 200 feet before the western section of Grove, however they are degraded urban stream reaches, with impairments including pathogenic. As much as 850 feet of stream restoration could occur between Fairmont Avenue and the eastern section of Grove Avenue. At least one homeowner has a retaining wall acting as a stream diversion close to the eastern section of Grove to protect against land loss and maintain grade.

Access may be a little difficult at these locations, but based on assumed property boundaries, it appears there is relatively easy access off Fairmont Ave. at the upstream end, and off Leininger Ave. for the downstream portions.

This effort should apply for Chesapeake Bay Protocol 1: Credit for Prevented Sediment during Storm Flow, at minimum.

Tom Sturgis Stream Channel (STR_02)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.303686	-75.982862

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
350	44.88	15,708

BMP Summary

- ReachCode: 02040203000750
- COMID: 25992936
- Length Miles: 1.188
- Map Symbology: HQ
- Length Miles: 1.188
- Desginated Use: 6
- DES Use ID: 4
- Use Description: HQ-CWF(HIGH QUALITY-COLD WATER FISHES)
- Migratory_Fish: Y
- HUC: 02040203

The reach extending approximately 700-800 feet upstream (west) of Thomas Drive is degraded. The banks are eroding badly in places, though it appears other areas are bedrock or other hard materials, including subbase for the J.D. Byrider automobile lot. There is significant sediment deposition in the channel, and several structural obstacles to natural flow and animal movement have occurred in the channel.

We recommend applying some bank treatments such as rock vanes, live stake planting, and other fortification as necessary to protect the high stress areas. Benching may be advised to take advantage of the lower flow conditions and maintain greater flow velocities to help transport the proper amount of sediment downstream. Some structural repair of the subbase and base for the J.D. Byrider lot are necessary, though it is not clear whose responsibility that function is. It is likely that other portions of this stream – extending west past Skateway, and east of Thomas Drive – are also in need of restoration work.

This effort should apply for Chesapeake Bay Protocol 1: Credit for Prevented Sediment during Storm Flow, at minimum.

Wyomissing Creek @ Berks County Park (Mohnton Playground) (STR_03)


Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.285752	-75.978859

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
500	44.88	22,440

BMP Summary

Wyomissing Creek, along Berks County Park in Mohnton and the Mohnton Playground, is experiencing some bank erosion which is threatening mature trees along the baseball fields. The inside bank, on river left, is eroding, though the bank on river right appears fairly stable throughout. There is some sediment deposition on river left which exacerbates near-bank shear stress on river right. A storm drain outfall near midway through the playground portion of the park is a corrugated metal pipe with rust in the bottom.

The outfall pipe will need to be at least lined, if not replaced, or it may soon become a safety risk. The river left banks should receive some rebuilding bank treatments such as cribbing and live stake planting, and possibly some rock structure to attenuate near-bank flow energy. As shown in the picture above, some informal attempts at bank armoring have occurred. There are some very regular stone structures in the stream channel, suggesting the possibility that some flow modification has already been implemented, though the banks are at high risk, even and in some cases especially in these areas. This is an excellent educational opportunity, and chance for exposure. This effort should apply for Chesapeake Bay Protocol 1: Credit for Prevented Sediment during Storm Flow, at minimum.

Bank/Wawa Swale (NR_01)


Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.306993	-75.974244

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.33		
Pervious	1.12		
Total	2.45	824.97	2,018

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.000	0.00	0.0%	0.0	0.0

BMP Summary

The storm drain outfall from the Wawa gas station and Riverfront Federal Credit union is approximately 50 feet east of Wyomissing Creek, and it flows NNE from the outfall across a wooded area and next to a retaining wall along Museum Road to Wyomissing Creek. Unfortunately, directly adjacent to the outfall pipe is a utility installation which needs access across the pipe, so the outfall cannot be moved. And the overland flow path of the effluent is directly adjacent to a 6-7 foot retaining wall along the roadway. Any efforts that we can identify to treat the runoff for water quality concerns would also directly or indirectly threaten the adjacent infrastructure.

While not addressing flow rate issues, some changes or upgrades to the storm drain inlets at the Wawa and credit union parking lots may help reduce the sediment load of the effluent. Currently, the inlets appear to all have Snout devices installed to reduce oil and other light, non-aqueous phase liquids (LNAPL) – a significant concern at the gas station site especially – and floating trash such as empty beverage bottles which were observed in many inlets. These devices do not do much to reduce sediment, especially the smaller particles. Some type of cyclonic or hydrodynamic separator could be installed at the upstream or downstream end of the final outfall pipe to reduce the sediment load. While this would not reduce the flow rate of the runoff, it would complement the Snout devices and further reduce the pollutant of concern, total suspended sediment (TSS).

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Though no pollutant reductions are offered or calculated, if some mechanical devices or other practices are identified in the future, please note that the impervious cover percentage of this drainage area is believed to be higher than what is reflected by the numbers provided above.

Beverly Court Basin (RP_02)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.311001	-75.988861

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	19.11		
Pervious	37.15		
Total	56.27	439.90	24,751

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.697	0.44	51.8%	12,817.9	12,817.9

BMP Summary

The Beverly Court basin has a lot of potential. Currently, two inlet pipes enter the basin. One short circuits the basin floor due to proximity, and the other due to a dedicated, channelized flow path directly to the outlet pipe. The outlet pipe is 30 inches in diameter, and provides no rate control except in extreme storm events. At the time of the site visit on 5/22/2017, water was flowing from the southern inlet, but not the northern inlet. Lush vegetation along the flow path from the southern inlet suggests that the greater portion of the runoff through this basin comes from that portion of the drainage area.

Retrofit options include, but are not limited to:

- Excavating from the basin floor and using that soil to form berms for retention ponding areas
- Altering the low-elevation outlet by blocking the existing 30" pipe and adding either staged orifices or a perforated standpipe system to create extended detention for 24-48 hours of the design storm, and adding native vegetation for additional water quality benefit
- If stage-storage calculations verify this is a possibility, simply raising the invert of the outlet (by blocking the existing pipe) to create an infiltration basin

It appears that the overflow and high-elevation outlet are robust protection against overtopping and roadway flooding. Freeboard should not be an issue if using the bottom couple feet of elevation for water quality treatment in detention or retention.

Elm Street – Shillington (NR_02)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.307386	-75.973796

BMP Summary

After investigation and discussion, we are unfortunately unable to make any significant or confident recommendations for retrofit within the context of water quality. This is a stormwater issue that probably needs to be addressed upstream in some fashion.

