Saw Mill Run
TMDL Strategy

For NPDES Permit No. PAI136133

DRAFT FOR PUBLIC COMMENT

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Pittsburgh Water and Sewer Authority
1200 Penn Ave, Pittsburgh PA 15222

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Attachment: PWSA/HMM Integrated Watershed Management Plan Draft Work Plan (20 Pages)

Section 1 General Information

1.1 Summary of TMDL Strategy

The Pittsburgh Water & Sewer Authority (PWSA) has developed this TMDL Strategy in response to the February 12, 2015 letter from the Pennsylvania DEP to identify the strategies that PWSA will be employing to meet the waste load reductions required in the EPA-approved Sediment TMDL in the Saw Mill Run watershed. This TMDL Strategy is divided into three main sections. In the first section is general information on the watershed, and the TMDLs. The second section focuses on the PWSA MS4 information, and the third section identifies the PWSA plans to meet the TMDL requirements.

PWSA's strategy to implement projects and practices to reduce the pollutants associated with the TMDLs for the Saw Mill Run watershed can be summarized as follows:

1. Identify BMPs that can be implemented in the near term to reduce the sediment loads to the stream to make immediate, quantifiable, incremental progress towards the specified load reductions; and
2. Work with the other communities in the watershed to prepare an Integrated Watershed Management Plan (IWMP) that can be used to identify the most beneficial projects over the next several NPDES permit cycles to fully implement necessary pollutant load reductions to meet the various Clean Water Act requirements, including those specified in the TMDLs.

1.2 Applicable TMDLs

There are two EPA-approved TMDLs within the Saw Mill Run watershed that are applicable to the MS4s within the watershed. They are for nutrients (phosphorous) and sediments.

The *"Nutrient Total Maximum Daily Load in Sawmill Run Watershed, Pennsylvania"* report was prepared by Louis Berger Associates for EPA Region III based on the Pennsylvania DEP 303(d) listings of impaired segments of Saw Mill Run in 1996 and 2002. The designated use that was listed as impaired was for aquatic life, with Saw Mill Run designated as a warm water fishery (WWF).

The *"AMD and Sediment Total Maximum Daily Loads for the Sawmill Run Watershed, Pennsylvania"* final report was prepared by Louis Berger Associates on April 9, 2007 for EPA Region III based on the Pennsylvania DEP 303(d) listings of impaired segments of Saw Mill Run in 1996 and 2002. The designated use that was listed as impaired was for aquatic life, with Saw Mill Run designated as a warm water fishery (WWF).

1.3 Surface Waters covered by TMDLs that receive Stormwater Discharges

Hydrology in the Saw Mill Run watershed has been greatly altered over time. The main branch of Saw Mill Run has been channelized to run parallel to roads and railroads (Figure 1-1). Much of the stream's banks have been reinforced with concrete or rock filled gabions, and there is very little connection to a natural floodplain. Several of the tributaries of Saw Mill Run have portions that are enclosed in piped systems, although many of them still have sections where there is a defined riparian corridor. Throughout the watershed, there is significant commercial and residential development adjacent to the streams.

In compiling the data for this project, the two primary hydrology data sets reviewed were Allegheny County's stream network and the USGS National Hydrology Data (NHD) high resolution stream network, which are shown together in Figure 1-1. The County's stream layer

was found to be more extensive than the NHD stream network and also follows the streamline more precisely compared to the aerial imagery. The County's stream layer includes 26 miles of stream length while the NHD only includes 20 miles. In both data sets, the stream network is shown as segmented due to the many areas where the streams are enclosed in culverts or storm sewers, although the segmentation is not entirely consistent between the two data sets.

The Allegheny County's stream network layer shows a number of smaller tributaries that are not shown in the USGS NHD stream network. Many of them may be non-perennial streams, with highly variable intermittent flows in response to precipitation and runoff. Because the PADEP uses the National Hydrography Dataset (NHD) hydrology geography dataset to define the Saw Mill Run stream segments, the water bodies that are covered by the TMDLs noted above include the Saw Mill Run main stem and major tributaries shown in the NHD stream network in the map below.

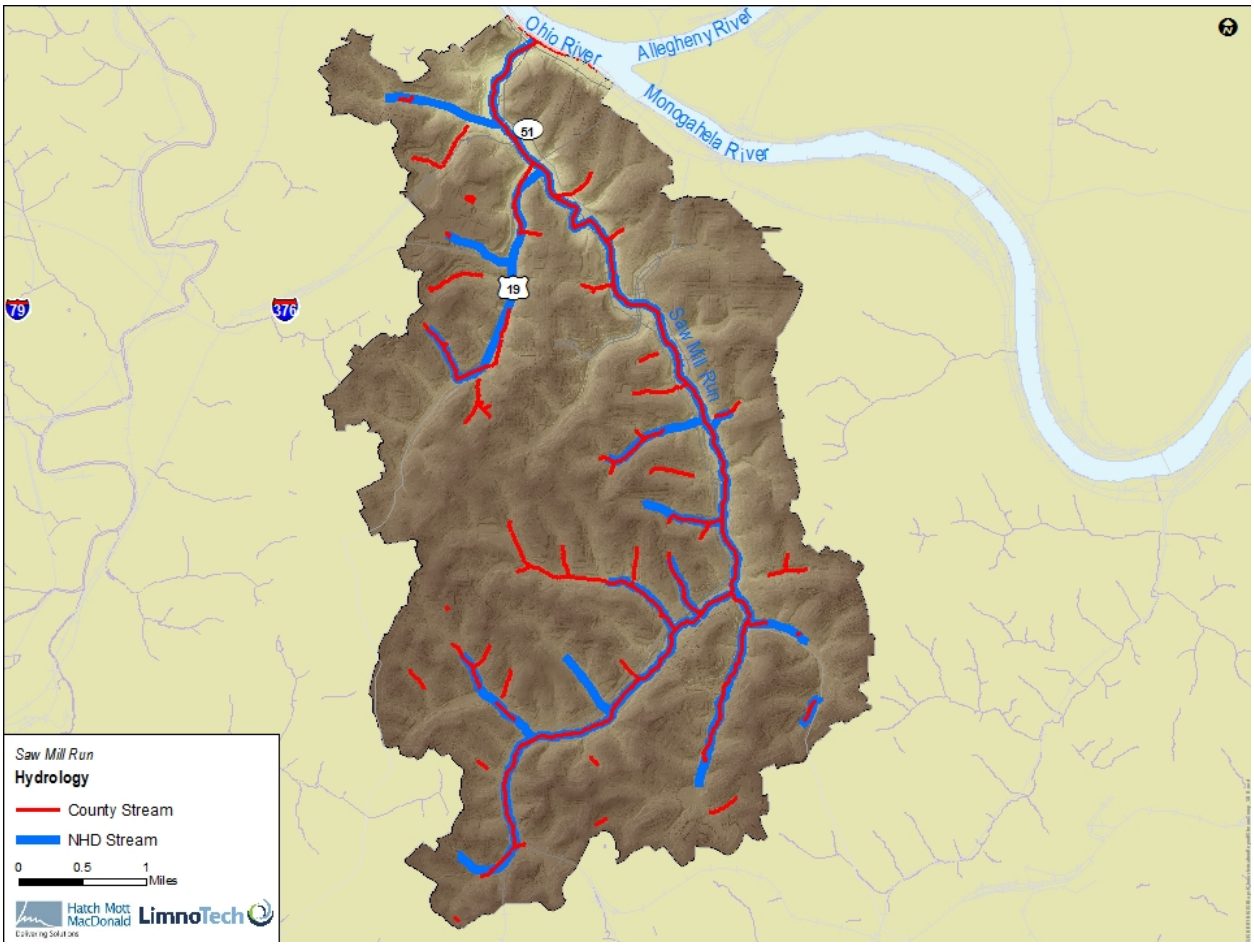


Figure 1-1 Comparison of Stream Hydrography Data Sets

1.3.1 Impaired Waters in Saw Mill Run Watershed

The PADEP GIS layer of impaired waterways listed on the 2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report – which meets the requirements of both section 303(d) and 305(b) of the Clean Water Act – was compiled for the Saw Mill Run watershed. PADEP uses the National Hydrography Dataset (NHD) hydrology geography dataset to define the Saw Mill Run stream segments, and all of the stream segments shown in the watershed are

listed as impaired. The seven impairments, shown together on Figure 1-2, are grouped in three different categories for display purposes. The left panel shows the Nutrients, Low Dissolved Oxygen (DO)/Biochemical Oxygen Demand (BOD), and Organic Enrichment/Low DO impairments. The Nutrient and Low DO/BOD impairment is limited to the main stem of the Saw Mill Run while the tributaries and the upper reaches of the main stem of Saw Mill Run are listed for the Organic Enrichment/Low DO impairments. CSOs have been identified as a source contributing to all three of these impairments.

The middle panel shows the streams segments that have Water/Flow Variability, Habitat Modification, and Siltation impairments. These impairments are interrelated (e.g. habitat can be affected by siltation and flow variability). Water Flow Variability is identified for all areas shown, while habitat modification and siltation are confined to smaller reaches. Siltation is limited to streams in the norther part of the watershed west of the main stem. Habitat modification is listed for a small portion of Saw Mill Run. CSO and MS4 sources have been identified as sources contributing to the flow variability impairment while MS4 is the primary source affecting the siltation impairment.

The right panel shows only the small stream segments on the main stem of Saw Mill Run that have been listed for Abandoned Mine Drainage (AMD) impairments.

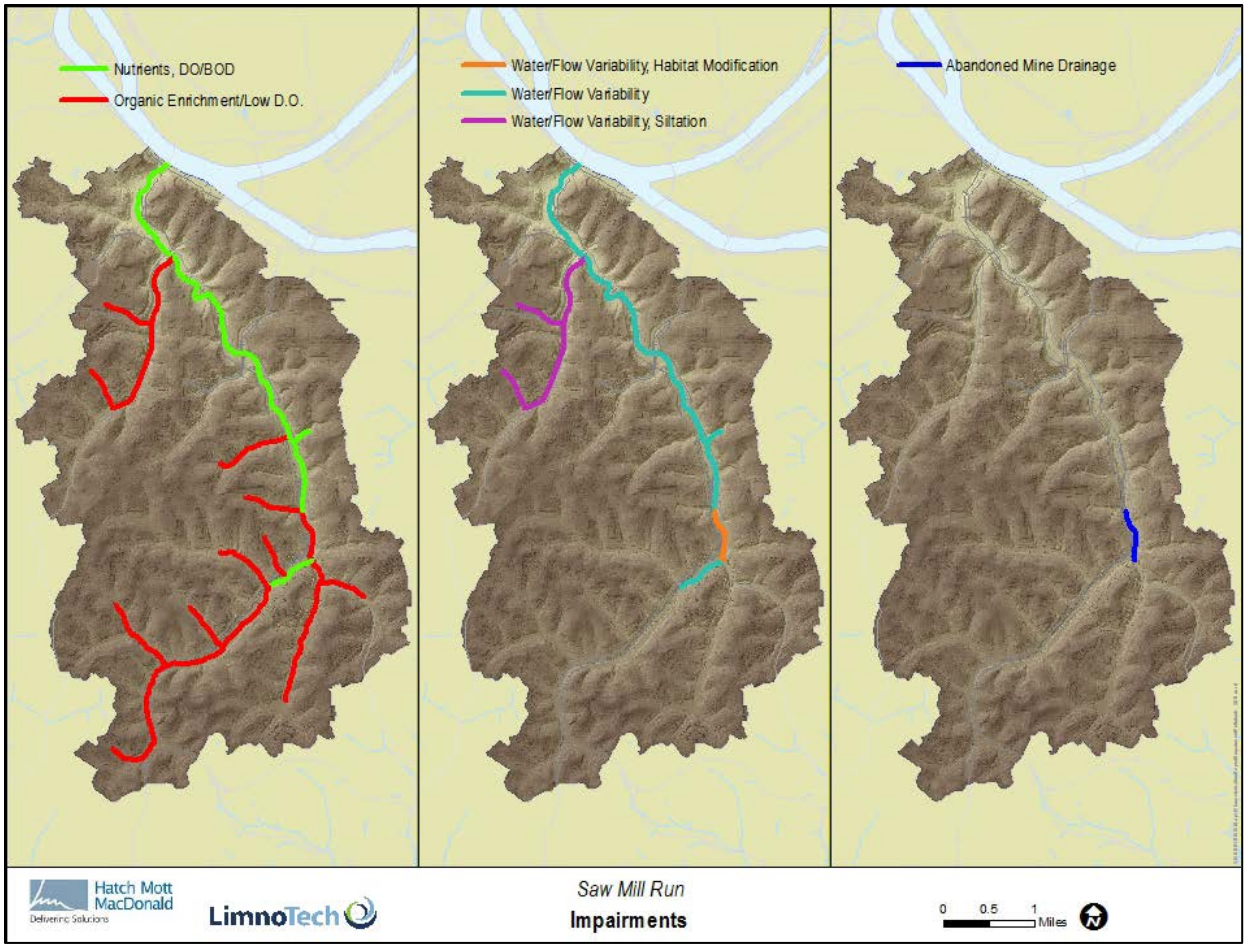


Figure 1-2 Saw Mill Run Waterway Impairments By Group

1.3.2 Identified Pollution Sources

The sources that were identified by the Pennsylvania DEP in the Integrated Water Quality List for the waters in the Saw Mill Run watershed are shown in the table below.

Table 1-1 Identified Pollution Sources

Impairment Causes	Identified Sources			
	Combined Sewer Overflow	Urban Runoff / Storm Sewers	Abandoned Mine Drainage (AMD)	Other Habitat Alteration
Nutrients	Y			
Low DO/BOD	Y			
Organic Enrichment/Low DO	Y			
Water/Flow variability	Y	Y		
Siltation	Y	Y		
Metals			Y	
Habitat Modification				Y

In the AMD and Sediment TMDL report, one significant source of sediment identified was stream bank erosion, which was estimated to contribute over 73% of the existing sediment loads to the stream. This estimate was based on an empirical formula in the AVGWLF watershed model used to prepare the TMDL. The formula is used to estimate the lateral erosion rate, and stream length was assumed based on the stream mapping. The TMDL report does not state whether the stream length used to calculate the instream erosion included the portions of the stream and tributaries that have been enclosed in pipes, or stabilized using concrete channel walls or stone-fill gabions.

