July 2017

Blair County Collaborative TMDL and Pollution Reduction Plan

Blair County Intergovernmental Stormwater Committee

Prepared by:
CENTER FOR WATERSHED PROTECTION

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Introduction

The Blair County Intergovernmental Stormwater Committee (ISC) currently consists of 11 entities: Allegheny Township, Antis Township, Bellwood Borough, Blair Township, City of Altoona, Duncansville Borough, Frankstown Township, Freedom Township, Hollidaysburg Borough, Logan Township, and Blair County. The ISC has chosen to collaborate on the creation and implementation of the combined Little Juniata Total Maximum Daily Load (TMDL) and Pollution Reduction Plan (PRP) in order to achieve sediment reductions to the Little Juniata, the Beaverdam Branch, and Frankstown Branch Juniata Rivers. The methodology followed to create this TMDL and PRP is entirely consistent with the requirements provided in the Pennsylvania Department of Environmental Protection's (PADEP's) TMDL and PRP Instruction documents. The joint TMDL and PRP Collaborative consists solely of contiguous land areas that encompass all of the planning area associated with (that drain into) the Altoona, PA 2010 US Census Urbanized Area (UA). The maps submitted in Section B – Mapping clearly illustrate the UA and associated planning area.

The ISC has specifically chosen not to parse or separate out the stormwater contributions from other permittees and entities in the ISC planning area such as:

- the Pennsylvania Department of Transportation (PennDOT),
- the Pennsylvania State University – Altoona (PSU – Altoona) Campus,
- the Commonwealth of PA Department of Military Affairs/Hollidaysburg Veterans Home,
- or the federal Verterans Affairs Hospital

Keeping the stormwater sediment contributions in the analysis was chosen in order to foster and support any opportunity for future collaboration with the above entities. During the permit term, the ISC will reach out to these agencies to determine if partnering opportunities exist that could benefit all parties to reach pollution reduction goals.

Please note that the PADEP required a very specific format for TMDL and PRPs. This document is organized precisely as required by the PADEP TMDL Instructions.

Section A - Public Participation

Public Participation. The ISC shall complete the following public participation measures listed below, report in the TMDL/PRP that each was completed and attach copies of applicable information. The ISC will:

- make a complete copy of the TMDL Plan available for public review.
- publish, in a newspaper of general circulation in the area, a public notice containing a statement describing the plan, where it may be reviewed by the public, and the length of time the permittee will provide for the receipt of comments. The public notice must be published at least 45 days prior to the deadline for submission of the TMDL Plan to DEP. Attach a copy of the public notice to the TMDL Plan.
- accept written comments for a minimum of 30 days from the date of public notice. Attach a copy of all written comments received from the public to the TMDL Plan.
- accept comments from any interested member of the public at a public meeting or hearing, which may include a regularly scheduled meeting of the governing body of the municipality or municipal authority that is the permittee.
- consider and make a record of the consideration of each timely comment received from the public during the public comment period concerning the plan, identifying any changes made to the plan in response to the comment. Attach a copy of the permittee's record of consideration of all timely comment received in the public comment period to the TMDL Plan.

As this TMDL/PRP was developed on a regional scale by multiple MS4 permittees, the collaborating permittees will implement these public participation requirements as a joint effort with the notice of the availability of the TMDL/PRP and the notice of a public meeting or hearing reaching the target audience groups of all permittees involved in the joint effort.

