Delaware River Basin Commission

Water Resources Program

FY 2020-2022

March 11, 2020

Authorization

The Delaware River Basin (DRB) Compact states:

The commission shall annually adopt a water resources program, based upon the comprehensive plan, consisting of the projects and facilities which the commission proposes to be undertaken by the commission and other authorized governmental and private agencies, organizations and persons during the ensuing six years or such other reasonably foreseeable period as the commission may determine. (§ 3.2 DRB Compact, 1961)

According to the Compact, "Project" shall mean any work, service or activity which is separately planned, financed, or identified by the commission, or any separate facility undertaken or to be undertaken within a specified area, for the conservation, utilization, control, development or management of water resources which can be established and utilized independently or as an addition to an existing facility, and can be considered as a separate entity for purposes of evaluation (§1.2.(g)).

Vision, Mission and Values

Vision:

The Delaware River Basin Commission (DRBC) will provide trusted, effective, and coordinated management of our shared water resources.

The vision of the Delaware River Basin Commission is built upon the Compact signed in 1961 by Delaware, New Jersey, New York, Pennsylvania, and the federal government. It is defined in the Delaware River Basin Compact as, "the conservation, utilization, development, management and control of water and related resources of the Delaware River Basin under a comprehensive multipurpose plan will bring the greatest benefits and produce the most efficient service in the public welfare."

Mission:

The DRBC will "develop and effectuate plans, policies and projects relating to the water resources of the Basin" through:

- Watershed-based planning and management
- Effective, efficient, and coordinated regulatory programs
- Policies and practices informed by science
- Collaboration with and among our state and federal signatory partners
- Adaptive and innovative water resource management
- Public education and outreach
- Public and stakeholder input
- Dedicated and engaged staff in a high performing workplace

To accomplish this mission, the Commission will continue to lead and collaborate with the signatory parties to: protect and improve water quality; manage river flows to meet diverse and at times conflicting Basin needs; reduce damage caused by floods; provide for the reasonable and sustainable development and use of surface and ground water; and promote water conservation and efficiency.

Values:

The DRBC will be guided in its mission by the following core values:

- Service: to the public, the regulated community and our DRBC colleagues.
- Respect: for each other, the public and the Basin's water resources.
- Professionalism: defined by high ethical standards, integrity, continuous improvement, and accountability.

Scope and Organization

The Water Resources Program (WRP) covers fiscal years (FY) 2020 through 2022 (July 1, 2019, through June 30, 2022) and is an element of strategic planning for DRBC program direction over the next three years. The architecture is based on the requirements of the Delaware River Basin Compact (Compact) and the goals of the Key Result Areas of the *Water Resources Plan for the Delaware River Basin* (Basin Plan 2004).

The Program is presented in two parts:

Section I: Conditions summarizes water resource conditions in the Basin, including hydrologic conditions, water use and sufficiency, overall assessment of water quality, landscape conditions, and emergent issues that could affect long-range water resource planning and management in the Basin.

Section II: Work Program notes the key issues that focus the Commission's programs and summarizes by Key Result Area the initiatives the Commission plans to undertake over the next three years.

