State of Delaware 2018 Combined Watershed Assessment Report (305(b)) and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs

(The Integrated Report)

Delaware Department of Natural Resources and Environmental Control

Division of Watershed Stewardship

Watershed Assessment and Management Section

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EXECUTIVE SUMMARY

The State of Delaware 2018 Combined Watershed Assessment Report (305(b)) and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs (the Integrated Report) provides a statewide assessment of surface water and ground water resources, highlights Delaware's initiatives in water resources management and pollution control and provides a list of waters that need Total Maximum Daily Load regulations (TMDLs) to meet water quality standards. The document fulfills the reporting requirements set forth under Sections 305(b) and 303(d) of the Federal Clean water Act of 1977, as amended in 1981 and 1987. The document is organized largely in accordance with the federal Environmental Protection Agency's (EPA) 2006 guidance document. In order to streamline the 2018 Integrated Report, many Departmental programs and other resources not specifically required in the report are briefly described and URLs for further information are supplied.

This Integrated Report summarizes statewide water quality assessments, provides an overview of major initiatives and concerns on a statewide basis, and lists waters needing TMDLs. Tables are provided which show the result of water quality analysis and designated use support findings for data from the period of January 2012 through December 2016 and the resulting Section 303(d) List of Waters Needing TMDLs from those assessments.

For the 2018 303(d) list, sixty six revisions to earlier lists are highlighted in "Change this cycle" column in the List. Under the Clean Water Act, "listing" a waterbody is an indication that the water body is not fully meeting its designated use, thus "impaired", and needs further controls to support the designated use. Once listed, a TMDL regulation or alternative must be developed that will return the waterbody to supporting the designated use. Delisting a waterbody for a pollutant indicates that the previously listed waterbody now supports a designated use and thus "attains the use". Segment/pollutant combinations allow the Department to track progress for individual pollutants in specified waterbodies. For example, one segment (which can be an entire waterbody or a section of larger waterbody) may be impacted by four fish tissue advisory pollutants, nutrients and bacteria. That segment would thus have six segment/pollutant combinations.

Four segments are newly listed for previously unlisted pollutants in their segments. Two of them are covered by TMDLs that are already in place and were listed in category 4a. Two of the new listings were for dieldrin as a result of fish tissue advisories and will be monitored for possible TMDL development in the future.

There were a total of thirty four delistings in this cycle. Twenty one of them were for nutrient, dissolved oxygen or bacteria impairments. Two delistings were for ammonia because data showed no exceedances of water quality criteria in those segments. One ammonia reduction was the result of removing a point source discharger per a TMDL agreement. Delistings for chlordane, mercury and dioxins and furans were a result of lowered levels in fish tissues from those waters.

For the 2018 assessments, the Department incorporated the Fish Tissue Advisories that were issued by the Delaware Departments of Health and the Department of Natural Resources and

Environmental Control on February 20th, 2018. As a result of the advisories, two segment/pollutant combinations were delisted and one segment that was incorrectly delisted in 2016 was relisted for 2018.

The Department has been using a strategy called the Watershed Approach to Toxics Assessment and Restoration (WATAR) to address toxic pollutant issues in the State. In March of 2018 the Department completed a report entitled "An Evaluation of Clean Water Act Section 303(d) Listings of Delaware Waters Affected by Fish Consumption Advisories" that is included in its entirety as an appendix to this report. The evaluation considered information gathered from the WATAR and Fish Tissue Advisories programs to do detailed trends analyses of pollutants in fish tissue using data from the 1990s forward. Consistent with the Department's 2016 Integrated Report, the Department made a series of recommendations for TMDL development in those waters. The evaluation recommended that six segments be delisted for some pollutants as those pollutants were no longer above the screening levels used for fish tissue advisories in those segments. Those segment pollutant combinations were changed to Category 1. Another recommendation was for seventeen segments to be placed into a new category of impairment known as Monitored Natural Recovery. That category is shown in this report as Category 5(MNR). In those waters, while the pollutant levels have not dipped below screening levels, they are expected to do so as shown in trend analyses of the available data. As suggested in the category name, the Department will continue to monitor fish in those waters and expects the contaminant level to decrease enough for future evaluations to recommend delisting those contaminants. The final recommended category in the Evaluation is to complete TMDLs in those waters where the above trend analyses shows that concentrations of those contaminants are not expected to reach acceptable levels in the near term without TMDL regulations. These five segments remain in Category 5, and the Department expects to complete them by 2022. See the table below for the recommendations table that is on page 6 in the complete Evaluation.

Excerpted table of Recommended Actions for Selected Segments/Contaminant Pairs Listed on Delaware's 2016 Clean Water Act Section List Based on Fish Consumption Advisories

Waterbody ID	Watershed Name	Segment	Pollutant	Recommendation
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	Chlordane	Delist
DE040-002	Brandywine Creek	Upper Brandywine	D and F TEQs	MNR
DE 260-001	Red Clay Creek	Mainstem	D and F TEQs	TMDL
DE120-001	Christina River	Lower Christina River	Dieldrin	MNR
DE120-004-01	Christina River	Lower Christina Creek	Dieldrin	MNR
N/A	Delaware River	DRBC Zone 5	D and F TEQs	TMDL
N/A	Delaware River	DRBC Zone 5	Dieldrin	TMDL
DE020-001	Army Creek	Lower Army Creek	D and F TEQs	MNR
DE020-002	Army Creek	Upper Army Creek	D and F TEQs	Delist
DE270-001-01	Red Lion Creek	Lower Red Lion	D and F TEQs	MNR
DE090-001	Chesapeake & Delaware Canal	C&D Canal	D and F TEQs	MNR
DE090-001	Chesapeake & Delaware Canal	C&D Canal	Dieldrin	MNR
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	D and F TEQs	MNR
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Dieldrin	MNR
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	D and F TEQs	Delist
DE010-001-03	Appoquinimink River	Drawyer Creek	D and F TEQs	MNR
DE010-L02	Appoquinimink River	Silver Lake	Dieldrin	MNR
DE290-001-01	Saint Jones River	Lower Saint Jones	Dieldrin	MNR
DE290-001-01	Saint Jones River	Lower Saint Jones	D and F TEQs	MNR
DE290-001-02	Saint Jones River	Upper Saint Jones	D and F TEQs	TMDL
DE290-001-02	Saint Jones River	Upper Saint Jones	Dieldrin	MNR
DE290-002	Saint Jones River	Wyoming Mill Pond	DDT	MNR
DE290-L02	Saint Jones River	Silver Lake	D and F TEQs	TMDL
DE290-L02	Saint Jones River	Silver Lake	Mercury	Delist
DE080-003	Cedar Creek	Slaughter Creek	D and F TEQs	MNR
DE060-008	Broadkill River	Primehook Creek	Mercury	Delist
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Mercury	Delist
N/A	Delaware Bay	DRBC Zone 6	Mercury	MNR

The Department has been working with US EPA to move Delaware's 303(d) listing information into EPA's Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) database which will allow EPA and stakeholders to track the conditions of the Nation's surface waters. As part of that effort, the Department has converted the list of impaired waters into a format more compatible with the ATTAINS database and geographical information systems (GIS). The new format is significantly longer than the older format, but much easier to use in those environments. The Department has worked closely with EPA staff to

transition to the ATTAINS reporting system. See the appendices for the new 303(d) listing format.

Groundwater-Quality Highlights

Groundwater quality in Delaware was assessed based on raw-water data collected during a two-year time period (October 1, 2015 through September 30, 2017) from public water-supply (PWS) wells. The water-quality database consisted of approximately 30,000 analyses. Five aquifer types were recognized for reporting purposes: (1) unconfined, (2) confined, (3) semi-confined, (4) fractured-rock, and (5) karst. Unconfined, confined, and semi-confined aquifers occur in the mid-Atlantic Coastal Plain Physiographic Province, which comprises most (~96%) of Delaware's land-surface area. Fractured-rock and karst aquifers occur in the Piedmont Physiographic Province in the remaining northernmost portion of the state; these aquifer types are poorly represented in this assessment due to limited or no water-quality data. There are 1,171 active PWS wells and a large majority of these wells (89%) produce from Coastal-Plain aquifers; 5% produce from Piedmont aquifers; and aquifer designations for the remainder are either not known or not yet established. Well depths range from 22 to 957 ft below land surface (bls) with a median well depth of 140 ft bls. Highlights from the groundwater-quality assessment follow*:

Based on nitrate data, almost two thirds of the wells evaluated are susceptible to human influence. Nitrate concentrations exceeded 0.4 mg/L, a threshold indicative of human impacts, in 63% of the samples.

The unconfined aquifer is the most susceptible to human influence. This aquifer had the highest median nitrate concentration (5.00 mg/L). This aquifer also had a large fraction of concentrations exceeding 0.4 mg/L (90.4%) and a small fraction of non-detectable concentrations (8.2%). The most elevated nitrate concentrations (up to 24.4 mg/L) were associated with unconfined wells.

Nitrate concentrations exceeded the drinking-water standard in <3% of all samples. Concentrations exceeded the Primary Maximum Contaminant Level (PMCL) of 10 mg/L for drinking water in 2.4% of the samples. Areally, PMCL exceedances were limited to unconfined wells located in Kent and Sussex counties.

Overall, nitrate concentrations decrease with depth. Trends in nitrate concentrations with respect to sample depth indicate that overall the vertical extent of human influence in Coast-Plain aquifers was primarily limited to depths of 220 ft below land surface and shallower. At depths greater than 220 ft, nitrate was not detected above the quantitation limit. The deepest nitrate detection was associated with a confined well. There were no nitrate data for Piedmont aquifers in this assessment.

Organic compounds were frequently nondetectable. Organic compounds were not detected in 96.4% of the analyses. Almost one half (43.2%) of the detections were found at concentrations less than 1 µg/L. Tetrachloroethylene (PCE), a solvent, was the most-frequently detected organic compound.

Organic compounds rarely exceeded drinking-water standards. Specifically, organic compounds exceeded PMCLs in 1.0% of the analyses. The following analytes were found above the PMCL: tetrachloroethylene (PCE) and trichloroethylene (TCE).

Some organic compounds have depth trends similar to nitrate. Specifically, concentrations of methyl tert-butyl ether (MTBE), tetrachloroethylene (PCE), and trichloroethylene (TCE) with respect to sample depth indicate that the vertical extent of human impact in the Coastal-Plain aquifers is limited to depths of ~150 ft bls. PCE and TCE were detected at greater depths in karst wells, which typically have very long open intervals that may allow contaminants to enter at shallower depths.

Trace elements were frequently nondetectable. Trace elements were not detected in 76% of the analyses. More than half (52%) of the detections were found at concentrations less than 0.1 mg/L and almost all detections (98%) were found at concentrations less than 1 mg/L. Barium, nickel, and chromium were the top three most-frequently detected trace elements.

Arsenic data were too limited in this assessment for meaningful analysis; based on previous assessments, arsenic detections were primarily limited to confined wells in glauconitic aquifers. Based on the 2014 assessment (Kasper, 2014), arsenic was one of the top five most frequently detected trace elements. Detections of arsenic were primarily limited to confined wells that produce from the Rancocas, Mt. Laurel, or Piney Point aquifers, which are associated with glauconitic geologic formations. A USGS study targeting the Rancocas aquifer and completed during the reporting period (Denver, 2016) found that 15 (41.7%) of 36 wells had arsenic concentrations in excess of the PMCL (10 µg/L).

Radionuclide data were very limited in this assessment. Available radionuclide data were limited to the following parameters with the number of analyses indicated in parentheses: uranium-238 (8) and gross alpha particle activity (2). All uranium-238 results were ND and thus below the 0.03 mg/L PMCL. All gross alpha particle activities were below the 15 pCi/L PMCL. A USGS study targeting the Rancocas aquifer and completed during the reporting period (Denver, 2016) found that 14 (44.4%) of 36 wells had radon concentrations above the lower proposed MCL (300 pCi/L); none of the radon concentrations exceeded the proposed alternative MCL of 4,000 pCi/L.

Other groundwater-quality findings:

Overall, groundwater is predominantly soft or moderately hard. Specifically, most of the results for Coastal-Plain aquifers (93.4%) met either of these criteria. There were no hardness data for Piedmont aquifers; based on previous assessments, the karst aquifer type routinely had the most elevated hardness values.

Groundwater was acidic in about half of the overall samples. Specifically, pH values were less than the lower limit of the Secondary Maximum Contaminant Level (SMCL) range (6.5-8.5 standard pH units) in 53.3% of the samples. Unconfined and semi-confined wells both had a median pH of 5.8 and the largest fractions of pH values below the SMCL range (74.2 and 87.5%, respectively); in contrast, confined wells had the highest median pH (7.5) and the largest fraction of values within the SMCL range (90.5%). There were no pH data for fractured-rock and karst wells; based on previous assessments, karst wells had the highest median pH and the largest fraction of samples within the SMCL range.

Iron was elevated in one quarter of the samples. Iron exceeded the SMCL (0.3 mg/L) in 24.6% of the samples. Elevated iron was detected at virtually all depths. Relative to other Coastal-Plain aquifer types, confined wells had the largest fraction of concentrations greater than the SMCL (44.2%).

Groundwater is generally dilute overall based on total dissolved solids (TDS) data. Specifically, the median TDS concentration was 113 mg/L. Confined wells had the highest median TDS concentration (254 mg/L), likely due to longer groundwater contact time with formation sediments. One TDS concentration was above the 500 mg/L SMCL; it was detected in an unconfined well. TDS concentrations in Coastal-Plain aquifers generally increase with depth. There were no TDS data for Piedmont wells; however, based on previous assessments, the karst aquifer type typically had the highest median TDS concentration.

Chloride concentrations did not exceed the drinking-water standard. Chloride concentrations in Coastal-Plain aquifers were below the SMCL (250 mg/L) in all of the samples. Unconfined wells had the highest median chloride concentration (15.3 mg/L), possibly indicative of human influence. The most elevated chloride concentration (174 mg/L), however, was associated with a confined well sample. There was no apparent trend in chloride with depth. There were no chloride data for Piedmont wells in this assessment.

Sodium concentrations were above the health advisory level in almost one third of the samples. Sodium concentrations in Coastal-Plain aquifers exceeded the Health Advisory (HA) of 20 mg/L in 29.4% of the samples. Sodium concentrations above the HA were found at virtually all depths, but the most elevated concentrations were found in deeper, confined wells. Specifically, confined wells had the highest median sodium concentration (25.4 mg/L) and the largest fraction of concentrations above the HA (56.8%). There were no sodium data for Piedmont wells in this assessment.

*Note: Because only raw or apparently raw groundwater-quality data were evaluated, the results may not be representative of finished or treated water delivered to consumers. Therefore, an exceedance of a drinking-water standard does not necessarily indicate that a public water-supply system is not in compliance.

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PART A. INTRODUCTION

The State of Delaware 2018 Combined Watershed Assessment Report (305(b)) and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs (the Integrated Report) provides a statewide assessment of surface water and ground water resources, highlights Delaware's initiatives in water resources management and pollution control and provides a list of waters that need Total Maximum Daily Load regulations (TMDLs) to meet water quality standards. The document fulfills the reporting requirements set forth under Sections 305(b) and 303(d) of the Federal Clean water Act of 1977, as amended in 1981 and 1987. The document is organized largely in accordance with the federal Environmental Protection Agency's (EPA) 2006 guidance document and subsequent updates.

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In order to streamline the 2018 Integrated Report, many Departmental programs and other resources not specifically required in the report are briefly described and URLs for further information are supplied.

PART B. BACKGROUND

B1. Total Waters

State Population[1]	961,939
State Surface Area	1981 square miles
Number of Basins	5
Number of Watersheds	45
Total Number of Stream and River Miles[2]	2509
Number of Perennial River Miles[2]	1778
Number of Intermittent Stream Miles [2]	405
Number of Ditches and Canals [2]	326
Number of Border Miles	87
Acres of Lakes/Reservoirs/Ponds [2]	2954
Square Miles of Estuarine Waters [3]	841
Number of Ocean Coastal Miles	25
Acres of Freshwater Wetlands	226,530
Acres of Tidal Wetlands	127,338

1. http://www.census.gov/quickfacts/table/PST045215/10
2. Values are being updated to reflect information in higher resolution mapping tools in cooperation with EPA and a contractor.
3. Surface area for Delaware River Zone 5 and Delaware Bay provided by the Delaware River Basin Commission (DRBC), 1994 -1995 305(b) Report. For purposes of this report, Delaware reports on the Inland Bays and DRBC reports on the Delaware River and Bay.

B2. Water Pollution Control Program

The Delaware Department of Natural Resources and Environmental Control (DNREC) has several programs related to water pollution control in its Watershed Assessment and Management Section. The Water Quality Standards program works with stakeholders and co-regulators to set the Designated Uses and Criteria for the State's waters to protect them as required under the Clean Water Act (CWA), EPA regulations and Delaware Code. The most recent Triennial Review of Water Quality Standards was done in 2014. DNREC anticipates another Triennial Review will start in 2018. DNREC does Integrated Reporting to meet its CWA Section 305(b) and 303(d) requirements, as shown in this report. Integrated reports are due on April 1st of even numbered years. The Total Maximum Daily Load (TMDL) program is also part of the Watershed Assessment and Management Section. Waterbodies that don't meet their designated uses due to pollutants, and thus part of the State's 303(d) list of impaired waters, are required to have TMDLs to meet their criteria. The TMDL program has completed TMDLs for most of the watersheds in the State for excessive nutrients and bacteria. TMDLs and alternatives for other pollutants are being addressed by the Watershed Approach to Assessment and Restoration (WATAR) Program.

The Drainage and Stormwater Section provides management and implementation of regulatory and non-regulatory programs to improve drainage, stormwater, water quality and dam safety.

The Surface Water Discharges Section regulates point and non-point sources of pollution to surface waters of the state. This section works with individuals, municipalities and industry to ensure that wastewater is properly treated, storm water is properly managed, and biosolids and residual wastes are beneficially reused. Delaware's National Pollutant Discharge Elimination System (NPDES) permits are part of this Section's programs.

The Nonpoint Source Program addresses nonpoint source pollution through educational programs, publications, and partnerships with other Delaware organizations. The Delaware NPS Program also administers a competitive grant made possible through Section 319 of the Clean Water Act, providing funding for projects designed to reduce NPS pollution.

The Ground Water Discharges Section (GWDS) is responsible for overseeing all aspects of the siting, design and installation of onsite wastewater treatment and disposal systems (aka septic systems). The section also issues waste transporter permits and licenses to percolation testers, designers, soil scientists, system contractors, liquid waste haulers and system inspectors.

The Ground-Water Protection Branch of the Water Supply Section is responsible for the ground-water protection program, source water assessment and protection program, and wellhead protection program. Hydrologists and environmental scientists of this branch provide technical expertise needed to protect the ground-water resources of Delaware. Responsibilities include regulatory review, resource assessment, database quality control, and public education.

The following table has web addresses for the programs mentioned above.

Program	Web Address
Water Quality Standards	http://www.dnrec.delaware.gov/swc/wa/Pages/Watershed%20Assessment%20Surface%20Water%20Quality%20Management.aspx
305(b) Reports and 303(d) lists	http://www.dnrec.delaware.gov/swc/wa/Pages/WatershedAssessment305band303dReports.aspx
Total Maximum Daily Loads	http://www.dnrec.delaware.gov/swc/wa/Pages/WatershedAssessmentTMDLs.aspx
Watershed Approach to Assessment and Restoration (WATAR)	http://www.dnrec.delaware.gov/dwhs/SIRB/Pages/WATAR.aspx
Drainage and Stormwater Section	http://www.dnrec.delaware.gov/swc/Drainage/Pages/Drainage.aspx
Nonpoint Source Program	http://www.dnrec.delaware.gov/swc/district/Pages/NPS-Program.aspx
Ground Water Discharges (septics)	http://www.dnrec.delaware.gov/wr/Services/Pages/GroundWaterDischarges.aspx
Surface Water Discharges	http://www.dnrec.delaware.gov/wr/Services/Pages/SurfaceWaterDischarges.aspx
Ground Water Protection Branch	http://www.dnrec.delaware.gov/wr/Services/OtherServices/Pages/WaterSupplyGroundWaterProtectionProgram.aspx
Municipal Separate Storm Sewer Systems (MS4s) Permits	http://www.dnrec.delaware.gov/wr/Information/SWDInfo/Pages/MS4.aspx

DNREC works closely with its partners in other Delaware agencies, other States and Federal agencies to address water issues that cross jurisdictional boundaries. For example, the Department works with the Delaware Department of Health and Social Services' Division of Public Health to collect and analyze for toxins in fish and then coordinate fish consumption advisories State wide. The Department works with the Nutrient Management Commission to work with non-point sources of nutrients to manage and/or reduce nutrient inputs to Delaware's waters. DNREC is also working closely with the Delaware Department of Transportation to develop and implement MS4 permits in New Castle County.

The Department is an active member of the Delaware River Basin Commission that works in the Delaware River and Delaware Bay to regulate both flow and water quality. Delaware is also working closely with partners and stakeholders from six states in the Chesapeake Bay watershed to implement the Chesapeake Bay Watershed Implementation Plan that will help restore the Chesapeake Bay's water quality.

B3. Cost/Benefit Assessment

Under the Clean Water Act and the implementing regulations, States are required to submit estimates of the environmental, economic and social costs and benefits needed to achieve the objectives of the Clean Water Act. In cooperation with the Department, The University of Delaware Water Resources Center prepared a white paper entitled "Economic Benefits of Improved Water Quality in Delaware." In the paper, the Center estimated the economic benefits of improved water quality to be $17.2 million dollars annually. The UD Water Resources Center has also concluded that Delaware watersheds and waterways support (1) over $6 billion in annual economic activity from water quality, flood control, water supply, fishing and wildlife viewing, recreation, agriculture, ports, forests, and parks, (2) ecosystem goods and services of $6.7 billion per year (2010 dollars) with a net present value (NPV) of $216.6 billion, (3) over 70,000 direct and indirect jobs with over $2 billion in wages, see http://www.wrc.udel.edu/research/watershed-economics/economic-benefits-and-jobs-provided-by-delaware-watersheds/. To date, cost estimates have not been compiled. Future iterations of the Integrated Report will expand the analysis of costs and benefits reported.

B4. Special State Concerns and Recommendations

The Department has been working on managing water quality issues for many years with stakeholders and other State and Federal agencies to address water quality issues statewide and in interstate waters. See Section B2 of this report for current activities in our water pollution control programs. The Department has been working with stakeholders on TMDLs that are being implemented with varying degrees of success. Toxics TMDLs for zinc have been implemented successfully in the Christina basin, bringing zinc levels into compliance with applicable water quality standards. Statewide trends analysis for nutrients shows that approximately half of the reporting stations considered are experiencing lower nutrient loads for nitrogen with fewer than ten percent of stations showing increasing trends. Continued TMDL implementation is still needed to continue those gains and achieve nutrient targets in Waters of the State.

The Department has been addressing remaining waterbodies needing TMDLs or alternatives for toxic pollutants in its WATAR program also described and linked to in Section B2 above. Tracking down pollution sources and using appropriate and cost effective approaches to remediate those sources is one keystone of the WATAR program. One such intervention at Mirror Lake in Dover was remarkably effective in reducing bioavailability of PCBs. The Department worked across Divisions, with other State and Federal agencies, and with academia to do the work at Mirror Lake. As a result, major reductions in PCBs in fish tissue in the fish in the lake were seen in less than a year. The Department believes working to expand the successes and lessons learned from the WATAR program will be important in reducing impacts from pollution statewide.

Climate change is an important issue long term in the State. The Department worked with a wide range of scientists and policy makers to create the Delaware Climate Change Impact Assessment that is online at : http://www.dnrec.delaware.gov/energy/Pages/The-Delaware-Climate-Impact-Assessment.aspx . One of the conclusions in the executive summary is that: “Delaware faces potential impacts from changes in temperature, precipitation, and sea level rise. State officials, local governments, residents, and businesses must prepare for changing climate conditions that will affect communities and economic sectors throughout Delaware.”

Water quality monitoring including fish tissue and other biological monitoring has been a keystone to understanding water quality issues statewide. The Department has invested heavily in monitoring data for many years. Scientists, citizens and policy makers rely on the continued availability of high quality data to track progress and make regulatory and policy decisions that affect a wide range of programs and interests. For example, the Department anticipates using site specific data from the WATAR program to set criteria in the water quality standards for toxic pollutants state wide in upcoming triennial reviews of water quality standards required under the Clean Water Act.

PART C. SURFACE WATER MONITORING AND ASSESSMENT

C1. Monitoring Program

The purpose of the Delaware's Surface Water Quality Monitoring Program is to collect data on the chemical, physical and biological characteristics of Delaware's surface waters. The information that is collected under this program is used to:

- Describe general surface water quality conditions in the State;
- Identify long term trends in surface water quality;
- Determine the suitability of Delaware surface waters for water supply, recreation, fish and aquatic life, and other uses;
- Monitor achievement of Surface Water Quality Standards;
- Identify and prioritize high quality and degraded surface waters;
- Calculate annual nutrient loads and track progress toward achieving Total Maximum Daily Loads (TMDLs) targets; and
- Evaluate the overall success of Delaware's water quality management efforts.
- Inform decisions by other stakeholders and programs

Delaware maintains a General Assessment Monitoring Network (GAMN) of ~ 134 stations. Twenty two of the stations are monitored monthly and the remaining stations are monitored either six or twelve times per year. Each station is monitored for conventional parameters such as nutrients, bacteria, dissolved oxygen, pH, alkalinity, and hardness. Some stations are monitored for dissolved metals. The data from this monitoring is entered into EPA's STORET database and used for this report and other uses by interested parties.
More information about Delaware's Water Quality monitoring is available online at:
http://www.dnrec.delaware.gov/swc/wa/Pages/WaterQualityMonitoring.aspx
In addition to uploading data to STORET, the Department also works in co-operation with the University of Delaware to share available water quality data in a more user friendly format in the Delaware Water Quality Portal at this URL: http://demac.udel.edu/waterquality/.

C2. Assessment Methodology

General Provisions

Data Considered**:**

All readily available data and information for the period of January 1, 2012 through December 31, 2016 will be considered for the assessment of most designated uses. Given that adequate water quality data may not be available in all cases, determinations of use attainment will be made with an abundance of caution.

Data Quality and Quantity

Data from the Department of Natural Resources and Environmental Control's (DNREC's) Environmental Laboratory Section (ELS) will be considered for use if it is collected and analyzed in accordance with the DNREC ELS Quality Assurance Project Plan. For data from sources other than the DNREC ELS, the Department will consider the quality controls used in collection and analysis to determine if it will be appropriate for use in this assessment. Data will be considered readily available if it is in an electronic format that can be imported into or exported from a modern spreadsheet or database program like Microsoft Excel or Access. Data that is only available on paper will be considered on a case by case basis given the limited resources available to the Department to convert such data to the more usable electronic format. The Department routinely currently collects water quality samples at more than 130 stations throughout the State. That data makes up the bulk of the data available for use in 305(b) assessments. The Department considers data from the most recent five-year period, thus, at each station, there are usually data from 20 sampling dates or more. Some stations are in place for a more limited time period and have smaller data sets. Other readily available data and reports are requested in advance of each assessment from parties outside of the Department and used when they are made available. In addition to electronic mail requests from specific organizations, a notice will be published in the Delaware State News and the News Journal.
For the 2018 assessment, the Department will consider data and information received on or before March 2018 from the following sources:

- Reports of ambient water quality data including State ambient water quality monitoring programs, citizen volunteer monitoring programs, complaint investigations, and other readily available data sources (e.g., EPA's Storage and Retrieval System (STORET), the United States Geological Survey, and research reports), and data and information provided by the public;
- Reports prepared to satisfy Clean Water Act (CWA) Sections 305(b), 303(d) and 314 and any updates;
- Fish and shellfish advisories
- Restrictions on water sports or recreational contact

Coordination with Delaware River Basin Commission (DRBC) and Chesapeake Bay Program Assessments

The DRBC prepares 305(b) assessment reports every two years for the Delaware River and Delaware Bay. Delaware will incorporate the most recent use attainment determinations made by DRBC for the shared waters of the Delaware River and Delaware Bay into its 2016 303(d) list.

Delaware expects to work cooperatively with the DRBC, member states and stakeholders to develop and implement TMDLs in waters of the Delaware River and Bay that the DRBC determines to be impaired.

The Chesapeake Bay Program (CBP) is doing assessments for waters in the Chesapeake Bay and nearby waters that drain into the bay in co-operation with Maryland, Virginia, Washington D.C. and Delaware. Delaware will incorporate the most recent use attainment determinations for waters of the state that use criteria developed by the CBP for waters that drain to the Chesapeake Bay.

Use of Environmental Protection Agency Integrated Assessment Guidance

US EPA has guidance online for preparation of Integrated Reports at the following URL: https://www.epa.gov/tmdl/integrated-reporting-guidance

The core recommendation of the guidance is to categorize all waters of the state according to the following five categories:

Category 1: All designated uses are met;

Category 2: Some of the designated uses are met but there is insufficient data to determine if remaining designated uses are met;

Category 3: Insufficient data to determine whether any designated uses are met. Either no data is available or some data is available, but it is insufficient to make a determination

Category 4: Water is impaired or threatened but a TMDL is not needed;

- 4A: All TMDLs for this segment have been completed and EPA approved. Class 4A waters have all necessary TMDLs approved, but one or more impairments exist, despite the approved TMDLs.
- 4B: Other required control measures are expected to result in the attainment of WQSs in a reasonable period of time
- 4C: The impairment or threat is not caused by a pollutant

Category 5: Water is impaired or threatened and a TMDL is needed for at least one pollutant or stressor

For the 2018 and forward 303(d) lists, the Department has created a sub-category of Category 5 waters based on recommendations in a March 2018 report prepared by the Department titled “An Evaluation of Clean Water Act Section 303(d) listings of Delaware Waters Affected by Fish Consumption Advisories”, a copy of which is included in the appendices to this report. That evaluation recommends that for some waters where trends indicate a downward slope in fish tissue contaminant concentrations that should be below fish tissue target levels within five to ten years without implementing a TMDL a subcategory of impaired waters be created. That subcategory is 5(MNR) in which MNR stands for “Monitored Natural Recovery”. As implied by the name, the Department plans to continue monitoring fish tissue in those waterbodies in accordance with the Fish Tissue Advisory program protocols until such time as the contaminants in the fish are no longer above levels of concern and beyond. When the data supports removing

the fish tissue advisories, the Department will consider that information for delisting decisions with stakeholder input. For more information about the Fish Tissue Advisory process see section C6 of this report. The Department also plans to pursue remediation efforts in affected watersheds in accordance with the WATAR program and process as discussed in other sections of this report and online at http://www.dnrec.delaware.gov/dwhs/SIRB/Pages/WATAR.aspx. If trends analyses at later dates show that trends in 5(MNR) waters are not in fact trending downward, or reaching their target levels, the Department will reclassify those waters as Category 5 and TMDLs for those pollutants will be developed.

The Department has been working with US EPA to move Delaware's 303(d) listing information into EPA's Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) database which will allow EPA and stakeholders to track the conditions of the Nation's surface waters. As part of that effort, the Department has converted the list of impaired waters into a format more compatible with the ATTAINS database and geographical information systems (GIS). The new format is significantly longer than the older format, but much easier to use in those environments. The Department considers this new format a transitional step to moving all 303(d) listing information to the ATTAINS system going forward. Future Integrated Reports are expected to be compiled largely within the ATTAINS system and reports for stakeholders will be prepared as needed for the public comment period.

The Department assesses data for a number of parameters in each segment that sufficient data is readily available for, and then assigns them the codes listed above for each parameter and segment combination. This gives the Department more information about specific parameters of concern and allows more detailed tracking of those concerns over time. Each of Delaware's monitored waterbody segments will be assigned to the appropriate category for each designated use and then 'rolled up' into a final categorization for the segment.

Dissolved Oxygen (DO) Aquatic Life Use Support (ALUS)

The following types of DO data are potentially available for analysis:

- Field measurements taken by personnel using handheld DO probes; and
- Continuous monitoring data collected using multiparameter monitoring systems that are typically deployed for several days, weeks, or months. In order to get a more accurate picture of dissolved oxygen dynamics and other water quality parameters, the Department continues to increase its use of continuous monitoring systems.

To determine ALUS with regard to Dissolved Oxygen (DO), the following methodology will be used to compare measured DO concentrations to two different standards, the minimum at all times and daily average concentrations. Average DO concentrations are considered to be met if the 10th percentile of available data is above the applicable criteria of 5.0 mg/l for marine waters and 5.5 mg/l for fresh waters. The statewide minimum DO concentration for surface waters is 4.0 mg/l at any time. Stations are judged to be in compliance with this criterion if the minimum is not violated by more than 1% of continuous monitoring data and no more than two field samples are below the minimum. Dissolved oxygen criteria in the Murderkill River are different from the Statewide averages for the period of May 16 to September 30th and the data from that period is considered in the same way as the rest of the State against the lower criteria.

Assessments of Average DO Criteria Attainment:

If sampling events occurred on at least ten different days during the assessment period for each station, attainment of the DO average criteria will be assessed using the method that follows. Stations with fewer than ten different sampling days will be considered to have insufficient data and be placed in Category 3 for this assessment cycle. Stations where monitoring has been discontinued that have data from fewer than 10 days will not be considered for further evaluation.

For purposes of DO compliance with the daily average criteria in a segment, continuous monitoring data, if available, will be averaged on a daily basis for each station. If no continuous data is available, then the field measurements (as available) will be considered to be representative of the daily average for that day. Any type of sample (continuous or field measurement) will be considered to be representative for that station at the time of collection. Once the daily average for each station (station daily average, SDA) has been determined, the SDAs for each station will be pooled and the upper confidence limit (UCL) of the nonparametric 10th percentile confidence interval will be determined using methods described in Section 3.7 of Helsel and Hirsch . That UCL will be compared to the applicable standard. If the UCL is above the applicable average criteria for all stations in a segment, the segment will be considered to be fully supporting (Category 1) for the DO average portion of ALUS. If the UCL from any station in a segment is below the applicable average, the segment will be considered not fully supportive of the aquatic life use (Category 5)

Formally stated, the following hypotheses will be tested:

H_0: at the 90% Confidence level, $X_{10} \geq$ Standard

H_1: at the 90% Confidence level, $X_{10} <$ Standard

Where X_{10}= Non parametric estimate of the 10th percentile of available data.

Assessments of Minimum DO Criteria Attainment:

Attainment of the minimum DO criteria will be assessed based on all available data (note that ten samples in 5 years are not needed for the comparison to the minimum). For stations for which no continuous DO monitoring data are available, two or more SDAs in five years below the applicable minimum will be sufficient evidence to show that the aquatic life use is not supported (Category 5).

For stations with continuous monitoring data, available continuous monitoring data will be pooled on an annual basis for each station. The UCL of the first percentile of the data will be calculated and compared to the minimum criteria in the same manner as the average comparison above for each year of the applicable five previous years. One or more years in which the upper confidence limit of the first percentile is below the minimum will be sufficient to determine that aquatic life use is not fully supported in the segment (Category 5). See the flow chart below for a graphical depiction of the dissolved oxygen assessment process.

Nutrient Enrichment Assessment

From a state-wide perspective, nutrient overenrichment is one of the leading causes of water quality impairment in Delaware. While nutrients are essential to the health of aquatic ecosystems, excessive nutrient loadings to surface waters can lead to an undesirable proliferation of aquatic weeds and algae, which in turn can result in oxygen depletion and associated impacts to fish and macroinvertebrate populations. Excessive aquatic plant growth can also preclude or seriously curtail water dependent activities such as fishing and boating when plant densities become so great that uses are not physically possible.

For tidal portions of the Indian River, Rehoboth Bay and Little Assawoman Bay watersheds, the water quality criterion for dissolved inorganic nitrogen is a seasonal average of 0.14 mg/l as N, and for dissolved inorganic phosphorus a seasonal average of 0.01 mg/l. For those stations where sampling events occurred on at least ten different days during the assessment period, the available data for the months of March to October from each station will be averaged and confidence intervals on the averages will be determined. The lower confidence limit on the averages will be compared to the above values to assess attainment of desired nutrient levels in these waters. Stations with fewer than ten different sampling days will be considered to have insufficient data and be placed in Category 3 for this assessment cycle. Segments with one or more stations whose lower confidence limit on their seasonal average is above the criteria will be considered to be not fully supporting the aquatic life use (Category 5).

For the remaining waters of the State, the Department has been developing and implementing nutrient and dissolved oxygen TMDLs using target values for total nitrogen of 2-3 mg/l and total phosphorus levels of 0.1 to 0.2 mg/l. These target values were developed in order to implement the narrative provisions in the Surface Water Quality Standards. For those stations with sampling events on at least ten different days during the five-year assessment period the data will be averaged and lower confidence limits on the averages will be calculated and compared to the maximum values above. Stations whose lower confidence limit on the 5 year average total nitrogen or total phosphorus levels are above those levels will be considered to be not fully supporting the aquatic life use (Category 5). Active stations with fewer than ten different sampling days will be considered to have insufficient data and be placed in Category 3 for this assessment cycle. Segments with one or more stations whose lower confidence limit on their average nutrient concentrations are above the target values will be considered to be not fully supporting the aquatic life use (Category 5).

The following conditions will also result in segments being listed in Category 5:

1. There were documented cases of nuisance algal blooms or excessive macrophyte growth. These cases violate Section 4.1.1.3 of Delaware's Standards which require waters of the State to be free from substances that may result in a dominance of nuisance species;
2. Detailed, site-specific monitoring studies indicated a strong linkage between nutrient levels and indicators of eutrophication such as high chlorophyll-a concentrations, extreme daily variation in dissolved oxygen levels, and high sediment oxygen demand; or
3. For ERES waters, a long-term trend analysis indicates a statistically significant increase in nutrient levels over time. Such increases are inconsistent with the short-term goal of "holding the line" on water quality in ERES waters. Such increases are also inconsistent

with the long-term goal of restoring those waters, to the extent feasible, to their natural state.

Assessments of Total Suspended Solids in the Tidal Inland Bays Watershed

For tidal portions of the Indian River, Rehoboth Bay and Little Assawoman Bay watersheds, the water quality criterion for total suspended solids (TSS) is a seasonal average of 20mg/l from March 1 to October 31. For those stations where sampling events occurred on at least ten different days during the assessment period, the available data for the months of March to October from each station will be averaged and confidence intervals on the averages will be determined. The lower confidence limit on the averages will be compared to the above values to assess attainment of desired TSS levels in these waters. Active stations with fewer than ten different sampling days will be considered to have insufficient data and be placed in Category 3 for this assessment cycle. Segments with one or more stations whose lower confidence limit on their seasonal average is above the criteria will be considered to be not fully supporting the aquatic life use (Category 5).

Primary Contact Recreation Use Assessments

Generally, total enterococcus bacteria water quality samples are collected several times each year at each monitoring station. In addition, for all guarded beaches and many unguarded beaches, samples are collected much more frequently from mid-May through mid-September as part of beach monitoring activities pursuant to the Beaches Environmental Assessment and Coastal Health (BEACH) Act. Assessment of the above two situations for primary contact recreation use support will be as follows.

For segments with no beach monitoring, if sampling events occurred on at least ten different days during the assessment period, the geometric mean of the available enterococcus (colonies/100 ml)data for each station will be compared to the geometric mean values shown in the table below. Stations with fewer than ten different sampling days will be considered to have insufficient data (Category 3) to make a determination if the geometric mean criterion is met. For segments with no beach monitoring, one or more station geometric means above the values in the table will be considered to not be in support of the Primary Contact Recreation designated use (Category 5).

Water Type	Geometric Mean (Enterococcus colonies/100 ml) Criteria for Primary Contact Use
Fresh	100
Marine	35

Segments with beaches that are closed as a result of poor bacterial water quality data two or more times in a single calendar year will be considered not to support the primary contact designated use (Category 5).

Temperature Assessments

Delaware surface water quality criteria indicate that, in freshwaters, no human induced increase of the daily maximum temperature above 86ºF (30.0 ºC) shall be allowed and in marine waters the maximum human induced temperature is 87 ºF (30.6 ºC). Stations for which two or more sampling events are above the criteria and whose segments receive thermal discharges will be deemed not in support of the aquatic life use. For the 2018 cycle, the Department delisted five small segments that had no point source heat discharges.

Assessment of Harvestable Shellfish Waters Use Support

Delaware is a member of the Interstate Shellfish Sanitation Conference (ISSC), the administrative body of the National Shellfish Sanitation Program (NSSP). Delaware's Shellfish Sanitation Regulations are administered as per ISSC / NSSP standards and practices. Section 3.2.1.3 of said Regulations specifies data collection / closure criteria for Delaware shellfish waters, which include parameters constituting administrative closure of shellfish waters. Parameters that would trigger administrative closures in compliance with ISSC/NSSP standards may include theoretical pollution loading, sanitary shoreline survey information, and numerical total coliform data. All Delaware shellfish waters designated as other-than-Approved, which may include Prohibited, Seasonally Approved, Conditionally Approved, or restricted, are so designated on the basis of administrative decisions. Specifically, these criteria include: 1) theoretical pollution loading, which is determined to be the potential for intermittent pollution discharges, making detection of said theoretical releases non-detectable via conventional sampling methodology; 2) sanitary shoreline survey findings which indicate potential for theoretical pollution loading, also non-detectable via conventional sampling methodology; and 3) may include dilution of theoretical virus discharges from point sources; however, not corresponding to increases in total coliform levels. In order to comply with ISSC / NSSP requirements, Delaware samples all shellfish waters not administratively closed for other reasons for total coliform bacteria. Delaware's Shellfish Program is assessed under the auspices of the U.S. Food and Drug Administration, as per ISSC/NSSP standards and practices, and submits bacteriological water quality data to the U.S. Food and Drug Administration to demonstrate compliance.

To assess the harvestable shellfish designated use, the Department will consider the data and reports to FDA for waters that are not administratively closed. Waters that have been administratively closed for shellfish harvesting as a result of total coliform exceedances during the assessment period will be assessed as category-5.

Listing Criteria for Waters with Fish Consumption Advisories

For purposes of developing Delaware's Integrated 305(b) Report and 303(d) List, the issuance of a "no consumption" or "limited consumption" fish advisory will be interpreted as a violation of Section 4.5.9.2.3 and Section 4.1.1.3 of Delaware's Surface Water Quality Standards. Those two narrative provisions provide, respectively, that:

1) waters of the State shall be maintained to prevent adverse toxic effects on human health resulting from ingestion of chemically contaminated aquatic organisms; and
2) waters of the State shall be free from pollutants that may endanger public health.

Any segment for which fish consumption advisories are in place as of the publishing of the Integrated Report will be placed in Category 5 for each of the chemicals of concern included in

each advisory. In the event that fish consumption advisories have been lifted, or any chemical of concern has been removed from an advisory, any requirements to develop a TMDL for that chemical in that segment will be removed if the fish tissue data was originally the sole cause for placement of the segment on the 303(d) list. In waters impaired by toxic pollutants, with both fish consumption advisories and water column data, both fish tissue and water column data will be assessed independently against the applicable criteria.

For the 2018 assessments, the Department incorporated the Fish Tissue Advisories that were issued by the Delaware Departments of Health and the Department of Natural Resources and Environmental Control on February 20th, 2018. As a result of the advisories, two segment/pollutant combinations were delisted and one segment that was incorrectly delisted in 2016 was relisted for 2018.

Ammonia assessments

In fresh waters, ammonia's toxicity is known to be controlled by both the temperature and pH of the water. Delaware's ammonia criteria are based on the presence or absence of early life stages of fish and specify that the criterion should not be exceeded more than one time in a three-year period. The applicable criterion is calculated for each sampling event.

For stations whose average salinity during the assessment period is below 5 ppt, total ammonia as nitrogen, temperature and pH data will be used to compare the total ammonia data to the criterion calculated according to the following formulas:

When fish early life stages are present:

$$\text{Criterion} = \frac{0.0577}{1 + 10^{7.688-pH}} + \frac{2.487}{1 + 10^{pH-7.688}} * \text{MIN}\left(2.85, 1.45 * 10^{0.028*(25-T)}\right)$$

When fish early life stages are absent:

$$\text{Criterion} = \frac{0.0577}{1 + 10^{7.688-pH}} + \frac{2.487}{1 + 10^{pH-7.688}} * \left[1.45\ 10^{0.028*(25-\text{MAX}(T,7))}\right]$$

If two or more sampling events from the same station result in exceedances of the calculated criteria within three years, the station will be deemed not supported for aquatic life use support based on ammonia toxicity.

Assessments of Aquatic Life Use Support Using Site-Specific Data That Results from Environmental Assessments and Other Programs

In the normal course of business, the Department requests, receives and evaluates water quality data for various environmental programs. Similar data may also come from other parties (e.g., State, Federal, or local agencies). The Department will use those site-specific studies to compare water quality data to the applicable water quality standard(s) and make assessment and listing decisions for the affected segments. If the data show no water quality criteria are exceeded and no uses are impaired, no further listing action will be taken. If the data are ambiguous or

inconclusive, the segment will be listed in Category 3. If water quality criteria are exceeded or uses are impaired as a result of a contaminated site, and the owners of the site are making substantial progress (as determined by the Department) toward correcting the pollution problem, the segment will be listed in Category 4 if an enforceable regulatory mechanism has been identified and implemented. If it appears that there is a water quality problem related to a contaminated site, and that substantial progress is not likely in the near future, the segment will be listed in Category 5.

Assessments of Biology and Habitat

The Department is working with the EPA to address prior listings for Biology and Habitat. As new stressor analyses and other data and information become available, appropriate measures will be taken to address these listings. Where no specific pollutant can be determined, the Department will delist those segments (move to category 4b or 4c as needed) and address water quality issues through restoration and other efforts as funding is available. If specific pollutants can be determined, TMDLs or other actions will be taken to address those pollutants.

Setting Priorities for Water Quality Limited Segments Still Needing TMDLs

The Department has set priorities for upcoming TMDLs in waters that remain in Category 5 or 5(MNR) according to the following protocol. Waters where TMDL development is not expected for five or more years are assigned to the "Low" priority group. For 2018 that includes waters listed for Habitat or Biology TMDL development. It also includes waters in Category 5(MNR) where waters are expected to be attaining for toxics in fish tissues within five to ten years as discussed above. As discussed above, the Department will change the priority of 5(MNR) waters if, for some reason, data shows that attainment of the use is not expected in a short period of time. The Department is working with EPA Region 3 to develop stressor analysis tools to try to resolve longstanding listings for Habit or Biology. Finally, there are some Delaware waters that are part of the DRBC waters and for which the DRBC and EPA will be taking the lead for TMDL development. Those are also listed as Low priority.

For waters the Department expects to develop TMDLs in more than 2 years, but less than 5 or more, the Department shows those as "Medium" priority. In those waters, plans are underway to collect data and other information to develop appropriate TMDLs. At this time, there are several waters in the Medium category and the Department expects to complete those TMDLs by 2022.

If the Department expects to develop TMDLs in the next two years or less, those waters are shown as "High" priority. For the 2018 cycle, there are no High Priority waters. The Department expects the waters in Medium category above to move to the High priority category in the 2020 Integrated Report cycle.

Rationale Used to Designate a Lower Category for Segments Previously Designated for TMDL Development

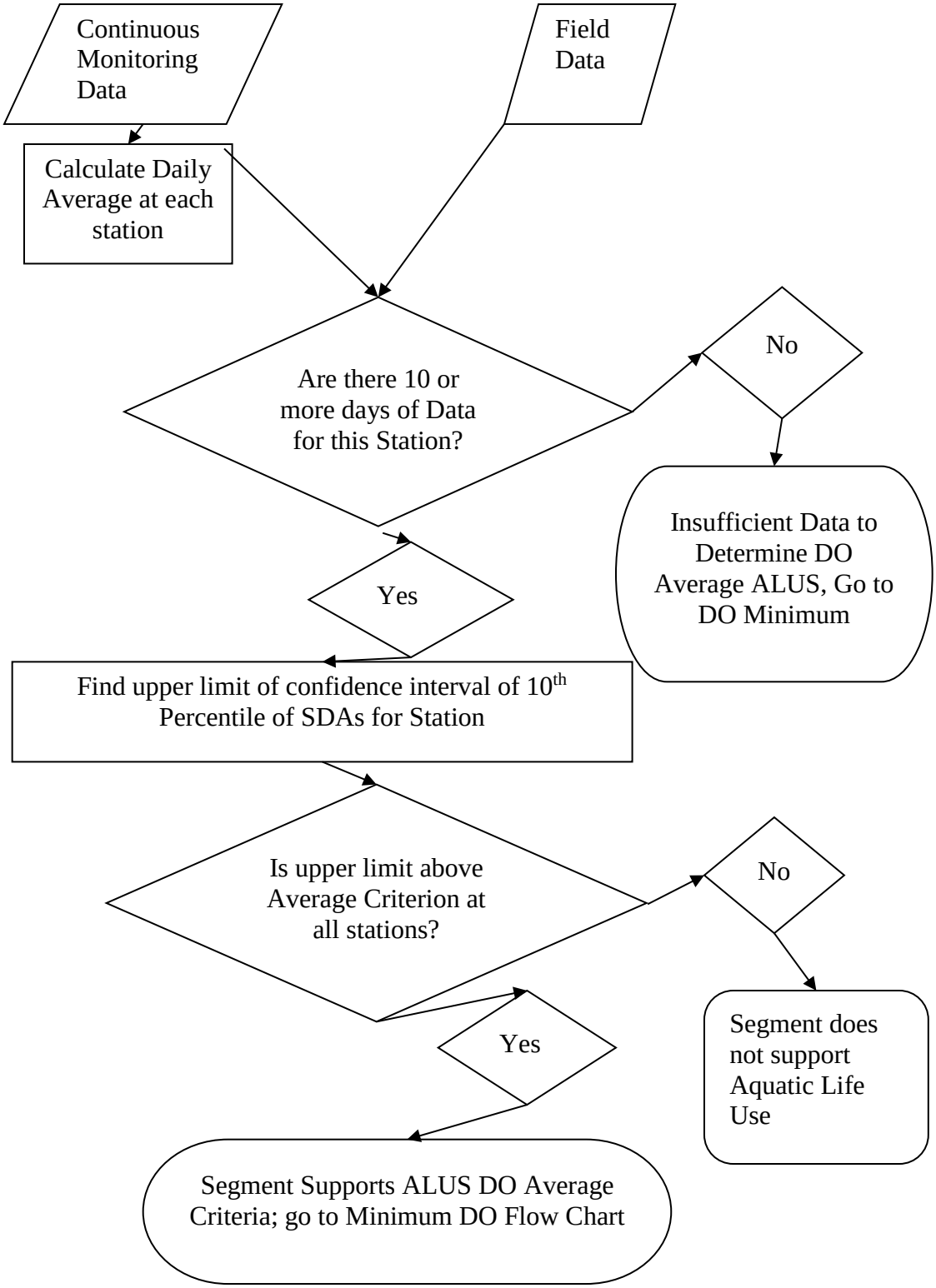
The Department may move segments from prior 303(d) Lists (equivalent to Category 5) to another category based on any of the following factors, and will document the reasons for doing so on a case-by-case basis. Once a TMDL has been promulgated and approved by the EPA, it is in place until it has been rescinded by the Department following applicable Departmental procedures.

- The assessment and interpretation of more recent or more accurate data demonstrate that the applicable WQS(s) is being met. (Move to category 1)
- The results of more sophisticated water quality modeling demonstrate that the applicable WQS(s) is being met. (Move to category 1)
- Demonstration that flaws in the original analysis of data and information led to the water being incorrectly listed. (Move to category 1)
- The development of a new listing methodology, consistent with State WQSs and federal listing requirements, and a reassessment of the data that led to the prior listing, concluding that WQSs are now attained. (Move to appropriate category)
- A demonstration pursuant to 40 CFR 130.7(b)(1)(ii) that there are effluent limitations required by State or local authorities that are more stringent than technology-based effluent limitations required by the CWA and that these more stringent effluent limitations will result in the attainment of WQSs for the pollutant causing the impairment. (Move to category 4A or 4B until data and analysis support move to Category 1)
- A demonstration pursuant to 40 CFR 130.7(b)(1)(iii) that there are other pollution control requirements required by State, local, or federal authority that will result in attainment of WQSs for a specific pollutant(s) within a reasonable time. (Move to category 4A or 4B until data and analysis support move to Category 1)
- Documentation that the State included on a previous Section 303(d) List an impaired water that was not required to be listed by EPA regulations; e.g., waters where there is no pollutant associated with the impairment. (Move to category 1 or 4C as appropriate)
- Approval or establishment by EPA of a TMDL since the last Section 303(d) List. (Move to category 4A or 4B until data and analysis support move to Category 1)

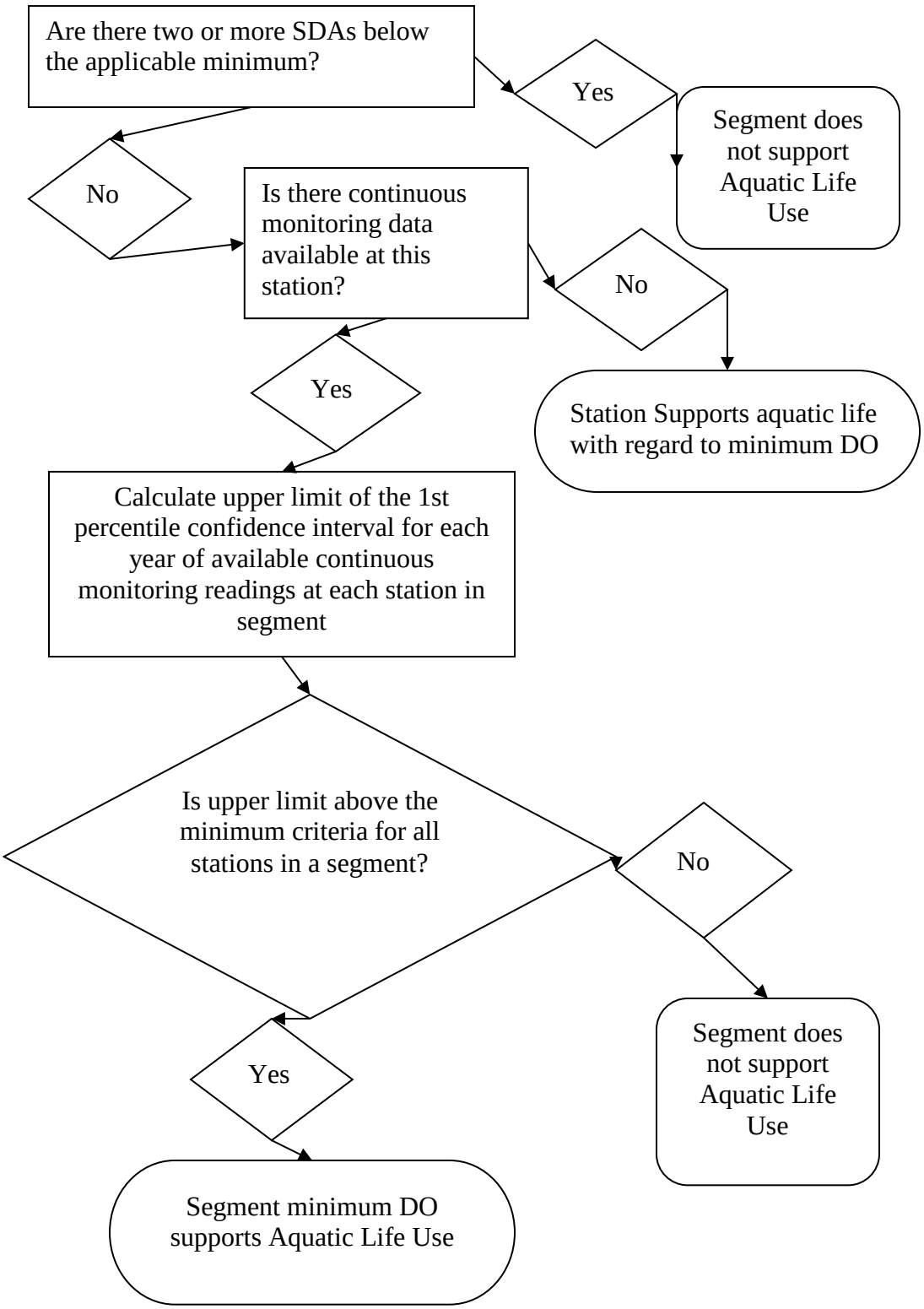
Other factors may also be used to change categories on a case by case basis, subject to EPA approval and appropriate stakeholder involvement.

Flow Charts for Designated Use Attainment

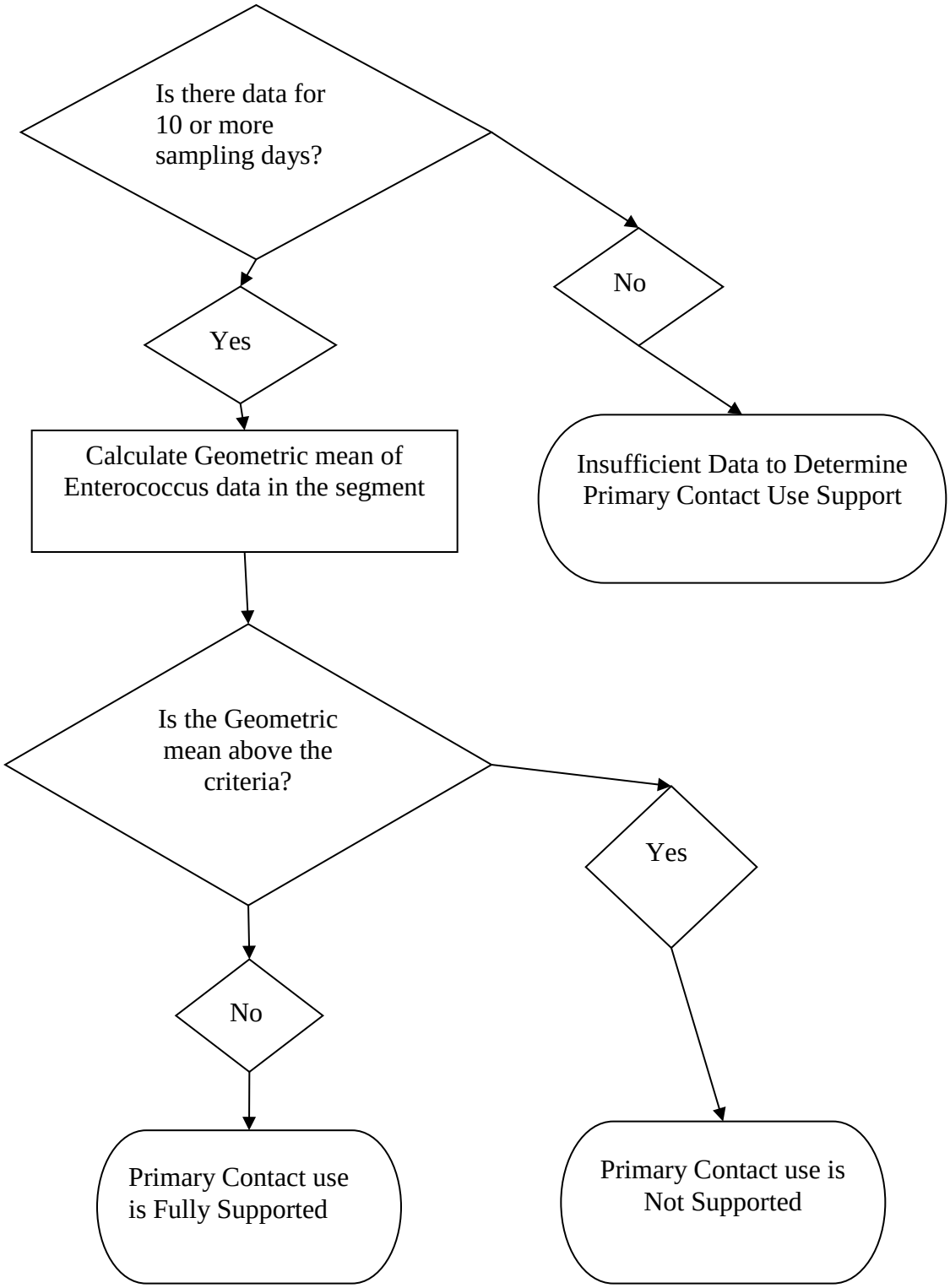
Assessment of Aquatic Life Use Support Using Average Dissolved Oxygen Criteria



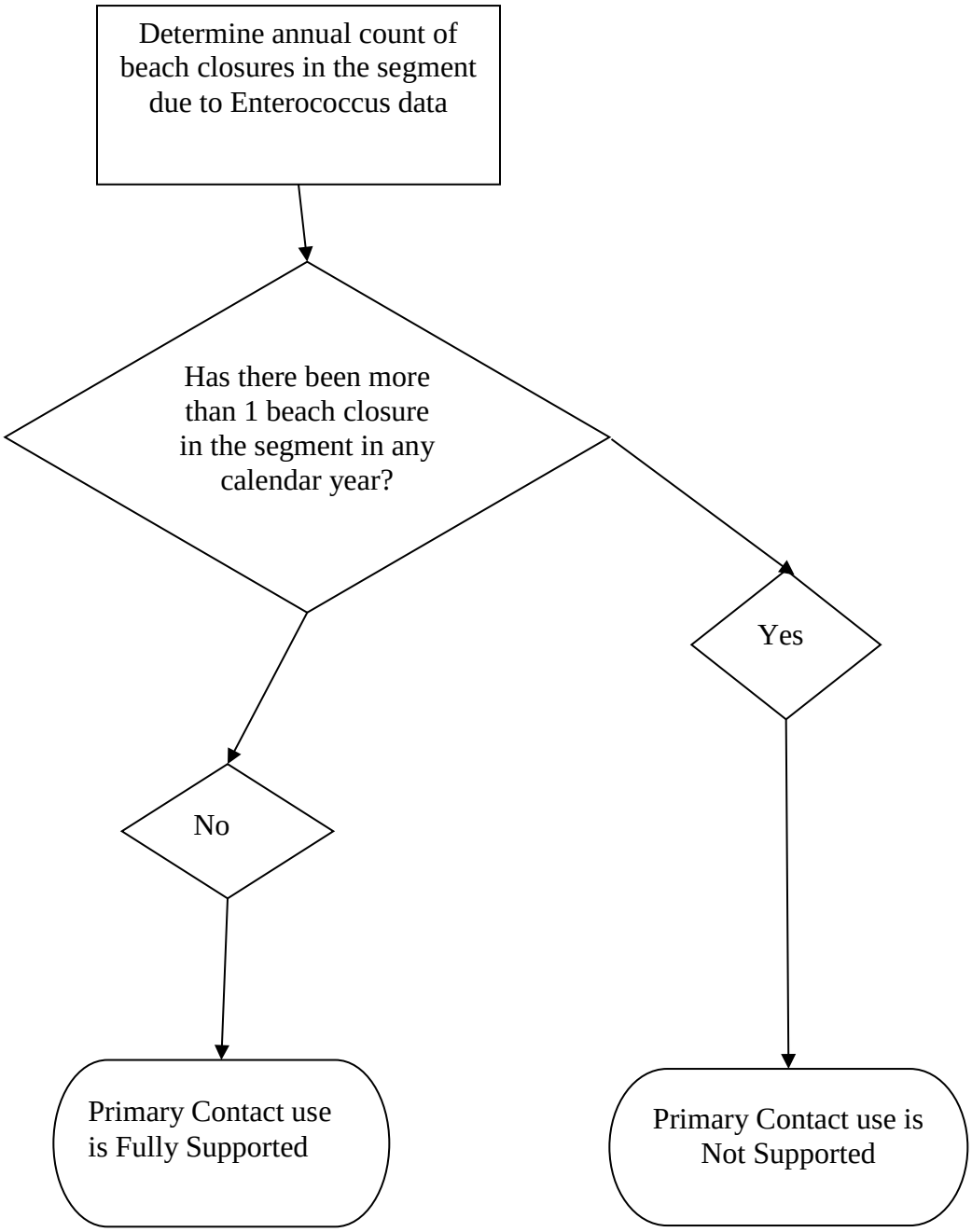
Assessment of Aquatic Life Use Support Using Minimum Dissolved Oxygen Criteria



Assessment of Primary Contact Use Support in Segments that do not have Beach Monitoring Programs



Assessment of Primary Contact Use Support in Segments with Beach Monitoring Programs



C3. Assessment Results

Appendix One: Station Roll ups shows the results of the data analyzed for each station evaluated for this report. Appendix Two: Segment Roll Ups shows the Assessments for each segment for this listing cycle. Appendix Three: An Evaluation of Clean Water Act Section 303(d) Listings of Delaware Waters Affected by Fish Consumption Advisories shows the report by that same title in its entirety. Appendix Four: Integrated Report Database shows the entire database as of 2018. Appendix Five: The Final Determination for the State of Delaware 2018 Clean Water Act Section 303(d) List of Waters Needing TMDLs shows only the waters in Category 5 or 5(MNR) as required by the CWA. Appendix Six: Volunteer Water Quality Monitoring Data shows results from volunteer monitoring results in the Inland Bays watershed, and the Nanticoke River Watershed. Appendix Seven is the Public Participation Section. Appendix Eight is the Groundwater Quality Assessment Based on Public Well Data.

The 2018 303(d) List shows 66 revisions from earlier Lists. Those revisions are highlighted in "Change this cycle" column in the List. Four segments are newly listed for previously unlisted pollutants in their segments. Two of them are covered by TMDLs that are already in place and were listed in category 4a. Two of the new listings were for dieldrin as a result of fish tissue advisories and will be monitored for possible TMDL development in the future.

There were a total of thirty four delistings in this cycle. Twenty two of them were for nutrient, dissolved oxygen or bacteria impairments. Two delistings were for ammonia because data showed no exceedances of water quality criteria in those segments. One ammonia reduction was the result of removing a point source discharger per a TMDL agreement. Delistings for chlordane, mercury and dioxins and furans were a result of lowered levels in fish tissues from those waters.

For the 2018 assessments, the Department incorporated the Fish Tissue Advisories that were issued by the Delaware Departments of Health and the Department of Natural Resources and Environmental Control on February 20th, 2018. As a result of the advisories, two segment/pollutant combinations were delisted and one segment that was incorrectly delisted in 2016 was relisted for 2018.

The Department has been using a strategy called the Watershed Approach to Toxics Assessment and Restoration (WATAR) to address toxic pollutant issues in the State. In March of 2018 the Department completed a report entitled "An Evaluation of Clean Water Act Section 303(d) Listings of Delaware Waters Affected by Fish Consumption Advisories" that is included in its entirety as an appendix to this report. The evaluation considered information gathered from the WATAR and Fish Tissue Advisories programs to do detailed trends analyses of pollutants in fish tissue using data from the 1990s forward. Consistent with the Department's 2016 Integrated Report, the Department made a series of recommendations for TMDL development in those

waters. The evaluation recommended that six segments be delisted for some pollutants as those pollutants were no longer above the screening levels used for fish tissue advisories in those segments. Those segment pollutant combinations were changed to Category 1. Another recommendation was for seventeen segments to be placed into a new category of impairment known as Monitored Natural Recovery. That category is shown in this report as Category 5(MNR). In those waters, while the pollutant levels have not dipped below screening levels, they are expected to do so as shown in trend analyses of the available data. As suggested in the category name, the Department will continue to monitor fish in those waters and expects the contaminant level to decrease enough for future evaluations to recommend delisting those contaminants. The final recommended category in the Evaluation is to complete TMDLs in those waters where the above trend analyses shows that concentrations of those contaminants are not expected to reach acceptable levels in the near term without TMDL regulations. These five segments remain in Category 5, and the Department expects to complete the non DRBC waters by 2022. See the table below for the recommendations table that is on page 6 in the complete Evaluation.

Excerpted table of Recommended Actions for Selected Segments/Contaminant Pairs Listed on Delaware's 2016 Clean Water Act Section List Based on Fish Consumption Advisories

Waterbody ID	Watershed Name	Segment	Pollutant	Recommendation
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	Chlordane	Delist
DE040-002	Brandywine Creek	Upper Brandywine	D and F TEQs	MNR
DE 260-001	Red Clay Creek	Mainstem	D and F TEQs	TMDL
DE120-001	Christina River	Lower Christina River	Dieldrin	MNR
DE120-004-01	Christina River	Lower Christina Creek	Dieldrin	MNR
N/A	Delaware River	DRBC Zone 5	D and F TEQs	TMDL
N/A	Delaware River	DRBC Zone 5	Dieldrin	TMDL
DE020-001	Army Creek	Lower Army Creek	D and F TEQs	MNR
DE020-002	Army Creek	Upper Army Creek	D and F TEQs	Delist
DE270-001-01	Red Lion Creek	Lower Red Lion	D and F TEQs	MNR
DE090-001	Chesapeake & Delaware Canal	C&D Canal	D and F TEQs	MNR
DE090-001	Chesapeake & Delaware Canal	C&D Canal	Dieldrin	MNR
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	D and F TEQs	MNR
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Dieldrin	MNR
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	D and F TEQs	Delist
DE010-001-03	Appoquinimink River	Drawyer Creek	D and F TEQs	MNR
DE010-L02	Appoquinimink River	Silver Lake	Dieldrin	MNR
DE290-001-01	Saint Jones River	Lower Saint Jones	Dieldrin	MNR
DE290-001-01	Saint Jones River	Lower Saint Jones	D and F TEQs	MNR
DE290-001-02	Saint Jones River	Upper Saint Jones	D and F TEQs	TMDL
DE290-001-02	Saint Jones River	Upper Saint Jones	Dieldrin	MNR
DE290-002	Saint Jones River	Wyoming Mill Pond	DDT	MNR
DE290-L02	Saint Jones River	Silver Lake	D and F TEQs	TMDL
DE290-L02	Saint Jones River	Silver Lake	Mercury	Delist
DE080-003	Cedar Creek	Slaughter Creek	D and F TEQs	MNR
DE060-008	Broadkill River	Primehook Creek	Mercury	Delist
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Mercury	Delist
N/A	Delaware Bay	DRBC Zone 6	Mercury	MNR

C4. Wetlands Program

The Goals, Objectives and Products of the Delaware Department of Natural Resources and Environmental Control's Wetland Monitoring and Assessment Program

Program Goals
The goal of DNREC's Wetland Monitoring and Assessment Program (WMAP) is to assess the condition, or health, of wetlands and the functions and ecosystem benefits that wetlands provide. This information is used to inform the citizens of Delaware and to improve existing education, restoration, protection, and land use planning efforts. The 2015 Delaware Wetland Management Plan will guide future efforts of the WMAP in the areas of protocol development, wetland monitoring and assessment activities, research, and application of information.

We work closely with other states through the Environmental Protection Agency's Mid-Atlantic Wetlands Program to establish and conduct research methods and share information.

Objectives:

- Develop scientifically valid wetland assessment methods.
- Assess the current condition of wetlands by watershed and identify major stressors that are impacting wetlands.
- Perform research to improve our understanding of wetland functions, the impact of stressors, and the ecosystem services provided by wetlands to humans and the environment.
- Evaluate the performance of wetland restoration and other compensatory wetland mitigation in replacing wetland acreage and function.
- Educate other state agencies, conservation partners, and the general public to improve efforts to protect and restore wetlands.
- Integrate monitoring and assessment data into watershed restoration plans and other conservation strategies.
- Meet requirements of the Clean Water Act.

Productivity

- Development of Delaware's nationally-recognized Monitoring and Assessment Protocols
- Developed a collaborative Delaware Wetland Management Plan
- Completed non-tidal wetland condition reports for the Nanticoke, Inland Bays, Murderkill, St. Jones, and Broadkill watersheds
- Completed wetland condition reports for the Nanticoke, Inland Bays, Murderkill, St. Jones, Broadkill and Mispillion watersheds
- Collaborative development of a Restoration Plan for the Nanticoke Watershed

Links to more information about Delaware's wetlands including Wetland Health Reports, the 2015 Delaware Wetland Management Plan, a review of Delaware's Wetland program and many

other resources are online at:
http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Pages/Portal.aspx.

C5. Trends Analysis for Surface Waters

Trend Analysis for Nitrogen and Phosphorus

Trend analysis for nitrite+nitrate, total nitrogen, and total phosphorus has been performed to assess water quality changes in Delaware Surface Waters and to track progresses made toward achieving the nutrients target loads established for various watersheds in Delaware as the result of the Total Maximum Daily Load (TMDL) Program. For this analysis, flow-normalized concentrations and loads, and their changes over a 10-year period (2008-2017), have been estimated using an R statistical package called "Exploration and Graphics for RivEr Trends (EGRET)", (Hirsch and DeCicco, 2015). This statistical package uses a multiple regression method called "Weighted Regressions on Time, Discharge, and Season (WRTDS)", (Hirsch and others, 2010). As the name indicates, WRTDS method estimates daily concentration by establishing a regression relationship between concentration, stream flow, and time of the year (season). "Flow-normalized" concentration refers to concentration during normal flow condition. Using flow-normalized concentration would eliminate the impact of flow variations on nutrient concentrations and loads and would allow investigating water quality changes that are occurring as the result of management actions. The WRTDS method has been widely used by many agencies for conducting trend analysis. For example, the United States Geological Survey (USGS) is relying on this method to assess water quality changes in non-tidal tributaries of the entire Chesapeake Bay Watershed.

To perform trend analysis for Delaware surface waters based on WRTDS method, daily mean stream flow and nutrients concentration for the 11 monitoring sites in Delaware that are collocated with a USGS stream gauging stations (C1 sites) were retrieved from the USGS website (https://maps.waterdata.usgs.gov/mapper/index.html) and from the Environmental Protection Agency's modernized STORET website (https://www.waterqualitydata.us/). Figure 1 below shows the location of the C1 monitoring sites used for this analysis and Table 1 provides information about the location of these 11 monitoring sites and the collocated USGS stream gaging station as well as the drainage area above the stream gaging station.

The results of trend analysis for the 11 C1 monitoring sites are grouped and graphically presented in Figures 2 and 3 for nitrite+ nitrate. In these Figures, the annual mean concentrations are shown as black dots and flow-normalized concentrations are shown as green line and reflect how the nitrite+nitrate concentration has changed over time (trend). The time span for trend analysis for a site is dependent on the data period used for the analysis and may be different from one site to the other. Table 2 shows the time period that data was used for the analysis for each monitoring site as well as concentration change (trend) over a 10-year period from 2008 through 2017. Negative values in the table indicate lowering concentrations (improving trend) and positive values indicate increasing concentrations (worsening condition). From Table 2 it can be seen that 9 sites have improving trend and 2 sites (Nanticoke River site and Marshyhope Creek site) have worsening trend with regard to nitrite+nitrate.

Figures 4 and 5 show the results of trend analysis for total nitrogen (TN) and Table 3 summaries these results. This table shows that similar to results for nitrite+nitrate, total nitrogen is improving at 9 sites and are worsening at 2 sites (Nanticoke River and Marshyhope Creek).

Figures 6 and 7 show the results of trend analysis for Total Phosphorus (TP) at the 11 C1 sites and Table 4 summarizes the results. The Table shows TP concentration is improving at 5 sites and worsening at 6 sites.

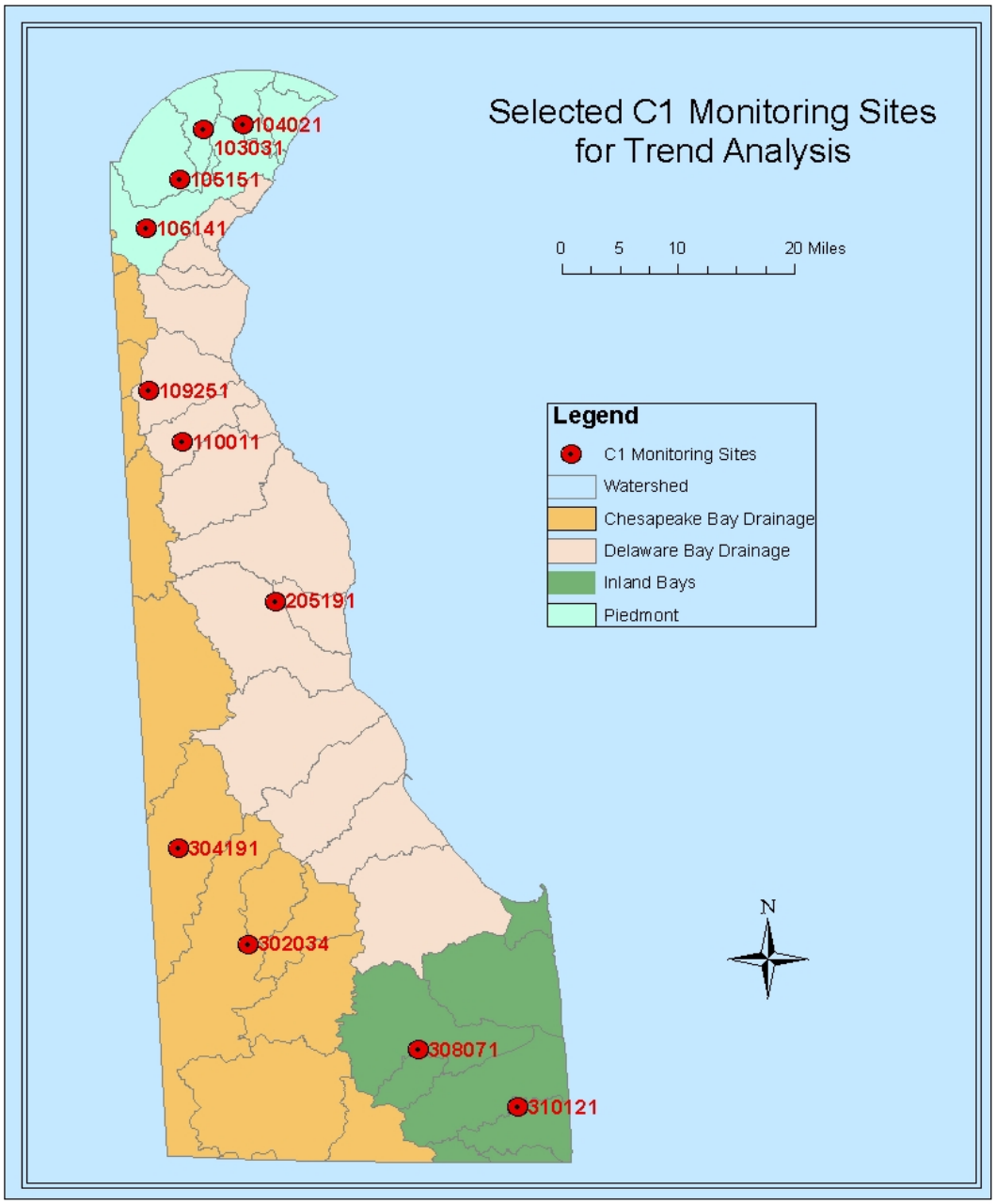


Figure 1.The 11 C1 Monitoring Sites used for WRTDS Trend Analysis

Table 1. The Monitoring Sites and Their Co-located USGS Stream Gage Site

Monitoring Site STORET ID	Location	USGS Stream Gage ID	USGS Stream Gage Name	Drainage Area above the gage (mi2)
103031	Red Clay Creek at Lancaster Pike (Rt. 48)	1480000	RED CLAY CREEK AT WOODDALE, DE	47.0
104021	Brandywine River at New Bridge Rd. (Rd. 279)	1481500	BRANDYWINE CREEK AT WILMINGTON, DE	314.0
105151	White Clay Creek at Delaware Park Blvd.	1479000	WHITE CLAY CREEK NEAR NEWARK, DE	89.1
106141	Christina River at Sunset Lake Rd. (Rt. 72)	1478000	CHRISTINA RIVER AT COOCHS BRIDGE, DE	20.5
109251	Appoquinimink River's tributary, Deep Creek Branch at Summit Bridge Rd. (Rt. 71)	1483155	SILVER LAKE TRIBUTARY AT MIDDLETOWN, DE	1.7
110011	Blackbird Creek at Blackbird Station Rd. (Rd. 463)	1483200	BLACKBIRD CREEK AT BLACKBIRD, DE	4.1
205191	St. Jones River at Silver Lake at Spillway (Dover City Park)	1483700	ST JONES RIVER AT DOVER, DE	31.9
302034	Marshyhope Creek at Fishers Bridge Rd. (Rd. 308)	1488500	MARSHYHOPE CREEK NEAR ADAMSVILLE, DE	46.8
304191	Nanticoke River at Rifle Range Rd. (Rd. 545)	1487000	NANTICOKE RIVER NEAR BRIDGEVILLE, DE	75.4
308071	Indian River at Millsboro Pond outlet at John Williams Hwy. (Rt. 24)	1484525	MILLSBORO POND OUTLET AT MILLSBORO, DE	61.7
310121	Little Assawoman Bay, Beaver Dam Ditch at Beaver Dam Rd. (Rd 368)	1484695	BEAVERDAM DITCH NEAR MILLVILLE, DE	2.2

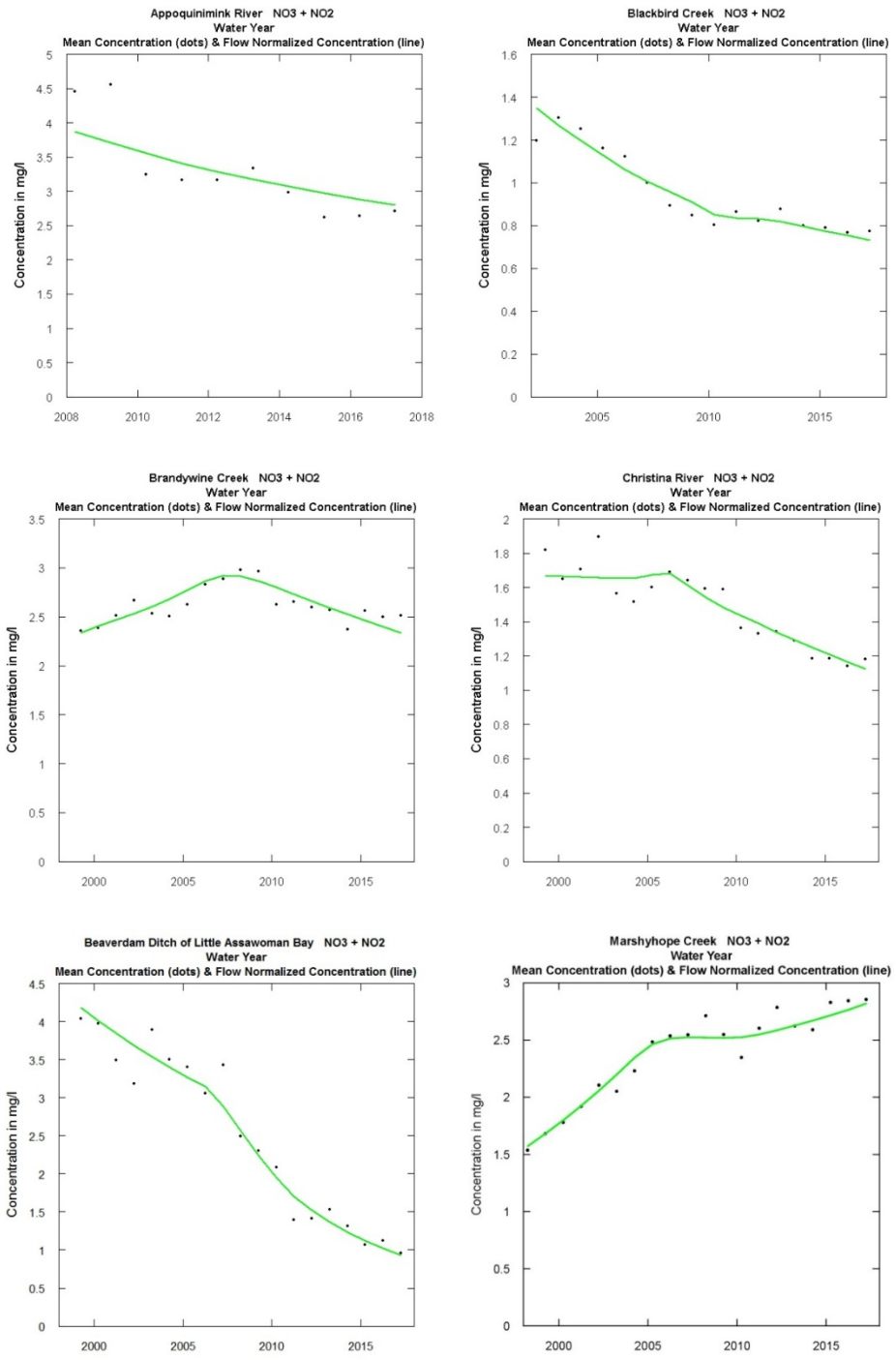


Figure 2. Annual mean Concentration (black dots) and Flow-Normalized Concentrations (green line) for Nitrite+Nitrate Nitrogen

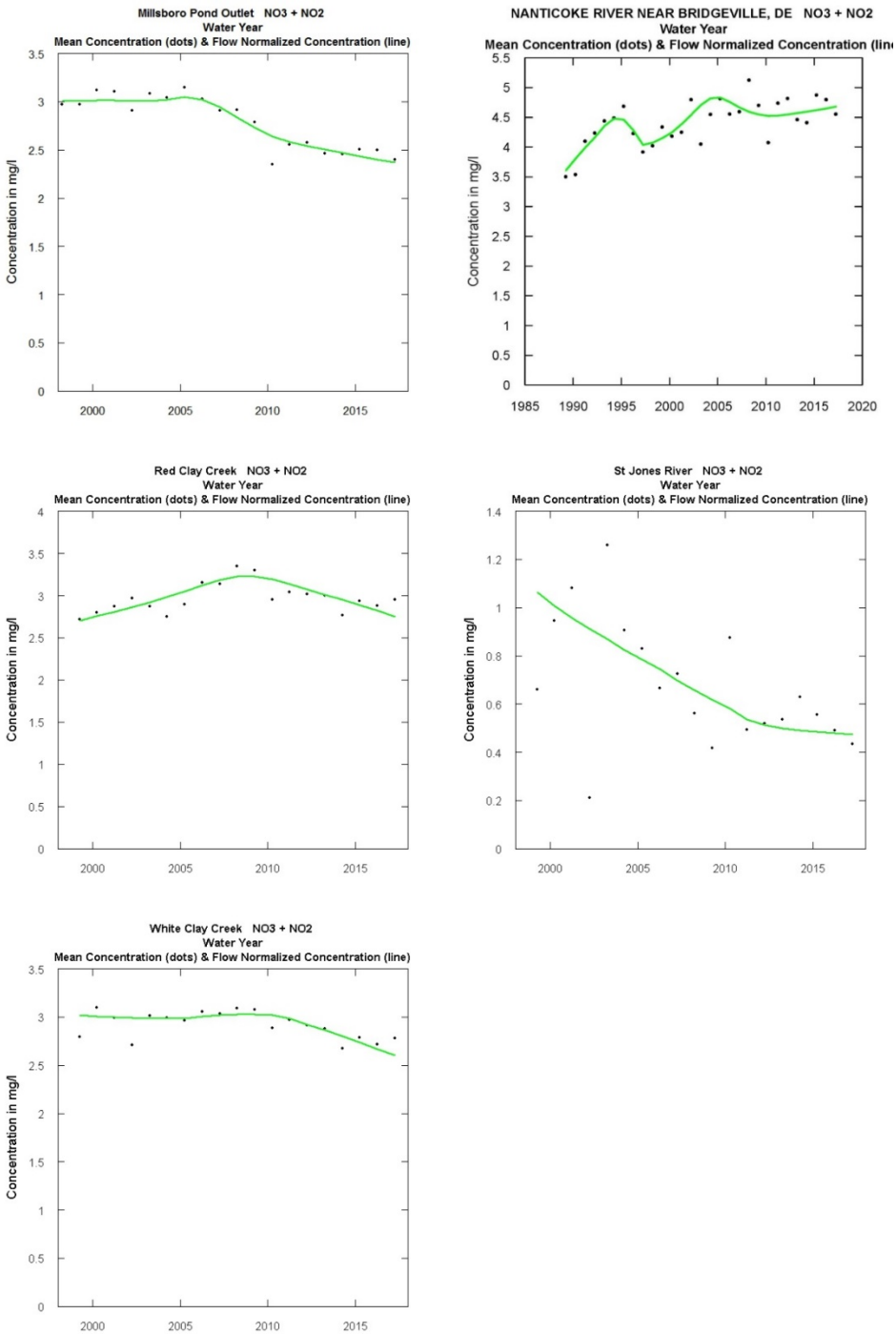


Figure 3. Annual mean Concentration (black dots) and Flow-Normalized Concentrations (green line) for Nitrite+Nitrate Nitrogen

Table 2. Data period used for trend analysis of Nitrite + Nitrate and the results

Monitoring Site ID	Site Description	Data used start year	Data used end year	Concentration change from 2008-2017 (mg/l)	Improving/ Worsening Trend
103031	Red Clay Creek at Lancaster Pike (Rt. 48)	1999	2017	-0.48	Improving
104021	Brandywine Creek at New Bridge Rd. (Rd. 279)	1999	2017	-0.58	Improving
105151	White Clay Creek at Delaware Park Blvd.	1999	2017	-0.43	Improving
106141	Christina River at Sunset Lake Rd. (Rt. 72)	1999	2017	-0.42	Improving
109251	Appoquinimink River trib, Deep Creek Br at Summit Bridge Rd. (Rt. 71)	2008	2017	-1.10	Improving
110011	Blackbird Creek at Blackbird Station Rd. (Rd. 463)	2002	2017	-0.23	Improving
205191	St. Jones River, Silver Lake at Spillway (Dover City Park)	1999	2017	-0.18	Improving
302034	Marshyhope Creek at Fishers Bridge Rd. (Rd. 308)	1998	2017	0.30	Worsening
304191	Nanticoke River at Rifle Range Rd. (Rd. 545)	1989	2017	0.09	Worsening
308071	Indian River, Millsboro Pond outlet at John Williams Hwy. (Rt. 24)	1998	2017	-0.47	Improving
310121	Little Assawoman Bay, Beaver Dam Ditch at Beaver Dam Rd. (Rd. 368)	1999	2017	-1.60	Improving

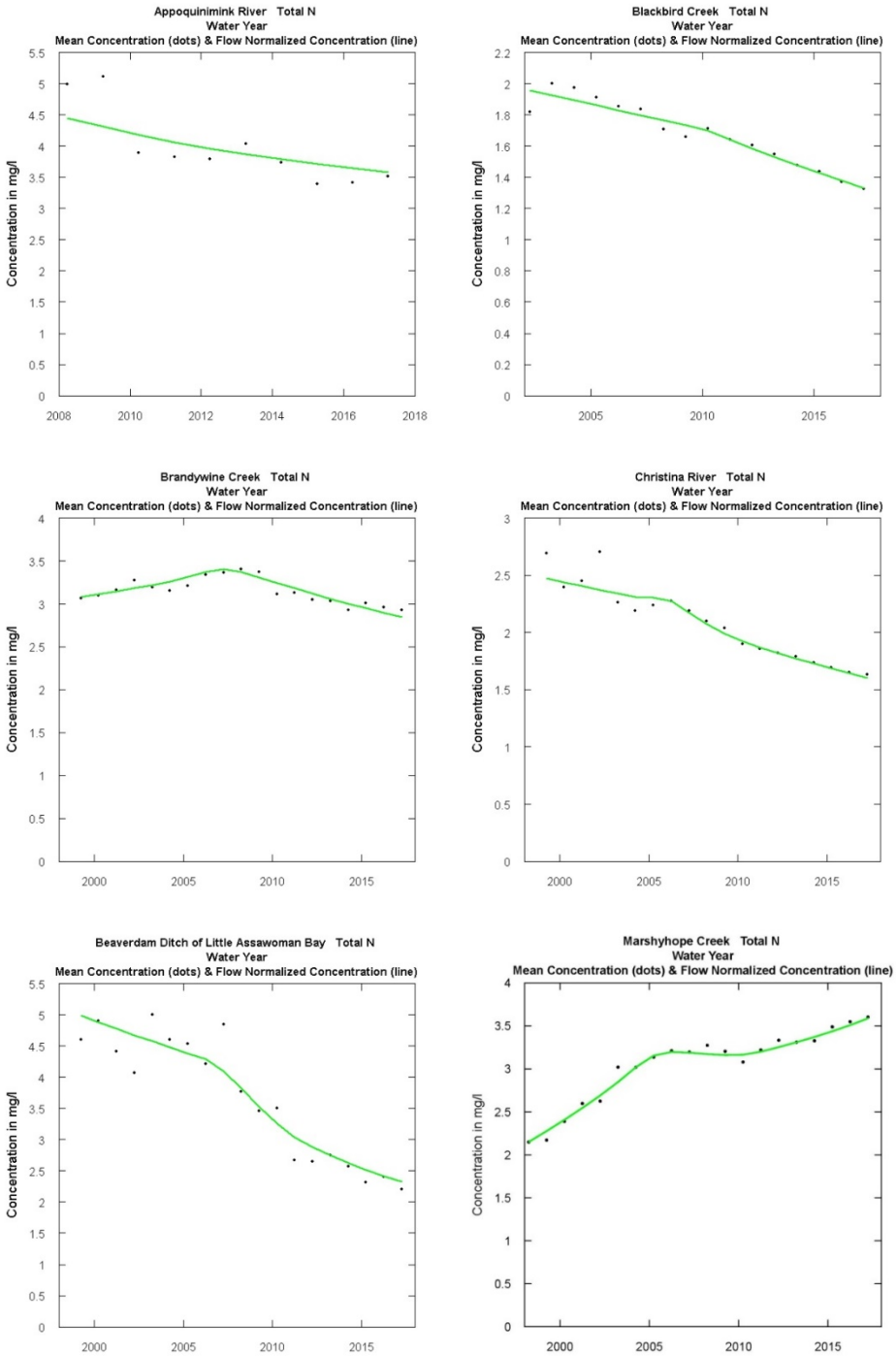


Figure 4. Annual mean Concentration (black dots) and Flow-Normalized Concentrations (green line) for Total Nitrogen (TN)

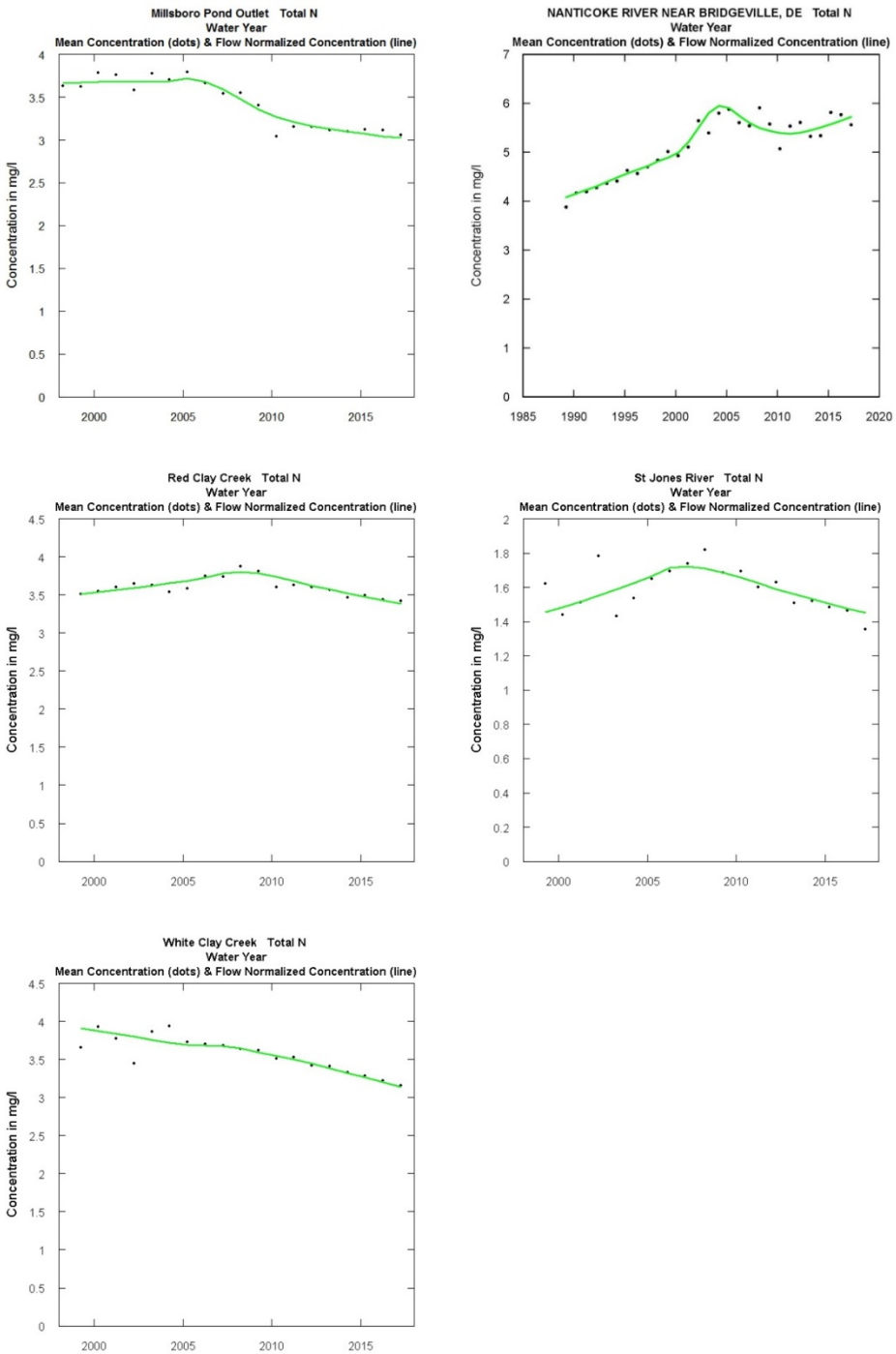


Figure 5. Annual mean Concentration (black dots) and Flow-Normalized Concentrations (green line) for Total Nitrogen (TN)

Table 3. Data period used for trend analysis of Total Nitrogen (TN) and the results

Monitoring Site ID	Site Description	Data used start year	Data used end year	Concentration change from 2008-2017 (mg/l)	Improving/ Worsening Trend
103031	Red Clay Creek at Lancaster Pike (Rt. 48)	1999	2017	-0.43	Improving
104021	Brandywine Creek at New Bridge Rd. (Rd. 279)	1999	2017	-0.53	Improving
105151	White Clay Creek at Delaware Park Blvd.	1999	2017	-0.50	Improving
106141	Christina River at Sunset Lake Rd. (Rt. 72)	1999	2017	-0.47	Improving
109251	Appoquinimink River trib, Deep Creek Br at Summit Bridge Rd. (Rt. 71)	2008	2017	-0.87	Improving
110011	Blackbird Creek at Blackbird Station Rd. (Rd. 463)	2002	2017	-0.43	Improving
205191	St. Jones River, Silver Lake at Spillway (Dover City Park)	1999	2017	-0.26	Improving
302034	Marshyhope Creek at Fishers Bridge Rd. (Rd. 308)	1998	2017	0.42	Worsening
304191	Nanticoke River at Rifle Range Rd. (Rd. 545)	1989	2017	0.23	Worsening
308071	Indian River, Millsboro Pond outlet at John Williams Hwy. (Rt. 24)	1998	2017	-0.45	Improving
310121	Little Assawoman Bay, Beaver Dam Ditch at Beaver Dam Rd. (Rd. 368)	1999	2017	-1.50	Improving

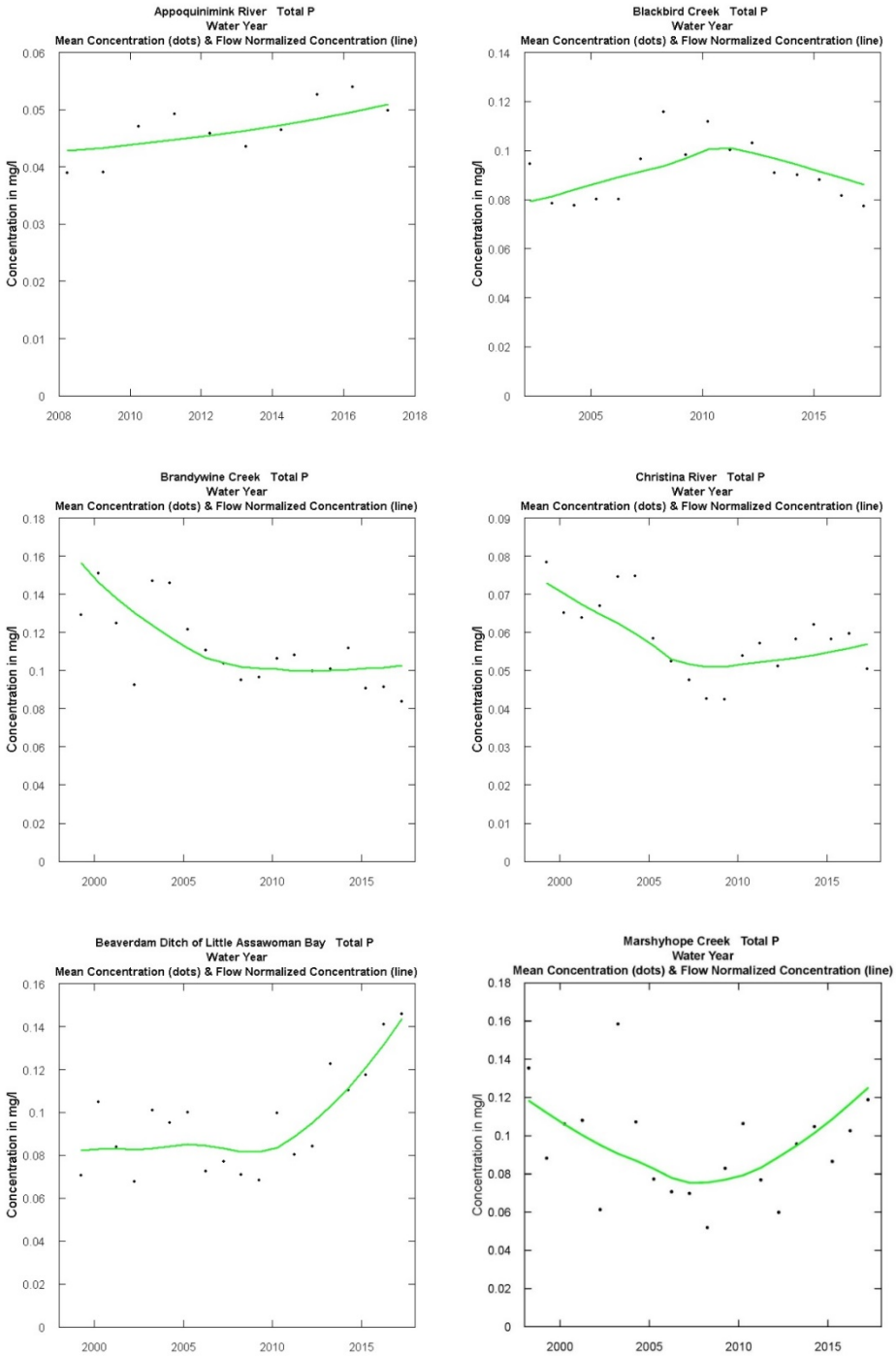


Figure 6. Annual mean Concentration (black dots) and Flow-Normalized Concentrations (green line) for Total Phosphorus (TP)

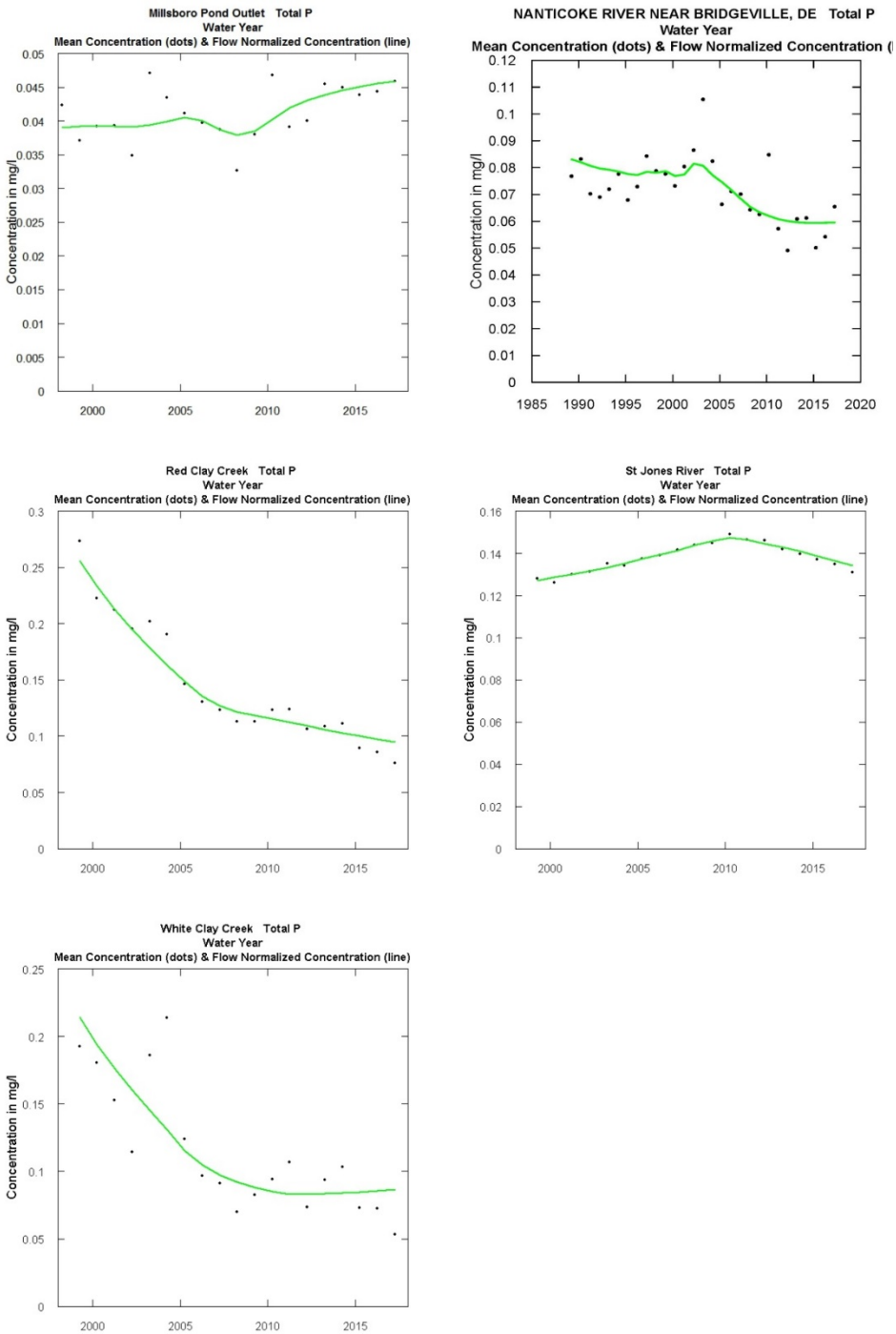


Figure 7. Annual mean Concentration (black dots) and Flow-Normalized Concentrations (green line) for Total Phosphorus (TP)

Table 4 Data period used for trend analysis of Total Phosphorus (TP) and the results

Monitoring Site ID	Site Description	Data used start year	Data used end year	Concentration change from 2008-2017 (mg/l)	Improving/ Worsening Trend
103031	Red Clay Creek at Lancaster Pike (Rt. 48)	1999	2017	-0.0270	Improving
104021	Brandywine Creek at New Bridge Rd. (Rd. 279)	1999	2017	0.0004	Worsening
105151	White Clay Creek at Delaware Park Blvd.	1999	2017	-0.0057	Improving
106141	Christina River at Sunset Lake Rd. (Rt. 72)	1999	2017	0.0059	Worsening
109251	Appoquinimink River trib, Deep Creek Br at Summit Bridge Rd. (Rt. 71)	2008	2017	0.0082	Worsening
110011	Blackbird Creek at Blackbird Station Rd. (Rd. 463)	2002	2017	-0.0077	Improving
205191	St. Jones River, Silver Lake at Spillway (Dover City Park)	1999	2017	-0.0096	Improving
302034	Marshyhope Creek at Fishers Bridge Rd. (Rd. 308)	1998	2017	0.0500	Worsening
304191	Nanticoke River at Rifle Range Rd. (Rd. 545)	1989	2017	-0.0058	Improving
308071	Indian River, Millsboro Pond outlet at John Williams Hwy. (Rt. 24)	1998	2017	0.0080	Worsening
310121	Little Assawoman Bay, Beaver Dam Ditch at Beaver Dam Rd. (Rd. 368)	1999	2017	0.0620	Worsening

C6. Public Health Issues

The Department addresses public health issues through various programs related to drinking water supplies, beach use and fish/shellfish advisories.

