

MS4 TMDL/Pollutant Reduction Plan
for
Middletown Township
Bucks County, Pennsylvania

DRAFT

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Middletown Township (Township) is submitting this Pollution Reduction Plan (PRP) in accordance with the requirements of *Individual Permit PAI-13 for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4)*; specifically, in accordance with the *MS4 Requirements Table (Municipal) Anticipated Obligations for Subsequent NPDES Permit Term*. The document also includes a Total Maximum Daily Load (TMDL) Plan for the Neshaminy Creek which receives stormwater discharges from the Township's MS4 area. The Township must create a PRP and TMDL Plan due to discharges from their MS4 to the Neshaminy Creek and unnamed tributaries to the Neshaminy Creek, Queen Anne Creek, Mill Creek, and Delaware River watersheds, as well as to Lake Luxembourg, Silver Lake, and Magnolia Lake, which have all been listed as impaired for sediment and nutrients as shown in the Municipal Requirements Table (Appendix A). As permitted by the *NPDES Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems TMDL Plan Instructions* included as part of the NPDES individual permit application for MS4s, the Township has chosen to combine the TMDL Plan with the PRP; this combined document is referred to as the MS4 TMDL/Pollutant Reduction Plan.

The intent of this MS4 Pollutant Reduction Plan is to establish the existing loading of pollutants discharged from the MS4 to the Neshaminy Creek and unnamed tributaries to the Neshaminy Creek, Queen Anne Creek, Mill Creek, and Delaware River watersheds, as well as to Lake Luxembourg, Silver Lake, and Magnolia Lake, and to present a plan to reduce these pollutant loadings. This MS4 PRP is organized to follow the "Required TMDL Plan Elements" presented in the TMDL Plan Instruction and also addresses the "Required PRP Elements" presented in the PRP Instructions included as part of the *Small MS4 PRP* instruction packages. This PRP will be evaluated and updated by the Township on an as-needed basis, based on its effectiveness in reducing pollutant loads in discharges from the regulated small MS4. If revisions or updates are required, the Township will work with the Pennsylvania Department of Environmental Protection (PADEP) for review and approval of any revisions or updates.

Per the *TMDL Plan* and *PRP* Instructions, this Plan includes the following required elements:

- Section A: General Information
- Section B: Public Participation;
- Section C: Map;
- Section D: Pollutants of Concern;
- Section E: Determine Existing Loading for Pollutants of Concern;
- Section F: Wasteload Allocations (WLAs);
- Section G: Analysis of TMDL Objectives;
- Section H: Select BMPs to Achieve the Minimum Required Reductions in Pollutant Loading;
- Section I: Identify Funding Mechanisms;
- Section J: Identify Responsible Parties for Operation and Maintenance (O&M) of BMPs;

A. General Information

Terms: The term "nutrients" refers to "Total Nitrogen" (TN) and "Total Phosphorus" (TP) unless specifically stated otherwise in DEP's latest integrated Report. The terms "sediment," "siltation," and "suspended solids" all refer to inorganic solids and are hereinafter referred to as "sediment."

The term, "storm sewershed" is defined in the PAG-13 General Permit as the land area that drains to the municipal separate storm sewer from within the jurisdiction of the MS4 permittee. This term is used as well as the term "TMDL Planning Area," "PRP Planning Area," as appropriate, or more generally as "Planning Area" which refers to all the storm sewersheds that an MS4 must calculate existing loads and plan load reductions for.

The term "baseline load" is used to refer to the pollutant load discharged by an MS4 as reported in a TMDL. A baseline load can be revised by 1) conducting a new modeling effort that utilizes the land use/land cover information from the original TMDL and 2) by considering the reductions achieved through structural BMPs installed prior to approval of a TMDL that were not considered during development of the TMDL.

The term "existing load" refers to the pollutant load that the MS4 estimates is draining to impaired waters from the Planning Area at the time of TMDL Plan submission. The existing load will be the same as the baseline load (regardless of whether or not the baseline load is revised) unless the MS4 accounts for reductions from structural BMPs installed between the date of TMDL approval and TMDL Plan submission.

Pollutants of Concern and Required Reductions: For all PRPs, MS4s shall calculate existing loading of the pollutant(s) of concern, in lbs/year; calculate the minimum reduction in loading, in lbs/year; select BMP(s) to reduce loading; and demonstrate that the selected BMP(s) will achieve the minimum reductions.

For PRPs developed for impaired waters (Appendix E), the pollutant(s) are based on the impairment listing, as provided in the MS4 Requirements Table. If the impairment is based on siltation only, a minimum 10% sediment reduction is required. If the impairment is based on nutrients only or other surrogates for nutrients (e.g., "Excessive Algal Growth" and "Organic Enrichment/Low D.O."), a minimum 5% TP

reduction is required. If the impaired is due to both siltation and nutrients, both sediment (10% reduction) and TP (5% reduction) must be addressed. PRPs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction. However, MS4s may not presume that a reduction in nutrients will accomplish a commensurate reduction in sediment.

The pollutants of concern for TMDL Plans will be based on the following:

If a WLA has been established in a TMDL for sediment, the MS4 is expected to develop the TMDL Plan based on the reduction of sediment.

If WLAs have been established in a TMDL for sediment and nutrients, the MS4 is expected to develop the TMDL Plan based on the reduction of sediment and TP, unless the MS4 chooses to utilize a presumptive approach for TP. DEP will allow MS4s to calculate loads and pollutant reductions based on sediment, under the assumption that the achievement of TMDL Plan objectives for sediment will also achieve the objectives for TP. MS4s must identify use of the presumptive approach in its TMDL Plan if chosen.

TMDL Plan Objectives: There are two objectives for a TMDL Plan:

1. Long-Term Reduction – plan for the reduction of pollutant load(s) to achieve the WLA(s) in the TMDL.

The TMDL Plan must describe a general plan as to how WLA(s) will ultimately be achieved.

2. Short-Term Reduction – plan for the short-term reduction of pollutant load(s) that will be achieved within the subsequent NPDES permit term (i.e., the 5-year permit term resulting from DEP's issuance of a permit in response to the receipt of the MS4's next submission of an individual permit application).

MS4s must achieve at least one of the following objectives within the 5-year permit term: 1) the WLA(s) in the TMDL, or 2) if the WLA(s) cannot be achieved, a load reduction of at least 10% for sediment and/or 5% for TP, compared to the existing load for these pollutants at the time of TMDL Plan submission. A load reduction of at least 10% for sediment may be used as the objective in lieu of a 5% reduction in TP under the

presumptive approach.

Existing Pollutant Loading: The estimation or determination of existing loads for TMDL Plans is different than the estimation of existing loads for PRPs. MS4s have two options in establishing the existing pollutant loads for pollutants of concern for TMDL Plans:

1. MS4s may report the existing loads specified in the TMDL (i.e., the TMDL “baseline load”). The baseline loads may be represented in the TMDL as either:
 - Loads that are specific to the MS4
 - Loads that are not specific to the MS4, in which the MS4 will need to delineate its individual loads

2. MS4s may choose to calculate its existing loads for a TMDL Plan through a new modeling effort using the MapShed model developed by the Pennsylvania State University (www.mapshed.psu.edu) or a comparable, or more robust, continuous simulation model. Any new modeling effort must focus on the TMDL Planning Area and account for overland flow as well as downstream channel and bank erosion; therefore, modeling must be done at a scale that allows for the quantification of both impacts. **New modeling must utilize the same land use/land cover information that was used to develop the TMDL or other quality assured land use/land cover data from the time of TMDL approval.**

If a combined PRP and TMDL Plan is developed, in which the PRP and TMDL Planning Areas are combined into one Planning Area, the existing loads for the Planning Area may only be derived using a new modeling effort.

Existing loading must be calculated and reported as of the date of the development of the PRP. MS4s may not claim credit for street sweeping and other non-structural BMPs implemented in the past. If structural BMPs were implemented prior to development of the PRP and continue to be operated and maintained, the MS4 may claim pollutant reduction credit in the form of reduced existing loading.

Each impairment identified on the MS4 Requirements Table (“Table”) must be addressed in a PRP document.

The Table listings for each MS4 are different because they reflect local conditions, which is why an MS4 must carefully interpret the information on the Table.

NOTE – An MS4 may not reduce its obligations for achieving pollutant load reductions through previously installed BMPs. An MS4 may only use such BMPs to reduce its estimate of existing pollutant loading. For example, if a rain garden was installed ten years ago and is expected to remove 100 lbs of sediment annually, and the overall annual loading of sediment in the storm sewershed is estimated to be 1,000 lbs without specifically addressing the rain garden, an MS4 may not claim that the rain garden satisfies its obligations to reduce sediment loading by 10%. The MS4 may, however, use the rain garden to demonstrate that existing loading is 900 lbs instead of 1,000 lbs, and 90 lbs rather than 100 lbs needs to be reduced during the term of permit coverage.

BMP Effectiveness: All MS4s must use the BMP effectiveness values contained within DEP's BMP Effectiveness Values document (3800-PM-BCW0100m) or Chesapeake Bay Program expert panel reports for BMPs listed in those resources when determining pollutant load reductions in TMDL Plans and PRPs, except as otherwise approved by DEP. For BMPs not listed in 3800-PM-BCW0100m or expert panel reports, MS4s may use effectiveness values from other technical resources; such resources must be documented in the TMDL Plan and PRP, and must reflect both overland flow and stream erosion components. For example, PRPs/TMDL Plans may also apply thoroughly vetted mechanistic models with self-contained BMP modules (e.g. Storm Water Management Model (SWMM), WinSLAMM) to demonstrate achievement of reduction targets. Application of these data intensive models could allow for a streamlining of the planning and design phases of the stormwater control process that may provide future cost savings as municipalities move toward implementation of the plan. Such resources must be documented in the Plan, and must reflect both overland flow and in-stream erosion components.

Combining Planning Obligations: MS4s with multiple TMDL Plan development obligations may develop one TMDL Plan for submission to DEP, if desired. If this is done, MS4s may elect to address each TMDL water separately or in combination. If done in combination, unless specifically restricted in the TMDL, the MS4 has flexibility when locating BMPs between the TMDL Planning Areas. If the MS4 elects to meet the percent reduction requirements (10% sediment or 5% TP) in lieu of meeting the WLA(s) within the first

permit term, it may elect to reduce pollutants by a greater percentage in one TMDL Planning Area over another, as long as the overall reduction for the planning effort achieves the percent reduction requirements.

MS4s may also combine TMDL Plans with PRPs, and the same flexibility is provided as discussed above. In addition, where TMDL Plans demonstrate: 1) WLA(s) have been achieved, or 2) WLA(s) will be achieved during the permit term, or 3) sediment and/or TP will be reduced by 10% and/or 5% during the permit term within the TMDL Planning Area, this satisfies all PRP requirements for any impaired waters within the watershed of the TMDL waters for the subsequent NPDES permit term. Where TMDL and PRP Planning Areas are combined, existing loads must be determined based on a new modeling effort.

BMP Selection: MS4s may select BMPs from the Pennsylvania Stormwater Best Management Practices Manual (363-0300-002), BMPs recognized by the EPA Chesapeake Bay Program, or other BMPs where the pollutant reduction efficiency is known or may be determined. Land use changes are not BMPs but may be used to demonstrate pollutant load reductions. For land use changes and BMPs implemented within a Planning Area as part of an NPDES permit requirement (e.g., post-construction stormwater management BMPs for Chapter 102 NPDES permits), pollutant load reduction credit may be claimed based on an analysis of pre- and post-construction or land use conditions, where the credit is a demonstrated net decrease in pollutant load.

MS4s may propose and take credit for only those BMPs that are not required to meet regulatory requirements or otherwise go above and beyond regulatory requirements. For example, a BMP that was installed to meet Chapter 102 NPDES permit requirements for stormwater associated with construction activities may not be used to meet permit term minimum pollutant reductions unless the MS4 can demonstrate that the BMP exceeded regulatory requirements; if this is done, the MS4 may take credit for only those reductions that will occur as a result of exceeding regulatory requirements.

NOTE – Street sweeping may be proposed as a BMP for pollutant loading reductions if 1) street sweeping is not the only method identified for reducing pollutant loading, and 2) the BMP effectiveness values contained in 3800-PM-BCW0100m or Chesapeake Bay Program expert panel reports are utilized.

Combining PRPs: If the MS4 discharges into multiple local surface waters impaired for nutrients and/or sediment, one PRP may be submitted to satisfy Appendix E but calculations and BMP selections must be completed independently for the storm sewershed of each impaired water. If, for example, an MS4 permittee must complete three PRPs according to the MS4 Requirements Table for three separate surface waters, storm sewershed maps must be developed, existing loads must be calculated and BMPs must be implemented for pollutant reductions independently within those storm sewersheds. In other words, BMPs cannot be implemented in one storm sewershed to count toward pollutant reductions in an entirely separate storm sewershed for a different impaired water.

Where local surface waters are impaired for nutrients and/or sediment, and those waters are tributary to a larger body of water that is also impaired, MS4s can propose BMPs within the upstream impaired waters to meet the pollutant reduction requirements of both the upstream and downstream waters. For example, if Stream A flows through an Township that is tributary to Stream B, both are impaired and the MS4 has discharges to both streams, the MS4 can implement BMPs in the storm sewershed of Stream A to satisfy pollutant reduction requirements for both Streams A and B. In general, the MS4 permittee would not be able to satisfy pollutant reduction requirements for both streams if BMPs were only implemented in the storm sewershed of Stream B; however, on a case by case basis DEP will consider such proposals where it can be demonstrated that implementing BMPs in the upstream storm sewershed is infeasible.

If, however, Stream A does not flow into Stream B, both are impaired and the MS4 has discharges to both streams, in general DEP would expect that BMPs be implemented in the storm sewershed of both streams to meet pollutant reduction requirements.

MS4s participating in collaborative efforts are encouraged to contact DEP's Bureau of Clean Water during the PRP development phase for feedback on proposed approaches.

Submission of PRP: Attach one copy of the PRP with the NOI or individual permit application that is submitted to the regional office of DEP responsible for reviewing the NOI or application. In addition, one copy of the PRP (not the NOI or application) must be submitted to DEP's Bureau of Clean Water (BCW). BCW prefers electronic copies of PRPs, if possible. Email the electronic version of the PRP, including map(s)

(if feasible), to RA-EPPAMS4@pa.gov. If the MS4 determines that submission of an electronic copy is not possible, submit a hard copy to: PA Department of Environmental Protection, Bureau of Clean Water, 400 Market Street, PO Box 8774, Harrisburg, PA 17105-8774.

PRP Implementation and Final Report: Under the PAI-13 General Permit, the permittee must achieve the required pollutant load reductions within 5 years following DEP's approval of coverage under the General Permit, and must submit a report demonstrating compliance with the minimum pollutant load reductions as an attachment to the first Annual MS4 Status Report that is due following completion of the 5th year of General Permit coverage. For example, if DEP issues written approval of coverage to a permittee on June 1, 2018, the required pollutant load reductions must be implemented by June 1, 2023 and the final report documenting the BMPs that were implemented (with appropriate calculations) must be attached to the annual report that is due September 30, 2023. In general, the same methodology used to calculate the existing pollutant loads should be used in the final report to demonstrate the reductions. If BMP effectiveness values are updated in DEP's BMP Effectiveness Values document or Chesapeake Bay Program expert panel reports between the time the PRP is approved and the time the final report is developed, those updated effectiveness values may be used.

B. Public Participation.

As part of the preparation of this MS4 PRP, public participation is required. The MS4 shall complete the public participation measures listed below, and report in the PRP that each was completed:

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

The PRP has been made available for public review/comment at the time of submission. The PRP is anticipated to be made available on May 23, 2022. The PRP will then be available for public review for a 30-day period. Comments will be accepted at a public meeting to be on June 13, 2022, at 7:00 PM. The Township has every intention to hear all public comments as required and consider making any changes to the plan in response to these comments. Any comments received and changes made to the plan will be forwarded to DEP to be included in their review of the PRP. The public comment period will end on June 22, 2022.

C. Map.

Mapping is an integral part of developing the PRP and requires a level of detail suitable to determine the existing land uses, impervious/pervious surface coverages, topography and loading for the sediment. The MS4 PRP map shall show land uses and/ or impervious/pervious surfaces and the storm sewershed boundary. The MS4 PRP map(s) shall also show the proposed locations of structural BMPs that will be implemented to achieve the required pollutant load reductions. The storm sewershed boundary shown on the Township MS4 PRP Map constitutes the storm sewershed to each of the MS4 outfalls within the MS4's jurisdiction that discharge to the Neshaminy Creek, Queen Anne Creek, Core Creek, and Mill Creek watersheds.

The Township MS4 PRP Map identifies the storm sewershed boundary, the existing land uses and impervious/pervious surface coverages, as well as the proposed locations of structural BMPs to be implemented to achieve required pollutant load reductions. The Township MS4 PRP Map is included in Appendix C.

The Township MS4 PRP Map also shows parsed areas, which are areas within the storm sewershed that are not included in the calculation of land area and existing pollutant loading. All BMPs located within these parsed areas have not been counted toward achieving pollutant reduction objectives. 2,008.96 acres have been parsed, which represents approximately 16.3% of the 12,305.41 acres of the Township's total service area. Examples of the land areas that have been parsed include:

- The land area associated with non-municipal stormwater NPDES permit coverage that exists within the urbanized area of the Township's service area; not including private basins;
- Land area associated with PennDOT roadways (roads and right of ways);
- Land areas in which stormwater runoff does not enter the MS4. Potential examples include homeowner's associations and schools which do not contain municipal roads or other municipal infrastructure.

The Municipality is continuing its ongoing field verification efforts to accurately locate all existing stormwater outfalls throughout the municipality. It should be noted that some stormwater infrastructure may

be inaccurate or missing from the current MS4 PRP Map. The Municipality will add all field-verified infrastructure to the MS4 PRP Map as they are located within the limits of the Compliance Schedule (Appendix 11). The areas on the MS4 PRP Map with missing infrastructure are included in the PRP Planning Area.

