

# **Watershed Approach to Toxics Assessment and Restoration (WATAR) Program**

## **2016 Progress Report Delaware Department of Natural Resources and Environmental Control (DNREC)**

**March 28, 2016**

### **WATAR TEAM:**

**Rick Greene, Steve Williams, Brittany Sturgis  
Watershed Assessment and Management Section (WAMS)**

**Todd Keyser, John Cargill, Randy Wolfe, Stephanie Gordon,  
Kate Durant, Eileen Capitoli, Vanessa Hamm  
Site Investigation and Restoration Section (SIRS)**

**Ellen Dickey, Robin Tyler  
Environmental Laboratory Section (ELS)**

**Introduction:** The Watershed Approach to Toxics Assessment and Restoration (WATAR) was conceived by DNREC in 2012 with the intention of building a bridge between the surface water toxics program and the site investigation and restoration program in Delaware. The focus of the WATAR program is surface waters, sediments, fish and other aquatic life impacted by toxics, the health of fish and shellfish consumers, and the link to the sources/sites responsible for those impacts. The concept was officially endorsed by DNREC leadership in the fall of 2012 following a series of briefings and the completion of a 5-year work plan. Data and information collected in conjunction with this plan will be used to document progress toward implementing Total Maximum Daily Loads (TMDLs) for PCBs in the Delaware Estuary and its tributaries. The data and information collected will also be used to identify other contaminants that may need TMDLs or other clean up actions in order to restore water quality.

The WATAR work plan identifies six (6) specific activities for 2016. Those 6 activities are listed below with a status report on each. In addition to the 6 items, there were numerous additional activities that arose during 2016 in which the WATAR team became involved. Those activities are also listed and discussed in this progress report.

#### **1. Continue data compilation**

**Status: Ongoing**

**Discussion:** As of December 31, 2016, all WATAR data reported during 2016 has been successfully entered into the EQUIS database. Further, data collected at sites where the high-resolution WATAR sampling approach was followed have been imported into EQUIS as part of the overall data compilation effort.

**2. Update Quality Assurance Project Plan (QAPP) for 2016 toxics monitoring**

**Status:** Completed

**Discussion:** The WATAR program operates under an existing QAPP developed by DNREC's Environmental Laboratory Section (ELS) and a separate QAPP developed by DNREC's Site Investigation and Restoration Section (SIRS). Field and laboratory procedures used by the WATAR program that go beyond what is covered in those existing QAPPs are fully documented in detailed project-specific Sampling and Analysis Plans (SAPs) developed each year.

**3. Use existing and readily available toxics data to update list of watersheds impaired by toxics.**

**Status:** Ongoing

**Discussion:** The WATAR program provided key information on fish advisories that were updated during 2016 to Delaware's 305(b) report/303(d) list coordinator. That information was incorporated into Delaware's draft 2016 303(d) list.

**4. Perform toxics monitoring for Slaughter Creek, Waples Pond, and Prime Hook Creek in accordance with the QAPP/Sampling and Analysis Plan (SAP). If Saint Jones fish tissue mercury concentrations remain elevated (based on 2013 samples), perform more extensive, specialized mercury sampling in the Saint Jones watershed.**

**Status:** Completed

**Discussion:** The WATAR team completed sampling for toxic substances in surface waters, sediment, and fish in Slaughter Creek, Waples Pond and Prime Hook Creek in Sussex County, Delaware. All samples specified in the SAP were successfully collected during the period 17 October 2016 through 20 October 2016. Personnel from four separate DNREC Divisions were involved in the effort: the Division of Watershed Stewardship (DWS); the Division of Waste and Hazardous Substances (DWHS); the Division of Water (DW); the Division of Fish and Wildlife (DFW). In addition, personnel from the Delaware River Basin Commission (DRBC) also complemented the Department's efforts by collecting surface water samples that were tested for toxicity using laboratory bioassays. Coordination also occurred between the Department and the U.S. Fish and Wildlife Service for sampling within the Prime Hook National Wildlife Refuge.

All samples were submitted to the various specialty laboratories for analysis. Following receipt of the data, detailed assessments will be performed, including i) an assessment of current conditions; ii) an assessment of long-term trends; iii) a determination whether fish advisories can be adjusted; iv) identification of areas of concern with regard to contaminants in sediments; and v) identification of linkages between upland sources and in-stream impacts.

In addition to the sampling discussed above, the WATAR team also performed fish tissue and water sampling in the Red Clay Creek near the DE-PA Stateline over the period 4 April 2016 through 27 June 2016. That work was part of an effort to assess the rate of contaminant uptake in stocked trout. The work had not originally been included in the 5-year WATAR work plan but was added later to address a request by the Delaware Division of Fish and Wildlife. The work was fully incorporated into the 2016 WATAR SAP. All samples were successfully collected and analyzed.

The other significant sampling performed by the WATAR team during 2016 involved the collection of fish tissue samples from the Delaware Estuary. This included striped bass samples from the tidal Delaware River and Delaware Bay, bluefish samples from the Delaware Bay, white perch samples from the Delaware Bay, and weakfish from the Delaware Bay. This sampling was reflected in the 2016 WATAR SAP. All samples were successfully collected except large bluefish from the Delaware Bay. An attempt will be made to collect those samples in the spring of 2017.

Finally, more extensive, specialized mercury sampling in the Saint Jones watershed was deemed unnecessary by the WATAR team. Fish tissue samples collected in the fall of 2013 revealed that methylmercury concentrations in fish have dropped below Delaware's criterion of 300 ppb throughout the Saint Jones watershed, with the exception of a single headwater tributary where the concentration marginally exceeded the criterion. Delaware did issue a fish advisory for this limited segment out of an abundance of caution. The WATAR team suspects that the slightly elevated methylmercury concentration in this segment is due to two factors. First, the segment is in close proximity to a former coal burning power plant that released mercury to the environment. Second, the segment passes through extensive freshwater wetlands that likely convert inorganic mercury that deposited in the area to methylmercury in anoxic wetland sediments. Given the marginal exceedance in the fish and the elimination of coal as a fuel at the nearby power plant, the expectation is that methylmercury concentrations in the fish will decline with time. The WATAR team plans to monitor the situation going forward.

#### **5. Continue tech transfer**

**Status:** Ongoing

**Discussion:** Calendar year 2016 marked the end of the fourth full year of the WATAR Program. Tech transfer is constantly occurring, both inside and outside of the Department. A summary of presentations and publications by WATAR team members is summarized below. While more difficult to document, the WATAR team gathers on a regular basis to provide insight from lessons learned on projects amongst technical peers as well as newly hired staff within DNREC. These meetings are part of the technical and policy mentoring that the WATAR team has implemented through this plan.

#### **6. Progress Report and Accounting for items listed above**

**Status:** Completed

**Discussion:** This document represents the Progress Report for 2016.

In addition to this document which summarizes the efforts and accomplishments of the WATAR team in 2016, Attachment A contains a presentation titled "WATAR – 5 Years of Progress." The presentation was prepared after receiving a request from a local environmental consulting firm for the WATAR team to speak at a lunchtime "brown-bag." In addition to employees of the consulting firm, several local county environmental officials were present. The team utilized the opportunity to provide a high level summary all of the work that has been accomplished over the past 5 years. It is anticipated that the same presentation will be used to update DNREC officials and other interested parties during 2017.

## Ongoing/Unfinished Work from Previous Years

### **HSCA Sediment Guidance**

**Status:** Not completed

**Discussion:** An overarching framework/technical guidance document for assessing contaminated sediments was not completed in 2015 as scheduled. However, an initial outline of the document was completed. Furthermore, the WATAR team documented several of its sediment quality screening assessment procedures and data evaluation methods based on previous site-specific assessments it has completed. That documentation will eventually become part of the guidance document. The WATAR team intends to make development of its sediment quality assessment guidance a priority as soon as time and resources permit.

Also noteworthy with regard to this task is that, at the end of 2015, a WATAR team member was invited to join an ASTM International Task Group related to development of a standard guide for Sediment Corrective Actions. Work related to the ASTM effort is still ongoing, and includes development of 4 potential standards: Corrective Action Objective Development, Risk Evaluation at Sediment Sites, Monitoring at Sediment Sites, and Analytical Tools for Sediment Evaluation. It is anticipated that the four draft ASTM standards will be ready for ASTM review by the end of 2017. Involvement in this Task Group will help to ensure that Delaware's sediment guidance is developed in accordance with the rapidly advancing science of sediment assessment and management.

### **Roll out pilot web-based mapping utility**

**Status:** Not completed

**Discussion:** As indicated in the WATAR 2015 Summary Report, evaluation of a web-based mapping utility by the WATAR team between 2014 and 2015 resulted in the conclusion that it would be best to wait until we have a more substantial data set to justify the cost associated with third party utility development. However, just recently, the EQUiS Enterprise utility was configured to allow some basic data mapping, by location and concentration, to occur. DNREC is continually working to expand data import/export capabilities utilizing the software that is already owned by the Department. As work continues to progress with the EQUiS database, a re-evaluation and cost/benefit analysis will be completed for a comprehensive and user friendly third party web-based mapping utility.

## **Other significant activities of the WATAR Team during 2016 are presented below.**

- **Saint Jones Watershed and Tar Ditch Stormwater Drainage System:** The Saint Jones River watershed was selected by the WATAR team as its priority watershed. WATAR sampling was first performed in the Saint Jones watershed in October 2013, followed quickly by the Mirror Lake Remediation and Restoration Project in November 2013. Additional extensive sampling and analysis was conducted in 2015 in the area downstream of Mirror Lake to Route 13. Among other findings, that work revealed elevated concentrations of polyaromatic hydrocarbons (PAHs) in the Saint Jones River between Court Street and Route 13. In partnership with University of Maryland – Baltimore County (UMBC) professor Upal Ghosh, DNREC's modeled toxicity to benthic aquatic life was confirmed; potential upland watershed sources of PAHs were evaluated; multiple lines of evidence were collected to support the hypothesis that historic contamination associated with the former Dover Gas Light NPL site (coal gasification plant) is responsible for the current impacts within the

study area; and in-situ carbon amendment to sediments, among other remedial technologies, may be effective in reducing/eliminating measured toxicity. The results of the assessment were presented to an EPA project team for evaluation in early 2017.

In a related activity, the City of Dover is continuing with its planning to make major modifications to the Tar Ditch stormwater conveyance system to alleviate flooding at the Bayhealth Kent General Hospital and to improve stormwater management (municipal separate stormwater sewer system - MS4) in the area. The WATAR team is engaged with the City of Dover on the project to ensure that contaminant issues related to former operations at the municipal yard are managed appropriately and will not cause additional impact to the Saint Jones River.

- **2016 Red Clay Creek Stocked Trout Study:** Trout stocking of Red Clay Creek was curtailed nearly thirty years ago based on contaminant concerns in resident fish and stocked trout. The Division of Fish & Wildlife would like to resume trout stocking in the Red Clay in the future but wants to know whether it's safe to do so. To answer that question, a 2016 study was designed to measure the uptake of various contaminants in stocked trout over a typical trout fishing season. Field work for the 2016 study occurred between 4 April 2016 and 27 June 2016 and involved personnel from the Divisions of Fish & Wildlife, Watershed Stewardship, Waste & Hazardous Substances, and Water (including several WATAR team members). The work was also coordinated with the Division of Parks & Recreation, which manages the Auburn Heights Preserve where the study was carried out. All fish and water sample data have been reported by the laboratories and have undergone preliminary review. An interpretive report will be prepared in early 2017.
- **City of Wilmington, New Castle County and DeIDOT MS4 Permit PCB PMP:** The WATAR team coordinated with the City of Wilmington, New Castle County Special Services and DeIDOT on PCB PMP monitoring requirements in respective point source and MS4 NPDES permits. As part of the effort, a previously reported 90% reduction in PCB concentrations and mass loading from the Wilmington wastewater treatment plant effluent was re-evaluated with more recent data from the DRBC. The evaluation showed that the City of Wilmington is continuing to make progress in minimizing the release of PCBs to the Delaware Estuary.

These and other data continue to provide the WATAR team with evidence that links sinks to sources and therefore provides compelling information to require remediation and restoration.

- **BASF Inadvertent PCB Production:** As part of PCB PMP traceback efforts in 2014-2015, BASF (a pigment manufacturer in Newport, DE) was identified as a potentially important source of PCBs entering the New Castle County sewer system. After reviewing DNREC's lines of evidence, BASF confirmed that they were inadvertently producing PCBs as a byproduct of their manufacturing process. During 2016, BASF installed treatment at their facility with the intent of minimizing release of PCBs to the sewer. Future testing in 2017 will verify that the treatment is effective.
- **Phase II PCB Mass Loading Study of Hazardous Substance Release Sites in Delaware under the Hazardous Substance Control Act (HSCA):** With contractor assistance, the WATAR team completed Phase II of the PCB Mass Loading Study of Hazardous Substance Release Sites in Delaware (<http://www.dnrec.delaware.gov/dwhs/Info/Pages/Phase-II---PCB-Mass-Loading-in-Delaware.aspx>). Phase II was a Statewide effort that followed up on Phase I, which focused on the Christina Basin and Shellpot Creek watershed in northern New Castle County, Delaware. Both Phase I and Phase II reports summarize PCB data at hazardous substance release sites in Delaware and provide estimates

of PCB releases to surface waters via overland flow and groundwater discharge from each site. This work provides a basis for prioritizing cleanups, implementing the Delaware Estuary PCB TMDL, and tracking progress into the future. The News Journal ran a feature article on this project (<http://delonline.us/1UTK2kD>). The article showcased the important work being done by Delaware's WATAR team and the connection between legacy pollutants like PCBs, fish contamination and fish advisories. The loading information was provided to the DRBC for use in developing the Stage 2 PCB TMDL for the Delaware Estuary in 2016. A draft of the TMDL document is anticipated to be released for State review in early to mid 2017.

- **Interface between WATAR Team and Delaware's Toxics in Biota Committee (Fish Advisories):** The WATAR team, in accordance with its 5-year plan, collects fish tissue samples from 303(d) toxics-listed Delaware watersheds. The Delaware Toxics in Biota Committee reviews these data and makes recommendations to the Secretary of DNREC and the Secretary of the Department of Health and Social Services (DHSS) when new or revised fish consumption advisories may be needed. Based on fish tissue data that the WATAR team had collected in the fall of 2015, DNREC and DHSS issued revised fish consumption advisories for the tidal and non-tidal Christina River, Little Mill Creek, tidal and non-tidal Brandywine River, tidal and non-tidal White Clay Creek, and Shellpot Creek. The revised advisories were announced on June 7, 2016 (<http://www.dnrec.delaware.gov/fw/Fisheries/Pages/Advisories.aspx>). Overall, the revisions reflect long-term improvements and lower risk associated with consuming fish from most of these waters.
- **Mirror Lake Post-Treatment Monitoring:** Sediment, surface water and fish samples (as well as passive samplers in sediment and surface water) were collected from the Mirror Lake Remediation and Restoration project area in Fall 2016, three years after the activated carbon product SediMite™ was incorporated into the sediments of Mirror Lake. Results from data analyses are expected from UMBC in early 2017.

Data collected from the site in October/November 2014, one year after remediation, showed: 78% reduction of dissolved PCB concentrations in the sediment pore water; 72% reduction of dissolved PCB in the water column; and 60% reduction in total PCB in resident fish within Mirror Lake.

- **Little Mill Creek Flood Risk Mitigation Project – Meco Drive Remediation:** The Little Mill Creek Flood Risk Mitigation Project was completed in the summer of 2015. This project, spearheaded by the US Army Corps of Engineers (USACE), the New Castle Conservation District (NCCD), DNREC, and New Castle County, commenced in 2014. The project involved excavation and removal of bank soils and creek sediments to increase hydraulic storage capacity and decrease flooding of nearby properties. DNREC will have the sampling and analysis report for this project completed in spring 2017. The report details the expedited sampling methodology, risk-based approach to analysis of the data obtained and the final disposition of the bank-side soil that was excavated to complete the flood risk mitigation project in LMC. The project partners responded to unanticipated contaminant conditions using methods employed by the WATAR team.
- **State Route 141 Wetland Mitigation Project** – DeIDOT is conducting a multi-year project to improve the Interstate 95 and State Route 141 interchange in New Castle County. One component of this project impacts the wetlands adjacent to the interchange. DeIDOT selected several acres in the Russel Peterson Wildlife Area where mitigation actions will occur to create sustainable wetlands to account for those destroyed. Several members of the WATAR team drafted a work plan for

sampling of the wetlands to determine if the proposed project would cause the release of previously buried contaminants. Results and subsequent analysis of analytical results by WATAR team members determined that there would be little to no risk presented by implementing the wetland restoration project. Assessment results were provided to DeIDOT in 2016.

- **NVF Zinc Remediation:** The WATAR team continues to monitor zinc concentrations in the Red Clay Creek, track compliance with the zinc TMDL and NVF Waste Load Allocation, and provide management of the NVF Yorklyn site cleanup and oversight of the redevelopment effort. During 2016, zinc concentrations downstream of the NVF site remained consistently below the applicable water quality criterion due mainly to the operation of the groundwater treatment system which captures groundwater that would otherwise discharge to the Red Clay Creek.

