



2021 Progress Report

Watershed Approach to Toxics Assessment and Restoration (WATAR) Program

Delaware Department of Natural Resources and Environmental Control (DNREC)

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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/remediation 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 other users of Delaware’s natural resources, 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 are intended to be used to document progress toward implementing Total Maximum Daily Loads (TMDLs) for PCBs and other toxic compounds in the Delaware Estuary and its tributaries. The data and information collected will also be used to identify other contaminants that may need TMDLs, Alternative Restoration Plans, or other clean up actions in order to restore water quality.

The second WATAR 5-year work plan (2018-2022) identifies eight (8) specific activities for 2021. Those 8 activities are listed below with a status report on each. In addition to the 8 items, there were numerous additional activities that have been ongoing, and for which updates are provided. Last, there were a few new items which arose during 2021 in which the WATAR team became involved. All of these items and activities are presented in this progress report.

As was noted in the WATAR 2018 Progress Report, Dr. Richard Greene retired from the State of Delaware’s DNREC (in April 2018). Dr. Greene managed many aspects of the WATAR program, and his depth of knowledge about Delaware’s surface waters and Delaware’s fish advisory program will be missed. To date, Dr. Greene’s position within the Watershed Assessment and Management Section of DNREC has not been filled. Until such time that the position is filled, and the incumbent is “brought up to speed” on WATAR related issues and projects, there may be a slight delay in the completion of some planned activities. This is not to say that the items won’t be addressed; only that some lower priority items will be pushed further down the 5-year schedule(s) of planned activities. WATAR Progress Reports, including this report, will serve to document items that have been put on hold, or cancelled altogether, with accompanying rationale. In the interim, the WATAR team has expanded to include staff from multiple programs across the Department that had previously not been formally acknowledged. The effort of staff in these other DNREC programs has assisted with the “cultural” change towards adoption of WATAR program principles across the Department.

Finally, COVID-19 work restrictions (office and field) began for DNREC on March 13, 2020. As a result, certain planned activities were not able to be completed. Restrictions were partially lifted in the summer and fall of 2021, which allowed the WATAR team to “catch up” on some activities that were not able to be completed in 2020. COVID-19 restrictions were again put in place during the winter of 2021 due to the surge of a particularly transmissive virus variant.

Items below are listed in the 2018-2022 five-year plan for calendar year 2021:

- 1. Collect consumption advisory follow-up fish tissue samples from the following watersheds:
Christina Basin and Shellpot Creek
Status: Complete**

Discussion: Fish tissue collection occurred in the Appoquinimink River, Army Creek, Christina Basin and Shellpot Creek between July 21 and November 18, 2021. This effort represents two years of watershed sampling due to last year's COVID related postponements. Samples are being processed by DNREC-Environmental Laboratory Section (ELS) and will be shipped to a subcontract laboratory for chemical analysis in April/May 2022. In total, 38 composited fish tissue samples and several quality assurance samples will be analyzed for PCBs, dioxins/furans, alkylated PAHs, organochlorine pesticides, methylmercury, PFAS by 537M DNREC REM (see Appendix A), and percent lipids. The distribution of composited fish tissue samples included two (2) from Army Creek, twelve (12) from the Appoquinimink River Watershed, three (3) from the Brandywine River, eight (8) from the Christina River Watershed, three (3) from Red Clay Creek, five (5) from White Clay Creek, and five (5) from Shellpot Creek. Once received from the subcontract laboratory, data will be used to track contaminant trends, to inform Delaware's 303(d) list, and to assess/modify fish consumption advisories.

2. Collect "head of tide" surface water samples for the Christina Basin and Shellpot Creek to track progress toward DRBC PCB TMDL (target 1 dry and 1 wet event).

Status: On Hold

Discussion: Initially, this sampling would have been conducted alongside fish tissue collection in the fall of 2021. However, prior to planning field exercises for the 2019 sampling, the WATAR team contacted the Delaware River Basin Commission (DRBC) to discuss sampling protocols and data quality objectives for the 'head of tide' samples. The DRBC recommended that Delaware hold off on the sampling until after the Stage II PCB TMDL was adopted. Further, the DRBC said that they, themselves, were conducting 'head of tide' PCB sampling in different Delaware River watersheds on a rotating basis. As a result, DNREC and WATAR have put this multi-year effort on hold until a later date and have instead focused on other emerging issues (e.g. PFAS). DRBC has assured DNREC that data will be shared to supplement WATAR efforts, as they are conducted.

3. Shellpot Creek Area(s) of Concern sampling (focus on sediments)

Status: On Hold

Discussion: As COVID related restrictions became less of a limiting factor in 2021, competing priorities for the WATAR team member's time and expertise has resulted in the postponement of Shellpot Creek sediment source trackback studies in 2021. These activities will simply be postponed until a later date and will be better informed by up-to-date fish tissue data (from the 2021 sampling described in item #1 above). In addition, DNREC and USEPA are close to finalizing a cleanup plan for the Amtrak-Wilmington Shops site, which directly discharges to the Shellpot Creek, and is known to have PCB impacts that need to be remediated. Trackback efforts in Shellpot Creek may be postponed until after cleanup activities are completed at the Amtrak site.