Delaware Source Water Protection Program

The Source Water Assessment and Protection Program (SWAPP) was created by Congress as part of the Safe Drinking Water Act Amendments of 1996. The goal of the SWAPP is to better protect public drinking water resources by providing local and state governments, and the public more information about those resources. The susceptibility of each source of public drinking water to various types of contamination will be determined and published. Congress has provided funding though the U.S. EPA to the states to support their efforts in conducting these assessments.

The Delaware Department of Natural Resources and Environmental Control (DNREC) has the lead role in the development and implementation of the Delaware SWAPP. The Delaware Division of Public Health and the Water Resources Agency, Institute for Public Administration at the University of Delaware, closely supports its work. A SWAPP Citizen and Technical Advisory Committee (CTAC) was formed at the start of this program in 1998 and continuing to assist in developing and implementing Delaware's SWAPP and ensures public involvement.

Program	Web Address
Delaware Source Water Protection Program (DNREC)	http://delawaresourcewater.org/
Delaware Department of Health and Human Services Office of Drinking Water	http://dhss.delaware.gov/dhss/dph/hsp/odw.html
University of Delaware Water Resources Agency, Institute for Public Administration	http://www.wra.udel.edu/

Delaware's Recreational Beach Monitoring Program

DNREC's Recreational Water Program protects the health of swimmers in a number of ways:

- Shoreline surveys are conducted adjacent to guarded recreational beaches to identify all actual and potential sources of pollution.
- Water samples are collected at least weekly at all guarded beaches during the swimming season (mid May through September).
- Water samples are analyzed to determine the levels of Enterococci bacteria in recreational waters. Enterococcus is one of several indicator organisms that signal the presence of potentially harmful bacteria and viruses.
- Signs have been posted at popular public access points around Rehoboth Bay, Indian River Bay, and Little Assawoman Bay to warn potential swimmers of the risks associated with swimming in poor quality waters.
- The Department recommends swimming only at guarded beaches where water samples are collected.

- There is a permanent caution regarding swimming in the Inland Bays. The Inland Bays suffer from nutrient and bacterial pollution that come from failing septic systems, fertilizers, and other sources. Water is slow to flush out of these bay, Indian River Bay, Rehoboth Bay and Little Assawoman Bay, so pollutants linger.

Up to date information about swimming advisories is available online at http://apps.dnrec.state.de.us/recwater/ or by phone on the 24-hour "Beach Hotline" at 1-800-922-WAVE (9283).

Fish Consumption Advisories

Fishing is an important activity in Delaware's inland and coastal waters. Among the benefits provided by fishing are quality recreational opportunities, direct and indirect input to the local economy, food for recreational anglers and food for the commercial marketplace. Fish are a good source of readily digestible protein, they are low in fat and sodium, and the unique type of fats found in fish are believed to provide cardiovascular benefits. Despite the general benefits of fishing and fish consumption, there has been a growing concern regarding the presence of chemical toxins in the flesh of finfish and shellfish taken from Delaware waters and the associated health risk to anglers and their families who consume their catch. The existence of chemicals in the edible portion of some fish has resulted in the public advisories (see Section C2 above). These advisories are as a result of joint action taken by the Department of Natural Resources and Environmental Control and the Department of Health and Social Service's (DHSS) Division of Public Health. Information about the latest advisories that are in effect is online at: http://www.dnrec.delaware.gov/fw/Fisheries/Pages/Advisories.aspx

PART D. GROUND WATER MONITORING AND ASSESSMENT

The following is the Executive Summary of Delaware's 2018 3059b) Groundwater-Quality Assessment Based on Public-Well Data which is included in its entirety as Appendix Nine of this report.

Groundwater quality in Delaware was assessed based on raw-water data collected during a two-year time period (October 1, 2015 through September 30, 2017) from public water-supply (PWS) wells. The water-quality database consisted of approximately 30,000 analyses. Five aquifer types were recognized for reporting purposes: (1) unconfined, (2) confined, (3) semi-confined, (4) fractured-rock, and (5) karst. Unconfined, confined, and semi-confined aquifers occur in the mid-Atlantic Coastal Plain Physiographic Province, which comprises most (~96%) of Delaware's land-surface area. Fractured-rock and karst aquifers occur in the Piedmont Physiographic Province in the remaining northernmost portion of the state; these aquifer types are poorly represented in this assessment due to limited or no water-quality data. There are 1,171 active PWS wells and a large majority of these wells (89%) produce from Coastal-Plain aquifers; 5% produce from Piedmont aquifers; and aquifer designations for the remainder are either not known or not yet established. Well depths range from 22 to 957 ft below land surface (bls) with a median well depth of 140 ft bls. Highlights from the groundwater-quality assessment follow*:

Based on nitrate data, almost two thirds of the wells evaluated are susceptible to human influence. Nitrate concentrations exceeded 0.4 mg/L, a threshold indicative of human impacts, in 63% of the samples.

The unconfined aquifer is the most susceptible to human influence. This aquifer had the highest median nitrate concentration (5.00 mg/L). This aquifer also had a large fraction of concentrations exceeding 0.4 mg/L (90.4%) and a small fraction of non-detectable concentrations (8.2%). The most elevated nitrate concentrations (up to 24.4 mg/L) were associated with unconfined wells.

Nitrate concentrations exceeded the drinking-water standard in <3% of all samples. Concentrations exceeded the Primary Maximum Contaminant Level (PMCL) of 10 mg/L for drinking water in 2.4% of the samples. Areally, PMCL exceedances were limited to unconfined wells located in Kent and Sussex counties.

Overall, nitrate concentrations decrease with depth. Trends in nitrate concentrations with respect to sample depth indicate that overall the vertical extent of human influence in Coast-Plain aquifers was primarily limited to depths of 220 ft below land surface and shallower. At depths greater than 220 ft, nitrate was not detected above the quantitation limit. The deepest nitrate detection was associated with a confined well. There were no nitrate data for Piedmont aquifers in this assessment.

Organic compounds were frequently nondetectable. Organic compounds were not detected in 96.4% of the analyses. Almost one half (43.2%) of the detections were found at concentrations less than 1 µg/L. Tetrachloroethylene (PCE), a solvent, was the most-frequently detected organic compound.

Organic compounds rarely exceeded drinking-water standards. Specifically, organic compounds exceeded PMCLs in 1.0% of the analyses. The following analytes were found above the PMCL: tetrachloroethylene (PCE) and trichloroethylene (TCE).

Some organic compounds have depth trends similar to nitrate. Specifically, concentrations of methyl tert-butyl ether (MTBE), tetrachloroethylene (PCE), and trichloroethylene (TCE) with respect to sample depth indicate that the vertical extent of human impact in the Coastal-Plain aquifers is limited to depths of ~150 ft bls. PCE and TCE were detected at greater depths in karst wells, which typically have very long open intervals that may allow contaminants to enter at shallower depths.

Trace elements were frequently nondetectable. Trace elements were not detected in 76% of the analyses. More than half (52%) of the detections were found at concentrations less than 0.1 mg/L and almost all detections (98%) were found at concentrations less than 1 mg/L. Barium, nickel, and chromium were the top three most-frequently detected trace elements.

Arsenic data were too limited in this assessment for meaningful analysis; based on previous assessments, arsenic detections were primarily limited to confined wells in glauconitic aquifers. Based on the 2014 assessment (Kasper, 2014), arsenic was one of the top five most frequently detected trace elements. Detections of arsenic were primarily limited to confined wells that produce from the Rancocas, Mt. Laurel, or Piney Point aquifers, which are associated with glauconitic geologic formations. A USGS study targeting the Rancocas aquifer and completed during the reporting period (Denver, 2016) found that 15 (41.7%) of 36 wells had arsenic concentrations in excess of the PMCL (10 µg/L).

Radionuclide data were very limited in this assessment. Available radionuclide data were limited to the following parameters with the number of analyses indicated in parentheses: uranium-238 (8) and gross alpha particle activity (2). All uranium-238 results were ND and thus below the 0.03 mg/L PMCL. All gross alpha particle activities were below the 15 pCi/L PMCL. A USGS study targeting the Rancocas aquifer and completed during the reporting period (Denver, 2016) found that 14 (44.4%) of 36 wells had radon concentrations above the lower proposed MCL (300 pCi/L); none of the radon concentrations exceeded the proposed alternative MCL of 4,000 pCi/L.

Other groundwater-quality findings:

Overall, groundwater is predominantly soft or moderately hard. Specifically, most of the results for Coastal-Plain aquifers (93.4%) met either of these criteria. There were no hardness data for Piedmont aquifers; based on previous assessments, the karst aquifer type routinely had the most elevated hardness values.

Groundwater was acidic in about half of the overall samples. Specifically, pH values were less than the lower limit of the Secondary Maximum Contaminant Level (SMCL) range (6.5-8.5 standard pH units) in 53.3% of the samples. Unconfined and semi-confined wells both had a median pH of 5.8 and the largest fractions of pH values below the SMCL range (74.2 and 87.5%, respectively); in contrast, confined wells had the highest median pH (7.5) and the largest fraction of values within the SMCL range (90.5%). There were no pH data for fractured-rock and karst wells; based on previous assessments, karst wells had the highest median pH and the largest fraction of samples within the SMCL range.

Iron was elevated in one quarter of the samples. Iron exceeded the SMCL (0.3 mg/L) in 24.6% of the samples. Elevated iron was detected at virtually all depths. Relative to other Coastal-Plain aquifer types, confined wells had the largest fraction of concentrations greater than the SMCL (44.2%).

Groundwater is generally dilute overall based on total dissolved solids (TDS) data. Specifically, the median TDS concentration was 113 mg/L. Confined wells had the highest median TDS concentration (254 mg/L), likely due to longer groundwater contact time with formation sediments. One TDS concentration was above the 500 mg/L SMCL; it was detected in an unconfined well. TDS concentrations in Coastal-Plain aquifers generally increase with depth. There were no TDS data for Piedmont wells; however, based on previous assessments, the karst aquifer type typically had the highest median TDS concentration.

Chloride concentrations did not exceed the drinking-water standard. Chloride concentrations in Coastal-Plain aquifers were below the SMCL (250 mg/L) in all of the samples. Unconfined wells had the highest median chloride concentration (15.3 mg/L), possibly indicative of human influence. The most elevated chloride concentration (174 mg/L), however, was associated with a confined well sample. There was no apparent trend in chloride with depth. There were no chloride data for Piedmont wells in this assessment.

Sodium concentrations were above the health advisory level in almost one third of the samples. Sodium concentrations in Coastal-Plain aquifers exceeded the Health Advisory (HA) of 20 mg/L in 29.4% of the samples. Sodium concentrations above the HA were found at virtually all depths, but the most elevated concentrations were found in deeper, confined wells. Specifically, confined wells had the highest median sodium concentration (25.4 mg/L) and the largest fraction of concentrations above the HA (56.8%). There were no sodium data for Piedmont wells in this assessment.

*Note: Because only raw or apparently raw groundwater-quality data were evaluated, the results may not be representative of finished or treated water delivered to consumers. Therefore, an exceedance of a drinking-water standard does not necessarily indicate that a public water-supply system is not in compliance.

PART E. PUBLIC PARTICIPATION

The Department kept the public informed of the process and progress of this Integrated Report using its website, an email list of interested parties and public notices placed in local newspapers. The sole commenter on the Draft Integrated Report was US EPA Region 3. Their comments were related to clerical issues that were corrected in this final report and the final updates to the ATTAINS database. The comments are included in their entirety in Appendix Eight.

Appendix One: Station Roll Ups

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
109171	DE 010-001-02	Appoquinimink River	MOT Gut (Appo Gut) - West Bank	f	51	136.9	5	52	5.68	2
306091	DE 280-E01	Rehoboth Bay	Buoy 7, Rehoboth Bay	m	19	7.9	1	40	6.32	0
306121	DE 140-E01	Indian River	Buoy 20, Indian River Bay	m	33	22.3	1	56	6.22	0
206231	DE 220-001	Murderkill River	Confluence of Kent County STP trib.	f	40	224.8	5	40	3.43	11
305011	DE 170-001	Lewes and Rehoboth Canal	Canal Rt. 1	m	42	44.9	5	49	4.84	5
306321	DE 140-E01	Indian River	Indian River Inlet	m	28	12.7	1	68	6.57	0
306341	DE 140-004	Indian River	Island Creek, upper third	m	26	29.9	1	40	6.34	0
312011	DE 140-001	Indian River	White Creek at the mouth of Assawoman Canal	m	36	22.8	1	49	5.69	2
206091	DE 220-001	Murderkill River	US Rt. 113 at Frederica By-Pass	f	48	155.2	5	49	4.04	7
305041	DE 170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal at Rd. 18 Bridge	m	44	18.7	1	49	4.88	4
306111	DE 280-E01	Rehoboth Bay	Massey's Ditch at Bouy 17	m	24	8.8	1	48	6.31	0
310031	DE 180-003	Little Assawoman Bay	Dirrickson Creek, Rd. 381	m	46	129.5	5	49	6.37	1
310071	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay, Mid-Bay	m	25	27.8	1	49	5.77	0
109121	DE 010-001-01	Appoquinimink River	Rt. 9 Bridge (East)	f	49	80.2	1	51	5.71	1
306331	DE 140-E02	Indian River	Island Creek mouth	m	26	16.4	1	40	6.05	0
310011	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay Ditch at Rd. 58 Bridge	m	17	13.3	1	49	5.59	2
308051	DE 280-001-01	Rehoboth Bay	Guinea Creek at Rt. 298 Bridge	m	48	221.3	5	47	5.99	2
306181	DE 140-004	Indian River	Buoy 49, Indian River	m	35	27.5	1	40	6.56	0
206141	DE 220-001	Murderkill River	3.25 miles from the mouth	m	39	150.8	5	40	3.71	10
109091	DE 010-001-01	Appoquinimink River	Delaware River (Appoquinimink at Mouth)	m	54	92.1	5	58	5.89	1
206101	DE 220-001	Murderkill River	Bowers Beach Wharf	m	49	41.8	5	52	5.73	1

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
101021	DE 230-001-02	Naamans Creek	Naamans Road	f	43	193.8	5	46	7.89	0
101031	DE 230-001-02	Naamans Creek	South Branch at Darley Rd.	f	44	160.4	5	46	7.49	0
101061	DE 230-001-02	Naamans Creek	South Branch at Marsh Rd.	f	43	118.3	5	46	7.99	0
102041	DE 300-001-01	Shellpot Creek	Cherry Island at Rd. 501 Bridge	f	42	163.3	5	45	3.54	13
102051	DE 300-001-02	Shellpot Creek	Rt. 13 Bus (Market Street) Bridge	f	74	316.1	5	83	8.15	0
102081	DE 300-001-02	Shellpot Creek	Carr Road Bridge	f	45	104.8	5	46	8.14	0
103011	DE 260-001	Red Clay Creek	Stanton, Rt. 4 at Stanton Bridge (USGS gage 01480015)	f	44	126.5	5	45	8.42	0
103031	DE 260-001	Red Clay Creek	Wooddale, Rt. 48 (USGS gage 01480000)	f	77	118.4	5	83	8.01	0
103041	DE 260-001	Red Clay Creek	Ashland, Rd. 258a	f	40	116.4	5	46	8.12	0
103061	DE 260-002	Red Clay Creek	Burrough's Run at Creek Rd. (Rt. 82)	f	43	116.8	5	46	8.51	0
104011	DE 040-001	Brandywine Creek	Footbridge in Brandywine State Park	f	45	83.3	1	45	7.97	0
104021	DE 040-002	Brandywine Creek	Rd. 279 Bridge (USGS guage 014)	f	80	102.4	5	83	8.02	0
104051	DE 040-002	Brandywine Creek	Smith Bridge	f	43	66.3	1	46	7.64	0
105031	DE 320-001	White Clay Creek	Chambers Rock Rd. (Road 329) near Thompson	f	39	172.5	5	46	8.43	0
105151	DE 320-001	White Clay Creek	DE Park Race Track (USGS gage 01479000), 35ft downstream	f	72	166.7	5	83	7.81	0
105171	DE 320-001	White Clay Creek	McKee Lane in Newark	f	41	127.7	5	44	7.84	0
106021	DE 120-002	Christina River	Rt. 141 Drawbridge, Newport (USGS tide gage 01480065)	f	45	176.3	5	45	6.32	0
106031	DE 120-003	Christina River	Smalley's Dam Spillway	f	45	85.2	1	46	6.72	1

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
106141	DE 120-004-01	Christina River	Rt. 72, Below Newark (USGS guage 01478000)	f	74	148.6	5	82	7.15	0
106191	DE 120-006	Christina River	Rt. 273, Above Newark	f	44	148.7	5	46	8.48	0
106281	DE 120-007-01	Christina River	Little Mill Creek at atlantic Avenue (USGS Gage 01480095)	f	42	159.9	5	45	8.26	0
106291	DE 120-001	Christina River	Conrail Bridge (USGS tide gage 01481602) Up river from Port	f	68	125.2	5	69	6.08	0
107011	DE 270-001-02	Red Lion Creek	Rt. 7	f	49	151.0	5	51	7.56	0
107031	DE 270-001-01	Red Lion Creek	Rt. 9 Bridge	f	45	164.5	5	51	5.06	4
108021	DE 090-001	Chesapeake & Delaware Canal	St. Georges Bridge	f	44	24.0	1	51	6.885	0
108111	DE 090-L01	Chesapeake & Delaware Canal	Lums Pond Boat Ramp	f	42	27.0	1	47	8.29	0
109041	DE 010-001-02	Appoquinimink River	Rt. 13 Bridge below Odessa	f	52	146.7	5	52	5.87	1
109071	DE 010-001-03	Appoquinimink River	Drawyer Creek, Rt 13	f	52	197.1	5	52	5.65	1
109131	DE 010-L01	Appoquinimink River	Noxontown Pond Overflow, Rd 38	f	43	20.1	1	52	7.1	0
109191	DE 010-L03	Appoquinimink River	Shallcross Lake Overflow, Dischrg Drawer Cr, Rd. 428	f	42	16.5	1	52	7.56	0
110011	DE 010-002-02	Appoquinimink River	Road 463 East of RR Tracks	f	75	104.2	5	78	7.13	2
110031	DE 030-001	Lower Blackbird	Rd 455, Blackbird Landing	f	51	245.5	5	52	5.31	0
110041	DE 030-001	Lower Blackbird	Rt. 9 Taylors Bridge	f	52	100.1	5	52	4.74	2
111011	DE 130-001	Dragon Run Creek	Rt. 9 Bridge	f	47	51.5	1	51	4.28	7
111031	DE 130-002	Dragon Run Creek	Rt. 13 Bridge (flow at Rd. 407), Dragon Creek	f	49	106.7	5	51	3.75	9
112021	DE 100-002	Chesapeake Drainage System	Sewell Branch at Rd. 95	f	43	59.9	1	45	4.88	4
114011	DE 020-001	Army Creek	Rt. 9 Below Llangollen Wells	f	45	71.3	1	49	5.55	2

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
114021	#N/A	Army Creek	Army Creek @ S. DuPont Hgwy. (Rt. 13)	f	18	260.2	5	20	5.73	0
114041	DE 020-003	Army Creek	Trib Army Crk. @ Rt. 13 near Airport Ind. Park	f	16	158.3	5	19	4.58	2
114051	DE 020-003	Army Creek	Army Creek @ Rt. 13 near Rt. 40	f	10	286.2	5	15	7.03	0
201011	DE 310-001	Smyrna River	Lake Como at US Route 13 Bridge	f	48	24.4	1	52	6.18	0
201021	DE 310-002	Smyrna River	Rd. 137 Bridge, Mill Creek	f	51	39.3	1	51	8.03	1
201041	DE 310-001	Smyrna River	Rt. 9 Fleming's Landing	m	52	137.2	5	52	4.86	4
201051	DE 310-003	Smyrna River	Rd. 485 Bridge at Smyrna Landing	f	50	269.7	5	52	5.44	1
201161	DE 310-003	Smyrna River	Rd. 38 Bridge, Providence Creek	f	50	65.0	1	52	7.72	0
202021	DE 160-L01	Leipsic River	Rt. 13 Bridge, Garrisons Lake	f	47	24.0	1	51	7.385	0
202031	DE 160-001	Leipsic River	DE Rt. 9 Bridge	m	51	100.9	5	52	3.7	13
202191	DE 160-002	Leipsic River	Upstream of Masseys Millpond at Rt. 15	f	51	94.7	1	52	7.33	0
204031	DE 190-001-01	Little River	Rt. 9 Bridge	m	51	376.2	5	52	4.13	3
204041	DE 190-001-02	Little River	Rt. 8 Bridge	f	50	66.1	1	52	3.28	14
205011	DE 290-001-01	Saint Jones River	St. Jones at Bowers Beach, mouth to Del.Bay.	m	59	65.2	5	65	6.45	0
205041	DE 290-001-01	Saint Jones River	3.5 miles from mouth at Barkers Landing	m	53	136.7	5	52	3.47	11
205091	DE 290-001-02	Saint Jones River	Rt. 10 Bridge near DAFB	f	53	138.1	5	52	3.71	9
205151	DE 290-003	Saint Jones River	Rd. 69 State College, Fork Branch	f	52	79.4	1	51	4.11	6
205181	DE 290-L01	Saint Jones River	Rt. 13 Alt. Moores Lake	f	52	37.3	1	51	8.14	0
205191	DE 290-L02	Saint Jones River	Silver Lake Spillway, Dover City Park	f	79	47.2	1	78	7.09	0
205211	DE 290-L03	Saint Jones River	Derby Pond at Rt. 13A	f	49	25.0	1	52	8.67	0

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
206011	DE 220-005	Murderkill River	US Rt. 13 Bridge below Felton	f	82	228.6	5	85	7.58	0
206041	DE 220-004	Murderkill River	Browns Branch at Rt. 14 Bridge	f	47	202.3	5	49	7.4	0
206361	DE 220-L05	Murderkill River	McCauley Pond near spillway	f	46	22.8	1	49	9.43	0
206451	DE 220-L03	Murderkill River	Coursey Pond at Rd. 388 Bridge	f	47	25.6	1	49	8.83	0
206561	DE 220-002	Murderkill River	Double Run at Rd. 371	f	47	286.7	5	48	6.31	0
207021	DE 110-003	Choptank	Cow Marsh Creek at Rd. 208	f	43	67.6	1	44	5.99	0
207081	DE 110-001	Choptank	Tappahanna Ditch at Rd. 222	f	45	72.1	1	47	6.56	0
207091	DE 110-002	Choptank	Culbreth Marsh at Rd. 210	f	45	77.6	1	47	6.28	0
207111	DE 110-003	Choptank	White Marsh Branch at Rd. 268	f	46	140.7	5	47	6.055	0
208021	DE 210-001	Mispillion River	Rt. 1 Bridge	f	49	113.5	5	50	7.58	0
208061	DE 210-001	Mispillion River	1.09 miles from mouth at lighthouse	m	62	37.2	5	65	4.88	3
208121	DE 210-001	Mispillion River	7.48 miles from mouth, mouth of Fishing Branch	f	11	139.0	5	11	4.16	1
208181	DE 210-L06	Mispillion River	Abbotts Pond at Rd. 620	f	48	51.0	1	50	7.29	0
208211	DE 210-L02	Mispillion River	Rt. 36 Silver Lake	f	48	29.2	1	50	7.91	0
208231	DE 210-L05	Mispillion River	Beaverdam Branch, Rd. 384	f	46	319.7	5	50	7.32	1
301021	DE 080-001	Cedar Creek	Rd. 212, Swiggetts Pond	f	39	10.6	1	50	8.36	0
301031	DE 080-001	Cedar Creek	Rt. 1 Bridge	f	50	113.7	5	50	6.52	0
301091	DE 080-001	Cedar Creek	Rt. 36 Bridge	m	46	49.4	5	50	4.85	5
302031	DE 200-001	Marshyhope Creek	Rd. 308 Bridge	f	83	61.2	1	92	7.54	0
303011	DE 060-005	Broadkill River	Ingram Branch, Savanah Ditch at Rd. 246	f	46	251.4	5	49	5.44	0
303021	DE 060-005	Broadkill River	Ingram Branch at Rd. 248	f	46	497.9	5	49	6.87	0
303031	DE 060-003	Broadkill River	Rt. 5 Bridge	f	82	33.3	1	85	7.98	0

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
303041	DE 060-001	Broadkill River	Rt. 1 Bridge (Mainstem)	f	47	274.9	5	49	5.06	2
303051	DE 060-007-01	Broadkill River	Red Mill Pond at Rt. 1	f	47	24.9	1	49	9.7	0
303061	DE 060-001	Broadkill River	0.10 Miles From Mouth	m	62	47.4	5	70	4.84	3
303181	DE 060-002	Broadkill River	Beaverdam Creek above Rd. 259, Hunters Mill Pond	f	45	383.8	5	48	6.05	1
303311	DE 060-004	Broadkill River	Round Pole Branch at Rd. 88	f	49	172.2	5	49	6.15	0
303331	DE 060-L03	Broadkill River	Waples Pond at Rt. 1	f	47	21.3	1	49	8.2	0
303341	DE 060-006	Broadkill River	Pemberton Branch at Rt. 30 above Wagamons Pond	f	46	314.0	5	48	7.19	0
304151	DE 240-001	Nanticoke River	Buoy 66 (Conf DuPont Gut)	f	39	162.2	5	41	6.82	1
304191	DE 240-002	Nanticoke River	Rd. 545 Mainstem Nanticoke	f	88	69.0	1	92	6.77	0
304311	DE 240-L02	Nanticoke River	Concord Pond overflow	f	43	12.2	1	46	7.46	0
304321	DE 240-L04	Nanticoke River	Williams Pond, below the pond at Rd. 535	f	45	22.8	1	46	7.15	0
304371	DE 240-003	Nanticoke River	Clear Brook @ Cannon Rd. (Rt. 18)	f	38	460.1	5	42	5.3	2
304381	DE 240-003	Nanticoke River	Bucks Branch at Rd. 546	f	45	264.0	5	45	7.14	0
304471	DE 240-001	Nanticoke River	Rt. 13 Bridge	f	46	59.8	1	46	7.11	0
304591	DE 240-004	Nanticoke River	Deep Creek above Concord Pond, near Old Furnace at Rd. 46	f	6	81.0	1	6	sufficient da	5
304681	DE 240-002	Nanticoke River	Nanticoke River at Beach HWY (Ellendale Greenwood HWY) on east edge of Greenwood	f	46	44.3	1	46	6.43	1
304741	DE 240-004	Nanticoke River	Deep Creek @ Old Furnace Rd. (Rd. 46)	f	37	38.3	1	40	7.51	0
307011	DE 050-L04	Broad Creek	Records Pond at Rt. 13	f	46	35.7	1	46	8.25	0
307031	DE 050-001	Broad Creek	Broad Creek at Main Street in Bethel (Rd 493)	f	46	64.7	1	46	7.67	0

station	Segment	Watershed	Description	Salinity	ENT count	ENT geomean	ENT Status	DO count	DO LCL	DO # < 4.0
307081	DE050-L07	Broad Creek	Trap Pond on Hitch Pond Branch @ Co. Rd. 449 or Trap Pond Rd	f	40	31.2	1	43	8.7	0
307171	DE050-L03	Broad Creek	Horseys Pond 50 Yards Above Spillway 50% RB	f	44	27.0	1	46	8.59	0
307371	DE 050-006-03	Broad Creek	Raccoon Prong @ Pepperbox Rd. (Rd. 66)	f	34	93.3	1	36	4.14	4
308031	DE 280-L01	Rehoboth Bay	Burton Pond, Rd. 24	f	43	9.8	1	47	6.53	1
308071	DE 140-L01	Indian River	Millsboro Dam Overflow	f	75	23.5	1	82	7.77	1
308091	DE 140-003	Indian River	Pepper Creek at Rt. 26	f	48	185.1	5	47	7.68	1
308281	DE 140-006	Indian River	Cow Bridge Branch Rd. 48	f	41	19.6	1	45	6.3	0
308341	DE 140-005	Indian River	Swan Creek at Rd. 297	f	47	184.3	5	46	7.91	0
308361	DE 140-002	Indian River	Blackwater Creek at Rd. 54	f	45	153.0	5	48	4.91	5
308371	DE 280-002	Rehoboth Bay	Bundick's Branch at Rt. 23	f	43	169.9	5	48	5.855	0
309041	DE 150-001	Iron Branch	Whartons Branch at Rt. 334 Bridge	f	46	122.9	5	47	7.17	0
311041	DE 070-001	Buntings Branch	Buntings Branch at Rt. 54	f	42	244.9	5	47	7.1	0
313011	DE 250-001	Pocomoke River	Rd. 419 Bridge	f	43	115.0	5	46	7.15	0
316011	DE 240-005	Nanticoke River	Gravelly Branch at Rd. 525 Bridge	f	46	70.0	1	46	7.54	0
316031	DE 240-005	Nanticoke River	Gravelly Branch at Deer Forest Road (Rd 565) on west edge of Redden State Forest Jester Tract	f	42	31.0	1	46	5.9	0
Key										
ENT= Enterococcus,DO= Dissolved Oxygen,LCL= Lower Confidence Level,DIN= Dissolved Inorganic Nitrogen,DIP= Dissolved Inorganic Phosphorus,TP= Total Phoshphorus,TN= Total Nitrogen,TSS= Total Suspended Solids,CU= Copper										

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
109171	DE 010-001-02	Appoquinimink River	MOT Gut (Appo Gut) - West Bank	1	--	--	--	--	--	--
306091	DE 280-E01	Rehoboth Bay	Buoy 7, Rehoboth Bay	1	21	0.02	1	31	0.0318	5
306121	DE 140-E01	Indian River	Buoy 20, Indian River Bay	1	31	0.04	1	45	0.0327	5
206231	DE 220-001	Murderkill River	Confluence of Kent County STP trib.	5	--	--	--	--	--	--
305011	DE 170-001	Lewes and Rehoboth Canal	Canal Rt. 1	5	32	0.05	1	33	0.0464	5
306321	DE 140-E01	Indian River	Indian River Inlet	1	31	0.02	1	46	0.0346	5
306341	DE 140-004	Indian River	Island Creek, upper third	1	29	0.48	5	32	0.0256	5
312011	DE 140-001	Indian River	White Creek at the mouth of Assawoman Canal	1	26	0.03	1	33	0.0247	5
206091	DE 220-001	Murderkill River	US Rt. 113 at Frederica By-Pass	5	--	--	--	--	--	--
305041	DE 170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal at Rd. 18 Bridge	5	33	0.06	1	33	0.0423	5
306111	DE 280-E01	Rehoboth Bay	Massey's Ditch at Bouy 17	1	22	0.01	1	33	0.0321	5
310031	DE 180-003	Little Assawoman Bay	Dirrickson Creek, Rd. 381	1	24	0.48	5	33	0.0433	5
310071	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay, Mid-Bay	1	24	0.02	1	32	0.0234	5
109121	DE 010-001-01	Appoquinimink River	Rt. 9 Bridge (East)	1	--	--	--	--	--	--
306331	DE 140-E02	Indian River	Island Creek mouth	1	25	0.32	5	32	0.0265	5
310011	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay Ditch at Rd. 58 Bridge	1	21	0.02	1	33	0.0259	5
308051	DE 280-001-01	Rehoboth Bay	Guinea Creek at Rt. 298 Bridge	1	31	0.66	5	33	0.0208	5
306181	DE 140-004	Indian River	Buoy 49, Indian River	1	27	0.6	5	31	0.0223	5
206141	DE 220-001	Murderkill River	3.25 miles from the mouth	5	--	--	--	--	--	--
109091	DE 010-001-01	Appoquinimink River	Delaware River (Appoquinimink at Mouth)	1	--	--	--	--	--	--
206101	DE 220-001	Murderkill River	Bowers Beach Wharf	1	--	--	--	--	--	--

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
101021	DE 230-001-02	Naamans Creek	Naamans Road	1	--	--	--	--	--	--
101031	DE 230-001-02	Naamans Creek	South Branch at Darley Rd.	1	--	--	--	--	--	--
101061	DE 230-001-02	Naamans Creek	South Branch at Marsh Rd.	1	--	--	--	--	--	--
102041	DE 300-001-01	Shellpot Creek	Cherry Island at Rd. 501 Bridge	5	--	--	--	--	--	--
102051	DE 300-001-02	Shellpot Creek	Rt. 13 Bus (Market Street) Bridge	1	--	--	--	--	--	--
102081	DE 300-001-02	Shellpot Creek	Carr Road Bridge	1	--	--	--	--	--	--
103011	DE 260-001	Red Clay Creek	Stanton, Rt. 4 at Stanton Bridge (USGS gage 01480015)	1	--	--	--	--	--	--
103031	DE 260-001	Red Clay Creek	Wooddale, Rt. 48 (USGS gage 01480000)	1	--	--	--	--	--	--
103041	DE 260-001	Red Clay Creek	Ashland, Rd. 258a	1	--	--	--	--	--	--
103061	DE 260-002	Red Clay Creek	Burrough's Run at Creek Rd. (Rt. 82)	1	--	--	--	--	--	--
104011	DE 040-001	Brandywine Creek	Footbridge in Brandywine State Park	1	--	--	--	--	--	--
104021	DE 040-002	Brandywine Creek	Rd. 279 Bridge (USGS guage 014)	1	--	--	--	--	--	--
104051	DE 040-002	Brandywine Creek	Smith Bridge	1	--	--	--	--	--	--
105031	DE 320-001	White Clay Creek	Chambers Rock Rd. (Road 329) near Thompson	1	--	--	--	--	--	--
105151	DE 320-001	White Clay Creek	DE Park Race Track (USGS gage 01479000), 35ft downstream	1	--	--	--	--	--	--
105171	DE 320-001	White Clay Creek	McKee Lane in Newark	1	--	--	--	--	--	--
106021	DE 120-002	Christina River	Rt. 141 Drawbridge, Newport (USGS tide gage 01480065)	1	--	--	--	--	--	--
106031	DE 120-003	Christina River	Smalley's Dam Spillway	1	--	--	--	--	--	--

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
106141	DE 120-004-01	Christina River	Rt. 72, Below Newark (USGS guage 01478000)	1	--	--	--	--	--	--
106191	DE 120-006	Christina River	Rt. 273, Above Newark	1	--	--	--	--	--	--
106281	DE 120-007-01	Christina River	Little Mill Creek at atlantic Avenue (USGS Gage 01480095)	1	--	--	--	--	--	--
106291	DE 120-001	Christina River	Conrail Bridge (USGS tide gage 01481602) Up river from Port	1	--	--	--	--	--	--
107011	DE 270-001-02	Red Lion Creek	Rt. 7	1	--	--	--	--	--	--
107031	DE 270-001-01	Red Lion Creek	Rt. 9 Bridge	5	--	--	--	--	--	--
108021	DE 090-001	Chesapeake & Delaware Canal	St. Georges Bridge	1	--	--	--	--	--	--
108111	DE 090-L01	Chesapeake & Delaware Canal	Lums Pond Boat Ramp	1	--	--	--	--	--	--
109041	DE 010-001-02	Appoquinimink River	Rt. 13 Bridge below Odessa	1	--	--	--	--	--	--
109071	DE 010-001-03	Appoquinimink River	Drawyer Creek, Rt 13	1	--	--	--	--	--	--
109131	DE 010-L01	Appoquinimink River	Noxontown Pond Overflow, Rd 38	1	--	--	--	--	--	--
109191	DE 010-L03	Appoquinimink River	Shallcross Lake Overflow, Dischrg Drawer Cr, Rd. 428	1	--	--	--	--	--	--
110011	DE 010-002-02	Appoquinimink River	Road 463 East of RR Tracks	1	--	--	--	--	--	--
110031	DE 030-001	Lower Blackbird	Rd 455, Blackbird Landing	5	--	--	--	--	--	--
110041	DE 030-001	Lower Blackbird	Rt. 9 Taylors Bridge	5	--	--	--	--	--	--
111011	DE 130-001	Dragon Run Creek	Rt. 9 Bridge	5	--	--	--	--	--	--
111031	DE 130-002	Dragon Run Creek	Rt. 13 Bridge (flow at Rd. 407), Dragon Creek	5	--	--	--	--	--	--
112021	DE 100-002	Chesapeake Drainage System	Sewell Branch at Rd. 95	5	--	--	--	--	--	--
114011	DE 020-001	Army Creek	Rt. 9 Below Llangollen Wells	1	--	--	--	--	--	--

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
114021	#N/A	Army Creek	Army Creek @ S. DuPont Hgwy. (Rt. 13)	1	--	--	--	--	--	--
114041	DE 020-003	Army Creek	Trib Army Crk. @ Rt. 13 near Airport Ind. Park	5	--	--	--	--	--	--
114051	DE 020-003	Army Creek	Army Creek @ Rt. 13 near Rt. 40	1	--	--	--	--	--	--
201011	DE 310-001	Smyrna River	Lake Como at US Route 13 Bridge	1	--	--	--	--	--	--
201021	DE 310-002	Smyrna River	Rd. 137 Bridge, Mill Creek	1	--	--	--	--	--	--
201041	DE 310-001	Smyrna River	Rt. 9 Fleming's Landing	5	--	--	--	--	--	--
201051	DE 310-003	Smyrna River	Rd. 485 Bridge at Smyrna Landing	5	--	--	--	--	--	--
201161	DE 310-003	Smyrna River	Rd. 38 Bridge, Providence Creek	1	--	--	--	--	--	--
202021	DE 160-L01	Leipsic River	Rt. 13 Bridge, Garrisons Lake	1	--	--	--	--	--	--
202031	DE 160-001	Leipsic River	DE Rt. 9 Bridge	5	--	--	--	--	--	--
202191	DE 160-002	Leipsic River	Upstream of Masseys Millpond at Rt. 15	1	--	--	--	--	--	--
204031	DE 190-001-01	Little River	Rt. 9 Bridge	5	--	--	--	--	--	--
204041	DE 190-001-02	Little River	Rt. 8 Bridge	5	--	--	--	--	--	--
205011	DE 290-001-01	Saint Jones River	St. Jones at Bowers Beach, mouth to Del.Bay.	1	--	--	--	--	--	--
205041	DE 290-001-01	Saint Jones River	3.5 miles from mouth at Barkers Landing	5	--	--	--	--	--	--
205091	DE 290-001-02	Saint Jones River	Rt. 10 Bridge near DAFB	5	--	--	--	--	--	--
205151	DE 290-003	Saint Jones River	Rd. 69 State College, Fork Branch	5	--	--	--	--	--	--
205181	DE 290-L01	Saint Jones River	Rt. 13 Alt. Moores Lake	1	--	--	--	--	--	--
205191	DE 290-L02	Saint Jones River	Silver Lake Spillway, Dover City Park	1	--	--	--	--	--	--
205211	DE 290-L03	Saint Jones River	Derby Pond at Rt. 13A	1	--	--	--	--	--	--

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
206011	DE 220-005	Murderkill River	US Rt. 13 Bridge below Felton	1	--	--	--	--	--	--
206041	DE 220-004	Murderkill River	Browns Branch at Rt. 14 Bridge	1	--	--	--	--	--	--
206361	DE 220-L05	Murderkill River	McCauley Pond near spillway	1	--	--	--	--	--	--
206451	DE 220-L03	Murderkill River	Coursey Pond at Rd. 388 Bridge	1	--	--	--	--	--	--
206561	DE 220-002	Murderkill River	Double Run at Rd. 371	1	--	--	--	--	--	--
207021	DE 110-003	Choptank	Cow Marsh Creek at Rd. 208	1	--	--	--	--	--	--
207081	DE 110-001	Choptank	Tappahanna Ditch at Rd. 222	1	--	--	--	--	--	--
207091	DE 110-002	Choptank	Culbreth Marsh at Rd. 210	1	--	--	--	--	--	--
207111	DE 110-003	Choptank	White Marsh Branch at Rd. 268	1	--	--	--	--	--	--
208021	DE 210-001	Mispillion River	Rt. 1 Bridge	1	--	--	--	--	--	--
208061	DE 210-001	Mispillion River	1.09 miles from mouth at lighthouse	5	--	--	--	--	--	--
208121	DE 210-001	Mispillion River	7.48 miles from mouth, mouth of Fishing Branch	5	--	--	--	--	--	--
208181	DE 210-L06	Mispillion River	Abbotts Pond at Rd. 620	1	--	--	--	--	--	--
208211	DE 210-L02	Mispillion River	Rt. 36 Silver Lake	1	--	--	--	--	--	--
208231	DE 210-L05	Mispillion River	Beaverdam Branch, Rd. 384	1	--	--	--	--	--	--
301021	DE 080-001	Cedar Creek	Rd. 212, Swiggetts Pond	1	--	--	--	--	--	--
301031	DE 080-001	Cedar Creek	Rt. 1 Bridge	1	--	--	--	--	--	--
301091	DE 080-001	Cedar Creek	Rt. 36 Bridge	5	--	--	--	--	--	--
302031	DE 200-001	Marshyhope Creek	Rd. 308 Bridge	1	--	--	--	--	--	--
303011	DE 060-005	Broadkill River	Ingram Branch, Savanah Ditch at Rd. 246	5	--	--	--	--	--	--
303021	DE 060-005	Broadkill River	Ingram Branch at Rd. 248	1	--	--	--	--	--	--
303031	DE 060-003	Broadkill River	Rt. 5 Bridge	1	--	--	--	--	--	--

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
303041	DE 060-001	Broadkill River	Rt. 1 Bridge (Mainstem)	5	--	--	--	--	--	--
303051	DE 060-007-01	Broadkill River	Red Mill Pond at Rt. 1	1	--	--	--	--	--	--
303061	DE 060-001	Broadkill River	0.10 Miles From Mouth	5	--	--	--	--	--	--
303181	DE 060-002	Broadkill River	Beaverdam Creek above Rd. 259, Hunters Mill Pond	1	--	--	--	--	--	--
303311	DE 060-004	Broadkill River	Round Pole Branch at Rd. 88	1	--	--	--	--	--	--
303331	DE 060-L03	Broadkill River	Waples Pond at Rt. 1	1	--	--	--	--	--	--
303341	DE 060-006	Broadkill River	Pemberton Branch at Rt. 30 above Wagamons Pond	1	--	--	--	--	--	--
304151	DE 240-001	Nanticoke River	Buoy 66 (Conf DuPont Gut)	1	--	--	--	--	--	--
304191	DE 240-002	Nanticoke River	Rd. 545 Mainstem Nanticoke	1	--	--	--	--	--	--
304311	DE 240-L02	Nanticoke River	Concord Pond overflow	1	--	--	--	--	--	--
304321	DE 240-L04	Nanticoke River	Williams Pond, below the pond at Rd. 535	1	--	--	--	--	--	--
304371	DE 240-003	Nanticoke River	Clear Brook @ Cannon Rd. (Rt. 18)	5	--	--	--	--	--	--
304381	DE 240-003	Nanticoke River	Bucks Branch at Rd. 546	1	--	--	--	--	--	--
304471	DE 240-001	Nanticoke River	Rt. 13 Bridge	1	--	--	--	--	--	--
304591	DE 240-004	Nanticoke River	Deep Creek above Concord Pond, near Old Furnace at Rd. 46	1	--	--	--	--	--	--
304681	DE 240-002	Nanticoke River	Nanticoke River at Beach HWY (Ellendale Greenwood HWY) on east edge of Greenwood	1	--	--	--	--	--	--
304741	DE 240-004	Nanticoke River	Deep Creek @ Old Furnace Rd. (Rd. 46)	1	--	--	--	--	--	--
307011	DE 050-L04	Broad Creek	Records Pond at Rt. 13	1	--	--	--	--	--	--
307031	DE 050-001	Broad Creek	Broad Creek at Main Street in Bethel (Rd 493)	1	--	--	--	--	--	--

station	Segment	Watershed	Description	DO Status	DIN count	DIN LCL	DIN Status	DIP count	DIP LCL	DIP Status
307081	DE050-L07	Broad Creek	Trap Pond on Hitch Pond Branch @ Co. Rd. 449 or Trap Pond Rd	1	--	--	--	--	--	--
307171	DE050-L03	Broad Creek	Horseys Pond 50 Yards Above Spillway 50% RB	1	--	--	--	--	--	--
307371	DE 050-006-03	Broad Creek	Raccoon Prong @ Pepperbox Rd. (Rd. 66)	5	--	--	--	--	--	--
308031	DE 280-L01	Rehoboth Bay	Burton Pond, Rd. 24	1	--	--	--	--	--	--
308071	DE 140-L01	Indian River	Millsboro Dam Overflow	1	--	--	--	--	--	--
308091	DE 140-003	Indian River	Pepper Creek at Rt. 26	1	33	0.99	5	33	0.0242	5
308281	DE 140-006	Indian River	Cow Bridge Branch Rd. 48	1	32	0.77	5	32	0.0158	5
308341	DE 140-005	Indian River	Swan Creek at Rd. 297	1	32	1.94	5	31	0.009	1
308361	DE 140-002	Indian River	Blackwater Creek at Rd. 54	5	32	2.53	5	32	0.0174	5
308371	DE 280-002	Rehoboth Bay	Bundick's Branch at Rt. 23	1	32	2.16	5	32	0.03	5
309041	DE 150-001	Iron Branch	Whartons Branch at Rt. 334 Bridge	1	33	1.03	5	32	0.0205	5
311041	DE 070-001	Buntings Branch	Buntings Branch at Rt. 54	1	33	1.68	5	33	0.0255	5
313011	DE 250-001	Pocomoke River	Rd. 419 Bridge	1	--	--	--	--	--	--
316011	DE 240-005	Nanticoke River	Gravelly Branch at Rd. 525 Bridge	1	--	--	--	--	--	--
316031	DE 240-005	Nanticoke River	Gravelly Branch at Deer Forest Road (Rd 565) on west edge of Redden State Forest Jester Tract	1	--	--	--	--	--	--
Key										
ENT= Enterococcus,DO= Dissolved Oxygen,LCL= Lower Confidence Level,DIN= Dissolved Inorganic Nitrogen,DIP= Dissolved Inorganic Phosphorus,TP= Total Phoshphorus,TN= Total Nitrogen,TSS= Total Suspended Solids,CU= Copper										

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
109171	DE 010-001-02	Appoquinimink River	MOT Gut (Appo Gut) - West Bank	52	0.173	1	52	1.61	1
306091	DE 280-E01	Rehoboth Bay	Buoy 7, Rehoboth Bay	41	0.056	1	41	0.49	1
306121	DE 140-E01	Indian River	Buoy 20, Indian River Bay	57	0.069	1	57	0.56	1
206231	DE 220-001	Murderkill River	Confluence of Kent County STP trib.	39	0.213	5	39	2.33	1
305011	DE 170-001	Lewes and Rehoboth Canal	Canal Rt. 1	48	0.079	1	48	0.81	1
306321	DE 140-E01	Indian River	Indian River Inlet	67	0.056	1	67	0.38	1
306341	DE 140-004	Indian River	Island Creek, upper third	41	0.093	1	41	1.66	1
312011	DE 140-001	Indian River	White Creek at the mouth of Assawoman Canal	48	0.049	1	48	0.65	1
206091	DE 220-001	Murderkill River	US Rt. 113 at Frederica By-Pass	49	0.172	1	49	2.72	1
305041	DE 170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal at Rd. 18 Bridge	48	0.079	1	48	0.70	1
306111	DE 280-E01	Rehoboth Bay	Massey's Ditch at Bouy 17	48	0.053	1	48	0.40	1
310031	DE 180-003	Little Assawoman Bay	Dirrickson Creek, Rd. 381	48	0.160	1	48	2.15	1
310071	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay, Mid-Bay	48	0.047	1	48	0.78	1
109121	DE 010-001-01	Appoquinimink River	Rt. 9 Bridge (East)	52	0.147	1	52	1.64	1
306331	DE 140-E02	Indian River	Island Creek mouth	41	0.087	1	41	1.29	1
310011	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay Ditch at Rd. 58 Bridge	48	0.047	1	48	0.68	1
308051	DE 280-001-01	Rehoboth Bay	Guinea Creek at Rt. 298 Bridge	48	0.066	1	48	1.74	1
306181	DE 140-004	Indian River	Buoy 49, Indian River	41	0.103	1	41	1.79	1
206141	DE 220-001	Murderkill River	3.25 miles from the mouth	40	0.176	1	40	1.78	1
109091	DE 010-001-01	Appoquinimink River	Delaware River (Appoquinimink at Mouth)	58	0.175	1	58	1.71	1
206101	DE 220-001	Murderkill River	Bowers Beach Wharf	52	0.157	1	52	1.26	1

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
101021	DE 230-001-02	Naamans Creek	Naamans Road	46	0.031	1	46	1.55	1
101031	DE 230-001-02	Naamans Creek	South Branch at Darley Rd.	45	0.042	1	45	1.12	1
101061	DE 230-001-02	Naamans Creek	South Branch at Marsh Rd.	46	0.046	1	46	1.69	1
102041	DE 300-001-01	Shellpot Creek	Cherry Island at Rd. 501 Bridge	45	0.105	1	45	1.75	1
102051	DE 300-001-02	Shellpot Creek	Rt. 13 Bus (Market Street) Bridge	84	0.047	1	84	1.13	1
102081	DE 300-001-02	Shellpot Creek	Carr Road Bridge	46	0.033	1	46	1.07	1
103011	DE 260-001	Red Clay Creek	Stanton, Rt. 4 at Stanton Bridge (USGS gage 01480015)	45	0.060	1	45	2.90	1
103031	DE 260-001	Red Clay Creek	Wooddale, Rt. 48 (USGS gage 01480000)	84	0.088	1	84	3.31	5
103041	DE 260-001	Red Clay Creek	Ashland, Rd. 258a	46	0.077	1	46	3.78	5
103061	DE 260-002	Red Clay Creek	Burrough's Run at Creek Rd. (Rt. 82)	46	0.026	1	46	1.88	1
104011	DE 040-001	Brandywine Creek	Footbridge in Brandywine State Park	45	0.071	1	45	2.88	1
104021	DE 040-002	Brandywine Creek	Rd. 279 Bridge (USGS guage 014)	84	0.085	1	84	2.83	1
104051	DE 040-002	Brandywine Creek	Smith Bridge	46	0.068	1	46	2.86	1
105031	DE 320-001	White Clay Creek	Chambers Rock Rd. (Road 329) near Thompson	46	0.060	1	46	3.90	5
105151	DE 320-001	White Clay Creek	DE Park Race Track (USGS gage 01479000), 35ft downstream	84	0.070	1	84	3.13	5
105171	DE 320-001	White Clay Creek	McKee Lane in Newark	44	0.055	1	44	3.72	5
106021	DE 120-002	Christina River	Rt. 141 Drawbridge, Newport (USGS tide gage 01480065)	45	0.086	1	45	2.05	1
106031	DE 120-003	Christina River	Smalley's Dam Spillway	46	0.062	1	46	1.32	1

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
106141	DE 120-004-01	Christina River	Rt. 72, Below Newark (USGS guage 01478000)	83	0.055	1	83	1.63	1
106191	DE 120-006	Christina River	Rt. 273, Above Newark	46	0.028	1	46	2.30	1
106281	DE 120-007-01	Christina River	Little Mill Creek at atlantic Avenue (USGS Gage 01480095)	46	0.031	1	46	1.12	1
106291	DE 120-001	Christina River	Conrail Bridge (USGS tide gage 01481602) Up river from Port	69	0.095	1	69	2.27	1
107011	DE 270-001-02	Red Lion Creek	Rt. 7	51	0.033	1	51	0.85	1
107031	DE 270-001-01	Red Lion Creek	Rt. 9 Bridge	51	0.128	1	51	1.59	1
108021	DE 090-001	Chesapeake & Delaware Canal	St. Georges Bridge	51	0.143	1	51	1.77	1
108111	DE 090-L01	Chesapeake & Delaware Canal	Lums Pond Boat Ramp	47	0.055	1	47	1.26	1
109041	DE 010-001-02	Appoquinimink River	Rt. 13 Bridge below Odessa	52	0.177	1	52	1.72	1
109071	DE 010-001-03	Appoquinimink River	Drawyer Creek, Rt 13	52	0.190	1	52	1.93	1
109131	DE 010-L01	Appoquinimink River	Noxontown Pond Overflow, Rd 38	52	0.068	1	52	1.61	1
109191	DE 010-L03	Appoquinimink River	Shallcross Lake Overflow, Dischrg Drawer Cr, Rd. 428	52	0.053	1	52	1.99	1
110011	DE 010-002-02	Appoquinimink River	Road 463 East of RR Tracks	79	0.079	1	79	1.35	1
110031	DE 030-001	Lower Blackbird	Rd 455, Blackbird Landing	52	0.212	5	52	1.54	1
110041	DE 030-001	Lower Blackbird	Rt. 9 Taylors Bridge	52	0.182	1	52	1.36	1
111011	DE 130-001	Dragon Run Creek	Rt. 9 Bridge	51	0.117	1	51	0.90	1
111031	DE 130-002	Dragon Run Creek	Rt. 13 Bridge (flow at Rd. 407), Dragon Creek	51	0.057	1	51	1.40	1
112021	DE 100-002	Chesapeake Drainage System	Sewell Branch at Rd. 95	44	0.198	1	44	1.74	1
114011	DE 020-001	Army Creek	Rt. 9 Below Llangollen Wells	49	0.172	1	49	1.16	1

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
114021	#N/A	Army Creek	Army Creek @ S. DuPont Hgwy. (Rt. 13)	20	0.055	1	20	1.26	1
114041	DE 020-003	Army Creek	Trib Army Crk. @ Rt. 13 near Airport Ind. Park	19	0.051	1	19	0.86	1
114051	DE 020-003	Army Creek	Army Creek @ Rt. 13 near Rt. 40	15	0.014	1	15	1.17	1
201011	DE 310-001	Smyrna River	Lake Como at US Route 13 Bridge	52	0.108	1	52	1.39	1
201021	DE 310-002	Smyrna River	Rd. 137 Bridge, Mill Creek	51	0.115	1	51	1.60	1
201041	DE 310-001	Smyrna River	Rt. 9 Fleming's Landing	52	0.207	5	52	1.52	1
201051	DE 310-003	Smyrna River	Rd. 485 Bridge at Smyrna Landing	52	0.216	5	52	1.97	1
201161	DE 310-003	Smyrna River	Rd. 38 Bridge, Providence Creek	52	0.040	1	52	3.12	5
202021	DE 160-L01	Leipsic River	Rt. 13 Bridge, Garrisons Lake	51	0.168	1	51	1.73	1
202031	DE 160-001	Leipsic River	DE Rt. 9 Bridge	52	0.238	5	52	1.36	1
202191	DE 160-002	Leipsic River	Upstream of Masseys Millpond at Rt. 15	52	0.118	1	52	3.09	5
204031	DE 190-001-01	Little River	Rt. 9 Bridge	52	0.298	5	52	2.23	1
204041	DE 190-001-02	Little River	Rt. 8 Bridge	52	0.108	1	52	1.64	1
205011	DE 290-001-01	Saint Jones River	St. Jones at Bowers Beach, mouth to Del.Bay.	63	0.210	5	65	1.33	1
205041	DE 290-001-01	Saint Jones River	3.5 miles from mouth at Barkers Landing	53	0.202	5	53	1.57	1
205091	DE 290-001-02	Saint Jones River	Rt. 10 Bridge near DAFB	53	0.186	1	53	1.81	1
205151	DE 290-003	Saint Jones River	Rd. 69 State College, Fork Branch	53	0.154	1	53	1.16	1
205181	DE 290-L01	Saint Jones River	Rt. 13 Alt. Moores Lake	53	0.067	1	53	3.60	5
205191	DE 290-L02	Saint Jones River	Silver Lake Spillway, Dover City Park	79	0.130	1	80	1.36	1
205211	DE 290-L03	Saint Jones River	Derby Pond at Rt. 13A	53	0.061	1	53	2.58	1

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
206011	DE 220-005	Murderkill River	US Rt. 13 Bridge below Felton	84	-0.026	1	85	3.12	5
206041	DE 220-004	Murderkill River	Browns Branch at Rt. 14 Bridge	49	0.041	1	49	2.82	1
206361	DE 220-L05	Murderkill River	McCauley Pond near spillway	49	0.067	1	49	3.81	5
206451	DE 220-L03	Murderkill River	Coursey Pond at Rd. 388 Bridge	49	0.081	1	49	3.15	5
206561	DE 220-002	Murderkill River	Double Run at Rd. 371	48	0.105	1	48	2.81	1
207021	DE 110-003	Choptank	Cow Marsh Creek at Rd. 208	43	0.063	1	43	1.50	1
207081	DE 110-001	Choptank	Tappahanna Ditch at Rd. 222	46	0.090	1	46	1.14	1
207091	DE 110-002	Choptank	Culbreth Marsh at Rd. 210	46	0.078	1	46	2.51	1
207111	DE 110-003	Choptank	White Marsh Branch at Rd. 268	46	0.066	1	46	5.08	5
208021	DE 210-001	Mispillion River	Rt. 1 Bridge	50	0.082	1	50	3.40	5
208061	DE 210-001	Mispillion River	1.09 miles from mouth at lighthouse	64	0.170	1	65	1.22	1
208121	DE 210-001	Mispillion River	7.48 miles from mouth, mouth of Fishing Branch	11	0.146	1	11	1.96	1
208181	DE 210-L06	Mispillion River	Abbotts Pond at Rd. 620	50	0.036	1	50	3.23	5
208211	DE 210-L02	Mispillion River	Rt. 36 Silver Lake	50	0.039	1	49	3.03	5
208231	DE 210-L05	Mispillion River	Beaverdam Branch, Rd. 384	50	0.041	1	50	4.45	5
301021	DE 080-001	Cedar Creek	Rd. 212, Swiggetts Pond	50	0.022	1	50	2.92	1
301031	DE 080-001	Cedar Creek	Rt. 1 Bridge	50	0.105	1	50	2.96	1
301091	DE 080-001	Cedar Creek	Rt. 36 Bridge	50	0.161	1	50	1.23	1
302031	DE 200-001	Marshyhope Creek	Rd. 308 Bridge	91	0.098	1	91	3.25	5
303011	DE 060-005	Broadkill River	Ingram Branch, Savanah Ditch at Rd. 246	48	0.286	5	48	11.30	5
303021	DE 060-005	Broadkill River	Ingram Branch at Rd. 248	48	0.238	5	48	8.36	5
303031	DE 060-003	Broadkill River	Rt. 5 Bridge	83	0.045	1	84	3.02	5

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
303041	DE 060-001	Broadkill River	Rt. 1 Bridge (Mainstem)	48	0.138	1	48	2.76	1
303051	DE 060-007-01	Broadkill River	Red Mill Pond at Rt. 1	48	0.077	1	48	2.09	1
303061	DE 060-001	Broadkill River	0.10 Miles From Mouth	68	0.101	1	69	1.12	1
303181	DE 060-002	Broadkill River	Beaverdam Creek above Rd. 259, Hunters Mill Pond	46	0.063	1	47	5.05	5
303311	DE 060-004	Broadkill River	Round Pole Branch at Rd. 88	48	0.063	1	48	4.14	5
303331	DE 060-L03	Broadkill River	Waples Pond at Rt. 1	48	0.024	1	48	2.97	1
303341	DE 060-006	Broadkill River	Pemberton Branch at Rt. 30 above Wagamons Pond	47	0.023	1	47	4.47	5
304151	DE 240-001	Nanticoke River	Buoy 66 (Conf DuPont Gut)	40	0.089	1	40	3.15	5
304191	DE 240-002	Nanticoke River	Rd. 545 Mainstem Nanticoke	91	0.046	1	91	5.16	5
304311	DE 240-L02	Nanticoke River	Concord Pond overflow	45	0.030	1	45	2.19	1
304321	DE 240-L04	Nanticoke River	Williams Pond, below the pond at Rd. 535	45	0.064	1	45	3.21	5
304371	DE 240-003	Nanticoke River	Clear Brook @ Cannon Rd. (Rt. 18)	41	0.122	1	41	3.14	5
304381	DE 240-003	Nanticoke River	Bucks Branch at Rd. 546	44	0.048	1	44	9.67	5
304471	DE 240-001	Nanticoke River	Rt. 13 Bridge	45	0.057	1	45	3.15	5
304591	DE 240-004	Nanticoke River	Deep Creek above Concord Pond, near Old Furnace at Rd. 46	6	0.037	1	6	0.63	1
304681	DE 240-002	Nanticoke River	Nanticoke River at Beach HWY (Ellendale Greenwood HWY) on east edge of Greenwood	45	0.052	1	45	3.66	5
304741	DE 240-004	Nanticoke River	Deep Creek @ Old Furnace Rd. (Rd. 46)	39	0.028	1	39	1.89	1
307011	DE 050-L04	Broad Creek	Records Pond at Rt. 13	45	0.054	1	45	4.37	5
307031	DE 050-001	Broad Creek	Broad Creek at Main Street in Bethel (Rd 493)	45	0.077	1	45	4.79	5

station	Segment	Watershed	Description	TP Count	TP LCL	TP Support	TN Count	TN LCL	TN Support
307081	DE050-L07	Broad Creek	Trap Pond on Hitch Pond Branch @ Co. Rd. 449 or Trap Pond Rd	42	0.088	1	42	1.73	1
307171	DE050-L03	Broad Creek	Horseys Pond 50 Yards Above Spillway 50% RB	45	0.064	1	45	3.14	5
307371	DE 050-006-03	Broad Creek	Raccoon Prong @ Pepperbox Rd. (Rd. 66)	35	0.051	1	35	1.34	1
308031	DE 280-L01	Rehoboth Bay	Burton Pond, Rd. 24	47	0.018	1	47	1.20	1
308071	DE 140-L01	Indian River	Millsboro Dam Overflow	83	0.040	1	83	2.92	1
308091	DE 140-003	Indian River	Pepper Creek at Rt. 26	48	0.088	1	48	2.12	1
308281	DE 140-006	Indian River	Cow Bridge Branch Rd. 48	45	0.041	1	45	1.56	1
308341	DE 140-005	Indian River	Swan Creek at Rd. 297	47	0.013	1	47	2.19	1
308361	DE 140-002	Indian River	Blackwater Creek at Rd. 54	47	0.054	1	47	4.14	5
308371	DE 280-002	Rehoboth Bay	Bundick's Branch at Rt. 23	47	0.039	1	47	2.85	1
309041	DE 150-001	Iron Branch	Whartons Branch at Rt. 334 Bridge	48	0.053	1	48	2.69	1
311041	DE 070-001	Buntings Branch	Buntings Branch at Rt. 54	48	0.079	1	48	3.40	5
313011	DE 250-001	Pocomoke River	Rd. 419 Bridge	46	0.094	1	46	2.33	1
316011	DE 240-005	Nanticoke River	Gravelly Branch at Rd. 525 Bridge	45	0.020	1	45	2.21	1
316031	DE 240-005	Nanticoke River	Gravelly Branch at Deer Forest Road (Rd 565) on west edge of Redden State Forest Jester Tract	45	0.031	1	45	1.82	1
Key									
ENT= Enterococcus,DO= Dissolved Oxygen,LCL= Lower Confidence Level,DIN= Dissolved Inorganic Nitrogen,DIP= Dissolved Inorganic Phosphorus,TP= Total Phoshphorus,TN= Total Nitrogen,TSS= Total Suspended Solids,CU= Copper									

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
109171	DE 010-001-02	Appoquinimink River	MOT Gut (Appo Gut) - West Bank	52	--	1	21	--	1
306091	DE 280-E01	Rehoboth Bay	Buoy 7, Rehoboth Bay	--	--	1	--	--	
306121	DE 140-E01	Indian River	Buoy 20, Indian River Bay	--	--	1	--	--	
206231	DE 220-001	Murderkill River	Confluence of Kent County STP trib.	40	--	1	21	--	1
305011	DE 170-001	Lewes and Rehoboth Canal	Canal Rt. 1	--	--	1	--	--	
306321	DE 140-E01	Indian River	Indian River Inlet	--	--	1	--	--	
306341	DE 140-004	Indian River	Island Creek, upper third	--	--	1	--	--	
312011	DE 140-001	Indian River	White Creek at the mouth of Assawoman Canal	--	--	1	--	--	
206091	DE 220-001	Murderkill River	US Rt. 113 at Frederica By-Pass	49	--	1	28	--	1
305041	DE 170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal at Rd. 18 Bridge	--	--	1	--	--	
306111	DE 280-E01	Rehoboth Bay	Massey's Ditch at Bouy 17	--	--	1	--	--	
310031	DE 180-003	Little Assawoman Bay	Dirrickson Creek, Rd. 381	--	--	1	18	--	1
310071	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay, Mid-Bay	--	--	1	--	--	
109121	DE 010-001-01	Appoquinimink River	Rt. 9 Bridge (East)	51	--	1	13	--	1
306331	DE 140-E02	Indian River	Island Creek mouth	--	--	1	--	--	
310011	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay Ditch at Rd. 58 Bridge	--	--	1	1	--	1
308051	DE 280-001-01	Rehoboth Bay	Guinea Creek at Rt. 298 Bridge	--	--	1	8	--	1
306181	DE 140-004	Indian River	Buoy 49, Indian River	--	--	1	1	--	1
206141	DE 220-001	Murderkill River	3.25 miles from the mouth	--	--	1	8	--	1
109091	DE 010-001-01	Appoquinimink River	Delaware River (Appoquinimink at Mouth)	--	--	1	9	--	1
206101	DE 220-001	Murderkill River	Bowers Beach Wharf	--	--	1	--	--	

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
101021	DE 230-001-02	Naamans Creek	Naamans Road	39	--	1	--	--	
101031	DE 230-001-02	Naamans Creek	South Branch at Darley Rd.	41	--	1	--	--	
101061	DE 230-001-02	Naamans Creek	South Branch at Marsh Rd.	36	--	1	--	--	
102041	DE 300-001-01	Shellpot Creek	Cherry Island at Rd. 501 Bridge	45	1	1	--	--	
102051	DE 300-001-02	Shellpot Creek	Rt. 13 Bus (Market Street) Bridge	78	--	1	--	--	
102081	DE 300-001-02	Shellpot Creek	Carr Road Bridge	31	--	1	--	--	
103011	DE 260-001	Red Clay Creek	Stanton, Rt. 4 at Stanton Bridge (USGS gage 01480015)	40	--	1	36	--	1
103031	DE 260-001	Red Clay Creek	Wooddale, Rt. 48 (USGS gage 01480000)	73	--	1	77	--	1
103041	DE 260-001	Red Clay Creek	Ashland, Rd. 258a	41	--	1	43	--	1
103061	DE 260-002	Red Clay Creek	Burrough's Run at Creek Rd. (Rt. 82)	36	--	1	23	--	1
104011	DE 040-001	Brandywine Creek	Footbridge in Brandywine State Park	42	--	1	26	--	1
104021	DE 040-002	Brandywine Creek	Rd. 279 Bridge (USGS guage 014)	83	--	1	56	--	1
104051	DE 040-002	Brandywine Creek	Smith Bridge	44	--	1	27	--	1
105031	DE 320-001	White Clay Creek	Chambers Rock Rd. (Road 329) near Thompson	39	--	1	26	--	1
105151	DE 320-001	White Clay Creek	DE Park Race Track (USGS gage 01479000), 35ft downstream	73	--	1	67	--	1
105171	DE 320-001	White Clay Creek	McKee Lane in Newark	39	--	1	30	--	1
106021	DE 120-002	Christina River	Rt. 141 Drawbridge, Newport (USGS tide gage 01480065)	44	--	1	38	1	1
106031	DE 120-003	Christina River	Smalley's Dam Spillway	45	--	1	40	1	1

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
106141	DE 120-004-01	Christina River	Rt. 72, Below Newark (USGS guage 01478000)	78	--	1	72	--	1
106191	DE 120-006	Christina River	Rt. 273, Above Newark	34	--	1	31	--	1
106281	DE 120-007-01	Christina River	Little Mill Creek at atlantic Avenue (USGS Gage 01480095)	41	--	1	43	--	1
106291	DE 120-001	Christina River	Conrail Bridge (USGS tide gage 01481602) Up river from Port	69	--	1	53	--	1
107011	DE 270-001-02	Red Lion Creek	Rt. 7	51	--	1	--	--	
107031	DE 270-001-01	Red Lion Creek	Rt. 9 Bridge	51	--	1	--	--	
108021	DE 090-001	Chesapeake & Delaware Canal	St. Georges Bridge	51	--	1	--	--	
108111	DE 090-L01	Chesapeake & Delaware Canal	Lums Pond Boat Ramp	47	--	1	--	--	
109041	DE 010-001-02	Appoquinimink River	Rt. 13 Bridge below Odessa	52	--	1	19	--	1
109071	DE 010-001-03	Appoquinimink River	Drawyer Creek, Rt 13	52	--	1	22	--	1
109131	DE 010-L01	Appoquinimink River	Noxontown Pond Overflow, Rd 38	49	--	1	21	--	1
109191	DE 010-L03	Appoquinimink River	Shallcross Lake Overflow, Dischrg Drawer Cr, Rd. 428	50	--	1	34	--	1
110011	DE 010-002-02	Appoquinimink River	Road 463 East of RR Tracks	75	--	1	--	--	
110031	DE 030-001	Lower Blackbird	Rd 455, Blackbird Landing	52	--	1	--	--	
110041	DE 030-001	Lower Blackbird	Rt. 9 Taylors Bridge	52	--	1	--	--	
111011	DE 130-001	Dragon Run Creek	Rt. 9 Bridge	51	--	1	--	--	
111031	DE 130-002	Dragon Run Creek	Rt. 13 Bridge (flow at Rd. 407), Dragon Creek	49	--	1	--	--	
112021	DE 100-002	Chesapeake Drainage System	Sewell Branch at Rd. 95	45	--	1	--	--	
114011	DE 020-001	Army Creek	Rt. 9 Below Llangollen Wells	49	--	1	--	--	

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
114021	#N/A	Army Creek	Army Creek @ S. DuPont Hgwy. (Rt. 13)	20	--	1	--	--	
114041	DE 020-003	Army Creek	Trib Army Crk. @ Rt. 13 near Airport Ind. Park	19	--	1	--	--	
114051	DE 020-003	Army Creek	Army Creek @ Rt. 13 near Rt. 40	15	--	1	--	--	
201011	DE 310-001	Smyrna River	Lake Como at US Route 13 Bridge	51	--	1	--	--	
201021	DE 310-002	Smyrna River	Rd. 137 Bridge, Mill Creek	49	--	1	--	--	
201041	DE 310-001	Smyrna River	Rt. 9 Fleming's Landing	--	--	1	--	--	
201051	DE 310-003	Smyrna River	Rd. 485 Bridge at Smyrna Landing	52	--	1	--	--	
201161	DE 310-003	Smyrna River	Rd. 38 Bridge, Providence Creek	48	--	1	--	--	
202021	DE 160-L01	Leipsic River	Rt. 13 Bridge, Garrisons Lake	49	--	1	--	--	
202031	DE 160-001	Leipsic River	DE Rt. 9 Bridge	--	--	1	--	--	
202191	DE 160-002	Leipsic River	Upstream of Masseys Millpond at Rt. 15	49	--	1	--	--	
204031	DE 190-001-01	Little River	Rt. 9 Bridge	--	--	1	--	--	
204041	DE 190-001-02	Little River	Rt. 8 Bridge	52	--	1	--	--	
205011	DE 290-001-01	Saint Jones River	St. Jones at Bowers Beach, mouth to Del.Bay.	--	--	1	--	--	
205041	DE 290-001-01	Saint Jones River	3.5 miles from mouth at Barkers Landing	--	--	1	--	--	
205091	DE 290-001-02	Saint Jones River	Rt. 10 Bridge near DAFB	52	--	1	--	--	
205151	DE 290-003	Saint Jones River	Rd. 69 State College, Fork Branch	51	--	1	--	--	
205181	DE 290-L01	Saint Jones River	Rt. 13 Alt. Moores Lake	49	--	1	--	--	
205191	DE 290-L02	Saint Jones River	Silver Lake Spillway, Dover City Park	76	--	1	--	--	
205211	DE 290-L03	Saint Jones River	Derby Pond at Rt. 13A	41	--	1	--	--	

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
206011	DE 220-005	Murderkill River	US Rt. 13 Bridge below Felton	83	--	1	77	--	1
206041	DE 220-004	Murderkill River	Browns Branch at Rt. 14 Bridge	49	--	1	46	--	1
206361	DE 220-L05	Murderkill River	McCauley Pond near spillway	46	--	1	35	--	1
206451	DE 220-L03	Murderkill River	Coursey Pond at Rd. 388 Bridge	46	--	1	34	1	1
206561	DE 220-002	Murderkill River	Double Run at Rd. 371	47	--	1	35	--	1
207021	DE 110-003	Choptank	Cow Marsh Creek at Rd. 208	44	--	1	--	--	
207081	DE 110-001	Choptank	Tappahanna Ditch at Rd. 222	46	--	1	--	--	
207091	DE 110-002	Choptank	Culbreth Marsh at Rd. 210	46	--	1	--	--	
207111	DE 110-003	Choptank	White Marsh Branch at Rd. 268	46	--	1	--	--	
208021	DE 210-001	Mispillion River	Rt. 1 Bridge	49	--	1	--	--	
208061	DE 210-001	Mispillion River	1.09 miles from mouth at lighthouse	--	--	1	--	--	
208121	DE 210-001	Mispillion River	7.48 miles from mouth, mouth of Fishing Branch	11	--	1	--	--	
208181	DE 210-L06	Mispillion River	Abbotts Pond at Rd. 620	50	--	1	--	--	
208211	DE 210-L02	Mispillion River	Rt. 36 Silver Lake	50	--	1	--	--	
208231	DE 210-L05	Mispillion River	Beaverdam Branch, Rd. 384	45	--	1	--	--	
301021	DE 080-001	Cedar Creek	Rd. 212, Swiggetts Pond	49	--	1	--	--	
301031	DE 080-001	Cedar Creek	Rt. 1 Bridge	50	--	1	--	--	
301091	DE 080-001	Cedar Creek	Rt. 36 Bridge	--	--	1	--	--	
302031	DE 200-001	Marshyhope Creek	Rd. 308 Bridge	86	--	1	73	--	1
303011	DE 060-005	Broadkill River	Ingram Branch, Savanah Ditch at Rd. 246	49	3	5	--	--	
303021	DE 060-005	Broadkill River	Ingram Branch at Rd. 248	49	2	5	--	--	
303031	DE 060-003	Broadkill River	Rt. 5 Bridge	85	--	1	--	--	

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
303041	DE 060-001	Broadkill River	Rt. 1 Bridge (Mainstem)	49	--	1	--	--	
303051	DE 060-007-01	Broadkill River	Red Mill Pond at Rt. 1	48	--	1	--	--	
303061	DE 060-001	Broadkill River	0.10 Miles From Mouth	--	--	1	--	--	
303181	DE 060-002	Broadkill River	Beaverdam Creek above Rd. 259, Hunters Mill Pond	48	--	1	--	--	
303311	DE 060-004	Broadkill River	Round Pole Branch at Rd. 88	49	--	1	--	--	
303331	DE 060-L03	Broadkill River	Waples Pond at Rt. 1	48	--	1	--	--	
303341	DE 060-006	Broadkill River	Pemberton Branch at Rt. 30 above Wagamons Pond	44	--	1	--	--	
304151	DE 240-001	Nanticoke River	Buoy 66 (Conf DuPont Gut)	39	--	1	36	--	1
304191	DE 240-002	Nanticoke River	Rd. 545 Mainstem Nanticoke	90	--	1	75	--	1
304311	DE 240-L02	Nanticoke River	Concord Pond overflow	45	--	1	41	--	1
304321	DE 240-L04	Nanticoke River	Williams Pond, below the pond at Rd. 535	42	--	1	38	--	1
304371	DE 240-003	Nanticoke River	Clear Brook @ Cannon Rd. (Rt. 18)	41	--	1	35	--	1
304381	DE 240-003	Nanticoke River	Bucks Branch at Rd. 546	44	--	1	38	--	1
304471	DE 240-001	Nanticoke River	Rt. 13 Bridge	43	--	1	39	--	1
304591	DE 240-004	Nanticoke River	Deep Creek above Concord Pond, near Old Furnace at Rd. 46	5	--	1	6	--	1
304681	DE 240-002	Nanticoke River	Nanticoke River at Beach HWY (Ellendale Greenwood HWY) on east edge of Greenwood	43	--	1	42	--	1
304741	DE 240-004	Nanticoke River	Deep Creek @ Old Furnace Rd. (Rd. 46)	40	--	1	37	4	5
307011	DE 050-L04	Broad Creek	Records Pond at Rt. 13	42	--	1	37	--	1
307031	DE 050-001	Broad Creek	Broad Creek at Main Street in Bethel (Rd 493)	45	--	1	38	--	1

station	Segment	Watershed	Description	Ammonia Tests	Ammonia > Criteria	Ammonia Status	Zinc Tests	Zinc > Criteria	Zinc Status
307081	DE050-L07	Broad Creek	Trap Pond on Hitch Pond Branch @ Co. Rd. 449 or Trap Pond Rd	38	--	1	34	--	1
307171	DE050-L03	Broad Creek	Horseys Pond 50 Yards Above Spillway 50% RB	43	--	1	35	--	1
307371	DE 050-006-03	Broad Creek	Raccoon Prong @ Pepperbox Rd. (Rd. 66)	36	--	1	29	--	1
308031	DE 280-L01	Rehoboth Bay	Burton Pond, Rd. 24	46	--	1	38	--	1
308071	DE 140-L01	Indian River	Millsboro Dam Overflow	81	--	1	64	--	1
308091	DE 140-003	Indian River	Pepper Creek at Rt. 26	47	--	1	46	--	1
308281	DE 140-006	Indian River	Cow Bridge Branch Rd. 48	44	--	1	37	--	1
308341	DE 140-005	Indian River	Swan Creek at Rd. 297	44	--	1	40	--	1
308361	DE 140-002	Indian River	Blackwater Creek at Rd. 54	48	--	1	41	--	1
308371	DE 280-002	Rehoboth Bay	Bundick's Branch at Rt. 23	45	--	1	41	--	1
309041	DE 150-001	Iron Branch	Whartons Branch at Rt. 334 Bridge	47	--	1	45	--	1
311041	DE 070-001	Buntings Branch	Buntings Branch at Rt. 54	47	--	1	46	--	1
313011	DE 250-001	Pocomoke River	Rd. 419 Bridge	46	--	1	--	--	
316011	DE 240-005	Nanticoke River	Gravelly Branch at Rd. 525 Bridge	45	--	1	40	--	1
316031	DE 240-005	Nanticoke River	Gravelly Branch at Deer Forest Road (Rd 565) on west edge of Redden State Forest Jester Tract	46	--	1	43	12	5
Key									
ENT= Enterococcus,DO= Dissolved Oxygen,LCL= Lower Confidence Level,DIN= Dissolved Inorganic Nitrogen,DIP= Dissolved Inorganic Phosphorus,TP= Total Phoshphorus,TN= Total Nitrogen,TSS= Total Suspended Solids,CU= Copper									

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
109171	DE 010-001-02	Appoquinimink River	MOT Gut (Appo Gut) - West Bank	--	--	--	2	1	1
306091	DE 280-E01	Rehoboth Bay	Buoy 7, Rehoboth Bay	32	15.9	1	7	2	5
306121	DE 140-E01	Indian River	Buoy 20, Indian River Bay	45	26.8	5	4	2	5
206231	DE 220-001	Murderkill River	Confluence of Kent County STP trib.	--	--	--	4	3	5
305011	DE 170-001	Lewes and Rehoboth Canal	Canal Rt. 1	--	--	--	8	3	5
306321	DE 140-E01	Indian River	Indian River Inlet	46	19.3	1	6	3	5
306341	DE 140-004	Indian River	Island Creek, upper third	32	21.7	5	10	3	5
312011	DE 140-001	Indian River	White Creek at the mouth of Assawoman Canal	--	--	--	8	3	5
206091	DE 220-001	Murderkill River	US Rt. 113 at Frederica By-Pass	--	--	--	5	4	5
305041	DE 170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal at Rd. 18 Bridge	--	--	--	10	4	5
306111	DE 280-E01	Rehoboth Bay	Massey's Ditch at Bouy 17	33	17.0	1	9	4	5
310031	DE 180-003	Little Assawoman Bay	Dirrickson Creek, Rd. 381	33	17.8	1	5	4	5
310071	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay, Mid-Bay	33	10.0	1	8	4	5
109121	DE 010-001-01	Appoquinimink River	Rt. 9 Bridge (East)	--	--	--	10	5	5
306331	DE 140-E02	Indian River	Island Creek mouth	32	26.0	5	8	5	5
310011	DE 180-E01	Little Assawoman Bay	Little Assawoman Bay Ditch at Rd. 58 Bridge	33	13.0	1	7	5	5
308051	DE 280-001-01	Rehoboth Bay	Guinea Creek at Rt. 298 Bridge	33	9.6	1	12	6	5
306181	DE 140-004	Indian River	Buoy 49, Indian River	32	35.4	5	12	8	5
206141	DE 220-001	Murderkill River	3.25 miles from the mouth	--	--	--	13	10	5
109091	DE 010-001-01	Appoquinimink River	Delaware River (Appoquinimink at Mouth)	--	--	--	20	11	5
206101	DE 220-001	Murderkill River	Bowers Beach Wharf	--	--	--	29	14	5

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
101021	DE 230-001-02	Naamans Creek	Naamans Road	--	--	--	--	--	
101031	DE 230-001-02	Naamans Creek	South Branch at Darley Rd.	--	--	--	--	--	
101061	DE 230-001-02	Naamans Creek	South Branch at Marsh Rd.	--	--	--	--	--	
102041	DE 300-001-01	Shellpot Creek	Cherry Island at Rd. 501 Bridge	--	--	--	--	--	
102051	DE 300-001-02	Shellpot Creek	Rt. 13 Bus (Market Street) Bridge	--	--	--	--	--	
102081	DE 300-001-02	Shellpot Creek	Carr Road Bridge	--	--	--	--	--	
103011	DE 260-001	Red Clay Creek	Stanton, Rt. 4 at Stanton Bridge (USGS gage 01480015)	--	--	--	--	--	
103031	DE 260-001	Red Clay Creek	Wooddale, Rt. 48 (USGS gage 01480000)	--	--	--	--	--	
103041	DE 260-001	Red Clay Creek	Ashland, Rd. 258a	--	--	--	--	--	
103061	DE 260-002	Red Clay Creek	Burrough's Run at Creek Rd. (Rt. 82)	--	--	--	--	--	
104011	DE 040-001	Brandywine Creek	Footbridge in Brandywine State Park	--	--	--	--	--	
104021	DE 040-002	Brandywine Creek	Rd. 279 Bridge (USGS guage 014)	--	--	--	--	--	
104051	DE 040-002	Brandywine Creek	Smith Bridge	--	--	--	--	--	
105031	DE 320-001	White Clay Creek	Chambers Rock Rd. (Road 329) near Thompson	--	--	--	--	--	
105151	DE 320-001	White Clay Creek	DE Park Race Track (USGS gage 01479000), 35ft downstream	--	--	--	--	--	
105171	DE 320-001	White Clay Creek	McKee Lane in Newark	--	--	--	--	--	
106021	DE 120-002	Christina River	Rt. 141 Drawbridge, Newport (USGS tide gage 01480065)	--	--	--	--	--	
106031	DE 120-003	Christina River	Smalley's Dam Spillway	--	--	--	--	--	

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
106141	DE 120-004-01	Christina River	Rt. 72, Below Newark (USGS guage 01478000)	--	--	--	--	--	
106191	DE 120-006	Christina River	Rt. 273, Above Newark	--	--	--	--	--	
106281	DE 120-007-01	Christina River	Little Mill Creek at atlantic Avenue (USGS Gage 01480095)	--	--	--	--	--	
106291	DE 120-001	Christina River	Conrail Bridge (USGS tide gage 01481602) Up river from Port	--	--	--	--	--	
107011	DE 270-001-02	Red Lion Creek	Rt. 7	--	--	--	--	--	
107031	DE 270-001-01	Red Lion Creek	Rt. 9 Bridge	--	--	--	--	--	
108021	DE 090-001	Chesapeake & Delaware Canal	St. Georges Bridge	--	--	--	--	--	
108111	DE 090-L01	Chesapeake & Delaware Canal	Lums Pond Boat Ramp	--	--	--	--	--	
109041	DE 010-001-02	Appoquinimink River	Rt. 13 Bridge below Odessa	--	--	--	1	--	
109071	DE 010-001-03	Appoquinimink River	Drawyer Creek, Rt 13	--	--	--	--	--	
109131	DE 010-L01	Appoquinimink River	Noxontown Pond Overflow, Rd 38	--	--	--	--	--	
109191	DE 010-L03	Appoquinimink River	Shallcross Lake Overflow, Dischrg Drawer Cr, Rd. 428	--	--	--	--	--	
110011	DE 010-002-02	Appoquinimink River	Road 463 East of RR Tracks	--	--	--	--	--	
110031	DE 030-001	Lower Blackbird	Rd 455, Blackbird Landing	--	--	--	--	--	
110041	DE 030-001	Lower Blackbird	Rt. 9 Taylors Bridge	--	--	--	--	--	
111011	DE 130-001	Dragon Run Creek	Rt. 9 Bridge	--	--	--	--	--	
111031	DE 130-002	Dragon Run Creek	Rt. 13 Bridge (flow at Rd. 407), Dragon Creek	--	--	--	--	--	
112021	DE 100-002	Chesapeake Drainage System	Sewell Branch at Rd. 95	--	--	--	--	--	
114011	DE 020-001	Army Creek	Rt. 9 Below Llangollen Wells	--	--	--	--	--	

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
114021	#N/A	Army Creek	Army Creek @ S. DuPont Hgwy. (Rt. 13)	--	--	--	--	--	
114041	DE 020-003	Army Creek	Trib Army Crk. @ Rt. 13 near Airport Ind. Park	--	--	--	--	--	
114051	DE 020-003	Army Creek	Army Creek @ Rt. 13 near Rt. 40	--	--	--	--	--	
201011	DE 310-001	Smyrna River	Lake Como at US Route 13 Bridge	--	--	--	--	--	
201021	DE 310-002	Smyrna River	Rd. 137 Bridge, Mill Creek	--	--	--	--	--	
201041	DE 310-001	Smyrna River	Rt. 9 Fleming's Landing	--	--	--	--	--	
201051	DE 310-003	Smyrna River	Rd. 485 Bridge at Smyrna Landing	--	--	--	--	--	
201161	DE 310-003	Smyrna River	Rd. 38 Bridge, Providence Creek	--	--	--	--	--	
202021	DE 160-L01	Leipsic River	Rt. 13 Bridge, Garrisons Lake	--	--	--	--	--	
202031	DE 160-001	Leipsic River	DE Rt. 9 Bridge	--	--	--	--	--	
202191	DE 160-002	Leipsic River	Upstream of Masseys Millpond at Rt. 15	--	--	--	--	--	
204031	DE 190-001-01	Little River	Rt. 9 Bridge	--	--	--	--	--	
204041	DE 190-001-02	Little River	Rt. 8 Bridge	--	--	--	--	--	
205011	DE 290-001-01	Saint Jones River	St. Jones at Bowers Beach, mouth to Del.Bay.	--	--	--	--	--	
205041	DE 290-001-01	Saint Jones River	3.5 miles from mouth at Barkers Landing	--	--	--	--	--	
205091	DE 290-001-02	Saint Jones River	Rt. 10 Bridge near DAFB	--	--	--	--	--	
205151	DE 290-003	Saint Jones River	Rd. 69 State College, Fork Branch	--	--	--	--	--	
205181	DE 290-L01	Saint Jones River	Rt. 13 Alt. Moores Lake	--	--	--	--	--	
205191	DE 290-L02	Saint Jones River	Silver Lake Spillway, Dover City Park	--	--	--	--	--	
205211	DE 290-L03	Saint Jones River	Derby Pond at Rt. 13A	--	--	--	--	--	

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
206011	DE 220-005	Murderkill River	US Rt. 13 Bridge below Felton	--	--	--	--	--	
206041	DE 220-004	Murderkill River	Browns Branch at Rt. 14 Bridge	--	--	--	--	--	
206361	DE 220-L05	Murderkill River	McCauley Pond near spillway	--	--	--	--	--	
206451	DE 220-L03	Murderkill River	Coursey Pond at Rd. 388 Bridge	--	--	--	--	--	
206561	DE 220-002	Murderkill River	Double Run at Rd. 371	--	--	--	--	--	
207021	DE 110-003	Choptank	Cow Marsh Creek at Rd. 208	--	--	--	--	--	
207081	DE 110-001	Choptank	Tappahanna Ditch at Rd. 222	--	--	--	--	--	
207091	DE 110-002	Choptank	Culbreth Marsh at Rd. 210	--	--	--	--	--	
207111	DE 110-003	Choptank	White Marsh Branch at Rd. 268	--	--	--	--	--	
208021	DE 210-001	Mispillion River	Rt. 1 Bridge	--	--	--	--	--	
208061	DE 210-001	Mispillion River	1.09 miles from mouth at lighthouse	--	--	--	--	--	
208121	DE 210-001	Mispillion River	7.48 miles from mouth, mouth of Fishing Branch	--	--	--	--	--	
208181	DE 210-L06	Mispillion River	Abbotts Pond at Rd. 620	--	--	--	--	--	
208211	DE 210-L02	Mispillion River	Rt. 36 Silver Lake	--	--	--	--	--	
208231	DE 210-L05	Mispillion River	Beaverdam Branch, Rd. 384	--	--	--	--	--	
301021	DE 080-001	Cedar Creek	Rd. 212, Swiggetts Pond	--	--	--	--	--	
301031	DE 080-001	Cedar Creek	Rt. 1 Bridge	--	--	--	--	--	
301091	DE 080-001	Cedar Creek	Rt. 36 Bridge	--	--	--	--	--	
302031	DE 200-001	Marshyhope Creek	Rd. 308 Bridge	--	--	--	--	--	
303011	DE 060-005	Broadkill River	Ingram Branch, Savanah Ditch at Rd. 246	--	--	--	--	--	
303021	DE 060-005	Broadkill River	Ingram Branch at Rd. 248	--	--	--	--	--	
303031	DE 060-003	Broadkill River	Rt. 5 Bridge	--	--	--	--	--	

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
303041	DE 060-001	Broadkill River	Rt. 1 Bridge (Mainstem)	--	--	--	--	--	
303051	DE 060-007-01	Broadkill River	Red Mill Pond at Rt. 1	--	--	--	--	--	
303061	DE 060-001	Broadkill River	0.10 Miles From Mouth	--	--	--	--	--	
303181	DE 060-002	Broadkill River	Beaverdam Creek above Rd. 259, Hunters Mill Pond	--	--	--	--	--	
303311	DE 060-004	Broadkill River	Round Pole Branch at Rd. 88	--	--	--	--	--	
303331	DE 060-L03	Broadkill River	Waples Pond at Rt. 1	--	--	--	--	--	
303341	DE 060-006	Broadkill River	Pemberton Branch at Rt. 30 above Wagamons Pond	--	--	--	--	--	
304151	DE 240-001	Nanticoke River	Buoy 66 (Conf DuPont Gut)	--	--	--	--	--	
304191	DE 240-002	Nanticoke River	Rd. 545 Mainstem Nanticoke	--	--	--	--	--	
304311	DE 240-L02	Nanticoke River	Concord Pond overflow	--	--	--	--	--	
304321	DE 240-L04	Nanticoke River	Williams Pond, below the pond at Rd. 535	--	--	--	--	--	
304371	DE 240-003	Nanticoke River	Clear Brook @ Cannon Rd. (Rt. 18)	--	--	--	--	--	
304381	DE 240-003	Nanticoke River	Bucks Branch at Rd. 546	--	--	--	--	--	
304471	DE 240-001	Nanticoke River	Rt. 13 Bridge	--	--	--	--	--	
304591	DE 240-004	Nanticoke River	Deep Creek above Concord Pond, near Old Furnace at Rd. 46	--	--	--	--	--	
304681	DE 240-002	Nanticoke River	Nanticoke River at Beach HWY (Ellendale Greenwood HWY) on east edge of Greenwood	--	--	--	--	--	
304741	DE 240-004	Nanticoke River	Deep Creek @ Old Furnace Rd. (Rd. 46)	--	--	--	--	--	
307011	DE 050-L04	Broad Creek	Records Pond at Rt. 13	--	--	--	--	--	
307031	DE 050-001	Broad Creek	Broad Creek at Main Street in Bethel (Rd 493)	--	--	--	--	--	

station	Segment	Watershed	Description	TSS Count	TSS LCL	TSS Status	Marine CU Count	Marine CU > Criteria	Marine CU Status
307081	DE050-L07	Broad Creek	Trap Pond on Hitch Pond Branch @ Co. Rd. 449 or Trap Pond Rd	--	--	--	--	--	
307171	DE050-L03	Broad Creek	Horseys Pond 50 Yards Above Spillway 50% RB	--	--	--	--	--	
307371	DE 050-006-03	Broad Creek	Raccoon Prong @ Pepperbox Rd. (Rd. 66)	--	--	--	--	--	
308031	DE 280-L01	Rehoboth Bay	Burton Pond, Rd. 24	26	2.6	1	--	--	
308071	DE 140-L01	Indian River	Millsboro Dam Overflow	58	4.7	1	--	--	
308091	DE 140-003	Indian River	Pepper Creek at Rt. 26	33	8.0	1	--	--	
308281	DE 140-006	Indian River	Cow Bridge Branch Rd. 48	31	3.8	1	--	--	
308341	DE 140-005	Indian River	Swan Creek at Rd. 297	27	1.0	1	--	--	
308361	DE 140-002	Indian River	Blackwater Creek at Rd. 54	32	5.5	1	--	--	
308371	DE 280-002	Rehoboth Bay	Bundick's Branch at Rt. 23	30	3.2	1	--	--	
309041	DE 150-001	Iron Branch	Whartons Branch at Rt. 334 Bridge	--	--	--	--	--	
311041	DE 070-001	Buntings Branch	Buntings Branch at Rt. 54	--	--	--	--	--	
313011	DE 250-001	Pocomoke River	Rd. 419 Bridge	--	--	--	--	--	
316011	DE 240-005	Nanticoke River	Gravelly Branch at Rd. 525 Bridge	--	--	--	--	--	
316031	DE 240-005	Nanticoke River	Gravelly Branch at Deer Forest Road (Rd 565) on west edge of Redden State Forest Jester Tract	--	--	--	--	--	
Key									
ENT= Enterococcus,DO= Dissolved Oxygen,LCL= Lower Confidence Level,DIN= Dissolved Inorganic Nitrogen,DIP= Dissolved Inorganic Phosphorus,TP= Total Phoshphorus,TN= Total Nitrogen,TSS= Total Suspended Solids,CU= Copper									

Appendix Two: Segment Roll Ups

Segment	Watershed	Description	Stations in Segment	ENT Status	DO Status	DIN Status	DIP Status	TP Status	TN Status	Ammonia Status	Zinc Status	TSS Status	Marine CU Status
DE 140-002	Indian River	Blackwater Creek	1	5	5	5	5	1	5	1	1	1	--
DE 140-003	Indian River	Pepper Creek, including tributaries	1	5	1	5	5	1	1	1	1	1	--
DE 140-005	Indian River	Swan Creek	1	5	1	5	1	1	1	1	1	1	--
DE 140-006	Indian River	Stockley Branch	1	1	1	5	5	1	1	1	1	1	--
DE 140-L01	Indian River	Millsboro Pond	1	1	1	5	5	1	1	1	1	1	--
DE 180-003	Little Assawoman Bay	Dirickson Creek	1	5	1	5	5	1	1	1	1	1	5
DE 180-E01	Little Assawoman Bay	Little Assawoman Bay	2	1	1	1	5	1	1	1	1	1	5
DE 280-001-01	Rehoboth Bay	Chapel Branch	1	5	1	5	5	1	1	1	1	1	5
DE 280-002	Rehoboth Bay	Love Creek, including tributaries	1	5	1	5	5	1	1	1	1	1	--
DE 280-E01	Rehoboth Bay	Rehoboth Bay	2	1	1	1	5	1	1	1	--	1	5
DE 280-L01	Rehoboth Bay	Burton Pond	1	1	1	5	5	1	1	1	1	1	--
DE 140-004	Indian River	Indian River	2	1	1	5	5	1	1	1	1	5	5
DE 140-E01	Indian River	Lower Indian River Bay	2	1	1	1	5	1	1	1	--	5	5
DE 140-E02	Indian River	Upper Indian River Bay	1	1	1	5	5	1	1	1	--	5	5
DE 010-001-01	Appoquinimink River	Lower Appoquinimink River	2	5	1	--	--	1	1	1	1	--	5
DE 010-001-02	Appoquinimink River	Upper Appoquinimink River	2	5	1	--	--	1	1	1	1	--	1
DE 010-001-03	Appoquinimink River	Drawyer Creek	1	5	1	--	--	1	1	1	1	--	--
DE 010-002-02	Appoquinimink River	Deep Creek to confluence with Silver Lake	1	5	1	--	--	1	1	1	--	--	--
DE 010-L01	Appoquinimink River	Noxontown Pond	1	1	1	--	--	1	1	1	1	--	--
DE 010-L03	Appoquinimink River	Shallcross Lake	1	1	1	--	--	1	1	1	1	--	--
DE 020-001	Army Creek	Lower Army Creek	1	1	1	--	--	1	1	1	--	--	--
DE 020-002	Army Creek	Upper Army Creek	1	5	1	--	--	1	1	1	--	--	--
DE 020-003	Army Creek	Tributary to Army Creek	2	5	5	--	--	1	1	1	--	--	--
DE 030-001	Lower Blackbird	Lower Blackbird	2	5	5	--	--	5	1	1	--	--	--
DE 040-001	Brandywine Creek	Lower Brandywine	1	1	1	--	--	1	1	1	1	--	--
DE 040-002	Brandywine Creek	Upper Brandywine	2	5	1	--	--	1	1	1	1	--	--
DE 050-001	Broad Creek	Lower Broad Creek	1	1	1	--	--	1	5	1	1	--	--
DE 050-006-03	Broad Creek	Raccoon Prong	1	1	5	--	--	1	1	1	1	--	--
DE 050-L03	Broad Creek	Horseys Pond	1	1	1	--	--	1	5	1	--	--	--
DE 050-L04	Broad Creek	Records Pond	1	1	1	--	--	1	5	1	1	--	--
DE 050-L07	Broad Creek	Trap Pond	1	1	1	--	--	1	1	1	--	--	--
DE 060-001	Broadkill River	Lower Broadkill	2	5	5	--	--	1	1	1	--	--	--
DE 060-002	Broadkill River	Beaverdam Creek	1	5	1	--	--	1	5	1	--	--	--
DE 060-003	Broadkill River	Upper Broadkill River	1	1	1	--	--	1	5	1	--	--	--
DE 060-004	Broadkill River	Round Pole Branch	1	5	1	--	--	1	5	1	--	--	--
DE 060-005	Broadkill River	Ingrams Branch	2	5	5	--	--	5	5	5	--	--	--
DE 060-006	Broadkill River	Pemberton Branch	1	5	1	--	--	1	5	1	--	--	--
DE 060-007-01	Broadkill River	Lower Red Mill Branch	1	1	1	--	--	1	1	1	--	--	--

Segment	Watershed	Description	Stations in Segment	ENT Status	DO Status	DIN Status	DIP Status	TP Status	TN Status	Ammonia Status	Zinc Status	TSS Status	Marine CU Status
DE 060-L03	Broadkill River	Waples Pond and Reynolds Pond	1	1	1	--	--	1	1	1	--	--	--
DE 070-001	Buntings Branch	Buntings Branch	1	5	1	5	5	1	5	1	1	--	--
DE 080-001	Cedar Creek	Lower Cedar Creek	3	5	5	--	--	1	1	1	--	--	--
DE 090-001	Chesapeake & Delaware Canal	C&D Canal	1	1	1	--	--	1	1	1	--	--	--
DE 090-L01	Chesapeake & Delaware Canal	Lums Pond	1	1	1	--	--	1	1	1	--	--	--
DE 100-002	Chesapeake Drainage System	Sewell Branch, including tributaries	1	1	5	--	--	1	1	1	--	--	--
DE 110-001	Choptank	Tappahanna Ditch	1	1	1	--	--	1	1	1	--	--	--
DE 110-002	Choptank	Culbreth Marsh Ditch	1	1	1	--	--	1	1	1	--	--	--
DE 110-003	Choptank	Cow Marsh Creek	2	5	1	--	--	1	5	1	--	--	--
DE 120-001	Christina River	Lower Christina River	1	5	1	--	--	1	1	1	1	--	--
DE 120-002	Christina River	Mid Christina River	1	5	1	--	--	1	1	1	1	--	--
DE 120-003	Christina River	Upper Christina River	1	1	1	--	--	1	1	1	1	--	--
DE 120-004-01	Christina River	Lower Christina Creek	1	5	1	--	--	1	1	1	1	--	--
DE 120-006	Christina River	Upper Christina Creek	1	5	1	--	--	1	1	1	1	--	--
DE 120-007-01	Christina River	Little Mill Creek and Willow Run	1	5	1	--	--	1	1	1	1	--	--
DE 130-001	Dragon Run Creek	Lower Dragon Run Creek	1	1	5	--	--	1	1	1	--	--	--
DE 130-002	Dragon Run Creek	Upper Dragon Run Creek	1	5	5	--	--	1	1	1	--	--	--
DE 140-001	Indian River	White Creek	1	1	1	1	5	1	1	1	--	--	5
DE 150-001	Iron Branch	Iron Branch	1	5	1	5	5	1	1	1	1	--	--
DE 160-001	Leipsic River	Lower Leipsic River	1	5	5	--	--	5	1	1	--	--	--
DE 160-002	Leipsic River	Upper Leipsic River	1	1	1	--	--	1	5	1	--	--	--
DE 160-L01	Leipsic River	Garrisons Lake	1	1	1	--	--	1	1	1	--	--	--
DE 170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	2	5	5	1	5	1	1	1	--	--	5
DE 190-001-01	Little River	Lower Little River	1	5	5	--	--	5	1	1	--	--	--
DE 190-001-02	Little River	Upper Little River	1	1	5	--	--	1	1	1	--	--	--
DE 200-001	Marshyhope Creek	Marshyhope Creek	1	1	1	--	--	1	5	1	1	--	--
DE 210-001	Mispillion River	Lower Mispillion	3	5	5	--	--	1	5	1	--	--	--
DE 210-L02	Mispillion River	Silver Lake	1	1	1	--	--	1	5	1	--	--	--
DE 210-L05	Mispillion River	Blairs Pond	1	5	1	--	--	1	5	1	--	--	--
DE 210-L06	Mispillion River	Abbotts Mill Pond	1	1	1	--	--	1	5	1	--	--	--
DE 220-001	Murderkill River	Lower Murderkill	4	5	5	--	--	5	1	1	1	--	5
DE 220-002	Murderkill River	Spring Creek	1	5	1	--	--	1	1	1	1	--	--
DE 220-004	Murderkill River	Browns Branch	1	5	1	--	--	1	1	1	1	--	--
DE 220-005	Murderkill River	Upper Murderkill River	1	5	1	--	--	1	5	1	1	--	--
DE 220-L03	Murderkill River	Coursey Pond	1	1	1	--	--	1	5	1	1	--	--
DE 220-L05	Murderkill River	McCauley Pond	1	1	1	--	--	1	5	1	1	--	--
DE 230-001-02	Naamans Creek	North Branch and South Branch	3	5	1	--	--	1	1	1	--	--	--
DE 240-001	Nanticoke River	Lower Nanticoke River	2	5	1	--	--	1	5	1	1	--	--

Segment	Watershed	Description	Stations in Segment	ENT Status	DO Status	DIN Status	DIP Status	TP Status	TN Status	Ammonia Status	Zinc Status	TSS Status	Marine CU Status
DE 240-002	Nanticoke River	Upper Nanticoke River	2	1	1	--	--	1	5	1	1	--	--
DE 240-003	Nanticoke River	Clear Brook Branch	2	5	5	--	--	1	5	1	1	--	--
DE 240-004	Nanticoke River	Deep Creek Branch	2	1	1	--	--	1	1	1	5	--	--
DE 240-005	Nanticoke River	Gravelly Branch	2	1	1	--	--	1	1	1	5	--	--
DE 240-L02	Nanticoke River	Concord Pond	1	1	1	--	--	1	1	1	1	--	--
DE 240-L04	Nanticoke River	Williams Pond	1	1	1	--	--	1	5	1	1	--	--
DE 250-001	Pocomoke River	Pocomoke River	1	5	1	--	--	1	1	1	--	--	--
DE 260-001	Red Clay Creek	Mainstem	3	5	1	--	--	1	5	1	1	--	--
DE 260-002	Red Clay Creek	Burroughs Run	1	5	1	--	--	1	1	1	1	--	--
DE 270-001-01	Red Lion Creek	Lower Red Lion	1	5	5	--	--	1	1	1	--	--	--
DE 270-001-02	Red Lion Creek	Upper Red Lion	1	5	1	--	--	1	1	1	--	--	--
DE 290-001-01	Saint Jones River	Lower Saint Jones	2	5	5	--	--	5	1	1	--	--	--
DE 290-001-02	Saint Jones River	Upper Saint Jones	1	5	5	--	--	1	1	1	--	--	--
DE 290-003	Saint Jones River	Fork Branch	1	1	5	--	--	1	1	1	--	--	--
DE 290-L01	Saint Jones River	Moores Lake	1	1	1	--	--	1	5	1	--	--	--
DE 290-L02	Saint Jones River	Silver Lake	1	1	1	--	--	1	1	1	--	--	--
DE 290-L03	Saint Jones River	Derby Pond	1	1	1	--	--	1	1	1	--	--	--
DE 300-001-01	Shellpot Creek	Lower Shellpot Creek	1	5	5	--	--	1	1	1	--	--	--
DE 300-001-02	Shellpot Creek	Upper Shellpot Creek	2	5	1	--	--	1	1	1	--	--	--
DE 310-001	Smyrna River	Lower Smyrna River	2	5	5	--	--	5	1	1	--	--	--
DE 310-002	Smyrna River	Mill Creek	1	1	1	--	--	1	1	1	--	--	--
DE 310-003	Smyrna River	Tributary of Smyrna River	2	5	5	--	--	5	5	1	--	--	--
DE 320-001	White Clay Creek	Mainstem	3	5	1	--	--	1	5	1	1	--	--

Appendix Three: An Evaluation of Clean Water Act Section 303(d) Listings of Delaware Waters Affected by Fish Consumption Advisories

An Evaluation of Clean Water Act Section 303(d) Listings of Delaware Waters Affected by Fish Consumption Advisories

Delaware DNREC

March 1, 2018

Introduction

The Delaware Department of Natural Resources and Environmental Control (DNREC) has monitored the concentration of chemical contaminants in fish collected from Delaware waters for several decades. The primary objective of this monitoring has and continues to be to identify areas where contaminant levels in the fish are elevated. Elevated concentrations in the fish leads to increased human health risk to recreational and subsistence anglers who consume their catch. When elevated health risks are identified, DNREC, in cooperation with the Delaware Department of Health and Social Service's Division of Public Health (DHSS/DPH), issues fish consumption advisories (FCAs) to warn the public. The idea is for the public to voluntarily reduce their consumption of the contaminated fish until which time the waterway can be cleaned up and the fish are safe to eat. Delaware's most recent FCAs (as of February 2018) are online at http://www.dnrec.delaware.gov/fw/Fisheries/Documents/2018-Delaware-Fish-Consumption-Advisory-Table.pdf.