1.4 Municipalities subject to TMDLs within the watershed

The municipalities that are subject to the TMDLs noted in Section 1.2 above are summarized in the table below:

Table 1-2 Municipalities Subject to TMDLs in the Saw Mill Run Watershed

MS4 Permit Holder	NPDES Permit	Sediment TMDL WLA (Tons / Yr)	Nutrient TMDL Total Phosphorus WLA (lb / Growing Season)	Municipal Area with Saw Mill Run Watershed (Acres)
Baldwin Borough	PAG136128	0.3	0.1	6
Baldwin Township	N/A[1]	17.3	5.5	318
Bethel Park Borough	PAG136147	32.6	10.5	612
Brentwood Borough	PAG136271	20.3	6.5	378

[1] No NPDES permit number based on DEP list of community requirements updated on 11/13/2015 at the following link:
http://www.keycomm.state.pa.us/portal/server.pt/gateway/PTARGS_0_2_1480787_0_0_18/Draft_MS4_Requirements_Table.pdf

Castle Shannon Borough	PAG136117	51.9	17.2	1,003
Crafton Borough	PAG136220	0.1	N/A	2
Dormont Borough	PAG136284	24.5	8.4	491
Green Tree Borough	PAG136268	14.8	5.0	292
Ingram Borough	PAG136261	0.1	0.0	2
Mt. Lebanon Township	PAG136275	84.1	25.5	1,483
Mt. Oliver Borough	PAG136242	1.5	0.5	29
Pittsburgh City	PAI136133	357.8	N/A	6,663
Scott Township	PAG136138	2.1	0.7	39
Whitehall Borough	PAG136222	61.4	19.1	1,114
Total		**668.9**	**99.1**	**12,432**

When the sediment TMDL for Saw Mill Run was prepared, the entire area within the each of the above listed municipalities was assumed to be tributary to the MS4 for that community, so the WLAs were prepared with the above assumptions.

1.5 Pollutants & Waste Load Allocations in TMDLs

The pollutants associated with TMDLs were iron, manganese, aluminum, acidity, sediment and phosphorus. There were no WLAs given for MS4s within the watershed for iron, manganese, aluminum, and acidity in the AMD TMDL. The WLAs for MS4s in the watershed for the sediment and phosphorus TMDLs are summarized in the tables below.

Table 1-3 Sawmill Run Sediment TMDL MS4 Waste Load Allocation Summary

Municipality	Existing Load (tons/yr)	Allocated Load (tons/yr)	Percent Reduction
Baldwin Borough	1.1	0.3	72.1%
Baldwin Township	62.5	17.3	72.4%
Bethel Park Borough	119.0	32.6	72.6%
Brentwood Borough	73.7	20.3	72.5%
Castle Shannon Borough	191.8	51.9	73.0%
Crafton Borough	0.3	0.1	72.7%
Dormont Borough	92.2	24.5	73.4%
Green Tree Borough	55.4	14.8	73.2%
Ingram Borough	0.3	0.1	72.7%
Mt. Lebanon Township	297.8	84.1	71.8%
Mt. Oliver Borough	5.6	1.5	72.7%
Pittsburgh City	1,299.6	357.8	72.5%
Scott Township	7.7	2.1	72.6%
Whitehall Borough	220.6	61.4	72.2%
TOTAL	**2,427.6**	**668.9**	**72.4%**

Table 1-4 Sawmill Run Nutrient TMDL MS4 Total Phosphorus Waste Load Allocation Summary

Municipality	Existing Load (lb / Growing Season)	Allocated Load (lb / Growing Season)	Percent Reduction
Baldwin Borough	2.1	0.1	95.0%
Baldwin Township	110.7	5.5	95.0%
Bethel Park Borough	213	10.5	95.1%
Brentwood Borough	131.6	6.5	95.1%
Castle Shannon Borough	349.1	17.2	95.1%
Crafton Borough	N/A	N/A	N/A
Dormont Borough	170.9	8.4	95.1%
Green Tree Borough	101.6	5.0	95.1%
Ingram Borough	0.7	0.0	95.0%
Mt. Lebanon Township	516.1	25.5	95.1%
Mt. Oliver Borough	10.1	0.5	95.0%
Pittsburgh City	N/A	N/A	N/A
Scott Township	13.6	0.7	95.0%
Whitehall Borough	387.7	19.1	95.1%
TOTAL	**2,427.6**	**99.1**	**95.0%**

The nutrient TMDL does not include a total phosphorus WLA for the City of Pittsburgh or Crafton Borough MS4 systems. No explanation is given in the TMDL report for those MS4s not being assigned WLAs.

Section 2PWSA MS4 Information

2.1 MS4 Discharge Points & Tributary Areas

The PWSA MS4 has 74 outfalls identified in the Saw Mill Run watershed that discharge to the main stem and tributaries. These outfalls were inspected in the field and surveyed between 2012 and 2013, and are shown on the map below.

Some of the outfalls identified are also overflow points from the combined sewer systems. The pipes that discharge at these outfalls serve as an overflow pipe for the CSO downstream of the diversion chamber, as well as separated storm sewers. Areas that drained to combined sewers upstream of the diversion chambers were not considered to be tributary to the PWSA MS4, since they are excluded by the definition of MS4.

The tributary areas to each of the outfalls identified above were delineated using the PWSA MS4 mapping, and a Digital Elevation Model (DEM) of the watershed. In addition to the PWSA MS4, there are other separated storm sewer systems that drain areas within the City of Pittsburgh that were not identified in the TMDL (e.g. PennDOT, Port Authority of Allegheny County), as well as significant areas that drain to combined sewers, or directly to the stream.

The areas that are tributary to the PWSA MS4 outfalls identified above are shown in the map below.

When the AMD and Sediment TMDL was prepared, it was assumed that the entire watershed area within the City of Pittsburgh was tributary to the PWSA MS4, which is not the case. The total area tributary to the PWSA MS4 is only 2,605 acres of the total of 6,663 acres of the Saw Mill Run watershed area within the City of Pittsburgh (39.1% of the area). The remaining areas

are tributary either to the combined sewer system, another MS4 as identified above, or directly to the streams.

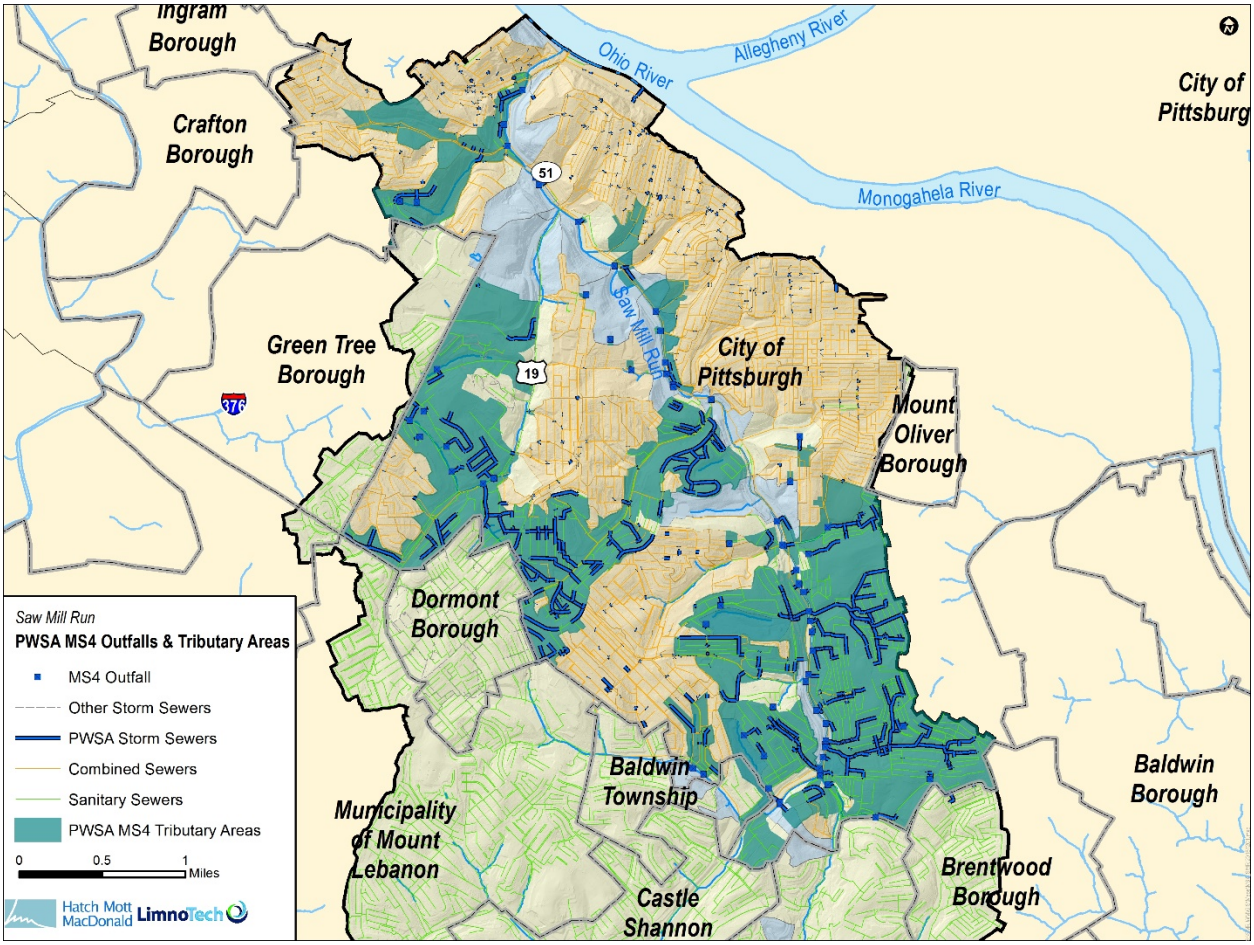


Figure 2-1 PWSA MS4 Outfalls & Tributary Areas

2.2 Existing BMPs and Estimated Load Reductions

Within the MS4 tributary areas delineated above, there is only one existing structural BMP that has been implemented to date. There is a rain garden / bio-retention cell installed on a residential property on Strachan Avenue. Since this was installed by the property owner, the design details are currently unknown, so no load reduction is assumed due to this BMP. While the relative impact of this single BMP is probably minimal, it is an important step in getting the public to participate in the process of reducing the wet weather-related impacts on the stream.

2.3 Parsed Current Pollutant Loads, WLA, & Required Pollutant Load Reductions

The TMDL for sediment was prepared using the assumption that all of the sources of sediment in the watershed are from point sources (MS4s and CSOs), and that there were no non-point sources of sediment within the watershed. That assumption means that the WLA for the PWSA MS4 assumed the entire area within the Pittsburgh City limits was tributary to the PWSA MS4, and that there were no direct drainage (nonpoint) sources of sediment (or flow) in the watershed. Based on the PWSA MS4 tributary areas outlined above, the WLAs need to be

parsed to account for only the areas within the watershed that are tributary to the MS4 PWSA system.

Based on the tributary areas delineated under Section 2.1, estimated current pollutant loads were calculated using the Land Area Approach outlined in the Pennsylvania DEP Draft Guidelines for Parsing MS4 Wasteload Allocations from TMDLs document. The resulting parsed existing loads, WLA, and the required percent reduction are shown in Table 2-1.

Table 2-1 Parsed Pollutant Loads, WLA, & Load Reductions for the City of Pittsburgh

Municipality	Existing Load (tons/yr)	Allocated Load (tons/yr)	Percent Reduction
Pittsburgh City	508.1	139.9	72.5%

Section 3Pollutant Control Strategy

3.1 Near-Term Sediment Control BMPS

In order for PWSA to make immediate, quantifiable, incremental progress towards the specified load reductions, BMPs that can be implemented in the near term to reduce the sediment loads to the stream have been identified.

1. Street Sweeping & Catch Basin Cleaning
2. Stormwater Treatment Unit at Volunteer's Field (Colerain Street)
3. Streambank Stabilization & Outfall Repairs
4. Green Infrastructure Grant Program

Further information on these BMPs is included below. PWSA anticipates beginning implementation of these BMPs during the current permit NPDES permit cycle, with further investigation and design work necessary to refine and complete the scope of work for each of them. The required Design Details will be developed and submitted to Pennsylvania DEP, and any changes in the scope will be reported at that time.

3.1.1 Street Sweeping & Catch Basin Cleaning

The City of Pittsburgh Department of Public Works (DPW) currently has a street sweeping program, but in order to remove and control sediment at its source, PWSA will work with the DPW to increase the frequency of street sweeping within the Saw Mill Run watershed, and to develop a system for documentation of the street sweeping program, including documentation of the frequency of sweeping and the amount of debris collected.

The street sweeping program will be supplemented by an annual catch basin cleaning program to ensure that the sumps in the catch basins designed to capture sediment are not filled. The target for implementation of the modified street sweeping and catch basin cleaning programs and quantification of the benefits is December 31, 2016.

3.1.2 Stormwater Treatment Unit at Volunteer's Field (Colerain Street)

There is an upland area of approximately 129 acres drained by the PWSA MS4 that is drained by a single storm sewer that runs down Colerain Street. Volunteer's Field is located near the junction of 3 storm sewers so it is a location where structural stormwater treatment best management practices (BMPs) could be installed to treat the runoff from a large tributary area. Based on the total MS4 tributary area within the City of Pittsburgh, the BMPs will be able to treat

the stormwater from 5% of the tributary area. Although specific BMPs have yet to be selected, the sediment removal efficiency of these types of BMPs can range from 75-90%, which could result in a reduction of approximately 4% of the total land-sources of sediment in the PWSA MS4 tributary area. The specific design details and locations of the BMPs will be determined and submitted with the design details, along with a detailed analysis of the estimated existing sediment loading based on the contributing land sources.