Section B – Mapping

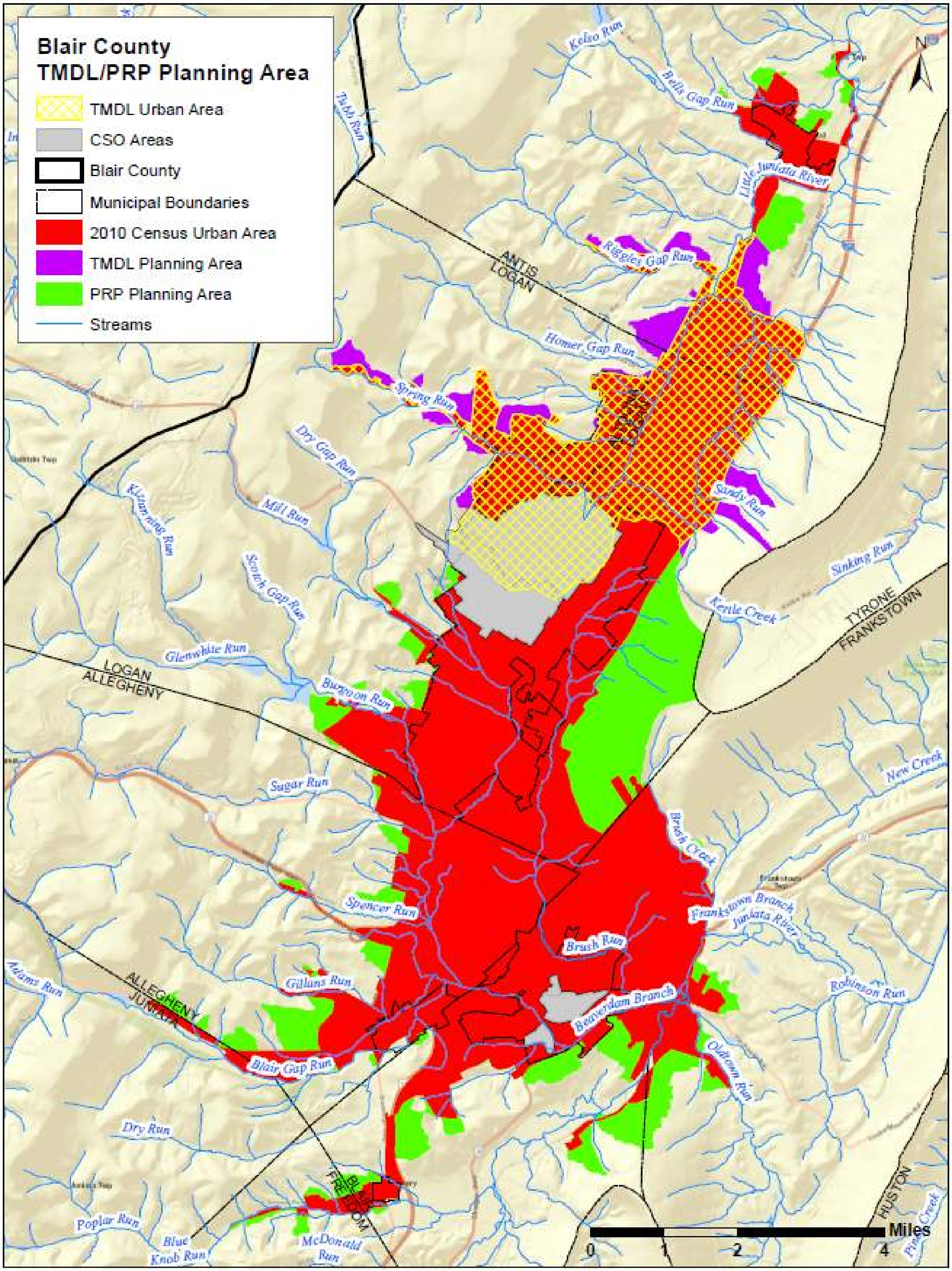

Figure 5: Blair County TMDL/PRP Planning Area

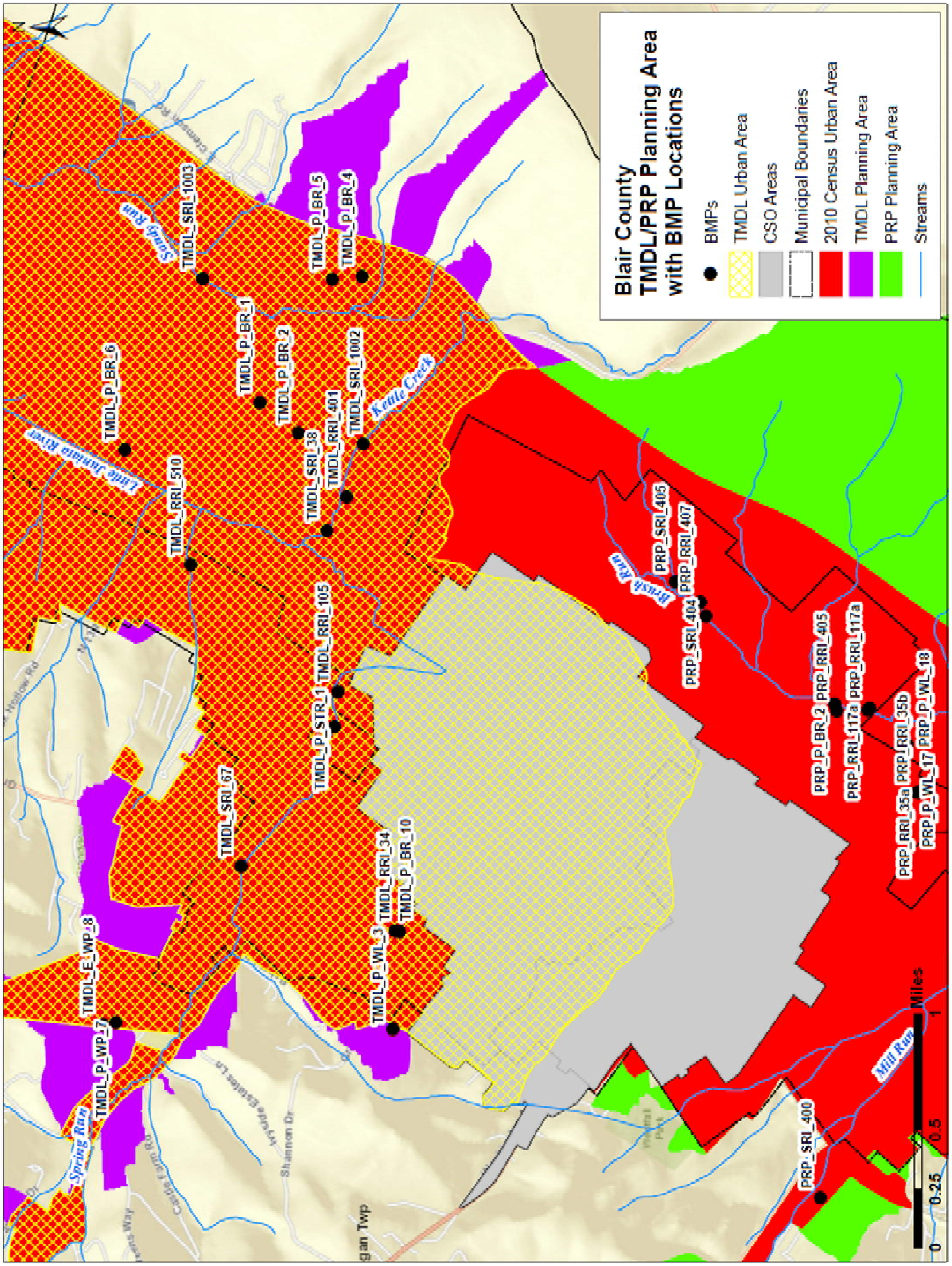

Figure 6: Blair County TMDL/PRP Planning Area with BMP Locations – Map 1

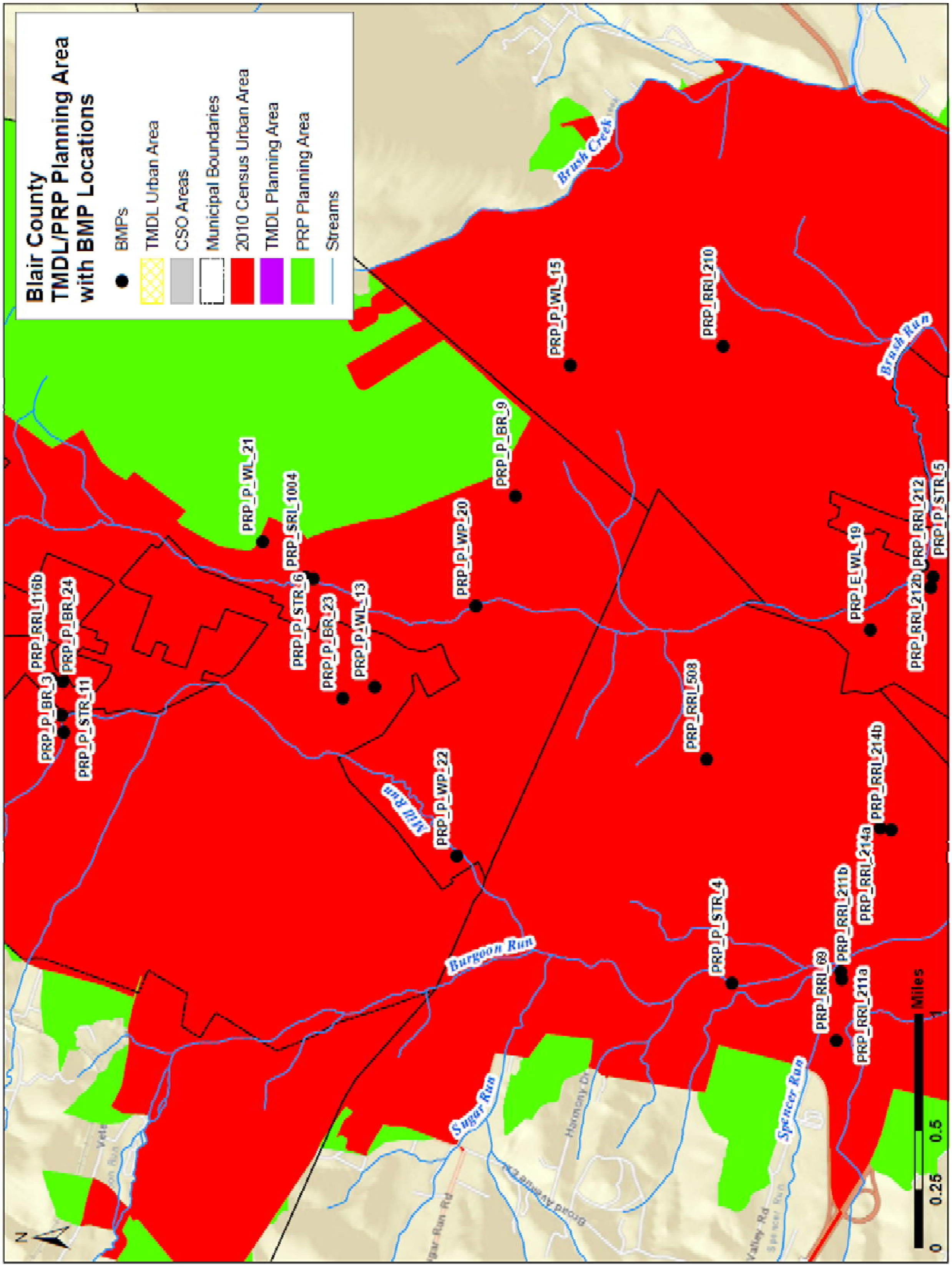

Figure 7: Blair County TMDL/PRP Planning Area with BMP Locations – Map 2

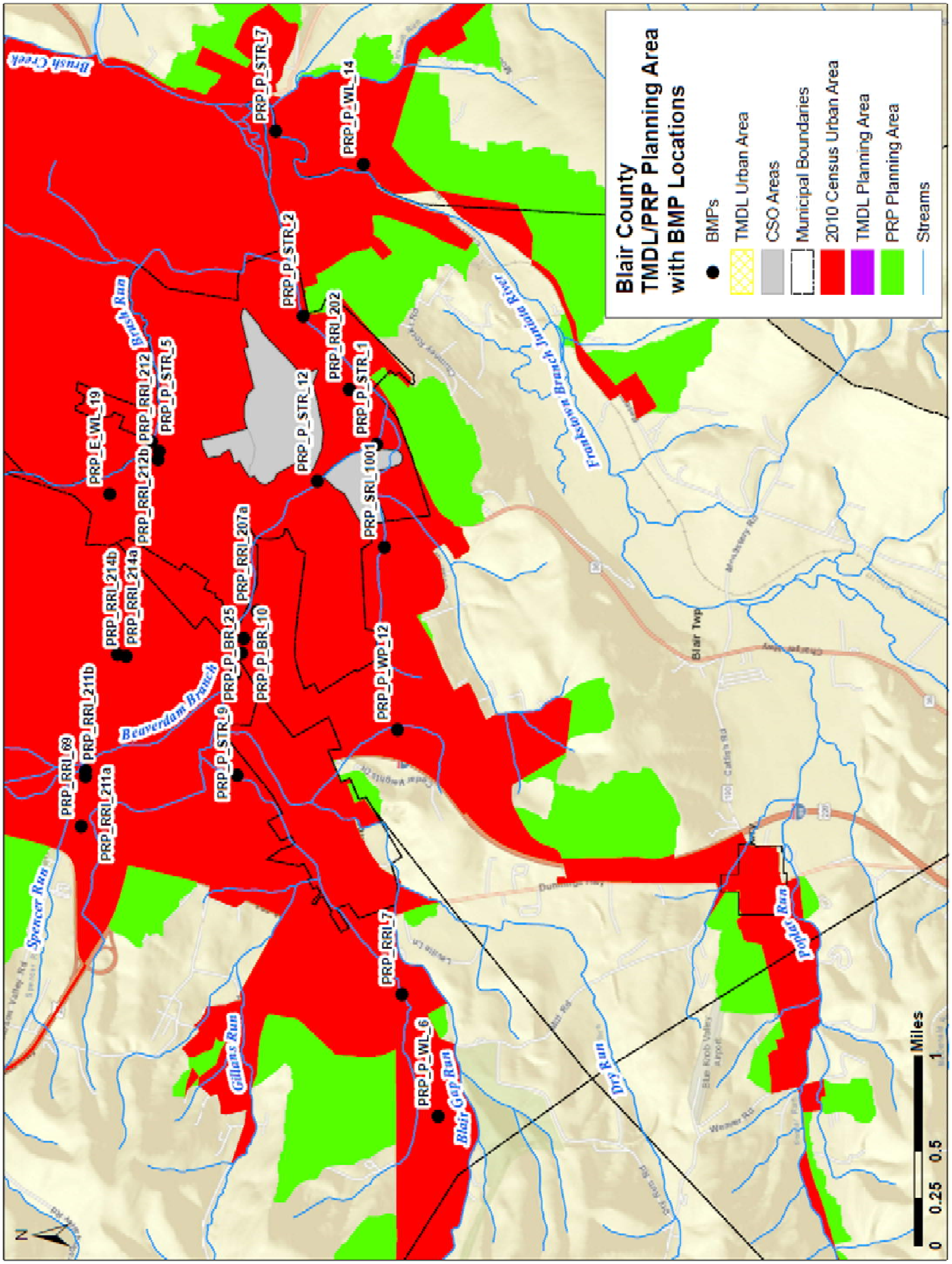

Figure 8: Blair County TMDL/PRP Planning Area with BMP Locations – Map 3

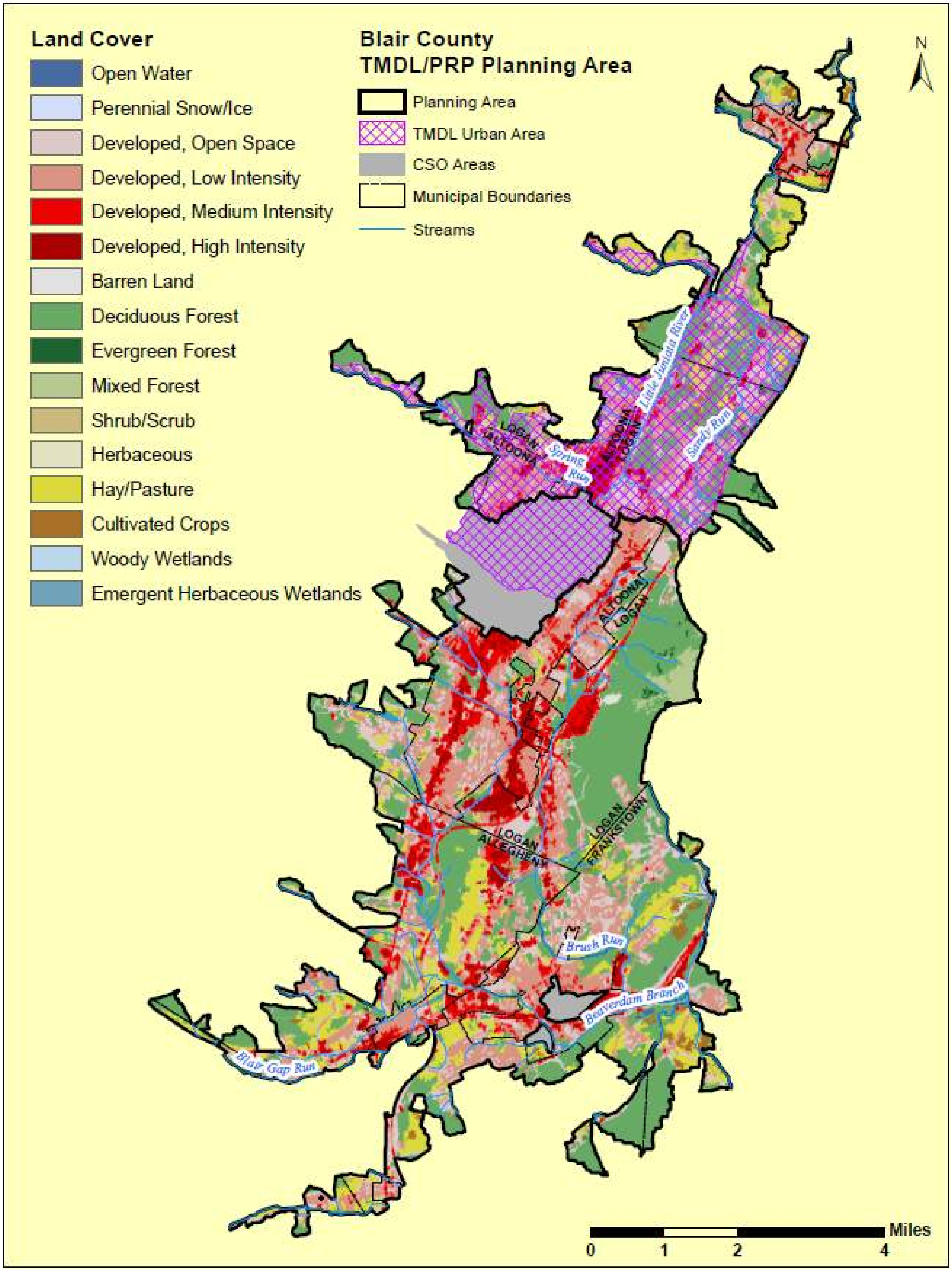

Figure 5 – Blair County TMDL/PRP Planning Area 2011 NLCD Land Uses

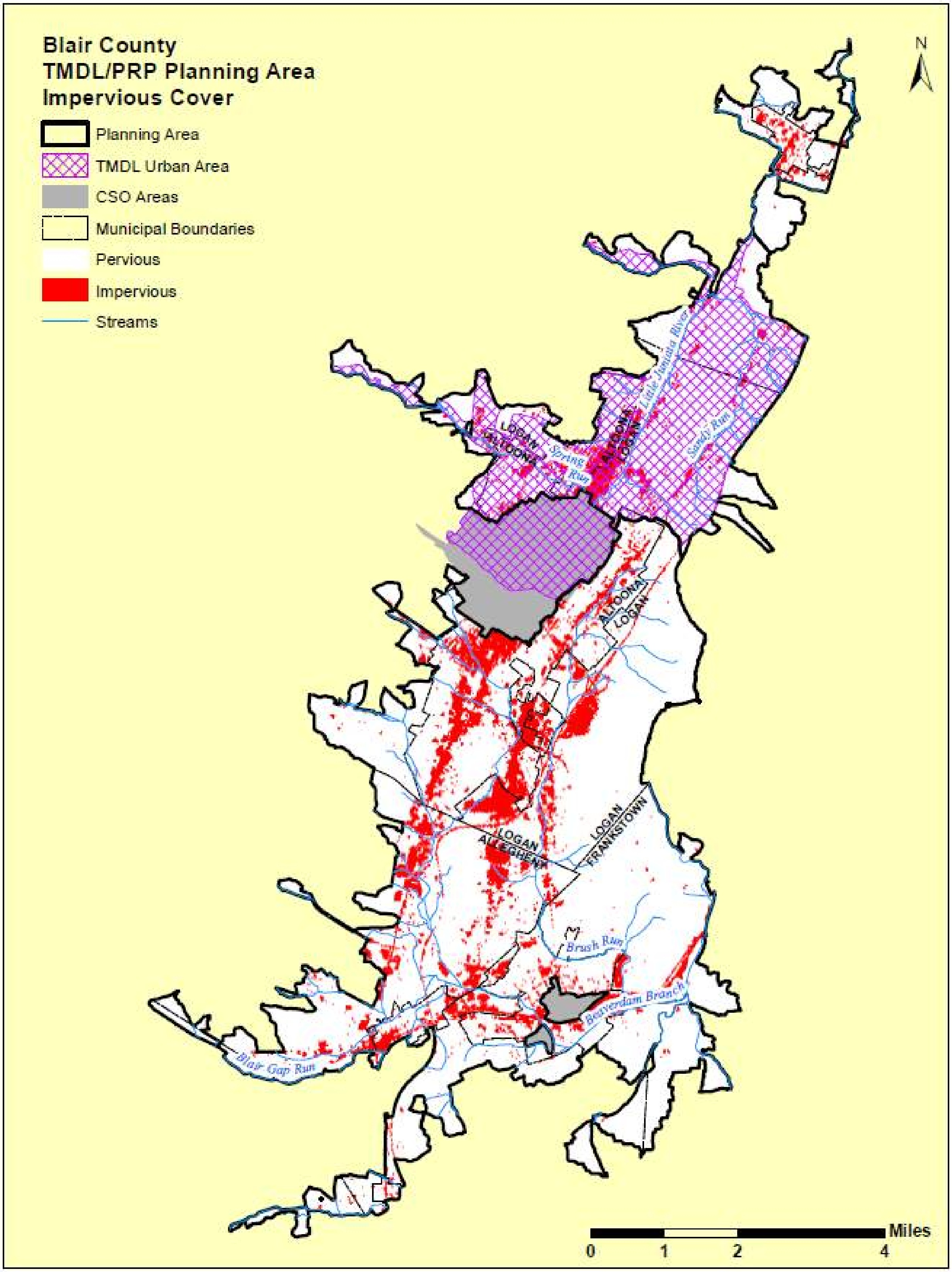

Figure 6 – Blair County TMDL/PRP Planning Area Impervious and Pervious Cover

Section C – Pollutants of Concern

The Little Juniata River Watershed Blair County TMDL was published in December of 2004 due to sediment impairments in the watershed. The TMDL contains a WLA of 2036 tons/year of sediment. Therefore, the pollutant of concern in the TMDL drainage area is sediment.

The entire PRP planning area lies within the Chesapeake Bay watershed and is subject to 10% sediment and 5% TP Appendix D requirements. There are numerous Appendix E requirements listed in the MS4 Requirements Table for both sediment and nutrients to the various local impairments within the ISC Combined Planning Area.

The PADEP document entitled, “Pollutant Aggregation Suggestions for MS4 Requirements Table Instructions” states that the:

> DEP Pollutant Reduction Plan (PRP) Instructions and TMDL Instructions allow flexibility in the location of BMPs for the upcoming permit term; load reductions need not necessarily be accomplished in each stream and tributary listed in the MS4 Requirements Table. Instead, the instructions promote planning on a larger scale. The MS4 is required to calculate the required pollutant load reduction for its entire Planning Area, but load reductions in some impaired surface waters can be more than what is required, and less than what is required in others, so long as the total reduction is at least the required percentage of the total (pg.1).

The TMDL Instructions state in Section 1.F (pg. 6) that MS4s may combine TMDL Plans with PRPs. In particular, Example 5 states:

> An MS4 must develop a TMDL Plan for Brook Run as well as a PRP for the Chesapeake Bay. The MS4 decides to combine the TMDL Plan and the PRP. The TMDL Planning Area for Brook Run encompasses 1,000 acres, but the area draining to waters within the Chesapeake Bay watershed is larger – 2,000 acres – and includes the Brook Run TMDL Planning Area……. Using a 10% sediment reduction target (i.e., the common target for both the TMDL Plan and PRP)…….The BMPs…….should preferentially be located in the Brook Run drainage area, but may be located anywhere within the Chesapeake Bay planning area if it is not feasible to locate them in the Brook Run watershed during the upcoming permit term (pg.6).

The PRP Instructions, in Section 1.B state that “PRPs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction”. Therefore, as the

- TMDL Planning Area requires a sediment reduction,
- The entire TMDL and PRP planning area for the ISC Combined Planning Area is in the Chesapeake Bay and subject to Appendix D,
- The Aggregation Suggestions promote planning on a larger scale,
- The TMDL Instructions allow for TMDL and PRP Planning Areas to be combined, and
- The presumptive approach allows for the 10% sediment reduction target to accomplish a 5% TP reduction,

the TMDL and PRP Planning Areas will be combined and considered as one Planning Area throughout this analysis and an overall 10% sediment reduction target will be pursued from the entire Combined Planning Area.

Section D – Existing Sediment Load

Determining the Planning Area - Methodology

The 2010 U.S. Census urbanized area (UA) layer was obtained from the ISC. Land directly draining to the urban area was delineated through a process that incorporated Arc Hydro version 10.5 and visual evaluation of topographic and hydrologic data. Data used in the Arc Hydro data model included a 10-meter resolution Digital Elevation Model (DEM) published in 2013 by the United States Geological Survey, and National Hydrography Dataset (NHD) Flowlines obtained from Pennsylvania Spatial Data Access (PASDA). The Arc Hydro terrain preprocessing steps were followed to allow for DEM-based watershed delineation and network generation.

Arc Hydro generates a series of catchments corresponding to stream segments that drain the area. All of the catchments that intersected the 2010 UA were selected and merged into an initial version of the planning area delineation. This initial version was then further refined to remove any areas where streams, and their corresponding drainage areas, entered into the UA, except as it applied to the Lakemont Reservoir. This resulted in the delineation of only the land immediately adjacent to the 2010 UA that drained into the UA. The drainage areas corresponding to the streams entering the UA were delineated using the point delineation tool in Arc Hydro, which delineates the watershed for an interactively defined point. After these watershed delineations were subtracted from the planning area, a visual inspection of the entire area was done to check the data and provide minor refinements where needed using the DEM, aerial photography basemap, NHD flowlines, and 20-foot contour lines obtained from PASDA.

Additional refinement involved determining the portion of the planning area included in the Little Juniata TMDL, as well as removal of the combined sewer overflow (CSO) areas and what drained to them. To determine the TMDL area as defined by the 2010 UA, the planning area was intersected with Little Juniata watershed boundary. The portion of the planning area within the Little Juniata boundary is referred to as the TMDL Planning Area. The portion of the planning area outside of the Little Juniata boundary is referred to as the PRP Planning Area. The CSO areas were obtained from the Altoona Water Authority, Logan Township, and Hollidaysburg Borough. The removed CSO areas and what would drain to them, totaled 1,369 acres in the TMDL planning area, and 1,143 acres in the PRP planning area.

The final maps with planning areas and CSO delineation can be viewed in Section B – Mapping.

Planning Area Land Use/Land Cover Analysis

The TMDL Instructions state on page 3:

> CAST/BayFAST may be used for remodeling efforts, as they apply loading information derived from the Chesapeake Bay Watershed Model; however, watershed/site-specific land use/land cover information must be substituted for defaults in load calculations at all scales (e.g., Planning Area and BMP-treated area)

Due to the size of the Combined Planning Area, and the fact that the entire Planning Area is within the Chesapeake Bay, BayFAST was chosen to model the existing sediment load from the Combined Planning Area.

The 2011 National Land Cover Database (NLCD) was used to calculate the land cover within the planning area delineation (Figure 5). The TMDL and PRP Planning Areas were intersected with the municipal boundaries so that land cover could be summarized by municipality. The Spatial Analyst Zonal Histogram Tool in ArcGIS Desktop 10.5 was used to calculate the area of each of the NLCD land cover categories by municipality and location within either the TMDL or PRP planning area. Translation was made from the 2011 NLCD land cover categories into the corresponding BayFAST land uses. A summary of the translations are provided in Table 1.

Table 1 - NLCD 2011 Land Use Conversion to BayFAST Land Use Categories

NLCD 2011 Land Use	BayFAST Land Use Conversion
Open Water	Open Water
Developed, Open Space	Divided into Regulated Pervious and Impervious Developed
Developed, Low Intensity	Divided into Regulated Pervious and Impervious Developed
Developed, Medium Intensity	Divided into Regulated Pervious and Impervious Developed
Developed High Intensity	Divided into Regulated Pervious and Impervious Developed
Barren Land	Regulated extractive
Deciduous Forest	Forest
Evergreen Forest	Forest
Mixed Forest	Forest
Herbaceous	Hay without Nutrients
Hay/Pasture	Pasture
Cultivated Crops	Hightill with Manure

In order to better illustrate the land use category translation from barren land to regulated extractive, herbaceous to hay without nutrients, and cultivated crops to hightill with manure the following definitions are provided:

- 2011 NLCD - Barren Land (Rock/Sand/Clay) - areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
- BayFAST - Regulated extractive - The extractive-active and abandoned mines land use is composed of mines, gravel pits, and the like. The area of extracted land that is in an MS4 area is in this category.
- 2011 NLCD - Herbaceous - Grassland/Herbaceous- areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- BayFAST - Hay without Nutrients - The hay-unfertilized category includes hay or other herbaceous agricultural areas that do not receive fertilizer and are not harvested, such as wild hay, idle cropland, and fallow land.
- 2011 NLCD - Cultivated Crops - areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
- BayFAST - Hightill with Manure - Conventional tillage with manure contains grain, corn, soybeans, and dry beans. Wheat, corn, and soybeans are the dominant crops in the Chesapeake

watershed, often planted in a 2-year rotation on the same parcel of land. Crops in this category receive nutrient inputs from manure application as well as fertilizer. The category name indicates that manure may be applied, not that manure is necessarily applied.

Finally, the acres of impervious cover were determined in order to translate the NLCD developed land cover classifications, into the regulated impervious and pervious developed classifications for use in BayFAST (Figure 6). Developed land cover categories in the NLCD include: developed open space, developed low intensity, developed medium intensity, and developed high intensity. The NLCD developed land cover categories provide only broad ranges of impervious percentages within each, and must be refined to obtain the regulated impervious and pervious developed acres needed for BayFAST. For example, the developed medium intensity classification contains a range of impervious surfaces from 50% to 79% of the total cover. Therefore, the NLCD was converted from a raster to a vector layer so that the developed land cover categories could be extracted as polygons. After these categories were exported to a new layer, they were intersected with the municipal boundaries and the TMDL/PRP planning area delineations. In a similar method to calculating land cover, the 2011 NLCD Developed Impervious dataset and Spatial Analyst Tools were used to summarize the acres of impervious cover by municipality and location within both the TMDL or PRP planning area.

BayFAST Model Results

The resulting final acreages of each BayFAST land use category, the land use loading rates provided by BayFAST, and the resulting sediment load are provided for the Combined Planning Area, TMDL Planning Area, and PRP Planning Area respectively in Tables 2, 3, and 4.

Table 2 - Combined Planning Area Model Results, and 10% Sediment Target without Existing BMP Reductions

Land Use	Acres	Loading Rate (lb/ac/yr)	Sediment Load (lb/yr)
Forest	9,824.9	106.6	1,047,134
Hay without Nutrients	11.1	445.2	4,949.8
Hightill with Manure	274.7	1,734.5	476,389.4
Pasture	2,988.3	129.9	388,029.7
Regulated Extractive	25.1	2,900.3	72,887.9
Regulated Impervious Developed	5,289.4	1,952.2	10,343,370.0
Regulated Pervious Developed	9,569.9	309.9	2,965,727.0
Water	19.3	0	0
Total	28,011.8		15,298,487.8
10% Sediment Target			**1,529,849**

Table 3 - TMDL Land Use Data, Model Results, and 10% Sediment Target (w/o Existing BMPs included)

Land Use	Acres	Loading Rate (lb/ac/yr)	Sediment Load (lb/yr)
Forest	2282.2	106.6	243237.3
Hay without Nutrients	5.1	445.2	2277.4
Hightill with Manure	51.8	1734.5	89876.1
Pasture	498.4	129.9	64714.6
Regulated Extractive	1.112	2900.3	3225.1
Regulated Impervious Developed	1136.3	1952.2	2218271.0
Regulated Pervious Developed	2488.7	309.9	771258.1
Water	2.4	0	0
Total	6,466.1		3,392,859.6
10% Sediment Target			**339,286**

Table 4 - PRP Land Use Data, Model Results, and 10% Sediment Target (w/o Existing BMPs included)

Land Use	Acres	Loading Rate (lb/ac/yr)	Sediment Load (lb/yr)
Forest	7542.7	106.6	803,896.7
Hay without Nutrients	6.0	445.2	2,672.4
Hightill with Manure	222.8	1734.5	386,513.3
Pasture	2489.9	129.9	323,315.1
Regulated Extractive	24.018	2900.3	69,662.8
Regulated Impervious Developed	4162.1	1952.2	8,125,099.0
Regulated Pervious Developed	7,081.2	309.9	2,194,469.0
Water	16.9	0	0
Total	21,545.7		11,905,628.0
10% Sediment Target			**1,190,563**

Existing BMPs

Per the TMDL and PRP instruction documents, the existing sediment load may be refined and reduced by accounting for the function of existing BMPs (Table 5). The project IDs: PRP_E_STR_1, PRP_E_WL_19, PRP_E_RG_4, and PRP_E_RG_5 function only to reduce the existing sediment loading. All other BMPs in Table 5 are retrofits that have an existing performance reduction that is deducted from the proposed performance to obtain a net retrofit sediment reduction performance value. All existing BMP performance, and retrofit BMP calculations with a description of the practice are available in Appendix B.