List of Acronyms/Abbreviations

7Q10	7-day average, one-in-ten years
AA	Administrative Agreement
ACCC	Advisory Committee on Climate Change
ACWA	Association of Clean Water Administrators
AEMR	Annual Effluent Monitoring Report
AWRA	American Water Resources Association
AWWA	American Water Works Association
BG	billion gallons
C&D	Chesapeake and Delaware (Canal)
CA2	Critical Area 2
CaCO3	calcium carbonate
CBOD	carbonaceous biochemical oxygen demand
CCMP	Comprehensive Conservation and Management Plan
cfs	cubic feet per second
CWMS	Corps Water Management System
CY	calendar year
CZM	Coastal Zone Management
D & R	Delaware and Raritan
DGS	Delaware Geological Survey
DNREC	Delaware Department of Natural Resources and Environmental Control
DO	dissolved oxygen
DOC	dissolved organic carbon
DRB	Delaware River Basin
DRB-PST	Delaware River Basin Planning Support Tool
DRBC	Delaware River Basin Commission
DWCF	Delaware Watershed Conservation Fund
ECL	Environmental Conservation Law
EFDC	Environmental Fluid Dynamics Code
EIC	Estuary Implementation Committee
EPA	Environmental Protection Agency
EWQ	Existing Water Quality
EWS	Early Warning System
FAC	Flood Advisory Committee
FFMP	Flexible Flow Management Program
FY	fiscal year
GIS	Geographic Information System
GWPA	Groundwater Protected Area
HEC-HMS	Hydrologic Engineering Center - Hydrologic Modeling System
HUC	Hydrologic Unit Code
IBI	Index of Biological Integrity
ICWP	Interstate Council of Water Policy
IWA	International Water Association
IWAAs	Integrated Water Availability Assessments
LNG	liquefied natural gas
MACC	Monitoring Advisory and Coordination Committee
mg/L	milligrams per liter
MGD	million gallons per day
mi	mile
MLR	multiple linear regression
mm	millimeters
MWh	megawatt hour
NBOD	nitrogenous biological oxygen demand
NFWF	National Fish and Wildlife Foundation
NGWMN	National Ground-Water Monitoring Network
NJDEP	New Jersey Department of Environmental Protection
NJWSP	New Jersey Water Supply Plan
NOAA	National Oceanic and Atmospheric Administration
NOAA-CSC	National Oceanic and Atmospheric Administration - Coastal Services Center
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NWS	National Weather Service
NYC	New York City
NYSDEC	New York State Department of Environmental Conservation

PADEP	Pennsylvania Department of Environmental Protection
PAFBC	Pennsylvania Fish and Boat Commission
PAS	Planning Assistance to States
PCB	polychlorinated biphenyls
PFC	perfluorinated compound
PFAS	perfluoroalkyl and polyfluoroalkyl substances
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PMP	Pollution Minimization Plan
ppb	parts per billion
PPL	Pennsylvania Power and Light
PRM	Potomac-Raritan-Magothy (aquifer system)
PWS	Public Water Supply
RFAC	Regulated Flow Advisory Committee
REF-DSS Riverine	Environmental Flow Decision Support System
RFP	Request for Proposal
RSM	Regional Sediment Management
SAN	Schuylkill Action Network
SEF	Subcommittee on Ecological Flows
SEPA GWPA	Southeast Pennsylvania Groundwater Protected Area
SPW	Special Protection Waters
SRMP	Scenic Rivers Monitoring Program
STAC	Science and Technical Advisory Committee
TAC	Toxics Advisory Committee
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAUSP	Water Availability and Use Science Program
WMAC	Water Management Advisory Committee
WPF	William Penn Foundation
WQAC	Water Quality Advisory Committee
WQM	Water Quality Management
WRP	Water Resources Program
WRRDA	Water Resources Reform and Development Act
WSCC	Water Supply Coordinating Council
WSSF	Water Supply Storage Fund
WTP	water treatment plant

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I. General Statement of Conditions in the Basin

A. Hydrologic Conditions : July 2018 – June 2019

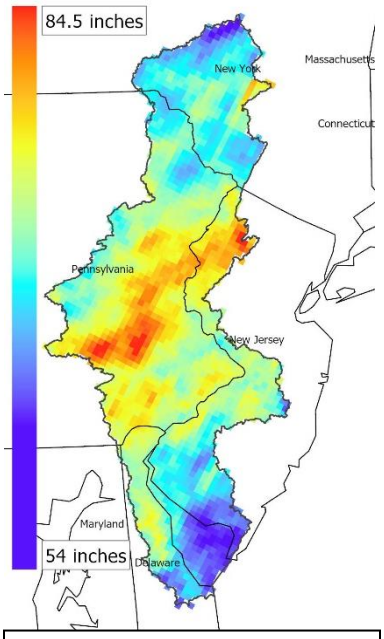


Figure 1. Rainfall in the Delaware River Basin, July 2018-June 2019.

i. Rainfall

Throughout the basin, rainfall for the period from July 2018 through June 2019 ranged from 54 inches to 84.5 inches. Figure 1 presents the range of rainfall amounts in the Basin. The higher amounts were more concentrated in the middle of the basin. These rainfall amounts were above normal for the entire basin. Some areas in the middle of the basin received over 80 inches of rain. Departures from normal ranged from 9 to 40 inches.

ii. Reservoir Conditions and Management

Combined storage in the three New York City (NYC) reservoirs, located in the upper basin, is presented in Figure 2 below. In July of 2018, the storage was below the median value. By the middle of August 2018, the reservoirs were at capacity due to high amounts of precipitation. The storage then remained above the median for the remainder of 2018 through June of 2019.