D. Pollutants of Concern

The Township shall calculate the existing loading of sediment in lbs/year; calculate the minimum reduction in loading in lbs/year; select BMP(s) to reduce loading; and demonstrate that the selected BMPs will achieve the minimum reductions.

For PRPs developed for impaired water ["Appendix E" noted in the Requirements Table column in the *MS4 Requirements Table (Municipal) Anticipated Obligations for Subsequent NPDES Permit Term*], the pollutants are based on the impairment listing as provided in the *MS4 Requirements Table (Municipal) Anticipated Obligations for Subsequent NPDES Permit Term*. If the impairment is based on siltation only, a minimum of 10% sediment reduction is required. If the impairment is based on nutrients only or other surrogates for nutrients (e.g., "Excessive Algal Growth" and "Organic Enrichment/Low D.O."), a minimum 5% Total Phosphorus (TP) reduction is required. If the impaired is due to both siltation and nutrients, both sediment (10% reduction) and TP (5% reduction) must be addressed. However, per the PRP and TMDL Instructions, the MS4 may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish the required TP reduction.

Furthermore, the TMDL Instructions indicate that MS4s may combine TMDL Plans with PRPs and, if the Plan demonstrates that the sediment and/or TP will be reduced by 10 percent and/or 5 percent during the permit term within the TMDL Planning Area, this satisfies all PRP requirements for any impaired waters within the watershed of the TMDL waters for the subsequent NPDES permit term.

This MS4 Pollutant Reduction Plan combines the TMDL Plans with the PRPs and uses the presumptive approach for the Neshaminy Creek, Queen Anne Creek, Core Creek, and Mill Creek watersheds, demonstrating how the Township will achieve the 10% sediment load reduction; therefore, the TP loads and reductions were calculated but are not directly addressed by the proposed BMPs.

The impaired downstream waters and causes of impairment that require a PRP are summarized in TABLE D-1. The impaired downstream waters and causes of impairment that require a TMDL Plan are summarized in TABLE D-2.

TABLE D-1: SUMMARY OF IMPAIRED WATERS – PRP REQUIRED

Impaired Downstream Waters Name	Requirements
Lake Luxembourg	Appendix E – Nutrients, Suspended Solids
Queen Anne Creek	Appendix E – Siltation
Silver Lake	Appendix E – Excessive Algal Growth, Nutrients, Suspended Solids
Magnolia Lake	Appendix E – Excessive Algal Growth, Nutrients, Organic Enrichment/Low D.O., Suspended Solids
Mill Creek	Appendix C – PCB; Appendix E - Siltation
Neshaminy Creek	Appendix B – Pathogens; Appendix C – PCB; Appendix E – Nutrients, Organic Enrichment/Low D.O.

TABLE D-2: SUMMARY OF IMPAIRED WATERS – TMDL PLAN REQUIRED

Impaired Downstream Waters Name	Requirements
Neshaminy Creek	TMDL Plan – Siltation, Suspended Solids

E. Determine Existing Loading for Pollutants of Concern

TABLE E-1 below summarizes the division of the total area for each watershed in Middletown Township.

TABLE E-1: SUMMARY OF AREAS

Area Description	Neshaminy Creek	Queen Anne Creek	Core Creek	Mill Creek	Total Area (acres)
Total Area (acres)	4,577.41	1,593.01	2,381.70	3,753.29	12,305.41
Parsed Areas (acres)	426.47	194.56	389.5	589.41	1,599.94
MS4 Areas (acres)	4,150.94	1,398.45	1,992.20	3,163.88	10,705.47

The loading and reduction for sediment was calculated as follows:

The Township's permit obligation applies to the land area that drains to the municipal separate storm sewer (See TABLE D-1) from within the jurisdiction of the MS4 permittee (the "storm sewershed") less that of the pre-developed condition. The storm sewershed land area that drains to the municipal separate storm sewer from within the jurisdiction of the MS4 to impaired water ways was delineated using PAMAP data known as Light Detection and Ranging (LiDAR) contours. Lands owned by the State or County as well as some streams were parsed. GIS software was then used to define impervious and pervious area in the Township's service area and the total area of each was used to calculate the total sediment loading to the impaired water ways created by the Township for the non-parsed areas. The existing sediment loading for the PRPs was calculated utilizing the Bucks County loading rates provided by DEP for pervious and impervious areas. The loading rates used for the calculations are 264.96 lbs/acre for pervious areas, and 1,839 lbs/acre for impervious areas. The existing sediment loading for the TMDL Plan was calculated using existing land use data and the existing loading rates that were calculated in the previously established TMDL Plan for Neshaminy Creek (See Appendix D).

For the Core Creek, Mill Creek, and Queen Anne Creek watersheds. since no TMDLs or WLAs exist but portions of the streams are impaired for sediment and nutrients, the PRP requirements apply to these watersheds; these are therefore considered PRP Planning Areas. As permitted per the PRP Instructions, the “simplified method” was used to calculate the existing pollutant loads. To determine the impervious and pervious surfaces, GIS land cover layers were used.

Since the TMDL Instructions indicate that existing pollutant loads for Planning Areas with a TMDL must be modeled in accordance with the existing loads specified in the TMDL, the loads for the Neshaminy Creek were calculated differently.

For the Neshaminy Creek, existing sediment loads were calculated using the information provided in the Total Maximum Daily Load (TMDL) Assessment for the Neshaminy Creek Watershed in Southeast Pennsylvania, approved by the United States Environmental Protection Agency (USEPA) on December 8, 2003. Existing sediment unit load rates for Neshaminy Creek Subwatershed #1 are from Table C14.2 “Loading Values for Neshaminy Creek South #1 Watershed” in the “TMDL Development Plan for Neshaminy Creek South #1 Watershed” chapter. Existing sediment unit load rates for Neshaminy Creek Subwatershed #2 are from Table C10.3 “Loading Values for Neshaminy Creek Tributary #2 Watershed, Year 2000 Land Use Conditions” in the “TMDL Development Plan for Neshaminy Creek Tributary #2 Watershed” chapter. Existing sediment unit load rates for Neshaminy Creek Subwatershed #3 are from Table C16.2 “Existing Loading Values for the Neshaminy Creek South #3 Watershed” in the “TMDL Development Plan for Neshaminy Creek South #3 Watershed” chapter. The presumptive approach was used to calculate the existing TP loads for the Neshaminy Creek watershed.

These calculations were an evaluation with DEP’s existing TMDL Plan. The overall reduction numbers, advised by DEP, were to apply the “simplified method” to each Subwatershed and apply the overall TMDL reduction percentage.

Table C14.2. Loading Values for Neshaminy Creek South #1 Watershed

<i>Land Use Category</i>	<i>Area (acres)</i>	<i>Sediment Load (lbs/year)</i>	<i>Unit Area Sediment Load (lbs/acre/yr)</i>
Hay/Pasture	62	3,040	49.0
Cropland	220	233,840	1,062.9
Coniferous Forest	269	2,080	7.7
Mixed Forest	267	2,760	10.3
Deciduous Forest	699	8,600	12.3
Transition	126	158,180	1,255.4
Lo Intensity Develop	2,355	154,220	65.5
Hi Intensity Develop	723	18,980	26.3
Stream Bank		2,491,660	
Groundwater			
Point Source			
Septic Systems			
Total	4,720	3,073,400	651.1

Table C10.3. Loading Values for Neshaminy Creek Tributary #2 Watershed, Year 2000 Land Use Conditions

<i>Land Use Category</i>	<i>Area (acres)</i>	<i>Sediment Load (lbs/year)</i>	<i>Unit Area Sed Load (lbs/acre/yr)</i>
Hay/Past	7	110	15.71
Cropland	52	16,600	319.23
Coniferous Forest	20	88	4.40
Mixed Forest	40	154	3.85
Deciduous Forest	121	1,170	9.67
Transitional	54	123,863	2,293.76
Low Intensity Dev	145	10,662	73.53
High Intensity Dev	17	552	32.47
Stream Bank		12,362	
Groundwater			
Point Source			
Septic Systems			
Total	456	165,561	363.02

Table C16.2. Existing Loading Values for the Neshaminy Creek South #3 Watershed

<i>Land Use Category</i>	<i>Area (acres)</i>	<i>Sediment Load (lbs/year)</i>	<i>Unit Area Sediment Load (lbs/acre/yr)</i>
Hay/Pasture	59	960	16.3
Cropland	158	44,320	280.5
Coniferous Forest	121	420	3.5
Mixed Forest	124	300	2.4
Deciduous Forest	321	1000	3.1
Transitional	57	18,520	324.9
Low Intensity Developed	1,643	34,120	20.8
High Intensity Developed	353	2,300	6.5
Stream Bank		1,312,360	
Groundwater			
Point Source			
Septic Systems			
Total	2,837	1,414,300	498.5

After obtaining the existing sediment load rates, the margin of safety (MOS) was calculated as 10% of the existing wasteloads. The WLA for each subwatershed was then calculated by subtracting the MOS from the existing wasteload. The TMDL Planning Areas were obtained from NLCD 2019 Land Cover Data through GIS. These areas were multiplied by the existing sediment unit loading rates to obtain the wasteloads. The required TMDL sediment load reduction percentages were obtained from the existing TMDL Assessments for the Neshaminy Creek watershed.

In summary, the existing pollutant loads for each Planning Area are as follows:

The existing loading conditions were calculated for the Township on September 27, 2021 (See TABLE E-2).

The Township has a total non-parsed sediment loading of 2,033,341.57 lbs/year in its Neshaminy Creek Subwatershed #1 storm Sewershed (See Table D-1D). In order to address the impairment, a minimum 30% sediment reduction (610,002.47 lbs/year) is required. The existing BMP load reduction is 42,618.39 lbs/year. Therefore, a minimum sediment reduction of 610,002.47 lbs/year is required. Achieving this minimum sediment reduction will result in the storm sewershed having a new sediment load of 1,423,339.10 lbs/year.

The Township has a total non-parsed sediment loading of 59,392.20 lbs/year in its Neshaminy Creek Subwatershed #2 storm Sewershed (See Table D-1E). In order to address the impairment, a minimum 66% sediment reduction (39,198.85 lbs/year) is required. Achieving this minimum sediment reduction will result in the storm sewershed having a new sediment load of 20,193.35 lbs/year.

The Township has a total non-parsed sediment loading of 420,090.40 lbs/year in its Neshaminy Creek Subwatershed #3 storm Sewershed (See Table D-1F). In order to address the impairment, a minimum 36% sediment reduction (126,027.12 lbs/year) is required. Achieving this minimum sediment reduction will result in the storm sewershed having a new sediment load of 294,063.28 lbs/year.

The Township has a total non-parsed sediment loading of 1,413,340.57 lbs/year in its Queen Anne Creek storm sewershed. The existing BMP load reduction is 23,794.11 lbs/year. Therefore, the total existing sediment load at Township outfalls is 1,389,546.46 lbs/year. In order to address the impairment, a minimum

10% sediment reduction (138,954.65 lbs/year) is required. Achieving this minimum sediment reduction will result in the storm sewershed having a new sediment load of 1,250,591.81 lbs/year.

The Township has a total non-parsed sediment loading of 1,023,812.19 lbs/year in its Core Creek storm sewershed. The existing BMP load reduction is 48,560.18 lbs/year. Therefore, the total existing sediment load at Township outfalls is 1,023,812.19 lbs/year. In order to address the impairment, a minimum 10% sediment reduction (102,381.22 lbs/year) is required. Achieving this minimum sediment reduction will result in the storm sewershed having a new sediment load of 921,430.97 lbs/year.

The Township has a total non-parsed sediment loading of 2,692,286.33 lbs/year in its Mill Creek storm sewershed. The existing BMP load reduction is 75,195.13 lbs/year. Therefore, the total existing sediment load at Township outfalls is 2,617,091.21 lbs/year. In order to address the impairment, a minimum 10% sediment reduction (261,709.12 lbs/year) is required. Achieving this minimum sediment reduction will result in the storm sewershed having a new sediment load of 2,355,382.09 lbs/year.

TABLE E -2: SUMMARY OF SEDIMENT LOADING REDUCTIONS

Watershed	Total Sediment Loading (lbs/year)	Reduction Required	Reduced Sediment Loading (lbs/year)
Neshaminy Creek	2,523,536.61	775,228.44	1,748,308.17
<i>Subwatershed #1</i>	<i>2,033,341.57</i>	<i>610,002.47</i>	<i>1,423,339.10</i>
<i>Subwatershed #2</i>	<i>59,392.20</i>	<i>39,198.85</i>	<i>20,193.35</i>
<i>Subwatershed #3</i>	<i>420,090.40</i>	<i>126,027.12</i>	<i>294,063.28</i>
Queen Anne Creek	1,389,546.46	138,954.65	1,250,591.81
Core Creek	1,023,812.19	102,381.22	921,430.97
Mill Creek	2,617,091.21	261,709.12	2,355,382.09
Total	8,078,729.01	1,440,739.42	6,637,989.60

F. Wasteload Allocations (WLAs)

Middletown Township's service area contains a watershed with a TMDL with specific wasteload allocations (WLAs) – the Neshaminy Creek. There are several subwatersheds within the Neshaminy Creek watershed, including three (3) subwatersheds that are in Middletown Township's MS4 service area. These three subwatersheds are referred to in this TMDL Plan as Neshaminy Creek Subwatershed #1, Neshaminy Creek Subwatershed #2, and Neshaminy Creek Subwatershed #3.

The Total Maximum Daily Load (TMDL) Assessment for the Neshaminy Creek Watershed in Southeast Pennsylvania requires a 30% reduction in sediment loads in Neshaminy Creek Subwatershed #1, a 66% reduction in sediment loads in Neshaminy Creek Subwatershed #2, and a 36% reduction in sediment loads in Neshaminy Creek Subwatershed #3. No WLA was provided in the TMDL Assessment specific to Middletown Township. The TMDL Planning Area for the Neshaminy Creek Subwatershed #1 is 3,267.30 acres and the existing sediment load was calculated to be 2,033,341.57 lbs/year, resulting in an allocated sediment wasteload of 2,033,341.57 lbs/year. The TMDL Planning Area for Neshaminy Creek Subwatershed #2 is 93.52 acres and the existing sediment load was calculated to be 59,392.20 lbs/year, resulting in an allocated sediment wasteload of 59,392.20 lbs/year. The TMDL Planning Area for Neshaminy Creek Subwatershed #3 is 529.89 acres and the existing sediment load was calculated to be 420,090.40 lbs/year, resulting in an allocated sediment wasteload of 420,090.40 lbs/year.

In summary, the wasteload allocations for the Planning Areas are as follows:

TABLE F-1: SUMMARY OF WLAs

Planning Area	Sediment WLA (lbs/year)
Neshaminy Creek Subwatershed #1	2,033,341.57
Neshaminy Creek Subwatershed #2	59,392.20
Neshaminy Creek Subwatershed #3	420,090.40

G. Analysis of TMDL Objectives

In the short-term, which is defined as this 5-year permit term beginning upon the DEP's issuance of an individual permit, Middletown Township has decided to pursue reducing the existing sediment load by 10 percent and, presumptively, the TP load by 5 percent as permitted by the TMDL Plan Instructions. Since the proposed pollutant load reductions and BMPs will affect the Planning Areas in each of the watersheds, the table below includes all watersheds in the Township even though there are no TMDLs for most watersheds. The existing sediment loadings for all watersheds, including the Neshaminy Creek watershed, were calculated utilizing the Bucks County loading rates provided by DEP for pervious and impervious areas. The loading rates used for the calculations are 264.96 lbs/acre for pervious areas, and 1,839 lbs/acre for impervious areas. This MS4 Pollutant Reduction Plan is intended to supersede and replace all MS4 TMDL Strategies previously submitted by Middletown Township. TABLE G-1 summarizes the existing pollutant loads and short-term TMDL reductions for each Planning Area from Appendix D.

TABLE G-1: SUMMARY OF EXISTING LOADS & SHORT-TERM TMDL REDUCTIONS

Planning Area	Existing Sediment Load (lbs/year)	Required Short-Term 10% Reduction (lbs/year)
Neshaminy Creek	2,523,536.61	252,353.66
Queen Anne Creek	1,389,546.46	138,954.65
Core Creek	1,023,812.19	102,381.22
Mill Creek	2,617,091.21	261,709.12
Total	7,553,986.47	755,398.65

In the long-term, Middletown Township is required to achieve a 30% reduction in sediment loads in Neshaminy Creek Subwatershed #1, a 41% reduction in sediment loads in Neshaminy Creek Subwatershed #2, and a 36% reduction in sediment loads in Neshaminy Creek Subwatershed #3.

The Township plans to systematically achieve the required long-term wasteload allocations through the use of structural and non-structural BMPs over a 10 to 15-year period intended to remove sediment and TP pollutants from stormwater runoff generated within the TMDL Planning Areas.

The wasteload allocation values have changed after direction from DEP as to how to calculate the sediment breakdown. DEP Central Office provided a breakdown for a more simplified approach for each Subwatershed utilizing the Subwatershed Reduction percentages.

This MS4 Pollutant Reduction Plan will be evaluated and updated by Middletown Township on an as-needed basis, based on its effectiveness in reducing pollutant loads in discharges from the Planning Areas. If the Township determines that updates are needed, the Township will work with DEP for review and approval of any revisions or updates.

TABLE G-2 summarizes the required long-term TMDL reductions for each Planning Area:

TABLE G-2: SUMMARY OF LONG-TERM TMDL REDUCTIONS

Planning Area	Existing Sediment Load (lbs/year)	% Sediment TMDL Reduction Required	Long-Term Sediment TMDL Reduction (lbs/year)
Neshaminy Creek	2,523,536.61	-	937,694.43
<i>Subwatershed #1</i>	2,033,341.57	30%	610,002.47
<i>Subwatershed #2</i>	59,392.20	66%	39,198.85
<i>Subwatershed #3</i>	420,090.40	36%	126,027.12
Queen Anne Creek	N/A	N/A	N/A
Core Creek	N/A	N/A	N/A
Mill Creek	N/A	N/A	N/A

H. Select BMPs to Achieve the Minimum Required Reductions in Pollutant Loading.

Drainage areas to proposed BMP locations (BMP DA) were delineated using the aforementioned LiDAR contours, and load reductions for several BMPs were calculated.