GAI-Tronics (RP_03)

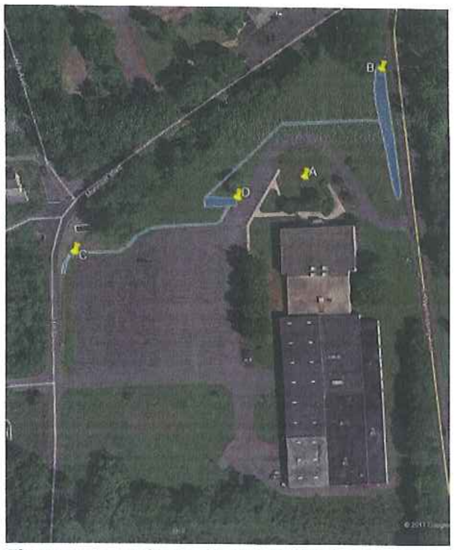

Figure 1. Locations of Retrofit Options

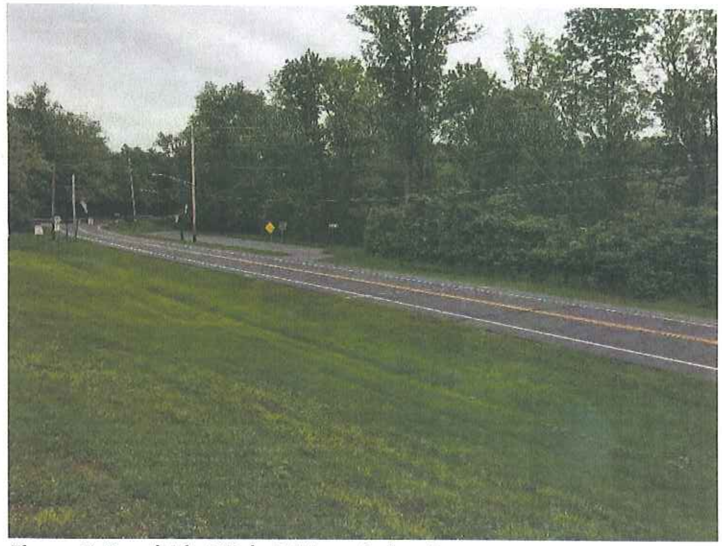

Figure 2. Roadside Ditch, E Wyomissing Ave.

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.293927	-75.980788

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.93		
Pervious	9.42		
Total	13.34	690.13	9,209

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.230	0.70	66.2%	6,097.2	6,097.2

BMP Summary

There is currently a tiny detention basin in front of the office, though it provides no long-term detention, and seems to have a very small drainage area. Much of the parking lot and building roof drains to a storm drain network which outfalls directly into the unnamed tributary of Wyomissing Creek at the north edge of the property along Mohnton Blvd. Runoff currently flows along the west edge of the property along Hill St., through the outfall into the creek, and through the small basin off to the northeast corner of the property into the roadside ditch.

A small retrofit would be to change the outlet pipe in the small basin to retain runoff and allow infiltration. The Soil Survey suggests B soils. See point A in Figure 1.

The next retrofit opportunity in terms of ease and cost would be a water quality swale along that northeast corner of the property along E Wyomissing Avenue. The drainage area to and through this ditch would need to be better verified for hydraulic calculations associated with any retaining or overflow structures such as check dams and weirs, though visual inspection suggests a very manageable flow, probably from a drainage area not much larger than that of the GAI-Tronics property itself. See point B in Figure 1, and Figure 2.

The next addition would be a swale to direct flow from along Hill Street and the surface runoff from the parking lot across the northern edge of the property to a water quality swale retrofit at the northeast corner of the property. Alternatively, this could be an infiltration trench, or a dry swale, designed to retain the runoff rather than direct it elsewhere. See point C in Figure 1.

Another potential addition would be to add an underground detention vault near the end of the existing storm drain system to attenuate flow rates to the outlet in the adjacent stream. This would help stave off some of the direct sediment deposition, and likely help reduce localized erosion and destabilization near the outfall pipe. See point D in Figure 1.

When visiting this site, we were greeted by the manager on duty who expressed concern about an unannounced visitor walking around the grounds taking pictures. It is best to communicate with the facility manager ahead of any visits.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Note that the impervious cover percentage of this drainage area is believed to be at least slightly higher than is reflected by the numbers above, which would in turn affect the performance efficiency of the BMP.

Gouglersville Fire Co. Environs (RP_04)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.274692	-76.019762

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.91		
Pervious	8.10		
Total	12.01	596.20	7,160

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.060	0.19	27.3%	1,953.5	1,953.5

BMP Summary

The runoff from the Gouglersville Fire Company, the playground and adjacent parking lot, and likely a portion of the residential area across Mohns Hill Road, all appears to flow along a shallow grass swale which runs immediately adjacent to the playground. Adding a more purposeful vegetated swale along this flow path, leading to a rain garden or other infiltration practice, will add water quality treatment to this site. Calculations shown are for a shallow water quality swale and rain garden, though given probable soil composition, deeper and larger infiltration practices are likely also possible. Given the lack of opportunity for an underdrain in the system, a soil boring would be advised if planning for a deeper infiltration practice like an infiltration trench or dry well.

Governor Mifflin Middle School (RP_05)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.304255	-75.964050

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.68		
Pervious	1.44		
Total	3.11	628.98	1,958

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.029	0.21	30%	583.1	583.1

BMP Summary

A few retrofit opportunities were identified at the Governor Mifflin Middle School, although the most significant for sediment reduction potential is on the Governor Mifflin High School grounds. The drainage area provided by Great Valley Consultants called "Gov Mifflin M.S. – Waverly," or a portion thereof, drains to a culvert pipe that outfalls in a wide grass swale adjacent to the baseball fields in front of the high school across S Waverly Street. Given probable B soils and ample room before the footbridge (beyond which the swale appears to be used as warm-up and practice space), a rain garden or other non-underdrain infiltration practice could be constructed.

Other on-site retrofits at the middle school include rain gardens, though the probable soil composition (based on Web Soil Survey) suggests shallow rain gardens with ample vegetation is advisable. Rain gardens would be highly visible, and could be fed by a rainwater harvesting system, effectively increasing the ponding and detention capacity of otherwise limited practices. While the rain gardens themselves may not detain much water, a rainwater cistern set to drain into the rain gardens very slowly over 48 hours increases their effective capacities.

The site is otherwise very flat, and therefore natural drainage patterns are very difficult to take advantage of.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Note that the impervious cover percentage of this drainage area is believed to be at least slightly higher than is reflected by the numbers above, which would in turn affect the performance efficiency of the BMP.

Grace Fellowship Church Basin (RP_06)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.297748	-75.996836

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.39		
Pervious	2.95		
Total	5.34	614.60	3,280

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.149	0.75	63.5%	2,083.6	2,083.6

BMP Summary

This dry detention pond has a small amount of wetland vegetation growing at the outlet structure. There is little to no head to make any significant modifications to the outlet structure; the overflow grate is 35 inches above the low-elevation orifice invert, and there is little discernable drop from the outlet pipe upper end to the invert of the outfall. However, the low-elevation orifice is eight (8) inches in diameter, which likely only controls effluent rate for very intense storm flows. This orifice could be partially blocked, or changed to something like a perforated standpipe to create an extended detention condition for 24-48 hours, provided hydraulic calculations indicate there are no safety issues posed for the adjacent roadway, Old Lancaster Pike. Additional options include adding small check dams of stone or filter socks along the primary inlet channel to slow the water from the inlet pipes next to the parking lot and pre-settle some of the sediment, excavate a little from the basin floor (which is sloped, and therefore not detaining any more water than is "grabbed" by the vegetation at the outlet), and purposely planting additional vegetation in the basin floor.

Highlands Basin 1 (RP_07)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.311457	-75.976172

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.41		
Pervious	17.38		
Total	23.80	577.58	13,744

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.459	0.86	71.5%	9,829.2	9,829.2

BMP Summary

The Highlands primary detention basin is vast, quite flat, and potential for easy retrofit. The low-elevation outlet is an 18" diameter pipe with a trash rack which likely does little to nothing to control flow rates except for intense, prolonged flows. Given the large surface area and six (6) foot high overflow, there is available head to detain or retain runoff in this basin without causing issues for adjacent properties. The overflow weir is quite wide and robustly constructed, further supporting retrofit efforts. The easiest retrofit is simply amending the outlet by blocking the outlet pipe, adding staged orifices in a cover plate to create extended detention by greatly reducing the size of the low-flow orifice, or retention by blocking the bottom of the pipe and raising the elevation of the invert of the low-flow orifice by 12 inches. More involved retrofits include constructing a filtration practice such as a bioretention within the detention basin.