Cleaning up contaminated waterways presents many technical, regulatory and financial challenges. For persistent, bioaccumulative and toxic (PBT) contaminants often responsible for fish consumption advisories, recovery can take decades, even after the contaminant has been banned or phased out of production and upland sources have been well controlled. Quite often, what is viewed as current contamination of fish is really associated with legacy contamination in aquatic sediments. A further complication arises for some fish species based on their migratory life cycle. These fish may accumulate a greater amount of contamination elsewhere and bring that body burden with them to local waters.

Under the Federal Clean Water Act (CWA), contamination from legacy contamination is treated no differently than contamination from an active, on-going source of pollution. Namely, if the water is not meeting its water quality standards, that water needs to be placed on the State's CWA Section 303(d) list of impaired waters. This in turn creates an expectation that a Total Maximum Daily Load (TMDL) or some other equivalent action or actions will be taken to address the impairment with the goal of restoring the waterbody.

DNREC considers issuance of a "no consumption" or "limited consumption" fish advisory as a violation of Section 4.5.9.2.3 and Section 4.1.1.3 of Delaware's Surface Water Quality Standards. Those two narrative provisions provide, respectively, that 1) waters of the State shall be maintained to prevent adverse toxic effects on human health resulting from ingestion of chemically contaminated aquatic organisms; and 2) waters of the State shall be free from pollutants that may endanger public health. Once an advisory is issued, the affected waterbody is placed on Delaware's Clean Water Act Section 303(d) List of Impaired Waters. Delaware's most recent 303(d) list (2016) includes 101 waterbody/contaminant pairs currently or previously impaired due to fish consumption advisories. Appendix 1 reproduces those listings. Important information can be extracted

from that Appendix to provide insight into Delaware's fish advisories and associated 303(d) listings.

Contaminants of Concern (COCs): PCBs are listed most frequently (n =30), followed by Dioxin and Furan TEQs (n = 19), Dieldrin (n = 19), Mercury (n = 9), DDT (n = 8), Chlordane (n = 7), and others with 3 or less appearances. Table 1 provides the number of listings by COC, breaking down the totals as Delisted or Active as of the 2016 303(d) list.

Table 1. Number of 303(d) Listings Associated with Fish Consumption Advisories

COC	Total (Active + Delisted)	Delisted	Active
PCBs	30	4	26
Dioxin and Furan TEQ	19	3	16
Dieldrin	19	3	16
Mercury	9	4	5
DDT	8	4	4
Chlordane	7	2	5
Arsenic	3	3	0
Heptachlor Epoxide	2	0	2
Toxaphene	2	2	0
Organochlorine Pesticides	1	1	0
Chlorinated Benzenes	1	1	0
TOTALS	**101**	**27**	**74**

Not only are PCBs the most frequent COC, they are also the primary "risk driver". Within the context of cumulative risk assessment, this means that PCBs contribute the greatest amount of risk compared to other contaminants in the fish. This is why DNREC has allocated considerable resources to address PCB problems statewide. Focusing on the biggest problem has the potential for the greatest risk reduction. Focusing on secondary COCs provides lesser benefits, especially when those ~~contaminates~~ contaminants are on a trajectory to drop below levels of concern in the near term.

Many secondary COCs have already dropped below levels of concern in Delaware. When this happens, the contaminant is removed as a COC contributing to the advisory. Further, during the next 303(d) listing cycle, that COC is delisted from the affected segment. These are shown in Appendix 1 as "Delisted" or equivalently as, "Not a contaminant of concern in fish consumption advisories for these waters." From the summary table above, note that there are 27 segment/contaminant pairs that have been delisted over the years since listing began in 1996. This represents approximately 27% of all historic listings for fish advisories.

PCB Listings: We continue our discussion of PCBs here as a special case of 303(d) listings in Delaware. From Table 1 above, note that there are a total of 26 active listings for PCBs. Note further from Appendix 1 that 24 of those listing are accompanied by a note that

references "EPA TMDL for PCBs in Delaware River Zone 5 [or 6] and tributaries." An additional segment (DRBC Zone 6) should have also included that note. The note reflects that a TMDL for PCBs has already been established which incorporates loading from the segment. Delaware is aggressively implementing that TMDL and will continue to do so. Implementation includes state-of-the science monitoring of PCBs in fish, sediment and water to track trends and identify areas of concern; identification, prioritization and cleanup of waste sites with PCBs; active participation in PCB Pollutant Minimization Plan (PMP) trackback studies for traditional NPDES discharges as well as MS4 storm water discharges; and deployment of innovative technologies to remediate contaminated sediments. A focus on PCBs also provides the additional benefit of incremental reduction of Dioxin and Furan TEQs, which are known contaminants in PCBs.

From the perspective of TMDL development and implementation, the 26 active listings for PCBs discussed above are already covered by joint regulatory actions by the EPA, DRBC and DNREC. No new TMDLs are necessary for those segments. Subtracting those 26 listings from the 74 active listings leaves 48 contaminant/COC pairs that need to be addressed. These cases are discussed next.

TMDLs for Contaminants Other Than PCBs: For contaminants other than PCBs, target dates for TMDLs fall into two timeframes. Contaminants listed prior to 2014 have TMDL target completion dates between 2022 and 2025, with most due in 2022. Contaminants listed in 2014 or later have TMDL target completion dates between 2022 and 2029, with most due in 2029.

The **first group (those with TMDLs due between 2022 and 2025)** have the following note presented in the 2016 303(d) List: "The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment." There are 26 such cases identified in the List. Two additional cases, dioxin and furan TEQs in Slaughter Creek and mercury in Zone 6 of the Delaware Estuary, should have also had this note in the 2016 303(d) List but did not. That brings a total of 28 cases that need to be evaluated as a follow-up to Delaware's 2016 303(d) List. These cases are of immediate attention and are the focus of this document. Those 28 cases appear in Appendix 2. Fourteen of the cases are for dioxin and furan TEQ; eight of the cases are for Dieldrin; four are for mercury; and one each are for Chlordane and DDT.

The **second group (those with TMDLs due between 2022 and 2029)** will be addressed in a future evaluation. There are 19 of those cases.

Note that there is a single case, DDT in the mainstem Red Clay Creek, which does not include a TMDL target date. Based on available data, the source or sources of DDT in the Delaware portion of the Red Clay Creek are located entirely upstream in Pennsylvania, out of Delaware's jurisdiction. Delaware has expressed its willingness to work with its

counterparts in Pennsylvania and the EPA in addressing this issue but no date for a TMDL or alternative has been set.

Objective

The objective of this analysis is to place the 28 cases discussed above into one of three categories: 1) proceed to a TMDL or equivalent; 2) monitor natural recovery (MNR) based on the circumstances of the case; or 3) delist the contaminant from the segment.

Methods

For each segment/COC pair, existing and readily available data on the contaminant concentration in fish tissue was compiled and placed into chronological order. Concentrations were plotted versus time to show temporal trends. In cases where decreasing (i.e. improving) trends were evident from the plot, the data were fit to a first order exponential model using Excel's SOLVER add-in. Specifically, the sum of square errors between observed and predicted concentrations were minimized by adjusting the first order exponential constant of the model. An exponential model was chosen based on both empirical observation and theoretical considerations which predict an exponential decline in environmental concentrations following abatement of external sources of contamination (Greene 2009).

Model predictions were plotted along with the observed values to show the visual fit of the model to the field data. The coefficient of determination (r^2) was also calculated to provide a quantitative measure of goodness-of-fit. Delaware's fish tissue contaminant screening values (DNREC and DHSS 2017) were also plotted on the graphs.

The rate constant determined by SOLVER was used to estimate the half-life associated with contaminant elimination from the fish. This is very useful because it provides a means of predicting the time required to reach some pre-defined concentration in the fish. In certain cases, concentrations may have already dropped below Delaware's screening value (SV). In other cases, the drop is well-defined but the most recent concentration is still above the SV. In still other cases, the drop may be slight or non-existent and the most recent concentrations may be well above Delaware's SV. Knowing which scenario applies to a particular situation informs management decisions by distinguishing between non-issues, issues that are sunsetting on their own in a reasonable time frame, and persistent problems that require intervention/mitigation through a TMDL or alternative.

Following the approach described above, each case was placed into one of three categories:

1. **TMDL or Equivalent Needed**. Proceed to a TMDL based on priorities and available resources.
2. **Monitored Natural Recovery (MNR)**. The concentrations in the fish are clearly dropping over time and are expected to fall below a level of concern within the next 5 to 10 years in response to existing regulatory programs and natural attenuation. These cases are on a trajectory to be delisted. Monitoring will be performed to confirm that delisting is justified. No TMDL or other specific action is anticipated.
3. **Delist**. Existing data demonstrates that the concentration in the fish has dropped below a level of concern. No TMDL or other specific action is necessary at the present time.

In arriving at recommendations, other relevant data and information were also considered for the individual cases. This included such things as existing and readily available data on the contaminant in the water column and sediment; the existence of known land-based sources with a release pathway to the segment; the regulatory history of the contaminant (e.g., banned versus still in use with active release); temporal trends of the contaminant in radiodated sediment cores; national and regional trends in atmospheric levels for contaminants derived from the atmosphere; maturity of regulatory programs responsible for remediating or otherwise controlling the release of contaminated soils; and any other information believed to be important. In reviewing multiple lines of evidence, the Department considers the quantity, quality, and vintage of the data, as well as the conditions under which the data were collected and the intended use of the data. The Department believes this approach is consistent with EPA's Policy of Independent Applicability (EPA, 2002).

Of particular relevance for legacy contaminants is whether there are any active upland source(s) that could be potentially controlled through existing regulatory programs or whether the problem in the fish is judged to be primarily associated with in-place contaminants in the aquatic sediments as a result of past release. For interstate waters, the Department also considers the extent to which sources originate upstream outside of Delaware's jurisdiction. Although the Department will list such segments as justified by the data, the Department will seek appropriate allocation of responsibility to address the problem through a TMDL or other means.

Results

Table 2 that follows presents the recommended action for each segment/contaminant pair. Fish tissue contaminant trend evaluations supporting the recommendations appear in Appendix 3 for each segment/contaminant pair. A summary of the trend evaluations, plus a discussion of other relevant data and information considered, appears below Table 2 for each segment/contaminant pair.

Table 2. Recommended Actions for Selected Segments/Contaminant Pairs Listed on Delaware's 2016 Clean Water Act Section List Based on Fish Consumption Advisories

Waterbody ID	Watershed Name	Segment	Pollutant	Recommendation
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	Chlordane	Delist
DE040-002	Brandywine Creek	Upper Brandywine	D and F TEQ	MNR
DE260-001	Red Clay Creek	Mainstem	D and F TEQ	TMDL
DE120-001	Christina River	Lower Christina River	Dieldrin	MNR
DE120-004-01	Christina River	Lower Christina Creek	Dieldrin	MNR
NA	Delaware River	DRBC Zone 5	D and F TEQ	TMDL
NA	Delaware River	DRBC Zone 5	Dieldrin	TMDL
DE020-001	Army Creek	Lower Army Creek	D and F TEQ	MNR
DE020-002	Army Creek	Upper Army Creek	D and F TEQ	Delist
DE270-001-01	Red Lion Creek	Lower Red Lion	D and F TEQ	MNR
DE090-001	Chesapeake & Delaware Canal	C&D Canal	D and F TEQ	MNR
DE090-001	Chesapeake & Delaware Canal	C&D Canal	Dieldrin	MNR
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	D and F TEQ	MNR
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Dieldrin	MNR
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	D and F TEQ	Delist
DE010-001-03	Appoquinimink River	Drawyer Creek	D and F TEQ	MNR
DE010-L02	Appoquinimink River	Silver Lake	Dieldrin	MNR
DE290-001-01	Saint Jones River	Lower Saint Jones	Dieldrin	MNR
DE290-001-01	Saint Jones River	Lower Saint Jones	D and F TEQ	MNR
DE290-001-02	Saint Jones River	Upper Saint Jones	Dieldrin	MNR
DE290-001-02	Saint Jones River	Upper Saint Jones	D and F TEQ	TMDL
DE290-002	Saint Jones River	Wyoming Mill Pond	DDT	MNR
DE290-L02	Saint Jones River	Silver Lake	D and F TEQ	TMDL
DE290-L02	Saint Jones River	Silver Lake	Mercury	Delist
DE080-003	Cedar Creek	Slaughter Creek	D and F TEQ	MNR
DE060-008	Broadkill River	Primehook Creek	Mercury	Delist
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Mercury	Delist
N/A	Delaware Bay	DRBC Zone 6	Mercury	MNR

Segment-by-Segment Summary of Relevant Data and Information Considered

1. **DE300-001-01, Lower Shellpot Creek, Chlordane:** Chlordane, an organochlorine insecticide first synthesized in 1948, was formerly used in the United States for termite-treatment, treatment of crops such as corn and citrus, and treatment of lawns and gardens. An estimated 30 million homes were treated

with chlordane for termite control until it was banned in 1988. Chlordane was banned 10 years earlier for food crops and outdoor uses. Chlordane is classified as a persistent, bioaccumulative and toxic (PBT) pollutant. Chlordane is a probable human carcinogen and is known to cause other adverse health effects. It is hydrophobic, sorbs strongly to soil, and can be released to surface water during erosion and runoff. It has a reported half-life of 10 to 20 years in the environment. In surface water, chlordane remains primarily associated with solid particles (bottom and suspended sediments), although it does partition into water and can accumulate in fish and other aquatic life. The presence of chlordane in fish from Shellpot Creek suggests heavy usage in the past, most likely in termite control and on lawns and gardens. A fish consumption advisory has been in place for Shellpot Creek since 2002 to reduce human exposure to contaminants in the locally caught and consumed fish.

Fish tissue monitoring conducted by DNREC in 1999, 2007 and 2015 shows that the concentration of chlordane in fish collected from the lower Shellpot Creek has dropped between 46% and 76%, depending on species considered (see Appendix 3). The improvement has been consistent over the period with an estimated half-life of elimination from the fish of 9.5 years. The concentration of chlordane in the two latest fish samples collected from the lower Shellpot Creek (collected in 2015) were both below Delaware's fish tissue screening value for chlordane.

There is limited data on the concentration of chlordane in the water column and sediments of the lower Shellpot Creek. Synoptic measurements made in the fall of 2015 confirmed the presence of chlordane in those media. Given the limited number of samples, the results provide no additional insight with regard to 303(d) listing.

Recommendation: It is recommended that chlordane be delisted as a contaminant of concern from Delaware's 303(d) List for the lower Shellpot Creek. Chlordane was listed based on elevated concentrations in fish tissue and those concentrations have steadily dropped to the point where the most recent concentrations are less than Delaware's fish tissue screening value. The larger context is that this chemical was removed from the commercial marketplace roughly 30 years ago. Although improvement has been slow in response to this action, it is clear that natural attenuation is occurring and that levels in the fish have recently attained acceptable concentrations.

Even though delisting is recommended for chlordane, the Department will continue to monitor contaminants in fish collected from the lower Shellpot Creek in the future. Although that monitoring is primarily driven by PCB concentrations in the fish, chlordane will also be tested. The Department will revisit its decision to delist chlordane from this segment at that time.

2. **DE040-002, Upper Brandywine Creek, Dioxin and Furan TEQ:** Dioxins and furans are a group of related organic chemicals that share a similar structure and biological activity. Their combined toxicity is often expressed as toxicity equivalents, or TEQs, for short. Dioxins and furans are inadvertently produced in certain chemical manufacturing processes and during combustion, including waste incineration, coal combustion and forest fires. Municipal waste incinerators, hospital waste incinerators, commercial, industrial and solid waste incinerators, and backyard burn barrels were once large sources of dioxins and furans to the atmosphere. Atmospheric deposition then delivered these compounds to the land and water, where they then became incorporated into soil, surface water, sediment, terrestrial animals, aquatic animals and humans. Dioxins and furans are considered persistent, bioaccumulative and toxic (PBTs).

   As a result of aggressive regulatory actions, the release of dioxins and furans to the air in the United States has been reduced by an estimated 90% or more since 1987. This presumably has resulted in less dioxin and furan loading to the land and water, nationally, regionally and locally.

   Locally, the improvement is clear based on declining levels of dioxin and furan TEQs in fish samples collected from the Upper Brandywine Creek segment DE040-002 (see Appendix 3). Over the period 1994 to 2015, gross reductions of between 63% and 67% have been observed depending on which species are considered. The drop since 1994 has been steady with an estimated half-life of elimination from the fish of 13.4 years. The concentration of dioxin and furan TEQs in two of the three most recent fish samples from the segment (collected in 2015) were below Delaware's fish tissue screening value. The third was slightly over the screening value. The average among the three samples, 0.36 parts per trillion (pptr), is only 0.01 pptr over the screening value.

   In addition to the fish data, the Department sponsored a study of contaminants in radiodated sediment cores collected in the Christina Basin in northern Delaware (Velinsky et.al. 2010). One of those cores, collected in December of 2007, was obtained from a deposition area in the segment of the Brandywine immediately downstream of segment DE040-002. That core was analyzed for dioxins and furans. Dioxin and furan TEQs peaked at a depth corresponding to 1978 and TEQs declined toward the surface, providing a consistent line of evidence with the fish tissue.

   With regard to water column data, the Department collected high volume water samples from two locations within segment DE040-002 in the fall of 2007. One station was just downstream of the Pennsylvania/Delaware border and the other was downstream near the I-95 bridge crossing. This same sampling was repeated in the fall of 2015. Results were similar across stations and across years. No spatial

or temporal trends were evident and concentrations were similar to the lab blanks. Given the lack of trends, concentrations at or less than blanks, and the limited number of samples, no additional insight is provided with regard to 303(d) listing based on the surface water data.

Recommendation: It is recommended that dioxin and furan TEQs in segment DE040-002 be monitored to track natural recovery (MNR). Given that concentrations in the fish are dropping in a predictable manner and that the most recent concentrations in the fish are essentially already at Delaware's fish tissue screening value, our expectation is that the next sampling will confirm a clear drop below the screening value.

3. **DE260-001, Red Clay Creek Mainstem, Dioxin and Furan TEQ:** The general discussion of dioxins and furans in the previous section applies to segment DE260-001 of the Red Clay Creek. What differs for the Red Clay is that dioxin and furan TEQs in the fish do not exhibit a clear monotonic decline over time (see Appendix 3). Although the oldest data (1995) captures the peak, concentrations between 2000, 2007 and 2015 show a modest (3.2X) increase. Although that increase is not excessive, the trend is not moving in the desired direction. Interestingly, the increase in the 2015 data is correlated with increasing lipid content of fish as a function of distance downstream of the Pennsylvania/Delaware stateline (see Appendix 3). Because dioxins and furans are lipophilic, increased lipid may explain the increase in TEQs as a function of distance for the 2015 dataset. That however does not explain the increase over time between 2000 and 2015, especially between 2007 and 2015. Although pure speculation, it is possible that major development upstream in the Pennsylvania portion of the Red Clay watershed contributed to the mobilization of dioxin and furan TEQs and downstream transport into the Delaware portion of the Red Clay watershed. This seems feasible as a former industrial site in Kennett Square, PA was being repurposed during this time period. Major demolition and earth moving was part of that work. Although stormwater and erosion controls were in place, those control are not expected to totally eliminate release to surface water.

   In addition to the fish data, the Department collected water column data from the mainstem Red Clay Creek in the fall of 2007 and again in the fall of 2015. Sampling stations included: the stateline, Wooddale, and Stanton. High volume samples were analyzed for dioxins and furans. Concentrations were similar across stations and across years. No spatial or temporal trends were evident and concentrations were similar to the lab blanks. Given the lack of trends, concentrations at or less than blanks, and the limited number of samples, no additional insight is provided with regard to 303(d) listing based on the surface water data.

   Recommendation: Based on the apparent increase in dioxin and furan TEQs in the fish from segment DE260-001 over the period 2000, 2007 and 2015, and that the

increase resulted in exceedances of Delaware's fish tissue screening values in 2007 and 2015, it is recommended that this segment be retained on Delaware's 303(d) List for TMDL development. As this appears to be related to interstate pollution, Delaware will need to engage the EPA and the Pennsylvania DEP in next steps. In the meantime, it is recommended that additional data be collected to see if concentrations in the Red Clay come back down following stabilization of the former industrial property mentioned above. If the concentrations do drop, there's a chance that a TMDL will not be necessary.

4. **DE120-001, Lower Christina River, Dieldrin:** Dieldrin is an organochlorine pesticide that was used extensively from the 1950s to 1970 as an insecticide on corn and cotton and in termite control. The EPA canceled its use in 1974 for all purposes except for controlling termites. The EPA banned all uses in 1987. Dieldrin is a persistent, bioaccumulative and toxic pollutant (PBT). It sorbs strongly to soil and sediments, accumulates in terrestrial and aquatic animals, and is a probable human carcinogen. It also affects the central nervous system. Dieldrin is related to Aldrin, another insecticide with a similar structure. Aldrin breaks down to Dieldrin in the body and in the environment. Dieldrin is also a stereo-isomer of Endrin.

   Residual Dieldrin exists in soils where it was used. Dieldrin likely reached the Lower Christina River based on its use for termite control within the larger Christina basin. Soil erosion and runoff would then act to deliver Dieldrin to surface water. Once in surface water, Dieldrin partitions into bottom sediments and accumulates in fish and other aquatic life.

   Available fish tissue data for Dieldrin in segment DE120-001 demonstrates that Dieldrin has dropped steadily and significantly between 2001 and 2015 (see Appendix 3). Overall reduction in the fish over the period is approximately 80% and the half-life for elimination from the fish is 9.1 years. The most recent (2015) catfish sample collected near Newport was less than Delaware's fish tissue screening value while the recent catfish sample collected near Walnut Street in south Wilmington was greater than the screening value.

   In addition to the fish tissue data, the Department collected high volume surface water samples from two locations within segment DE120-001 in the fall of 2007 and again in the fall of 2015. One station was in Newport and the other was at Walnut Street. Concentrations of Dieldrin were similar across stations and years. In light of the limited number of samples, no additional insight is provided with regard to 303(d) listing based on the surface water data.

   Recommendation: Given that concentrations in the fish are dropping steeply and that the average concentration among the two most recent (2015) samples is only

2.3 times above Delaware's fish tissue screening value, it is recommended that Dieldrin in segment DE120-001 be monitored to track natural recovery (MNR).

5. **DE120-004-01, Lower Christina Creek, Dieldrin:** The general discussion concerning Dieldrin in the previous section applies here to segment DE120-004-01. Note that segment DE120-004-01 discussed in this section refers to the Lower Christina *Creek*, while segment DE120-001 discussed in the previous section refers to the Lower Christina *River*. The *Creek* is non-tidal and lies upstream of the tidal *River*.

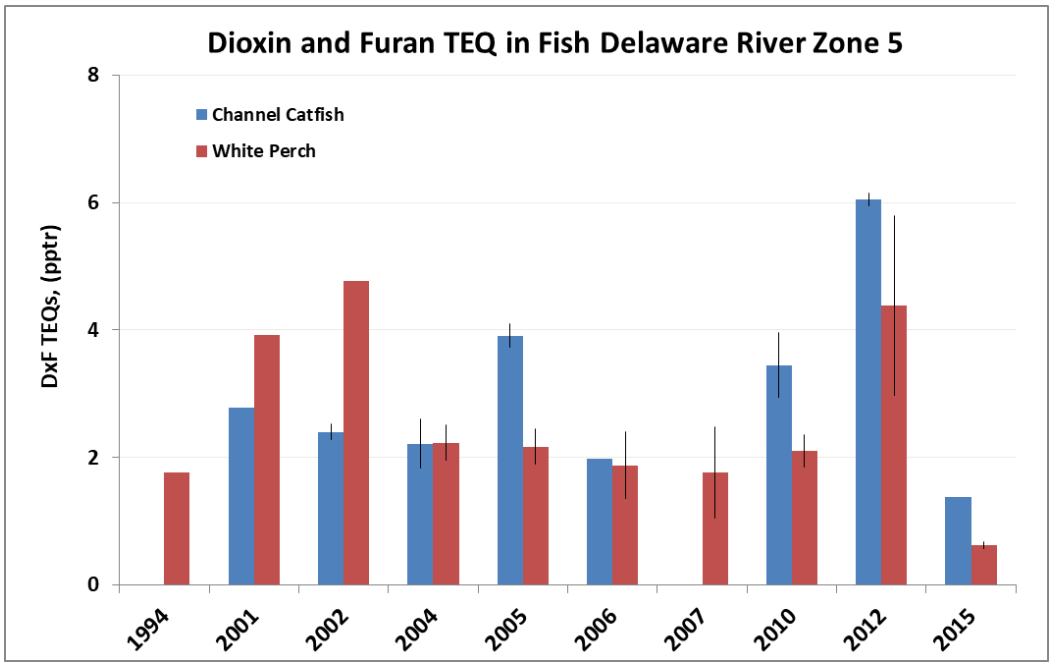
   Dieldrin concentrations in fish collected from the non-tidal Creek, like the tidal River, are improving steadily and significantly (see Appendix 3). There has been a 69% drop since 2000 and the estimated half-life for Dieldrin elimination from the fish is 7.9 years. Dieldrin in the most recent (2015) sample is still slightly (1.6 times) greater than Delaware's fish tissue screening value.

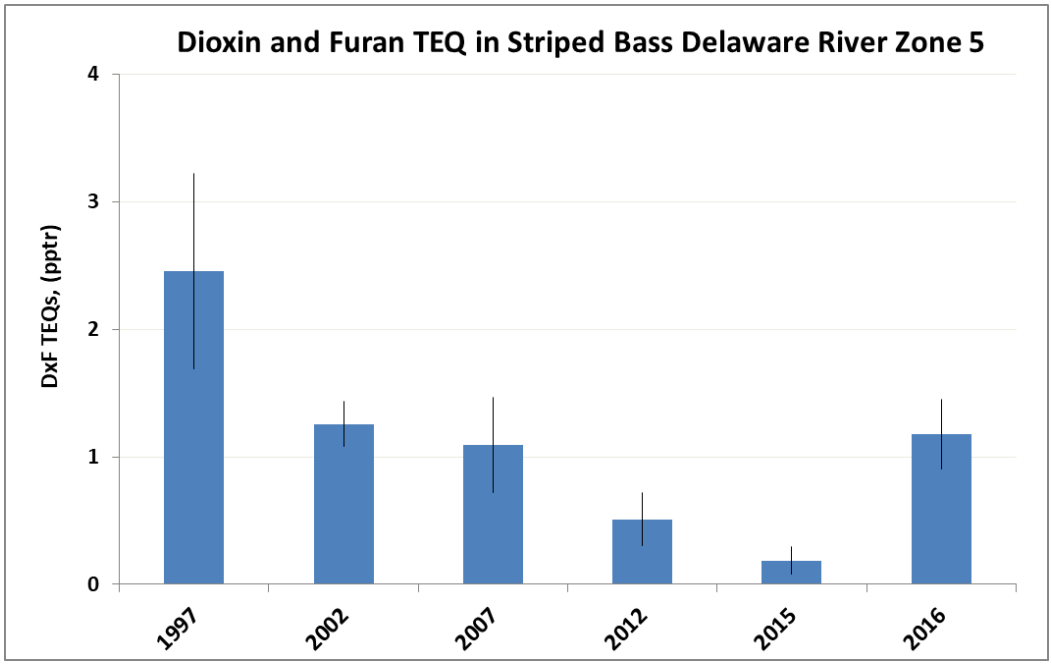
   With regard to surface water data for segment DE120-004-01, the Department collected a high volume sample at Route 72 in the fall of 2007 and again at this same station in the fall of 2015. Results were similar. Given the limited number of samples, these results provide no additional insight with regard to 303(d) listing.

   Recommendation: Given that concentrations in the fish are dropping steadily and predictably and that the most recent results are only marginally greater than Delaware's screening value, it is recommended that Dieldrin in segment DE120-004-01 be monitored to track natural recovery (MNR).

6. **Delaware River, DRBC Zone 5, Dioxin and Furan TEQ:** The general discussion of dioxins and furans presented previously applies here to Zone 5 of the Delaware River. Zone 5 is part of the tidal Delaware Estuary. It is downstream and adjacent to the Philadelphia-Camden-Wilmington urban industrial complex. A total of fifty-eight (58) dioxin and furan TEQ results for fish samples collected from Zone 5 were identified (see Appendix 3). Data cover the period 1994 through 2016 and consist of 14 channel catfish samples, 17 white perch samples, 25 striped bass samples, 1 American eel sample, and 1 weakfish sample. The vast majority of samples exceed Delaware's fish tissue screening value of 0.35 pptr.

   Long-term temporal trends are not apparent in channel catfish or white perch. There did appear to be a significant increase in dioxin and furan TEQ in 2012 for both species, followed by a steep decrease in 2015 (see plot below taken from Appendix 3). For striped bass, there was a steady improvement between 1997 and 2015, followed by an increase in 2016 (see plot below).





The fish tissue data presented above paints a mixed picture for dioxin and furan TEQ in Zone 5. While the 2015 data for channel catfish, white perch and striped bass all looked promising, the 2016 results for striped bass introduces uncertainty going forward. Given that channel catfish are true year-round residents in Zone 5 and that white perch are resident in Zone 5 for much of the year, greater weight should be given to those species compared to the striped bass for purposes of

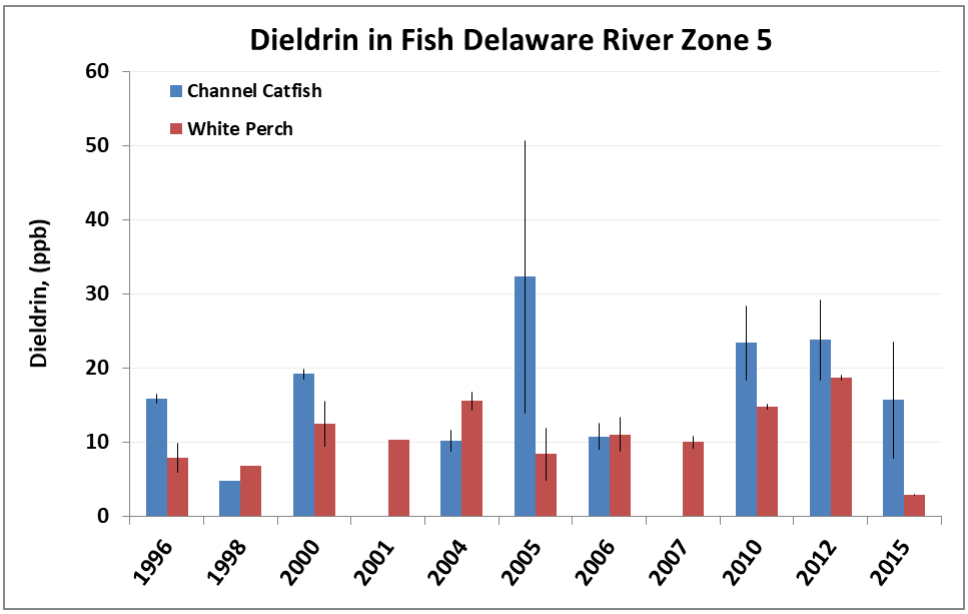
understanding environmental conditions within Zone 5 and deciding on a course of action.

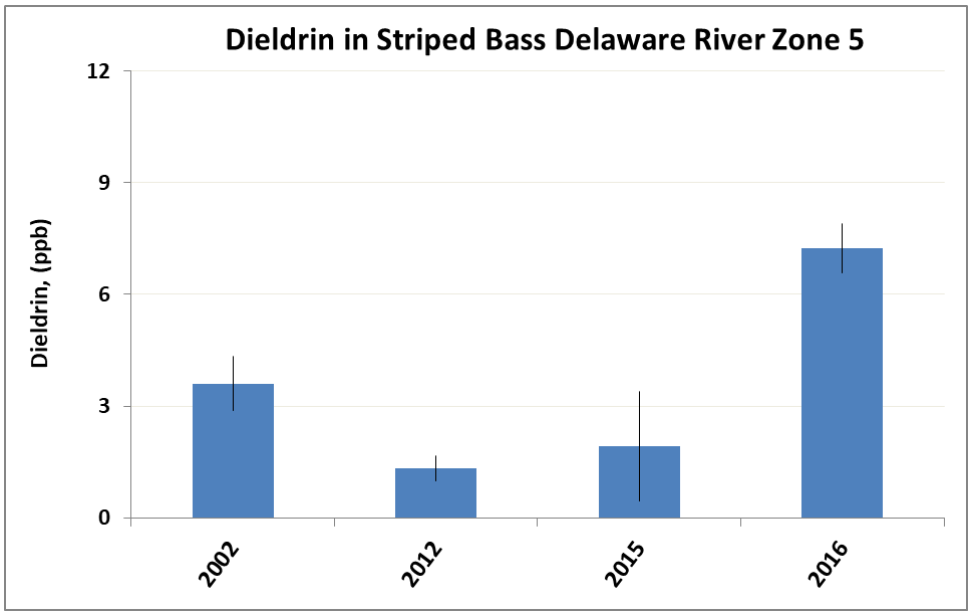
It is also important to understand that dioxin and furan TEQ concentrations in fish collected upstream of Zone 5 are similarly contaminated to those in Zone 5. Hence, this is not a problem limited to Zone 5.

Recommendation: Out of an abundance of caution, it is recommended that dioxin and furan TEQ in Zone 5 of the Delaware Estuary be retained on Delaware's 303(d) List for TMDL development or other equivalent action(s). As this appears to be a broader geographic issue, Delaware should coordinate efforts with the DRBC, EPA, NJDEP and PADEP, possibly through the DRBC's Toxics Advisory Committee. While coordination is underway, monitoring and additional file review should also be conducted to gather relevant information. New fish tissue data may in fact indicate that dioxin and furan TEQ concentrations are more in line with 2015 concentrations or even lower, in which case it may not be necessary to proceed to a TMDL or equivalent.

7. **Delaware River, DRBC Zone 5, Dieldrin:** The general discussion concerning Dieldrin presented previously applies here to Zone 5 of the Delaware River. Zone 5 is part of the tidal Delaware Estuary. It is downstream and adjacent to the Philadelphia-Camden-Wilmington urban industrial complex. A total of seventy-two (72) Dieldrin results for fish samples collected from Zone 5 were identified (see Appendix 3). Data cover the period 1998 through 2015 and consist of 18 channel catfish samples, 22 white perch samples, 26 striped bass samples, 3 weakfish samples, 1 American shad sample, and 1 blue crab sample. The vast majority of samples exceed Delaware's fish tissue screening value of 3 ppb, with resident species channel catfish showing the highest concentrations, followed by the semi-anadromous species white perch, and finally by the fully anadromous striped bass. It is a minor consolation that the Dieldrin concentrations in the two white perch samples collected in 2015 were both less than Delaware's screening value. Further, Dieldrin in the weakfish samples and the blue crab sample were less than Delaware's screening value, while the American shad sample, weighing in at nearly 50% lipid content, exceeded the screening value.

   Consistent temporal trends are not apparent in channel catfish, white perch or striped bass (see plots below taken from Appendix 3). Note the difference in the vertical scale of the two plots.





Although the data are not presented here, it is important to note that Zone 5 Dieldrin concentrations in channel catfish and white perch are not significantly better or worse than concentrations upstream in the Estuary, particularly Zones 3 and 4. The point here is that the geographic extent of the Dieldrin issue in the Delaware Estuary is far larger than Zone 5. This has important implications for management response.

Recommendation: It is recommended that Dieldrin in Zone 5 of the Delaware Estuary be retained on Delaware's 303(d) List for TMDL development or other equivalent action(s). As this appears to be a regional issue, Delaware should coordinate efforts with the DRBC, EPA, NJDEP and PADEP, possibly through the DRBC's Toxics Advisory Committee. While coordination is underway, monitoring and additional file review should also be conducted to gather relevant information. For instance, a review of historical fish tissue data for Cobbs Creek in Philadelphia indicates a Dieldrin concentration of 450 ppb in a whole body white sucker sample collected in 1986 and analyzed as part of EPA's National Bioaccumulation Study (EPA 1992).

8. **DE020-001, Lower Army Creek, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE020-001. The Department has collected a variety of fish species from Lower Army Creek beginning first in 1996 and ending most recently in 2014 (see Appendix 3). The lack of a consistent species at a consistent station hampers trend assessment. Averaging across stations and species however, it appears that dioxin and furan TEQs have dropped from 1.44 pptr in 1996; to 0.94 pptr in 2003; to 0.90 pptr in 2014. Depending on what species and locations are considered, percent reduction varies from 38% (all species and locations combined); to 57% (carp in Army Pond); to 84% (brown bullhead at Route 9). Of these stations, access for recreational anglers is best at Route 9 and is likely where the majority of such fishing occurs. It is noteworthy that the concentration of dioxin and furan TEQ in the brown bullhead sample collected from Route 9 in 2014 was actually less than Delaware's fish tissue screening value. It's equally important to note that the largemouth bass sample collected at Route 9 in 2014 was a single fish and that catching that fish at that location came as somewhat of a surprise to DNREC biologists. It was speculated that a recreational angler had caught the bass elsewhere and released it into Army Creek. There is not an expectation that a robust population of largemouth bass exists at this location. In contrast, brown bullhead catfish are known to be resident and abundant at this location. Dioxin and furan TEQs in this resident species at this location have apparently dropped, although the available data is clearly limited. Further, supplemental data on dioxin and furan TEQs in water and sediment samples is also limited and of little use in better characterizing conditions in Lower Army Creek.

   Recommendation: The recommendation for this segment is to collect additional data for brown bullhead catfish at the Route 9 station to confirm that dioxin and furan TEQ concentrations continue to decline (MNR).

9. **DE020-002, Upper Army Creek, Dioxin and Furan TEQ:** This is the headwater segment of the Army Creek watershed. The segment is very narrow and shallow. It has very limited public access. And it does not hold a population of sport fish

targeted by recreational anglers. No fish tissue or water column data exist for dioxin and furan TEQs for this segment. The segment was originally listed because the entire watershed was listed.

Recommendation: This segment should be delisted as there is no basis to keep it on Delaware's 303(d) List.

10. **DE270-001-01, Lower Red Lion, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE270-001-01. Fish tissue data for dioxin and furan TEQ are available for this segment for 1993, 2003 and 2013 (see Appendix 3). Trends are not uniformly falling over the full record and species tested are not consistent from sample to sample. There is however a clear improvement between 2003 and 2013, with a 61% reduction when averaging across species. The half-life of dioxin and furan TEQ elimination from the fish over this period is 7.4 years. Two of the three samples analyzed in 2013 had TEQ concentrations less than Delaware's fish tissue screening value. The average of the three samples collected in 2013 from this segment is basically equal to Delaware's screening value.

    With regard to surface water data for segment DE270-001-01, the Department collected high volume samples at Route 9 and the tide gate in the fall of 2013. Given the limited number of samples, these results provide no additional insight with regard to 303(d) listing.

    Recommendation: The recommendation for this segment is to continue to monitor dioxin and furan TEQ in fish to document ongoing improvement and natural recovery (MNR).

11. **DE090-001, Chesapeake and Delaware Canal, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE090-001. Fish tissue data for dioxin and furan TEQ are available for this segment for 1993, 1996 (Greene 1999), 2003 and 2013 (see Appendix 3). Trends are not uniformly falling over the full record since the mean for 2003 is nominally greater than the mean in 1996. Those means are not statistically different. With this in mind, it is clear that dioxin and furan TEQ concentrations in fish from this segment are falling over the long term with a 68% reduction between 1993 and 2013. The half-life of dioxin and furan TEQ elimination from the fish over this period is 16.8 years. Despite the clear improvement, all twenty-five samples analyzed historically have exceeded Delaware's fish tissue screening value.

    With regard to surface water data for segment DE090-001, the Department collected high volume samples from this segment in the fall of 2013. Given the

limited number of samples, these results provide no additional insight with regard to 303(d) listing.

Recommendation: The recommendation for this segment is to continue to monitor dioxin and furan TEQ in fish to document ongoing improvement and natural recovery (MNR).

12. **DE090-001, Chesapeake and Delaware Canal, Dieldrin:** The general discussion regarding Dieldrin presented previously applies to segment DE090-001. Fish tissue data for Dieldrin are available for this segment for 1993, 1996 (Greene 1996), 2003 and 2013 (see Appendix 3). Data collected in 1996 was primarily reported as not-detected and so summary statistics could not be confidently estimated from those results. Consequently, the 1996 data are not displayed in the means plot presented in Appendix 3. The 1996 data aside, there has been a clear and substantial drop in Dieldrin concentrations in fish from this segment over time. Between 1996 and 2013, there has been a 78% drop in Dieldrin concentration in the fish. The half-life of Dieldrin elimination from the fish over this period is 8.4 years.

    With regard to surface water data for segment DE090-001, the Department collected high volume samples from this segment in the fall of 2013. Given the limited number of samples, these results provide no additional insight with regard to 303(d) listing.

    Recommendation: The recommendation for this segment is to continue to monitor Dieldrin in fish to document ongoing improvement and natural recovery (MNR).

13. **DE010-001-01, Lower Appoquinimink River, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE010-001-01. The Department has monitored dioxin and furan TEQs in fish samples collected from segment DE010-001-01 for several years, including 1993, 1994, 2004, 2005 and 2014 (see Appendix 3). Concentrations have fallen over the period 1994 to 2014, although there was little change between 1994 and 2004. The degree of reduction ranges from 20% to 70% and depends on the species and period considered. Averaging across species and multiple stations within the segment, there has been a 41% reduction in dioxin and furan TEQs over the twenty year period between 1994 and 2014. Despite the reduction, the vast majority of samples (i.e. 21 of 23) have historically exceeded Delaware's fish tissue screening value. Even the most recent samples collected in 2014 exceed the screening value by a factor of 5, on average.

    It is important to note that this segment includes data for several locations and that there appears to be a spatial trend in addition to a temporal trend (see

Appendix 3). Specifically, channel catfish collected near the mouth of the Lower Appoquinimink River (near the confluence with the Delaware River) have higher dioxin and furan TEQ concentrations than channel catfish collected at Rt. 299 (Odessa), roughly seven miles upstream from the mouth. This was true for channel catfish samples collected at both stations in 1994 and again in 2014. Further, these trends were not related to differences in fish length. Both stations are tidal and there is no tide gate at the mouth of the Appoquinimink River to impede the movement of water (and contamination) upstream into the Appoquinimink River all the way upstream past Rt.299. The reduction in TEQ concentration in the upstream direction is likely the result of dilution of Delaware River water with less contaminated water moving down from the non-tidal headwaters of the Appoquinimink watershed. Support for this hypothesis is that fish collected from Noxontown Pond and Silver Lake (Middletown) in 2014 had extremely low dioxin and furan TEQ concentrations. These two ponds serve as the head of tide for the Appoquinimink mainstem. Low concentrations in the fish from these two ponds indicate that the freshwater entering the tidal Appoquinimink at the head of tide is clean relative to the water entering the tidal Appoquinimink from the Delaware River.

In light of the above, it appears that a primary, if not the primary source of dioxin and furan TEQ contamination in the Lower Appoquinimink River is tidal inflow from the Delaware River. This is in contrast to sources within the Appoquinimink watershed. The situation is further complicated by the fact that dioxins and furans associated with suspended matter that enter the Appoquinimink from the Delaware River can settle out and become incorporated into the extensive tidal wetlands connected to the Lower Appoquinimink. In this way, the wetlands can serve as both a short-term source and a long-term sink for dioxin and furan TEQ entering from the Delaware River.

Recommendation: The recommendation for this segment is to monitor the ongoing reduction of dioxin and furan TEQs in the fish (MNR). Although current TEQs in the fish remain somewhat higher than Delaware's fish tissue screening value, the circumstances do not appear to be well suited for a TMDL or equivalent approach. The rate of improvement in this segment will depend, in part, on improvements in the Delaware River, coupled with deep burial of in-place contamination on the marsh bench. This process is expected to be slow but sure.

14. **DE010-001-01, Lower Appoquinimink River, Dieldrin:** The general discussion regarding Dieldrin presented previously applies to segment DE010-001-02. Fish tissue data for Dieldrin are available for this segment for 1994, 2004, 2005 and 2014 (see Appendix 3). There has been a clear and substantial drop in Dieldrin concentrations in fish for this segment over time. Between 1994 and 2014, there has been a 69% drop in Dieldrin concentration in fish for data averaged over

species and stations. For channel catfish specifically, the drop has been 78% between 2004 and 2014. The half-life of Dieldrin elimination averaged over species and location for this segment is 9.4 years. Based on the most recent data (2014), the average Dieldrin concentration in the fish is only 2.3 times greater than Delaware's fish tissue screening value.

With regard to surface water data for segment DE010-001-01, the Department collected high volume samples from this segment in the fall of 2014. Given the limited number of samples, these results provide no additional insight with regard to 303(d) listing.

Recommendation: The recommendation for this segment is to continue to monitor Dieldrin in fish to document ongoing improvement and natural recovery (MNR).

15. **DE010-001-02, Upper Appoquinimink River, Dioxin and Furan TEQ:** The general discussion regarding Dieldrin presented previously applies to segment DE010-001-02. No fish tissue or water column data exist for Dieldrin for this segment. The segment was originally listed because the entire tidal Appoquinimink River was listed as part of the fish consumption advisory.

    Recommendation: This segment should be delisted as there is no basis to keep it on Delaware's 303(d) List. Please see the extensive discussion for this segment in Appendix 3.

16. **DE010-001-03, Drawyer Creek, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE010-001-03. Fish tissue data for dioxin and furan TEQ are available for this segment for 2004, 2005, and 2014 (see Appendix 3). Unfortunately, channel catfish samples collected in 1998 were not analyzed for dioxins and furans. For the available data, there is a clear drop between 2005 and 2014, with a 65% reduction across species and a 71% reduction specifically for channel catfish. The half-life of dioxin and furan TEQ elimination from the fish over this period is 6.0 years. The most recent sample (2014) is within a factor of 2.9 of Delaware's fish tissue screening value.

    With regard to surface water data for segment DE270-001-01, the Department collected high volume samples at Route 1/Route 13 in the fall of 2014. Given the limited number of samples, these results provide no additional insight with regard to 303(d) listing.

    Recommendation: The recommendation for this segment is to continue to monitor dioxin and furan TEQ in fish to document ongoing improvement and natural recovery (MNR). Addition justification for this recommendation can be found in Appendix 3.

17. **DE010-L02, Silver Lake (Appoquinimink watershed), Dieldrin:** The general discussion regarding Dieldrin presented previously applies to segment DE010-L02. Fish tissue data for Dieldrin are available for this segment for 1994, 2005, and 2014 (see Appendix 3).). There has been an 89% reduction over the full record and across species. Specifically for largemouth bass, there has been a 60% reduction in Dieldrin concentration between 2005 and 2014. The estimated half-life for Dieldrin elimination from the fish is 6.1 years. Dieldrin in the most recent (2014) sample is only 2.2 times greater than Delaware's fish tissue screening value.

    With regard to surface water data for segment DE010-L02, the Department collected a high volume sample from Silver Lake in the fall of 2014. Given the limited number of samples, the results provide no additional insight with regard to 303(d) listing.

    Recommendation: Given that concentrations in the fish are dropping steadily and predictably, it is recommended that Dieldrin in segment DE010-L02 be monitored to track natural recovery (MNR).

18. **DE290-001-01, Lower Saint Jones, Dieldrin:** The general discussion regarding Dieldrin presented previously applies to segment DE290-001-01. Fish tissue data for Dieldrin are available for this segment for 1990, 2005, and 2013 (see Appendix 3). There has been a steady and significant reduction of Dieldrin in fish from this segment. Averaged across species and stations, there has been a 79% reduction over the full record. The reduction has been a bit more modest (47%) when considering only resident white catfish. White perch, which are migratory, show no change between 2005 and 2013. The estimated half-life for Dieldrin elimination across species and stations is 10.3 years. The average Dieldrin concentration in the two most recent samples from this segment is only 1.5 times greater than Delaware's fish tissue screening value.

    With regard to surface water data, the Department collected high volume samples from segment DE290-001-01 in the fall of 2013. Given the limited number of samples, the results provide no additional insight with regard to 303(d) listing.

    Recommendation: Given that concentrations in the fish are dropping steadily and predictably and currently stand marginally above Delaware's screening value, it is recommended that Dieldrin in segment DE290-001-01 be monitored to track natural recovery (MNR).

19. **DE290-001-01, Lower Saint Jones, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE290-001-01. Fish tissue data for dioxin and furan TEQ are available for this segment for 1995, 1996, 2005 and 2013 (see Appendix 3). There has not been a

uniformly declining concentration of dioxin and furan TEQ in the fish from this segment over the full record. There has however been a significant drop in TEQs between 2005 and 2013. Averaging across species and stations for this time period, there has been an 80% drop in TEQs. Considering only white perch for this period, the drop has been a more modest 52%. The average of the two most recent (2013) white perch samples is only 1.3 times higher than Delaware's fish tissue screening value.

With regard to surface water data, the Department collected high volume samples from segment DE290-001-01 in the fall of 2013. Given the limited number of samples, the results provide no additional insight with regard to 303(d) listing.

Recommendation: Given that concentrations in the fish have dropped significantly between 2005 and 2013, and that the most recent concentrations are marginally greater than Delaware's screening value, it is recommended that dioxin and furan TEQ in segment DE290-001-01 be monitored to track ongoing natural recovery (MNR).

20. **DE290-001-02, Upper Saint Jones, Dieldrin:** The general discussion regarding Dieldrin presented previously applies to segment DE290-001-02. Fish tissue data for Dieldrin are available for this segment for 2005, 2013, and 2015 (see Appendix 3). There is also data from 1996 but those results were reported as non-detected at a minimum detection level of 9.2 ppb. Considering the data from 2005 forward, there has been a 45% reduction in Dieldrin concentration in the fish averaged across species and stations. The reduction for channel catfish over the period was 78%. The estimated half-life for Dieldrin elimination across species and stations is 11.7 years. The concentration of Dieldrin in the most recent sample (channel catfish collected in 2015) is 2.6 times greater than Delaware's fish tissue screening value.

    With regard to surface water data, the Department collected high volume samples from segment DE290-001-02 in the fall of 2013. Given the limited number of samples, the results provide no additional insight with regard to 303(d) listing.

    Recommendation: Given that concentrations in the fish are dropping steadily and predictably and currently stand marginally above Delaware's screening value, it is recommended that Dieldrin in segment DE290-001-02 be monitored to track natural recovery (MNR).

21. **DE290-001-02, Upper Saint Jones, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE290-001-02. Fish tissue data for dioxin and furan TEQ are available for this segment for 1995, 1996, 2005, 2013, and 2015 (see Appendix 3). Notwithstanding an

anomalously low value in a largemouth bass sample collected in 1996, there has been steady improvement over the available record. Averaging across species and stations, there has been a 51% decline in dioxin and furan TEQ over the 20 year period between 1995 and 2015. For channel catfish only, the drop over this same period was better at 70%. The concentration in the most recent (2015) sample was 3.9 times higher than Delaware's fish tissue screening value. The estimated half-life for elimination from the fish is 20.3 years (estimate censors anomalous result from 1996).

With regard to surface water data, the Department collected a high volume sample from segment DE290-001-02 in the fall of 2013. Given the limited number of samples, the result provide no additional insight with regard to 303(d) listing.

Recommendation: It is recommended that this segment be retained on Delaware's 303(d) List for TMDL development or equivalent actions. Although dioxin and furan TEQ concentrations have dropped significantly between 2005 and 2013, the most recent concentrations (2013) are still moderately above Delaware's fish tissue screening value. Furthermore, the estimated half-life for elimination from the fish is over 20 years, which is a slow trajectory. Finally, the segment upstream from this segment includes Silver Lake Dover, which is also being retained for dioxin and furan TMDL development or equivalent action. In the meantime, additional monitoring should be conducted in both of these segments to better understand conditions.

22. **DE290-002, Wyoming Mill Pond, DDT:** DDT is a chlorinated pesticide that was formerly used by farmers, public health programs, the military, and the public to kill insects and control the spread of insect-borne disease. Although discovered several decades before, major commercial production began in the 1940s and ran through the end of the 1970s. Global production peaked in 1963, while U.S. production peaked in 1959. EPA banned the manufacture of DDT in 1972, with an exception for emergency disease control. DDT and its breakdown products DDD and DDE are infamous for causing eggshell thinning and population declines in birds of prey. DDT is classified as a probable human carcinogen and is associated with several non-cancer effects in animals, including immunotoxicity and neurodevelopmental effects. DDT is super hydrophobic and breaks down slowly in the environment. Like Chlordane and Dieldrin, residual DDT in upland soils where it had been applied can be eroded off the land and delivered to area waterways where it becomes incorporated into bottom sediments and accumulates in fish and other aquatic life. DDT is considered a persistent, bioaccumulative and toxic (PBT) pollutant.

DDT and its breakdown products DDD and DDE (collectively DDX) in the fish from Wyoming Mill Pond are thought to have originated from DDT used in local fruit orchards (peaches mostly) surrounding the pond. It has been speculated that high concentrations of DDX buried in deep sediments in the pond were inadvertently mobilized and mixed with the pond during a dredging operation several decades ago. The surrounding land use and pesticide usage, coupled with the dredging event helps to explain the elevated baseline concentrations in the fish in 1993, the spike in fish tissue concentrations in 2005, and the ensuing recovery by 2013 (see Appendix 3). The peak DDX concentration detected in 2005 (1857 ppb) is the highest value ever recorded in Delaware. The most recent (2013) result is now only marginally above Delaware's fish tissue screening value for DDX. The estimated half-life for DDX elimination from the fish is a very short 2.8 years.

The Department collected a single high volume water sample from Wyoming Mill Pond in the fall of 2013. Given the limited number of samples, the result provides no additional insight with regard to 303(d) listing.

Recommendation: Given the dramatic decline of DDX in the fish between 2005 and 2013, coupled with the marginal exceedance of Delaware's screening value I the most recent sample, it is recommended that DDX in Wyoming Mill Pond be monitored to track natural recovery (MNR). It is further recommended that future dredging operations in the pond should be coordinated by the appropriate DNREC divisions.

23. **DE290-L02, Silver Lake (Saint Jones watershed), Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE290-L02 (Silver Lake, Dover). Fish tissue data for dioxin and furan TEQ are available for this segment for 1995, 2005, and 2013 (see Appendix 3). The average TEQ concentration in the fish increased between 1995 and 2005 and then remained more or less constant between 2005 and 2013. The 2013 data showed very large variation between two different catfish species collected at the same location. One species (channel catfish) had a TEQ concentration well above Delaware's fish tissue screening value while the second species (white catfish) had a TEQ concentration well below the screening value.

    With regard to surface water data, the Department collected a single high volume sample from Silver Lake Dover in the fall of 2013. Given the limited number of samples, the result provides no additional insight with regard to 303(d) listing.

    Recommendation: Given the large variability in the 2013 fish sample, it is recommended that a more detailed study of dioxin and furan TEQs in Silver Lake be conducted. This should include multiple fish species, bottom sediments and

the water column. Samples should also include inflow and outflow of the lake. Passive sampling should be considered and should include deployments in the water column and sediments at multiple depths. All of this information will prove useful if a TMDL is ultimately necessary, which it may. For now, this segment should be retained on Delaware's 303(d) List for TMDL development. The new information will help support a technically sound TMDL or equivalent, or will support NMR or delisting as appropriate.

24. **DE290-L02, Silver Lake (Saint Jones watershed), Mercury:** Mercury is a persistent, bioaccumulative and toxic (PBT) pollutant naturally present in the earth and redistributed and dispersed as a result of anthropogenic activities. Because of its unique properties, mercury has been used purposefully and effectively in a variety of industrial, commercial and medical applications. It is often associated with stack emissions from coal and petroleum-fired power plants, mining operations, and chlor-alkali production facilities. Mercury released to the atmosphere from coal combustion is thought to represent roughly half of total release. Once released to the air, mercury can return to the earth as part of atmospheric deposition. Mercury can be deposited directly to surface water and can be delivered as part of watershed runoff. Once in a waterway, mercury associates with bottom sediments where it then can undergo complex biogeochemical reactions that convert the mercury from a relatively benign form (inorganic mercury) to a soluble, bioaccumulative and potent neurotoxin (methylmercury). This conversion is mediated by bacteria and is enhanced in anaerobic environments, which often coincide with wetland-dominated areas.

    For the case of Silver Lake Dover, mercury in the fish is most likely associated with a power plant located directly adjacent to the lake that previously used coal as a fuel source for decades. The lake is eutrophic and bottom sediments are known to go anaerobic on a seasonal basis. Furthermore, the headwaters of the Saint Jones watershed, which drain down to the lake, have a high percentage of wooded wetlands. Both of these factors would act to enhance the conversion of inorganic mercury deposited in and upstream of the lake to methylmercury. Since the power plant no longer burns coal, new active release has been curtailed and concentrations in the fish in Silver Lake are expected to drop with time.

    Existing fish tissue mercury data for Silver Lake shows an increase from 1988 to 1995, then additional increase between 1995 and 2005, and finally a drop between 2005 and 2013. This sequence matches the chronology of coal combustion at the adjacent power plant. The two most recent samples (2013) are well below Delaware's fish tissue criterion of 300 ppb.

    Recommendation: Based on the above discussion, it is recommended that mercury be delisted from this segment.

25. **DE080-003, Slaughter Creek, Dioxin and Furan TEQ:** The general discussion regarding dioxins and furans presented previously applies to segment DE080-003. Fish tissue data for dioxin and furan TEQ are available for this segment for 2006 and 2016 (see Appendix 3). There are only three samples: resident carp in 2006; migratory white perch in 2016; and resident prey fish (mummichog) in 2016. All three samples were collected at the same location, Road 38, which is essentially the only easy public access from a road crossing where larger fish can get caught. A challenge in collecting a consistent fish species at the site has been a major shift in the ecology as a result of major breaches of dunes separating Slaughter Creek from Delaware Bay over the previous decade. These breaches have allowed saline water (and fish adapted to saline water) to move into Slaughter Creek. That confounder aside, the TEQ concentrations in the samples collected in 2016 are lower than the sample collected in 2006. TEQ in the white perch sample collected in 2016, which consisted of 5 large specimens, was only 2.1 times Delaware's fish tissue screening value. These are the kind of fish that a recreational anglers would likely target from this location.

    As an aside, the 2016 prey sample was collected because the location falls within the footprint of the Prime Hook National Wildlife Refuge and there was a desire to know contaminant levels in the forage base for piscivorous birds such as ospreys, eagles and great blue herons. A screening level ecological risk assessment performed by the Department concluded that ecological risks were minimal (Greene 2017). The USFWS concurred with that assessment.

    As to a potential source or sources of dioxin and furan TEQ in the fish at this location, there are two. The first is general atmospheric deposition as previously described. That source is thought to be diminishing over large areas on a decadal time scale in response to better controls on combustion. The second potential source, which is more local, are fires which occur within the marshes. These can be caused accidentally or deliberately, as is occasionally done to control Phragmites, an invasive reed that crowds out native plant species.

    With regard to surface water data for segment DE080-003, the Department collected a single high volume samples at Route 38 in 2016. Given the limited number of samples, this result provides no additional insight with regard to 303(d) listing.

    Recommendation: The recommendation for this segment is to continue to monitor dioxin and furan TEQ in fish to document changes and natural recovery (MNR).

26. **DE060-008, Primehook Creek, Mercury:** The general discussion regarding mercury presented previously applies to segment DE060-008. This segment lies

entirely within the Primehook National Wildlife Refuge (NWR). Fish tissue data for mercury for this segment are available for 2006 and 2016 (see Appendix 3). Six of the seven largemouth bass samples collected from this segment in 2006 had estimated ~~methymercury~~methylmercury concentrations in excess of Delaware's fish tissue criterion of 300 ppb. In 2016, methylmercury concentrations in largemouth bass and black crappie collected from this segment were both well below Delaware's criterion, prompting Delaware to lift the mercury advisory for Prime Hook Creek in February of 2018.~~.~~ Further, a whole body mummichog sample collected in 2016 from this segment also had a very low methylmercury concentration. Excluding the mummichog sample (which was collected for ecological risk assessment purposes), the concentration of mercury in large predator fish from this segment declined 76% over the ten year period 2006 – 2016. Considering only largemouth bass, the reduction has been 73%. The half-life for methylmercury reduction in the predatory fish is estimated to be a very short 5 years.

The dramatic reduction of mercury in the fish from this segment is attributed to two factors. First, two coal-fired power plants upwind and within 10 to 15 miles of the segment have drastically reduced or eliminated the use of coal. This has reduced the release of mercury to the atmosphere and presumably, has released the deposition of mercury onto the segment. The second factor contributing to a reduction in mercury concentrations in the fish from this segment is better flushing between impounded water within the Refuge and water from the Delaware Bay. The improved flushing was caused by major breaches in the dunes separating the Refuge from the Bay in response to Hurricane Sandy and other major storms. The USFWS has permanently reestablished the hydraulic connection between the Refuge and Bay. Not only has flushing been improved, but the degree of anoxia in bottom sediments has also likely been reduced. Anoxia recall provides one of the conditions necessary for inorganic mercury to be converted to methylmercury. Of course, reducing atmospheric deposition of mercury provides less inorganic mercury to be converted, which is key to breaking (or more correctly lessening the effect of) the previous conditions.

No low level mercury data are available for the water column of this segment.

Recommendation: It is recommended that mercury be delisted from this segment.

27. **DE060-L03, Waples Pond, Mercury:** The general discussion regarding mercury presented previously applies to segment DE060-L03 (Waples Pond). Note that the outflow of Waples Pond serves as the main inflow into the top of segment DE060-008 (Primehook Creek) discussed immediately above. Fish tissue data for mercury for Waples Pond are available for 2006 and 2016 (see Appendix 3). All data are for largemouth bass with the exception of a black crappie sample which served to

complement the largemouth bass sample in 2016. Three of five largemouth bass samples collected in 2006 from Waples Pond exceeded Delaware's fish tissue criterion of 300 ppb. All five of the largemouth bass samples collected from Waples Pond in 2016 were well below the criterion, leading Delaware to lift the mercury advisory for Waples Pond in February of 2018. The 2016 mean for largemouth bass is 69% lower than the 2006 mean. The estimated half-life of methylmercury reduction in largemouth bass from Waples Pond is 6.2 years.

As to why the concentration of mercury in Waples Pond fish has dropped so dramatically, the discussion for segment DE060-008 (Primehook Creek) presented above also applies to Waples Pond, except that Waples Pond did not benefit from flushing as a second factor as did Primehook Creek. In other words, Primehook Creek benefited from both reduced atmospheric deposition of mercury as well as increased flushing, while Waples Pond benefited only from reduced atmospheric deposition. This is suggested/reflected in the slightly larger reduction for the Primehook Creek fish compared to the Waples Pond fish.

No low level mercury data are available for the water column of Waples Pond.

Recommendation: It is recommended that mercury be delisted from this segment.

28. **Delaware Bay, DRBC Zone 6, Mercury:** The general discussion regarding mercury presented previously applies to the Delaware Bay, Zone 6. Zone 6 is by far the largest segment considered in this current assessment. It encompasses 782 square miles of open water. It lies between Liston Point, DE in southern New Castle County and Cape Henlopen in southern Sussex County. Delaware Bay also has the greatest amount of recreational and commercial fish landings in Delaware. Several fish species landed in Delaware Bay are highly migratory and move between the Delaware Bay and the nearby Atlantic Ocean. As such, mercury data for samples collected from the Delaware Bay and nearby Atlantic Ocean are both considered here.

    A total of 269 mercury results were identified for fish and shellfish samples collected from the Delaware Bay and adjacent Atlantic Ocean (see Appendix 3). Two hundred and thirty-six (236) samples were collected in the Delaware Bay and the remaining thirty-three (33) were collected from the nearby Atlantic Ocean. A total of twenty-seven (27) different species are represented. Records span the thirty-eight (38) year period from 1979 through 2017. Data are included from six (6) different collection/reporting entities: DNREC, DRBC, EPA, NOAA, UD, and USFWS.

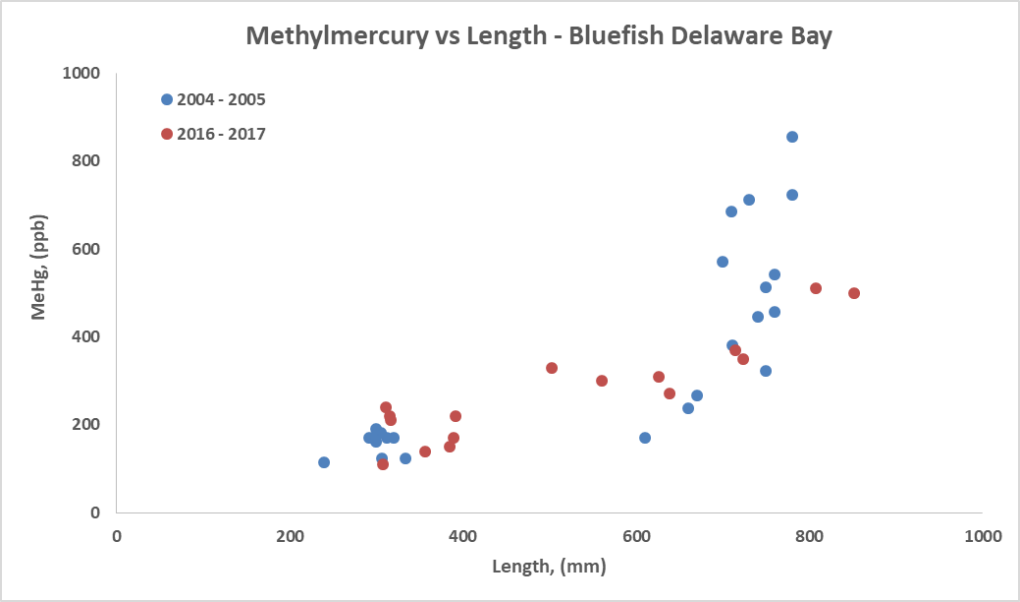
    Of the twenty-seven (27) species, only two (2) had exceedances of Delaware's fish tissue criterion of 300 ppb: Bluefin tuna and bluefish. Both species are highly

migratory; both are long-lived; and both occupy top trophic positions in the aquatic food chain. The Bluefin tuna listed in Appendix 3 was a "giant", weighing 873 pounds, caught by a recreational angler in 2005 near Hot Dog Canyon, 35 miles east of Indian River Inlet, DE (Greene 2007). Edible muscle tissue from this fish was obtain from the angler and was analyzed in triplicate by DNREC. The mercury concentration in all 3 subsamples was similar and ranged between 1710 ppb to 1805 ppb, well in excess of 300 ppb and nearly twice the FDA's action level.

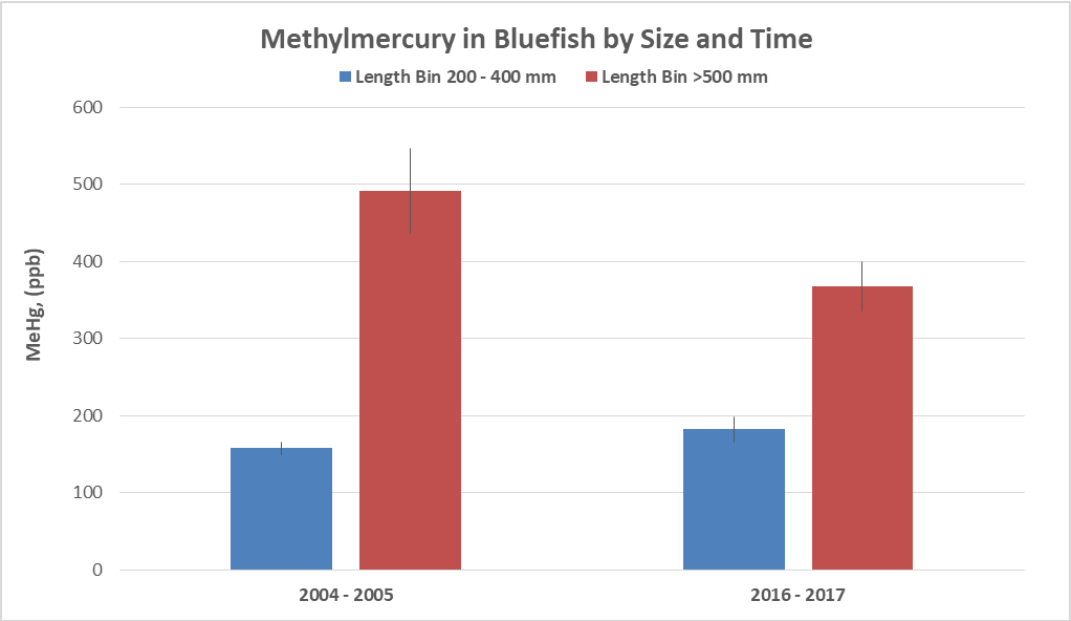
The detected concentrations in this tuna fell within the expected range of 250 ppb to 3150 ppb reported in over 1000 Bluefin tuna samples collected from the North Atlantic Ocean between 2004 and 2012 (Lee et.al. 2016). In this same paper, Lee et.al. also reports that mercury levels in Bluefin tuna have declining 19% over an 8-year period from the 1990s to the early 2000s. Lee et.al. notes that the decline parallels comparable reduction in anthropogenic emissions in North America during the same period.

As an aside, the "giant" tuna discussed above was caught well outside of Delaware's waters and so no health advisory was issued. DNREC did however advise the angler, even before mercury or any other contaminant results were available, that consumption of this fish should be moderated and that women of childbearing age and young children should avoid eating it based on anticipated contaminant concentrations.

With regard to bluefish, seventeen (17) of forty-two (42) samples listed in Appendix 3 exceeded Delaware's criterion of 300 ppb. All seventeen exceedances were for fish larger than 500 mm (approximately 20 inches). A plot of mercury concentration versus length appears in Appendix 3. That plot is also reproduced below and shows that mercury increases with fish length, a feature recognized by Delaware and New Jersey in the fish consumption advisory that applies to bluefish from Delaware Bay.



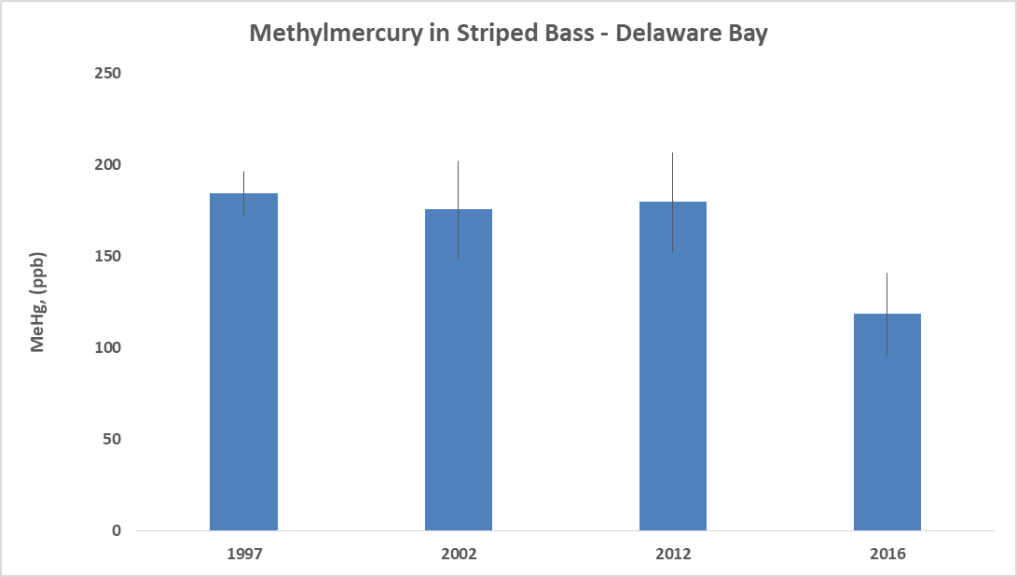
The additional plot below, also drawn from Appendix 3, compares average mercury concentrations in small and large bluefish collected in the 2004-2005 time period to small and large bluefish collected in the 2016-2017 time period. There has not been any significant change for the smaller bluefish, although none of those fish exceed the criterion anyway. For the larger fish, the mean concentration has dropped by roughly 25% over the 11 year period. The 2017 mean (368 ppb) and median (340 ppb) are both still marginally greater than the criterion of 300 ppb.



The reduction observed for large bluefish is consistent with that reported by researchers at NOAA for similarly-sized bluefish collected from the Mid-Atlantic Coast of the U.S.A. (Cross et.al. 2015). These authors suggest that reductions in the large bluefish are tracking reductions in atmospheric deposition, riverine input, and seawater.

With regard to riverine input to Zone 6, a study commissioned by DNREC notes that the concentration of dissolved mercury in the water column of Zone 5 of the Delaware Estuary (upstream of Delaware Bay) dropped roughly 70% between 2002 and 2012 (Mason et.al 2014).

As an aside, it is also interesting to consider mercury concentrations in striped bass from Delaware Bay. As shown in the figure below and in Appendix 3, the mean concentration has dropped 34% between 2012 and 2016/2017. No striped bass samples from the Delaware Bay have exceeded the criterion of 300 ppb. Several samples of striped bass collected from Zone 5 of the Delaware Estuary previously exceeded the 300 ppb criterion. That is no longer the case and DNREC has removed mercury from its 303(d) List for Zone 5.



Recommendation: It is recommended that bluefish from Delaware Bay be monitored from time to time to track ongoing improvements and natural recovery (MNR).

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Appendix 1

CURRENT AND PAST 303(d) LISTINGS IN DELAWARE BASED ON FISH CONSUMPTION ADVISORIES

CURRENT AND PAST 303(d) LISTINGS IN DELAWARE BASED ON FISH CONSUMPTION ADVISORIES

WATERBODY ID	WATERSHED NAME	SEGMENT	Overall CALM Code	DESCRIPTION	SIZE	POLLUTANT OR STRESSOR	PROBABLE SOURCE(S)	YEAR LISTED	TARGET DATE FOR TMDL	TMDL DATE	Pollutant CALM Code	Year Changed from Category 5 Pe 305(b) Assessment and Methodology	Change this cycle	Notes
Piedmont Basin														
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	5	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.0 mile	PCBs	NPS Del. River, UNK	2002	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	5	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.0 mile	Chlordane	NPS Del. River, UNK	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	5	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.0 mile	Dieldrin	NPS Del. River, UNK	2016	2029		5		y	
DE300-001-02	Shellpot Creek	Upper Shellpot Creek	5	From the headwaters to the head of tide below the east set of railroad tracks	7.7 miles	Dieldrin	NPS	2012	2025					
DE300-001-02	Shellpot Creek	Upper Shellpot Creek	5	From the headwaters to the head of tide below the east set of railroad tracks	7.7 miles	PCBs	UNK	2016	2029	2003	4a		y	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE300-001-02	Shellpot Creek	Upper Shellpot Creek	5	From the headwaters to the head of tide below the east set of railroad tracks	7.7 miles	Chlordane	UNK	2016	2029		5		y	
DE300-001-02	Shellpot Creek	Upper Shellpot Creek	5	From the headwaters to the head of tide below the east set of railroad tracks	7.7 miles	Heptachlor Epoxide	UNK	2016	2029		5		y	
DE040-001	Brandywine Creek	Lower Brandywine	5	Mainstem Lower Brandywine	3.8 miles	PCBs	PS, NPS, SF, UNK	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-001	Brandywine Creek	Lower Brandywine	5	Mainstem Lower Brandywine	3.8 miles	D and F TEQs*	PS, NPS, SF, UNK	2016	2029		5		y	
DE040-001	Brandywine Creek	Lower Brandywine	5	Mainstem Lower Brandywine	3.8 miles	Dieldrin	PS, NPS, SF, UNK	2016	2029		5		y	
DE040-002	Brandywine Creek	Upper Brandywine	5	From State Line to Wilmington	9.3 miles	PCBs	PS, NPS, SF, UNK	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-002	Brandywine Creek	Upper Brandywine	5	From State Line to Wilmington	9.3 miles	D and F TEQs*		2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE040-002	Brandywine Creek	Upper Brandywine	5	From State Line to Wilmington	9.3 miles	Dieldrin		2016	2029		5		y	
DE260-001	Red Clay Creek	Mainstem	5	From PA-DE line to the confluence with White Clay Creek	12.8 miles	PCBs		1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE260-001	Red Clay Creek	Mainstem	5	From PA-DE line to the confluence with White Clay Creek	12.8 miles	D and F TEQs*		2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE260-001	Red Clay Creek	Mainstem	5	From PA-DE line to the confluence with White Clay Creek	12.8 miles	Chlorinated Pesticides		2002	2017		1	2016	y	TMDL Target date changed from 2009 to 2017 in the 2012 Cycle, per the WATAR plan. "Chlorinated Pesticides" removed in 2016 and replaced with specific chlorinated pesticides.
DE260-001	Red Clay Creek	Mainstem	5	From PA-DE line to the confluence with White Clay Creek	12.8 miles	DDT	Upstream Sources out of State	2014			3			DDT levels at the State Line exceed human health and aquatic life criteria and decline downstream in a response fully explained by simple dilution, indicating sources are in Pennsylvania. The Department has done extensive sampling in the basin in 2015 as part of the WATAR process. The Department has initiated the process of working with Pennsylvania and US EPA to address this issue.
DE260-001	Red Clay Creek	Mainstem	5	From PA-DE line to the confluence with White Clay Creek	12.8 miles	Dieldrin	UNK	2016	2029		5		y	

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Piedmont Basin														
DE320-001	White Clay Creek	Mainstem	5	White Clay Creek from the PA-DE line to the confluence with the Christina River	15.6 miles	PCBs	PS, NPS	1996, 2006	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE320-001	White Clay Creek	Mainstem	5	White Clay Creek from the PA-DE line to the confluence with the Christina River	15.6 miles	Dieldrin	UNK	2016	2029		5		y	
DE320-001	White Clay Creek	Mainstem	5	Tidal White Clay from the River mouth to Rt4	1.5 Miles	DDT and Metabolites	UNK	2016	2029		5		y	
DE320-001	White Clay Creek	Mainstem	5	Tidal White Clay from the River mouth to Rt4	1.5 Miles	Chlordane	UNK	2016	2029		5		y	
DE120-001	Christina River	Lower Christina River	5	Mainstem Lower Christina River	1.5 miles	PCBs	NPS, SF	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-001	Christina River	Lower Christina River	5	Mainstem Lower Christina River	1.5 miles	Dieldrin	PS, NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE120-001	Christina River	Lower Christina River	5	Mainstem Lower Christina River	1.5 miles	D and F TEQs*	UNK	2016	2029		5		y	
DE120-001	Christina River	Lower Christina River	5	Mainstem Lower Christina River	1.5 miles	DDT and Metabolites	UNK	2016	2029		5		y	
DE120-001	Christina River	Lower Christina River	5	Mainstem Lower Christina River	1.5 miles	Chlordane	UNK	2016	2029		5		y	
DE120-002	Christina River	Mid Christina River	5	Between White Clay Creek and Brandywine River	7.5 miles	PCBs	SF	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-002	Christina River	Mid Christina River	5	Between White Clay Creek and Brandywine River	7.5 miles	Dieldrin	NPS	2002	2017		1		y	Delisted 2016 as dieldrin is no longer a contaminant of concern in fish consumption advisories for these waters
DE120-003	Christina River	Upper Christina River	5	Mainstem Upper Christina River	6.3 miles	PCBs	NPS, PS	1996	2003	2003	1	2016	y	Prior to 2016, EPA TMDL for PCBS in Delaware River Zone 5 and tributaries. Delisted 2016 because PCBs are no longer a contaminant of concern in fish consumption advisories for these waters.
DE120-003	Christina River	Upper Christina River	5	Mainstem Upper Christina River	6.3 miles	Chlordane	NPS, PS	2006	2017		1	2016	y	Delisted 2016 because Chlordane is no longer a contaminant of concern in fish consumption advisories for these waters.
DE120-004-01	Christina River	Lower Christina Creek	5	Mainstem Lower Christina Creek	8.4 miles	PCBs	NPS, SF	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-004-01	Christina River	Lower Christina Creek	5	Mainstem Lower Christina Creek	8.4 miles	Dieldrin	NPS	2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE120-007-01	Christina River	Little Mill Creek and Willow Run	5	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	5.1 miles	PCBs	NPS	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-007-01	Christina River	Little Mill Creek and Willow Run	5	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	5.1 miles	Dieldrin	UNK	2016	2029		5		y	
DE120-007-01	Christina River	Little Mill Creek and Willow Run	5	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	5.1 miles	Chlordane	UNK	2016	2029		5		y	
DE120-007-01	Christina River	Little Mill Creek and Willow Run	5	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	5.1 miles	Heptachlor Epoxide	UNK	2016	2029		5		y	

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WATERBODY ID	WATERSHED NAME	SEGMENT	Overall CALM Code	DESCRIPTION	SIZE	POLLUTANT OR STRESSOR	PROBABLE SOURCE(S)	YEAR LISTED	TARGET DATE FOR TMDL	TMDL DATE	Polllutant CALM Code	Year Changed from Category 5 Pe 305(b) Assessment and Methodology	Change this cycle	Notes
Piedmont Basin														
DE120-L01	Christina River	Smalleys Pond	5	Smalleys Pond east of Newark	30.0 acres	PCBs	NPS	1996	2003	2003	4a	2012		EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-L02	Christina River	Becks Pond	5	Becks Pond southeast of Newark	25.6 acres	PCBs	NPS	2002	2003		1			Listed in 2002, Delisted 2010 due to removal of advisory. EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-L02	Christina River	Becks Pond	5	Becks Pond southeast of Newark	25.6 acres	Mercury	NPS	2002	2009		1			Listed in 2002. Delisted 2010 due to removal of advisory..
DELAWARE BAY BASIN														
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	PCBs	PS, NPS, SF	1996	2005	2003	4a	2006		
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	Arsenic	PS, NPS, SF	2002			1	2006		Not a contaminant of concern in fish consumption advisories for these waters
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	D and F TEQs*	PS, NPS, SF	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	Mercury	PS, NPS, SF	2002	2016		1	2014		Mercury, Listed 2002, Delisted 2014, not a contaminant of concern in fish consumption advisories for these waters.
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	Dieldrin	PS, NPS, SF	2002	2022		5		y	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific. The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE020-001	Army Creek	Lower Army Creek	5	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	3.0 miles	PCBs		2006	2015	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE020-001	Army Creek	Lower Army Creek	5	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	3.0 miles	D and F TEQs*		2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE020-001	Army Creek	Lower Army Creek	5	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	3.0 miles	Dieldrin		2006			1	2016	y	Delisted 2016 as dieldrin is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-001	Army Creek	Lower Army Creek	5	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	3.0 miles	Toxaphene		2006			1	2016	y	Delisted 2016 as toxaphene is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-002	Army Creek	Upper Army Creek	5	Nontidal segment from headwaters to Route 13	1.1 miles	PCBs		2006	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE020-002	Army Creek	Upper Army Creek	5	Nontidal segment from headwaters to Route 13	1.1 miles	D and F TEQs*		2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE020-002	Army Creek	Upper Army Creek	5	Nontidal segment from headwaters to Route 13	1.1 miles	Dieldrin		2006	2017		1	2016	y	Delisted 2016 as dieldrin is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-002	Army Creek	Upper Army Creek	5	Nontidal segment from headwaters to Route 13	1.1 miles	Toxaphene		2006	2017		1	2016	y	Delisted 2016 as toxaphene is no longer a contaminant of concern in fish consumption advisories for these waters
DE270-001-01	Red Lion Creek	Lower Red Lion	5	From U.S. Route 13 to the mouth at Delaware River	1.5 miles	Chlorinated Benzenes		1996			1	2002		Chlorinated Benzene, listed in 1996, delisted 2002 based on improved conditions.
DE270-001-01	Red Lion Creek	Lower Red Lion	5	From U.S. Route 13 to the mouth at Delaware River	1.5 miles	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE270-001-01	Red Lion Creek	Lower Red Lion	5	From U.S. Route 13 to the mouth at Delaware River	1.5 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment

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DELAWARE BAY BASIN														
DE270-001-02	Red Lion Creek	Upper Red Lion	5	From the headwaters to the location where Route 13 intersects Red Lion Creek	1.9 miles	PCBs	NPS	2014		2006	4a	2014		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE270-001-02	Red Lion Creek	Upper Red Lion	5	From the headwaters to the location where Route 13 intersects Red Lion Creek	1.9 miles	Dieldrin	NPS	2014	2025		5			
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	Dieldrin	NPS	2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	Chlordane	NPS	2006	2017		1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	DDT	NPS	2012	2017		1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	5	Saline Tidal Reach, excluding Hangman's Run	7.1 miles	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	5	Saline Tidal Reach, excluding Hangman's Run	7.1 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	5	Saline Tidal Reach, excluding Hangman's Run	7.1 miles	Dieldrin	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	5	Freshwater Tidal Reach	6.1 miles	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	5	Freshwater Tidal Reach	6.1 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-03	Appoquinimink River	Drawyer Creek	5	Tidal Portion	5.45 miles	D and F TEQs*	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-03	Appoquinimink River	Drawyer Creek	5	Tidal Portion	5.45 miles	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE010-001-03	Appoquinimink River	Drawyer Creek	5	Tidal Portion	5.45 miles	DDT	NPS	2002			1	2016	y	Delisted 2016 as DDT is no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L02	Appoquinimink River	Silver Lake	5	Lake adjacent to Middletown, below Deep Creek	38.7 acres	PCB	NPS	2002	2006	2006	1	2012	y	Delisted 2016 as PCB is no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L02	Appoquinimink River	Silver Lake	5	Lake adjacent to Middletown, below Deep Creek	38.7 acres	Dieldrin	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-L02	Appoquinimink River	Silver Lake	5	Lake adjacent to Middletown, below Deep Creek	38.7 acres	DDT	NPS	2002	2017		1		y	Delisted 2016 as DDT is no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L02	Appoquinimink River	Silver Lake	5	Lake adjacent to Middletown, below Deep Creek	38.7 acres	D and F TEQs*	NPS	2002	2017		1		y	Delisted 2016 as these are no longer a contaminant of concern in fish consumption advisories for these waters

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WATERBODY ID	WATERSHED NAME	SEGMENT	Overall CALM Code	DESCRIPTION	SIZE	POLLUTANT OR STRESSOR	PROBABLE SOURCE(S)	YEAR LISTED	TARGET DATE FOR TMDL	TMDL DATE	Pollutant CALM Code	Year Changed from Category 5 Pe 305(b) Assessment and Methodology	Change this cycle	Notes
DELAWARE BAY BASIN														
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	Dieldrin	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	Mercury	NPS	2002	2017		1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	Arsenic	NPS	2002			1	2006		Not a contaminant of concern in fish consumption advisories for these waters
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	Dieldrin	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	Mercury	NPS	2002	2017		1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	Arsenic	NPS	2002			1	2006		Not a contaminant of concern in fish consumption advisories for these waters
DE290-002	Saint Jones River	Isaac Branch	5	Wyoming Mill Pond	28.5 Acres	PCB	NPS	2002	2006	2006	1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE290-002	Saint Jones River	Isaac Branch	5	Wyoming Mill Pond	28.5 Acres	D and F TEQs*	NPS	2002	2017		1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE290-002	Saint Jones River	Isaac Branch	5	Wyoming Mill Pond	28.5 Acres	DDT	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-003	Saint Jones River	Fork Branch	5	From the headwaters to Silver Lake in Dover	7.7 miles	Mercury	NPS	2014	2025		5			
DE290-L01	Saint Jones River	Moores Lake	5	Lake east of Camden	27.1 acres	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-L01	Saint Jones River	Moores Lake	5	Lake east of Camden	27.1 acres	DDT	NPS	2002	2017		1	2014		Not a contaminant of concern in fish consumption advisories for these waters
DE290-L02	Saint Jones River	Silver Lake	5	Silver Lake at Dover	157.8 acres	PCBs	NPS	2002	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-L02	Saint Jones River	Silver Lake	5	Silver Lake at Dover	157.8 acres	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-L02	Saint Jones River	Silver Lake	5	Silver Lake at Dover	157.8 acres	Mercury	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment

CURRENT AND PAST 303(d) LISTINGS IN DELAWARE BASED ON FISH CONSUMPTION ADVISORIES

WATERBODY ID	WATERSHED NAME	SEGMENT	Overall CALM Code	DESCRIPTION	SIZE	POLLUTANT OR STRESSOR	PROBABLE SOURCE(S)	YEAR LISTED	TARGET DATE FOR TMDL	TMDL DATE	Polllutant CALM Code	Year Changed from Category 5 Pe 305(b) Assessment and Methodology	Change this cycle	Notes
DELAWARE BAY BASIN														
DE080-003	Cedar Creek	Slaughter Creek	4a	From the headwaters to The Confluence with Cedar Creek	7.91 Miles	PCBs	NPS	2010	2006	2006	4a	2012		EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE080-003	Cedar Creek	Slaughter Creek	4a	From the headwaters to The Confluence with Cedar Creek	7.91 Miles	D and F TEQs*	NPS	2010	2023					The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE060-008	Broadkill River	Primehook Creek	5	Entire Creek	12.6 miles	Mercury	NPS	2010	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	4a	Ponds located on Sowbridge Branch of Primehook Creek	88.8 acres	Mercury	NPS	2010	2022				y	Mercury listing in Waples Pond Only. The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DELAWARE ESTUARY BASIN														
N/A	Delaware Bay	DRBC Zone 6	5	From Liston Point to the confluence with the Atlantic Ocean	782.0 sq. mi.	PCBs	PS, NPS, SF	1996	2005	2006	4a	2008		EPA TMDL for PCBs in Delaware River Zone 6 and tributaries
N/A	Delaware Bay	DRBC Zone 6	5	From Liston Point to the confluence with the Atlantic Ocean	782.0 sq. mi.	Mercury	PS, NPS, SF	2002	2016		5			TMDL Target date of 2012 changed to 2016 in the 2102 Cycle. The Department will complete an evaluation of WATAR data by the end of the calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
N/A	Delaware Bay	DRBC Zone 6	5	From Liston Point to the confluence with the Atlantic Ocean	782.0 sq. mi.	D and F TEQs*	PS, NPS, SF	2002			1	2006		Not a contaminant of concern in fish consumption advisories for these waters

Appendix 2

SEGMENT/CONTAMINANT PAIRS TARGETTED FOR EVALUATION BY THE END OF 2017

SEGMENT/CONTAMINANT PAIRS ON DELAWARE'S 2016 303(d) LIST
BASED ON FISH CONSUMPTION ADVISORIES THAT ARE TARGETTED FOR EVALUATION BY END OF 2017

WATERBODY ID	WATERSHED NAME	SEGMENT	Overall CALM Code	DESCRIPTION	SIZE	POLLUTANT OR STRESSOR	PROBABLE SOURCE(S)	YEAR LISTED	TARGET DATE FOR TMDL	TMDL DATE	Pollutant CALM Code	Year Changed from Category 5 Pe 305(b) Assessment and Methodology	Change this cycle	Notes
Piedmont Basin														
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	5	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.0 mile	Chlordane	NPS Del. River, UNK	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE040-002	Brandywine Creek	Upper Brandywine	5	From State Line to Wilmington	9.3 miles	D and F TEQs*		2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE260-001	Red Clay Creek	Mainstem	5	From PA-DE line to the confluence with White Clay Creek	12.8 miles	D and F TEQs*		2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE120-001	Christina River	Lower Christina River	5	Mainstem Lower Christina River	1.5 miles	Dieldrin	PS, NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE120-004-01	Christina River	Lower Christina Creek	5	Mainstem Lower Christina Creek	8.4 miles	Dieldrin	NPS	2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DELAWARE BAY BASIN														
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	D and F TEQs*	PS, NPS, SF	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
NA	Delaware River	DRBC Zone 5	5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	59.0 sq. mi.	Dieldrin	PS, NPS, SF	2002	2022		5		y	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific. The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE020-001	Army Creek	Lower Army Creek	5	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	3.0 miles	D and F TEQs*		2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE020-002	Army Creek	Upper Army Creek	5	Nontidal segment from headwaters to Route 13	1.1 miles	D and F TEQs*		2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE270-001-01	Red Lion Creek	Lower Red Lion	5	From U.S. Route 13 to the mouth at Delaware River	1.5 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE090-001	Chesapeake & Delaware Canal	C&D Canal	5	C&D Canal from the MD Line to Delaware River	15.0M	Dieldrin	NPS	2006	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	5	Saline Tidal Reach, excluding Hangman's Run	7.1 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	5	Saline Tidal Reach, excluding Hangman's Run	7.1 miles	Dieldrin	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment

SEGMENT/CONTAMINANT PAIRS ON DELAWARE'S 2016 303(d) LIST
BASED ON FISH CONSUMPTION ADVISORIES THAT ARE TARGETTED FOR EVALUATION BY END OF 2017

WATERBODY ID	WATERSHED NAME	SEGMENT	Overall CALM Code	DESCRIPTION	SIZE	POLLUTANT OR STRESSOR	PROBABLE SOURCE(S)	YEAR LISTED	TARGET DATE FOR TMDL	TMDL DATE	Pollutant CALM Code	Year Changed from Category 5 Per 305(b) Assessment and Methodology	Change this cycle	Notes
DELAWARE BAY BASIN														
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	5	Freshwater Tidal Reach	6.1 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-001-03	Appoquinimink River	Drawyer Creek	5	Tidal Portion	5.45 miles	D and F TEQs*	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE010-L02	Appoquinimink River	Silver Lake	5	Lake adjacent to Middletown, below Deep Creek	38.7 acres	Dieldrin	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	Dieldrin	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-01	Saint Jones River	Lower Saint Jones	5	From Old Lebanon Bridge to the mouth of Delaware Bay	8.3 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	Dieldrin	UNK	2016	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-001-02	Saint Jones River	Upper Saint Jones	5	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	6.7 miles	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-002	Saint Jones River	Isaac Branch	5	Wyoming Mill Pond	28.5 Acres	DDT	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-L02	Saint Jones River	Silver Lake	5	Silver Lake at Dover	157.8 acres	D and F TEQs*	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE290-L02	Saint Jones River	Silver Lake	5	Silver Lake at Dover	157.8 acres	Mercury	NPS	2002	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE080-003	Cedar Creek	Slaughter Creek	4a	From the headwaters to The Confluence with Cedar Creek	7.91 Miles	D and F TEQs*	NPS	2010	2023					The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE060-008	Broadkill River	Primehook Creek	5	Entire Creek	12.6 miles	Mercury	NPS	2010	2022		5		y	The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	4a	Ponds located on Sowbridge Branch of Primehook Creek	88.8 acres	Mercury	NPS	2010	2022				y	Mercury listing in Waples Pond Only. The Department will complete an evaluation of WATAR data by the end of calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment
DELAWARE ESTUARY BASIN														
N/A	Delaware Bay	DRBC Zone 6	5	From Liston Point to the confluence with the Atlantic Ocean	782.0 sq. mi.	Mercury	PS, NPS, SF	2002	2016		5			TMDL Target date of 2012 changed to 2016 in the 2102 Cycle. The Department will complete an evaluation of WATAR data by the end of the calendar year 2017 with recommendations for TMDLs, alternatives, or delisting for this segment

Appendix 3

SEGMENT/CONTAMINANT PAIR EVALUATIONS

SEGMENT DE300-001-01
SHELLPOT CREEK
LOWER SHELLPOT CREEK
1 MILE

CHLORDANE

Total Chlordane in Fish Samples, Shellpot Creek, Segment DE 300-001001 (Mouth to 495, lower 1 mile)

Total Chlordane is the sum of cis-Chlordane, trans-Chlordane, oxy-Chlordane, cis-Nonachlor and trans-Nonachlor

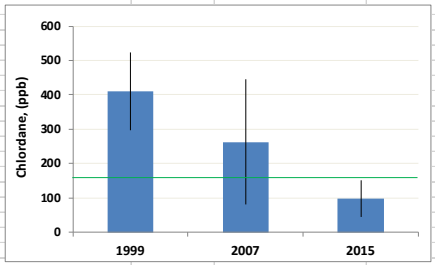
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Total Chlordane (ppb)	% Lipid	Total Chlordane (ug/g lipid)	Data Source	Lab
99044090	Shellpot Creek	Hay Road	39 44 20.7	75 30 38.2	11/03/99	Brown Bullhead	Fillet Skin Off	1	31.5	31.5	31.5	500.0	500.0	500.0	176.4	1.66	10.63	DNREC FY'00 Fish Tissue Data_RG Calcs	Midwest Research Institute
99044100	Shellpot Creek	Hay Road	39 44 20.7	75 30 38.2	11/03/99	Brown Bullhead	Fillet Skin Off	1	32.3	32.3	32.3	600.0	600.0	600.0	455.8	2.89	15.77	DNREC FY'00 Fish Tissue Data_RG Calcs	Midwest Research Institute
99044110	Shellpot Creek	Hay Road	39 44 20.7	75 30 38.2	11/03/99	Brown Bullhead	Fillet Skin Off	1	24.1	24.1	24.1	225.0	225.0	225.0	799	2.28	35.04	DNREC FY'00 Fish Tissue Data_RG Calcs	Midwest Research Institute
99044120	Shellpot Creek	Hay Road	39 44 20.7	75 30 38.2	11/03/99	Brown Bullhead	Fillet Skin Off	1	24.5	24.5	24.5	240.0	240.0	240.0	426.6	2.30	18.55	DNREC FY'00 Fish Tissue Data_RG Calcs	Midwest Research Institute
99044560	Shellpot Creek	Hay Road	39 44 20.7	75 30 38.2	11/03/99	Brown Bullhead	Fillet Skin Off	1	33.7	33.7	33.7	575.0	575.0	575.0	195.6	1.58	12.38	DNREC FY'00 Fish Tissue Data_RG Calcs	Midwest Research Institute
0710045-006B	Shellpot Creek	Between Tide Gate & Mouth	39° 44.198' N	75° 30.463' W	10/23/2007	Channel Catfish	Pan-dressed	5	48.7	45.5	51.5	1238.0	890.0	1580.0	81.3	7.43	1.09	2007 Biota Results_RG Calcs	AXYS Analytical
0710046-009	Shellpot Creek	I-495 to Wires	39° 44.614' N	75° 30.772' W	10/24/2007	Eastern Silvery Minnow	Whole	99				8.2			444.4	6.69	6.64	2007 Biota Results_RG Calcs	AXYS Analytical
Shell495Wires-FISH-1015	Shellpot Creek	I-495 to Wires	39.741230	-75.513360	11/3/2015	White Sucker	Pan-dressed	1	34.9			470.0			151.84	1.48	10.26	WATAR_2015 Fish Tissue Data_RG Calcs	AXYS Analytical
ShellTGMouth-FISH-1015	Shellpot Creek	Between Tide Gate & Mouth	39.734620	-75.504830	11/4/2015	Channel Catfish	Fillet, skin off	5	51.3	47	55.2	1280.0	1000	1630	43.56	2.10	2.07	WATAR_2015 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 154 ppb for adults.

Summary Statistics - Total Chlordane in Fish (ppb)

Shellpot Creek, Segment DE 300-001-01 (Mouth to I-495, lower 1 mile)

	1999	*2007*	*2015*
Mean	410.68	262.85	97.7
Standard Error	112.74	181.55	54.14
Median	426.60	262.85	97.70
Mode	#N/A	#N/A	#N/A
Standard Deviation	252.11	256.75	76.57
Sample Variance	63557.05	65920.81	5862.28
Kurtosis	0.63	#DIV/0!	#DIV/0!
Skewness	0.93	#DIV/0!	#DIV/0!
Range	622.60	363.10	108.28
Minimum	176.40	81.30	43.56
Maximum	799.00	444.40	151.84
Sum	2053.40	525.70	195.40
Count	5	2	2
Confidence Level(95.0%)	313.03	2306.81	687.91



DE Fish Tissue Screening Value =	154	ppb
% Reduction from Peak, All Samples =	76.21	%
Duration =	16.00	yr
Ave Annual % Reduction =	4.76	% per yr
% Reduction Channel Catfish Only =	46.42	%
Duration =	8.03	yr
Ave Annual % Reduction =	5.78	% per yr

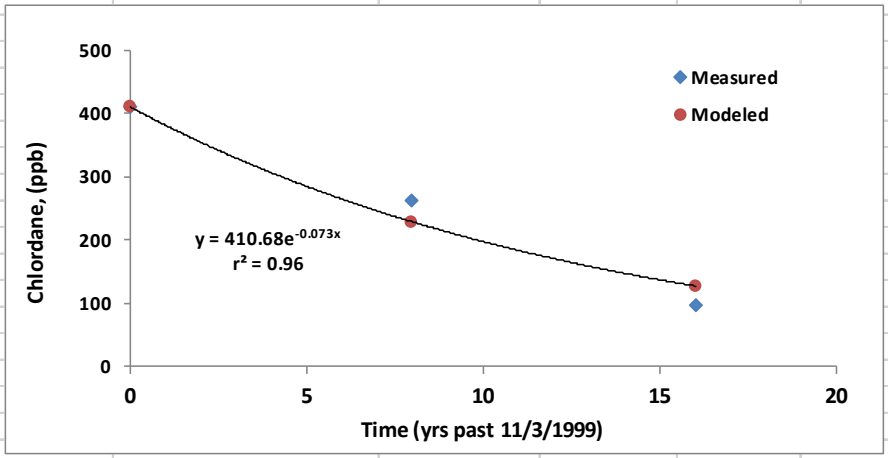
Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	410.68	ppb	
Lumped first order rate constant, k =	0.0730	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	9.5	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Chlordane (ppb)	Modeled Chlordane (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
11/3/1999	0	0.00	410.68	410.68	0	23593.98401
10/23/2007	2911	7.97	262.85	229.44	1116.29237	33.33137778
11/3/2015	5844	16.00	97.700	127.62	895.233003	25400.92188

Sum of Squares =	2011.52538
Sum of Squared Total =	49028.23727
Correlation Coefficient, r =	0.98
Coefficient of Determination, r^2 =	0.96



SEGMENT DE040-002
BRANDYWINE CREEK
UPPER BRANDYWINE
9.3 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Brandywine Creek, Segment DE 040-002 (Stateline to Wilm, 9.3 mi.)

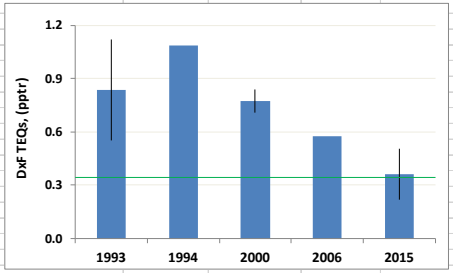
TEQs are based on WHO 2005 TEFs

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
933672	Brandywine	Smith Bridge	39 50 15.8	-75 34 44.4	10/15/93	White Sucker	Fillet Skin On	1	36.5	36.5	36.5	440.0	440.0	440.0	0.567	2.7	21.1	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
933673	Brandywine	Smith Bridge	39 50 15.8	-75 34 44.4	10/15/93	White Sucker	Fillet Skin On	1	34.7	34.7	34.7	450.0	450.0	450.0	0.369	4.1	9.1	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
933674	Brandywine	Smith Bridge	39 50 15.8	-75 34 44.4	10/15/93	White Sucker	Fillet Skin On	1	33.0	33.0	33.0	395.0	395.0	395.0	1.949	7.4	26.4	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
933675	Brandywine	Smith Bridge	39 50 15.8	-75 34 44.4	10/15/93	White Sucker	Fillet Skin On	1	32.3	32.3	32.3	375.0	375.0	375.0	0.508	5.3	9.6	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
933676	Brandywine	Smith Bridge	39 50 15.8	-75 34 44.4	10/15/93	White Sucker	Fillet Skin On	1	35.7	35.7	35.7	475.0	475.0	475.0	0.789	2.7	29.1	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
94017440	Brandywine	Hagley	39 46 27.5	75 34 39.0	06/29/94	Rock Bass	Fillet Skin On	4	16.9	16.0	17.5	96.3	83.0	116.0	1.080	1.5	72.0	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
00037740	Brandywine	Smith Bridge	39 50 15.8	-75 34 44.4	12/05/00	White Sucker	Fillet Skin On	5	39.3	35.9	43.4	840.0	625.0	1025.0	0.838	3.20	26.2	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
00037750	Brandywine	Hagley	39 46 27.5	-75 34 39.0	12/05/00	White Sucker	Fillet Skin On	5	38.9	39.1	40.7	843.0	730.0	935.0	0.709	5.89	12.0	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
0709067	Brandywine	Smith Bridge	39° 50.213' N	75° 34.705' W	10/3/2006	White Sucker	Pan-dressed	5	39.0	32.0	51.0	330.0	306.0	360.0	0.575	2.55	22.5	2007 Biota Results_RG Calcs	AXYS Analytical
BRSmithBr-FISH-1015	Brandywine	Smith Bridge	39.837722	-75.579000	10/15/2015	White Sucker	Pan-dressed	5	387	742	366	413	620	950	0.311	3.09	10.1	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical
BRRocklandRd-FISH-1015	Brandywine	Rockland Road	39.796464	-75.575145	10/15/2015	White Sucker	Pan-dressed	5	404	817	370	435	541	978	0.632	4.25	14.9	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical
BRRocklandRd-SMB-1015	Brandywine	Rockland Road	39.796464	-75.575145	10/15/2015	Smallmouth Bass	Fillet, skin on	2	435	1342	430	440	1235	1449	0.146	1.36	10.7	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)
Brandywine River, Segment DE 040-002 (Stateline to Wilmington, 9.3 miles)

	1993	*1994*	*2000*	*2006*	*2015*
Mean	0.8363	1.0842	0.7735	0.5750	0.3630
Standard Error	0.2862		0.0647		0.1427
Median	0.5667		0.7735		0.3110
Mode	#N/A		#N/A		#N/A
Standard Deviation	0.6400		0.0915		0.2471
Sample Variance	0.4096		0.0084		0.0611
Kurtosis	3.8891		#DIV/0!		#DIV/0!
Skewness	1.9381		#DIV/0!		0.9049
Range	1.5796		0.1294		0.4860
Minimum	0.3690		0.7088		0.1460
Maximum	1.9486		0.8382		0.6320
Sum	4.1813		1.5471		1.0890
Count	5		2		3
Confidence Level(95.0%)	0.7947		0.8221		0.6139



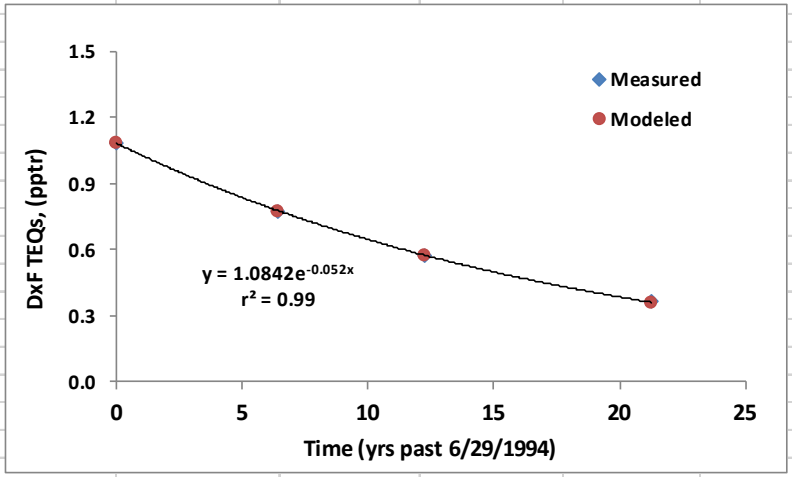
DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	66.52	%
Duration =	21.30	yr
Ave Annual % Reduction =	3.12	% per yr
% Reduction White Sucker, Smith Br =	62.81	%
Duration =	22.00	yr
Ave Annual % Reduction =	2.86	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	1.0842	pptr	
Lumped first order rate constant, k =	0.0517	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	13.4	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
6/29/1994	0	0.00	1.0842	1.0842	0	0.14842259
12/5/2000	2351	6.44	0.7735	0.7773	1.37941E-05	0.005566417
10/3/2006	4479	12.26	0.5750	0.5751	7.26364E-09	0.015359258
10/15/2015	7778	21.30	0.3630	0.3605	6.24346E-06	0.112850628
				Sum of Squares =	2.00448E-05	
				Sum of Squared Total =		0.282198893
				Correlation Coefficient, r =		0.99996
				Coefficient of Determination, r^2 =		0.99993



SEGMENT DE260-001
RED CLAY CREEK
MAINSTEM
12.8 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Red Clay Creek, Segment DE 260-001 (Stateline to White Clay, 12.8 mi.)