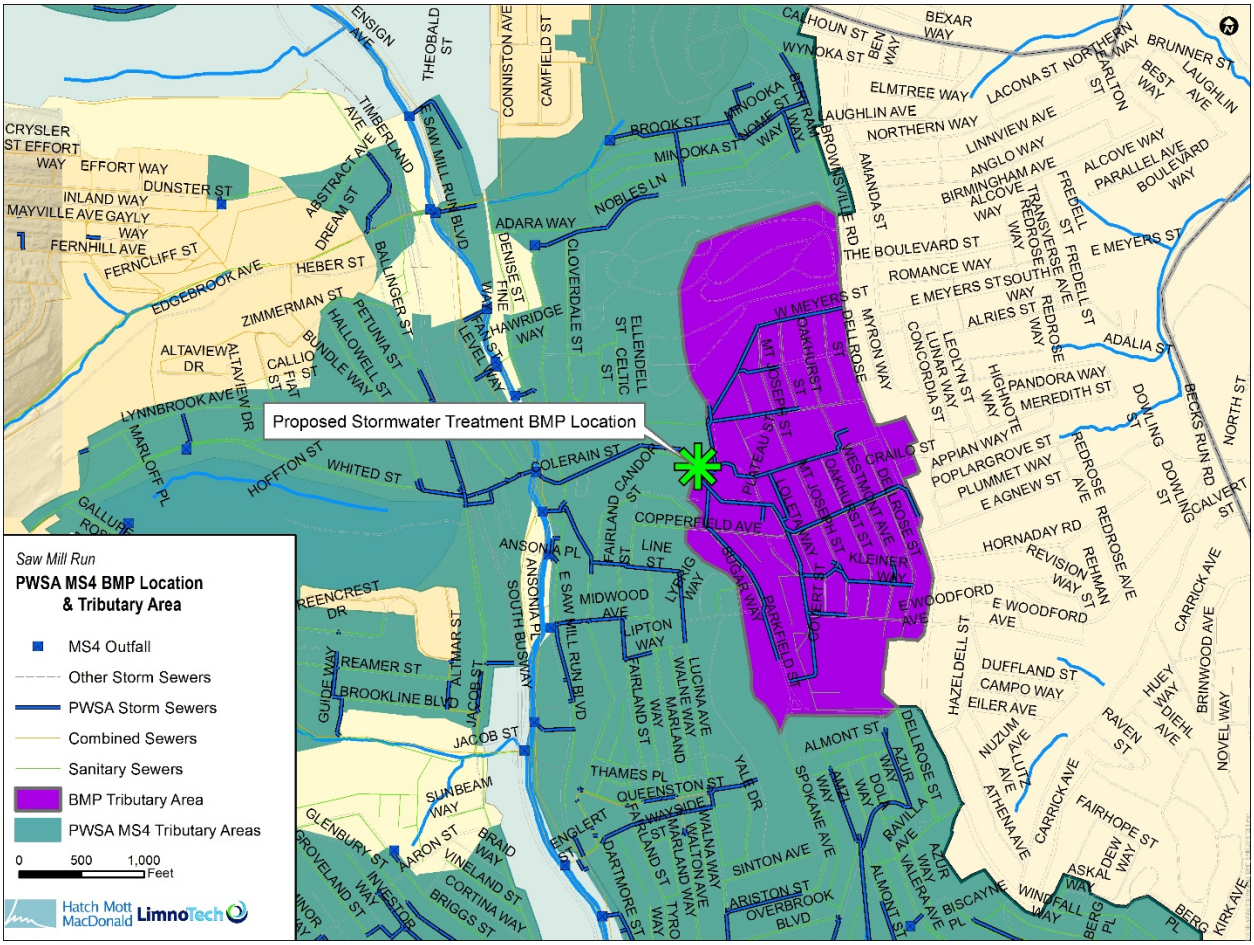


Figure 3-1 MS4 BMP Location & Tributary Area Map

3.1.3 Streambank Stabilization & Outfall Repairs

As previously noted, the largest source of sediment noted in the TMDL report was from streambank erosion. The TMDL has a waste load reduction goal of 78% of the streambank erosion in the watershed. The City of Pittsburgh will be undertaking a project in 2016 to repair an eroding section of streambank located near the West End.

In addition, to further address sediment, the City of Pittsburgh/PWSA will perform a streambank stabilization project, with a particular emphasis on selecting an MS4 outfall site(s) where there is significant erosion. As a part of the IWMP, a stream walk and field documentation of the stream conditions have been completed. The field work has been completed, but the mapping and data processing were not completed in time to include the site selection in this strategy. The site will be selected and prioritized using the following factors:

1. Severity of erosion
2. Site Access
3. Public Property & Infrastructure Protection
4. Private Property & Infrastructure Protection
5. Ability to detain peak flows upstream to reduce peak flow discharges into the stream

In repairing erosion sites, the restoration of a natural channel cross section with floodplain storage will be maximized wherever possible. In addition, the ability to detain peak flows upstream to reduce peak flow from the stormwater discharge into the stream will be considered. Site selection will be completed during 2016 and will be submitted to DEP with the Design Details. Design of the improvements will rely on the in-stream hydraulic model being developed as a part of the IWMP to ensure that the improvements are designed to withstand the shear stresses that will be encountered during high flows.

The quantification of the sediment waste load reductions as a result of this project cannot be quantified at this time, however, they will be estimated and tracked during the site selection and design to document the incremental progress towards meeting the required waste load reductions.

3.1.4 PWSA Green Infrastructure Grant Programs

Within the watershed, PWSA does not control the property or the land use over the majority of the area since it is privately owned. Without participation from private property owners to implement source controls for sediment and runoff from their own properties, meeting the waste load reductions specified in the TMDLs will be difficult in the long run. Along with the other public education and outreach activities and storm water regulations for development/re-development of private property (outlined in previously submitted Storm Water Management/TMDL Plan), PWSA has developed a green infrastructure (GI) grant program to encourage the use of green infrastructure on private property. The goals of the GI grant program are to:

- Increase the number of GI installations in the City;
- Improve water quality;
- Collect data on performance effectiveness of GI and impact on the community;
- Engage community members;
- Boost the local market for GI design and installation services;
- Increase public awareness of GI benefits;
- Stimulate economic development;

In 2015, PWSA awarded $250,000 in grants to 17 green infrastructure projects across the city of Pittsburgh. This inaugural grant program encouraged property owners and community organizations to manage stormwater. A total of 38 applications were received, and PWSA awarded 10 Mini-Grants and 7 Matching Grants. By using matching grants, PWSA was able to leverage the additional private investment to increase the use of GI across the City. The grant projects incorporated structural and educational projects that have a combined total project value of over $1 million. PWSA estimates that, when completed, these projects will manage between 3.5 and 4 million gallons of stormwater annually.

The Mini-Grant Program (grants of $1,000 - $5,000) was designed for non-profit organizations and community groups to implement projects or activities that improve water quality, enhance

conservation, restore habitat, stimulate economic growth, and educate the community about stormwater issues. This year, PWSA awarded ten mini grants of $5,000 each.

The Matching Grant Program was designed for property owners and agencies to implement larger scale projects. PWSA will reimburse up to 50% of the project's GI cost, with grants from $5,000 - $50,000. The seven matching grants awarded this year ranged from $8,000-$40,000. These were used to construct a number of different types of GI, including rain gardens, cisterns for stormwater re-use, bio-retention areas, residential rain barrels, and a green roof.

The projects in the first year of the grant program were widely distributed across the City, and none were within the Saw Mill Run watershed. However, future years of the grant program will consider environmental impacts, including TMDL implementation, as a factor in prioritizing grant awards.

Since this program is dependent on participation from the private sector, it is difficult to predict the specific waste load reductions that can be achieved within the Saw Mill Run watershed as a result of this program, either in the near-term or long-term. However, one of the goals of the IWMP described later within this document is to help highlight the importance of the stream, and use the restoration of the waterway as an economic development tool. Achieving success in the economic development within the watershed coupled with this program will help to achieve the water quality goals as well.

3.2 Long-Term Pollution Control - Integrated Watershed Management Plan

To identify the best holistic ways to comply with the multiple CWA requirements within this watershed, PWSA is working the other communities to prepare an Integrated Watershed Management Plan (IWMP). This section describes the IWMP process, and the progress on that project to date, and the expected outcomes for meeting the waste load reductions specified in the TMDL. The work plan for the IWMP is attached to this plan as well for further information on the process.

3.2.1 Overview of Integrated Planning Process

The streams in the Saw Mill Run watershed have been listed on the DEP's 303(d) list for several different impairments, including Nutrients, Low DO/BOD, Organic Enrichment/Low DO, Water/Flow variability, Siltation, Metals and Habitat Modification. The TMDLs have been prepared to address only 3 of these impairments, and the WLA in those TMDLs only address sources from permitted point sources. In addition to the TMDLs, there are other regulatory requirements for meeting the Clean Water Act (CWA) in this watershed, including CSO/SSO Controls with Consent Orders and Agreements (COAs) for multiple jurisdictions. There are various governmental entities, including multiple municipalities, PWSA, ALCOSAN, etc. responsible for meeting these regulatory requirements under a number of different permits.

The Integrated Watershed Management Plan (IWMP) is based upon the principles and elements recommended in EPA's Integrated Planning Framework and Section 208 of the Clean Water Act (CWA). USEPA supports integrated planning, which takes into account multiple sources of surface water pollution, from combined and sanitary overflows, stormwater, and other pollution sources to address their relevant regulatory requirements. The planning process identifies projects which provide comprehensive pollution abatement solutions, including the use of green infrastructure.

The IWMP for Saw Mill Run seeks to replace the traditional, end-of-pipe solution for the CSOs and SSOs in the watershed with a combination of green, gray and watershed-wide elements throughout the watershed that not only achieve PWSA's, ALCOSAN's and the municipalities' consent order & Clean Water Act requirements, but also address other water quality and quantity issues, including stormwater, in the watershed, improve quality of life and contribute to economic development, wherever possible. The IWMP will identify the pollutant sources through additional water quality monitoring and development of water quality models, identify detailed strategies to control the pollutants, and implement early demonstration projects with follow-up monitoring to demonstrate the effectiveness of the approach. The IWMP will be re-evaluated based on the results of the monitoring of the early demonstration projects, and adjusted for final implementation.

As noted above, the EPA-approved TMDLs with WLAs for the MS4s are only one of the sources for a sub-set of the impairments to the streams in the watershed, and plans to implement the TMDLs alone will not achieve CWA compliance. The TMDL requirements need to be considered along with the other regulatory requirements to plan for investment in projects that can maximize the water quality benefits across multiple sources. The IWMP provides this mechanism and will include demonstration of how stormwater runoff quality and quantity pollution can be cost-effectively addressed to maximize water quality improvements and help to achieve CWA compliance.

Although the primary purpose of the IWMP is not to apply for Section 319 grants, the IWMP will be prepared using the EPA's guidance for watershed plans, and will include at least the nine minimum elements required under that funding program, as listed below.

1. Identify the causes and sources of pollution
2. Estimate pollutant loading into the watershed and the expected load reductions.
3. Describe management measures that will achieve the load reductions and target critical areas.
4. Estimate the amounts of technical and financial assistance and the relevant authorities needed to implement the plan.
5. Develop an information/education component
6. Develop a project Schedule
7. Describe the interim, measureable milestones
8. Identify indicators to measure progress
9. Develop a monitoring component.

3.2.2 Water Quality Sampling Program

The objective the current Water Quality Sampling Program is to characterize storm water, CSO, SSO, and tributary influence on Saw Mill Run during both dry (base flow) and wet weather conditions. The Water Quality Sampling Program is designed to support the updating and/or development of existing and new watershed and surface water quality models for use in the development of the IWMP. Understanding the sources will allow PWSA and the other communities in the Saw Mill Run watershed to identify and prioritize water quality improvement projects that provide the highest impact and value to the public.

The Water Quality Sampling Program consists of four components:

1. Dry weather water quality sampling in the Saw Mill Run and its tributaries, and two reference reaches;

2. Wet weather water quality sampling in the Saw Mill Run, its tributaries, and CSO, SSO and storm water outfalls, and two reference reaches;
3. Continuous water quality monitoring sondes installed at three locations in the Saw Mill Run watershed;
4. Watershed flow monitoring at three upstream/headwater tributary locations in the Saw Mill Run watershed.

The goal of the monitoring program is to start sampling during fall 2015, and to be completed primarily within the 2016 recreation season (April – June). Monitoring and sampling locations have been selected to characterize the watershed at a sub-watershed level recognizing various political and hydrologic features, land use, and potential pollutant sources. Site selection and analytical parameters are designed to characterize stream segments and pollutant sources primarily along the main stem. The map below shows the sampling locations and the different sample types that will be included in this project.

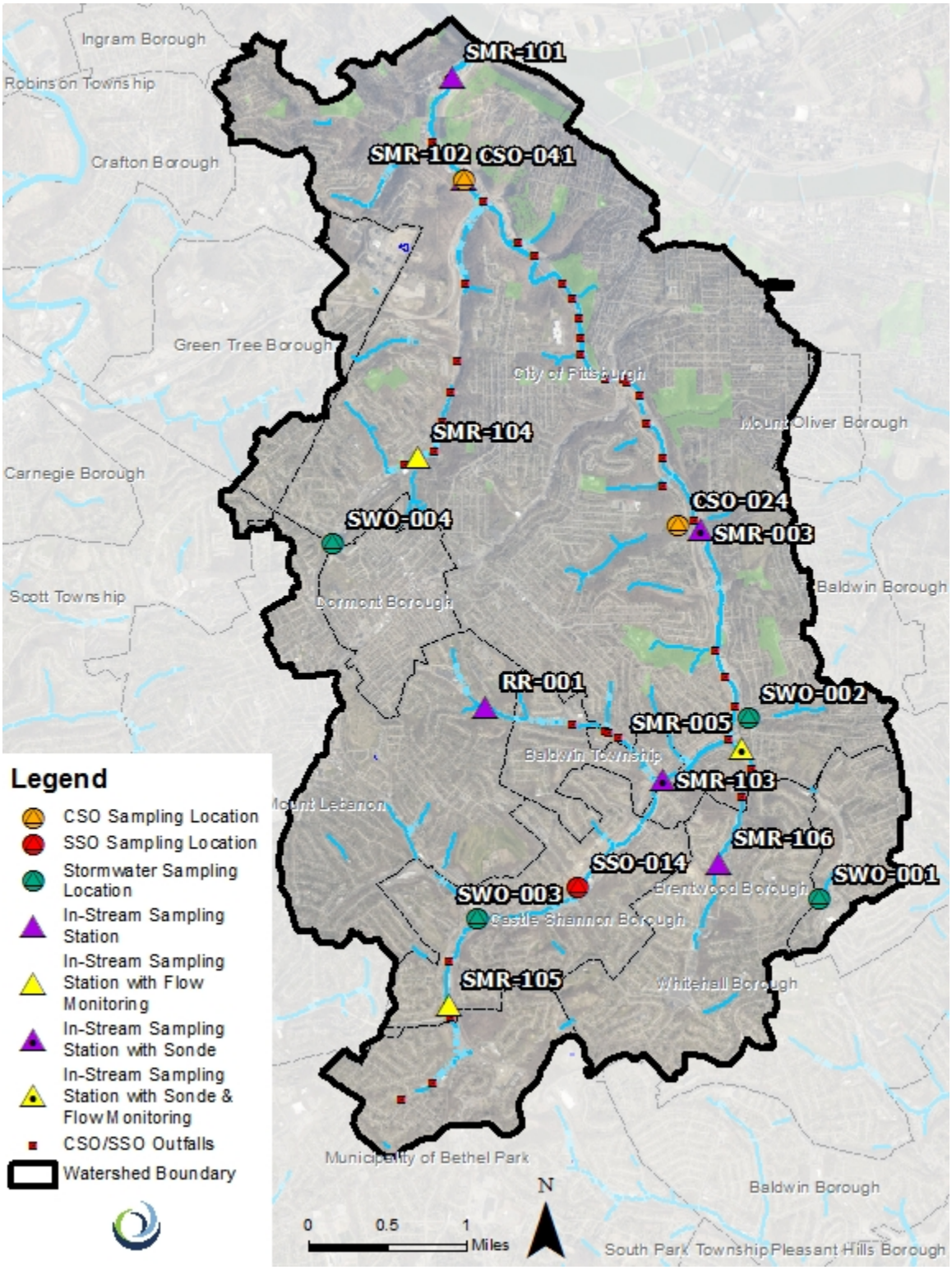


Figure 3-2 Sampling Location Map

3.2.2.1 Dry Weather Sampling

An understanding of dry weather sources and conditions is necessary to better quantify the benefits of wet weather source controls. Therefore, the objective of this task is to characterize base flow conditions in Saw Mill Run and its tributaries for the water quality model calibration and source characterization.