The long swale that extends from the outlet of the detention basin is both a potential location for an underdrain for a newly-constructed filtration practice, or an additional location for a water quality practice; a water quality swale, either vegetated, dry, or potentially wet depending on soil exploration results, would provide additional treatment for the primary drainage area, and potentially some treatment for an additional 11 acres of development. That additional 11 acres appears to have been developed between 2008 and 2010, so it is possible the stormwater controls for that new cul-de-sac are already at a high enough standard that additional treatment is not worth the cost. The additional treatment a water quality swale might provide for the primary drainage area of 23.8 acres is an additional 900 pounds of sediment per year, approximately.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Note that the impervious cover percentage of this drainage area is believed to be at least slightly higher than is reflected by the numbers above, which would in turn affect the performance efficiency of the BMP.

Highlands Basin 2 (RP_08)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.310866	-75.973386

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.17		
Pervious	7.28		
Total	8.45	557.59	4,712

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.142	1.45	81.1%	3,823.2	3,823.2

BMP Summary

A dry detention basin on the east end of the Highlands development appears to treat runoff from approximately 8.5 acres. This basin could also have the low-elevation orifice modified or raised to create extended detention or some retention. Overflow is at approximately six (6) feet elevation. Low-flow orifice is four (4) inches in diameter. Overflow grate in outlet structure is at approximately 40 inches. The outlet structure, however, is being undercut by scour, and is at least leaning, if not sinking. The outlet structure is canted at least five degrees, and the supporting soil is visibly eroding. The outlet structure likely needs to be repaired or replaced regardless of whether retrofit is done, so retrofit is simply a matter of coordination, rather than additional cost, though a change in design may have regulatory constraints associated with it.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. Note that the impervious cover percentage of this drainage area is believed to be at least slightly higher than is reflected by the numbers above, which would in turn affect the performance efficiency of the BMP.

Hilgert/Frederick Avenue Basin (RP_09)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.304479	-75.993774

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.96		
Pervious	6.60		
Total	7.56	342.57	2,590

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.030	0.37	43.5%	1,126.5	1,126.5

BMP Summary

The dry detention basin at Hilgert and Frederick Avenues was, at the time of the site visit in late May, 2017, almost devoid of vegetation or turf cover in the basin floor. The cause(s) is unknown. The outlet structure is also overgrown with climbing vegetation, which will interfere with the capacity of the BMP to prevent overtopping of the berm, should a severe storm occur. Both of these vegetation issues should be addressed – remove vegetation from the outlet structure, and add vegetation to the basin floor.

Retrofitting potential is limited due to site constraints and steep slopes, but the overflow grate is 90 inches above the low-elevation orifice invert, leaving a lot of room for small water quality retrofits. A simple retrofit would be to add a standpipe to the existing four (4) inch orifice, and begin perforations one foot up from the bottom, to create 12" of retention (or detention if soils don't infiltrate at all), and then some extended detention for larger runoff events. As mentioned before, vegetation should be added, but planting native, hydrophilic vegetation instead of turfgrass will add to the treatment capability of the basin.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. This site is one of few that was significantly off. As such, the impervious cover percentage of this drainage area was estimated using satellite imagery, rather than calculated using GIS analysis. This change reduces the [inches per impervious acre] ratio provided by the proposed BMP, and therefore reduces the efficiency or performance ability of the BMP, thus providing less pollutant removal.

Hilgert/Gerald Avenue Basin (RP_10)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.302391	-75.992691

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.03		
Pervious	22.88		
Total	22.91	369.71	8,469

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.115	0.54	58.6%	4,961.6	4,961.6

BMP Summary

The detention basin on Hilgert Avenue near Gerald Avenue is in very good condition, but the inlet is immediately adjacent to the outlet causing a short-circuit flow path for runoff. Recommendation is to excavate from the long sides of the basin floor, and use in-situ soil to build a berm longitudinally down the middle of the basin to force a long flow path from the inlet to the outlet. Also, the 6-inch low-elevation orifice does little to attenuate flows except in larger storms. Blocking this orifice and adding one higher up, or adding a turned-up perforated standpipe will create some extended detention and/or retention in this basin. Soils likely allow for some infiltration. The 1.5-2.0 feet of drop from the inlet pipe to the outlet should allow the long flow path, and some detention or retention, without significant modification.

The National Land Cover Dataset (NLCD) impervious cover layer used to calculate impervious cover within the drainage area was at a 30-meter resolution. In some cases, such as for this site, the low-resolution data resulted in inaccurate impervious cover percentages used to calculate load reductions per the Chesapeake Bay Retrofit Curves. This site is one of few that was significantly off. As such, the impervious cover percentage of this drainage area was estimated using satellite imagery, rather than calculated using GIS analysis. This change reduces the [inches per impervious acre] ratio provided by the proposed BMP, and therefore reduces the efficiency or performance ability of the BMP, thus providing less pollutant removal.

Joseph's Way Basin (RP_11)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.294466	-76.002951

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.03		
Pervious	7.09		
Total	9.12	548.74	5,004

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.064	0.38	47.3%	2,364.9	2,364.9

BMP Summary

The dry detention pond on Joseph's Way needs some minor maintenance, and could receive a simple retrofit at the same time. The two inlet pipes have very short flow paths to the outlet, though this is not an easily remediable situation. There is significant sediment accumulation at both inlet pipes, and in front of and covering the lowest orifice in the outlet structure. The sediment blocking the inlet pipes should be removed. The low-elevation orifice of the outlet structure is almost completely clogged, but this essentially made it a low-flow orifice by natural formation, which is accidentally good. However, the orifice directly above that one is eight (8) inches in diameter, which does little to attenuate flow rates except in more intense storms. We recommend either:

- Clearing the lowest orifice, and either partially blocking or adding a perforated standpipe to the next orifice up
- Leaving the low-elevation orifice blocked, blocking the second orifice, adding a third orifice a foot or two above the second one with a perforated standpipe connected to it
- Possibly excavating some soil from the basin floor to create a berm separating the inlets from the outlet structure to cause a little retention and take advantage of the probable B soils
- Since there is about 3-feet of drop from the inlets to the outlet, this basin could be converted to a surface sand filter by creating a retaining wall or berm around the outlet structure as the overflow, and adding sand to the basin floor. In this case, it would be good to add stilling pools beneath the inlet pipes.

Mohnton Playground (RP_12)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.288389	-75.977751

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.09		
Pervious	0.00		
Total	0.09	859.20	79

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.018	2.40	84.6%	66.7	66.7

BMP Summary

The Mohnton Playground offers an opportunity for exposure and education, but very little in the way of pollutant removal, apart from the stream restoration potential described in the summary for Site STR_03. Educational practices, which would add amenity value as well, include combination rainwater harvesting cisterns and rain gardens at the pavilion structures. These pavilion structures do not currently have rain gutters, which would be a nice upgrade, and allow for rainwater harvesting. The rainwater harvesting cisterns could act as additional ponding for shallow rain garden practices if set to slowly draw down over 24-48 hours when full.

The runoff from the end of Walnut Street appears to flow north through a curb cut into a grassy area at the southwest corner of the playground area. One other retrofit option is a rain garden in this location, provided electric or other utility lines are not a constraint.

Any vegetation for rain gardens in this area would have to be carefully selected for shade tolerance, given the excellent tree cover for the playground area.

An existing storm drain pipe outfall is corroding at the end at Wyomissing Creek (at the north end of the park), and this will need to be lined or replaced at some point.