In April 2016, a major press event associated with the NVF remediation and redevelopment was held in Yorklyn, Delaware. Former Delaware Governor Jack Markell, Former DNREC Secretary David Small, Former EPA Region 3 Administrator and current DNREC Secretary Shawn Garvin, and other dignitaries joined to praise the project for marrying environmental remediation, historic preservation, economic revitalization and recreational amenities. A short video about the remedial efforts at the NVF site can be seen here: [https://youtu.be/9-Rb\\_3q-6Hk](https://youtu.be/9-Rb_3q-6Hk).

In December 2016, earthwork began on a large scale source removal effort at the former vulcanized fiber manufacturing facility. By Spring 2017, a new 2-acre wetland will be constructed in the area where zinc contaminated soils are being removed, thus providing flood storage during heavy rain events. With the removal of the zinc source, it is anticipated that the groundwater extraction/treatment system, which has been in operation at the site since 2008, will be able to be shut down without harm to the adjacent Red Clay Creek in a reasonably short period of time. The remediation work is being funded through DNREC's Clean Water Revolving Loan Fund, and represents the first time these funds have been requested and used for remediation purposes in Delaware.

- **Supplemental Focused Feasibility Study (FFS) – Amtrak Former Refueling Facility:** This site represents one of the largest, if not *the* largest, contributor of PCBs to the Brandywine Creek and the Delaware Estuary. DNREC, specifically WATAR team members, and EPA Region 3 Toxics Substance Control Act (TSCA) staff are anticipating the submittal of a final Focused Feasibility Study (FFS) on or before June 30, 2017.

During 2016, several things occurred at the site. First, Amtrak collected an additional 400 soil samples to fill data gaps identified by DNREC during review of the last report. In addition, an area of the site that was tied up in a land dispute was sampled in order to be incorporated into the FFS. Amtrak also undertook several site improvement projects (new buildings or structures) which required regulatory input and oversight from both DNREC and USEPA TSCA. All of the soil data collected in association with the site improvement projects will also be incorporated into the FFS.

A pilot test of the proposed remedy for the eastern and western drainage ditch sediments onsite was conducted in 2016 after DNREC and USEPA TSCA approval of an updated In-Situ Stabilization Pilot Study Work Plan. All fieldwork was completed in accordance with the work plan. Samples collected for analysis of compressive strength and leachability were collected and are being analyzed at 30 days, 90 days, 180 days and 365 days of cure time. The 180 day sample results will

be utilized to determine the success of the different stabilization mixes and will be incorporated into the FFS.

DNREC anticipates that a Proposed Plan of Remedial Action will be developed for the entirety of the Former Fueling Facility Site by the end of 2017. Environmental investigation work on the adjacent Maintenance Facility property is ongoing.

Based upon newly obtained information from the DRBC, the WATAR team has updated a trend assessment of PCB release from the Amtrak site to the tidal Brandywine River through NPDES outfall 006.

- **Amtrak West Yard:** The Amtrak West Yard site is located west of Wilmington in close proximity to Little Mill Creek and the Peterson Wildlife Area. Cleanup of this site is being overseen by DNREC-SIRS through its Voluntary Cleanup Program. Sampling of Little Mill Creek in anticipation of the Meco Drive ditch remediation and the Little Mill Creek flood risk mitigation project identified the Amtrak West Yards as a probable source of PCB loading to Little Mill Creek and the Christina River. These data along with data collected as part of a USACE project to restore wetlands on the site indicated significant levels of PCBs in site soils directly adjacent to the wetlands. Amtrak submitted a remedial investigation work plan that included all existing data points along with a plan to collect additional soil, sediment, and groundwater samples across the site. DNREC-SIRS approved the work plan at the end of 2016. The work to investigate and evaluate the site will commence in spring 2017.
- **South Wilmington Wetland Assessment Project:** The South Wilmington Wetlands Area (SWWA) is a large remediation, restoration and flood mitigation project along the tidal Christina River in south Wilmington. The WATAR team is providing comments and technical support to the designers of this project to ensure that the remediation portion of the project meets criteria and objectives. Based upon the current wetland design, a new “final” grade following excavation was. The new final grade soils were sampled and the material has undergone a bioavailability analysis to determine its toxicity. This analysis followed WATAR protocols to determine if the presence of PCBs and metals in the environment combined with the site-specific characteristics poses a risk to ecological receptors. The application of this bioavailability analysis provided vital information and resulted in an adjustment to the default cleanup standards (and thus the amount of material that requires excavation and disposal) for the project, and allowed for site-specific cleanup goals to be calculated. An updated Ecological Remediation Goals Report was approved in 2016. Taking the updated report into consideration, a Proposed Plan of Remedial Action was developed by DNREC in early 2017.

In addition to the wetland project footprint, WATAR team members conducted a cursory review of data collected in 2015 in the ditch that provides flow in and out of the proposed South Wilmington Wetland, and the shoal located at the outfall of the ditch (within the Christina River). Elevated levels of PCBs have been identified and need to be remediated along with, or prior to the construction of the new wetland. The WATAR team is currently engaging the overall project team to develop a plan for remediating the ditch.

- **Former CitiSteel/EVRAZ Claymont Steel Remedial Investigation (RI):** A Voluntary Cleanup Program agreement was signed in January 2015 between Claymont Properties, LLC (the subsidiary) and DNREC for completion of a Remedial Investigation through Certificate of Completion of Remedy for all unacceptable risk to human health and ecological receptors from releases at the 450+ acre site

located on the Delaware River in Claymont, Delaware. The site has been divided into 6 operable units. A status of each operable unit is summarized below:

**OU-1 (former Scrap Yard):** Final Plan of Remedial Action was issued in June 2016

**OU-2 (undeveloped land adjacent to Delaware River):** Remedial Investigation underway. Several areas of concern exist on this portion of the property.

**OU-3 (former process and storage facilities):** Demolition activities have prohibited any environmental work from occurring. However, demolition was substantially complete in late 2016. DNREC anticipates a work plan for investigation of OU-3 soon.

**OU-4 (former cooling water pond):** Final Plan of Remedial Action was issued in July 2016. The former cooling pond must be closed/filled.

**OU-5 (former product storage area):** Final Plan of Remedial Action was issued in July 2016.

**OU-6 (former administrative building area):** Investigation completed in winter 2016. Anticipate issuance of the Final Plan of Remedial Action in early 2017.

- **I-495 Arsenic Investigation/University of Delaware Partnership:** WATAR team members negotiated a mutually beneficial partnership with Dr. Don Sparks at the University of Delaware (UD) in 2014 to better characterize arsenic contamination at a site adjacent to the Christina River at the Port of Wilmington. Dr. Sparks, an internationally recognized expert in soil chemistry, and his students speciated arsenic from sediment and soil samples collected at the Halby Chemical Superfund Site (DE-0067) and the Potts Property (DE-0169) HSCA Site to characterize the nature of and help determine the source of elevated arsenic concentrations detected in a drainage ditch that parallels I-495 near the Port of Wilmington. After incorporating comments by both DNREC and USEPA, a final report was completed by UD in March 2016. Conclusions suggest that arsenite (3+) may have sourced from the Halby Chemical site and has migrated via natural groundwater flow under the Potts Property site where it encountered an abundance of more stable arsenate (5+). Due to the anaerobic conditions below the Potts Site and the abundance of arsenate, the majority of arsenite did not change valence state and continued to migrate through groundwater to the ditch face, where it quickly oxidized and transformed almost entirely to arsenate. Due to the retirement of the USEPA Remedial Project Manager (RPM) for the Halby Chemical Superfund Site, and a delay in the site being assigned to a new RPM, additional progress has been slow. Currently, a new RPM has been assigned and has been briefed on the results of the study. The Halby Chemical site is undergoing a 5 Year Review by USEPA in 2017, at which time the arsenic issues in the I-495 drainage ditch will be addressed.
- **Calculation of Bioaccumulation Factors for benzo[a]pyrene:** In 2016, one WATAR team member utilized data collected during previous WATAR sampling events to calculate several site/state specific bioaccumulation factors (BAFs) for benzo[a]pyrene (using water column and fish tissue data). Results showed that Delaware Specific BAFs are much lower than the BAF that the USEPA used to derive a new national recommended human health water quality criterion for B[a]P in 2015. Although the USEPA Region 3 Water Quality Standards program is encouraging states to adopt the recommended criterion, DNREC is unsure. The DNREC analysis was provided to Region 3 staff, who also shared it with an expert in the EPA Office of Research and Development who championed the

new methodology used to derive the National BAF and associated human health criterion. Delaware's (WATAR) data is unique across the U.S., and based on the strength of the analysis, EPA has agreed to consider a Delaware proposal to adopt Delaware-specific human health criteria.

- **Del Chapel Zinc:** WATAR team members continue to help DNREC SIRS staff in monitoring and assessing surface water downstream of the Del Chapel Site in Newark, Delaware. Zinc contamination associated with another former vulcanized fiber production facility discharges to a small tributary that flows into Cool Run, which in turn flows into the White Clay Creek near Ogetown, Delaware. Groundwater at the Del Chapel site was previously treated with magnesium hydroxide to precipitate dissolved zinc and prevent it from discharging to surface water. The approach worked for approximately 5 years, but zinc levels in surface water are starting to elevate. The WATAR team will continue to assist in the development of additional remedial action objectives and evaluate additional remedial measures in the future.
- **DRBC Toxics Advisory Committee:** DNREC's WATAR team is represented on the DRBC Toxics Advisory Committee and assisted with following items in 2016:
  - Tracking of DRBC's progress in developing the Stage 2 PCB TMDL for the Delaware Estuary. Water, sediment and fish data sets, along with interpretation of conditions and trends, have been shared with DRBC for TMDL development.
  - Assistance with assessment of a new aquatic life criteria for ammonia.
  - Coordination of water sampling in Prime Hook National Wildlife Refuge for toxicity testing to complement the chemical-specific samples collected by the WATAR team in Fall 2016.
  - Coordination of fish sampling for toxics in the Delaware Estuary so that combined efforts of the WATAR team and DRBC were complementary.
- **Chesapeake Bay Toxics:** On June 16, 2014, Governor Jack Markell signed the new Chesapeake Bay Watershed Agreement. The Agreement included a goal to "ensure that the Bay and its rivers are free of effects of toxic contaminants on living resources and human health." The WATAR team developed a multi-year plan to assess and address toxics in the portion of Delaware that flows to the Chesapeake Bay. Preliminary planning was conducted in 2016, and will be detailed following completion of the current five-year WATAR work plan. Specific tasks will include: development of a QAPP; compilation of existing toxics data; collection of new data (including radio-dated sediment cores to characterize trends); and creation of a priority list of sources in need of clean-up and restoration.
- **Interface between WATAR Team and Remediation Funding:** Funding to carry out the existing 5-year WATAR work plan comes from the Watershed Assessment & Management Section (WAMS) and the Site Investigation and Restoration Section (SIRS) of DNREC. Those funds are primarily being used to gather state-of-the-science data on toxics in impacted watersheds so that informed decisions can be made about cleanup activities. The existing WATAR budget does not include funds for actual site and/or watershed remediation or restoration. Funds for cleanup activities typically come from the State HSCA fund and the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) funds, where applicable. Further, funds for restoration may come from settlement of Natural Resource Damage (NRDA) claims filed by Federal and State Trustees, or through other sources. State funding allocated to cleaning up WATAR-related sites since 2013 has been significant. Those cleanups include the Mirror Lake assessment and

remediation (~\$1M), Meco Ditch assessment and remediation (~\$400k), Little Mill Creek assessment and remediation (~\$350k), South Wilmington Stormwater Pilot Brownfield assessment and planned remediation (~\$500k), NVF assessment and planned remediation (~\$10M), Fort DuPont permeable reactive barrier (~\$65K) and the St. Jones River/Tar Ditch assessment (~\$60K), as well as oversight of numerous responsible party led investigation/remediation projects. Available funding under HSCA is diminishing, however, based on a decrease in revenue and severe budget cuts. This has led the WATAR team to seek alternative sources of funding to supplement and accelerate its cleanup work. One such source is the State of Delaware Water Pollution Control Revolving Fund. The WATAR team worked with the DNREC's Environmental Finance Office during 2015 to incorporate consideration of toxics into FAB's "Standard Operating Procedures for Establishing the Project Priority List". In 2016, WATAR team members successfully acquired a loan from the RLF for completion of the NVF Wetland Construction Project outlined above, and began remediation/construction in December 2016.

Lastly, the WATAR team has identified potential opportunities and has had discussions with several local and/or regional environmental groups that may be able to help now, or in the future. Those groups included the Christina Conservancy, Delaware Nature Society, Delaware National Estuarine Research Reserve, and William Penn Foundation.

**WATAR Related Presentations:** Members of the WATAR team delivered the following presentations during 2016:

- Greene R. 2016. Monitoring & Assessment of Toxics in the Christina Basin. Presentation dated January 13, 2016. Presentation given to William Penn Foundation at the University of Delaware, Newark, Delaware.
- Cargill J. 2016. Mirror Lake Remediation & Restoration – The First Full-Scale Application of Activated Carbon. Presentation dated February 3, 2016. Presentation given at 2016 Delaware Wetlands Conference, Wilmington, Delaware.
- Keyser, T. 2016. Watershed Approach to Toxics Assessment and Restoration: Addressing Chemical Contaminants and Legacy Pollutants in Delaware Waterways. Presentation dated May 3, 2016. Presentation given at regular meeting of the Delaware Nature Society.
- Greene R, Cargill J, and Ghosh U. 2016. St. Jones River & Tar Ditch PAH Assessment: A WATAR Case Study. Presentation dated September 15, 2016. Presentation given at American Water Resources Association Mid-Atlantic Chapter Symposium, Wilmington, Delaware.
- Keyser T. 2016. WATAR – 5 Years of Success. Presentation dated September 15, 2016. Presentation given at American Water Resources Association Mid-Atlantic Chapter Symposium, Wilmington, Delaware.
- Cargill J. 2016. A Street Ditch/Christina Basin PCBs. Presentation dated September 22, 2016. Presentation given at South Wilmington Wetland Design and Remediation Workshop, Wilmington, Delaware.
- Greene R and Cargill J. 2016. WATAR – 5 Years of Progress. Presentation dated November 15, 2016. Presentation given at Duffield Associates, Wilmington, Delaware.

- Greene R. 2016. Monitoring & Assessment of Toxics in Delaware Surface Waters. Presentation dated November 16, 2016. Presentation given at the Torch Club of Delaware, Newark, Delaware.
- Cargill J. 2016. St. Jones River & Tar Ditch PAH Assessment: A WATAR Case Study. Presentation dated December 7, 2016. Presentation given at DNREC Hydrologist Roundtable, New Castle, Delaware.

**WATAR-Related Awards:** Members of the WATAR team received the following awards in 2016:

- On April 20, 2016, Rick Greene, John Cargill and Todd Keyser received the “Government Award” for the Mirror Lake Project at the 34<sup>th</sup> Annual Recognition Dinner of the Water Resources Association of the Delaware River Basin, held in Philadelphia, Pennsylvania.

Notable attendees included former Delaware DNREC Secretary David Small, former EPA Region 3 Water Management Division direction John Capacasa, Partnership for the Delaware Estuary Executive Director Jennifer Atkins, new DRBC Executive Director Steven Tambini, and the Academy of Natural Sciences of Drexel University Senior Scientist Richard Horwitz.

**Peer Reviewed Publications:** The following article, coauthored by WATAR team member Rick Greene, was published in 2016:

Gosnell K, Balcom P, Ortiz V, DiMento B, Schartup A, **Greene R**, Mason R. 2016. Seasonal Cycling and Transport of Mercury and Methylmercury in the Turbidity Maximum of the Delaware Estuary. *Aquat Geochemistry*, Vol 22, Issue 4, pp 313-336.

**National Organization Involvement:** WATAR team Members play key roles in advancing watershed scale assessment and management of contaminated sediments nationally in 2016:

ITRC Contaminated Sediments Internet Based Training Team. WATAR team Member John Cargill is active in the training efforts related to the 2014 publication of the Interstate Technology and Regulatory Council’s Remedy Selection for Contaminated Sediments web-based guidance document.

ASTM International Task Group for Developing a New Standard Guide for Sediment Corrective Action. WATAR team Member John Cargill is facilitator for the Risk Evaluation Standard subgroup. The standard will apply to the assessment/management and remediation of contaminated sediments.

2017 Battelle International Conference on Remediation and Management of Contaminated Sediments. During 2016, WATAR team Member John Cargill served on the Technical Advisory Committee for the Conference, which was held in New Orleans, LA in January 2017.

Association of State and Territorial Solid Waste Management Officials (ASTSWMO) – WATAR team member Todd Keyser is a member of the ASTSWMO Sediments Focus Group. In this role Todd participates in several national forums designed to foster collaboration, innovation and consistency amongst state agencies when determining regulation, policy and innovative approaches to contaminated sediment investigation, analysis and remediation.