TEQs are based on WHO 2005 TEFs

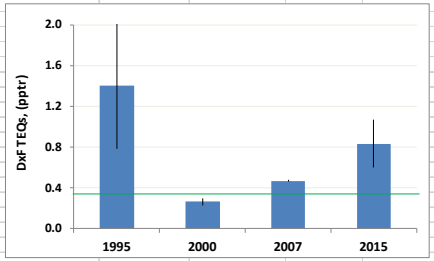
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
95023550	Red Clay Creek	Ashland	39 47 53.8	75 39 29.1	09/07/95	White Sucker	Fillet Skin On	5	24.7	23.5	25.5	138.8	122.0	160.0	1.706826	1.9	89.8	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
95023560	Red Clay Creek	Ashland	39 47 53.8	75 39 29.1	09/07/95	American Eel	Fillet Skin Off	4	77.3	72.5	84.4	1037.5	875.0	1250.0	3.028115	13.2	22.9	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
95023570	Red Clay Creek	Stanton	39 42 54.1	75 38 24.5	09/07/95	White Sucker	Fillet Skin On	5	30.5	29.5	31.5	305.0	275.0	370.0	0.475333	1.9	25.4	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
95023580	Red Clay Creek	Stanton	39 42 54.1	75 38 24.5	09/07/95	Redbreast Sunfish	Fillet Skin On	5	16.2	15.6	16.8	78.0	65.0	91.0	0.401972	1.5	26.8	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
00035020	Red Clay Creek	Mt. Cuba	39 47 16.8	75 38 24.9	11/01/00	White Sucker	Fillet Skin On	7	24.2	21.7	30.0	150.7	110.0	275.0	0.220	0.821	26.8	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
00035290	Red Clay Creek	State Line	39 48 47.1	75 40 53.6	11/06/00	White Sucker	Fillet Skin On	5	26.1	24.5	27.0	179.0	150.0	200.0	0.331	1.08	30.6	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
00036510	Red Clay Creek	Stanton	39 42 54.1	75 38 24.5	11/20/00	White Sucker	Fillet Skin On	5	24.3	23.5	26.1	173.0	150.0	215.0	0.233	1.10	21.2	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
0709066-006B	Red Clay Creek	Stateline	39° 48.957' N	75° 41.469' W	9/24/2007	White Sucker	Pan-dressed	5	27.5	26	29	196	130	225	0.460	3.33	13.8	DNREC FY'08 Fish Tissue Data_RG Calcs	AXYS Analytical
0709065-006B	Red Clay Creek	Wooddale	39° 45.739' N	75° 38.163' W	9/24/2007	White Sucker	Pan-dressed	5	27.6	23.1	33.1	204	110	300	0.478	1.72	27.8	DNREC FY'08 Fish Tissue Data_RG Calcs	AXYS Analytical
RCStateline-FISH-1015	Red Clay Creek	0.4 Miles Below P	39.808170	-75.681350	10/14/2015	White Sucker	Pan-dressed	5	299	267	275	320	200	340	0.422	1.19	35.5	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical
RCWooddale-FISH-1015	Red Clay Creek	Wooddale	39.763873	-75.637852	10/14/2015	White Sucker	Pan-dressed	5	381	577	337	440	410	905	0.84	2.93	28.7	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical
RCStanton-FISH-1015	Red Clay Creek	Stanton	39.716781	-75.640075	10/14/2015	White Sucker	Pan-dressed	5	317	352	291	341	290	440	1.23	3.42	36.0	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Red Clay Creek, Segment DE 260-001 (Stateline to White Clay, 12.8 miles)

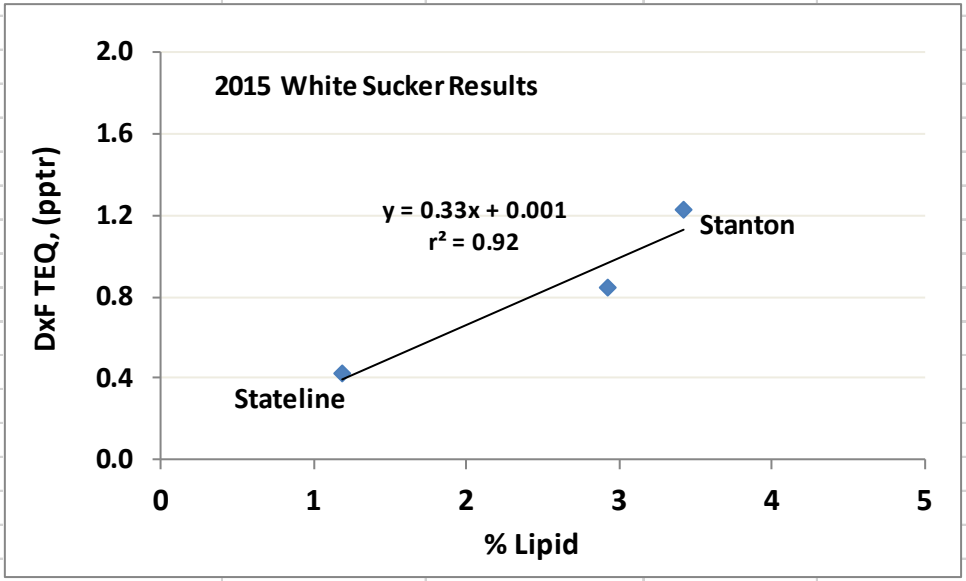
	1995	*2000*	*2007*	*2015*
Mean	1.4031	0.2613	0.4690	0.8307
Standard Error	0.6189	0.0350	0.0090	0.2333
Median	1.0911	0.2328	0.4690	0.8400
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation	1.2377	0.0606	0.0127	0.4041
Sample Variance	1.5320	0.0037	0.0002	0.1633
Kurtosis	-1.1046	#DIV/0!	#DIV/0!	#DIV/0!
Skewness	0.8852	1.6472	#DIV/0!	-0.1039
Range	2.6261	0.1107	0.0180	0.8080
Minimum	0.4020	0.2201	0.4600	0.4220
Maximum	3.0281	0.3309	0.4780	1.2300
Sum	5.6122	0.7838	0.9380	2.4920
Count	4	3	2	3
Confidence Level(95.0%)	1.9695	0.1506	0.1144	1.0038



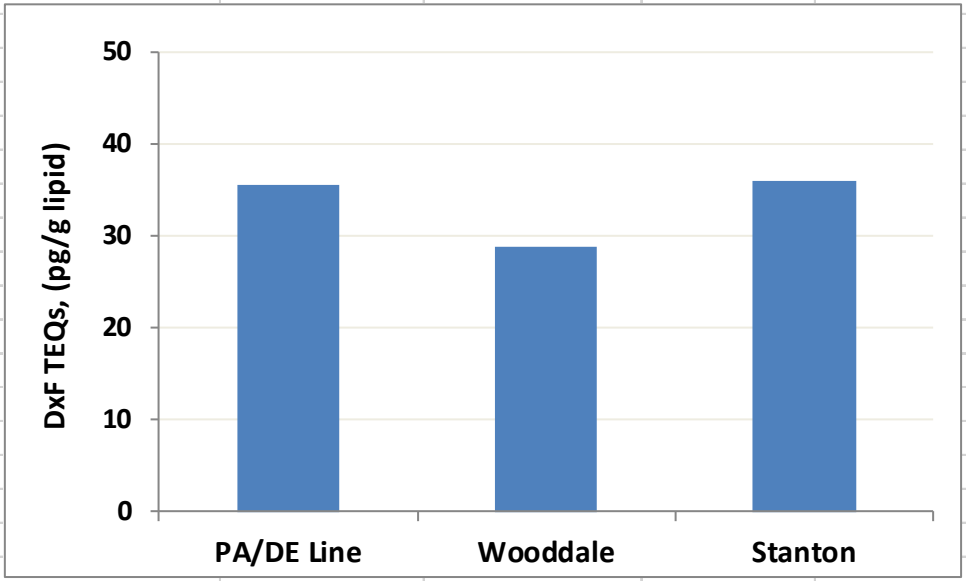
DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	40.80	%
Duration =	20.10	yr
Ave Annual % Reduction =	2.03	% per yr

The temporal trend is not monotonic decreasing and so the data were not fit to an exponential decay curve.

A close examination of the 2015 data, which appears to show a moderate increase in DxF TEQs, also indicates that TEQs increase in the downstream direction beginning at the PA/DE line, down to Wooddale, and finally to Stanton. That apparent increase is positively correlated with lipid content of the fish, which also increases in the downstream direction (see plot below). An increase in DxF TEQs with lipid is expected based on the lipophilic nature of dioxins and furans. The lipid content of fish is one measure of biological condition. A lower lipid content of the fish at the PA/DE line may suggest a less abundant food supply there and/or that these fish need to expend more energy (and fat stores) to secure food. Ironically, a diminished bioenergetic condition of the fish at the PA/DE line may lower partitioning of dioxins and furans into these fish. By extention, a better bioenergetic condition of the downstream fish may increase partitioning of dioxins and furans into these fish. This explanation runs counter to the notion that "pollution" increases in the downstream direction.



Based on the above information, it is useful to compare the lipid normalized concentration of DxF TEQs in the 2015 white sucker samples at the upstream station (near the PA/DE line), the intermediate station (Wooddale), and the downstream station (Stanton). That plot appears below. The relative percent difference across all three stations is only 21.9% and the concentration at the PA/DE Line is essentially equal to the concentration at Stanton. Hence, on a lipid normalized basis, the degree of contaminantion remains largely unchanged from the Stateline all the way down to Stanton.



SEGMENT DE120-001
CHRISTINA RIVER
LOWER CHRISTINA RIVER
1.5 MILES

DIELDRIN

Dieldrin in Fish Samples, Christina River, Segment DE 120-001 (lower 1.5 miles)

This segment is located between the mouth of the Christina River and the mouth of the Brandywine. There are no fish tissue data for this specific segment. The fish advisory for this segment is based on fish tissue data for the segment immediately upstream (DE 120-002), which runs between the mouth of the Brandywine and the mouth of the White Clay Creek. Because there are no data for segment DE 120-001, data for segment DE 120-002 are considered here and conclusions for DE 120-002 are applied to DE 120-001.

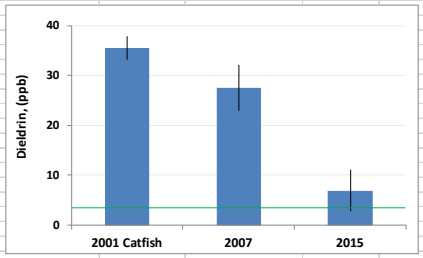
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
01011600	Christina River	Christina Park	39 44 07.0	75 32 30.0	05/07/01& 05/1	Channel Catfish	Fillet Skin Off	5	43.5	39.0	48.5	821.6	475.0	1200.0	37.9	8.71	0.44	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
01012510	Christina River	Christina Park	39 44 07.0	75 32 30.0	05/11/01	Largemouth Bass	Fillet Skin On	4	30.4	25.0	34.0	431.3	260.0	555.0	5.03	0.772	0.65	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
01011890	Christina River	Newport	39 42 38.6	75 36 26.9	05/08/01	Channel Catfish	Fillet Skin Off	4	48.2	42.0	54.9	1075.0	500.0	1800.0	33.2	4.61	0.72	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
0710038-006B	Christina River	Newport	39° 42.157' N	75° 37.026' W	10/16/2007	Channel Catfish	Pan-dressed	5	41.0	39.4	43.6	600	500	750	32.2	4.82	0.67	DNREC FY'08 Fish Tissue Data_RG Calcs	AXYS Analytical
0710039-006B	Christina River	Christina Park	39° 44.071' N	75° 32.980' W	10/17/2007	Channel Catfish	Pan-dressed	5	44.1	43.0	46.0	786	650	950	23	5.91	0.39	DNREC FY'08 Fish Tissue Data_RG Calcs	AXYS Analytical
ChrNewport-FISH-1015	Christina	Newport to Churchman	39.698190	-75.620030	10/19/2015	White Catfish	Fillet, skin off	4	38.3	36.5	40.0	735	565	951	2.79	0.79	0.35	WATAR_2015 Fish Tissue Data_RG Calcs	AXYS Analytical
ChrPkWalnutSt-FISH-1015	Christina	Walnut Street	39.734517	-75.549667	10/21/2015	Channel Catfish	Fillet, skin off	3	45.5	44.5	47.5	779	588	987	11.1	3.04	0.37	WATAR_2015 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.

Summary Statistics - Dieldrin in Fish (ppb)

Mid-Christina River, Segment DE 120- 002 (Between Mouth of Brandywine & Mouth of White Clay Creek, 7.5 miles)

	2001 - All	*2001 Catfish*	*2007*	*2015*
Mean	25.38	35.55	27.60	6.95
Standard Error	10.26	2.35	4.60	4.16
Median	33.20	35.55	27.60	6.95
Mode	#N/A		#N/A	#N/A
Standard Deviation	17.78	3.32	6.51	5.88
Sample Variance	316.01		42.32	34.53
Kurtosis	#DIV/0!		#DIV/0!	#DIV/0!
Skewness	-1.60		#DIV/0!	#DIV/0!
Range	32.87		9.20	8.31
Minimum	5.03	33.20	23.00	2.79
Maximum	37.90	37.90	32.20	11.10
Sum	76.13		55.20	13.89
Count	3	2	2	2
Confidence Level(95.0%)	44.16		58.45	52.79



DE Fish Tissue Screening Value =	3	ppb
% Reduction Catfish Species Only =	80.46	%
Duration =	14.45	yr
Ave Annual % Reduction =	5.57	% per yr

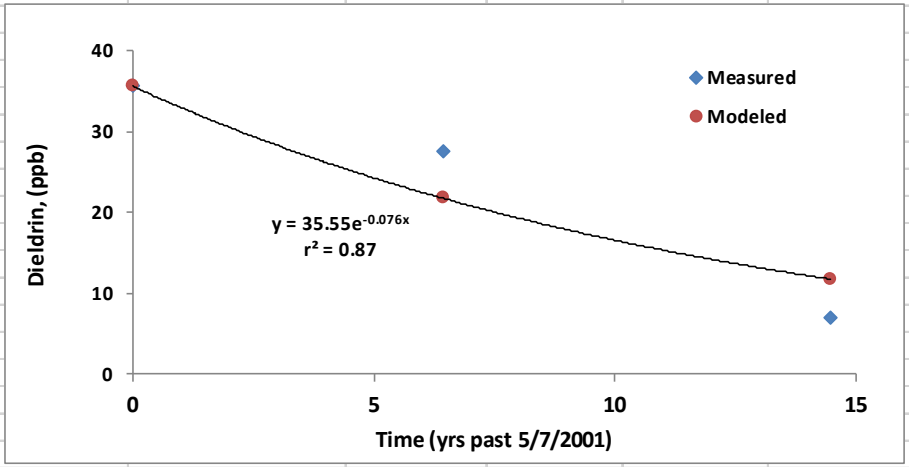
Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	35.55	ppb	
Lumped first order rate constant, k =	0.076445533	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	9.1	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
5/7/2001	0	0.00	35.55	35.55	0	148.474225
10/16/2007	2353	6.44	27.60	21.73	34.51513754	17.935225
10/20/2015	5279	14.45	6.95	11.78	23.33862591	269.6164

Sum of Squares =	57.85376344
Sum of Squared Total =	436.02585
Correlation Coefficient, r =	0.93
Coefficient of Determination, r^2 =	0.87



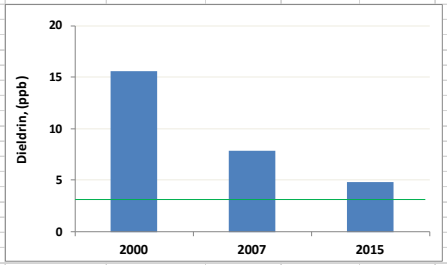
SEGMENT DE120-004-01
CHRISTINA RIVER
LOWER CHRISTINA CREEK
8.4 MILES

DIELDRIN

Dieldrin in Fish Samples, Christina Creek, Segment DE 120-004-01 (South Newark to Smalleys Pond, 8.4 mi.)

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
00035910	Christina	Rittenhouse Park	39 39 17.7	75 45 26.2	11/13/2000	White Sucker	Fillet Skin On	3	33.0	26.5	37.5	433.3	200.0	580.0	15.6	1.30	1.20	DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
00037070	Christina	Coochs Bridge	39 38 24.4	75 44 10.4	11/27/2000	White Sucker	Fillet Skin On	8	28.2	19.0	31.1	303.0	255.0	360.0	U (1.98)	0.819		DNREC FY'01 Fish Tissue Data_RG Calcs	Midwest Research Institute
0710033-006B	Christina	Coochs Bridge	39° 38.243' N	75° 43.703' W	10/2/2007	White Sucker	Pan-dressed	5	28.8	27.0	30.1	238.0	210.0	270.0	7.88	1.08	0.73	2007 Biota Results_RG Calcs	AXYS Analytical
ChrRoute72-FISH-1015	Christina	Coochs Bridge	39.636731	-75.727840	10/12/2015	Fallfish	Pan-dressed	5	21.4	18.2	23.9	98.0	70.0	118.0	4.85	1.02	0.48	WATAR_2015_Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.



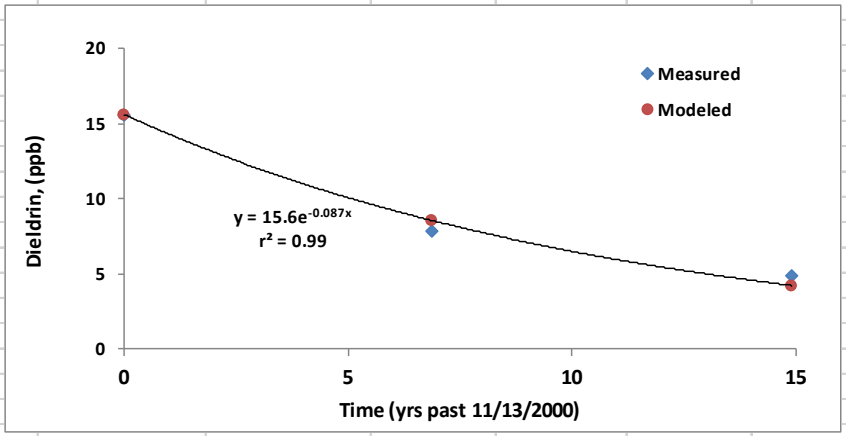
DE Fish Tissue Screening Value =	3	ppb
% Reduction from Peak, All Samples =	68.91	%
Duration =	14.91	yr
Ave Annual % Reduction =	4.62	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	15.6	ppb	
Lumped first order rate constant, k =	0.087488997	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	7.9	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
11/13/2000	0	0.00	15.6	15.60	0	37.90454444
10/2/2007	2514	6.88	7.88	8.54	0.439293656	2.444011111
10/12/2015	5446	14.91	4.85	4.23	0.381370034	21.09871111
				Sum of Squares =	0.82066369	
				Sum of Squared Total =		61.44726667
				Correlation Coefficient, r =		0.99
				Coefficient of Determination, r^2 =		0.99



SEGMENT NA
DELAWARE RIVER
DRBC ZONE 5
59 SQUARE MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQ in Fish Samples, Delaware Estuary Zone 5 (DE/PA/NJ Border to Liston Point)

Note: The mouth of Raccoon Creek enters the Delaware River just upstream of the DE/NJ Stateline. Technically, the Raccoon Creek station is in Zone 4. However, given its proximity to Zone 5, data for this station is considered relevant and applicable for purpose of this compilation.

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Mean Length (mm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQs (pptr ww fillet)	% Lipid	DxF TEQ (pg/g lipid)
110801 05 COR	Delaware River	Zone 5, Between C&D Canal and DE Mem. Br.	39.633310	75.582560	11/08/01	Channel Catfish	Fillet Skin Off	5	40.98		33.8	52	636.4	291	1410	2.7770	3.22	86.2434
032002 05 COR	Delaware River	Zone 5, Between C&D Canal and DE Mem. Br.	39.633310	75.582560	03/20/02	Channel Catfish	Fillet Skin Off	5	42		38.5	48	654.43	470.46	1021.6	2.4031	3.43	70.0607
SR-CC-S04	Delaware River	Salem River			2004	Channel Catfish	Fillet			400			622.1			2.0916		
RC-CC-S04	Delaware River	Raccoon Creek			2004	Channel Catfish	Fillet			443			892.0			2.3419		
SR-CC-S05	Delaware River	Salem River			2005	Channel Catfish	Fillet			449			827.6			3.5288		
RC-CC-S05	Delaware River	Raccoon Creek			2005	Channel Catfish	Fillet			343			351.2			4.3000		
SR-CC-S06	Delaware River	Salem River			2006	Channel Catfish	Fillet			419			698.1			1.7981		
RC-CC-S06	Delaware River	Raccoon Creek			2006	Channel Catfish	Fillet			351			413.2			2.1720		
SR-CC-S10	Delaware River	Salem River			2010	Channel Catfish	Fillet			416			700.5			3.2647		
RC-CC-S10	Delaware River	Raccoon Creek			2010	Channel Catfish	Fillet			500			1170.0			3.6347		
SR-CC-S12	Delaware River	Salem River			2012	Channel Catfish	Fillet			469			1036.2			5.5408		
RC-CC-S12	Delaware River	Raccoon Creek			2012	Channel Catfish	Fillet			377			549.8			6.5540		
SR-CC-S15	Delaware River	Salem River			2015	Channel Catfish	Fillet			381			477.4			1.2756		
RC-CC-S15	Delaware River	Raccoon Creek			2015	Channel Catfish	Fillet			202			129.6			1.4823		
94034500	Delaware River	Augustine Beach	39.504670	75.580280	08/12/94	White Perch	Fillet Skin On	6	22.0		19.5	24.2	165.7	116.0	219.0	1.7713	2.89	61.2913
110801 05 Core	Delaware River	Zone 5, Between C&D Canal and DE Mem. Br.	39.633310	75.582560	11/08/01	White Perch	Fillet Skin On	5	20		18.6	22.3	121.8	93	161	3.9294	4.80	81.8616
032002 05 COR	Delaware River	Zone 5, Between C&D Canal and DE Mem. Br.	39.633310	75.582560	03/20/02	White Perch	Fillet Skin On	5	21.08		19.1	23.8	171.4	115	220	4.7627	4.67	101.9843
SR-WP-S04	Delaware River	Salem River			2004	White Perch	Fillet			220			177.7			2.5059		
RC-WP-S04	Delaware River	Raccoon Creek			2004	White Perch	Fillet			186			105.0			1.9572		
SR-WP-S05	Delaware River	Salem River			2005	White Perch	Fillet			190			112.4			1.8911		
RC-WP-S05	Delaware River	Raccoon Creek			2005	White Perch	Fillet			190			102.4			2.4506		
SR-WP-S06	Delaware River	Salem River			2006	White Perch	Fillet			168			82.0			1.3499		
RC-WP-S06	Delaware River	Raccoon Creek			2006	White Perch	Fillet			164			70.2			2.3996		
SR-WP-S07	Delaware River	Salem River			2007	White Perch	Fillet			160			62.0			1.0424		
RC-WP-S07	Delaware River	Raccoon Creek			2007	White Perch	Fillet			149			48.4			2.4848		
SR-WP-S10	Delaware River	Salem River			2010	White Perch	Fillet			189			105.3			1.8490		
RC-WP-S10	Delaware River	Raccoon Creek			2010	White Perch	Fillet			220			171.6			2.3557		
SR-WP-S12	Delaware River	Salem River			2012	White Perch	Fillet			193			113.6			2.9709		
RC-WP-S12	Delaware River	Raccoon Creek			2012	White Perch	Fillet			212			142.1			5.7962		
SR-WP-S15	Delaware River	Salem River			2015	White Perch	Fillet			219			160.9			0.5765		
RC-WP-S15	Delaware River	Raccoon Creek			2015	White Perch	Fillet			467			973.8			0.6803		
97014520	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/28/97	Striped Bass	Fillet Skin On	1	71.2		71.2	71.2	4082.0	4082.0	4082.0	3.6611	2.83	129.3692
97014530	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/28/97	Striped Bass	Fillet Skin On	1	83.5		83.5	83.5	6350.0	6350.0	6350.0	3.3284	0.75	443.7927
97015780	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	06/05/97	Striped Bass	Fillet Skin On	1	72.5		72.5	72.5	4082.0	4082.0	4082.0	4.0878	2.62	156.0210
97015790	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	06/05/97	Striped Bass	Fillet Skin On	1	90.0		90.0	90.0	7257.0	7257.0	7257.0	0.4892	4.03	12.1385
97015800	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	06/05/97	Striped Bass	Fillet Skin On	1	84.0		84.0	84.0	9071.0	9071.0	9071.0	0.7260	6.86	10.5835
0205026-001	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/08/02	Striped Bass	Fillet Skin On	1	66.6		66.6	66.6	3390	3390	3390	1.7231	2.95	58.4099
0205053-001A	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/22/02	Striped Bass	Fillet Skin On	1	66.6		66.6	66.6	2722	2722	2722	0.8119	0.70	115.9824
0205053-002A	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/22/02	Striped Bass	Fillet Skin On	1	61.5		61.5	61.5	2268	2268	2268	1.6324	2.10	77.7332
0205053-003A	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/22/02	Striped Bass	Fillet Skin On	1	60.5		60.5	60.5	2313	2313	2313	1.0301	1.92	53.6509
0205053-004A	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	05/22/02	Striped Bass	Fillet Skin On	1	65.7		65.7	65.7	2631	2631	2631	1.0964	0.58	188.0542
0705045-003B	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	5/8/2007	Striped Bass	Fillet Skin On	1	80.3		80.3	80.3	5700	5700	5700	1.6630	5.45	30.5145
0705045-004B	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	5/8/2007	Striped Bass	Fillet Skin On	1	72.6		72.6	72.6	4000	4000	4000	0.8150	1.50	54.3347
0705045-005B	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	5/8/2007	Striped Bass	Fillet Skin On	1	105.9		105.9	105.9	15000	15000	15000	2.2434	5.75	39.0157
0705045-007B	Delaware River	Cherry Island Flats, DE	39.731048	75.490257	5/17/2007	Striped Bass	Fillet Skin On	1	96.8		96.8	96.8	9560	9560	9560	0.3970	1.01	39.3076
0705045-008B	Delaware River	Near Mouth of Oldmans Creek	39.784947	75.436471	5/17/2007	Striped Bass	Fillet Skin On	1	86.8		86.8	86.8	6900	6900	6900	0.3413	2.21	15.4445
1208016-001A	Delaware River	Port Penn	39.51323	-75.54263	8/2/2012	Striped Bass	Skin on fillet	1								0.9050	0.33	274.2424
1208016-002A	Delaware River	Port Penn	39.52443	-75.54203	8/2/2012	Striped Bass	Skin on fillet	1								0.4370	0.29	150.6897
1208016-003A	Delaware River	Port Penn	39.52443	-75.54203	8/2/2012	Striped Bass	Skin on fillet	1								0.1900	0.42	45.2381
Striped Bass #1	Delaware River	Bullpen - NE Side of Reedy Island	39.516892	-75.560483	8/27/2015	Striped Bass	Fillet, Skin On	1								0.0772	0.78	9.8974
Striped Bass #2	Delaware River	Bullpen - NE Side of Reedy Island	39.516892	-75.560483	8/27/2015	Striped Bass	Fillet, Skin On	1								0.2950	0.26	113.4615
CIF-SB-2016-1	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/9/2016	Striped Bass	Fillet, skin on	1								0.832	1.92	43.3333
CIF-SB-2016-2	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/9/2016	Striped Bass	Fillet, skin on	1								0.388	3.26	11.9018
CIF-SB-2016-3	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/24/2016	Striped Bass	Fillet, skin on	1								1.96	5.14	38.1323
CIF-SB-2016-4	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/24/2016	Striped Bass	Fillet, skin on	1								1.17	3.84	30.4688
CIF-SB-2016-5	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/9/2016	Striped Bass	Fillet, skin on	1								1.54	1.4	110.0000
95028120	Delaware River	Pea Patch Island	39.586220	75.560920	10/27/95	American Eel	Fillet Skin Off	3	56.8		54.5	60.0	402.5	345.0	471.4	1.7222	8.10	21.2613
DB069105	Delaware River	Salem	39 34 30	75 31 00	08/29/88	Weakfish	Fillet	5	na		na	na	na	na	na	0.0000		0.0000

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics for Dioxin and Furan TEQ in Channel Catfish, Zone 5 Delaware River

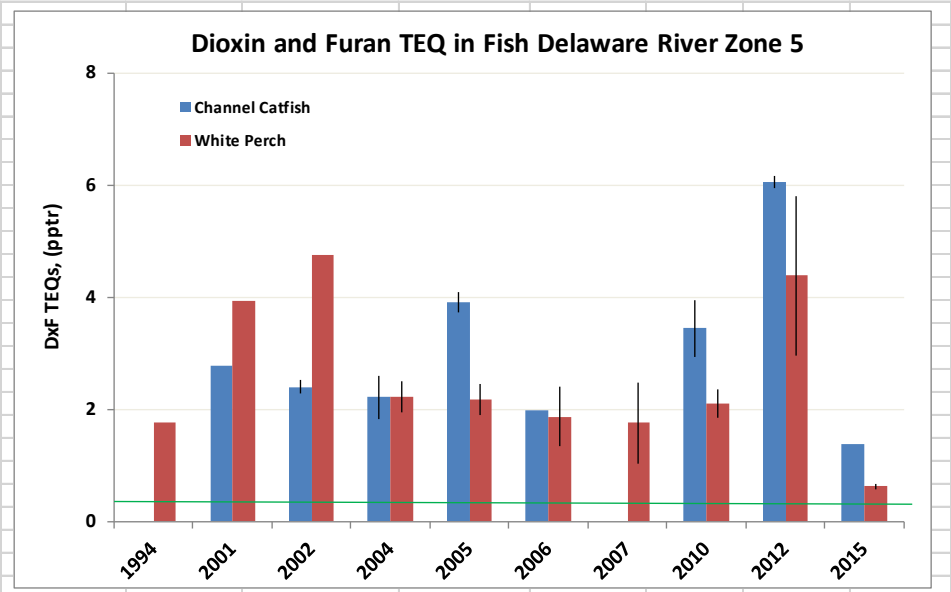
	1994	*2001*	*2002*	*2004*	*2005*	*2006*	*2007*	*2010*	*2012*	*2015*
Mean		2.777	2.403	2.217	3.914	1.985		3.450	6.047	1.379
Standard Error		0.000	0.000	0.125	0.386	0.187		0.185	0.507	0.103
Median		2.777	2.403	2.217	3.914	1.985		3.450	6.047	1.379
Mode		#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	#N/A	#N/A
Standard Deviation		#DIV/0!	#DIV/0!	0.177	0.545	0.264		0.262	0.716	0.146
Sample Variance		#DIV/0!	#DIV/0!	0.031	0.297	0.070		0.068	0.513	0.021
Kurtosis		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
Skewness		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
Range		0.000	0.000	0.250	0.771	0.374		0.370	1.013	0.207
Minimum		2.777	2.403	2.092	3.529	1.798		3.265	5.541	1.276
Maximum		2.777	2.403	2.342	4.300	2.172		3.635	6.554	1.482
Sum		2.777	2.403	4.434	7.829	3.970		6.899	12.095	2.758
Count		1.000	1.000	2.000	2.000	2.000		2.000	2.000	2.000
Confidence Level(95.0%)		#NUM!	#NUM!	1.590	4.900	2.375		2.351	6.437	1.313

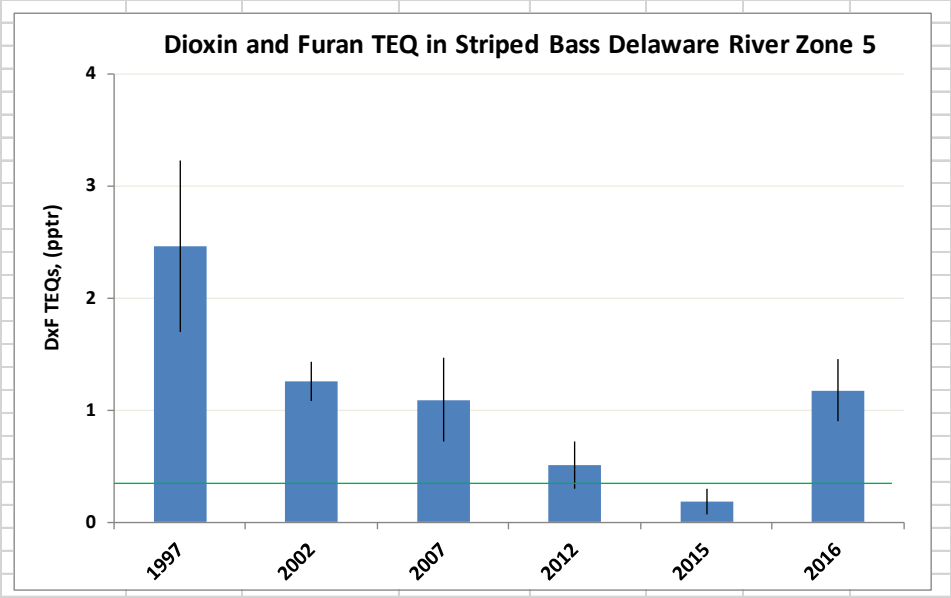
Summary Statistics for Dioxin and Furan TEQ in in White Perch, Zone 5 Delaware River

	1994	*2001*	*2002*	*2004*	*2005*	*2006*	*2007*	*2010*	*2012*	*2015*
Mean	1.771	3.929	4.763	2.232	2.171	1.875	1.764	2.102	4.384	0.628
Standard Error	0.000	0.000	0.000	0.274	0.280	0.525	0.721	0.253	1.413	0.052
Median	1.771	3.929	4.763	2.232	2.171	1.875	1.764	2.102	4.384	0.628
Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	#DIV/0!	#DIV/0!	#DIV/0!	0.388	0.396	0.742	1.020	0.358	1.998	0.073
Sample Variance	#DIV/0!	#DIV/0!	#DIV/0!	0.151	0.157	0.551	1.040	0.128	3.991	0.005
Kurtosis	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Skewness	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Range	0.000	0.000	0.000	0.549	0.560	1.050	1.442	0.507	2.825	0.104
Minimum	1.771	3.929	4.763	1.957	1.891	1.350	1.042	1.849	2.971	0.577
Maximum	1.771	3.929	4.763	2.506	2.451	2.400	2.485	2.356	5.796	0.680
Sum	1.771	3.929	4.763	4.463	4.342	3.750	3.527	4.205	8.767	1.257
Count	1.000	1.000	1.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Confidence Level(95.0%)	#NUM!	#NUM!	#NUM!	3.486	3.555	6.669	9.164	3.219	17.949	0.659

Summary Statistics for Dioxin and Furan TEQ in Striped Bass, Zone 5 Delaware River

	1997	*2002*	*2007*	*2012*	*2015*	*2016*
Mean	2.459	1.259	1.092	0.511	0.186	1.178
Standard Error	0.766	0.178	0.372	0.210	0.109	0.273
Median	3.328	1.096	0.815	0.437	0.186	1.170
Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	1.713	0.398	0.833	0.363	0.154	0.610
Sample Variance	2.934	0.158	0.694	0.132	0.024	0.372
Kurtosis	-3.099	-2.555	-1.713	#DIV/0!	#DIV/0!	-0.804
Skewness	-0.507	0.309	0.673	0.875	#DIV/0!	-0.016
Range	3.599	0.911	1.902	0.715	0.218	1.572
Minimum	0.489	0.812	0.341	0.190	0.077	0.388
Maximum	4.088	1.723	2.243	0.905	0.295	1.960
Sum	12.293	6.294	5.460	1.532	0.372	5.890
Count	5.000	5.000	5.000	3.000	2.000	5.000
Confidence Level(95.0%)	2.127	0.494	1.034	0.902	1.384	0.757


Dioxin and Furan TEQ in Fish Delaware River Zone 5
Channel Catfish
White Perch
DxF TEQs, (pptr)
0
2
4
6
8
1994
2001
2002
2004
2005
2006
2007
2010
2012
2015


Dioxin and Furan TEQ in Striped Bass Delaware River Zone 5
DxF TEQs, (pptr)
0
1
2
3
4
1997
2002
2007
2012
2015
2016

SEGMENT NA
DELAWARE RIVER
DRBC ZONE 5
59 SQUARE MILES

DIELDRIN

Dieldrin in Fish Samples, Delaware Estuary Zone 5 (DE/PA/NJ Border to Liston Point)

Note: The mouth of Raccoon Creek enters the Delaware River just upstream of the DE/NJ Stateline. Technically, the Raccoon Creek station is in Zone 4. However, given its proximity to Zone 5, data for this station is considered relevant and applicable for purpose of this compilation.

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Mean Length (mm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	DQC	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
4278	Delaware River	Deepwater	39 41 33.9	75 30 48.2	08/07/96	Channel Catfish	Fillet	5	42.0	420	38.0	52.0	825.8	505.0	1239.0	15.30		7.0	0.219	DRBC	
4275	Delaware River	C&D Canal	39 33 41.7	75 32 22.7	09/11/96	Channel Catfish	Fillet	5	38.2	382	34.0	48.5	551.8	352.0	1162.0	16.45		7.6	0.218	DRBC	
6479	Delaware River	C&D Canal	39 33 41.7	75 32 22.7	1998	Channel Catfish	Fillet	5	na		na	na	na	na	na	4.76		9.1	0.052	DRBC	
DE000047-FC2	Delaware River	Near Edgemoor, ~3.9 mi. below DE/PA/NJ stateline	39.7670	75.4740	10/11/00	Channel Catfish	Fillet, Skin On	9	22.9	229	20.4	26.0	na	na	na	20		4.89	0.409	DRBC/EPA Coastal 2004	
F-2713	Delaware River	C&D Canal	39 33 41.7	75 32 22.7	10/26/00	Channel Catfish	Fillet	5	na		na	na	na	na	na	17.84		5.9	0.301	DRBC	
F-2711	Delaware River	Deepwater	39 41 33.9	75 30 48.2	11/28/00	Channel Catfish	Fillet	5	na		na	na	na	na	na	19.71		4.1	0.480	DRBC	
SR-CC-S04	Delaware River	Salem River			2004	Channel Catfish	Fillet			400			622.1			11.6		3.34	0.347	DRBC	AXYS
RC-CC-S04	Delaware River	Raccoon Creek			2004	Channel Catfish	Fillet			443			892.0			8.84		2.17	0.407	DRBC	AXYS
SR-CC-S05	Delaware River	Salem River			2005	Channel Catfish	Fillet			449			827.6			13.9		4.39	0.317	DRBC	AXYS
RC-CC-S05	Delaware River	Raccoon Creek			2005	Channel Catfish	Fillet			343			351.2			50.7		5.19	0.977	DRBC	AXYS
SR-CC-S06	Delaware River	Salem River			2006	Channel Catfish	Fillet			419			698.1			9.06		3.95	0.229	DRBC	AXYS
RC-CC-S06	Delaware River	Raccoon Creek			2006	Channel Catfish	Fillet			351			413.2			12.5		3.52	0.355	DRBC	AXYS
SR-CC-S10	Delaware River	Salem River			2010	Channel Catfish	Fillet			416			700.5			28.4	B D	7.91	0.359	DRBC	AXYS
RC-CC-S10	Delaware River	Raccoon Creek			2010	Channel Catfish	Fillet			500			1170.0			18.4	B D	3.47	0.530	DRBC	AXYS
SR-CC-S12	Delaware River	Salem River			2012	Channel Catfish	Fillet			469			1036.2			18.4	D	5.93	0.310	DRBC	AXYS
RC-CC-S12	Delaware River	Raccoon Creek			2012	Channel Catfish	Fillet			377			549.8			29.2	D	7.67	0.381	DRBC	AXYS
SR-CC-S15	Delaware River	Salem River			2015	Channel Catfish	Fillet			381			477.4			7.85		2.27	0.346	DRBC	AXYS
RC-CC-S15	Delaware River	Raccoon Creek			2015	Channel Catfish	Fillet			202			129.6			23.5	D	5.18	0.454	DRBC	AXYS
4270	Delaware River	Deepwater	39 41 33.9	75 30 48.2	08/07/96	White Perch	Fillet	5	20.0	200	19.0	21.0	118.6	106.0	143.0	9.87		3.2	0.311	DRBC	
4272	Delaware River	C&D Canal	39 33 41.7	75 32 22.7	09/04/96	White Perch	Fillet	5	21.8	218	20.0	24.0	129.2	107.0	178.0	5.88		1.5	0.392	DRBC	
6477	Delaware River	C&D Canal	39 33 41.7	75 32 22.7	1998	White Perch	Fillet	5	na		na	na	na	na	na	6.87		8.8	0.078	DRBC	
DE000051-FC1	Delaware River	~0.61 mi. E of Reedy Island, DE	39.5110	75.5530	10/11/00	White Perch	Fillet, Skin On	7	16.7	167	14.5	18.7	na	na	na	6.8		1.76	0.386	DRBC/EPA Coastal 2000	
DE000047-FC1	Delaware River	Near Edgemoor, ~3.9 mi. below DE/PA/NJ stateline	39.7670	75.4740	10/11/00	White Perch	Fillet, Skin On	9	15.4	154	10.1	17.1	na	na	na	21		4.09	0.513	DRBC/EPA Coastal 2002	
DE000049-FC1	Delaware River	~0.92 mi. ESE of New Castle, DE	39.6530	75.5460	10/11/00	White Perch	Fillet, Skin On	5	15.1	151	12.3	16.4	na	na	na	11		2.24	0.491	DRBC/EPA Coastal 2003	
F-2712	Delaware River	C&D Canal	39 33 41.7	75 32 22.7	10/26/00	White Perch	Fillet	5	na		na	na	na	na	na	11.24		2.4	0.473	DRBC	
F-2710	Delaware River	Deepwater	39 41 33.9	75 30 48.2	05/23/01	White Perch	Fillet	5	na		na	na	na	na	na	10.35		2.3	0.448	DRBC	
SR-WP-S04	Delaware River	Salem River			2004	White Perch	Fillet			220			177.7			16.8	D	5.04	0.333	DRBC	AXYS
RC-WP-S04	Delaware River	Raccoon Creek			2004	White Perch	Fillet			186			105.0			14.3	D	3.46	0.413	DRBC	AXYS
SR-WP-S05	Delaware River	Salem River			2005	White Perch	Fillet			190			112.4			11.9		2.62	0.454	DRBC	AXYS
RC-WP-S05	Delaware River	Raccoon Creek			2005	White Perch	Fillet			190			102.4			4.91		1.53	0.321	DRBC	AXYS
SR-WP-S06	Delaware River	Salem River			2006	White Perch	Fillet			168			82.0			8.73		3.85	0.227	DRBC	AXYS
RC-WP-S06	Delaware River	Raccoon Creek			2006	White Perch	Fillet			164			70.2			13.4		2.91	0.460	DRBC	AXYS
SR-WP-S07	Delaware River	Salem River			2007	White Perch	Fillet			160			62.0			9.23	D	2.35	0.393	DRBC	AXYS
RC-WP-S07	Delaware River	Raccoon Creek			2007	White Perch	Fillet			149			48.4			10.8		1.42	0.761	DRBC	AXYS
SR-WP-S10	Delaware River	Salem River			2010	White Perch	Fillet			189			105.3			15.1	B D	4.08	0.370	DRBC	AXYS
RC-WP-S10	Delaware River	Raccoon Creek			2010	White Perch	Fillet			220			171.6			14.5	B D	3.78	0.384	DRBC	AXYS
SR-WP-S12	Delaware River	Salem River			2012	White Perch	Fillet			193			113.6			18.4	D	4.89	0.376	DRBC	AXYS
RC-WP-S12	Delaware River	Raccoon Creek			2012	White Perch	Fillet			212			142.1			19	D	4.81	0.395	DRBC	AXYS
SR-WP-S15	Delaware River	Salem River			2015	White Perch	Fillet			219			160.9			2.87		1.3	0.221	DRBC	AXYS
RC-WP-S15	Delaware River	Raccoon Creek			2015	White Perch	Fillet			467			973.8			2.95		0.89	0.331	DRBC	AXYS
1659	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/10/91	Striped Bass	Fillet Skin On	1	55.4	554						U(10)		5.4		DNREC	DNREC
1660	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/10/91	Striped Bass	Fillet Skin On	1	55.9	559						U(10)		2.6		DNREC	DNREC
1661	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/10/91	Striped Bass	Fillet Skin On	1	60.7	607						U(10)		2.7		DNREC	DNREC
1662	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/10/91	Striped Bass	Fillet Skin On	1	51.8	518						U(10)		1.1		DNREC	DNREC
1663	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/10/91	Striped Bass	Fillet Skin On	1	55.1	551						U(10)		1.2		DNREC	DNREC
1664	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/10/91	Striped Bass	Fillet Skin On	1	52.1	521						U(10)		4.5		DNREC	DNREC
97014520	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/28/97	Striped Bass	Fillet Skin On	1	71.2	712			4082			U(10)		2.8		DNREC	MRI
97014530	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/28/97	Striped Bass	Fillet Skin On	1	83.5	835			6350			U(10)		0.8		DNREC	MRI
97015780	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	06/05/97	Striped Bass	Fillet Skin On	1	72.5	725			4082			U(10)		2.6		DNREC	MRI
97015790	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	06/05/97	Striped Bass	Fillet Skin On	1	90.0	900			7257			U(10)		4.0		DNREC	MRI
97015800	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	06/05/97	Striped Bass	Fillet Skin On	1	84.0	840			9071			U(10)		6.9		DNREC	MRI
0205026-001	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/08/02	Striped Bass	Fillet Skin On	1	66.6	666	66.6	66.6	3390	3390.0	3390.0	5.52		2.95	0.187	DNREC FY'03 Fish Tissue Data_RG Calcs	AXYS
0205053-001	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/22/02	Striped Bass	Fillet Skin On	1	66.6	666	66.6	66.6	2722	2722.0	2722.0	2.11		0.7	0.301	DNREC FY'03 Fish Tissue Data_RG Calcs	AXYS
0205053-002	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/22/02	Striped Bass	Fillet Skin On	1	61.5	615	61.5	61.5	2268	2268.0	2268.0	4.78		2.1	0.228	DNREC FY'03 Fish Tissue Data_RG Calcs	AXYS
0205053-003	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/22/02	Striped Bass	Fillet Skin On	1	60.5	605	60.5	60.5	2313	2313.0	2313.0	3.84		1.92	0.200	DNREC FY'03 Fish Tissue Data_RG Calcs	AXYS
0205053-004	Delaware River	Cherry Island Flats	39 44 30.6	75 29 44.7	05/22/02	Striped Bass	Fillet Skin On	1	65.7	657	65.7	65.7	2631	2631.0	2631.0	1.77		0.583	0.304	DNREC FY'03 Fish Tissue Data_RG Calcs	AXYS
1208016-001A	Delaware River	Port Penn	39.51323	-75.54263	8/2/2012	Striped Bass	Skin on fillet	1	49.5	495			1045			0.667		0.33	0.202	DNREC FY'12 Fish Tissue Data_RG Calcs	AXYS
1208016-002A	Delaware River	Port Penn	39.52443	-75.54203	8/2/2012	Striped Bass	Skin on fillet	1	58.6	586			1980			1.84		0.29	0.634	DNREC FY'12 Fish Tissue Data_RG Calcs	AXYS
1208016-003A	Delaware River	Port Penn	39.52443	-75.54203	8/2/2012	Striped Bass	Skin on fillet	1	57.8	578			1770			1.47		0.42	0.350	DNREC FY'12 Fish Tissue Data_RG Calcs	AXYS
Striped Bass #1 DE R	Delaware River	Bullpen - NE Side of Reedy Island	39.516892	-75.560483	8/27/2015	Striped Bass	Fillet, Skin On	1	44.2	442			796			3.39		0.78	0.435	2015 Supplemental Fish Tissue Data_RG Calcs	AXYS
Striped Bass #2 DE R	Delaware River	Bullpen - NE Side of Reedy Island	39.516892	-75.560483	8/27/2015	Striped Bass	Fillet, Skin On	1	57.5	575			1441			0.453		0.26	0.174	2015 Supplemental Fish Tissue Data_RG Calcs	AXYS
CIF-SB-2016-1	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/9/2016	Striped Bass	Fillet, skin on	1		723			4190			7.16		1.92	0.373	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs	AXYS
CIF-SB-2016-2	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/9/2016	Striped Bass	Fillet, skin on	1		803			5290			7.05		3.26	0.216	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs	AXYS
CIF-SB-2016-3	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/24/2016	Striped Bass	Fillet, skin on	1		721			5350			9.64		5.14	0.188	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs	AXYS
CIF-SB-2016-4	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/24/2016	Striped Bass	Fillet, skin on	1		657			2900			6.86		3.84	0.179	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs	AXYS
CIF-SB-2016-5	Delaware River	Cherry Island Flats	39.745080	-75.483863	5/9/2016	Striped Bass	Fillet, skin on	1		716			3700			5.53		1.4	0.395	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs	AXYS
DB069105	Delaware River	Salem	39 34 30	75 31 00	08/29/88	Weakfish	Fillet	5		na	na	na	na	na	na	<2.5	ND	1.7		EPA National Bioaccumulation Study	AXYS
5252100	Delaware River	~1.2 mi. W of Salem River Mouth, NJ	39.571	75.535	Jul-98	Weakfish	Fillet	4	10.6	106						0.50		0.5	0.093	DRBC/EPA MAIA	TDI-Brooks
5161100	Delaware River	~0.4 mi. SW of Hope Creek Mouth, NJ	39.447	75.506	Jul-98	Weakfish	Fillet	5	7.8	78						0.60		0.7	0.087	DRBC/EPA MAIA	TDI-Brooks
DE000053-FC1	Delaware River	~2 mi. NE of Woodland Beach Wildlife Area, DE	39.3740	75.4680	10/04/00	Weakfish	Fillet, Skin On	5	30.2	302	27.5	32.0	na	na	na	2		4.7	0.043	DRBC/EPA Coastal 2001	
6481	Delaware River	Reedy Island	39 30 53.8	75 33 08.3	Jan.,1998	American Shad	Fillet	5	Adult		na	na	na	na	na	13.79		48.6	0.028	DRBC	
5161120	Delaware River	~0.4 mi. SW of Hope Creek Mouth, NJ	39.447	75.506	09/04/98	Blue Crab	Meat	9	14.0	140						0.10	J	0.4	0.023	DRBC/EPA MAIA	TDI-Brooks

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.

Summary Statistics for Dieldrin in Channel Catfish, Zone 5 Delaware River

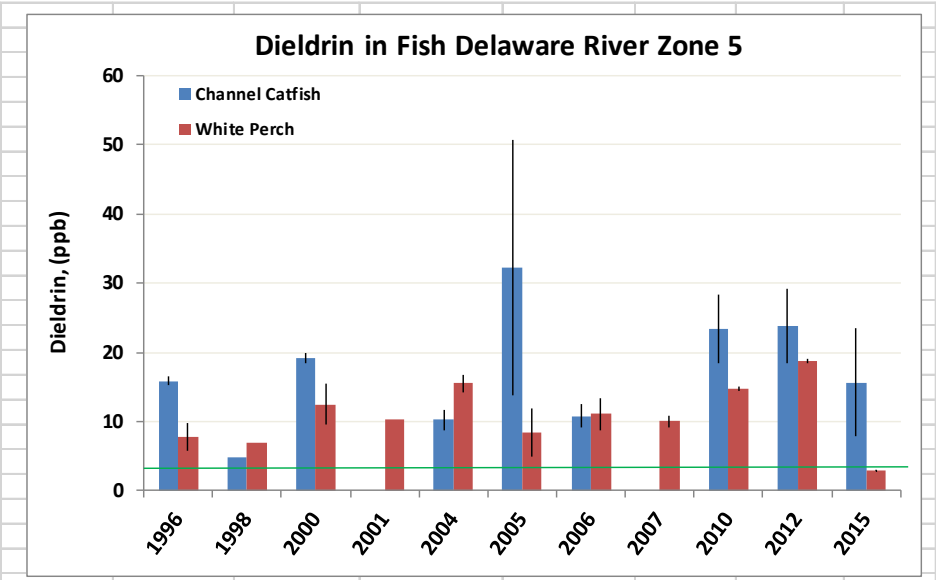
	1996	*1998*	*2000*	*2001*	*2004*	*2005*	*2006*	*2007*	*2010*	*2012*	*2015*
Mean	15.87	4.76	19.18		10.22	32.3	10.78		23.4	23.8	15.675
Standard Error	0.57	0.00	0.68		1.38	18.4	1.72		5	5.4	7.825
Median	15.87	4.76	19.71		10.22	32.3	10.78		23.4	23.8	15.675
Mode	#N/A	#N/A	#N/A		#N/A	#N/A	#N/A		#N/A	#N/A	#N/A
Standard Deviation	0.81	#DIV/0!	1.17		1.95	26.02	2.43		7.07	7.64	11.07
Sample Variance	0.66	#DIV/0!	1.38		3.81	677.12	5.92		50.00	58.32	122.46
Kurtosis	#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
Skewness	#DIV/0!	#DIV/0!	-1.61		#DIV/0!	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
Range	1.15	0.00	2.16		2.76	36.8	3.44		10	10.8	15.65
Minimum	15.30	4.76	17.84		8.84	13.9	9.06		18.4	18.4	7.85
Maximum	16.4470145	4.756754582	20		11.6	50.7	12.5		28.4	29.2	23.5
Sum	31.75	4.76	57.55		20.44	64.6	21.56		46.8	47.6	31.35
Count	2	1	3		2	2	2		2	2	2
Confidence Level(95.0%)	7.30	#NUM!	2.92		17.53	233.79	21.85		63.53	68.61	99.43

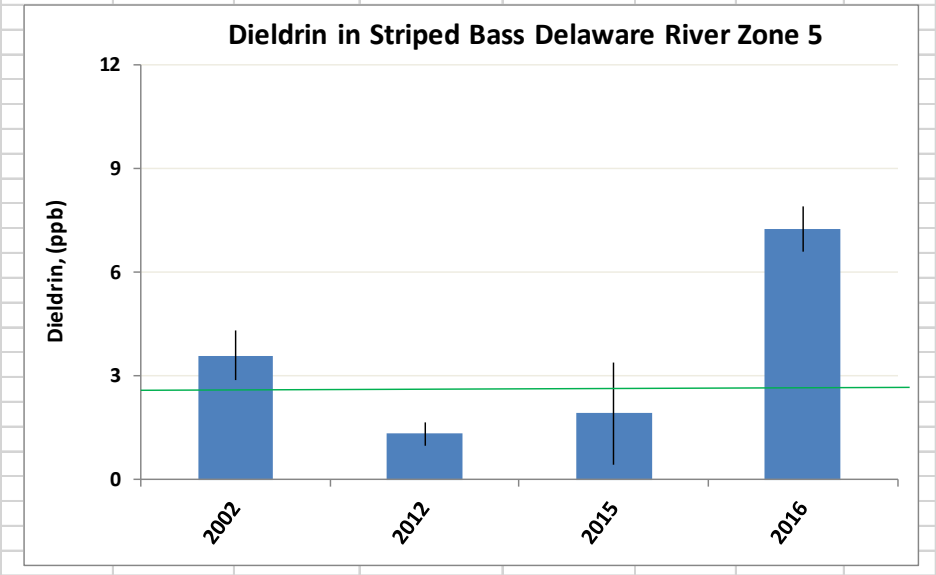
Summary Statistics for Dieldrin in White Perch, Zone 5 Delaware River

	1996	*1998*	*2000*	*2001*	*2004*	*2005*	*2006*	*2007*	*2010*	*2012*	*2015*
Mean	7.87	6.87	12.51	10.35	15.55	8.405	11.065	10.015	14.8	18.7	2.91
Standard Error	1.99	0.00	3.01	0.00	1.25	3.495	2.335	0.785	0.3	0.3	0.04
Median	7.87	6.87	11.12	10.35	15.55	8.405	11.065	10.015	14.8	18.7	2.91
Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	2.82	#DIV/0!	6.02	#DIV/0!	1.77	4.94	3.30	1.110158	0.42	0.42	0.056569
Sample Variance	7.95	#DIV/0!	36.19	#DIV/0!	3.13	24.43	10.90	1.23245	0.18	0.18	0.0032
Kurtosis	#DIV/0!	#DIV/0!	2.45	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Skewness	#DIV/0!	#DIV/0!	1.29	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Range	3.99	0.00	14.20	0.00	2.5	6.99	4.67	1.57	0.6	0.6	0.08
Minimum	5.88	6.87	6.80	10.35	14.3	4.91	8.73	9.23	14.5	18.4	2.87
Maximum	9.86716919	6.871551015	21	10.345129	16.8	11.9	13.4	10.8	15.1	19	2.95
Sum	15.75	6.87	50.04	10.35	31.1	16.81	22.13	20.03	29.6	37.4	5.82
Count	2	1	4	1	2	2	2	2	2	2	2
Confidence Level(95.0%)	25.33	#NUM!	9.57	#NUM!	15.88	44.41	29.67	9.97	3.81	3.81	0.51

Summary Statistics for Dieldrin in Striped Bass, Zone 5 Delaware River

	2002	*2012*	*2015*	*2016*
Mean	3.60	1.33	1.92	7.25
Standard Error	0.73	0.35	1.47	0.67
Median	3.84	1.47	1.92	7.05
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation	1.64	0.60	2.08	1.49
Sample Variance	2.68	0.36	4.31	2.22
Kurtosis	-2.4700177	#DIV/0!	#DIV/0!	2.54
Skewness	-0.08	-1.02	#DIV/0!	1.08
Range	3.75	1.17	2.94	4.11
Minimum	1.77	0.67	0.45	5.53
Maximum	5.52	1.84	3.39	9.64
Sum	18.02	3.98	3.84	36.24
Count	5	3	2	5
Confidence Level(95.0%)	2.03	1.49	18.66	1.85


Dieldrin in Fish Delaware River Zone 5
Channel Catfish
White Perch
Dieldrin, (ppb)
60
50
40
30
20
10
0
1996
1998
2000
2001
2004
2005
2006
2007
2010
2012
2015


Dieldrin in Striped Bass Delaware River Zone 5
Dieldrin, (ppb)
12
9
6
3
0
2002
2012
2015
2016

SEGMENT DE020-001
ARMY CREEK
LOWER ARMY CREEK
3.0 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Army Creek, Segment DE 020-001 (Route 13 to Mouth, 3 mi.)

TEQs are based on WHO 2005 TEFs

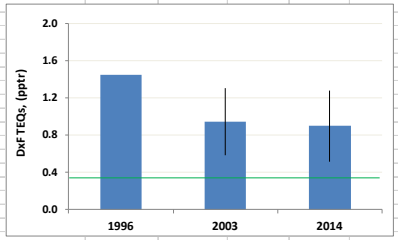
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
96028180	Army Creek	Route 9	39 39 06.4	75 35 17.4	09/03/96	Common Carp	Fillet Skin On	3	45.0	42.0	51.0	1275.0	1050.0	1700.0	1.442	6.66	21.7	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
0310028-001	Army Creek	Route 9	39 39 06.4	75 35 17.4	10/14/2003	Brown Bullhead Catfish	Edible portion skin off	5	25.4	23.5	26.5	235	160	300	1.688	3.03	55.7	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310030-001	Army Creek	Army Pond	39 39 07.4	75 36 25.3	10/15/2003	Brown Bullhead Catfish	Edible portion skin off	1	23.5	23.5	23.5	165	165	165	0.593	1.69	35.1	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310030-002	Army Creek	Army Pond	39 39 07.4	75 36 25.3	10/15/2003	Common Carp	Skin on fillet	3	50.0	48.5	52.0	1767	1550	2050	1.364	2.82	48.4	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310030-003	Army Creek	Army Pond	39 39 07.4	75 36 25.3	10/15/2003	Common Carp	Skin on fillet	4	35.2	34.5	36	560	510	610	0.111	0.32	35.2	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
ArmyCrk9-FISHBB-1014	Army Creek	Route 9	39.651811	-75.588246	10/8/2014	Brown Bullhead Catfish	Pan-dressed	3	28.3	27.5	29.3	293	260	330	0.269	0.86	31.2	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
ArmyCrk9-FISHLMB-1014	Army Creek	Route 9	39.651811	-75.588246	10/8/2014	Largemouth Bass	Fillet, skin on	1	35.0			610			2.004	0.75	267.2	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
ArmyPd-FISH-1014	Army Creek	Army Pond	39.651945	-75.607168	10/8/2014	Common Carp	Pan-dressed	5	31.2	30.8	31.6	376	350	400	0.583	1.30	44.8	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
ArmyCrk13-FISH-1014	Army Creek	Route 13	39.648890	-75.621261	10/9/2014	Green Sunfish and Pumpkinseed Sunfish	Whole organism	14	11.7	10.4	13.2	31	22	49	0.736	2.36	31.2	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Army Creek, Segment DE 020-001 (Route 13 to Mouth, 3 miles)

	1996	*2003*	*2014*
Mean	1.442	0.939	0.898
Standard Error		0.359	0.381
Median	1.442	0.979	0.660
Mode	#N/A	#N/A	#N/A
Standard Deviation		0.718	0.763
Sample Variance		0.516	0.582
Kurtosis		-3.071	2.897
Skewness		-0.202	1.606
Range		1.578	1.736
Minimum	1.442	0.111	0.269
Maximum	1.442	1.688	2.004
Sum		3.757	3.592
Count	1	4	4
Confidence Level(95.0%)		1.143	1.214



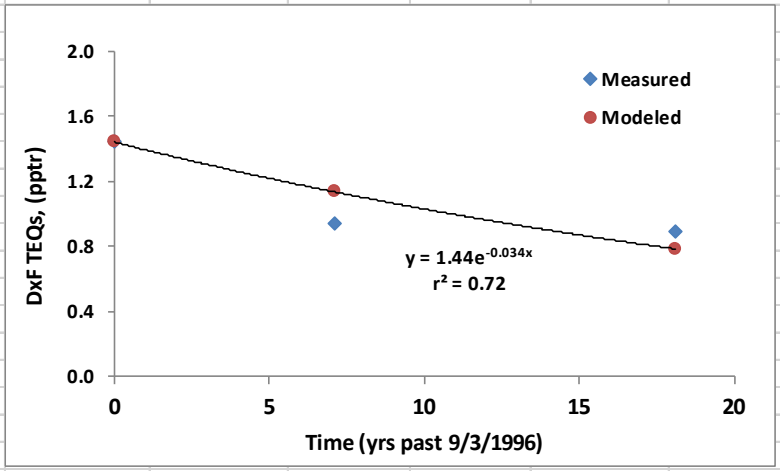
DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	37.74	%
Duration =	18.09	yr
Ave Annual % Reduction =	2.09	% per yr
% Reduction, Army Pond Carp =	57.27	%
Duration =	10.98	yr
Ave Annual % Reduction =	5.21	% per yr
% Reduction, Route 9 Brown Bullhead =	84.09	%
Duration =	10.98	yr
Ave Annual % Reduction =	7.66	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	1.442	pptr	
Lumped first order rate constant, k =	0.033549557	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	20.6	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
09/03/96	0	0.00	1.442	1.4424	0	0.121946681
10/14/2003	2597	7.11	0.939	1.1363	0.038847421	0.023718048
10/8/2014	6609	18.09	0.898	0.7860	0.012535	0.038103821
				Sum of Squares =	0.051382422	
				Sum of Squared Total =		0.18376855
				Correlation Coefficient, r =		0.84876
				Coefficient of Determination, r^2 =		0.72040



SEGMENT DE020-002
ARMY CREEK
UPPER ARMY CREEK
1.1 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Army Creek, Segment DE 020-002 (Headwaters to Route 13, 1.1 mi.)

This segment was included on Delaware's 303(d) List based on a watershed-wide fish advisory that includes dioxin and furan TEQs as a contributing risk factor. The segement was not listed based on actual fish tissue data.

This segment does not support a significant game fishery. The creek is very shallow and narrow upstream of Route 13. Fish biomass consists mostly of small prey species not targeted by fishermen. Further, public access to the creek for purposes of fishing is quite limited. For these reasons, DNREC has not collected and analyzed fish samples from this segment.

The lack of fish tissue data for the segment makes it impossible to perform a trend assessment for dioxin and furan TEQs in fish from this segement.

SEGMENT DE270-001-01
RED LION CREEK
LOWER RED LION
1.5 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Red Lion Creek, Segment DE 270-001-01 (Route 13 to Mouth, 1.5 mi.)

TEQs are based on WHO 2005 TEFs

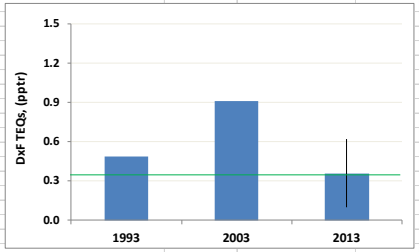
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
932632	Red Lion	Route 9	39 36 18.8	75 37 50.2	08/05/93	Brown Bullhead	Fillet Skin Off	3	23.0	22.5	24.0	158.3	150.0	165.0	0.4869	4.8	10.183	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institut
0309054-001	Red Lion	Route 9	39 36 18.8	75 37 50.2	9/23/2003	Carp	Skin on fillet	2	48.25	46.5	50.0	1600	1500	1700	0.90768	2.13	42.614	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
Red Lion Creek at Tide Gate 5CC	Red Lion	Upstream of Tide Gate	39.60664	-75.61433	9/23/2013	Channel Catfish	Fillet, skin off	5	46.9	41.5	50.8	889	597	1229	0.871	2.12	41.085	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
Red Lion Creek at Route 9 2CC	Red Lion	Route 9	39.60535	-75.62989	9/23/2013	Channel Catfish	Fillet, skin off	2	49.9	46.4	53.5	856	820	892	0.173	1.22	14.180	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
Red Lion Creek at Route 9 LMB	Red Lion	Route 9	39.60535	-75.62989	9/23/2013	Largemouth Bass	Fillet, skin on	1	33.6			609			0.026	0.44	5.909	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Red Lion Creek, Segment DE 270-001-01 (Route 13 to Mouth, 1.5 miles)

	1993	*2003*	*2013*
Mean	0.486939	0.90768	0.35666667
Standard Error			0.26064429
Median	0.486939	0.90768	0.173
Mode	#N/A	#N/A	#N/A
Standard Deviation			0.45144915
Sample Variance			0.20380633
Kurtosis			#DIV/0!
Skewness			1.52774698
Range			0.845
Minimum	0.486939	0.90768	0.026
Maximum	0.486939	0.90768	0.871
Sum	0.486939	0.90768	1.07
Count	1	1	3
Confidence Level(95.0%)			1.12146185



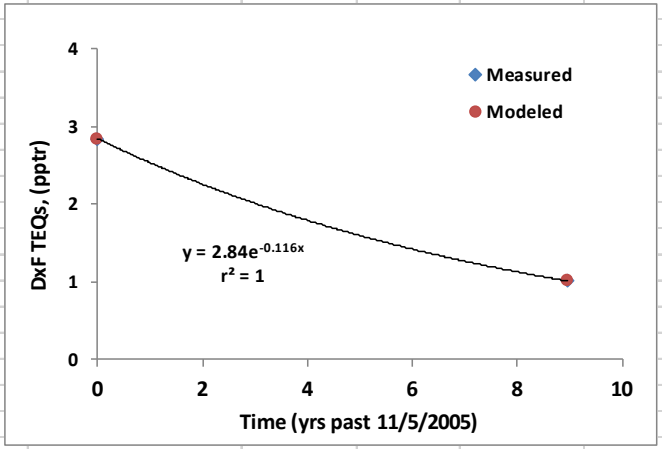
DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	60.71	%
Duration =	10.00	yr
Ave Annual % Reduction =	6.07	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	0.908	pptr	
Lumped first order rate constant, k =	0.09339624	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	7.4	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
9/23/2003	0	0.00	0.908	0.9077	0	0.075903923
9/23/2013	3653	10.00	0.357	0.3567	0	0.075903923
				Sum of Squares =	0	
					Sum of Squared Total =	0.151807847
					Correlation Coefficient, r =	1.000
					Coefficient of Determination, r^2 =	1.000



Note: An r-squared of 1 is expected in this example because the peak initial concentration is pinned and there is only 1 additional data point.

SEGMENT DE090-001
CHESAPEAKE AND DELAWARE CANAL
C7D CANAL
15.0 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, C&D Canal, Segment DE 090-001 (MD/DE Line to Del R., 15 mi.)

TEQs are based on WHO 2005 TEFs

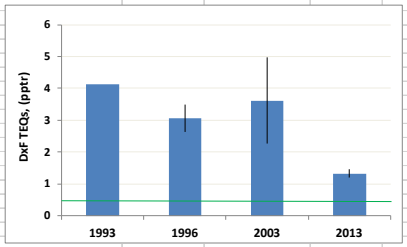
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
933208	C&D Canal	Route 13	39 33 08.0	75 39 02.5	09/20/93	Channel Catfish	Fillet Skin Off	4	42.9	40.0	44.5	827.5	640.0	1000.0	4.133	13.4	30.8	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022050	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	36.5	36.5	36.5	452.0	452.0	452.0	4.116	8.9	46.1	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022060	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	48.2	48.2	48.2	1150.0	1150.0	1150.0	5.476	16.0	34.2	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022070	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	40.0	40.0	40.0	520.0	520.0	520.0	1.755	8.6	20.4	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022080	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	40.0	40.0	40.0	590.0	590.0	590.0	3.886	11.8	32.9	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018180	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	50.5	50.5	50.5	1600.0	1600.0	1600.0	3.875	18.4	21.1	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018190	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	43.0	43.0	43.0	1050.0	1050.0	1050.0	1.564	21.8	7.2	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018200	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	42.5	42.5	42.5	900.0	900.0	900.0	4.713	15.5	30.4	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018210	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	50.0	50.0	50.0	1300.0	1300.0	1300.0	6.036	6.8	88.8	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018220	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	43.5	43.5	43.5	1000.0	1000.0	1000.0	1.273	16.5	7.7	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020520	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	43.5	43.5	43.5	950.0	950.0	950.0	1.154	18.1	6.4	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020530	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	47.0	47.0	47.0	950.0	950.0	950.0	1.193	4.9	24.5	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020540	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	42.1	42.1	42.1	700.0	700.0	700.0	2.482	15.6	15.9	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020550	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	33.5	33.5	33.5	400.0	400.0	400.0	2.564	11.1	23.1	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020560	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	32.5	32.5	32.5	650.0	650.0	650.0	2.727	8.5	32.0	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
0309061-001	C & D Canal	Rt. 9 to Rt. 13	39 33 11.0	75 37 01.9	9/29/2003	Channel Catfish	Edible portion	4	46.5	44.3	49.4	1403	650	2494	3.388	12.9	26.3	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310048-001	C & D Canal	MD/DE Border	39 32 07.5	75 46 46.1	10/28/2003	Channel Catfish	Edible portion	1	40.9	40.9	40.9	595	595	595	6.063	12.2	49.7	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310048-002	C & D Canal	MD/DE Border	39 32 07.5	75 46 46.1	10/28/2003	Channel Catfish	Edible portion	1	60.5	60.5	60.5	2268	2268	2268	1.410	11.7	12.1	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at State line 3CC	C & D Canal	MD/DE Line	39.53539	-75.77917	9/12/2013	Channel Catfish	Fillet, skin off	3	42.7	40.0	46.0	740	550	1070	0.987	3.83	25.8	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at State line 1CC	C & D Canal	MD/DE Line	39.53539	-75.77917	9/12/2013	Channel Catfish	Fillet, skin off	1	56.5			2040			0.814	3.5	23.3	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Summit Marina 2CC	C & D Canal	Near Summit Marina	39.54333	-75.71567	9/10/2013	Channel Catfish	Fillet, skin off	2	53.1	48.8	57.4	1400	1000	1800	1.670	3.6	46.4	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Summit Marina 1CC	C & D Canal	Near Summit Marina	39.54333	-75.71567	9/10/2013	Channel Catfish	Fillet, skin off	1	70.0			4550			1.562	3.4	45.9	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Rt. 13 CC	C & D Canal	Route 13	39.55115	-75.65313	9/11/2013	Channel Catfish	Fillet, skin off	4	55.3	50.2	61.2	1745	1140	2500	1.492	0.65	229.5	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Rt. 9 CC	C & D Canal	Route 9	39.55812	-75.58272	9/11/2013	Channel Catfish	Fillet, skin off	4	47.4	46.5	54.5	1288	1050	1500	1.644	4.05	40.6	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal WP	C & D Canal	Route 13 to Route 9	39.55187	-75.61882	9/11/2013	White Perch	Pan-dressed	4	17.1	15.2	19.5	60	30	90	1.073	1.87	57.4	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

C & D Canal, Segment DE 090-001 (MD/DE Line to Del R., 15 miles)

	1993	*1996*	*2003*	*2013*
Mean	4.133	3.058	3.620	1.320
Standard Error		0.437	1.348	0.133
Median	4.133	2.645	3.388	1.492
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation		1.637	2.335	0.352
Sample Variance		2.679	5.453	0.124
Kurtosis		-1.012	#DIV/0!	-1.997
Skewness		0.458	0.444	-0.460
Range		4.882	4.653	0.856
Minimum	4.133	1.154	1.410	0.814
Maximum	4.133	6.036	6.063	1.670
Sum	4.133	42.814	10.861	9.242
Count	1	14	3	7
Confidence Level(95.0%)		0.945	5.801	0.326



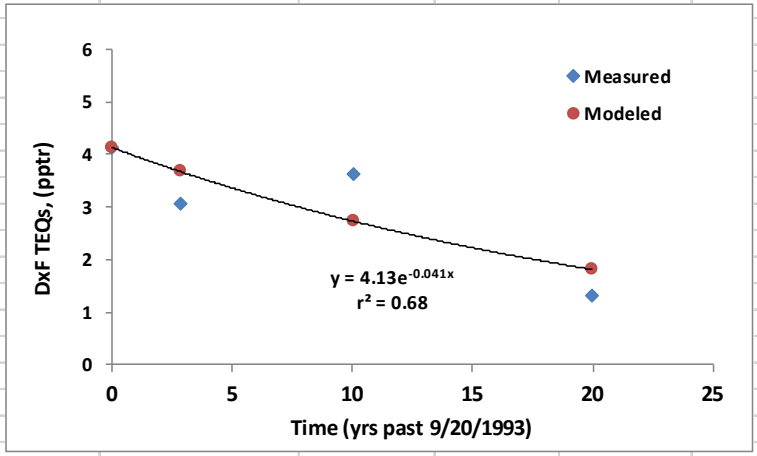
DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	68.06	%
Duration =	19.98	yr
Ave Annual % Reduction =	3.41	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	4.133	pptr	
Lumped first order rate constant, k =	0.041249929	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	16.8	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
09/20/93	0	0.00	4.133	4.1333	0	1.210587769
07/16/96	1030	2.82	3.058	3.6794	0.385987641	0.000629624
9/29/2003	3661	10.02	3.620	2.7336	0.786546162	0.345065431
9/11/2013	7296	19.98	1.320	1.8132	0.24298094	2.933622695
				Sum of Squares =	1.415514742	
				Sum of Squared Total =		4.489905519
				Correlation Coefficient, r =		0.82749
				Coefficient of Determination, r^2 =		0.68473



SEGMENT DE090-001
CHESAPEAKE AND DELAWARE CANAL
C&D CANAL
15.0 MILES

DIELDRIN

Dieldrin in Fish Samples, C&D Canal, Segment DE 090-001 (MD/DE Line to Del R., 15 mi.)

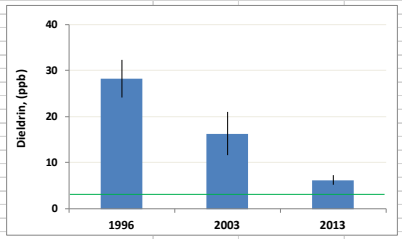
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
933208	C & D Canal	Route 13	39 33 08.0	75 39 02.5	09/20/93	Channel Catfish	Fillet Skin Off	4	42.9	40.0	44.5	827.5	640.0	1000.0	U(13.3 empc)	13.4		DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022050	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	36.5	36.5	36.5	452.0	452.0	452.0	U(10)	8.9		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022060	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	48.2	48.2	48.2	1150.0	1150.0	1150.0	U(10)	16.0		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022070	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	40.0	40.0	40.0	520.0	520.0	520.0	U(10)	8.6		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96022080	C & D Canal	Route 9	39 33 29.1	75 34 56.9	07/23/96	Channel Catfish	Fillet Skin Off	1	40.0	40.0	40.0	590.0	590.0	590.0	U(10)	11.8		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018180	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	50.5	50.5	50.5	1600.0	1600.0	1600.0	U(10)	18.4		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018190	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	43.0	43.0	43.0	1050.0	1050.0	1050.0	U(10)	21.8		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018200	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	42.5	42.5	42.5	900.0	900.0	900.0	32.33	15.5	0.21	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018210	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	50.0	50.0	50.0	1300.0	1300.0	1300.0	U(10)	6.8		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96018220	C & D Canal	Route 13	39 33 08.0	75 39 02.5	07/02/96	Channel Catfish	Fillet Skin Off	1	43.5	43.5	43.5	1000.0	1000.0	1000.0	U(10)	16.5		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020520	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	43.5	43.5	43.5	950.0	950.0	950.0	U(10)	18.1		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020530	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	47.0	47.0	47.0	950.0	950.0	950.0	U(10)	4.9		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020540	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	42.1	42.1	42.1	700.0	700.0	700.0	24.20	15.6	0.15	DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020550	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	33.5	33.5	33.5	400.0	400.0	400.0	U(10)	11.1		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
96020560	C & D Canal	Route 896	39 32 27.0	75 44 19.4	07/16/96	Channel Catfish	Fillet Skin Off	1	32.5	32.5	32.5	650.0	650.0	650.0	U(10)	8.5		DNREC FY'97 Fish Tissue Data_RG Calcs	Midwest Research Institute
0309061-001	C & D Canal	Rt. 9 to Rt. 13	39 33 11.0	75 37 01.9	9/29/2003	Channel Catfish	Edible portion skin off	4	46.5	44.3	49.4	1403	650	2494	24.4	12.9	0.19	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310048-001	C & D Canal	MD/DE Border	39 32 07.5	75 46 46.1	10/28/2003	Channel Catfish	Edible portion skin off	1	40.9	40.9	40.9	595	595	595	16.3	12.2	0.13	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
0310048-002	C & D Canal	MD/DE Border	39 32 07.5	75 46 46.1	10/28/2003	Channel Catfish	Edible portion skin off	1	60.5	60.5	60.5	2268	2268	2268	8.18	11.7	0.07	DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at State line 3CC	C & D Canal	MD/DE Line	39.53539	-75.77917	9/12/2013	Channel Catfish	Fillet, skin off	3	42.7	40.0	46.0	740	550	1070	5.05	3.83	0.13	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at State line 1CC	C & D Canal	MD/DE Line	39.53539	-75.77917	9/12/2013	Channel Catfish	Fillet, skin off	1	56.5			2040			7.28	3.5	0.21	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Summit Marina 2CC	C & D Canal	Near Summit Marina	39.54333	-75.71567	9/10/2013	Channel Catfish	Fillet, skin off	2	53.1	48.8	57.4	1400	1000	1800	8.93	3.6	0.25	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Summit Marina 1CC	C & D Canal	Near Summit Marina	39.54333	-75.71567	9/10/2013	Channel Catfish	Fillet, skin off	1	70.0			4550			7.96	3.4	0.23	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Rt. 13 CC	C & D Canal	Route 13	39.55115	-75.65313	9/11/2013	Channel Catfish	Fillet, skin off	4	55.3	50.2	61.2	1745	1140	2500	1.15	0.65	0.18	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal at Rt. 9 CC	C & D Canal	Route 9	39.55812	-75.58272	9/11/2013	Channel Catfish	Fillet, skin off	4	47.4	46.5	54.5	1288	1050	1500	7.61	4.05	0.19	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
C and D Canal WP	C & D Canal	Route 13 to Route 9	39.55187	-75.61882	9/11/2013	White Perch	Pan-dressed	4	17.1	15.2	19.5	60	30	90	5.66	1.87	0.30	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.

Summary Statistics - Dieldrin in Fish (ppb)
C & D Canal, Segment DE 090-001 (MD/DE Line to Del R., 15 miles)

	1996	*2003*	*2013*
Mean	28.265	16.293	6.234
Standard Error	4.061	4.682	0.986
Median	28.265	16.300	7.280
Mode	#N/A	#N/A	#N/A
Standard Deviation		8.110	2.608
Sample Variance		65.772	6.802
Kurtosis		#DIV/0!	2.031
Skewness		-0.004	-1.378
Range		16.220	7.780
Minimum	28.265	8.180	1.150
Maximum	28.265	24.400	8.930
Sum	28.265	48.880	43.640
Count	2	3	7
Confidence Level(95.0%)		20.146	2.412

Note: The 1996 mean considers only the two samples with reported concentrations.



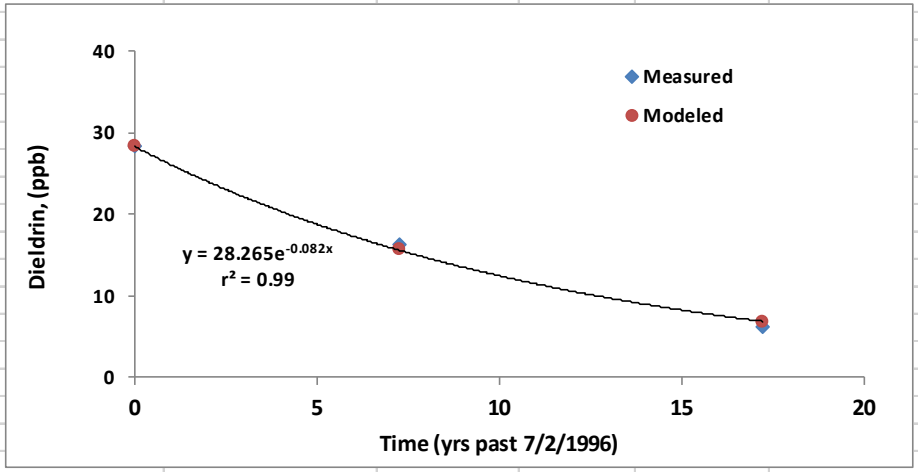
DE Fish Tissue Screening Value =	3	ppb
% Reduction from Peak, All Samples =	77.94	%
Duration =	17.19	yr
Ave Annual % Reduction =	4.53	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	28.265	pptr	
Lumped first order rate constant, k =	0.082063756	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER
Half-life for exponential loss, $t_{1/2}$ =	8.4	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
07/02/96	0	0.00	28.265	28.2650	0	128.4624345
9/29/2003	2645	7.24	16.293	15.6012	0.478998809	0.406456847
9/11/2013	6280	17.19	6.234	6.8940	0.435159103	114.4169799
				Sum of Squares =	0.914157913	
				Sum of Squared Total =		243.2858712
				Correlation Coefficient, r =		0.99812
				Coefficient of Determination, r^2 =		0.99624



SEGMENT DE010-001-01
APPOQUINIMINK RIVER
LOWER APPOQUINIMINK RIVER
7.1 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Appoquinimink River, Segment DE 010-001-01 (Saline Tidal Reach, 7.1 mi.)

TEQs are based on WHO 2005 TEFs

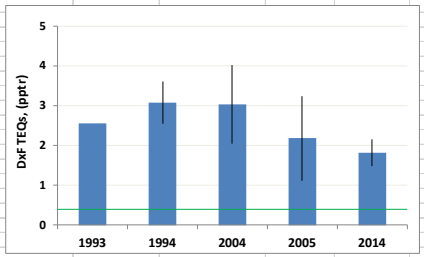
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
932631	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	08/04/93	Channel Catfish	Fillet Skin Off	4	34.0	32.0	35.0	375.0	310.0	425.0	2.561	6.6	39.0	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034320	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	38.2	38.2	38.2	500.0	500.0	500.0	3.300	6.5	50.8	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034330	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	38.2	38.2	38.2	700.0	700.0	700.0	4.138	3.3	124.3	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034340	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	42.5	42.5	42.5	700.0	700.0	700.0	4.161	8.4	49.6	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034350	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	35.5	35.5	35.5	450.0	450.0	450.0	6.140	5.5	111.6	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034360	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	41.0	41.0	41.0	550.0	550.0	550.0	2.769	3.2	87.6	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034270	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	47.3	47.3	47.3	1000.0	1000.0	1000.0	0.265	1.3	20.9	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034280	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	46.3	46.3	46.3	1000.0	1000.0	1000.0	2.297	7.5	30.6	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034290	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	45.2	45.2	45.2	825.0	825.0	825.0	4.120	9.8	42.1	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034300	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	44.1	44.1	44.1	850.0	850.0	850.0	1.524	6.5	23.4	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034310	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	42.6	42.6	42.6	900.0	900.0	900.0	2.023	6.7	30.2	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
0411021-001	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	11/16/2004	White Perch	Edible Portion/Skin on	5	17.9	17.5	18.5	97	84	105	2.035	3.31	61.5	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0411021-002	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	11/16/2004	Channel Catfish	Edible Portion/Skin off	1	42.0	42.0	42.0	970	970	970	4.018	11.5	34.9	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-002	Appoquinimink	East of Route 9	39 26 80.4	75 36 15.0	11/9/2005	Channel Catfish	Edible Portion/Skin off	1	54.0	54.0	54.0	1700	1700	1700	3.845	9.64	39.9	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-003	Appoquinimink	East of Route 9	39 26 80.4	75 36 15.0	11/9/2005	American Eel	Edible Portion/Skin off	2	50.5	43.5	57.5	244	139	349	0.211	2.69	7.9	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-001	Appoquinimink	Above Odessa	30 26 42.1	75 39 88.5	11/9/2005	White Catfish	Edible Portion/Skin off	2	45.3	42.5	48.0	1312.5	1100	1525	2.466	2.24	110.1	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoRMouth-CC-1014	Appoquinimink	Mouth	39.449126	-75.578927	10/28/2014	Channel Catfish	Fillet, skin off	1	44.5			794			3.511	2.08	168.8	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR9-CC-1014	Appoquinimink	Route 9	39.465000	-75.611364	10/28/2014	Channel Catfish	Fillet, skin off	2	46.0	44.1	47.9	940	712	1170	1.611	2.79	57.7	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR299-CC-1014	Appoquinimink	Route 299	39.452991	-75.653966	10/27/2014 an	Channel Catfish	Fillet, skin off	3	46.7	43.8	52.0	978	674	1530	2.234	3.94	56.7	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoTidal-WC-1014	Appoquinimink	Route 299, Route 9 and Mouth			10/28/2014	White Catfish	Fillet, skin off	7	44.4	39.0	53.0	1282	833	2000	0.727	0.88	82.7	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoRMouth-WP-1014	Appoquinimink	Mouth	39.449126	-75.578927	10/27/2014	White Perch	Pan-dressed	10	17.9	16.7	20.0	92.5	50	125	1.389	4.09	34.0	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR9-WP-1014	Appoquinimink	Route 9	39.465000	-75.611364	10/27/2014	White Perch	Pan-dressed	10	17.3	15.0	20.5	88	50	125	2.028	3.98	51.0	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR299-WP-1014	Appoquinimink	Route 299	39.452991	-75.653966	10/27/2014	White Perch	Pan-dressed	10	18.3	32.0	38.5	633	496	770	1.255	2.67	47.0	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Appoquinimink River, Segment DE 010-001-01 (Saline Tidal Reach, 7.1 miles)

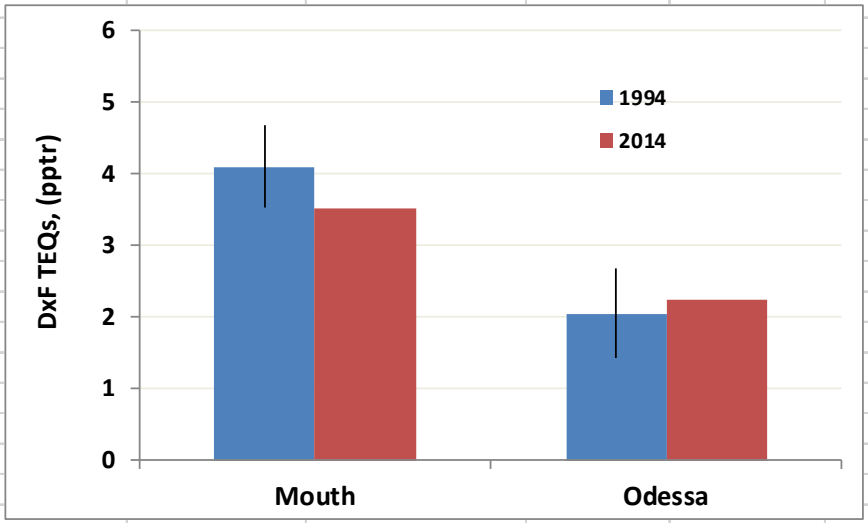
	1993	*1994*	*2004*	*2005*	*2014*
Mean	2.561	3.074	3.027	2.174	1.822
Standard Error		0.527	0.992	1.059	0.339
Median	2.561	3.034	3.027	2.466	1.611
Mode	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation		1.665	1.403	1.834	0.896
Sample Variance		2.772	1.968	3.364	0.803
Kurtosis		0.256	#DIV/0!	#DIV/0!	1.656
Skewness		0.148	#DIV/0!	-0.698	1.074
Range		5.875	1.984	3.633	2.784
Minimum	2.561	0.265	2.035	0.211	0.727
Maximum	2.561	6.140	4.018	3.845	3.511
Sum	2.561	30.737	6.053	6.522	12.755
Count	1	10	2	3	7
Confidence Level(95.0%)		1.191	12.603	4.557	0.829



DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	40.72	%
Duration =	20.08	yr
Ave Annual % Reduction =	2.03	% per yr
% Reduction Channel Catfish Only =	20.23	%
Duration =	20.08	yr
Ave Annual % Reduction =	1.01	% per yr
% Reduction White Catfish Only =	70.51	%
Duration =	8.97	yr
Ave Annual % Reduction =	7.86	% per yr
% Reduction White Perch Odessa =	38.30	%
Duration =	9.94	yr
Ave Annual % Reduction =	3.85	% per yr

Careful inspection of the channel catfish data suggests a spatial effect in addition to the temporal effect addressed above. Below are mean and standard errors for DxF TEQs in channel catfish collected near the mouth of the Appoquinimimink River and at Odessa (a.k.a. Route 299), both in 1994 and 2014. The data are also plotted.

	Year	Mean	St. Error
Mouth	1994	4.101	0.573
Odessa	1994	2.046	0.625
Mouth	2014	3.511	
Odessa	2014	2.234	



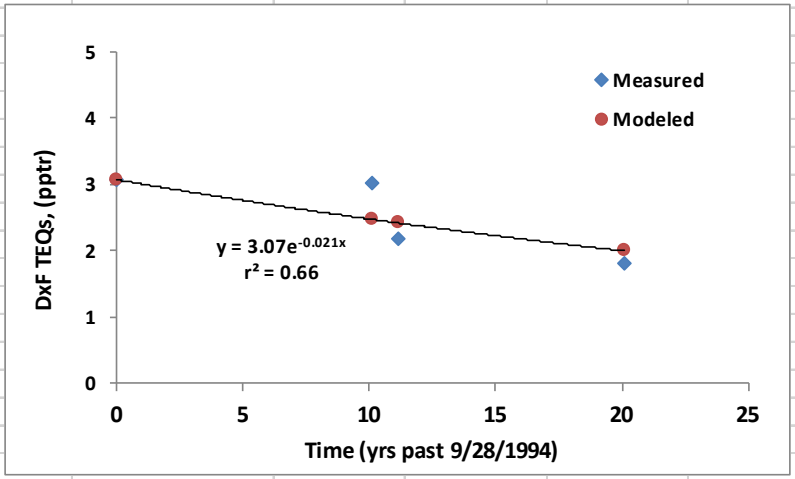
The above spatial effect is not related to the size of the fish as the more contaminated fish are similar in size or slightly smaller than the less contaminated fish. This pattern suggests the fish in the tidal Appo are being contaminated by dioxin and furan TEQ entering from the tidal Delaware River. Support for this position will be presented in the evaluation of segment DE010-001-02 (Upper Appoquinimink River).

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	3.074	pptr	
Lumped first order rate constant, k =	0.021398262	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	32.3	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
09/28/94	0	0.00	3.074	3.0737	0	0.302012122
11/16/2004	3702	10.14	3.027	2.4744	0.304864162	0.252418516
11/9/2005	4060	11.12	2.174	2.4230	0.061976329	0.122527071
10/28/2014	7335	20.08	1.822	2.0000	0.031621503	0.492706173
				Sum of Squares =	0.398461993	
				Sum of Squared Total =		1.169663882
				Correlation Coefficient, r =		0.81200
				Coefficient of Determination, r^2 =		0.65934



SEGMENT DE010-001-01
APPOQUINIMINK RIVER
LOWER APPOQUINIMINK RIVER
7.1 MILES

DIELDRIN

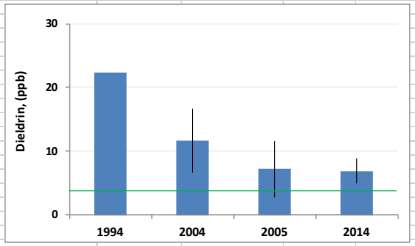
Dieldrin in Fish Samples, Appoquinimink River, Segment DE 010-001-01 (Saline Tidal Reach, 7.1 mi.)

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
932631	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	08/04/93	Channel Catfish	Fillet Skin Off	4	U(206 empc)	6.6		DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034320	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	22.4	6.5	0.34	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034330	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	U(16.4 empc)	3.3		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034340	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	U(37 empc)	8.4		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034350	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	U(15 empc)	5.5		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034360	Appoquinimink	1.5 mi. from Mouth	39 26 50.2	75 36 07.4	09/28/94	Channel Catfish	Fillet Skin Off	1	U(19 empc)	3.2		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034270	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	U(21.9 empc)	1.3		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034280	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	U(19.3)	7.5		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034290	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	U(25.8)	9.8		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034300	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	U(4.18 empc)	6.5		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94034310	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	09/27/94	Channel Catfish	Fillet Skin Off	1	U(28.4 empc)	6.7		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
0411021-001	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	11/16/2004	White Perch	Edible Portion/Skin on	5	6.68	3.31	0.20	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0411021-002	Appoquinimink	Odessa	39 27 09.0	75 39 19.0	11/16/2004	Channel Catfish	Edible Portion/Skin off	1	16.7	11.5	0.15	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-002	Appoquinimink	East of Route 9	39 26 80.4	75 36 15.0	11/9/2005	Channel Catfish	Edible Portion/Skin off	1	16	9.64	0.17	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-003	Appoquinimink	East of Route 9	39 26 80.4	75 36 15.0	11/9/2005	American Eel	Edible Portion/Skin off	2	3.21	2.69	0.12	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-001	Appoquinimink	Above Odessa	30 26 42.1	75 39 88.5	11/9/2005	White Catfish	Edible Portion/Skin off	2	2.31	2.24	0.10	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoRMouth-CC-1014	Appoquinimink	Mouth	39.449126	-75.578927	10/28/2014	Channel Catfish	Fillet, skin off	1	6.34	2.08	0.30	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR9-CC-1014	Appoquinimink	Route 9	39.465000	-75.611364	10/28/2014	Channel Catfish	Fillet, skin off	2	3.13	2.79	0.11	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR299-CC-1014	Appoquinimink	Route 299	39.452991	-75.653966	10/27/2014 anc	Channel Catfish	Fillet, skin off	3	5.3	3.94	0.13	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoTidal-WC-1014	Appoquinimink	Route 299, Route 9 and Mouth			10/28/2014	White Catfish	Fillet, skin off	7	1.25	0.88	0.14	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoRMouth-WP-1014	Appoquinimink	Mouth	39.449126	-75.578927	10/27/2014	White Perch	Pan-dressed	10	13.4	4.09	0.33	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR9-WP-1014	Appoquinimink	Route 9	39.465000	-75.611364	10/27/2014	White Perch	Pan-dressed	10	14.7	3.98	0.37	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical
AppoR299-WP-1014	Appoquinimink	Route 299	39.452991	-75.653966	10/27/2014	White Perch	Pan-dressed	10	4.07	2.67	0.15	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.

Summary Statistics - Dieldrin in Fish (ppb)
Appoquinimink River, Segment DE 010-001-01 (Saline Tidal Reach, 7.1 miles)

	1994	*2004*	*2005*	*2014*
Mean	22.40	11.69	7.17	6.88
Standard Error		5.01	4.42	1.95
Median	22.40	11.69	3.21	5.30
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation		7.09	7.66	5.17
Sample Variance		50.20	58.64	26.68
Kurtosis		#DIV/0!	#DIV/0!	-0.94
Skewness		#DIV/0!	1.71	0.84
Range		10.02	13.69	13.45
Minimum	22.40	6.68	2.31	1.25
Maximum	22.40	16.70	16.00	14.70
Sum	22.40	23.38	21.52	48.19
Count	1	2	3	7
Confidence Level(95.0%)		63.66	19.02	4.78



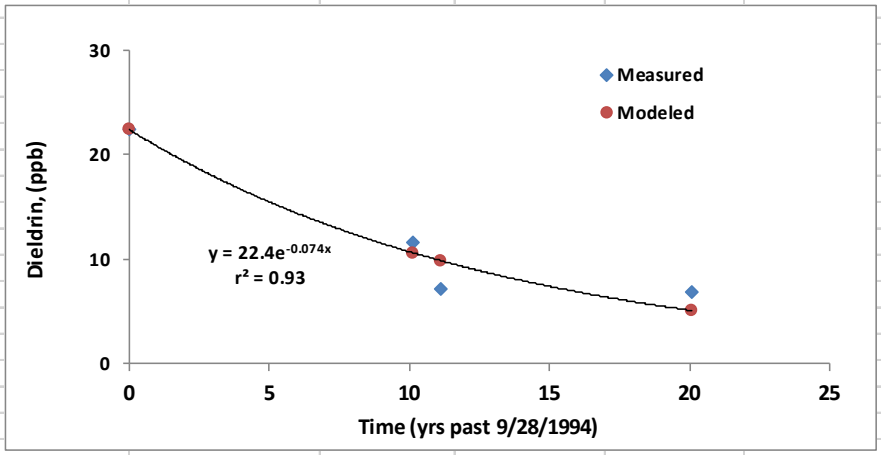
DE Fish Tissue Screening Value =	3	ppb
% Reduction from Peak, All Samples =	69.27	%
Duration =	20.08	yr
Ave Annual % Reduction =	3.45	% per yr
% Reduction Channel Catfish Only =	78.02	%
Duration =	20.08	yr
Ave Annual % Reduction =	3.89	% per yr
% Reduction White Catfish Only =	45.89	%
Duration =	8.97	yr
Ave Annual % Reduction =	5.12	% per yr
% Reduction White Perch Odessa =	39.07	%
Duration =	9.94	yr
Ave Annual % Reduction =	3.93	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	22.40	pptr	
Lumped first order rate constant, k =	0.073627525	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	9.4	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
09/28/94	0	0.00	22.40	22.4000	0	107.3937429
11/16/2004	3702	10.14	11.69	10.6207	1.143345383	0.120342914
11/9/2005	4060	11.12	7.17	9.8813	7.332938859	23.65432704
10/28/2014	7335	20.08	6.88	5.1062	3.161451942	26.54948305
				Sum of Squares =	11.63773618	
				Sum of Squared Total =		157.7178959
				Correlation Coefficient, r =		0.96240
				Coefficient of Determination, r^2 =		0.92621



SEGMENT DE010-001-02
APPOQUINIMINK RIVER
UPPER APPOQUINIMINK RIVER
6.1 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Appoquinimink River, Segment DE 010-001-02 (Tidal Freshwater, 6.1 mi.)

This segment was included on Delaware's 303(d) List based on a fish advisory that covers the entire tidal portion of the mainstem Appoquinimink River, which includes two segments (DE 010-001-01 and DE 010-001-02). Although there is a modest amount of fish tissue data for the lower saline tidal segment (DE010-001-01), there is no fish tissue data for the upper freshwater tidal segment (DE010-001-02). Nevertheless, water and fish are expected to readily exchange between these segments and so the advisory was conservatively extended upstream to the freshwater tidal segment.

There is no fish tissue data for the upper freshwater tidal segment for good reason. The segment is largely inaccessible from land due to extensive freshwater wetlands and intertidal mudflats. Further, access by boat travelling from the lower segment to the upper segment is difficult and dangerous. The bridge at Route 299 in Odessa has very low clearance. Further, there are partially submerged pilings in the water and strong currents on a 90 degree bend in the River at this location. All of these factors effectively limit safe navigation by water between the lower and upper segments. With limited access by land or water, there is little to no recreational fishing in the upper freshwater tidal segment of the Appoquinimink River. As such, DNREC has not made collecting fish under it's monitoring and advisory program a priority for this segment.

The lack of fish tissue data for the segment makes it impossible to perform a trend assessment for dioxin and furan TEQs in fish from this segement. As such, conclusions drawn from the lower saline tidal segement are extented to the upper freshwater tidal segement, with some important caveats as explained below.

Outflow from Noxontown Pond and Silver Lake Middletown serve as the main tributary inputs to the upper tidal freshwater segment of the Appoquinimink River. Dams at the base of these ponds create the head of tide for the tidal Appoquinimink River. Largemouth bass samples collected in 2014 from these ponds had extremely low dioxin and furan TEQ concentrations. A five fish composite of adult largemouth bass from Noxontown Pond had a dioxin and furan TEQ concentration of 0.00834 pptr ww. A five fish composite of adult largemouth bass from Silver Lake Middletown had a TEQ concentration of 0.00185 pptr ww. These levels are exceedingly low and certainly lower than Delaware's fish tissue screening value of 0.35 pptr ww. Low TEQ concentrations in the fish from Noxontown Pond and Silver Middletown implies that water flowing from these ponds into the upper freshwater tidal segment of the Appoquinimink River is likewise low in TEQ content. This means that TEQ concentrations in fish that reside in the Appoquinimink River directly below the head of tide are likely to be less contaminated than fish that reside in the Appoquinimink River further downstream, say at Odessa (Route 299), Route 9 and the mouth, which are all in the saline tidal segment.

Recall that it was previously demonstrated that dioxin and furan TEQ concentrations in channel catfish collected at Odessa are consistently less contaminated than channel catfish collected further downstream at the mouth of the Appoquinimink River. Hence, there appears to be a decreasing gradient of dioxin and furan TEQs in fish going from the fresh nontidal headwaters, down through the tidal freshwater segment, and finally down through the tidal saline segment to the Delaware River. This gradient suggests that tidal transport of dioxin and furan TEQs from the Delaware River into the Appoquinimink River has a strong influence on conditions in the tidal Appoquinimink River, not the other way around. So dioxin and furan TEQ levels in fish from the tidal Appoquinimink River are expected to depend in large part on conditions in the Delaware River.

There is evidence that dioxin and furan TEQ concentrations in fish collected from the Delaware River are dropping (Greene, 2008). It was also demonstrated that dioxin and furan TEQ concentrations in fish from the lower saline tidal segment of the Appoquinimink River are also dropping (see tab DE010-001DxF). Hence, these drops are occurring together, supporting the idea that conditions in the Delaware River affect conditions in the Appoquinimink River. The rate of improvement in the Appoquinimink River fish appears to be slower than the Delaware River fish. This may be explained and understood by recognizing that the tidal Appoquinimink is characterized by extensive tidal wetlands which act to trap particle-reactive contaminants like dioxins and furans, PCBs, and organochlorine pesticides in the marsh sediments. Once incorporated into the marsh sediments, these contaminants can act as an ongoing source of contamination in the system through bioturbation, resuspension, and food chain transfer.

Ultimately, the rate of improvement of dioxin and furan TEQs in fish in the tidal Appoquinimink will depend on: 1) continued improvement in the Delaware River; 2) sedimentation and incorporation of cleaner sediments on the marsh; and 3) decay. This will take time.

SEGMENT DE010-001-03
APPOQUINIMINK RIVER
DRAWYER CREEK
5.45 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Drawyer Creek, Segment DE 010-001-03 (Tidal Portion, 5.45 mi.)