The Township has a requirement to reduce sediment by 10% in the Neshaminy Creek, Queen Anne Creek, Core Creek, and Mill Creek storm sewersheds within the 5-year permit term. Implementation of BMPs or land use changes must be proposed that will result in meeting the minimum required reduction in pollutant loading with the storm sewershed(s) identified by the MS4. These BMP(s) must be implemented within five (5) years of DEP's approval of coverage under the Individual Permit, and must be located within the storm sewersheds of the applicable impaired waters, on either public or private property. As previously stated, DEP has determined that a 10% sediment load reduction will also result in at least a 5% TP load reduction; therefore, TP load reductions were not separately examined and calculated as part of this MS4 Pollutant Reduction Plan.

The Township plans to achieve the sediment reduction by designing, constructing, operating and maintaining Best Management Practices (BMPs).

The Proposed BMPs between two neighboring Municipalities have been discussed and the process for these BMPs is understood. An Intermunicipal agreement and credit breakdown will be submitted with the approval of any of these BMPs. If the Municipality moves forward with these projects, an additional public comment period will be submitted for these BMPs as well.

The Township is required to implement this plan over the next five (5) years. Tables H-1 through H-4 are a summary of the proposed BMPs under consideration for each storm sewershed, including location, type, area treated, and sediment removed:

TABLE H -1: SUMMARY OF BMPs – NESHAMINY CREEK WATERSHED

BMP #	BMP LOCATION	BMP TYPE	AREA TREATED BY BMP (acres)	SEDIMENT REMOVED BY BMP (lbs/year)
1	SR-1	Streambank Restoration (2,000 feet)	See Section H Paragraph 3	71,808.00
2	SR-2	Chubb Run Streambank Restoration (1,200 feet)	See Section H Paragraph 3	24,684.00
3	Township Streets	Storm Sewer System Solids Removal (Inlet Sediment Filter Bags)	827.00	124,927.84
4	NC-DB-01	Detention Basin Retrofit to Dry Extended or Retention Basin	21.98	7,841.08
5	NC-DB-02	Detention Basin Retrofit to Dry Extended or Retention Basin	14.68	10,807.10
6	NC-DB-05	Detention Basin Retrofit to Dry Extended or Retention Basin	4.67	1,429.37
7	NC-DB-06	Detention Basin Retrofit to Dry Extended or Retention Basin	16.42	6,331.44
8	NC-DB-07	Detention Basin Retrofit to Dry Extended or Retention Basin	37.55	14,748.89
9	NC-DB-09	Detention Basin Retrofit to Dry Extended or Retention Basin	13.48	6,314.02

10	NC-DB-11	Detention Basin Retrofit to Dry Extended or Retention Basin	8.44	3,711.58
11	NC-DB-12	Detention Basin Retrofit to Dry Extended or Retention Basin	33.99	15,946.66
12	NC-DB-13	Detention Basin Retrofit to Dry Extended or Retention Basin	17.83	3,903.02
13	NC-DB-15	Detention Basin Retrofit to Dry Extended or Retention Basin	14.08	7,084.25
14	NC-DB-16	Detention Basin Retrofit to Dry Extended or Retention Basin	14.19	6,157.36
15	NC-DB-19	Detention Basin Retrofit to Dry Extended or Retention Basin	12.17	9,908.09
			TOTAL:	315,602.70

TABLE H -2: SUMMARY OF BMPs – QUEEN ANNE CREEK WATERSHED

BMP #	BMP LOCATION	BMP TYPE	AREA TREATED BY BMP (acres)	SEDIMENT REMOVED BY BMP (lbs/year)
1	SR-4	Streambank Restoration (1,400 feet)		50,265.60
2	Township Streets	Storm Sewer System Solids Removal (Inlet Sediment Filter Bags)	576.50	68,928.04
3	Varies	Projects with Neighboring Municipalities	See Section H Paragraph 3	Varies
4	QAC-DB-03	Detention Basin Retrofit to Dry Extended or Retention Basin	27.59	20,119.68
5	Twins Oaks Park	Underground Basin	11.23	5,564.59
			TOTAL:	144,877.91

TABLE H-3: SUMMARY OF BMPs – CORE CREEK WATERSHED

BMP #	BMP LOCATION	BMP TYPE	AREA TREATED BY BMP (acres)	SEDIMENT REMOVED BY BMP (lbs/year)
1	Township Streets	Storm Sewer System Solids Removal (Inlet Sediment Filter Bags)	405.00	51,119.47
2	CC-DB-01	Detention Basin Retrofit to Dry Extended or Retention Basin	33.11	12,382.73
3	CC-DB-09	Detention Basin Retrofit to Dry Extended or Retention Basin	6.58	2,027.81
4	CC-DB-10	Detention Basin Retrofit to Dry Extended or Retention Basin	3.15	1,181.97
5	CC-DB-11	Detention Basin Retrofit to Dry Extended or Retention Basin	77.52	31,771.37
6	CC-DB-16	Detention Basin Retrofit to Dry Extended or Retention Basin	9.22	3,087.51
7	CC-DB-22	Detention Basin Retrofit to Dry Extended or Retention Basin	11.94	9,055.37
			TOTAL:	110,626.23

TABLE H -4: SUMMARY OF BMPs – MILL CREEK WATERSHED

BMP #	BMP LOCATION	BMP TYPE	AREA TREATED BY BMP (acres)	SEDIMENT REMOVED BY BMP (lbs/year)
1	SR-3	Streambank Restoration (1,400 feet)		50,265.60
2	Township Streets	Storm Sewer System Solids Removal (Inlet Sediment Filter Bags)	1,068.00	130,854.56
3	MC-DB-02	Detention Basin Retrofit to Dry Extended or Retention Basin	49.41	20,429.27
4	MC-DB-03	Detention Basin Retrofit to Dry Extended or Retention Basin	91.54	33,431.52
5	MC-DB-05	Detention Basin Retrofit to Dry Extended or Retention Basin	73.03	31,278.84
6	MC-DB-06	Detention Basin Retrofit to Dry Extended or Retention Basin	10.90	4,404.41
7	MC-DB-16	Detention Basin Retrofit to Dry Extended or Retention Basin	34.01	14,083.90
8	MC-DB-17	Detention Basin Retrofit to Dry Extended or Retention Basin	21.31	8,962.37
			TOTAL:	293,710.47

As noted in Section F, after proposed BMPs are implemented for the Neshaminy Creek Watershed in the short-term, the sediment load should be at most 2,271,182.95 lbs/year. As demonstrated above in Table H-1, upon implementation of all BMPs the proposed total sediment load reduction will be at least 316,851.69

lbs/year, which exceeds the minimum required reduction in pollutant loading.

As noted in Section E, after proposed BMPs are implemented for the Queen Anne Creek Watershed, the sediment load should be at most 1,250,591.81 lbs/year. As demonstrated above in Table H-2, upon implementation of all BMPs the proposed total sediment load reduction will be at least 145,427.19 lbs/year, which exceeds the minimum required reduction in pollutant loading.

As noted in Section E, after proposed BMPs are implemented for the Core Creek Watershed, the sediment load should be at most 920,150.42 lbs/year. As demonstrated above in Table H-3, upon implementation of all BMPs the proposed total sediment load reduction will be at least 110,697.37 lbs/year, which exceeds the minimum required reduction in pollutant loading.

As noted in Section E, after proposed BMPs are implemented for the Mill Creek Watershed, the sediment load should be at most 2,355,382.09 lbs/year. As demonstrated above in Table H-4, upon implementation of all BMPs the proposed total sediment load reduction will be at least 293,710.47 lbs/year, which exceeds the minimum required reduction in pollutant loading.

Note that only 50% of the total required sediment reduction of each watershed can be achieved through the proposed Storm Sewer System Solids Removal (Inlet Cleaning) BMP. The current acreage in the tables represents numerous inlets that will get filter bags over time, which will collect sediment. Therefore, only 50% of the total proposed sediment load reduction from BMPs is from the proposed solids removal BMP.

Table H-5 summarizes the sediment load and required sediment reduction for each of the Township's Planning Areas.

TABLE H-5: MS4 PRP STRATEGY SUMMARY

Description	Neshaminy Creek	Queen Anne Creek	Core Creek	Mill Creek
Watershed Area (acres)	4,577.41	1,593.01	2,381.70	3,753.29
Parsed Area (acres)	426.47	194.56	389.5	589.41
Storm Sewershed Area (acres)	4,150.94	1,398.45	1,992.20	3,163.88
Existing Sediment Load (lbs/year)	2,523,536.61	1,389,546.46	1,023,812.19	2,617,091.21
Minimum Required Pollutant Load Reduction (lbs/year)	252,353.66	138,954.65	102,381.22	261,709.12
Proposed Sediment Load Reduction from BMPs (lbs/year)	316,851.69	145,427.19	110,697.37	293,710.48
Proposed Sediment Total Load with Proposed BMPs Installed (lbs/year)	2,206,684.92	1,244,119.28	913,114.82	2,323,380.73

I. Identify Funding Mechanism(s)

The Township will be working during the five-year term of the individual permit coverage to determine the best funding source for each proposed BMP, as each project is undertaken. Funding sources for the proposed structural BMPs outlined in this MS4 Pollutant Reduction Plan could include the following:

- General Fund
- Developer Cooperation
- Grant Funding
- PennVest Low-Interest Loan
- Bond

For example, the Township intends to apply for all related grants, such as the PADEP Growing Greener Program, to implement these BMPs. The Township intends to utilize general fund monies to cover the design and construction costs for the proposed BMPs should grant money not be awarded. The BMPs are expected to be constructed in the last three years of the new permit cycle. Once the PRP has been approved by PADEP, the Borough intends to approve design of the BMPs, upon which time a feasibility and cost analysis will be prepared and shared with PADEP.

J. Identify Responsible Parties for Operation and Maintenance (O&M) of BMPs

Once implemented, the BMPs must be maintained in order to continue producing the expected pollutant reductions. Applicants must identify the following for each selected BMP:

- The parties responsible for ongoing O&M;
- The activities involved with O&M for each BMP; and
- The frequency at which O&M activities will occur.

TABLE J-1: OPERATION AND MAINTENANCE OF BMPs

BMP #	BMP LOCATION	BMP TYPE	OWNER/ RESPONSIBLE PARTY	O&M ACTIVITY & FREQUENCY
1	SR-1, SR-2, SR-3, SR-4	Streambank Restoration	Middletown Township	Bi-Annual Inspection *
2	Township Streets	Storm Sewer System Solids Removal (Inlet Sediment Filter Bags)	Middletown Township	Bi-Annual Inspection & Cleaning, as well as after runoff events, or as necessary*
3	Twin Oaks Park	Underground Basin	Middletown Township	Bi-Annual Inspection & Cleaning*
4	CC-DB-01, CC-DB-09, CC-DB-10, CC-DB-11, CC-DB-16, CC-DB-22,	Detention Basin Retrofit to Dry Extended or Retention Basin	Middletown Township	Bi-Annual Inspection *

	MC-DB-02, MC-DB-03, MC-DB-05, MC-DB-06, MC-DB-16, MC-DB-17, QAC-DB-13, NC-DB-01, NC-DB-02, NC-DB-05, NC-DB-06, NC-DB-07, NC-DB-09, NC-DB-11, NC-DB-12, NC-DB-13, NC-DB-15, NC-DB-16, NC-DB-19			
5	Varies	Projects with Neighboring Municipalities	Middletown Township & Neighboring Municipalities, as applicable	*

*Note: Actual O&M activities will be identified by the Township in their Annual MS4 Status Reports, submitted under the General Permit. The development and enforcement of the Stormwater O&M agreements are the responsibility of the Township. Once the PRP has been approved by PADEP and the Township begins design of the BMPs, an O&M manual will be created and submitted to PADEP for review and comment.

Appendix A

MS4 Requirements Table

Appendix A-1: Applicable Portion of the MS4 Requirements Table (Municipal) Anticipated Obligations
for Subsequent NPDES Permit Term

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Bucks County						
MIDDLETOWN TWP	PAG130028	Yes	TMDL Plan	Neshaminy Creek TMDL	TMDL Plan-Siltation, Suspended Solids (4a)	
				Lake Luxembourg	Appendix E-Nutrients, Suspended Solids (4a)	
				Queen Anne Creek	Appendix E-Siltation (5)	Other Habitat Alterations, Water/Flow Variability (4c)
				Silver Lake	Appendix E-Excessive Algal Growth, Nutrients, Suspended Solids (5)	Other Habitat Alterations (5)
				Unnamed Tributaries to Neshaminy Creek		Water/Flow Variability (4c)
				Delaware River	Appendix C-PCB (4a)	
				Magnolia Lake	Appendix E-Excessive Algal Growth, Nutrients, Organic Enrichment/Low D.O., Suspended Solids (5)	
				Mill Creek	Appendix C-PCB (4a), Appendix E-Siltation (5)	Other Habitat Alterations, Water/Flow Variability (4c)
				Neshaminy Creek	Appendix B-Pathogens (5), Appendix C-PCB (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5)	
MILFORD TWP	PAI130022	Yes	SP, IP	Tohickon Creek	Appendix E-Nutrients, Siltation (5)	
				Morgan Creek	Appendix E-Nutrients, Siltation (5)	
				Delmont Lake		Exotic Species (5)
				Beaver Run	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Unnamed Tributaries to Unami Creek	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Unnamed Tributaries to Beaver Run		Other Habitat Alterations (4c)
MORRISVILLE BORO	PAG130104	No		Delaware River	Appendix C-PCB (4a)	
				Martins Creek	Appendix C-PCB (4a), Appendix E-Siltation (5)	Flow Alterations (4c)
				Rock Run	Appendix E-Siltation (5)	Flow Alterations (4c)
NEW BRITAIN BORO	PAG130154	Yes	TMDL Plan	Neshaminy Creek	Appendix B-Pathogens (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5)	
				Cooks Run	Appendix E-Nutrients (5)	
				Pine Run	Appendix E-Excessive Algal Growth (5)	
				North Branch Neshaminy Creek		Water/Flow Variability (4c)
				Neshaminy Creek TMDL	TMDL Plan-Siltation, Suspended Solids (4a)	

Appendix B

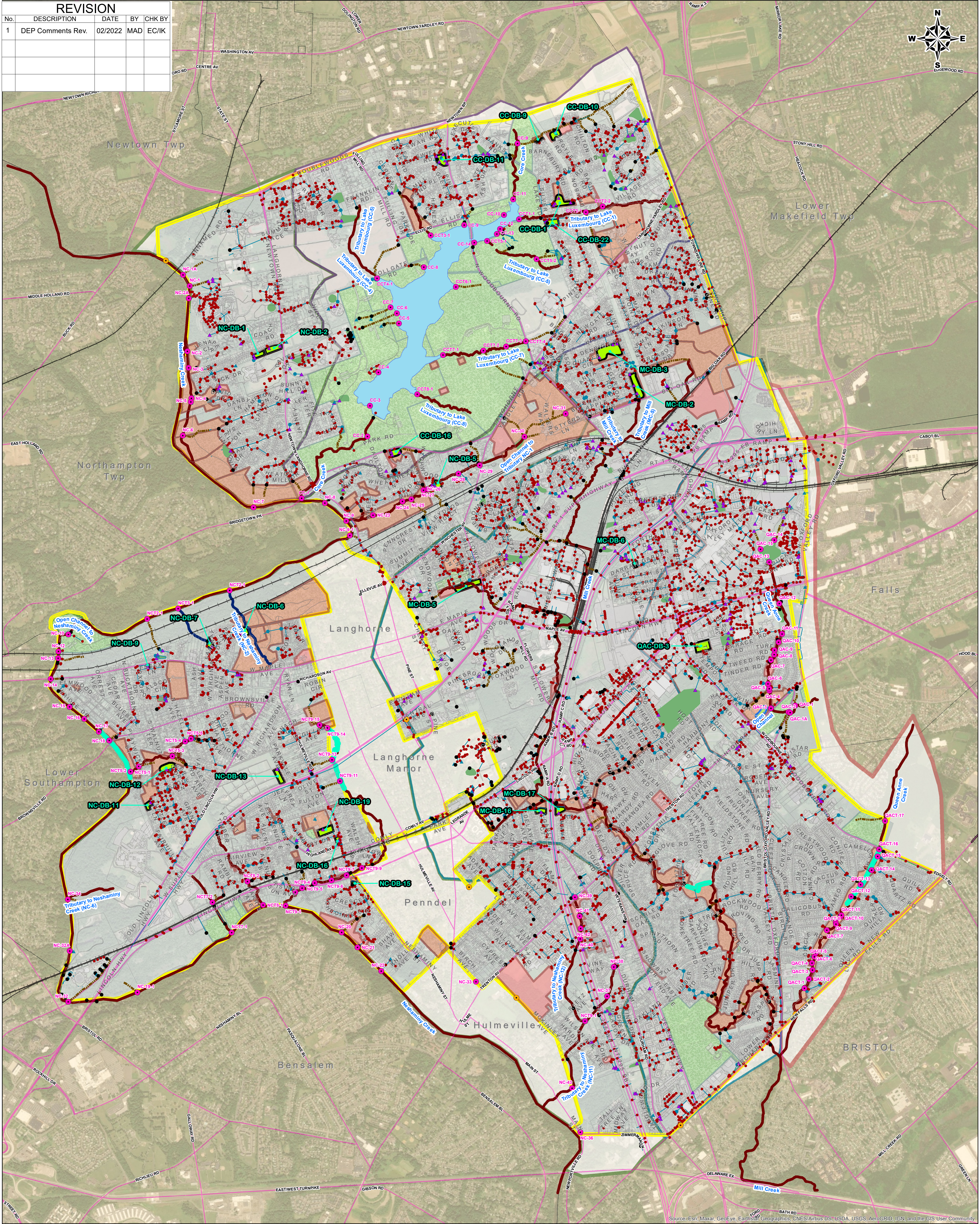
Public Participation

Appendix C

Maps

Appendix C: Middletown Township MS4 PRP/TMDL Maps

REVISION				
No.	DESCRIPTION	DATE	BY	CHK BY
1	DEP Comments Rev.	02/2022	MAD	EC/K



General Notes and Data Sources:

This Geographic Information System (GIS) MS4 map is for demonstration purposes only. Any use of this product with respect to accuracy and precision shall be the sole responsibility of the end user.