Table 5 - BMPs with Existing Load Reductions

Project	Municipal Location	Project ID	BMP Type	Sediment Load to BMP (lb/yr)	Percent Reduction (%)	Existing Load Reduction (lb/yr)
Lakemont Reservoir	Logan	PRP_P_WP_20	Wet Pond/Reservoir	2,424,182	42.7%	1,035,766
Blair Gap Run	Duncansville	PRP_E_STR_1	Stream Restoration	2630 ft @ 44.88 lbs/ft		118,034
Hollidaysburg ASHS	Hollidaysburg	PRP_E_WL_19	Wetland	11,717	29.2%	3,420
American Legion	Hollidaysburg	PRP_E_RG_4	Infiltration Practice	864	84.9%	734
Bellwood-Antis	Bellwood	PRP_E_RG_5	Rain Garden	9,135	2.4%	218
Chapel Hill P 1	Logan	PRP_P_BR_9	Detention Basin w/Wetland Pocket	16,054	16.7%	2,679
Five Star Mit	Altoona	PRP_P_WL_13	Detention Basin w/Wetland Pocket	4,281	7.1%	305
Franks Twp DP	Frankstown	PRP_P_WL_15	Detention Basin w/Wetland Pockets	29,488	30.0%	8,853
Healthsouth 1	Logan	PRP_P_WL_17	Detention Basin w/Wetland Pockets	8,245	22.6%	1,867
Healthsouth 2	Altoona	PRP_P_WL_18	Wetland	46,353	17.1%	7,937
Logan Town P 1	Logan	PRP_P_WL_21	Detention Basin w/Wetland Pocket	33,101	8.7%	2,877
Strip Mall	Blair	PRP_P_BR_25	Infiltration Basin	3,470	64.3%	2,230
Beverly Hills P 1	Logan	TMDL_P_WL_3	Detention Basin w/Wetland Pocket	2,642	15.0%	396
Brush Oaks P 1	Logan	TMDL_P_BR_4	Detention Basin w/Wetland Pocket	3,346	7.9%	264
Brush Oaks P 2	Logan	TMDL_P_BR_5	Detention Basin w/Wetland Pocket	4,844	45.8%	2,218
Burgmeier's Hauling	Logan	TMDL_P_BR_6	Detention Basin w/Wetland Pocket	3,945	3.6%	143
Nittany Pointe 1	Logan	TMDL_P_WP_7	Detention Basin w/Wetland Pocket	15,759	8.4%	1,316
Nittany Pointe 2	Logan	TMDL_E_WP_8	Wet pond/Wetland	16,621	78.8%	13,099

With the existing BMP sediment reductions accounted for, the existing sediment load is adjusted and the final adjusted 10% sediment target is provided in Table 6.

Table 6 – Determination of the Final Adjusted 10% Sediment Target

Drainage Area	Sediment Load w/o Accounting for Existing BMPs (lb/yr)	Sediment Load Reduced by Existing BMPs (lb/yr)	Final Adjusted Sediment Load (lb/yr)	Final Adjusted 10% Sediment Target (lb/yr)
TMDL	3,392,860	17,437	3,375,423	337,542
PRP	11,905,628	1,184,918	10,720,710	1,072,071
Combined Planning Area	15,298,488	1,202,355	14,096,133	1,409,613

Section E – Wasteload Allocation

The Little Juniata River Watershed Blair County TMDL was published in December of 2004 due sediment impairments in the watershed. The TMDL was modeled using the 2000 US Census Urbanized Area (UA) which resulted in a WLA of 2036 tons/year of sediment. In 2013 PADEP provided supplemental information to assist in dividing the WLA amongst the three municipalities subject to the Little Juniata TMDL. The PADEP remodeled the TMDL watershed with the MapShed software package utilizing the 2011 NLCD with the 2000 US Census UA. The MapShed output resulted in a WLA of 2,467 tons/yr.

Section F – Analysis of TMDL Objectives

The 2013 PADEP supplemental information (developed from the 2000 US Census UA and referenced in Section E – Wasteload Allocation) also provided the percent reduction necessary to achieve the WLA, which averaged across the TMDL watershed, totaled 41.7%. The following Table 7, applies the 41.7% reduction to the BayFAST model results for the current TMDL Planning Area that was developed by delineating the drainage area into the 2010 US Census UA.

Table 7 – Sediment Load Reduction Requirement to Achieve the WLA

Existing Sediment Load w/o BMP Adjustment (lb/yr)	% Reduction to Achieve WLA	Sediment Load Reduction Requirement to Achieve the WLA (lb/yr)
3,392,860	41.7	1,414,823

However, due to the collaborative nature of the ISC, which requires the flexibility to construct projects across the entire Combined Planning Area, the ISC has opted to combine the TMDL and PRP Planning Areas into one Planning Area, and engage in a 10% sediment reduction target from the entire Combined Planning Area.

Section G – Select BMPs to Achieve the Minimum Required Reductions in Pollutant Load

Short Term Reductions for the Permit Term

The locations of, and calculation specifics pertaining to the BMPs that have been utilized to meet the short-term reductions for the permit term are provided in Appendix A and Appendix B. The BMP reductions have been calculated in two separate sets of analysis. The Center for Watershed Protection worked with jurisdictions in Blair County in 2014 to create a collaborative Chesapeake Bay Pollution Reduction Plan to address the requirements of the 2013 to 2018 permit term. Several BMPs that were discussed in that report, that have not yet been constructed, were reanalyzed using the current BMP Effectiveness Values table calculation methodology. Those BMPs, and all calculations to determine the sediment load reduction are available in “Appendix A – Recalculation of 2014 BMP Projects”. Many additional projects were analyzed in the field during January through June of 2017. The sediment reduction performance of those projects were calculated using the Performance Standard and Retrofit Curve methodologies from the respective Expert Panel Reports. Pictures, calculations, and a brief narrative are provided for each of those projects in “Appendix B - BMP Summary Sheets”. The total sediment reductions combining the projects calculated in both Appendix A and B are summarized in Table 8.

As discussed above, in Section C – Pollutants of Concern, the TMDL Instructions state in Section 1.F (pg. 6) that MS4s may combine TMDL Plans with PRPs. In particular, Example 5 states:

> Using a 10% sediment reduction target (i.e., the common target for both the TMDL Plan and PRP)…….The BMPs…….should preferentially be located in the Brook Run drainage area, but may be located anywhere within the Chesapeake Bay planning area if it is not feasible to locate them in the Brook Run watershed during the upcoming permit term (pg.6).

Indeed, the TMDL Planning Area was preferentially targeted in this analysis. However, the Little Juniata TMDL Planning Area is dominated by the City of Altoona, which is composed of much higher density urban development than the PRP Planning Area. To achieve the high levels of sediment reduction necessary to accomplish the permit term goals in the TMDL Planning Area requires large sediment reducing projects, such as floodplain reconnection, stream restoration and upland volume reducing BMPs, all of which are much more difficult to site in higher density urban land uses. Therefore, increased effort was placed in siting BMPs in the PRP Planning Area to accomplish the overall 10% sediment reduction from the Combined Planning Area as allowed by the TMDL Instructions. As demonstrated in Table 8, the minimum 10% Combined Planning Area sediment reductions are substantially exceeded. Greater reductions are provided than the minimum requirements mandate due to the following important considerations:

- The BMPs and their associated sediment reduction values are estimated from planning level analysis and will be refined throughout the permit term
- Certain projects may achieve more or less sediment reductions than conceptually calculated
- Unforeseen projects may be added to the TMDL and PRP as new opportunities arise
- Certain projects may prove to be entirely unfeasible due to utilities, land acquisition, permitting obstacles, or any number of unanticipated constraints

- Collaboration with entities such as PennDOT, PSU-Altoona, or the Commonwealth of PA may provide for a host of unexpected projects with varying sediment reduction potential

Overall, the implementation of the TMDL and PRP will be dynamic in nature, and as such the ISC sought be conservative in putting forward a wealth of potential projects. However, the ISC is not obligated to achieve any greater sediment reduction than the minimum 10% requirement established by the PADEP.

Table 8 – Sediment Load Reduced by Proposed BMPs to Meet the Sediment Reduction Target

Drainage Area	Final Adjusted 10% Sediment Target (lb/yr)	Sediment Load Reduced by Proposed BMPs (lb/yr)
TMDL	337,542	218,683
PRP	1,072,071	2,160,141
Combined Planning Area	1,409,613	2,378,824

Long Term Reductions to Meet the WLA

Meeting the WLA provided in the Little Juniata TMDL Planning Area will be a challenge given the previously described, higher intensity urban development. The large sediment reduction required to meet the WLA necessitate large sediment reducing projects, such as floodplain reconnection, stream restoration, and upland volume reducing BMPs. It is a significant challenge to locate, permit, and construct these types of BMPs in dense urban land uses, and therefore will require time to effectively strategize the appropriate site locations.

The ISC will gain a tremendous amount of experience in taking the concept level BMPs outlined in this document through the design phase, obtaining permits, selecting contractors, overcoming construction obstacles, and performing the necessary operation and maintenance (O and M) of the installed BMPs during this upcoming permit term. The ISC will take this experience and apply it towards the final achievement of the TMDL WLA. As opportunities arise for BMP projects with the ISC, preference will be given to projects in the TMDL Planning Area. It is estimated that it may take 20 years to achieve the WLA provided in the Little Juniata TMDL through the design, permitting, and construction of floodplain reconnection, stream restoration, and upland volume reducing BMPs.

Section H – Identify Funding Mechanisms

The Blair County MS4 partners, while not having any formal final funding mechanism available at the time of this PRP submission, is on the right track to develop a secure and long-term financing strategy in the future. Please consider the following information about the efforts to formalize a collaborative approach to stormwater and MS4 permitting in Blair County and to see that future financing can be addressed by this organization.

An informal Blair County MS4 Workgroup was started in 2012. The MS4 permittees in Blair County believed that with their overlapping school districts, news media and their interconnecting stormwater collection and conveyance systems, a collaborative effort would help all to meet their individual MS4 requirements. Initially started in response to the 2012 permit renewal requirement, the group continued to meet and eventually began discussing formalizing their organization.

In addition to 11 municipal partners, the group continues to benefit by partnering with the Blair County Conservation District. Benefits have included the conservation district's help in meeting the Public Education and Public Participation MCM's. Additional benefits resulted with the conservation district being awarded funds form the National Fish and Wildlife Foundation (NFWF) in 2013 for a comprehensive set of initiatives to address stormwater pollution from the Blair County region. The Blair County Conservation District was able to provide funds to assist Blair County MS4 Workgroup members with both BMP design and implementation projects.

The 2013 NFWF grant funding targeted the Upper Juniata Watershed and the urbanized area of Altoona. The existence of the Blair County MS4 Workgroup in that targeted area was a significant benefit to not only the Blair County Conservation District's grant request, but also to the Alliance for the Chesapeake Bay. The Alliance was also awarded NFWF funding. The Blair County MS4 Workgroup benefited from the Alliance's funded project which offered implementation, education, and planning tools.

A significant financial planning tool was provided through the Alliance for the Chesapeake Bay's grant project with a financing study completed by the Environmental Finance Center (EFC). The EFC was able to offer several scenarios in financing a collaborative group with financial commitments from all members. Two different approaches to financing were offered. All participants could pay the same amount or a rated amount based on differing factors. Financing commitment calculations were suggested using several factors for each potential member municipality and the defined Urbanized Area (UA) within the municipality. These factors that could be considered included population, impervious surface cover, stream length and impaired stream length within the UA for each MS4 municipality. The EFC assumed implementation of all BMP's identified in the 2014 TMDL/CBPRP plan prepared by the Center for Watershed Protection in their various financing scenarios.

In late 2015 when this information was presented to the group, it became clear that a significant financial commitment was needed to assure implementation of the BMP's identified in the 2014 TMDL/CBPRP – a financial commitment that all potential members did not have available in their next year's budget. Since the TMDL/CBPRP had not been approved by DEP, it seemed premature to even commit to implementing the projects identified in the plan. The Blair County MS4 Workgroup began to realize that to assure this needed financial commitment in the future, a more formal arrangement would be required. Research in formalizing the group began in earnest. This research included discussions with other municipalities or counties in Pennsylvania that had more formal arrangements for stormwater or other multi-municipal responsibilities.

By 2016 the group had decided to initiate efforts to form a Council of Governments (COG). All member municipalities adopted an ordinance needed to form a stormwater COG. A formal agreement was signed by all in late 2016 forming the ISC. The group understood that the next permit renewal required the development of a TMDL/PRP, but since the costs to implement BMP's needed to meet the TMDL/PRP requirement could not be known until the actual plan was completed, the Blair County MS4 Workgroup in forming the ISC, decided on a financing formula that would provide funds to begin administrative duties that would lead to the development of a joint TMDL/PRP and hire a staff person to provide coordination to assist municipalities with other MS4 MCM requirements. Therefore, the agreement signed in 2016 was for 2 years. It is during this time period that a joint or collaborative TMDL/PRP would need to be developed and all permit renewals obtained. Since implementation costs were not known, this was not considered in the financing strategy reached in the agreement.

ISC members understand that financing of TMDL/PRP implementation is needed in the future. The ISC agreement will allow the members to vote on the continuation of the ISC beyond the initial two year agreement. At that time the following issues will be more specifically addressed in the ISC re-organization: project selection; long-term O and M, scheduling and prioritization of projects; selection of needed contractual services; costs and financing needed for the TMDL/PRP implementation and commitment to and management of this TMDL/PRP. The ISC currently has a Technical Subcommittee consisting of ISC board members and individual municipal delegated engineers. This subcommittee advises the ISC board on the technical issues listed above. It is assumed this subcommittee will continue after the 2-year re-organization and will assist the ISC board in making the decisions needed to address these specific issues. It is hoped by that time the ISC will have a full-time staff person working to assure MS4 permit compliance for all members which will include administration of the TMDL/PRP.

Knowing more specifically what financial commitment is needed for TMDL/PRP implementation will help member municipalities make decisions regarding how to obtain the needed funds. The ISC has sufficient guidance on assessing future obligations and financial commitments with the completion of the required TMDL/PRP, the past work by the EFC, and the continued advice from the Technical Subcommittee.

It should also be noted that several ISC members and partners have successfully obtained grant funds from a variety of sources for BMP implementation over the past several years. Funding sources have included the NFWF funded projects mentioned above, Pennsylvania Growing Greener funds, PA DEP/EPA Chesapeake Bay Implementation Grants Program, and Chesapeake Bay Trust Green Streets, Green Jobs, Green Towns funding. With a proven track record for grant administration it is anticipated that the ISC will continue to seek funding from a variety of sources.

Section I – Identify Responsible Parties for Operation and Maintenance of BMPs

While the finalization of the TMDL and PRP is occurring with the PADEP, the ISC will move forward in updating the existing Intergovernmental Stormwater Committee Agreement to dictate the parties responsible for BMP O and M. As of this submission, it is anticipated that the BMP O and M will be performed by the municipality where the BMP is located.

As each BMP is selected for implementation and a specific design is created, the O and M requirements (including the frequency of the activities) will be specifically tailored to that BMP and clearly defined. The design specific O and M activities and verification that such activities have been performed will be provided in the Annual MS4 Status Reports submitted under the permit. Likewise, once complete, the ISC Agreement will be provided to PADEP.

General Operation and Maintenance Activities for Consideration for each BMP Proposed

The following basic O and M requirements for each BMP are provided below and will be the starting point for defining the design specific O and M requirements throughout the permit term.

Bioretention

A bioretention area (also referred to as a rain garden) is a shallow planted depression designed to retain stormwater before it is infiltrated or discharged downstream. Considerations for effective inspection, operation, and maintenance of bioretention practices are provided below.

- A site-specific O and M plan that includes the following considerations should be prepared by the designer prior to putting the bioretention practice into operation:
    - Operating instructions for outlet component
    - Vegetation maintenance schedule
    - Inspection checklists
    - Routine maintenance checklists
- Adequate access to all facilities for inspection, maintenance and landscaping upkeep.
- The surface of the bioretention area may become clogged with fine sediment over time. Core aeration or cultivating of non-vegetated areas may be required to ensure adequate filtration.
- Bioretention areas should not be used as dedicated snow storage areas:
    - Areas designed for infiltration should be protected from excessive snow storage where sand and salt is applied.
- In areas of high salt use in the winter the bioretention area should be planted with salt tolerant and non woody plant species.
    - Bioretention areas should be periodically inspected for sediment build-up on the surface.

Recommended maintenance activities

- During establishment
    - Water plants as needed unless rainfall is adequate.
    - Replace dead plant material.
- As needed

    - Prune and weed to maintain appearance and plant survival
    - Replace mulch as needed
    - Remove trash and debris
    - Replace vegetation whenever percent cover of acceptable vegetation falls below acceptable levels
- Semi-annually
    - Inspect inflow and overflow points for clogging; remove any sediment and debris
    - Inspect for erosion or gullying as necessary
    - Evaluate the health of plant material and replanted as appropriate to meet project goals
    - Remove any dead or severely diseased vegetation
    - Cut back and remove previous year's plant material and remove accumulated leaves if needed (or controlled burn where appropriate).

Bioswale

A bioswale or vegetated swale is a form of bioretention used to treat water quality, attenuate flooding potential and convey stormwater away from critical infrastructure. These systems are linear, with length and width dimensions much greater than typical bioretention cells. Considerations for effective inspection, operation, and maintenance of bioswales practices are provided below.

- A site-specific O and M plan that includes the following considerations should be prepared by the designer prior to putting the bioretention practice into operation:
    - Operating instructions for outlet and inlet components if applicable
    - Vegetation maintenance schedule
    - Inspection checklists
    - Routine maintenance checklists
- Adequate access to all facilities for inspection, maintenance and landscaping upkeep.
- The surface of the ponding area may become clogged with fine sediment over time. Core aeration or cultivating of non-vegetated areas may be required to ensure adequate filtration.
- Bioswale areas should be periodically inspected for sediment build-up on the surface.

Recommended maintenance activities

- During establishment
    - Water plants as needed unless rainfall is adequate.
    - Replace dead plant material.
- As needed
    - Prune and weed to maintain appearance and plant survival
    - Replace mulch as needed
    - Remove trash and debris
    - Replace vegetation whenever percent cover of acceptable vegetation falls below acceptable levels
- Semi-annually
    - Inspect inflow and overflow points for clogging; remove any sediment and debris
    - Inspect for erosion or gullying as necessary
    - Inspect check dams for erosion, bypass, and stability.