Museum Road/Margaret St. Asphalt Triangle (RP_13)

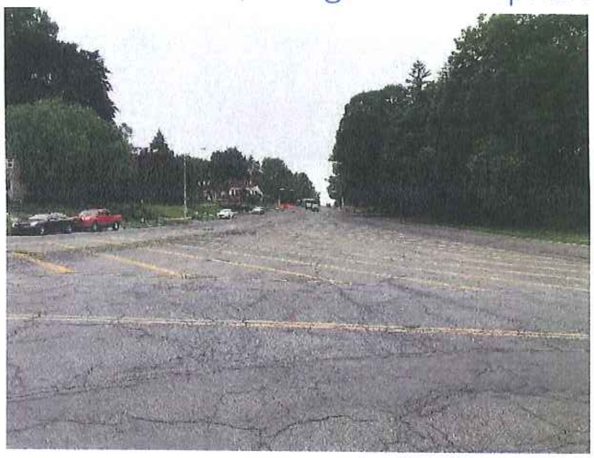

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.324481	-75.952524

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.35		
Pervious	0.00		
Total	0.35	859.20	302

Table 3. Sediment Removal/Reduction

Land Use	Loading Rate
High-Density Mixed	859.20 lbs/ac/yr
Turfgrass	150.67 lbs/ac/yr
Load Reduction = (0.35 x (859.20-150.67))	**248.9 lbs/year**

BMP Summary

The only feasible practice identified for the asphalt triangle on Museum Road at Margaret Street is impervious cover removal. Demolishing this asphalt, and constructing a turfgrass-covered traffic island would reduce the heat island effect, improve the appearance of this intersection, and reduce the loading rate of the area affected. The load reduction was derived by multiplying the 0.35 impervious acres by the difference in loading rates between High Density Mixed Urban land use and Turfgrass land use. Note that this practice has a very low return on investment if the sole purpose is for pollutant removal credit, and cost is a major driver.

The site visit did reveal one potential retrofit opportunity at the School of Health Sciences just downhill from this triangle. See School of Health Sciences, Site RP_20.

PennDOT Lancaster 1 (RP_14)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.313335	-75.997663

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.10		
Pervious	3.91		
Total	6.00	612.32	3,677

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.236	1.35	80.1%	2,946.0	2,946.0

BMP Summary

There are no existing BMPs at this location. A riprap-lined channel directs flow from a culvert pipe to the southern end of the site. Water quality improvement options include a dry swale and excavated basin for a filtration practice. Excavating a small basin, and using the spoil to build the retaining berm, can provide some retention. Removing the riprap-lined channel and creating a more sinuous channel with check dams and perhaps amended soils, will also add to the retention capacity.

PennDOT Lancaster 2 (RP_15)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.312238	-75.997866

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.42		
Pervious	1.69		
Total	3.11	669.49	2,084

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.247	2.09	84.1%	1,753.1	1,753.1

BMP Summary

This depression is not a detention basin, but merely a runoff guide. The depression has a yard inlet at the low point, leading into a storm drain system. There is opportunity to create a filtration or infiltration practice here, such as a surface sand filter or shallow retention and infiltration basin.

PennDOT Ramp CB Basin 1 (RP_16)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.327156	-75.980468

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.31		
Pervious	3.36		
Total	4.67	610.95	2,853

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.230	2.10	84.1%	2,400.3	2,400.3

BMP Summary

This basin offers no existing retention or detention, but does have a yard inlet with plenty of available head for retrofit opportunities. The drainage area is relatively small, so an inexpensive and easy retrofit is suggested. A surface sand filter around the existing inlet with a riser structure over the existing yard inlet is a simple, yet effective, filtration practice. Soil Survey suggests HSG B soils.

PennDOT Ramp CB Basin 2 (RP_17)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.327444	-75.978436

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.29		
Pervious	2.05		
Total	3.34	422.37	1,409

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.143	1.34	80.0%	1,127.1	1,127.1

BMP Summary

Similar to PennDOT Ramp CB Basin 1 (RP_16), this basin offers no existing retention or detention. A surface sand filter around the existing inlet with a riser structure over the existing yard inlet is a simple, yet effective, filtration practice. Soil Survey suggests HSG B soils.

PennDOT Ramp DC Basin (RP_19)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.337392	-75.965966

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	63.36		
Pervious	32.49		
Total	95.85	797.71	76,463

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.907	0.17	25.6%	19,578.4	19,578.4

BMP Summary

This basin, like PennDOT Ramp DB Basin (RP_18), was designed to provide quantity control in extreme storm events. There is a concrete channel around the edge of the basin allowing runoff from the inlets – including the runoff received from the DB Basin – to completely bypass the basin floor, which is between 6 inches and two feet higher than these channels. This basin's outlet also has a partially clogged perforated metal plate over it, causing a bit of standing water behind it with some hydrophilic vegetation now established.

The recommendations are to remove the channels from inlets to outlet, excavate within the basin floor, spoil excavated soil on site in compacted and vegetated mounds, or berms to force long flow paths from the inlets. Lowering the basin floor to, or below, the inlet inverts will allow for detention and some infiltration of smaller storms, and reduce runoff. The drainage areas for these basins are very large, and the potential sediment removal benefit quite high for a simple on-site earth-moving project. A more robust outlet structure to detain the 1- to 2-year storm for 24 hours, but allow high-rate flows to pass, would offer significant cost effectiveness in retrofitting. This may involve simply rebuilding the existing, damaged outlet structure. Shallow grades within the basin, including over the berms, and simple turfgrass (highway mix) vegetation won't require additional maintenance beyond that for the existing basin, but will achieve significant water quality benefits.

The Berkshire Blvd – Walmart (RP_01) is within the greater drainage area delineated for this basin. The drainage area calculations for this basin exclude those for the shopping center. If the Berkshire Blvd basin effluent does in fact drain to this basin, it may be necessary to account for the pollutant concentration effects of any BMPs implemented there to get precise pollutant removal effects of this proposed BMP.

School of Health Sciences (RP_20)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.325009	-75.951803

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.99		
Pervious	6.24		
Total	8.23	655.36	5,393

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.155	0.93	68.5%	3,696.2	3,696.2

BMP Summary

When assessing the Museum Road asphalt triangle (RP_13), a large swath of managed turf downhill of the asphalt triangle was observed. If the School of Health Sciences (SHS) and the property management would be amenable to this idea, it is possible that the storm drain inlets on either side of Museum Road and Old Wyomissing Road could be redirected to outfall to the top of this slope at the southwest portion of the SHS property. A swale-and-rain-garden practice could be built here with a series of berms to create ponding and provide a water quality benefit, as well as reduce the amount of mowing and lawn maintenance required by SHS property management.

The drainage area to this proposed practice (storm drain inlets in curb/gutter on roadsides) would include the area of the asphalt triangle at the intersection of Museum Rd., Margaret St., and Old Wyomissing Rd. If a practice is implemented at the SHS, the asphalt triangle impervious cover removal would not be recommended to be done in conjunction, as the cost:benefit ratio is very high. The drainage area estimate for this practice includes the impervious area of the asphalt triangle, since we recommend only one of these practices be built.

Sturbridge Drive Basin (RP_22)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.316623	-75.981398

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.03		
Pervious	19.99		
Total	24.02	633.65	15,219

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.505	1.50	76.1%	11,575.0	11,575.0

BMP Summary

The Sturbridge Drive basin is very large and shallow. Similar to the Stanford Avenue Dam, a series of berms using in-situ soils, or a series of check dams and some minor grading, will offer great benefit for the cost. The pollutant removal numbers provided assume a wide water quality swale with check dams, and a widened pool behind a berm at the end before the dam, with an average of one foot of ponding through those areas.