# **Attachment A**

WATAR - 5 Years of Progress



# WATAR 5 YEARS OF PROGRESS

**Delaware Department of Natural Resources and Environmental Control**

Richard W. Greene – DNREC Division of Watershed Stewardship

John G. Cargill – DNREC Division of Waste and Hazardous Substances

November 15, 2016

# PRESENTATION OUTLINE

Part 1 - General WATAR concept and overview of past 5 years of data collection

Part 2 - Technical – How are the data being used?

Part 3 – The next 5 years . . .

# PART 1

GENERAL WATAR CONCEPT AND OVERVIEW OF  
PAST 5 YEARS OF DATA COLLECTION

# WHAT IS WATAR?

## WATERSHED APPROACH TO TOXICS ASSESSMENT AND RESTORATION

- **Whole Basin Management framework** – “...programs from throughout DNREC work in an integrated manner to assess different geographic areas of the State defined on the basis of drainage patterns”
- **Focus on Persistent, Bioaccumulative, and Toxic (PBT) compounds** – Risk drivers for fish advisories
- **Linking Sources and Sinks** – advanced sampling and analysis utilizing multiple lines of evidence
- **Clean Water Act (1972), 303d listing and TMDL implementation tool** - assess impact of toxics in waterways
- **HSCA site prioritization tool** – target DNREC remediation efforts

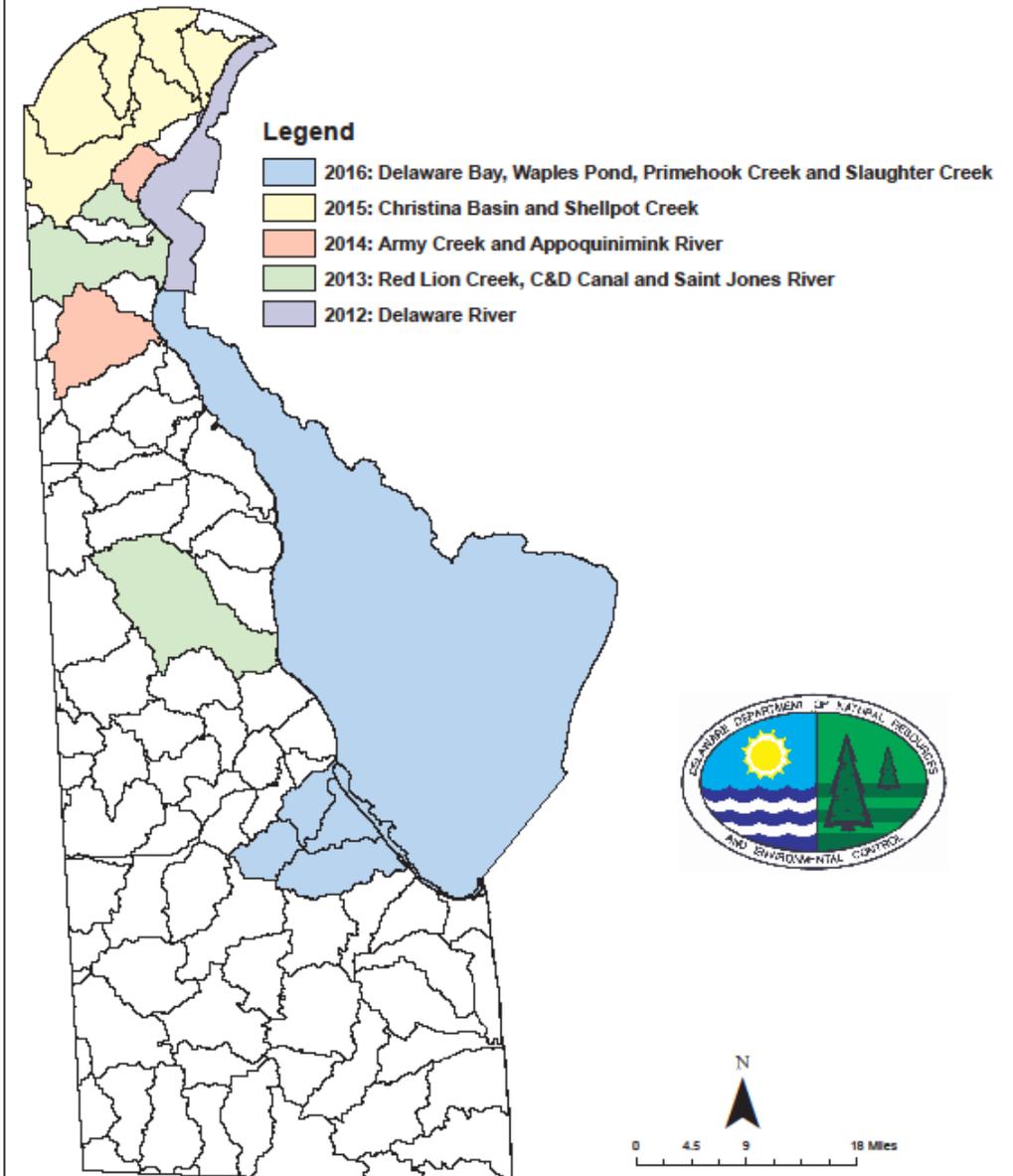
# OBJECTIVES OF WATAR

- Compile existing toxics data for the surface waters, sediments, and biota
- Create a “clearing house” of data for regulatory and remedial decision making and prioritization
- Sample current levels of toxic substances in priority waters
- Develop HSCA sediment guidance
- Establish TMDLs for toxics as needed
- Identify high priority remediation projects that have potential for significant watershed scale results
- Facilitate technology transfer to incorporate WATAR into management decisions
- A shorter timeframe for removal of fish advisories throughout the State

# WATERSHEDS SAMPLED

- **2012** - Delaware River
- **2013** - Red Lion Creek, C&D Canal, Saint Jones River
- **2014** - Army Creek, Appoquinimink River
- **2015** - Christina River Basin (Christina River, White Clay Creek, Red Clay Creek, Brandywine Creek) and Shellpot Creek
- **2016** - Delaware Bay, Waples Pond, Prime Hook Creek, Slaughter Creek, Red Clay Creek Trout Study

## Watershed Approach to Toxic Assessment and Restoration (WATAR) Study Map



# SAMPLE STATION SELECTION CRITERIA

- Within 303(d) listed watershed
- Provides coverage of entire watershed
- Previous data available for comparison/trend assessment
- Fills a data gap
- Proximity to former/current waste site
- Co-located with USGS gage
- Known fishing spot and/or upstream of drinking water intake
- Close to Stateline (interstate waters)
- Accessibility
- Safety (listed last but was always first)

# SAMPLING TIMING

- Targeted fall, steady, low flow conditions
- Not worst case for mass loading but possibly for bioavailability
- Lower probability of rainfall & other severe weather events making sustained sampling effort under desired conditions more favorable & safer
- Chemical equilibrium between phases (water, sediment and fish) more likely, allowing for comparisons between observed & predicted partitioning
- Lipid concentrations more steady for most fish species in fall
- Nice time of year to be in the field!

# MEDIA SAMPLED & ANALYTICAL PARAMETERS

## **SURFACE WATER**

- PCBs by EPA Method 1668
- Dioxins and Furans by EPA Method 1613
- Organochlorine Pesticides by EPA Method 1699
- PAHs + Alkylated Homologs by EPA Method 8270/1625

## **General WATER parameters and sorbents**

- BC of Suspended Sediments
- PC, POC, DOC
- Chl-a
- TSS
- DO, T, Cond, pH

## **SEDIMENT**

- PCBs by EPA Method 1668
- Dioxins and Furans by EPA Method 1613
- Organochlorine Pesticides by EPA Method 8081
- PAHs + Alkylated Homologs by EPA Method 8270 SIM
- Mercury by EPA Method 7471

## **General SEDIMENT parameters and sorbents**

- TOC/BC
- Bulk Density
- Specific Gravity of Solids
- % Moisture
- Grain Size

## **FISH TISSUE**

- PCBs by EPA Method 1668
- Dioxins and Furans by EPA Method 1613
- Organochlorine Pesticides by EPA Method 1699
- PAHs + Alkylated Homologs by EPA Method 8270/1625
- Total Mercury by EPA Method 1631
- Methyl Mercury by EPA Method 1630
- % lipid

## **Other for Water, Sediment and Fish**

- Chlorinated Benzenes in Red Lion Watershed
- Metals in Christina Basin (Sediment only)
- Ambient toxicity (Water only – DRBC)

# WATER SAMPLE COLLECTION METHODS



High Volume Samples



Bankside



Passive Samplers



20 Liter Kegs



Wading - Midstream



From Boat

# SEDIMENT SAMPLE COLLECTION METHODS



Wading - Bank Sampling



Ponar From Boat



Sediment Coring



Ponar over water



Homogenization



Wading With Ponar

# FISH SAMPLE COLLECTION METHODS



Electrofishing - Zodiac



Shocking Pram



Gill Netting



Trot Lines



Backpack Shocking



Hook & Line

# 2012 – DELAWARE RIVER

Two monitoring efforts completed, one on contaminants in striped bass and the other on biogeochemical cycling of mercury, both in tidal Delaware River. Results documented in:

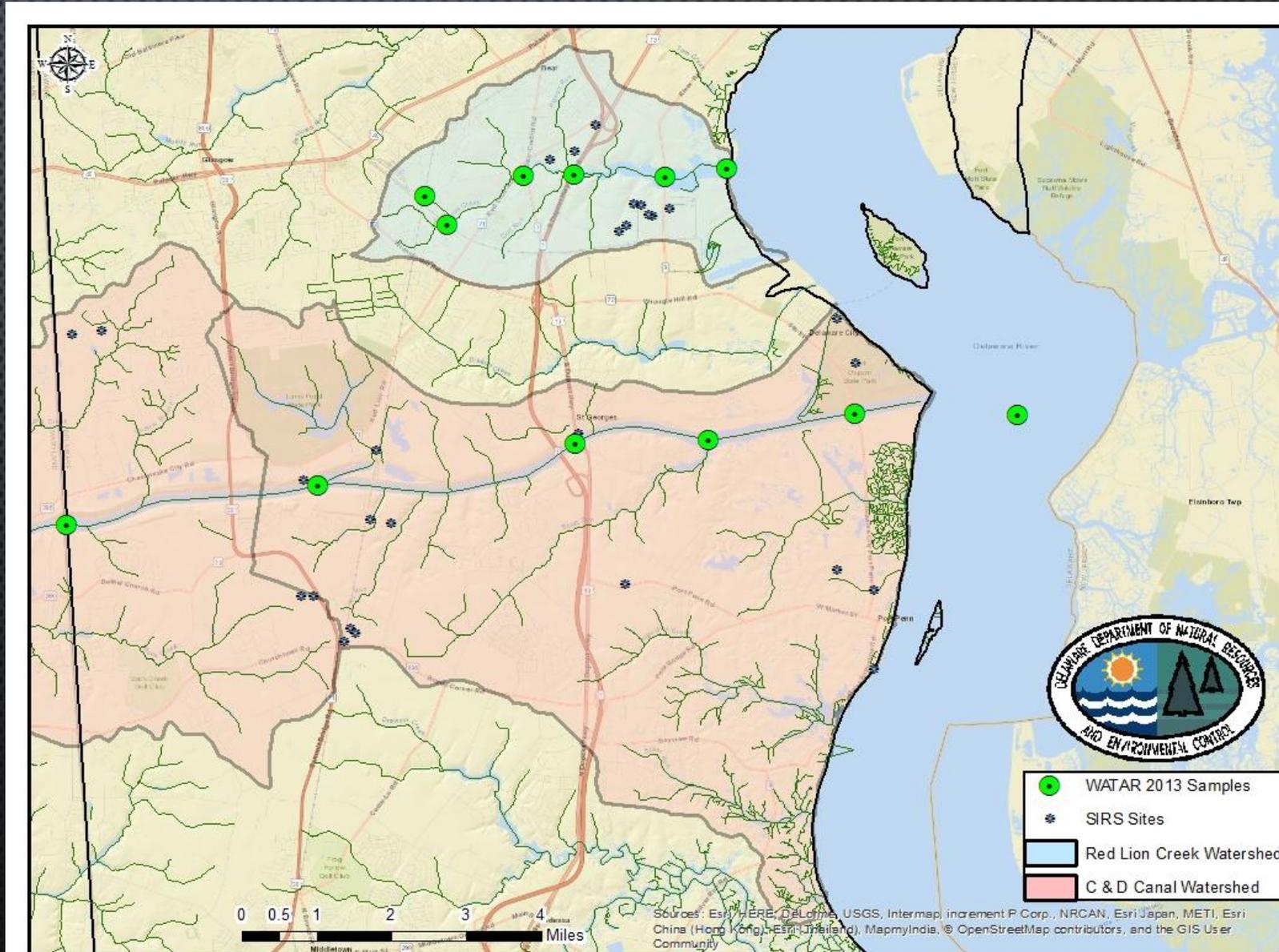
- Greene R. 2013. Assessment of 2012 Delaware Toxics in Biota Data. Report dated August 19, 2013. Delaware Department of Natural Resources and Environmental Control, Dover, DE.
- Gosnell K, et. al. 2016. Seasonal Cycling and Transport of Mercury and Methylmercury in the Turbidity Maximum of the Delaware Estuary. *Aquatic Geochemistry* 22(4): 313 – 336.
- Buckman K, et. al. Landscape Influences on MeHg Bioaccumulation in an Urban Estuary: Delaware River USA. *In review*.

# 2013 – RED LION CREEK, C&D CANAL

12 Sediment Samples  
10 Surface Water Samples  
10 Fish Tissue Samples

## Preliminary Results:

- **Red Lion Creek** – Source area between Rt 9 & Rt 13 confirmed. Tidal effect from Del R seen. Potential PCB source in headwater. Fish improved. No biologically significant toxicity observed.
- **C+D Canal** – Slight W to E gradient apparent with possible source areas at Summit and near mouth of Scott Run. Fish improved.



# 2013 – SAINT JONES RIVER WATERSHED

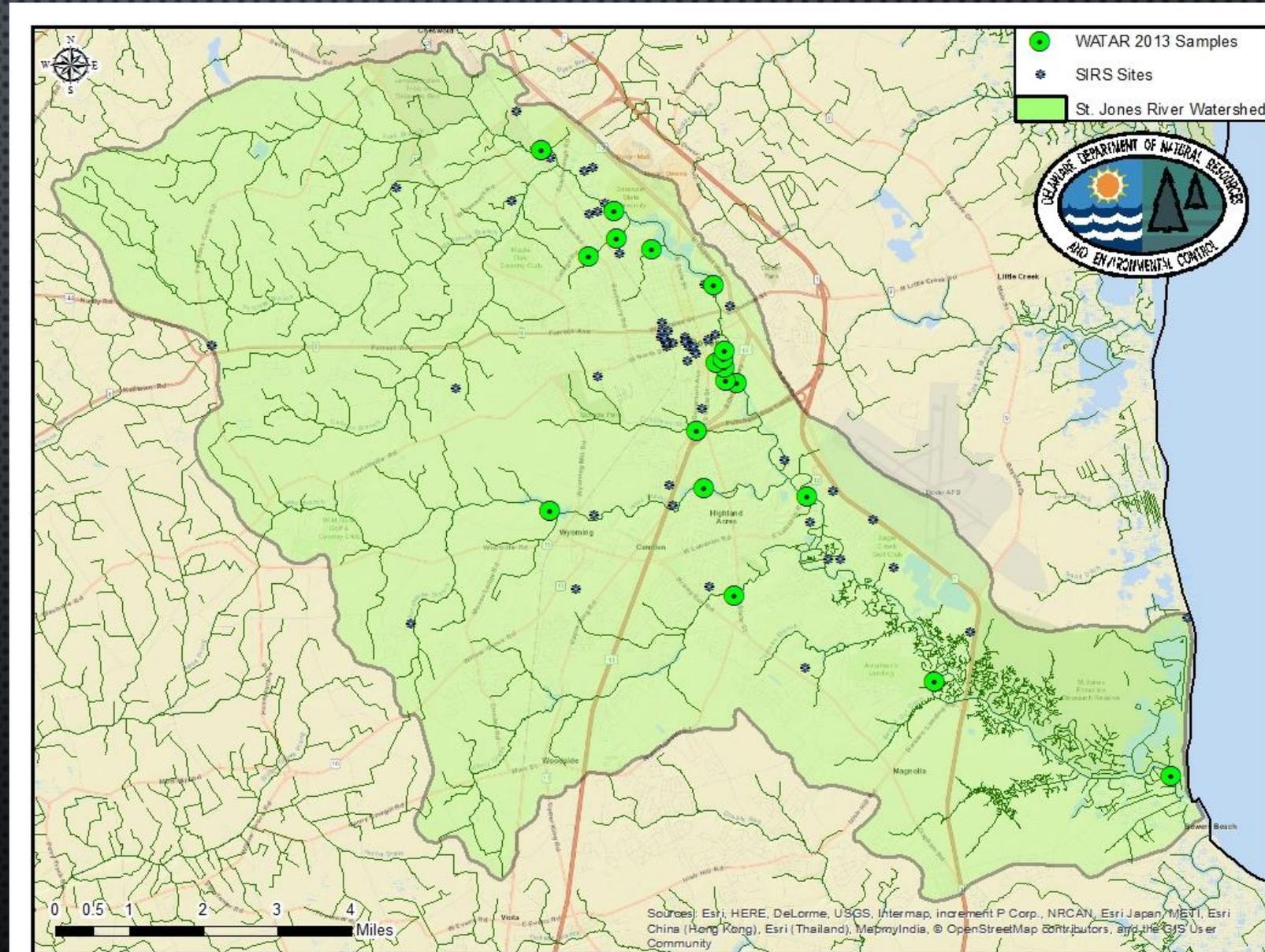
26 Sediment Samples

16 Surface Water Samples

9 Fish Tissue Samples

## Preliminary Results:

- Elevated PAHs & PCBs between Silver Lake & Rt 13.
- Mirror Lake Remediation to be discussed, as will Tar Ditch PAH project.
- Fish improved overall. Hg in fish upstream of Silver Lake.