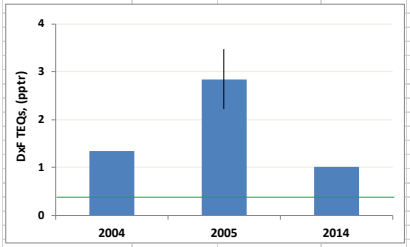
TEQs are based on WHO 2005 TEFs

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
98042940	Drawyer Creek	Route 13	39 28 21.0	75 39 03.0	09/16/98	Channel Catfish	Fillet Skin Off	1	39.0	39.0	39.0	525.0	525.0	525.0	NT	2.2		DNREC FY'99 Fish Tissue Data_RG Calcs	Midwest Research Institute
98042950	Drawyer Creek	Route 13	39 28 21.0	75 39 03.0	09/16/98	Channel Catfish	Fillet Skin Off	1	43.0	43.0	43.0	800.0	800.0	800.0	NT	3.7		DNREC FY'99 Fish Tissue Data_RG Calcs	Midwest Research Institute
98042960	Drawyer Creek	Route 13	39 28 21.0	75 39 03.0	09/16/98	Channel Catfish	Fillet Skin Off	1	44.5	44.5	44.5	950.0	950.0	950.0	NT	3.5		DNREC FY'99 Fish Tissue Data_RG Calcs	Midwest Research Institute
98042970	Drawyer Creek	Route 13	39 28 21.0	75 39 03.0	09/16/98	Channel Catfish	Fillet Skin Off	1	55.0	55.0	55.0	1350.0	1350.0	1350.0	NT	4.8		DNREC FY'99 Fish Tissue Data_RG Calcs	Midwest Research Institute
0411021-003	Drawyer Creek	Route 1/Route 13	39 28 19.9	75 39 02.7	11/16/2004	White Perch	Edible Portion/Skin on	5	19.3	17.1	21.8	121	85	163	1.351	2.5	54.0	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-004	Drawyer Creek	Route 1/Route 13	39 28 19.9	75 39 02.7	11/9/2005	Channel Catfish	Edible Portion/Skin off	3	45.8	40.0	51.5	1224.3	750	1598	3.467	3.5	99.1	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511014-005	Drawyer Creek	Route 1/Route 13	39 28 19.9	75 39 02.7	11/9/2005	White Catfish	Edible Portion/Skin off	2	39.5	36.0	43.0	837.5	575	1100	2.216	2.39	92.7	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
DrawyerCrk13-CC-1014	Drawyer Creek	Route 13	39.470221	-75.651824	10/28/2014	Channel Catfish	Fillet, skin off	4	39.3	30.8	43.9	568	325	790	1.009	3.58	28.2	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.
NT = Sample not tested for dioxins and furans due to budget constraint.

Summary Statistics - DxF TEQs in Fish (pptr)
Drawyer Creek, Segment DE 010-001-03 (Tidal Reach, 5.45 miles)

	2004	*2005*	*2014*
Mean	1.351	2.842	1.009
Standard Error		0.625	0.000
Median	1.351	2.842	1.009
Mode	#N/A	#N/A	#N/A
Standard Deviation		0.885	
Sample Variance		0.782	
Kurtosis		#DIV/0!	
Skewness		#DIV/0!	
Range		1.251	
Minimum	1.351	2.216	1.009
Maximum	1.351	3.467	1.009
Sum	1.351	5.684	1.009
Count	1	2	1
Confidence Level(95.0%)		7.947	



DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	64.50	%
Duration =	8.97	yr
Ave Annual % Reduction =	7.19	% per yr
% Reduction Channel Catfish Only =	70.90	%
Duration =	8.97	yr
Ave Annual % Reduction =	7.91	% per yr

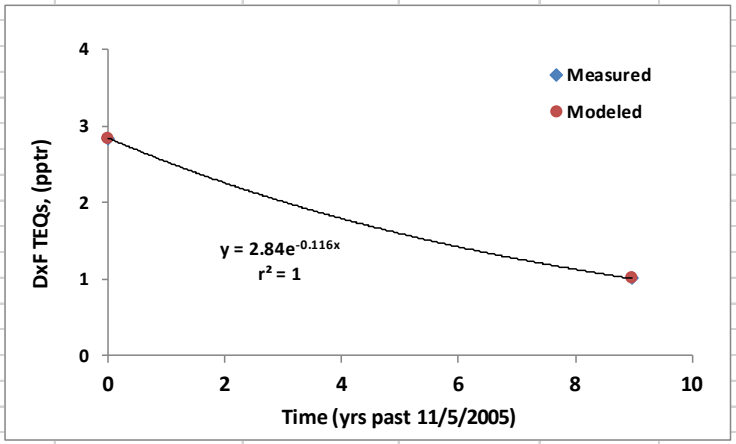
Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	2.842	pptr	
Lumped first order rate constant, k =	0.115503111	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	6.0	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
11/9/2005	0	0.00	2.842	2.8419	0	0.839985631
10/28/2014	3275	8.97	1.009	1.0088	1.9722E-31	0.839985631

Sum of Squares =	1.9722E-31
Sum of Squared Total =	1.679971262
Correlation Coefficient, r =	1.000
Coefficient of Determination, r^2 =	1.000



Note: An r-squared of 1 is expected in this example because the peak initial concentration is pinned and there is only 1 additional data point.

Additional Comments: Drawyer Creek is a major tributary to the saline tidal reach of the Appoquinimink River. Conditions in Drawyer Creek are influenced by freshwater inflows, tidal pumping from the Appoquinimink River, and fate processes along Drawyer Creek. The mainstem Drawyer Creek is tidal up to Shallcross Lake. Previous testing of adult largemouth bass from Shallcross Lake (6/28/2005) indicates very low concentrations of DxF TEQs (0.012 pptr ww). Drawyers Creek also receives significant freshwater inflow from Dove Nest Branch, which is the main inflow besides Shallcross Lake. Previous testing of whole body sunfish collected from Dove Nest Branch downstream from Middletown (10/30/2014) also indicates very low levels of DxF TEQs in fish (0.088 pptr ww). Hence, the main fresh-water inflows into Drawyer Creek have very low DxF concentrations in fish.

As previously noted, the saline tidal reach of the Appoquinimink River (DE 010-001) has slightly elevated concentrations of DxF TEQs in fish. The distance between Route 13/Route 1 on Drawyer Creek and the confluence of Drawyer Creek and the Appoquinimink River is easily within a tidal excursion. Hence, any contamination in the saline tidal Appoquinimink River is able to be transported upstream in Drawyer Creek to at least Route 13/Route 1. Further, the extensive tidal wetlands along Drawyers Creek act to trap contamination associated with particles that get transported and settle there. In this way, the marsh serves as both sink and source of contamination to the foodchain in the tidal Drawyer Creek. At the same time, the clean inflow from Shallcross Lake and Dove Nest Branch act to dilute and reduce the concentration of DxF TEQs in the fish in Drawyers Creek. For this conceptual model to be true, DxF TEQ concentrations in fish from Drawyer Creek should be less than concentrations in fish from the saline tidal segement of the Appoquinimink River. This is indeed true. As noted above, the DxF TEQ concentration in channel catfish collected from Drawyer Creek on 10/28/2014 was 1 pptr ww. In contrast, DxF TEQs in a channel catfish sample collected near the mouth of the Appoquinimink on that same day was 3.5 pptr ww. Further, DxF TEQs in a channel catfish sample also collected on 10/28/2014 at Route 9 along the Appoquinimink was 1.6 pptr ww.

For spatial reference, Route 9 crosses the tidal saline Appoquinimink River 3.24 miles above the mouth. Drawyer Creek enters the tidal saline Appoquinimink 4.08 miles above the mouth. Hence, the mouth of Drawyer Creek is less than a mile upstream of the Route 9 crossing of the Appoquinimink River. Finally, the distance upstream between the mouth of Drawyer Creek and Route 13 is approximately 2.3 miles.

Considering the concentration and distince information together, we see that DxF TEQ concentrations decrease up the Appoquinimink River from the mouth to Route 9, then decrease further as we travel up Drawyer Creek to Route 13. This information is made more compelling considering the samples were all collected the same day, were the same species, and were of similar size.

It is conclude from the data that DxF concentrations in Drawyer Creek fish are driven by upstream tidal transport from the Appoquinimink River and attenuation from clean inputs (Shallcross Lake and Dove Nest Branch) and particle trapping in the tide marsh. Fortunately, DxF concentrations in the fish in Drawyer Creek are not considerable greater than Delaware's conservative fish tissue screening value and concentrations appear to be declining with time.

SEGMENT DE010-L02
APPOQUINIMINK RIVER
SILVER LAKE
38.7 ACRES

DIELDRIN

Dieldrin in Fish Samples, Silver Lake Middletown, Segment DE 010-002 (38.7 acres)

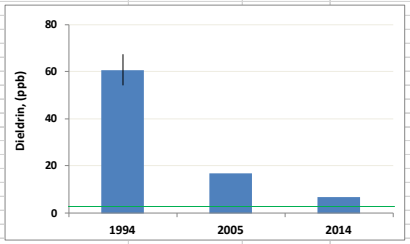
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
94039210	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	09/21/94	White Perch	Fillet Skin On	1	23.0	23.0	23.0	184.0	184.0	184.0	70.4	1.8	3.91	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94039220	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	09/21/94	White Perch	Fillet Skin On	1	23.0	23.0	23.0	186.0	186.0	186.0	71.4	3.1	2.30	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94039240	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	09/21/94	White Perch	Fillet Skin On	1	23.5	23.5	23.5	192.0	192.0	192.0	43.7	3.2	1.37	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94039250	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	09/21/94	White Perch	Fillet Skin On	1	22.5	22.5	22.5	155.0	155.0	155.0	57.5	2.1	2.75	DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
94039230	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	09/21/94	White Perch	Fillet Skin On	1	22.0	22.0	22.0	172.0	172.0	172.0	U(55.9 empc)	5.6		DNREC FY'95 Fish Tissue Data_RG Calcs	Midwest Research Institute
0510038-001	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	10/24/2005	Largemouth Bass	Edible Portion/Skin on	5	33.8	32.7	34.3	552	523	590	17	1.38	1.23	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0510038-002	Appoquinimink	Silver Lake	39 26 12.7	75 41 55.1	10/24/2005	American Eel	Edible Portion/Skin off	5	53.9	47.0	60.0	291	215	400	178	19.5	0.91	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
SilverLk442-LMB-1014	Appoquinimink	Silver Lake	39.438725	-75.693194	10/29/2014	Largemouth Bass	Fillet, skin on	5	38.3	37.0	39.8	775	672	860	6.73	0.54	1.25	WATAR_2014 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.
The eel result from 2005 is a statistical outlier and is omitted from the trend analysis.

Summary Statistics - Dieldrin in Fish (ppb)
Silver Lake Middletown, Segment DE 010-L02 (38.7 acres)

	1994	*2005*	*2014*
Mean	60.75	17	6.73
Standard Error	6.51		
Median	63.95	17	6.73
Mode	#N/A	#N/A	#N/A
Standard Deviation	13.01		
Sample Variance	169.27		
Kurtosis	-1.15		
Skewness	-0.87		
Range	27.7		
Minimum	43.7	17	6.73
Maximum	71.4	17	6.73
Sum	243	17	6.73
Count	4	1	1
Confidence Level(95.0%)	20.70		

The 1994 empc result is omitted from the above summary statistics.
The 2005 eel result is a statistical outlier and is omitted from the above summary statistics.



DE Fish Tissue Screening Value =	3	ppb
% Reduction from Peak, All Samples =	88.92	%
Duration =	20.10	yr
Ave Annual % Reduction =	4.42	% per yr
% Reduction Largemouth Bass Only =	60.41	%
Duration =	9.01	yr
Ave Annual % Reduction =	6.70	% per yr

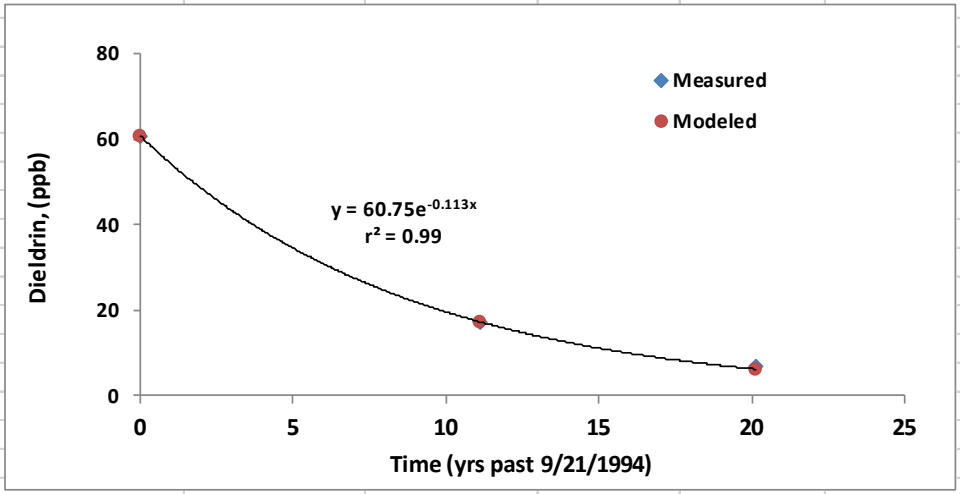
Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	60.75	pptr	
Lumped first order rate constant, k =	0.113161144	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	6.1	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
09/21/94	0	0.00	60.75	60.7500	0	1062.1081
10/24/2005	4051	11.09	17	17.3171	0.100536875	124.5456
10/29/2014	7343	20.10	6.73	6.2449	0.235285817	459.2449

Sum of Squares =	0.335822693
Sum of Squared Total =	1645.8986
Correlation Coefficient, r =	0.99990
Coefficient of Determination, r^2 =	0.99980



SEGMENT DE290-001-01
SAINT JONES RIVER
LOWER SAINT JONES
8.3 MILES

DIELDRIN

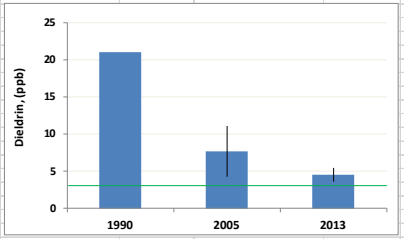
Dieldrin in Fish Samples, Saint Jones River, Segment DE 290-001-01 (Old Lebanon Bridge to Mouth, 8.3 mi.)

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
9003174	Saint Jones	Barkers Landing	39 05 06.0	75 27 40.4	09/24/90	White Catfish	Edible Muscle	3	31.2	28.0	36.0	486.7	274.0	908.0	21	4.1	0.51	DNREC Pre-1993 ELS Fish Tissue Data_DE Drainage	DNREC ELS
95024150	Saint Jones	Barkers Landing	39 05 06.0	75 27 40.4	09/13/95	White Perch	Fillet Skin On	5	18.1	17.0	20.5	87.0	70.0	120.0	U(30.4 empc)	2.7		DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
96015020	Saint Jones	Barkers Landing	39 05 06.0	75 27 40.4	06/13/96	White Catfish	Fillet Skin Off	5	30.9	29.3	32.7	400.0	320.0	510.0	U(16.2)	3.4		DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
0505038-001	Saint Jones	Barkers to Bowers	39 04 20.8	75 25 51.8	5/16/2005	White Perch	Edible Portion/Skin on	5	19.9	17.8	20.9	151	107	188	4.21	3.45	0.12	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511017-001	Saint Jones	Barkers to Bowers	39 04 20.8	75 25 51.8	11/15/2005	White Catfish	Edible Portion/Skin off	5	40.4	37.0	44.5	955	700	1200	11.1	4.73	0.23	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Mouth_WP	Saint Jones	Mouth	39.07019	-75.40553	10/7/2013	White Perch	Pan-dressed	5	21.2	20.0	22.5	138	100	180	3.57	1.57	0.23	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Route 1_WP	Saint Jones	Route 1 (Barkers Landing)	39.08881	-75.46483	10/8/2013	White Perch	Pan-dressed	5	19.5	18.7	20.5	144	100	190	5.46	4.45	0.12	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.

Summary Statistics - Dieldrin in Fish (ppb)
Saint Jones River, Segment DE 290-001-01 (8.31 mi.)

	1990	*2005*	*2013*
Mean	21	7.66	4.52
Standard Error		3.45	0.95
Median	21	7.66	4.52
Mode	#N/A	#N/A	#N/A
Standard Deviation		4.87	1.34
Sample Variance		23.74	1.79
Kurtosis		#DIV/0!	#DIV/0!
Skewness		#DIV/0!	#DIV/0!
Range		6.89	1.89
Minimum	21	4.21	3.57
Maximum	21	11.10	5.46
Sum	21	15.31	9.03
Count	1	2	2
Confidence Level(95.0%)		43.77	12.01



DE Fish Tissue Screening Value =	3	ppb
% Reduction from Peak, All Samples =	78.50	%
Duration =	23.04	yr
Ave Annual % Reduction =	3.41	% per yr
% Reduction White Catfish Only =	47.14	%
Duration =	15.14	yr
Ave Annual % Reduction =	3.11	% per yr
% Reduction White Perch Only =	-7.24	%
Duration =	8.39	yr
Ave Annual % Reduction =	-0.86	% per yr

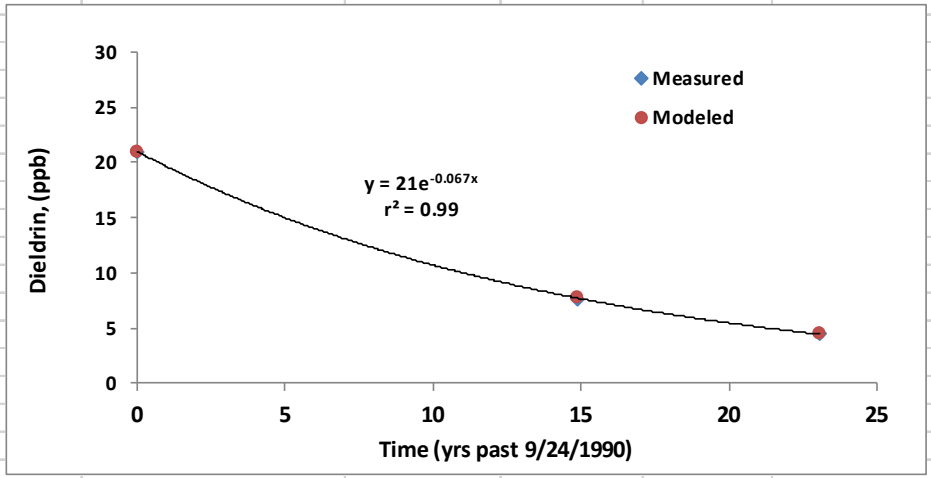
Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	21.00	pptr	
Lumped first order rate constant, k =	0.06730311	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	10.3	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
09/24/90	0	0.00	21	21.0000	0	98.86987778
8/15/2005	5439	14.89	7.66	7.7083	0.00284309	11.57133611
10/7/2013	8414	23.04	4.52	4.4554	0.00355613	42.79340278

Sum of Squares =	0.00639922
Sum of Squared Total =	153.2346167
Correlation Coefficient, r =	0.99998
Coefficient of Determination, r^2 =	0.99996



SEGMENT DE290-001-01
SAINT JONES RIVER
LOWER SAINT JONES
8.3 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Saint Jones River, Segment DE 290-001-01 (Old Lebanon Bridge to Mouth, 8.3 mi.)

TEQs are based on WHO 2005 TEFs

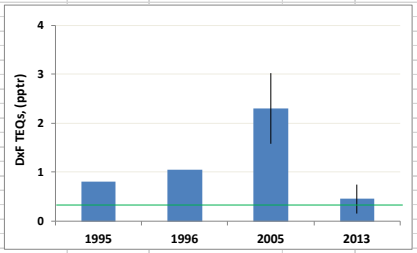
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
95024150	Saint Jones	Barkers Landing	39 05 06.0	75 27 40.4	09/13/95	White Perch	Fillet Skin On	5	18.1	17.0	20.5	87.0	70.0	120.0	0.801	2.7	30.0	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
96015020	Saint Jones	Barkers Landing	39 05 06.0	75 27 40.4	06/13/96	White Catfish	Fillet Skin Off	5	30.9	29.3	32.7	400.0	320.0	510.0	1.052	3.4	31.3	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
0505038-001	Saint Jones	Barkers to Bowers	39 04 20.8	75 25 51.8	5/16/2005	White Perch	Edible Portion/Skin on	5	19.9	17.8	20.9	151	107	188	1.579	3.45	45.8	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511017-001	Saint Jones	Barkers to Bowers	39 04 20.8	75 25 51.8	11/15/2005	White Catfish	Edible Portion/Skin off	5	40.4	37.0	44.5	955	700	1200	3.026	4.73	64.0	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Mouth_WP	Saint Jones	Mouth	39.07019	-75.40553	10/7/2013	White Perch	Pan-dressed	5	21.2	20.0	22.5	138	100	180	0.165	1.57	10.5	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Route 1_WP	Saint Jones	Route 1 (Barkers Landing)	39.08881	-75.46483	10/8/2013	White Perch	Pan-dressed	5	19.5	18.7	20.5	144	100	190	0.756	4.45	17.0	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Saint Jones River, Segment DE 290-001-01 (Old Lebanon Bridge to Mouth, 8.3 mi.)

	1995	*1996*	*2005*	*2013*
Mean	0.801	1.052	2.302	0.461
Standard Error			0.724	0.296
Median	0.801	1.052	2.302	0.461
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation			1.023	0.418
Sample Variance			1.047	0.175
Kurtosis			#DIV/0!	#DIV/0!
Skewness			#DIV/0!	#DIV/0!
Range			1.447	0.591
Minimum	0.801	1.052	1.579	0.165
Maximum	0.801	1.052	3.026	0.756
Sum	0.801	1.052	4.605	0.921
Count	1	1	2	2
Confidence Level(95.0%)			9.194	3.755



DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	80.00	%
Duration =	8.15	yr
Ave Annual % Reduction =	9.82	% per yr
% Reduction White Perch Only =	100.00	%
Duration =	8.39	yr
Ave Annual % Reduction =	11.91	% per yr
% Reduction White Catfish Only =	-187.58	%
Duration =	9.42	yr
Ave Annual % Reduction =	-19.91	% per yr

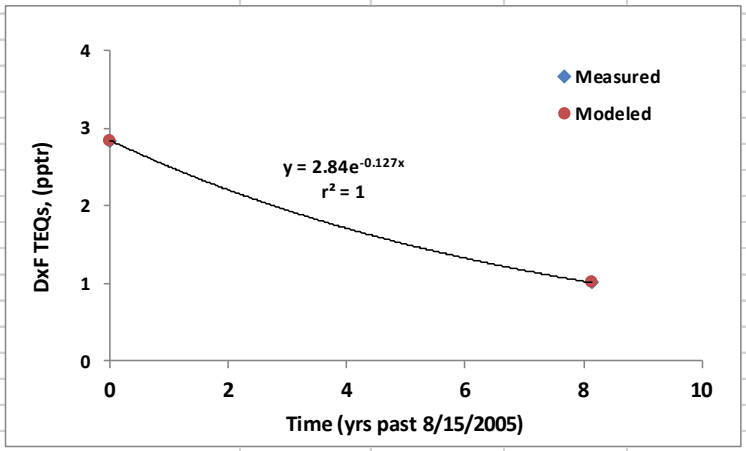
Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	2.302	pptr	
Lumped first order rate constant, k =	0.197591271	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	3.5	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
8/15/2005	0	0.00	2.302	2.3024	0	0.848164559
10/7/2013	2975	8.15	0.461	0.4605	2.7733E-32	0.848164559

Sum of Squares =	2.7733E-32
Sum of Squared Total =	1.696329117
Correlation Coefficient, r =	1.000
Coefficient of Determination, r^2 =	1.000



Note: An r-squared of 1 is expected in this example because the peak initial concentration is pinned and there is only 1 additional data point.

SEGMENT DE290-001-02
SAINT JONES RIVER
UPPER SAINT JONES
6.7 MILES

DIELDRIN

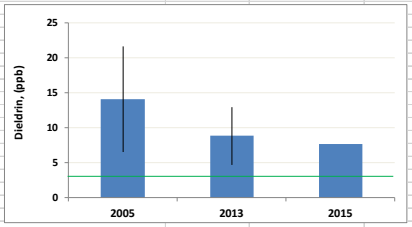
Dieldrin in Fish Samples, Saint Jones River, Segment DE 290-001-02 (Silver Lake Dam to Old Lebanon Bridge, 6.7 mi.)

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Dieldrin (ppb)	% Lipid	Dieldrin (ug/g lipid)	Data Source	Lab
95024810	Saint Jones	Route 13	39 08 56.0	75 30 55.0	09/20/95	Channel Catfish	Fillet Skin Off	3	52.0	50.0	55.0	1666.7	1450.0	2000.0	U(46.2)	7.0		DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
95026020	Saint Jones	Route 13	39 08 56.0	75 30 55.0	10/04/95	White Perch	Fillet Skin On	6	16.9	16.0	17.6	67.8	58.0	82.0	U(9.23)	1.6		DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
96007340	Saint Jones	Route 13	39 08 56.0	75 30 55.0	04/04/96	Largemouth Bass	Fillet Skin On	3	30.4	29.6	31.5	413.7	351.0	490.0	U(18.5 empc)	1.0		DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
0505038-002	Saint Jones	Route 10 to Lebanon	39 07 10.4	75 29 36.7	5/16/2005	White Perch	Edible Portion/Skin On	5	19.7	18.5	21.4	118	98	142	1.99	0.45	0.44	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0509042-001	Saint Jones	Route 10 to Lebanon	39 07 10.4	75 29 36.7	9/21/2005	White Catfish	Edible Portion/Skin Off	5	37.7	35.0	73.5	728	620	1000	4.73	2.01	0.24	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0510034-001	Saint Jones	Court Street	39 09 27.0	75 31 02.9	10/17/2005	Largemouth Bass	Edible Portion/Skin On	4	37.8	35.6	40.0	917	743	1087	14.2	2.43	0.58	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511017-002	Saint Jones	Court Street to Route 13	39 09 06.3	75 31 05.1	11/15/2005 ar	Channel Catfish	Edible Portion/Skin Off	4	44.1	32.0	51.5	1064.6	380	1800	35.3	4.9	0.72	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Route 10_WC	Saint Jones	Route 10	39.12614	-75.49639	10/7/2013	White Catfish	Fillet, Skin Off	4	30.1	25.5	36.5	395	270	640	4.71	2.37	0.20	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Route 13_BB	Saint Jones	Route 13	39.14883	-75.51487	10/7/2013	Brown Bullhead Catfish	Fillet, Skin Off	6	25.5	23.0	28.5	278	187	320	12.9	2.27	0.57	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
Channel Catfish Saint Jones @ Tar Ditch	Saint Jones	Near Mouth of Tar Ditch	39.153929	-75.518429	8/31/2015	Channel Catfish	Fillet, Skin Off	1	43.0			686			7.69	0.85	0.90	2015 Supplemental Fish Tissue Samples_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 3 ppb for adults.

Summary Statistics - Dieldrin in Fish (ppb)
Saint Jones River, Segment DE 290-001-02 (Silver Lake Dam to Old Lebanon Bridge, 6.7 mi.)

	2005	*2013*	*2015*
Mean	14.06	8.81	7.69
Standard Error	7.55	4.10	
Median	9.47	8.81	7.69
Mode	#N/A	#N/A	#N/A
Standard Deviation	15.10	5.79	
Sample Variance	227.96	33.54	
Kurtosis	1.41	#DIV/0!	
Skewness	1.36	#DIV/0!	
Range	33.31	8.19	
Minimum	1.99	4.71	7.69
Maximum	35.30	12.90	7.69
Sum	56.22	17.61	7.69
Count	4	2	1
Confidence Level(95.0%)	24.03	52.03	



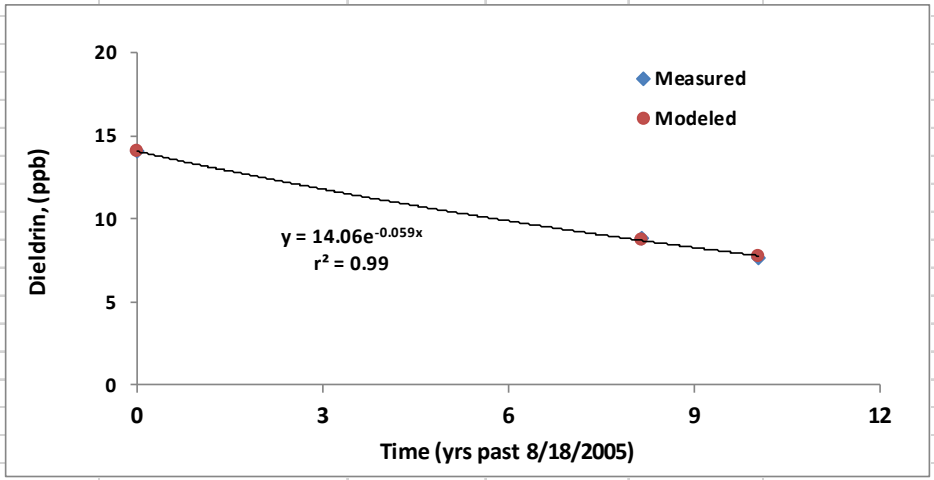
DE Fish Tissue Screening Value =	3	ppb
% Reduction from Peak, All Samples =	45.29	%
Duration =	10.03	yr
Ave Annual % Reduction =	4.51	% per yr
% Reduction Channel Catfish Only =	78.22	%
Duration =	9.77	yr
Ave Annual % Reduction =	8.00	% per yr
% Reduction White Catfish Only =	0.42	%
Duration =	8.04	yr
Ave Annual % Reduction =	0.05	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	14.06	pptr	
Lumped first order rate constant, k =	0.058907311	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	11.7	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean Dieldrin (ppb)	Modeled Dieldrin (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
8/18/2005	0	0.00	14.06	14.0550	0	14.98980278
10/7/2013	2972	8.14	8.81	8.7029	0.010425404	1.899802778
8/31/2015	3665	10.03	7.69	7.7826	0.008572783	6.216711111
				Sum of Squares =	0.018998186	
				Sum of Squared Total =		23.10631667
				Correlation Coefficient, r =		0.99959
				Coefficient of Determination, r^2 =		0.99918



SEGMENT DE290-001-02
SAINT JONES RIVER
UPPER SAINT JONES
6.7 MILES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Saint Jones River, Segment DE 290-001-02 (Silver Lake Dam to Old Lebanon Bridge, 6.7 mi.)

TEQs are based on WHO 2005 TEFs

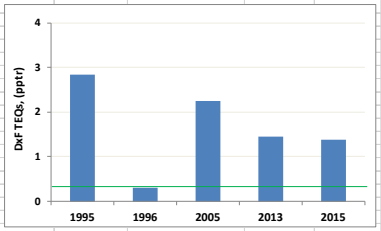
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
95024810	Saint Jones	Route 13	39 08 56.0	75 30 55.0	09/20/95	Channel Catfish	Fillet Skin Off	3	52.0	50.0	55.0	1666.7	1450.0	2000.0	4.531	7.0	65.0	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
95026020	Saint Jones	Route 13	39 08 56.0	75 30 55.0	10/04/95	White Perch	Fillet Skin On	6	16.9	16.0	17.6	67.8	58.0	82.0	1.158	1.6	73.8	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
96007340	Saint Jones	Route 13	39 08 56.0	75 30 55.0	04/04/96	Largemouth Bass	Fillet Skin On	3	30.4	29.6	31.5	413.7	351.0	490.0	0.312	1.0	30.3	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
0505038-002	Saint Jones	Route 10 to Lebanon	39 07 10.4	75 29 36.7	5/16/2005	White Perch	Edible Portion/Skin on	5	19.7	18.5	21.4	118	98	142	1.691	0.45	375.8	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0509042-001	Saint Jones	Route 10 to Lebanon	39 07 10.4	75 29 36.7	9/21/2005	White Catfish	Edible Portion/Skin off	5	37.7	35.0	73.5	728	620	1000	2.315	2.01	115.2	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0510034-001	Saint Jones	Court Street	39 09 27.0	75 31 02.9	10/17/2005	Largemouth Bass	Edible Portion/Skin on	4	37.8	35.6	40.0	917	743	1087	0.985	2.43	40.5	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0511017-002	Saint Jones	Court Street to Route 13	39 09 06.3	75 31 05.1	11/15/2005 a	Channel Catfish	Edible Portion/Skin off	4	44.1	32.0	51.5	1064.6	380	1800	3.991	4.9	81.4	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Route 10_WC	Saint Jones	Route 10	39.12614	-75.49639	10/7/2013	White Catfish	Fillet, skin off	4	30.1	25.5	36.5	395	270	640	1.45	2.37	61.2	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
SJ_Route 13_BB	Saint Jones	Route 13	39.14883	-75.51487	10/7/2013	Brown Bullhead Catfish	Fillet, skin off	6	25.5	23.0	28.5	278	187	320	1.44	2.27	63.4	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
Channel Catfish Saint Jones @ Tar Ditch	Saint Jones	Near Mouth of Tar Ditch	39.153929	-75.518429	8/31/2015	Channel Catfish	Fillet, Skin Off	1	43.0			686			1.38	0.85	162.4	2015 Supplemental Fish Tissue Samples_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Saint Jones River, Segment DE 290-001-02 (Silver Lake Dam to Old Lebanon Bridge, 6.7 mi.)

	1995	*1996*	*2005*	*2013*	*2015*
Mean	2.845	0.312	2.245	1.445	1.380
Standard Error	1.686		0.642	0.005	
Median	2.845	0.312	2.003	1.445	1.380
Mode	#N/A	#N/A	#N/A	#N/A	#N/A
Standard Deviation	2.385		1.284	0.007	
Sample Variance	5.688		1.649	0.000	
Kurtosis	#DIV/0!		1.082	#DIV/0!	
Skewness	#DIV/0!		0.989	#DIV/0!	
Range	3.373		3.006	0.010	
Minimum	1.158	0.312	0.985	1.440	1.380
Maximum	4.531	0.312	3.991	1.450	1.380
Sum	5.689	0.312	8.982	2.890	1.380
Count	2	1	4	2	1
Confidence Level(95.0%)	21.429		2.043	0.064	



DE Fish Tissue Screening Value =	0.35	pptr
% Reduction from Peak, All Samples =	51.49	%
Duration =	19.95	yr
Ave Annual % Reduction =	2.58	% per yr
% Reduction Channel Catfish Only =	69.54	%
Duration =	19.95	yr
Ave Annual % Reduction =	3.49	% per yr
% Reduction White Catfish Only =	37.38	%
Duration =	8.04	yr
Ave Annual % Reduction =	4.65	% per yr
% Reduction Largemouth Bass Only =	-215.66	%
Duration =	9.54	yr
Ave Annual % Reduction =	-22.62	% per yr

Data Fit to a First Order Exponential Model

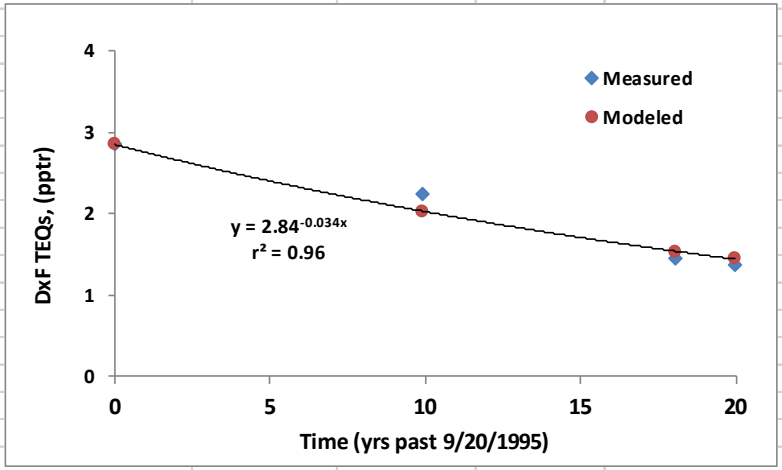
Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	2.845	pptr	
Lumped first order rate constant, k =	0.034080385	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponential loss, $t_{1/2}$ =	20.3	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
09/20/95	0	0.00	2.845	2.8447	0	0.749847364
8/18/2005	3620	9.91	2.245	2.0293	0.04672992	0.071120876
10/7/2013	6592	18.05	1.445	1.5379	0.00862383	0.284954317
8/31/2015	7285	19.95	1.380	1.4416	0.00379091	0.358574763

Largemouth Bass sample from 1996 omitted from trend assessment.

Sum of Squares =	0.05914466
Sum of Squared Total =	1.464497321
Correlation Coefficient, r =	0.980
Coefficient of Determination, r^2 =	0.960



SEGMENT DE290-002
SAINT JONES RIVER
ISAAC BRANCH/WYOMING MILL POND
28.5 ACRES

DDT

Total DDT in Fish Samples, Wyoming Mill Pond, Segment DE 290-002 (28.5 acres)

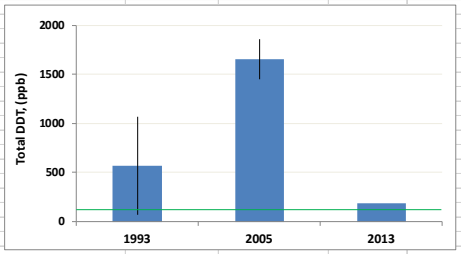
Total DDT (sometimes referred to as DDX) is the sum of the o,p and p,p' isomers of DDT, DDD, and DDE

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Total DDT (ppb)	% Lipid	Total DDT (ug/g lipid)	Data Source	Lab
932312	Saint Jones	Wyoming Mill Pond	39 07 23.6	75 33 41.1	06/29/93	White Perch	Fillet Skin On	6	18.5	18.0	19.0	85.8	75.0	100.0	1072.1	3.8	28.37	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
932313	Saint Jones	Wyoming Mill Pond	39 07 23.6	75 33 41.1	06/29/93	Carp	Fillet Skin On	5	52.1	50.5	54.5	1840.0	1700.0	2150.0	68.8	8.7	0.79	DNREC FY'94 Fish Tissue Data_RG Calcs	Midwest Research Institute
0506042-002	Saint Jones	Wyoming Mill Pond	39 07 23.6	75 33 41.1	6/20/2005	American Eel	Edible Portion/Skin off	3	53.7	51.0	55.0	317	270	360	1856.7	10.6	17.52	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0506042-001	Saint Jones	Wyoming Mill Pond	39 07 23.6	75 33 41.1	6/20/2005	Largemouth Bass	Edible Portion/Skin on	5	38.9	37.3	40.4	774	698	834	1449.12	0.74	195.83	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
Wyoming Pond_LMB	Saint Jones	Wyoming Mill Pond	39.12242	-75.56207	10/14/2013	Largemouth Bass	Fillet, skin on	4	44.0	40.5	47.0	1388	1050	1820	186.923	0.42	44.51	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 159 ppb for adults.

Summary Statistics - Total DDT in Fish (ppb)
Wyoming Mill Pond, Segment DE 290-002 (28.5 acres)

	1993	*2005*	*2013*
Mean	570.45	1652.91	186.923
Standard Error	501.65	203.79	
Median	570.45	1652.91	186.923
Mode	#N/A	#N/A	#N/A
Standard Deviation	709.4402336	288.2025819	
Sample Variance	503305.445	83060.7282	
Kurtosis	#DIV/0!	#DIV/0!	
Skewness	#DIV/0!	#DIV/0!	
Range	1003.3	407.58	
Minimum	68.8	1449.12	186.923
Maximum	1072.1	1856.7	186.923
Sum	1140.9	3305.82	186.923
Count	2	2	1
Confidence Level(95.0%)	6374.067606	2589.397463	



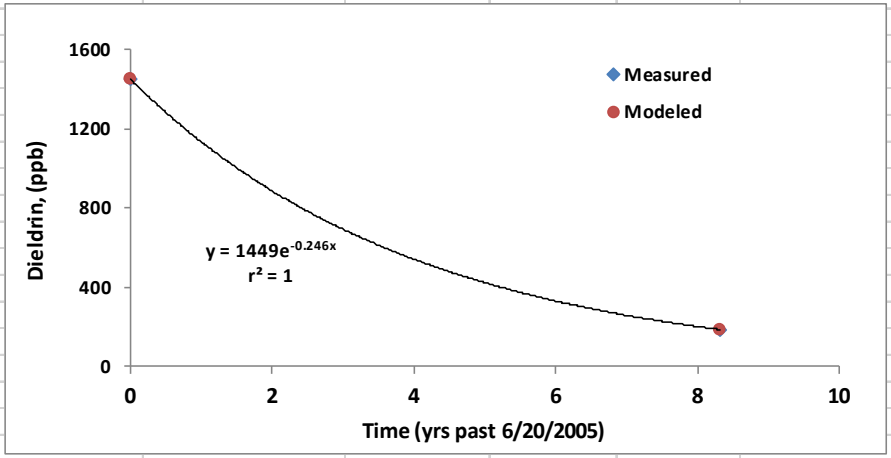
DE Fish Tissue Screening Value =	159	ppb
% Reduction from Peak, All Samples =	88.69	%
Duration =	8.32	yr
Ave Annual % Reduction =	10.66	% per yr
% Reduction Largemouth Bass Only =	87.10	%
Duration =	8.32	yr
Ave Annual % Reduction =	10.47	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	1449.1	pptr	
Lumped first order rate constant, k =	0.24622695	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	2.8	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DDDT (pptr)	Modeled Total DDT (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
6/20/2005	0	0.00	1449.1	1449.1200	0	398285.3167
10/14/2013	3038	8.32	186.9	186.9230	0	398285.3167
				Sum of Squares =	0	
				Sum of Squared Total =		796570.6334
				Correlation Coefficient, r =		1.000
				Coefficient of Determination, r^2 =		1.000



Note: An r-squared of 1 is expected in this example because only 2 point were considered and 1 was pinned.

SEGMENT DE290-L02
SAINT JONES RIVER
SILVER LAKE
157.8 ACRES

DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Silver Lake Dover, Segment DE 290-L02 (157.8 acres)

TEQs are based on WHO 2005 TEFs

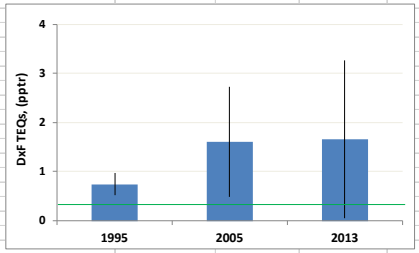
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source	Lab
95024840	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	09/21/95	Channel Catfish	Fillet Skin Off	3	41.9	38.2	44.5	598.7	412.0	761.0	0.981	6.9	14.1	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
95024830	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	09/21/95	Largemouth Bass	Fillet Skin On	5	38.8	38.2	39.8	830.8	739.0	881.0	0.515	1.5	33.4	DNREC FY'96 Fish Tissue Data_RG Calcs	Midwest Research Institute
0506035-002	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	6/13/2005	American Eel	Edible Portion/Skin off	5	40.1	38.0	43.5	112	100	130	2.724	18	15.1	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
0506035-001	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	6/13/2005	Largemouth Bass	Edible Portion/Skin on	5	41.3	40.7	42.1	1057	1026	1140	0.494	1.57	31.5	DNREC FY'06 Fish Tissue Data_RG Calcs	AXYS Analytical
Silver Lake_CC	Saint Jones	Silver Lake	39.16984	-75.52497	10/9/2013	Channel Catfish	Fillet, skin off	1	44.2			670			3.26	7.08	46.0	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical
Silver Lake_WC	Saint Jones	Silver Lake	39.16984	-75.52497	10/9/2013	White Catfish	Fillet, skin off	4	36.5	32.3	39.1	597	390	770	0.0469	0.97	4.8	WATAR_2013 Fish Tissue Data_RG Calcs	AXYS Analytical

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for adults.

Summary Statistics - DxF TEQs in Fish (pptr)

Silver Lake Dover, Segment DE 290-L02 (157.8 acres)

	1995	*2005*	*2013*
Mean	0.748	1.609	1.653
Standard Error	0.233	1.115	1.607
Median	0.748	1.609	1.653
Mode	#N/A	#N/A	#N/A
Standard Deviation	0.329	1.577	2.272
Sample Variance	0.108	2.486	5.162
Kurtosis	#DIV/0!	#DIV/0!	#DIV/0!
Skewness	#DIV/0!	#DIV/0!	#DIV/0!
Range	0.466	2.230	3.213
Minimum	0.515	0.494	0.047
Maximum	0.981	2.724	3.260
Sum	1.495	3.218	3.307
Count	2	2	2
Confidence Level(95.0%)	2.959	14.165	20.413



DE Fish Tissue Screening Value =	0.35	pptr
% Reduction Largemouth Bass Only =	3.97	%
Duration =	9.73	yr
Ave Annual % Reduction =	0.41	% per yr

No temporal trend is evident from the available data, although inter-annual variability appears to be increasing. Because no trend is evident, the data have not been fit to an exponential loss curve.

As to why there is no apparent temporal trend, one theory involves the proximity of Silver Lake to a power plant that formerly used coal as a fuel source. Coal-fired boilers used in the past may have produced stack emissions containing dioxins and furans. A portion of those emissions may have entered Silver Lake through atmospheric deposition and surface water runoff. Once in the lake, dioxins & furans would tend to associate with bed sediments and suspended sediments, resulting in an ongoing source of exposure to the fish.

Now that coal is no longer used at this facility, loading of dioxins and furans to the lake is expected to diminish with time and new cleaner sediment will bury the older more contaminated sediments. This will reduce exposure of the fish through the contaminated sediment pathway and the concentration in the fish should drop accordingly. This can be tracked over time. In the meantime, the most important action to reduce exposure has already occurred; namely, the power plant no longer burns coal.

SEGMENT DE290-L02
SAINT JONES RIVER
SILVER LAKE
157.8 ACRES

MERCURY

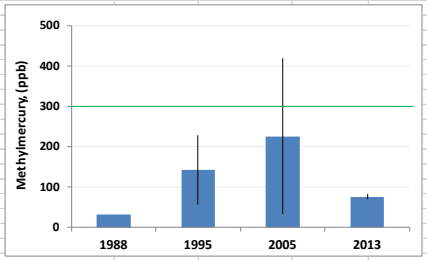
Mercury in Fish Samples, Silver Lake Dover, Segment DE 290-L02 (157.8 acres)

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Total Mercury (ppb)	Estimated MeHg (ppb)	Measured MeHg (ppb)	Data Source	Lab
8804037	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	07/27/88	Channel Catfish	Edible Muscle	5	na	30.5	<45.7	na	na	na	34	32.3		DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs	DNREC ELS
95024840	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	09/21/95	Channel Catfish	Fillet Skin Off	3	41.9	38.2	44.5	598.7	412.0	761.0	60	57		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
95024830	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	09/21/95	Largemouth Bass	Fillet Skin On	5	38.8	38.2	39.8	830.8	739.0	881.0	240	228		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0506035-002	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	6/13/2005	American Eel	Edible Portion/Skin off	5	40.1	38.0	43.5	112	100	130	35	33.25		DNREC FY'06 Fish Tissue Data_RG Calcs	DNREC ELS
0506035-001	Saint Jones	Silver Lake	39 10 20.0	75 31 40.0	6/13/2005	Largemouth Bass	Edible Portion/Skin on	5	41.3	40.7	42.1	1057	1026	1140	440	418		DNREC FY'06 Fish Tissue Data_RG Calcs	DNREC ELS
Silver Lake_CC	Saint Jones	Silver Lake	39.16984	-75.52497	10/9/2013	Channel Catfish	Fillet, skin off	1	44.2			670			39		69	WATAR_2013 Fish Tissue Data_RG Calcs	Test American Canton
Silver Lake_WC	Saint Jones	Silver Lake	39.16984	-75.52497	10/9/2013	White Catfish	Fillet, skin off	4	36.5	32.3	39.1	597	390	770	53		83	WATAR_2013 Fish Tissue Data_RG Calcs	Test American Canton

Highlighted values exceed Delaware's fish tissue criterion of 300 ppb methylmercury.

Summary Statistics - Methylmercury in Fish (pptr)
Silver Lake Dover, Segment DE 290-L02 (157.8 acres)

	1988	*1995*	*2005*	*2013*
Mean	32.3	142.5	225.6	76
Standard Error		85.5	192.4	7
Median	32.3	142.5	225.6	76
Mode	#N/A	#N/A	#N/A	#N/A
Standard Deviation		120.9	272.1	9.89949494
Sample Variance		14620.5	74016.3	98
Kurtosis		#DIV/0!	#DIV/0!	#DIV/0!
Skewness		#DIV/0!	#DIV/0!	#DIV/0!
Range		171.0	384.8	14
Minimum	32.3	57.0	33.3	69
Maximum	32.3	228.0	418.0	83
Sum	32.3	285.0	451.3	152
Count	1	2	2	2
Confidence Level(95.0%)		1086.4	2444.4	88.9



DE Fish Tissue Screening Value =	300	ppb
% Reduction from Peak, All Samples =	66.32	%
Duration =	8.32	yr
Ave Annual % Reduction =	7.97	% per yr

The reduction between 2005 and 2013 is driven by the elevated total mercury concentration measured in the largemouth bass sample collected in 2005. Methylmercury in that sample was estimated as 95% of total mercury. This estimate, plus the lack of largemouth bass data after 2005 creates significant uncertainty in the trend assessment for methylmercury in Silver Lake Dover. As such, no attempt is made here to fit the data to a trend line.

Existing uncertainty can be reduced through the collection of new methylmercury data in fish samples from Silver Lake, with a focus on largemouth bass.

The expectation is that methylmercury in largemouth bass will fall in the future compared to 2005. A power plant directly adjacent to Silver Lake formerly burned coal as a fuel source. Mercury is known to be released to the atmosphere during coal combustion. The facility no longer burns coal and so mercury emissions are expected to decline. This is expected to reduce mercury deposition to Silver Lake, which in turn is expected mercury concentrations to fall in the fish over time.

SEGMENT DE080--003
CEDAR CREEK
SLAUGHTER CREEK
7.91 MILES

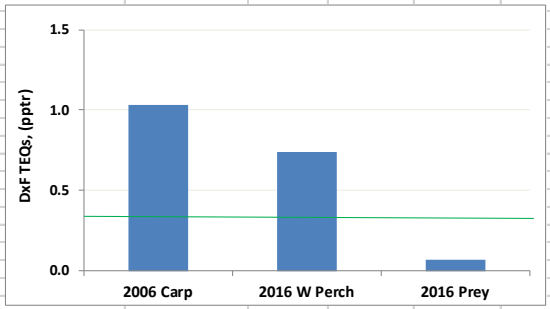
DIOXIN AND FURAN TEQ

Dioxin and Furan TEQs in Fish Samples, Slaughter Creek, Segment DE 080-003

TEQs are based on WHO 2005 TEFs

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (mm)	Mean Weight (gm)	DxF TEQ (pptr)	% Lipid	DxF TEQ (pg/g lipid)	Data Source
0609052-006A	Slaughter Creek	Road 38	38.8603	75.2929	9/27/2006	Carp	Fillet, skin on	5	446.2	1126	1.03	4.66	22.1	DNREC FY'07 Fish Tissue Data_RG Calcs
SCCodsRd-FISH-1016	Slaughter Creek	Road 38	38.86053	-75.29212	10/19/2016	White Perch	Pan-dressed	5	231	206	0.741	3.31	22.4	2016 WATAR_Fish Tissue Data_Prime Hook Refuge_RG Calcs
SCCodsRd-PREYFISH-1016	Slaughter Creek	Road 38	38.86091	-75.29157	10/25/2016	Mummichog	Whole	36	78.4	7.7	0.0704	3.52	2.0	2017 WATAR_Fish Tissue Data_Prime Hook Refuge_RG Calcs

Highlighted values exceed Delaware's fish tissue screening value of 0.35 pptr for



2006 Carp
2016 W Perch
2016 Prey

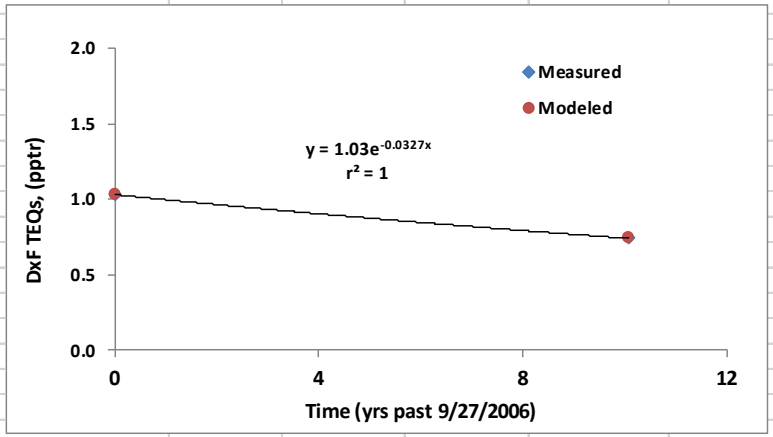
DE Fish Tissue Screening Value =	0.35	pptr
% Reduction Non-Prey Fish Only =	28.06	%
Duration =	10.06	yr
Ave Annual % Reduction =	2.79	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	1.030	pptr	
Lumped first order rate constant, k =	0.03272973	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	21.1	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean DxF TEQs (pptr)	Modeled DxF TEQs (pptr)	Squared Error (i.e., Difference^2)	Squared Totals
9/27/2006	0	0.00	1.03	1.0300	0	0.02088025
10/19/2016	3675	10.06	0.741	0.7410	0	0.02088025
				Sum of Squares =	0	
					Sum of Squared Total =	0.0417605
					Correlation Coefficient, r =	1.000
					Coefficient of Determination, r^2 =	1.000



Note: An r-squared of 1 is expected in this example because only 2 point were considered and 1 was pinned.

SEGMENT DE060-008
BROADKILL RIVER
PRIMEHOOK CREEK
12.6 MILES

MERCURY

Mercury in Fish Samples, Prime Hook Creek, Segment DE 060-008 (12.6 mi.)

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Total Mercury (ppb)	Estimated MeHg (ppb)	Measured MeHg (ppb)	Data Source	Lab
0606028-001	Prime Hook Creek	Refuge near shop	38.8353	75.2576	6/6/2006	Largemouth bass	Fillet, skin on	1	39.5			900			570	541.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606028-002	Prime Hook Creek	Refuge near shop	38.8353	75.2576	6/6/2006	Largemouth bass	Fillet, skin on	1	40.4			1000			520	494		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606028-003	Prime Hook Creek	Refuge near shop	38.8353	75.2576	6/6/2006	Largemouth bass	Fillet, skin on	1	40.3			1000			420	399		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606028-004	Prime Hook Creek	Refuge near shop	38.8353	75.2576	6/6/2006	Largemouth bass	Fillet, skin on	1	34.4			700			280	266		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606028-005	Prime Hook Creek	Refuge near shooting range	38.8273	75.2811	6/6/2006	Largemouth bass	Fillet, skin on	1	44.8			1475			570	541.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606028-006	Prime Hook Creek	Refuge near shooting range	38.8273	75.2811	6/6/2006	Largemouth bass	Fillet, skin on	1	37.5			825			470	446.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606028-007	Prime Hook Creek	Refuge near shooting range	38.8273	75.2811	6/6/2006	Largemouth bass	Fillet, skin on	1	40.2			825			490	465.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
PHCSR-FISH-2016	Prime Hook Creek	Refuge near shooting range	38.82707	-75.286	10/18/2016	Largemouth bass	Fillet, skin on	1	35.3			610					120	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
PHCSHOP-FISH-1016	Prime Hook Creek	Refuge near shop	38.83579	-75.2601	10/18/2016	Black crappie	Pan-dressed	1	25.2			280					94	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
PHCSHOP-PREYFISH-1016	Prime Hook Creek	Refuge near shop	38.83579	-75.2601	10/25/2016	Mummichog	Whole	20	7.7			7.1					17	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton

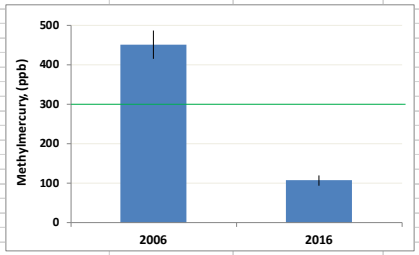
Highlighted values exceed Delaware's fish tissue criterion of 300 ppb methylmercury.

Summary Statistics - Methylmercury in Fish (pptr)
Prime Hook Creek, Segment DE 060-008 (12.6 mi.)

	2006	*2016*
Mean	450.6	107.0
Standard Error	36.3	13.0
Median	465.5	107.0
Mode	541.5	#N/A
Standard Deviation	96.1	18.4
Sample Variance	9231.3	338.0
Kurtosis	1.8	#DIV/0!
Skewness	-1.3	#DIV/0!
Range	275.5	26.0
Minimum	266.0	94.0
Maximum	541.5	120.0
Sum	3154.0	214.0
Count	7	2
Confidence Level(95.0%)	88.9	165.2

Notes:

1. 2006 Results: MeHg in largemouth bass samples collected near the shop is not statistically different than MeHg in largemouth bass collected near the shooting range and so results from these 2 stations are combined to characterize MeHg concentrations in this segment in 2006.
2. 2016 Results: MeHg in largemouth bass and black crappie were combined because the concentrations were similar. The whole body mummichog result was omitted because it was much lower than the 2 other results and mummichogs are not consumed by humans. This sample was collected because Prime Hook Creek flows through a national wildlife refuge and we were interested in ecological and wildlife risks associated with consumption of this prey species by piscivorous animals.



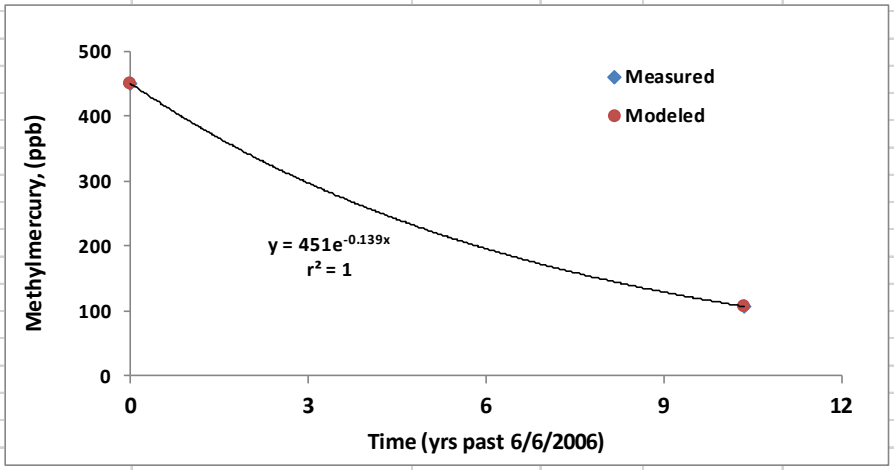
DE Fish Tissue Screening Value =	300	ppb
% Reduction, All Samples =	76.25	%
Duration =	10.37	yr
Ave Annual % Reduction =	7.35	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	450.6	pptr	
Lumped first order rate constant, k =	0.138662652	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER
Half-life for exponental loss, $t_{1/2}$ =	5.0	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean MeHg (ppb)	Modeled MeHg (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
6/6/2006	0	0.00	450.6	450.5714	0	29510.33163
10/18/2016	3787	10.37	107.0	107.0000	2.01948E-28	29510.33163
				Sum of Squares =	2.01948E-28	
					Sum of Squared Total =	59020.66327
					Correlation Coefficient, r =	1.000
					Coefficient of Determination, r^2 =	1.000



Note: An r-squared of 1 is expected in this example because only 2 point were considered and 1 was pinned.

SEGMENT DE060-008
BROADKILL RIVER
WAPLES POND/REYNOLDS POND
88.8 ACRES

MERCURY

Mercury in Fish Samples, Waples Pond, Segment DE 060-L03 (88.8 acres)

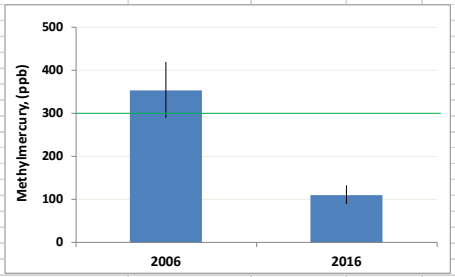
Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Min Length (cm)	Max Length (cm)	Mean Weight (gm)	Min Weight (gm)	Max Weight (gm)	Total Mercury (ppb)	Estimated MeHg (ppb)	Measured MeHg (ppb)	Data Source	Lab
0606033-001	Prime Hook Creek	Waples Pond	38.8233	75.3111	6/8/2006	Largemouth bass	Fillet, skin on	1	45.7			1588			370	351.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606033-002	Prime Hook Creek	Waples Pond	38.8233	75.3111	6/8/2006	Largemouth bass	Fillet, skin on	1	39.4			794			520	494		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606033-003	Prime Hook Creek	Waples Pond	38.8233	75.3111	6/8/2006	Largemouth bass	Fillet, skin on	1	36.8			567			190	180.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606033-004	Prime Hook Creek	Waples Pond	38.8233	75.3111	6/8/2006	Largemouth bass	Fillet, skin on	1	36.8			680			250	237.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
0606033-005	Prime Hook Creek	Waples Pond	38.8233	75.3111	6/8/2006	Largemouth bass	Fillet, skin on	1	38.7			635			530	503.5		DNREC FY'96 Fish Tissue Data_RG Calcs	DNREC ELS
WAPLES-LMB1-2016	Prime Hook Creek	Waples Pond	38.82432	-75.30736	10/19/2016	Largemouth bass	Fillet, skin on	1	33.7			590					200	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
WAPLES-LMB2-2016	Prime Hook Creek	Waples Pond	38.82432	-75.30736	10/19/2016	Largemouth bass	Fillet, skin on	1	34.0			570					88	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
WAPLES-LMB3-2016	Prime Hook Creek	Waples Pond	38.82432	-75.30736	10/19/2016	Largemouth bass	Fillet, skin on	1	33.5			600					95	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
WAPLES-LMB4-2016	Prime Hook Creek	Waples Pond	38.82432	-75.30736	10/19/2016	Largemouth bass	Fillet, skin on	1	33.7			540					79	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
WAPLES-LMB5-2016	Prime Hook Creek	Waples Pond	38.82432	-75.30736	10/19/2016	Largemouth bass	Fillet, skin on	1	35.0			530					92	WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton
WAPLES-BC-1016	Prime Hook Creek	Waples Pond	38.82432	-75.30736	10/19/2016	Black crappie	Pan-dressed	1	24.4			205			46.7	44.4		WATAR_2016 Fish Tissue Data_RG Calcs	Test American Canton

Highlighted values exceed Delaware's fish tissue criterion of 300 ppb methylmercury.

Summary Statistics - Methylmercury in Fish (pptr)
Waples Pond, Segment DE 060-L03 (88.8 acres)

	2006	*2016*
Mean	353.4	110.8
Standard Error	65.4	22.5
Median	351.5	92.0
Mode	#N/A	#N/A
Standard Deviation	146.3	50.2
Sample Variance	21407.3	2522.7
Kurtosis	-2.6	4.7
Skewness	-0.1	2.2
Range	323.0	121.0
Minimum	180.5	79.0
Maximum	503.5	200.0
Sum	1767.0	554.0
Count	5	5
Confidence Level(95.0%)	181.7	62.4

Note: Only largemouth bass considered in the above summary statistics.



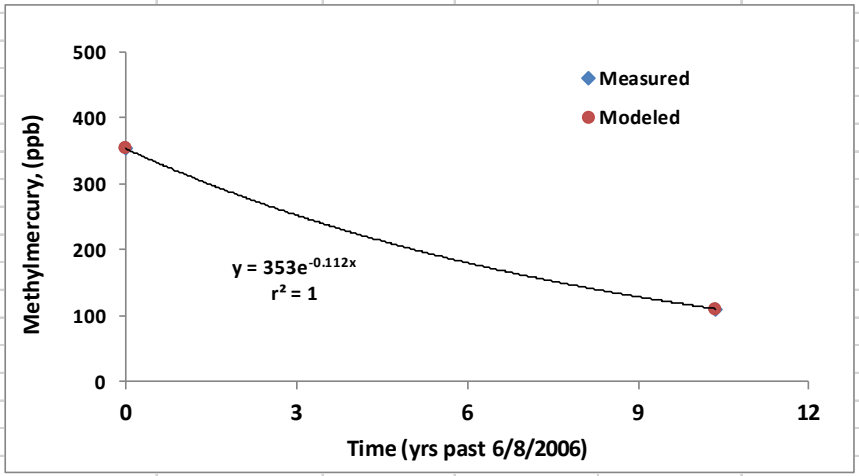
DE Fish Tissue Screening Value =	300	ppb
% Reduction, Largemouth Bass Samples =	68.65	%
Duration =	10.37	yr
Ave Annual % Reduction =	6.62	% per yr

Data Fit to a First Order Exponential Model

Approach: Use Excel SOLVER to minimize the sum of squared errors between measured and modelled values. Pin initial value and allow SOLVER to adjust the first order rate constant until sum of squared error is minimized. SOLVER must be loaded into Excel for this spreadsheet to work properly (see Help if necessary). Once loaded, click on Data, then SOLVER.

Assumed Exponential Model:	$C(t) = C_0 \exp(-kt)$		
Peak concentration, C_0 =	353.4	pptr	
Lumped first order rate constant, k =	0.111897491	yr^{-1}	Start with guess of 0.1/yr, then run SOLVER.
Half-life for exponental loss, $t_{1/2}$ =	6.2	yr	

Date Formatted	Time Past C_0 (Days)	Time Past C_0 (Years)	Measured Mean MeHg (ppb)	Modeled MeHg (ppb)	Squared Error (i.e., Difference^2)	Squared Totals
6/8/2006	0	0.00	353.4	353.4000	0	14713.69
10/19/2016	3786	10.37	110.8	110.8000	0	14713.69
				Sum of Squares =	0	
				Sum of Squared Total =		29427.38
				Correlation Coefficient, r =		1.000
				Coefficient of Determination, r^2 =		1.000



Note: An r-squared of 1 is expected in this example because only 2 point were considered and 1 was pinned.

SEGMENT NA
DELAWARE BAY
DRBC ZONE 6
782.0 SQUARE MILES

MERCURY

Mercury in Fish Samples, Delaware Bay Zone 6 (782 sq. mi.)

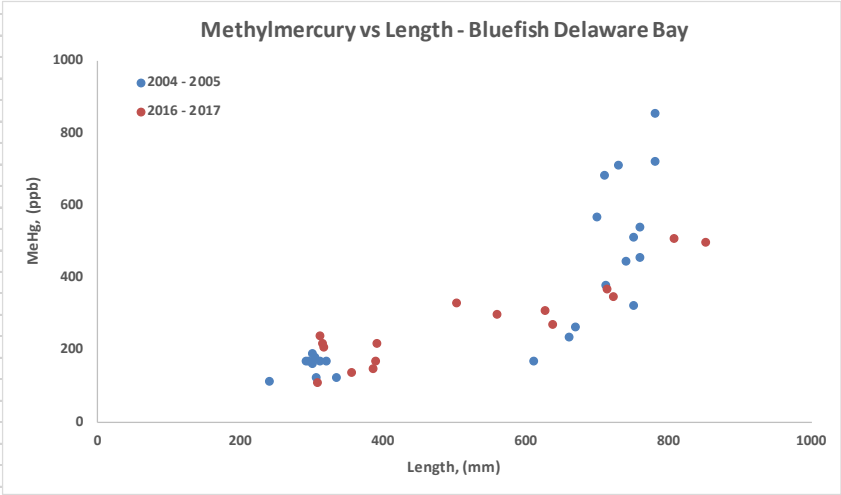
Mercury in fish from the Delaware Estuary is a regional issue and so data are presented for the broader Delaware Estuary from Trenton to the mouth of the Delaware Bay.

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Mean Weight (gm)	Total Mercury (ppb)	DQC	Estimated MeHg (ppb)	Measured MeHg (ppb)	DQC	Data Source
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Alewife	Epaxial Muscle Plug	1			65		61.8			Pest. Monit. Jour. 11(3): 132-133.
95027090	Delaware Bay	Collins Beach	39 23 14.7	75 30 39.6	10/17/95	American Eel	Fillet Skin Off	3	60.2	496.3	< 20		<19			DNREC FY'96 Fish Tissue Data_RG Calcs
0609044-001A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	311	300	66		62.7			DNREC FY'07 Fish Tissue Data_RG Calcs
0609044-002A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	290	300	100		95.0			DNREC FY'07 Fish Tissue Data_RG Calcs
0609044-003A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	315	405	140		133.0			DNREC FY'07 Fish Tissue Data_RG Calcs
0609044-004A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	265	215	53		50.4			DNREC FY'07 Fish Tissue Data_RG Calcs
0609044-005A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	295	300	110		104.5			DNREC FY'07 Fish Tissue Data_RG Calcs
0609044-006A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	260	210	71		67.5			DNREC FY'07 Fish Tissue Data_RG Calcs
0609044-007A	Atlantic Coast	9.6 mi. E of Indian River Inlet	38.6218	74.8861	9/18/2006	Atlantic croaker	Tissue Plugs	1	250	200	37		35.2			DNREC FY'07 Fish Tissue Data_RG Calcs
0607059-001A	Delaware Bay	Reef Site 5	38.9000	75.1976	7/11/2006	Atlantic croaker	Tissue Plugs	1	285	300	69		65.6			DNREC FY'07 Fish Tissue Data_RG Calcs
0607059-002A	Delaware Bay	Reef Site 5	38.9000	75.1976	7/11/2006	Atlantic croaker	Tissue Plugs	1	275	250	47		44.7			DNREC FY'07 Fish Tissue Data_RG Calcs
0607059-003A	Delaware Bay	Reef Site 5	38.9000	75.1976	7/11/2006	Atlantic croaker	Tissue Plugs	1	285	320	180		171.0			DNREC FY'07 Fish Tissue Data_RG Calcs
0607059-004A	Delaware Bay	Reef Site 5	38.9000	75.1976	7/11/2006	Atlantic croaker	Tissue Plugs	1	255	235	51		48.5			DNREC FY'07 Fish Tissue Data_RG Calcs
0607059-005A	Delaware Bay	Reef Site 5	38.9000	75.1976	7/11/2006	Atlantic croaker	Tissue Plugs	1	250	225	48		45.6			DNREC FY'07 Fish Tissue Data_RG Calcs
0607059-006A	Delaware Bay	Reef Site 5	38.9000	75.1976	7/13/2006	Atlantic croaker	Tissue Plugs	1	255	220	41		39.0			DNREC FY'07 Fish Tissue Data_RG Calcs
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Atlantic Herring	Epaxial Muscle Plug	1			104		98.8			Pest. Monit. Jour. 11(3): 132-133.
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Bay Anchovy	Whole Body	1			51		48.5			Pest. Monit. Jour. 11(3): 132-133.
0605050-001A	Atlantic Coast	Reef Site 11	38.6785	74.7250	5/30/2006	Black sea bass	Tissue Plugs	5	30.5	455.8	72		68.4			DNREC FY'07 Fish Tissue Data_RG Calcs
890814-35	Delaware Bay	Bowers Beach	39 05 08	75 21 12	6/28/1989	Blue Crab	muscle*	14	16.2	211.8	50		47.5			1991 EPA III Fish Tissue Report
5271120	Delaware Bay	~ 0.7 mi. SW of Arnold Point, NJ	39.381	75.435	09/04/98	Blue Crab	Meat	9	14.0	35.4	25		23.8			1998 MAIA Fish Tissue Data
5271120	Delaware Bay	~ 0.7 mi. SW of Arnold Point, NJ	39.381	75.435	09/04/98	Blue Crab	Carcass	9	14.0	29.7	17		16.2			1998 MAIA Fish Tissue Data
5271120	Delaware Bay	~ 0.7 mi. SW of Arnold Point, NJ	39.381	75.435	09/04/98	Blue Crab	Whole Body	9	14.0	65.1	21		20.0			1998 MAIA Fish Tissue Data
5160120	Delaware Bay	Immediately Offshore of Woodland Beach, DE	39.343	75.485	09/04/98	Blue Crab	Meat	9	14.1	32.1	31		29.5			1998 MAIA Fish Tissue Data
5160120	Delaware Bay	Immediately Offshore of Woodland Beach, DE	39.343	75.485	09/04/98	Blue Crab	Carcass	9	14.1	34.5	23		21.9			1998 MAIA Fish Tissue Data
5160120	Delaware Bay	Immediately Offshore of Woodland Beach, DE	39.343	75.485	09/04/98	Blue Crab	Whole Body	9	14.1	66.7	27		25.7			1998 MAIA Fish Tissue Data
NJ000067-FC1	Delaware Bay	~0.4 mi. W of Dennis Creek mouth, NJ	39.1634	74.8996	10/03/00	Blue Crab	Whole Body	7	13.7	na	30		28.5			DRBC_EPA Coastal 2000
DE000037-FC1	Delaware Bay	~0.25 mi. ENE of Simons River mouth, DE	39.2254	75.4005	09/28/00	Blue Crab	Whole Body	6	13.7	na	30		28.5			DRBC_EPA Coastal 2000
DE000039-FC1	Delaware Bay	~0.87 mi. ENE of Bowers Beach, DE	39.0634	75.3805	10/09/00	Blue Crab	Whole Body	5	14.0	na	20		19.0			DRBC_EPA Coastal 2000
NJ000065-FC1	Delaware Bay	~2.9 mi. W of False Egg Island Point, NJ	39.2007	75.2214	10/12/00	Blue Crab	Whole Body	6	15.0	na	20		19.0			DRBC_EPA Coastal 2000
0507033-001	Atlantic Ocean	The Hotdog	38 07 00.0	74 17 00.0	7/2/2005	Bluefin Tuna	Steak, Skin off	1	289.6	395984	1800		1710.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0507033-001A	Atlantic Ocean	The Hotdog	38 07 00.0	74 17 00.0	7/2/2005	Bluefin Tuna	Steak, Skin off	1	289.6	395984	1900		1805.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0507033-001B	Atlantic Ocean	The Hotdog	38 07 00.0	74 17 00.0	7/2/2005	Bluefin Tuna	Steak, Skin off	1	289.6	395984	1800		1710.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0408073-001	Alantic Ocean	~31.6 mi. ESE of Indian River Inlet	38 22 26.0	74 33 49.0	8/29/2004	Bluefish	Skin on fillet	1	75.0	3800	340		323.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0505048-001	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	5/29/2005	Bluefish	Fillet, Skin On	1	73.0	3380	750		712.5			DNREC FY'06 Fish Tissue Data_RG Calcs
0505048-002	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	5/29/2005	Bluefish	Fillet, Skin On	1	78.0	3540	900		855.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0505048-003	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	5/29/2005	Bluefish	Fillet, Skin On	1	70.0	2930	600		570.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0505048-004	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	5/29/2005	Bluefish	Fillet, Skin On	1	71.0	3450	720		684.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0505048-005	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	5/29/2005	Bluefish	Fillet, Skin On	1	75.0	3740	540		513.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-001	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	66.0	2720	250		237.5			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-002	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	61.0	2060	180		171.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-003	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	67.0	2700	280		266.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-004	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	76.0	3760	570		541.5			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-005	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	76.0	2790	480		456.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-006	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	74.0	3040	470		446.5			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-007	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	78.0	3330	760		722.0			DNREC FY'06 Fish Tissue Data_RG Calcs
0506029-008	Atlantic Ocean	Delaware Lightship	38 28 00.0	74 42 50.0	6/6/2005	Bluefish	Fillet, Skin On	1	71.1	2680	400		380.0			DNREC FY'06 Fish Tissue Data_RG Calcs
890814-34	Delaware Bay	Bowers Beach	39 05 08	75 21 12	6/28/1989	bluefish	fillet, skin off	5	50.8	1174	230		218.5			1991 EPA III Fish Tissue Report
94025950	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	08/26/94	Bluefish	Fillet Skin On	5	39.1	620.0	55		52.3			DNREC FY'95 Fish Tissue Data_RG Calcs
0406055-001	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	6/27/2004	Bluefish	Skin on fillet	1	32.0	300	180		171.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-002	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/1/2004	Bluefish	Skin on fillet	1	30.6	260	130		123.5			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-003	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/1/2004	Bluefish	Skin on fillet	1	24.0	296	120		114.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-004	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/4/2004	Bluefish	Skin on fillet	1	33.4	320	130		123.5			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-005	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/10/2004	Bluefish	Skin on fillet	1	30.5	285	190		180.5			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-006	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/10/2004	Bluefish	Skin on fillet	1	29.2	240	180		171.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-007	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/10/2004	Bluefish	Skin on fillet	1	29.6	245	180		171.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-008	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/10/2004	Bluefish	Skin on fillet	1	31.2	285	180		171.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-009	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/10/2004	Bluefish	Skin on fillet	1	30.0	250	200		190.0			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
0406055-010	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	7/11/2004	Bluefish	Skin on fillet	1	30.0	255	170		161.5			DNREC FY'04 and FY'05 Fish Tissue Data_RG Calcs_rev
MLB-BL-10to14-2016-1	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	315	294				220		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-10to14-2016-2	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	311	272				240		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-10to14-2016-3	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	316	298				210		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-10to14-2016-4	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	308	266				110		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-14to20-2016-1	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	385	565				150		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-14to20-2016-2	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	389	518				170		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-14to20-2016-3	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	391	602				220		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-14to20-2016-4	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Bluefish	Fillet, skin on	1	356	418				140		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Mean Weight (gm)	Total Mercury (ppb)	DQC	Estimated MeHg (ppb)	Measured MeHg (ppb)	DQC	Data Source
MLB-BL-20to26-2017-1	Delaware Bay	Mid to Lower Bay	38.845450	-75.221500	5/17/2017	Bluefish	Fillet, skin on	1	503	1150				330	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-20to26-2017-2	Delaware Bay	Mid to Lower Bay	38.845450	-75.221500	5/17/2017	Bluefish	Fillet, skin on	1	560	1450				300	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-20to26-2017-3	Delaware Bay	Mid to Lower Bay	38.796300	-75.094200	5/18/2017	Bluefish	Fillet, skin on	1	626	1950				310	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-20to26-2017-4	Delaware Bay	Mid to Lower Bay	38.796300	-75.094200	5/18/2017	Bluefish	Fillet, skin on	1	638	2000				270	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-26to32-2017-1	Delaware Bay	Mid to Lower Bay	38.850850	-75.228937	5/3/2017	Bluefish	Fillet, skin on	1	807	3950				510	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-26to32-2017-2	Delaware Bay	Mid to Lower Bay	38.845450	-75.221500	5/17/2017	Bluefish	Fillet, skin on	1	852	3900				500	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-26to32-2017-3	Delaware Bay	Mid to Lower Bay	38.796300	-75.094200	5/18/2017	Bluefish	Fillet, skin on	1	714	2940				370	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-BL-26to32-2017-4	Delaware Bay	Mid to Lower Bay	38.796300	-75.094200	5/18/2017	Bluefish	Fillet, skin on	1	723	2950				350	Z	2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Clearnose Skate	Epaxial Muscle Plug	1			214		203.3			Pest. Monit. Jour. 11(3): 132-133.
8303970	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	10/06/83	Eastern Oyster	Meat	27	na	na	<20		<19			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
8403531	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	09/17/84	Eastern Oyster	Meat	36	na	na	40		38			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
8502395	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	08/01/85	Eastern Oyster	Meat	48	na	na	17		16.15			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
8604328	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	12/04/86	Eastern Oyster	Meat	25	na	na	16		15.2			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
8704479	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	10/23/87	Eastern Oyster	Meat	11	na	na	20		19			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
8804256	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	10/17/88	Eastern Oyster	Meat	32	na	na	<180		<171			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
8904029	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	11/27/89	Eastern Oyster	Meat	26	9.2	19.2	<500		<475			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
9003809	Delaware Bay	Port Mahon Ridge Grounds	39 12 32.0	75 21 40.0	11/19/90	Eastern Oyster	Meat	53	7.1	14.4	<20		<19			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
92FBEI01	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				25.5		24.2			1992 USFWS Horseshoe Crab Data
92FBEI02	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				16.4		15.6			1992 USFWS Horseshoe Crab Data
92FBEI03	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				18.5		17.6			1992 USFWS Horseshoe Crab Data
92FBEI04	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				16.9		16.0			1992 USFWS Horseshoe Crab Data
92FBEI05	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				16.6		15.8			1992 USFWS Horseshoe Crab Data
92FBEI06	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				36.1		34.3			1992 USFWS Horseshoe Crab Data
92FBEI07	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				17.1		16.2			1992 USFWS Horseshoe Crab Data
92FBEI08	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				16.0		15.2			1992 USFWS Horseshoe Crab Data
92FBEI09	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				16.2		15.4			1992 USFWS Horseshoe Crab Data
92FBEI10	Delaware Bay	South Bowers Beach, DE	39 03 20	75 23 36	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				18.9		17.9			1992 USFWS Horseshoe Crab Data
92LCEI01	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				15.9		15.1			1992 USFWS Horseshoe Crab Data
92LCEI02	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				20.3		19.3			1992 USFWS Horseshoe Crab Data
92LCEI03	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				17.0		16.2			1992 USFWS Horseshoe Crab Data
92LCEI04	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				14.9		14.1			1992 USFWS Horseshoe Crab Data
92LCEI05	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				39.2		37.2			1992 USFWS Horseshoe Crab Data
92LCEI06	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				14.2		13.5			1992 USFWS Horseshoe Crab Data
92LCEI07	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				16.3		15.5			1992 USFWS Horseshoe Crab Data
92LCEI08	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				19.1		18.1			1992 USFWS Horseshoe Crab Data
92LCEI09	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				24.4		23.2			1992 USFWS Horseshoe Crab Data
92LCEI10	Delaware Bay	Port Mahon, DE	39 11 07	75 24 2.6	7/1/92 to 7/4/92	Horseshoe Crab	Egg Masses				19.6		18.6			1992 USFWS Horseshoe Crab Data
MW1989DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/19/1988	Mussel	Meat	~30			24.4		23.2			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1990DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/11/1989	Mussel	Meat	~30			6.8		6.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1991DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/11/1990	Mussel	Meat	~30			15.2		14.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1992DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/20/1991	Mussel	Meat	~30			13.2		12.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1993DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	1/10/1993	Mussel	Meat	~30			21.6		20.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1995DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	1/11/1995	Mussel	Meat	~30			33.5		31.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1996DBCH1ME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	1/23/1996	Mussel	Meat	~30			13.2		12.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1998DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/11/1997	Mussel	Meat	~30			40.4		38.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2000DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/6/1999	Mussel	Meat	~30			16.3		15.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2002DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/15/2001	Mussel	Meat	~30			18.2		17.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2004DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	11/16/2003	Mussel	Meat	~30			22.2		21.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2006DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	11/30/2005	Mussel	Meat	~30			15.7		14.9			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2008DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	11/28/2007	Mussel	Meat	~30			13.7		13.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2010DBCHME	Delaware Bay	Cape Henlopen	38.7835	-75.1205	12/7/2009	Mussel	Meat	~30			21.1		20.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1989DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	1/6/1989	Mussel	Meat	~30			20.4		19.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1990DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/10/1989	Mussel	Meat	~30			10.0		9.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1991DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/5/1990	Mussel	Meat	~30			20.0		19.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1992DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/18/1991	Mussel	Meat	~30			19.2		18.2			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1993DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	1/8/1993	Mussel	Meat	~30			18.0		17.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1995DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/20/1994	Mussel	Meat	~30			25.7		24.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1996DBCM1ME	Delaware Bay	Cape May	38.9822	-74.9613	12/9/1995	Mussel	Meat	~30			22.8		21.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1998DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/8/1997	Mussel	Meat	~30			28.1		26.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2000DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/8/1999	Mussel	Meat	~30			15.2		14.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2002DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/13/2001	Mussel	Meat	~30			23.0		21.9			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2004DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	11/14/2003	Mussel	Meat	~30			26.6		25.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2008DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	11/27/2007	Mussel	Meat	~30			14.9		14.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2010DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	12/5/2009	Mussel	Meat	~30			23.9		22.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2012DBCMME	Delaware Bay	Cape May	38.9822	-74.9613	1/5/2012	Mussel	Meat	~30			18.7		17.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2005DBHCME	Delaware Bay	Hope Creek	39.4267	-75.4933	1/2/2005	Mussel	Meat	~30			24.2		23.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Northern Sea Robin	Epaxial Muscle Plug	1			89		84.6			Pest. Monit. Jour. 11(3): 132-133.

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Mean Weight (gm)	Total Mercury (ppb)	DQC	Estimated MeHg (ppb)	Measured MeHg (ppb)	DQC	Data Source
MW1986DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	3/25/1986	Oyster	Meat	~30			10.4		9.9			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1987DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/17/1986	Oyster	Meat	~30			8.8		8.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1988DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	1/22/1988	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1990DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/15/1989	Oyster	Meat	~30			17.2		16.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1991DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/12/1990	Oyster	Meat	~30			11.2		10.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1992DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/22/1991	Oyster	Meat	~30			12.0		11.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1994DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	3/8/1994	Oyster	Meat	~30			13.2		12.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1996DBAP1CV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/14/1995	Oyster	Meat	~30			14.4		13.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1998DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/11/1997	Oyster	Meat	~30			28.0		26.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2000DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/7/1999	Oyster	Meat	~30			15.8		15.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2004DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	11/17/2003	Oyster	Meat	~30			25.3		24.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2005DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	1/2/2005	Oyster	Meat	~30			31.1		29.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2006DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/1/2005	Oyster	Meat	~30			14.2		13.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2008DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	11/28/2007	Oyster	Meat	~30			14.3		13.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2010DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/6/2009	Oyster	Meat	~30			19.8		18.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2012DBAPCV	Delaware Bay	Arnolds Point Shoal	39.3833	-75.45	12/29/2011	Oyster	Meat	~30			19.8		18.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1986DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	3/22/1986	Oyster	Meat	~30			9.2		8.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1987DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/16/1986	Oyster	Meat	~30			8.0		7.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1988DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	1/18/1988	Oyster	Meat	~30			10.8		10.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1989DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/8/1988	Oyster	Meat	~30			10.8		10.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1990DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/13/1989	Oyster	Meat	~30			12.4		11.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1993DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	1/7/1993	Oyster	Meat	~30			9.6		9.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1995DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/20/1994	Oyster	Meat	~30			12.2		11.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1996DBBD1CV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/13/1995	Oyster	Meat	~30			13.2		12.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1998DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/10/1997	Oyster	Meat	~30			20.9		19.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2000DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/7/1999	Oyster	Meat	~30			11.4		10.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2002DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/14/2001	Oyster	Meat	~30			10.3		9.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2004DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	11/16/2003	Oyster	Meat	~30			17.9		17.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2005DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	1/2/2005	Oyster	Meat	~30			15.5		14.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2006DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	11/30/2005	Oyster	Meat	~30			10.8		10.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2010DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/7/2009	Oyster	Meat	~30			12.7		12.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2012DBBDCV	Delaware Bay	Ben Davis Pt. Shoal	39.2523	-75.3028	12/29/2011	Oyster	Meat	~30			16.1		15.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2006DBCMCV	Delaware Bay	Cape May	38.9822	-74.9613	11/29/2005	Oyster	Meat	~30			9.7		9.2			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1986DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	3/22/1986	Oyster	Meat	~30			8.8		8.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1987DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/16/1986	Oyster	Meat	~30			9.6		9.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1988DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	1/11/1988	Oyster	Meat	~30			10.0		9.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1990DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/12/1989	Oyster	Meat	~30			20.0		19.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1991DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/7/1990	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1992DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/21/1991	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1994DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	3/9/1994	Oyster	Meat	~30			7.2		6.8			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1996DBFE1CV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/14/1995	Oyster	Meat	~30			12.0		11.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1998DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/9/1997	Oyster	Meat	~30			18.5		17.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2000DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/8/1999	Oyster	Meat	~30			11.9		11.3			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2002DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/14/2001	Oyster	Meat	~30			8.3		7.9			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2012DBFECV	Delaware Bay	False Egg Island Point	39.2117	-75.1917	12/29/2011	Oyster	Meat	~30			10.1		9.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1989DBHCCV	Delaware Bay	Hope Creek	39.4267	-75.4933	1/7/1989	Oyster	Meat	~30			14.8		14.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1986DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	3/27/1986	Oyster	Meat	~30			9.2		8.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1987DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	1/6/1987	Oyster	Meat	~30			8.8		8.4			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1988DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	1/21/1988	Oyster	Meat	~30			13.2		12.5			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1989DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	12/14/1988	Oyster	Meat	~30			13.6		12.9			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1990DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	12/16/1989	Oyster	Meat	~30			11.2		10.6			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1991DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	1/3/1991	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1992DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	1/9/1992	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1994DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	3/9/1994	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1996DBKI1CV	Delaware Bay	Kelly Island	39.2032	-75.359	12/15/1995	Oyster	Meat	~30			8.4		8.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1998DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	12/9/1997	Oyster	Meat	~30			12.7		12.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2000DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	12/7/1999	Oyster	Meat	~30			9.4		8.9			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2002DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	12/14/2001	Oyster	Meat	~30			12.4		11.7			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2004DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	11/16/2003	Oyster	Meat	~30			13.9		13.2			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2008DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	11/29/2007	Oyster	Meat	~30			8.6		8.2			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW2010DBKICV	Delaware Bay	Kelly Island	39.2032	-75.359	12/7/2009	Oyster	Meat	~30			12.6		12.0			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
MW1989DBWBCV	Delaware Bay	Woodland Beach	39.332	-75.457	12/10/1988	Oyster	Meat	~30			9.6		9.1			NOAA Mussel Watch_DE Bay_Hg_retrieved March2017
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Red Hake	Epaxial Muscle Plug	1			75		71.3			Pest. Monit. Jour. 11(3): 132-133.
VA91-341	Delaware Bay	~2.5 mi. SSW of Egg Island Wildlife Area, NJ	39.1447	75.1500	09/05/91	Scup	Fillet, Skin On	5	18.58		47.5		45.1			1991 EMAP Virginian Province Fish Tissue Data
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Silver Hake	Epaxial Muscle Plug	1			46		43.7			Pest. Monit. Jour. 11(3): 132-133.
VA91-342	Delaware Bay	~2.7 mi. W. of Dennis Creek Wildlife Area, NJ	39.1583	74.9377	09/05/91	Spot	Fillet, Skin On	5	21.54		32.1		30.5			1991 EMAP Virginian Province Fish Tissue Data
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Spotted Hake	Epaxial Muscle Plug	1			62		58.9			Pest. Monit. Jour. 11(3): 132-133.
97005920	Delaware Bay	East of Big Stone Beach, DE	39 00 02.8	75 10 30.3	02/28/97	Striped Bass	Fillet Skin On	1	79.6	5970.0	178		169.1			DNREC FY'98 Fish Tissue Data_RG Calcs
97005930	Delaware Bay	East of Big Stone Beach, DE	39 00 02.8	75 10 30.3	02/28/97	Striped Bass	Fillet Skin On	1	73.0	4460.0	224		212.8			DNREC FY'98 Fish Tissue Data_RG Calcs
97006220	Delaware Bay	East of Big Stone Beach, DE	39 00 02.8	75 10 30.3	03/04/97	Striped Bass	Fillet Skin On	1	75.5	5443.0	152		144.4			DNREC FY'98 Fish Tissue Data_RG Calcs
97006230	Delaware Bay	East of Big Stone Beach, DE	39 00 02.8	75 10 30.3	03/04/97	Striped Bass	Fillet Skin On	1	73.0	4536.0	208		197.6			DNREC FY'98 Fish Tissue Data_RG Calcs
97009210	Delaware Bay	East of Big Stone Beach, DE	39 00 02.8	75 10 30.3	04/14/97	Striped Bass	Fillet Skin On	1	79.5	4876.0	208		197.6			DNREC FY'98 Fish Tissue Data_RG Calcs
0203029-001	Delaware Bay	Delaware Bay, ~0.3 mi. ESE of Big Stone Bea	38 59 57.4	75 18 57.6	3/21/2002	Striped Bass	Fillet Skin On	1	66.5	2850	165		156.8			DNREC FY'03 Fish Tissue Data_RG Calcs
0203029-002	Delaware Bay	Delaware Bay, ~0.3 mi. ESE of Big Stone Bea	38 59 57.4	75 18 57.6	3/21/2002	Striped Bass	Fillet Skin On	1	68.4	3000	232		220.4			DNREC FY'03 Fish Tissue Data_RG Calcs
0203029-003	Delaware Bay	Delaware Bay, ~0.3 mi. ESE of Big Stone Bea	38 59 57.4	75 18 57.6	3/21/2002	Striped Bass	Fillet Skin On	1	66.2	2900	267		253.7			DNREC FY'03 Fish Tissue Data_RG Calcs
0203029-004	Delaware Bay	Delaware Bay, ~0.3 mi. ESE of Big Stone Bea	38 59 57.4	75 18 57.6	3/21/2002	Striped Bass	Fillet Skin On	1	67.1	2750	119		113.1			DNREC FY'03 Fish Tissue Data_RG Calcs
0203029-005	Delaware Bay	Delaware Bay, ~0.3 mi. ESE of Big Stone Bea	38 59 57.4	75 18 57.6	3/21/2002	Striped Bass	Fillet Skin On	1	62.6	2550	141		134.0			DNREC FY'03 Fish Tissue Data_RG Calcs

Sample ID	Waterbody	Location	Latitude	Longitude	Date Sampled	Species	Portion Analyzed	No. of Fish in Sample	Mean Length (cm)	Mean Weight (gm)	Total Mercury (ppb)	DQC	Estimated MeHg (ppb)	Measured MeHg (ppb)	DQC	Data Source
1204018-001A	Delaware Bay	Woodland Beach	39.3499	-75.44203	4/18/2012	Striped Bass	Skin on fillet	1	75.2	5400	201		191.0			DNREC FY'12 Fish Tissue Data_RG Calcs
1204018-002A	Delaware Bay	Woodland Beach	39.3499	-75.44203	4/18/2012	Striped Bass	Skin on fillet	1	76.7	5900	231		219.5			DNREC FY'12 Fish Tissue Data_RG Calcs
1204018-003A	Delaware Bay	Woodland Beach	39.3499	-75.44203	4/18/2012	Striped Bass	Skin on fillet	1	75.5	5800	135		128.3			DNREC FY'12 Fish Tissue Data_RG Calcs
MLB-SB-2016-1	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	805	5360				210		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-2	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	790	5500				56		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-3	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	740	4720				63		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-4	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	740	4780				81		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-5	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	800	6280				95		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-6	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	760	5510				170		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-7	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	775	6080				110		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-8	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	770	4860				260		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-9	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	715	4620				54		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-SB-2016-10	Delaware Bay	Mid to Lower Bay	39.057913	-75.324776	5/2/2016	Striped Bass	Fillet, skin on	1	780	5220				85		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
9104262	Delaware Bay	~8.3 miles ENE of Bowers Beach, DE	39 08 52.0	75 17 27.0	11/07/91	Summer Flounder	Fillet	4	36.9	466.0	<20		<19			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
5175110	Delaware Bay	~2.6 mi. ESE of Port Mahon, DE	39.178	75.353	09/19/98	Summer Flounder	Fillet	2	38.0	101.0	39		37.1			1998 MAIA Fish Tissue Data
5175110	Delaware Bay	~2.6 mi. ESE of Port Mahon, DE	39.178	75.353	09/19/98	Summer Flounder	Carcass	2	38.0	494.0	50		47.5			1998 MAIA Fish Tissue Data
5175110	Delaware Bay	~2.6 mi. ESE of Port Mahon, DE	39.178	75.353	09/19/98	Summer Flounder	Whole Body	2	38.0	596.0	48		45.6			1998 MAIA Fish Tissue Data
5207100	Delaware Bay	~7 mi. WSW of Egg Island Wildlife Area, NJ	39.129	75.251	09/19/98	Summer Flounder	Fillet	6	32.2	63.7	33		31.4			1998 MAIA Fish Tissue Data
5207100	Delaware Bay	~7 mi. WSW of Egg Island Wildlife Area, NJ	39.129	75.251	09/19/98	Summer Flounder	Carcass	6	32.2	268.0	32		30.4			1998 MAIA Fish Tissue Data
5207100	Delaware Bay	~7 mi. WSW of Egg Island Wildlife Area, NJ	39.129	75.251	09/19/98	Summer Flounder	Whole Body	6	32.2	332.0	32		30.4			1998 MAIA Fish Tissue Data
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Summer Flounder	Epaxial Muscle Plug	1			96		91.2			Pest. Monit. Jour. 11(3): 132-133.
0906039-001	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	35.5	1030	120		114.0			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-002	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	39.8	1450	83		78.9			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-003	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	39.5	1380	111		105.5			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-004	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	38.5	1130	90		85.5			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-005	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	35.5	1080	95		90.3			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-006	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	37.2	1100	178		169.1			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-007	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	41.5	1580	130		123.5			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-008	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	35.5	1130	109		103.6			DNREC FY'09 Fish Tissue Data_RG Calcs
0906039-009	Atlantic Coast	Reef Site 10 - Atlantic Ocean	38.60019	-74.93336	6/8/2009	Tautog	Tissue Plugs	1	38.0	1100	104		98.8			DNREC FY'09 Fish Tissue Data_RG Calcs
0605041-001A	Delaware Bay	Reef Site 8	38.8678	75.1444	5/16/2006	Tautog	Tissue Plugs	4	41.1	1620	140		133.0			DNREC FY'07 Fish Tissue Data_RG Calcs
0905025-001	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	36.5	1200	149		141.6			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-002	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	39.5	1300	62		58.9			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-003	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	44.0	1700	116		110.2			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-004	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	45.0	1900	106		100.7			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-005	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	42.0	1490	88		83.6			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-006	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	41.0	1280	91		86.5			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-007	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	44.0	1500	95		90.3			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-008	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	43.5	1720	92		87.4			DNREC FY'09 Fish Tissue Data_RG Calcs
0905025-009	Delaware Bay	Reef Site 8 - Del Bay	38.86667	-75.13347	5/11/2009	Tautog	Tissue Plugs	1	45.0	1800	78		74.1			DNREC FY'09 Fish Tissue Data_RG Calcs
9204501	Delaware Bay	Crossledge, ~5.2 mi. E of Bombay Hook Wildli	39 12 47.0	75 17 56.0	10/28/92	Weakfish	Fillet	5	34.8	441.2	80		76			DNREC Pre-1993 ELS Fish Tissue Data_RG Calcs
VA91-335	Delaware Bay	~ 4.3 mi. NNW of Cape Henlopen, DE	38.8640	75.1138	09/06/91	Weakfish	Fillet, Skin On	5	17.34		27.8		26.4			1991 EMAP Virginian Province Fish Tissue Data
VA91-337	Delaware Bay	~ 4.8 mi. E. of Big Stone Beach, DE	38.9973	75.2378	09/06/91	Weakfish	Fillet, Skin On	5	16.32		14.9		14.2			1991 EMAP Virginian Province Fish Tissue Data
VA91-338	Delaware Bay	~ 6.2 mi. NW of Cape May, NJ	39.0112	75.0260	09/05/91	Weakfish	Fillet, Skin On	5	15.50		16.8		16.0			1991 EMAP Virginian Province Fish Tissue Data
VA91-340	Delaware Bay	~2.4 mi. E. of Little Creek Wildlife Area, DE	39.1307	75.3622	09/07/91	Weakfish	Fillet, Skin On	4	27.30		72		68.4			1991 EMAP Virginian Province Fish Tissue Data
94039200	Delaware Bay	Mid-Bay	39 00 00.9	75 11 08.8	09/12/94	Weakfish	Fillet Skin On	3	35.0	427.7	55		52.3			DNREC FY'95 Fish Tissue Data_RG Calcs
MLB-WK-2016	Delaware Bay	Mid to Lower Bay	38.913725	-75.281767	8/15/2016	Weakfish	Fillet, skin on	5	322	301				130		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
NJ000061-FC1	Delaware Bay	~1.0 mi. WNW of Cape May Canal mouth, NJ	38.9723	74.9821	10/03/00	Weakfish	Fillet, Skin On	4	30.0	na	100		95.0			DRBC_EPA Coastal 2000
NJ000061-FC2	Delaware Bay	~1.0 mi. WNW of Cape May Canal mouth, NJ	38.9723	74.9821	10/03/00	Weakfish	Fillet, Skin On	11	25.8	na	40		38.0			DRBC_EPA Coastal 2000
NJ000061-FC1-ROF	Delaware Bay	~1.0 mi. WNW of Cape May Canal mouth, NJ	38.9723	74.9821	10/03/00	Weakfish	Carcass	4	30.0	na	70		66.5			DRBC_EPA Coastal 2000
NJ000061-FC2-ROF	Delaware Bay	~1.0 mi. WNW of Cape May Canal mouth, NJ	38.9723	74.9821	10/03/00	Weakfish	Carcass	11	25.8	na	60		57.0			DRBC_EPA Coastal 2000
5271100	Delaware Bay	~0.7 mi. SW of Arnold Point, NJ	39.381	75.435	Jul-98	Weakfish	Fillet	5	11.7	na	19.3		18.3			DRBC_EPA MAIA 1998
5175100	Delaware Bay	~2.6 mi. ESE of Port Mahon, DE	39.178	75.353	Jul-98	Weakfish	Fillet	5	15.3	na	22.3		21.2			DRBC_EPA MAIA 1998
5207110	Delaware Bay	~7 mi. WSW of Egg Island Wildlife Area, NJ	39.129	75.251	Jul-98	Weakfish	Fillet	7	6.9	na	24.7		23.5			DRBC_EPA MAIA 1998
MLB-WP-2016-A	Delaware Bay	Mid to Lower Bay	38.933813	-75.324796	8/23/2016	White Perch	Pan-dressed	5	206	154				97		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-WP-2016-B	Delaware Bay	Mid to Lower Bay	38.931971	-75.309663	12/1/2016	White Perch	Pan-dressed	5	236	207				82		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-WP-2016-C	Delaware Bay	Mid to Lower Bay	38.931971	-75.309663	12/1/2016	White Perch	Pan-dressed	5	238	213				140		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
MLB-WP-2016-D	Delaware Bay	Mid to Lower Bay	38.931971	-75.309663	12/1/2016	White Perch	Pan-dressed	5	237	225				190		2016_2017 WATAR_Fish Tissue Data_Del Est_RG Calcs
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Windowpane	Epaxial Muscle Plug	1			149		141.6			Pest. Monit. Jour. 11(3): 132-133.
na	Delaware Bay	East of Fowler Beach	38 52 50	75 10 25	4/10/1975	Winter Flounder	Epaxial Muscle Plug	1			57		54.2			Pest. Monit. Jour. 11(3): 132-133.