Collection of water quality samples will be performed for up to five (5) dry weather events for the in-stream and reference reach locations. The dry weather sampling program will begin in fall 2015, if any qualifying events can be captured, with the remainder of the wet weather sampling being performed in the spring of 2016.

Dry weather event samples shall be taken at the following locations:

- **Eight (8) In-Stream Sampling Locations:** Five (5) locations will be on the main stem of Saw Mill Run, one (1) on the Unit 37166 tributary, and two (2) on the Unit 37170 tributary.
- **Two in-stream reference reaches:** A reference reach in a nearby watershed with similar geographic and waterway characteristics has been selected for sampling to compare the nutrient, AMD, and sediment loads with those encountered in Saw Mill Run. A second potential reference reach location within the Saw Mill Run watershed has also been selected based on the County Streams GIS layer showing a stream that is not included on the PADEP list of impaired streams within the watershed.

No dry weather sampling will be taken at the storm water, CSO, and SSO outfall locations.

3.2.2.2 Wet Weather Sampling

Collection of water quality samples will be performed for up to four (4) wet weather events for the in-stream and reference reach locations, and the stormwater outfalls. The CSO outfall locations will only be sampled for up to three (3) events, since there is some existing data on the water quality of the CSO discharges from ALCOSAN's previous work. The wet weather events will span a range of precipitation, flow and seasonal conditions. The objectives of this sampling program are to:

1. Characterize water quality in wet weather sources, such as CSO, SSO and storm water
2. Characterize wet weather water quality in the Saw Mill Run and its major tributaries so that benefits of proposed control projects can be quantified
3. Provide calibration datasets for the watershed and water quality models

The wet weather sampling program will begin in October 2015, if any qualifying events can be captured, with the remainder of the wet weather sampling being performed in the spring of 2016.

Wet weather event samples shall be taken at the following locations in the intervals described below:

- **Eight (8) In-Stream Sampling Locations:** Five (5) locations will be on the main stem of Saw Mill Run, one (1) on the Unit 37166 tributary, and two (2) on the Unit 37170 tributary.

  In-stream locations will be sampled up to seven times per event at the following intervals: Hour 0, Hour 3, Hour 6, Hour 12, Hour 24, Hour 36 and Hour 48. A total of 49 samples will be collected during each wet weather sampling event. Approximately 5

additional samples per event will be collected to be used as field quality control (e.g. field blanks, field duplicates).

- **Two in-stream reference reaches:** A reference reach in a nearby watershed with similar geographic and waterway characteristics has been selected for sampling to compare the nutrient, AMD, and sediment loads with those encountered in Saw Mill Run. A second potential reference reach location within the Saw Mill Run watershed has also been selected based on the County Streams GIS layer showing a stream that is not included on the PADEP list of impaired streams within the watershed. The reference reaches will be sampled following the same protocol as the in-stream locations. A total of fourteen (14) samples will be collected during each wet weather sampling event. Approximately 2 additional samples per event will be collected to be used as field quality control.
- **Seven (7) Outfall Locations:** Sampling will be done at a mixture of stormwater outfalls, CSO outfalls, and SSO outfalls. The SSO outfall is not likely to activate, unless there is a very high precipitation event. In order to characterize the water quality of the flow from an SSO for modeling purposes, the manhole adjacent to the SSO should be sampled during one of the wet weather sampling events, preferably if there is greater than 1" of rainfall.

  The CSO outfalls will only be sampled for up to three (3) wet weather events, since there is already some data from ALCOSAN's CSO water quality sampling program from 2010.

  There are four stormwater outfall locations to be sampled, geographically distributed throughout the watershed, and each from a different MS4.

  It is assumed that each of the outfall locations will have up to eight (8) sets of samples collected for each event at the following intervals: 1st flush (as soon as overflow starts), 30 minutes, and 60 minutes, 1 per hour until hour 4, then 1 every 2 hours until the end of the discharge or eight hours of overflow, whichever occurs first. If a location is not flowing at a scheduled sampling time, no sample will be collected.

To provide robust calibration datasets for the water quality model, intensive sampling at the beginning of the storm is needed to ensure that the peak pollutant concentrations are captured in the sampling. The in-stream sampling will also be extended after the expected peak concentration so that the creek's return to base flow and/or the upstream pollutant load is also captured by the sampling program

To characterize water quality in wet weather sources, the outfall locations will also be sampled intensively at the beginning of each event to ensure that any first flush effect is captured. Additional samples will also be collected to ensure that representative estimates of water quality from each source can be obtained. Although six (6) outfalls have been identified for water quality sampling, it is important to note that not all of them will overflow during a wet weather event. Actively discharging outfalls among those identified will be sampled during each wet weather sampling event.

3.2.2.3 Continuous Monitoring Sondes

The sampling contractor will install continuous water quality monitoring sondes at three locations in Saw Mill Run as shown the sampling locations table to monitor pH, dissolved oxygen, and specific conductivity and temperature on a 15-minute frequency for an extended period (approximately 90 days) during the sampling program. The continuous monitoring

sondes will be deployed during the spring water quality sampling period (approximately March through June 2016).

3.2.2.4 Flow Characterization

The watershed runoff hydrology will be characterized through the implementation of continuous depth measurements using pressure transducers at four in-stream locations, generally near the headwaters of the stream. Pressure transducers will be deployed at the (4) in-stream locations noted the sampling locations table for the spring duration of the sampling program (approximately 90 days). The sampling contractor shall then monitor flow and velocity approximately 20 times at each location during a wide range of flows so that a rating curve relating flow to depth can be developed. The continuous recording pressure transducers will be deployed during the spring water quality sampling period (approximately March through June 2016).

3.2.2.5 Proposed Sampling Locations

No.	Waterbody	Location	Sample Type(s)	Reason for Inclusion
SMR-101	Saw Mill Run	S. Main St. Bridge over Saw Mill Run	Dry Weather Wet Weather	Downstream end of the watershed, approximately 0.3 miles from the mouth. Far enough upstream to avoid backwater from the Ohio River.
SMR-102	Saw Mill Run	USGS Gage at Minnotte Square & Woodville Ave	Dry Weather Wet Weather	Coincides with location that has flow data. Good location to confirm pollutant loadings predicted in model with data-based values.
SMR-003	Saw Mill Run	Rte. 51 bridge over Saw Mill Run. 300 ft. S of Edgebrook Ave	Dry Weather Wet Weather Sonde	TMDL Sampling Point. Downstream end of segment with AMD TMDL.
SMR-103	Saw Mill Run	McNeilly Rd. bridge over Saw Mill Run. 50 ft. NE of Library Rd.	Dry Weather Wet Weather Sonde	Main stem upstream of AMD area and confluence of major tributary.
SMR-005	Tributary – Unit # 37170	Saw Mill Run Blvd. Bridge adjacent to Rite Aid Pharmacy.	Dry Weather Wet Weather Sonde Flow Characterization	TMDL Sampling Point - Major tributary approximately 550 ft. from confluence. In AMD area identified by DEP.
SMR-104	Tributary – Unit # 37166	Carnahan Rd. bridge over tributary located 50 ft. NE of Banksville Rd. (Rte. 19).	Dry Weather Wet Weather Flow Characterization	Major tributary. Will inform characterization of loads and sources by waterbody.
SMR-105	Saw Mill Run	Smith Road bridge over Saw Mill Run (Closed). 150 ft. west of Library Rd.	Dry Weather Wet Weather Flow Characterization	Site of USGS gage number 03085160 (not currently active). ALCOSAN sampling location. Location requested by municipality.
SMR-106	Tributary – Unit 37170	Heinen Street Footbridge over Weyman's Run	Dry Weather Wet Weather	Upstream of CSO/SSO and AMD influence. Location requested by municipality.

REFERENCE REACH SAMPLING LOCATIONS				
RR-001	Tributary – Unit #37172	935 McNeilly Road driveway bridge over the stream.	Dry Weather Wet Weather	Potential reference reach located in the Saw Mill Run Watershed
RR-002	Tributary to Lowries Run	800 Wittmer Rd, McCandless, PA, 15237	Dry Weather Wet Weather	Potential reference reach in a nearby watershed
SOURCE CHARACTERIZATION SAMPLING LOCATIONS				
CSO-041	ALCOSAN CSO Outfall S-41-00	Diversion chamber in Minnotte Square & Woodville Ave (Adjacent to USGS Gage)	Wet Weather (3 Events)	CSO Source Characterization
CSO-024	ALCOSAN CSO Outfall S-24-00	Diversion chamber in Edgebrook Ave. 650 ft. west of Saw Mill Run Blvd.	Wet Weather (3 Events)	CSO Source Characterization
SSO-014	ALCOSAN SSO Outfall SMR-CS-14	Manhole located south of RR tracks near the intersection of Willow Ave and Sleepy Hollow Rd.	Wet Weather (Single Event Only)	SSO Source Characterization
SWO-001	Brentwood MS4	Outfall located at the end of Rockwood Dr.	Wet Weather	Storm Water Source Characterization Location requested by municipality.
SWO-002	PWSA MS4	Manhole located adjacent to Maytide Street east of Saw Mill Run Blvd.	Wet Weather	Storm Water Source Characterization
SWO-003	Castle Shannon MS4	MH in James Street	Wet Weather	Storm Water Source Characterization Multi-municipal culvert
SWO-004	Dormont MS4	MH in PNC Bank parking lot on Banksville Road	Wet Weather	Storm Water Source Characterization Location requested by municipality.

3.2.2.6 Analytical Water Quality Parameters

Parameter	Description	Sampling Program	Sample Type
E. coli	Escherichia coliform	Dry, Wet	Grab
Fecal coliform	Fecal coliform	Dry, Wet	Grab
TSS	Total suspended solids	Dry, Wet	Grab
TDS	Total dissolved solids	Dry, Wet	Grab
Total Fe	Total iron	Dry, Wet	Grab
Dissolved Fe	Dissolved Iron	Dry, Wet	Grab
Total Mn	Total Manganese	Dry, Wet	Grab
Dissolved Mn	Dissolved Manganese	Dry, Wet	Grab
Total Al	Total Aluminum	Dry, Wet	Grab
Dissolved Al	Dissolved Aluminum	Dry, Wet	Grab
Total Cu	Total Copper	Dry, Wet	Grab

Dissolved Cu	Dissolved Copper	Dry, Wet	Grab
Total Zn	Total Zinc	Dry, Wet	Grab
Dissolved Zn	Dissolved Zinc	Dry, Wet	Grab
SO4	Sulfate	Dry, Wet	Grab
CBOD5	5-day Carbonaceous Oxygen Demand	Dry, Wet	Grab
NH3	Total ammonia (NH3)	Dry, Wet	Grab
NO3+NO2	Nitrate plus nitrite (NO3+NO2)	Dry, Wet	Grab
TKN	Total Kjeldahl nitrogen	Dry, Wet	Grab
TP	Total Phosphorus	Dry, Wet	Grab
oPO4	ortho-Phosphate	Dry, Wet	Grab
DO	Dissolved Oxygen	Dry, Wet	In-situ
wTemp	Water Temperature	Dry, Wet	In-situ
pH	pH	Dry, Wet	In-situ
Cond	Conductivity	Dry, Wet	In-situ
DO	Dissolved Oxygen	Sonde	Continuous In-situ
wTemp	Water Temperature	Sonde	Continuous In-situ
pH	pH	Sonde	Continuous In-situ
Cond	Conductivity	Sonde	Continuous In-situ

3.2.3 Water Quality Modeling Approach

The IWMP will utilize a watershed characterization that involves both field data collection and water quality model development for waterways to assess their current conditions, and response to combined and sanitary sewer overflows, stormwater, and other sources of pollution. The following is a brief description of the proposed model framework to be used in the preparation of the IWMP.

3.2.3.1 Watershed Model:

HSPF will be used to model the hydrological processes (precipitation, runoff, infiltration and interflow) and pollutant buildup and washoff in the watershed. The watershed will be divided into subwatersheds for modeling based on the land use, soils characteristics, slopes, and other factors. The HSPF model will be used to model areas that drain to the stream either through direct drainage or through separate storm sewers.

3.2.3.2 Collection System Model

An EPA SWMM model of the CSO and seprated sanitary sewer systems within the watershed has been constructed previously for LTCP preparation and SSO elimination. The models are being updated to add further details, and to improve the model calibration to estimate the CSO/SSO volumes discharged to the stream.

3.2.3.3 In-Stream Hydraulic Model

PWSA is working with the U.S. Army Corps. of Engineering (USACE) through the Planning Assistance to the States program to develop a hydraulic model of Saw Mill Run and the major tributaries. It is anticipated that the in-stream model will be developed in HEC-RAS, and will be used to identify critical areas of flooding, and to quantify potential strategies to mitigate the flooding. In addition, it will be used to define the in-stream physical transport parameters to be used in the in-stream water quality model.

3.2.3.4 In-Stream Water Quality Model

An in-stream water quality model utilizing the WASP model will be constructed to analyze the in-stream fate and transport of the pollutants in the waterway. The model will utilize the flows and pollutant loads from the watershed and collection system models, as well as the stream hydraulics of the HEC-RAS model to be developed by the USACE.

The models described above will be calibrated using the data collected during the Water Quality Sampling Program. The models will be used to further characterize the pollutant sources, and analyze the impact of BMPs and projects on the in-stream water quality. This will help to identify projects that are the most cost effective measures to control pollutants from point and non-point sources based on the water quality impacts to the streams.

3.3 IWMP Implementation

3.3.1 IWMP Project Schedule

A summary of the schedule for the preparation of the IWMP project with the anticipated milestones is listed below:

- Kickoff: April 2015
- Data & Modeling Gap Analysis: Complete
- In-Stream Flow & Water Quality Sampling: November 2015 – late Spring 2016
- Collection System Supplemental Flow Monitoring: November 2016 – June 2016
- In-Stream & Collection System Model Updates: January 2016 – Early Summer 2016
- Early Demonstration Projects Identification: Complete first quarter 2016
- Early Demonstration Projects Design & Construction: 2016 – 2017
- Post-Construction Monitoring of Demo Projects: 2017 – 2018
- Baseline Pollution Pie Charts Complete: Fall 2016
- Optimized Level of Control & Solutions Development: Fall 2016 – Summer 2017
- Select & Rank Final Projects: Fall 2017
- Comparison against Traditional LTCP: Fall 2017
- Final IWM Plan Complete: 12/31/17

3.3.2 IWMP Project Selection Criteria

The IWMP process will include the selection of up to five (5) early demonstration projects in the watershed, to be selected in 2016, with construction schedules to be developed during the IWMP. These may be joint projects with multiple municipalities participating, and other agencies (e.g. USACE), and will be selected based on the following factors:

1. Pollutant Reduction
    a. Total Loading Reductions

   b. Types of Pollutants (single, multiple, pollutants of concern)
   c. Cost efficiency of removal
2. CSO Volume Reduction
3. SSO Volume Reduction (including Rainfall Derived Inflow/Infiltration (RDII) removal)
4. Stormwater Volume / Peak Flow Reduction
5. BMP Type - Demonstrate a particular type of BMP of interest, Structural vs. Non-structural
6. Outfall Conditions – hydromodification or bank erosion downstream of outfall
7. Partnership opportunities with other municipalities
8. Other Considerations – Economic, Social

The final weighting of all of the above factors will take into account input from the stakeholders (watershed group, other communities) as well as the public.