    - Evaluate the health of plant material and replanted as appropriate to meet project goals.
    - Remove any dead or severely diseased vegetation
    - Cut back and remove previous years plant material and remove accumulated leaves if needed.

Step pool storm conveyance

Step Pool Storm Conveyance (also referred to as regenerative stormwater conveyance or RSC) are open-channel conveyance structures that convert, through attenuation ponds and a sand seepage filter, surface storm flow to shallow groundwater flow. These systems safely convey, attenuate, and treat the quality of storm flow. These structures utilize a series of constructed shallow aquatic pools, riffle grade control, native vegetation, and an underlying sand/woodchip mix filter bed media. Considerations for effective inspection, operation, and maintenance of step pool storm conveyance practices are provided below.

- A site-specific O and M plan that includes the following considerations should be prepared by the designer prior to putting the RSC practice into operation:
    - Vegetation maintenance schedule
    - Inspection checklists
    - Routine maintenance checklists
- Adequate access to all facilities for inspection, maintenance and landscaping upkeep.

Recommended maintenance activities

- During establishment
    - Inlet and outlet cleaning
    - Replace dead plant material.
    - Remove litter and debris
- As needed
    - Prune and weed to maintain appearance and plant survival
    - Repair of damaged check dams
    - Realignment of rip-rap or cobble
    - Sediment removal
    - Repair erosion areas
- Semi Annual
    - Regular inspections should be undertaken after significant storm

Stormwater Pond Retrofit

Retrofitting existing stormwater basins to provide additional storage and/or water quality treatment is an effective way to provide additional water quality and downstream benefits. There are a variety of approaches to retrofitting existing basins and therefore each project may be unique and require their own specific operation and maintenance requirements. However common considerations for effective inspection, operation, and maintenance of basin retrofit practices are provided below.

- A site-specific O and M plan that includes the following considerations should be prepared by the designer prior to putting the bioretention practice into operation:

    - Operating instructions for outlet and inlet components if applicable
    - Inspection checklists
    - Routine maintenance checklists
- Adequate access to all facilities for inspection, maintenance and landscaping upkeep.

Recommended maintenance activities

- Semi-annually
    - Inspect inflow and overflow points for clogging.
    - Inspect for erosion or gullying as necessary
- As needed
    - Remove sediment and debris from forebay
    - Mow pond buffer to maintain access
    - Remove woody vegetation from embankments
- Periodically
    - Remove sediment from permanent pool every 2-7 years or after 50 percent of permanent pool capacity has been lost.
        - Prevent rapid release and minimize the discharge of sediments or anoxic water.

Stormwater Wetlands

Stormwater wetlands are similar to stormwater wet ponds and can be a form of a retrofit. Stormwater wetlands incorporate vegetation and wetland plants into the design. Similar to bioretention pollutant removal is achieved through settling and biological uptake within the practice. Stormwater wetlands also can provide aesthetic and habitat benefits. There are a variety of design variations of the stormwater wetlands. However common considerations for effective inspection, operation, and maintenance considerations for basin retrofit practices are provided below.

- A site-specific O and M plan that includes the following considerations should be prepared by the designer prior to putting the bioretention practice into operation:
    - Operating instructions for outlet and inlet components if applicable
    - Vegetation maintenance schedule
    - Inspection checklists
    - Routine maintenance checklists
- Adequate access to all facilities for inspection, maintenance and landscaping upkeep.

Recommended maintenance activities

- Semi-annually
    - Inspect inflow and overflow points for clogging.
    - Inspect for erosion or gullying as necessary
- As needed
    - Remove sediment and debris from forebay
    - Mow pond buffer to maintain access
    - Remove woody vegetation from embankments
    - Repair slumping, animal burrows, and seepage associated with dam
- Periodically
    - Manage invasive plants

Stream Restoration

Stream restoration in the broadest sense is a set of activities that aim to restore the natural state and functioning of the stream system to support, biodiversity, recreation, flood management and landscape development. Stream restoration typically involves the Application of fluvial geomorphology to create stable channels that maintain a state of dynamic equilibrium among water, sediment, and vegetation such that the channel does not aggrade or degrade over time. Stream restoration projects may or may not include substantial floodplain connection. While there are a variety of approaches to stream restoration, some common considerations for effective inspection, operation, and maintenance considerations for stream restoration are provided below.

Recommended maintenance activities

- During establishment
    - Replace dead plant material.
    - Remove litter and debris
- As needed
    - Prune and weed to maintain appearance and plant survival
- Semi Annual
    - Regular inspections should be undertaken after significant storm
        - Inspect structural elements (weirs, rock veins, etc.)

Concluding Remarks on the Blair ISC Collaboration

The TMDL Instructions under Section 1.H state that "for all joint TMDL Plans, the participating parties must execute and submit with the plan an agreement for the planning, design, construction, and O&M of BMPs and for future adaptations to the Plan" (pg.7). On Monday, December 12, 2016, Scott Arwood of the PADEP Southcentral Regional Office sent the following email:

> **From:** Arwood, Scott [mailto:sarwood@pa.gov]
> **Sent:** Monday, December 12, 2016 2:46 PM
> **To:** Arwood, Scott <sarwood@pa.gov>
> **Subject:** Consultant PRP Meetings
>
> Dear MS4 engineering consultant/PRP preparer,
>
> DEP Southcentral Regional Office (SCRO), along with DEP Central Office, is offering one-on-one PRP/TMDL Plan development informational/instructional meetings. These meetings would be held at the SCRO in Harrisburg and would include regional and central office MS4 staff.
>
> We hope that the meetings will expand upon the recent public trainings and provide more focused instruction you may need to prepare acceptable plans.
>
> If interested, we ask that you follow these guidelines:
>
> - Consolidate your firm's questions as much as possible (exception-separate firm branches with unique clientele),
> - Get far enough into the process such that you believe that most questions/issues are identified,
> - Submit your proposed questions/issues in advance (not to limit the discussion, but will help us prepare, additional questions/discussion are always welcome).
>
> Contact me if you would like to take advantage of this opportunity. Feel free to forward this message to others within your firm.
>
> **Scott M. Arwood, P.E.** | Senior Civil Engineer Hydraulic
> Department of Environmental Protection | Clean Water Program
> Southcentral Regional Office
> 909 Elmerton Avenue | Harrisburg, PA 17110
> Phone: 717.705.6640 | Fax: 717.705.4760
> www.dep.pa.gov

The ISC Collaborative took full advantage of this opportunity and met with PADEP on the morning of Wednesday, June 28th. The following are the meeting minutes as taken Bryan Seipp of the Center for Watershed Protection:

Blair County TMDL/PRP DEP Meeting Notes

Date: June 28, 2017

Attendees: DEP- Scott Arwood, Bill Brown; Blair County ISC- Tom Levine, Nathan Kissell, Cassandra Schmick, Teddie Kreitz, Brian Shura; CWP- Bryan Seipp

Location: Pennsylvania Department of Environmental Protection South-Central Office, Harrisburg, PA

- Status of the Blair ISC Intergovernmental Stormwater Committee Agreement
    - Not having an agreement in place that fully covers cost sharing arrangements for implementation and O&M does not prevent the group from submitting as a group
        - Provide existing arrangement as documentation
        - Briefly, describe next steps for the group post plan submittal to develop that agreement.
- Discuss the Mapping
    - No major issues
- Review the GIS mapping prepared
    - No major issues
- Discuss the Modeling Strategy
    - Using the 10% sediment assumptive approach taken for entire planning area (both TMDL and PRP) is acceptable.
        - Present the data as one entire area but show the breakdown of TMDL and PRP as supporting documentation.
    - The modeling process used to determine the existing and target sediment loads from the TMDL, PRP, and total planning areas is fine.
    - The BMP summary sheets upon initial review look good.
        - Add a statement that absent a group O&M agreement that the jurisdiction in which the BMP is located will be responsible for the O&M.
- Lakemont Reservoir
        - Initially there are no objections to using the crediting approach outlined in the handout for this project.
        - DEP does not know if the pond is currently accounted for in the bay model.
        - If additional data related to the pond becomes available for further engineering analysis and it can be shown that the pond is not currently functioning for water quality, then DEP would be open to accepting full credit for restoring sediment capacity to the pond.

One key point that was discussed during the meeting, and shown as the first bullet in the meeting notes, is the fact that the ISC has no ability to draft, verify with respective municipal officials, and execute an agreement for the planning, design, construction, cost share approach, O and M of BMPs, or future adaptations to the Plan, ***until there is a fully completed TMDL and Pollution Reduction Plan***. The representatives from PADEP were understanding of this, and requested that the existing ISC Agreement is provided with this document. The document is provided as Appendix C. The PADEP representatives also requested that an outline is provided that describes the steps taken for the Blair ISC Agreement to achieve the specificity outlined in the TMDL Plan Instructions. The following are the steps that will be taken:

- Receive notification from DEP of approval of TMDL and Pollution Reduction Plan;
- Develop cost estimate to implement BMP's identified in plan;
- Utilizing the previously developed cost-share formula from the Environmental Finance Center's financing strategy, which will consider the individual member's population, stream length, and impervious surface to calculate the cost per member for implementation;
- Vote by ISC on the cost per member calculation;
- After adoption by the ISC, each ISC member must go back to their governing bodies and determine how to pay their fair share; and
- December 2018 - vote to continue participation in the ISC.

Appendix A – Re-Calculation of 2014 BMP Projects

Appendix A - Recalculation of 2014 BMP Projects

Site_ID	Location	Latitude	Longitude	TMDL or PRP	BMP Type	Drainage Area (ac)	Pervious DA (ac)	Impervious DA (ac)	Pervious TSS Load to BMP (lbs)	Impervious TSS Load to BMP (lbs)	Total TSS Load to BMP (lbs)	HSG	Reduction by BMP (%)	Linear feet (ft)	Sediment Reduction (lbs/yr)
RRI_105	Thompson Pharmacy; 600 East Chestnut	40.532523	-78.387564	TMDL	Dry swale with underdrain	0.89	0.44	0.44	137.6	866.8	1004.4	B	0.8	0	803.5
RRI_34	Altoona Central Catholic School	40.528606	-78.406994	TMDL	Bioretention	1.68	0.08	1.60	26.0	3115.7	3141.7	D	0.55	0	1,727.9
RRI_401	Behind Logan Elementary bus garage	40.532065	-78.371770	TMDL	Bioretention/tree planting/buffer	1.76	0.00	1.76	0.0	3435.8	3435.8	B/D	0.8	0	2,748.7
RRI_510	Matheson Valley; 1004 North 4th Avenue	40.541663	-78.377346	TMDL	Bioretention	0.55	0.00	0.55	0.0	1069.8	1069.8	D	0.55	0	588.4
SRI_1002	325 Greenwood Rd	40.531031	-78.367451	TMDL	Stream restoration with possible floodplain reconnection	889.00	844.55	44.45	261726.0	86774.0	348500.0	B	0.2	200	8,976.0
RRI_116b	Pleasant Valley ES	40.493216	-78.402049	PRP	Dry swale or bioretention	1.57	0.31	1.26	97.3	2451.9	2549.2	B	0.8	0	2,039.4
RRI_117a	Valley View Rd and S Jaggard St	40.499771	-78.388763	PRP	Bioretention or wetland creation	9.48	4.74	4.74	1468.9	9253.3	10722.2	D	0.55	0	5,897.2
RRI_202	Blair County Maintenance Garage	40.424455	-78.386915	PRP	Pond retrofit	5.04	0.50	4.54	156.2	8855.0	9011.2		0.6	0	5,406.7
RRI_207a	Martin's Grocery Store	40.431380	-78.409190	PRP	Pond retrofit	4.15	0.21	3.94	64.3	7696.4	7760.7	C	0.6	0	4,656.4
RRI_210	Brush Mountain Rd and Wertz Dr	40.451875	-78.374719	PRP	Regenerative stormwater conveyance	6.11	3.97	2.14	1230.8	4174.7	5405.5	C	0.5	0	2,702.7
RRI_211a	Allegheny I ES	40.444299	-78.425892	PRP	Riparian forest buffer	18.13	13.60	4.53	4213.9	8848.2	13062.1	C/D	0.5	0	6,531.0
RRI_211b	Allegheny I ES	40.444339	-78.425291	PRP	Wetland	18.13	13.60	4.53	4213.9	8848.2	13062.1	C/D	0.6	0	7,837.2
RRI_212	YMCA Holidaysburg	40.438868	-78.393250	PRP	Bioretention	0.35	0.07	0.28	21.7	546.6	568.3	D	0.55	0	312.6
RRI_212b	YMCA Holidaysburg	40.438972	-78.394105	PRP	Porous paver	0.93	0.00	0.93	0.0	1815.5	1815.5	D	0.55	0	998.5
RRI_214a	Veterans Home	40.442000	-78.413653	PRP	Bioswale	8.18	3.27	4.91	1013.7	9578.9	10592.7	B/D	0.8	0	8,474.1
RRI_214b	Veterans Home	40.441313	-78.413781	PRP	Bioswale	9.15	3.66	5.49	1134.2	10717.4	11851.6	B/D	0.8	0	9,481.3
RRI_35a	Bishop Guilfoyle Catholic High School	40.496523	-78.395386	PRP	Bioretention	0.80	0.60	0.20	185.9	390.4	576.4	B	0.8	0	461.1
RRI_35b	Bishop Guilfoyle Catholic High School	40.496636	-78.395400	PRP	Bioretention	1.22	0.00	1.22	0.0	2381.6	2381.6	B	0.8	0	1,905.3
RRI_405	Penske Truck Rental	40.501678	-78.388832	PRP	Pond retrofit	4.09	0.20	3.89	63.4	7585.2	7648.5	B/D	0.6	0	4,589.1
RRI_407	A-1 PRO Disaster Restoration	40.510103	-78.380110	PRP	Bioretention	0.96	0.10	0.86	29.8	1686.7	1716.4	D	0.55	0	944.0
RRI_508	Wal Mart; 2600 W Plank Rd	40.452743	-78.408171	PRP	Bioretention	1.07	0.00	1.07	0.0	2088.8	2088.8	B/C	0.55	0	1,148.9
RRI_69	Alleghaney Township Office	40.444627	-78.430865	PRP	Bioswale	1.37	0.69	0.69	212.3	1337.2	1549.5	D	0.8	0	1,239.6
RRI_7	Foot of Ten Elementary School	40.420089	-78.447440	PRP	Regenerative stormwater conveyance	1.89	0.19	1.70	58.6	3320.6	3379.2	D	0.5	0	1,689.6
SRI_1001	Blair Township Muni Building	40.421696	-78.402689	PRP	Bank Stabilization	0	0	0	0	0	0		0	350	15,708.0
SRI_1004	Park Ave at Lakemont Park	40.477581	-78.393677	PRP	Stream restoration with possible floodplain reconnection	8.53	7.25	1.28	2246.9	2497.8	4744.7	C/D	0.2	150	6,732.0
SRI_400	14th St and Weaver	40.504730	-78.431072	PRP	Extend existing stream restoration practice	0	0	0	0	0	0		0	1100	49,368.0
SRI_404	8th and Valley View	40.509800	-78.381233	PRP	Check dams in eroding ditch	0	0	0	0	0	0		0	160	7,180.8
SRI_405	Weis off Pleasant Valley Rd	40.511654	-78.378464	PRP	Bank stabilization/natural channel design	0	0	0	0	0	0		0	1000	44,880.0

Sediment loading rates	
1952.17	lbs per impervious acre
309.9	lbs per pervious acre

Appendix B – BMP Narratives

Lakemont Reservoir (PRP_P_WP_20)

Overview

Lakemont Reservoir lies in Logan Township, just southeast of the City of Altoona by approximately one mile at coordinates 40.467913, -78.396145 (Figure 1). The Lakemont Reservoir is currently owned and operated by Blair County. A 1979 Dam Inspection Report [hereafter referred to as "the Report" (a copy of which has been included with this TMDL/PRP document as Attachment A)] stands as the only available source of information regarding the reservoir history and storage capacity due to the age of the dam and the lack of any other available documentation. The Report describes the Lakemont Dam in Section 1.2, as "an earth embankment approximately 500 feet long with a maximum height of approximately 12 feet from the downstream toe. Two discharge structures associated with a centrally located two-span reinforced concrete bridge constitute the spillway and outlet facilities for the dam" (pg. 1). The Report states that sources allege that "the dam was constructed in the late 1890s by Altoona and Logan Valley Electric Railway Company" (pg. B1 of 5).

The drainage area to the reservoir consists of 4026 acres of which approximately 18% is impervious area (Table 1). An aerial image of the drainage area is provided in Figure 2. The modeled sediment load to the reservoir totals 2,424,180 lb/yr (Table 2).

Table 1 - Lakemont Reservoir Drainage Area Information

Land Use Category	Total Drainage Area (acres)
Regulated Impervious Developed	716.4
Regulated Pervious Developed	3309.6
Total	4026.0

Table 2 - Modeled Sediment Load to the Lakemont Reservoir

Land Use Category	Total Drainage Area (acres)	Modeled Sediment Loading Rate (lb/ac/yr)	Modeled Sediment Load to the Lakemont Reservoir (lb/yr)
Regulated Impervious Developed	716.4	1952.17	1,398,531
Regulated Pervious Developed	3309.6	309.90	1,025651
Total	4026.0		**2,424,182**

Existing Lakemont Reservoir Performance - Background

The Report contains conflicting information regarding the storage capacity of the reservoir and the source of that information. That Report states that design reports, design computations, and the hydrology and hydraulics are all unavailable (pg. B2 of 5). However, the Report contains Storage vs Elevation computations on page D1 of 7 in Appendix D (also shown in Figure 3) and states in Note (4) that there are PennDER files that were used to obtain a 25.8 ac-ft volume within the reservoir. The PennDER files have not been located. The same table on page D1 lists in Note (3) that the maximum depth estimated by the owner is 6 ft and that the average depth is equal to 2 plus ft. It is not clear if the 2 foot average depth is assumed by the owner or measured by some method that is not described.