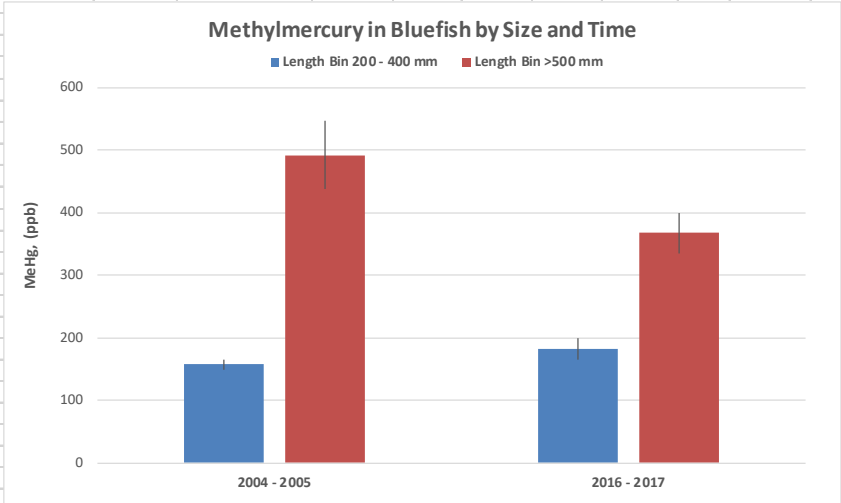
Length Bin 200 - 400 mm

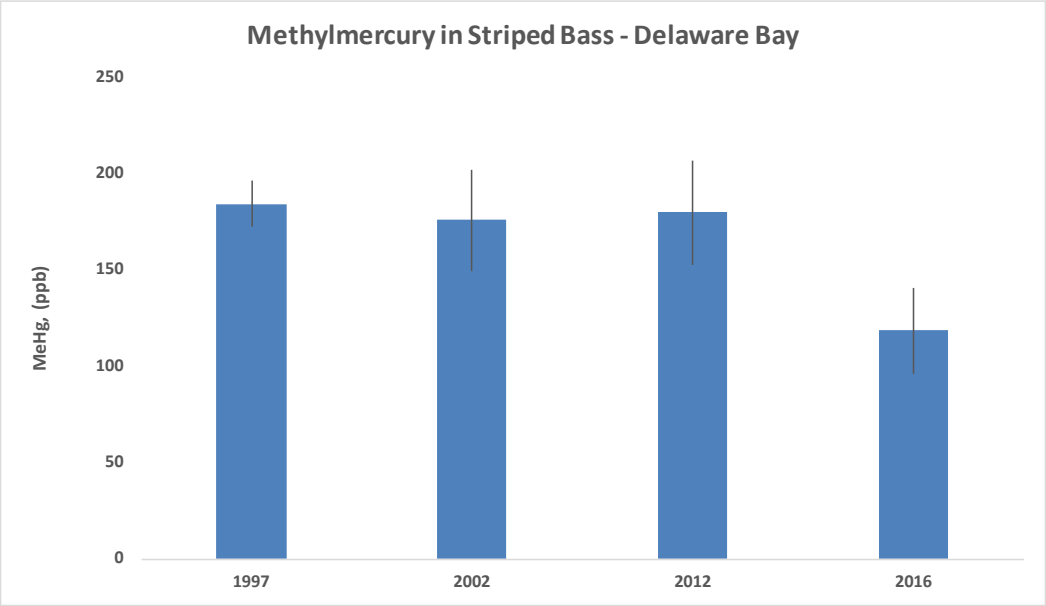
Year	Mean MeHg	S.E. MeHg
2004 - 2005	157.7	8.5
2016 - 2017	183	16.4

Length Bin >500 mm

Year	Mean MeHg	S.E. MeHg
2004 - 2005	491.3	54.6
2016 - 2017	368	31.9

% Reduction Small Bin =	0
% Reduction Large Bin =	25.2





MeHg in Striped Bass Delaware Bay - All Fish >28"

Year	Mean (ppb)	S.E. (ppb)
1997	184.30	12.23
2002	175.56	26.55
2012	179.55	26.94
2016	118.40	22.45

% Reduction 2012 - 2016 = 34.1

Appendix Four: Integrated Report Database

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2018
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	ENTEROCOCCUS		2002		4A	Bacteria, listed 2002, delisted 2006, Relisted 2018
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	DIOXIN				2	Delisted 2018 per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2018
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	2002		4A	
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	FURAN COMPOUNDS				2	Delisted 2018 per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE010-001-02	Appoquinimink River	Upper Appoquinimink River	Freshwater Tidal Reach	5.3027	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE010-001-03-01	Appoquinimink River	Drawyer Creek	From the headwaters of Drawyer Creek to the confluence with the Appoquinimink River, including Shallcross Lake	7.5153	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008, Relisted 2014, Delisted 2018
DE010-001-03-01	Appoquinimink River	Drawyer Creek	From the headwaters of Drawyer Creek to the confluence with the Appoquinimink River, including Shallcross Lake	7.5153	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, listed 1996, delisted 2008, Relisted 2010
DE010-001-03-01	Appoquinimink River	Drawyer Creek	From the headwaters of Drawyer Creek to the confluence with the Appoquinimink River, including Shallcross Lake	7.5153	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE010-001-03-02	Appoquinimink River	Drawyer Creek	Tributary of Drawyer Creek--from the confluence of the headwaters to the confluence with the mainstem	2.2416	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-001-03-02	Appoquinimink River	Drawyer Creek	Tributary of Drawyer Creek--from the confluence of the headwaters to the confluence with the mainstem	2.2416	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE010-001-03-03	Appoquinimink River	Drawyer Creek	Western tributary of the headwaters of Drawyer Creek to its confluence	2.3581	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	DDT (DICHLORODIPHENYLTRICHLOR OETHANE)				2	Delisted 2016 as DDT is no longer a contaminant of concern in fish consumption advisories for these waters
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	DIELDRIN	SOURCE UNKNOWN	2018	Low	5	
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	DIOXIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	FURAN COMPOUNDS	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE010-002-01-01	Appoquinimink River	Wiggins Mill Pond to confluence with Silver Lake	From the headwaters of Wiggins Mill Pond to the confluence with Noxontown Pond	3.588	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE010-002-01-01	Appoquinimink River	Wiggins Mill Pond to confluence with Silver Lake	From the headwaters of Wiggins Mill Pond to the confluence with Noxontown Pond	3.588	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE010-002-01-01	Appoquinimink River	Wiggins Mill Pond to confluence with Silver Lake	From the headwaters of Wiggins Mill Pond to the confluence with Noxontown Pond	3.588	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE010-002-01-02	Appoquinimink River	Wiggins Mill Pond to confluence with Silver Lake	From the confluence of the headwaters of Wiggins Mill Pond to the confluence with Noxontown Pond	1.4277	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-002-02-01	Appoquinimink River	Deep Creek to confluence with Silver Lake	From the headwaters of Deep Creek to confluence with Silver Lake, excluding Silver Lake	2.4015	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002 , relisted 2012, delisted 2014, relisted 2016, Delisted 2018
DE010-002-02-01	Appoquinimink River	Deep Creek to confluence with Silver Lake	From the headwaters of Deep Creek to confluence with Silver Lake, excluding Silver Lake	2.4015	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE010-002-02-01	Appoquinimink River	Deep Creek to confluence with Silver Lake	From the headwaters of Deep Creek to confluence with Silver Lake, excluding Silver Lake	2.4015	Miles	NUTRIENTS				2	Nutrients, Listed 2002, Delisted 2018
DE010-002-02-02	Appoquinimink River	Deep Creek to confluence with Silver Lake	First western tributary after the headwaters of Silver Lake	2.1762	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-002-02-03	Appoquinimink River	Deep Creek to confluence with Silver Lake	Deep Creek.-- from the confluence of the headwaters to Appoquinimink River	1.7551	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-L01	Appoquinimink River	Noxontown Pond	Pond southwest of Odessa	178.3	Acres	ENTEROCOCCUS				2	Bacteria, listed 1998, delisted 2006
DE010-L01	Appoquinimink River	Noxontown Pond	Pond southwest of Odessa	178.3	Acres	NUTRIENTS				2	Nutrients, Listed 1998, Delisted 2012
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	DDT (DICHLORODIPHENYLTRICHLOR OETHANE)				2	Delisted 2016 as DDT is no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	DIELDRIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	DIOXIN				2	Delisted 2016 as these are no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2006

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	FURAN COMPOUNDS				2	Delisted 2016 as these are no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	EPA TMDL in place since 2003 for nutrients. Online at http://www.dnrec.delaware.gov/swc/wa/Documents/Xia/Appo_NutrientsTMDL_TechReport_2003.pdf
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.278	Acres	POLYCHLORINATED BIPHENYLS (PCBS)				2	Delisted 2016 as PCB is no longer a contaminant of concern in fish consumption advisories for these waters
DE010-L03	Appoquinimink River	Shallcross Lake	Lake above Drawyer Creek	50.096	Acres	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE010-L03	Appoquinimink River	Shallcross Lake	Lake above Drawyer Creek	50.096	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2004
DE010-L03	Appoquinimink River	Shallcross Lake	Lake above Drawyer Creek	50.096	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	DIELDRIN				2	Delisted 2016 as dieldrin is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	DIOXIN	SOURCE UNKNOWN	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, Delisted 2016
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	ENTEROCOCCUS				2	Bacteria, Listed 2002, Delisted 2010
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	FURAN COMPOUNDS	SOURCE UNKNOWN	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	NUTRIENTS				2	Nutrients, Listed 2006, Delisted 2012
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	SOURCE UNKNOWN	2006		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	TOXAPHENE				2	Delisted 2016 as toxaphene is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-001-02	Army Creek	Lower Army Creek	First tributary on Army Creek after the headwaters	0.8282	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	DIELDRIN				2	Delisted 2016 as dieldrin is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	DIOXIN				2	Delisted 2018 per March 1, 2018 Evaluation of Fish Consumption Advisories
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	DISSOLVED OXYGEN				2	DO, Listed 2006, Delisted 2012
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	FURAN COMPOUNDS				2	Delisted 2018 per March 1, 2018 Evaluation of Fish Consumption Advisories
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	NUTRIENTS				2	Nutrients, Listed 1998, Delisted 2012
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	SOURCE UNKNOWN	2006		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE020-002	Army Creek	Upper Army Creek	Nontidal segment from headwaters to Route 13	1.3059	Miles	TOXAPHENE				2	Delisted 2016 as toxaphene is no longer a contaminant of concern in fish consumption advisories for these waters
DE020-003	Army Creek	Tributary to Army Creek	Unnamed Tributary to Army Creek, monitored by STORET station 114051	0.6973	Miles	DISSOLVED OXYGEN		2018		4A	DO, listed 2006, delisted 2008, Relisted 2018
DE020-003	Army Creek	Tributary to Army Creek	Unnamed Tributary to Army Creek, monitored by STORET station 114051	0.6973	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE020-003	Army Creek	Tributary to Army Creek	Unnamed Tributary to Army Creek, monitored by STORET station 114051	0.6973	Miles	NUTRIENTS				2	Nutrients, Listed 2006, Delisted 2018
DE030-001	Blackbird Creek	Lower Blackbird	Tidal segment from Route 13 to mouth of the Delaware River	12.498	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE030-001	Blackbird Creek	Lower Blackbird	Tidal segment from Route 13 to mouth of the Delaware River	12.498	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE030-001	Blackbird Creek	Lower Blackbird	Tidal segment from Route 13 to mouth of the Delaware River	12.498	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	Nutrients, Listed 1996, Delisted 2014, relisted 2016
DE030-002-01	Blackbird Creek	Upper Blackbird	Nontidal segment from headwaters to Route 13	4.3926	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	DO, listed 1996, delisted 2008, Relisted 2010
DE030-002-01	Blackbird Creek	Upper Blackbird	Nontidal segment from headwaters to Route 13	4.3926	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010
DE030-002-01	Blackbird Creek	Upper Blackbird	Nontidal segment from headwaters to Route 13	4.3926	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE030-002-02	Blackbird Creek	Upper Blackbird	First eastern tributary after the headwaters to the confluence with Blackbird Creek	2.4922	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE030-002-03	Blackbird Creek	Upper Blackbird	Upper Blackbird Creek--from the confluence of the headwaters to the confluence with Barlow Branch	3.393	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	

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DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIELDRIN	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIELDRIN	NON-POINT SOURCE	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIOXIN	NON-POINT SOURCE	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	ENTEROCOCCUS				2	Listed 2002, Delisted 2016
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	NUTRIENTS	CERCLA NPL (SUPERFUND) SITES	1996		4A	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIELDRIN	NON-POINT SOURCE	2016	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIELDRIN	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	ENTEROCOCCUS	CERCLA NPL (SUPERFUND) SITES	1996		4A	Bacteria, listed in 1996, delisted 2006 , relisted 2008
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, listed in 1996, delisted 2006 , relisted 2008
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	Bacteria, listed in 1996, delisted 2006 , relisted 2008
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE040-002-02	Brandywine Creek	Upper Brandywine	From State line to the confluence with the Christina River	10.714	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-01	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of Beaver Creek, from headwaters to the confluence with mainstem Beaver Creek	1.6078	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-01	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of Beaver Creek, from headwaters to the confluence with mainstem Beaver Creek	1.6078	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-02	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary originating in Pennsylvania on the western side of Brandywine Creek	0.7287	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-02	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary originating in Pennsylvania on the western side of Brandywine Creek	0.7287	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-03	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary of Brandywine Creek, off Route 100 (near PA-DE border)	1.4239	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	

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DE040-003-04	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary of Brandywine Creek just below Beaver Creek	0.4998	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-05	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of the headwaters of Rocky Run(upper half)	1.0237	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-06	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of the headwaters of Rocky Run(lower half)	1.0362	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-06	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of the headwaters of Rocky Run(lower half)	1.0362	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-07	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	From the confluence of the headwaters of Wilson Run to the next larger stream order (lower half)	0.6683	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-08	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	From the confluence of the headwaters of Wilson Run to the next larger stream order (upper half)	1.4837	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-08	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	From the confluence of the headwaters of Wilson Run to the next larger stream order (upper half)	1.4837	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-09	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Wilson Run, from start of the third order stream to the confluence with Brandywine Creek	0.9837	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-10	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary of Wilson Run on Montchanin Road from the headwaters to the first confluence	0.5357	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-001-01	Broad Creek	Lower Broad Creek	Lower Broad Creek, including Collins and Culvert Ditch, Holly Ditch, and Rossakatum and Cooper Branches	24.884	Miles	DISSOLVED OXYGEN				2	DO, listed 2002, Delisted 2010
DE050-001-01	Broad Creek	Lower Broad Creek	Lower Broad Creek, including Collins and Culvert Ditch, Holly Ditch, and Rossakatum and Cooper Branches	24.884	Miles	ENTEROCOCCUS				2	Bacteria Listed 1996, Delisted 2016
DE050-001-01	Broad Creek	Lower Broad Creek	Lower Broad Creek, including Collins and Culvert Ditch, Holly Ditch, and Rossakatum and Cooper Branches	24.884	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-001-01	Broad Creek	Lower Broad Creek	Lower Broad Creek, including Collins and Culvert Ditch, Holly Ditch, and Rossakatum and Cooper Branches	24.884	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE050-001-02	Broad Creek	Lower Broad Creek	Cooper Branch--from the start of the third order stream on Rossakatum Branch to the confluence of Broad Creek	2.588	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-002-01	Broad Creek	Tussocky Branch	Tributary west of Laurel, excluding Portsville and Tussock Ponds	6.7948	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-002-01	Broad Creek	Tussocky Branch	Tributary west of Laurel, excluding Portsville and Tussock Ponds	6.7948	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-002-02	Broad Creek	Tussocky Branch	Tussocky Branch--from the confluence of Mill Creek to the confluence with Broad Creek	3.814	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-003	Broad Creek	Little Creek	Tributary south of Laurel, excluding Horsey's Pond	2.3628	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-004-01	Broad Creek	Chipman Pond Branch	Tributary northeast of Laurel, excluding Chipman Pond	6.9415	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-004-01	Broad Creek	Chipman Pond Branch	Tributary northeast of Laurel, excluding Chipman Pond	6.9415	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-004-02	Broad Creek	Chipman Pond Branch	Jobs Ditch--from the headwaters to the confluence with Dukes and Jobs Branch	1.0709	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-004-03	Broad Creek	Chipman Pond Branch	Mirey Branch--from the start of the third order stream to the confluence with Elliott Pond Branch	2.0697	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-004-04	Broad Creek	Chipman Pond Branch	Dukes Ditch--from the headwaters to the confluence with Dukes and Jobs Branch	2.4651	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-005-01	Broad Creek	James Branch	James Branch, including Pepper Pond Branch, Hitch Pond Branch, and Grays Branch	17.83	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE050-005-01	Broad Creek	James Branch	James Branch, including Pepper Pond Branch, Hitch Pond Branch, and Grays Branch	17.83	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-005-01	Broad Creek	James Branch	James Branch, including Pepper Pond Branch, Hitch Pond Branch, and Grays Branch	17.83	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-005-02-01	Broad Creek	Trussum Pond Branch	From the headwaters to the confluence with James Branch, excluding Trussum Pond	3.1227	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-005-02-02	Broad Creek	Trussum Pond Branch	Wards Branch--from the confluence of the headwaters to the confluence with James Branch	3.4874	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE050-006-01	Broad Creek	Trap Pond Branch	From the headwaters of Trap Pond including Saunders and Thompson Branches	7.3001	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-006-01	Broad Creek	Trap Pond Branch	From the headwaters of Trap Pond including Saunders and Thompson Branches	7.3001	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-006-03	Broad Creek	Raccoon Prong	Headwaters of Raccoon Pond and Trap pond	5.3033	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE050-006-03	Broad Creek	Raccoon Prong	Headwaters of Raccoon Pond and Trap pond	5.3033	Miles	ENTEROCOCCUS				2	Bacteria, listed 2002, delisted 2006, relisted 2008, Delisted 2018
DE050-006-03	Broad Creek	Raccoon Prong	Headwaters of Raccoon Pond and Trap pond	5.3033	Miles	NUTRIENTS				2	Nutrients, Listed 2002, Delisted 2012
DE050-L01	Broad Creek	Portsville Pond	Pond west of Laurel on Tussocky Branch	17.575	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-L01	Broad Creek	Portsville Pond	Pond west of Laurel on Tussocky Branch	17.575	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-L02	Broad Creek	Tussock Pond	Pond southwest of Laurel	6.3055	Acres	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE050-L02	Broad Creek	Tussock Pond	Pond southwest of Laurel	6.3055	Acres	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE050-L03	Broad Creek	Horseys Pond	Pond south of Laurel on Little Creek tributary	58.345	Acres	ENTEROCOCCUS				2	Bacteria , listed in 1996, delisted 2004
DE050-L03	Broad Creek	Horseys Pond	Pond south of Laurel on Little Creek tributary	58.345	Acres	NUTRIENTS		2018		4A	Nutrients, Listed 1996, Delisted 2014, Relisted 2018
DE050-L04	Broad Creek	Records Pond	Pond adjacent to Laurel	83.931	Acres	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002, relisted 2006, delisted 2008
DE050-L04	Broad Creek	Records Pond	Pond adjacent to Laurel	83.931	Acres	ENTEROCOCCUS				2	Bacteria, Listed in 1996, delisted 2008
DE050-L04	Broad Creek	Records Pond	Pond adjacent to Laurel	83.931	Acres	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE050-L04	Broad Creek	Records Pond	Pond adjacent to Laurel	83.931	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-L05	Broad Creek	Chipman Pond	Pond located north of Laurel on Chipman Branch	54.821	Acres	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE050-L05	Broad Creek	Chipman Pond	Pond located north of Laurel on Chipman Branch	54.821	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-L06	Broad Creek	Trussum Pond	Pond southeast of Laurel on James Branch	54.95	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE050-L06	Broad Creek	Trussum Pond	Pond southeast of Laurel on James Branch	54.95	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-L06	Broad Creek	Trussum Pond	Pond southeast of Laurel on James Branch	54.95	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE050-L07	Broad Creek	Trap Pond	Pond east of Laurel on Hitch Pond Branch	94.618	Acres	AMMONIA				2	Ammonia, Listed 2012, Delisted 2018
DE050-L07	Broad Creek	Trap Pond	Pond east of Laurel on Hitch Pond Branch	94.618	Acres	DISSOLVED OXYGEN				2	DO, Listed 2002, Delisted 2014
DE050-L07	Broad Creek	Trap Pond	Pond east of Laurel on Hitch Pond Branch	94.618	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2002
DE050-L07	Broad Creek	Trap Pond	Pond east of Laurel on Hitch Pond Branch	94.618	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE050-L08	Broad Creek	Raccoon Pond	Pond east of Laurel on Hitch Pond Branch	17.473	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE050-L08	Broad Creek	Raccoon Pond	Pond east of Laurel on Hitch Pond Branch	17.473	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE050-L08	Broad Creek	Raccoon Pond	Pond east of Laurel on Hitch Pond Branch	17.473	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-001	Broadkill River	Lower Broadkill	From the confluence with Beaver Dam Creek to mouth at Delaware Bay, excluding Red Mill Pond	8.2044	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE060-001	Broadkill River	Lower Broadkill	From the confluence with Beaver Dam Creek to mouth at Delaware Bay, excluding Red Mill Pond	8.2044	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE060-001	Broadkill River	Lower Broadkill	From the confluence with Beaver Dam Creek to mouth at Delaware Bay, excluding Red Mill Pond	8.2044	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE060-002	Broadkill River	Beaverdam Creek	From the headwaters to the confluence with Broadkill River	8.743	Miles	DISSOLVED OXYGEN				2	DO, listed 2002, delisted 2008, Relisted 2012, Delisted 2016
DE060-002	Broadkill River	Beaverdam Creek	From the headwaters to the confluence with Broadkill River	8.743	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE060-002	Broadkill River	Beaverdam Creek	From the headwaters to the confluence with Broadkill River	8.743	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE060-002	Broadkill River	Beaverdam Creek	From the headwaters to the confluence with Broadkill River	8.743	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE060-002	Broadkill River	Beaverdam Creek	From the headwaters to the confluence with Broadkill River	8.743	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-003	Broadkill River	Upper Broadkill River	Broadkill River from below Waggamons Pond to the confluence with Beaver Dam Creek	4.8152	Miles	DISSOLVED OXYGEN				2	DO, Listed 2006, Delisted 2012
DE060-003	Broadkill River	Upper Broadkill River	Broadkill River from below Waggamons Pond to the confluence with Beaver Dam Creek	4.8152	Miles	ENTEROCOCCUS				2	Bacteria, listed in 1998, delisted 2004 , relisted 2006, delisted 2012
DE060-003	Broadkill River	Upper Broadkill River	Broadkill River from below Waggamons Pond to the confluence with Beaver Dam Creek	4.8152	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	2018		4A	Nutrients, listed 1998, delisted 2016, Relisted 2018
DE060-003	Broadkill River	Upper Broadkill River	Broadkill River from below Waggamons Pond to the confluence with Beaver Dam Creek	4.8152	Miles	NUTRIENTS	NON-POINT SOURCE	2018		4A	Nutrients, listed 1998, delisted 2016, Relisted 2018
DE060-004	Broadkill River	Round Pole Branch	Tributary from the headwaters to confluence with Upper Broadkill River	4.8819	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2012
DE060-004	Broadkill River	Round Pole Branch	Tributary from the headwaters to confluence with Upper Broadkill River	4.8819	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, listed 1996, delisted 2006, relisted 2008
DE060-004	Broadkill River	Round Pole Branch	Tributary from the headwaters to confluence with Upper Broadkill River	4.8819	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-005-01	Broadkill River	Ingrams Branch	From the headwaters to Waggamons Pond, including Diamond Pond	7.995	Miles	AMMONIA, TOTAL		2018		4A	Ammonia comes under nutrient TMDL
DE060-005-01	Broadkill River	Ingrams Branch	From the headwaters to Waggamons Pond, including Diamond Pond	7.995	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	DO, Listed 1996, Delisted 2012, Relisted 2014
DE060-005-01	Broadkill River	Ingrams Branch	From the headwaters to Waggamons Pond, including Diamond Pond	7.995	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE060-005-01	Broadkill River	Ingrams Branch	From the headwaters to Waggamons Pond, including Diamond Pond	7.995	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-005-02	Broadkill River	Ingrams Branch	Ingrams Branch-- western tributary of the headwaters	1.6929	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE060-005-02	Broadkill River	Ingrams Branch	Ingrams Branch-- western tributary of the headwaters	1.6929	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE060-006	Broadkill River	Pemberton Branch	From the headwaters to Waggamons Pond	4.4917	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE060-006	Broadkill River	Pemberton Branch	From the headwaters to Waggamons Pond	4.4917	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-007-01	Broadkill River	Lower Red Mill Branch	From Red Mill Pond to the confluence with Lower Broadkill River	5.9209	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002
DE060-007-01	Broadkill River	Lower Red Mill Branch	From Red Mill Pond to the confluence with Lower Broadkill River	5.9209	Miles	ENTEROCOCCUS				2	Bacteria, listed in 2002, delisted 2004
DE060-007-01	Broadkill River	Lower Red Mill Branch	From Red Mill Pond to the confluence with Lower Broadkill River	5.9209	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE060-007-02-01	Broadkill River	Martin Branch	From the headwaters to Red Mill Pond	1.9572	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2006
DE060-007-02-01	Broadkill River	Martin Branch	From the headwaters to Red Mill Pond	1.9572	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE060-007-02-01	Broadkill River	Martin Branch	From the headwaters to Red Mill Pond	1.9572	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-007-02-02	Broadkill River	Martin Branch	Tributary above Red Mill Pond--from start of the second order stream to the confluence with Red Mill Pond	0.418	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE060-007-03	Broadkill River	Heronwood Branch	From the headwaters to Red Mill Pond	0.8977	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE060-007-03	Broadkill River	Heronwood Branch	From the headwaters to Red Mill Pond	0.8977	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE060-008	Broadkill River	Primehook Creek	Entire Creek	7.5589	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2012	Low	5	
DE060-008	Broadkill River	Primehook Creek	Entire Creek	7.5589	Miles	MERCURY				2	Mercury, listed 2010, Delisted 2018 as it is no longer a contaminant of concern in fish tissue
DE060-L01	Broadkill River	Red Mill Pond	Pond located on Martin Branch	191.63	Acres	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE060-L01	Broadkill River	Red Mill Pond	Pond located on Martin Branch	191.63	Acres	ENTEROCOCCUS				2	Bacteria , listed in 1996, delisted 2006
DE060-L01	Broadkill River	Red Mill Pond	Pond located on Martin Branch	191.63	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-L02	Broadkill River	Waggamons Pond	Pond adjacent to Milton	41.565	Acres	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE060-L02	Broadkill River	Waggamons Pond	Pond adjacent to Milton	41.565	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Ponds located on Sowbridge Branch of Primehook Creek	84.917	Acres	DISSOLVED OXYGEN				2	DO, listed 1998, delisted 2006, Relisted 2012, Delisted 2014
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Ponds located on Sowbridge Branch of Primehook Creek	84.917	Acres	ENTEROCOCCUS				2	Bacteria , listed in 1998, delisted 2006, Relisted 2012, delisted 2016
DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Ponds located on Sowbridge Branch of Primehook Creek	84.917	Acres	MERCURY				2	Mercury listing in Waples Pond Only. Listed 2010, Delisted 2018 as Mercury is no longer a contaminant of concern in fish tissue

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DE060-L03	Broadkill River	Waples Pond and Reynolds Pond	Ponds located on Sowbridge Branch of Primehook Creek	84.917	Acres	NUTRIENTS				2	Nutrients Listed 1998, Delisted 2016
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	DISSOLVED OXYGEN				2	
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	2002		4A	
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4B	Delaware DNREC, EPA and MD Dept. of Environment are working cooperatively to implement the MD TMDL for the downstream portion in Delaware's portion of this shared waterbody for these parameters. DO, listed 1996, delisted 2008, relisted 2012, Delisted 2014
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4B	Delaware DNREC, EPA and MD Dept. of Environment are working cooperatively to implement the MD TMDL for the downstream portion in Delaware's portion of this shared waterbody for these parameters. DO, listed 1996, delisted 2008, relisted 2012, Delisted 2014
DE080-001	Cedar Creek	Lower Cedar Creek	Tidal segment from Cedar Creek Mill Pond to mouth at Delaware Bay	9.4302	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE080-001	Cedar Creek	Lower Cedar Creek	Tidal segment from Cedar Creek Mill Pond to mouth at Delaware Bay	9.4302	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE080-001	Cedar Creek	Lower Cedar Creek	Tidal segment from Cedar Creek Mill Pond to mouth at Delaware Bay	9.4302	Miles	NUTRIENTS				2	
DE080-002	Cedar Creek	Upper Cedar Creek	From the headwaters to Cedar Creek Mill Pond, including Church Branch and Cedar Mill Pond, Cubbage Pond, Clendaniel Pond and Hudson Pond	12.091	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE080-002	Cedar Creek	Upper Cedar Creek	From the headwaters to Cedar Creek Mill Pond, including Church Branch and Cedar Mill Pond, Cubbage Pond, Clendaniel Pond and Hudson Pond	12.091	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE080-002	Cedar Creek	Upper Cedar Creek	From the headwaters to Cedar Creek Mill Pond, including Church Branch and Cedar Mill Pond, Cubbage Pond, Clendaniel Pond and Hudson Pond	12.091	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.647	Miles	DIOXIN	NON-POINT SOURCE	2010	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.647	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.647	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.647	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2010	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.647	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.647	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2010		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	CHLORDANE				2	Not a contaminant of concern in fish consumption advisories for these waters
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	DDT (DICHLORODIPHENYLTRICHLOROETHANE)				2	Not a contaminant of concern in fish consumption advisories for these waters
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	DIELDRIN	NON-POINT SOURCE	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	NUTRIENTS				2	Nutrients, Listed 2002, Delisted 2012
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.859	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE090-002-01	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Scott Run-- from the headwaters to the confluence with Chesapeake & Delaware Canal	5.747	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-01	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Scott Run-- from the headwaters to the confluence with Chesapeake & Delaware Canal	5.747	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE090-002-01	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Scott Run-- from the headwaters to the confluence with Chesapeake & Delaware Canal	5.747	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE090-002-02	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Crystal Run--from the headwaters to the confluence with Chesapeake & Delaware Canal	1.8474	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-03	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Joy Run--from the headwaters to the confluence with Chesapeake & Delaware Canal	2.6418	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-04	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Eastern tributary on Lums Pond--from the headwaters to the confluence with Lums Pond	0.4515	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-04	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Eastern tributary on Lums Pond--from the headwaters to the confluence with Lums Pond	0.4515	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE090-002-05	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Unnamed Tributary referred to as "Southesat Creek," outflowing from Lums Pond to C&D Canal	0.8368	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2012		4A	
DE090-L01	Chesapeake & Delaware Canal	Lums Pond	Pond south of Newark	197.59	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2004
DE090-L01	Chesapeake & Delaware Canal	Lums Pond	Pond south of Newark	197.59	Acres	NUTRIENTS				2	Nutrients, Listed 2002, Delisted 2012
DE100-001-01	Chesapeake Drainage System	Cypress Branch, including tributaries	Mainstem	5.4383	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE100-001-01	Chesapeake Drainage System	Cypress Branch, including tributaries	Mainstem	5.4383	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE100-001-01	Chesapeake Drainage System	Cypress Branch, including tributaries	Mainstem	5.4383	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	

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DE100-001-02	Chesapeake Drainage System	Cypress Branch, including tributaries	Cypress Branch--from the confluence of Black Stallion Ditch to the MD-DE line	2.5805	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-001-02	Chesapeake Drainage System	Cypress Branch, including tributaries	Cypress Branch--from the confluence of Black Stallion Ditch to the MD-DE line	2.5805	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE100-001-03	Chesapeake Drainage System	Cypress Branch, including tributaries	Tributary of Cypress Branch--from the confluence of the headwaters to the confluence with the mainstem	1.5443	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-002-01	Chesapeake Drainage System	Sewell Branch, including tributaries	Mainstem	4.5453	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE100-002-01	Chesapeake Drainage System	Sewell Branch, including tributaries	Mainstem	4.5453	Miles	ENTEROCOCCUS				2	Delisted 2016
DE100-002-01	Chesapeake Drainage System	Sewell Branch, including tributaries	Mainstem	4.5453	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE100-002-02	Chesapeake Drainage System	Sewell Branch, including tributaries	From the confluence of the headwaters to the confluence with Sewell Branch	0.9476	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-002-02	Chesapeake Drainage System	Sewell Branch, including tributaries	From the confluence of the headwaters to the confluence with Sewell Branch	0.9476	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE100-002-02	Chesapeake Drainage System	Sewell Branch, including tributaries	From the confluence of the headwaters to the confluence with Sewell Branch	0.9476	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-01	Chesapeake Drainage System	Gravelly Run, including tributaries	Mainstem	3.7494	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, delisted 2008
DE100-003-01	Chesapeake Drainage System	Gravelly Run, including tributaries	Mainstem	3.7494	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE100-003-01	Chesapeake Drainage System	Gravelly Run, including tributaries	Mainstem	3.7494	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE100-003-02	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the confluence of Jamison Branch to the MD-DE line	1.0894	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-003-02	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the confluence of Jamison Branch to the MD-DE line	1.0894	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-03	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--from the headwaters to the confluence with the mainstem	0.6894	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-04	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--first western tributary upstream of Gravelly Run	1.3432	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-003-04	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--first western tributary upstream of Gravelly Run	1.3432	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-05	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--second eastern tributary from the headwaters of Gravelly Run to the mainstem	1.2767	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-06	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the start of the third order stream to the confluence with Jamison Branch	1.0335	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-003-06	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the start of the third order stream to the confluence with Jamison Branch	1.0335	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-004-01	Chesapeake Drainage System	Tributaries of Elk River	First eastern tributary after the headwaters of Great Bohemia Creek	1.6087	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-004-02	Chesapeake Drainage System	Tributaries of Elk River	Eastern tributary of the headwaters of Back Creek to its confluence	1.7668	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-005-01	Chesapeake Drainage System	Tributaries of Sassafras River	Western tributary of the headwaters of Sassafras River to its confluence	2.2761	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-005-02	Chesapeake Drainage System	Tributaries of Sassafras River	From the confluence of the headwaters of Sassafras River to the next larger stream order	1.2176	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-005-02	Chesapeake Drainage System	Tributaries of Sassafras River	From the confluence of the headwaters of Sassafras River to the next larger stream order	1.2176	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-01	Choptank	Tappahanna Ditch	Mainstem	8.1295	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE110-001-01	Choptank	Tappahanna Ditch	Mainstem	8.1295	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010, Relisted 2014, Delisted 2018
DE110-001-01	Choptank	Tappahanna Ditch	Mainstem	8.1295	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE110-001-02	Choptank	Tappahanna Ditch	From start of the fourth order stream to the confluence with Tidy Island Creek	3.281	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-02	Choptank	Tappahanna Ditch	From start of the fourth order stream to the confluence with Tidy Island Creek	3.281	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-03	Choptank	Tappahanna Ditch	Start of third order stream on Tappahanna Ditch to the confluence of the next larger stream order	3.0282	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-03	Choptank	Tappahanna Ditch	Start of third order stream on Tappahanna Ditch to the confluence of the next larger stream order	3.0282	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-04	Choptank	Tappahanna Ditch	First western tributary after the headwaters of Tappahanna Ditch to its confluence	0.9089	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-05	Choptank	Tappahanna Ditch	Tidy Island Creek--from the confluence with Tappahanna Ditch to the MD-DE line	0.5572	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-06	Choptank	Tappahanna Ditch	Choptank River--from the start of the third order stream to the confluence with Choptank River	2.9172	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-06	Choptank	Tappahanna Ditch	Choptank River--from the start of the third order stream to the confluence with Choptank River	2.9172	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-07	Choptank	Tappahanna Ditch	Seventh eastern tributary upstream of Tappahanna Ditch	1.4249	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE110-001-07	Choptank	Tappahanna Ditch	Seventh eastern tributary upstream of Tappahanna Ditch	1.4249	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-08	Choptank	Tappahanna Ditch	Tributary of Tappahanna Ditch--western tributary of the headwaters to its confluence	0.3371	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-08	Choptank	Tappahanna Ditch	Tributary of Tappahanna Ditch--western tributary of the headwaters to its confluence	0.3371	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-09	Choptank	Tappahanna Ditch	Second western tributary after the headwaters of Tappahanna Ditch to its confluence	0.7614	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-09	Choptank	Tappahanna Ditch	Second western tributary after the headwaters of Tappahanna Ditch to its confluence	0.7614	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-01	Choptank	Culbreth Marsh Ditch	Mainstem	6.8379	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE110-002-01	Choptank	Culbreth Marsh Ditch	Mainstem	6.8379	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010, Relisted 2014, Delisted 2018
DE110-002-01	Choptank	Culbreth Marsh Ditch	Mainstem	6.8379	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE110-002-02	Choptank	Culbreth Marsh Ditch	Luther Marvel Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	1.1611	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-02	Choptank	Culbreth Marsh Ditch	Luther Marvel Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	1.1611	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE110-002-03	Choptank	Culbreth Marsh Ditch	From the confluence of Powell Ditch to the confluence with Ross Prong	1.3125	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-04	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (lower half)	1.8458	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-05	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (upper half)	1.9906	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-05	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (upper half)	1.9906	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE110-002-05	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (upper half)	1.9906	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-05	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (upper half)	1.9906	Miles	TEMPERATURE				2	Temperature, listed in 1998, Delisted 2018 as there are no point source discharges
DE110-002-06	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from the confluence of Ross Prong to the confluence with the next larger stream order	3.7481	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-06	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from the confluence of Ross Prong to the confluence with the next larger stream order	3.7481	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-07	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from the confluence of Mud Millpond to the confluence of Cow Marsh Creek	2.0824	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-08	Choptank	Culbreth Marsh Ditch	Third western tributary upstream of Culbreth Marsh Ditch	1.8136	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-08	Choptank	Culbreth Marsh Ditch	Third western tributary upstream of Culbreth Marsh Ditch	1.8136	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-09	Choptank	Culbreth Marsh Ditch	Ross Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	2.6118	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-09	Choptank	Culbreth Marsh Ditch	Ross Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	2.6118	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-01	Choptank	Cow Marsh Creek	Mainstem	6.529	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE110-003-01	Choptank	Cow Marsh Creek	Mainstem	6.529	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE110-003-01	Choptank	Cow Marsh Creek	Mainstem	6.529	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE110-003-02	Choptank	Cow Marsh Creek	First upstream tributary on Meredith Branch	0.4299	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-03	Choptank	Cow Marsh Creek	From the confluence of the headwaters of Sangston Prong to the confluence Gravelly Branch	1.9683	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-03	Choptank	Cow Marsh Creek	From the confluence of the headwaters of Sangston Prong to the confluence Gravelly Branch	1.9683	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-04	Choptank	Cow Marsh Creek	Tributary of Gary Mill Pond Branch--from the confluence of the headwaters to the confluence with Gary Mill Pond Branch	0.5351	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-04	Choptank	Cow Marsh Creek	Tributary of Gary Mill Pond Branch--from the confluence of the headwaters to the confluence with Gary Mill Pond Branch	0.5351	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-05	Choptank	Cow Marsh Creek	First eastern tributary after the headwaters of Wildcat Branch	0.9278	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-05	Choptank	Cow Marsh Creek	First eastern tributary after the headwaters of Wildcat Branch	0.9278	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-06	Choptank	Cow Marsh Creek	Willow Grove Prong--from the start of the third order stream to the confluence with Cow Marsh Creek	1.2142	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-06	Choptank	Cow Marsh Creek	Willow Grove Prong--from the start of the third order stream to the confluence with Cow Marsh Creek	1.2142	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-07	Choptank	Cow Marsh Creek	Tributary of Cow Marsh Creek--first eastern tributary upstream of Cow Marsh Creek	1.4231	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-08	Choptank	Cow Marsh Creek	Cow Marsh Ditch--from start of third order stream to the confluence with Cow Marsh Creek	1.3608	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-09	Choptank	Cow Marsh Creek	Cow Marsh Ditch--from the confluence of the headwaters to the confluence with the next larger stream order	1.557	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-10	Choptank	Cow Marsh Creek	Bullock Prong--mainstem to the confluence with Price Prong	1.4668	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-11	Choptank	Cow Marsh Creek	Third tributary upstream of Cow Marsh Ditch--from the headwaters to the confluence with Cow Marsh Ditch	2.4429	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-12	Choptank	Cow Marsh Creek	Iron Mine Prong--from the confluence of Black Swamp to the next larger stream order	4.1329	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-13	Choptank	Cow Marsh Creek	Meredith Branch--from the start of the third stream order to the confluence with the next larger stream order	2.1655	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-13	Choptank	Cow Marsh Creek	Meredith Branch--from the start of the third stream order to the confluence with the next larger stream order	2.1655	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-14	Choptank	Cow Marsh Creek	White Marsh Branch--from the start of the third order stream to the confluence with Gravelly Branch and Sangston Prong	3.0627	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-15	Choptank	Cow Marsh Creek	Cow Marsh Creek--from the confluence of Iron Mine Prong to the confluence with Choptank River	4.9306	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-L01	Choptank	Mud Mill Pond	Pond south of Marydel	39.775	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE110-L01	Choptank	Mud Mill Pond	Pond south of Marydel	39.775	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE110-L01	Choptank	Mud Mill Pond	Pond south of Marydel	39.775	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DDD (DICHLORODIPHENYLDICHLOROETHANE)	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DDE (DICHLORODIPHENYLDICHLOROETHYLENE)	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DDT (DICHLORODIPHENYLTRICHLOROETHANE)	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DIELDRIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DIOXIN	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002

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DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	2002		4A	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	FURAN COMPOUNDS	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	DIELDRIN		2002	Low	5	Delisted 2016 in error, Restored category 5 Listing 2018
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2008		4A	DO Listed 2008, Delisted 2010, Relisted 2016
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	2002		4A	
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012, relisted 2016, Delisted 2018
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	CHLORDANE				2	Delisted 2016 because Chlordane is no longer a contaminant of concern in fish consumption advisories for these waters.
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	DIELDRIN	SOURCE UNKNOWN	2018	Low	5	
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	DISSOLVED OXYGEN				2	DO, listed in 2004, delisted 2006
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010, Relisted 2014, Delisted 2018
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	POLYCHLORINATED BIPHENYLS (PCBS)				2	Prior to 2016, EPA TMDL for PCBS in Delaware River Zone 5 and tributaries. Delisted 2016 because PCBs are no longer a contaminant of concern in fish consumption advisories for these waters.
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE120-003-03	Christina River	Upper Christina River	Tributary downstream of Smalleys Pond on the Christina River	0.7073	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	DIELDRIN	NON-POINT SOURCE	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	DISSOLVED OXYGEN				2	DO, listed in 2002, delisted 2006
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-004-02	Christina River	Lower Christina Creek	From the confluence of West Branch Christina River to the confluence with the mainstem	6.6563	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-02	Christina River	Lower Christina Creek	From the confluence of West Branch Christina River to the confluence with the mainstem	6.6563	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE120-004-02-03	Christina River	Belltown Run	Western tributary of the headwaters of Belltown Run to its confluence	0.8388	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-01	Christina River	Muddy Run	From the headwaters above Sunset Pond to the confluence with Belltown Run below Becks Pond	9.4606	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-004-03-02	Christina River	Muddy Run	From the headwaters of Iron Hill Run to the next larger stream order	2.3	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-03	Christina River	Muddy Run	Eastern tributary of the headwaters of Iron Hill Run	0.4967	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-04	Christina River	Muddy Run	Eastern tributary above Sunset Pond to the confluence of the next larger stream order	1.5227	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-05	Christina River	Muddy Run	Eastern tributary of the headwaters of Muddy Run to its confluence	0.4967	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-005-01	Christina River	West Branch	West Branch including Persimmon Run and Stine Haskell Branch	3.1715	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-005-01	Christina River	West Branch	West Branch including Persimmon Run and Stine Haskell Branch	3.1715	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE120-006-01	Christina River	Upper Christina Creek	Mainstem Upper Christina Creek	6.044	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	

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DE120-006-01	Christina River	Upper Christina Creek	Mainstem Upper Christina Creek	6.044	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE120-006-02	Christina River	Upper Christina Creek	From the confluence of the headwaters of Upper Christina River to the confluence of West Branch	4.7621	Miles	BIOLOGICAL INTEGRITY		1998	Low	5	
DE120-006-02	Christina River	Upper Christina Creek	From the confluence of the headwaters of Upper Christina River to the confluence of West Branch	4.7621	Miles	HABITAT ASSESSMENT		1998	Low	5	
DE120-006-03	Christina River	Upper Christina Creek	First western tributary after the headwaters of the Upper Christina River to mainstem Upper Christina River (upper half)	0.4682	Miles	HABITAT ASSESSMENT		1998	Low	5	
DE120-006-04	Christina River	Upper Christina Creek	First western tributary after the headwaters of the Upper Christina River to mainstem Upper Christina River (lower half)	0.395	Miles	BIOLOGICAL INTEGRITY		1998	Low	5	
DE120-006-04	Christina River	Upper Christina Creek	First western tributary after the headwaters of the Upper Christina River to mainstem Upper Christina River (lower half)	0.395	Miles	HABITAT ASSESSMENT		1998	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	HEPTACHLOR EPOXIDE	SOURCE UNKNOWN	2016	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-007-01-02	Christina River	Little Mill Creek and Willow Run	First western tributary after the headwaters of Little Mill Creek to the confluence with mainstem Little Mill Creek	1.889	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-03	Christina River	Little Mill Creek and Willow Run	From the headwaters of Willow Run to the confluence with the Christina River	0.253	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-04	Christina River	Little Mill Creek and Willow Run	From the confluence of the headwaters of Little Mill Creek to the confluence of Chestnut Run	3.3219	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-04	Christina River	Little Mill Creek and Willow Run	From the confluence of the headwaters of Little Mill Creek to the confluence of Chestnut Run	3.3219	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-05	Christina River	Little Mill Creek and Willow Run	Little Mill Creek--from the confluence of Chestnut Run to the confluence with the Christina River	3.5389	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-05	Christina River	Little Mill Creek and Willow Run	Little Mill Creek--from the confluence of Chestnut Run to the confluence with the Christina River	3.5389	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-02-01	Christina River	Chestnut Run	From the headwaters of Chestnut Run to the confluence with the Mill Creek	1.7297	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-007-02-02	Christina River	Chestnut Run	Eastern tributary of the headwaters of Chestnut Run to the confluence of the next larger stream order	1.0346	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-02-03	Christina River	Chestnut Run	From the headwaters of Chestnut Run to unnamed pond/water monitoring station	0.4455	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-007-02-03	Christina River	Chestnut Run	From the headwaters of Chestnut Run to unnamed pond/water monitoring station	0.4455	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-L01	Christina River	Smalleys Pond	Smalleys Pond east of Newark	17.588	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE120-L01	Christina River	Smalleys Pond	Smalleys Pond east of Newark	17.588	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-L01	Christina River	Smalleys Pond	Smalleys Pond east of Newark	17.588	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE120-L01	Christina River	Smalleys Pond	Smalleys Pond east of Newark	17.588	Acres	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-L02	Christina River	Becks Pond	Becks Pond southeast of Newark	27.821	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-L02	Christina River	Becks Pond	Becks Pond southeast of Newark	27.821	Acres	MERCURY				2	
DE120-L02	Christina River	Becks Pond	Becks Pond southeast of Newark	27.821	Acres	NUTRIENTS				2	Nutrients, listed in 1996, delisted 2002
DE120-L02	Christina River	Becks Pond	Becks Pond southeast of Newark	27.821	Acres	POLYCHLORINATED BIPHENYLS (PCBS)				2	Listed in 2002, Delisted 2010 due to removal of advisory. EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE120-L03	Christina River	Sunset Pond	Sunset Pond south of Newark	45.52	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE120-L03	Christina River	Sunset Pond	Sunset Pond south of Newark	45.52	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE120-L03	Christina River	Sunset Pond	Sunset Pond south of Newark	45.52	Acres	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE130-001	Dragon Run Creek	Lower Dragon Run Creek	From dam at the water supply pond to the mouth of Delaware River	3.1695	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE130-001	Dragon Run Creek	Lower Dragon Run Creek	From dam at the water supply pond to the mouth of Delaware River	3.1695	Miles	ENTEROCOCCUS				2	Bacteria, listed 2002, delisted 2006, relisted 2008, Delisted 2010
DE130-001	Dragon Run Creek	Lower Dragon Run Creek	From dam at the water supply pond to the mouth of Delaware River	3.1695	Miles	NUTRIENTS				2	Nutrients, Listed 1998, Delisted 2012
DE130-002-01	Dragon Run Creek	Upper Dragon Run Creek	From headwaters to water supply pond	4.4561	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE130-002-01	Dragon Run Creek	Upper Dragon Run Creek	From headwaters to water supply pond	4.4561	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, Listed 1996, Delisted 2010, Relisted 2012
DE130-002-01	Dragon Run Creek	Upper Dragon Run Creek	From headwaters to water supply pond	4.4561	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE130-002-02	Dragon Run Creek	Upper Dragon Run Creek	From the confluence of the headwaters to the water supply dam	4.07	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE140-001	Indian River	White Creek	Saline tidal waters extending from the north end of Assawoman Canal to the Indian River Bay	4.1383	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-001	Indian River	White Creek	Saline tidal waters extending from the north end of Assawoman Canal to the Indian River Bay	4.1383	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008, Relisted 2010, Delisted 2018
DE140-001	Indian River	White Creek	Saline tidal waters extending from the north end of Assawoman Canal to the Indian River Bay	4.1383	Miles	ENTEROCOCCUS				2	Bacteria, listed 1996, delisted 2008
DE140-001	Indian River	White Creek	Saline tidal waters extending from the north end of Assawoman Canal to the Indian River Bay	4.1383	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE140-002	Indian River	Blackwater Creek	Saline tidal waters from the headwaters to the confluence with Indian River Bay	7.2361	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE140-002	Indian River	Blackwater Creek	Saline tidal waters from the headwaters to the confluence with Indian River Bay	7.2361	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-002	Indian River	Blackwater Creek	Saline tidal waters from the headwaters to the confluence with Indian River Bay	7.2361	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE140-003	Indian River	Pepper Creek, including tributaries	Pepper Creek including Vines Creek, McCrays Branch, and Deep Hole Branch	22.471	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2010
DE140-003	Indian River	Pepper Creek, including tributaries	Pepper Creek including Vines Creek, McCrays Branch, and Deep Hole Branch	22.471	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-003	Indian River	Pepper Creek, including tributaries	Pepper Creek including Vines Creek, McCrays Branch, and Deep Hole Branch	22.471	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	DISSOLVED OXYGEN				2	DO, listed 2002, Delisted 2012
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2014, relisted 2016, Delisted 2018
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	TEMPERATURE	NON-POINT SOURCE	1996		4A	EPA TMDL December 2004
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	TEMPERATURE	POINT SOURCE(S) - UNSPECIFIED	1996		4A	EPA TMDL December 2004
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	TOTAL SUSPENDED SOLIDS (TSS)	NON-POINT SOURCE	1996		4A	Inland Bays Nutrient TMDLs addressed Suspended Solids
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	TOTAL SUSPENDED SOLIDS (TSS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	Inland Bays Nutrient TMDLs addressed Suspended Solids
DE140-005	Indian River	Swan Creek	Freshwater tidal river from the headwaters of Swan Creek to the confluence with Indian River	6.546	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-005	Indian River	Swan Creek	Freshwater tidal river from the headwaters of Swan Creek to the confluence with Indian River	6.546	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-005	Indian River	Swan Creek	Freshwater tidal river from the headwaters of Swan Creek to the confluence with Indian River	6.546	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-005	Indian River	Swan Creek	Freshwater tidal river from the headwaters of Swan Creek to the confluence with Indian River	6.546	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-005	Indian River	Swan Creek	Freshwater tidal river from the headwaters of Swan Creek to the confluence with Indian River	6.546	Miles	TEMPERATURE				2	Temperature, listed in 1996, delisted in 2002 as sole point source discharger was removed
DE140-006	Indian River	Stockley Branch	From the confluence of Alms House Ditch with Stockley Branch to the confluence with Millsboro Pond	5.2661	Miles	DISSOLVED OXYGEN				2	DO, listed in 2002, delisted 2004
DE140-006	Indian River	Stockley Branch	From the confluence of Alms House Ditch with Stockley Branch to the confluence with Millsboro Pond	5.2661	Miles	ENTEROCOCCUS				2	Bacteria, listed 1996, delisted 2008
DE140-006	Indian River	Stockley Branch	From the confluence of Alms House Ditch with Stockley Branch to the confluence with Millsboro Pond	5.2661	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	2018		4A	Nutrients, listed 1996, delisted 2016, Relisted 2018
DE140-006	Indian River	Stockley Branch	From the confluence of Alms House Ditch with Stockley Branch to the confluence with Millsboro Pond	5.2661	Miles	NUTRIENTS	NON-POINT SOURCE	2018		4A	Nutrients, listed 1996, delisted 2016, Relisted 2018
DE140-007	Indian River	Eli Walls Tax Ditch	From the headwaters of McGee Ditch, Eli Walls Tax Ditch, and Gills Branch to the confluence with Morris Millpond	11.306	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-007	Indian River	Eli Walls Tax Ditch	From the headwaters of McGee Ditch, Eli Walls Tax Ditch, and Gills Branch to the confluence with Morris Millpond	11.306	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-007	Indian River	Eli Walls Tax Ditch	From the headwaters of McGee Ditch, Eli Walls Tax Ditch, and Gills Branch to the confluence with Morris Millpond	11.306	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-007	Indian River	Eli Walls Tax Ditch	From the headwaters of McGee Ditch, Eli Walls Tax Ditch, and Gills Branch to the confluence with Morris Millpond	11.306	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-008	Indian River	Deep Branch, including tributary	Deep Branch, including Peterkins Branch, White Oak Swamp Ditch, Sockorockets Ditch, Welsh Branch, and Simpler Branch	15.456	Miles	DISSOLVED OXYGEN	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-008	Indian River	Deep Branch, including tributary	Deep Branch, including Peterkins Branch, White Oak Swamp Ditch, Sockorockets Ditch, Welsh Branch, and Simpler Branch	15.456	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE140-008	Indian River	Deep Branch, including tributary	Deep Branch, including Peterkins Branch, White Oak Swamp Ditch, Sockorockets Ditch, Welsh Branch, and Simpler Branch	15.456	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-008	Indian River	Deep Branch, including tributary	Deep Branch, including Peterkins Branch, White Oak Swamp Ditch, Sockorockets Ditch, Welsh Branch, and Simpler Branch	15.456	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-008	Indian River	Deep Branch, including tributary	Deep Branch, including Peterkins Branch, White Oak Swamp Ditch, Sockorockets Ditch, Welsh Branch, and Simpler Branch	15.456	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-008	Indian River	Deep Branch, including tributary	Deep Branch, including Peterkins Branch, White Oak Swamp Ditch, Sockorockets Ditch, Welsh Branch, and Simpler Branch	15.456	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-009-01	Indian River	Mirey Branch, including tributaries	Mirey Branch, including Sheep Pen Ditch, and Narrow Drain	16.59	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-009-01	Indian River	Mirey Branch, including tributaries	Mirey Branch, including Sheep Pen Ditch, and Narrow Drain	16.59	Miles	NUTRIENTS	NON-POINT SOURCE	2004		4A	
DE140-009-02	Indian River	Mirey Branch, including tributaries	Mirey Branch-- from the confluence of the headwaters to the confluence with Sheep Pen Ditch	5.8888	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE140-010	Indian River	Betts Pond Branch	From the headwaters of the tributaries of Ingrams Pond and Betts Pond to the confluence with Millsboro Pond, excluding Betts and Millsboro Pond	16.993	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE140-010	Indian River	Betts Pond Branch	From the headwaters of the tributaries of Ingrams Pond and Betts Pond to the confluence with Millsboro Pond, excluding Betts and Millsboro Pond	16.993	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-010	Indian River	Betts Pond Branch	From the headwaters of the tributaries of Ingrams Pond and Betts Pond to the confluence with Millsboro Pond, excluding Betts and Millsboro Pond	16.993	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	ENTEROCOCCUS				2	Bacteria, listed 1996, Delisted 2010
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	TOTAL SUSPENDED SOLIDS (TSS)	NON-POINT SOURCE	2018		4A	TMDL in place for Suspended Solids in Inland Bays TMDL of 2006
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	DISSOLVED OXYGEN				2	DO listed 2002, Delisted 2010, Relisted 2012, Delisted 2013
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	ENTEROCOCCUS				2	Bacteria, listed 1996, Delisted 2010
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	TEMPERATURE	NON-POINT SOURCE	1996		4A	EPA TMDL December 2004
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	TOTAL SUSPENDED SOLIDS (TSS)	NON-POINT SOURCE	2014		4A	
DE140-L01	Indian River	Millsboro Pond	Pond north of Millsboro	133.96	Acres	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002 , relisted 2004 , delisted 2006
DE140-L01	Indian River	Millsboro Pond	Pond north of Millsboro	133.96	Acres	ENTEROCOCCUS				2	Bacteria, listed 1996, delisted 2006
DE140-L01	Indian River	Millsboro Pond	Pond north of Millsboro	133.96	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE140-L02	Indian River	Betts Pond	Pond northwest of Millsboro	32.861	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2004
DE140-L02	Indian River	Betts Pond	Pond northwest of Millsboro	32.861	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-L03	Indian River	Ingrams Pond	Pond west of Millsboro	57.274	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE140-L03	Indian River	Ingrams Pond	Pond west of Millsboro	57.274	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE140-L04	Indian River	Morris Mill Pond	Pond between Millsboro and Georgetown	44.231	Acres	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE140-L04	Indian River	Morris Mill Pond	Pond between Millsboro and Georgetown	44.231	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE150-001-01	Iron Branch	Iron Branch	From the headwaters of Iron Branch and Whartons Branch to the confluence with Indian River	10.64	Miles	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE150-001-01	Iron Branch	Iron Branch	From the headwaters of Iron Branch and Whartons Branch to the confluence with Indian River	10.64	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE150-001-01	Iron Branch	Iron Branch	From the headwaters of Iron Branch and Whartons Branch to the confluence with Indian River	10.64	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE150-001-01	Iron Branch	Iron Branch	From the headwaters of Iron Branch and Whartons Branch to the confluence with Indian River	10.64	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE150-001-02	Iron Branch	Iron Branch	Whartons Ditch--from the start of the third order stream to the confluence with Whartons Branch	3.5521	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE150-001-02	Iron Branch	Iron Branch	Whartons Ditch--from the start of the third order stream to the confluence with Whartons Branch	3.5521	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE150-001-02	Iron Branch	Iron Branch	Whartons Ditch--from the start of the third order stream to the confluence with Whartons Branch	3.5521	Miles	TEMPERATURE				2	Temperature, listed in 1998, Delisted 2018 as there are no point source discharges
DE160-001	Leipsic River	Lower Leipsic River	From dam at Garrisons Lake to mouth at Delaware River	13.067	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE160-001	Leipsic River	Lower Leipsic River	From dam at Garrisons Lake to mouth at Delaware River	13.067	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE160-001	Leipsic River	Lower Leipsic River	From dam at Garrisons Lake to mouth at Delaware River	13.067	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE160-002-01	Leipsic River	Upper Leipsic River	From headwaters to Garrisons Lake, excluding Masseys Mill Pond	2.415	Miles	DISSOLVED OXYGEN				2	DO listed 1996, Delisted 2010
DE160-002-01	Leipsic River	Upper Leipsic River	From headwaters to Garrisons Lake, excluding Masseys Mill Pond	2.415	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2018
DE160-002-01	Leipsic River	Upper Leipsic River	From headwaters to Garrisons Lake, excluding Masseys Mill Pond	2.415	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE160-002-02	Leipsic River	Upper Leipsic River	From the start of the third order stream on Pinks Branch to the confluence with Garrison Lake	3.3065	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE160-002-02	Leipsic River	Upper Leipsic River	From the start of the third order stream on Pinks Branch to the confluence with Garrison Lake	3.3065	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE160-002-03	Leipsic River	Upper Leipsic River	Tributary of Leipsic River--from the confluence of the headwaters to the confluence with Leipsic River	0.9463	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE160-003-01	Leipsic River	Tributary from the dam at Garrisons Lake to mouth at Delaware Bay	From the confluence of the headwaters of Alston Branch to the confluence Leipsic River	1.7496	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE160-003-02	Leipsic River	Tributary from the dam at Garrisons Lake to mouth at Delaware Bay	Tributary of Leipsic River--eastern tributary of the headwaters to its confluence	1.2596	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE160-003-03	Leipsic River	Dyke Branch	Dyke Branch from headwaters to confluence with Leipsic River	4.9307	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE160-003-03	Leipsic River	Dyke Branch	Dyke Branch from headwaters to confluence with Leipsic River	4.9307	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE160-003-03	Leipsic River	Dyke Branch	Dyke Branch from headwaters to confluence with Leipsic River	4.9307	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	
DE160-004	Leipsic River	Muddy Branch	Muddy Branch from headwaters to the confluence with Leipsic River	7.7585	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE160-004	Leipsic River	Muddy Branch	Muddy Branch from headwaters to the confluence with Leipsic River	7.7585	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE160-004	Leipsic River	Muddy Branch	Muddy Branch from headwaters to the confluence with Leipsic River	7.7585	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	
DE160-L01	Leipsic River	Garrisons Lake	Lake south of Smyrna	83.762	Acres	DISSOLVED OXYGEN				2	DO, Listed 2002, Delisted 2010
DE160-L01	Leipsic River	Garrisons Lake	Lake south of Smyrna	83.762	Acres	ENTEROCOCCUS				2	Bacteria, Listed 1996, delisted 2006

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE160-L01	Leipsic River	Garrisons Lake	Lake south of Smyrna	83.762	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE160-L02	Leipsic River	Masseys Mill Pond	Pond south of Clayton	38.641	Acres	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2012
DE160-L02	Leipsic River	Masseys Mill Pond	Pond south of Clayton	38.641	Acres	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2012
DE160-L02	Leipsic River	Masseys Mill Pond	Pond south of Clayton	38.641	Acres	NUTRIENTS				2	Nutrients, Listed in 1996, Delisted 2012
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	DISSOLVED OXYGEN		1996		4A	DO, listed in 1996, delisted 2002 and relisted 2004.
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, Listed 1996, Delisted 2014, relisted 2016
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	Bacteria, Listed 1996, Delisted 2014, relisted 2016
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE180-001	Little Assawoman Bay	Little Assawoman Canal	Saline tidal waters from the confluence with White Creek to the confluence with little Assawoman Bay	4.3188	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE180-001	Little Assawoman Bay	Little Assawoman Canal	Saline tidal waters from the confluence with White Creek to the confluence with little Assawoman Bay	4.3188	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE180-001	Little Assawoman Bay	Little Assawoman Canal	Saline tidal waters from the confluence with White Creek to the confluence with little Assawoman Bay	4.3188	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE180-002-01	Little Assawoman Bay	Miller Creek	From the headwaters of Miller Creek to the confluence with Little Assawoman bay	4.104	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, Delisted 2016
DE180-002-01	Little Assawoman Bay	Miller Creek	From the headwaters of Miller Creek to the confluence with Little Assawoman bay	4.104	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE180-002-01	Little Assawoman Bay	Miller Creek	From the headwaters of Miller Creek to the confluence with Little Assawoman bay	4.104	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE180-002-02	Little Assawoman Bay	Miller Creek	Beaver Dam Ditch--from the confluence of Blackwater Creek to the confluence with the next larger stream order	2.3804	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE180-003-01	Little Assawoman Bay	Dirickson Creek	From the headwaters of Dirickson Creek to the confluence with Little Assawoman bay	3.6516	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE180-003-01	Little Assawoman Bay	Dirickson Creek	From the headwaters of Dirickson Creek to the confluence with Little Assawoman bay	3.6516	Miles	DISSOLVED OXYGEN				2	DO listed 2002, Delisted 2010
DE180-003-01	Little Assawoman Bay	Dirickson Creek	From the headwaters of Dirickson Creek to the confluence with Little Assawoman bay	3.6516	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE180-003-01	Little Assawoman Bay	Dirickson Creek	From the headwaters of Dirickson Creek to the confluence with Little Assawoman bay	3.6516	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE180-003-02	Little Assawoman Bay	Dirickson Creek	Bearhole Ditch--from the confluence. of the headwaters to the confluence with Batson Branch	2.543	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE180-003-03	Little Assawoman Bay	Dirickson Creek	Agricultural Ditch--from the confluence of the headwaters to the confluence with Dirickson Creek	2.9533	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE180-E01	Little Assawoman Bay	Little Assawoman Bay	Estuary from the confluence with Assawoman Canal to the confluence with Assawoman Bay	2.4428	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE180-E01	Little Assawoman Bay	Little Assawoman Bay	Estuary from the confluence with Assawoman Canal to the confluence with Assawoman Bay	2.4428	Square Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008, Relisted 2010, Delisted 2014
DE180-E01	Little Assawoman Bay	Little Assawoman Bay	Estuary from the confluence with Assawoman Canal to the confluence with Assawoman Bay	2.4428	Square Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, delisted 2006
DE180-E01	Little Assawoman Bay	Little Assawoman Bay	Estuary from the confluence with Assawoman Canal to the confluence with Assawoman Bay	2.4428	Square Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE190-001-01	Little River	Lower Little River	From the confluence of Upper Little River and Pipe Elm Branch with the Lower Little River to the mouth at Delaware Bay	2.3991	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE190-001-01	Little River	Lower Little River	From the confluence of Upper Little River and Pipe Elm Branch with the Lower Little River to the mouth at Delaware Bay	2.3991	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE190-001-01	Little River	Lower Little River	From the confluence of Upper Little River and Pipe Elm Branch with the Lower Little River to the mouth at Delaware Bay	2.3991	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE190-001-02-01	Little River	Upper Little River	From the headwaters to the confluence with Lower Little River	5.8103	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE190-001-02-01	Little River	Upper Little River	From the headwaters to the confluence with Lower Little River	5.8103	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010
DE190-001-02-01	Little River	Upper Little River	From the headwaters to the confluence with Lower Little River	5.8103	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE190-001-02-02	Little River	Upper Little River	Morgan Branch--from the confluence of the headwaters to the confluence with the next larger stream order	1.9316	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE190-001-02-03	Little River	Upper Little River	Start of the third order stream near the headwaters of Little River to the confluence with Morgan Branch	2.1185	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE190-001-02-03	Little River	Upper Little River	Start of the third order stream near the headwaters of Little River to the confluence with Morgan Branch	2.1185	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE190-001-03	Little River	Pipe Elm Branch	From the headwaters to the confluence with Little River	2.5346	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2010
DE190-001-03	Little River	Pipe Elm Branch	From the headwaters to the confluence with Little River	2.5346	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, Listed 1996, Delisted 2010, Relisted 2012
DE190-001-03	Little River	Pipe Elm Branch	From the headwaters to the confluence with Little River	2.5346	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE200-001-01	Marshyhope Creek	Marshyhope Creek	From the headwaters to the State Line	12.5	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE200-001-01	Marshyhope Creek	Marshyhope Creek	From the headwaters to the State Line	12.5	Miles	ENTEROCOCCUS				2	Bacteria, listed 1996, delisted 2008
DE200-001-01	Marshyhope Creek	Marshyhope Creek	From the headwaters to the State Line	12.5	Miles	NUTRIENTS		2018		4A	Nutrients, Listed 1996, Delisted 2014, relisted 2018
DE200-001-02	Marshyhope Creek	Marshyhope Creek	Tributary to Black Arm Prong--third tributary upstream of Black Arm Prong	0.6066	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-001-03	Marshyhope Creek	Marshyhope Creek	Marshyhope Creek--from the confluence of Prospect Branch to the confluence with the MD-DE line	9.1261	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	

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DE200-001-04	Marshyhope Creek	Marshyhope Creek	From the confluence of Black Prong and Marshyhope Ditch to the confluence of Prospect Branch	4.519	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-001-04	Marshyhope Creek	Marshyhope Creek	From the confluence of Black Prong and Marshyhope Ditch to the confluence of Prospect Branch	4.519	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-01	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Marshyhope Ditch	3.8359	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE200-002-01	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Marshyhope Ditch	3.8359	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE200-002-01	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Marshyhope Ditch	3.8359	Miles	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE200-002-02	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	First tributary upstream of Prong No. 2--from the eastern headwater to its confluence	1.6563	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-03	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Point Branch--from the headwaters to the confluence with the first tributary downstream	1.0832	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-04	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Tomahawk Branch--third eastern tributary downstream of the headwaters	0.7445	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-05	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Tomahawk Branch--first eastern tributary upstream	0.6386	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-06	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	0.905	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-06	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	0.905	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-07	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Salisbury Creek--from the start of the third order stream to the confluence with Cattail Branch (upper half)	1.0752	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-07	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Salisbury Creek--from the start of the third order stream to the confluence with Cattail Branch (upper half)	1.0752	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-08	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Salisbury Creek--from the start of the third order stream to the confluence with Cattail Branch (lower half)	0.8275	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-09	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Prospect Branch--western tributary of the headwaters to its confluence	1.7974	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-10	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Prong No. 2--from the start of the third order stream to the confluence with Bright-Haines Glade Branch	1.8403	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-10	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Prong No. 2--from the start of the third order stream to the confluence with Bright-Haines Glade Branch	1.8403	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-11	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	From the confluence of the headwaters of Green Branch to the confluence with Marshyhope Creek	5.2057	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-11	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	From the confluence of the headwaters of Green Branch to the confluence with Marshyhope Creek	5.2057	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-12	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	1.2777	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-12	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	1.2777	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-13	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Short and Hall Ditch--from the confluence of the headwaters of with Marshyhope Creek	1.3953	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-14	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Brights Branch--from the start of the third order stream to the MD-DE line	1.3657	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-15	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Bright-Haines Glade Branch--from the start of the fourth order stream and Prospect Branch to the confluence with Marshyhope Creek	1.2268	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE200-002-15	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Bright-Haines Glade Branch--from the start of the fourth order stream and Prospect Branch to the confluence with Marshyhope Creek	1.2268	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-15	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Bright-Haines Glade Branch--from the start of the fourth order stream and Prospect Branch to the confluence with Marshyhope Creek	1.2268	Miles	TEMPERATURE				2	Temperature, listed in 1998, Delisted 2018 as there are no point source discharges
DE200-002-16	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (upper half)	1.4572	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-16	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (upper half)	1.4572	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-17	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (lower half)	1.2752	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE200-002-17	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (lower half)	1.2752	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-17	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (lower half)	1.2752	Miles	TEMPERATURE				2	Temperature, listed in 1998, Delisted 2018 as there are no point source discharges
DE200-002-18	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Black Arm Prong--second tributary after the headwaters	0.6066	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-19	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Eastern tributary of the headwaters of Cattail Branch to its confluence	0.7145	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-21	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Cattail Branch--fourth western tributary downstream of the headwaters of Cattail Branch	0.6636	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-21	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Cattail Branch--fourth western tributary downstream of the headwaters of Cattail Branch	0.6636	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-23	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Cattail Branch--third western tributary upstream of Salisbury Creek	1.0775	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-24	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Tomahawk Branch--first western tributary after the headwaters	1.5618	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE210-001	Mispillion River	Lower Mispillion	From dam at Silver Lake to mouth at Delaware Bay	11.532	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE210-001	Mispillion River	Lower Mispillion	From dam at Silver Lake to mouth at Delaware Bay	11.532	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE210-001	Mispillion River	Lower Mispillion	From dam at Silver Lake to mouth at Delaware Bay	11.532	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE210-002-01	Mispillion River	Upper Mispillion	From the headwaters to Silver Lake in Milford, excluding Silver, Haven, and Griffith Lakes; Blairs, Abbotts, and Tub Mill Ponds	1.2523	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2006
DE210-002-01	Mispillion River	Upper Mispillion	From the headwaters to Silver Lake in Milford, excluding Silver, Haven, and Griffith Lakes; Blairs, Abbotts, and Tub Mill Ponds	1.2523	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE210-002-01	Mispillion River	Upper Mispillion	From the headwaters to Silver Lake in Milford, excluding Silver, Haven, and Griffith Lakes; Blairs, Abbotts, and Tub Mill Ponds	1.2523	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE210-002-02	Mispillion River	Upper Mispillion	Tantrough Branch--from the headwaters to the confluence with Blairs Pond	4.0511	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE210-002-03	Mispillion River	Upper Mispillion	Beaverdam Branch--western tributary of the headwaters to its confluence	3.1506	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE210-003	Mispillion River	Johnson Branch including its tributaries	Johnson Branch--from the confluence of the headwaters to the confluence with Haven Lake	5.271	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE210-003	Mispillion River	Johnson Branch including its tributaries	Johnson Branch--from the confluence of the headwaters to the confluence with Haven Lake	5.271	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE210-003	Mispillion River	Johnson Branch including its tributaries	Johnson Branch--from the confluence of the headwaters to the confluence with Haven Lake	5.271	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	
DE210-004	Mispillion River	Mispillion River Tributary from the headwaters to Silver Lake	Lednum Branch---eastern tributary of the headwaters to its confluence	1.6906	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE210-004	Mispillion River	Mispillion River Tributary from the headwaters to Silver Lake	Lednum Branch---eastern tributary of the headwaters to its confluence	1.6906	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE210-004	Mispillion River	Mispillion River Tributary from the headwaters to Silver Lake	Lednum Branch---eastern tributary of the headwaters to its confluence	1.6906	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	
DE210-005	Mispillion River	Mispillion Tributaries From Dam At Silver Lake To The Mouth	King's Causeway Branch	2.1799	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2004		4A	
DE210-005	Mispillion River	Mispillion Tributaries From Dam At Silver Lake To The Mouth	King's Causeway Branch	2.1799	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2006		4A	
DE210-005	Mispillion River	Mispillion Tributaries From Dam At Silver Lake To The Mouth	King's Causeway Branch	2.1799	Miles	NUTRIENTS	NON-POINT SOURCE	2006		4A	
DE210-L01	Mispillion River	Tub Mill Pond	Pond north of Milford	10.322	Acres	DISSOLVED OXYGEN				2	DO, listed 2006, delisted 2008
DE210-L01	Mispillion River	Tub Mill Pond	Pond north of Milford	10.322	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE210-L02	Mispillion River	Silver Lake	Silver Lake at Milford	28.959	Acres	ENTEROCOCCUS				2	Bacteria, listed 1996, delisted 2006
DE210-L02	Mispillion River	Silver Lake	Silver Lake at Milford	28.959	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE210-L03	Mispillion River	Haven Lake	Lake west of Milford; upstream of Silver Lake	85.44	Acres	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2006
DE210-L03	Mispillion River	Haven Lake	Lake west of Milford; upstream of Silver Lake	85.44	Acres	ENTEROCOCCUS				2	Bacteria, listed in 2002, delisted 2004
DE210-L03	Mispillion River	Haven Lake	Lake west of Milford; upstream of Silver Lake	85.44	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE210-L04	Mispillion River	Griffith Lake	Lake west of Milford; upstream of Haven Lake	39.186	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE210-L05	Mispillion River	Blairs Pond	Pond southwest of Milford	31.232	Acres	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002
DE210-L05	Mispillion River	Blairs Pond	Pond southwest of Milford	31.232	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE210-L05	Mispillion River	Blairs Pond	Pond southwest of Milford	31.232	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE210-L06	Mispillion River	Abbotts Mill Pond	Pond southwest of Milford	15.925	Acres	DISSOLVED OXYGEN				2	DO, Listed 2002, Delisted 2012
DE210-L06	Mispillion River	Abbotts Mill Pond	Pond southwest of Milford	15.925	Acres	ENTEROCOCCUS				2	Bacteria, listed 1998, delisted 2006
DE210-L06	Mispillion River	Abbotts Mill Pond	Pond southwest of Milford	15.925	Acres	NUTRIENTS	NON-POINT SOURCE	1998		4A	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	DISSOLVED OXYGEN	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	2002		4A	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	NUTRIENTS	NON-POINT SOURCE	2018		4A	Nutrients, Listed 1996, Delisted 2014, Relisted 2018
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	2018		4A	Nutrients, Listed 1996, Delisted 2014, Relisted 2018
DE220-002-01	Murderkill River	Spring Creek	From the headwaters to the confluence with Murderkill River , excluding Andrews Lake and McGinnis Pond	16.019	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2014
DE220-002-01	Murderkill River	Spring Creek	From the headwaters to the confluence with Murderkill River , excluding Andrews Lake and McGinnis Pond	16.019	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE220-002-01	Murderkill River	Spring Creek	From the headwaters to the confluence with Murderkill River , excluding Andrews Lake and McGinnis Pond	16.019	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE220-002-01	Murderkill River	Spring Creek	From the headwaters to the confluence with Murderkill River , excluding Andrews Lake and McGinnis Pond	16.019	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE220-002-02	Murderkill River	Spring Creek	Tributary of Hudson River--from the headwaters to the confluence with the next larger stream order	0.5726	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-002-02	Murderkill River	Spring Creek	Tributary of Hudson River--from the headwaters to the confluence with the next larger stream order	0.5726	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-002-03	Murderkill River	Spring Creek	Pratt Branch--eastern tributary of the headwaters to its confluence	0.7853	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-003-01	Murderkill River	Mid Murderkill River	From McCauley and Coursey Pond to the confluence with Spring Creek	9.0984	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE220-003-01	Murderkill River	Mid Murderkill River	From McCauley and Coursey Pond to the confluence with Spring Creek	9.0984	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE220-003-01	Murderkill River	Mid Murderkill River	From McCauley and Coursey Pond to the confluence with Spring Creek	9.0984	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE220-003-01	Murderkill River	Mid Murderkill River	From McCauley and Coursey Pond to the confluence with Spring Creek	9.0984	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE220-003-02	Murderkill River	Mid Murderkill River	Ash Gut-- from the headwaters to the confluence with the next larger stream order	1.1839	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-003-02	Murderkill River	Mid Murderkill River	Ash Gut-- from the headwaters to the confluence with the next larger stream order	1.1839	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-004-01	Murderkill River	Browns Branch	From the headwaters adjacent to Harrington to the confluence with McCauley Pond	7.6875	Miles	AMMONIA				2	Ammonia, listed 2004, Delisted 2018
DE220-004-01	Murderkill River	Browns Branch	From the headwaters adjacent to Harrington to the confluence with McCauley Pond	7.6875	Miles	DISSOLVED OXYGEN				2	DO, listed 1998, delisted 2008
DE220-004-01	Murderkill River	Browns Branch	From the headwaters adjacent to Harrington to the confluence with McCauley Pond	7.6875	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1998		4A	
DE220-004-01	Murderkill River	Browns Branch	From the headwaters adjacent to Harrington to the confluence with McCauley Pond	7.6875	Miles	NUTRIENTS				2	Nutrients, listed 1998, Delisted 2016
DE220-004-02	Murderkill River	Browns Branch	Tributary of Browns Branch-- from the confuence of the headwaters wtot he confluence with Browns Branch	1.8117	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-004-02	Murderkill River	Browns Branch	Tributary of Browns Branch-- from the confuence of the headwaters wtot he confluence with Browns Branch	1.8117	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-005-01	Murderkill River	Upper Murderkill River	From the headwaters to the confluence with Coursey pond, excluding Killens and Coursey Ponds	5.8427	Miles	DISSOLVED OXYGEN				2	DO, listed in 2004, delisted 2006
DE220-005-01	Murderkill River	Upper Murderkill River	From the headwaters to the confluence with Coursey pond, excluding Killens and Coursey Ponds	5.8427	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE220-005-01	Murderkill River	Upper Murderkill River	From the headwaters to the confluence with Coursey pond, excluding Killens and Coursey Ponds	5.8427	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE220-005-02	Murderkill River	Upper Murderkill River	Spring Branch--tributary on Coursey Pond	3.3146	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-005-03	Murderkill River	Upper Murderkill River	Fan Branch--from the headwaters to the confluence with Murderkill River	2.5777	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998	Low	5	
DE220-005-03	Murderkill River	Upper Murderkill River	Fan Branch--from the headwaters to the confluence with Murderkill River	2.5777	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-005-03	Murderkill River	Upper Murderkill River	Fan Branch--from the headwaters to the confluence with Murderkill River	2.5777	Miles	TEMPERATURE				2	Temperature, listed in 1998, Delisted 2018 as there are no point source discharges
DE220-005-04	Murderkill River	Upper Murderkill River	Tributary of Black Swamp Creek--from the headwaters to its confluence	0.8191	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-005-05	Murderkill River	Upper Murderkill River	Beaver Dam Branch--from the confluence of the headwaters to the confluence with Murderkill River and Black Swamp Creek	1.5105	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-005-06	Murderkill River	Upper Murderkill River	Black Swamp Creek--from the headwaters of Black Swamp to the confluence with the next larger stream order	1.7395	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-005-06	Murderkill River	Upper Murderkill River	Black Swamp Creek--from the headwaters of Black Swamp to the confluence with the next larger stream order	1.7395	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998	Low	5	
DE220-005-06	Murderkill River	Upper Murderkill River	Black Swamp Creek--from the headwaters of Black Swamp to the confluence with the next larger stream order	1.7395	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-L01	Murderkill River	McGinnis Pond	Pond east of Viola	38.347	Acres	DISSOLVED OXYGEN				2	DO, listed 2002, delisted 2008
DE220-L01	Murderkill River	McGinnis Pond	Pond east of Viola	38.347	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1998, delisted 2006
DE220-L01	Murderkill River	McGinnis Pond	Pond east of Viola	38.347	Acres	NUTRIENTS	NON-POINT SOURCE	1998		4A	
DE220-L02	Murderkill River	Andrews Lake	Pond West of Frederica	20.738	Acres	ENTEROCOCCUS				2	Bacteria, listed in 2002, delisted 2006
DE220-L02	Murderkill River	Andrews Lake	Pond West of Frederica	20.738	Acres	NUTRIENTS	NON-POINT SOURCE	2002		4A	
DE220-L03	Murderkill River	Coursey Pond	Pond southwest of Frederica	59.795	Acres	ENTEROCOCCUS				2	Bacteria, listed in 2002, delisted 2004
DE220-L03	Murderkill River	Coursey Pond	Pond southwest of Frederica	59.795	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE220-L04	Murderkill River	Killens Pond	Pond southwest of Felton	78.907	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE220-L04	Murderkill River	Killens Pond	Pond southwest of Felton	78.907	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE220-L05	Murderkill River	McCauley Pond	Pond northeast of Harrington	57.204	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2004
DE220-L05	Murderkill River	McCauley Pond	Pond northeast of Harrington	57.204	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE230-001-01	Naamans Creek	Lower Naamans Creek	From the mouth at the Delaware River, upstream to the first railroad bridge crossing	0.4231	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE230-001-01	Naamans Creek	Lower Naamans Creek	From the mouth at the Delaware River, upstream to the first railroad bridge crossing	0.4231	Miles	NUTRIENTS				2	Nutrients, Listed 2002, Delisted 2012
DE230-001-02-01	Naamans Creek	North Branch and South Branch	Upper Naamans Creek, including all tributaries on the North Branch and South Branch	7.2149	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE230-001-02-01	Naamans Creek	North Branch and South Branch	Upper Naamans Creek, including all tributaries on the North Branch and South Branch	7.2149	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE230-001-02-02	Naamans Creek	North Branch and South Branch	First tributary after the headwaters of South Naamans Creek to the mainstem	1.1382	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE230-001-02-02	Naamans Creek	North Branch and South Branch	First tributary after the headwaters of South Naamans Creek to the mainstem	1.1382	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-001	Nanticoke River	Lower Nanticoke River	From the head of tide in Middleford to the MD-DE State line	13.244	Miles	DISSOLVED OXYGEN				2	DO, Listed 1996, Delisted 2010
DE240-001	Nanticoke River	Lower Nanticoke River	From the head of tide in Middleford to the MD-DE State line	13.244	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, listed in 1996, delisted 2004, relisted 2014
DE240-001	Nanticoke River	Lower Nanticoke River	From the head of tide in Middleford to the MD-DE State line	13.244	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	Bacteria, listed in 1996, delisted 2004, relisted 2014
DE240-001	Nanticoke River	Lower Nanticoke River	From the head of tide in Middleford to the MD-DE State line	13.244	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	Nutrients, Listed 1996, Delisted 2014, relisted 2016
DE240-001	Nanticoke River	Lower Nanticoke River	From the head of tide in Middleford to the MD-DE State line	13.244	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	Nutrients, Listed 1996, Delisted 2014, relisted 2016
DE240-002-01	Nanticoke River	Upper Nanticoke River	From the headwaters of the Nanticoke River to the head of tide at Middleford	19.586	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002, relisted 2016, Delisted 2018
DE240-002-01	Nanticoke River	Upper Nanticoke River	From the headwaters of the Nanticoke River to the head of tide at Middleford	19.586	Miles	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2004, relisted 2012, delisted 2016
DE240-002-01	Nanticoke River	Upper Nanticoke River	From the headwaters of the Nanticoke River to the head of tide at Middleford	19.586	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE240-002-01	Nanticoke River	Upper Nanticoke River	From the headwaters of the Nanticoke River to the head of tide at Middleford	19.586	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE240-002-02	Nanticoke River	Upper Nanticoke River	Tributary of White Marsh Branch--first western tributary downstream of the headwaters of White Marsh Branch	2.2842	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE240-002-03	Nanticoke River	Upper Nanticoke River	Kent-Sussex Line Branch--from the start of the third order stream to the confluence with Nanticoke River (lower half)	1.6734	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-04	Nanticoke River	Upper Nanticoke River	Kent-Sussex Line Branch--from the start of the third order stream to the confluence with Nanticoke River (upper half)	1.9218	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE240-002-04	Nanticoke River	Upper Nanticoke River	Kent-Sussex Line Branch--from the start of the third order stream to the confluence with Nanticoke River (upper half)	1.9218	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-05	Nanticoke River	Upper Nanticoke River	Nanticoke Branch--from the confluence of Polk Branch to the confluence with Gum Branch	3.3619	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-06	Nanticoke River	Upper Nanticoke River	Grubby Neck Branch--from the confluence of Polk Branch to the confluence with Gum Branch	0.4325	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-07	Nanticoke River	Upper Nanticoke River	Nanticoke Branch--from the confluence of Kent-Sussex Line Branch to the confluence with Cart Branch	4.0077	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-08	Nanticoke River	Upper Nanticoke River	Nanticoke River--from the start of the third order stream to the confluence with Kent-Sussex Line Branch.	3.16	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE240-002-08	Nanticoke River	Upper Nanticoke River	Nanticoke River--from the start of the third order stream to the confluence with Kent-Sussex Line Branch.	3.16	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-09	Nanticoke River	Upper Nanticoke River	Tributary to Marsh Branch--first eastern tributary after the headwaters to its confluence	0.3295	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-003	Nanticoke River	Clear Brook Branch	From the headwaters of Clear Brook, Friedel Prong, and Bucks Branch to the confluence with Williams Pond	15.166	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	DO, listed in 1996, delisted 2006, relisted 2016
DE240-003	Nanticoke River	Clear Brook Branch	From the headwaters of Clear Brook, Friedel Prong, and Bucks Branch to the confluence with Williams Pond	15.166	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, listed in 1996, delisted 2006, relisted 2010
DE240-003	Nanticoke River	Clear Brook Branch	From the headwaters of Clear Brook, Friedel Prong, and Bucks Branch to the confluence with Williams Pond	15.166	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE240-004-01	Nanticoke River	Deep Creek Branch	From the headwaters above Concord Pond to the confluence with the Nanticoke River, excluding Concord Pond	3.5053	Miles	DISSOLVED OXYGEN				2	DO, Listed 2012, Delisted 2018
DE240-004-01	Nanticoke River	Deep Creek Branch	From the headwaters above Concord Pond to the confluence with the Nanticoke River, excluding Concord Pond	3.5053	Miles	ENTEROCOCCUS				2	Bacteria Listed 1996, Delisted 2016
DE240-004-01	Nanticoke River	Deep Creek Branch	From the headwaters above Concord Pond to the confluence with the Nanticoke River, excluding Concord Pond	3.5053	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE240-004-02	Nanticoke River	Deep Creek Branch	McColleys Branch--from the confluence of New Ditch to the confluence with Deep Creek	2.3654	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-004-03	Nanticoke River	Deep Creek Branch	Deep Creek--from the start of the third order stream to the confluence with Deep Creek and McColleys Branch	1.8278	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-004-04	Nanticoke River	Deep Creek Branch	Tyndall Branch--from the start of the third order stream on Stoney Creek to the confluence of Tyndall Branch and Deep Creek	5.5978	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-005-01	Nanticoke River	Gravelly Branch	From the headwaters of Gravelly Branch above Collins Pond to the confluence with the Nanticoke River, excluding Collins Pond	7.8311	Miles	ENTEROCOCCUS				2	Bacteria, listed 1996, delisted 2008
DE240-005-01	Nanticoke River	Gravelly Branch	From the headwaters of Gravelly Branch above Collins Pond to the confluence with the Nanticoke River, excluding Collins Pond	7.8311	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE240-005-01	Nanticoke River	Gravelly Branch	From the headwaters of Gravelly Branch above Collins Pond to the confluence with the Nanticoke River, excluding Collins Pond	7.8311	Miles	ZINC	SOURCE UNKNOWN	2014	Low	5	
DE240-005-02	Nanticoke River	Gravelly Branch	Prong No. 1--from the start of fourth order stream to the confluence with Gravelly Branch on Nanticoke River	1.9965	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-005-03	Nanticoke River	Gravelly Branch	Maple Branch-- from the start of the third order stream to the confluence with Prong No. 1	0.7074	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-005-04	Nanticoke River	Gravelly Branch	Maple Branch-- from the start of the third order stream to the confluence with Prong No. 1	1.0852	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-006-01	Nanticoke River	Bridgeville Branch	From the headwaters of Bridgeville Branch to the confluence with Nanticoke River	5.6997	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE240-006-01	Nanticoke River	Bridgeville Branch	From the headwaters of Bridgeville Branch to the confluence with Nanticoke River	5.6997	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE240-006-01	Nanticoke River	Bridgeville Branch	From the headwaters of Bridgeville Branch to the confluence with Nanticoke River	5.6997	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE240-006-02	Nanticoke River	Bridgeville Branch	Bridgeville Branch---from the start of the third order stream to the confluence with Nanticoke River	2.078	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-007-01	Nanticoke River	Gum Branch	From the headwaters located northeast of Woodland Ferry to the confluence with Nanticoke River	5.9982	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE240-007-01	Nanticoke River	Gum Branch	From the headwaters located northeast of Woodland Ferry to the confluence with Nanticoke River	5.9982	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE240-007-02	Nanticoke River	Gum Branch	Gum Branch.--from the start of the third order stream to the confluence with Nanticoke River	2.2177	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-008	Nanticoke River	Lewes Creek	Lewes Creek, including Butler Mill Branch and Chapel Branch	8.1892	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE240-008	Nanticoke River	Lewes Creek	Lewes Creek, including Butler Mill Branch and Chapel Branch	8.1892	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE240-008	Nanticoke River	Lewes Creek	Lewes Creek, including Butler Mill Branch and Chapel Branch	8.1892	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE240-010-01	Nanticoke River	Gum Branch on Upper Nanticoke River	Gum Branch--from the confluence of Stallion Head Branch to the confluence with West Branch Gum Branch	3.3475	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-010-02	Nanticoke River	Gum Branch on Upper Nanticoke River	Toms Dam Branch--from the start of the third order stream to the confluence with Gum Branch	4.4601	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-L01	Nanticoke River	Craigs Pond	Pond southwest of Seaford and below Butler Mill Branch	16.466	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	2002		4A	
DE240-L01	Nanticoke River	Craigs Pond	Pond southwest of Seaford and below Butler Mill Branch	16.466	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE240-L01	Nanticoke River	Craigs Pond	Pond southwest of Seaford and below Butler Mill Branch	16.466	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE240-L02	Nanticoke River	Concord Pond	Pond east of Seaford on Deep Creek Branch	77.697	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE240-L04	Nanticoke River	Williams Pond	Pond located in Seaford and below Middleford	86.185	Acres	ENTEROCOCCUS				2	Bacteria, Listed in 2002, delisted 2006
DE240-L04	Nanticoke River	Williams Pond	Pond located in Seaford and below Middleford	86.185	Acres	NUTRIENTS		2018		4A	Nutrients, Listed 1996 delisted 2016, Relisted 2018
DE240-L05	Nanticoke River	Hearns Pond	Pond located north of Seaford on Clear Brook Branch	61.002	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE240-L05	Nanticoke River	Hearns Pond	Pond located north of Seaford on Clear Brook Branch	61.002	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE250-001-01	Pocomoke River	Pocomoke River	Pocomoke River, from headwaters to the MD-DE State line	10.761	Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2008
DE250-001-01	Pocomoke River	Pocomoke River	Pocomoke River, from headwaters to the MD-DE State line	10.761	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE250-001-01	Pocomoke River	Pocomoke River	Pocomoke River, from headwaters to the MD-DE State line	10.761	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE250-001-02	Pocomoke River	Pocomoke River	Pocomoke River--from the confluence of Bald Cypress Branch and Gum Branch to the MD-DE line	0.9624	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE250-001-03	Pocomoke River	Pocomoke River	Pocomoke River--from start of the third order stream to the confluence with Bald Cypress Branch and Gum Branch	5.1233	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE250-002	Pocomoke River	Pocomoke River Tributaries from the headwaters to MD-DE State line	Bald Cypress Branch--from the confluence of the headwaters to the confluence with the next larger stream order	3.6044	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2006		4A	
DE250-002	Pocomoke River	Pocomoke River Tributaries from the headwaters to MD-DE State line	Bald Cypress Branch--from the confluence of the headwaters to the confluence with the next larger stream order	3.6044	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2004		4A	
DE250-002	Pocomoke River	Pocomoke River Tributaries from the headwaters to MD-DE State line	Bald Cypress Branch--from the confluence of the headwaters to the confluence with the next larger stream order	3.6044	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE250-002	Pocomoke River	Pocomoke River Tributaries from the headwaters to MD-DE State line	Bald Cypress Branch--from the confluence of the headwaters to the confluence with the next larger stream order	3.6044	Miles	NUTRIENTS	NON-POINT SOURCE	2004		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	CHLORINATED PESTICIDES				2	TMDL Target date changed from 2009 to 2017 in the 2012 Cycle, per the WATAR plan. Delisted 2016 as these are not contaminants of concern in fish tissue advisories.
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	DDT (DICHLORODIPHENYLTRICHLOROETHANE)				3	DDT levels at the State Line exceed human health and aquatic life criteria and decline downstream in a response fully explained by simple dilution, indicating sources are in Pennsylvania. The Department has done extensive sampling in the basin in 2015 as
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	DIOXIN	NON-POINT SOURCE	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	ENTEROCOCCUS	CERCLA NPL (SUPERFUND) SITES	1996		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	NUTRIENTS	CERCLA NPL (SUPERFUND) SITES	1996		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.834	Miles	ZINC				2	Listed in 1996 for zinc impairment, 2004 TMDL. Delisted 2014
DE260-001-02	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	6.2915	Miles	HABITAT ASSESSMENT				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE260-001-03	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (upper half)	6.5429	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE260-001-03	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (upper half)	6.5429	Miles	HABITAT ASSESSMENT				2	Delisted 2014 per Tetra Tech Report for EPA and Delaware DNREC
DE260-002-01	Red Clay Creek	Burroughs Run	From PA-DE line to the confluence with Red Clay Creek	2.7427	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE260-002-01	Red Clay Creek	Burroughs Run	From PA-DE line to the confluence with Red Clay Creek	2.7427	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	Bacteria, listed 1996, Delisted 2014, relisted 2016
DE260-002-01	Red Clay Creek	Burroughs Run	From PA-DE line to the confluence with Red Clay Creek	2.7427	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE260-003-01	Red Clay Creek	Red Clay Creek All other tributaries located in the watershed but NOT on the mainstem	Second tributary below Burroughs Run to the confluence with Red Clay Creek	1.2977	Miles	HABITAT ASSESSMENT				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE260-003-02	Red Clay Creek	Red Clay Creek All other tributaries located in the watershed but NOT on the mainstem	Western tributary of the headwaters of Hyde Run to the confluence with the next larger stream order	1.468	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE260-003-02	Red Clay Creek	Red Clay Creek All other tributaries located in the watershed but NOT on the mainstem	Western tributary of the headwaters of Hyde Run to the confluence with the next larger stream order	1.468	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE260-L01	Red Clay Creek	Red Clay Creek Reservoir	Hoopes Reservoir	187.86	Acres	ENTEROCOCCUS				3	This segment was listed in 1996, apparently based on earlier reports but no data were used for the listing. No data has been collected in the interim. The Department will study the segment to determine if a listing is appropriate.

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	CHLORINATED BENZENES				2	Chlorinated Benzene, listed in 1996, delisted 2002 based on improved conditions.
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	CHRONIC TOXICITY	NON-POINT SOURCE	2012	Low	5	Listed Based on 2011 journal article. Likely cause is a federal superfund site. The Department is working with EPA on the cleanup and possible TMDL.
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	CHRONIC TOXICITY	POINT SOURCE(S) - UNSPECIFIED	2012	Low	5	Listed Based on 2011 journal article. Likely cause is a federal superfund site. The Department is working with EPA on the cleanup and possible TMDL.
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE270-001-01-02	Red Lion Creek	Lower Red Lion	First tributary downstream of Doll Run from the headwaters to the confluence with Red Lion Creek	1.1228	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE270-001-02-01	Red Lion Creek	Upper Red Lion	From the headwaters to the location where Route 13 intersects Red Lion Creek	3.1065	Miles	DIELDRIN	NON-POINT SOURCE	2014	Low	5	
DE270-001-02-01	Red Lion Creek	Upper Red Lion	From the headwaters to the location where Route 13 intersects Red Lion Creek	3.1065	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE270-001-02-01	Red Lion Creek	Upper Red Lion	From the headwaters to the location where Route 13 intersects Red Lion Creek	3.1065	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE270-001-02-01	Red Lion Creek	Upper Red Lion	From the headwaters to the location where Route 13 intersects Red Lion Creek	3.1065	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2014		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE270-001-02-02	Red Lion Creek	Upper Red Lion	First tributary after the headwaters of Red Lion Creek	0.9842	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE280-001-01-01	Rehoboth Bay	Chapel Branch	From the headwaters of Chapel Branch to the confluence of Herring Creek, including Hopkins Prong, Unity Branch, Phillips Branch, and Guinea Creek	22.695	Miles	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE280-001-01-01	Rehoboth Bay	Chapel Branch	From the headwaters of Chapel Branch to the confluence of Herring Creek, including Hopkins Prong, Unity Branch, Phillips Branch, and Guinea Creek	22.695	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2004, Relisted 2012, Delisted 2018
DE280-001-01-01	Rehoboth Bay	Chapel Branch	From the headwaters of Chapel Branch to the confluence of Herring Creek, including Hopkins Prong, Unity Branch, Phillips Branch, and Guinea Creek	22.695	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE280-001-01-01	Rehoboth Bay	Chapel Branch	From the headwaters of Chapel Branch to the confluence of Herring Creek, including Hopkins Prong, Unity Branch, Phillips Branch, and Guinea Creek	22.695	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE280-001-01-02	Rehoboth Bay	Chapel Branch	Chapel Branch--from the start of the second order stream to the confluence with Herring Creek	5.1442	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE280-002	Rehoboth Bay	Love Creek, including tributaries	Love Creek, Bundicks Branch and Goslee Creek to the confluence with Rehoboth Bay	11.296	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002
DE280-002	Rehoboth Bay	Love Creek, including tributaries	Love Creek, Bundicks Branch and Goslee Creek to the confluence with Rehoboth Bay	11.296	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE280-002	Rehoboth Bay	Love Creek, including tributaries	Love Creek, Bundicks Branch and Goslee Creek to the confluence with Rehoboth Bay	11.296	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE280-E01	Rehoboth Bay	Rehoboth Bay	Near coastal waters extending north from the confluence with Indian River Bay at Burton Island	13.063	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE280-E01	Rehoboth Bay	Rehoboth Bay	Near coastal waters extending north from the confluence with Indian River Bay at Burton Island	13.063	Square Miles	DISSOLVED OXYGEN				2	DO, listed 1996, delisted 2006, relisted 2016, Delisted 2018
DE280-E01	Rehoboth Bay	Rehoboth Bay	Near coastal waters extending north from the confluence with Indian River Bay at Burton Island	13.063	Square Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE280-E01	Rehoboth Bay	Rehoboth Bay	Near coastal waters extending north from the confluence with Indian River Bay at Burton Island	13.063	Square Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE280-L01	Rehoboth Bay	Burton Pond	Pond northeast of Millsboro	40.345	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	2016		4A	DO listed 2016
DE280-L01	Rehoboth Bay	Burton Pond	Pond northeast of Millsboro	40.345	Acres	NUTRIENTS				2	Nutrients, Listed 1998, Delisted 2018
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	ARSENIC				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	MERCURY				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	ARSENIC				2	Not a contaminant of concern in fish consumption advisories for these waters

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	DIOXIN	NON-POINT SOURCE	2002	Medium	5	
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Medium	5	
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	MERCURY				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014, relisted 2016, Delisted 2018
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-001-02-02	Saint Jones River	Upper Saint Jones	Tributary of Silver Lake in Dover	0.4933	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-001-02-03	Saint Jones River	Upper Saint Jones	Puncheon Branch--from the confluence of the headwaters to the confluence with the Saint Jones River	3.4005	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-001-02-03	Saint Jones River	Upper Saint Jones	Puncheon Branch--from the confluence of the headwaters to the confluence with the Saint Jones River	3.4005	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-002-01	Saint Jones River	Isaac Branch	From the headwaters to the confluence with Saint Jones River, excluding Moores Lake	9.1271	Miles	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002
DE290-002-01	Saint Jones River	Isaac Branch	From the headwaters to the confluence with Saint Jones River, excluding Moores Lake	9.1271	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE290-002-01	Saint Jones River	Isaac Branch	From the headwaters to the confluence with Saint Jones River, excluding Moores Lake	9.1271	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE290-002-02	Saint Jones River	Isaac Branch	From the confluence of Allabands Mill Stream to the confluence with Saint Jones River	1.8162	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-002-03	Saint Jones River	Isaac Branch	From the confluence of the headwaters of Almhouse Branch to the confluence of Isaac Branch	3.5642	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-002-04	Saint Jones River	Isaac Branch	Second tributary upstream of Wyoming Lake on Isaac Branch	1.1341	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-002-05	Saint Jones River	Isaac Branch	Wyoming Mill Pond	47.004	Acres	DDT (DICHLORODIPHENYLTRICHLOROETHANE)	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-002-05	Saint Jones River	Isaac Branch	Wyoming Mill Pond	47.004	Acres	DIOXIN				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-002-05	Saint Jones River	Isaac Branch	Wyoming Mill Pond	47.004	Acres	FURAN COMPOUNDS				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-002-05	Saint Jones River	Isaac Branch	Wyoming Mill Pond	47.004	Acres	POLYCHLORINATED BIPHENYLS (PCBS)				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-003-01	Saint Jones River	Fork Branch	From the headwaters to Silver Lake in Dover	8.9149	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE290-003-01	Saint Jones River	Fork Branch	From the headwaters to Silver Lake in Dover	8.9149	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010, Relisted 2014, Delisted 2016
DE290-003-01	Saint Jones River	Fork Branch	From the headwaters to Silver Lake in Dover	8.9149	Miles	MERCURY	NON-POINT SOURCE	2014	Low	5	
DE290-003-01	Saint Jones River	Fork Branch	From the headwaters to Silver Lake in Dover	8.9149	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE290-003-02	Saint Jones River	Fork Branch	Cahoon Branch--from the confluence of the headwaters to the confluence with the next larger stream order	2.2128	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-003-03	Saint Jones River	Fork Branch	Maidstone Branch- from the confluence of the third order stream to the confluence with Cahoon Branch	2.911	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-003-04	Saint Jones River	Fork Branch	Tributary to Maidstone Branch---from the confluence of the headwaters to the confluence with Maidstone Branch	0.9781	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-003-05	Saint Jones River	Fork Branch	Fork Branch--from the start of the third order stream to the confluence with Silver Lake in Dover	6.2166	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998		4A	
DE290-003-05	Saint Jones River	Fork Branch	Fork Branch--from the start of the third order stream to the confluence with Silver Lake in Dover	6.2166	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-003-06	Saint Jones River	Fork Branch	From the start of the third order stream on Cahoon Branch to the confluence with Maidstone Branch	2.3266	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-004-01	Saint Jones River	Tidbury Branch	From below Derby Pond to the confluence with the Saint Jones River	4.8466	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-004-01	Saint Jones River	Tidbury Branch	From below Derby Pond to the confluence with the Saint Jones River	4.8466	Miles	DISSOLVED OXYGEN		2002		4A	
DE290-004-01	Saint Jones River	Tidbury Branch	From below Derby Pond to the confluence with the Saint Jones River	4.8466	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE290-004-01	Saint Jones River	Tidbury Branch	From below Derby Pond to the confluence with the Saint Jones River	4.8466	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE290-004-02	Saint Jones River	Tidbury Branch	From the confluence of the headwaters of Tidbury Creek to the confluence with Derby Pond	3.116	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-004-02	Saint Jones River	Tidbury Branch	From the confluence of the headwaters of Tidbury Creek to the confluence with Derby Pond	3.116	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-004-03	Saint Jones River	Tidbury Branch	Tributary of Tidbury Creek--from the headwaters to the confluence with Tidbury Creek	0.922	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-004-04	Saint Jones River	Tidbury Branch	Red House Branch--from the confluence of the headwaters to the confluence with Derby Pond	1.4404	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-L01	Saint Jones River	Moores Lake	Lake east of Camden	29.756	Acres	DDT (DICHLORODIPHENYLTRICHLOROETHANE)				2	Not a contaminant of concern in fish consumption advisories for these waters
DE290-L01	Saint Jones River	Moores Lake	Lake east of Camden	29.756	Acres	DISSOLVED OXYGEN				2	DO, listed in 1996, delisted 2002
DE290-L01	Saint Jones River	Moores Lake	Lake east of Camden	29.756	Acres	ENTEROCOCCUS				2	Bacteria, listed 2006, delisted 2008
DE290-L01	Saint Jones River	Moores Lake	Lake east of Camden	29.756	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE290-L01	Saint Jones River	Moores Lake	Lake east of Camden	29.756	Acres	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.49	Acres	DIOXIN	NON-POINT SOURCE	2002	Medium	5	
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.49	Acres	ENTEROCOCCUS				2	Bacteria, Listed 2006, Delisted 2012
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.49	Acres	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Medium	5	
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.49	Acres	MERCURY				2	Delisted 2018 per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.49	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.49	Acres	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 6 and tributaries
DE290-L03	Saint Jones River	Derby Pond	Pond south of Wyoming	22.972	Acres	ENTEROCOCCUS				2	Bacteria, listed in 1996, delisted 2004
DE290-L03	Saint Jones River	Derby Pond	Pond south of Wyoming	22.972	Acres	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2014
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	CHLORDANE				2	Delisted 2018 per March 1, 2018 Evaluation of Fish Consumption Advisories
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	DIELDRIN	NON-POINT SOURCE	2016	Low	5	
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	DO, Listed 1996, Delisted 2016, Relisted 2018
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	2002		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	DIELDRIN	NON-POINT SOURCE	2012	Low	5	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	HEPTACHLOR EPOXIDE	SOURCE UNKNOWN	2016	Low	5	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	NUTRIENTS				2	Nutrients, Listed 1998, Delisted 2012
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	SOURCE UNKNOWN	2016		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE300-001-02-02	Shellpot Creek	Upper Shellpot Creek	Western tributary of the headwaters to the confluence of the next larger stream order	1.5718	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE300-001-02-02	Shellpot Creek	Upper Shellpot Creek	Western tributary of the headwaters to the confluence of the next larger stream order	1.5718	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-02-03	Shellpot Creek	Upper Shellpot Creek	From the headwaters of Matson Run to the confluence with mainstem Shellpot Creek	1.8625	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE300-001-02-03	Shellpot Creek	Upper Shellpot Creek	From the headwaters of Matson Run to the confluence with mainstem Shellpot Creek	1.8625	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-01	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	Western tributary of the headwaters of Stoney Creek to the confluence with mainstem Stoney Creek	0.8514	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-02	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	From the confluence of the headwaters of Stoney Creek to the mouth of the Delaware River	1.8194	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-02	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	From the confluence of the headwaters of Stoney Creek to the mouth of the Delaware River	1.8194	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2010		4A	
DE300-001-03-02	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	From the confluence of the headwaters of Stoney Creek to the mouth of the Delaware River	1.8194	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-02	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	From the confluence of the headwaters of Stoney Creek to the mouth of the Delaware River	1.8194	Miles	NUTRIENTS				2	Nutrients, Listed 2008, Delisted 2012
DE310-001	Smyrna River	Lower Smyrna River	From the head of tide to the Delaware River	7.2167	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1996		4A	
DE310-001	Smyrna River	Lower Smyrna River	From the head of tide to the Delaware River	7.2167	Miles	ENTEROCOCCUS	NON-POINT SOURCE	2002		4A	
DE310-001	Smyrna River	Lower Smyrna River	From the head of tide to the Delaware River	7.2167	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE310-002-01	Smyrna River	Mill Creek	From the headwaters to Lake Como	5.5145	Miles	DISSOLVED OXYGEN				2	DO, listed 2002, delisted 2008
DE310-002-01	Smyrna River	Mill Creek	From the headwaters to Lake Como	5.5145	Miles	ENTEROCOCCUS				2	Bacteria, Listed 1996, Delisted 2010
DE310-002-01	Smyrna River	Mill Creek	From the headwaters to Lake Como	5.5145	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE310-002-02	Smyrna River	Mill Creek	Providence Creek--from the confluence of the headwaters of Mill Creek to the confluence with Lake Como	4.4562	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE310-002-02	Smyrna River	Mill Creek	Providence Creek--from the confluence of the headwaters of Mill Creek to the confluence with Lake Como	4.4562	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-01	Smyrna River	Tributary of Smyrna River	Tributaries from the headwaters to the confluence with Delaware Bay	8.9308	Miles	DISSOLVED OXYGEN		2004		4A	Nutrients, Listed 2004, Delisted 2014, Relisted 2018
DE310-003-01	Smyrna River	Tributary of Smyrna River	Tributaries from the headwaters to the confluence with Delaware Bay	8.9308	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1998		4A	
DE310-003-01	Smyrna River	Tributary of Smyrna River	Tributaries from the headwaters to the confluence with Delaware Bay	8.9308	Miles	NUTRIENTS	NON-POINT SOURCE	1998		4A	
DE310-003-02	Smyrna River	Tributary of Smyrna River	From the confluence of the headwaters of Paw Paw Branch to the confluence with Providence Creek	3.0297	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE310-003-02	Smyrna River	Tributary of Smyrna River	From the confluence of the headwaters of Paw Paw Branch to the confluence with Providence Creek	3.0297	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-03	Smyrna River	Tributary of Smyrna River	First eastern tributary after the headwaters of Paw Paw Branch to the confluence with Smyrna River	1.6394	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE310-003-04	Smyrna River	Tributary of Smyrna River	Eastern tributary of the headwaters of Sawmill Branch to its confluence	0.6833	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE310-003-04	Smyrna River	Tributary of Smyrna River	Eastern tributary of the headwaters of Sawmill Branch to its confluence	0.6833	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-05	Smyrna River	Tributary of Smyrna River	Sawmill Branch--from the confluence of the headwaters to the next larger stream order	3.2651	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE310-L01	Smyrna River	Lake Como and Duck Creek Pond	Lake Como in Smyrna	81.94	Acres	DISSOLVED OXYGEN	NON-POINT SOURCE	2006		4A	
DE310-L01	Smyrna River	Lake Como and Duck Creek Pond	Lake Como in Smyrna	81.94	Acres	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE310-L01	Smyrna River	Lake Como and Duck Creek Pond	Lake Como in Smyrna	81.94	Acres	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	BIOLOGICAL INTEGRITY				2	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	ENTEROCOCCUS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	HABITAT ASSESSMENT				2	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	NUTRIENTS	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	EPA TMDL for PCBS in Delaware River Zone 5 and tributaries
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.781	Miles	ZINC				2	Zinc, listed in 1999 delisted 2004 based on improved water quality
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	DDD (DICHLORODIPHENYLDICHLOROETHANE)	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	DDE (DICHLORODIPHENYLDICHLOROETHYLENE)	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	DDT (DICHLORODIPHENYLTRICHLOROETHANE)	SOURCE UNKNOWN	2016	Low	5	
DE320-002-01	White Clay Creek	Mill Creek	From the headwaters to the confluence with White Clay Creek	9.517	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE320-002-01	White Clay Creek	Mill Creek	From the headwaters to the confluence with White Clay Creek	9.517	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE320-002-02	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with the next larger stream order	1.7954	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-002-02	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with the next larger stream order	1.7954	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-002-03	White Clay Creek	Mill Creek	Second western tributary-- From the headwaters of mainstem Mill Creek	0.0399	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-002-04	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with White Clay Creek (upper half)	4.5786	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	2014	Low	5	
DE320-002-04	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with White Clay Creek (upper half)	4.5786	Miles	HABITAT ASSESSMENT				2	Delisting per Tetra Tech Report for EPA and Delaware DNREC
DE320-002-05	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with White Clay Creek (lower half)	4.9384	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-002-05	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with White Clay Creek (lower half)	4.9384	Miles	HABITAT ASSESSMENT				2	
DE320-003-01	White Clay Creek	Pike Creek	From the headwaters to the confluence with White Clay Creek	6.7654	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE320-003-01	White Clay Creek	Pike Creek	From the headwaters to the confluence with White Clay Creek	6.7654	Miles	NUTRIENTS	NON-POINT SOURCE	1996		4A	
DE320-003-02	White Clay Creek	Pike Creek	Third eastern tributary after the headwaters of Pike Creek (upper half)	0.3824	Miles	BIOLOGICAL INTEGRITY				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-003-03	White Clay Creek	Pike Creek	Third eastern tributary after the headwaters of Pike Creek (lower half)	0.3727	Miles	BIOLOGICAL INTEGRITY				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-003-03	White Clay Creek	Pike Creek	Third eastern tributary after the headwaters of Pike Creek (lower half)	0.3727	Miles	HABITAT ASSESSMENT				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-003-04	White Clay Creek	Pike Creek	Second eastern tributary after the headwaters of Pike Creek	1.0587	Miles	BIOLOGICAL INTEGRITY				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-003-04	White Clay Creek	Pike Creek	Second eastern tributary after the headwaters of Pike Creek	1.0587	Miles	HABITAT ASSESSMENT				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-003-05	White Clay Creek	Pike Creek	From the confluence of the headwaters of Pike Creek to the confluence with White Clay Creek	5.5357	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-003-05	White Clay Creek	Pike Creek	From the confluence of the headwaters of Pike Creek to the confluence with White Clay Creek	5.5357	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-004-01	White Clay Creek	Middle Run	From the headwaters to the confluence with White Clay Creek	5.0435	Miles	ENTEROCOCCUS	NON-POINT SOURCE	1996		4A	
DE320-004-01	White Clay Creek	Middle Run	From the headwaters to the confluence with White Clay Creek	5.0435	Miles	NUTRIENTS				2	Nutrients, Listed 1996, Delisted 2012
DE320-004-02	White Clay Creek	Middle Run	Eastern tributary of the headwaters of Middle Run to the confluence of the next larger stream order (upper half)	0.2477	Miles	BIOLOGICAL INTEGRITY				3	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE320-004-03	White Clay Creek	Middle Run	Eastern tributary of the headwaters of Middle Run to the confluence of the next larger stream order (lower half)	0.2304	Miles	BIOLOGICAL INTEGRITY				3	
DE320-004-03	White Clay Creek	Middle Run	Eastern tributary of the headwaters of Middle Run to the confluence of the next larger stream order (lower half)	0.2304	Miles	HABITAT ASSESSMENT				3	
DE320-004-04	White Clay Creek	Middle Run	Western tributary of the headwaters of Middle Run to the confluence with the mainstem	1.6393	Miles	HABITAT ASSESSMENT				3	
DE320-005-01	White Clay Creek	White Clay Creek All tributaries from the headwaters to the confluence with the Christina River	First tributary after State line to the confluence of White Clay Creek, along Thompson Station Road	2.0527	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-005-02	White Clay Creek	White Clay Creek All tributaries from the headwaters to the confluence with the Christina River	Tributary off The Hunt at Louviers	2.074	Miles	BIOLOGICAL INTEGRITY				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE320-005-04	White Clay Creek	White Clay Creek All tributaries from the headwaters to the confluence with the Christina River	First tributary after Pike Creek--from the headwaters to the confluence with White Clay Creek	0.8026	Miles	HABITAT ASSESSMENT				3	Per Tetra Tech Report for EPA and Delaware DNREC
DE350-E01	Assawoman Bay	Assawoman Bay	Portion of the estuary up to the MD-DE State line	0.3935	Square Miles	ENTEROCOCCUS	NON-POINT SOURCE	1998		4A	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	ARSENIC				2	Not a contaminant of concern in fish consumption advisories for these waters
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	CHRONIC TOXICITY				2	Bioassays performed in 2005, 2007, and 2008 indicate no chronic toxicity in Zone 5 mainstem samples.ï¿½ Chronic toxicity, listed in 2002, Delisted in 2012 based on 2011 journal article.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	DIELDRIN	NON-POINT SOURCE	2002	Low	5	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	DIELDRIN	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	ENTEROCOCCUS				2	Bacteria , listed in 1996, delisted 2004 based on 2004 DRBC 305(b) assessment
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	IRON				3	Surface water levels of iron in the segment sometimes exceed the applicable criterion. The Department believes further study of surface water iron levels and a determination of whether a use impairment is resulting from those levels is an appropriate resp
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	MERCURY				2	Mercury, Listed 2002, Delisted 2014, not a contaminant of concern in fish consumption advisories for these waters.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	POLYCHLORINATED BIPHENYLS (PCBS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.082	Square Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	
DEDRBCZone5c	Delaware River	DRBC Zone 5c	Lower portion of DRBC Zone 5	30.463	Square Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2006	Low	5	Delaware will work with the DRBC, EPA, other States and Stakeholders to develop and implement a TMDL in these waters.
DEDRBCZone5c	Delaware River	DRBC Zone 5c	Lower portion of DRBC Zone 5	30.463	Square Miles	DISSOLVED OXYGEN	POINT SOURCE(S) - UNSPECIFIED	2006	Low	5	Delaware will work with the DRBC, EPA, other States and Stakeholders to develop and implement a TMDL in these waters.
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	DIOXIN				2	Not a contaminant of concern in fish consumption advisories for these waters
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	ENTEROCOCCUS				2	Bacteria , listed in 1996, delisted 2004 based on 2004 DRBC 305(b) assessment
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	FURAN COMPOUNDS				2	Not a contaminant of concern in fish consumption advisories for these waters
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	MERCURY		2002	Low	5	TMDL Target date of 2012 changed to 2016 in the 2012 Cycle. Changed to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	POLYCHLORINATED BIPHENYLS (PCBS)	POINT SOURCE(S) - UNSPECIFIED	1996		4A	
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	POLYCHLORINATED BIPHENYLS (PCBS)	NON-POINT SOURCE	1996		4A	
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.53	Square Miles	POLYCHLORINATED BIPHENYLS (PCBS)	CERCLA NPL (SUPERFUND) SITES	1996		4A	