# 2014 – ARMY CREEK WATERSHED

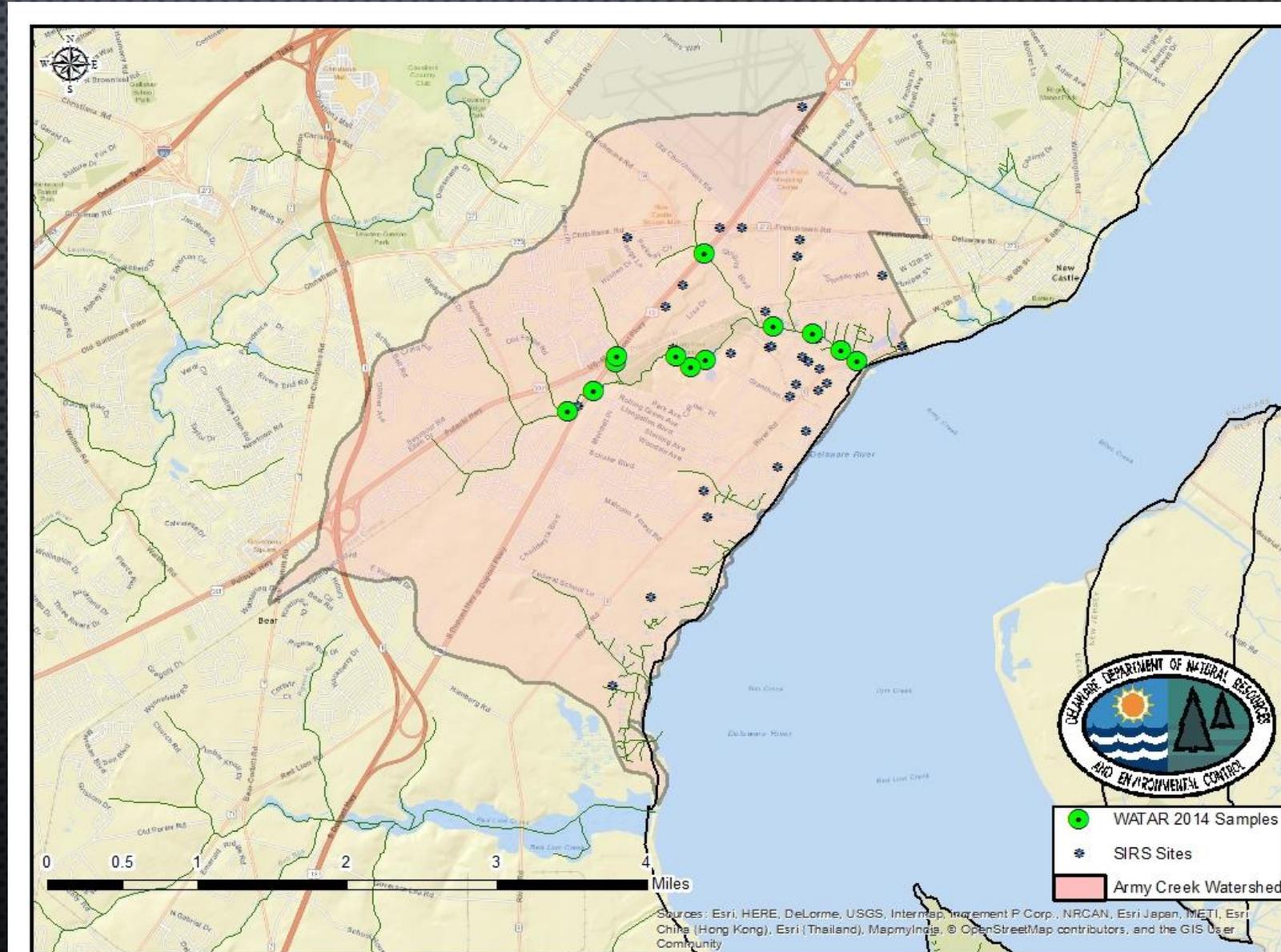
12 Sediment Samples

6 Surface Water Samples

6 Fish Tissue Samples

## Preliminary Results:

- PCB in all media decrease from Rt 13 downstream to Rt 9, with a step increase evident in Army Pond.
- Tribs relatively clean.
- Fish improved overall. Dieldrin in fish elevated at Rt 13.



# 2014 – APPOQUINIMINK WATERSHED

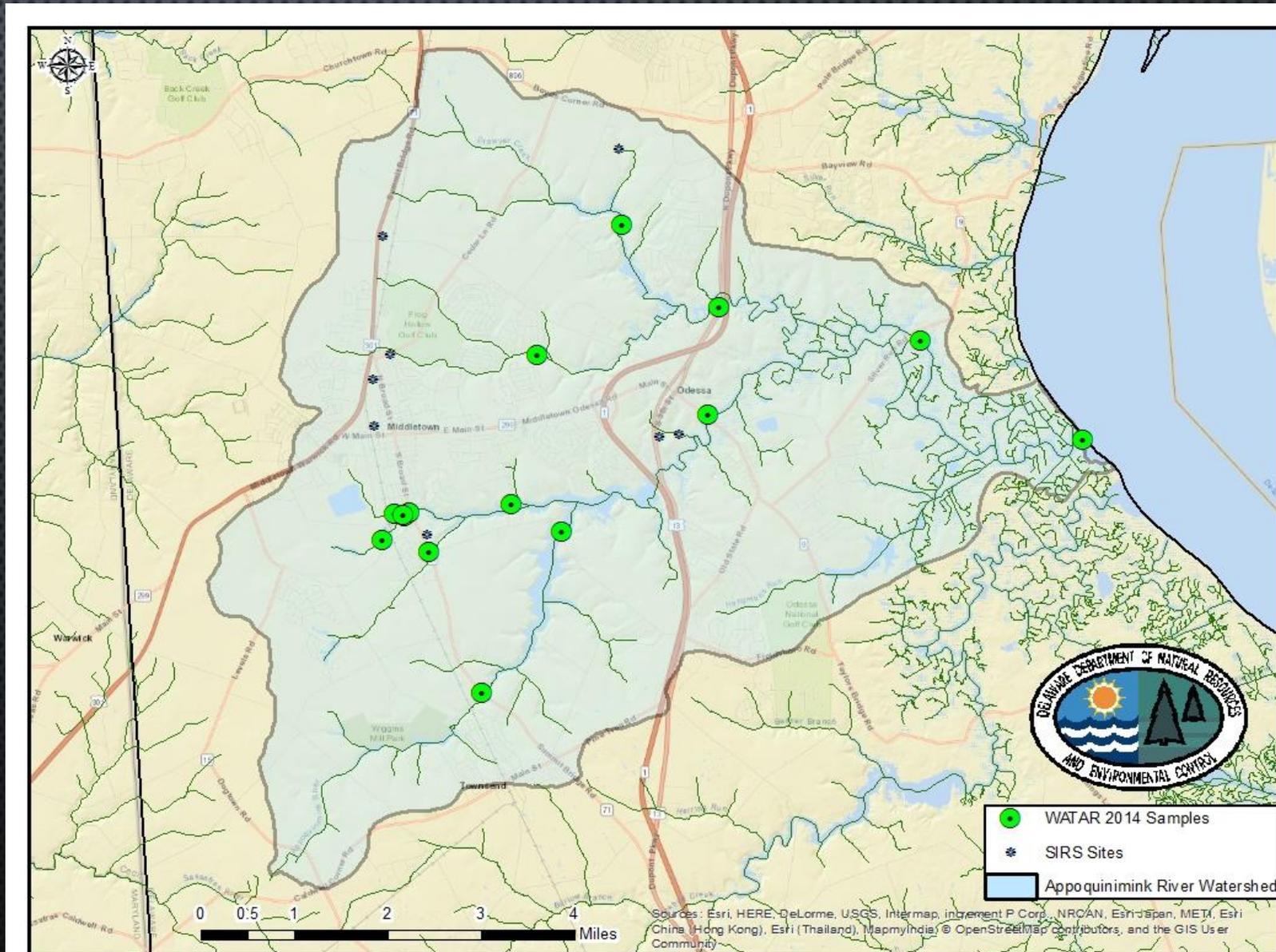
14 Sediment Samples

9 Surface Water Samples

9 Fish Tissue Samples

## Preliminary Results:

- Tidal transport of PCBs into Appo & Drawyer Cr from Del R evident based on PCB 209 tracer
- Overall, tributaries not heavily impacted
- Fish somewhat improved, although hi freq/low mag exceedance of dieldrin



# 2015 – CHRISTINA BASIN, SHELLPOT WATERSHED

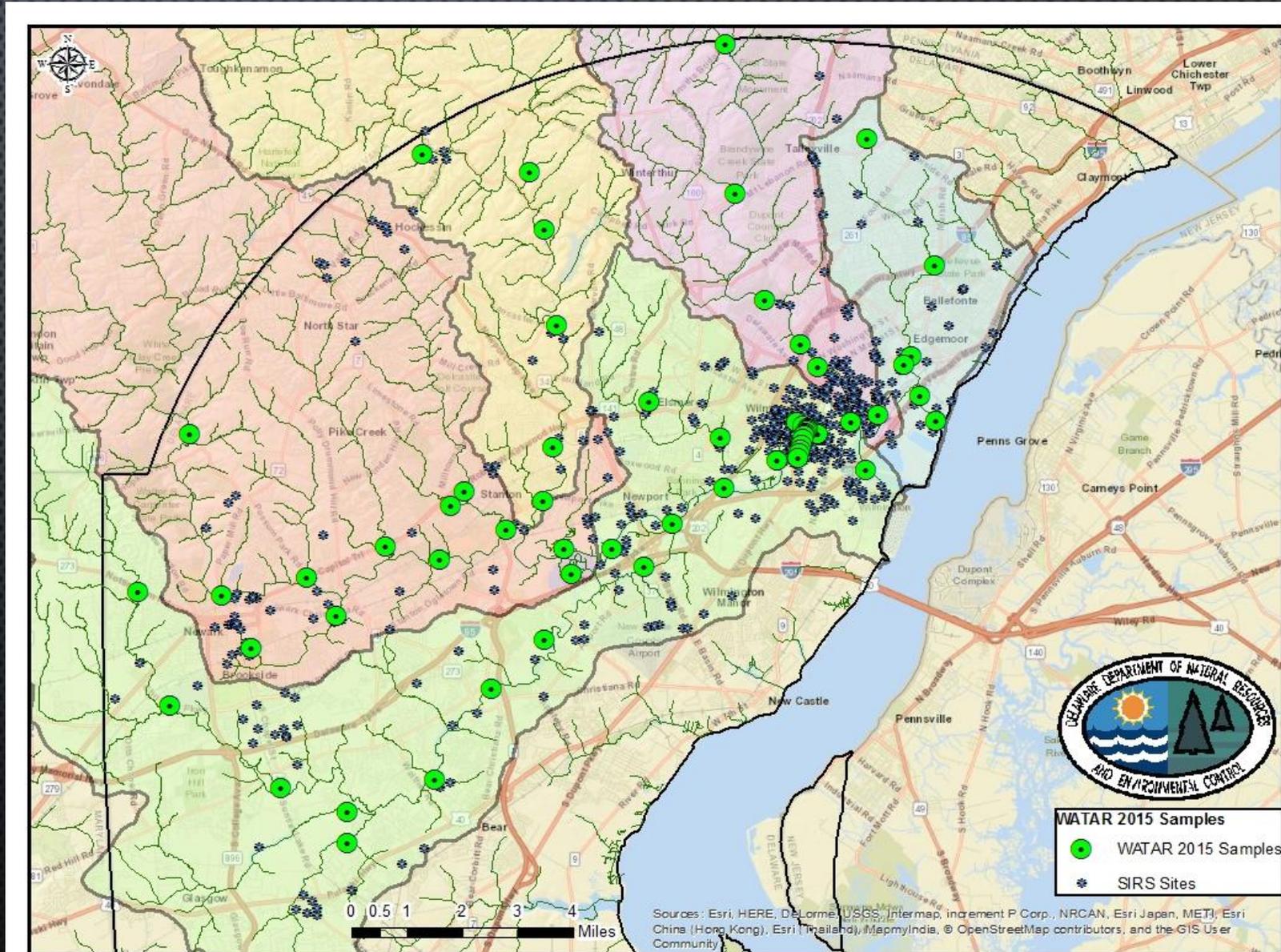
65 Sediment Samples

25 Surface Water Samples

25 Fish Tissue Samples

## Preliminary Results:

- Lower Christina, tidal Brandywine & lower Shellpot AOCs
- Tribs not heavily contaminated, although uptick in DDX in RCC
- Fish improved overall.
- No ambient tox



# 2016 – WAPLES POND, PRIME HOOK CREEK AND SLAUGHTER CREEK

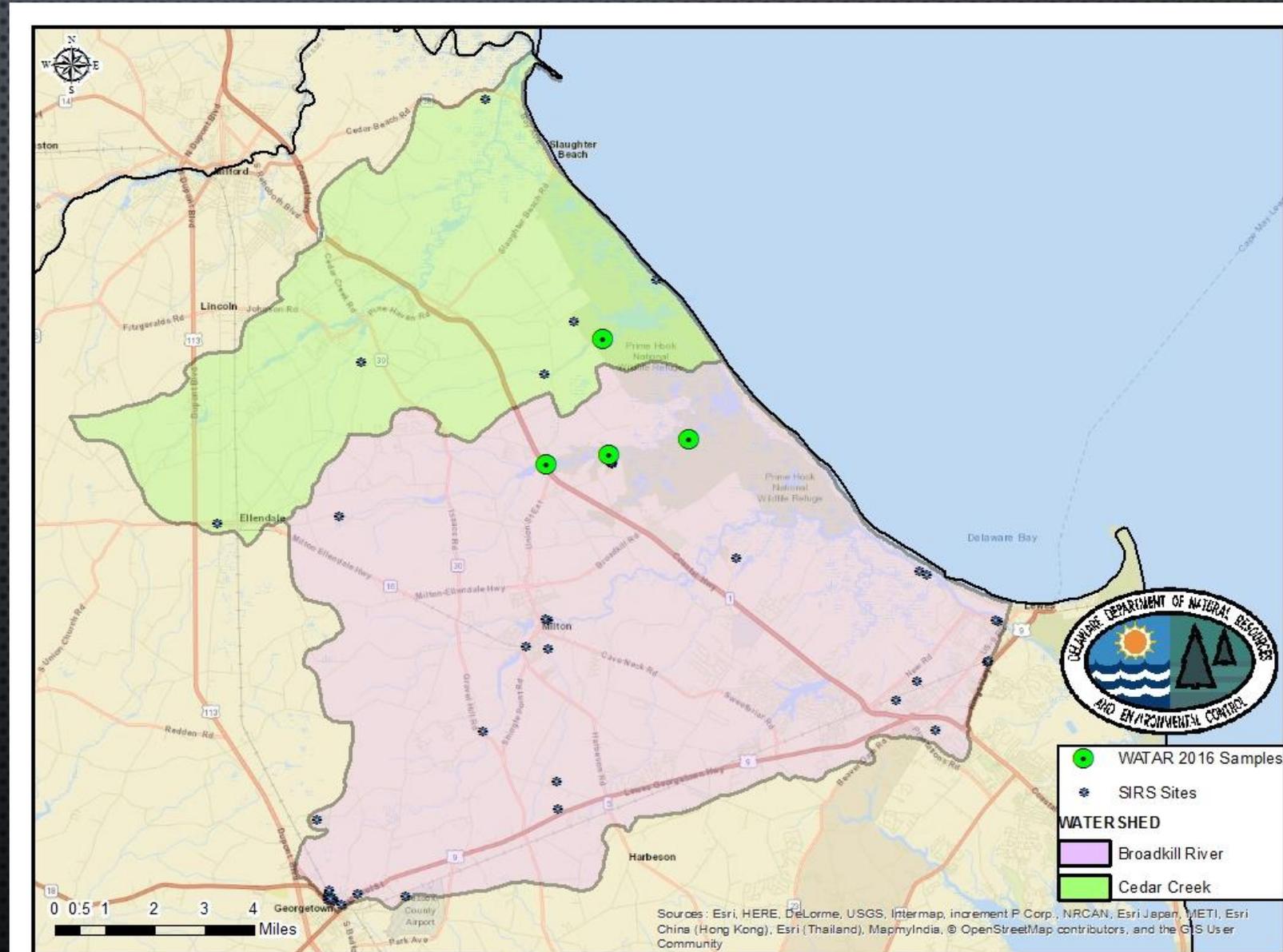
4 Sediment Samples

4 Surface Water  
Samples

6 Fish Tissue Samples

Preliminary Results:

➤ No data yet



# OTHER WATER SAMPLING DURING 2016

- Red Clay Creek Kinetic Uptake Study of Contaminants in Stocked Trout (n = 4 fish samples and 4 surface water samples)
- Delaware Estuary Contaminants in Fish (n = 37 fish samples, including striped bass, bluefish, white perch and weakfish)
- Mirror Lake Year 3 Sampling (n = 7 bulk sediment samples, 7 sediment pore water passive samples, 9 surface water passive samples, 8 surface water grab samples and 4 fish samples)



# **PART I - QUESTION & ANSWER BREAK**

## **PART 2**

**TECHNICAL – HOW ARE THE DATA BEING USED ?**

# HOW ARE THE DATA BEING USED ?

- Inform and Implement the Delaware Estuary PCB TMDL (including PMPs) 
- Document improvements (trends) in fish contamination and support revised fish consumption advisories 
- Improve/Justify 303(d) listing/delisting decisions 
- Identify target areas for follow-up investigation/remediation 
- Develop State-specific BAFs & BSAFs and associated human health water quality criteria
- Test and validate role of black carbon in PCB partitioning
- Support NRDA evaluations/actions
- Complement ambient toxicity testing by the Delaware River Basin Commission
- Improve assessments for DNREC's Source Water Assessment and Protection Program (drinking water) in the Christina Basin

# PCB MASS LOADING FROM DE WASTE SITES



Purpose: estimate PCB load from waste sites to surface water via overland flow + groundwater transport

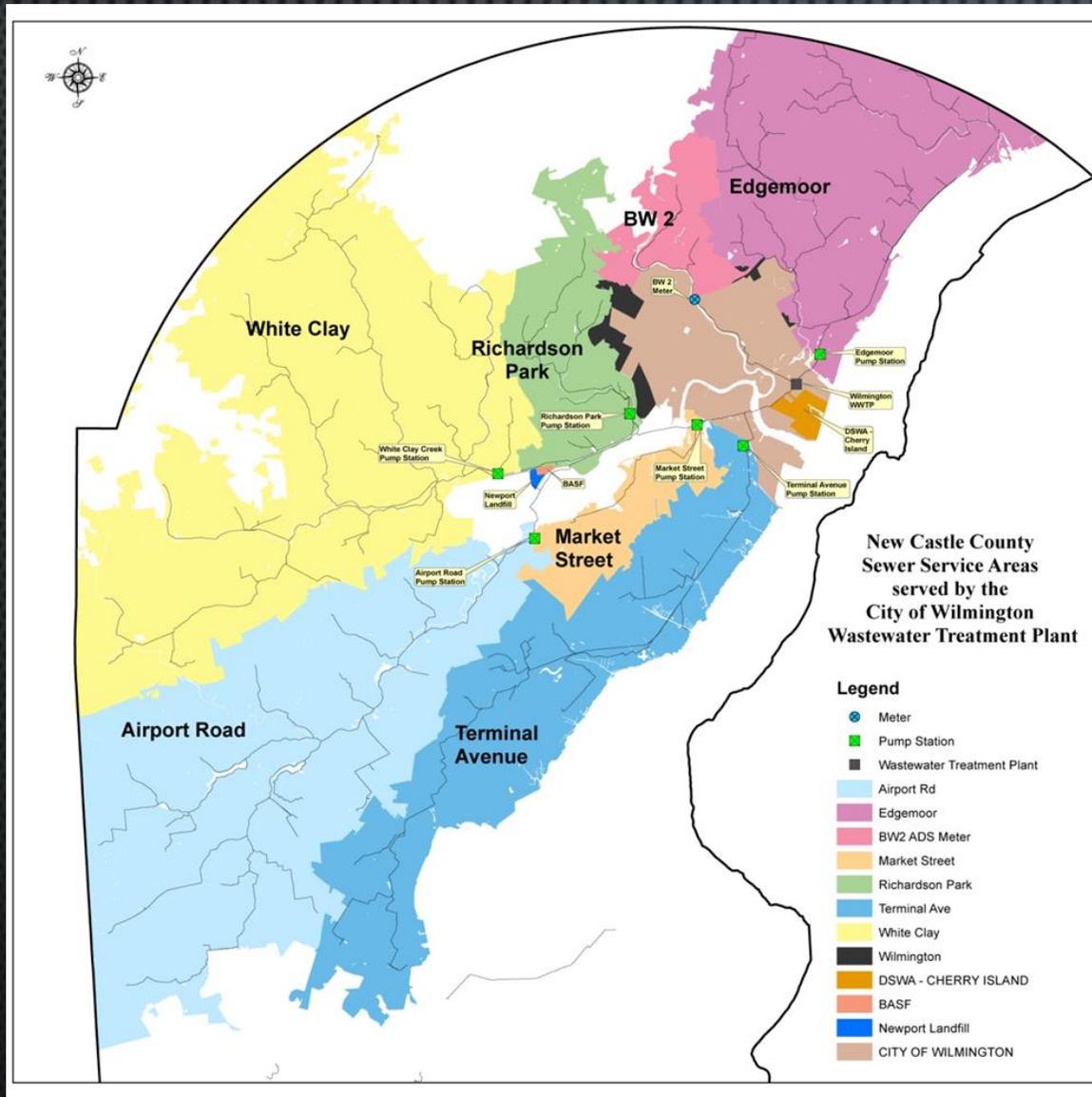
Collaboration between SIRS & WAS served as catalyst for WATAR

Phase I completed 2009 (n = 32, Christina Basin); Phase II completed 2015 (n = 29, rest of DE)

Provides individual & cumulative loading, relative ranking & framework for tracking

Directly supports the DRBC PCB TMDL

# WILMINGTON & NCC SEWERSHED TRACKBACK



City of Wilm has NPDES permit to discharge treated ww to Del Est

PCB discharge exceeds WLA established by EPA as part of TMDL

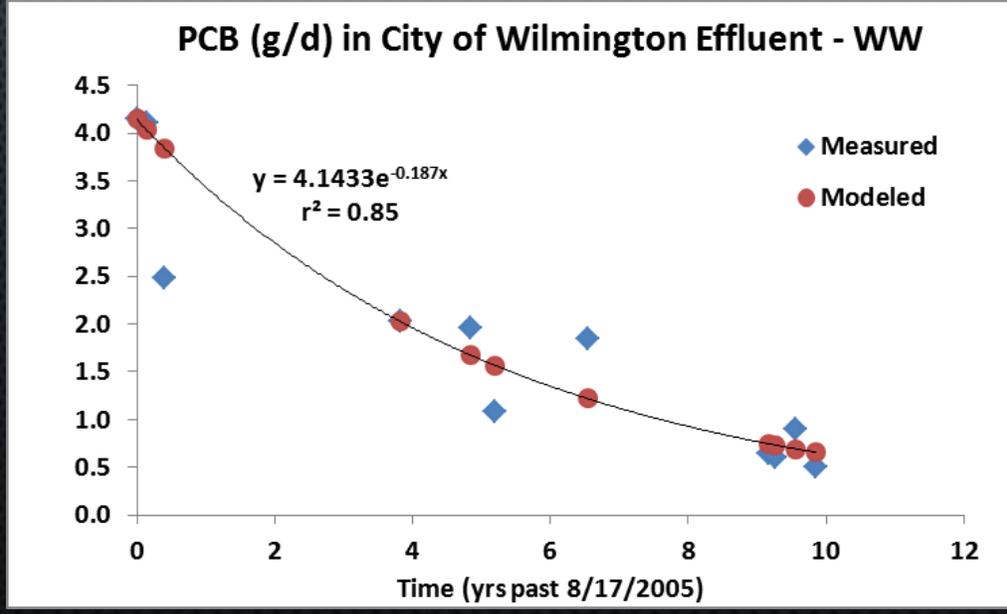
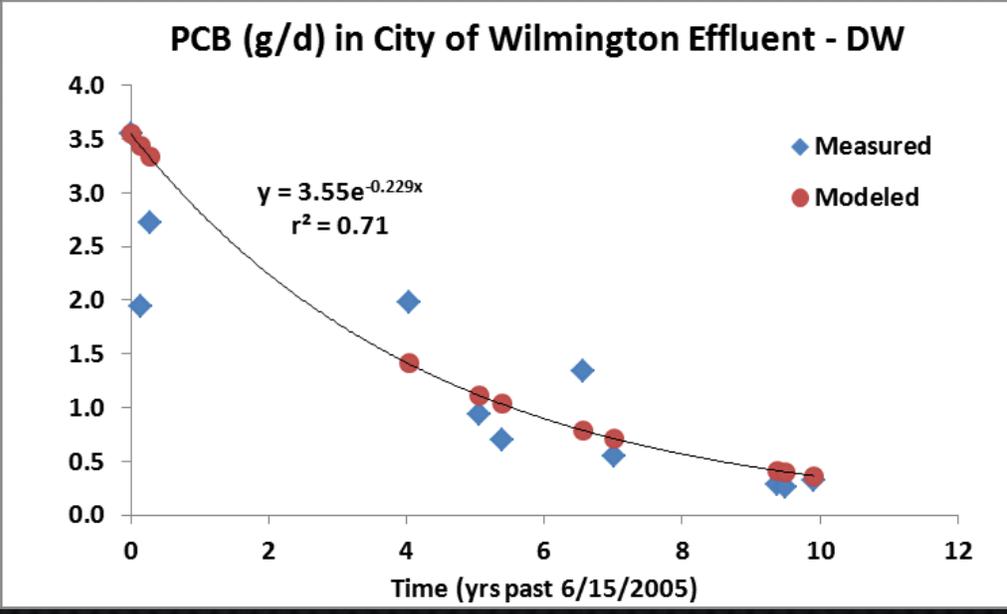
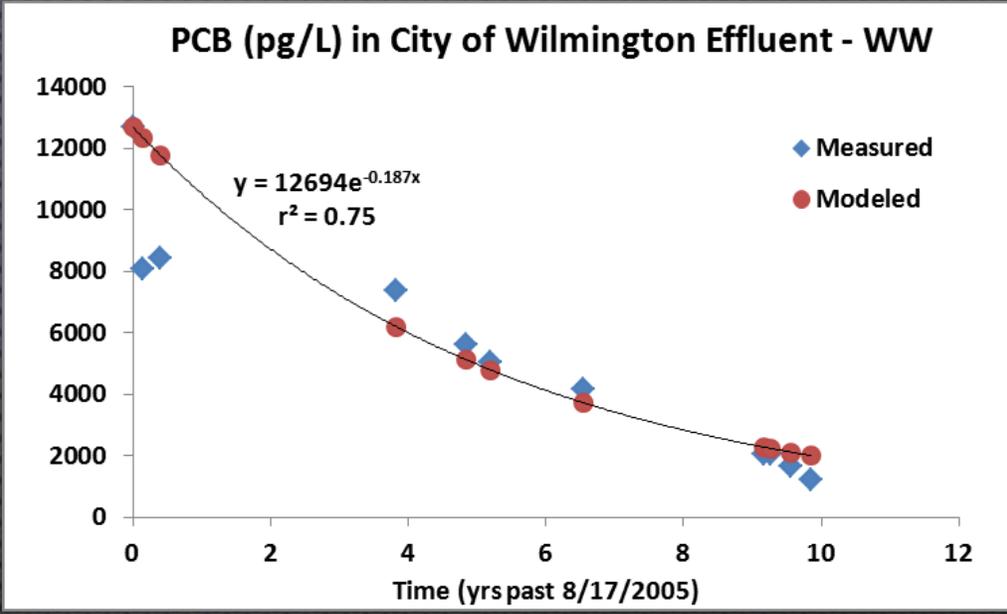
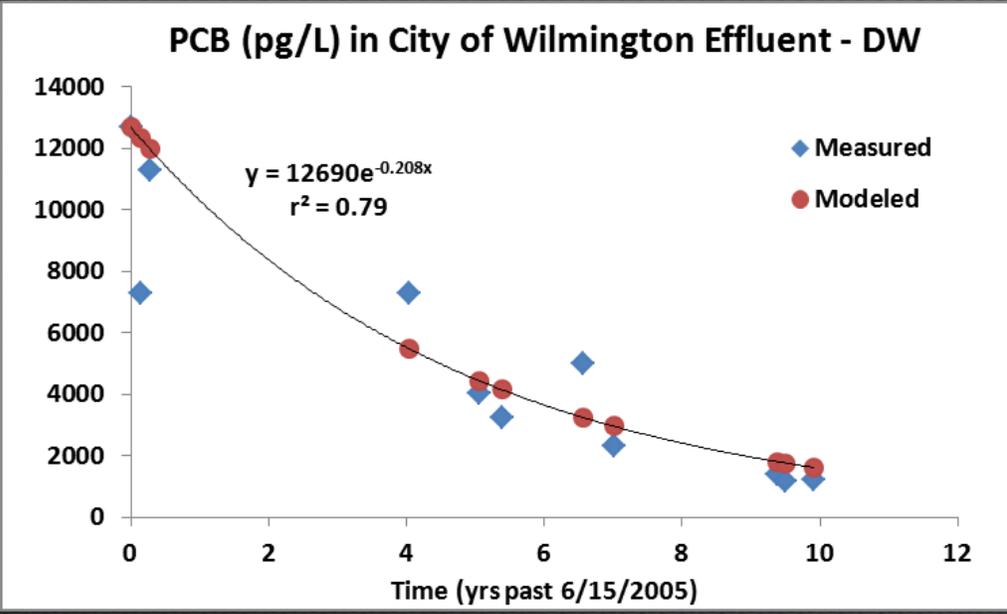
Permit has special condition to reduce PCB load through PMP

Key element of PMP is a PCB trackback to id sources

Sewershed includes City & NCC

WATAR team assisted in data assessment

# ~90% PCB REDUCTION – WILMINGTON WWTP



Dry weather concentrations

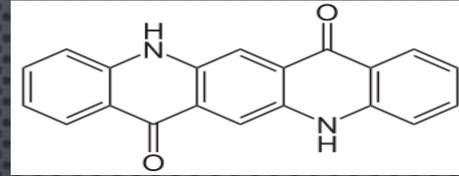
Wet weather concentrations

Dry weather mass loading

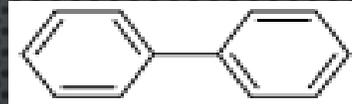
Wet weather mass loading

# FINGERPRINTING TO ID INADVERTENT PRODUCTION

- BASF Newport manufactures Quinacridone pigment (QA). WW to sewer.



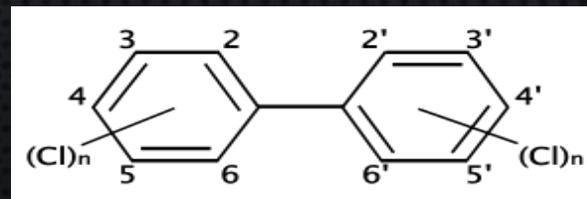
- Therminol VP-1 is used in QA synthesis. It contains ~26.5% Biphenyl, the basic building block of PCBs.



- Manufacturing process also involves chlorinated anilines (*used as a diazo component*).



- Side-reaction of chloroanilines in the presence of biphenyl may produce PCBs through a free radical mechanism or other means.