Due to the high flows throughout much of the year, water was not required to meet the Montague Flow Objective, except for a short period in July of 2018. The volume of water that was required was 3,945 million gallons. No releases were required from the NYC DRB reservoirs to meet the Trenton Equivalent Flow Objective.

In the Lower Basin, Beltzville and Blue Marsh Reservoirs maintained normal storage during the 365-day period ending June 30, 2019. The DRBC was not required to make releases from Lower Basin reservoirs to maintain the streamflow objective of 3,000 CFS at Trenton, NJ.

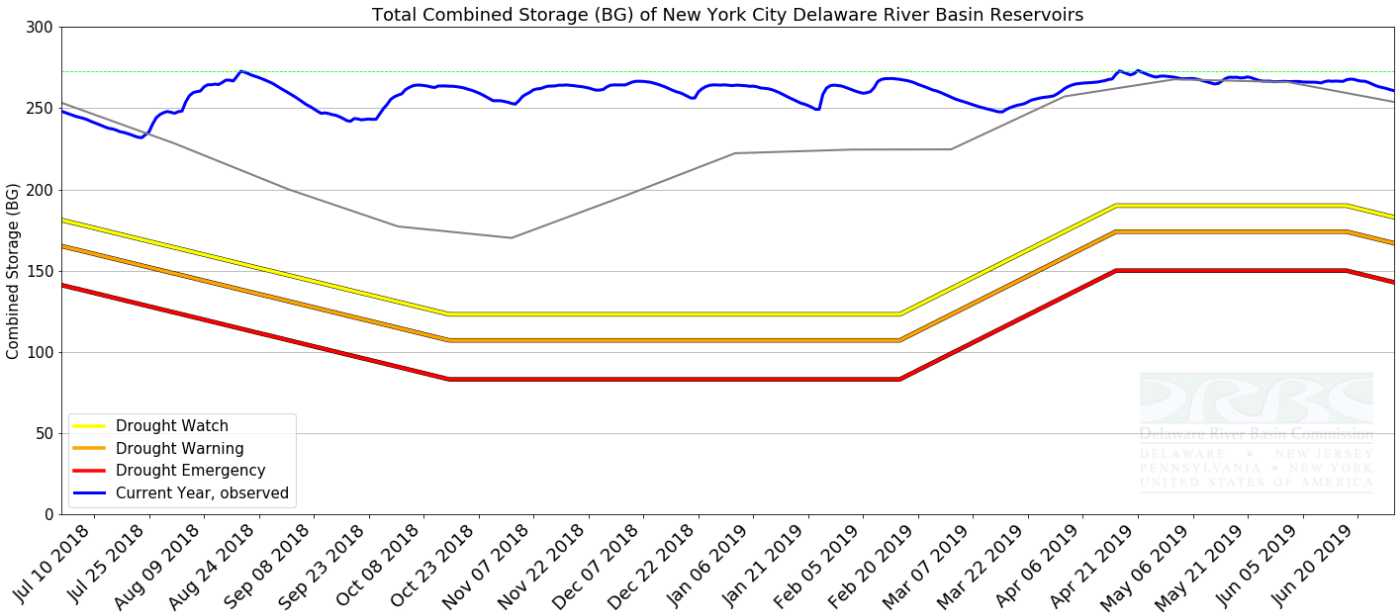


Figure 2. New York City's Delaware River Basin Storage, July 2018-June 2019.

iii. Groundwater Conditions

Pennsylvania

Groundwater levels in five selected USGS county observation wells were used to represent Pennsylvania's groundwater conditions during July 2018 - June 2019. The individual wells were selected based on their geographic locations in the Pennsylvania portion of the DRB: Wayne County WN 64 (northern), Schuylkill County SC 296 (western), Lehigh County LE 644 (central), Bucks County BK 1020 (eastern), and Chester County CH 10 (southern).

The Wayne County and Schuylkill County observation wells (Figures 3 and 4) were below the historical median at the start of July 2018. Groundwater levels then rose in August and remained above normal through January of 2019. Levels remained normal or just above normal for the remainder of the report period. In mid-April, the water levels in the Schuylkill well were close to being below normal.