Appendix Five: The Final Determination for the State of Delaware 2018 Clean Water Act Section 303(d) List of Waters Needing TMDLs

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-01	Appoquinimink River	Lower Appoquinimink River	Saline Tidal Reach, excluding Hangman's Run	4.3766	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-03-02	Appoquinimink River	Drawyer Creek	Tributary of Drawyer Creek--from the confluence of the headwaters to the confluence with the mainstem	2.2416	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-001-03-02	Appoquinimink River	Drawyer Creek	Tributary of Drawyer Creek--from the confluence of the headwaters to the confluence with the mainstem	2.2416	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE010-001-03-03	Appoquinimink River	Drawyer Creek	Western tributary of the headwaters of Drawyer Creek to its confluence	2.3581	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	DIELDRIN	SOURCE UNKNOWN	2018	Low	5	
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	DIOXIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-001-03-04	Appoquinimink River	Drawyer Creek	Tidal Portion	4.4931	Miles	FURAN COMPOUNDS	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-002-01-02	Appoquinimink River	Wiggins Mill Pond to confluence with Silver Lake	From the confluence of the headwaters of Wiggins Mill Pond to the confluence with Noxontown Pond	1.4277	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-002-02-02	Appoquinimink River	Deep Creek to confluence with Silver Lake	First western tributary after the headwaters of Silver Lake	2.1762	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-002-02-03	Appoquinimink River	Deep Creek to confluence with Silver Lake	Deep Creek.-- from the confluence of the headwaters to Appoquinimink River	1.7551	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE010-L02	Appoquinimink River	Silver Lake	Lake adjacent to Middletown, below Deep Creek	41.2776	Acres	DIELDRIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE010-L03	Appoquinimink River	Shallcross Lake	Lake above Drawyer Creek	50.0957	Acres	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	DIOXIN	SOURCE UNKNOWN	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	FURAN COMPOUNDS	SOURCE UNKNOWN	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE020-001-01	Army Creek	Lower Army Creek	Segment from Route 13 to mouth at Delaware River tidal freshwater segment	2.3621	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE020-001-02	Army Creek	Lower Army Creek	First tributary on Army Creek after the headwaters	0.8282	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE030-002-02	Blackbird Creek	Upper Blackbird	First eastern tributary after the headwaters to the confluence with Blackbird Creek	2.4922	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE030-002-03	Blackbird Creek	Upper Blackbird	Upper Blackbird Creek--from the confluence of the headwaters to the confluence with Barlow Branch	3.393	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE030-003	Blackbird Creek	Tributaries on the mainstem	Sandom Branch to the confluence with Blackbird Creek (upper half)	1.2363	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIELDRIN	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIELDRIN	NON-POINT SOURCE	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIOXIN	NON-POINT SOURCE	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-001	Brandywine Creek	Lower Brandywine	Mainstem Lower Brandywine	3.8061	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2016	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIELDRIN	NON-POINT SOURCE	2016	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIELDRIN	CERCLA NPL (SUPERFUND) SITES	2016	Low	5	
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-01	Brandywine Creek	Upper Brandywine	From State Line to Wilmington	6.9076	Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE040-002-02	Brandywine Creek	Upper Brandywine	From State line to the confluence with the Christina River	10.7137	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-01	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of Beaver Creek, from headwaters to the confluence with mainstem Beaver Creek	1.6078	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-01	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of Beaver Creek, from headwaters to the confluence with mainstem Beaver Creek	1.6078	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-02	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary originating in Pennsylvania on the western side of Brandywine Creek	0.7287	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-02	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary originating in Pennsylvania on the western side of Brandywine Creek	0.7287	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-03	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary of Brandywine Creek, off Route 100 (near PA-DE border)	1.4239	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-04	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary of Brandywine Creek just below Beaver Creek	0.4998	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-05	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of the headwaters of Rocky Run(upper half)	1.0237	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-06	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of the headwaters of Rocky Run(lower half)	1.0362	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-06	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Eastern tributary of the headwaters of Rocky Run(lower half)	1.0362	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-07	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	From the confluence of the headwaters of Wilson Run to the next larger stream order (lower half)	0.6683	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-08	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	From the confluence of the headwaters of Wilson Run to the next larger stream order (upper half)	1.4837	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-08	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	From the confluence of the headwaters of Wilson Run to the next larger stream order (upper half)	1.4837	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE040-003-09	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Wilson Run, from start of the third order stream to the confluence with Brandywine Creek	0.9837	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE040-003-10	Brandywine Creek	All tributaries on Brandywine Creek from the headwaters at PA-DE line to the confluence with the Christina River	Tributary of Wilson Run on Montchanin Road from the headwaters to the first confluence	0.5357	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-001-02	Broad Creek	Lower Broad Creek	Cooper Branch--from the start of the third order stream on Rossakatum Branch to the confluence of Broad Creek	2.588	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-002-02	Broad Creek	Tussocky Branch	Tussocky Branch--from the confluence of Mill Creek to the confluence with Broad Creek	3.814	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-004-02	Broad Creek	Chipman Pond Branch	Jobs Ditch--from the headwaters to the confluence with Dukes and Jobs Branch	1.0709	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-004-03	Broad Creek	Chipman Pond Branch	Mirey Branch--from the start of the third order stream to the confluence with Elliott Pond Branch	2.0697	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE050-004-04	Broad Creek	Chipman Pond Branch	Dukes Ditch--from the headwaters to the confluence with Dukes and Jobs Branch	2.4651	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE060-005-02	Broadkill River	Ingrams Branch	Ingrams Branch-- western tributary of the headwaters	1.6929	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE060-007-02-02	Broadkill River	Martin Branch	Tributary above Red Mill Pond--from start of the second order stream to the confluence with Red Mill Pond	0.418	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE060-008	Broadkill River	Primehook Creek	Entire Creek	7.5589	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2012	Low	5	
DE070-001	Buntings Branch	Buntings Branch	From the headwaters to the MD-DE State line	0.9929	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.6465	Miles	DIOXIN	NON-POINT SOURCE	2010	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE080-003	Cedar Creek	Slaughter Creek	From the headwaters to The Confluence with Cedar Creek	10.6465	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2010	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.8594	Miles	DIELDRIN	NON-POINT SOURCE	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories

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DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.8594	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE090-001	Chesapeake & Delaware Canal	C&D Canal	C&D Canal from the MD Line to Delaware River	11.8594	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE090-002-01	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Scott Run-- from the headwaters to the confluence with Chesapeake & Delaware Canal	5.747	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-01	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Scott Run-- from the headwaters to the confluence with Chesapeake & Delaware Canal	5.747	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE090-002-02	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Crystal Run--from the headwaters to the confluence with Chesapeake & Delaware Canal	1.8474	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-03	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Joy Run--from the headwaters to the confluence with Chesapeake & Delaware Canal	2.6418	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-04	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Eastern tributary on Lums Pond--from the headwaters to the confluence with Lums Pond	0.4515	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE090-002-04	Chesapeake & Delaware Canal	Tributaries of Chesapeake & Delaware Canal	Eastern tributary on Lums Pond--from the headwaters to the confluence with Lums Pond	0.4515	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-001-02	Chesapeake Drainage System	Cypress Branch, including tributaries	Cypress Branch--from the confluence of Black Stallion Ditch to the MD-DE line	2.5805	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-001-03	Chesapeake Drainage System	Cypress Branch, including tributaries	Tributary of Cypress Branch--from the confluence of the headwaters to the confluence with the mainstem	1.5443	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-002-02	Chesapeake Drainage System	Sewell Branch, including tributaries	From the confluence of the headwaters to the confluence with Sewell Branch	0.9476	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-002-02	Chesapeake Drainage System	Sewell Branch, including tributaries	From the confluence of the headwaters to the confluence with Sewell Branch	0.9476	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-02	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the confluence of Jamison Branch to the MD-DE line	1.0894	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-003-02	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the confluence of Jamison Branch to the MD-DE line	1.0894	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-03	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--from the headwaters to the confluence with the mainstem	0.6894	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-04	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--first western tributary upstream of Gravelly Run	1.3432	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-003-04	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--first western tributary upstream of Gravelly Run	1.3432	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-05	Chesapeake Drainage System	Gravelly Run, including tributaries	Tributary of Gravelly Run--second eastern tributary from the headwaters of Gravelly Run to the mainstem	1.2767	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-003-06	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the start of the third order stream to the confluence with Jamison Branch	1.0335	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-003-06	Chesapeake Drainage System	Gravelly Run, including tributaries	Gravelly Run--from the start of the third order stream to the confluence with Jamison Branch	1.0335	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-004-01	Chesapeake Drainage System	Tributaries of Elk River	First eastern tributary after the headwaters of Great Bohemia Creek	1.6087	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE100-004-02	Chesapeake Drainage System	Tributaries of Elk River	Eastern tributary of the headwaters of Back Creek to its confluence	1.7668	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-005-01	Chesapeake Drainage System	Tributaries of Sassafras River	Western tributary of the headwaters of Sassafras River to its confluence	2.2761	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-005-02	Chesapeake Drainage System	Tributaries of Sassafras River	From the confluence of the headwaters of Sassafras River to the next larger stream order	1.2176	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE100-005-02	Chesapeake Drainage System	Tributaries of Sassafras River	From the confluence of the headwaters of Sassafras River to the next larger stream order	1.2176	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-02	Choptank	Tappahanna Ditch	From start of the fourth order stream to the confluence with Tidy Island Creek	3.281	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-02	Choptank	Tappahanna Ditch	From start of the fourth order stream to the confluence with Tidy Island Creek	3.281	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-03	Choptank	Tappahanna Ditch	Start of third order stream on Tappahanna Ditch to the confluence of the next larger stream order	3.0282	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-03	Choptank	Tappahanna Ditch	Start of third order stream on Tappahanna Ditch to the confluence of the next larger stream order	3.0282	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-04	Choptank	Tappahanna Ditch	First western tributary after the headwaters of Tappahanna Ditch to its confluence	0.9089	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-05	Choptank	Tappahanna Ditch	Tidy Island Creek--from the confluence with Tappahanna Ditch to the MD-DE line	0.5572	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-06	Choptank	Tappahanna Ditch	Choptank River--from the start of the third order stream to the confluence with Choptank River	2.9172	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-06	Choptank	Tappahanna Ditch	Choptank River--from the start of the third order stream to the confluence with Choptank River	2.9172	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-07	Choptank	Tappahanna Ditch	Seventh eastern tributary upstream of Tappahanna Ditch	1.4249	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-08	Choptank	Tappahanna Ditch	Tributary of Tappahanna Ditch--western tributary of the headwaters to its confluence	0.3371	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-08	Choptank	Tappahanna Ditch	Tributary of Tappahanna Ditch--western tributary of the headwaters to its confluence	0.3371	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-001-09	Choptank	Tappahanna Ditch	Second western tributary after the headwaters of Tappahanna Ditch to its confluence	0.7614	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-001-09	Choptank	Tappahanna Ditch	Second western tributary after the headwaters of Tappahanna Ditch to its confluence	0.7614	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-02	Choptank	Culbreth Marsh Ditch	Luther Marvel Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	1.1611	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	

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DE110-002-02	Choptank	Culbreth Marsh Ditch	Luther Marvel Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	1.1611	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-03	Choptank	Culbreth Marsh Ditch	From the confluence of Powell Ditch to the confluence with Ross Prong	1.3125	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-04	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (lower half)	1.8458	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-05	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (upper half)	1.9906	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-05	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from start of the fourth order stream to the confluence with Mud Millpond (upper half)	1.9906	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-06	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from the confluence of Ross Prong to the confluence with the next larger stream order	3.7481	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-06	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from the confluence of Ross Prong to the confluence with the next larger stream order	3.7481	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-07	Choptank	Culbreth Marsh Ditch	Culbreth Marsh Ditch--from the confluence of Mud Millpond to the confluence of Cow Marsh Creek	2.0824	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-08	Choptank	Culbreth Marsh Ditch	Third western tributary upstream of Culbreth Marsh Ditch	1.8136	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-08	Choptank	Culbreth Marsh Ditch	Third western tributary upstream of Culbreth Marsh Ditch	1.8136	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-002-09	Choptank	Culbreth Marsh Ditch	Ross Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	2.6118	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-002-09	Choptank	Culbreth Marsh Ditch	Ross Prong--from the confluence of the headwaters to the confluence with Culbreth Marsh Ditch	2.6118	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-02	Choptank	Cow Marsh Creek	First upstream tributary on Meredith Branch	0.4299	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-03	Choptank	Cow Marsh Creek	From the confluence of the headwaters of Sangston Prong to the confluence Gravelly Branch	1.9683	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-03	Choptank	Cow Marsh Creek	From the confluence of the headwaters of Sangston Prong to the confluence Gravelly Branch	1.9683	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-04	Choptank	Cow Marsh Creek	Tributary of Gary Mill Pond Branch--from the confluence of the headwaters to the confluence with Gary Mill Pond Branch	0.5351	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-04	Choptank	Cow Marsh Creek	Tributary of Gary Mill Pond Branch--from the confluence of the headwaters to the confluence with Gary Mill Pond Branch	0.5351	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-05	Choptank	Cow Marsh Creek	First eastern tributary after the headwaters of Wildcat Branch	0.9278	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-05	Choptank	Cow Marsh Creek	First eastern tributary after the headwaters of Wildcat Branch	0.9278	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-06	Choptank	Cow Marsh Creek	Willow Grove Prong--from the start of the third order stream to the confluence with Cow Marsh Creek	1.2142	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-06	Choptank	Cow Marsh Creek	Willow Grove Prong--from the start of the third order stream to the confluence with Cow Marsh Creek	1.2142	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-07	Choptank	Cow Marsh Creek	Tributary of Cow Marsh Creek--first eastern tributary upstream of Cow Marsh Creek	1.4231	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-08	Choptank	Cow Marsh Creek	Cow Marsh Ditch--from start of third order stream to the confluence with Cow Marsh Creek	1.3608	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-09	Choptank	Cow Marsh Creek	Cow Marsh Ditch--from the confluence of the headwaters to the confluence with the next larger stream order	1.557	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-10	Choptank	Cow Marsh Creek	Bullock Prong--mainstem to the confluence with Price Prong	1.4668	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-11	Choptank	Cow Marsh Creek	Third tributary upstream of Cow Marsh Ditch--from the headwaters to the confluence with Cow Marsh Ditch	2.4429	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-12	Choptank	Cow Marsh Creek	Iron Mine Prong--from the confluence of Black Swamp to the next larger stream order	4.1329	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-13	Choptank	Cow Marsh Creek	Meredith Branch--from the start of the third stream order to the confluence with the next larger stream order	2.1655	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-13	Choptank	Cow Marsh Creek	Meredith Branch--from the start of the third stream order to the confluence with the next larger stream order	2.1655	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE110-003-14	Choptank	Cow Marsh Creek	White Marsh Branch--from the start of the third order stream to the confluence with Gravelly Branch and Sangston Prong	3.0627	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE110-003-15	Choptank	Cow Marsh Creek	Cow Marsh Creek--from the confluence of Iron Mine Prong to the confluence with Choptank River	4.9306	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DDD (DICHLORODIPHENYLDICHLO	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DDE (DICHLORODIPHENYLDICHLO	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DDT (DICHLORODIPHENYLTRICHL	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DIELDRIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	DIOXIN	SOURCE UNKNOWN	2016	Low	5	
DE120-001	Christina River	Lower Christina River	Mainstem Lower Christina River	1.726	Miles	FURAN COMPOUNDS	SOURCE UNKNOWN	2016	Low	5	
DE120-002	Christina River	Mid Christina River	Between White Clay Creek and Brandywine River	6.9553	Miles	DIELDRIN		2002	Low	5	Delisted 2016 in error, Restored category 5 Listing 2018
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	DIELDRIN	SOURCE UNKNOWN	2018	Low	5	
DE120-003-01	Christina River	Upper Christina River	Mainstem Upper Christina River	6.5732	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-003-02-01	Christina River	Lower Christina Creek	Tributary from Smalleys Pond overflow to White Clay Creek	1	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-003-03	Christina River	Upper Christina River	Tributary downstream of Smalleys Pond on the Christina River	0.7073	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	COPPER	SOURCE UNKNOWN	2016	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE120-004-01	Christina River	Lower Christina Creek	Mainstem Lower Christina Creek	9.7014	Miles	DIELDRIN	NON-POINT SOURCE	2006	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE120-004-02	Christina River	Lower Christina Creek	From the confluence of West Branch Christina River to the confluence with the mainstem	6.6563	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-02	Christina River	Lower Christina Creek	From the confluence of West Branch Christina River to the confluence with the mainstem	6.6563	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-02-01	Christina River	Belltown Run	From the headwaters above Becks Pond to the confluence with the Christina River	4.7235	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-02-03	Christina River	Belltown Run	Western tributary of the headwaters of Belltown Run to its confluence	0.8388	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-02	Christina River	Muddy Run	From the headwaters of Iron Hill Run to the next larger stream order	2.3	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-03	Christina River	Muddy Run	Eastern tributary of the headwaters of Iron Hill Run	0.4967	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-04	Christina River	Muddy Run	Eastern tributary above Sunset Pond to the confluence of the next larger stream order	1.5227	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-004-03-05	Christina River	Muddy Run	Eastern tributary of the headwaters of Muddy Run to its confluence	0.4967	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-006-02	Christina River	Upper Christina Creek	From the confluence of the headwaters of Upper Christina River to the confluence of West Branch	4.7621	Miles	BIOLOGICAL INTEGRITY		1998	Low	5	
DE120-006-02	Christina River	Upper Christina Creek	From the confluence of the headwaters of Upper Christina River to the confluence of West Branch	4.7621	Miles	HABITAT ASSESSMENT		1998	Low	5	
DE120-006-03	Christina River	Upper Christina Creek	First western tributary after the headwaters of the Upper Christina River to mainstem Upper Christina River (upper half)	0.4682	Miles	HABITAT ASSESSMENT		1998	Low	5	
DE120-006-04	Christina River	Upper Christina Creek	First western tributary after the headwaters of the Upper Christina River to mainstem Upper Christina River (lower half)	0.395	Miles	BIOLOGICAL INTEGRITY		1998	Low	5	
DE120-006-04	Christina River	Upper Christina Creek	First western tributary after the headwaters of the Upper Christina River to mainstem Upper Christina River (lower half)	0.395	Miles	HABITAT ASSESSMENT		1998	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	
DE120-007-01-01	Christina River	Little Mill Creek and Willow Run	From the confluence of Willow Run and Chestnut Run to the confluence with the Christina River	4.0072	Miles	HEPTACHLOR EPOXIDE	SOURCE UNKNOWN	2016	Low	5	
DE120-007-01-02	Christina River	Little Mill Creek and Willow Run	First western tributary after the headwaters of Little Mill Creek to the confluence with mainstem Little Mill Creek	1.889	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-03	Christina River	Little Mill Creek and Willow Run	From the headwaters of Willow Run to the confluence with the Christina River	0.253	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-04	Christina River	Little Mill Creek and Willow Run	From the confluence of the headwaters of Little Mill Creek to the confluence of Chestnut Run	3.3219	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-04	Christina River	Little Mill Creek and Willow Run	From the confluence of the headwaters of Little Mill Creek to the confluence of Chestnut Run	3.3219	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-05	Christina River	Little Mill Creek and Willow Run	Little Mill Creek--from the confluence of Chestnut Run to the confluence with the Christina River	3.5389	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-007-01-05	Christina River	Little Mill Creek and Willow Run	Little Mill Creek--from the confluence of Chestnut Run to the confluence with the Christina River	3.5389	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-02-02	Christina River	Chestnut Run	Eastern tributary of the headwaters of Chestnut Run to the confluence of the next larger stream order	1.0346	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE120-007-02-03	Christina River	Chestnut Run	From the headwaters of Chestnut Run to unnamed pond/water monitoring station	0.4455	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE120-007-02-03	Christina River	Chestnut Run	From the headwaters of Chestnut Run to unnamed pond/water monitoring station	0.4455	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE130-002-02	Dragon Run Creek	Upper Dragon Run Creek	From the confluence of the headwaters to the water supply dam	4.07	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE140-001	Indian River	White Creek	Saline tidal waters extending from the north end of Assawoman Canal to the Indian River Bay	4.1383	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-004	Indian River	Indian River	Saline tidal portion of river from Millsboro Pond to Power Plant intake	7.3387	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-009-02	Indian River	Mirey Branch, including tributaries	Mirey Branch-- from the confluence of the headwaters to the confluence with Sheep Pen Ditch	5.8888	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE140-E01	Indian River	Lower Indian River Bay	From inlet to Pepper Creek	12.181	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE140-E02	Indian River	Upper Indian River Bay	Upper portion of estuary from power plant cooling water intake to Pepper Creek, including Island Creek	1.0639	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE150-001-01	Iron Branch	Iron Branch	From the headwaters of Iron Branch and Whartons Branch to the confluence with Indian River	10.6402	Miles	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE150-001-02	Iron Branch	Iron Branch	Whartons Ditch--from the start of the third order stream to the confluence with Whartons Branch	3.5521	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE160-002-02	Leipsic River	Upper Leipsic River	From the start of the third order stream on Pinks Branch to the confluence with Garrison Lake	3.3065	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE160-002-03	Leipsic River	Upper Leipsic River	Tributary of Leipsic River--from the confluence of the headwaters to the confluence with Leipsic River	0.9463	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE160-003-01	Leipsic River	Tributary from the dam at Garrisons Lake to mouth at Delaware Bay	From the confluence of the headwaters of Alston Branch to the confluence Leipsic River	1.7496	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE160-003-02	Leipsic River	Tributary from the dam at Garrisons Lake to mouth at Delaware Bay	Tributary of Leipsic River--eastern tributary of the headwaters to its confluence	1.2596	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE170-001	Lewes and Rehoboth Canal	Lewes and Rehoboth Canal	Tidal waters from the confluence of Delaware Bay to the confluence with Rehoboth Bay	8.9646	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE180-002-02	Little Assawoman Bay	Miller Creek	Beaver Dam Ditch--from the confluence of Blackwater Creek to the confluence with the next larger stream order	2.3804	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE180-003-01	Little Assawoman Bay	Dirickson Creek	From the headwaters of Dirickson Creek to the confluence with Little Assawoman bay	3.6516	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE180-003-02	Little Assawoman Bay	Dirickson Creek	Bearhole Ditch--from the confluence. of the headwaters to the confluence with Batson Branch	2.543	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE180-003-03	Little Assawoman Bay	Dirickson Creek	Agricultural Ditch--from the confluence of the headwaters to the confluence with Dirickson Creek	2.9533	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE180-E01	Little Assawoman Bay	Little Assawoman Bay	Estuary from the confluence with Assawoman Canal to the confluence with Assawoman Bay	2.4428	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE190-001-02-02	Little River	Upper Little River	Morgan Branch--from the confluence of the headwaters to the confluence with the next larger stream order	1.9316	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE190-001-02-03	Little River	Upper Little River	Start of the third order stream near the headwaters of Little River to the confluence with Morgan Branch	2.1185	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE190-001-02-03	Little River	Upper Little River	Start of the third order stream near the headwaters of Little River to the confluence with Morgan Branch	2.1185	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-001-02	Marshyhope Creek	Marshyhope Creek	Tributary to Black Arm Prong--third tributary upstream of Black Arm Prong	0.6066	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-001-03	Marshyhope Creek	Marshyhope Creek	Marshyhope Creek--from the confluence of Prospect Branch to the confluence with the MD-DE line	9.1261	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-001-04	Marshyhope Creek	Marshyhope Creek	From the confluence of Black Prong and Marshyhope Ditch to the confluence of Prospect Branch	4.519	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-001-04	Marshyhope Creek	Marshyhope Creek	From the confluence of Black Prong and Marshyhope Ditch to the confluence of Prospect Branch	4.519	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-02	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	First tributary upstream of Prong No. 2--from the eastern headwater to its confluence	1.6563	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-03	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Point Branch--from the headwaters to the confluence with the first tributary downstream	1.0832	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-04	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Tomahawk Branch--third eastern tributary downstream of the headwaters	0.7445	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-05	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Tomahawk Branch--first eastern tributary upstream	0.6386	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-06	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	0.905	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-06	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	0.905	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-07	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Salisbury Creek--from the start of the third order stream to the confluence with Cattail Branch (upper half)	1.0752	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-07	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Salisbury Creek--from the start of the third order stream to the confluence with Cattail Branch (upper half)	1.0752	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-08	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Salisbury Creek--from the start of the third order stream to the confluence with Cattail Branch (lower half)	0.8275	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-09	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Prospect Branch--western tributary of the headwaters to its confluence	1.7974	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-10	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Prong No. 2--from the start of the third order stream to the confluence with Bright-Haines Glade Branch	1.8403	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-10	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Prong No. 2--from the start of the third order stream to the confluence with Bright-Haines Glade Branch	1.8403	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-11	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	From the confluence of the headwaters of Green Branch to the confluence with Marshyhope Creek	5.2057	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-11	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	From the confluence of the headwaters of Green Branch to the confluence with Marshyhope Creek	5.2057	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-12	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	1.2777	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-12	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary of Salisbury Creek--from the MD-DE line to the confluence with Salisbury Creek	1.2777	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-13	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Short and Hall Ditch--from the confluence of the headwaters of with Marshyhope Creek	1.3953	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-14	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Brights Branch--from the start of the third order stream to the MD-DE line	1.3657	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-15	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Bright-Haines Glade Branch--from the start of the fourth order stream and Prospect Branch to the confluence with Marshyhope Creek	1.2268	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-16	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (upper half)	1.4572	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE200-002-16	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (upper half)	1.4572	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-17	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Cattail Branch--from the start of the fourth order stream to the confluence with Salisbury Creek (lower half)	1.2752	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-18	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Black Arm Prong--second tributary after the headwaters	0.6066	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-19	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Eastern tributary of the headwaters of Cattail Branch to its confluence	0.7145	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-21	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Cattail Branch--fourth western tributary downstream of the headwaters of Cattail Branch	0.6636	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE200-002-21	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Cattail Branch--fourth western tributary downstream of the headwaters of Cattail Branch	0.6636	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-23	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Cattail Branch--third western tributary upstream of Salisbury Creek	1.0775	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE200-002-24	Marshyhope Creek	Marshyhope Creek Tributaries from the headwaters to the State line	Tributary to Tomahawk Branch--first western tributary after the headwaters	1.5618	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE210-002-02	Mispillion River	Upper Mispillion	Tantrough Branch--from the headwaters to the confluence with Blairs Pond	4.0511	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE210-002-03	Mispillion River	Upper Mispillion	Beaverdam Branch--western tributary of the headwaters to its confluence	3.1506	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE210-003	Mispillion River	Johnson Branch including its tributaries	Johnson Branch--from the confluence of the headwaters to the confluence with Haven Lake	5.271	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE210-004	Mispillion River	Mispillion River Tributary from the headwaters to Silver Lake	Lednum Branch---eastern tributary of the headwaters to its confluence	1.6906	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-001	Murderkill River	Lower Murderkill	From the confluence with Spring Creek to the mouth at Delaware Bay	7.5536	Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE220-002-02	Murderkill River	Spring Creek	Tributary of Hudson River--from the headwaters to the confluence with the next larger stream order	0.5726	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-002-02	Murderkill River	Spring Creek	Tributary of Hudson River--from the headwaters to the confluence with the next larger stream order	0.5726	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-002-03	Murderkill River	Spring Creek	Pratt Branch--eastern tributary of the headwaters to its confluence	0.7853	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-003-02	Murderkill River	Mid Murderkill River	Ash Gut-- from the headwaters to the confluence with the next larger stream order	1.1839	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-003-02	Murderkill River	Mid Murderkill River	Ash Gut-- from the headwaters to the confluence with the next larger stream order	1.1839	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-004-02	Murderkill River	Browns Branch	Tributary of Browns Branch-- from the confuence of the headwaters wtot he confluence with Browns Branch	1.8117	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-004-02	Murderkill River	Browns Branch	Tributary of Browns Branch-- from the confuence of the headwaters wtot he confluence with Browns Branch	1.8117	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-005-02	Murderkill River	Upper Murderkill River	Spring Branch--tributary on Coursey Pond	3.3146	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-005-03	Murderkill River	Upper Murderkill River	Fan Branch--from the headwaters to the confluence with Murderkill River	2.5777	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998	Low	5	
DE220-005-03	Murderkill River	Upper Murderkill River	Fan Branch--from the headwaters to the confluence with Murderkill River	2.5777	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-005-04	Murderkill River	Upper Murderkill River	Tributary of Black Swamp Creek--from the headwaters to its confluence	0.8191	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE220-005-05	Murderkill River	Upper Murderkill River	Beaver Dam Branch--from the confluence of the headwaters to the confluence with Murderkill River and Black Swamp Creek	1.5105	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-005-06	Murderkill River	Upper Murderkill River	Black Swamp Creek--from the headwaters of Black Swamp to the confluence with the next larger stream order	1.7395	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE220-005-06	Murderkill River	Upper Murderkill River	Black Swamp Creek--from the headwaters of Black Swamp to the confluence with the next larger stream order	1.7395	Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	1998	Low	5	
DE220-005-06	Murderkill River	Upper Murderkill River	Black Swamp Creek--from the headwaters of Black Swamp to the confluence with the next larger stream order	1.7395	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE230-001-02-02	Naamans Creek	North Branch and South Branch	First tributary after the headwaters of South Naamans Creek to the mainstem	1.1382	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE230-001-02-02	Naamans Creek	North Branch and South Branch	First tributary after the headwaters of South Naamans Creek to the mainstem	1.1382	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-02	Nanticoke River	Upper Nanticoke River	Tributary of White Marsh Branch--first western tributary downstream of the headwaters of White Marsh Branch	2.2842	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-03	Nanticoke River	Upper Nanticoke River	Kent-Sussex Line Branch--from the start of the third order stream to the confluence with Nanticoke River (lower half)	1.6734	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-04	Nanticoke River	Upper Nanticoke River	Kent-Sussex Line Branch--from the start of the third order stream to the confluence with Nanticoke River (upper half)	1.9218	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE240-002-04	Nanticoke River	Upper Nanticoke River	Kent-Sussex Line Branch--from the start of the third order stream to the confluence with Nanticoke River (upper half)	1.9218	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-05	Nanticoke River	Upper Nanticoke River	Nanticoke Branch--from the confluence of Polk Branch to the confluence with Gum Branch	3.3619	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-06	Nanticoke River	Upper Nanticoke River	Grubby Neck Branch--from the confluence of Polk Branch to the confluence with Gum Branch	0.4325	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-07	Nanticoke River	Upper Nanticoke River	Nanticoke Branch--from the confluence of Kent-Sussex Line Branch to the confluence with Cart Branch	4.0077	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-08	Nanticoke River	Upper Nanticoke River	Nanticoke River--from the start of the third order stream to the confluence with Kent-Sussex Line Branch.	3.16	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE240-002-08	Nanticoke River	Upper Nanticoke River	Nanticoke River--from the start of the third order stream to the confluence with Kent-Sussex Line Branch.	3.16	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-002-09	Nanticoke River	Upper Nanticoke River	Tributary to Marsh Branch--first eastern tributary after the headwaters to its confluence	0.3295	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-004-02	Nanticoke River	Deep Creek Branch	McColleys Branch--from the confluence of New Ditch to the confluence with Deep Creek	2.3654	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-004-03	Nanticoke River	Deep Creek Branch	Deep Creek--from the start of the third order stream to the confluence with Deep Creek and McColleys Branch	1.8278	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-004-04	Nanticoke River	Deep Creek Branch	Tyndall Branch--from the start of the third order stream on Stoney Creek to the confluence of Tyndall Branch and Deep Creek	5.5978	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-005-01	Nanticoke River	Gravelly Branch	From the headwaters of Gravelly Branch above Collins Pond to the confluence with the Nanticoke River, excluding Collins Pond	7.8311	Miles	ZINC	SOURCE UNKNOWN	2014	Low	5	

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DE240-005-02	Nanticoke River	Gravelly Branch	Prong No. 1--from the start of fourth order stream to the confluence with Gravelly Branch on Nanticoke River	1.9965	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-005-03	Nanticoke River	Gravelly Branch	Maple Branch-- from the start of the third order stream to the confluence with Prong No. 1	0.7074	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-005-04	Nanticoke River	Gravelly Branch	Maple Branch-- from the start of the third order stream to the confluence with Prong No. 1	1.0852	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-006-02	Nanticoke River	Bridgeville Branch	Bridgeville Branch---from the start of the third order stream to the confluence with Nanticoke River	2.078	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-007-02	Nanticoke River	Gum Branch	Gum Branch.--from the start of the third order stream to the confluence with Nanticoke River	2.2177	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-010-01	Nanticoke River	Gum Branch on Upper Nanticoke River	Gum Branch--from the confluence of Stallion Head Branch to the confluence with West Branch Gum Branch	3.3475	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE240-010-02	Nanticoke River	Gum Branch on Upper Nanticoke River	Toms Dam Branch--from the start of the third order stream to the confluence with Gum Branch	4.4601	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE250-001-02	Pocomoke River	Pocomoke River	Pocomoke River--from the confluence of Bald Cypress Branch and Gum Branch to the MD-DE line	0.9624	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE250-001-03	Pocomoke River	Pocomoke River	Pocomoke River--from start of the third order stream to the confluence with Bald Cypress Branch and Gum Branch	5.1233	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE250-002	Pocomoke River	Pocomoke River Tributaries from the headwaters to MD-DE State line	Bald Cypress Branch--from the confluence of the headwaters to the confluence with the next larger stream order	3.6044	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	DIOXIN	NON-POINT SOURCE	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2002	Medium	5	
DE260-001-01	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (lower half)	12.8344	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Medium	5	
DE260-001-03	Red Clay Creek	Red Clay Creek Mainstem	From the confluence of West Branch Red Clay Creek to the confluence with White Clay Creek (upper half)	6.5429	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE260-002-01	Red Clay Creek	Burroughs Run	From PA-DE line to the confluence with Red Clay Creek	2.7427	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE260-003-02	Red Clay Creek	Red Clay Creek All other tributaries located in the watershed but NOT on the mainstem	Western tributary of the headwaters of Hyde Run to the confluence with the next larger stream order	1.468	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE260-003-02	Red Clay Creek	Red Clay Creek All other tributaries located in the watershed but NOT on the mainstem	Western tributary of the headwaters of Hyde Run to the confluence with the next larger stream order	1.468	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	CHRONIC TOXICITY	NON-POINT SOURCE	2012	Low	5	Listed Based on 2011 journal article. Likely cause is a federal superfund site. The Department is working with EPA on the cleanup and possible TMDL.
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	CHRONIC TOXICITY	POINT SOURCE(S) - UNSPECIFIED	2012	Low	5	Listed Based on 2011 journal article. Likely cause is a federal superfund site. The Department is working with EPA on the cleanup and possible TMDL.
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE270-001-01-01	Red Lion Creek	Lower Red Lion	From U.S. Route 13 to the mouth at Delaware River	2.3229	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE270-001-01-02	Red Lion Creek	Lower Red Lion	First tributary downstream of Doll Run from the headwaters to the confluence with Red Lion Creek	1.1228	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE270-001-02-01	Red Lion Creek	Upper Red Lion	From the headwaters to the location where Route 13 intersects Red Lion Creek	3.1065	Miles	DIELDRIN	NON-POINT SOURCE	2014	Low	5	
DE270-001-02-02	Red Lion Creek	Upper Red Lion	First tributary after the headwaters of Red Lion Creek	0.9842	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE280-001-01-01	Rehoboth Bay	Chapel Branch	From the headwaters of Chapel Branch to the confluence of Herring Creek, including Hopkins Prong, Unity Branch, Phillips Branch, and Guinea Creek	22.6946	Miles	COPPER	SOURCE UNKNOWN	2016	Low	5	
DE280-001-01-02	Rehoboth Bay	Chapel Branch	Chapel Branch--from the start of the second order stream to the confluence with Herring Creek	5.1442	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE280-E01	Rehoboth Bay	Rehoboth Bay	Near coastal waters extending north from the confluence with Indian River Bay at Burton Island	13.0633	Square Miles	COPPER	SOURCE UNKNOWN	2014	Low	5	
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-01	Saint Jones River	Lower Saint Jones	From Old Lebanon Bridge to the mouth of Delaware Bay	7.6103	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories

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DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	DIOXIN	NON-POINT SOURCE	2002	Medium	5	
DE290-001-02-01	Saint Jones River	Upper Saint Jones	From the dam at Silver Lake to Old Lebanon Bridge at Road 357	5.2131	Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Medium	5	
DE290-001-02-02	Saint Jones River	Upper Saint Jones	Tributary of Silver Lake in Dover	0.4933	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-001-02-03	Saint Jones River	Upper Saint Jones	Puncheon Branch--from the confluence of the headwaters to the confluence with the Saint Jones River	3.4005	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-001-02-03	Saint Jones River	Upper Saint Jones	Puncheon Branch--from the confluence of the headwaters to the confluence with the Saint Jones River	3.4005	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-002-02	Saint Jones River	Isaac Branch	From the confluence of Allabands Mill Stream to the confluence with Saint Jones River	1.8162	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-002-03	Saint Jones River	Isaac Branch	From the confluence of the headwaters of Almhouse Branch to the confluence of Isaac Branch	3.5642	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-002-04	Saint Jones River	Isaac Branch	Second tributary upstream of Wyoming Lake on Isaac Branch	1.1341	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-002-05	Saint Jones River	Isaac Branch	Wyoming Mill Pond	47.0041	Acres	DDT (DICHLORODIPHENYLTRICHL	NON-POINT SOURCE	2002	Low	5	Changed 2018 to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories
DE290-003-01	Saint Jones River	Fork Branch	From the headwaters to Silver Lake in Dover	8.9149	Miles	MERCURY	NON-POINT SOURCE	2014	Low	5	
DE290-003-02	Saint Jones River	Fork Branch	Cahoon Branch--from the confluence of the headwaters to the confluence with the next larger stream order	2.2128	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-003-03	Saint Jones River	Fork Branch	Maidstone Branch- from the confluence of the third order stream to the confluence with Cahoon Branch	2.911	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-003-04	Saint Jones River	Fork Branch	Tributary to Maidstone Branch---from the confluence of the headwaters to the confluence with Maidstone Branch	0.9781	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-003-05	Saint Jones River	Fork Branch	Fork Branch--from the start of the third order stream to the confluence with Silver Lake in Dover	6.2166	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-003-06	Saint Jones River	Fork Branch	From the start of the third order stream on Cahoon Branch to the confluence with Maidstone Branch	2.3266	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-004-01	Saint Jones River	Tidbury Branch	From below Derby Pond to the confluence with the Saint Jones River	4.8466	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-004-02	Saint Jones River	Tidbury Branch	From the confluence of the headwaters of Tidbury Creek to the confluence with Derby Pond	3.116	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-004-02	Saint Jones River	Tidbury Branch	From the confluence of the headwaters of Tidbury Creek to the confluence with Derby Pond	3.116	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-004-03	Saint Jones River	Tidbury Branch	Tributary of Tidbury Creek--from the headwaters to the confluence with Tidbury Creek	0.922	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE290-004-04	Saint Jones River	Tidbury Branch	Red House Branch--from the confluence of the headwaters to the confluence with Derby Pond	1.4404	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.493	Acres	DIOXIN	NON-POINT SOURCE	2002	Medium	5	
DE290-L02	Saint Jones River	Silver Lake	Silver Lake at Dover	168.493	Acres	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Medium	5	
DE300-001-01	Shellpot Creek	Lower Shellpot Creek	From the head of tide below the east set of railroad tracks to the mouth of the Delaware River	1.2385	Miles	DIELDRIN	NON-POINT SOURCE	2016	Low	5	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	DIELDRIN	NON-POINT SOURCE	2012	Low	5	
DE300-001-02-01	Shellpot Creek	Upper Shellpot Creek	From the headwaters to the head of tide below the east set of railroad tracks	6.6245	Miles	HEPTACHLOR EPOXIDE	SOURCE UNKNOWN	2016	Low	5	
DE300-001-02-02	Shellpot Creek	Upper Shellpot Creek	Western tributary of the headwaters to the confluence of the next larger stream order	1.5718	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE300-001-02-02	Shellpot Creek	Upper Shellpot Creek	Western tributary of the headwaters to the confluence of the next larger stream order	1.5718	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-02-03	Shellpot Creek	Upper Shellpot Creek	From the headwaters of Matson Run to the confluence with mainstem Shellpot Creek	1.8625	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE300-001-02-03	Shellpot Creek	Upper Shellpot Creek	From the headwaters of Matson Run to the confluence with mainstem Shellpot Creek	1.8625	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-01	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	Western tributary of the headwaters of Stoney Creek to the confluence with mainstem Stoney Creek	0.8514	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-02	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	From the confluence of the headwaters of Stoney Creek to the mouth of the Delaware River	1.8194	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE300-001-03-02	Shellpot Creek	Shellpot Creek All other tributaries located in the watershed but NOT on the mainstem	From the confluence of the headwaters of Stoney Creek to the mouth of the Delaware River	1.8194	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-002-02	Smyrna River	Mill Creek	Providence Creek--from the confluence of the headwaters of Mill Creek to the confluence with Lake Como	4.4562	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE310-002-02	Smyrna River	Mill Creek	Providence Creek--from the confluence of the headwaters of Mill Creek to the confluence with Lake Como	4.4562	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-02	Smyrna River	Tributary of Smyrna River	From the confluence of the headwaters of Paw Paw Branch to the confluence with Providence Creek	3.0297	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE310-003-02	Smyrna River	Tributary of Smyrna River	From the confluence of the headwaters of Paw Paw Branch to the confluence with Providence Creek	3.0297	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-03	Smyrna River	Tributary of Smyrna River	First eastern tributary after the headwaters of Paw Paw Branch to the confluence with Smyrna River	1.6394	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-04	Smyrna River	Tributary of Smyrna River	Eastern tributary of the headwaters of Sawmill Branch to its confluence	0.6833	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	

ASSESSMENT_UNIT_ID	LOCATION_TEXT	ASSESSMENT_UNIT_NAME	LOCATION_DESCRIPTION	WATER_SIZE	WATER_UNIT	PARAM_NAME	SOURCE_NAME	PARAM_YEAR_LISTED	PARAM_PRIORITY_RANKING	EPA_IR_CATEGORY	PARAM_COMMENT
DE310-003-04	Smyrna River	Tributary of Smyrna River	Eastern tributary of the headwaters of Sawmill Branch to its confluence	0.6833	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE310-003-05	Smyrna River	Tributary of Smyrna River	Sawmill Branch--from the confluence of the headwaters to the next larger stream order	3.2651	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-001-01	White Clay Creek	White Clay Creek Mainstem	White Clay Creek from the PA-DE line to the confluence with the Christina River	14.7806	Miles	DIELDRIN	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	CHLORDANE	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	DDD (DICHLORODIPHENYLDICHLO	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	DDE (DICHLORODIPHENYLDICHLO	SOURCE UNKNOWN	2016	Low	5	
DE320-001-03	White Clay Creek	White Clay Creek Mainstem	Tidal White Clay from the River mouth to Rt4	3.0312	Miles	DDT (DICHLORODIPHENYLTRICHL	SOURCE UNKNOWN	2016	Low	5	
DE320-002-02	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with the next larger stream order	1.7954	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-002-02	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with the next larger stream order	1.7954	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-002-03	White Clay Creek	Mill Creek	Second western tributary-- From the headwaters of mainstem Mill Creek	0.0399	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-002-04	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with White Clay Creek (upper half)	4.5786	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	2014	Low	5	
DE320-002-05	White Clay Creek	Mill Creek	From the confluence of the headwaters of Mill Creek to the confluence with White Clay Creek (lower half)	4.9384	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-003-05	White Clay Creek	Pike Creek	From the confluence of the headwaters of Pike Creek to the confluence with White Clay Creek	5.5357	Miles	BIOLOGICAL INTEGRITY	NON-POINT SOURCE	1998	Low	5	
DE320-003-05	White Clay Creek	Pike Creek	From the confluence of the headwaters of Pike Creek to the confluence with White Clay Creek	5.5357	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DE320-005-01	White Clay Creek	White Clay Creek All tributaries from the headwaters to the confluence with the Christina River	First tributary after State line to the confluence of White Clay Creek, along Thompson Station Road	2.0527	Miles	HABITAT ASSESSMENT	NON-POINT SOURCE	1998	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	DIELDRIN	NON-POINT SOURCE	2002	Low	5	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	DIELDRIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	DIELDRIN	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	2016 Changed from "Chlorinated Pesticides" to Dieldrin to be more specific.
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	DIOXIN	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	DIOXIN	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	DIOXIN	NON-POINT SOURCE	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	FURAN COMPOUNDS	CERCLA NPL (SUPERFUND) SITES	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	FURAN COMPOUNDS	POINT SOURCE(S) - UNSPECIFIED	2002	Low	5	
DEDRBCZone5	Delaware River	DRBC Zone 5	From the Pennsylvania- Delaware line to Liston Point, Delaware.	65.0823	Square Miles	FURAN COMPOUNDS	NON-POINT SOURCE	2002	Low	5	
DEDRBCZone5c	Delaware River	DRBC Zone 5c	Lower portion of DRBC Zone 5	30.463	Square Miles	DISSOLVED OXYGEN	NON-POINT SOURCE	2006	Low	5	Delaware will work with the DRBC, EPA, other States and Stakeholders to develop and implement a TMDL in these waters.
DEDRBCZone5c	Delaware River	DRBC Zone 5c	Lower portion of DRBC Zone 5	30.463	Square Miles	DISSOLVED OXYGEN	POINT SOURCE(S) - UNSPECIFIED	2006	Low	5	Delaware will work with the DRBC, EPA, other States and Stakeholders to develop and implement a TMDL in these waters.
DEDRBCZone6	Delaware Bay	DRBC Zone 6	From Liston Point to the confluence with the Atlantic Ocean	680.526	Square Miles	MERCURY		2002	Low	5	TMDL Target date of 2012 changed to 2016 in the 2012 Cycle. Changed to Monitored Natural Recovery per March 1, 2018 Evaluation of Fish Consumption Advisories

Appendix Six: Volunteer Water Quality Monitoring Data

UD Citizen Monitoring Program
Dissolved Oxygen (D.O.) Statistics
01/01/12 - 12/31/16, Sites with 4 or more measurements.
Aquatic Life Use is not supported if 2 or more D.O. samples are less than 4.0 mg/L in the 5 year period

Test Site Code	Test Site Description	# of D.O. Samples	Average D.O. (mg/L)	# of D.O. Samples less than 4.0 mg/L
	Delaware Bay - Tidal			
DB01	End of Cape Shores pier	101	7.7	0
	Broadkill River Watershed - Fresh			
BR06	Ingram Ditch at the intersection of Rds 212 and 231.	41	6.8	5
BR10	Ingram Branch at Rt 319	43	6.9	1
BR47	Sowbridge Branch 1/2 mile upstream of Reynolds Pond	24	7.7	0
BR48	Diamond Pond at Spillway	107	9.8	2
BR54	Red Mill Pond outlet at Rt 1	13	9.9	0
	Broadkill River Watershed - Tidal			
BR01	Broadkill river @ PEL dock.	141	6.6	10
BR02	Prime Hook NWR Petersfield Ditch water control structure, 50m N of Rt 16.	50	4.7	28
BR03	Prime Hook Creek at Boat Ramp at Refuge Headquarters	150	5.7	59
BR13	2707 S. Bayshore Drive	111	5.3	36
BR19	Canary Creek at New Road	13	5.1	5
BR20	Broadkill River at Milton tidal pond	145	7.2	1
BR21	Old Mill Creek downstream from Red Mill Pond	156	4.3	85
BR40	Canary Creek at Pilottown Rd	126	6.2	25
	Rehoboth Bay Watershed - Fresh			
RB10	Guinea Creek above golf course	59	5.6	11
RB81	Bundicks Branch at Beaverdam Rd	5	7.3	0
RB82	Goslee Creek at Jimtown Rd	6	6.5	0
RB83	Love Creek at Robinsonville Rd	5	7.7	0
	Rehoboth Bay Watershed - Tidal			
ML	Massey's Landing	19	8.1	0
RB04	Herring Creek, Mid-Section	31	8.0	2
RB05	Mouth of Guinea Creek (Pot Nets Creekside)	43	8.2	1
RB06	Guinea Creek (Winding Creek Village)	126	6.2	21
RB06A	Guinea Creek @ Rd 298 Bridge	60	5.7	13
RB06B	Guinea Creek (Winding Village) by Boat	10	4.2	4
RB07	West Bay Park	43	6.6	4
RB16E	Rusty Rudder Pier-end	6	5.1	1
RB16M	Rusty Rudder Pier-middle	6	5.3	1
RB16N	Rusty Rudder Pier-near shore	6	5.4	0
RB34	Love Creek at Rt 24 Bridge	70	6.9	7
RB34B	Love Creek at Rt 24 Bridge by boat	4	6.8	1
RB64	Torquay Canal, west side of Land's End near UD Site #1	111	4.2	57
RB75B	Junction of Guinea and Herring Creeks	12	4.8	2
RB76B	Herring Creek at Rehoboth Bay	12	5.1	0
RB77B	Lower Central Rehoboth Bay	12	6.3	0
RB78B	Mid Central Rehoboth Bay	12	6.2	0
RB79B	Upper Central Rehoboth Bay	12	5.8	0
RB80	Upper Love Creek at Webb Landing	11	6.1	2
RB80B	Upper Love Creek at Webb Landing by boat	4	7.5	0
RB84B	Upper reach of Hetty Fisher Glade by boat	4	4.8	0
RB85B	Mouth of Stillman Glade by boat	4	6.2	1
RB86B	Mouth of Hetty Fisher Glade by boat	4	6.5	1
RB87B	Upper Love Creek, upstream of Webb Landing by boat	4	6.0	1
RB88B	Upper Love Creek, just below marsh area by boat	4	7.0	0
RB90	Burton Prong	38	5.3	7
RLC1W	Mouth of Love Creek, shellfish site	15	5.3	2
	Indian River Bay Watershed - Tidal			
IR04	Warwick Cove	61	9.2	1
IR07	Holt's Landing State Park	15	7.4	0
IR11	Pot Nets Seaside Pier	67	7.8	0
IR12	Broken marshes, 1/4 mile SE of Quillens Point - 300 Bayfront Drive	121	6.2	12

UD Citizen Monitoring Program
Dissolved Oxygen (D.O.) Statistics
01/01/12 - 12/31/16, Sites with 4 or more measurements.
Aquatic Life Use is not supported if 2 or more D.O. samples are less than 4.0 mg/L in the 5 year period

Test Site Code	Test Site Description	# of D.O. Samples	Average D.O. (mg/L)	# of D.O. Samples less than 4.0 mg/L
	Indian River Bay Watershed - Tidal (continued)			
IR20	Bay Colony	52	5.9	12
IR24	Iron Branch - County road 331 at bridge	116	7.0	15
IR26	Possum Point	45	7.2	2
IR28B	White Creek Green #7	14	5.7	0
IR29	Holly Terrace Acres Canal, White Creek	109	5.5	37
IR32	Holly Terrace Acres Canal Dead End, White Creek	115	4.6	59
IR36	James Farm, base of Pasture Point Knee deep 150 yds from shore	60	6.9	4
IR38	Vines Lane	137	5.7	29
IR39	North side of Inlet at Wheelchair fishing platform under new bridge.	64	7.0	0
IR41B	Indian River buoy #1	14	6.4	0
IR42B	Indian River buoy #R26, N of Grey's Pt	14	6.2	0
IR43B	Indian River buoy #R22; N of Holt's Lnd	14	6.5	0
IR46B	Pepper Creek Buoy #1	14	6.0	1
IR48B	Indian River green buoy #G5 west of White Creek	14	6.2	0
IR50	Assawoman Canal at N end, Ocean View Marina	167	5.8	43
IR51	Pepper Creek, Creekside	74	6.6	8
IR62	Loop Canal, Pa Ave terminus, Bethany Beach	37	3.7	25
IR73	Western edge of Salt Pond	56	4.5	26
	Little Assawoman Bay Watershed - Fresh			
LA29	Upper Dirickson Creek @ Rt20	49	5.0	13
LA38	The Hamlet at Dirickson Pond	142	8.5	0
	Little Assawoman Bay Watershed - Tidal			
JC08B	SB, Jefferson Creek Basin between Assawoman canal extensions, by boat	20	5.2	1
LA02B	North of Fenwick Island by boat	20	4.9	2
LA03	Mulberry Landing	91	6.2	13
LA03B	Mulberry Landing by boat at mid channel	20	5.4	0
LA09	Dirickson Creek at Road 381 bridge.	107	5.6	37
LA10	Assawoman Canal S end, Kent Ave Bridge	43	5.2	20
LA15B	Near red channel marker #12 by boat	20	5.5	0
LA19B	Mid Dirickson Creek off Swann Keys by boat	20	4.8	4
LA42B	Narrows, South of state beach at point by boat	20	5.3	0
LA43	Fenwick Island Lagoon	27	5.2	12
LA44	Fenwick Island Cove	26	5.7	8
LA45	Fenwick Island Bayside	44	6.1	9
LA46	Fenwick Island Tide Gauge	38	6.5	2
LA48	W. Georgetown St. Canal - Fenwick	100	5.8	18
SB01	Anchorage Canal @ Rt 1	150	4.3	85
SB02	Anchorage Canal near elbow	150	6.0	36
SB04	Petherton canal/rt1	150	4.6	77
SB05	Petherton canal, between lots 156 and 162	151	6.1	24
SB06	Brandywine Canal	143	4.7	59
SB07	Layton Canal, South Bethany	151	6.3	15
SB09	Carlisle canal	150	4.8	75
SB10E	Russell Canal east dead end	152	4.1	79
SB10W	Russell Canal west dead end	151	4.9	59
SB12	Jefferson Canal West side @ tidal gage	151	6.0	19
SB13	South end of York Canal	58	6.4	7
	Assawoman Bay Watershed - Tidal			
AB01	Bayside Point Pier	13	5.7	0
BA01	Keenwick on Bay, Roy Creek	16	6.9	2

UD Citizen Monitoring Program
Statistics for Total Suspended Solids (TSS), Chlorophyll (Chla), Dissolved Inorganic Nitrogen (DIN) and Phosphorus (DIP), and Total Enterococcus (TE)
1/1/2012 - 12/31/2016
Exceedance of Standards (Std) indicates impairment

Test Site Code	Test Site Description	# of TSS Samples	Avg TSS (mg/L) *Std=20*	# of Chla Samples	Avg Chla (µg/L) *Std=15*	# of DIP Samples	Avg DIP (mg/L) *Std=0.01*	# of DIN Samples	Avg DIN (mg/L) *Std=0.14*	# of TE Samples	Geomean TE Marine (MPN/100ml) *Std=35*	Geomean TE Fresh (MPN/100ml) *Std=100*
Delaware Bay-marine												
DB01	End of Cape Shores pier	2	63.9	2	12.4	0		0		64	8	
Broadkill River Watershed - fresh												
BR06	Ingram Ditch at the intersection of Rds 212 and 231.	41	3.3	41	1.6	0		0		38		373
BR10	Ingram Branch at Rt 319	43	6.8	43	3.0	0		0		40		476
BR44	Wagamon's Pond on Northern Shoreline, Milton	41	17.0	41	20.5	27	0.040	27	1.925	53		395
BR47	Sowbridge Branch 1/2 mile upstream of Reynolds Pond	25	2.1	25	0.5	0		0		25		538
BR48	Diamond Pond at Spillway	43	3.4	44	13.3	29	0.015	29	1.798	68		16
BR54	Red Mill Pond outlet at Rt 1	0		0		0		0		12		14
Broadkill River Watershed - marine												
BR01	Broadkill river @ PEL dock.	72	56.5	72	10.5	37	0.021	37	0.171	69	12	
BR03	Prime Hook Creek at Boat Ramp at Refuge Headquarters	43	91.0	43	108.6	15	0.124	15	0.228	62	106	
BR19	Canary Creek at New Road	13	56.3	13	27.6	6	0.018	6	0.444	10	297	
BR20	Broadkill River at Milton tidal pond	71	5.8	71	11.9	56	0.009	56	2.557	68	65	
BR21	Old Mill Creek downstream from Red Mill Pond	39	26.5	40	20.8	16	0.017	16	0.317	62	200	
BR40	Canary Creek at Pilottown Rd	44	48.5	44	9.8	10	0.014	10	0.090	67	17	
Rehoboth Bay Watershed - fresh												
RB10	Guinea Creek above golf course	0		0		0		0		67		444
RB81	Bundicks Branch at Beaverdam Rd	0		0		0		0		6		646
RB82	Goslee Creek at Jimtown Rd	0		0		0		0		6		675
RB83	Love Creek at Robinsonville Rd	0		0		0		0		6		33
Rehoboth Bay Watershed - marine												
ML	Massey's Landing	19	50.2	19	6.7	19	0.011	19	0.052	16	8	
RB04	Herring Creek, Mid-Section	30	35.8	30	13.1	30	0.007	30	0.516	27	46	
RB05	Mouth of Guinea Creek (Pot Nets Creekside)	44	72.5	44	13.0	0		0		41	22	
RB06	Guinea Creek (Winding Creek Village)	71	21.6	71	13.9	62	0.008	62	0.588	72	347	
RB06A	Guinea Creek @ Rd 298 Bridge	0		0		0		0		68	786	
RB07	West Bay Park	38	60.1	38	10.5	38	0.010	38	0.053	35	16	
RB16E	Rusty Rudder Pier End	0		0		0		0		6	33	
RB16M	Rusty Rudder Pier Middle	0		0		0		0		6	34	
RB16N	Rusty Rudder Pier Near	0		0		0		0		6	43	
RB34	Love Creek at Rt 24 Bridge	71	29.9	71	22.7	61	0.009	61	0.619	69	137	
RB34B	Love Creek at Rt 24 bridge by boat	0		0		0		0		5	200	
RB80	Upper Love Creek at Webb Landing	0		0		0		0		8	85	
RB80B	Upper Love Creek at Webb Landing by boat	0		0		0		0		5	153	
RB84B	Upper reach of Hetty Fisher Glade	0		0		0		0		5	1067	
RB85B	Mouth of Stillman Glade	0		0		0		0		5	192	
RB86B	Mouth of Hetty Fisher Glade	0		0		0		0		5	251	
RB87B	Upper Love Creek, Upstream of Webb Landing	0		0		0		0		5	106	
RB88B	Upper Love Creek, just below marsh area	0		0		0		0		5	97	

UD Citizen Monitoring Program
Statistics for Total Suspended Solids (TSS), Chlorophyll (Chla), Dissolved Inorganic Nitrogen (DIN) and Phosphorus (DIP), and Total Enterococcus (TE)
1/1/2012 - 12/31/2016
Exceedance of Standards (Std) indicates impairment

Test Site Code	Test Site Description	# of TSS Samples	Avg TSS (mg/L) *Std=20*	# of Chla Samples	Avg Chla (µg/L) *Std=15*	# of DIP Samples	Avg DIP (mg/L) *Std=0.01*	# of DIN Samples	Avg DIN (mg/L) *Std=0.14*	# of TE Samples	Geomean TE Marine (MPN/100ml) *Std=35*	Geomean TE Fresh (MPN/100ml) *Std=100*
Rehoboth Bay Watershed - marine (continued)												
RB90	Burton Prong	0		0		0		0		33	385	
Indian River Bay Watershed - marine												
IR04	Warwick Cove	52	39.2	52	22.5	52	0.012	52	0.526	49	19	
IR07	Holt's Landing State Park	0		0		0		0		13	36	
IR11	Pot Nets Seaside Pier	68	41.3	67	8.1	68	0.009	68	0.061	65	9	
IR20	Bay Colony	39	41.8	39	15.4	39	0.014	39	0.413	37	27	
IR24	Iron Branch - County road 331 at bridge	16	29.2	16	19.2	0		0		42	460	
IR32	Holly Terrace Acres Canal Dead End, White Creek	45	42.9	45	19.3	0		0		49	56	
IR36	James Farm, base of Pasture Point Knee deep 150 yds from	41	60.4	42	9.1	8	0.006	8	0.025	62	33	
IR38	Vines Lane	71	37.1	71	21.3	71	0.014	71	0.612	69	66	
IR51	Pepper Creek, Creekside	1	54.7	1	18.9	0		0		10	85	
Little Assawoman Bay Watershed - fresh												
LA29	Upper Dirickson Creek @ Rt20	0		0		0		0		23		486
LA38	The Hamlet at Dirickson Pond	1	7.0	1	3.5	0		0		68		13
Little Assawoman Bay Watershed - marine												
LA03	Mulberry Landing	69	29.9	68	13.1	69	0.005	69	0.199	65	18	
LA09	Dirickson Creek at Road 381 bridge.	72	23.5	72	25.4	63	0.060	63	0.755	71	239	
LA10	Assawoman Canal S end, Kent Ave Bridge	42	42.8	42	6.8	0		0		40	345	
LA43	Fenwick Island Lagoon	0		0		0		0		13	45	
LA44	Fenwick Island Cove	0		0		0		0		12	60	
LA45	Fenwick Island Bayside	30	41.0	31	8.2	31	0.006	31	0.146	30	24	
LA46	Fenwick Island Tide Gauge	38	31.7	38	7.0	38	0.008	38	0.119	39	16	
LA48	W. Georgetown St. Canal - Fenwick	0		0		0		0		70	20	
SB01	Anchorage Canal @ Rt 1	72	33.0	73	21.4	71	0.018	71	0.216	71	177	
SB04	Petherton canal/rt1	0		0		0		0		71	153	
SB06	Brandywine Canal	0		0		0		0		68	86	
SB07	Layton Canal, South Bethany	72	31.2	73	8.0	57	0.006	57	0.105	71	25	
Assawoman Bay Watershed - marine												
AB01	Bayside Point Pier	0		0		0		0		6	6	
BA01	Keenwick on Bay, Roy Creek	16	47.2	16	8.1	16	0.004	16	0.121	13	15	

Appendix Seven: Public Participation

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

OCT 04 2019

Mr. Stephen Williams, Manager
Watershed Assessment and Management Section
Division of Watershed Stewardship
Delaware Department of Natural Resources
and Environmental Control
89 Kings Highway
Dover, Delaware 19901

Dear Mr. Williams:

Thank you for the opportunity to comment on Delaware Department of Natural Resources and Environmental Control's (DNREC) draft 2018 Integrated Report (IR). Outlined below are comments from the Environmental Protection Agency (EPA) on the report.

General Comments:

1. EPA appreciates DNREC including your 2018 IR narrative with the materials available during your public comment period. Please provide public notice details to EPA that include how availability was advertised to the public (including newspaper announcement) and publication dates. Public notice information is necessary for EPA's review of Delaware's final IR submission.

2. EPA appreciates DNREC working with EPA to revise Delaware's list of priority waters for TMDL development under the 303(d) Program Vision. EPA encourages DNREC to provide updated priority water information to the public and allow for public comment.

3. EPA appreciates DNREC's cooperation and effort updating DE's assessment information in EPA's ATTAINS database and updating statewide water quality GIS coverages. The updated Delaware information in ATTAINS will help both EPA and DNREC accurately report water quality conditions of Delaware waters.

Executive Summary Comments:

4. The report states "The 2018 303(d) List shows 65 revisions from earlier Lists.", but *Appendix 5-Changes to Database This Cycle* appears to have 66 entries.

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5. The report states "There were a total of thirty two delistings in this cycle. Twenty two of them were for nutrient, dissolved oxygen or bacteria impairments." But *Appendix 5- Changes to Database This Cycle* appears to have **34** delisting entries, and only **21** appear to be for nutrients, DO or bacteria.

6. The report states "Two delistings were for ammonia, **one of which was the result of removing a point source discharger per a TMDL agreement**." The bolded text does not appear to be reflected in the "Notes" column of *Appendix 5- Changes to Database This Cycle* (or the full database appendix).

ATTAINS Updates:

7. The table below outlines changes that need to be made to Delaware's 2018 data in ATTAINS prior to final IR submission.

AU ID DELETED in ATTAINS	AU ID KEPT in ATTAINS	Notes
DE030-002-04	DE030-002-03	Spatial duplicate.
DE100-003-07	DE100-003-02	Spatial duplicates. BIOLOGY (Nonpoint Source, 1998 year listed, 2010 target TMDL, and category 5) from deleted AU was added to kept AU
DE120-003-02	DE120-003-01	Spatial duplicates. BIOLOGY and HABITAT (Nonpoint Source, 1998 year listed, 2009 target TMDL, and category 5) from deleted AU were added to kept AU
DE120-004-02-02	DE120-004-02-01	Spatial duplicates. BIOLOGY and HABITAT (Nonpoint Source, 1998 year listed, 2009 target TMDL, and category 5) from deleted AU were added to kept AU
DE200-002-20	DE200-002-11	Spatial duplicate.
DE200-002-22	DE200-002-10	Spatial duplicate.
DE230-001-02-03		Deleted as its outside of DE
DE240-009		Deleted.
DE260-002-02	DE260-002-01	Spatial duplicates. BIOLOGY (Nonpoint Source, 1998 year listed, 2009 target TMDL, and category 5) from deleted AU was added to kept AU
DE290-004-05	DE290-004-01	Spatial duplicates. BIOLOGY (Nonpoint Source, 1998 year listed, 2011 target TMDL, and category 5) from deleted AU was added to kept AU
DE020-001-03	DE020-001-01	Spatial duplicates. HABITAT and BIOLOGY (Nonpoint Source, 1998 year listed, 2011 target TMDL, and category 5) from deleted AU were added to kept AU
DE320-001-02	DE320-001-01	Spatial duplicates. BIOLOGY and HABITAT (Nonpoint Source, 1998 year listed, 2009 target TMDL, and category 2) from deleted AU were added to kept AU
DE320-005-03	DE320-005-02	Spatial duplicate.

EPA looks forward to receiving DNREC's final 2018 IR submission via ATTAINS. EPA staff are available to assist DNREC staff with your final ATTAINS submission if needed. If you have any questions pertaining to EPA's comments, please contact me or have your staff contact Bill Richardson at richardson.william@epa.gov or 215-814-5675.

Sincerely,

Evelyn S. MacKnight

Evelyn S. MacKnight, Associate Director
Office of Standards, Assessment and TMDLs

Appendix Eight: Delaware's 2018 305(b) Groundwater-Quality Assessment Based on Public-Well Data: Results of Sampling, October 1, 2015 through September 30, 2017

State of Delaware
DEPARTMENT OF
NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
Shawn M. Garvin, Secretary

Delaware's 2018 305(b) Groundwater-Quality Assessment Based on Public-Well Data: Results of Sampling, October 1, 2015 through September 30, 2017

by Joshua W. Kasper[1]

2018

[1] Division of Water, Water Supply Section, Groundwater Protection Branch

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Groundwater-Quality Highlights

Groundwater quality in Delaware was assessed based on raw-water data collected during a two-year time period (October 1, 2015 through September 30, 2017) from public water-supply (PWS) wells. The water-quality database consisted of approximately 30,000 analyses. Five aquifer types were recognized for reporting purposes: (1) unconfined, (2) confined, (3) semi-confined, (4) fractured-rock, and (5) karst. Unconfined, confined, and semi-confined aquifers occur in the mid-Atlantic Coastal Plain Physiographic Province, which comprises most (~96%) of Delaware's land-surface area. Fractured-rock and karst aquifers occur in the Piedmont Physiographic Province in the remaining northernmost portion of the state; these aquifer types are poorly represented in this assessment due to limited or no water-quality data. There are 1,171 active PWS wells and a large majority of these wells (89%) produce from Coastal-Plain aquifers; 5% produce from Piedmont aquifers; and aquifer designations for the remainder are either not known or not yet established. Well depths range from 22 to 957 ft below land surface (bls) with a median well depth of 140 ft bls. Highlights from the groundwater-quality assessment follow*:

- **Based on nitrate data, almost two thirds of the wells evaluated are susceptible to human influence.** Nitrate concentrations exceeded 0.4 mg/L, a threshold indicative of human impacts, in 63% of the samples.
- **The unconfined aquifer is the most susceptible to human influence.** This aquifer had the highest median nitrate concentration (5.00 mg/L). This aquifer also had a large fraction of concentrations exceeding 0.4 mg/L (90.4%) and a small fraction of non-detectable concentrations (8.2%). The most elevated nitrate concentrations (up to 24.4 mg/L) were associated with unconfined wells.
- **Nitrate concentrations exceeded the drinking-water standard in <3% of all samples.** Concentrations exceeded the Primary Maximum Contaminant Level (PMCL) of 10 mg/L for drinking water in 2.4% of the samples. Areally, PMCL exceedances were limited to unconfined wells located in Kent and Sussex counties.
- **Overall, nitrate concentrations decrease with depth.** Trends in nitrate concentrations with respect to sample depth indicate that overall the vertical extent of human influence in Coast-Plain aquifers was primarily limited to depths of 220 ft below land surface and shallower. At depths greater than 220 ft, nitrate was not detected above the quantitation limit. The deepest nitrate detection was associated with a confined well. There were no nitrate data for Piedmont aquifers in this assessment.
- **Organic compounds were frequently nondetectable.** Organic compounds were not detected in 96.4% of the analyses. Almost one half (43.2%) of the detections were found at concentrations less than 1 µg/L. Tetrachloroethylene (PCE), a solvent, was the most-frequently detected organic compound.
- **Organic compounds rarely exceeded drinking-water standards.** Specifically, organic compounds exceeded PMCLs in 1.0% of the analyses. The following analytes were found above the PMCL: tetrachloroethylene (PCE) and trichloroethylene (TCE).
- **Some organic compounds have depth trends similar to nitrate.** Specifically, concentrations of methyl tert-butyl ether (MTBE), tetrachloroethylene (PCE), and trichloroethylene (TCE) with respect to sample depth indicate that the vertical extent of human impact in the Coastal-Plain aquifers is limited to depths of ~150 ft bls. PCE and TCE were detected at greater depths in karst wells, which typically have very long open intervals that may allow contaminants to enter at shallower depths.
- **Trace elements were frequently nondetectable.** Trace elements were not detected in 76% of the analyses. More than half (52%) of the detections were found at concentrations less than 0.1 mg/L and almost all detections (98%) were found at concentrations less than 1 mg/L.
  Barium, nickel, and chromium were the top three most-frequently detected trace elements.
- **Arsenic data were too limited in this assessment for meaningful analysis; based on previous assessments, arsenic detections were primarily limited to confined wells in glauconitic aquifers.** Based on the 2014 assessment (Kasper, 2014), arsenic was one of the top five most frequently detected trace elements. Detections of arsenic were primarily limited to confined wells that produce from the Rancocas, Mt. Laurel, or Piney Point aquifers, which are associated with glauconitic geologic formations. A USGS study targeting the Rancocas aquifer and completed during the reporting period

(Denver, 2016) found that 15 (41.7%) of 36 wells had arsenic concentrations in excess of the PMCL (10 µg/L).

- **Radionuclide data were very limited in this assessment.** Available radionuclide data were limited to the following parameters with the number of analyses indicated in parentheses: uranium-238 (8) and gross alpha particle activity (2). All uranium-238 results were ND and thus below the 0.03 mg/L PMCL. All gross alpha particle activities were below the 15 pCi/L PMCL. A USGS study targeting the Rancocas aquifer and completed during the reporting period (Denver, 2016) found that 14 (44.4%) of 36 wells had radon concentrations above the lower proposed MCL (300 pCi/L); none of the radon concentrations exceeded the proposed alternative MCL of 4,000 pCi/L.

Other groundwater-quality findings:

- **Overall, groundwater is predominantly soft or moderately hard.** Specifically, most of the results for Coastal-Plain aquifers (93.4%) met either of these criteria. There were no hardness data for Piedmont aquifers; based on previous assessments, the karst aquifer type routinely had the most elevated hardness values.
- **Groundwater was acidic in about half of the overall samples.** Specifically, pH values were less than the lower limit of the Secondary Maximum Contaminant Level (SMCL) range (6.5-8.5 standard pH units) in 53.3% of the samples. Unconfined and semi-confined wells both had a median pH of 5.8 and the largest fractions of pH values below the SMCL range (74.2 and 87.5%, respectively); in contrast, confined wells had the highest median pH (7.5) and the largest fraction of values within the SMCL range (90.5%). There were no pH data for fractured-rock and karst wells; based on previous assessments, karst wells had the highest median pH and the largest fraction of samples within the SMCL range.
- **Iron was elevated in one quarter of the samples.** Iron exceeded the SMCL (0.3 mg/L) in 24.6% of the samples. Elevated iron was detected at virtually all depths. Relative to other Coastal-Plain aquifer types, confined wells had the largest fraction of concentrations greater than the SMCL (44.2%).
- **Groundwater is generally dilute overall based on total dissolved solids (TDS) data.** Specifically, the median TDS concentration was 113 mg/L. Confined wells had the highest median TDS concentration (254 mg/L), likely due to longer groundwater contact time with formation sediments. One TDS concentration was above the 500 mg/L SMCL; it was detected in an unconfined well. TDS concentrations in Coastal-Plain aquifers generally increase with depth. There were no TDS data for Piedmont wells; however, based on previous assessments, the karst aquifer type typically had the highest median TDS concentration.
- **Chloride concentrations did not exceed the drinking-water standard.** Chloride concentrations in Coastal-Plain aquifers were below the SMCL (250 mg/L) in all of the samples. Unconfined wells had the highest median chloride concentration (15.3 mg/L), possibly indicative of human influence. The most elevated chloride concentration (174 mg/L), however, was associated with a confined well sample. There was no apparent trend in chloride with depth. There were no chloride data for Piedmont wells in this assessment.
- **Sodium concentrations were above the health advisory level in almost one third of the samples.** Sodium concentrations in Coastal-Plain aquifers exceeded the Health Advisory (HA) of 20 mg/L in 29.4% of the samples. Sodium concentrations above the HA were found at virtually all depths, but the most elevated concentrations were found in deeper, confined wells. Specifically, confined wells had the highest median sodium concentration (25.4 mg/L) and the largest fraction of concentrations above the HA (56.8%). There were no sodium data for Piedmont wells in this assessment.

*Note: Because only raw or apparently raw groundwater-quality data were evaluated, the results may not be representative of finished or treated water delivered to consumers. Therefore, an exceedance of a drinking-water standard does not necessarily indicate that a public water-supply system is not in compliance.

Introduction

Per Section 106(e) of the Federal Water Pollution Control Act (FWPCA; as amended through P.L. 107-303, November 27, 2002), more commonly known as the Clean Water Act, States are required to collect, compile, and analyze water-quality data and report results to the U.S. Environmental Protection (U.S. EPA) on a biennial basis. Because reporting requirements are outlined in Section 305(b) of the FWPCA, these reports are commonly referred to as "305(b) reports." Although the FWPCA focuses primarily on the quality of navigable [surface] waters, Section 106(e) states that groundwater quality must be reported "…to the extent practicable." Guidelines to this end have consequently been developed (U.S. EPA, 1997).

Inter-Departmental policy for Delaware has improved the Department of Natural Resources and Environmental Control's (DNREC's) ability to assess statewide groundwater quality (DNREC, 2007). The referenced policy requires that all groundwater samples collected in Delaware be identified by well permit number or "DNREC ID." The DNREC ID is the only statewide numbering system unique to well permits issued in Delaware and, therefore, the primary means to obtain well-construction information (DNREC, 2007). Well-construction information, in conjunction with geographic data and hydrogeologic mapping, allows for determinations of aquifer or aquifer type, basic data that are critical to any groundwater-quality investigation.

Efforts by the Department of Health and Social Services (DHSS) have been underway to identify water-quality data for public wells by DNREC ID. Electronic water-quality data are stored in the DHSS's Safe Drinking Water Information System (SDWIS). DNREC's Source Water Assessment and Protection Program (SWAPP) maintains a database (hereafter the "SWAPP database") that contains DNREC IDs, well-construction details, geographic coordinates, and hydrogeologic data for public water-supply wells in Delaware. This 305(b) groundwater-quality assessment is based on information stored in the SDWIS and the SWAPP database; supplemental groundwater-quality data were provided by Tidewater Utilities, Inc. (TUI). Methodologies for data acquisition and analysis are similar to those employed in DNREC's previous 305(b) groundwater-quality assessments (Kasper, 2008, 2010, 2014, 2017; Kasper and Strohmeier, 2012).

Purpose and scope

This report serves as "Part IV: Groundwater Assessment" of Delaware's overall 2018 305(b) report (DNREC, 2018). The primary purpose of this report is to summarize and report raw or apparently raw groundwater-quality data collected from public water-supply wells in Delaware during the timeframe spanning October 1, 2015 through September 30, 2017. Per U.S. EPA (1997) guidance, data are evaluated with respect to hydrogeologic setting and water-quality criteria where possible. The scope of this report is limited to available data obtained from two primary sources: the DHSS's SDWIS and the DNREC's SWAPP database. For this assessment, these databases were supplemented with data collected during 2016 and 2017 by Tidewater Utilities, Inc.

Acknowledgements

Philippe Maitre of the DHSS is gratefully acknowledged for developing SDWIS queries to generate raw (or apparently raw) groundwater-quality data for public water-supply wells. Douglas Rambo of the DNREC assisted with the acquisition of up-to-date SWAPP data.

Tidewater Utilities, Inc. is acknowledged for providing supplemental groundwater-monitoring data, which greatly improved the DNREC's reporting capabilities. Funding for this project is from a U.S. EPA grant pursuant to Section 106 of the Clean Water Act.

General hydrogeology

Delaware covers ~2,010 mi^2 and is comprised of two Physiographic Provinces: the Piedmont and the Atlantic Coastal Plain. The Piedmont covers ~82 mi^2 in northern Delaware (Figure 1) and is comprised of meta-sedimentary, meta-igneous, and igneous rocks (Plank et al., 2000). Areally, metamorphic rocks (mostly gneiss) are dominant based on 1-36,000-scale mapping of bedrock geology in Delaware's Piedmont (Schenck et al., 2000). Bedrock ages range from Precambrian to Silurian, although diabase dikes of Mesozoic age have been identified (Plank et al., 2000; Schenck et al., 2000).

Two main hydrogeologic units have been recognized in Delaware's Piedmont (after Werkheiser, 1995): non-carbonate and carbonate aquifers. Werkheiser (1995) used the term "non-carbonate aquifer" to describe the hydrologic unit occurring predominantly in fractured gneiss. For the purpose of this reporting, however, "fractured-rock aquifer" is used so as to avoid confusion with other non-carbonate aquifers occurring in Coastal-Plain sediments (Table 1). This aquifer-type designation is generally consistent with the SWAPP database. The Cockeysville aquifer, which occurs in the Cockeysville Marble, is the only carbonate aquifer in Delaware. Although the outcrop of the Cockeysville Marble is relatively small (~2.2 mi^2), the Cockeysville aquifer is a major source of public and domestic water supply in northern Delaware (Talley, 1995; Werkheiser, 1995). In this report the term "karst aquifer" is used in lieu of carbonate or Cockeysville aquifer (Table 1). This aquifer-type designation is consistent with the SWAPP database.

The remaining 1,928 mi^2 (96%) of Delaware's land-surface area is underlain by Mid-Atlantic Coastal Plain sediments that onlap crystalline basement rocks (i.e., bedrock). These seaward-dipping and -thickening sediments range in age from Triassic to Holocene (Table 1). Depositional environments vary, but most sediments were laid down in marine, estuarine, and fluvial environments. Overall, 13 major and several minor aquifers are recognized in the Coastal Plain of Delaware (Table 1). Minor, unnamed aquifers occur mostly in Miocene-age sediments (Table 1) and hence the name "minor-Miocene aquifers" has been used to designate these hydrologic units.

For the purpose of this reporting, Coastal-Plain aquifers are subdivided into three main aquifer types: unconfined, semi-confined, and confined. These aquifer-type designations are consistent with the SWAPP database. The unconfined aquifer, also called the Columbia aquifer, occurs predominantly in Pleistocene- to Pliocene-age sediments that comprise Delaware's surficial geologic framework (Table 1). (The term "unconfined aquifer" is used in this report in lieu of "Columbia aquifer" because, as indicated in Table 1, the Columbia aquifer may be confined in some locations.) In areas where confined aquifers subcrop, however, the unconfined aquifer can be in direct hydraulic connection with older geologic units. The semi-confined and confined aquifers predominantly occur in sediments of Miocene age or older. In general, with reference to Table 1, Miocene aquifers are used for potable water supply in Kent County and Sussex County; Eocene and Paleocene aquifers are used in southern New Castle County and Kent County; and Cretaceous aquifers are used in New Castle County.

Table 1. Hydrostratigraphic units in Delaware. [Modified after the Delaware Geological Survey, https://www.dgs.udel.edu/delaware-geology/coastal-plain-hydrostratigraphic-chart.pdf, accessed June 22, 2018.]

AGE	GEOLOGIC UNITS	HYDROLOGIC UNITS
Holocene	various informal deposits	Unassigned
Pleistocene	Delaware Bay Group	Columbia aquifer
	Nanticoke River Group	
	Assawoman Bay Group	
	unassigned	Confining beds / minor, poor aquifer
	Columbia Fm.	Columbia aquifer
Pliocene	Beaverdam Fm.	
Miocene	Bethany Fm.	Pocomoke aquifer and confining beds
	Cat Hill Fm.	Manokin aquifer and confining beds
	St. Marys Fm.	Confining beds / minor, poor aquifer
	Choptank Fm.	unnamed aquifers and confining beds
		Milford aquifer
	Calvert Fm.	Confining beds
		Frederica aquifer
		Confining beds
		Federalsburg aquifer
		Confining beds
		Cheswold aquifer
		Confining beds
Oligocene	glauconitic unit	unassigned
Eocene	glauconitic unit	
	Piney Point Fm.	Piney Point aquifer and confining beds
	Shark River Fm.	Confining beds
	Deal Fm.	
	Manasquan Fm.	Rancocas aquifer and confining beds
Paleocene	Vincentown Fm.	
	Hornerstown Fm.	Confining beds
Cretaceous	Navesink Fm.	
	Mount Laurel Fm.	Mount Laurel aquifer
	Marshalltown Fm.	Confining beds
	Englishtown Fm.	Englishtown aquifer
	Merchantville Fm.	Confining beds
	Magothy Fm.	Magothy aquifer
	Potomac Fm.	Potomac aquifer system and confining beds
Jurassic to Triassic	Post-rift unconformity rocks (of Jurassic age) and rift-basin rocks (inferred)	unassigned
Paleozoic to Precambrian	Various Fms. (bedrock)	Fractured-rock aquifer
		Cockeysville (karst) aquifer

Methods of investigation

Groundwater quality in Delaware was assessed based on pre-existing information stored in two separate databases: the DHSS's SDWIS and the DNREC's SWAPP database. DHSS staff developed queries to extract SDWIS records of raw or apparently raw groundwater-quality data collected from public water-supply systems during the reporting period (October 1, 2015 through September 30, 2017). Data resulting from these queries (30,312 analyses) were provided to DNREC in November 2017 in a Microsoft Office Access ("Access") database. For the 2016 assessment, supplemental groundwater-quality data for 63 public wells (1,096 analyses) were obtained from a private water utility, Tidewater Utilities, Inc. Combined, the data sources contained 31,408 water-quality analyses. Records obtained from the SWAPP database were current as of February 8, 2018. The records included well details such as DNREC ID, depth, geographic coordinates, geologic formation, aquifer, and aquifer type.

Access was used to link and extract data from SDWIS and the SWAPP database. For wells with more than one analysis of a given analyte, results were averaged. Analytes not detected above laboratory quantitation limits ("nondetects") were treated as zeros in all calculations. Results were evaluated with respect to Primary Maximum Contaminant Levels (PMCLs), Secondary Maximum Contaminant Levels (SMCLs), and Health Advisories (HAs) for public water-supply systems (DHSS, 2017; U.S. EPA, 2018). Hardness data were evaluated with respect to the scale of Love (1962). Because only raw or apparently raw groundwater-quality data were evaluated, the results may not be representative of finished or treated water delivered to consumers. Therefore, an exceedance of a drinking-water standard does not necessarily indicate that a public water-supply system is not in compliance (see also Ferrari, 2001, p. 5).

Where possible, data were evaluated with respect to aquifer type (i.e., unconfined, confined, semi-confined, fractured-rock, or karst). Data were, however, generally insufficient in quantity for meaningful analyses of groundwater quality in specific aquifers (Table 1). Some data also were evaluated with respect to sample depth, which was taken to be the bottom of a well's screened interval. Evaluation of trends (e.g., concentration vs. depth) in this assessment are qualitative and not statistically derived. Environmental Systems Research Institute's (ESRI's) ArcMap, a geographic information system (GIS), was used for the spatial analysis of groundwater data. Tabulated statistics (e.g., Table 2) are the result Microsoft Office Excel 2010 ("Excel") calculations. Golden Software, Inc.'s Grapher version 11 ("Grapher") was used to construct percentile diagrams. Values plot as outliers on percentile diagrams (e.g., Figure 4) if either of the following criteria are met:

$$\text{Value} < \text{QL} - 1.5 \times \text{IQR} \quad \text{or} \quad \text{Value} > \text{QU} + 1.5 \times \text{IQR}$$

Where:

IQR is the interquartile range (i.e., the difference between the 75th and 25th percentiles)
QL is the lower quartile or 25th percentile (i.e, the bottom of the box in Figure 4)
QU is the upper quartile or 75th percentile (i.e., the top of the box in Figure 4)

Differences between tabulated statistics (e.g., Table 2) and corresponding percentile diagrams (e.g., Figure 4) are the result of differences in the computational methods of Excel and Grapher.

Public wells

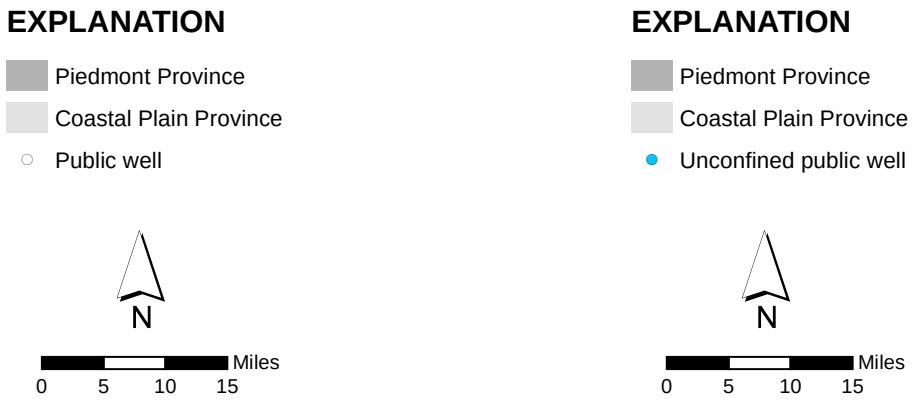
As of February 8, 2018, there were 1,171 active public water-supply wells in the SWAPP database. Of the active wells, 1,122 (97%) have geographic coordinates and are plotted in Figure 1A. With reference to Figure 1A, there are 220 wells (20%) in New Castle County, 311 wells (28%) in Kent County, and 584 wells (52%) in Sussex County. (Percentages in this report may not total 100% due to rounding.)

Aquifer type is known for 1,094 (93%) of the 1,171 active wells (Figure 2). Wells where aquifer type is known and geographic coordinates are available are plotted in Figures 1B thru 1F. Out of all active wells, Coastal-Plain wells account for 1,039 (89%) and Piedmont wells account for 55 (5%) (Figure 2). The large percentage of Coastal-Plain wells relative to Piedmont wells is due to both land-area differences and the fact that public-water supply in the Piedmont and New Castle County is largely from surface-water resources (Wheeler, 2003). Aquifer type for the remaining 77 active wells is either unknown (due to a lack of well-construction data) or not yet assigned (Figure 2).

Coastal-Plain wells include wells screened in unconfined, semi-confined, or confined aquifers (Figures 1B thru 1D and Figure 2). Out of the 1,171 active wells, unconfined wells account for 480 (41%), confined wells account for 508 (43%), and semi-confined wells account for 51 (4%) (Figure 2). A large majority of the unconfined wells with geographic coordinates (386 of 465 or 83%) are located in Sussex County; the remaining unconfined wells include 50 (11%) in Kent County and 29 (6%) in New Castle County (Figure 1B). Confined wells are more evenly distributed throughout the Coastal Plain of Delaware, with most of these wells situated in Kent County (Figure 1C). Specifically, out of 491 confined wells with geographic coordinates, 217 (44%) are located in Kent County, 129 (26%) are located in New Castle County, and 145 (30%) are located in Sussex County. All 51 semi-confined wells have geographic coordinates (Figure 1D); 24 (47%) are located in Kent County, 33 (65%) are located in Sussex County, and 4 (8%) are located in New Castle County.

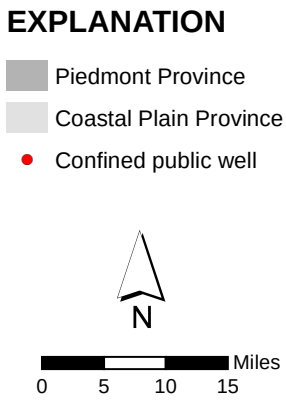
Piedmont wells include fractured-rock and karst wells and are limited to the northernmost portion of the State (Figures 1E and 1F and Figure 2). Out of the 1,171 active wells, fractured-rock wells account for 47 (4%) and karst wells account for 8 (1%) (Figure 2). All 47 fractured-rock and 8 karst wells (Figure 2) have geographic coordinates and are plotted in Figures 1E and 1F, respectively. Karst wells coincide with the Cockeysville Marble outcrop in northern New Castle County (Figure 1F).

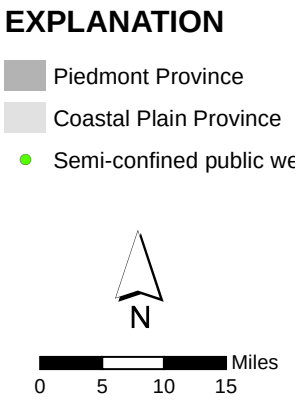
Well depths, taken as the bottom of the well screen, are known for 1,087 (93%) of 1,171 active wells (Figure 3). Overall, well depths range from 22 to 957 ft below land surface (bls) and are skewed (Figure 3). The median well depth is 140 ft bls and the 25th and 75th percentiles are 86 and 242.5 ft bls, respectively. Well depths are not known or have not been assigned for 84 (7%) of the active wells (Figure 3).



(A) **(B)**

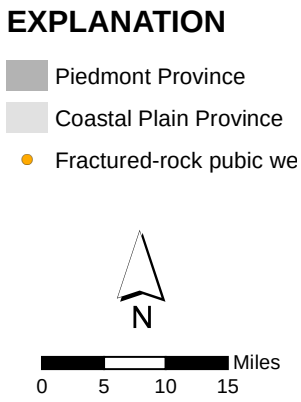
Figure 1. Maps of active public water-supply wells in Delaware – (A) all wells and (B) unconfined wells.

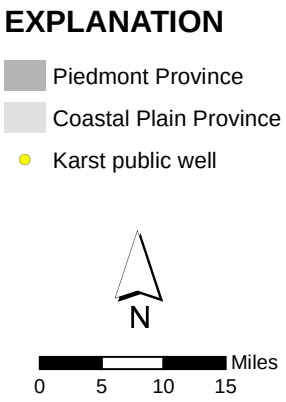




(C) **(D)**

Figure 1. Maps of active public water-supply wells in Delaware (*cont*.) – (C) confined wells and (D) semi-confined wells.





(E) **(F)**

Figure 1. Maps of active public water-supply wells in Delaware (*cont*.) – (E) fractured-rock wells and (F) karst wells.

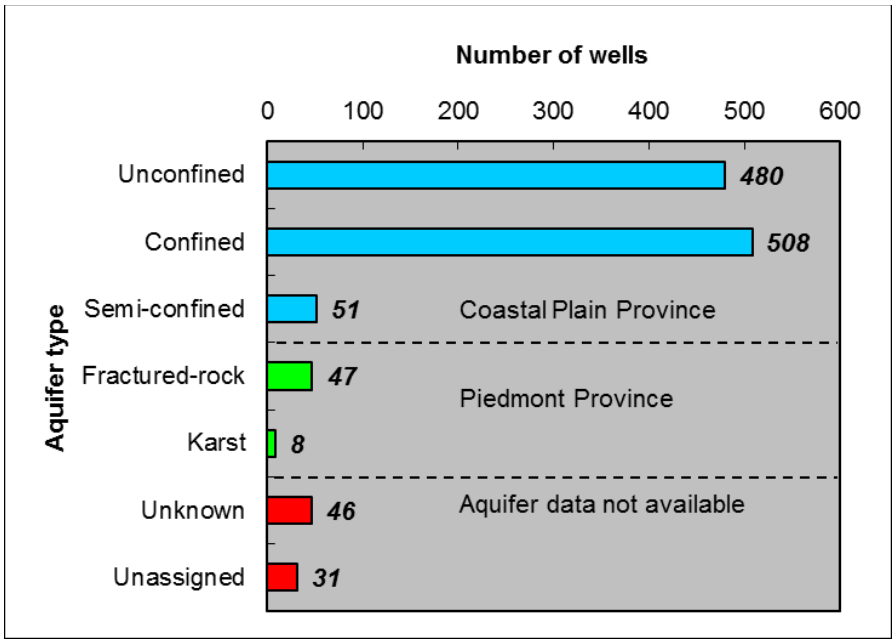


Figure 2. Histogram of active public water-supply wells by aquifer type.

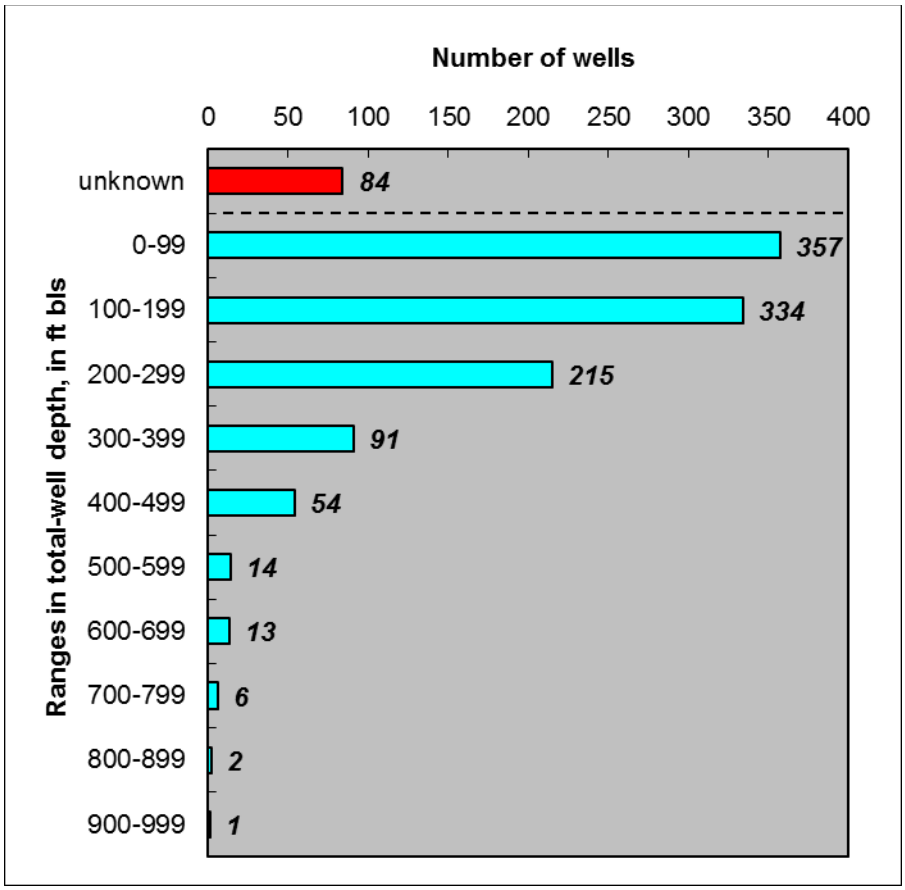


Figure 3. Histogram of active public water-supply wells by ranges in total-well depth.

Results and discussion

Results are grouped into four main categories: general chemistry, organic compounds, trace elements, and radionuclides.

General chemistry

For this assessment, general groundwater chemistry includes parameters routinely measured in public water-supply systems: Nitrate as nitrogen, total dissolved solids, chloride, sodium, iron, hardness as $CaCO_3$, and pH. Nitrate as nitrogen is the only parameter in this category with a PMCL (10 mg/L; U.S. EPA, 2018). Other parameters in this category include those that generally affect the aesthetic qualities of the water supply, such as taste, odor, color, corrosiveness, etc. Most of these parameters have SMCLs.

Nitrate as nitrogen

Overall, 1,136 nitrate as nitrogen ("nitrate") analyses are in the SDWIS query provided to DNREC. Of these, 81 (7%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 57 nitrate analyses. Duplicate analyses for individual wells were averaged resulting in a total of 127 nitrate analyses where aquifer type is known (Table 2). This number translates to ~12% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, nitrate concentrations ranged from nondetectable (ND) to 24.4 mg/L with a median of 2.13 mg/L (Table 2 and Figure 4). Nitrate was not detected above the laboratory quantitation limit in 46 (36.2%) of the 127 analyses (Table 2). Concentrations in 80 (63%) of the samples exceeded 0.4 mg/L (Table 2), a threshold used to distinguish between natural and human-impacted groundwater (Hamilton et al., 1993). Nitrate concentrations exceeded the PMCL (10 mg/L) in 3 (2.4%) of the 127 samples (Table 2). The PMCL exceedances occurred in Kent and Sussex counties (Figure 5). Overall, nitrate concentrations decrease with depth and, below depths of 100 ft bls, concentrations never exceeded the PMCL (Figure 6). Nitrate concentrations exceeded 0.4 mg/L to depths of 220 ft bls, and this may be an indication of the vertical extent of human influence on groundwater quality. Only nitrate data for wells in Coastal-Plain aquifers (i.e., unconfined, confined, and semi-confined aquifers) are represented in this assessment; there were no data for wells in Piedmont aquifers.

Unconfined wells account for 73 (57.5%) of the 127 individual samples linked by DNREC ID (Table 2). This number translates to ~15% of the total number of active unconfined wells (480) statewide (Figure 2). Nitrate was not detected above the laboratory quantitation limit in 6 (8.2%) of the 73 samples. Concentrations in 66 (90.4%) of the 73 samples exceeded 0.4 mg/L suggesting that groundwater quality in the unconfined aquifer is largely affected by human activities. Nitrate concentrations below 0.4 mg/L may reflect natural groundwater quality or geochemical conditions that do not favor nitrification. For example, the southeastern corner of Sussex County coincides with an area where shallow groundwater is largely anoxic and nitrate concentrations are often <0.4 mg/L (Kasper and Strohmeier, 2007). The most elevated nitrate concentration (24.4 mg/L) was detected in an unconfined well (Table 2 and Figure 4). Out of the five aquifer types, unconfined wells had the highest median nitrate concentration (5 mg/L; Table 2 and Figure 4). The median nitrate concentration is in agreement with the median concentration (4.884 mg/L) from a USGS study of 30 randomly-selected unconfined public water-supply wells in Delaware (Reyes, 2010), as well as the median of 4.95 mg/L reported by Fleming et al. (2017)

for 48 wells in the surficial aquifer of Delaware. Moreover, the median nitrate concentration from this study is slightly lower than the median concentrations for shallow (5.4 mg/L) and intermediate (5.5 mg/L) depths in the unconfined aquifer on the Delmarva Peninsula (Denver et al., 2004). A watershed-scale study in Sussex County, Delaware, reported a higher median nitrate concentration (6.4 mg/L) for the unconfined aquifer (Kasper and Strohmeier, 2007). Land use in that watershed is and has been largely agricultural. For this assessment, nitrate exceeded the PMCL in 3 (4.1%) of the 73 unconfined aquifer samples (Table 2), and all of the exceedances occurred in Kent and Sussex counties (Figure 5a). This percentage of PMCL exceedances is slightly lower than the percentage reported by Reyes (2010), who found two out of 30 public wells with nitrate above the PMCL. Other studies of shallow groundwater quality at the State scale (Pellerito et al., 2008; Fleming et al., 2017) reported higher percentages of PMCL exceedances (18 and 19%, respectively). A watershed- scale study within a portion of the Inland Bays drainage area (Kasper and Strohmeier, 2007) reported nitrate above the PMCL in 32% of groundwater samples from the surficial aquifer. There is no apparent trend in nitrate concentrations with depth in the unconfined aquifer (Figure 6). The deepest unconfined PMCL exceedance and most elevated concentration (24.4 mg/L) occurred at a depth of 100 ft bls; the shallowest PMCL exceedance (13.2 mg/L) occurred at a depth of 45 ft bls. Analysis of unconfined nitrate data for the last six assessments indicates no substantial changes in aggregate statistics over time (Figure 7). Specifically, median nitrate concentrations, as well as interquartile ranges, have remained fairly stable since 2008 when current reporting methodologies were put in place. Furthermore, although not indicated in Figure 7, the fractions of unconfined nitrate concentrations above 0.4 mg/L (82 to 91%) have remained consistent over time. The fractions of PMCL exceedances have ranged from 4 to 12% based on all reporting to date.