4. Continue work on Christina River remediation initiative

Status: Ongoing

Discussion: In August 2020, the WATAR team secured funding through a State of Delaware Bond Bill allocation to initiate a sediment remediation feasibility study process for portions of the tidal Christina and tidal Brandywine Rivers. A proposal was requested and received from Brightfields, Inc, (<https://www.brightfieldsinc.com/>) who partnered with AnchorQEA

(<https://www.anchorqea.com/>) on the project. Three tasks were fully funded by the State of Delaware (including funds from Delaware Coastal Programs), including compilation of existing data and information, development of a conceptual site model, and identification of data gaps. A summary report of the three tasks is anticipated in Spring 2022. Additional tasks, yet to be funded, will include sampling to fill data gaps, development of remedial alternatives, comparison of alternatives and costs, and recommendation of a preferred alternative.

The feasibility study is part of a larger initiative called the Christina & Brandywine River Remediation Restoration and Resilience project, or CBR4. The DNREC WATAR team has partnered with DNREC Coastal Programs, Christina Conservancy, American Rivers, Brightfields, Inc., and others to develop conceptual plans for restoration and resilience projects within the project area, and to help involve the surrounding urban communities in the process. More details regarding the CBR4 Project are included below.

5. Continue to provide technical assistance to the City of Wilmington and New Castle County Special Services on the City's PCB trackback and implementation, and coordinate with DRBC

Status: Ongoing

Discussion: In an ongoing fashion, the WATAR team has worked with the City of Wilmington and New Castle County as well as the DRBC to better understand, isolate and control sources of PCBs in the City and County's sewer system, which flows to the City's 100 MGD regional wastewater treatment plant. Effluent from the plant, in turn, discharges to the Delaware River. Through source identification studies and subsequent remedial actions, the City of Wilmington has achieved an approximate 90% reduction of PCB loading from their wastewater treatment plant effluent.

The WATAR team continues to offer technical assistance, as necessary, and reviews annual pollution minimization reports when submitted to DNREC and DRBC. The WATAR team has focused efforts on Matson Run, a tributary to Shellpot Creek. As determined through multiple investigations, PCBs are present in Matson Run surface water and in the City's sanitary sewer in the area. Matson Run has also been the location of several DNREC Emergency Responses over the past decade related to the presence of oil sheen and on surface water. The City of Wilmington, its contractors and DNREC collaborated during 2021 to initiate a robust trackback sampling, source identification and survey. In Spring 2022, the WATAR team will take the lead on extensive sampling in surface water combined with an unmanned aerial vehicle (UAV) survey of Matson Run in an attempt to narrow down a source.

Additionally, the individual NPDES permit for the City of Wilmington's wastewater treatment plant and Combined Sewer System (CSS) requires a pollutant minimization plan for PCBs throughout the CSS. An updated permit will be issued in 2022 which will require continuation of Pollution Minimization Plan (PMP) activities for PCBs.

6. Provide technical assistance to New Castle County Special Services and DeDOT on their MS4 PCB PMP trackback and implementation, and coordinate with the DRBC

Status: Ongoing

Discussion: The WATAR team has previously worked with New Castle County Special Services and the Delaware Department of Transportation in the design and implementation of a sampling plan for analysis of PCBs in regulated stormwater discharges. This work was purposefully designed to complement sampling of receiving waters performed by the WATAR team within watersheds known to be impacted by PCBs. Results of the sampling events are reported to DNREC and DRBC as required by their MS4 permits. In 2021, the WATAR team continued its efforts to improve source tracking of PCBs to the Delaware River by assisting DNREC’s MS4 group with reviewing trackback studies and corrective actions to mitigate larger stormwater PCB loads in impacted waterways as required by the Phase I NPDES permit. The Phase I permit covers New Castle County, Wilmington and 5 smaller municipalities. A new Phase I permit that will build upon the PCB trackback and mitigation work, and that will be in synch with Phase II general permits, is scheduled for issuance in 2022.

7. Tech Transfer: DNREC Leadership & Staff, DNERR, USEPA, ASTWSMO, ITRC, DENIN, etc.

Status: Ongoing

Discussion: An original goal of the WATAR program was to communicate and partner with others within and outside of DNREC to raise awareness and identify synergies leading to accelerated improvement of water quality in Delaware. Due to its success, the WATAR team continues to accomplish that goal by making presentations at local, regional, and national meetings; preparing videos highlighting various projects; and preparing annual reports describing work accomplished. The WATAR approach has been noticed and sought out by government agencies at all levels; non-governmental organizations (NGOs) such as the Partnership for the Delaware Estuary, the Delaware Nature Society, the William Penn Foundation, the Christina Conservancy, American Rivers, Collaborate Northeast and the Center for the Inland Bays; academia and the private sector. Specific presentations given in 2021 are listed below. In addition, but 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 its overall plan.