3.3.3 Performance Monitoring Requirements

In planning the above described initial Water Quality Data Collection program, PWSA is making a significant investment to characterize the local streams and watershed, as well as the combined, sanitary sewer systems, and separated storm sewer systems. As a part of the IWMP, PWSA has also expanded the scope of characterization efforts to encompass other watershed information such as physical and natural features, land use, and inventory of possible pollutant sources and associated pollutant loads.

PWSA will continue to build upon this investment with an ongoing water quality monitoring program to support several needs, including updates to the characterization of the infrastructure, pollutant sources, and watersheds over time; and to monitor performance of constructed controls.

This ongoing monitoring will be important to be aware of the current performance of the systems, provide valuable and useful data for the update of hydraulic and water quality models so that they can be used to inform future adaptive management decisions, and understand the impacts of different control projects (reduction in CSOs, elimination of SSOs, reduction of stormwater runoff volumes and pollutant loads).

The final IWMP will include monitoring programs specific to project performance, the sanitary and combined sewer collection systems, the MS4 systems, and watershed monitoring.

Performance monitoring plans will be included in the detailed design for the early demonstration projects in the IWMP, as appropriate, and will continue through the full implementation of the IWMP. Performance monitoring is necessary to evaluate specific watershed, green and integrated infrastructure control projects, test the effectiveness of phased controls (and aid in decisions about additional levels of control), and inform decisions about cost-effective projects in future control planning cycles. Because site-specific and cost data on these controls are needed for this location, performance monitoring may also be necessary to test the effectiveness of green infrastructure or watershed controls before decisions are made about implementation at other sites, or to inform the overall potential of these controls to improve water quality.

Performance evaluations will be based on the specific project being monitored and may include quantifying volume or load reductions, peak flow attenuation, or other volume and pollutant measures. The data will be used to update model assumptions regarding volume and/or load

reductions, as well as cost assumptions for controls considered in future planning cycles. Performance monitoring data will be included in PWSA's databases and used to modify PWSA tools, as appropriate.

Sampling plans will be developed for each control project so that monitoring may be tailored to meet specific objectives of measuring the control's performance. Example elements of a project-based performance monitoring plan to evaluate the effectiveness of the control against the expected performance include:

- Event-based influent and effluent monitoring (flow and/or water quality) of the control itself;
- Flow monitoring of the sewer system upstream and downstream of specific control project;
- Event-based watershed monitoring of waterbodies upstream and downstream of specific control project;
- Hydraulic and water quality model evaluations; and
- Operation and maintenance tracking associated with the control (e.g. sediment accumulation in basins, etc.).

Green infrastructure performance monitoring will be a critical element in the early stages of the implementation of the IWMP, and will ultimately shape the level and extent of specific strategies, as well as the overall role that green infrastructure will play in achieving PWSA's water quality improvement goals for the Saw Mill Run watershed. The primary objectives of this monitoring are to measure and document specific project and/or BMP performance and to compare this data to modeled projections. This data may also prove useful in identifying the key design parameters that impact overall performance which will then allow for better and more cost effective designs moving forward.

Monitoring efforts will be designed to determine the performance of both individual BMPs as well as the benefits of program elements such as downspout disconnection, street sweeping, catch basin cleaning, and other ongoing maintenance programs.

The monitoring will be designed to generate the data necessary to verify the performance assumptions that PWSA has incorporated into the watershed plans. For example, in instances where PWSA has estimated a percent reduction in runoff volume through implementation of an infiltration feature, PWSA will conduct influent and effluent sampling of similarly designed features at various locations throughout the study area. The data produced from this sampling effort will aid in verifying that assumed infiltration rates are reasonable and sustainable across the study area. The results from this monitoring will allow PWSA to adjust modeled infiltration rates based on local data for future watershed plans. This same approach will also be employed for water quality based BMPs, where the focus will be on verifying that modeled pollutant load reductions are realistic, for a range of BMP types. The results of this BMP specific monitoring will help PWSA evaluate the effectiveness of the pollution controls implemented.

The results of this monitoring will determine the effectiveness of green controls (BMPs) in the region. This information will help guide the selection of future projects/BMPs needed to achieve desired volume or pollutant load reductions for CSO control and water quality improvements. Critical data will include:

- Infiltration rates,

- Pollutant load reductions,
- Peak flow reductions,
- BMP/drainage area ratios,
- Maintenance issues, and
- Performance over time.

The monitoring will consist of both short term and long term monitoring schedules. Select representative controls will be monitored for extended periods of time, ranging from one year to multiple years. This type of monitoring will address questions relating to seasonal variation and long term performance. Additionally, short term monitoring and event-based monitoring will be performed on a larger number of sites, which will provide information on a wide array of practices over a large geographic area. All monitoring data will be evaluated to determine trends in the performance of various green infrastructure BMPs.

Results from the green infrastructure performance monitoring will be used to right-size the gray infrastructure components required to achieve the desired level of control for CSO controls, as well as peak flow, volume, and pollutant loading from the MS4s.

3.3.4 Adaptive Management Practices

It is anticipated that the first phase of the IWMP will contain a detailed Five-year Improvement Program, with the initial pollutant control strategies identified for the various sources (stormwater, CSOs, SSOs, watershed and in-stream sources). The IWMP will also include PWSA's watershed management program, which consists of an iterative program of characterization, monitoring, modeling, and ranking of challenges and solutions. PWSA will plan to submit updates to these plans to the DEP and EPA for approval on a regular cycle to be determined during the planning process, such as every five years, which would correspond the NPDES permit cycle renewal.

The IWMP project selection will be targeting resources on the most cost-effective controls first, while assessing the feasibility and benefits of controlling other sources through green, gray and watershed approaches. This will allow PWSA to test the effectiveness of new technologies, such as green infrastructure, for incorporation into the next cycle of watershed planning. As PWSA implements the controls identified in the first IWMP cycle, additional information will be collected to assess effectiveness, fill data gaps, refine the watershed management program, and refine the additional controls proposed in the next set of plans.

A comprehensive program of monitoring stream water quality, habitat and biological assessments, demonstration of project performance, and flow monitoring will help to identify additional problem areas and track improvements to the system. Data collected through the monitoring efforts will support the selection of goals and the prioritization process for gray, green and watershed controls in the next IWMP cycle. Data collection from pilot projects will include pre- and post-monitoring to provide performance information for specific technologies to better inform and support future plans and design processes.

As with the current IWMP project, public input and community participation will continue to shape goals and assist in the prioritization of the projects for future updates to the IWMP. In future years, public input and priorities may have an increasing role, as the initial projects are completed and additional resources and experiences are available for project selection. Also in subsequent IWMP updates, system improvements and post-construction monitoring will provide

greater understanding of remaining pollutant source reduction needs in comparison to water quality standards for public consideration.

PWSA's IWMP update process will also include the modification of operational plans to account for any long-term pollutant controls. This includes operational changes for existing infrastructure, such street sweeping and catch basin cleaning, as well as the required operation and maintenance of any new proposed projects such as inline storage structures, stormwater treatment units, or other PWSA owned facilities.

3.3.5 Regulatory Communications Plan

The IWMP will allow for further characterization of the watershed, understanding of the sources, and updated water quality data and water quality modeling. If, based on the additional knowledge of the watershed and the pollutant sources, the WLAs in the TMDLs need to be modified to take into account the new information, PWSA and the other municipalities within the watershed will notify both PADEP and EPA Region 3 of the requested modifications to the TMDLs, along with the technical data supporting any requested changes. If the additional data collection and modeling support that the WLA reductions specified by the TMDLs will result in CWA compliance, then progress towards those WLA reductions will be used as a factor in identifying and prioritizing projects in the IWMP. The goal is to have the IWMP reflect the best understanding of the water quality issues in the watershed, and to have the most effective path to compliance with the water quality endpoints identified. That will only be possible with regular communications between PWSA, Pennsylvania DEP, and EPA Region 3 about the ongoing work in the development of the IWMP.

DRAFT
Dated: 1/16/2015

Integrated Watershed Management Plan

DRAFT Work Plan

January 16, 2014

Purpose:

The purpose of this document is to identify measures to meet the CSO volume reduction requirements of the PWSA Consent Order and Agreement (COA) through an Integrated Planning approach, while selecting holistic projects that will also provide the best water quality improvements possible and maximize the benefits of the investment for the ratepayers.

This Work Plan describes the process to develop the Saw Mill Run Integrated Watershed Management (IWM) Plan. Eleven action steps are listed below to prepare the IWM Plan. The approximate watershed boundary for the Saw Mill Run IWM Plan is shown in Figure A.

Step 6 of the Work Plan identifies and evaluates specific projects to address overflow volume reduction requirements. This process will identify the optimum and affordable combination of gray, green, and watershed-based controls to address the various watershed pollution sources, including new or revised projects/measures to reduce combined overflows cost-effectively and maximize water quality standard compliance. These approaches will be designed to comply with the requirements of our COA and maximize in-stream water quality improvements within the watershed.

Saw Mill Run Watershed

# of Tributary Municipalities			12
Drainage Area	19.7 sq. miles	51% in PWSA	67% separated, 7% un-sewered
Population	106,460	54% in PWSA	5404 / sq. mile
CSO Structures	72	46 are PWSA	26 ALCOSAN
CSO TY Activations	1276	434 MG/TY	
SSO Structures	7	0 are PWSA	3 ALCOSAN, 4 Other Munis
SSO TY Activations	3	0.27 MG/TY	
TMDLs	Nutrients, Metals, AMD & Sediment. Also listed impaired due to low BOD & DO		
MS4	All Munis within the watershed are MS4 permit holders		
CD	ALCOSAN and Allegheny County under Consent Decree with EPA		
COA	All Munis under Consent Order & Agreement with DEP & ACHD		

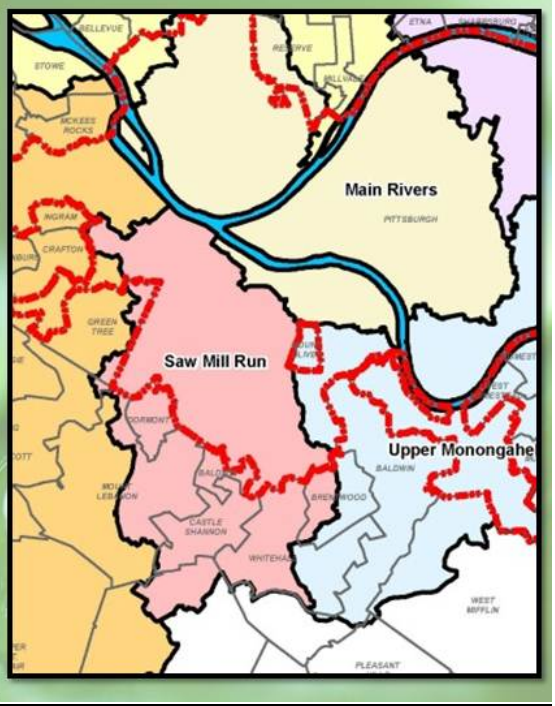


Figure A – Approximate Boundary and statistics for the Saw Mill Run Watershed IWM Plan.

Notes: TY= Typical Year rainfall events

Red line indicates PWSA's sewer service boundary

Background

The Integrated Watershed Management approach is based upon the principles and elements recommended in EPA's Integrated Planning Framework and Section 208 of the Clean Water Act (CWA). USEPA supports integrated planning, which takes into account multiple sources of surface water pollution, from combined and sanitary overflows, stormwater, and other pollution sources to address their relevant regulatory requirements. The planning process identifies projects which provide comprehensive pollution abatement solutions, including the use of green infrastructure.

For PWSA, the IWM approach focuses on cost-effectively addressing the specific obligations of the COA as well as the numerous requirements of the federal CWA. One intended result of the IWM Plan will be to prevent, when possible, PWSA spending once to construct volume-only control obligations (under the COA) and then spending again (twice or more) to meet existing (and future) water quality non-impairment obligations (under Total Maximum Daily Loads (TMDLs) and the CWA). The IWM approach has the potential to benefit both the environment and ratepayers by increasing pollution abatement and minimizing rate payer costs.

Introduction to Integrated Watershed Management

What is meant by an Integrated Watershed Management Approach?

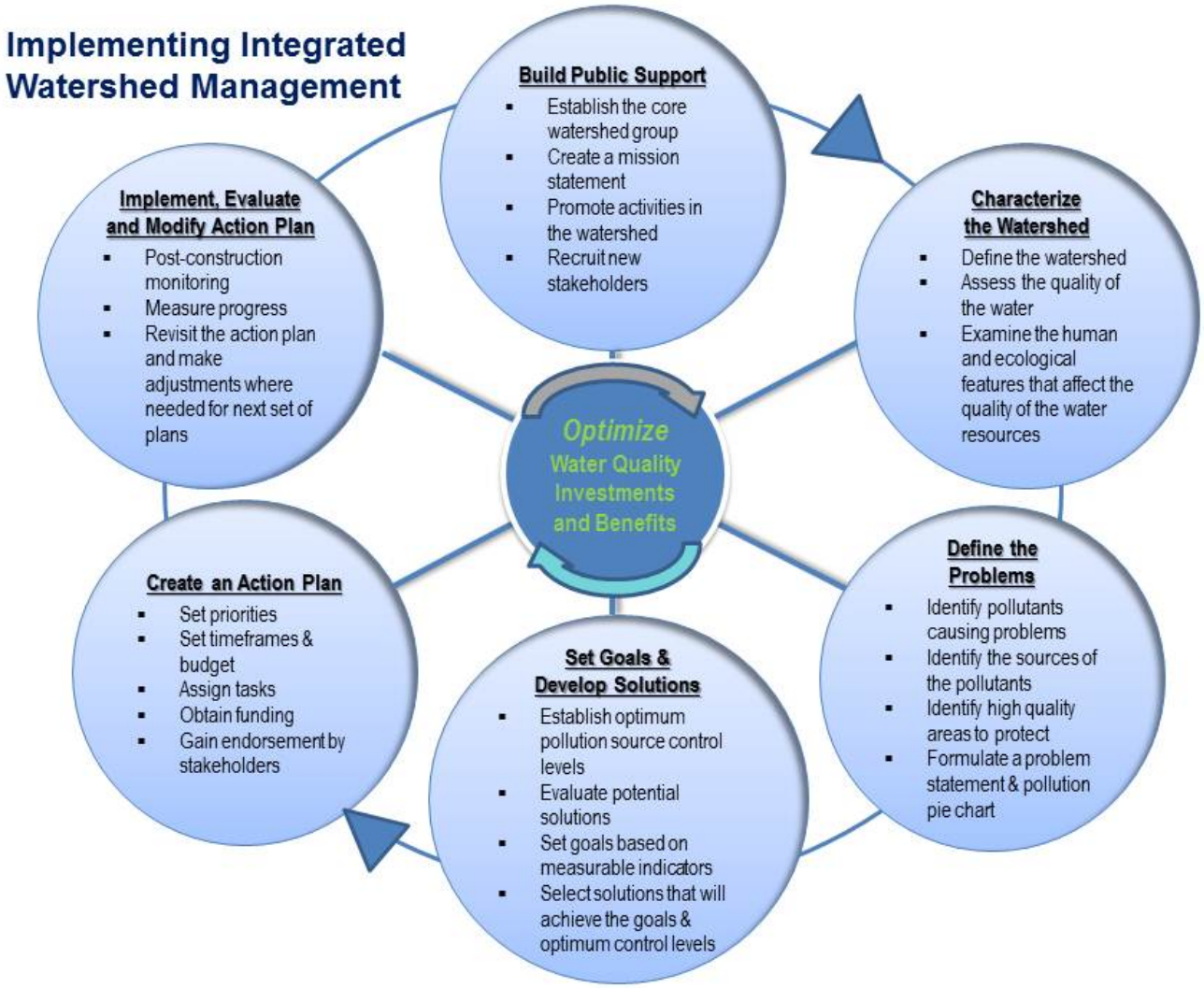
The end goal of the Clean Water Act is to maintain and restore the chemical, physical and biological integrity of the US waterways to make them "fishable and swimmable" and safe for recreation. These goals will require a long term commitment to CWA compliance investments to achieve the water quality goals and maintain long-term compliance with those goals. Sewer overflows during wet weather events—while an important source of waterway pollution—are not the only source of pollution affecting our waterways. Pollution sources such as dry weather pollution, stormwater runoff, and legacy pollutants, other than wet weather overflows are alone causing non-attainment with water quality standards. Data shows that fecal coliform levels in stormwater runoff typically far exceed recreational season criteria thresholds and urban watersheds in Allegheny County often do not meet water quality standards in dry weather.[1] As a result, controlling wet weather overflows will not achieve attainment with water quality standards unless other pollution sources are also controlled.