Water levels in both the Lehigh County and Bucks County observation wells (Figures 5 and 6) were above normal for most of the report period, with the exception of June 2018 when levels were in the low end of the normal range. The Bucks County well levels had large fluctuations throughout the year and approached below normal conditions for most of April 2019.

The water level in the Chester County well (Figure 7) was in the normal range for July and then reached and remained above normal through June of 2019.

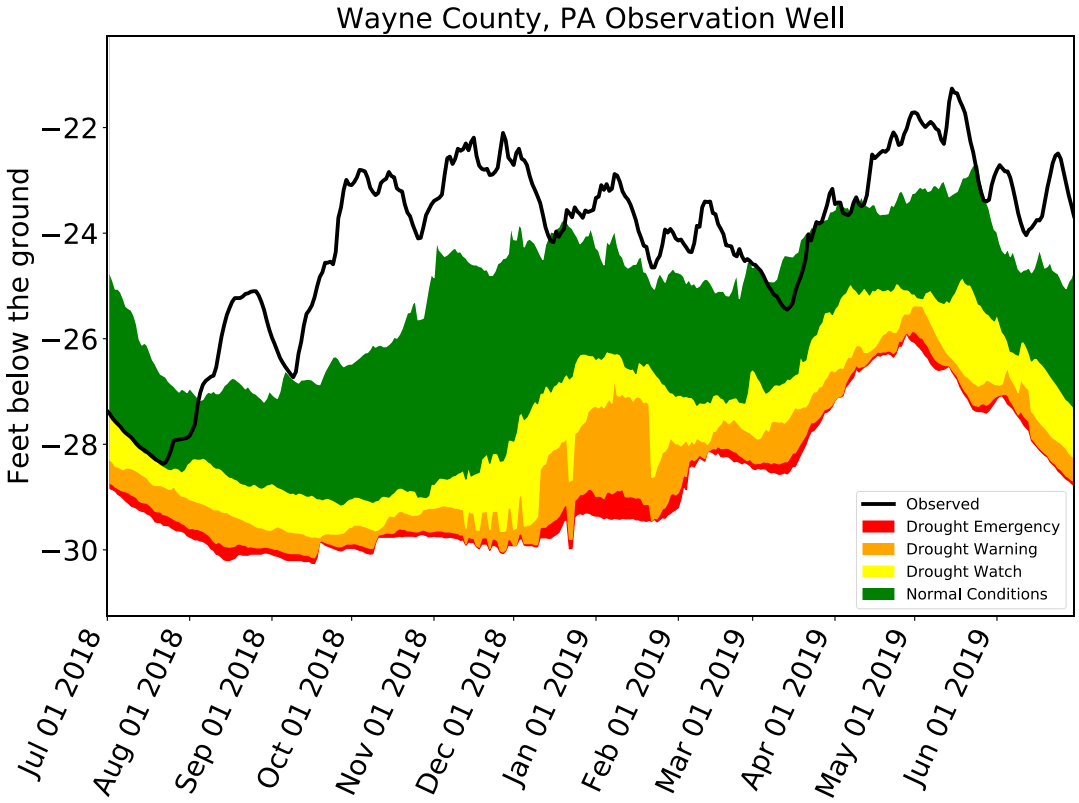


Figure 3. USGS well in Wayne Co., PA. July 2018-June 2019 Observed Daily Mean (black line) vs. Historical Statistics.