8. Progress Report

Status: Completed

Discussion: This document represents the Progress Report for 2021.

Ongoing/Unfinished Work from Previous Years: Since the initiation of the WATAR program in 2012, priorities and specific project momentum have shifted from time to time. The following section summarizes some of the projects that are important to the program, but that were either ‘On Hold’ or ‘Ongoing’ in previous progress reports and that have an update since the last year’s report.

For Delaware watersheds that flow towards the Chesapeake Bay, create a priority list of potential actions to address sources of toxics in need of follow-up investigation, clean-up and/or restoration
Status: Ongoing

Discussion: As was summarized in detail in the 2018 Annual Report, the DNREC-WATAR team collected sediment, water, and fish samples from Delaware's Chesapeake Bay watersheds in 2017 and 2018. At this time, DNREC is working with a contractor to compile a WATAR-Chesapeake Drainage data summary report. Completion of the report is expected by Summer 2022. Once completed, the report will be submitted to the USEPA Chesapeake Bay Program.

Two priority actions based upon the data collected in 2017 and 2018 have been initiated, however. Fish tissue data evaluation showed two potential areas of concern in Delaware's Chesapeake Bay drainages. Specifically, PCB concentrations from composite samples of blue catfish from the Nanticoke River in 2017 were above Delaware's fish tissue screening value. In addition, methylmercury concentrations from composite samples of largemouth bass from the Marshyhope Creek in 2017 were above Delaware's fish tissue screening value. WATAR team members from WAMS and F&W were able to safely collect largemouth bass samples for individual analysis from the Marshyhope Creek in the fall of 2020. Analysis of the data in 2021 showed that there is no need to issue fish consumption advice based upon mercury in the Marshyhope Creek. In addition, and in cooperation with USGS, DNREC was able to obtain portions of blue catfish for PCB analysis from a separate study being conducted by the USGS in the Nanticoke River. Samples were processed and transported a subcontract laboratory for analysis in early 2022.

A-Street Ditch /Christina River Pilot Study (Sedimite™ with inoculant)

Status: Ongoing

Discussion: As was reported in the 2018 WATAR Annual Report, funding for the innovative PCB destroying technology was awarded by DNREC-RS in June 2018. Per the DNREC approved workplan, baseline sampling of sediments using traditional techniques and more innovative passive sampling techniques (time integrated) was conducted in April/May 2019. Application of the inoculated Sedimite™ was conducted in June 2019. A USEPA Multipurpose Grant was awarded to the DNREC WATAR program to help fund sampling, analysis and reporting of samples collected in November/December 2019, and June/July 2020. DNREC-RS funding was again used to collect monitoring samples in June/July 2021 (two-years post remedy).

Results of DNREC's July 2021 sampling of the A-Street Ditch continue to show an overall reduction (average of 50% reduction at all sample sites) in total PCB concentrations across the project area, indicating that the micro-organisms are doing their intended job of reducing PCB mass. Dissolved PCBs in the sediment porewater remain lower than pre-test conditions at two of the three sampling sites, as well, indicating that the carbon continues to affect the bioavailability of PCBs in the sediment. However, some rebound appears to be occurring. The rebound is likely the result of both upstream (temporary) and downstream PCB influences. Anomalies in the data seen during the July 2020 sampling appear to have been the result of heterogeneous distributions of PCBs and/or inadvertent sampling within and erosional feature at the site. DNREC is planning to assess PCB concentrations in sediment, surface water and sediment porewater one final time in July 2022. However, the technology has already shown its promise for use in a larger scale in this area of the Christina River. Visit the [DNREC-WATAR webpage](#) for monitoring reports and a DNREC YouTube video about the [A-Street Ditch project](#).

Continue evaluation of Delaware specific bioaccumulation factors (BAFs) and biota sediment accumulation factors (BSAFs)

Status: On-Hold

Discussion: In 2016, the WATAR team reported that Delaware specific BAFs may be much lower than some of the BAFs used by USEPA to derive national recommended human health water quality criteria (specifically for B[a]P). This evaluation was based upon Delaware's unique set of WATAR data. Based on the strength of the analysis, EPA has agreed to consider a Delaware proposal to adopt Delaware-specific human health criteria using Delaware-specific BAFs. Draft BAF calculations were submitted to EPA Region 3 for discussion in the first quarter of 2021, and EPA responded with comments and questions about the calculations in March 2021. Due to setbacks related to the compilation of data and internal approval of DNREC's draft Triennial Review at the end of 2021, no additional progress has been made related to BAFs and BSAFs.