Summit Heights Outfall Plunge Pool (NR_03)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.282477	-75.997344

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.37		
Pervious	19.88		
Total	26.24	585.88	15,375

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.000	0.00	0.0%	0.0	0.0

BMP Summary

This is a very constrained site, partly because of the thorough tree cover. After investigation and discussion, stream restoration for prevented did not seem like a viable and defensible option. The erosion beneath the outfall pipe on the south side of the access road off Rudloff Lane is significant, and requires repair before it damages the utility station. However, it does not meet the qualifying conditions of stream restoration to be greater than 100 linear feet or meet the definition of a stream.

The erosion north of the access road is also significant, and has eroded away enough soil to almost form an unintentional basin. A dedicated detention facility could be constructed at this location with a bit of clearing to control flow rates coming from the upland drainage area. The water currently runs full rate through large pipes which do almost nothing to attenuate flow. An extended detention facility at this location would help prevent bank and soil loss beneath the outfall pipe. It is also possible that a Contech, or other similar device, could be installed to mechanically separate sediment and provide a water quality benefit to an important infrastructure-protection project.

Thomas Drive Basin (RP_23)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.304333	-75.981528

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.15		
Pervious	8.97		
Total	13.12	641.42	8,416

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.145	0.42	47.0%	3,953.8	3,953.8

BMP Summary

This basin contains (2) 8-inch orifices at the basin floor, and the next orifice up is a triangular opening just below the overflow. Without further hydraulic and hydrologic calculations, it cannot be definitively determined if the low-elevation orifices could be raised without risk to the adjacent roadway. However, there are no visual indicators that the water level in this basin ever rises to a concerning level. There are two recommendations, pending safety computations: 1) replace the low-elevation orifices with a staged-discharge outlet modification to add 24-48 hours of detention for the one inch storm; and 2) add some native, hydrophilic vegetation to the basin to aid in pollutant capture and processing.

This basin most likely outfalls to the unnamed HQ designated use tributary of the Wyomissing Creek which runs alongside Thomas Drive and J.D. Byrider.

Wyomissing Hills Elementary (RP_24)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.336131	-75.978580

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.33		
Pervious	13.46		
Total	17.79	632.52	11,254

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.092	0.25	35.4%	3,982.8	3,982.8

BMP Summary

A vegetated swale along the northwest edge of the school grounds would simultaneously treat runoff from the western portion of the property, and convey it to a rain garden or bioretention near Daleview Road. Runoff from the existing storm drain network may be able to be redirected to this surface BMP. A rain garden, bioretention, or potentially a surface sand filter, could be constructed near the end of Daleview Road, where there are two yard inlets next to each other.

There is currently a small detention basin with a robust overflow weir in front of the school next to the parking lot. This provides little to no detention, and no water quality treatment. This, too, could be converted into a rain garden, as much for educational as water quality benefit.

Wyomissing Junior/Senior High School (RP_25)

 

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.323555	-75.971344

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.19		
Pervious	1.14		
Total	3.34	633.66	2,114

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) **(Retrofits Only)**]
0.009	0.05	7.8%	164.2	164.2

BMP Summary

The stormwater basin at the Wyomissing Junior/Senior High School (WHS) has been used to install an art exhibit. As such, retrofit in this basin would probably threaten its existing use. Even if retrofit, it would not provide very significant sediment reductions.

Other options exist for retrofits at the high school. Similar to the Governor Mifflin Middle School (RP_05), rainwater harvesting cisterns coupled with rain gardens could provide both water quality treatment in otherwise unused space (managed turf), and educational opportunity due to exposure. The northeast and southwest corners of the building areas are ideally suited for this due to the traffic patterns and associated exposure. There is ample space along the northeast and east side of the campus.

It is important to note that these options have their value in education, not pollutant reduction. Even though they may be inexpensive practices, the pollutant removal potential is quite low.

Appendix C – Cost Estimates

PROJECT: WYOMISSING CREEK WATERSHED COALITION TMDL PLAN
TITLE: TMDL BMP COST ESTIMATES
DATE: 07-24-17

ITEM NO.	DESCRIPTION	UNITS	TOTAL PLAN UNITS	ESTIMATED UNIT PRICE	CONTRACT AMOUNT
I. BMP-1	**STANFORD AVENUE DAM RETROFIT**				
A. DESIGN ENGINEERING & PERMITTING (W/ PERMIT FEES)		LS	1.00	$75,000.00	**$75,000.00**
B. LAND ACQUISITION COSTS		LS	0.00	$0.00	**$0.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$15,000.00	$15,000.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$25,000.00	$25,000.00
3.	BULK EXCAVATION	CY	9000.00	$5.00	$45,000.00
4.	PLANTING SOIL	CY	7000.00	$40.00	$280,000.00
5.	SEEDING AND LANDSCAPING	LS	1.00	$25,000.00	$25,000.00
6.	DEMO EXISTING LOW-FLOW CHANNEL	LS	1.00	$15,000.00	$15,000.00
7.	OUTLET STRUCTURE RETROFIT	LS	1.00	$10,000.00	$10,000.00
8.	MONITORING EQUIPMENT/SCADA	LS	1.00	$18,000.00	$18,000.00
9.	GEOTECHNICAL WORK	LS	1.00	$25,000.00	$25,000.00
	SUBTOTAL OF ITEM C.				**$443,000.00**
D. 10% CONTINGENCY					**$44,300.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$10,000.00	**$10,000.00**
	PROJECT TOTALS				**$572,300.00**
II. BMP-2	**HIGHBROOK CHANNEL**				
A. DESIGN ENGINEERING & PERMITTING		LS	1.00	$14,000.00	**$14,000.00**
B. LAND ACQUISITION COSTS		LS	1.00	$5,000.00	**$5,000.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$5,000.00	$5,000.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$6,000.00	$6,000.00
3.	BULK EXCAVATION	CY	300.00	$5.00	$1,500.00
4.	PLANTING SOIL	CY	100.00	$40.00	$4,000.00
5.	SEEDING AND LANDSCAPING	LS	1.00	$3,700.00	$3,700.00
6.	RIP RAP	CY	60.00	$150.00	$9,000.00
7.	PIPE LINING & STABILIZATION	LS	1.00	$8,500.00	$8,500.00
	SUBTOTAL OF ITEM C.				**$37,700.00**
D. 10% CONTINGENCY					**$3,770.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$5,400.00	**$5,400.00**
	PROJECT TOTALS				**$62,100.00**