# AMTRAK FORMER FUELING FACILITY - WILMINGTON



- Amtrak is major ongoing source of PCB to surface water
- Congener data collected through PMP resulted in revised conceptual site model
- DNREC, EPA, COE & DRBC working with Amtrak on comprehensive cleanup, including pilot test of ISS of sediments in Eastern Drainage Ditch

# COORDINATION ON NCC/DELDOT MS4 PCB PMP



Setting the Standards for Innovative Environmental Solutions

## SAMPLING AND ANALYSIS PLAN

### ARMY CREEK AND APPOQUINIMINK RIVER WATERSHEDS

Pollution Minimization Plan (PMP) for  
Polychlorinated Biphenyls (PCBs)

National Pollutant Discharge Elimination System (NPDES)

Permit Number: DE 0051071  
State Permit Number: WPC 3063A/96

December 31, 2014

Prepared for:

**DUFFIELD ASSOCIATES, INC.**  
5400 Limestone Road  
Wilmington, DE 19808-1232

Prepared by:

**ENVIRONMENTAL STANDARDS, INC.**  
1140 Valley Forge Road  
P.O. Box 810  
Valley Forge, PA 19482-0810

DNREC assisted in  
SAP design &  
suggested an  
approach for data  
assessment/display

MS4 sampling  
sequenced to  
complement WATAR  
sampling

Compliance through  
progress



Setting the Standards for Innovative Environmental Solutions

## SAMPLING AND ANALYSIS PLAN

### CHRISTINA BASIN AND SHELLPOT CREEK WATERSHEDS

POLLUTION MINIMIZATION PLAN (PMP) FOR  
POLYCHLORINATED BIPHENYLS (PCBS)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)

PERMIT NUMBER: DE 0051071  
STATE PERMIT NUMBER: WPC 3063A/96

June 3, 2016

Prepared for:

**DUFFIELD ASSOCIATES, INC.**  
5400 Limestone Road  
Wilmington, DE 19808-1232

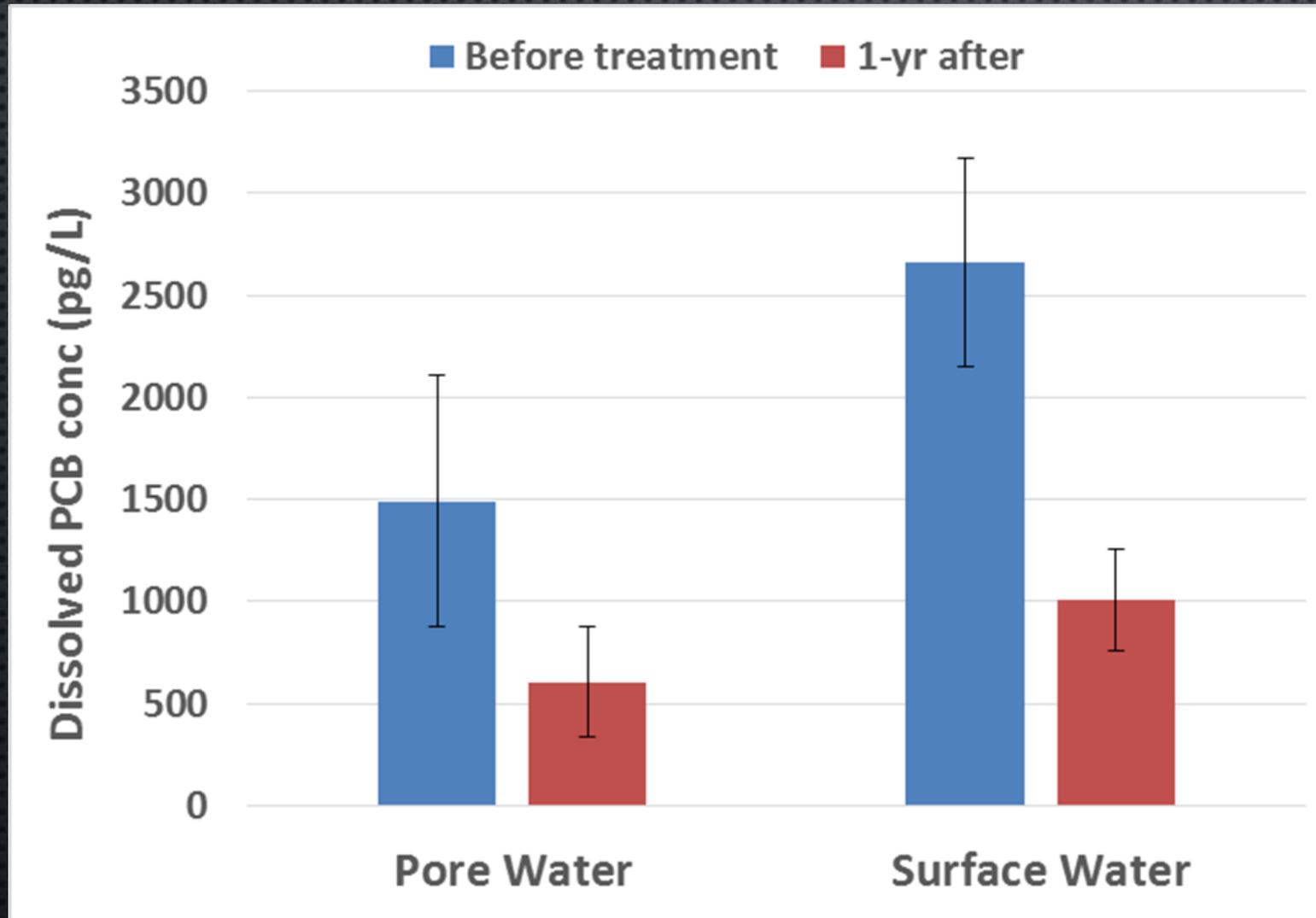
Prepared by:

**ENVIRONMENTAL STANDARDS, INC.**  
1140 Valley Forge Road  
P.O. Box 810  
Valley Forge, PA 19482-0810

# MIRROR LAKE REMEDIATION & RESTORATION



# REDUCTION IN PCB BIOAVAILABILITY - MIRROR LAKE

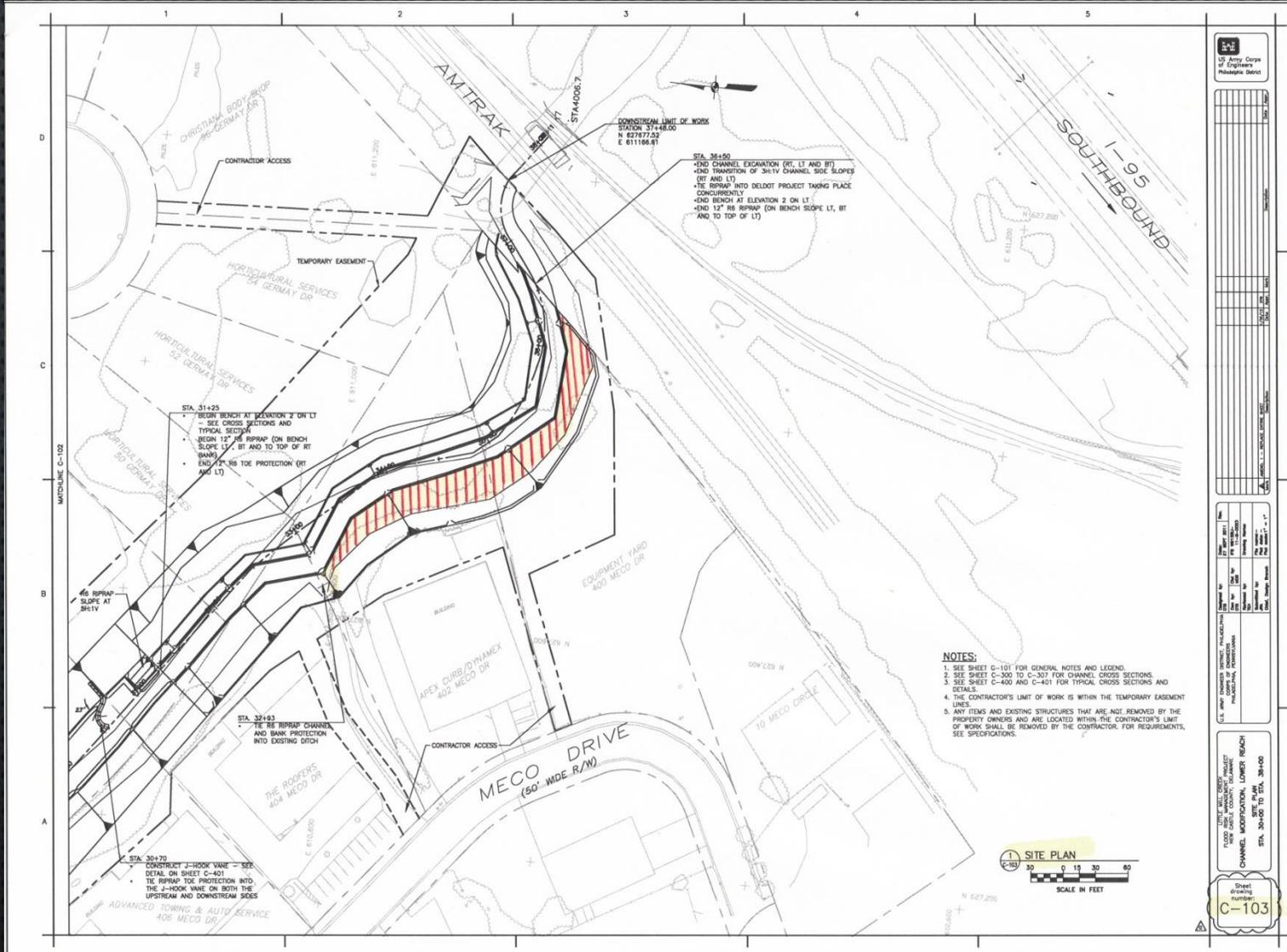


- 78% reduction of dissolved phase PCB in sediment pore water.
- 72% reduction of dissolved phase PCB in water column.
- Led to 60% reduction of PCB in resident fish in 1 year.
- This would have taken ~20 years via natural attenuation.

# MECO DITCH/LITTLE MILL CREEK



# MECO DITCH/LITTLE MILL CREEK – AC ADDITION



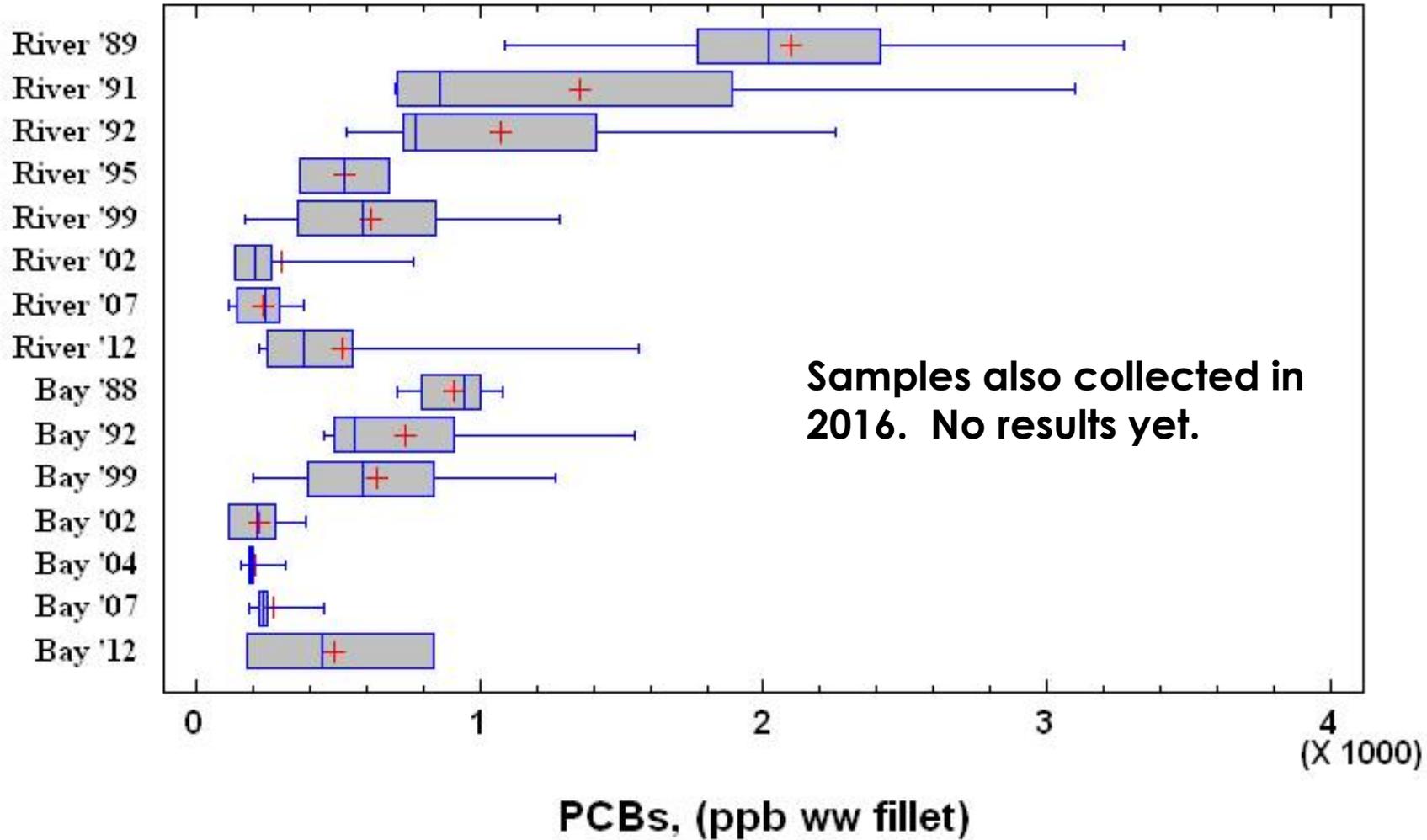
# UPDATED FISH ADVISORIES USING WATAR DATA

## Less Restrictive Advisories Issued:

- October 23, 2013: Delaware River
- July 3, 2014: C & D Canal, Red Lion Creek, and Saint Jones Watershed
- September 11, 2015: Army Creek and Appo Watershed
- June 7, 2016: Christina Basin and Shellpot Creek



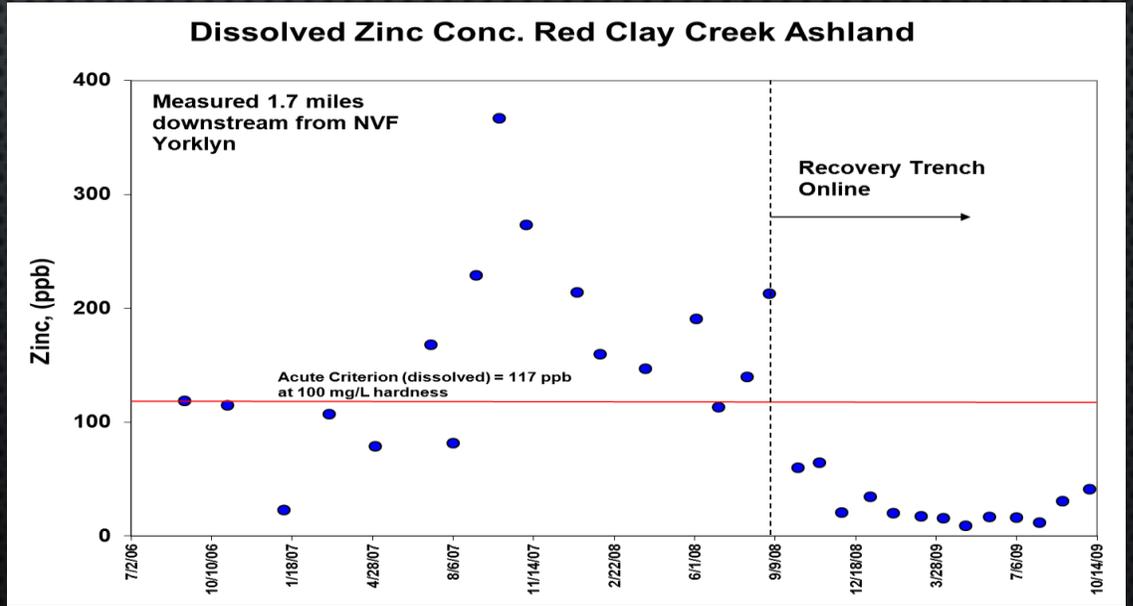
# PCB IN STRIPED BASS - DELAWARE ESTUARY