This map was created, in part, utilizing parcel, municipal boundary and location data provided by the Bucks County Planning Commission.

Additional GIS resource data and imagery data was provided by the Pennsylvania Spatial Data Access. The (PASDA) data was obtained and provided by the Pennsylvania Spatial Data Access (PASDA): <https://www.pasda.psu.edu/>

Additional cadastral feature mapping data, such as, waterways, roadways, railroads, aerial orthophotography, etc. was obtained from the Pennsylvania Department of Environmental Protection (PADEP). The PADEP data was obtained and provided by the Pennsylvania Department of Environmental Protection: <http://www.state.nj.us/dep/gis/>. This secondary product has not been verified by (PADEP) and is not state-authorized.

All positions are based on the following:
 - NAD 83 (horizontal datum)
 - Pennsylvania State Plane Coordinate System
 - English units (feet)

The geodetic accuracy and precision of the Geographic Information System (GIS) data contained in this mapping has not been developed nor verified by a professional licensed land surveyor and shall not be nor is intended to be used in matters requiring delineation and location of true ground horizontal and/or vertical controls.

All Geographic Information System (GIS) MS4 mapping was prepared in compliance with Middletown Township Stormwater Ordinance and the Small MS4 Permit Program and is the property of Middletown Township and states the following: "Not for distribution, no reproduction without permission by Remington & Vernick Engineers and the Middletown Township Board of Supervisors". For further information, please contact Isaac Kessler, Township Engineer with Remington & Vernick Engineers; at Isaac.kessler@rve.com.

Legend

Storm Infrastructure Streams

- Endwall
- Headwall
- Outlet Structures
- Inlet
- Manholes
- Outfall
- Observation Points
- Storm Pipes
- Open Channel
- Rail
- State Roads

Assesment

- Impaired
- Not Impaired
- Proposed Streambank Restoration
- Basins
- Proposed Basin Retrofits
- Proposed Underground Basin
- Core Creek Watershed
- Mill Creek Watershed
- Neshaminy Creek Watershed
- Queen Anne Watershed
- Township Owned Land
- Parcels

0 750 1,500 3,000 4,500 6,000 Feet

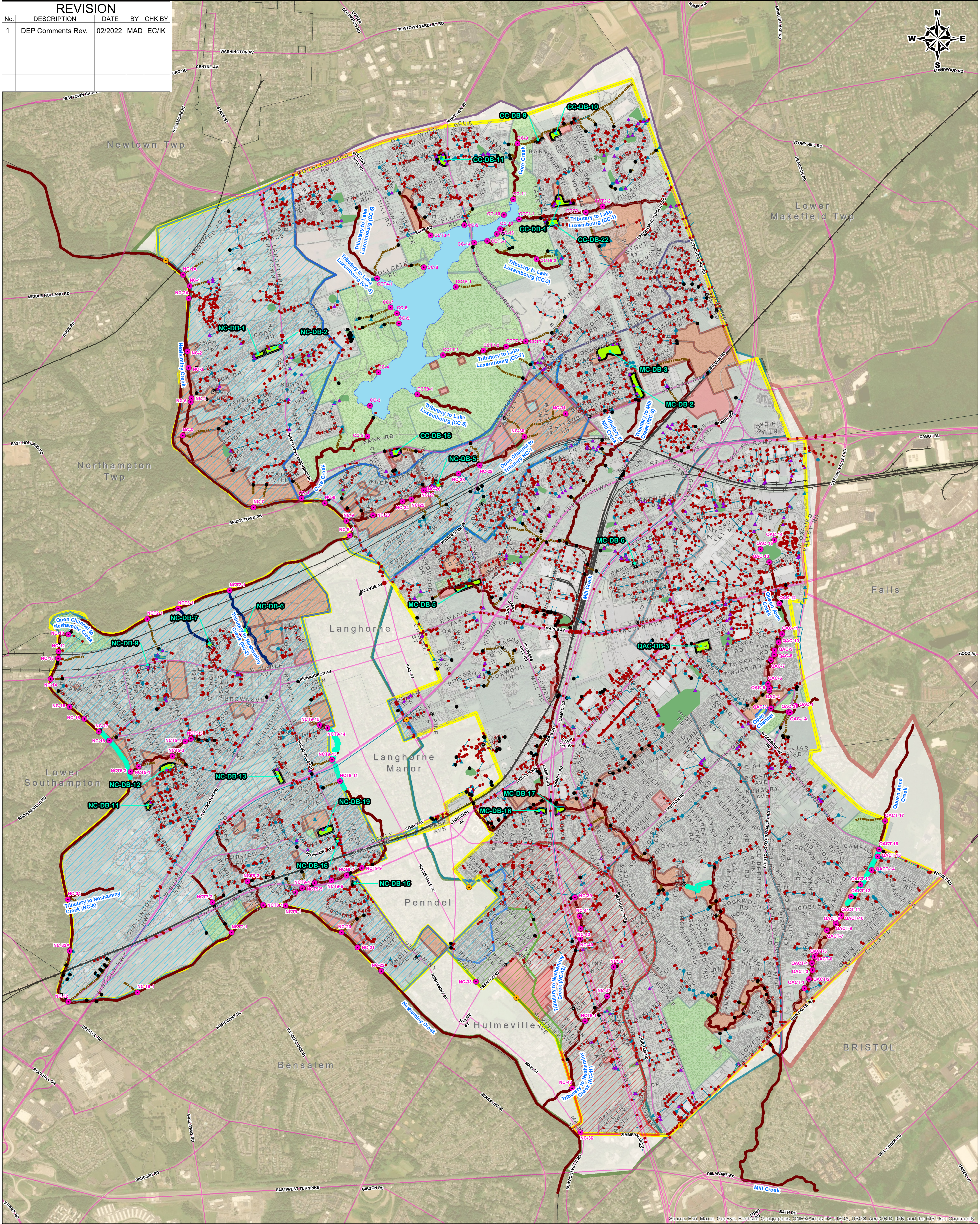
MS4 Map
 TOWNSHIP OF
MIDDLETOWN
 BUCKS COUNTY

02/02/2022 SCALE: 1" = 1,500'

DRAFT

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 Certificate of Authorization: 24 GA 28003300
 -ENGINEERING EXCELLENCE-

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No.	DESCRIPTION	DATE	BY	CHK BY
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 - English units (feet)

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Legend

Storm Infrastructure Streams

- ▲ Endwall
- ▲ Headwall
- Outlet Structures
- Inlet
- Manholes
- Outfall
- Observation Points
- Storm Pipes
- Open Channel
- Rail
- State Roads

Assesment

- Impaired
- Not Impaired
- Proposed Streambank Restoration
- Basins
- Proposed Basin Retrofits
- Proposed Underground Basin
- Core Creek Watershed
- Mill Creek Watershed
- Neshaminy Creek Watershed
- Queen Anne Watershed
- Township Owned Land
- Parcels

0 750 1,500 3,000 4,500 6,000 Feet

Subwatershed Legend

- Neshaminy Creek Subwatershed #1
- Neshaminy Creek Subwatershed Trib. #1
- Neshaminy Creek Subwatershed #3

MS4 Subwatershed Map
 TOWNSHIP OF
MIDDLETOWN
 BUCKS COUNTY

02/02/2022 SCALE: 1" = 1,500'

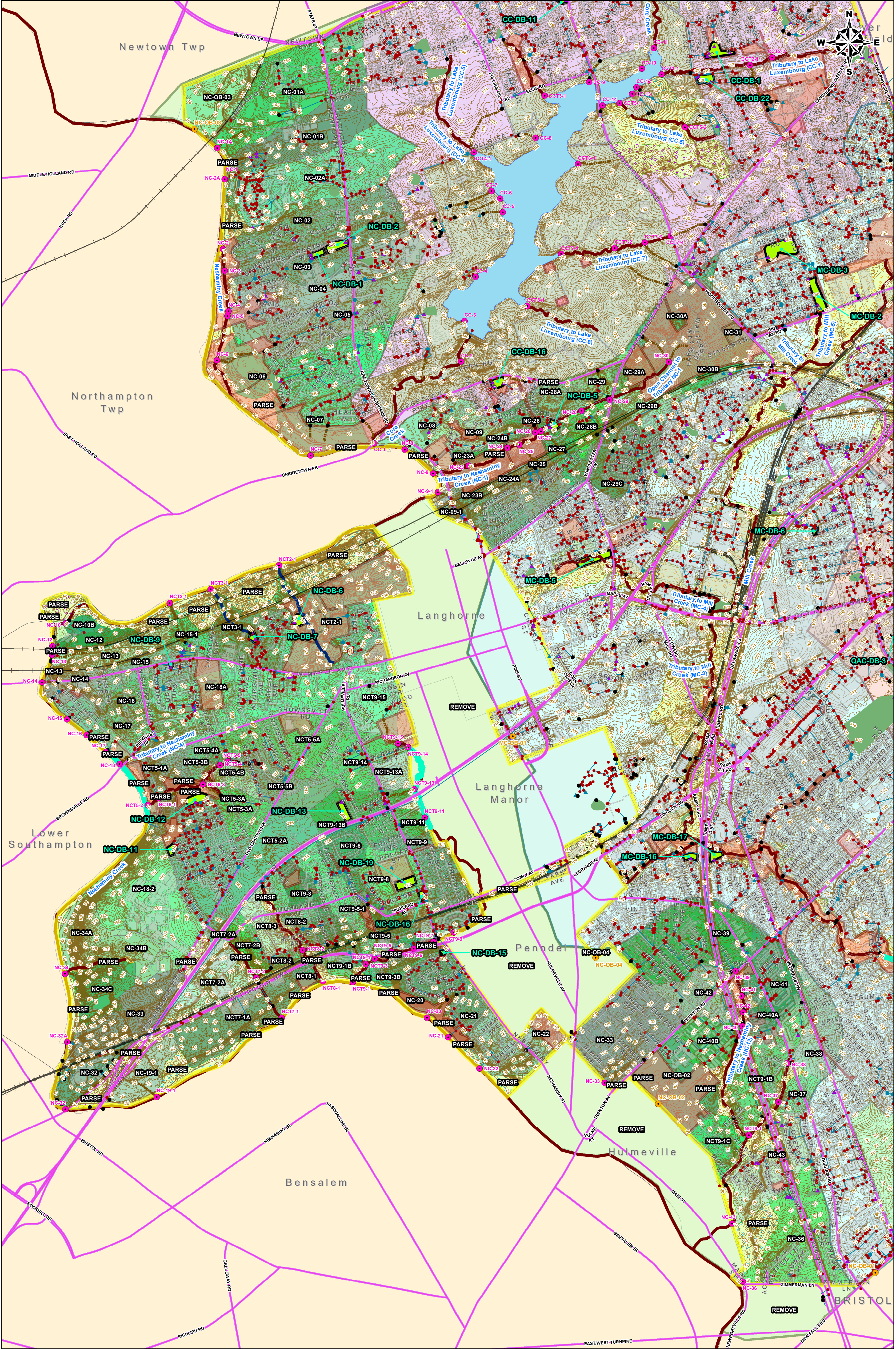
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Parsing Classification	
	300 FT PARSE
	BCCD PARSE
	DIRECT DISCHARGE PARSE
	PRIVATE LAND PARSE
	RAILROAD PARSE
	STATE ROAD PARSE

Neshaminy Creek Sewersheds	
	NC-01A
	NC-01B
	NC-02
	NC-02A
	NC-03
	NC-04
	NC-05
	NC-06
	NC-07
	NC-08
	NC-09
	NC-09-1
	NC-10B
	NC-12
	NC-13
	NC-14
	NC-15
	NC-15-1
	NC-16
	NC-17
	NC-18-2
	NC-18A
	NC-19-1
	NC-20
	NC-21
	NC-22
	NC-23A
	NC-23B
	NC-24A
	NC-24B
	NC-25
	NC-26
	NC-27
	NC-28
	NC-28A
	NC-28B
	NC-29
	NC-29A
	NC-29B
	NC-29C
	NC-30-1
	NC-30A
	NC-30B
	NC-31
	NC-32
	NC-33
	NC-34A
	NC-34B
	NC-34C
	NC-36
	NC-37
	NC-38
	NC-39
	NC-40A
	NC-40B
	NC-41
	NC-42
	NC-43
	NC-OB-02
	NC-OB-03
	NC-OB-04
	NCT2-1
	NCT3-1
	NCT5-1A
	NCT5-2A
	NCT5-3A
	NCT5-3B
	NCT5-4A
	NCT5-4B
	NCT5-5A
	NCT5-5B
	NCT7-1A
	NCT7-2A
	NCT7-2B
	NCT8-1
	NCT8-2
	NCT8-3
	NCT9-11
	NCT9-13A
	NCT9-13B
	NCT9-14
	NCT9-15
	NCT9-1B
	NCT9-1C
	NCT9-3
	NCT9-3B
	NCT9-5
	NCT9-5-1
	NCT9-6
	NCT9-7
	NCT9-8
	NCT9-9



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- English units (feet)

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Legend

	Endwall		Impaired		Queen Anne Watershed
	Headwall		Not Impaired		Neshaminy Creek Watershed
	Outlet Structures		Proposed Streambank Restoration		Mill Creek Watershed
	Inlet		Basins		Core Creek Watershed
	Manholes		Proposed Basin Retrofits		Township Owned Land
	Outfall		Proposed Underground Basin		Parcels
	Observation Points		Impervious		
	Storm Pipes				
	Open Channel				
	Rail				
	State Roads				

DRAFT

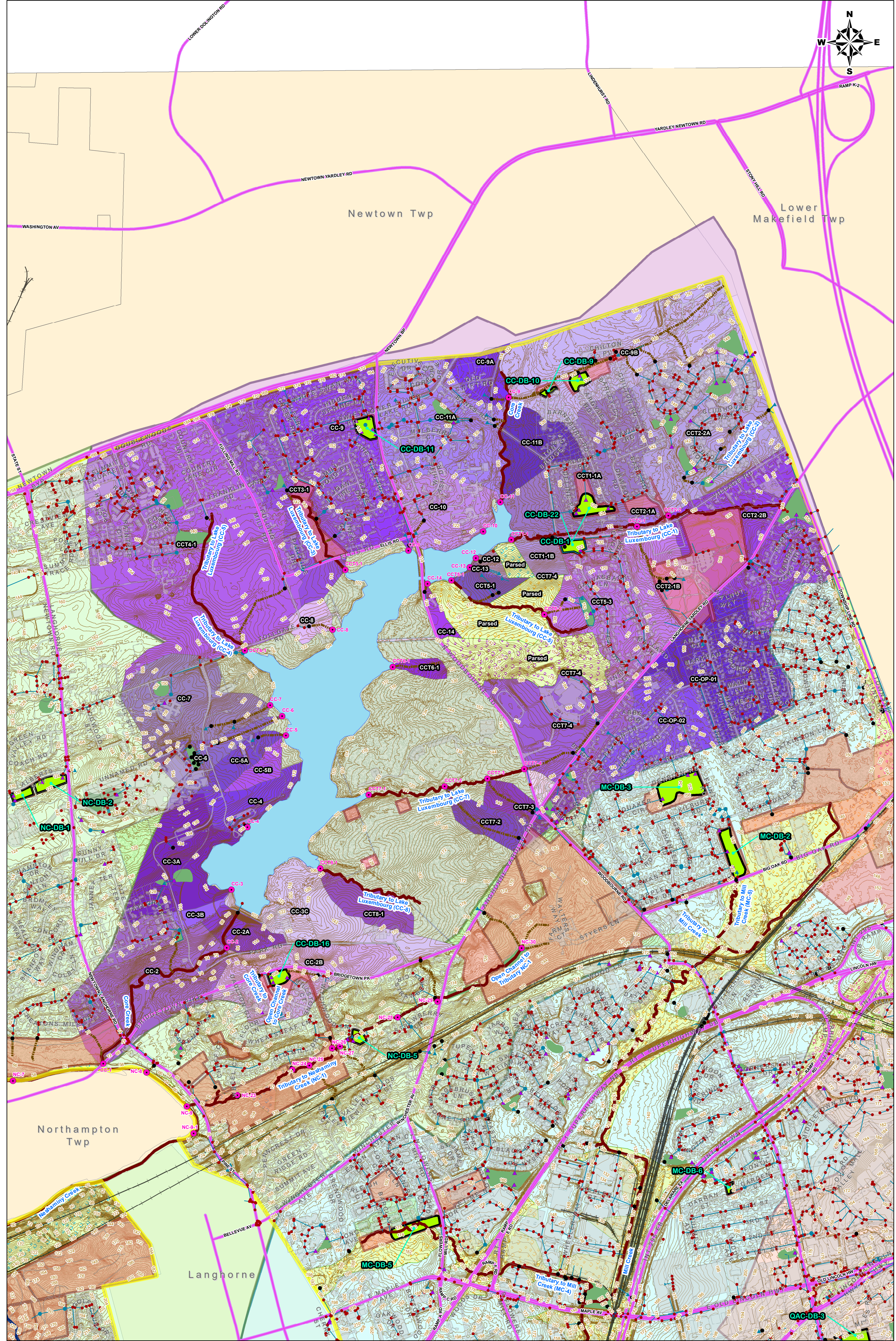
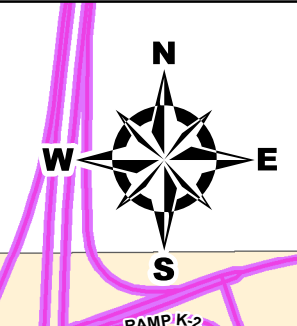
MS4 Sewershed Map