III. BMP-3	"BURGIS" NORTHRIDGE BASIN				
A. DESIGN ENGINEERING & PERMITTING		LS	1.00	$26,000.00	**$26,000.00**
B. LAND ACQUISITION COSTS		LS	1.00	$12,000.00	**$12,000.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$6,500.00	$6,500.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$6,500.00	$6,500.00
3.	BULK EXCAVATION	CY	450.00	$5.00	$2,250.00
4.	PLANTING SOIL	CY	200.00	$40.00	$8,000.00
5.	SEEDING AND LANDSCAPING	LS	1.00	$4,500.00	$4,500.00
6.	RIP RAP	CY	90.00	$150.00	$13,500.00
7.	OUTLET STRUCTURE RETROFIT	LS	1.00	$6,800.00	$6,800.00
	SUBTOTAL OF ITEM C.				**$48,050.00**
D. 10% CONTINGENCY					**$4,805.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$4,600.00	**$4,600.00**
	PROJECT TOTALS				**$90,650.00**
IV. BMP-4	FAIRMONT AVENUE STREAMBANK RESTORATION				
A. DESIGN ENGINEERING & PERMITTING (W/ PERMIT FEES)		LS	1.00	$45,000.00	**$45,000.00**
B. LAND ACQUISITION COSTS		LS	1.00	$24,000.00	**$24,000.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$7,800.00	$7,800.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$12,000.00	$12,000.00
3.	BULK EXCAVATION	CY	1600.00	$12.00	$19,200.00
4.	PLANTING SOIL	CY	500.00	$40.00	$20,000.00
5.	SEEDING AND LANDSCAPING	LS	1.00	$35,000.00	$35,000.00
6.	STREAM BYPASSING	LS	1.00	$25,000.00	$25,000.00
7.	CULVERT REPLACEMENTS	EA	2.00	$12,500.00	$25,000.00
8.	FENCING	LF	2500.00	$30.00	$75,000.00
	SUBTOTAL OF ITEM C.				**$136,200.00**
D. 10% CONTINGENCY					**$13,620.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$7,000.00	**$7,000.00**
	PROJECT TOTALS				**$212,200.00**
V. BMP-5	BERKSHIRE BOULEVARD BASIN RETROFIT				
A. DESIGN ENGINEERING & PERMITTING		LS	1.00	$18,000.00	**$18,000.00**
B. LAND ACQUISITION COSTS		LS	1.00	$22,000.00	**$22,000.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$8,400.00	$8,400.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$9,000.00	$9,000.00
3.	BULK EXCAVATION	CY	4000.00	$6.50	$26,000.00
4.	PLANTING SOIL	CY	2700.00	$40.00	$108,000.00
5.	SEEDING AND LANDSCAPING	LS	1.00	$16,000.00	$16,000.00
6.	GEOTECHNICAL WORK	LS	1.00	$18,000.00	$18,000.00
7.	RIP RAP	CY	120.00	$150.00	$18,000.00
8.	OUTLET STRUCTURE RETROFIT	LS	1.00	$6,000.00	$6,000.00
	SUBTOTAL OF ITEM C.				**$209,400.00**
D. 10% CONTINGENCY					**$20,940.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$6,500.00	**$6,500.00**
	PROJECT TOTALS				**$255,900.00**

VI. BMP-6	RAMP DB BASIN RETROFIT				
A. DESIGN ENGINEERING & PERMITTING		LS	1.00	$24,000.00	**$24,000.00**
B. LAND ACQUISITION COSTS		LS	1.00	$32,000.00	**$32,000.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$9,200.00	$9,200.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$9,500.00	$9,500.00
3.	BULK EXCAVATION	CY	3800.00	$6.50	$24,700.00
4.	PLANTING SOIL	CY	2400.00	$40.00	$96,000.00
5.	SEEDING AND LANDSCAPING	LS	1.00	$13,000.00	$13,000.00
6.	DEMOLISH EXISTING FLOW CHANNELS	LS	1.00	$18,000.00	$18,000.00
7.	RIP RAP	CY	140.00	$150.00	$21,000.00
8.	OUTLET STRUCTURE RETROFIT	LS	1.00	$8,800.00	$8,800.00
	SUBTOTAL OF ITEM C.				**$200,200.00**
D. 10% CONTINGENCY					**$20,020.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$8,000.00	**$8,000.00**
	PROJECT TOTALS				**$264,200.00**
VII. BMP-7	**MISCELLANEOUS RAIN GARDENS - MUNICIPAL AND SCHOOL BUILDINGS AND FACILITIES**				
A. DESIGN ENGINEERING & PERMITTING		LS	1.00	$14,000.00	**$14,000.00**
B. LAND ACQUISITION COSTS (LEGAL COORDINATION ONLY)		LS	1.00	$8,000.00	**$8,000.00**
C. CONSTRUCTION					
1.	MOBILIZATION & DEMOBILIZATION	LS	1.00	$4,500.00	$4,500.00
2.	EROSION AND SEDIMENT CONTROLS	LS	1.00	$4,500.00	$4,500.00
3.	BULK EXCAVATION	CY	500.00	$6.50	$3,250.00
4.	PLANTING SOIL	CY	500.00	$40.00	$20,000.00
5.	SEEDING AND LANDSCAPING (MATERIALS ONLY)	LS	1.00	$8,000.00	$8,000.00
	SUBTOTAL OF ITEM C.				**$40,250.00**
D. 10% CONTINGENCY					**$4,025.00**
E. CONSTRUCTION PHASE ENGINEERING		LS	1.00	$3,000.00	**$3,000.00**
	PROJECT TOTALS				**$65,250.00**
GRAND TOTAL					**$1,522,600.00**

Appendix D – Draft Intermunicipal Agreement

WYOMISSING CREEK WATERSHED STORMWATER COALITION

FIRST RESTATEMENT OF COST-SHARING AND COOPERATION AGREEMENT

THIS AGREEMENT ("Agreement"), is made this ______ day of _____________, 2017, by and among the municipalities identified below as the Participating Members located in Berks County, Pennsylvania of the Wyomissing Creek Watershed Stormwater Coalition (hereinafter, the "Coalition"), pursuant to the authority granted by the various municipal laws of the Commonwealth of Pennsylvania and respective Ordinances.

BACKGROUND

WHEREAS, areas within the following municipalities are located within the Wyomissing Creek Watershed:

The Township of Brecknock, a Township of the Second Class incorporated under the laws of the Commonwealth of Pennsylvania having an address of 889 Alleghenyville Road, Mohnton, Pennsylvania 19540;

The Township of Cumru, a Township of the First Class incorporated under the laws of the Commonwealth of Pennsylvania having an address of 1776 Welsh Road, Mohnton, Pennsylvania 19540;

The Borough of Mohnton, a municipal corporation incorporated as a Borough under the laws of the Commonwealth of Pennsylvania having an address of 21 O'Neil Street, Mohnton, Pennsylvania 19540;

The Borough of Shillington, a municipal corporation incorporated as a Borough under the laws of the Commonwealth of Pennsylvania having an address of Two East Lancaster Avenue, Shillington, Pennsylvania 19607;

The City of Reading, a City of the Third Class operating as a Home Rule Charter under the laws of the Commonwealth of Pennsylvania having an address of 815 Washington Street, Reading, Pennsylvania 19601;

The Township of Spring, a Township of the Second Class incorporated under the laws of the Commonwealth of Pennsylvania having an address of 2850 Windmill Road, Sinking Spring, Pennsylvania 19608;

The Borough of West Reading, a municipal corporation incorporated as a Borough under the laws of the Commonwealth of Pennsylvania having an address of 500 Chestnut Street, West Reading, Pennsylvania 19611;

The Borough of Wyomissing, a municipal corporation incorporated as a Borough under the laws of the Commonwealth of Pennsylvania having an address of 22 Reading Boulevard, Wyomissing, Pennsylvania 19610; and

WHEREAS, all of the aforesaid municipalities are subject to the National Pollutant Discharge Elimination System permitting for stormwater discharges from a regulated Small Municipal Separate Storm Sewer Systems Permit (MS4 permit) process administered by the Pennsylvania Department of Environmental Protection on behalf of the United States Environmental Protection Agency (EPA), which requires a significant reduction of the amount of sediment, and by proxy, the quantity and rate of stormwater discharged to the Wyomissing Creek to comply with the Wyomissing Creek TMDL (Total Maximum Daily Load); and

WHEREAS, MS4 permit regulations require TMDL implementation plans to be coordinated and complied with on a regional or watershed basis; and