The principles and elements contained in EPA's Integrated Planning Framework and the CWA dictate a broad pollutant abatement program to address such water quality impairments. In fact, as an example, of an integrated planning framework developed by other States, Ohio EPA in concert with USEPA, developed a guide in 1997 to help stakeholders conduct integrated watershed management to address the various watershed pollution sources across Ohio. PWSA's IWM plan contains many of the same elements contained within this guidance example. Ohio EPA's Watershed Action Plan Guide states:

> *"The watershed approach refers to a comprehensive effort to address multiple causes of water quality and habitat degradation in a watershed. It is a process that emphasizes prioritizing problem areas and developing comprehensive, integrated solutions by involving stakeholders from both inside and outside of government."*

[1] ALCOSAN Long Term Control Plan, January 2013

Figure 1 exemplifies PWSA's IWM approach.



The IWM Plan will evaluate the various sources of pollution in a given watershed, including SSOs and CSOs, put them into context with one another, and develop the optimum combination of gray, green, and watershed-based controls on the various pollutant sources to comply with the COA. This approach cost-effectively maximizes in-stream compliance with water quality standards, watershed health improvements, and community benefits for the dollar spent.

Our IWM Plan will balance compliance with the requirements of PWSA's COA and our CWA obligations with achieving faster and more comprehensive water quality improvement for the community, county and region. See Figure 2 below.

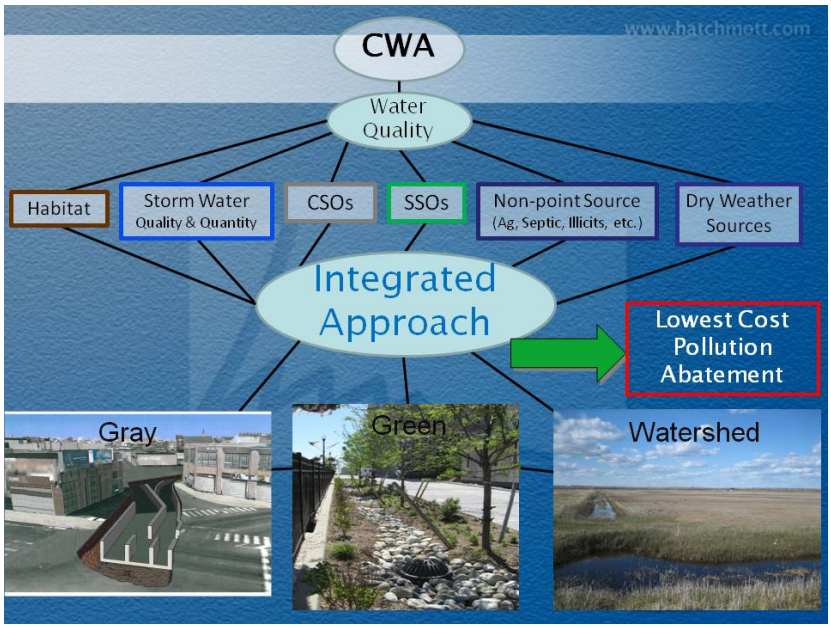


Figure 2. *Integrated Watershed Management results in the lowest cost pollution abatement while also providing faster and more comprehensive water quality improvement for our community, county & region.*

IWM Work Plan Action Steps

The Work for the IWM Plan will be based upon USEPA's Integrated Planning Framework, the principles espoused in Section 208 of the CWA and will generally follow the process identified in Figure 1 consisting of the following major action steps:

1. **Public Outreach & Involvement [Led by Economic Development South & PWSA]**

   A comprehensive stakeholder involvement and decision-making process will be developed and implemented throughout the duration of the IWM process. For example, political jurisdictions and environmental stakeholders in the Saw Mill Run watershed will be invited to attend workshops to learn about the IWM Plan to be developed within their communities, share information, and gain agreement on participation on a steering committee to help shape and accomplish the IWM Plan.

   Other key elements of Step 1 of the IWM Plan are:

   - Regular meetings during the IWM Plan development to inform and gain input and consensus on the findings, outcomes and overall direction of the IWM Plan.
   - Reviewing, helping to develop/shape, and endorsing the IWM Plan work plan and scope of work.
   - Meeting to identify the problem areas, known pollution sources, and available data within each of the political jurisdictions.
   - Identifying priorities to be used in project selection and ranking.
   - Helping select and rank specific projects.
   - Identifying external funding sources where appropriate or necessary.

2. Watershed & Source Characterization [PWSA/PM Team with Support from Outside Consultants]

Step 2 will identify the water quality and key pollution sources in the watershed. This information can then be used to determine which projects can best meet COA obligations *and* also meet CWA obligations. Utilizing existing and new water quality data and overflow information, relevant pollutants and impairments in the watershed will be identified and characterized as described below:

a. Identify impairments and/or other adverse impacts in the waterways in order to answer the question: Why is the waterway not meeting Water Quality Standards (WQS) (e.g., combined overflow-based bacteria levels are too high, metals are toxic to biota, flash flows are too high to support habitat, etc.)? Evaluate PWSA system and non-PWSA system contributions to WQ issues. Utilize existing water quality data collected from EPA, ALCOSAN, TMDLs, other watershed stakeholders and hydraulic and water quality models developed to identify the pollutants of concern. Identify data gaps.

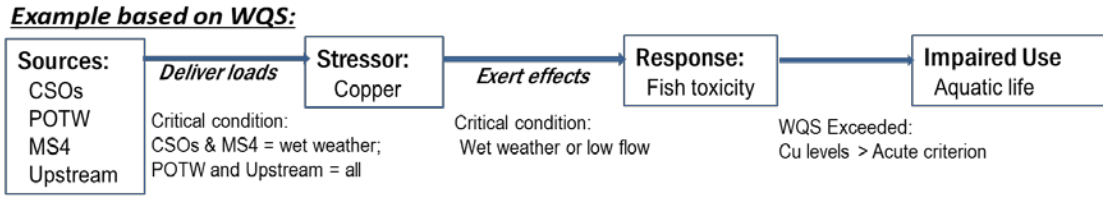
b. **[Outside Consultant]** Perform field and GIS mapping investigations to identify:

   i. Existing physical, chemical and biological integrity impairments in the watershed,
   ii. Location and extent of the various watershed pollution sources for the identified pollutants of concern, including, but not limited to:
   iii. Point sources: CSOs, SSOs, stormwater discharges, septic systems, legacy pollutants (industrial, commercial, acid mine drainage)
   iv. Non-point sources: Localized and larger extent overland flooding, stormwater runoff via sheet flow, acid mine drainage, etc.
   v. Record all data collected in a geodatabase within GIS.

c. Prepare and perform in-system, in-stream and outfall monitoring and water quality sampling programs as needed to supplement/fill-in gaps in data. **[Outside Consultant]**

d. Update the calibration and validation of available existing hydraulic and water quality (both watershed and in-stream) models and build new models, where needed, to meet industry standards to reflect the collected water quality and flow data. **[PWSA/PM Team]**

e. Identify pollution parameters of concern and other stressors to the watershed system in order to answer the question: What pollutants in the waterway don't meet WQS or threshold criteria? Evaluate PWSA and non-PWSA pollutant contributions to WQS issues. See Figure 3. **[PWSA/PM Team]**



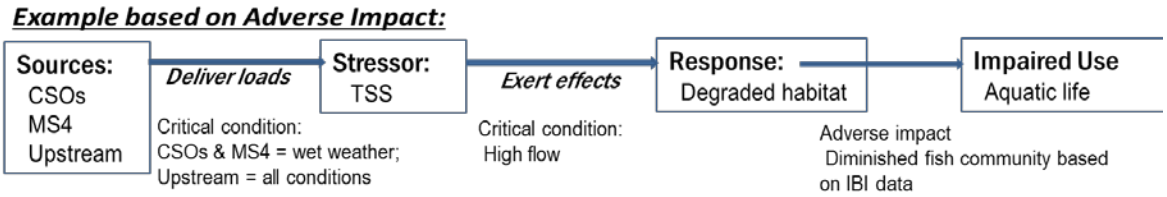


Figure 3. *Watershed Characterization to identify Pollution Sources & Impacts.*

3. Identify Pollution Sources in Local Waterways [PWSA/PM Team]

Step 3 identifies the primary potential pollutant sources and their relative loadings in order to answer the question: What does the waterway's pollutant pie chart for each pollutant of concern look like? This step will be performed in conjunction with Step 4 described below.

Next, relevant pollution sources are then further examined to rank their individual water quality impacts. See Figure 4 below.

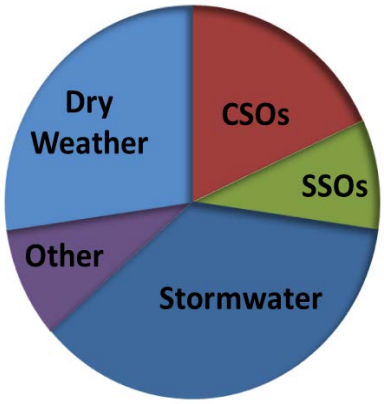


Figure 4. *Pollutant Sources of Concern Pie Chart based on pollutant loadings to waterway.*

4. Evaluate Collection System Response & Waterway Response [PWSA/PM Team]

Step 4 confirms that the hydraulic and water quality models developed in Step 2 meet calibration and validation industry standards, and that sufficient in-system and in-stream data has been collected for sound decision-making.

The hydraulic and water quality models will be used to determine the flows and overflows in the sanitary and stormwater collection systems and the associated inputs into the water quality models. The watershed models will also provide the other pollutant source contributions to the in-stream water quality models. The water quality models will be run with the inputs from the collection system and watershed models to understand the baseline (current) effects on in-stream water quality standards compliance and the impacts that relevant pollutant sources are having on the waterway and aquatic environment.

This step will confirm and establish the relative importance and contributions of the pollution sources (both PWSA and non-PWSA sources), their relative contribution to in-stream WQS

exceedances, and their relative contribution to aquatic environment impacts. This analysis will identify critical conditions affecting waterway and watershed sources in order to answer the questions: What conditions is the waterway most sensitive to and what are the associated sources? Remaining data gaps identified with this work will be assessed and supplemental data collected when appropriate.

5. Source Context & Select Optimized LOC for each Pollutant and Source [PWSA/PM Team]

Once the sources of pollution and their relative impacts are known, these sources can be put into relative context with one another, including CSOs and SSOs. The optimum level of control for each pollutant and pollutant source will be identified. For example, pollutants such as Bacteria, Nutrients, TSS, Temperature, Habitat loss, etc., and the associated sources, such as CSOs, SSOs, stormwater runoff quantity and quality, dry weather sources, legacy pollutants, etc., impairing the waterway can be compared to determine the optimum level of control to maximize compliance with in-stream water quality standards or in-stream target concentrations (if no water quality standard currently exists).

An IWM approach can effectively select the required level of control for each pollutant source, where the remaining pollutant source discharge would not cause or contribute to in-stream water quality standard or target concentration exceedances, in order to maximize water quality improvements and compliance with in-stream WQSs.

This analysis is performed for each pollutant source and pollutant impairing the waterway. Using the in-stream sampling data and the water quality models, with and without background sources, the more stringent level of control is selected. For each pollutant source and pollutant impairing the waterway, the water quality analysis consists of three steps:

1) Run the models with all sources of pollution (with background sources) (assume, however, that SSOs have been eliminated). Evaluate the control level for the selected pollutant source where “no additional water quality benefit” occurs due to the pollutant loads from other sources;
2) Run the models with ONLY the pollutant source, such as CSO overflows, (without background sources) and evaluate the control level where “water quality standard compliance” occurs; defined as remaining pollutant source discharge would not cause or contribute to in-stream water quality standard exceedances; and
3) Compare the levels of control identified from Step 1 and Step 2 and select the highest (e.g. most restrictive) level of control.

This analysis is performed for the various pollutants impairing the waterway, such as Bacteria, Nutrients, TSS, Temperature, metals, Habitat loss, etc., and the associated sources, such as CSOs, SSOs, stormwater runoff quantity and quality, dry weather sources, legacy pollutants, etc.

The results of this step are a listing of the optimal level of control for each pollutant source.

6. Identify Cost-Effective Gray, Green & Watershed Controls

[Guidelines & Methodologies for analysis to be developed by PWSA/PM Team.] [Cost-effective controls identification & analysis by Outside Consultant.]

Outside Consultant work to include:

A. Identify various potential gray, green, and watershed projects to meet the identified optimum control level(s). PWSA through the data collected above and hydraulic and water quality modeling will determine the optimum level of control for each pollutant and source to meet the goals of the IWM project and will provide this data to the Consultant.

B. Prepare cost estimates of the identified controls based on site evaluations and other local factors. PWSA will establish standard protocols and procedures for cost estimates preparation by the selected Consultant.