TOWNSHIP OF
MIDDLETOWN
BUCKS COUNTY

02/02/2022 SCALE: 1 inch = 1,250 feet

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- Parsing Classification**
- 300 FT PARSE
 - BCCD PARSE
 - DIRECT DISCHARGE PARSE
 - PRIVATE LAND PARSE
 - RAILROAD PARSE
 - STATE ROAD PARSE
- Core Creek Sewersheds**
- CC-10
 - CC-11A
 - CC-11B
 - CC-12
 - CC-13
 - CC-14
 - CC-2
 - CC-2A
 - CC-2B
 - CC-3A
 - CC-3B
 - CC-3C
 - CC-4
 - CC-5A
 - CC-5B
 - CC-6
 - CC-7
 - CC-8
 - CC-9
 - CC-9A
 - CC-9B
 - CC-OP-01
 - CC-OP-02
 - CCT1-1A
 - CCT1-1B
 - CCT2-1A
 - CCT2-1B
 - CCT2-2A
 - CCT2-2B
 - CCT3-1
 - CCT4-1
 - CCT5-1
 - CCT5-3
 - CCT6-1
 - CCT7-2
 - CCT7-3
 - CCT7-4
 - CCT8-1

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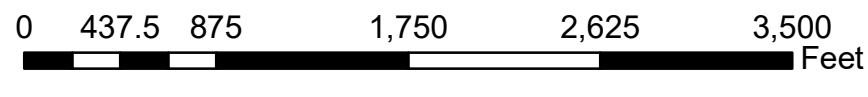
- Legend**
- | | | |
|--------------------|---------------------------------|---------------------------|
| Endwall | Impaired | Queen Anne Watershed |
| Headwall | Not Impaired | Neshaminy Creek Watershed |
| Outlet Structures | Proposed Streambank Restoration | Mill Creek Watershed |
| Inlet | Basins | Core Creek Watershed |
| Manholes | Proposed Basin Retrofits | Township Owned Land |
| Outfall | Proposed Underground Basin | Parcels |
| Observation Points | Impervious | |
| Storm Pipes | | |
| Open Channel | | |
| Rail | | |
| State Roads | | |

DRAFT

MS4 Sewershed Map
TOWNSHIP OF
MIDDLETOWN
BUCKS COUNTY

02/02/2022 SCALE: 1 inch = 875 feet

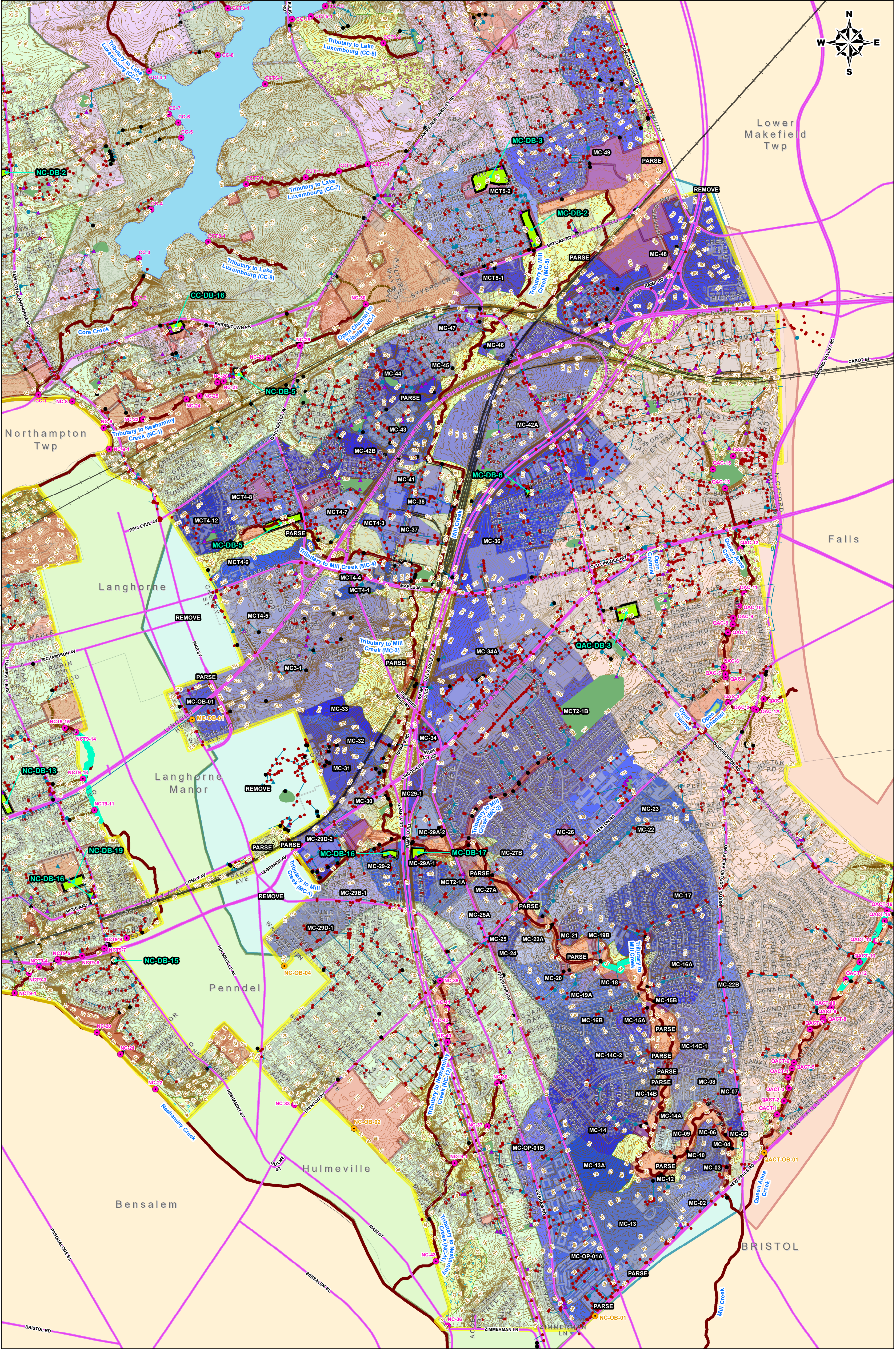
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- Parsing Classification**
- 300 FT PARSE
 - BCCD PARSE
 - DIRECT DISCHARGE PARSE
 - PRIVATE LAND PARSE
 - RAILROAD PARSE
 - STATE ROAD PARSE

- Mill Creek Sewersheds**
- MC-02
 - MC-03
 - MC-04
 - MC-05
 - MC-06
 - MC-07
 - MC-08
 - MC-09
 - MC-10
 - MC-11
 - MC-12
 - MC-13
 - MC-13A
 - MC-14
 - MC-14A
 - MC-14B
 - MC-14C-1
 - MC-14C-2
 - MC-15A
 - MC-15B
 - MC-16A
 - MC-16B
 - MC-17
 - MC-18
 - MC-19A
 - MC-19B
 - MC-20
 - MC-21
 - MC-22
 - MC-22A
 - MC-22B
 - MC-23
 - MC-24
 - MC-25
 - MC-25A
 - MC-26
 - MC-27A
 - MC-27B
 - MC-28
 - MC-29-2
 - MC-29A-1
 - MC-29A-2
 - MC-29B-1
 - MC-29B-2
 - MC-29D-1
 - MC-29D-2
 - MC-30
 - MC-31
 - MC-32
 - MC-33
 - MC-34
 - MC-34A
 - MC-34A
 - MC-36
 - MC-37
 - MC-38
 - MC-41
 - MC-42A
 - MC-42B
 - MC-43
 - MC-44
 - MC-45
 - MC-46
 - MC-47
 - MC-48
 - MC-49
 - MC-OB-01
 - MC-OP-01A
 - MC-OP-01B
 - MC29-1
 - MC3-1
 - MCT2-1A
 - MCT2-1B
 - MCT4-1
 - MCT4-12
 - MCT4-3
 - MCT4-4
 - MCT4-5
 - MCT4-6
 - MCT4-7
 - MCT4-8
 - MCT5-1
 - MCT5-2



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Legend

Endwall	Headwall	Outlet Structures	Inlet	Manholes	Outfall	Observation Points	Storm Pipes	Open Channel	Rail	State Roads		
Impaired	Not Impaired	Proposed Streambank Restoration	Basins	Proposed Basin Retrofits	Proposed Underground Basin	Impervious	Queen Anne Watershed	Neshaminy Creek Watershed	Mill Creek Watershed	Core Creek Watershed	Township Owned Land	Parcels

DRAFT

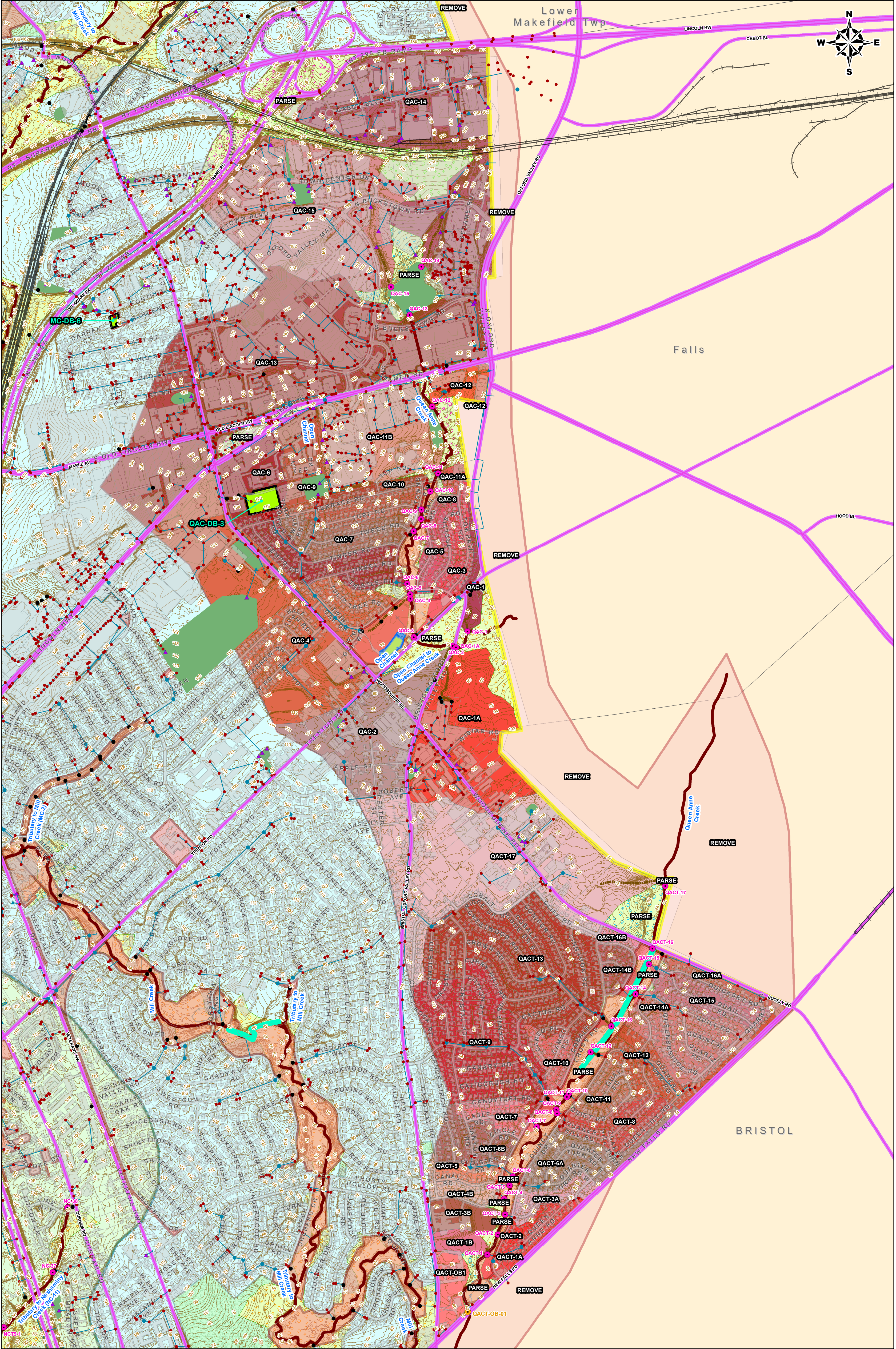
MS4 Sewershed Map

TOWNSHIP OF
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BUCKS COUNTY

02/02/2022 SCALE: 1 inch = 1,125 feet

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- 300 FT PARSE
 - BCCD PARSE
 - DIRECT DISCHARGE PARSE
 - PRIVATE LAND PARSE
 - RAILROAD PARSE
 - STATE ROAD PARSE
- Queen Anne Sewersheds**
- QAC-1
 - QACT-OB1
 - QAC-10
 - QAC-11A
 - QAC-11B
 - QAC-12
 - QAC-13
 - QAC-14
 - QAC-15
 - QAC-1A
 - QAC-2
 - QAC-3
 - QAC-4
 - QAC-5
 - QAC-6
 - QAC-7
 - QAC-8
 - QAC-9
 - QACT-10
 - QACT-11
 - QACT-12
 - QACT-13
 - QACT-14A
 - QACT-14B
 - QACT-15
 - QACT-16A
 - QACT-16B
 - QACT-17
 - QACT-1A
 - QACT-1B
 - QACT-2
 - QACT-3A
 - QACT-3B
 - QACT-4B
 - QACT-5
 - QACT-6A
 - QACT-6B
 - QACT-7
 - QACT-8
 - QACT-9

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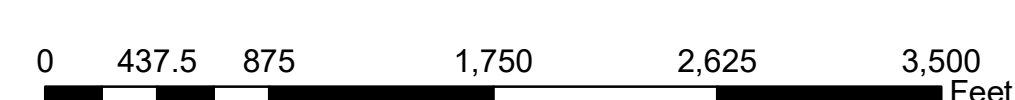
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- Legend**
- Storm Infrastructure**
- Endwall
 - Headwall
 - Outlet Structures
 - Inlet
 - Manholes
 - Outfall
 - Observation Points
 - Storm Pipes
 - Open Channel
 - Rail
 - State Roads
- Streams**
- Assesment**
- Impaired
 - Not Impaired
 - Proposed Streambank Restoration
 - Basins
 - Proposed Basin Retrofits
 - Proposed Underground Basin
 - Impervious
- Queen Anne Watershed
- Neshaminy Creek Watershed
- Mill Creek Watershed
- Core Creek Watershed
- Township Owned Land
- Parcels



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MS4 Sewershed Map

TOWNSHIP OF
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BUCKS COUNTY

02/02/2022 SCALE: 1 inch = 750 feet

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Appendix D

Existing Loading for Pollutants of Concern Calculations

Appendix D-1A: Evaluation Reductions – Neshaminy Creek Subwatershed #1

Appendix D-1B: Evaluation Reductions – Neshaminy Creek Subwatershed #2

Appendix D-1C: Evaluation Reductions – Neshaminy Creek Subwatershed #3

Appendix D-1D: TMDL Neshaminy Creek South #1 Reductions

Appendix D-1E: TMDL Neshaminy Creek Subwatershed Tributary #2 Reductions

Appendix D-1F: TMDL Neshaminy Creek Subwatershed #3 Reductions

Appendix D-1G: Neshaminy Creek 10% Calculations

Appendix D-2: Queen Anne Creek PRP Calculations

Appendix D-3: Core Creek PRP Calculations

Appendix D-4: Mill Creek PRP Calculations

Appendix D-5: Sediment Reduction per Watershed

Appendix D-1A: Evaluation Reductions - Neshaminy Creek Subwatershed #1

TMDL Planning Area - Sediment Load Calculation

Sediment Load Calculations															
Land Use Source	Area of Neshaminy Creek SubWatershed #1 (acres; stream miles)	2000 TMDL Pollutant Loadings (lbs/year)	TMDL Sediment Unit Loading Rate (lbs/ac/year)	Margin of Safety (MOS)	Allocated Wasteload (WLA) (lb/year)	Target Sediment Loading Rate	Middletown Township Existing Baseline TMDL Areas (acres)	Middletown Township Baseline TMDL Areas (acres)	Middletown Baseline Loading Rate	Margin of Safety (MOS)	Middletown Baseline Allocated Wasteload	Final TMDL % Sediment Reduction Required	Existing Sediment Reduction (with TMDL Reduction Required) (lbs/year)**	Existing BMP Load Reduction	Total Sediment Load with Reduction (lbs/year)
Hay/Pasture	62	3,040	49.03	304.00	2,736.00	44.13	147.30	147.30	7,222.45	722.25	6,500.21	30.0%	2,166.7		873.3
Cropland	220	233,840	1,062.91	23,384.00	210,456.00	956.62	49.90	49.90	53,039.16	5,303.92	47,735.25	30.0%	15,911.7		217,928.3
Coniferous Forest	269	2,080	7.73	208.00	1,872.00	6.96	1.00	0.89	6.88	0.69	6.19	30.0%	2.1		2,077.9
Mixed Forest	267	2,760	10.34	276.00	2,484.00	9.30	38.78	38.78	400.87	40.09	360.78	30.0%	120.3		2,639.7
Deciduous Forest	699	8,600	12.30	860.00	7,740.00	11.07	961.00	961.00	11,823.46	1,182.35	10,641.12	30.0%	3,547.0		5,053.0
Transitional Land	126	158,180	1,255.40	15,818.00	142,362.00	1,129.86	38.41	38.41	48,219.79	4,821.98	43,397.81	30.0%	14,465.9		143,714.1
Low Intensity Development	2,355	154,220	65.49	15,422.00	138,798.00	58.94	919.40	919.40	60,208.01	6,020.80	54,187.21	30.0%	18,062.4		136,157.6
High Intensity Development	723	18,980	26.25	1,898.00	17,082.00	23.63	285.50	285.50	7,494.87	749.49	6,745.38	30.0%	2,248.5		16,731.5
Streambank Erosion	7.6	2,491,660	327,850	249,166.00	2,242,494.00	295,065	7.40	7.40	2,426,090.00	242,609.00	2,183,481.00	30.0%	727,827.0		1,763,833.0
Total	4,728.60	3,073,360.00	330,339.45	307,336.00	2,766,024.00	297,305.50	2,448.69	2,448.58	2,614,505.50	261,450.55	2,353,054.95	30.0%	782,093.52	2,258.13	1,832,411.99