WHEREAS, all of the Participating Members above are parties to a prior Cost-Sharing and Cooperation Agreement which formed the Coalition, provided for cost sharing and cooperation among the Participating Members in assessing the impact of the MS4 permit requirements on their communities and, as necessary, provided for the implementation of measures to comply with the MS4 Permit implementation plan, and which prior agreement was approved and adopted by ordinance of each of the Participating Members, effective in 2012 as to all Participating Members other than Brecknock Township, and effective as of October 1, 2013 as to Brecknock Township (hereinafter the "Founding Agreement"); and

WHEREAS, pursuant to the Pennsylvania Intergovernmental Cooperation Act, 53 Pa. C.S. §2301, *et seq.*, the governing body of two or more local governments may make agreements with other municipalities to jointly cooperate in performing governmental functions, powers, and responsibilities; and

WHEREAS, pursuant to the First Class Township Code, 53 P.S. § 56553, the Township of Cumru is authorized to enter into agreements with other municipal corporations to perform governmental powers, duties and functions; and

WHEREAS, pursuant to the Second Class Township Code, 53 P.S. §66507, the Townships of Brecknock and Spring are authorized to enter into agreements with other municipal corporations to perform governmental powers, duties and functions; and

WHEREAS, pursuant to the Borough Code, 8 Pa.C.S.A. §1202(24), the Boroughs of Mohnton, Shillington, West Reading and Wyomissing may enter into contracts with other municipalities to perform governmental powers, duties and functions; and

WHEREAS, pursuant to the Third Class City Code and Home Rule Charter, the City of Reading is authorized to enter into agreements with other municipal corporations to perform governmental powers, duties and functions; and

WHEREAS, upon review of the MS4 permit requirements for the upcoming 2018-2023 permitting cycle, the Participating Members have acknowledged that significant capital projects will be required to be completed to achieve MS4 compliance on a watershed basis, and that the scope and cost of achieving such compliance should no longer be shared equally among the Participating Members, but rather should be allocated based upon the proportionate amount of urbanized area (as defined in the MS4 regulations) within the Wyomissing Creek watershed that is contained within the geographic boundaries of each Participating Member's municipality, and the shared benefits to be received by each Participating Member; and

WHEREAS, the Participating Members wish to enter into this First Restatement of Cost-Sharing and Cooperation Agreement, in order to revise the allocation of the cost-sharing obligations among the Participating Members, and to revise the budgeting obligations of the Participating Members, in order to facilitate the proper financing of the activities of the Coalition; and

NOW, THEREFORE, in consideration of the above and with the intention to be legally bound hereby, the Participating Members agree as follows:

FORMATION OF COALITION

1. The Participating Members hereby acknowledge that the Founding Agreement had the effect of forming and establishing a Coalition titled "The Wyomissing Creek Watershed Stormwater Coalition", as authorized by the Pennsylvania Intergovernmental Cooperation Act, 53 Pa.C.S.§2301 et seq, (the "Act"), the applicable municipal codes of the Commonwealth of Pennsylvania and Ordinances duly enacted by the Participating Members, with such Coalition having the powers and duties as provided for in the Ordinances and the Founding Agreement, consistent with the authority of the Act and other applicable laws. Each Participating Member agrees and pledges continued good faith cooperation in the exercise of the powers, duties and functions of the Coalition to each other.

PURPOSE AND AUTHORITY

2. The Purpose of the Coalition is to coordinate and share the costs of planning and implementation to comply with the Wyomissing Creek Watershed TMDL MS4 requirements pursuant to Pennsylvania Department of Environmental Protection and United States Environmental Protection Agency MS4 permitting regulations.

DEFINITION

3. PARTICIPATING MEMBERS - The following municipal units are the Participating Members of this Coalition: the Township of Brecknock, the Township of Cumru, the Borough of Mohnton, the City of Reading, the Borough of Shillington, the Township of Spring, the Borough of West Reading, and the Borough of Wyomissing.

MEMBERSHIP

4. Each of the Participating Members has become a member of the Coalition by adopting an Ordinance authorizing Coalition membership and approving the Founding Agreement. To remain a Participating Member, a municipality shall adopt an Ordinance authorizing and executing this First Restatement of Cost-Sharing and Cooperation Agreement, and comply with all requirements set forth in this Agreement.

5. In addition to the Participating Members, the Coalition can add an additional Participating Member upon a majority vote as described herein. A late entrance fee shall be determined by the Steering Committee based upon costs previously incurred at the time of joining.

ORGANIZATION

6. At the beginning of each permitting period, each Participating Member shall designate a Representative to serve as a member of the Steering Committee.

7. Each Participating Member may designate an alternate Representative to serve as a member of the Steering Committee in the absence of the Representative.

8. The Steering Committee shall select one of its members to serve as the Steering Committee's Chairperson.

9. The Steering Committee shall also select one of its members to serve as Vice Chairperson of the Committee.

10. The Representative on the Steering Committee of the municipality selected to collect Membership Fees and Assessments from each Participating Member shall serve as the Treasurer for the Steering Committee.

11. All Participating Members shall communicate through the Steering Committee.

MEMBERSHIP FEES AND CONTRIBUTIONS

12. Each Participating Member paid an initial membership fee at the time of execution of the Founding Agreement in the amount of $5,000 ("Membership Fee").

13. Through the date of this Agreement, each Participating Member has contributed an equal share based upon assessment by the Coalition.

14. Effective as of the commencement date of the 2018-2023 MS4 permit cycle, which date is anticipated to be on or about March 10, 2018 (the said commencement date hereinafter referred to as the "Effective Date", and the five (5) year period beginning on such Effective Date is referred to hereinafter as the "2018-2023 MS4 Permit Cycle"), each Participating Member shall financially contribute to the Coalition based upon the following table, with such

percentages of financial responsibility having been calculated based upon the acreage of Urbanized Area within the Wyomissing Creek watershed that is contained within the geographic boundaries of each Participating Member's municipality, and an estimate of the equally shared benefits to be received by each Participating Member, said percentages to be fixed as provided below, unless otherwise revised by written agreement of all Participating Members:

	Urbanized Area Acreage	Proposed Share of Financial Responsibility
Brecknock	259	6.3%
Cumru	1,706	20.0%
Mohnton	490	11.9%
Reading	275	6.7%
Shillington	434	10.5%
Spring	1,942	20.0%
West Reading	188	4.6%
Wyomissing	2,065	20.0%
TOTAL	7,359	100.0%

BUDGET

15. The fiscal year for purposes of the Coalition shall run for 365 days from the first calendar day of the 2018-2023 MS4 Permit Cycle, which is anticipated to be March 10, thereby resulting in a fiscal year of March 10 to March 9of the following calendar year.

16. The Participating Members acknowledge that the anticipated expenditures of the Coalition from the Effective Date through the end of the 2018-2023 MS4 Permit Cycle are $2,000,000. The Coalition's annual budget for each fiscal year beginning on the Effective Date and through the end of the 2018-2023 MS4 Permit Cycle shall be $400,000 for fees, costs and expenses, plus the amount of any budgeted but unexpended funds remaining from each of the Coalition's prior fiscal year budgets. The annual cap may be increased upon written notification to all Participating Members, with a detailed accounting of the expenditures incurred within the initial cap and the justification for the request of additional funding.

17. Each Participating Member shall prepare its own annual budget based upon its proportionate share of financial responsibility referenced in Paragraph 14 above, with the budget for any given fiscal year to be increased by the amount of any funds budgeted to Coalition activities during each prior fiscal year during the 2018-2023 MS4 Permit Cycle, but which funds were not expended. The sum of the total annual assessments of each Participating Member shall not exceed the annual budget for the Coalition, unless the initial cap is so increased.