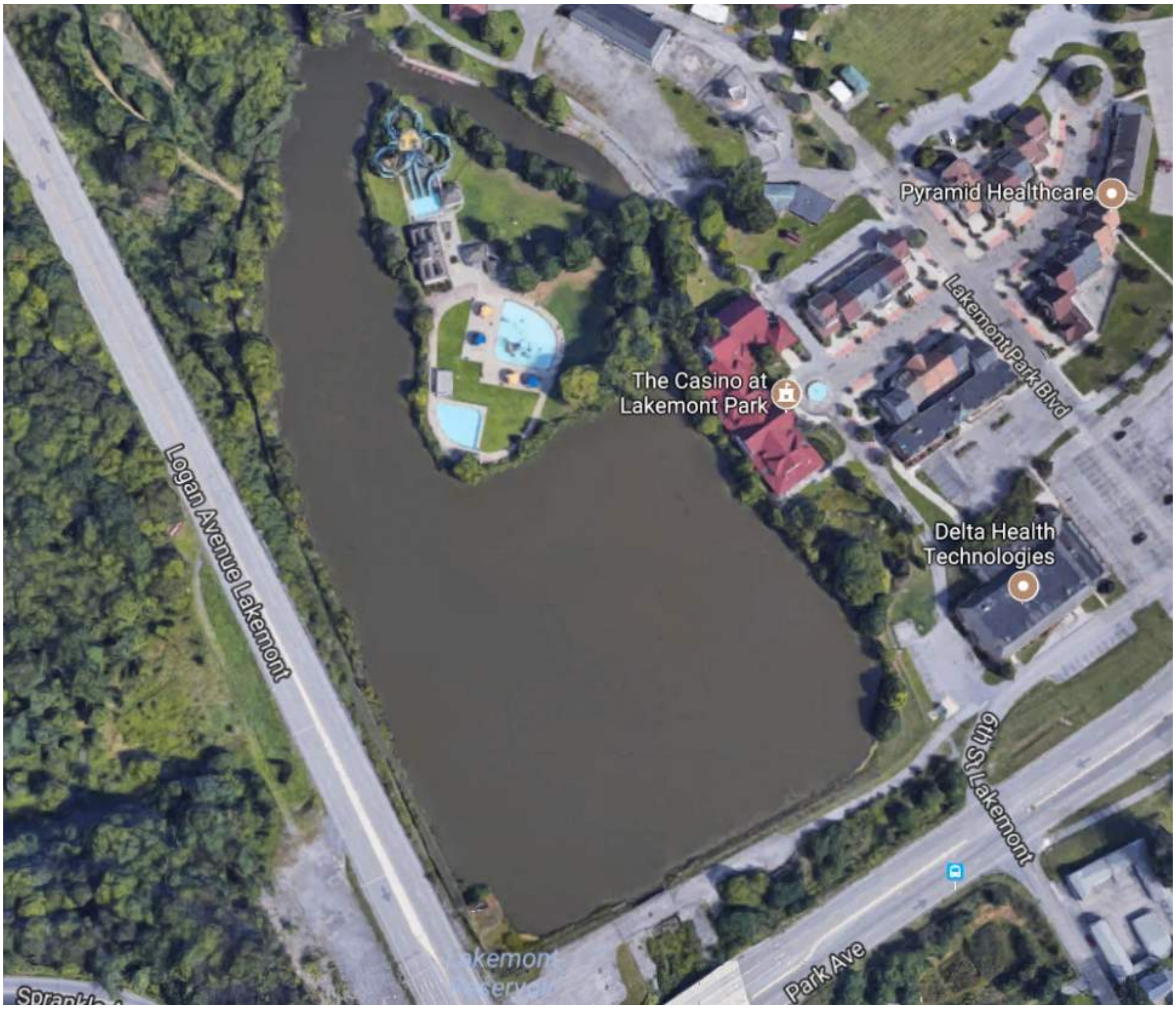

Figure 1 – Aerial Image of Lakemont Reservoir

Section 1.3 of the Report states on page 2:

> The elevations referred to in this and subsequent sections of this report were calculated based on approximate field measurements assuming the spillway crest elevation to be at Elevation 1006, which is the lake elevation shown in the U.S. Geological Survey (USGS) Hollidaysburg 7-1/2-minute quadrangle map.

Please recall that Note (4) to the Storage vs. Elevation Table in the Report states that PennDER files were used to obtain a 25.8 ac-ft volume within the reservoir. Note (1) states that the area of the reservoir at the 1006 ft elevation, was planimetered from USGS maps to obtain a 12.9 acre measurement. It appears that the 12.9 acre planimetered map measurement is multiplied by the average 2 ft depth assumption to estimate the 25.8 ac-ft storage and perhaps compared to a similar figure in PennDER correspondence files. However, this is conjecture as there is no clear information to determine exactly where the storage was derived, but what is clear is that the PennDER files contained no design data. As stated on Page 5 of the Report in 2.1.a:

The available data consists of files provided by the Commonwealth of Pennsylvania, Department of Environmental Resources (PennDER). Available information includes state inspection reports and various correspondence. No information on the design and construction of the dam was found.

Again, on Page 6 of the Report in 2.5.a, the document states that the “available information includes no technical data to assess the adequacy of the design and construction of the dam”.

However, it is also clear that the Report considers the water surface elevation at 1006 ft to correspond to the spillway crest height (Figure 4) and a storage of 25.8 or approximately 26 ac-ft in the reservoir (Figures 3 and 5).

Figure 2 – Lakemont Reservoir Drainage Area Map

STORAGE VS. ELEVATION

ELEVATION	ΔH, FEET	AREA (ACRES)(1)	ΔVOLUME (ACRE-FEET)(2)	STORAGE (ACRE-FEET)
10 0		44.1		403.1
	14		377.3	
1006		12.9		25.8
	6(3)		25.8(4)	
1000		0		0

(1) Planimetered from USGS maps.

(2) $\Delta Volume = \Delta H/3\ (A_1 + A_2 + \sqrt{A_1 A_2})$.

(3) Maximum depth estimated by owner, average depth = 2'+.

(4) From PennDER files.

PAGE D1 of 7

Figure 3 - Storage vs. Elevation Table in 1979 Dam Inspection Report Demonstrating Depth Assumption and Storage of 25.8 ac-ft Possibly Obtained from PennDER Files

SPILLWAY CAPACITY

THE RESULTS OF A DEC. 5, 1979 FIELD INSPECTION INDICATE THE SPILLWAYS ARE AS SHOWN BELOW.

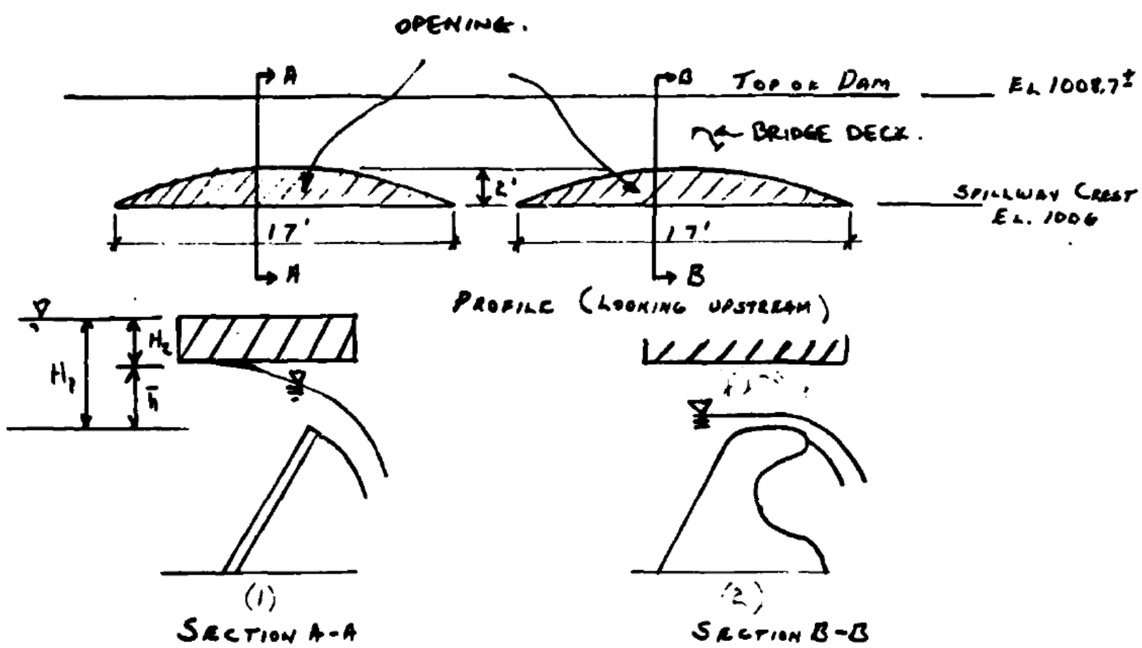

Figure 4 - Spillway Capacity Drawing from 1979 Dam Inspection Report Indicating Spillway Crest Labeled at Elevation 1006 ft

CHECKLIST
ENGINEERING DATA
HYDROLOGIC AND HYDRAULIC

DRAINAGE AREA CHARACTERISTICS: 6 square miles

ELEVATION; TOP NORMAL POOL AND STORAGE CAPACITY: 1006 (26 acre-feet)

ELEVATION; TOP FLOOD CONTROL POOL AND STORAGE CAPACITY: 1008.5 (93±)

ELEVATION: MAXIMUM DESIGN POOL: 1009.3 (top of bridge deck)

ELEVATION; TOP DAM: 1008.5 (measured low spot)

SPILLWAY: (Uncontrolled Overflow Section)

- a. Elevation 1006
- b. Type Ogee overflow section
- c. Width 17 feet (perpendicular to flow)
- d. Length Not applicable
- e. Location Spillover Adjacent to spillway bridge
- f. Number and Type of Gates Two manually operated spillway gates

OUTLET WORKS:

- a. Type (The dam has no low-level outlet works)
- b. Location Not applicable
- c. Entrance Inverts Not applicable
- d. Exit Inverts Not applicable

Figure 5 - Excerpt from 1979 Dam Inspection Report (pg. B5 of 5 in Appendix B)

On June 7, 2017, a Center for Watershed Protection staff member kayaked the Lakemont Reservoir and measured the water depth to the accumulated sediment on the reservoir floor (Figure 6). The reservoir was observed to be very shallow due to the siltation deposited by the watershed, so shallow that objects which appeared to be floating on the water surface, upon closer inspection, were found to actually be resting on the accumulated sediment (Figure 7). The depth measurement data points ranged from 4 to 6 inches up to 42 inches by the dam structure. The average depth in the reservoir was estimated to be 27.02 inches or 2.25 ft.

Indeed, it appears that siltation in the reservoir has been a problem for some time. During the inspection in December of 1979 the Report notes:

> A map review indicates that approximately 25 percent of the watershed consists of urban residential areas. It appears that with continued development in the watershed, the siltation problem, which is reported to have existed in the past, will continue to be a problem in the future (pg.8).

During the June 7, 2017 field survey, it was also observed that the spillway was not at the 1006 ft elevation described in the dam inspection report (Figure 8). If the spillway crest opening is indeed 2 ft, as indicated in the Spillway Capacity Drawing (Figure 4), then the water surface elevation appears to be approximately 6 to 8 inches below the 1006 ft, 25.8 ac-ft storage elevation.

Further, Figure 8 depicts measurement of the reservoir area using Pennsylvania Department of Environmental Protection's (PADEP's) eMapPA. Note that reservoir area measurement yields 9.6 acres, much less than the planimetered estimate obtained from the Report.

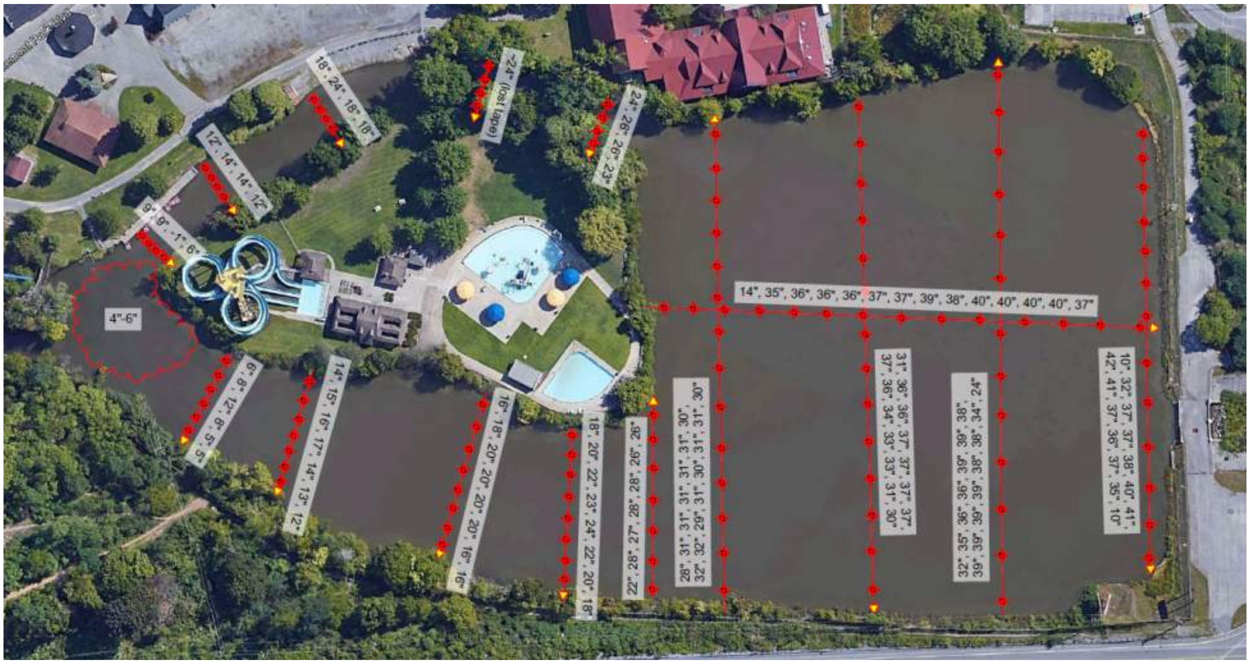

Figure 6 - Map from June 7, 2017 Field Visit with Depth Measurements and their Field Locations

Figure 7 - Picture of the North End of the Reservoir Detailing the Extent of Sediment Accumulation

Figure 8 - Photograph from June 7, 2017 Detailing that the Water Surface Elevation is Approximately 8 Inches Below the Spillway Crest Opening

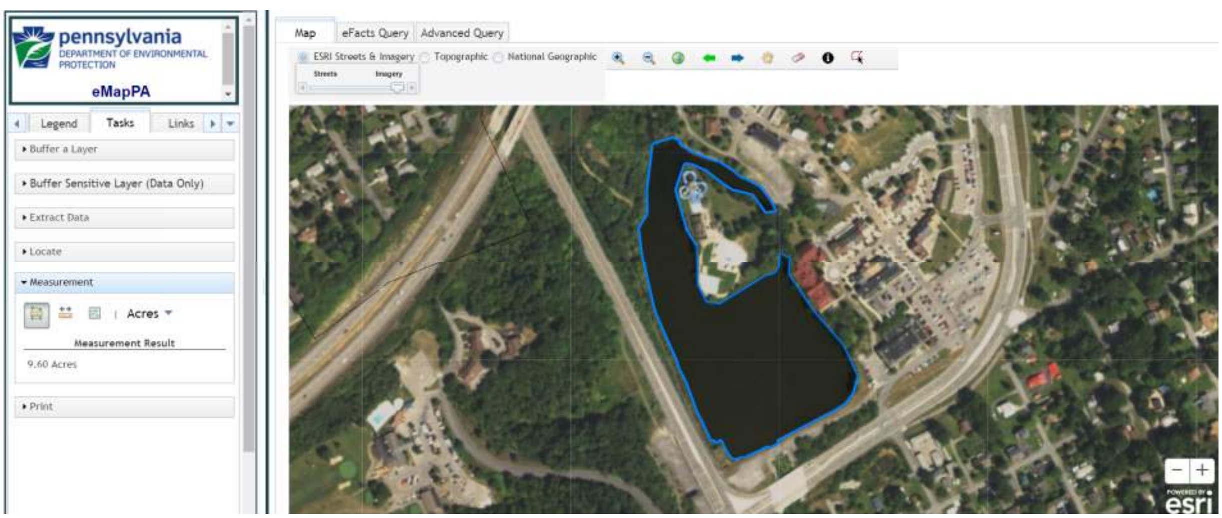

Figure 9 - Lakemont Reservoir Area Measured by PADEP's eMapPA at 9.60 acres

Existing Lakemont Reservoir Performance – Summary of Findings

Due to the lack of design data available in the Report and the inaccuracy inherent in planimetering an area from a USGS map, the aerial measurement from eMapPA, and the average depth measurements obtained from the June 7, 2017 field survey have been chosen to calculate the existing reservoir storage and thereby performance (Tables 3 and 4). However, it is noted that the spillway crest does contain a mechanical gate, and the storage can be altered, thereby increasing the area of the reservoir. Therefore, in order to ensure consistency and a conservatively low estimate of the reservoir performance, the 9.60-acre reservoir area will be used for both the existing and proposed reservoir performance.

Table 3 Existing Reservoir Storage

Reservoir Area (acres)	Average Reservoir Depth (ft)	Existing Reservoir Storage (ac-ft)
9.60	2.25	21.60

Using the calculation methodology outlined in the "Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects", the standard retrofit equation is used as follows with the inputs and outputs summarized in Table 4:

$$\frac{(RS)(12)}{IA}$$

Where:

RS = Runoff Storage Volume (acre-feet)

IA = Impervious Area (acres)

Consistent with the calculation methodology outlined in the "Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects", the stormwater treatment (ST) sediment curve is utilized due to the reservoir functioning as a large wet pond.

Table 4 Existing Reservoir Performance Calculation

Existing Reservoir Storage (ac-ft)	Impervious Area Draining to the Reservoir (acres)	Standard Retrofit Equation Result (inches)	Resulting Percent Reduction from ST Curve (%)	Modeled Sediment Load to the Lakemont Reservoir (lb/yr)	Existing Reservoir Sediment Reduction (lb/yr)
21.60	716.4	0.362	42.7	2,424,182	1,035,766

Proposed Performance

It is proposed that Lakemont Reservoir is dredged to restore its capacity to remove sediment. The Report on page A8 of 9 (Figure 10) states that "owner reported that the reservoir has significantly silted and that the average depth is on the order of 4 feet". However, during the site visit conducted on June 7, 2017, the operator of Lakemont Park stated that the reservoir depth should be approximately 8 ft deep. In order to be conservative in the calculation approach, the lower 4 ft depth restoration assumption for the proposed reservoir condition will be used to determine the proposed performance (Tables 5 and 6) with the same calculation methodology utilized for the existing performance.