* NOTE- Stream along border of Middletown

Appendix D-1B: Evaluation Reductions - Neshaminy Creek Subwatershed Tributary #

TMDL Planning Area - Sediment Load Calculation

Sediment Load Calculations															
Land Use Source	Area of Neshaminy Creek SubWatershed #2 (acres; stream miles)	2000 TMDL Pollutant Loadings (lbs/year)	TMDL Sediment Unit Loading Rate (lbs/ac/year)	Margin of Safety (MOS)	Allocated Wasteload (WLA) (lb/year)	Target Sediment Loading Rate	Middletown Township Existing Baseline TMDL Areas (acres)	Middletown Township Baseline TMDL Areas (acres)	Middletown Baseline Loading Rate	Margin of Safety (MOS)	Middletown Baseline Allocated Wasteload	Final TMDL % Sediment Reduction Required	Existing Sediment Reduction (with TMDL Reduction Required) (lbs/year)**	Existing BMP Load Reduction	Total Sediment Load with Reduction (lbs/year)
Hay/Pasture	7	110	15.71	11.00	99.00	14.14	1.33	1.33	20.90	2.09	18.81	66.0%	13.8		96.2
Cropland	52	16,600	319.23	1,660.00	14,940.00	287.31	8.63	8.63	2,754.96	275.50	2,479.47	66.0%	1,818.3		14,781.7
Coniferous Forest	20	88	4.40	8.80	79.20	3.96	0.00	0.00	0.00	0.00	0.00	66.0%	0.0		88.0
Mixed Forest	40	154	3.85	15.40	138.60	3.47	1.77	1.77	6.81	0.68	6.13	66.0%	4.5		149.5
Deciduous Forest	121	1,170	9.67	117.00	1,053.00	8.70	27.26	27.26	263.59	26.36	237.23	66.0%	174.0		996.0
Transitional Land	54	123,863	2,293.76	12,386.30	111,476.70	2,064.38	0.00	0.00	0.00	0.00	0.00	66.0%	0.0		123,863.0
Low Intensity Development	145	10,662	73.53	1,066.20	9,595.80	66.18	25.87	25.87	1,902.25	190.22	1,712.02	66.0%	1,255.5		9,406.5
High Intensity Development	17	552	32.47	55.20	496.80	29.22	1.45	1.45	47.08	4.71	42.37	66.0%	31.1		520.9
Streambank Erosion	1.5	12,362	8,241	1,236.20	11,125.80	7,417	0.63	0.63	5,192.04	519.20	4,672.84	66.0%	3,426.7		8,935.3
Total	457.50	165,561.00	10,993.96	16,556.10	149,004.90	9,894.56	66.94	66.94	10,187.63	1,018.76	9,168.87		6,723.84	0.00	3,463.80

Appendix D-1C: Evaluation Reductions - Neshaminy Creek Subwatershed #3

TMDL Planning Area - Sediment Load Calculation

Sediment Load Calculations															
Land Use Source	Area of Neshaminy Creek SubWatershed #3 (acres; stream miles)	2000 TMDL Pollutant Loadings (lbs/year)	TMDL Sediment Unit Loading Rate (lbs/ac/year)	Margin of Safety (MOS)	Allocated Wasteload (WLA) (lb/year)	Target Sediment Loading Rate	Middletown Township Existing Baseline TMDL Areas (acres)	Middletown Township Baseline TMDL Areas (acres)	Middletown Baseline Loading Rate	Margin of Safety (MOS)	Middletown Baseline Allocated Wasteload	Final TMDL % Sediment Reduction Required	Existing Sediment Reduction (with TMDL Reduction Required) (lbs/year)**	Existing BMP Load Reduction	Total Sediment Load with Reduction (lbs/year)
Hay/Pasture	59	960	16.27	96.00	864.00	14.64	3.03	3.03	49.30	4.93	44.37	36.0%	17.7		942.3
Cropland	158	44,320	280.51	4,432.00	39,888.00	252.46	10.78	10.78	3,023.86	302.39	2,721.47	36.0%	1,088.6		43,231.4
Coniferous Forest	121	420	3.47	42.00	378.00	3.12	0.00	0.00	0.00	0.00	0.00	36.0%	0.0		420.0
Mixed Forest	124	300	2.42	30.00	270.00	2.18	3.50	1.64	3.97	0.40	3.57	36.0%	1.4		298.6
Deciduous Forest	321	1,000	3.12	100.00	900.00	2.80	114.40	114.40	356.39	35.64	320.75	36.0%	128.3		871.7
Transitional Land	57	18,520	324.91	1,852.00	16,668.00	292.42	3.40	0.00	0.00	0.00	0.00	36.0%	0.0		18,520.0
Low Intensity Development	1,643	34,120	20.77	3,412.00	30,708.00	18.69	235.70	235.70	4,894.76	489.48	4,405.28	36.0%	1,762.1		32,357.9
High Intensity Development	353	2,300	6.52	230.00	2,070.00	5.86	87.00	87.00	566.86	56.69	510.17	36.0%	204.1		2,095.9
Streambank Erosion	5.4	1,312,360	243.030	131,236.00	1,181,124.00	218,727	1.70	1.70	413,150.37	41,315.04	371,835.33	36.0%	148,734.1		1,163,625.9
Total	2,841.40	1,414,300.00	243,687.61	141,430.00	1,272,870.00	219,318.85	459.51	454.25	422,045.50	42,204.55	379,840.95	36.0%	151,936.38	0.00	270,109.12

Appendix D-1D: TMDL Neshaminy Creek South #1 Reductions

Subwatershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
Neshaminy Creek South #1	3,267.30	768.88	2,498.42	1,839	264.96	2,075,959.96	42,618.39

Totals (ac.)	3,267.30	768.88	2,498.42
Percents of Impervious and Pervious		23.53%	76.47%

2,033,341.57
610,002.47

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (30%)

Appendix D-1E: TMDL Neshaminy Creek Subwatershed Tributary #2 Reductions

Subwatershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
Neshaminy Creek Subwatershed Tributary #2	93.52	21.99	71.53	1,839	264.96	59,392.20	0.00

Totals (ac.)	93.52	21.99	71.53
Percents of Impervious and Pervious		23.51%	76.49%

59,392.20
39,198.85

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (66%)

Appendix D-1F: TMDL Neshaminy Creek Subwatershed #3 Reductions

Subwatershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
Neshaminy Creek South #3	529.89	177.69	352.20	1,839	264.96	420,090.40	0.00

Totals (ac.)	529.89	177.69	352.20
Percents of Impervious and Pervious		33.53%	66.47%

420,090.40
126,027.12

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (36%)

Appendix D-1G: Neshaminy Creek 10% Calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
NC-01A	133.16	35.45	97.71	1,839	264.96	91,082.58	
NC-01B	72.39	10.39	62.00	1,839	264.96	35,534.10	
NC-02	48.41	9.28	39.13	1,839	264.96	27,427.09	
NC-02A	127.14	30.90	96.24	1,839	264.96	82,324.85	
NC-03	109.98	31.92	78.06	1,839	264.96	79,383.39	
NC-04	68.70	19.12	49.58	1,839	264.96	48,298.95	
NC-05	95.23	24.72	70.51	1,839	264.96	64,141.32	
NC-06	93.93	21.04	72.89	1,839	264.96	58,006.77	
NC-07	67.66	11.02	56.64	1,839	264.96	35,274.31	
NC-08	32.17	5.91	26.27	1,839	264.96	17,820.31	
NC-09	33.91	8.13	25.77	1,839	264.96	21,782.84	
NC-09-1	9.23	2.27	6.96	1,839	264.96	6,021.26	
NC-10B	7.20	0.21	6.99	1,839	264.96	2,236.77	
NC-12	16.77	1.34	15.43	1,839	264.96	6,546.89	
NC-13	33.11	0.29	32.81	1,839	264.96	9,228.45	
NC-14	22.79	4.16	18.63	1,839	264.96	12,594.59	
NC-15	58.60	16.44	42.16	1,839	264.96	41,403.48	
NC-15-1	16.34	1.41	14.94	1,839	264.96	6,546.55	
NC-16	21.67	5.27	16.40	1,839	264.96	14,041.45	
NC-17	10.18	2.23	7.95	1,839	264.96	6,209.31	
NC-18-2	114.14	29.03	85.11	1,839	264.96	75,935.59	
NC-18A	158.04	45.99	112.05	1,839	264.96	114,264.64	
NC-19-1	29.08	0.00	29.08	1,839	264.96	7,705.27	

Appendix D-1G: Neshaminy Creek 10% Calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
NC-20	38.51	15.39	23.12	1,839	264.96	34,428.19	
NC-21	14.96	4.36	10.60	1,839	264.96	10,827.64	
NC-22	32.93	6.10	26.83	1,839	264.96	18,335.58	
NC-23A	7.79	1.28	6.50	1,839	264.96	4,086.04	
NC-23B	43.97	8.00	35.97	1,839	264.96	24,236.97	
NC-24A	27.10	4.14	22.96	1,839	264.96	13,689.64	
NC-24B	5.97	1.84	4.13	1,839	264.96	4,480.99	
NC-25	22.22	4.03	18.19	1,839	264.96	12,225.84	
NC-26	8.04	2.13	5.91	1,839	264.96	5,490.16	
NC-27	14.20	2.98	11.22	1,839	264.96	8,457.13	
NC-28A	19.18	2.50	16.68	1,839	264.96	9,012.95	
NC-28B	18.49	3.40	15.09	1,839	264.96	10,250.85	
NC-29	16.84	4.14	12.69	1,839	264.96	10,979.89	
NC-29A	15.21	1.83	13.39	1,839	264.96	6,903.92	
NC-29B	13.41	4.22	9.19	1,839	264.96	10,193.25	
NC-29C	62.76	21.43	41.33	1,839	264.96	50,361.44	
NC-30-1	38.40	6.00	32.40	1,839	264.96	19,623.73	
NC-30A	18.38	1.19	17.19	1,839	264.96	6,742.77	
NC-30B	27.67	3.03	24.64	1,839	264.96	12,092.97	
NC-31	9.24	2.34	6.89	1,839	264.96	6,136.31	
NC-32	36.54	11.80	24.74	1,839	264.96	28,254.73	
NC-32A	58.69	31.66	27.03	1,839	264.96	65,385.64	
NC-33	92.49	31.66	60.83	1,839	264.96	74,339.97	
NC-34A	30.65	0.01	30.64	1,839	264.96	8,134.36	
NC-34B	37.41	5.33	32.08	1,839	264.96	18,294.98	
NC-34C	38.25	0.51	37.74	1,839	264.96	10,936.82	

Appendix D-1G: Neshaminy Creek 10% Calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
NC-36	96.15	18.96	77.19	1,839	264.96	55,318.88	
NC-37	14.91	4.32	10.59	1,839	264.96	10,754.32	
NC-38	43.12	14.74	28.38	1,839	264.96	34,625.68	
NC-39	106.15	38.05	68.10	1,839	264.96	88,016.93	
NC-40A	20.54	8.80	11.73	1,839	264.96	19,298.81	
NC-40B	31.51	17.18	14.33	1,839	264.96	35,390.63	
NC-41	40.29	19.30	20.99	1,839	264.96	41,053.23	
NC-42	42.43	16.22	26.21	1,839	264.96	36,774.27	
NC-43	57.32	14.32	43.00	1,839	264.96	37,728.63	
NC-OB-02	23.19	5.11	18.08	1,839	264.96	14,181.76	
NC-OB-03	48.53	0.56	47.97	1,839	264.96	13,739.97	
NC-OB-04	1.00	0.46	0.54	1,839	264.96	989.02	
NCT2-1	89.32	13.21	76.11	1,839	264.96	44,457.97	
NCT3-1	55.19	14.16	41.03	1,839	264.96	36,910.70	
NCT5-1A	24.89	4.82	20.08	1,839	264.96	14,181.12	
NCT5-2A	155.91	39.89	116.02	1,839	264.96	104,099.43	
NCT5-3A	30.09	10.33	19.76	1,839	264.96	24,232.24	
NCT5-3B	11.36	3.37	7.99	1,839	264.96	8,316.43	
NCT5-4A	4.81	1.52	3.29	1,839	264.96	3,663.94	
NCT5-4B	10.62	3.24	7.38	1,839	264.96	7,920.85	
NCT5-5A	69.10	19.87	49.23	1,839	264.96	49,585.52	
NCT5-5B	41.10	10.00	31.10	1,839	264.96	26,625.89	
NCT7-1A	69.01	7.73	61.27	1,839	264.96	30,459.18	
NCT7-2A	43.74	14.61	29.13	1,839	264.96	34,587.05	
NCT7-2B	19.85	4.08	15.78	1,839	264.96	11,676.82	
NCT8-1	6.36	1.05	5.31	1,839	264.96	3,331.51	
NCT8-2A	5.50	3.73	1.77	1,839	264.96	7,324.74	
NCT8-2B	21.22	3.73	17.49	1,839	264.96	11,490.82	

Appendix D-1G: Neshaminy Creek 10% Calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate (lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-5)
NCT8-3	22.61	5.82	16.79	1,839	264.96	15,159.88	
NCT9-11	21.18	6.05	15.13	1,839	264.96	15,137.18	
NCT9-13A	14.83	1.96	12.87	1,839	264.96	7,014.64	
NCT9-13B	38.29	11.95	26.34	1,839	264.96	28,955.15	
NCT9-14	55.33	15.27	40.06	1,839	264.96	38,694.64	
NCT9-15	57.02	12.61	44.41	1,839	264.96	34,957.22	
NCT9-1B	82.27	22.51	59.76	1,839	264.96	57,229.75	
NCT9-1C	17.13	3.26	13.88	1,839	264.96	9,666.18	
NCT9-3	42.28	13.16	29.12	1,839	264.96	31,917.83	
NCT9-3B	15.43	2.54	12.90	1,839	264.96	8,080.45	
NCT9-5	3.60	1.50	2.10	1,839	264.96	3,323.02	
NCT9-5-1	39.88	14.28	25.60	1,839	264.96	33,044.88	
NCT9-6	54.15	16.49	37.66	1,839	264.96	40,303.00	
NCT9-7	7.99	1.62	6.38	1,839	264.96	4,666.70	
NCT9-8	50.92	16.17	34.75	1,839	264.96	38,943.43	
NCT9-9	55.44	19.01	36.43	1,839	264.96	44,611.22	
						2,566,155.00	42,618.39

Totals (ac.)	3,890.71	975.37	2,915.34
Percents of Impervious and Pervious		25.07%	74.93%

2,523,536.61
252,353.66

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (10%)

Appendix D-2: Queen Anne Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-6)
QAC-01	6.75	0.94	5.81	1,839	264.96	3,270.20	
QACT-OB-01	11.58	5.03	6.55	1,839	264.96	10,985.66	
QAC-02	43.99	16.65	27.34	1,839	264.96	37,862.74	
QAC-03	13.97	5.71	8.26	1,839	264.96	12,688.91	
QAC-04	130.00	53.19	76.81	1,839	264.96	118,168.06	
QAC-05	9.82	4.04	5.78	1,839	264.96	8,957.20	
QAC-06	47.06	24.65	22.41	1,839	264.96	51,267.99	
QAC-07	18.32	7.79	10.53	1,839	264.96	17,113.48	
QAC-08	1.92	1.07	0.85	1,839	264.96	2,195.16	
QAC-09	33.53	16.07	17.46	1,839	264.96	34,180.00	
QAC-10	6.56	2.62	3.94	1,839	264.96	5,859.25	
QAC-11A	3.15	1.52	1.63	1,839	264.96	3,228.97	
QAC-11B	50.05	31.06	18.99	1,839	264.96	62,152.13	
QAC-12	8.87	3.87	5.01	1,839	264.96	8,435.47	
QAC-13	170.37	133.70	36.67	1,839	264.96	255,590.27	
QAC-14	111.87	70.76	41.11	1,839	264.96	141,019.79	
QAC-15	107.63	76.47	31.16	1,839	264.96	148,884.36	
QAC-1A	65.00	21.11	43.89	1,839	264.96	50,449.87	
QACT-10	9.72	4.13	5.59	1,839	264.96	9,069.17	

Appendix D-2: Queen Anne Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-6)
QACT-11	6.41	2.60	3.81	1,839	264.96	5,787.13	
QACT-12	21.51	9.25	12.25	1,839	264.96	20,260.64	
QACT-13	80.90	36.69	44.21	1,839	264.96	79,187.45	
QACT-14A	29.61	13.38	16.23	1,839	264.96	28,906.66	
QACT-14B	8.68	3.40	5.28	1,839	264.96	7,658.71	
QACT-15	16.48	6.95	9.54	1,839	264.96	15,301.76	
QACT-16A	6.98	2.64	4.34	1,839	264.96	6,011.09	
QACT-16B	3.37	1.05	2.32	1,839	264.96	2,538.23	
QACT-17	132.11	39.80	92.31	1,839	264.96	97,651.27	
QACT-1A	12.43	5.07	7.36	1,839	264.96	11,274.06	
QACT-1B	5.74	0.56	5.18	1,839	264.96	2,397.40	
QACT-2	3.55	1.08	2.47	1,839	264.96	2,642.22	
QACT-3A	8.27	3.41	4.86	1,839	264.96	7,557.20	
QACT-3B	9.42	3.81	5.61	1,839	264.96	8,487.92	
QACT-4B	6.82	2.98	3.84	1,839	264.96	6,505.91	
QACT-5	6.69	2.81	3.88	1,839	264.96	6,194.36	
QACT-6A	22.29	9.71	12.58	1,839	264.96	21,182.07	
QACT-6B	16.22	6.91	9.31	1,839	264.96	15,177.95	
QACT-7	9.81	4.43	5.37	1,839	264.96	9,577.62	
QACT-8	17.48	8.29	9.19	1,839	264.96	17,679.86	
QACT-9	62.00	27.67	34.33	1,839	264.96	59,982.39	
Totals (ac.)	1,336.95	672.86	664.09			1,413,340.57	23,794.11
Percents of Impervious and Pervious		50.33%	49.67%				