# RED CLAY CREEK ZINC DELISTING

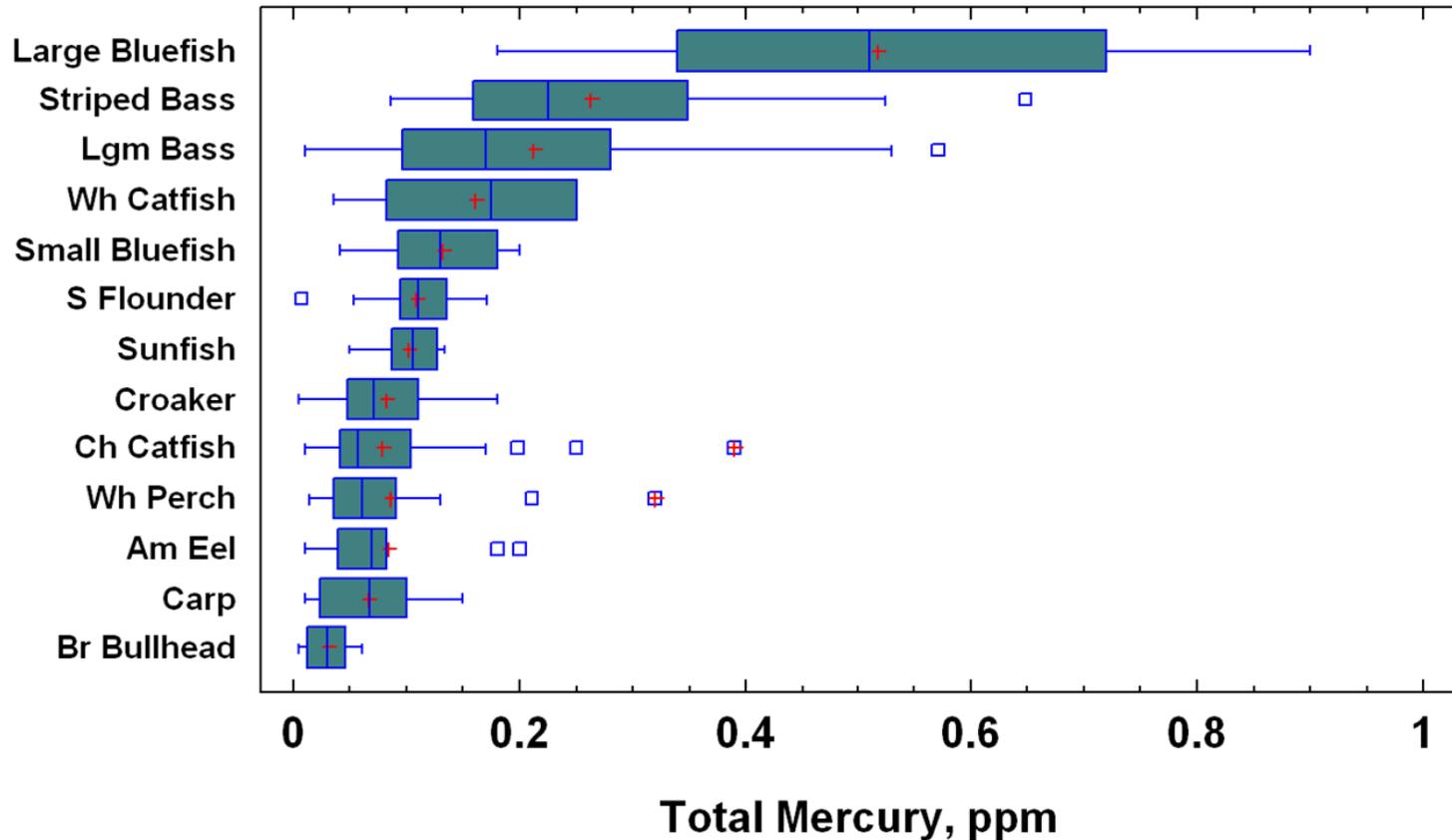


- NVF Yorklyn manufactured vulcanized fiber from 1900 to ~2005.
- Copious amounts of zinc released to groundwater, which then moved to Red Clay Creek.
- Zinc TMDL adopted, appealed & revised based on lognormal probability analysis.
- Zinc recovery system installed Fall 2008.
- Criteria no longer exceeded. Zinc delisted.
- Site being repurposed.



# DELAWARE RIVER MERCURY DELISTING

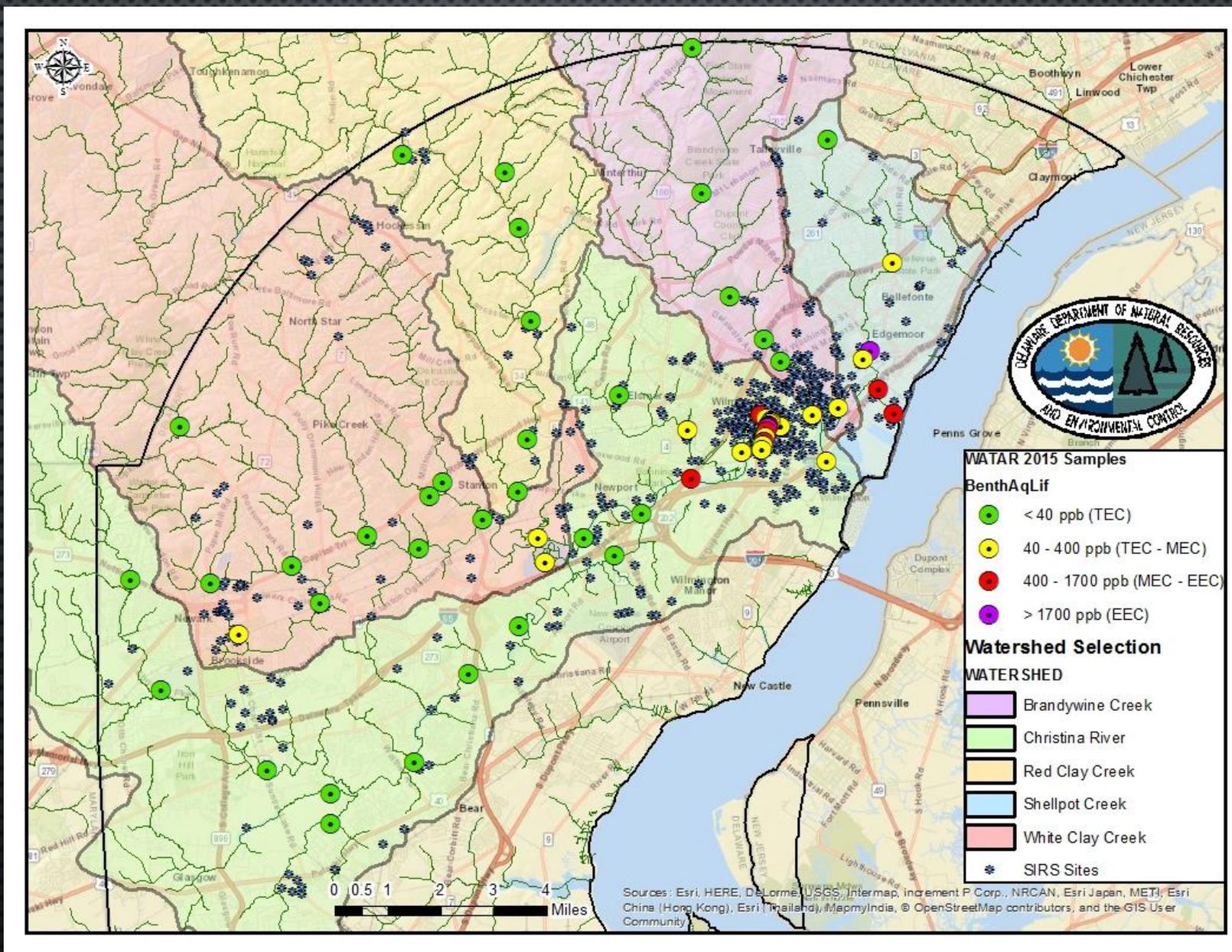
## Mercury in Delaware Fish 1993 - 2006



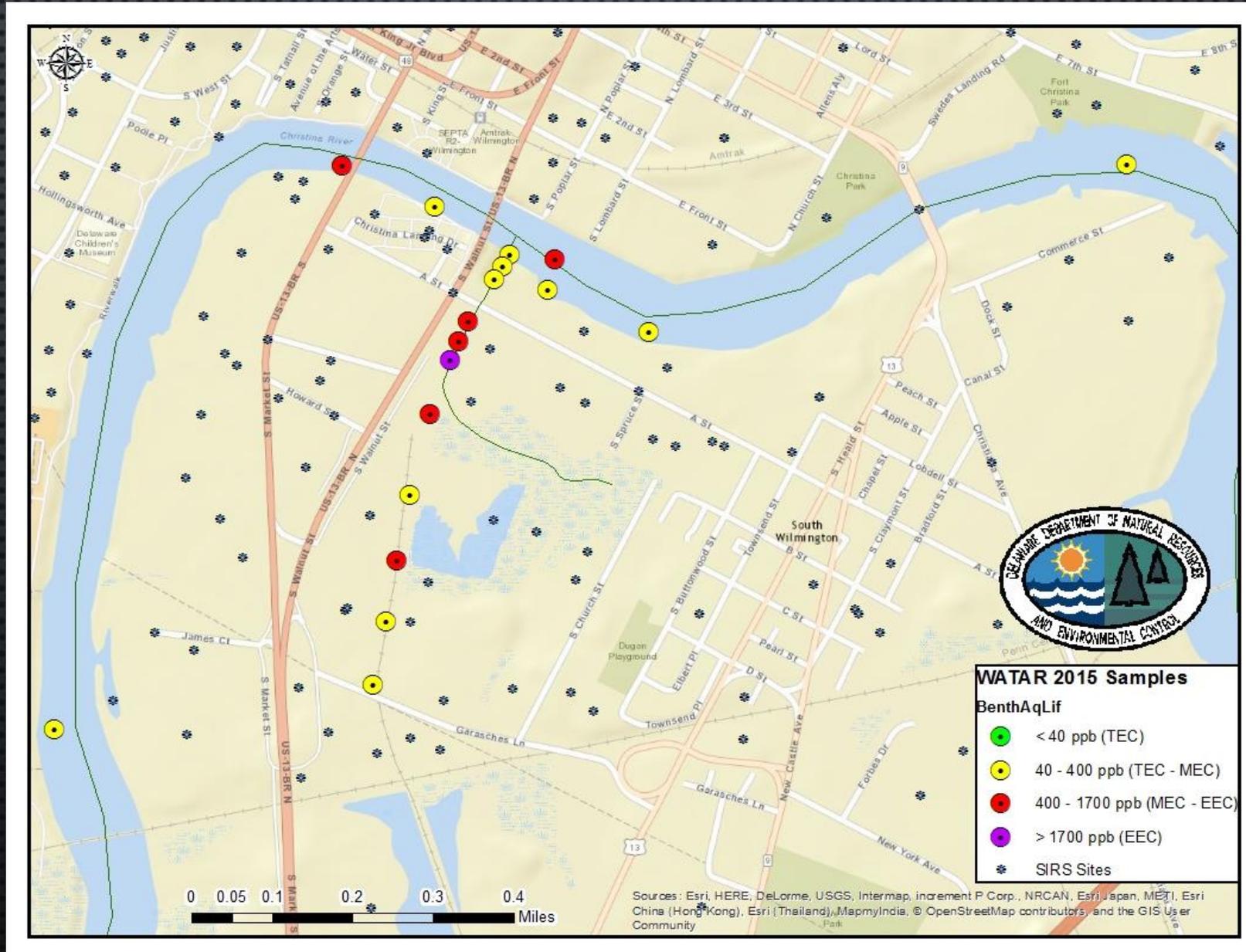
- DNREC & DRBC partnered with UCONN to study Hg cycling in Zone 5 of Del R.
- Between 2002 – 2012, dissolved Hg in water dropped ~70%.
- Over same period, Hg in Del River striped bass fell ~50%, leading to delisting in 2014.
- Bay still listed for Hg. New data for stripers & bluefish being collected 2016.



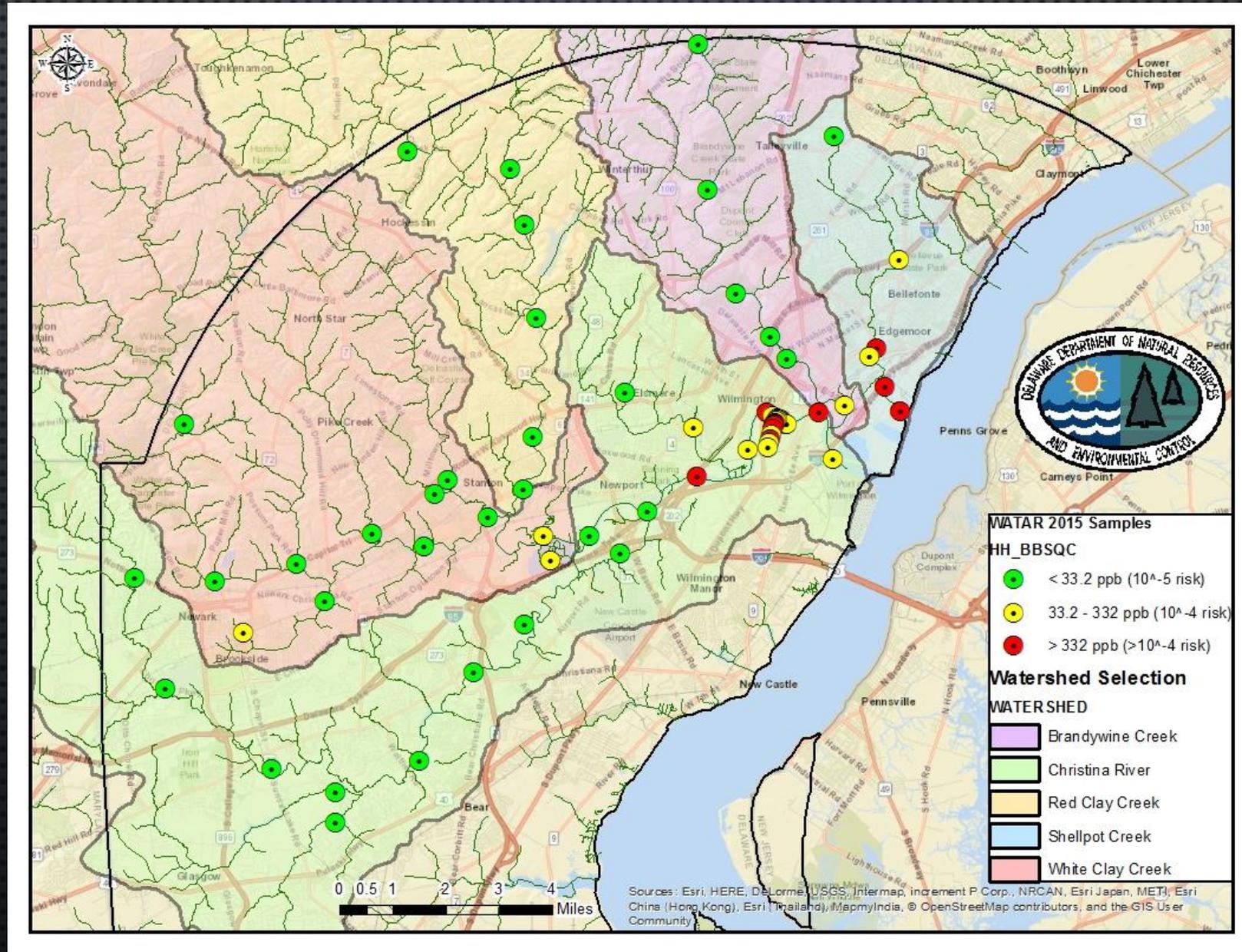
# BASIN-WIDE PCB RISK TO BENTHIC AQUATIC LIFE



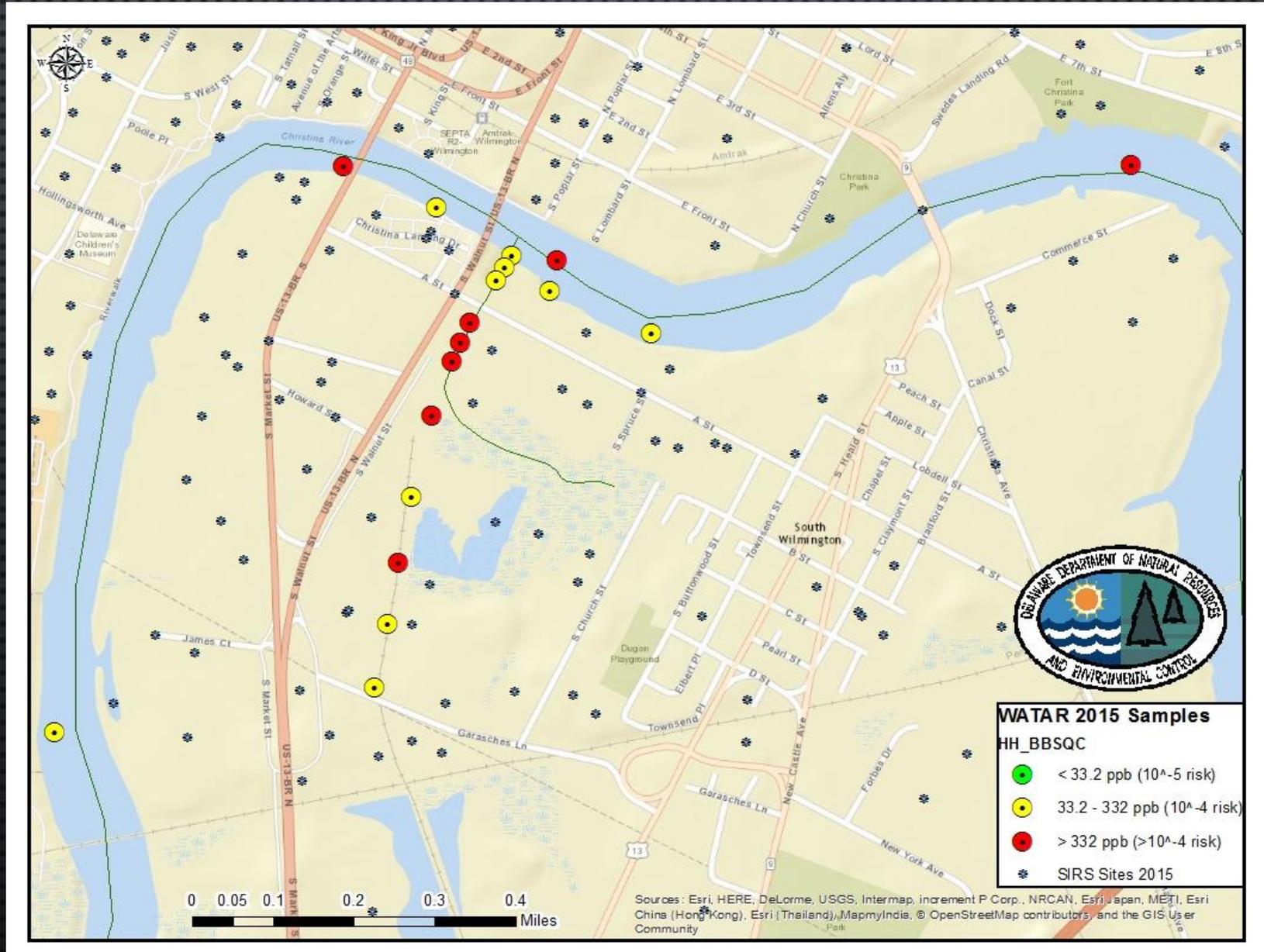
# A ST. DITCH PCB RISK TO BENTHIC AQUATIC LIFE