Coordinate with the DRBC and USEPA on Stage 2 PCB TMDL for Delaware Estuary

Status: Ongoing – No Changes in 2021

Discussion: In February 2020, EPA requested that basin states provide a formal determination as to whether they would support EPA finalizing the Stage II PCB TMDL, or whether they would complete the TMDL independently. DNREC requested that EPA provide the latest draft for review, which was received on May 14, 2020. A deadline of June 30, 2020 was requested for a response. The WATAR team took the lead in reviewing the document and coordinating comments between DNREC programs (Division of Water and Division of Watershed Stewardship). In addition, the WATAR team took the lead in coordinating a conversation between appropriate basin state staffers to ensure that each jurisdiction was aware of each other's concerns. Due to the complexity of the document, DNREC requested, and was granted, a 30-day extension to the June 30 deadline for response. DNREC's final letter supporting the finalization of the Draft Stage II PCB TMDL, with considerations, was submitted to EPA on July 22, 2020.

Christina and Brandywine River Remediation, Restoration and Resilience (CBR4)

Status: Ongoing

Discussion: Beginning in 2017, DNREC's WATAR team coordinated with the Christina Conservancy to scope a high-resolution bathymetric survey of the lower Christina River and lower Brandywine Creek, where previous sampling of sediment, water and fish tissue has shown the most impact from chemical contaminants. The survey was completed in 2018 and will serve as a baseline for other programs and partners to overlay data and restoration plans.

Following completion of the bathymetric survey in 2018, DNREC's WATAR team co-sponsored a kickoff symposium for the long-term initiative to clean up the Lower Christina River and Lower Brandywine River in September 2019. The initiative, dubbed CBR4 (Christina/Brandywine River Remediation, Restoration and Resilience), aims to leverage public and private dollars in a concerted effort to reduce chemical and nutrient loading to the rivers, along with preparations for sea level rise in this commercially and recreationally used portion of New Castle County. DNREC's WATAR team is leading the effort for the remedial portion of the project by planning a feasibility study of remedial technologies to understand the costs and timing requirements needed for success. Details about the feasibility study portion of the project are highlighted in item #4 above.

Delaware's Christina Conservancy and American Rivers were awarded a two-year NFWF grant in 2020 for resilience and restoration planning in the project area. The WATAR team is a primary partner in restoration and resilience planning efforts, as well. The DNREC Division of Climate, Coastal and Energy have assumed a prominent role in organization, planning and communication for the CBR4 vision that will undoubtedly take years to implement. Funding through grants administered by the Delaware Coastal Programs has jump-started the effort to create a sustainable project with a multitude of partners. Planning activities, including monthly project team meetings, continued throughout 2021.

Coordinate with the City of Wilmington on the A-Street Ditch and South Wilmington Wetlands Project remediation.

Status: Ongoing

Discussion: The City of Wilmington began the construction phase of the South Wilmington Wetland remediation and restoration project in Summer 2019. Construction was ongoing through 2020, and inoculated Sedimite™ application in the west side of the A-Street Ditch occurred in July 2020. In addition, cleanout of stormwater system piping beneath Walnut Street and conduits beneath A-Street occurred in May and June 2020, respectively. Due to COVID related restrictions and weather delays, the remediation and restoration of the South Wilmington Wetland site wasn't completed until the summer of 2021. CSO separation within the project area is still ongoing. This project, when combined with other remedial projects conducted in the area, will have a positive impact on water quality (including PCBs) in this area of the Christina River. The DNREC-RS project oversight manager is also a WATAR team member.

Interface between WATAR Team and Delaware's Toxics in Biota Committee (Fish Advisories)

Status: Ongoing

Discussion: The WATAR team, in accordance with its 5-year plans, collects fish tissue samples mainly from 303(d) toxics-listed Delaware watersheds. The Delaware Toxics in Biota Committee, led by a WATAR team member, 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. Sampling of fish in Army Creek and the Appoquinimink River were postponed due to COVID related restrictions in 2020. However, sampling of fish in Delaware's portion of the Marshyhope Creek and Nanticoke Rivers was conducted in 2020. Sampling of fish in Army Creek, the Appoquinimink River, the Christina Basin and Shellpot Creek was successfully conducted between August and November 2021.

Little Mill Creek/Meco Ditch post-remediation sampling - Meco Pipe

Status: Ongoing

Discussion: 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. Monitoring of the success of the project was planned for 2017, but the team did not complete the task due to inclement weather and extreme temperatures along with a discovery of a low volume leak of oil from a subsurface stormwater pipe.

In early spring 2020, DNREC-RS completed a pipe replacement project to mitigate the leak of oil at the Meco Drive site before being able to issue a Certificate of Completion of Remedy (COCR). The DNREC-RS project oversight manager is also a WATAR team member.

In November 2021, the WATAR team completed surface water and sediment sampling of Little Mill Creek for PCBs and PAHs to determine the success of the overall remedial action and the flood risk mitigation project along with assessing the ongoing impact of other sources of PCBs in close proximity to the Meco Drive site. Those data were received at the beginning of 2022 and are currently being assessed by the WATAR team.