C. Control selection and costing shall be coordinated with planned public works projects in each municipality.

D. PWSA will perform modeling of the identified projects to confirm final sizing to meet the project goals and coordinate with the selected Consultant.

E. Determine the triple bottom line benefits of the identified controls, including social and environmental benefits. PWSA will provide a list of various TBL benefits and the selected consultant(s) will work with PWSA to develop a methodology for quantifying the TBL benefits for each selected control or groups of controls.

Once the optimum level of control is determined for each relevant pollutant source in Step 5, then the range of gray, green, and watershed-based projects can be identified to reduce the extent and duration of pollutants in order to ultimately achieve the optimum level of control identified. These projects are identified not only to maximize in-stream WQ benefit but also to impart community and triple–bottom line (TBL) benefits. Community & TBL benefits will include, but not be limited to:

- ✓ Reducing public health risk,
- ✓ Flooding, Basement Backups Reduction,
- ✓ Ecosystem restoration & recreational opportunities creation,
- ✓ Enhancing public access to urban waters,
- ✓ Enhance economic growth & local job creation, and
- ✓ Beautifying & Increasing property values in neighborhoods.

The final list of community and TBL benefits for this analysis will be developed jointly with the stakeholders as identified in Step 1. Developing these benefits will involve active stakeholder input as part of this process.

The range of projects will also incorporate financial cost-effectiveness to identify high and low cost-to-benefit projects.

A large variety of potential projects will be identified in the IWM Plan. Among the categories of such projects are the following, with a more detailed list attached as Attachment 1.

- ✓ Focused sanitary and storm collection system improvement projects such as:
  - I/I Reduction at same time as structural renewal
  - Illicit (sewage) discharges identification and removal
  - Flooding & Basement Backup Solutions
- ✓ Creek and River water intrusion prevention
  a. Green infrastructure & source control projects, such as bioretention, green streets, downspout disconnection, etc. Projects to include Green Boulevard (in the valley) projects and Green Umbrella (in the uplands) projects within the watershed.
- ✓ Constructed wetlands
- ✓ Other Source Controls
  - ✓ Dry Weather Sources
  - Legacy Pollutants
  - Possible WQ Trading opportunities
- ✓ Large Scale Gray Infrastructure to balance the above identified projects with the remaining volume reduction requirements to meet the CSOs in accordance with the COA.

Initial projects will be identified and the capital and operating cost estimates and community and TBL benefits will be developed. Projects <u>that control CSOs, SSOs, stormwater, dry weather sources, and other pollutant sources</u> can then be <u>equitably</u> compared and ranked against one another based upon common metrics such as <u>increase in in-stream water quality standards compliance, increase in attainment of in-stream target concentrations, volumetric pollutant abatement reductions, and other environmental related benefits</u>.

To evaluate multiple projects, graphical tools will be used to chart/plot the relative water quality benefits associated with addressing each pollutant source and a comparison of each project's pollutant reduction benefits as they relate to in-stream water quality and volume reduction. These types of methods will be performed in order to assist in the ranking of projects. See Figure 6 below for an example.

Plots similar to Figure 6 will be made for water quality benefits associated with each pollutant source and a comparison of each project's pollutant reduction benefits as they relate to in-stream WQS compliance will be performed in order to inform project selection. For example, a project may provide a significant benefit for bacteria WQS compliance, but may provide little to no benefit for nutrient in-stream target level compliance. Whereas, another project may provide less bacteria WQS compliance, but more nutrient in-stream target level compliance.

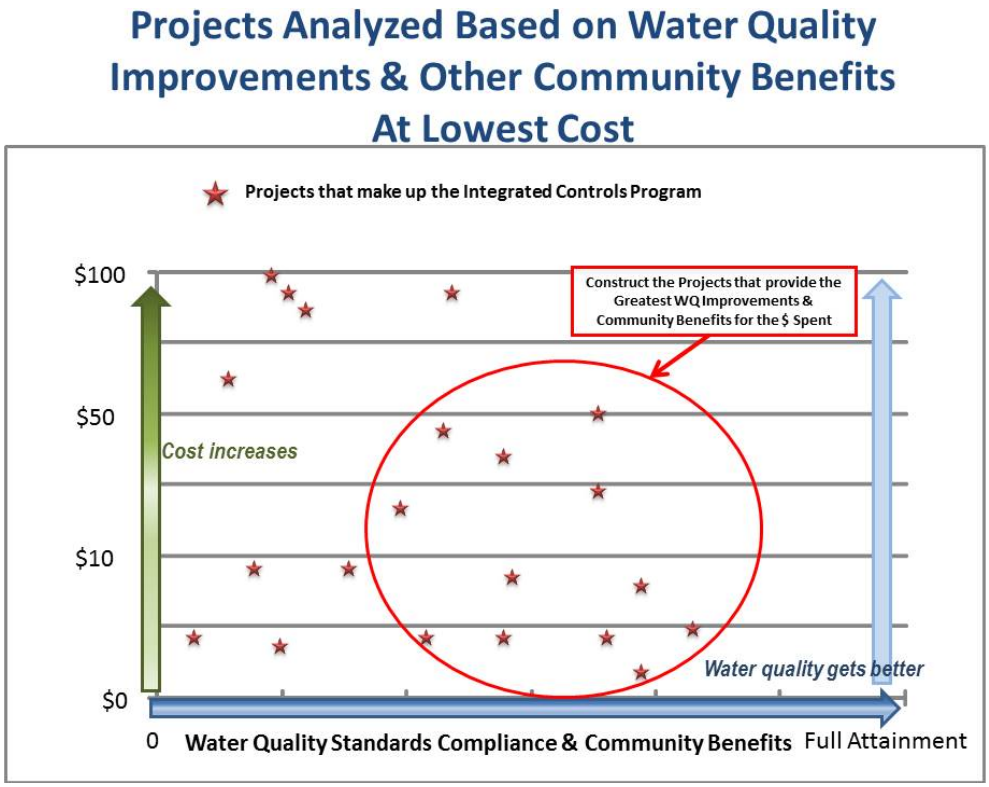


Figure 6. *Project comparison & development to identify projects that maximize improvement to in-stream water quality standards compliance at the lowest cost.*

In this manner, cost-effective high water quality benefit and community benefit projects can be identified for the watershed and ranked by cost and benefit utilizing comprehensive water quality tools. The volumetric impact of each project, or group of projects, will be determined and included in the overall evaluation. The nature of integrated watershed management planning utilizes tools such as models to regularly analyze results to ensure that resources are spent wisely and that priorities are met. A robust stakeholder involvement program will be conducted during this step and throughout the IWM Plan to prioritize projects. This stakeholder input will be used to inform the project selection process and prioritize scheduling for selected projects.

By its nature, Integrated Planning involves a comprehensive review of pollutant sources. This is highly beneficial to understand how projects relate to water quality as well as volume controls. The integrated approach will thus also identify projects to address non-PWSA sources of pollution, as described in Attachment 1.

For example, opportunities for addressing a pollutant source within a local upstream political jurisdiction may provide more water quality and community benefits and be more cost-effective than addressing a downstream pollutant source. In this case, PWSA may find it more beneficial to facilitate abatement of the upstream pollutant source in partnership with the upstream political jurisdiction. It is important to recognize though that not every political jurisdiction may receive a project within their community. PWSA also recognizes that projects developed as part of this process must meet the requirements of our COA. This analysis will also identify the source owners, impacts/benefits to the local communities, the possible governmental policies/legal strategies needed, and alternative funding sources available in order to implement the identified projects. PWSA will explore these types of opportunities in our IWM Plan so as to optimize the

watershed communities' recognition and collaboration with their "watershed partners" to improve the overall watershed water quality. Attachment 1 describes in more detail the role that the PWSA will play in collaboration with the watershed stakeholders in order to facilitate addressing the other sources of identified pollution in the waterways.

The results of this step include a listing of projects with volumetric, water quality, and community benefits.

7. Select and Rank Final Projects

[Guidelines & Methodologies for analysis to be developed by PWSA/PM Team] [Final ranking of projects based on Triple Bottom Line (TBL) benefits analyses by Outside Consultant]

Outside Consultant work to include:

Final ranking of projects based on the TBL benefits, including final modeled benefits. Hydraulic and water quality modeling work will be performed by PWSA based on the final identified and selected controls to quantify estimated overflow reduction benefits, stormwater reduction benefits, and water quality improvements. The Consultant shall merge these benefits with the other identified TBL benefits for the final project ranking and prioritization.

Step 7 will result in a prioritized ranking of projects identified in Step 6. The ranking process will use a comprehensive comparison of relevant metrics:

1. Volume control of overflows
2. Water quality impacts
3. Costs
4. Community & TBL benefits
5. Feasibility, and
6. Reliability

The projects that provide the greatest in-stream compliance with water quality standards, compliance with our COA, and maximize other watershed health and community benefits at the lowest cost will then be selected to advance to implementation first as shown in the purple curve in Figure 7 below. As compared to a traditional CSO LTCP which has a primary focus on just volumetric control, the IWM Plan incorporates a phased approach to address all environmental impacts to optimize the in-stream water quality improvements and community benefits. Figure 7 provides an insight into the benefits of integrated planning: it allows for long-term cost-effective solutions to water quality impairments, including both volume-based and water-quality based projects. This approach selects projects to balance addressing a source with relatively low volume, but relatively high water quality impairment, with projects that address a source with a high volume, low water quality impairment. The "small volume but high impact" projects would be ranked low if volume were the only or primary criterion.

The projects that provide greatest compliance with the COA requirements, address water quality standard impairment, and maximize relevant other community and environmental benefits will then be selected for project ranking. Prioritized ranking will inform scheduling of project construction.

The results from this step will allow PWSA—in cooperation with the other political jurisdictions and stakeholders—to address the most pressing public health, water quality, and environmental protection issues first while still meeting the obligations of our COA and CWA.

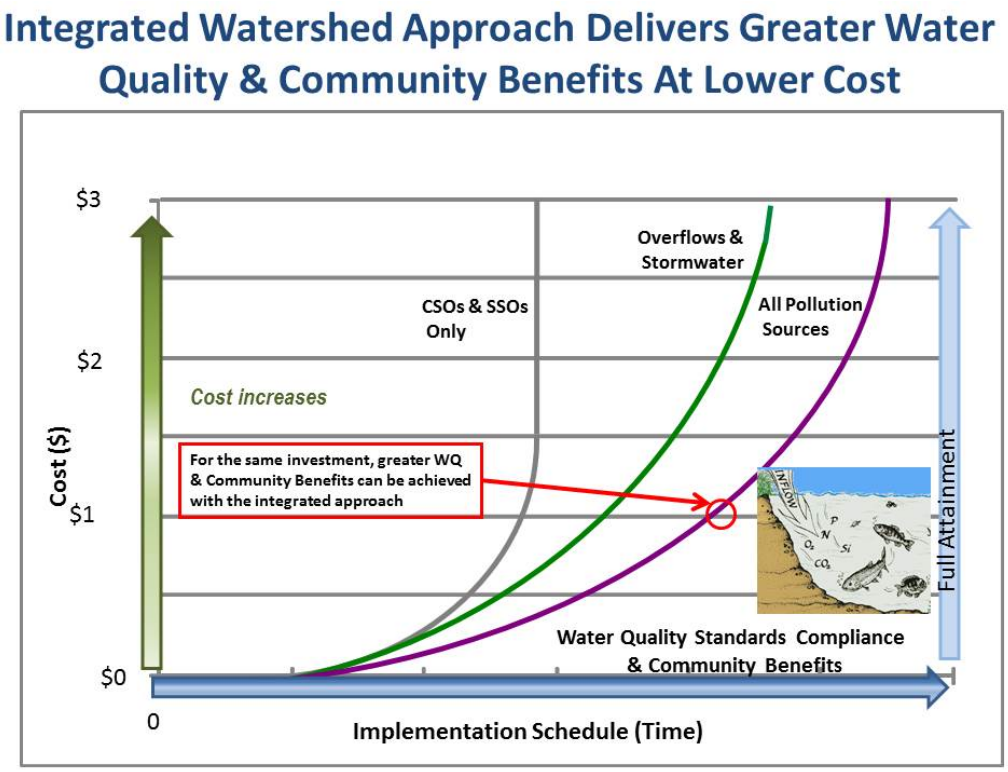


Figure 7. *An integrated watershed management plan provides greater water quality improvement and community benefits at an equal or lower cost as compared to a traditional LTCP*

8. Traditional LTCP versus IWM Plan [PWSA/PM Team]

The costs and estimated water quality improvements based upon the traditional gray Long Term Control Plan identified in PWSA's Feasibility Study will be compared to those selected from the IWM Plan. The analysis will establish comparisons between the costs and benefits of the traditional LTCP and the IWM Plan. The comparison will also consider the relative impact of the remaining pollutants—including the duration (time) and extent (miles) of water quality improvements, and the resultant need for, and prioritization of, additional abatement activities.

9. Integrated Watershed Management Plan Implementation Schedule Development [PWSA/PM Team]

Step 9 will result in the development of a proposed schedule for implementation of the IWM Plan projects being proposed for Regulator approval. The schedule will include milestone dates for Start Construction, and End Construction. The outcome will be an affordable capital program spending level and schedule for implementation of the IWM Plan projects to maximize in-stream compliance with water quality standards, watershed health improvements, comply with the COA, and provide community benefits.

As illustrated in Figure 8 below, the implementation schedule for the IWM Plan projects will be focused on performing those projects **first** that provide the most watershed water quality benefit at the lowest cost. The focus is on continuous improvement of water quality and public health over time at an affordable level for PWSA and Allegheny County's ratepayers.