VISUAL INSPECTION
PHASE I
RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Reservoir slopes are gentle. No significant shoreline erosion was noted.	
SEDIMENTATION	The owner reported that the reservoir has significantly silted and the average depth is on the order of 4 feet.	
UPSTREAM RESERVOIRS	None	

Figure 10 - Visual Inspection in 1979 Dam Inspection Report (pg A8 of 9, Appendix A) Stating that Average Reservoir Depth Reported by the Owner was Estimated at 4 ft

Table 5 Proposed Reservoir Storage

Reservoir Area (acres)	Average Reservoir Depth (ft)	Proposed Reservoir Storage (ac-ft)
9.60	4.00	38.40

Table 6 Proposed Reservoir Performance Calculation

Proposed Reservoir Storage (ac-ft)	Impervious Area Draining to the Reservoir (acres)	Standard Retrofit Equation Result (inches)	Resulting Percent Reduction from ST Curve (%)	Modeled Sediment Load to the Lakemont Reservoir (lb/yr)	Proposed Reservoir Sediment Reduction (lb/yr)
38.40	716.4	0.643	59.5	2,424,182	1,441,692

Final Reservoir Performance

The “Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects” pg. 9 states the following:

> BMP restoration applies to major maintenance upgrades to existing BMPs that have either failed or lost their original stormwater treatment capacity. **The method to calculate the removal rate increase depends on whether or not the BMP has previously been reported to EPA. [emphasis added]**
>
> If the BMP has been previously reported, a lower removal rate is calculated using the curves that reflects the existing level of treatment, and this value must be reported for at least one progress reporting cycle. After the qualifying BMP restoration is completed, the curves are used to derive a higher rate for the increased treatment volume in subsequent years. **If the BMP was**

not previously reported to EPA, it is considered a new retrofit, and the curves are used to define the removal rate based on the total treatment volume provided. [emphasis added]

Only four types of BMP restoration are allowed:

(a) Major Sediment Cleanouts – Removal of sediment, muck and debris that is equal to or greater than 1/10 the volume of the facility. For wet ponds, the volume of the facility would be where the normal water elevation or invert of the outfall pipe is. For dry ponds or enhanced extended detention facilities, the volume would include the volume of any fore bays, to their overflows, and ½ the height of the dewatering structure.

The proposed dredging would remove enough sediment to restore 44% of the volume of the facility exceeding the 10% volume restoration requirement. However, if more original design information becomes available, or after further analysis, the Blair County ISC may explore dredging further to obtain more storage.

Currently, it is not clear if the reservoir has been reported to the EPA as a BMP. Therefore, there are two possible sediment reductions to report, as identified in Table 7.

Table 7 Potential Sediment Reporting Options Based on Past EPA Reporting

Existing Performance (lb/yr)	Proposed Performance (lb/yr)	EPA Reported (Proposed- Existing) (lb/yr)	Not EPA Reported (Proposed Only) (lb/yr)
1,035,766	1,441,692	**405,926**	**1,441,692**

In order to maintain the conservative approach employed throughout this document, the value of 405,926 lb/yr will for utilized for calculating the sediment reductions from the Lakemont Reservoir in this document. However, as more information becomes available, the sediment reduction value will be refined to reflect the new information.

Beaverdam Branch, Blair SCD Property (PRP_P_STR_1)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.422321	-78.392386

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
450	44.88	20,196

BMP Summary

This reach of Beaverdam Branch is on Blair Soil Conservation District (SCD) property, and the stream restoration project will be an extension of a demonstration project that includes wetland mitigation, riparian buffer plantings, invasive species removal, and continued stream monitoring. Concept plans have been created for much of this work and is available from the SCD. The stream has long, deep pools, some steep and eroding banks, and Japanese knotweed presence.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Beaverdam Branch, DeGol (PRP_P_STR_12)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.428020	-78.379606

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
8,350	44.88	374,748

BMP Summary

The assessed reach begins at the E Loop Rd. bridge near Chip N Dale's, runs between River Rd. and Degol Industrial Dr., and the reach extends eastward to the confluence with the Frankstown Branch at Reservoir Rd. Significant bank erosion is occurring due to various causes. Major in-stream aggradation is also occurring. A massive debris jam at Lat/Long [40.430724, -78.361899] appears to have diverted the stream channel in such a way as to create very tight meanders, probable oxbows, and some significant braiding.

Due to the constraints of the adjacent road and railroad track, excavating the banks to reduce the bank angles is not very feasible in most places, though near the end of the reach, some excavation may be advised. Remediation recommendations include a multiple-method approach of stabilizing the stream banks by using a variety of methods. Stream bank stabilization will likely include a combination of structural practices such as rock and log vanes and J-hooks, along with bioengineering methods such as live stake planting, root wad placement, and cribbing at the steeper banks in more constrained areas. Removal of some of the aggraded sediment may be advisable, and some benching to create some faster flows to transport the sediment that is currently aggrading and forming islands may be advisable. Narrowing the channel in these areas and building a low floodplain within the existing stream channel using a soil-in-coir technique will prevent the formations that are exacerbating the near-bank shear stresses. The aforementioned debris jam may need to be removed or modified. The debris jam likely serves as significant habitat at this point, and it's possible that an engineering design will involve leaving it in place since the stream does already diverge at that location. It does not appear that grade control structures are necessary, but at least a concept design is necessary to confirm such a conclusion.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow. It is important to note that the issues at this stream reach are likely caused upstream, and stabilizing through this reach should be accompanied by significant upstream improvement in the form of upland volume and rate control and other stream restoration efforts, or this effort will most likely pass the issues downstream, exacerbating the issues in the Frankstown Branch of the Juniata River.

Beaverdam Branch, Knights of Columbus (PRP_P_STR_2)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.426792	-78.396132

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

A portion of Beaverdam Branch behind the Knights of Columbus property at Canal Basin Park is nearly vertical, eroding quickly, and actually threatening significant property damage. Some makeshift attempts at bank stabilization in the form of armoring have occurred, but they have not been effective.

At this location, bank stabilization is required to prevent significant sediment loss. Cribbing and likely some stone diversion structures are necessary. Some excavation of the channel bed to slow velocity at this location may also be advised during concept or engineering design.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Beaverdam Branch, Plank Rd. to 22 (PRP_P_STR_3)


Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.433031	-78.415458

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
6,200	44.88	278,256

BMP Summary

Beginning at the Plank Rd. bridge behind Hoss's Steak House, Beaverdam Branch has system-wide steep and severely eroding banks, significant aggradation, and conditions that are causing these issues to continue. The banks are between eight feet and 14 feet tall, and they are vertical or overhanging in places. Large trees are being undercut and are falling into the stream. Some of the aggradation is in-stream creating islands, and some are creating shelves on the sides. Woody vegetation is established on most of these. Adjacent to Legion Memorial Park there is some channel splitting and major deposition along the left and center, with the flow getting forced along the right side causing some undercut.

Benching to help sediment move through this reach will help prevent aggradation, which will in turn help prevent the increased near-bank shear stress causing bank erosion and undercutting. It is important to note that likely a large portion of the aggrading sediment in this reach is being deposited from upstream, both from upland sources and upstream reaches such as Gillian's Run at/through the Barefoot Farm (ID: PRP_P_STR_9) just east of Route 99, and Gillian's Run west of N 13th St. Stream bank treatments such as cribbing and log and rock vanes are recommended to divert strong flows away from vulnerable banks sections. Some grade control structures have naturally occurred, but in the first half of this reach some constructed additions such as rock or log sills may be required to help control velocities.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Beaverdam Branch, Westerly Wastewater Treatment Plant (PRP_P_STR_4)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.451066	-78.426291

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
4,850	44.88	217,668

BMP Summary

Beaverdam Branch south of the Westerly Wastewater Treatment Plant is an excellent opportunity for restoration of localized erosion issues. Power/utility poles on east side of stream may present a constraint, as will the railroad tracks on the west side of the stream, though the threat to the tracks is a driver for restoration efforts assuming the tracks are in active use; stream bank erosion is threatening the railroad track foundation and ballast at multiple points. One such location is visible in satellite imagery right where the stream channel most closely approaches the railroad tracks and the bend creates higher shear stress on the banks. The banks are between six and ten feet tall, steep, and eroding badly in places. Other areas have relatively shallow and stable banks, but these areas are scattered, and not the norm.

In locations where the banks alongside the railroad tracks are eroding, cribbing, root wad embedment, and rock diversion structures will likely be necessary to preserve and protect the slope. Similar bank treatment is advised for the steep and bare banks on the opposite side of the stream. Vanes and hooks to guide the flow path will help preserve the less severely impacted portions of stream bank. Grade control structures such as log and rock sills or cross vanes will also help prevent bank destabilization.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Blair Gap Run (PRP_E_STR_1)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Restoration	40.424593	-78.429777

Table 2. Stream Restoration Existing Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
2,630	44.88	118,034

BMP Summary

Banks are shallow angle at most places. Bank treatments employed include live stakes, rip-rap, rock vanes, rock deflectors, and some riparian plantings. Banks generally look quite good and are stable. There is minor undercutting in a few spots. There is floodplain connection as well, although some of the floodplain is neighboring property.

The completed stream restoration project should qualify for at least the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Brush Run, Blairmont/Sylvan Hills golf course (PRP_P_STR_5)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.439457	-78.392319

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
2,300	44.88	103,224

BMP Summary

The reach of Brush Run through the Blairmont/Sylvan Hills golf course is an exemplary urban stream reach to illustrate the impacts of a lack of buffer. The reach exhibits a combination of severe stream bank erosion and major sediment deposition/aggradation. The sediment being deposited is due in large part to imports from upstream. Improvement/upgrade to the Lakemont Reservoir will likely benefit this reach significantly.

Recommendations include bank cut where appropriate, benching with soil in coir matting and live stakes to establish stable banks with narrower bankfull width that will help transport sediment through this reach, which will in turn help prevent further bank shearing. Since the golf course use will preclude a full and proper stream buffer, the benching should be as stout as possible, and some low-height but deep-rooted vegetation should be established along the banks if and where possible. The debris jam just downstream of the western terminus of the identified reach should be removed. It is believed the property owner/manager is amenable to a stream restoration project at this location. Minor utility constraints are likely.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Brush Run – Lakemont Reservoir (PRP_P_STR_6)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.477140	-78.393744

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
2,960	44.88	132,844

BMP Summary

The Brush Run reach immediately upstream of the Lakemont Reservoir is seeing both bank erosion and major sediment deposition. While sedimentation of the reservoir is not desirable, premature deposition indirectly leads to increased sedimentation of the reservoir via deposition-bank-erosion chain reactions.

Benching based on flow regime calculations to help stabilize the banks and transport sediment downstream to the reservoir, ideally with a forebay for easy sediment removal and maintenance, is advised. Some bank treatment options such as live stake and root wad plantings, and perhaps rock or log vanes in particularly sensitive places, would also help prevent bank erosion. Currently, the bank erosion is not only causing increased sinuosity, but it is also threatening the miniature railroad track foundation in the amusement park. Also, at the bridges over the identified reach, significant debris is collecting at the piers, which, under large storm flows, creates additional and potentially damaging forces to be applied to the bridges. Upstream and downstream of these piers, significant sediment deposition has created islands, now wooded, which are exacerbating the shear stress and bank erosion.

Addressing these issues will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Frankstown Branch, River Rd. (DeGol) (PRP_P_STR_7)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.430194	-78.361088

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
1,130	44.88	50,714

BMP Summary

The Frankstown Branch of the Juniata River, just south of River Road across from the major debris jam identified on Beaverdam Branch, has significant bank erosion and highly erodible characteristics with bare, steep slopes. There is some braiding as well, with notable stream channel split and tight bends.

Benching to maintain flow velocity and prevent sediment deposition, along with bank treatments to protect the existing banks from storm flows, are recommended. The banks are not very tall, and the stream appears relatively shallow, thus making the work relatively feasible/practical for a channel as wide as it is.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Gillian's Run, Barefoot Farm (PRP_P_STR_9)

 

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.432760	-78.425661

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
2,060	44.88	92,453

BMP Summary

The reach of Gillian's Run just east of Route 99 runs through a farm owned by the Barefoot family. This reach, in part because of the lack of buffer and root mass for bank stabilization, is experiencing extreme bank erosion and channel meander. The banks are between very steep and overhanging, and completely bare, save the top layer of turfgrass. Some minor attempts at bank armoring have been installed, but are not sufficient, nor are they complete. The reach immediately upstream of this, on the west side of Route 99, has been recently stabilized.

It is recommended to shorten the reach, creating a gentler meander, while filling the portion of the channel that is cut off in the process. Bank treatments including cribbing, mudsills, and log vanes are recommended. Some floodplain reconnection is also possible if the landowner is amenable. Also, some fencing to keep livestock off the banks and out of the stream channel is highly recommended to prevent further degradation in the future.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Mill Run, Union Ave. (Altoona Bible Church) (PRP_P_STR_11)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.492494	-78.406360

Table 6. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
4,400	44.88	197,472

BMP Summary

Mill Run, starting at Union Avenue next to Altoona Bible Church, is a tightly constrained urban stream which is experiencing some severe bank erosion. Some of this bank erosion is threatening private property and is already very close to destroying some fences along several properties. There is some channel splitting and deposition, some steep and bare banks, and falling trees due to undercutting. Several property owners or tenants along this reach have attempted to do some armoring themselves with little or no effect.

Cribbing at the severely eroded and vertical banks and log or rock vanes for bank treatment and deflection along the less severe stretches are recommended. Some cross vanes, either log or stone, will also likely be helpful.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Kettle Creek, Ward Trucking to E. 3rd Ave. (TMDL_SRI_38)


Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.531947	-78.369403

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
800	44.88	35,904

BMP Summary

Kettle Creek, beginning immediately adjacent to Allegheny Trucks (formerly Ward Trucking) has various forms and degrees of degradation. At the upstream end of this reach, stretching approximately 570 feet, Kettle Creek is merely a stone-lined channel with no natural bedform, vegetation, sinuosity, or other natural structure or ecological function. Once the stream channel crosses under Greenwood Rd., it takes a much more natural form, but lacks important ecosystem functions and structure, and is suffering from typical urban stream bank erosion and refuse collection.

Recommendations include both bank treatments such as log and rock vanes, and cribbing in some of the more affected and steeper locations, and also grade control structures and channel bed modifications such as cross vanes, sills, and potentially excavated pools. Trash removal is of course also recommended. In front of Allegheny Trucks, the channel restoration practices will have to be "ground up" in nature, with stone removal, soil import, bedform construction, and to the extent possible, vegetation establishment.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Spring Run, Juniata Ball Field (TMDL_P_STR_1)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.532650	-78.390416

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
600	44.88	26,928

BMP Summary

This stream reach is tightly constrained by the Juniata Ball Field and adjacent properties on the opposite side of the stream, but those same private properties are at the top of approximately 14-foot-tall, nearly vertical, bare banks. The soils do not appear to be particular susceptible to erosion; however, there is evidence they are eroding, and the bank angle, bankfull ratio, and lack of armoring still make the overall assessment one of severe erosion vulnerability. Conversation with a local resident who is involved with the Juniata Civics (owners of the ball field) suggests that a buffer planting project was planned but never completed.

Cribbing and deflection structures along the southern bank (river right) are highly recommended. Live stake planting and other bioengineering to increase bank coverage would also be highly beneficial.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Sandy Run – Dartmouth Ave. to Harvard Ln. (TMDL_SRI_1003)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.541019	-78.354118

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
800	44.88	35,904

BMP Summary

Sandy Run flows parallel and adjacent to E. Pleasant Valley Rd. The reach starting in front of the Sheetz gas station at S. Dartmouth Ave. has significant degradation. The channel immediately in front of Sheetz has only turfgrass vegetation on the banks, and no stabilizing buffer. This reach of Sandy Run is partially buried, running through culverts for much of the next 2,250 feet (to Harvard Ln.). Though the stream likely cannot receive the benefit of daylighting in these locations, portions can be returned to a more natural form with the inclusion of bank treatments and some widening and pool formation where practical. Recommendations include buffer plantings in front of Sheetz to help stabilize the channel and prevent erosion from the drainage outfalls from the gas station impervious areas, some bank treatments including cribbing and rock diversions, complementing some improved/increased sinuosity.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Spring Run, Good Shepherd Rd. to W 14th Ave. (TMDL_SRI_67)


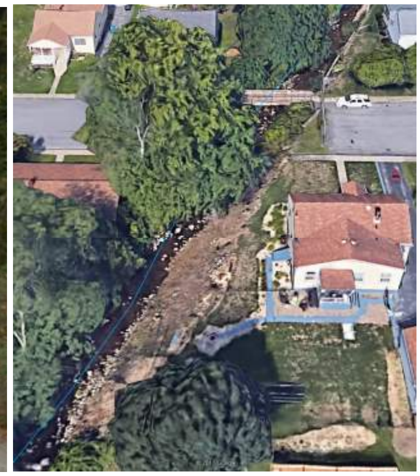

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Reach	40.543915	-78.418759

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
1,820	44.88	81,682

BMP Summary

Spring Run, starting around the First Church of Christ on Juniata Gap Rd. and running to W 14th Ave., is a tightly constrained urban stream experiencing some severe bank erosion, channel splitting, and deposition; the Penn State campus and some commercial and industrial properties are exacerbating the unnatural sinuosity. Some of this bank erosion is threatening private property. Several property owners or tenants along this reach have attempted to do some armoring themselves, and some armoring efforts look more organized and professional, but are not natural, and were necessary to stave off bank erosion, protect private property and infrastructure.

Cribbing at the severely eroded and vertical banks and log or rock vanes for bank treatment and deflection along the less severe stretches are recommended. Some in-stream structures like cross vanes and sills, either log or stone, will also likely be helpful. Some benching may be necessary due to the constrained channel geometry, which will also help transport sediment downstream and avoid deposition, which exacerbates near bank shear stress. There are areas which may require the more severe treatments which do not qualify as stream restoration, such as mortared stone walls or gabion baskets, in order to preserve adjacent properties and transportation infrastructure.

This approach will achieve the Chesapeake Bay Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow.

Adams Basin 1 (TMDL_P_BR_1)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.537450	-78.364183

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.31	1952.17	8,414
Pervious	11.09	309.90	3,437
Total	15.40		11,851

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0	0.00	0.00%	0.00

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	0.05	7.7%	908.2	908.2

BMP Summary

This basin provides rate control, but apparently provides negligible water quality treatment of storm flows. The hydrologic soil group in this location is B according to the Web Soil Survey, allowing for infiltration. Since little depth is available above the basin floor, it is recommended to excavate six or more inches to create retention volume, and to reduce the low-elevation orifice size to provide some velocity control in larger storm events. No access issues are present, and no utilities appear to present conflicts.

Adams Basin 2 (TMDL_P_BR_2)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.535017	-78.366550

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	9.70	1,952.17	18,936.05
Pervious	19.08	309.90	5,912.89
Total	28.78		24,849

Table 3. Existing Condition Calculations

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

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**)]
0.081	0.10	15.6%	3,876.1	3,876.1

BMP Summary

This basin has significant woody vegetation beginning to establish itself. It appears to have been designed to control velocities in large storm events, but no signs indicate that any volume is detained for any significant period of time; it is expected that only extremely large and fast storm events are detained for any time, and then only very briefly.