Red Clay Creek zinc TMDL/NVF Yorklyn post-remediation monitoring

Status: Long Term Monitoring

Discussion: During the summer/fall of 2017, DNREC-RS completed a comprehensive source removal action at the NVF-Yorklyn site that resulted in the removal and disposal of approximately 170 tons of zinc from the soil. This soil source served as an ongoing groundwater source, which for almost a decade was captured to remove dissolved zinc prior to reaching the Red Clay Creek. In December 2017, and as part of the post-remediation monitoring, the zinc groundwater treatment system was taken offline. The Red Clay Creek was monitored monthly through 2018 to evaluate the effectiveness of source removal on loading of dissolved zinc through groundwater discharge. Regular monitoring of zinc in Red Clay Creek has been ongoing since 2019 through Delaware's statewide network sampling. There have been no exceedances of the zinc water quality criterion observed since the treatment system was taken offline. The next step, albeit a low priority currently, is to formally document the monitoring results and take the necessary steps to delist zinc as a contaminant-of-concern in the Red Clay Creek in Delaware. The DNREC-RS project oversight manager is also a WATAR team member.

Red Clay Creek per- and polyfluorinated substances (PFAS) investigation

Status: Ongoing

Discussion: The WATAR team completed several rounds of sampling for per- and poly-fluorinated substances (PFAS) in Red Clay Creek in New Castle County in 2019. Following multiple detections and models regarding potential sources, the WATAR team conducted surface water sampling in the lower Red Clay Creek below Kirkwood Highway (Route 2). Data analysis has not been able to determine where the PFAS impact(s) to the tributaries of the Red Clay Creek are originating. However, a facility located along the main stem of the Red Clay Creek is currently negotiating a Voluntary Cleanup Program (VCP) agreement with DNREC-RS to conduct PFAS related remedial actions. The primary transport pathway for PFAS at this facility was through stack emissions.

A resampling of lower Red Clay Creek and tributaries has been funded and is being planned for Spring 2022. The determination and mitigation of the source or sources of PFAS to the Red Clay Creek is critical as this water body is used for drinking water in New Castle County. Results of this sampling will be summarized in the 2022 WATAR Progress Report.

Coordinate with EPA on Saint Jones River Sediment Assessment and Potential Remediation (associated with former Dover Gas Light site)

Status: In USEPA Control – No Changes in 2021

Discussion: DNREC personnel met with USEPA’s Environmental Response Team (ERT) and R3 personnel in May 2018 to discuss findings from their independent assessment of PAHs in sediments of the Saint Jones River in the area of interest. At that meeting, DNREC identified a potential mathematical error in USEPA’s evaluation, which was later confirmed, and which changed the overall evaluation results and potential steps forward. DNREC received a final report in 2019 which summarized the field activities and evaluated data collected at the site. The conclusion was that a layer of coal tar related to the Dover Gas Light site exists beneath the sediments in the Saint Jones River in proximity to the former Tar Ditch (Meetinghouse Branch). Concentrations in sediments are causing impacts to benthic aquatic life in the Saint Jones River, and the full downstream extent of the PAH contaminated layer was not determined. Because the Dover Gas Light site is on the National Priorities List and cleanup is under the control of the USEPA (all responsible parties settled years ago), it is up to them to determine next steps.

DNREC’s WATAR team last contacted EPA about assessment activities in the river in September 2020. EPA indicated to DNREC that a new Remedial Project Manager was being assigned to the Dover Gas Light Site (Chris Vallone), and that the Saint Jones River sediments were “not a closed issue for EPA.” The email indicated that EPA would be moving forward with a Baseline Ecological Risk Assessment (BERA) in the future. No indication of schedule was provided.

Continue data compilation and summary for 2013 – 2017 WATAR sampling

Status: On Hold – To Be Incorporated Into Future Alternative Restoration Plan Reports

Discussion: Due to the retirement of key personnel in early 2018, reorganization of the Site Investigation and Restoration Section into the Remediation Section in 2019 and redistribution of tasks outlined in the WATAR workplan, this action item has not been a high priority.

As described in greater detail below, DNREC is working with USEPA on a TMDL Alternative/Alternative Restoration Plan (ARP) framework for toxic compounds, which could be applied to any contaminant in any watershed. It is now envisioned that data collected by the WATAR team between 2012 and 2016 will be used along with historic and newer data to show that DNREC has achieved/is achieving significant reductions in listed compounds. Ongoing areas of concern (AOCs) will be noted along with known or suspected sources (both point sources and non-point sources). Results from WATAR sampling conducted in 2017 and 2018 in Delaware’s Chesapeake Basin drainages are currently being summarized in a separate report to be submitted to USEPA’s Chesapeake Bay Program upon completion. In the interim, WATAR data are stored in the State of Delaware Environmental Quality Information System (EQuIS) for assessment and reporting.

Continue data compilation

Status: Ongoing

Discussion: As of December 31, 2021, all WATAR data reported during calendar year 2020 was successfully entered into the EQuIS database. Further, data collected at other sites where the high-

resolution WATAR sampling approach was followed have been imported into EQUiS as part of the overall data compilation effort (e.g., sediment data from dredging evaluations).