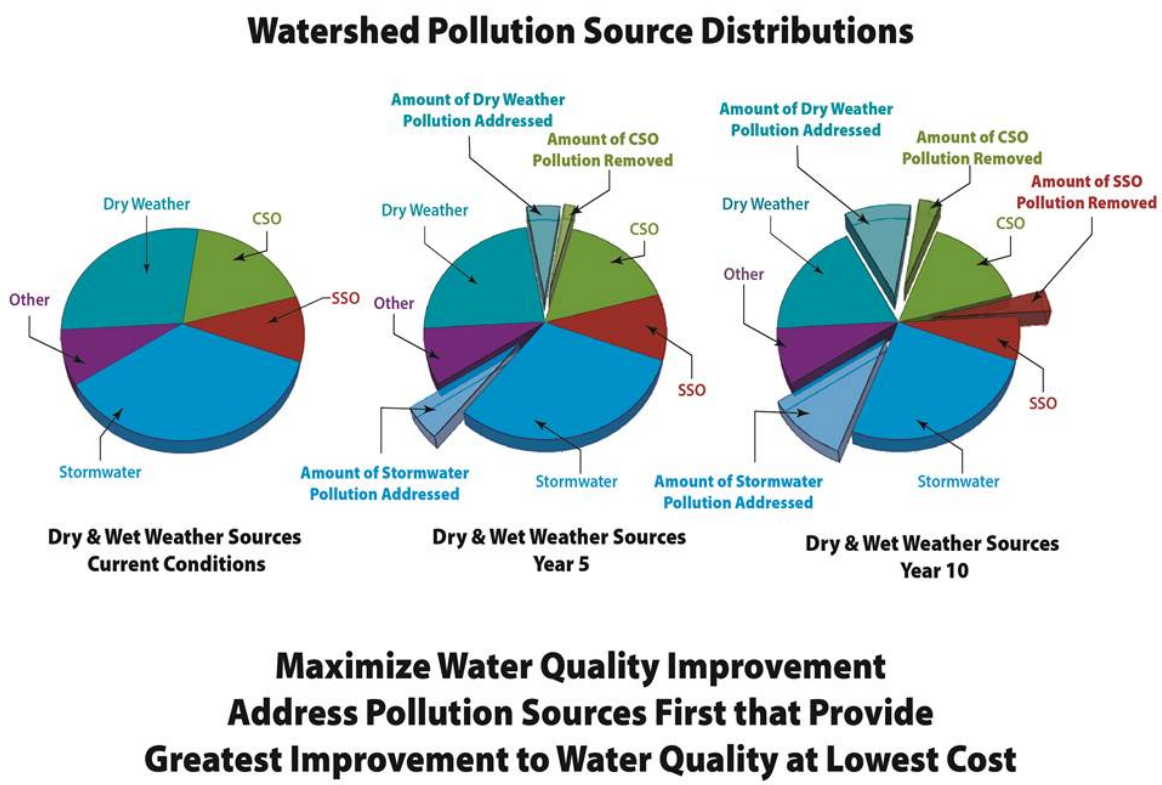


Figure 8. *PWSA's Integrated Watershed Management Plan is focused on addressing the pollution sources first that provide the greatest improvement to water quality at the lowest cost.*

10. Regular Regulator Involvement [PWSA/PM Team]

To maximize success of the IWM Plan approach, PWSA will provide updates to the Regulators at key intervals throughout the IWM Plan action steps identified above to keep them informed and help set the stage for an affordable IWM Plan that meets the COA and CWA requirements.

11. Final IWM Plan Report [PWSA/PM Team] [Technical memoranda will be provided by outside consultant and included in Final Report]

The final step will be the submission of a final report to the Regulators. The report will summarize the work conducted in Steps 1-10 above. The report will include, at a minimum, the following information:

- Watershed boundaries and relevant topographic and physical information
- Existing projects (if any) in watershed and relevant performance criteria
- Communication with political jurisdictions and key stakeholders (Step 1)
- Watershed and source characterization (Step 2)
- Pollution source identification (Step 3)
- Evaluation of collection system and watershed responses (Step 4)
- Source context and identify optimized levels of control by pollutant and source (Step 5)
- Identify and evaluate Cost-Effective Gray, Green & Watershed Controls(Step 6)
- Select and rank final projects, with recommended projects, benefits, and costs (Step 7)
- Compare proposed project(s) with existing LTCP project(s) (Step 8)
- Schedule of project implementation, including Milestone Dates (Step 9)
- Summary of communications with Regulators (Step 10)
- Summary of proposed IWM Plan projects, benefits, costs, and implementation schedule
- References

Closing

Many municipalities across the United States have entered into COAs and Consent Decrees with EPA. As a key performance component of many of the Orders or Decrees, volumetric control reduction requirements are specified. Additionally, the regulators have indicated that the ultimate requirements of the Consent Orders are to comply with the water quality-based requirements of the CWA which indicates remaining pollutant discharges shall not cause or contribute to in-stream exceedances of water quality standards. To that end, PWSA has entered into a COA that identified presumptive remedies (volumetric control). However, the COA indicates that if after complying with its requirements, there are still in-stream water quality exceedances, the parties are required to continue to address such exceedances.

In light of the ultimate goal, PWSA proposes to embark on an integrated watershed management approach that puts the focus on the end goal, achieving in-stream water quality standards, and performs those projects for the investment that achieve significant water quality improvements and the optimum levels of volumetric control, further advancing ultimate CWA

compliance. This approach provides the benefit of improving water quality as the first priority, thus addressing the sources of pollution regardless of size and quantity of overflow.

This approach also ensures that CSOs are addressed in combination with the other sources of watershed pollution through the optimum combination of gray, green and watershed-based controls allowing for prioritization and implementation of projects that achieve the greatest environmental and community benefits for the investment.

The IWM approach also recognizes that the total CSO volumetric control requirements may not be obtained simply with upstream gray, green and watershed-based controls and projects. The IWM Plan will identify the optimum and affordable combination of these upstream watershed controls coupled with downstream gray controls to be coordinated with ALCOSAN's LTCP to attain the required volumetric control, meet the water quality based requirements of the COA and CWA, and maximize in-stream water quality improvements.

As stated in EPA Watershed Plan guidance,

"Addressing one pollutant source at a time may appear to be the simplest approach. Most agencies and groups specialize in one land management activity; therefore, concentrating on one segment of the population makes documenting progress in installing controls or changing behavior easier. The one-source-at-a-time approach rarely results in clean water. What often happens is that one problem is "cleaned up," while others become more evident. The public perceives that its money has been wasted, and support for the project fades."[2]

The IWM approach will prevent this outcome and result in a comprehensive identification and evaluation of green, gray, and watershed projects which address volume requirements but also focus on the water quality impairment reductions required by the COA and CWA.

[2] *Watershed Action Planning Process from EPA Guide, June 1997*

Attachment 1

List of potential project types and examples

This list is a partial summary list of the types of projects which may arise from an Integrated Watershed Management Plan, but is not a limited set of such types of projects.

1. **Sanitary and storm collection system: generally low cost/high impact improvement projects to include:**
   - **Asset Management Projects**
     i. I/I reduction projects by renewing existing sewers and structures within the sewershed.
     ii. I/I reduction projects through private source removal, such as lateral renewal, downspouts, driveway drains, and sump pumps disconnections.
     iii. Identification and removal of Illicit (sewage) discharges into the storm sewer system. Coordinated with the local jurisdiction MS4s.
   - **Flooding & Basement Backup Solutions**
     i. New sanitary or stormwater infrastructure to address local flooding and basement backups while also reducing stormwater entering the sanitary or combined sewer systems to reduce/eliminate SSOs and CSOs
     ii. I/I reduction projects through private source removal, such as downspouts, driveway drains, and sump pumps disconnection.
   - **River & Creek Water Intrusion elimination to eliminate dry weather CSOs, sewer exfiltration, and reduce/eliminate wet weather overflows**
     i. Relocation of interceptor regulators to higher elevation,
     ii. Raising weirs,
     iii. Adding gates/valves on the end of outfalls,
     iv. Relocating sewers and manholes out of the creeks and streams,
     v. Renewal or replacement of sewer infrastructure to seal from water intrusion

2. **Green Infrastructure & Source Control opportunities analysis & projects**
   a. Review of sewershed and land use for GI and stormwater disconnection opportunities and projects. Coordinated with existing flooding and hydromodification, basement backups, existing pollutant sources, and overflow locations. Projects to include Green Boulevard (in the valley) projects and Green Umbrella (in the uplands) projects within the watershed.

   b. Technologies to be utilized in both the combined and separate sewer systems include, but not limited to:
      - Street-load and hillside/existing creeks stormwater separation with water quality and quantity treatment with GI best management practices; also increases baseflow to local waterways
      - Retrofit of existing detention basins to bioretention for infiltration and slow release,
      - New bioretention,
      - Constructed wetlands,

- Green Streets
- Rain gardens,
- Bioswales,
- Stormwater tree trenches
- Downspout or other private property source disconnection
- Re-naturalization of streams and creeks (day-lighting),
- Streambank restoration
- Removal of low head dams due to sewer infrastructure to improve aquatic habitat, fish passage and prevent creek or stream intrusion into the sewers.
- Public/private partnerships for retrofits or associated with new/redevelopment to address new and existing impervious areas and associated stormwater runoff to the waterways or combined sewer system

c. **Funded GI O&M Program**. Just as with any new gray infrastructure that is constructed a robust and funded operation and maintenance (O&M) program is required for green infrastructure and source control. If the PWSA proposes to implement GI or source control projects, PWSA understands that it is responsible for the long-term O&M. The PWSA will either directly maintain that GI or work with local watershed partners to operate and maintain the GI. Routine inspection programs will be developed and funded for this O&M in a similar fashion to how PWSA currently and routinely inspects its sewer system and gray infrastructure assets.

3. **Gray Infrastructure** – The IWM approach recognizes that the total CSO volumetric control requirements may not be obtained simply with upstream gray, green and watershed-based controls and projects. The IWM Plan will identify the optimum and affordable combination of these upstream watershed controls coupled with downstream gray controls, such as: storage, conveyance and treatment (either remote or at the WWTP) to attain the required volumetric control as identified in the COA, meet the water quality based requirements of the CWA, and maximize in-stream water quality improvements.

   The potential gray infrastructure measures that will be considered include, but are not necessarily limited to:

- Adjustment of sizing of gray infrastructure technologies planned for in the ALCOSAN LTCP
- Storage within the SSO and CSO watersheds to address localized peak flows, including:
    - Remote storage tanks
    - Inline storage
    - Storage at treatment facilities
- High rate treatment facilities
    - Ballasted flocculation (based on Actiflo™),
    - Non-ballasted high rate clarification (based on DensaDeg),
    - High rate filtration (based on WWETCO high rate compressible media filter),
    - CoMag Magnetite Ballasted Systems (based on Siemens systems),
    - Chemically Enhanced High Rate Treatment,
    - Vertical shaft treatment technology
- Increased storage and conveyance capacity
    - Relief sewers,
    - New larger interceptors,

    - Tunnels
- Increased WWTP capacity
- Partial separation of stormwater systems from existing combined systems
- In isolated areas, pursuing full separation

4. Other Source Controls.

Examples include, but are not limited to:

a. **Dry Weather Source Elimination.**

Example dry weather source elimination projects could include, but not be limited to:

i. Repair and/or replacement of existing sanitary and storm sewers contributing to dry weather bacteria or other source pollution through deterioration or exfiltration;

ii. Extending sewers to failing private sewage disposal systems to connect the local properties.

iii. Disconnection of private properties sewage connected to the storm system;

iv. Partnerships with local jurisdictions to address localized dry weather sources and access grants or other funding opportunities

b. **Legacy Pollutants Reduction.**

Legacy pollutants for the purpose of this document are defined as pollution sources other than sanitary or stormwater associated infrastructure. Examples could include, but not be limited to:

- existing industrial sites,
- abandoned landfills,
- abandoned industrial sites,
- acid mine drainage
- contaminated groundwater,
- channelized streams or waterways.

PWSA will provide the leadership needed to address these legacy pollutants through:

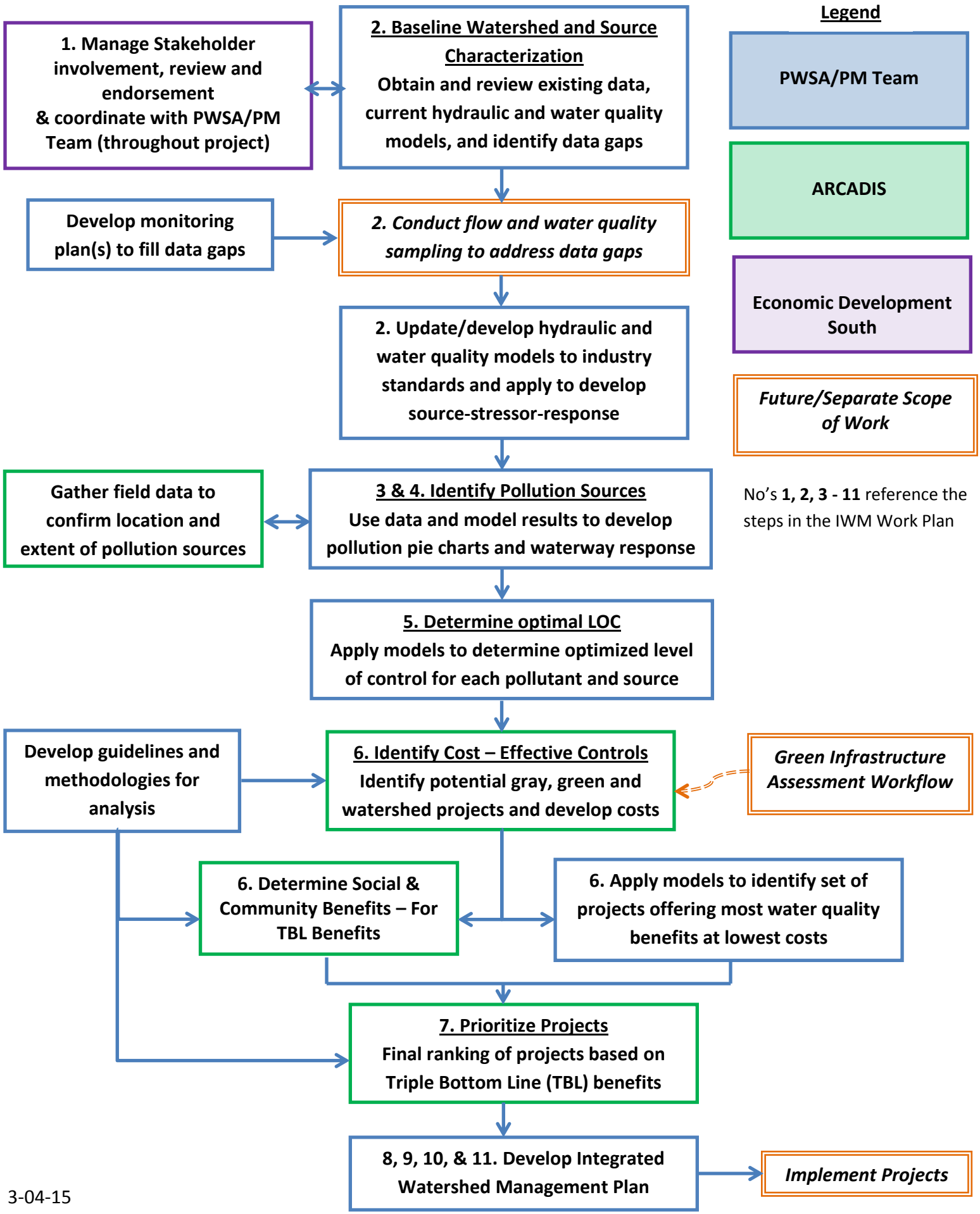
i. Identification and relative quantification of the various sources within the watersheds as part of the water quality and watershed characterization work to understand their relative contribution to the waterway pollution;

ii. Partnerships with local watershed groups and other stakeholders to access state and federal grants and funding for site cleanups, stream restoration, and/or conservation easements;

iii. Public/Private partnerships to clean-up existing sites for new or redevelopment;

iv. Identification of where the legacy pollutants may be entering the sanitary and stormwater infrastructure and entering the waterways via overflows or otherwise. Disconnection of these sources to properly address and minimize/eliminate the pollutants from reaching the waterways.

Saw Mill Run Integrated Watershed Management Workflow



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