18. The proposed budget for the Coalition shall be prepared by September 1 of the year prior to the proposed budget year and shall include a detailed accounting of all anticipated costs.

19. The proposed budget for the Coalition shall be presented to each Participating Member by its Representative prior to a vote on the final budget.

20. The final annual budget for the Coalition shall be approved by November 1 of the year prior to the proposed budget year.

21. Each Participating Member shall pay any contribution due within forty-five (45) days of notice of such assessment by the Coalition.

22. All fees, costs, and expenses associated with the Coalition shall be reviewed and managed by the Steering Committee.

23. The Treasurer shall maintain an account in the name of the Coalition to hold all Coalition funds, including Membership Fees and contribution assessments.

24. At the request of two (2) Participating Members, the Coalition shall be audited by a certified public accounting firm selected by the Steering Committee. All costs for such audit shall be paid by the requesting Participating Members.

25. Each Participating Member shall be responsible for its own out of pocket costs and solicitor fees attendant to their involvement with the Coalition.

MEETINGS

26. The Coalition shall hold regular meetings which shall take place monthly at such place and time as determined by the Steering Committee.

27. Notice of meetings shall occur in accordance with the Sunshine Act of the Commonwealth of Pennsylvania.

28. All meetings must have a Quorum consisting of five (5) of the eight (8) members of the Steering Committee present as set forth herein to conduct Coalition business.

29. If a Quorum is not present at the start of the meeting, or available to remotely participate via teleconferencing or videoconferencing, the meeting shall be delayed or rescheduled.

30. A Secretary shall be selected by the Steering Committee who shall prepare minutes of meetings and maintain official records of the Coalition. The Secretary shall distribute approved minutes to each Participating Member on a monthly basis.

31. Any decision affecting the allocation of Coalition funds or directing the Coalition to perform any act that is either not contemplated in this Agreement, or exceeds the terms of this Agreement, shall require a majority vote of the Participating Members.

32. A majority vote for actions contemplated by this Agreement shall consist of a majority of the entire membership of the Steering Committee.

33. Representatives may vote by being present at or remotely participating in the meeting.

TERM

34. This Agreement shall continue in full force and effect, except as modified by mutual agreement of the parties or if terminated pursuant to paragraph 36 hereof.

NOTICE

35. Any notice given hereunder by any party to another party shall be in writing and shall be deemed given when delivered personally or five (5) days after being sent by certified mail, return receipt requested, as follows:

To the Participating Member:	Copy to:
Township of Brecknock 889 Alleghenyville Road Mohnton, PA 19540	Hartman Valeriano Magovern & Lutz 1100 Berkshire Blvd, Suite 301 PO Box 5828 Wyomissing, PA 19610
Township of Cumru 1775 Welsh Road Mohnton, PA 19540	Georgeadis Setley Four Park Plaza Second Floor Wyomissing, PA 19610
Borough of Mohnton 21 N. O'Neil Street Mohnton, PA 19540	Hoffert & Klonis 536 Court Street Reading, PA 19603
City of Reading Managing Director's Office 815 Washington Street Reading, PA 19601	City of Reading Dept. of Law 815 Washington Street Room 2-54 Reading, PA 19601
Borough of Shillington 2 E. Lancaster Avenue Shillington, PA 19607	Hoffert & Klonis 536 Court Street Reading, PA 19603
Township of Spring 2850 Windmill Road Sinking Spring, PA 19608	Kozloff Stoudt 2640 Westview Drive Wyomissing, PA 19610
Borough of West Reading 500 Chestnut Street West Reading, PA 19611	Barley Snyder P.O. Box 942 Reading, PA 19603

Borough of Wyomissing
22 Reading Boulevard
Wyomissing, PA 19610

Hartman Valeriano Magovern & Lutz
1100 Berkshire Blvd, Suite 301
PO Box 5828
Wyomissing, PA 19610

TERMINATION

36. If at any time, a Participating Member wishes to end its participation in the Coalition and to terminate its rights and obligations under this Agreement, it shall give the Chairperson of the Steering Committee thirty (30) days written notice that it no longer wishes to participate.

37. In no event shall any funds already contributed to the Coalition be refunded to a Participating Member that seeks to end its participation in the Coalition, solely on the basis that it has ended its participation.

MISCELLANEOUS PROVISIONS

38. The services performed and expenditures incurred under this Agreement shall be deemed for public and governmental purposes, and all immunities from liabilities enjoyed by the Participating Members within their respective municipal boundaries shall extend to their participation in services outside their respective boundaries and within the geographical area served by the Coalition.

39. The invalidity, illegality or unconstitutionality of any portion of this Agreement shall not impair or affect the invalidity of this Agreement as a whole or any other part thereof.

40. This Agreement shall be binding upon the parties hereto and their respective successors and assigns.

41. This Agreement may be signed in counterparts or any number of duplicate originals, each of which shall be deemed an original, but all which together shall constitute one and the same instrument.

42. This Agreement shall be construed in accordance with the laws of the Commonwealth of Pennsylvania.

43. This Agreement represents the entire agreement between the parties hereto. Any amendment to this Agreement shall be in writing and must be signed by all parties hereto in order to be valid and enforceable.

44. This Agreement shall become effective on the date ("Effective Date") occurring five (5) days after the date of enactment of an authorizing ordinance by the last Participating Municipality to enact an authorizing Ordinance.

IN WITNESS WHEREOF, the Participating Municipalities have caused this Agreement to be duly executed as of the day and year above written.

Approved by Ordinance __________ of the Township of Brecknock, the ___ day of ____________________________, 2017.

ATTEST: TOWNSHIP OF BRECKNOCK:

_________________________ _________________________
Signature Signature

_________________________ _________________________
Print Name Print Name

____
Chairman, Board of Supervisors

Approved by Ordinance __________ of the Township of Cumru, the ___ day of ____________________________, 2017.

ATTEST: TOWNSHIP OF CUMRU:

_________________________ _________________________
Signature Signature

_________________________ _________________________
Print Name Print Name

____
President, Board of Commissioners

Approved by Ordinance __________ of the Borough of Mohnton the ___ day of ________________________________, 2017.

ATTEST: BOROUGH OF MOHNTON:

____
Signature

____
Print Name

____
Signature

____
Print Name

____
President of Borough Council

____
Mayor

Approved by Ordinance _______________ of the Borough of Shillington the ___ day of __________________________, 2017.

ATTEST: BOROUGH OF SHILLINGTON:

____
Signature

____
Print Name

____
Signature

____
Print Name

____
President of Borough Council

____
Mayor

Approved by Ordinance _____________of the City of Reading the ___ day of ______________________, 2017.

ATTEST:

____
Signature

____
Print Name

____
Title

CITY OF READING:

____
Signature

____
Print Name

____
Title

____
Signature

____
Print Name

Mayor_______________________
Title

Approved by Ordinance _______________of the Township of Spring the ___ day of ____________________________, 2017.

ATTEST:

____
Signature

____
Print Name

TOWNSHIP OF SPRING:

____
Signature

____
Print Name

____
Chairman of Board of Supervisors

Approved by Ordinance ___________of the Borough of West Reading the ___ day of ___________________________, 2017.

ATTEST: BOROUGH OF WEST READING:

______________________ Signature	______________________ Signature
______________________ Print Name	______________________ Print Name
	______________________ President of Borough Council
	______________________ Mayor

Approved by Ordinance _________of the Borough of Wyomissing the ___ day of ___________________________, 2017.

ATTEST: BOROUGH OF WYOMISSING:

______________________ Signature	______________________ Signature
______________________ Print Name	______________________ Print Name
	______________________ President of Borough Council
	______________________ Mayor