Roll out pilot web-based mapping utility

Status: Ongoing

Discussion: DNREC and the WATAR team have explored several options for a sustainable approach to a web-based data mapping utility. No progress was made in 2021 on determining which platform to use, what to depict, what context to provide and who would maintain the platform. Several strategic hires were made at the end of 2021, and are anticipated into 2022, that will ultimately provide more robust, in-house data management capabilities and a renewed commitment to sharing useful data. This effort does not wholly focus on the work of WATAR, but instead incorporates WATAR data along with other sources to better depict all the potential or ongoing impacts to soil, water, groundwater, sediment and air. WATAR will report on the progress being made in 2022.

Other significant activities of the WATAR team during 2021: The items below are summaries of projects/initiatives that were unplanned during preparation of the WATAR 5-Year Plan (2018-2022), but for which the WATAR team has become involved.

PFAS Team and Steering Committee:

Status: Ongoing

Discussion: Staff from multiple Departments in the State of Delaware began meeting in 2020 to coordinate efforts related to PFAS. Staff have formed a PFAS team to report on investigations and responses and a PFAS Steering Committee to focus the efforts of the team. Meetings are held on an as-needed basis and membership is voluntary. The team is a forum for sharing training and education opportunities, as well as sampling results, analysis, and data interpretation. Several WATAR team members participate in the PFAS team and Steering Committee. Meetings continued throughout 2021.

Further, two WATAR team members are at the forefront of Delaware's efforts to identify the type and extent of PFAS contamination in Delaware in groundwater, surface water and fish tissue.

Groundwater/drinking water evaluations were initiated in 2021 and are ongoing. Planning for a statewide surface water sampling project were initiated in 2021, and analysis of fish tissue associated with DNREC's fish advisory program continued in 2021 for all watersheds described in item #1 above.

Alternative Restoration Plan Development

Status: Initiated and Ongoing

Discussion: In July 2021, DNREC and USEPA began a collaboration to develop an Alternative Restoration Plan (ARP) Framework (TMDL Alternative) and example for toxic contaminants. The ARP will be loosely based upon the DNREC WATAR Program, its activities, and its successes over the past decade. The project team chose the St. Jones River watershed as its pilot. Both DNREC and EPA team members worked through 2021 to collect data/background information for the pilot watershed, to compile contaminant trend information, and to develop an initial outline of the ARP document. Work is ongoing.

Port of Wilmington Expansion Project Permitting

Status: Ongoing

Discussion: Originally summarized under the heading **Dupont Edgemoor Dredging Data Review** in previous WATAR Progress Reports, primary data evaluation was completed in 2020. However, the DNREC WATAR team continues to be heavily involved with the project through coordination with DNREC's permitting group, USACE and DRBC on associated contaminant issues. DNREC issued its Subaqueous Lands Permit for the construction project in September 2021. The federal permitting processes are still in progress. The proposed primary disposal site for the 3.3 million cubic yards of sediment proposed for dredging is the Wilmington Harbor South (WHS) Confined Disposal Facility (CDF). WHS is located near the mouth of the Christina River along the Delaware River. Some of the dredge material will also be beneficially reused during upland port construction. The overall port expansion project represents the removal of a significant source of both land based and aquatic based PCBs and other compounds to the Delaware River and Estuary. It also presents challenges for monitoring of contaminants resulting from both the dredging itself and from dewatering of the dredge slurry and reintroduction of water back to the Delaware River. The WATAR team was instrumental in development of the Dredging Monitoring Plan for the project, as well as in development of both state and federal compensatory mitigation plans related to the port construction.

Delaware Dredging Framework Policy Guidance Update

Status: Initiated and Ongoing

Discussion: In September 2021, DNREC initiated a contract with AnchorQEA (<https://www.anchorqea.com/>) to provide technical support to DNREC's effort to update the state's dredging framework policy document that was created in 2001. Contracted efforts will include regional and national review of dredging project components, best management practices, and recommendations for a Delaware specific decision framework/process/protocol to assess and evaluate the chemical and physical quality of sediments proposed for dredging and disposition in the State of Delaware. The end product is intended to be a technically credible reference document to establish transparent expectations between DNREC (the permitting agency) and permit applicants regarding the information/data needed to obtain permits and how such information will be evaluated for decision making.

The project is being funded by DNREC's Division of Water, DNREC's Division of Watershed Stewardship, and DNREC's Division of Climate, Coastal and Energy. A WATAR team member is managing the project and will have influence on activities related to associated toxic contaminant associated assessment and monitoring requirements. It is anticipated that the contracted portion of the project will be completed in 2022.

Unregulated Dam Removals

Status: Ongoing

Discussion: Dam 2, 4 and 5 Brandywine & Dam 2 and 4 on White Clay Creek In early 2020, DNREC's WATAR team was contacted by University of Delaware (UD) to discuss potential requirements related to the removal of Dam #2 and Dam #4 in the White Clay Creek. UD was awarded a NFWF grant to assist in the removal process in September 2020. As a result, in November 2020 the WATAR team consulted on sampling requirements and shared data analysis techniques to assist UD with obtaining permits for dam removal. UD recently informed WATAR team members that a permit application was submitted to DNREC's Subaqueous Lands Section in December 2021 for removal of Dam #2. The permit application for Dam #4 will be submitted in early 2022.