# BASIN-WIDE PCB RISK TO HUMAN HEALTH: SEDIMENT TO FISH



# A ST. DITCH PCB RISK TO HUMAN HEALTH: SEDIMENT TO FISH



# SJR/TAR DITCH ASSESSMENT APPROACH

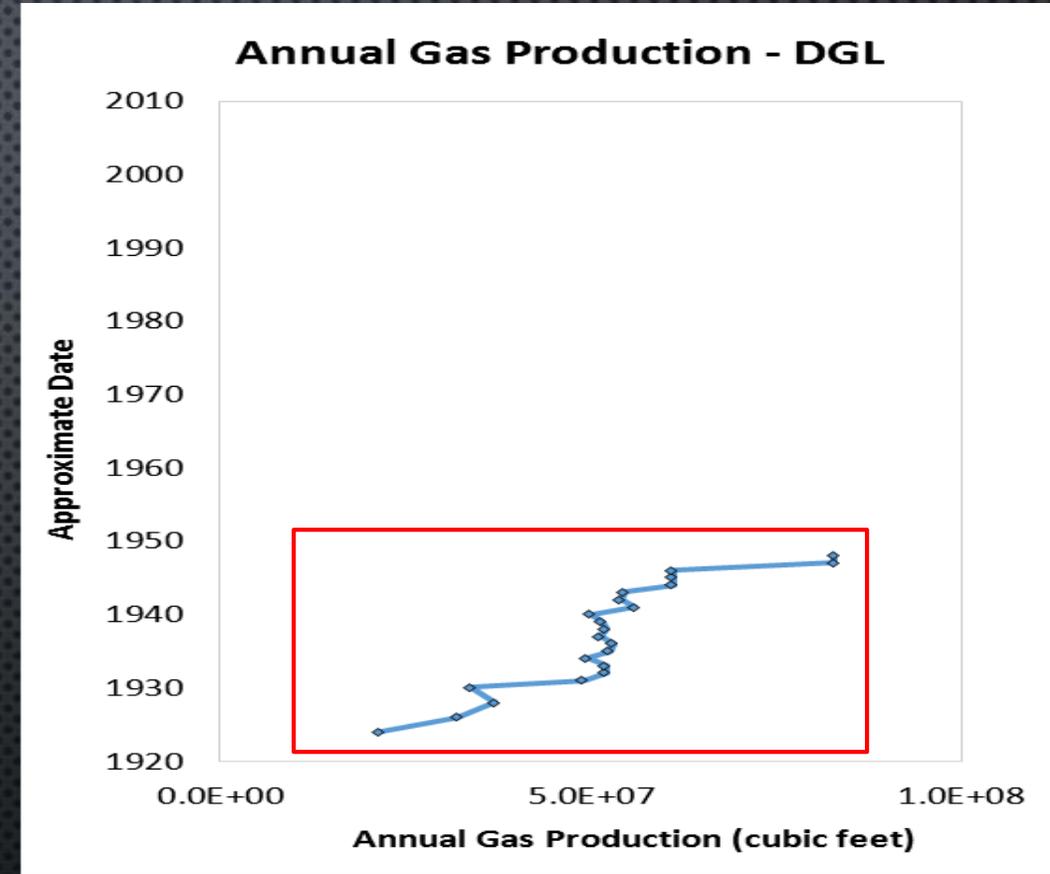
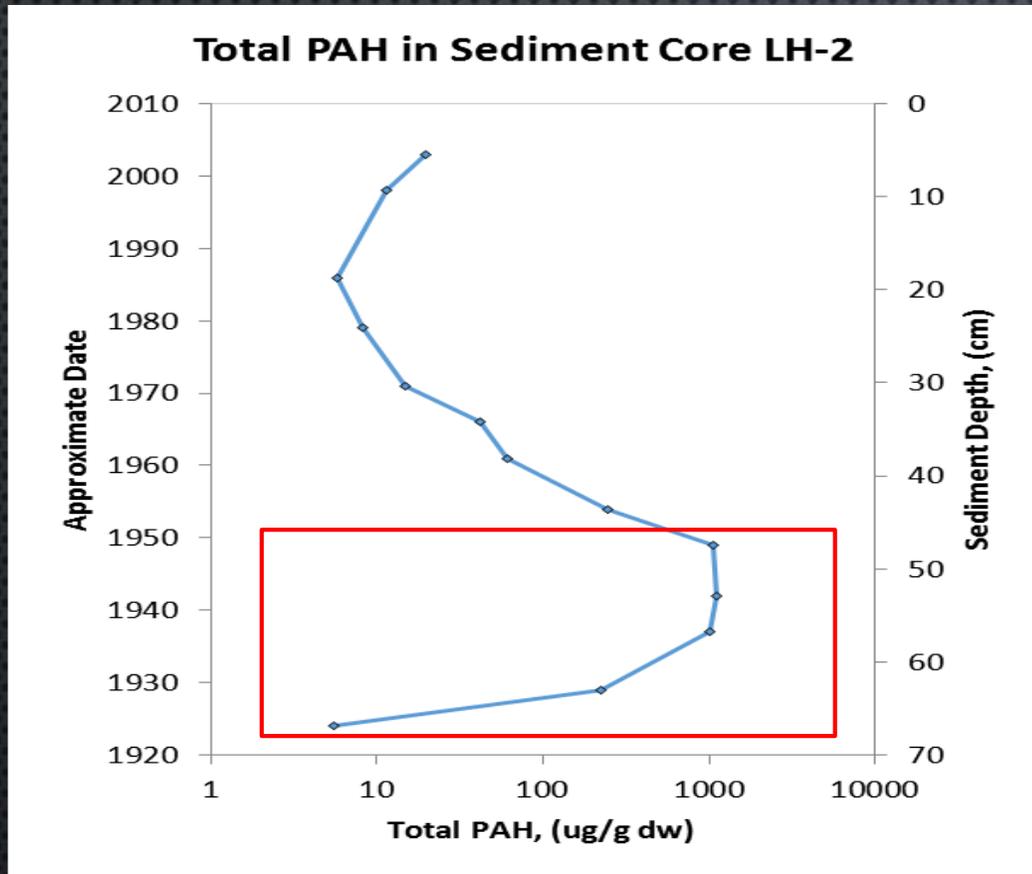
- **Watershed Scale:** surface water, surface sediment, and fish tissue samples collected throughout the watershed in 2013
- **Spatial Targeting:** focused on 0.75 mi., 10 acre reach between Court St and Rt 13, plus the Tar Ditch drainage. Specialized testing used to characterize distribution, bioavailability, bioaccumulation and toxicity in 2015/2016
- **Temporal Trends:** considered through radiodated sediment cores
- **Integration:** Multiple lines of evidence used to characterize impact, source(s), and restoration potential

# SOURCE REVEALED IN DEEP CORE



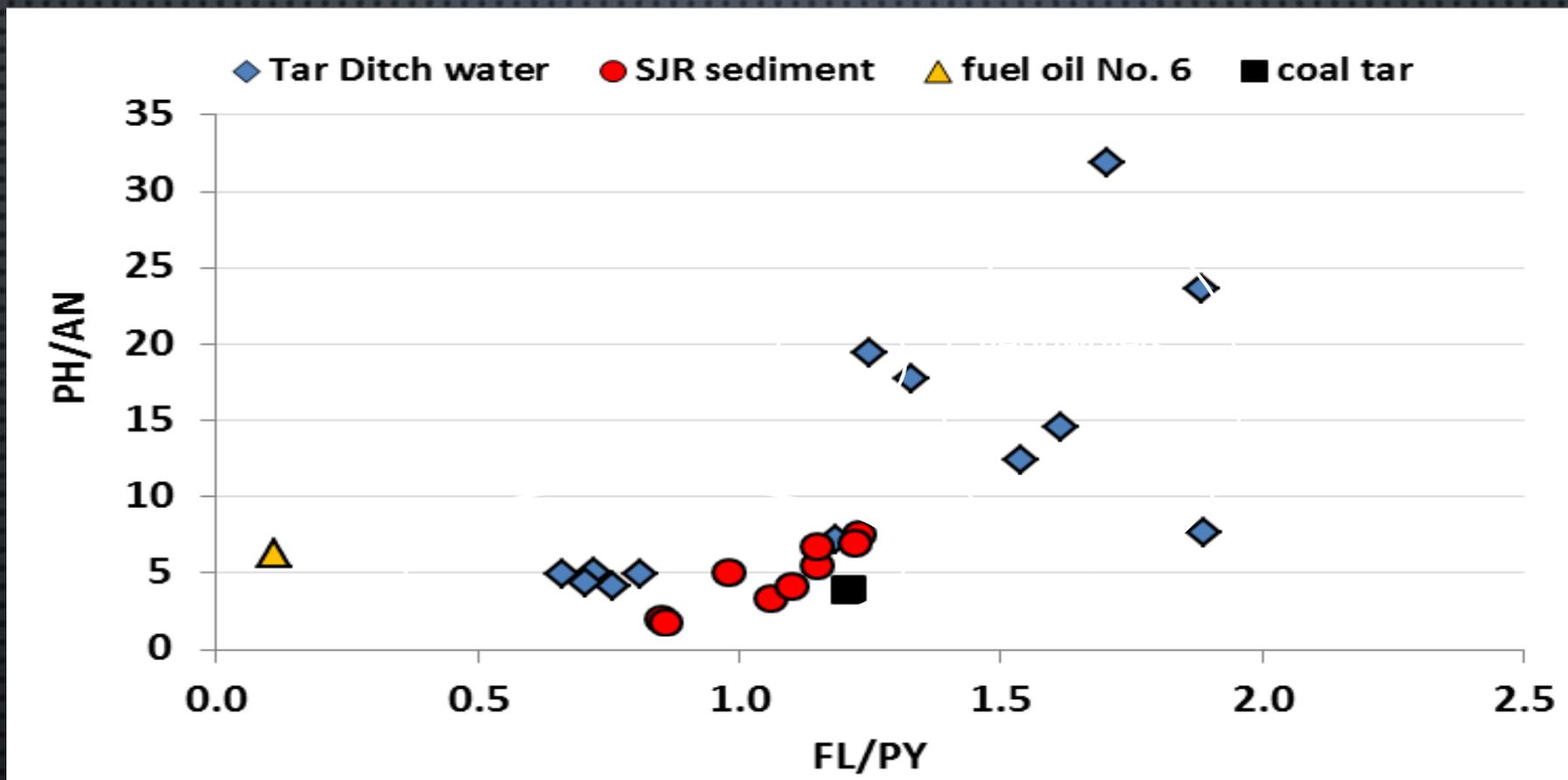
- UD and ANSP collected deep sediment cores from the SJR just upstream of Tar Ditch in 2003.
- Slices radiodated to determine depth-age relationship & sedimentation rate.
- Slices also analyzed for contaminants, including PAHs, to determine “pollution history”.
- Downcore PAH profile compared to gas production log of the DGL MGP.

# CHRONOLOGY MATCHES



- DGL operated 1859 – 1948. Tar Ditch went “underground” 1927 – 1934.
- Rapid increase in PAH in St Jones sediments mid-1920s followed by decline ~1950 tracks gas production at DGL.
- Max Total PAH ~1,000 ppm at a depth of 50 – 60 cm (1.5 - 2 ft)

# AND MORE ... SOURCE RATIOS



- Diagnostic PAH source ratios calculated & compared between SJR sediments, Tar Ditch samples, coal tar and No. 6 fuel oil.
- Clusters evident. Seds & lower TD stations have coal tar signature.

# INTEGRATION/SUMMARY OF FINDINGS

- PAH impacts in SJR confirmed in area between Court St and Rt 13.
- Impact in surface sediments & water column primarily due to legacy contamination in deeper sediments that diffuse upward. Deep sediments are “hot”.
- Original source was DGL plant and transport pathway was Tar Ditch.
- Watershed sources have been evaluated & are largely controlled. Still a few coal tar hotspots in Tar Ditch drainage area that deserve a second look.
- The SJR between Court St and Rt 13 should be considered for sediment remediation.

# **PART 2 - QUESTION & ANSWER BREAK**

# **PART 3**

**THE NEXT 5 YEARS . . .**

# NEXT 5 YEAR PLAN (2017-2021)

- Prepare Work Plan for next 5 years, to include:
  - *Chesapeake Bay drainage monitoring*
  - *Revisit AOCs identified in first 5 years to pinpoint sources*
  - *Choose long-term surveillance stations to support trend assessment*
  - *Consider adding several emerging contaminants to mix*
- Complete interpretive data report(s) for 2013-2016 efforts
- Continue to implement Delaware Estuary PCB TMDL
  - *Coordinate on PMPs (point sources and MS4s)*
  - *Monitor loads at head of tide to document progress*

# NEXT 5 YEAR PLAN (2017-2021)

- By the end of 2017, re-evaluate existing 303(d) listed segments for possible delisting, monitored natural recovery (MNR), or TMDL
- Evaluate/advance various sediment cleanups:
  - *Amtrak Former Fueling Facility In-situ Sediment Stabilization (ISS)*
  - *A Street Ditch/Walnut Street Shoal*
  - *Saint Jones River, Court Street to Route 13*
  - *Red Lion Creek adjacent to Standard Chlorine Delaware*
  - *Shellpot Creek*
- Increase effort on Delaware Sediment Guidance development

# NEXT 5 YEAR PLAN (2017-2021)

- Explore/Expand Collaboration
  - *Delaware Environmental Institute (DENIN) – EPSCOR*
  - *Delaware National Estuarine Research Reserve (DNERR)*
- Explore new funding opportunities
  - *Incorporate select WATAR projects into Water Pollution Control revolving loan program (e.g., NVF-Yorklyn first example)*
  - *Clean Water for Delaware's Future; Task Force on Flooding & Water Quality*
  - *William Penn Foundation*
  - *Christina Conservancy*
- Executive Order 41 – Prepare for Sea Level Rise

# NEXT 5 YEAR PLAN (2017-2021)

- Develop Delaware specific bioaccumulation metrics (BAF/BSAF)
- Publish findings. Examples:
  - *Mirror Lake*
  - *Black carbon measurements in water column & sediment and role in partitioning*
  - *Simultaneous measurements in surface water, sediment and fish (therefore, BAFs & BSAFs). Unique dataset regionally and nationally.*
- Refine database and usage
- Learn/Adapt/Grow/Provide Meaningful Insight

# **PART 3 - QUESTION & ANSWER BREAK**

# CONTACT INFORMATION

[HTTP://WWW.DNREC.DELAWARE.GOV/DWHS/SIRB/PAGES/WATAR.ASPX](http://www.dnrec.delaware.gov/dwhs/sirb/pages/watar.aspx)

Richard Greene  
DNREC- Division of Watershed Stewardship  
Watershed Assessment & Management Section  
[Richard.Greene@state.de.us](mailto:Richard.Greene@state.de.us)  
302-739-9939

John G. Cargill, IV  
DNREC- Division of Waste and Hazardous Substances  
Site Investigation and Restoration Section & Division  
of Watershed Stewardship  
[John.Cargill@state.de.us](mailto:John.Cargill@state.de.us)  
302-395-2600

Todd Keyser  
DNREC- Division of Waste and Hazardous Substances  
Director's Office  
[Todd.Keyser@state.de.us](mailto:Todd.Keyser@state.de.us)  
302-395-2600

# ACKNOWLEDGEMENT - GIS MAPPING

Kathryn Durant  
DNREC- Division of Waste and Hazardous Substances  
Site Investigation and Restoration Section  
[Kathryn.Durant@state.de.us](mailto:Kathryn.Durant@state.de.us)  
302-395-2600