Confined wells account for 44 (34.6%) of the 127 individual samples linked by DNREC ID (Table 2). This number translates to ~9% of the total number of active confined wells (508) statewide (Figure 2). Nitrate was not detected above the laboratory quantitation limit in 40 (90.9%) of the 44 samples. Concentrations in 4 (9.1%) of the 44 wells exceeded 0.4 mg/L suggesting that groundwater quality in a small fraction of confined aquifer wells may be susceptible to human activities (Table 2). Nitrate was below the PMCL in all confined well samples (Table 2; Figure 5b). Nitrate concentrations generally decrease with depth in confined aquifers, consistent with the overall trend (Figure 6). The most elevated confined nitrate concentration (8.63 mg/L) was associated with a 220-ft-deep well.

Semi-confined wells account for 10 (7.9%) of the 127 individual samples linked by DNREC ID (Table 2). This number translates to ~20% of the total number of active semi-confined wells (51) statewide (Figure 2). Nitrate was detected above the laboratory quantitation limit in all (100%) of the 13 samples. Limited data suggest that semi-confined wells have an intermediate susceptibility to human impacts relative to confined and unconfined wells (Table 2). Specifically, nitrate concentrations in all of the semi-confined well samples (100%) exceeded 0.4 mg/L, indicating human influence on groundwater quality. Nitrate was below the PMCL in all semi-confined well samples (Table 2; Figure 5b). The most elevated semi-confined nitrate concentration (7.69 mg/L) was associated with a 155-ft-deep well.

Again, there are no nitrate data for fractured-rock or karst wells for this assessment. For more information on the occurrence of nitrate in these aquifer types, the interested reader is referred to previous assessments (Kasper, 2008, 2010, 2014, 2017; Kasper and Strohmeier, 2012).

Table 2. Statistical summary of nitrate data by aquifer type. [mg/L, milligrams per liter; ND, not detected above laboratory quantitation limit; ---, no data; PMCL, primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	127	73	44	10	---	---
Percent of total (%)	100	57.5	34.6	7.9	---	---
Maximum (mg/L)	24.40	24.40	8.63	7.69	---	---
75th percentile (mg/L)	5.95	7.00	ND	5.19	---	---
50th percentile (mg/L)	2.13	5.00	ND	2.42	---	---
25th percentile (mg/L)	ND	2.20	ND	1.46	---	---
Minimum (mg/L)	ND	ND	ND	0.85	---	---
Number not detected (#ND)	46	6	40	0	---	---
Percent not detected (%ND)	36.2	8.2	90.9	0.0	---	---
Number > 0.4 mg/L (#)	80	66	4	10	---	---
Percent > 0.4 mg/L (%)	63.0	90.4	9.1	100.0	---	---
Number > 10 mg/L PMCL (#)	3	3	0	0	---	---
Percent > 10 mg/L PMCL (%)	2.4	4.1	0.0	0.0	---	---

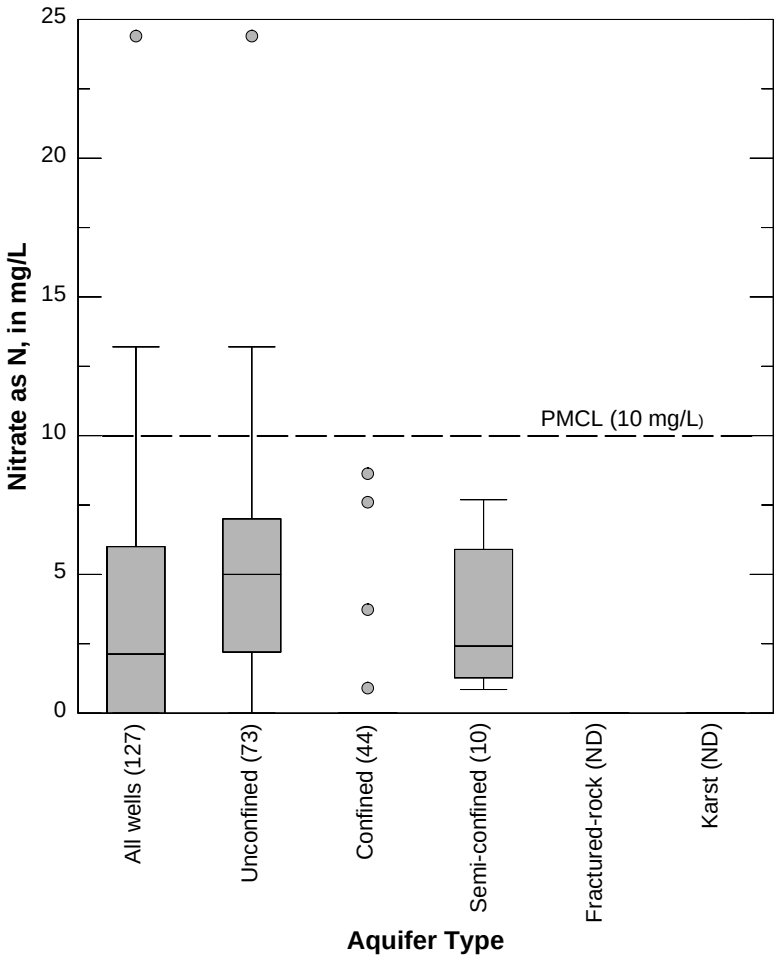
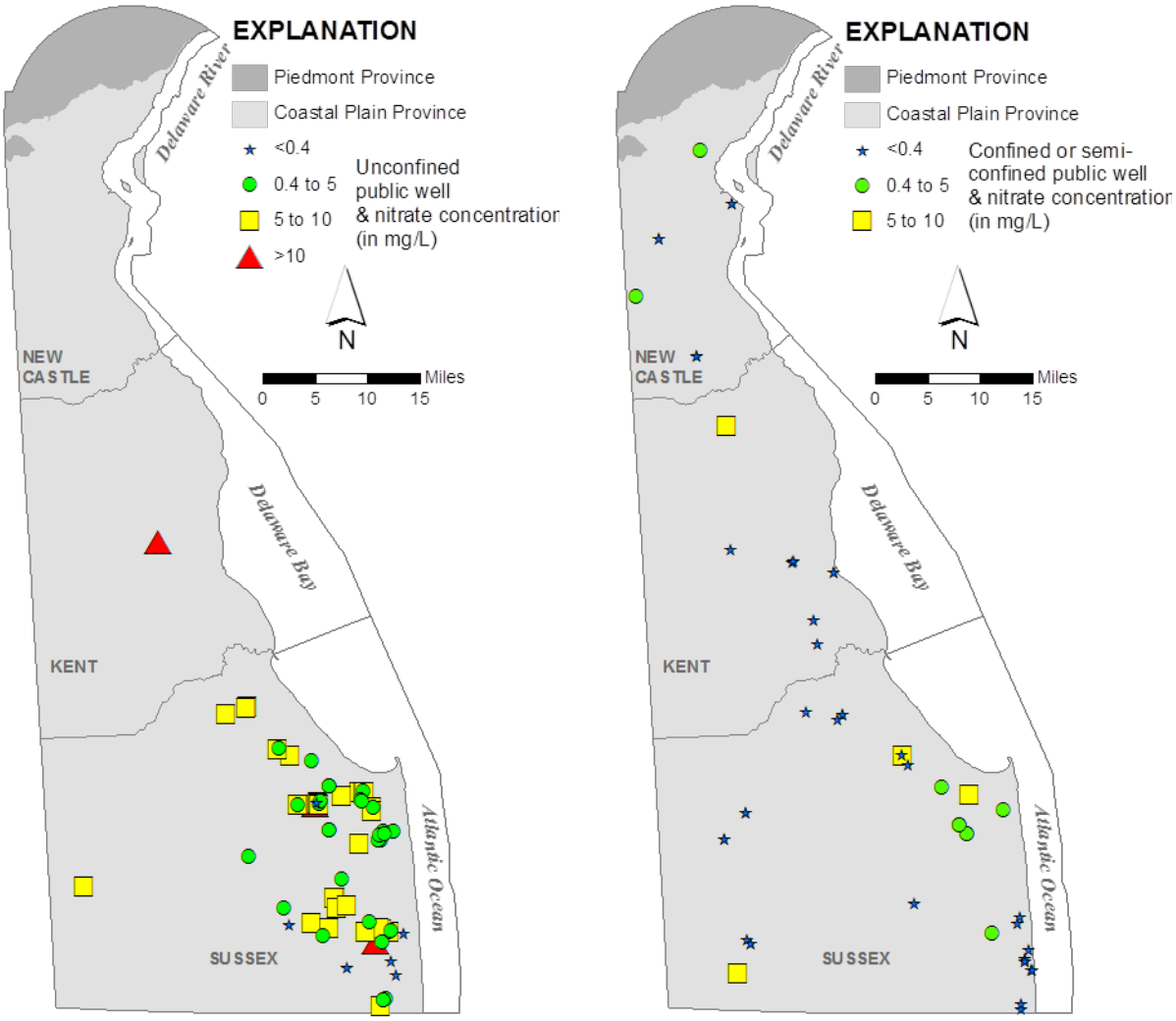


Figure 4. Percentile diagrams of nitrate data by aquifer type. [mg/L, milligrams per liter; circles, outliers; (#), number of samples per aquifer type; PMCL, primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]



(A) **(B)**

Figure 5. Maps showing nitrate concentration ranges in (A) unconfined and (B) confined/semi-confined public water-supply wells.

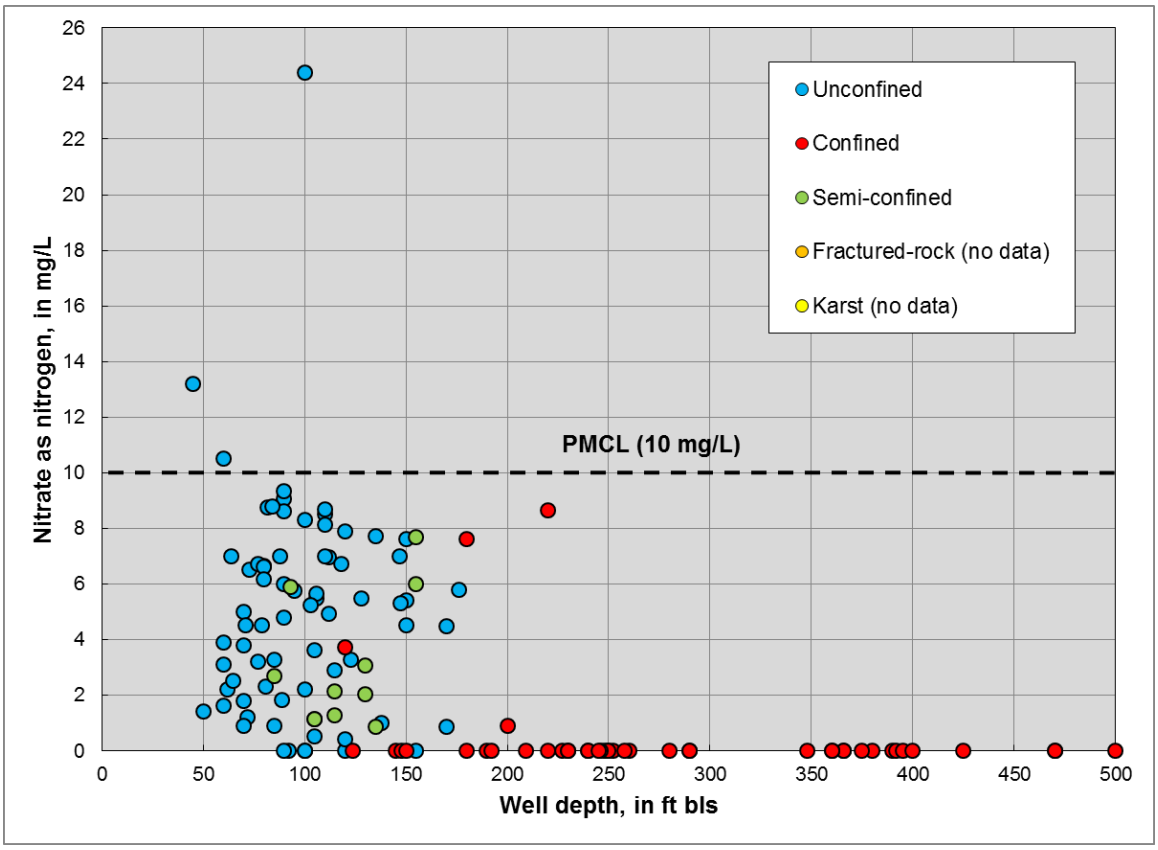


Figure 6. Scatter plot of nitrate versus well depth. [mg/L, milligrams per liter; ft bls, feet below land surface; PMCL, primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

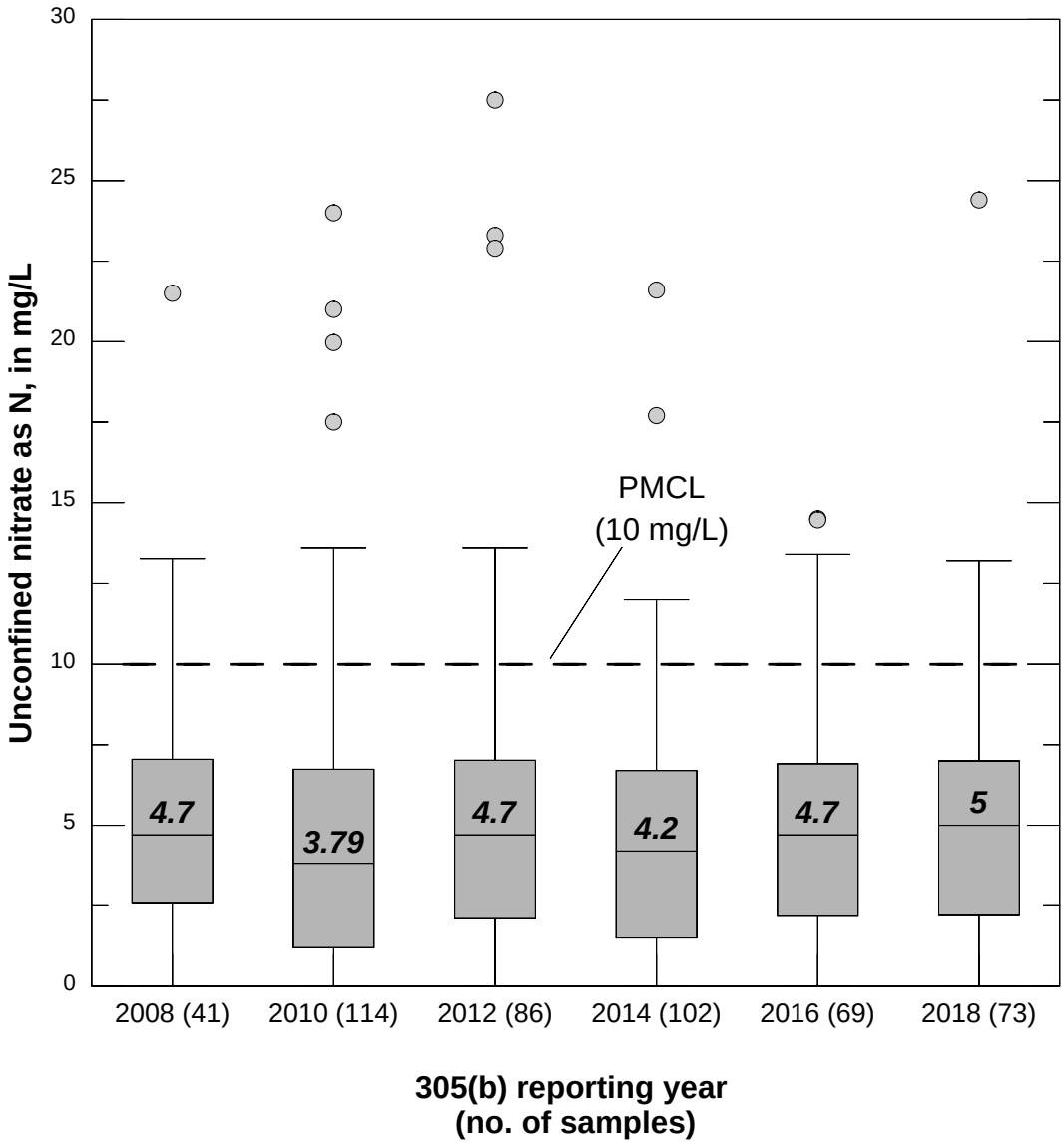


Figure 7. Percentile diagrams of unconfined nitrate data for current and past assessments (Kasper, 2008, 2010, 2014, 2017; Kasper and Strohmeier, 2012). [mg/L, milligrams per liter; circles, outliers; (#), number of samples per reporting period; bold, italicized numbers on diagrams denote median concentrations; PMCL, primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Total dissolved solids

Overall, 37 total dissolved solids (TDS) analyses are in the SDWIS query provided to DNREC. Of these, 9 (58%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 55 TDS analyses. Duplicate analyses for individual wells were averaged resulting in a total of 60 TDS analyses where aquifer type is known (Table 3). This number translates to ~5.5% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, TDS concentrations ranged from 49 to 588 mg/L with a median value of 113 mg/L (Table 3 and Figure 8). One TDS concentration was detected above the SMCL (500 mg/L; Table 3).

There were no TDS data for karst wells for this assessment; however, this aquifer type had the highest median TDS concentration based on previous assessments (Kasper, 2010; Kasper and Strohmeier, 2012). In addition, there were no TDS data for fractured-rock wells (Table 3). Based on previous 305(b) assessments, TDS data for karst and fractured-rock wells were in sharp contrast, a finding that is consistent with Werkheiser (1995). Elevated TDS in karst wells has been attributed to the dissolution of carbonate rocks (Werkheiser, 1995). Based on 33 samples, unconfined wells had a median TDS concentration of 101 mg/L (Table 3 and Figure 8), a value that is lower than, but in general agreement with, the median value of 116 mg/L reported by Ferrari (2001) and Reyes (2010). Confined wells had the highest median TDS concentration (254 mg/L; Table 3 and Figure 8), likely due to longer groundwater contact time with formation sediments. The median TDS concentration for semi-confined wells was much lower (66 mg/L), but this value is based on limited data (8 samples; Table 3). TDS concentrations generally increase with depth; however, the most elevated TDS concentration (588 mg/L) was associated with a 170-ft deep unconfined well (Figure 9).

Table 3. Statistical summary of total dissolved solids (TDS) data by aquifer type. [mg/L, milligrams per liter; ND, not detected above laboratory quantitation limit; ---, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	60	33	19	8	---	---
Percent of total (%)	100	55.0	31.7	13.3	---	---
Maximum (mg/L)	588	588	480	89	---	---
75th percentile (mg/L)	179	117	313	76	---	---
50th percentile (mg/L)	113	101	254	66	---	---
25th percentile (mg/L)	78	77	146	62	---	---
Minimum (mg/L)	49	52	117	49	---	---
Number not detected (#ND)	0	0	0	0	---	---
Percent not detected (%ND)	0.0	0.0	0.0	0.0	---	---
Number > 500 mg/L SMCL (#)	1	1	0	0	---	---
Percent > 500 mg/L SMCL (%)	1.7	3.0	0.0	0.0	---	---

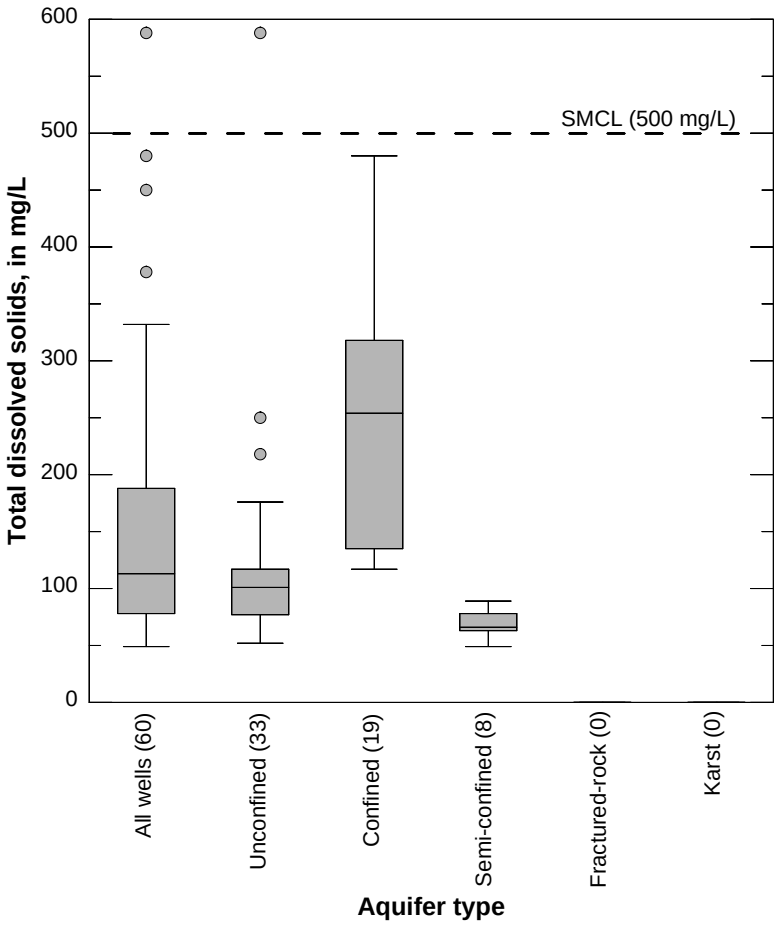


Figure 8. Percentile diagrams of total dissolved solids (TDS) data by aquifer type. [mg/L, milligrams per liter; circles, outliers; (#), number of samples; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

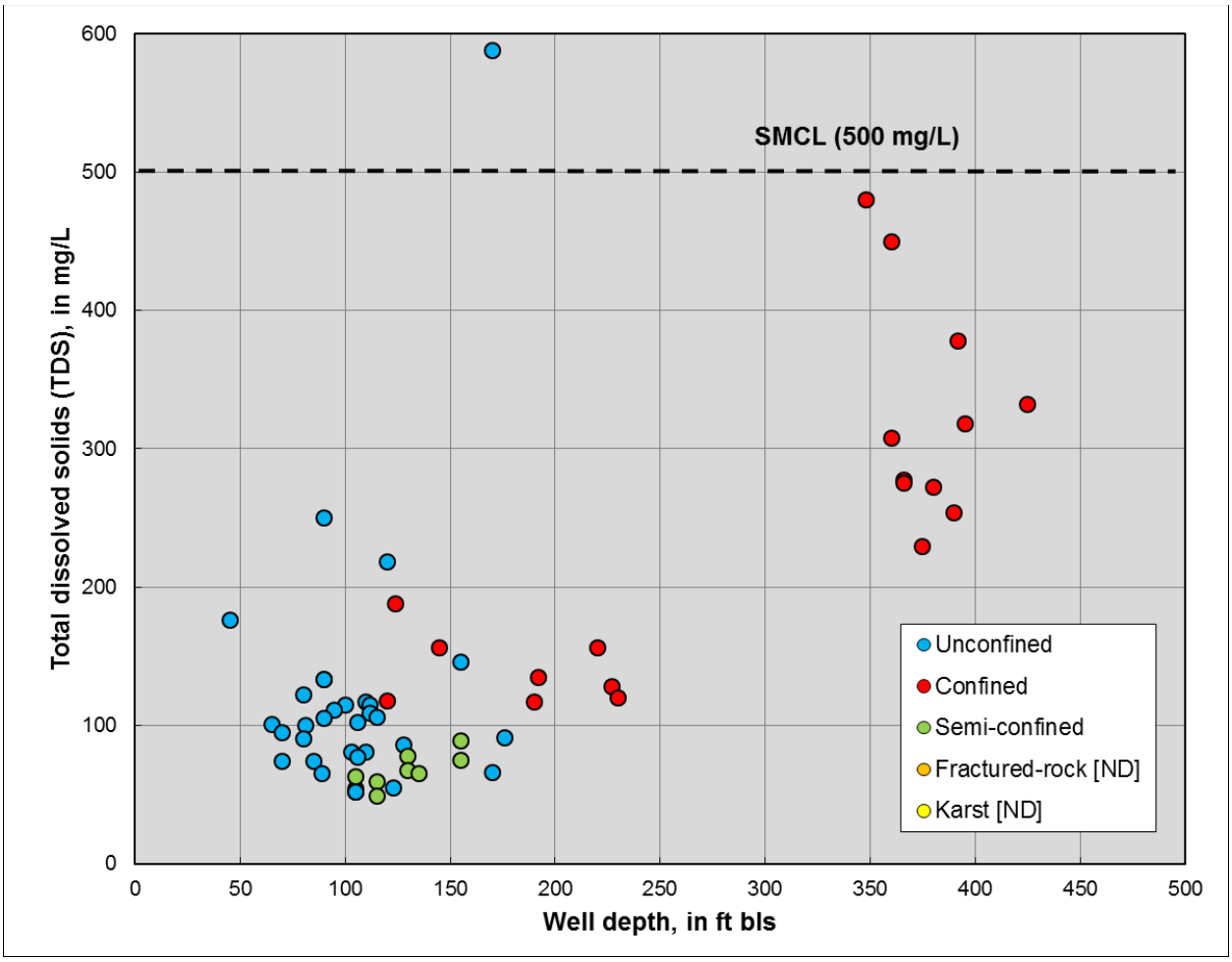


Figure 9. Scatter plot of total dissolved solids (TDS) versus well depth. [mg/L, milligrams per liter; ft bls, feet below land surface; ND, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Chloride

Overall, 1,153 chloride analyses are in the SDWIS query provided to DNREC. Of these, 96 (8.3%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 55 chloride analyses. Duplicate analyses for individual wells were averaged resulting in 130 chloride analyses where aquifer type is known (Table 4). This number translates to ~12% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, chloride concentrations ranged from 1.0 to 174 mg/L with a median value of 14 mg/L (Table 4 and Figure 10). Chloride concentrations did not exceed the SMCL (250 mg/L) in any of the 130 analyses (Table 4).

Unconfined wells had the highest median chloride concentration (15.3 mg/L). These results may be indicative of impacts from human activities occurring at or near the land surface (e.g., road salting). The median value for the unconfined aquifer is in general agreement with, but lower than, Ferrari's (2001) median of 18.3 mg/L and Reyes' (2010) median of 18.6 mg/L. Semi-confined and confined wells had lower median chloride concentrations (10.1 and 12.4

mg/L, respectively; Table 4 and Figure 10). There is no apparent trend in chloride concentrations with depth (Figure 11). The most-elevated chloride concentration (174 mg/L) was associated with a confined well. There were no data for karst or fractured-rock wells in this assessment. For more information on the occurrence of chloride in these aquifer types, the interested reader is referred to previous assessments (Kasper, 2008, 2010, 2014; Kasper and Strohmeier, 2012).

Table 4. Statistical summary of chloride data by aquifer type. [mg/L, milligrams per liter; ND, not detected above laboratory quantitation limit; ---, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	130	73	47	10	---	---
Percent of total (%)	100	56.2	36.2	7.7	---	---
Maximum (mg/L)	174.0	127.0	174.0	25.0	---	---
75th percentile (mg/L)	22.5	22.2	28.5	12.3	---	---
50th percentile (mg/L)	14.0	15.3	12.4	10.1	---	---
25th percentile (mg/L)	10.0	12.6	3.6	8.3	---	---
Minimum (mg/L)	1.0	5.9	1.0	7.4	---	---
Number not detected (#ND)	0	0	0	0	---	---
Percent not detected (%ND)	0.0	0.0	0.0	0.0	---	---
Number > 250 mg/L SMCL (#)	0	0	0	0	---	---
Percent > 250 mg/L SMCL (%)	0.0	0.0	0.0	0.0	---	---

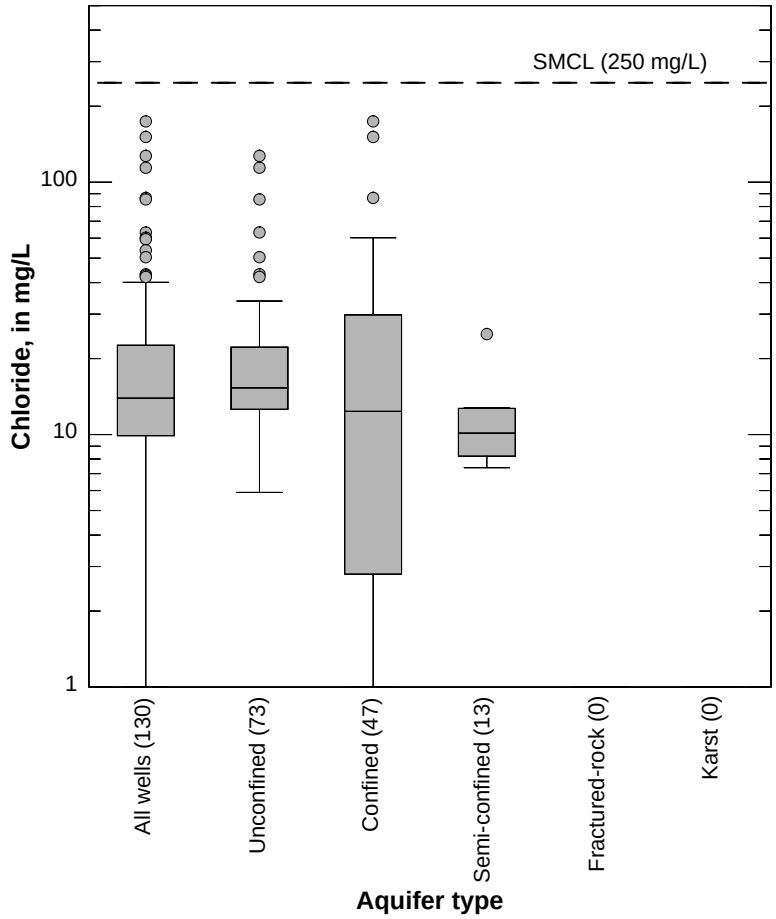


Figure 10. Percentile diagrams of chloride data by aquifer type. [mg/L, milligrams per liter; circles, outliers; (#), number of samples; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

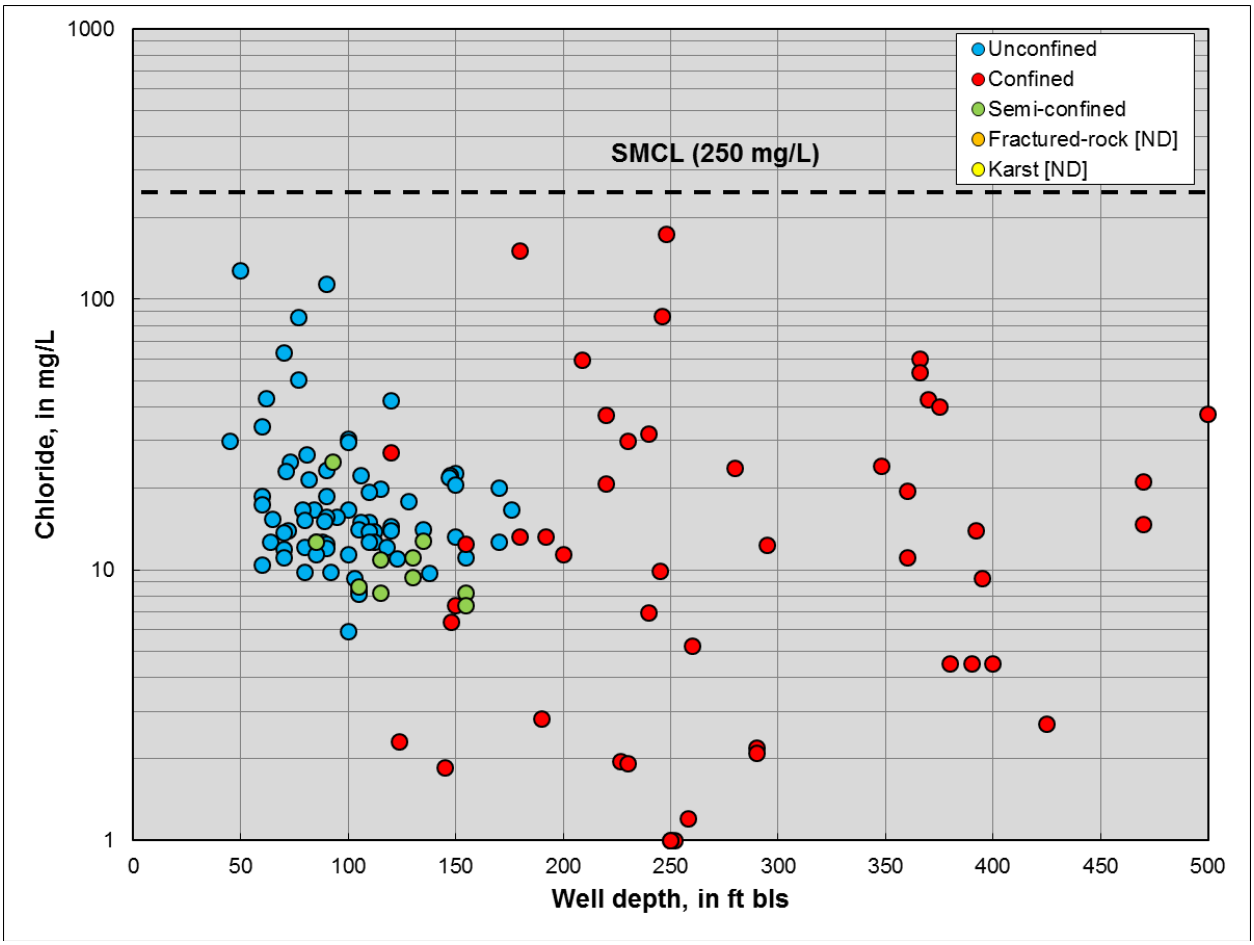


Figure 11. Scatter plot of chloride versus well depth. [mg/L, milligrams per liter; ft bls, feet below land surface; ND, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Sodium

Overall, 532 sodium analyses are in the SDWIS query provided to DNREC. Of these, 79 (14.8%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 55 sodium analyses. Duplicate analyses for individual wells were averaged resulting in 126 sodium analyses where aquifer type is known (Table 5). This number translates to ~11.5% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, sodium concentrations ranged from 3.5 to 359 mg/L with a median value of 13.2 mg/L (Table 5 and Figure 12). Sodium concentrations exceeded the Health Advisor (HA; 20 mg/L) in 37 (29.4%) of the 126 samples (Table 5).

The median sodium concentration for the unconfined aquifer (12.8 mg/L) was comparable to Ferrari's (2001) median of 11.7 mg/L and Reyes' (2010) median of 14.2 mg/L. Unconfined wells also had a substantial fraction of concentrations above the HA (16.7%; Table 5 and Figure 12). Sodium is a component of the human diet and poultry manure and, therefore, its presence in shallow aquifers can reflect impacts from wastewater disposal and agricultural practices (Denver, 1989). Confined wells had the highest median sodium concentration (25.4

mg/L) and the largest fraction of concentrations above the HA (56.8%; Table 5 and Figure 12). In some instances, elevated sodium concentrations can be detected in glauconitic aquifers (e.g., the Piney Point aquifer) due to ion-exchange processes (Spoljaric, 1986). Relative to other Coastal-Plain aquifer types, semi-confined wells had a median sodium concentration (11.6 mg/L) comparable to unconfined wells, but this is based on limited data; none of the semi-confined sodium concentrations exceeded the HA (Table 5 and Figure 12). There were no data for karst or fractured-rock wells in this assessment. For more information on the occurrence of sodium in these aquifer types, the interested reader is referred to previous assessments (Kasper, 2008, 2010, 2014; Kasper and Strohmeier, 2012). Overall, sodium concentrations exceeded the HA at virtually all depths; the most elevated sodium concentration (359 mg/L) was associated with a 170-ft-deep unconfined well (Figure 13).

Table 5. Statistical summary of sodium data by aquifer type. [mg/L, milligrams per liter; ND, not detected above laboratory quantitation limit; ---, no data; HA, health advisory for public water-supply systems (U.S. EPA, 2018).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	126	72	44	10	---	---
Percent of total (%)	100	57.1	34.9	7.9	---	---
Maximum (mg/L)	359.0	359.0	177.6	18.0	---	---
75th percentile (mg/L)	25.4	16.0	69.2	13.0	---	---
50th percentile (mg/L)	13.2	12.8	25.4	11.6	---	---
25th percentile (mg/L)	9.8	9.8	9.8	9.8	---	---
Minimum (mg/L)	3.5	6.0	3.5	8.3	---	---
Number not detected (#ND)	0	0	0	0	---	---
Percent not detected (%ND)	0.0	0.0	0.0	0.0	---	---
Number > 20 mg/L HA (#)	37	12	25	0	---	---
Percent > 20 mg/L HA (%)	29.4	16.7	56.8	0.0	---	---

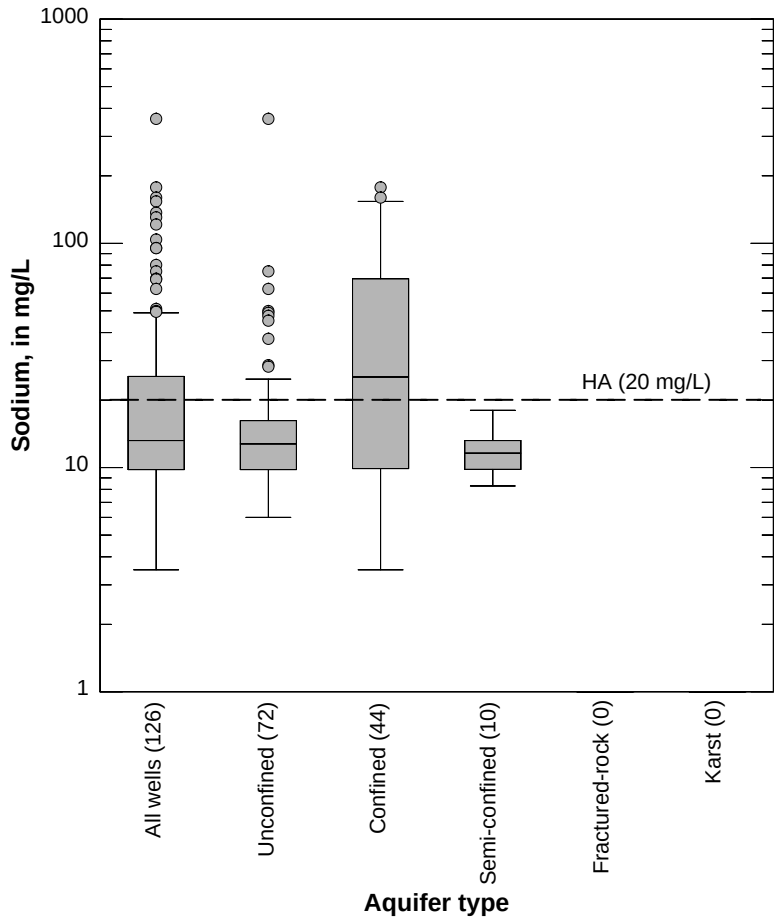


Figure 12. Percentile diagrams of sodium data by aquifer type. [mg/L, milligrams per liter; circles, outliers; (#), number of samples; HA, health advisory for public water-supply systems (U.S. EPA, 2018).]

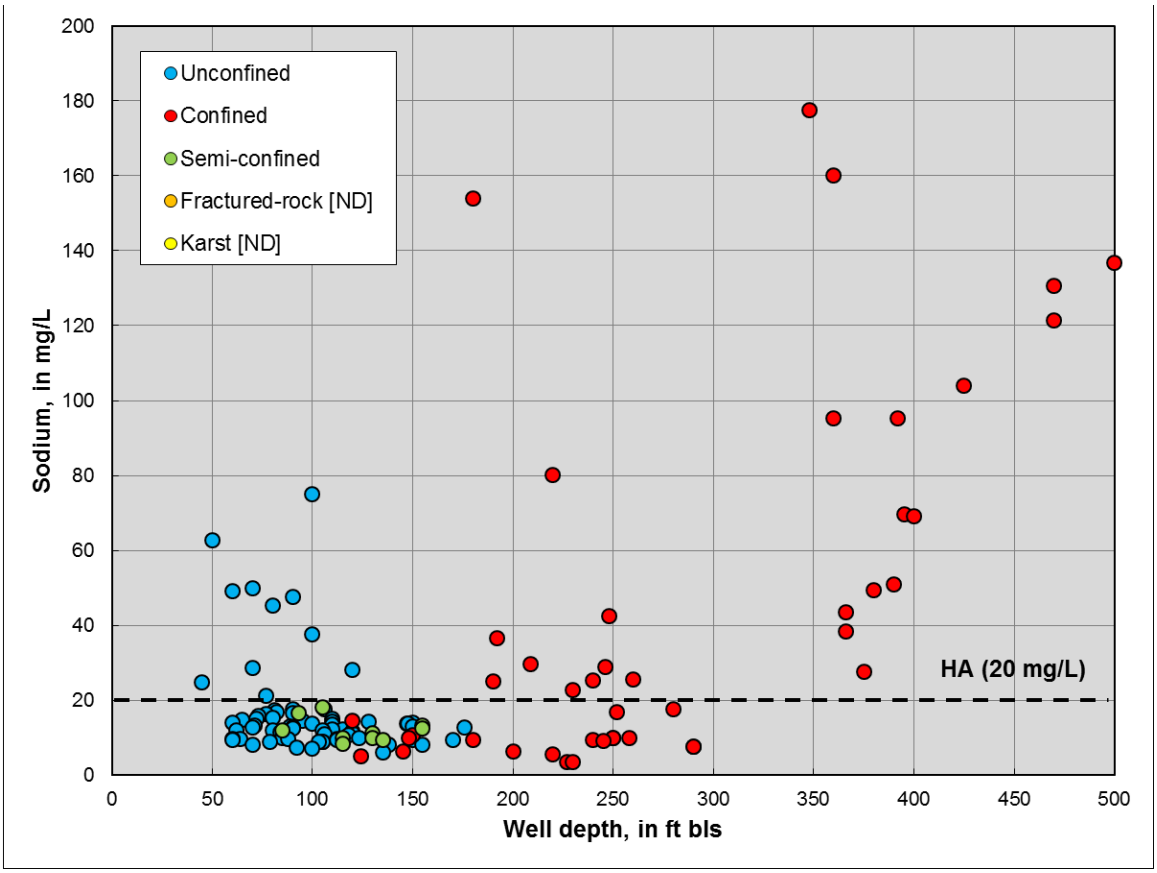


Figure 13. Scatter plot of sodium versus well depth. [mg/L, milligrams per liter; ft bls, feet below land surface; ND, no data; plot does not show single unconfined well outlier of 359 mg/L at depth of 170 ft; HA, health advisory for public water-supply systems (U.S. EPA, 2018).]

Iron

Overall, 533 iron analyses are in the SDWIS query provided to DNREC. Of these, 81 (15.2%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 71 iron analyses. Duplicate analyses for individual wells were averaged resulting in 134 iron analyses where aquifer type is known (Table 6). This number translates to ~12.2% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, iron concentrations ranged from ND to 22.90 mg/L with a median value of ND (Table 6 and Figure 14). Iron was not detected above the laboratory quantitation limit in 80 (59.7%) of the 134 analyses. Iron concentrations exceeded the SMCL (0.3 mg/L) in 33 (24.6%) of the 134 samples (Table 6).

Relative to other Coastal-Plain aquifer types, confined wells had the highest median iron concentration (0.01 mg/L), the smallest fraction of ND concentrations (50%), and the largest fraction of concentrations above the SMCL (44.2%; Table 6 and Figure 14). Although elevated iron concentrations (up to 22.90 mg/L) were associated with unconfined wells, this aquifer type had a median iron concentration of ND and the smallest fraction of concentrations above the SMCL (11.1%; Table 6 and Figure 14). The fraction of unconfined iron concentrations above the SMCL was less than, but comparable to, those reported by Ferrari (2001; 17%) and Reyes

(2010; 13%). Iron statistics for semi-confined wells were generally comparable to unconfined wells, but this is based on limited data (n=10; Table 6 and Figure 14) There were no data for karst or fractured-rock wells in this assessment. For more information on the occurrence of iron in these aquifer types, the interested reader is referred to previous assessments (Kasper, 2008, 2010, 2014; Kasper and Strohmeier, 2012). Overall, iron exceeded the SMCL at virtually all depths (Figure 15).

Table 6. Statistical summary of iron data by aquifer type. [mg/L, milligrams per liter; ND, not detected above laboratory quantitation limit; ---, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	134	72	52	10	---	---
Percent of total (%)	100	53.7	38.8	7.5	---	---
Maximum (mg/L)	22.90	22.90	12.40	0.98	---	---
75th percentile (mg/L)	0.27	0.08	2.37	0.08	---	---
50th percentile (mg/L)	ND	ND	0.01	ND	---	---
25th percentile (mg/L)	ND	ND	ND	ND	---	---
Minimum (mg/L)	ND	ND	ND	ND	---	---
Number not detected (#ND)	80	47	26	7	---	---
Percent not detected (%ND)	59.7	65.3	50.0	70.0	---	---
Number > 0.3 mg/L SMCL (#)	33	8	23	2	---	---
Percent > 0.3 mg/L SMCL (%)	24.6	11.1	44.2	20.0	---	---

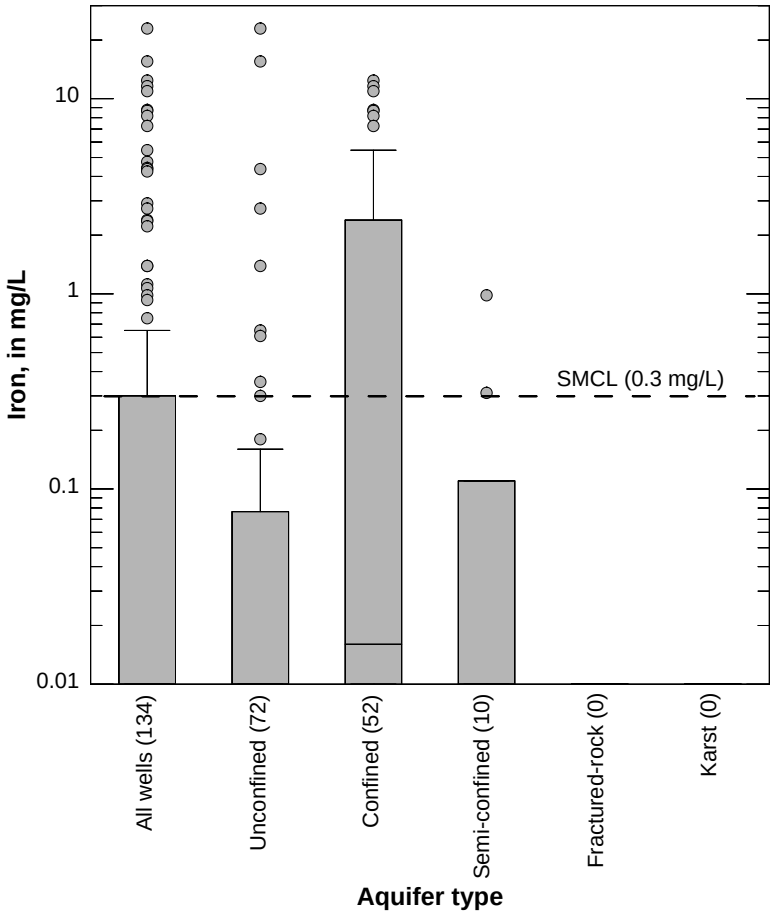


Figure 14. Percentile diagrams of iron data by aquifer type. [mg/L, milligrams per liter; circles, outliers; (#), number of samples; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018); nondetects assigned values of 0.01 mg/L to allow display on semi-logarithmic plot.]

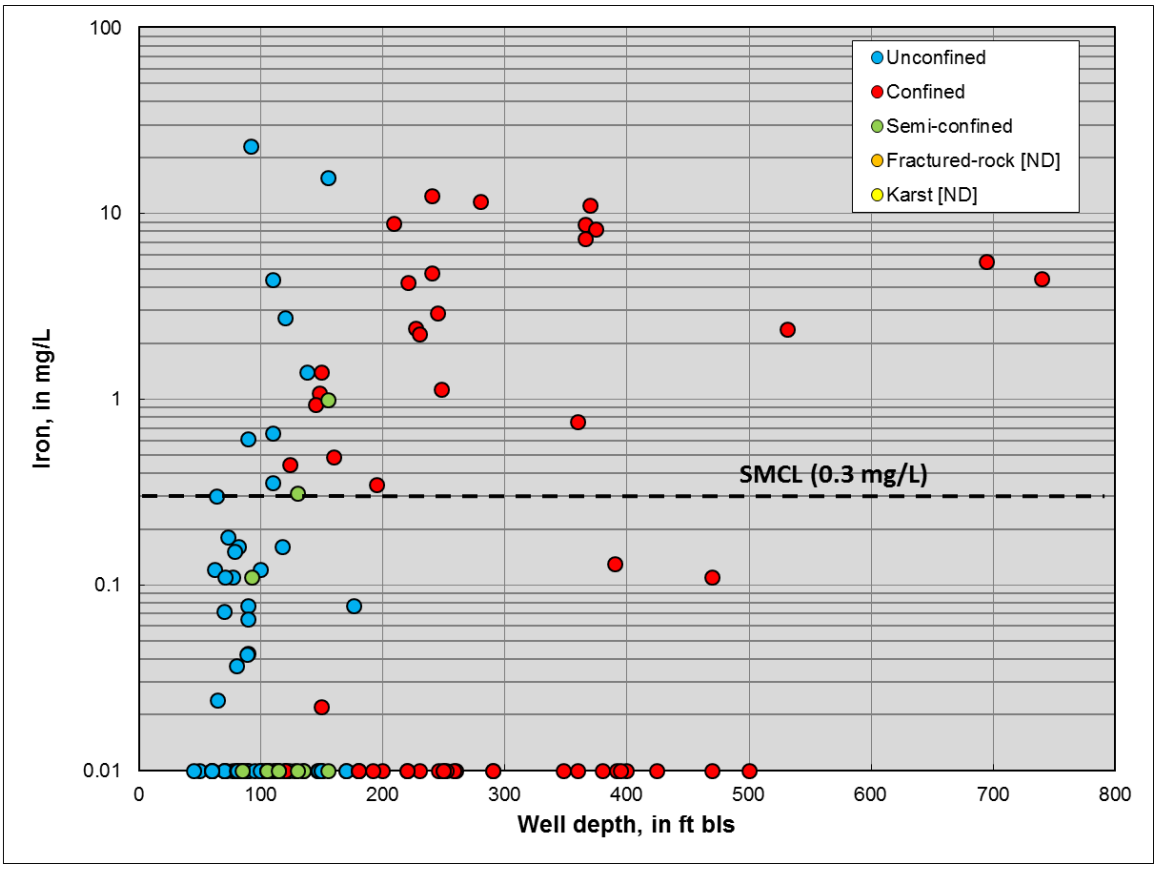


Figure 15. Scatter plot of iron versus well depth. [mg/L, milligrams per liter; ft bls, feet below land surface; ND, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018); nondetects assigned values of 0.01 mg/L to allow display on semi-logarithmic plot.]

Hardness as $CaCO_3$

Water hardness is affected by the amount of dissolved calcium and magnesium in the water, as well as other constituents. Overall, 37 hardness as $CaCO_3$ ("hardness") analyses are in the SDWIS query provided to DNREC. Of these, 10 (27.0%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 55 hardness analyses. Duplicate analyses for individual wells were averaged resulting in 61 hardness analyses where aquifer type is known (Table 7). This number translates to ~5.6% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, hardness concentrations ranged from 6.0 to 258 mg/L with a median value of 31.2 mg/L (Table 7 and Figure 16). With respect to the hardness scale of Love (1962), most of the analyses (57 or 93.4%) were classified as soft or moderately hard; the remaining 6.6% of the analyses were classified as hard or very hard (Table 7).

There were no hardness data for karst or fractured-rock wells for this assessment; however, based on previous assessments, the karst aquifer type had the highest median hardness concentration and the largest fraction of concentrations classified as very hard (Kasper, 2010; Kasper and Strohmeier, 2012). Previously reported hardness results for karst wells were in

general agreement with Werkheiser (1995), who reported that more than 75% of karst well samples could be classified as very hard. Hardness data for karst and fractured-rock wells are typically in sharp contrast (Werkheiser, 1995). Confined wells had the highest median hardness concentration (83.5 mg/L) and the largest fractions classified as moderately hard (45%), hard (10%), and very hard (5%; Table 7 and Figure 16). All of the semi-confined well samples were classified as soft (Table 7 and Figure 16). Most of the unconfined well samples were classified as soft (93.9%; Table 7 and Figure 16). There was no clear trend in hardness with respect to sample depth; groundwater classified as hard or very hard occurred at depths ranging from 120 to almost 400 ft bls (Figure 17).

Table 7. Statistical summary of hardness data by aquifer type. [mg/L, milligrams per liter; ND, not detected; ---, no data; hardness scale after Love (1962).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	61	33	20	8	0	0
Percent of total (%)	100	54.1	32.8	13.1	0.0	0.0
Maximum (mg/L)	258.0	124.0	258.0	17.2	---	---
75th percentile (mg/L)	54.6	38.1	102.3	15.1	---	---
50th percentile (mg/L)	31.2	28.6	83.5	11.1	---	---
25th percentile (mg/L)	18.1	19.2	49.2	7.9	---	---
Minimum (mg/L)	6.0	9.6	16.7	6.0	---	---
Number not detected (#ND)	0	0	0	0	---	---
Percent not detected (%ND)	0.0	0.0	0.0	0.0	---	---
Soft; 0-60 mg/L (#)	47	31	8	8	---	---
Soft; 0-60 mg/L (%)	77.0	93.9	40.0	100.0	---	---
Mod. hard; 61-120 mg/L (#)	10	1	9	0	---	---
Mod. hard; 61-120 mg/L (%)	16.4	3.0	45.0	0.0	---	---
Hard; 121-180 mg/L (#)	3	1	2	0	---	---
Hard; 121-180 mg/L (%)	4.9	3.0	10.0	0.0	---	---
Very hard; >180 mg/L (#)	1	0	1	0	---	---
Very hard; >180 mg/L (%)	1.6	0.0	5.0	0.0	---	---

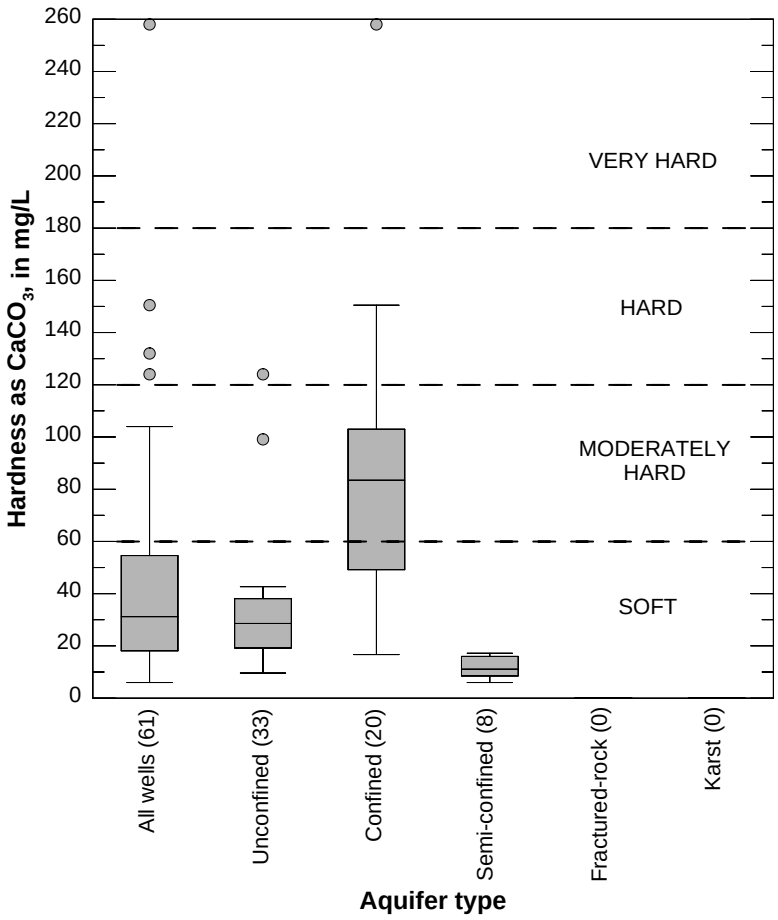


Figure 16. Percentile diagrams of hardness data by aquifer type. [mg/L, milligrams per liter; circles, outliers; (#), number of samples; hardness scale after Love (1962).]

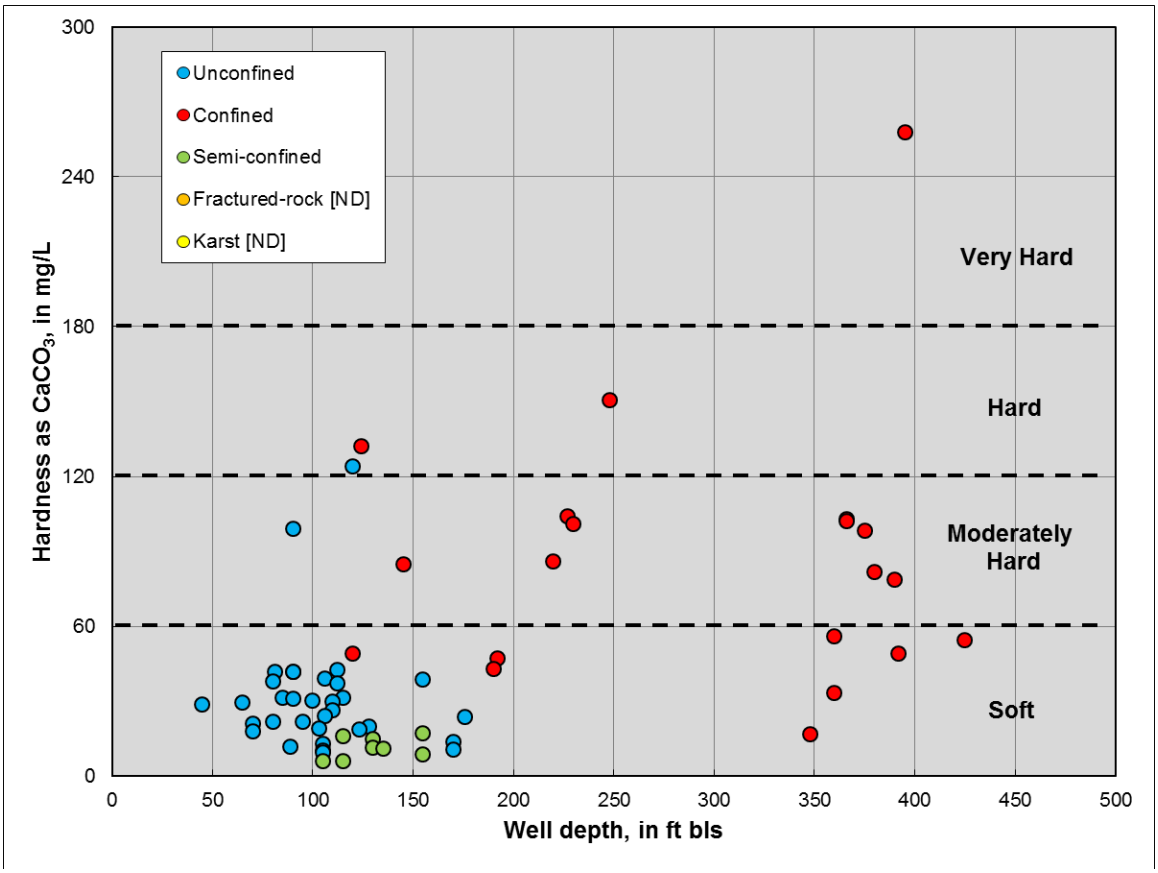


Figure 17. Scatter plot of hardness versus well depth. [mg/L, milligrams per liter; ft bls, feet below land surface; ND, no data; hardness scale after Love (1962).]

pH

Overall, 384 pH analyses are in the SDWIS query provided to DNREC. Of these, 12 (8.7%) could be linked by DNREC ID. Supplemental data collected by Tidewater Utilities, Inc. provided an additional 53 pH analyses. Duplicate analyses for individual wells were averaged resulting in 60 pH analyses where aquifer type is known (Table 8). This number translates to 5.5% of the total number of wells (1,094) where aquifer type is known (Figure 2). Overall, pH ranged from 5.1 to 8.2 standard units (S.U.) with a median value of 6.1 S.U. (Table 8 and Figure 18). Values of pH were below the lower limit of the SMCL range (6.5 to 8.5 S.U.) in 32 (53.3%) of the 60 samples; values were within the SMCL range in 28 (46.7%) of the 60 samples (Table 8). None of the pH values exceeded the upper limit of the SMCL range.

Confined wells had the highest median pH value (7.5 S.U.) and the largest fraction of samples within the SMCL range (90.5%; Table 8). Although there were no pH data for karst wells for this assessment, based on previous assessments, this aquifer type had the highest median pH concentration and the largest fraction of values within the SMCL range (Kasper, 2010; Kasper and Strohmeier, 2012). Calcium carbonate in the karst aquifer (due to marble) and some confined and semi-confined aquifers (due to shell material) buffers the pH of groundwater that flows through these aquifers. Unconfined and semi-confined wells had the same median pH value (55.8) and both aquifer types had large fractions of values below 6.5 S.U. and outside the

SMCL range (74.2 and 87.5%, respectively; Table 8 and Figure 18). Like karst wells, there were no pH data for fractured-rock wells in this assessment. Overall, pH values below 6.5 S.U. were most prevalent at depths of ~220 ft bls and shallower (Figure 19).

Table 8. Statistical summary of pH data by aquifer type. [S.U., standard units; ---, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Statistics	All Wells	Unconfined Wells	Confined Wells	Semi-Confined Wells	Fractured-Rock Wells	Karst Wells
Number of wells/samples (#)	60	31	21	8	0	0
Percent of total (%)	100.0	51.7	35.0	13.3	0.0	0.0
Maximum (S.U.)	8.2	7.7	8.2	6.9	---	---
75th percentile (S.U.)	7.2	6.3	7.9	6.2	---	---
50th percentile (S.U.)	6.1	5.8	7.5	5.8	---	---
25th percentile (S.U.)	5.7	5.5	7.0	5.6	---	---
Minimum (S.U.)	5.1	5.1	5.7	5.3	---	---
pH <6.5 SMCL (#)	32	23	2	7	---	---
pH <6.5 SMCL (%)	53.3	74.2	9.5	87.5	---	---
pH 6.5 to 8.5 (#)	28	8	19	1	---	---
pH 6.5 to 8.5 (%)	46.7	25.8	90.5	12.5	---	---
pH >8.5 SMCL (#)	0	0	0	0	---	---
pH >8.5 SMCL (%)	0.0	0.0	0.0	0.0	---	---

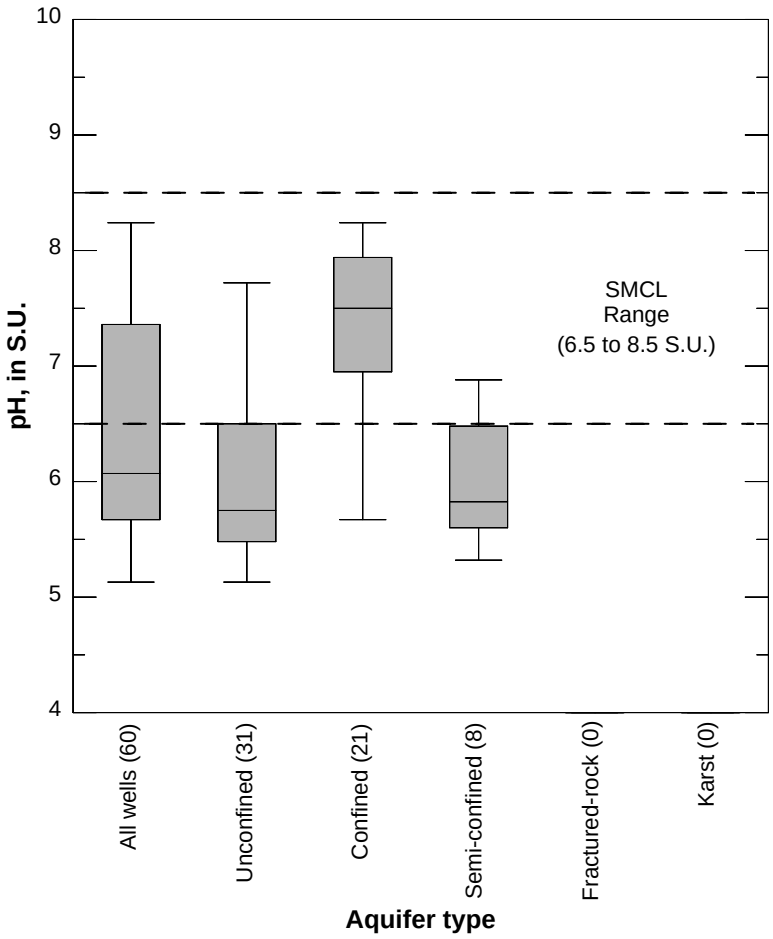


Figure 18. Percentile diagrams of pH data by aquifer type. [S.U., standard units; circles, outliers; (#), number of samples; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2015; U.S. EPA, 2012).]

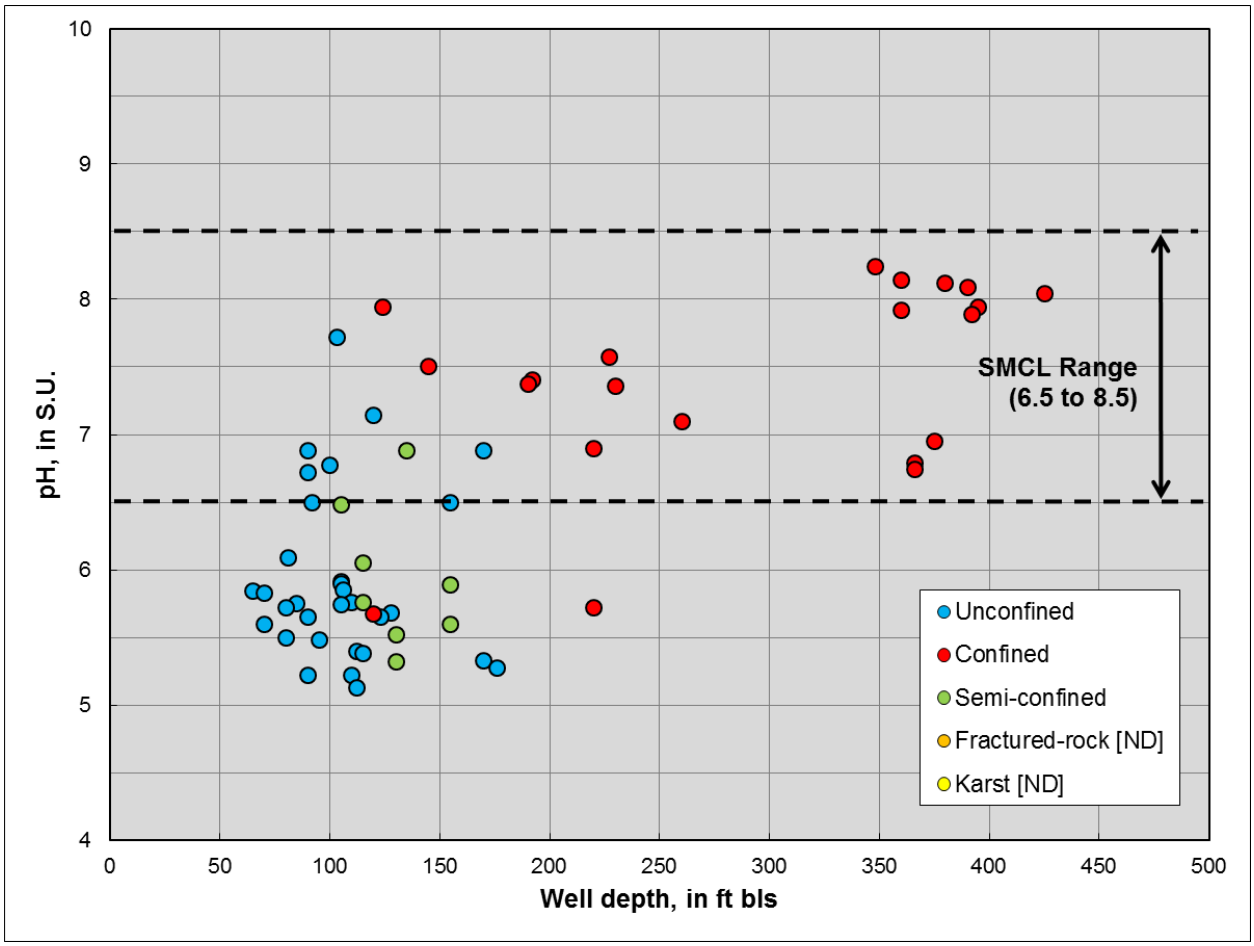


Figure 19. Scatter plot of pH versus well depth. [S.U., standard units; ft bls, feet below land surface; ND, no data; SMCL, secondary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

Organic compounds

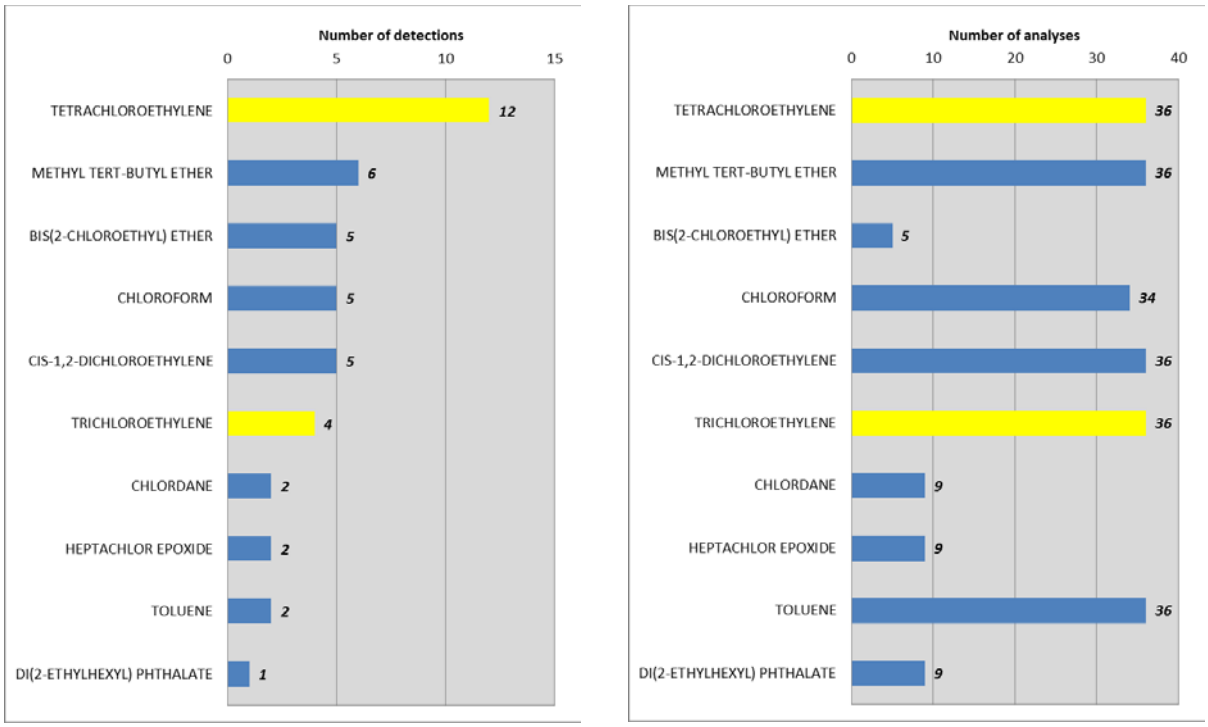
Because organic compounds (OCs) include a broad list of volatiles, semi-volatiles, and pesticides, they are treated in this report as a group of analytes rather than individual analytes. Overall, 18,378 OC analyses are in the SDWIS query provided to DNREC. Of these, 5,896 (32.1%) could be linked by DNREC ID. Duplicate analyses for individual wells were averaged resulting in 1,216 OC analyses. OCs were not detected in 1,172 (96.4%) of the 1,216 analyses. Out of the 59 organic compounds analyzed, 10 (16.9%) were detected (Figure 20).

Of the 44 OC detections, almost one half (19 or 43.2%) were found at concentrations less than 1 µg/L. The top five most-frequently detected OCs are summarized as follows: tetrachloroethylene (PCE), a solvent; methyl tert-butyl ether (MTBE), a gasoline oxygenate; bis(2-chloroethyl) ether (BCEE), a solvent; chloroform, a disinfection byproduct; and cis-1,2-dichloroethylene (DCE), a solvent (Figure 20). Trichloroethylene (TCE), a solvent, was ranked sixth in terms of detection frequency (Figure 20). These findings are generally consistent with studies by Ferrari (2001) and Reyes (2010) involving water-quality data for 30 unconfined public

water-supply wells in Delaware, as well as previous 305(b) groundwater-quality assessments (Kasper, 2008, 2010, 2014, 2017; Kasper and Strohmeier, 2012). These results are also consistent with nationwide VOC data collected by the USGS (Zogorski et al., 2006).

PMCLs were exceeded in 12 (1.0%) of the 1,216 analyses. The following analytes were found above the PMCL: PCE (10 exceedances) and TCE (2 exceedances). Aquifer type was established for eleven of the samples with PMCL exceedances. Of these, four PCE exceedances were associated with unconfined wells and three PCE exceedances were associated with karst wells. Two PCE exceedances, as well as the two TCE exceedances, were associated with confined wells completed in the Potomac aquifer system, an extremely heterogeneous fluvial system used most extensively for water supply in the northern, most populated portion of Delaware (McKenna et al., 2004). These findings, although limited, further illustrate the susceptibility of the unconfined aquifer, the karst aquifer, and the Potomac aquifer system to anthropogenic contamination.

MTBE, TCE, and PCE are within the top ten most frequently detected OCs (Figure 20), consistent with the findings of Ferrari (2001), Reyes (2010), and previous 305(b) groundwater-quality assessments (Kasper, 2008, 2010, 2014, 2017; Kasper and Strohmeier, 2012). Well depths were established for 33 MTBE, 33 TCE, and 33 PCE analyses, and scatter plots of these parameters versus well depth are shown in Figure 21. Although OC data for this assessment were somewhat limited, MTBE, TCE, and PCE detections were limited to depths of ~150 ft bls in Coastal-Plain aquifers, a trend that is generally consistent with Kasper (2008, 2010, 2014, 2017) and Kasper and Strohmeier (2012). TCE and PCE were detected at greater depths in karst wells, which typically have very long open intervals that may allow contaminants to enter at shallower depths. Overall, these findings are consistent with trends of nitrate versus well depth (Figure 5), and appear to provide another indication of the vertical extent of human impact on groundwater quality in Delaware.



(A) **(B)**

Figure 20. Frequency distributions of organic compound (A) detections and (B) analyses. [Bars highlighted yellow indicate one or more concentration above the PMCL or primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

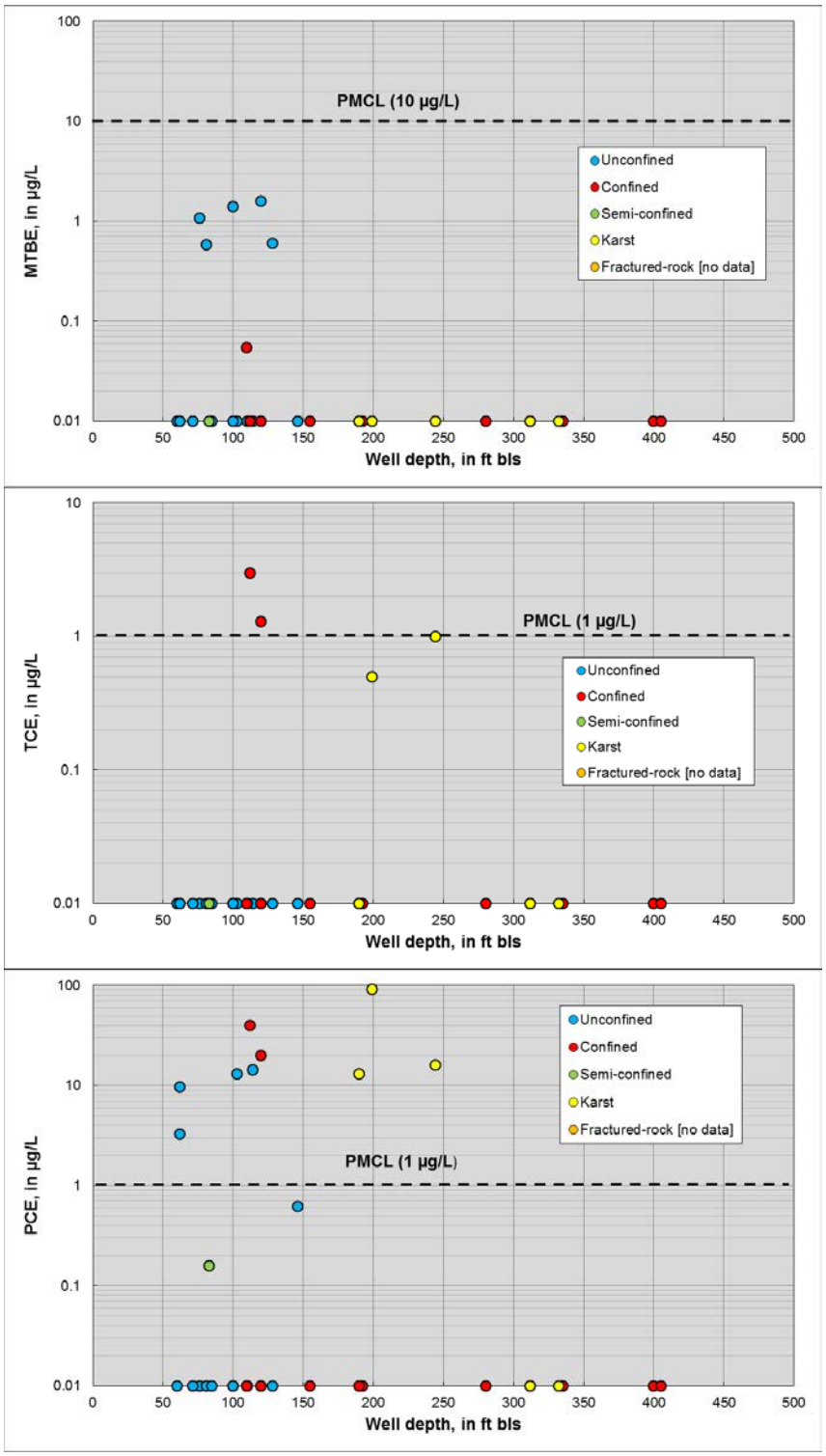


Figure 21. Scatter plots of methyl tert-butyl ether (MTBE), trichloroethylene (TCE), and tetrachloroethylene (PCE) versus well depth. [µg/L, micrograms per liter; ft bls, feet below land surface; PMCL, primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018); nondetectable concentrations (zeros) assigned values of 0.01 µg/L to allow display on semi-logarithmic plots.]

Trace elements

For this assessment, trace elements are limited to the following analytes with PMCLs (DHSS, 2017; U.S. EPA, 2018): antimony (0.006 mg/L), arsenic (0.010 mg/L), barium (2 mg/L), beryllium (0.004 mg/L), cadmium (0.005 mg/L), chromium (0.1 mg/L), cyanide (0.2 mg/L), fluoride (2 mg/L), lead (0.015 mg/L*), mercury (0.002 mg/L), nickel (0.1 mg/L), selenium (0.05 mg/L), and thallium (0.002 mg/L). (*Action level for Treatment Technique (TT; U.S. EPA, 2018).) Overall, 1,820 trace-element analyses are in the SDWIS query provided to DNREC. Of these, 310 (17.0%) were identified by DNREC ID. Duplicate analyses for individual wells were averaged resulting in 255 trace-element analyses. Trace elements were not detected in 195 (76%) of the 255 analyses.

Although trace element data for this assessment were limited, based on available data, detectable concentrations were less than 0.1 mg/L in 31 (52%) of the 60 detections and less than 1 mg/L in all 59 (98%) of the detections. Barium, nickel, and chromium were the three most-frequently detected trace elements (Figure 22), consistent with previous 305(b) groundwater-quality assessments. (Although fluoride had the largest number of detections (27), it also had the largest number of analyses (101) and it was detected in a relatively smaller fraction (27%) of analyses (Figure 22).) Barium was detected in 12 (92%) of the 13 analyses, nickel was detected in 7 (54%) of the 13 analyses, and chromium was detected in 4 (31%) of the 13 analyses (Figure 22). Arsenic, selenium, lead, beryllium, and cadmium were also detected in some groundwater samples (Figure 22). Cadmium and arsenic were the only trace elements found above the respective PMCL.

The fate, transport, and remediation of arsenic in Delaware soil have been evaluated (DNREC, 2005; Sparks et al., 2007). Published data on arsenic in Delaware's groundwater are generally lacking, however, and limited to the surficial aquifer system (see, for e.g., Denver et al., 2004) and, more recently, the Rancocas aquifer (Denver, 2016). Sources of arsenic in groundwater on the Delmarva Peninsula include, but are not limited to, poultry manure applied to agricultural fields, pesticides and fertilizers, abandoned tanneries, lumber treated with chromium copper arsenate, and glauconitic sediments deposited in marine environments (Denver et al., 2004; DNREC, 2005). A study of arsenic in groundwater in the Coastal-Plain aquifers of Maryland (Drummond and Bolton, 2010) found that arsenic concentrations in excess of the PMCL were primarily limited to the Piney Point and Aquia aquifers. (Note that the Aquia aquifer of Maryland is analogous to the Rancocas aquifer of Delaware; see Table 1.) Arsenic in these aquifers is apparently due to naturally-occurring sources, which may include calcareous shell material and cement, glauconite grains, phosphate pellets, goethite pellets, and iron oxyhydroxide coatings on mineral grains (Drummond and Bolton, 2010).

In this assessment, arsenic data were limited to only 16 analyses and three detections (Figure 22). Based on a previous 305(b) assessment (Kasper, 2014), arsenic was detected in 23 (42.6%) of 54 analyses and what follows is an excerpt from that assessment.

> *Overall, concentrations ranged from nondetectable to 0.0093 mg/L, which is slightly below the PMCL (0.010 mg/L). Aquifer type was established for 46 (85%) of the 54 arsenic analyses. Of these 46 analyses, 15 were associated with unconfined wells, 2 were associated with a semi-confined wells, 28 were associated with confined wells, and one was associated with a fractured-rock well; no data were associated with karst wells. Although arsenic concentrations never exceeded the PMCL, the most-elevated detections were associated with*

confined wells with depths ranging from ~250 to 500 ft bls (Figure 22 [Figure 23, this report]*). All of these confined wells produce from either the Rancocas, Mt. Laurel, or Piney Point aquifers, which are associated with glauconitic geologic formations (Ramsey, 2005, 2007). These findings are consistent with Drummond and Bolton (2010). Arsenic was detected at very low concentrations in six of the 15 unconfined well samples as well as the single fractured-rock well sample. Arsenic was ND in the two semi-confined well samples.*

In 2015, the USGS evaluated the occurrence and distribution of arsenic and radon in Delaware's Rancocas aquifer, which is an important source of drinking water in southern New Castle County and northwestern Kent County (Denver, 2016). Arsenic was detected in 34 (94.4%) of the 36 samples and concentrations ranged from about 0.11 to 27 µg/L. Arsenic exceeded the PMCL (0.010 mg/L) in 15 (41.7%) of the 36 samples. The most elevated arsenic concentrations were detected in the southern portion of the study area in a southwest-northeast trending band that coincides with geologic strike (Figure 24). This spatial pattern of arsenic concentrations in Delaware's Rancocas aquifer is an extension of previous work by the Maryland Geological Survey (Drummon and Bolton, 2010; Figure 24).

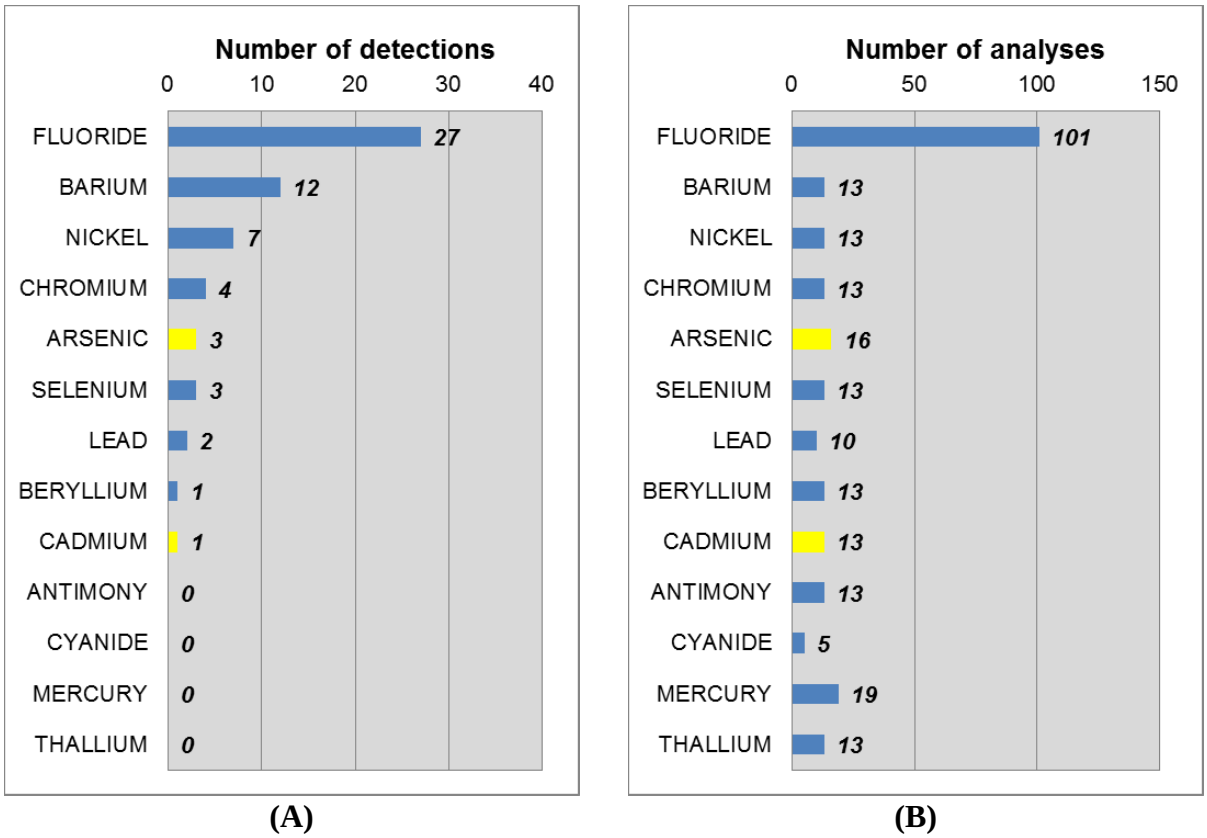


Figure 22. Frequency distributions of trace element (A) detections and (B) analyses. [Bars highlighted yellow indicate one or more concentration above the PMCL or primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

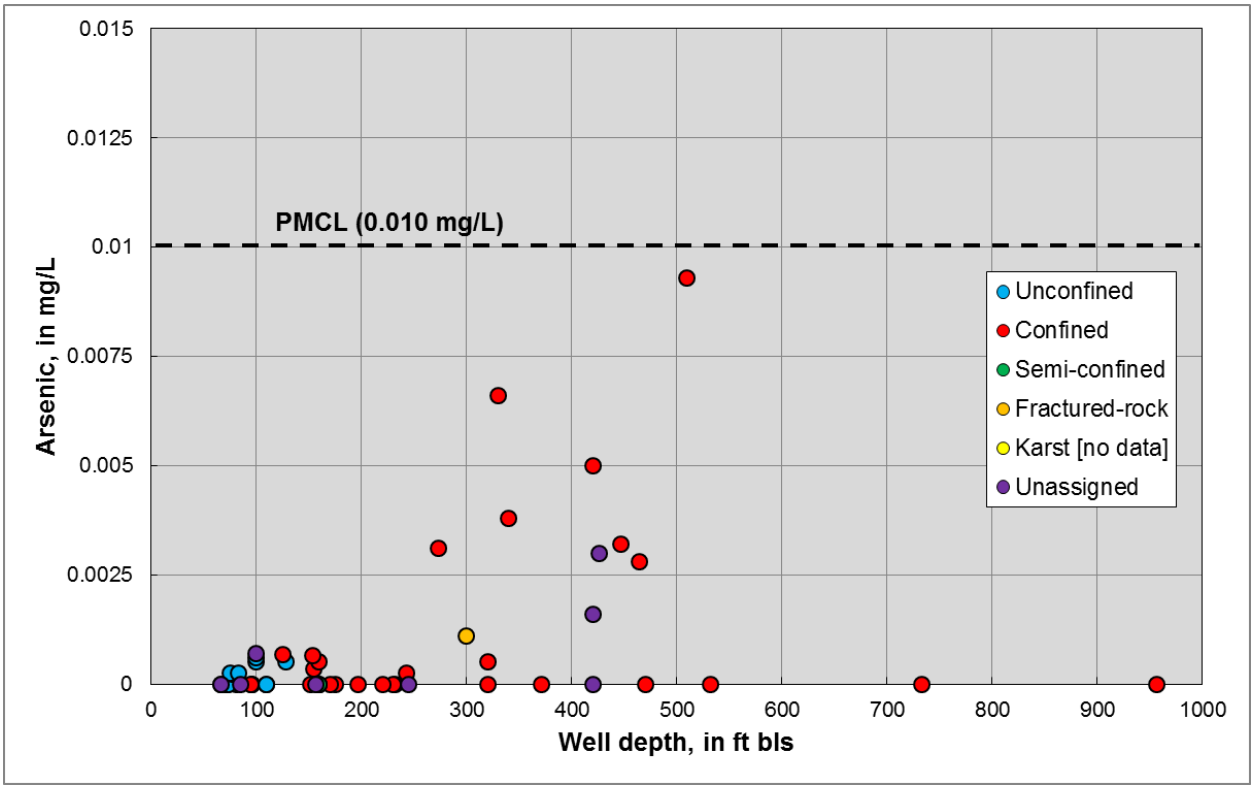


Figure 23. Scatter plot of arsenic versus well depth from Delaware's 2014 305(b) groundwater-quality assessment based on public-well data (Kasper, 2014). [mg/L, milligrams per liter; ft bls, feet below land surface; PMCL, primary maximum contaminant level for public water-supply systems (DHSS, 2017; U.S. EPA, 2018).]

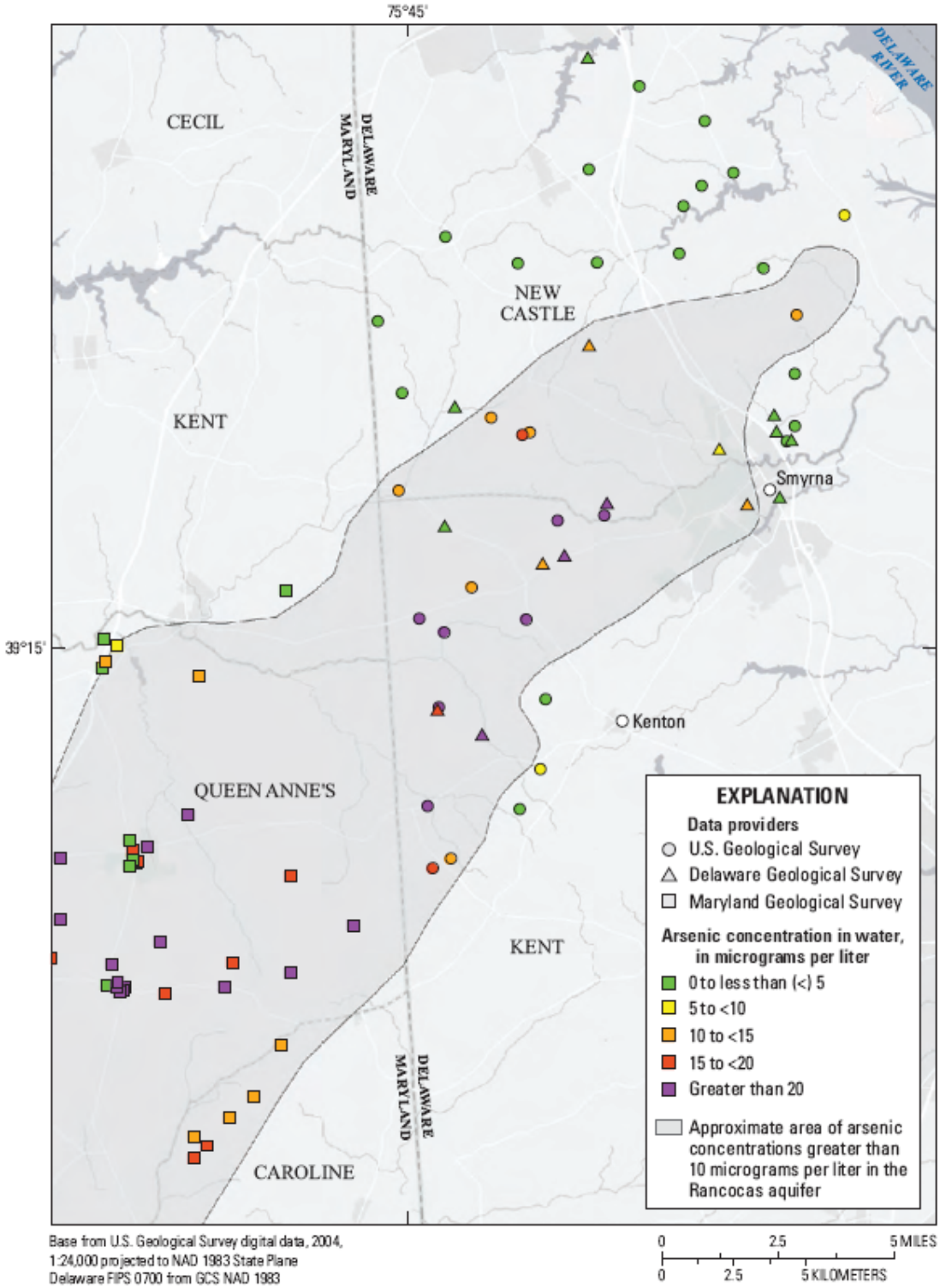


Figure 24. Map showing the distribution of arsenic in the Rancocas aquifer of Delaware and the corresponding Aquia aquifer in adjacent parts of Maryland. [Modified after Figure 5 of Denver (2016).]

Radionuclides

Radionuclides include the following parameters and their associated PMCLs (DHSS, 2017; U.S. EPA, 2018): beta particle and photon activity (4 millirems per year (mrem/yr)); gross alpha particle activity (15 picocuries per liter (pCi/L)); radium-226 and radium-228 combined (5 pCi/L); and uranium (0.03 mg/L). For radon, which is a gas derived from the radioactive decay of radium, there is a proposed PMCL of 300 pCi/L as well as a proposed alternative MCL or AMCL of 4,000 pCi/L (U.S. EPA, 1999). The higher AMCL would apply to multi-media mitigation (MMM) programs that also address radon in indoor air; the lower PMCL would apply if a MMM program is not in place (U.S. EPA, 1999).

For this 305(b) groundwater assessment, radionuclide data are limited to the following parameters: uranium-238, radium-226, radium-228, and gross alpha particle activity. Overall, 277 radionuclide analyses are in the SDWIS query provided to DNREC. Of these, 11 (22.8%) could be linked by DNREC ID. Duplicate analyses for individual wells were averaged resulting in 10 radionuclide analyses, which are summarized as follows: uranium-238 (8 analyses) and gross alpha particle activity (2 analyses). Uranium-238 was ND in all of the analyses. Gross alpha particle activity was below the 15 pCi/L PMCL in each of the two analyses.

As previously noted, in 2015 the USGS evaluated the occurrence and distribution of arsenic and radon in Delaware's Rancocas aquifer, which is an important source of drinking water in southern New Castle County and northwestern Kent County (Denver, 2016). Radon was detected in all 36 of the groundwater samples and concentrations ranged from 85 to 1,870 pCi/L. Radon concentrations in 16 (44.4%) of the 36 well samples were above the lower proposed MCL of 300 pCi/L. Most of these samples were located in a similar part of the aquifer as the region of elevated arsenic depicted in Figure 24. None of the radon concentrations exceeded the proposed alternative MCL of 4,000 pCi/L.

For more information on radionuclides in Delaware groundwater, the reader is referred to Bachman and Ferrari (1995) and Ferrari (2001). Studies in the Coastal-Plain regions of Maryland (Bolton, 2000) and New Jersey (Szabo and dePaul, 1998; Szabo et al., 2004; dePaul and Szabo, 2007) also have been conducted.

Summary and conclusions

The Department of Natural Resources and Environmental Control (DNREC) assessed groundwater quality in Delaware based on data collected during a two-year time period (October 1, 2015 through September 30, 2017) from public water-supply wells. The results of this assessment serve as "Part IV: Groundwater Assessment" of Delaware's overall 2016 305(b) report (DNREC, 2018). Water-quality data were obtained from the Department of Health and Social Services (DHSS) Safe Drinking Water Information System (SDWIS). SDWIS queries developed by DHSS staff provide data (30,312 analyses) indicative of raw or apparently raw groundwater quality. Supplemental groundwater-quality data for 63 public wells (1,096 analyses) were obtained from a private water utility, Tidewater Utilities, Inc. Water-quality data were linked with the DNREC's Source Water Assessment and Protection Program (SWAPP) database, which contains public-well records such as DNREC ID, depth, geographic coordinates, geologic formation, aquifer, and aquifer type. Per U.S. EPA (1997) guidance, data were evaluated with respect to hydrogeologic setting where possible and drinking-water standards or criteria where applicable (DHSS, 2017; U.S. EPA, 2018, 2012; Love, 1962).

Five aquifer types were recognized in this assessment: unconfined, confined, semi-confined, fractured-rock, and karst aquifers. Unconfined, confined, and semi-confined aquifers occur in the mid-Atlantic Coastal Plain Physiographic Province, which comprises most (~96%) of Delaware's land-surface area. Fractured-rock and karst aquifers occur in the Piedmont Physiographic Province in the northernmost portion of the state. As of February 8, 2018, there were 1,171 active public water-supply wells in Delaware and aquifer type has been established for 1,094 (93%) of these wells. Most of the wells (89%) produce from Coastal-Plain aquifers while a much smaller percentage of the wells (5%) produce from Piedmont aquifers. General statistics on aquifer type for the 1,171 active wells follow: unconfined wells (480 or 41%), confined wells (508 or 43%), semi-confined wells (51 or 4%), fractured-rock wells (47 or 4%), and karst wells (8 or 1%). Fractured-rock and karst aquifers are poorly represented in this assessment due to limited groundwater-quality data. Aquifer type is not known or has not yet been established for the remaining 77 or 7% of the wells. (Percentages may not total 100% due to rounding.) Well depths range from 22 to 957 ft below land surface (bls) with a median well depth of 140 ft bls.

Overall, groundwater is predominantly soft to moderately hard based on the hardness scale of Love (1962). Specifically, most of the results (93.4%) meet either of these criteria. With respect to Coastal-Plain aquifers, fractions of hardness results classified as soft or moderately hard are summarized as follows: unconfined wells (96.9%), confined wells (85%), and semi-confined wells (100%). There were no hardness data for Piedmont aquifers (fractured-rock and karst wells) in this assessment. Based on previous assessments, karst wells had the highest median hardness concentration and the largest fraction of concentrations classified as very hard (Kasper, 2010; Kasper and Strohmeier, 2012). Groundwater is partially acidic overall, with pH values less than the lower limit of the Secondary Maximum Contaminant Level (SMCL) range (6.5 to 8.5 S.U.) in 53.3% of the samples; pH values were within the SMCL range in 46.7% of the samples. Unconfined and semi-confined wells had the largest fractions of pH values below the SMCL range (74.2 and 87.5%, respectively); in contrast, confined wells had pH values that were predominantly within the SMCL range (90.5%). There were no data for pH in Piedmont aquifers (fractured-rock and karst wells) in this assessment. Based on previous assessments, karst wells had the highest median pH concentration and the largest fraction of values within the SMCL range (Kasper, 2010; Kasper and Strohmeier, 2012). Overall, iron exceeded the 0.3 mg/L SMCL in a substantial fraction of the samples (24.6%) and was found above the SMCL at virtually all depths. Relative to other Coastal-Plain aquifer types, confined wells had the largest fraction of iron concentrations greater than the SMCL (44.2%). There were no iron data for Piedmont aquifers in this assessment. Groundwater is generally dilute overall with a median total dissolved solids (TDS) concentration of 113 mg/L. TDS concentrations were below the 500 mg/L SMCL in all but one of the samples. Confined wells had the highest median TDS concentration (254 mg/L). Although there were no TDS data for Piedmont aquifers for this assessment, based on previous assessments, the karst aquifer type had the highest median TDS concentration (Kasper, 2010; Kasper and Strohmeier, 2012). TDS concentrations generally increase with depth. Chloride concentrations were below the SMCL (250 mg/L) in all of the samples. Unconfined wells had the highest median chloride concentration (15.3 mg/L). The most elevated chloride concentration (174 mg/L), however, was associated with a confined well sample. Overall, sodium concentrations exceeded the 20 mg/L Health Advisory or HA in a considerable fraction of the samples (29.4%) and at virtually all depths. Confined wells had the

highest median sodium concentration (25.4 mg/L) and the largest fraction of concentrations above the HA (56.8%).

Nitrate data were used as a proxy of the extent of human influence on groundwater quality. Overall, nitrate concentrations exceeded the Primary Maximum Contaminant Level (PMCL; 10 mg/L) in 2.4% of the analyses. A large fraction of the wells (63%) had nitrate concentrations greater than 0.4 mg/L, a threshold indicative of anthropogenic impacts (Hamilton et al., 1993). Of the aquifer types evaluated, the unconfined aquifer, which is primarily represented in this assessment by wells in Sussex County, is the most susceptible to human impacts; it had the highest median nitrate concentration (5.0 mg/L) and the largest fraction of concentrations greater than 0.4 mg/L (90.4%). The unconfined aquifer also had the most elevated nitrate concentration (24.4 mg/L) and the largest (and only) fraction of concentrations above the 10 mg/L Primary Maximum Contaminant Level or PMCL (4.1%). The semi-confined aquifers had an intermediate median nitrate concentration (2.42 mg/L) with 100% of the concentrations greater than 0.4 mg/L. Confined aquifers had the lowest median nitrate concentration (nondetectable) and the smallest fraction of concentrations greater than 0.4 mg/L (9.1%). Confined aquifers also had the largest fraction of nondetectable nitrate concentrations (90.9%). In Coastal-Plain aquifers, the vertical extent of human influence was primarily limited to depths of ~220 ft below land surface (bls) and shallower; at greater depths nitrate was not detected above the quantitation limit. There were no nitrate data for fractured-rock and karst aquifers in this assessment; based on past assessments, the deepest nitrate detections were often associated with Piedmont wells with extremely long open intervals, which may allow nitrate to enter the wells at shallower depths. Areally, PMCL exceedances were limited to unconfined wells located in Kent and Sussex counties.

Organic compounds (OCs) were not frequently detected and, when detected, rarely exceeded PMCLs. Specifically, OCs were not detected in 1,172 (96.4%) of 1,216 analyses. Of the 44 OC detections, almost one half (19 or 43.2%) were found at concentrations less than 1 µg/L. Tetrachloroethylene (PCE), a solvent, was the most-frequently detected OC. PMCLs were exceeded in a very small fraction (12 or 1.0%) of the 1,216 analyses. The following analytes were found above the PMCL: PCE (10 exceedances) and trichloroethylene (TCE; 2 exceedances). Aquifer type was established for eleven of the samples with PMCL exceedances. Four of the PMCL exceedances for PCE were associated with unconfined wells and three were associated with karst wells. Two PCE exceedances, as well as the two TCE exceedances, were associated with confined wells in the Potomac aquifer system. Methyl tert-butyl ether (MTBE), PCE, and TCE were among the top-ten most-frequently detected OCs. Based on limited data for unconfined, semi-confined, and confined wells, concentrations of MTBE, TCE, and PCE with respect to sample depth indicate that the vertical extent of human impact is limited to depths of ~150 ft bls and shallower; at greater depths these contaminants were not detected. TCE and PCE were detected at greater depths in karst wells, which typically have very long open intervals that may allow contaminants to enter at shallower depths. As previously noted, similar trends in nitrate with respect to sample depth were identified for Coastal-Plain wells. Many of the OC results are in agreement with Ferrari (2001), Reyes (2010), previous 305(b) groundwater-quality assessments (Kasper, 2008, 2010, 2014, 2017; Kasper and Strohmeier, 2012), and nationwide results (Zogorski et al., 2006).

Similar to OCs, trace elements were not frequently detected. Specifically, trace elements were not detected in 195 (76%) of 255 analyses. Of the 60 trace-element detections, 31 (52%) were found at concentrations less than 0.1 mg/L and 59 (98%) were found at concentrations less

than 1 mg/L. Barium, nickel, and chromium were the top three most-frequently detected trace elements. PMCLs were exceeded in two of the 255 analyses. Although arsenic data were limited for this assessment, based on the 2014 assessment (Kasper, 2014), it was one of the top five most frequently detected trace elements. The most elevated arsenic detections in the 2014 assessment were primarily limited to confined wells with depths ranging from ~250 to 500 ft bls, and all of these confined wells produce from either the Rancocas, Mt. Laurel, or Piney Point aquifers, which are associated with glauconitic geologic formations (Ramsey, 2005, 2007). This finding is consistent with Drummond and Bolton (2010) and previous 305(b) groundwater-quality assessments (Kasper, 2008, 2010; Kasper and Strohmeier, 2012). A USGS study targeting the Rancocas aquifer in Delaware and completed during 2015 found arsenic above the PMCL (0.010 mg/L) in 15 (41.7%) of the 36 samples (Denver, 2016).

Radionuclide data were very limited in this assessment and available data that could be identified by DNREC ID were limited to the following parameters: uranium-238 and gross alpha particle activity. Uranium-238 was ND in all of the analyses (n = 8). Gross alpha particle activity was below the 15 pCi/L PMCL in each of the two analyses. A USGS study targeting the Rancocas aquifer in Delaware and completed during the reporting period found radon above the proposed PMCL (300 pCi/L) in 16 (44.4%) of the 36 well samples; none of the radon concentrations exceeded the proposed alternative MCL of 4,000 pCi/L (Denver, 2016; U.S. EPA, 1999).

This 305(b) groundwater-quality assessment is the DNREC's sixth attempt to report raw or apparently raw groundwater data with respect to hydrogeologic setting on a statewide basis. The results of this assessment represent a subset of the total number of active public water-supply wells in Delaware and, therefore, should be viewed in that context. Provided that water-quality data in SDWIS continue to be identified by DNREC ID, future 305(b) groundwater-quality assessments should provide a more complete picture of groundwater quality in Delaware.

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