Various Dredging Project Assessments

Status: Ongoing

Discussion: The WATAR team regularly assists multiple other DNREC programs in the preparation of sediment assessments or the review/evaluation of toxic contaminant data collected in relation to proposed dredging projects. These groups include the DNREC Wetland and Subaqueous Lands Section, Shoreline and Waterway Management Section and Coastal Program's Federal Consistency program. Evaluations of sediment toxicity were either initiated, or completed, for the following projects in 2021:

- PSEG Wind Port Project, NJ data analysis/review – 1/2021
- White Creek Sediment Assessment – Coordination with Contractor – 2/2021
- Delaware City Refining Company Permit Review – 4/2021
- Delaware City Branch Canal Sediment Assessment – 5/2021
- Delaware River – Port of Wilmington Expansion Assessment & Monitoring Coordination and Review – 6/2021
- Port of Wilmington Maintenance Dredging Permit Review – 6/2021
- New Castle County Water Farm No. 1 Sampling Proposal Review – 9/2021
- Assawoman Canal Assessment – 10/2021
- Indian River Marina – 10/2021

Review Remedial Investigation and Focused Feasibility Study for the Amtrak Wilmington Maintenance Facility

Status: Ongoing

Discussion: As agreed to by USEPA TSCA and DNREC-RS, the Former Fueling Facility Site and the Maintenance Facility Site (contiguous properties) will be brought to the same DNREC regulatory process point (Final Plan of Remedial Action) before any remedial action begins. The purpose of this decision is to allow for a global remedy to occur on both portions of the site simultaneously. This rationale will likely result in a more comprehensive remedy that is implemented in a shorter timeframe. As such, DNREC and USEPA TSCA received a Remedial Investigation and Focused Feasibility Study Report for the Maintenance Facility Site in April 2020. Although outside of the reporting period, but important nonetheless, USEPA TSCA and DNREC reviewed an addendum to the RIFFS in late 2021 and early 2022 and subsequently approved the document. DNREC prepared a Proposed Plan of Remedial Action for public review and comment in March 2022. The DNREC-RS project oversight manager is also a WATAR team member.

Review the Amtrak West Yards Remedial Investigation Report

Status: Ongoing

Discussion: DNREC received the Remedial Investigation (RI) Report in May 2019. RI Report comments were provided to Amtrak in late 2020, and comments were addressed by Amtrak in 2021. As noted above, in November 2021, the WATAR team collected samples of surface water and sediment samples from the hydraulically connected Little Mill Creek and adjacent tributaries. These data, once assessed, will be provided to Amtrak and their consultant.

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- RS through its Voluntary

Cleanup Program, similar to the other two Amtrak sites in Wilmington. 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. The DNREC-RS project oversight manager is also a WATAR team member.

Fish Advisory Sign Project

Status: Ongoing

Discussion: In early 2020, DNREC-RS staff and DNREC-WAMS staff began collecting information about locations of fish consumption advisory/swimming advisory signs across the state. An application was created for use on phones and/or tablets that allowed location information and photos to be uploaded as other field work was conducted in 303(d) listed water bodies. Although it will take some time to inventory all signs, the intent is to replace/update or remove signs that provide misinformation. COVID restrictions impacted field activities in 2021 and to some degree in 2021. This project will be revisited when conditions are favorable and when staff has time.

Economic Analysis of Impacts from Sea Level Rise

Status: Completed

Discussion: In late 2020, WATAR team members coordinated with DNREC Coastal Programs staff and contractors on their Economic Analysis of Impacts from sea level rise. Specifically, the WATAR team assisted with evaluation of costs related to the inundation of contaminated sites within the state. A final report, titled *Economic Analysis of the Impacts to Climate Change in Delaware*, was finalized in February 2021.

WATAR Related Presentations: Members of the WATAR team delivered the following presentations related to the program's activities during 2021:

- Cargill IV, J.G., 2021. Innovative Sediment Remediation Projects – Delaware DNREC-WATAR – Brown & Caldwell Risk Assessment and Sediments Communities of Practice Webinar, February 16, 2021.
- Cargill IV, J.G., Keyser, T.A., Thornton, K., CBR4 Project – Christina & Brandywine River Remediation, Restoration & Resilience, Division Directors Briefing, February 19, 2021.
- Cargill IV, J.G., and Young, M., 2021. Environmental Justice & Urban Waters: Wilmington Delaware Updates, ASTSWMO Mid-Year Meeting – CERCLA and Brownfields Session, April 8, 2021.
- Cargill and Keyser, 2021. Updated “What Is WATAR” video for DNREC-WATAR webpage – May 2021. Video now titled “WATAR 2021” <https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/watar/>
- Cargill IV, J.G, 2021. Head of Tide Sampling Discussion/Presentation – Chesapeake Bay Program Toxic Contaminant Workgroup, September 8, 2021
- Keyser, T.A., WATAR and CBR4, Osher Lifelong Learning Institute, November 12, 2021