1,389,546.46
138,954.65

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (10%)

Appendix D-3: Core Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (lbs/year) (See Appendix E-7)
CC-02	93.85	13.29	80.56	1,839	264.96	45,785.49	
CC-04	21.11	2.57	18.54	1,839	264.96	9,634.95	
CC-06	23.69	8.78	14.91	1,839	264.96	20,095.27	
CC-07	61.29	7.15	54.14	1,839	264.96	27,498.09	
CC-08	8.96	0.59	8.37	1,839	264.96	3,294.32	
CC-09	77.36	20.60	56.76	1,839	264.96	52,923.39	
CC-10	40.00	7.61	32.39	1,839	264.96	22,580.96	
CC-11A	85.73	20.19	65.54	1,839	264.96	54,494.23	
CC-11B	30.77	3.23	27.55	1,839	264.96	13,231.70	
CC-12	3.30	0.00	3.30	1,839	264.96	873.25	
CC-13	1.07	0.00	1.07	1,839	264.96	284.52	
CC-14	4.84	0.23	4.61	1,839	264.96	1,644.37	
CC-2A	15.17	0.33	14.84	1,839	264.96	4,531.74	
CC-2B	62.64	9.41	53.23	1,839	264.96	31,412.01	
CC-3A	53.66	6.53	47.12	1,839	264.96	24,501.98	
CC-3B	5.23	0.34	4.89	1,839	264.96	1,918.39	
CC-3C	50.70	4.25	46.45	1,839	264.96	20,130.92	
CC-5A	13.53	1.42	12.11	1,839	264.96	5,828.74	

Appendix D-3: Core Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (lbs/year) (See Appendix E-7)
CC-5B	8.36	0.08	8.28	1,839	264.96	2,344.01	
CC-9A	16.59	1.84	14.75	1,839	264.96	7,291.47	
CC-9B	139.60	21.64	117.96	1,839	264.96	71,051.05	
CC-OP-01	79.71	25.03	54.68	1,839	264.96	60,518.32	
CC-OP-02	50.44	15.73	34.71	1,839	264.96	38,123.23	
CCT1-1A	89.65	20.34	69.31	1,839	264.96	55,770.48	
CCT1-1B	10.34	0.00	10.34	1,839	264.96	2,739.27	
CCT2-1A	3.76	0.64	3.12	1,839	264.96	2,009.16	
CCT2-1B	47.34	8.17	39.16	1,839	264.96	25,406.79	
CCT2-2A	94.98	31.62	63.36	1,839	264.96	74,936.65	
CCT2-2B	109.21	25.31	83.90	1,839	264.96	68,775.80	
CCT3-1	101.06	22.16	78.90	1,839	264.96	61,657.43	
CCT4-1	263.43	49.55	213.88	1,839	264.96	147,793.01	
CCT5-1	9.54	0.00	9.54	1,839	264.96	2,527.42	
CCT6-1	5.37	0.00	5.37	1,839	264.96	1,422.84	
CCT5-3	68.55	16.72	51.83	1,839	264.96	44,481.66	
CCT7-2	17.64	0.93	16.71	1,839	264.96	6,131.69	
CCT7-3	17.53	2.79	14.73	1,839	264.96	9,042.64	
CCT7-4	75.97	18.43	57.54	1,839	264.96	49,137.59	
CCT8-1	1.00	0.18	0.82	1,839	264.96	547.57	
						1,072,372.37	48,560.18

Totals (ac.)	1,862.97	367.69	1,495.28
Percents of Impervious and Pervious		19.74%	80.26%

1,023,812.19
102,381.22

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (10%)

Appendix D-4: Mill Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-8)
MC-02	16.43	7.54	8.89	1,839	264.96	16,215.83	
MC-03	5.99	1.18	4.81	1,839	264.96	3,446.71	
MC-04	1.15	0.34	0.81	1,839	264.96	846.47	
MC-05	4.59	1.50	3.08	1,839	264.96	3,582.55	
MC-06	2.82	1.02	1.80	1,839	264.96	2,350.49	
MC-07	8.44	3.24	5.19	1,839	264.96	7,337.41	
MC-08	13.48	5.57	7.91	1,839	264.96	12,341.33	
MC-09	6.88	2.26	4.62	1,839	264.96	5,374.00	
MC-10	8.37	2.67	5.70	1,839	264.96	6,426.92	
MC-11	4.33	1.67	2.66	1,839	264.96	3,777.06	
MC-12	4.40	1.87	2.53	1,839	264.96	4,101.33	
MC-13	52.76	8.12	44.64	1,839	264.96	26,763.84	
MC-13A	29.61	2.37	27.25	1,839	264.96	11,569.39	
MC-14	67.51	23.96	43.55	1,839	264.96	55,600.64	
MC-14A	6.80	3.22	3.58	1,839	264.96	6,864.48	
MC-14B	9.71	3.46	6.25	1,839	264.96	8,021.63	
MC-14C-1	31.88	11.95	19.93	1,839	264.96	27,256.80	
MC-14C-2	31.53	12.58	18.95	1,839	264.96	28,154.51	
MC-15A	11.52	3.16	8.36	1,839	264.96	8,033.60	
MC-15B	8.87	3.24	5.62	1,839	264.96	7,453.44	
MC-16A	26.88	10.01	16.87	1,839	264.96	22,879.19	
MC-16B	33.65	12.75	20.90	1,839	264.96	28,985.27	
MC-17	91.72	33.22	58.50	1,839	264.96	76,591.97	
MC-18	12.95	3.67	9.28	1,839	264.96	9,215.73	
MC-19A	5.64	1.94	3.70	1,839	264.96	4,550.40	
MC-19B	15.18	6.15	9.03	1,839	264.96	13,700.12	
MC-20	25.94	9.64	16.30	1,839	264.96	22,044.62	
MC-21	8.00	2.07	5.93	1,839	264.96	5,373.26	

Appendix D-4: Mill Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-8)
MC-22	65.11	24.32	40.79	1,839	264.96	55,531.81	
MC-22A	13.98	5.00	8.97	1,839	264.96	11,580.97	
MC-22B	52.02	19.19	32.83	1,839	264.96	43,989.55	
MC-23	47.46	18.02	29.44	1,839	264.96	40,937.96	
MC-24	5.77	2.33	3.44	1,839	264.96	5,201.58	
MC-25	7.65	2.85	4.80	1,839	264.96	6,508.23	
MC-25A	24.40	11.54	12.86	1,839	264.96	24,629.76	
MC-26	89.49	40.71	48.78	1,839	264.96	87,791.09	
MC-27A	5.67	2.63	3.04	1,839	264.96	5,639.06	
MC-27B	7.04	3.53	3.51	1,839	264.96	7,420.55	
MC-28	5.67	2.17	3.50	1,839	264.96	4,913.24	
MC29-1	7.08	1.84	5.24	1,839	264.96	4,775.17	
MC-29-2	21.89	6.77	15.12	1,839	264.96	16,456.09	
MC-29A-1	16.68	5.22	11.46	1,839	264.96	12,630.24	
MC-29A-2	20.27	12.02	8.25	1,839	264.96	24,290.04	
MC-29B-1	23.25	8.84	14.41	1,839	264.96	20,069.38	
MC-29B-2	10.40	2.62	7.78	1,839	264.96	6,870.54	
MC-29D-1	33.62	13.01	20.61	1,839	264.96	29,386.67	
MC-29D-2	23.62	15.82	7.80	1,839	264.96	31,158.94	
MC-30	4.88	4.28	0.60	1,839	264.96	8,029.73	
MC3-1	159.78	40.58	119.20	1,839	264.96	106,209.29	
MC-31	38.65	10.11	28.54	1,839	264.96	26,154.55	
MC-32	18.96	1.70	17.26	1,839	264.96	7,700.03	
MC-33	14.70	1.11	13.60	1,839	264.96	5,634.52	
MC-34	8.46	4.04	4.42	1,839	264.96	8,601.98	
MC-34A	124.45	69.12	55.33	1,839	264.96	141,770.67	
MC-36	173.50	86.21	87.29	1,839	264.96	181,668.55	
MC-37	14.42	10.61	3.81	1,839	264.96	20,522.55	
MC-38	21.64	14.01	7.63	1,839	264.96	27,786.94	
MC-41	14.88	10.08	4.80	1,839	264.96	19,809.96	
MC-42A	140.88	28.92	111.96	1,839	264.96	82,849.54	

Appendix D-4: Mill Creek PRP calculations

Sewershed Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutants Load (TSS) (lbs/year)	BMP Reduction (See Appendix E-8)
MC-42B	60.44	22.94	37.50	1,839	264.96	52,123.74	
MC-43	43.16	15.64	27.52	1,839	264.96	36,054.87	
MC-44	43.34	18.59	24.75	1,839	264.96	40,744.09	
MC-45	13.48	8.43	5.05	1,839	264.96	16,841.95	
MC-46	26.76	8.92	17.84	1,839	264.96	21,137.88	
MC-47	25.91	9.46	16.45	1,839	264.96	21,762.32	
MC-48	179.80	41.43	138.37	1,839	264.96	112,852.64	
MC-49	157.79	44.06	113.73	1,839	264.96	111,159.31	
MC-OB-01	19.16	5.84	13.32	1,839	264.96	14,269.87	
MC-OP-01A	95.84	52.39	43.45	1,839	264.96	107,857.89	
MC-OP-01B	45.20	18.03	27.17	1,839	264.96	40,357.17	
MCT2-1A	18.59	7.75	10.84	1,839	264.96	17,116.81	
MCT2-1B	258.77	130.90	127.87	1,839	264.96	274,605.23	
MCT4-1	16.37	7.58	8.79	1,839	264.96	16,268.48	
MCT4-12	35.21	12.31	22.90	1,839	264.96	28,706.39	
MCT4-3	8.05	6.20	1.85	1,839	264.96	11,896.17	
MCT4-4	16.17	7.41	8.76	1,839	264.96	15,953.69	
MCT4-5	59.79	19.75	40.04	1,839	264.96	46,929.17	
MCT4-6	22.58	5.44	17.14	1,839	264.96	14,542.91	
MCT4-7	23.51	14.94	8.57	1,839	264.96	29,745.32	
MCT4-8	53.58	23.90	29.68	1,839	264.96	51,814.88	
MCT5-1	22.15	5.34	16.81	1,839	264.96	14,280.09	
MCT5-2	116.71	37.46	79.25	1,839	264.96	89,887.28	
Totals						2,692,286.33	

Totals (ac.)	3,125.64	1,184.29	1,941.35
Percents of Impervious and Pervious		37.89%	62.11%

2,617,091.21
261,709.12

lbs/year
lbs/year

< Total Existing Sediment Load at Township Outfalls
< Required Sediment Reduction (10%)

Appendix D-5 Reduction per Watershed within Middletown Township		
Watershed Name	Total Sediment per Watershed	10% Reduction
Neshaminy Creek	2,523,536.61	252,353.66
Queen Anne Creek	1,389,546.46	138,954.65
Core Creek	1,023,812.19	102,381.22
Mill Creek	2,617,091.21	261,709.12
Total	7,553,986.47	755,398.65

Appendix E

Loading Reduction Calculations

Appendix E-1: Proposed Streambank Restoration –Neshaminy Creek

Appendix E-2: Proposed Streambank Restoration – Chubb Run

Appendix E-3: Proposed Streambank Restoration – Mill Creek

Appendix E-4: Proposed Streambank Restoration – Queen Anne Creek

Appendix E-5: Neshaminy Creek Drainage Area and BMP Calculations

Appendix E-6: Queen Anne Creek Drainage Area and BMP Calculations

Appendix E-7: Mill Creek Drainage Area and BMP Calculations

Appendix E-8: Core Creek Drainage Area and BMP Calculations

Appendix E-9: Sediment Removal from Inlets within the Township

Appendix E-10: Middletown Township BMP Menu

Appendix E-11: Field Verification Compliance Schedule

Appendix E-1: Stream Bank Restoration - Neshaminy Creek

Stream Restoration BMP Sediment Effectiveness Value	44.88	lb/ft/yr
Linear Feet of Stream Proposed	2,000	LF
Assuming a 80% effectiveness value	80%	
Sediment Load Reduction	71,808	lb/yr
<i>BMP Name and BMP Sediment Effectiveness Values from the PADEP's BMP Effectiveness Values document (3800-PM-BCW0100m)</i>		

Appendix E-2: Stream Bank Restoration - Chubb Run

Stream Restoration BMP Sediment Effectiveness Value	44.88	lb/ft/yr
Linear Feet of Stream Proposed	1,100	LF
Assuming a 80% effectiveness value	50%	
Sediment Load Reduction	24,684	lb/yr
<i>BMP Name and BMP Sediment Effectiveness Values from the PADEP's BMP Effectiveness Values document (3800-PM-BCW0100m)</i>		

Appendix E-3: Stream Bank Restoration - Mill Creek

Stream Restoration BMP Sediment Effectiveness Value	44.88	lb/ft/yr
Linear Feet of Stream Proposed	1,400	LF
Assuming a 80% effectiveness value	80%	
Sediment Load Reduction	50,266	lb/yr
<i>BMP Name and BMP Sediment Effectiveness Values from the PADEP's BMP Effectiveness Values document (3800-PM-BCW0100m)</i>		

Appendix E-4: Stream Bank Restoration - Queen Anne Creek

Stream Restoration BMP Sediment Effectiveness Value	44.88	lb/ft/yr
Linear Feet of Stream Proposed	1,400	LF
Assuming a 80% effectiveness value	80%	
Sediment Load Reduction	50,266	lb/yr
<i>BMP Name and BMP Sediment Effectiveness Values from the PADEP's BMP Effectiveness Values document (3800-PM-BCW0100m)</i>		

Appendix E-5: Neshaminy Creek Drainage Area and BMP Calculations

BMP Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutant Load (lbs/year)	BMP Reduction (%)	Reduction (lbs/year)	Retrofit Percentage	BMP Reduction
NC-DB-1	21.98	6.26	15.72	1,839.00	264.96	15,682.15	10%	1,568.22	50%	7,841.08
NC-DB-2	14.68	3.42	11.26	1,839.00	264.96	9,281.21	10%	928.12	50%	4,640.61
NC-DB-3	45.16	15.74	29.42	1,839.00	264.96	36,741.34	10%	3,674.13	50%	18,370.67
NC-DB-4	15.76	4.35	11.42	1,839.00	264.96	11,021.07	10%	1,102.11	50%	5,510.54
NC-DB-5	4.67	1.03	3.64	1,839.00	264.96	2,858.73	10%	285.87	50%	1,429.37
NC-DB-6	16.42	5.28	11.14	1,839.00	264.96	12,662.88	10%	1,266.29	50%	6,331.44
NC-DB-7	37.55	12.42	25.13	1,839.00	264.96	29,497.79	10%	2,949.78	50%	14,748.89
NC-DB-8	5.34	2.17	3.17	1,839.00	264.96	4,835.46	10%	483.55	50%	2,417.73
NC-DB-9	13.48	5.75	7.73	1,839.00	264.96	12,628.04	10%	1,262.80	50%	6,314.02
NC-RG-10	12.04	5.04	7.00	1,839.00	264.96	11,116.47	80%	8,893.18	0%	0.00
NC-DB-11	8.44	3.30	5.14	1,839.00	264.96	7,423.16	10%	742.32	50%	3,711.58
NC-DB-12	33.99	14.54	19.45	1,839.00	264.96	31,893.32	10%	3,189.33	50%	15,946.66
NC-DB-13	17.83	1.96	15.88	1,839.00	264.96	7,806.05	10%	780.60	50%	3,903.02
NC-DB-14	7.32	3.07	4.25	1,839.00	264.96	6,779.46	10%	677.95	50%	3,389.73
NC-DB-15	14.08	6.63	7.45	1,839.00	264.96	14,168.50	10%	1,416.85	50%	7,084.25
NC-DB-16	14.19	5.44	8.75	1,839.00	264.96	12,314.72	10%	1,231.47	50%	6,157.36
NC-DB-17	3.17	1.02	2.16	1,839.00	264.96	2,438.79	10%	243.88	50%	1,219.39
NC-DB-18	6.56	2.27	4.29	1,839.00	264.96	5,316.29	10%	531.63	50%	2,658.14
NC-DB-19	12.17	1.64	10.54	1,839.00	264.96	5,800.00	10%	580.00	50%	2,900.00
NC-DB-20	7.73	2.88	4.85	1,839.00	264.96	6,582.34	10%	658.23	50%	3,291.17
NC-DB-21	14.57	4.89	9.68	1,839.00	264.96	11,554.94	10%	1,155.49	50%	5,777.47
NC-DB-22	5.61	2.02	3.59	1,839.00	264.96	4,664.76	10%	466.48	50%	2,332.38
NC-DB-23	4.78	1.86	2.92	1,839.00	264.96	4,191.68	10%	419.17	50%	2,095.84
NC-DB-24	15.25	5.77	9.48	1,839.00	264.96	13,122.76	10%	1,312.28	50%	6,561.38
NC-DB-25	12.42	2.72	9.70	1,839.00	264.96	7,576.86	10%	757.69	50%	3,788.43
NC-DB-26	21.90	10.48	11.42	1,839.00	264.96	22,298.33	10%	2,229.83	50%	11,149.16
NC-DB-27	5.02	1.94	3.08	1,839.00	264.96	4,376.68	10%	437.67	50%	2,188.34
NC-DB-28	9.83	1.47	8.37	1,839.00	264.96	4,913.03	10%	491.30	50%	2,456.51
NC-DB-29	3.02	0.72	2.30	1,839.00	264.96	1,941.78	10%	194.18	50%	970.89
NC-DB-30	7.70	5.58	2.12	1,839.00	264.96	10,822.06	10%	1,082.21	50%	5,411.03
NC-DB-31	4.34	1.64	2.70	1,839.00	264.96	3,724.97	10%	372.50	50%	1,862.49
Total						336,035.62		41,385.09		162,459.58

Note: **BOLDED BMPs** symbolize BMPs being utilized for achieving 10% reduction.