There is significant head available between the existing basin floor and the outfall elevation. The outfall is stable. The hydrologic soil group is B according to the Web Soil Survey. Excavation to add retention and infiltration capacity is possible to achieve 0.08 ac-ft treatment. The only access or other constraint appears to be the slope to the basin through the adjacent homeowner's yard, though the property boundaries are unknown; the homeowner may simply be mowing some of the community stormwater management parcel for aesthetic maintenance.

Altoona Beauty School (PRP_P_BR_2)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.501792	-78.388274

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.08	1952.17	156
Pervious	0.32	309.90	99
Total	0.40		255

Table 3. Existing Condition Calculations

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

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**)]
0.013	1.89	77.9%	199.0	199.0

BMP Summary

This is a very small basin, though the drainage area to it appears to also be quite small. No evidence of volume or detention time issues exists. The low-elevation orifice is four inches in diameter, and appears to do nothing to control flows. The outlet structure is immediately adjacent to an upstream portion of Brush Run. It is recommended to block the low-elevation orifice. No freeboard or flooding issues should arise from this action, as the secondary orifice is at eight inches above the basin floor elevation, and the overflow weir is 14 inches above that. No access issues exist, and no utility conflicts are apparent.

Altoona Bible Church (PRP_P_BR_3)


Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.501792	-78.388274

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.68	1952.17	1,327
Pervious	0.20	309.90	62
Total	0.88		1,389

Table 3. Existing Condition Calculations

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

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**)]
0.052	0.92	73.1%	1,015.2	1,015.2

BMP Summary

No existing stormwater treatment is evident on the property. Stormwater management appears to be an inlet and pipe system directing runoff into Mill Run which runs adjacent to the church parcel. No underground detention or storage is evident.

Due to the available head from the parking lot elevation to the stream bed, a filtration practice such as a bioretention is possible and advised. The drainage pattern naturally flows to the east and southeast of the parking lot, and any runoff that would flow directly south to the stream could be redirected with a rolled asphalt or concrete curb to the southeast corner of the parking lot. Currently there appears to be no access constraint, utility conflict, or other dedicated use of the space adjacent to the corner of the parking lot. An underdrain could or should be installed given the likelihood that the soils are compacted urban soils, and not conducive to infiltration.

American Legion (PRP_E_RG_4)


Table 1. Background Information

BMP Type	Latitude	Longitude
Rain Garden	40.434571	-78.406029

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.13	1952.17	254
Pervious	1.97	309.90	611
Total	2.10		864

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.042	2.50	84.9%	733.8

BMP Summary

There are two depressions at the American Legion site receiving runoff from the building and parking lot. While there are no specific plantings typical of rain garden installations, these depressions functions as rain gardens, just with turfgrass. There is potential to increase the depth, add mulch and native plants, or even excavate and add a typical bioretention as the adjacent drainage channel is low enough to accommodate an underdrain from bioretentions. No access issues exist, and it does not appear that any utility conflicts are present.

Bellwood – Antis Park (PRP_E_RG_5)

Table 1. Background Information

BMP Type	Latitude	Longitude
Rain Garden	40.601001	-78.336057

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.53	1952.17	6,891
Pervious	7.24	309.90	2,244
Total	10.77		9,135

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.006	0.02	2.38	217.72

BMP Summary

A rain garden was recently installed inline with a drainage conveyance swale that leads to Bells Gap Run on the south side of Bellwood-Antis Park. The rain garden includes educational signage, and is well constructed.

Beverly Hills Pond 1 (TMDL_P_WL_3)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.528917	-78.414900

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.735	1952.17	1,435
Pervious	3.895	309.90	1,207
Total	4.63		2,642

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.006	0.10	15.0%	396.2

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**)]
0.014	0.23	30.1%	796.4	400.3

BMP Summary

A small detention pond was installed to control flow volumes from four homes in the Beverly Hills development. While the basin does not appear to control the rate of runoff passing through it, according to conversation with the homeowner who lives immediately adjacent to the basin, there is sufficient retention and impermeable soils that the basin floor remained wet enough to foster wetland taxa. There is potential to raise the low-elevation orifice to add retention capacity, without creating any flooding or freeboard issues. No utility or access constraints are apparent.

A unique retrofit opportunity may exist in the property immediately across Beverly Boulevard to the southeast. The home there is apparently abandoned and now bank-owned, and a liability. There is ample space in the yard of that property, and the drainage from a culvert under Beverly Blvd. runs to and through this yard. That culvert conveys runoff from a much larger drainage area than the basin in question, including much of the road, and the land uphill from the culvert. This may provide opportunity to treat a significant amount of water for sediment removal. Access is easy, and no apparent utility conflicts exist. However, ownership of the property complicates any retrofits here.

Blair Co. Christian School and Foot of Ten Church 1 (PRP_P_WL_6)


Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.417268	-78.459605

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	1952.17	6,188
Pervious	12.61	309.90	3,908
Total	15.78		10,096

Table 3. Existing Condition Calculations

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

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**)]
0.075	0.28	35.8%	3,612.3	3,612.3

BMP Summary

A drainage swale conveying runoff from the adjacent Muleshoe Estates mobile home park runs through the Blair County Christian School and Foot of Ten Church property. There is space available to create some detention in-line with the swale. The only apparent constraints are the existing trees which should be preserved by avoiding root disturbance. A small pocket wetland may provide an educational opportunity as well as water quality treatment.

Brush Oaks Development Pond 1 (TMDL_P_BR_4)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.531250	-78.353767

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.93	1952.17	1,816
Pervious	4.94	309.90	1,531
Total	5.87		3,346

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.004	0.05	7.9%	263.7

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**)]
0.045	0.59	56.9%	1,904.0	1,640.3

BMP Summary

The upper Brush Oaks 1 detention pond treats runoff from a few homes and a portion of Brush Oaks Drive. The basin itself is shallow, with no perceptible elevation drop to the outfall in the adjacent conveyance channel. A small amount of treatment is currently being provided by non-turf vegetation and some retained water in the basin floor. The floor of the basin could be excavated and leveled to substantially increase retention, potentially creating a pocket wetland. Access is easy and dedicated, with available staging and laydown area just to the south. There are no apparent utility constraints.

Brush Oaks Development Pond 2 (TMDL_P_BR_5)


Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.533008	-78.354137

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.44	1952.17	859
Pervious	12.86	309.90	3,985
Total	13.30		4,844

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.015	0.40	45.8%	2,218.2

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**)]
0.177	2.5	78.8%	3,817.9	1,599.6

BMP Summary

The Brush Oaks 2 basin captures runoff from several homes and a portion of Brush Oaks Drive. The outlet structure appears to be designed for extended detention with several staged outlets, though based on visual inspection and conversation with the adjacent homeowner, detention time is very short (less than a couple hours in very heavy storms) with the water level only ever reaching approximately one-foot depth. A small amount of treatment is currently provided by some incidental wetland vegetation, but retention could be expanded significantly by blocking or raising the low-elevation orifice, which would foster more wetland vegetation and provide more water quality treatment. There are no apparent utility or access constraints. The adjacent homeowner, and/or the homeowners' association, may present some administrative constraints.

Burgmeier's Hauling (TMDL_P_BR_6)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.545750	-78.368074

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.80	1952.17	3,514
Pervious	1.39	309.90	431
Total	3.19		3,945

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.004	0.03	3.6%	143.4

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**)]
0.164	1.09	71.5%	2,822.3	2,678.9

BMP Summary

The basin appears to be a simple detention pond for rate control, but due to soils and grades, wetland plants have been established, including fairly robust wooded wetland pockets in the channel leading to the basin, the roadside channel beside the basin, and across the street at the nearby intersection. The basin floor itself also retains a small amount of water and a small amount of wetland vegetation has taken hold. The floor of the basin has a significant slope upward to the east, reducing the potentially available volume. The floor could be excavated to increase retention. The low-flow, low-elevation orifice is sufficiently small to provide some rate control, though it could be raised or fitted with a perforated standpipe to provide longer detention, even above the increased retention volume from basin floor modification. No access or utility constraints are apparent.

Chapel Hill Pond 1 (PRP_P_BR_9)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.464517	-78.386967

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.52	1952.17	6,872
Pervious	29.63	309.90	9,182
Total	33.15		16,054

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.034	0.12	16.7%	2,679.4

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**)]
0.122	0.42	46.8%	7,511.7	4,832.3

BMP Summary

This basin currently has either no low-elevation orifice, or most likely a completely blocked and buried low orifice. Conversations with homeowners familiar with this basin indicate that the water level never rises more than another foot or so and only for very short times, and no visual indicators on the basin side slopes suggest otherwise. Due to probable blockage of the low-elevation orifice, there is approximately six inches of standing water in the basin which has fostered wetland vegetation throughout the basin floor. There is available head and space on the outlet structure to raise the low-elevation orifice to create greater retention without threatening any impacts on surrounding properties or roads. Recommendation is to raise orifice 18 inches, and add perforated standpipe for additional extended detention beyond that retention volume. Access is very easy, and no apparent access or utility conflicts exist.

Comfort Inn (PRP_P_BR_10)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.432511	-78.413375

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.33	1952.17	4,549
Pervious	1.5	309.90	465
Total	3.83		5,013

Table 3. Existing Condition Calculations

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

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**)]
0.344	1.77	77.5%	3,887.7	3,887.7

BMP Summary

The current basin design is unusual. The orifices in the outlet structure present a questionable picture, not consistent with either extended detention or more standard channel protection and flood control. The floor of the basin has significant slope downward toward the outlet, with approximately six (6) feet of elevation drop, just within the basin floor, not including the sides; this puts the upper portion of the basin floor about level with the overflow weir elevation. There are also a pair of corrugated plastic pipes that seem to come from, and lead to, nowhere, right in the middle of the low portion of the basin.

Recommendations: excavate the elevated portion of the basin floor, raise the low-elevation orifice, reduce the size of the replacement low-flow orifice, and either block or otherwise address the odd plastic pipes which seem to point generally northeast. This will create some retention volume, allowing the basin to provide some water quality treatment. Even without excavating, merely raising the low-elevation orifice, blocking it and drilling a new one, or installing a standpipe to raise the effective orifice invert elevation, will add retention volume, provided the pipes in the basin floor are not also acting as drains.

Edgewood Dr. (Alpaca) Pond (PRP_P_WP_12)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.420565	-78.420933

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.98	1952.17	7,770
Pervious	9.84	309.90	3,049
Total	13.82		10,819

Table 3. Existing Condition Calculations

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

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**)]
0.59	1.79	77.6%	8,397.5	8,397.5

BMP Summary

A dry pond currently functions to provide peak rate control for a range of storms, but does not provide any measurable treatment. A retrofit within the existing pond can provide some water quality treatment. The two options the Center recommends, in increasing order of benefit, are conversion from dry pond to dry extended detention water quality basin or conversion to permanent wet pond. The existing dry pond is well suited dimensionally to upgrade to either of these retrofit options. Dimensions of the bottom of the pond are approximately 51'x94', with height of 6'-7', and side slopes of approximately 3:1. The upgrade to an extended detention facility would require only changes to the existing outflow structure, restricting the lowest orifice.

Converting to a permanent wet pond, or semi-permanent wet pond, would require excavating the bottom of the pond 2'-6', verification that soils have low conductivity, installation of a simple sedimentation forebay, and possibly constriction of the lowest orifice of the outflow structure for additional downstream channel protection. Also, without knowing the subsurface conditions of the current outflow structure, it is possible that it would require either foundation modification, or replacement.

Access is clear and easy, and there are no apparent utility constraints.

Five Star Mitsubishi (PRP_P_WL_13)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.473289	-78.402524

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.09	1952.17	4,080
Pervious	0.65	309.90	201
Total	2.74		4,281

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.009	0.05	7.1%	305.2

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**)]
0.065	0.37	43.4%	1,859.6	1,554.4

BMP Summary

The basin at Five Star Mitsubishi is an oddity, in that no familiar design pattern is identifiable. It appears to be a rain garden style depression, with an overflow weir into a conveyance channel in the form of a vegetated swale. The larger portion of the runoff appears to bypass the rain garden area, which has now established some wetland vegetation throughout. Design plans or more thorough survey may be required. The only recommendation would be to excavate to add a little depth to the basin portion of this, or if there is available depth, excavate and add some sandy soil media to make the swale into more of a bioswale instead of merely a conveyance swale. Access is easy, but existing land use and site constraints preclude many options. Utility constraints are not easily identified.

Frankstown ES (PRP_P_WL_14)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.423490	-78.364379

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.69	1,952.17	1,347
Pervious	6.51	309.90	2,017
Total	7.2		3,364

Table 3. Existing Condition Calculations

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

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**)]
0.15	2.50	78.8%	2,651.6	2,651.6

BMP Summary

The Frankstown Elementary School detention pond is a small, shallow depression. The basin itself could be excavated to add some depth and therefore retention volume. However, the biggest benefit would be achieved through expanding the footprint. There is an apparently unused triangular yard area just south of the basketball courts, to the southeast of the detention basin. This area could become additional area for retention or detention. A school maintenance crew member indicated during conversation that this area gets “swampy” anyway, and the natural surface drainage pattern flows over and through this area. There are no access constraints, no apparent utility constraints, and the only site modification apart from the excavation would be moving or removing a small section of chain link fence.

This would be a good educational and demonstration project due to its location and exposure.

Frankstown Township Detention Pond (PRP_P_WL_15)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pockets	40.461383	-78.376333

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.49	1952.17	8,765
Pervious	66.87	309.90	20,723
Total	71.36		29,488

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.084	0.23	30.0%	8,852.9

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**)]
0.81	2.17	78.4%	23,106.2	14,253.3

BMP Summary

This detention pond has some wetland vegetation taking hold in a mostly direct path between the largest inlet and the outlet, and just in front of the smaller inlet. Though the Soil Survey suggests the hydrologic soil group is B, it is likely that they are C or less permeable. The basin floor is large and open, and access is easy with both an access point off the road, and a shallow ramp into the basin. The low-elevation outlet is a caged rectangular orifice. Partially blocking this could be the low-investment option for adding retention volume to the basin. Another option would be to excavate some pools, or perhaps even the entire floor, which would likely create more of a wetland retrofit, adding to the existing wetland vegetation currently in place. Both actions together would add retention and some peak volume shaving to help protect downstream channels. As mentioned, access is easy and open. There are no apparent utility conflicts.

Healthsouth 1 (PRP_P_WL_17)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pockets	40.497233	-78.391417

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.73	1,952.17	7,282
Pervious	3.11	309.90	964
Total	6.84		8,245

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.05	0.16	22.6%	1,867.2

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**)]
0.20	0.65	59.6%	4,914.2	3,047

BMP Summary

This detention basin has a little sediment accumulation at the inlet closest to the entrance drive, and some sediment accumulation in the basin. Wetland vegetation has established itself in this basin due to consistent moisture conditions. Low-elevation orifice is a caged rectangular opening, which could be easily partially blocked to add some retention volume and increase treatment. Reducing the size of this orifice would add some improved peak shaving of the storm hydrograph, which would benefit the Brush Run stream channel immediately downstream of the outfall. Alternatively, or in addition, some excavation or sediment removal could add some depth to the basin floor. No access issues or apparent utility conflicts exist.

Healthsouth 2 (PRP_P_WL_18)

Table 1. Background Information

BMP Type	Latitude	Longitude
Wetland	40.497233	-78.392017

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	15.48	1952.17	30,220
Pervious	52.06	309.90	16,133
Total	67.54		46,353

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.15	0.12	17.1%	7,936.7

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**)]
0.52	0.40	45.7%	21,179.9	13,243.3

BMP Summary

This doesn't appear to be a dedicated or purposeful basin per se, but rather grew and fosters wetland vegetation due to having a wide, shallow area and a significant drainage area. It receives drainage from upstream conveyance channels, several parcels, and Valley View Blvd. No access issues are present, though some utilities are very near the area which could be identified as a basin, including water, sanitary sewer, and electric; however, none of these are anticipated within the basin area. Recommendations include excavating some deeper pool areas to increase detention volume, and potentially increasing the footprint in the available space between the basin and Valley View Blvd. An alternative would be to add a weir structure at or near the entrance drive culvert, thereby increasing the effective outlet elevation to increase detention volume.

Hollidaysburg Area Senior HS (PRP_E_WL_19)

Table 1. Background Information

BMP Type	Latitude	Longitude
Wetland	40.442653	-78.397601

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	5.01	1952.17	9,780
Pervious	6.25	309.90	1,937
Total	11.26		11,717

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.091	0.22	29.2%	3,419.6

BMP Summary

Existing detention basins at Hollidaysburg Area Senior High School have naturally evolved into pocket wetlands which are providing some water quality treatment and some ecosystem services. These basins are adjacent to parking lots. They receive runoff from sports fields, buildings, and parking lots. They appear to be in good condition, and no action is recommended.

Logan Town Centre / Hilton Pond 1 (PRP_P_WL_21)


Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.480317	-78.390883

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.77	1952.17	1,503
Pervious	101.96	309.90	31,598
Total	102.73		33,101

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.004	0.06	8.7%	2,876.5

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**)]
0.041	0.64	59.5%	19,696.2	16,819.7

BMP Summary

This small detention basin actually has a seemingly well-designed outlet structure for extended detention. It currently receives runoff from a largely pervious drainage area, but it appears that development is planned immediately adjacent to it, and given the location, it is likely that it is commercial in nature. Recommendation is to excavate the bottom to add depth below the low-flow orifice. Alternatively, if the detention function will not be adversely affected by this, raising the low-flow orifice by either blocking it and adding a new one above it, or adding an upturned standpipe, will add retention volume. Access is easy, and there are no apparent utility conflicts.

Logan Valley Mall (PRP_P_WP_22)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.468133	-78.416167

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.4	1952.17	8,590
Pervious	1.74	309.90	539
Total	6.14		9,129

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.002	0.00	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**)
0.196	0.54	54.3%	4,953.8	4,953.8

BMP Summary

This detention basin serves as rate and peak velocity control for a portion of the Logan Valley Mall property, largely impervious in nature due to the parking lot and buildings. The low-elevation orifice is six (6) inches in diameter, and therefore this is unlikely to detain any water for a sufficient period to provide much service in peak shaving of the storm hydrograph. There is a riprap-lined path from the inlet to the outlet which may have been installed to stabilize a gulley. The basin floor was a little soggy at the time of the site visit, but only very near this flow path. Recommendations include either removing the riprap, or merely adding a short transverse berm about halfway through the basin to increase the flow path length. Also recommended is blocking the bottom four to five (4-5) inches of the low-elevation orifice, or adding a perforated standpipe to lengthen the detention time. A good combination effort would be blocking the low-elevation orifice, adding a new two inch (2") orifice with an invert 12 inches above the existing orifice, and adding a short transverse berm to increase the flow path through the detained water. This would add water quality treatment, and downstream channel protection functions. No access issues exist, and no utility conflicts are apparent.