Peer Reviewed Publications:

- Cargill, J.G., *More Than a Drink of WATAR* – Outdoor Delaware Online Magazine, Jan/Feb 2021
- Pletta, M., and Cargill, J.G., *WATAR you up to?* –Wetland Monitoring & Assessment Program Blog, May 2021

National Organization Involvement: WATAR team members played key roles in advancing watershed scale assessment and management of contaminated sediments nationally in 2021:

- Association of State and Territorial Solid Waste Management Officials (ASTSWMO) – WATAR team member Todd Keyser is the Chair of the ASTSWMO Investigation and Remedy Selection Focus Group. The focus of the team has been to foster collaboration, innovation and consistency amongst state agencies when determining regulation, policy and innovative approaches to contaminated media investigation, analysis and remediation. The team completed a climate change and resilience report at the end of 2021 that will soon be available on the ASTSWMO web page.
- Interstate Technology and Regulatory Council – WATAR team member John Cargill is a member of the Contaminated Sediments – Capping Update Team. The focus of the team is to update the Capping section of the 2014 ITRC Contaminated Sediments – Remediation Technical and Regulatory Guidance Document. New advances in sediment capping technologies and monitoring tools will be documented. The team was formed at the end of 2021 and will work through 2022 on the document.

Kudos related to WATAR work –

- **2021 Governor’s Team Excellence Award** for the Port of Wilmington Expansion Permitting Team. WATAR team members were involved as Agency experts to evaluate the potential for toxic contaminant impacts to aquatic life from the dredging of 3.3M cubic yards of sediment adjacent to the former DuPont Edgemoor industrial facility.

Grant Support for Innovative Research: Due to the innovative nature of much of the WATAR team’s work, DNREC was contacted to support several grant proposals in 2020:

- In February 2021, DNREC provided a letter of support to University of Maryland Baltimore County (UMBC) for a NIEHS Superfund Research Program Center grant proposal titled: *Reducing Exposure Pathways To Arsenic And Assessing Immune Response.*
- In February 2021, DNREC provided a letter of support to University of Delaware for a SERDP Grant proposal titled: *Elucidating And Modeling The Role Of Ion Pairs In Enhancing PFAS Bioconcentration In The Marine Environment.*

- In May 2021, DNREC provided a letter of support to University of Delaware for a Delaware Sea Grant proposal titled: *Investigating The Sources And Bioaccumulation Of Per- And Polyfluoroalkyl Substances (PFAS) In The Delaware Bay Food Web.*
- In June 2021, DNREC provided a letter of support to University of Delaware for a USGS WRRI Grant proposal titled: *Assessing The Distribution, Sources And Fate Of Per-And Polyfluorinated Alkyl Substances (PFAS) Across The Land-Sea Transition.*

Local and Regional Workgroup Involvement: WATAR team Members played participatory roles in advancing regional and local initiatives in 2021:

- DRBC Toxics Advisory Committee
- DRBC Co-Regulators Committee
- Chesapeake Bay Program Toxic Contaminants Workgroup
- Chesapeake Basin States PFAS Roundtable/Workgroup
- DENIN External Advisory Board (Delaware Environmental Institute – UD)
- DGS State Map Geologic Mapping Advisory Committee
- Delaware Environmental Monitoring Coordination Council

Visit the [DNREC-WATAR webpage](#) for past progress reports and for more detailed information on select projects.

APPENDIX A

537M DNREC REM Analyte List

537M DNREC REM PFAS Compound Analyte List as of May 2022

11Cl-PF3OUdS
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)
4:2 FTS
6:2 FTS
8:2 FTS
9Cl-PF3ONS
HFPO-DA (GenX)
NEtFOSAA
NFDHA
NMeFOSAA
Perfluorobutanesulfonic acid (PFBS)
Perfluorobutanoic acid (PFBA)
Perfluorodecanoic acid (PFDA)
Perfluorododecanoic acid (PFDoA)
Perfluoroheptanesulfonic Acid (PFHpS)
Perfluoroheptanoic acid (PFHpA)
Perfluorohexanesulfonic acid (PFHxS)
Perfluorohexanoic acid (PFHxA)
Perfluorononanoic acid (PFNA)
Perfluorooctanesulfonic acid (PFOS)
Perfluorooctanoic acid (PFOA)
Perfluoropentanesulfonic acid (PFPeS)
Perfluoropentanoic acid (PFPeA)
Perfluorotetradecanoic acid (PFTeA)
Perfluorotridecanoic acid (PFTrDA)
Perfluoroundecanoic acid (PFUnA)
PFEESA
PFMBA
PFMPA
5:3 FTCA
6:2 FTCA
6:2 FTUCA
Hydro-PS Acid
PFMOAA
PFO2HxA
PFO3OA
PPF Acid