Appendix E-6: Queen Anne Creek Drainage Area and BMP Calculations

BMP Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutant Load (lbs/year)	BMP Reduction (%)	Reduction (lbs/year)	Retrofit Percentage	BMP Reduction
QAC-DB-1	7.75	4.59	3.16	1,839.00	264.96	9,282.30	0.10	928.23	50%	4,641.15
QAC-RB-2	18.41	10.40	8.01	1,839.00	264.96	21,248.14	0.60	12,748.89	0%	0.00
QAC-DB-3	27.59	20.92	6.67	1,839.00	264.96	40,239.35	0.10	4,023.94	50%	20,119.68
QAC-DB-4	10.95	7.20	3.74	1,839.00	264.96	14,239.22	0.10	1,423.92	50%	7,119.61
QAC-DB-5	2.93	1.19	1.75	1,839.00	264.96	2,642.70	0.10	264.27	50%	1,321.35
QAC-DB-6	4.65	2.43	2.22	1,839.00	264.96	5,059.43	0.10	505.94	50%	2,529.71
QAC-DB-7	2.99	1.32	1.67	1,839.00	264.96	2,873.18	0.10	287.32	50%	1,436.59
QAC-DB-8	3.70	2.16	1.54	1,839.00	264.96	4,384.89	0.10	438.49	50%	2,192.45
QAC-DB-9	5.83	4.08	1.75	1,839.00	264.96	7,966.06	0.10	796.61	50%	3,983.03
QAC-DB-10	2.66	0.78	1.88	1,839.00	264.96	1,929.46	0.10	192.95	50%	964.73
QAC-DB-11	1.50	1.17	0.33	1,839.00	264.96	2,242.65	0.10	224.26	50%	1,121.32
QAC-DB-12	16.60	9.65	6.94	1,839.00	264.96	19,593.01	0.10	1,959.30	50%	9,796.50
					Total	131,700.38		23,794.11		55,226.12

Note: **BOLDED BMPs** symbolize BMPs being utilized for achieving 10% reduction.

Appendix E-7: Mill Creek Drainage Area and BMP Calculations

BMP Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutant Load (lbs/year)	BMP Reduction (%)	Reduction (lbs/year)	Retrofit %	BMP Reduction
MC-RB-1	10.55	5.50	5.05	1,839.00	264.96	11,448.42	0.60	6,869.05	0%	0.00
MC-DB-2	49.41	17.64	31.77	1,839.00	264.96	40,858.54	0.10	4,085.85	50%	20,429.27
MC-DB-3	91.54	27.07	64.47	1,839.00	264.96	66,863.05	0.10	6,686.30	50%	33,431.52
MC-DB-4	3.97	3.05	0.92	1,839.00	264.96	5,847.60	0.10	584.76	50%	2,923.80
MC-DB-5	73.03	27.45	45.58	1,839.00	264.96	62,557.68	0.10	6,255.77	50%	31,278.84
MC-DB-6	10.90	3.76	7.14	1,839.00	264.96	8,808.82	0.10	880.88	50%	4,404.41
MC-DB-7	16.05	5.91	10.14	1,839.00	264.96	13,551.92	0.10	1,355.19	50%	6,775.96
MC-DB-8	11.36	4.95	6.41	1,839.00	264.96	10,793.65	0.10	1,079.37	50%	5,396.83
MC-DB-9	24.24	9.33	14.91	1,839.00	264.96	21,115.69	0.10	2,111.57	50%	10,557.84
MC-DB-10	17.74	9.68	8.06	1,839.00	264.96	19,931.94	0.10	1,993.19	50%	9,965.97
MC-RB-11	4.21	4.05	0.16	1,839.00	264.96	7,497.12	0.60	4,498.27	0%	0.00
MC-DB-12	7.15	3.03	4.11	1,839.00	264.96	6,667.86	0.10	666.79	50%	3,333.93
MC-DB-13	8.89	4.73	4.16	1,839.00	264.96	9,797.01	0.10	979.70	50%	4,898.51
MC-DB-14	50.17	29.60	20.57	1,839.00	264.96	59,883.41	0.10	5,988.34	50%	29,941.70
MC-DB-15	56.39	26.31	30.08	1,839.00	264.96	56,353.24	0.10	5,635.32	50%	28,176.62
MC-DB-16	34.01	12.17	21.84	1,839.00	264.96	28,167.80	0.10	2,816.78	50%	14,083.90
MC-DB-17	21.31	7.80	13.51	1,839.00	264.96	17,924.75	0.10	1,792.47	50%	8,962.37
MC-DB-18	20.73	16.10	4.63	1,839.00	264.96	30,835.26	0.10	3,083.53	50%	15,417.63
MC-DB-19	14.78	2.87	11.91	1,839.00	264.96	8,438.61	0.10	843.86	50%	4,219.31
MC-DB-20	8.99	6.12	2.87	1,839.00	264.96	12,018.31	0.10	1,201.83	50%	6,009.16
MC-DB-21	11.66	5.75	5.91	1,839.00	264.96	12,141.68	0.10	1,214.17	50%	6,070.84
MC-DB-22	31.25	20.86	10.39	1,839.00	264.96	41,115.30	0.10	4,111.53	50%	20,557.65
MC-RB-24	13.52	7.96	5.56	1,839.00	264.96	16,113.46	0.60	9,668.07	0%	0.00
MC-DB-25	11.11	3.17	7.94	1,839.00	264.96	7,925.11	0.10	792.51	50%	3,962.56
Totals						576,656.26		75,195.13		270,798.63

Note: **BOLDED BMPs** symbolize BMPs being utilized for achieving 10% reduction.

Appendix E-8: Core Creek Drainage Area and BMP Calculations

BMP Name	Total Area (ac.)	Impervious Area (ac.)	Pervious Area (ac.)	Impervious Loading Rate (lbs/acre)	Pervious Sediment Loading Rate(lbs/acre)	Pollutant Load (lbs/year)	BMP Reduction (%)	Reduction (lbs/year)	Retrofit Percentage	BMP Reduction
CC-DB-01	33.11	10.16	22.95	1,839.00	264.96	24,765.46	0.60	14,859.27	0%	0.00
CC-RB-02	13.41	8.70	4.71	1,839.00	264.96	17,247.55	0.10	1,724.75	50%	8,623.77
CC-RB-03	18.14	10.63	7.51	1,839.00	264.96	21,539.65	0.10	2,153.97	50%	10,769.83
CC-RB-04	14.61	4.67	9.94	1,839.00	264.96	11,223.40	0.10	1,122.34	50%	5,611.70
CC-RB-05	14.07	7.89	6.17	1,839.00	264.96	16,147.61	0.10	1,614.76	50%	8,073.81
CC-RB-06	5.42	1.29	4.12	1,839.00	264.96	3,472.11	0.10	347.21	50%	1,736.05
CC-DB-08	26.75	8.90	17.85	1,839.00	264.96	21,094.74	0.10	2,109.47	50%	10,547.37
CC-DB-09	6.58	1.47	5.11	1,839.00	264.96	4,055.62	0.10	405.56	50%	2,027.81
CC-DB-10	3.15	0.97	2.18	1,839.00	264.96	2,363.94	0.10	236.39	50%	1,181.97
CC-DB-11	77.52	27.32	50.20	1,839.00	264.96	63,542.74	0.10	6,354.27	50%	31,771.37
CC-DB-12	20.91	5.26	15.65	1,839.00	264.96	13,822.78	0.60	8,293.67	0%	0.00
CC-DB-13	16.49	7.37	9.13	1,839.00	264.96	15,964.46	0.10	1,596.45	50%	7,982.23
CC-DB-14	31.23	15.01	16.22	1,839.00	264.96	31,900.55	0.10	3,190.06	50%	15,950.28
CC-DB-15	6.51	3.67	2.84	1,839.00	264.96	7,496.10	0.10	749.61	50%	3,748.05
CC-DB-16	9.22	2.37	6.85	1,839.00	264.96	6,175.02	0.10	617.50	50%	3,087.51
CC-DB-17	8.54	4.77	3.77	1,839.00	264.96	9,768.77	0.10	976.88	50%	4,884.39
CC-DB-17	6.29	1.95	4.34	1,839.00	264.96	4,737.82	0.10	473.78	50%	2,368.91
CC-DB-18	14.77	3.50	11.26	1,839.00	264.96	9,426.21	0.10	942.62	50%	4,713.10
CC-DB-19	19.07	4.41	14.66	1,839.00	264.96	11,999.60	0.10	1,199.96	50%	5,999.80
CC-DB-20	13.59	9.51	4.08	1,839.00	264.96	18,566.15	0.10	1,856.61	50%	9,283.07
CC-DB-21	27.69	4.06	23.63	1,839.00	264.96	13,721.94	0.10	1,372.19	50%	6,860.97
CC-DB-22	11.94	9.50	2.44	1,839.00	264.96	18,110.74	0.10	1,811.07	50%	9,055.37
CC-DB-23	30.40	1.53	28.87	1,839.00	264.96	10,469.97	0.60	6,281.98	0%	0.00
CC-DB-24	5.82	3.17	2.66	1,839.00	264.96	6,525.12	0.10	652.51	50%	3,262.56
					Totals	364,138.05		60,942.91		157,539.92

Note: **BOLDED BMPs** symbolize BMPs being utilized for achieving 10% reduction.

Appendix E-9: Sediment Removal from Inlets within the Township

Watershed	Watershed Area (Acres)	# of Inlets	Max Drainage Area for each inlet (Acres)	Max Amount of Acres for Sediment	Sediment Load per Inlet (lbs/year)	Sediment Reduction(lbs/year)	* Can only account for 50% of Sediment Reduction throughout the Watershed
Mill Creek	3,125.64	2,136	0.5	1,068.00	894,233.47	715,386.78	130,854.56
Core Creek	2,381.70	810	0.5	405.00	174,095.79	139,276.63	51,190.61
Queen Anne's Creek	667.83	1,153	0.5	576.50	1,199,523.13	959,618.50	69,477.32
Neshaminy Creek - Subwatershed #1*	2,448.58	1,363	0.5	681.50	727,681.15	582,144.92	391,046.76
Neshaminy Creek - Tributary #2 Watershed*	67.13	13	0.5	6.50	986.44	789.15	2,088.47
Neshaminy Creek - Subwatershed #3*	457.65	278	0.5	139.00	128,186.00	102,548.80	75,968.19
Neshaminy Creek 10%	2,973.36	1,654.00	0.50	827.00	856,853.59	685,482.87	126,176.83
						Total	377,699.32

*Left out of Total Reduction, only analyzing the 10% Reduction values.

Appendix E-10: Middletown Township BMP Menu							
Proposed BMP Name	Watershed the Proposed BMP is Within	Location of BMP	BMP Type	Estimated Size	Units	Preliminary Cost Range	BMP Sediment Load Reduction (lbs/year)
CC-DB-01	Core Creek	Southeast of Adeline Place	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	130,000	SF	\$390,000 to \$520,000	12,382.73
CC-DB-09	Core Creek	Northwest of Dorset Court	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	20,000	SF	\$60,000 to \$80,000	2,027.81
CC-DB-10	Core Creek	North of Argyle Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	70,000	SF	\$210,000 to \$280,000	1,181.97
CC-DB-11	Core Creek	Southwest of the Intersection of Swift Road and Woodbourne Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	110,000	SF	\$330,000 to \$440,000	31,771.37
CC-DB-16	Core Creek	Southeast Intersection of Old Mill Drive and Bridgetown Pike	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	73,000	SF	\$219,000 to \$292,000	3,087.51
CC-DB-22	Core Creek	Northwest of Teal Drive	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	87,000	SF	\$261,000 to \$348,000	9,055.37
Inlet Sediment Removal*	Core Creek	Varies	Inlet Sediment Filter Bags	Varies	LS	Varies	51,190.61

*Inlet Sediment Removal Reduction is currently at its maximum, that means 50% of required reduction throughout the watershed. Inlet Filter Bags will be placed strategically with the help of the Township.

Appendix E-10: Middletown Township BMP Menu							
Proposed BMP Name	Watershed the Proposed BMP is Within	Location of BMP	BMP Type	Estimated Size	Units	Preliminary Cost Range	BMP Sediment Load Reduction (lbs/year)
MC-DB-02	Mill Creek	East of Flint Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	167,000	SF	\$501,000 to \$668,000	20,429.27
MC-DB-03	Mill Creek	Southwest of the Intersection of Flint Road and Denbign Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	270,000	SF	\$810,000 to \$1,080,000	33,431.52
MC-DB-05	Mill Creek	South of Oxford Court	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	155,000	SF	\$465,000 to \$620,000	31,278.84
MC-DB-06	Mill Creek	East of Garden Court	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	22,000	SF	\$66,000 to \$80,000	4,404.41
MC-DB-16	Mill Creek	North of Gables Court	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	51,000	SF	\$153,000 to \$204,000	14,083.90
MC-DB-17	Mill Creek	Northwest of Dawn Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	58,000	SF	\$174,000 to \$232,000	8,962.37
Inlet Sediment Removal*	Mill Creek	Varies	Inlet Sediment Filter Bags	Varies	LS	Varies	130,854.56
Prop. Streambank Restoration	Mill Creek	Varies	Streambank Restoration	1,400	LF	\$483,338 to \$580,000	50,265.60
QAC-DB-03	Queen Anne Creek	Northwest of Tarn Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	150,000	SF	\$450,000 to \$600,000	20,119.68
Prop. Underground Basin	Queen Anne Creek	Municipal Way Baseball Field Parking Lot	New Underground Basin	55,000	SF	\$165,000 to \$220,000	5,564.59
Prop. Streambank Restoration	Queen Anne Creek	Varies	Streambank Restoration	1,400	LF	\$483,338 to \$580,000	50,265.60
Projects With Neighboring Muniplaities	Queen Anne Creek	Varies	Varies	Varies	N/A	Varies	Varies
Inlet Sediment Removal*	Queen Anne Creek	Varies	Inlet Sediment Filter Bags	Varies	LS	Varies	69,477.32

*Inlet Sediment Removal Reduction is currently at its maximum, that means 50% of required reduction throughout the watershed. Inlet Filter Bags will be placed strategically with the help of the Township.

Appendix E-10: Middletown Township BMP Menu							
Proposed BMP Name	Watershed the Proposed BMP is Within	Location of BMP	BMP Type	Estimated Size	Units	Preliminary Cost Range	BMP Sediment Load Reduction (lbs/year)
NC-DB-01	Neshaminy Creek	South of Alberts Way	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	52,000	SF	\$156,000 to \$208,000	7,841.08
NC-DB-02	Neshaminy Creek	South of Alberts Way	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	103,000	SF	\$309,000 to \$412,000	10,807.10
NC-DB-05	Neshaminy Creek	South of Wychwood Lane	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	46,000	SF	\$138,000 to \$184,000	1,429.37
NC-DB-06	Neshaminy Creek	East of Fairway Drive	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	65,000	SF	\$195,000 to \$260,000	6,331.44
NC-DB-07	Neshaminy Creek	Northwest of Fairway Drive	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	47,000	SF	\$141,000 to \$188,000	14,748.89
NC-DB-09	Neshaminy Creek	North of Essex Lane	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	8,600	SF	\$25,800 to \$34,400	6,314.02
NC-DB-11	Neshaminy Creek	East of Turtle Lane	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	46,000	SF	\$138,000 to \$184,000	3,711.58
NC-DB-12	Neshaminy Creek	North of the Intersection of Deer Drive and Grand Avenue	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	98,000	SF	\$294,000 to \$392,000	15,946.66
NC-DB-13	Neshaminy Creek	East of Parkvale Avenue	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	79,000	SF	\$237,000 to \$316,000	3,903.02
NC-DB-15	Neshaminy Creek	Northeast of Highpoint Circle	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	16,000	SF	\$48,000 to \$64,000	7,084.25
NC-DB-16	Neshaminy Creek	Southwest of the Intersection of Duxbury Drive and Hulmville Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	32,000	SF	\$96,000 to \$128,000	6,157.36
NC-DB-19	Neshaminy Creek	Northwest of the Intersection of Duxbury Drive and Hulmville Road	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	103,000	SF	\$309,000 to \$412,000	9,908.09
Chubb Run Streambank Project	Neshaminy Creek	Chubb Run (Tributary of Neshaminy Creek)	Basin Retrofit (Detention Basin to Dry Extended or Retention Basin)	1,200	LF	\$207,145 to \$248,574	24,684.00
Prop. Streambank Restoration	Neshaminy Creek	Varies	Streambank Restoration	2,000	LF	\$693,480 to \$828,580	71,808.00
Inlet Sediment Removal*	Neshaminy Creek	Varies	Inlet Sediment Filter Bags	Varies	LS	Varies	126,176.83

*Inlet Sediment Removal Reduction is currently at its maximum, that means 50% of required reduction throughout the watershed. Inlet Filter Bags will be placed strategically with the help of the Township.

Appendix E-11 Field Verification Compliance Schedule		
Watershed Name	Field Verification Complete (Y/N)	Year of Completion
Neshaminy Creek	Y	2020/21
Mill Creek	Ongoing	2021/22
Queen Anne Creek	N	2022/23
Core Creek	N	2023/24