Martin’s Grocery (PRP_P_BR_23)

Table 1. Background Information

BMP Type	Latitude	Longitude
Unknown	40.475231	-78.403463

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.58	1952.17	6,989
Pervious	0.07	309.90	22
Total	3.65		7,010

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

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**)]
0.179	0.60	57.5%	4,034.4	4,034.4

BMP Summary

This BMP was unidentifiable in terms of type and function. Several yard inlets were scattered throughout a very shallow basin, and were not at the ground level, but were slightly elevated. They all appeared to interconnect with a storm drain pipe network and lead away from the basin area. The existing vegetation (a few planted trees) are also in very poor shape, or dead.

A very feasible retrofit to provide water quality benefit without much modification to the existing infrastructure would be to remove the top 1-2 feet of soil, being careful of the connecting storm drain pipes, add underdrain pipes connected to the concrete inlet structures, a layer of underdrain gravel, and replace the top layer with sand to create a surface sand filter. The existing yard inlet grates would still function as overflows for the sand filter, but the runoff would be able to permeate and be filtered by the sand before draining into the lower portions of the inlets.

No access or utility issues are apparent.

Nittany Pointe 1 (TMDL_P_WP_7)

Table 1. Background Information

BMP Type	Latitude	Longitude
Detention Basin w/ Wetland Pocket	40.546917	-78.414667

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	5.68	1952.17	11,088
Pervious	15.07	309.90	4,670
Total	20.75		15,759

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.027	0.06	8.4%	1,315.9

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**)]
0.526	1.11	71.8%	11,315.2	9,999.3

BMP Summary

This dry detention basin has remained wet enough to grow some wooded wetland vegetation. The inflow from the pipe short-circuits to the outlet. The outlet and the overflow appear to be in good condition, however the low-elevation orifice is 12 inches in diameter, which precludes any useful volume control except in the most severe peak flows.

Given that there is room to expand the footprint of this BMP, and it is located in the TMDL area, an excavation and footprint expansion is recommended, along with an outlet structure modification to reduce the size of the low-elevation orifice. Some hydraulic calculations are necessary to confirm this, but a 3-inch orifice will likely suffice and provide better velocity control. It is recommended to block the existing low orifice and add the new low-flow orifice above it to provide greater detention time, allow some infiltration, and achieve better water quality treatment.

The only access issue appears to be steep slopes, and no probable utility conflicts are apparent, apart from the utility easement along the access road, but this would not affect work.

Nittany Pointe 2 (TMDL_E_WP_8)

Table 1. Background Information

BMP Type	Latitude	Longitude
Wet Pond/Wetland	40.546879	-78.414722

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.01	1952.17	20
Pervious	53.57	309.90	16,601
Total	53.58		16,621

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.057	2.50	78.8%	13,099.3

BMP Summary

The Nittany Pointe 2 basin receives runoff from the land above the Nittany Pointe housing, almost exclusively pervious drainage area. The basin itself has no obvious outlet, but the water surface elevation was not at the lowest natural overflow point, so the water within it is either infiltrating to a degree, or moving laterally to the adjacent stream which is immediately west of the basin. The basin has established emergent and submerged wetland vegetation, algae, and amphibious inhabitants.

No action is recommended, given the low potential for increased treatment, and the apparent healthy condition of the basin as habitat.

Pleasant Valley ES (PRP_P_BR_24)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.492592	-78.402298

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.44	1952.17	4,763
Pervious	3.62	309.90	1,122
Total	6.06		5,885

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

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**)]
0.209	1.03	75.5%	4,441.0	4,441.0

BMP Summary

The dry detention basin at Pleasant Valley Elementary School is in good condition, but vegetation management has either been lacking or has been purposefully allowed to thicken around the outlet structure. As such, any modifications to the outlet structure will likely require more than mowing since two-inch diameter black locust trees and other woody vegetation have become well established immediately in front of the outlet. Recommendation for retrofit is simple: block lowest elevation orifice, and block bottom half of the second orifice. The remaining orifices, coupled with likely permeable soils, should be able to manage influent without issue. There is ample head from inlets to basin floor.

The only access issue is the steep side slopes of the basin, and no utility issues are apparent.

St. Therese Church Bioretention (TMDL_P_BR_10)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.528880	-78.406937

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.11	1952.17	8,023
Pervious	2.85	309.90	883
Total	6.96		8,907

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

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	0.18	26.0%	2,318.2	2,318.2

BMP Summary

The City of Altoona is installing a bioretention in the traffic island. Engineering designs may be available with the City to confirm assumptions made here. No retrofit or modification is necessary since this is a new BMP being constructed. Drainage area estimates may be off, but site-level survey is required for precision in highly urban locations due to micro-topographical features such as curbs, gutters, slight depressions, and even minor sediment accumulation ridges.

Strip Mall (PRP_P_BR_25)

Table 1. Background Information

BMP Type	Latitude	Longitude
Infiltration Basin	40.432321	-78.411924

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.43	1952.17	2,792
Pervious	2.19	309.90	679
Total	3.62		3,470

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.078	0.65	64.3%	2229.80

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**)]
0.156	1.31	79.7%	2,765.5	535.7

BMP Summary

This basin is an unconventional design since it has no dedicated outlet structure or channel; it is merely a set of inlets and a shallow depression. Conversation with employees of the retail establishments immediately adjacent to the basin revealed that during larger storm events, water collects in the basin, and then drains down over a period of 1-3 days. This indicates that the basin is functioning as an infiltration basin. As such, the recommended retrofit is merely to increase capacity by removing approximately six (6) inches of soil. Alternatively, if the desire exists to create more of an infiltration and extended detention basin, more soil can be excavated and an outlet structure or channel could be incorporated. This basin is approximately 200 feet from Beaverdam Branch, about 200 feet upstream of Legion Memorial Park. No access or utility issues are apparent.

Appendix C – ISC Agreement

INTERGOVERNMENTAL STORMWATER COMMITTEE AGREEMENT

THIS INTERGOVERNMENTAL STORMWATER COMMITTEE AGREEMENT, (hereinafter, at times, "Agreement") is made and entered this 5th day of June, 2016, by and among **ALLEGHENY TOWNSHIP, ANTIS TOWNSHIP, BELLWOOD BOROUGH, BLAIR TOWNSHIP, CITY OF ALTOONA, DUNCANSVILLE BOROUGH, FRANKSTOWN TOWNSHIP, FREEDOM TOWNSHIP, HOLLIDAYSBURG BOROUGH, LOGAN TOWNSHIP AND BLAIR COUNTY**, (hereinafter individually "Municipality" or collectively "Municipalities") all Pennsylvania political subdivisions located in Blair County, Pennsylvania.

WITNESSETH:

WHEREAS, the Municipalities hold a Pennsylvania Department of Environmental Protection (hereinafter "DEP") MS4 Permit (regarding stormwater discharges) and are required to prepare and implement a Chesapeake Bay Pollutant Reduction Plan (hereinafter "CBPRP"); and

WHEREAS, the Municipalities have partnered together for the past several years to determine how best to comply with heightened best management practices (hereinafter "BMPs") and inspection requirements by DEP in order to renew their respective MS4 Permits; and

WHEREAS, BMPs or BMP projects require capital expenditures, in some cases, significant capital expenditures; and

WHEREAS, the Municipalities have had discussions with DEP wherein each Municipality shall obtain an individual MS4 Permit for each Municipality but will be given credit for BMP projects implemented by each of the other Municipalities; and

WHEREAS, recognizing that such BMP projects will be beneficial to all the Municipalities given the joint credit for such BMP projects, the Municipalities desire to formalize their relationship by entering into an intergovernmental agreement to establish an Intergovernmental Stormwater Committee and delegate to such Committee certain municipal MS4 duties as may be authorized by the Municipalities from time to time; and

WHEREAS, the Municipalities must approve all intergovernmental agreements by Ordinance in accordance with Act 177 of 1996, 53 Pa. C.S.§ 2301 et seq., as amended, known as the "Intergovernmental Cooperation Act" (hereinafter "Act").

NOW, THEREFORE, in consideration of the mutual covenants and promises herein contained, the parties hereto, intending to be legally bound hereby, agree as follows:

1. Incorporation of Recitals. The above recitals are hereby incorporated herein as if fully set forth.

2. Intergovernmental Stormwater Committee established. The Municipalities hereby establish the Intergovernmental Stormwater Committee (ISC), which said Committee shall, by contract or otherwise:

A. Procure the services of a qualified professional or entity to coordinate the efforts of the Municipalities in complying with governmental (including, but not limited to, DEP) stormwater requirements, including but not limited to those involving the MS4 Program and establish the rate of pay and/or benefits to be provided; and

B. Communicate with DEP and other applicable governmental agencies on behalf of the Municipalities, subject to the approval of any such Municipality involved, and advise the Municipalities to ensure the requirements of the MS4 Program are fully understood, including but not limited to, ranking the BMP's developed by the Center for Watershed Protection, as to value of the BMPs to the Municipalities in terms of DEP/MS4 and Chesapeake Bay regional water quality requirements for the least cost for such BMPs; however, it is acknowledged by the parties hereto that although the ISC shall rank such BMPs, a decision as to which BMPs shall be undertaken and when is not part of this Agreement; and

C. Regularly convene the ISC, maintain all ISC records, and communicate pertinent information with the Municipalities between such regular meetings; and

D. Receive, invest and distribute any and all real estate and funds, from grants or whatever source derived in accordance with this Agreement and/or the Act in order to administer this Agreement pursuant to its terms; and

E. Coordinate the completion of all required reports and plans, including the CBPRP, public education plans, public involvement plan, annual reports and progress reports for the Municipalities and assist in the implementation of these plans to ensure among other goals that the Municipalities receive joint credit for BMPs undertaken in any Municipality; and

F. Carry out appropriate Minimum Control Measures (MCMs), including public education and involvement activities, at a regional level on behalf of the Municipalities; and

G. Select and, thereafter, manage, supervise and evaluate any professional consultants hired to perform work for the Municipalities at a regional level, including preparing the CBPRP; and

H. Oversee and assist in the implementation of MS4 related mapping, GIS and field work activities completed by or on behalf of the Municipalities; and

I. Coordinate regular MS4 trainings, tours and information sharing sessions for appropriate staff of the Municipalities; and

J. Research funding opportunities, prepare and submit grant applications in support of MS4 compliance and the ISC; and

K. Attend DEP or other applicable governmental agency inspections of Municipalities' MS4 programs and meeting with such agencies pertaining to the MS4 Program and assist Municipalities in addressing any required follow-up to identified deficiencies; and L. Participate in continuing updates to the Blair County Stormwater Management Plan and implementation thereof through evaluation of and possible amendments to Municipalities' stormwater management ordinances; and

M. Monitor and maintain a working knowledge of state and federal laws pertaining to MS4s and court case precedent decisions having potential impact on the Municipalities and regularly apprise the Municipalities of such legal issues; and

N. Coordinate and take the lead on updating and submitting future MS4 permit applications, as renewals or re-submittals become necessary, subject to the approval of any affected Municipality and coordinate the addition of future MS4 municipalities to the ISC as necessary; and

O. Utilize the functions, powers and responsibilities which the member Municipalities and any participating organization may respectively have with respect to the operation, management, administration and enforcement of any program undertaken pursuant to this Agreement, including but not limited to, any such function, power and responsibility found under Pennsylvania or federal law, regulation or rule now or hereafter enacted or effective affecting such member municipality and/or participating organization, including but not limited to, the purchase (from an insurance company authorized to transact business in Pennsylvania) insurance insuring the property of the

Committee against loss or damage and insuring the Committee, its employees, Board members, officers, solicitor, and officials against liability exposure; and

P. Take other actions consistent with the Act as may be assigned to the ISC by a majority of the governing bodies by resolution setting forth such action to be undertaken by the ISC.

3. ISC Membership.

A. Composition.

(i) Initial Members. The ISC shall be initially composed of one (1) person from each Municipality hereinabove listed. Each Municipality shall appoint a member and a substitute member and notify the ISC in writing of the names of the persons so appointed.

(ii) Future Members. Any municipality may become a member of the ISC as follows:

(a) A municipality shall submit a written request for membership signed by the chief executive officer of the said municipality and duly attested indicating the names of the officials proposed as representatives to the ISC.

(b) Upon receipt of the written request for membership, the member Municipalities of the ISC shall vote on the request and if affirmative action is taken by a majority of the said member Municipalities, the Secretary of the ISC shall forward an ISC Membership Agreement, to the requesting municipality for appropriate execution. Upon execution by the requesting municipality, the said municipality shall forward the Agreement, together with the Ordinance of that Municipality approving the said Membership Agreement, to the ISC for execution by the President and Secretary of the ISC.

Thereafter, upon compliance with the cost sharing provisions set forth in Paragraph 5, the requesting municipality shall become a voting member Municipality of the ISC. The ISC and the Municipalities shall not be required to undertake any other action with regard to admittance of any additional municipalities other than such action as set forth herein.

(c) Upon membership of any additional municipality, said municipality shall have the rights and responsibilities as set forth in this Agreement.

4. Conduct of Business. All action taken by the ISC pursuant to this Agreement shall be by a majority vote of the member Municipalities of the ISC. No action may be taken by a tie vote. The ISC may adopt any rules of order it deems appropriate for conducting its business.

A. Assignment of Votes, Quorum. Each of the Municipalities shall be entitled to one (1) vote only. Each vote shall count on the percentage formula basis set forth in Paragraph 5A, entitled "Cost Sharing". A quorum of the ISC shall be declared if a majority of Municipalities are represented. All action taken by the ISC shall be by a majority vote of the members at which a quorum is present.

B. Officers. The officers of the ISC shall be a chair/president, vice chair/president, secretary and treasurer and such other officers as the ISC desires to create from time to time. Officers shall be elected annually at the ISC's organizational meeting from the membership of the ISC with each officer position being held by separate member Municipality. If the chair/president and/or vice chair/president refuse or are unable to serve, the ISC shall appoint an acting president. The ISC shall be authorized to take all action necessary to organize, structure and administer its duties and responsibilities hereunder.

C. Meetings. The ISC shall meet at least four times per year on a quarterly basis and at such other times as it may determine.

D. Grant of Immunities. As a matter reciprocal to the responsibilities and duties delegated in this Agreement, the ISC, its employees, members, representatives, officers and officials shall have the same immunities from liability, the same limitations on damages, the same rights and benefits, and the same powers as would be had by, preserved to or applicable to a municipality, its employees, officers and officials under the provisions of the Political Subdivisions Tort Claims Act (Subchapter C of Chapter 85 of Title 42 of the Pennsylvania Consolidated Statutes, Act 142 of October 5, 1980, as amended, 42 PA Con. Stat. Ann. §8541 et seq.), and/or under the provisions of any other Pennsylvania law or any federal law, now or hereafter enacted which provides for immunities, limitations, rights, benefits, or powers in connection with the subject matter of this Agreement.

5. Cost Sharing.

A. Costs. The Municipalities shall contribute the sum of One Hundred Thousand $100,000.00 Dollars to pay for the cost to be incurred by the ISC for each year of the term of this Agreement for a total of Two Hundred Thousand ($200,000.00) for the term of this two (2) year Agreement. Said sum shall be divided, as set forth hereinafter on a percentage formula basis among the Municipalities and with said portion to be paid as hereafter set forth. Any future member municipality accepted as a member shall pay the amount allocated to such future municipality on the percentage formula basis determined at the time of such members admission to the ISC, regardless of the time of year in which said municipality becomes a member of the ISC, unless otherwise directed by the

ISC. Such yearly compensation shall include the cost to administer this ISC and for such other costs incurred by the ISC to carry out the purposes of the ISC including, but not limited to, the hiring of consultants. The percentage formula basis upon which the annual costs are to be shared by the Municipalities was developed by the Environmental Finance Center and is based on population, stream length, and impervious surface, resulting in the following breakdown of annual cost:

Allegheny Township	13.04%	$13,040.00
Altoona City	37.27%	$37,270.00
Antis Township	5.22%	$5,220.00
Bellwood Borough	1.63%	$1,630.00
Blair County	0.56%	$560.00
Blair Township	5.87%	$5,870.00
Duncansville Borough	1.96%	$1,960.00
Frankstown Township	6.37%	$6,370.00
Freedom Township	2.56%	$2,560.00
Hollidaysburg Borough	7.86%	$7,860.00
Logan Township	17.66%	$17,660.00
Total	100%	$100,000.00

B. Time of Payment of Costs. Each member Municipality shall pay their share of any costs, set forth in this Agreement on at least a quarterly basis with the first such payment to be paid not later than the 31st day of January 2017. In order for a Municipality to be able to cast a vote on the ISC, the Municipality shall have first paid in full any invoice received pursuant to the Agreement within the time set forth in the invoice for payment to be made. In the event a Municipality fails to pay any such invoice in full by the time required, such Municipality shall not be entitled to vote until such invoice is paid in full and any such shortfall shall be distributed among those Municipalities who have made such payment in the same proportion as payment of cost are allocated in this Agreement. Once such defaulting Municipality makes such payment, the same shall be distributed to those Municipalities who made such payment on behalf of the defaulting Municipality on the same basis as the payment was made. In the case of future member municipalities which join other than on January 1, said costs shall be paid to the ISC in the amount and at the time which the ISC directs by written notice to the municipality requesting membership.

6. Additional Revenues. Any and all revenues received by the ISC or by a Municipality or other entity on behalf of the ISC, from whatever source derived, including but not limited to grant funds, shall not be used to offset any amounts due by the Municipalities but instead shall be used by the ISC to fund such undertakings deemed appropriate by the ISC.

7. Term of Agreement. This Agreement shall commence on the 1st day of January, 2017, and shall continue to be in effect until the 31st day of December, 2018. This Agreement may be renewed upon the ISC receiving a resolution of the governing bodies of a Municipality indicating the terms and conditions of such renewal. In the event a Municipality does not supply such a resolution to the ISC by December 1, 2018, the Agreement as renewed shall not include any such Municipality as a member and such Municipality shall not be entitled to the benefits nor be encumbered with any duties as set forth in any such renewed agreement. This Intergovernmental Stormwater Committee Agreement is adopted pursuant to the Intergovernmental Cooperation Law of the Commonwealth of Pennsylvania, found at 53 Pa. Stat. Ann. §2301 et seq., and each member Municipality, whether initial or future, shall take all necessary steps under said statute to comply with the same, including but not limited to the enactment of an ordinance to approve this Agreement. This Agreement may not be terminated without the written agreement of all the Municipalities a party hereto.

8. Entire Agreement. This Agreement constitutes the entire contract by the parties hereto, and there are no other understandings, oral or written, relating to the subject matter hereof. This Agreement may not be changed, modified, or amended in whole or in part except in writing, signed by all the parties hereto.

9. Binding Effect. This Agreement and all of its terms and conditions shall extend to and be binding upon the parties hereto and upon their respective heirs, executors, administrators, successors and assigns.

10. Governing Law. This Agreement shall be governed by the Laws of the Commonwealth of Pennsylvania.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first above written.