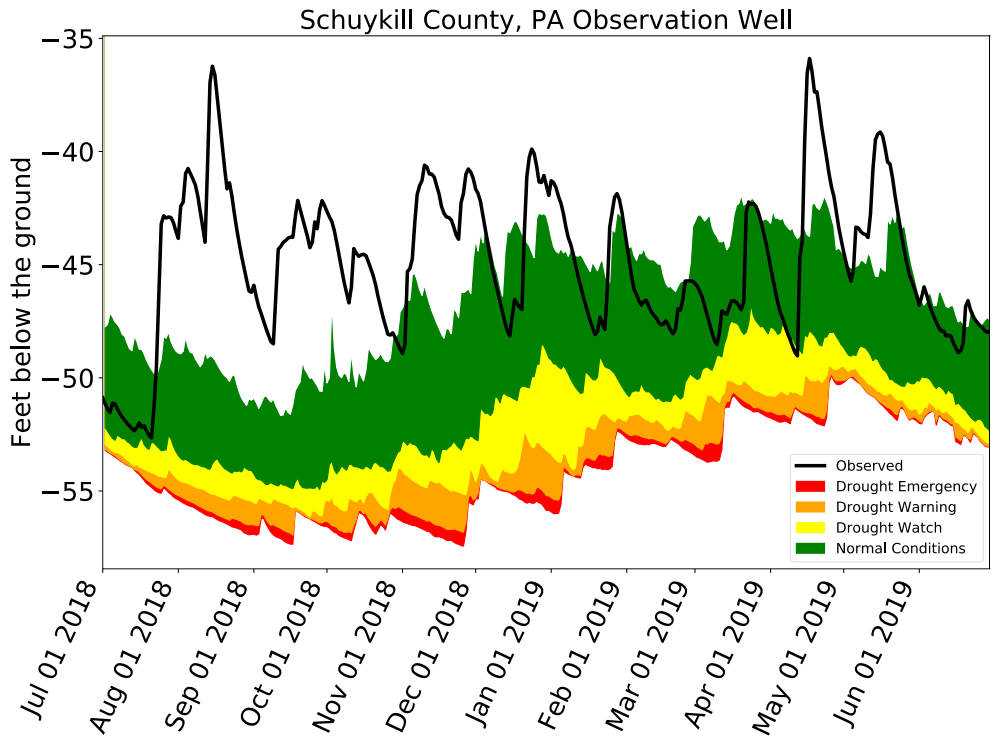


Figure 4. USGS well in Schuylkill Co., PA. July 2018-June 2019 Observed Daily Mean (black line) vs. Historical Statistics.

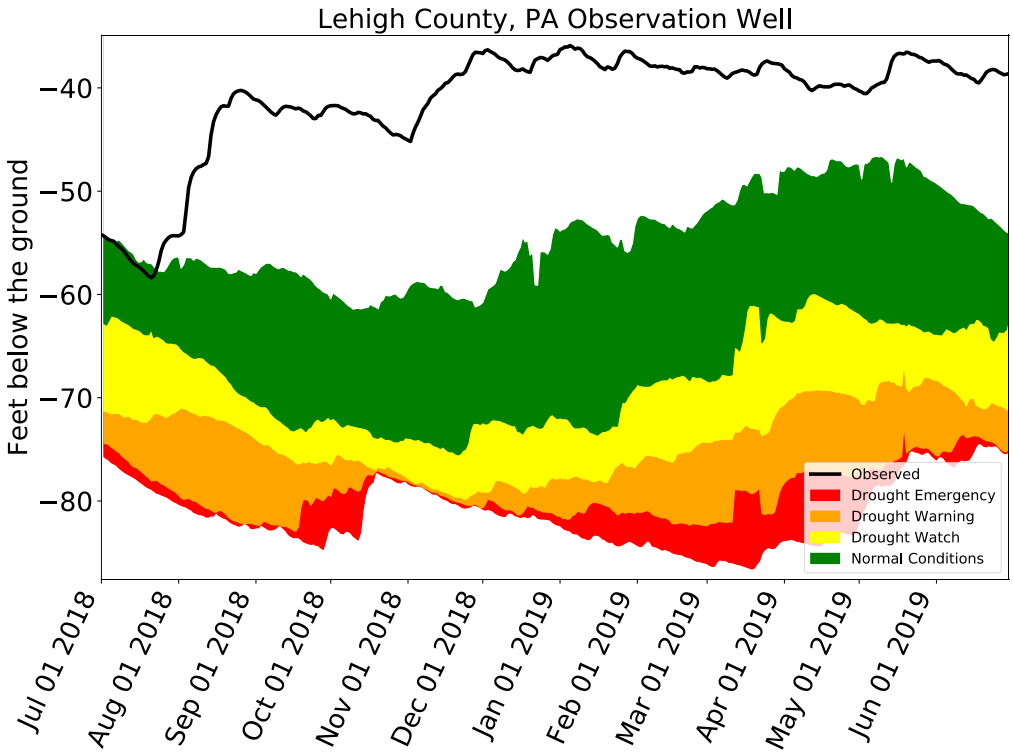


Figure 5. USGS well in Lehigh Co., PA. July 2018-June 2019 Observed Daily Mean (black line) vs. Historical Statistics.

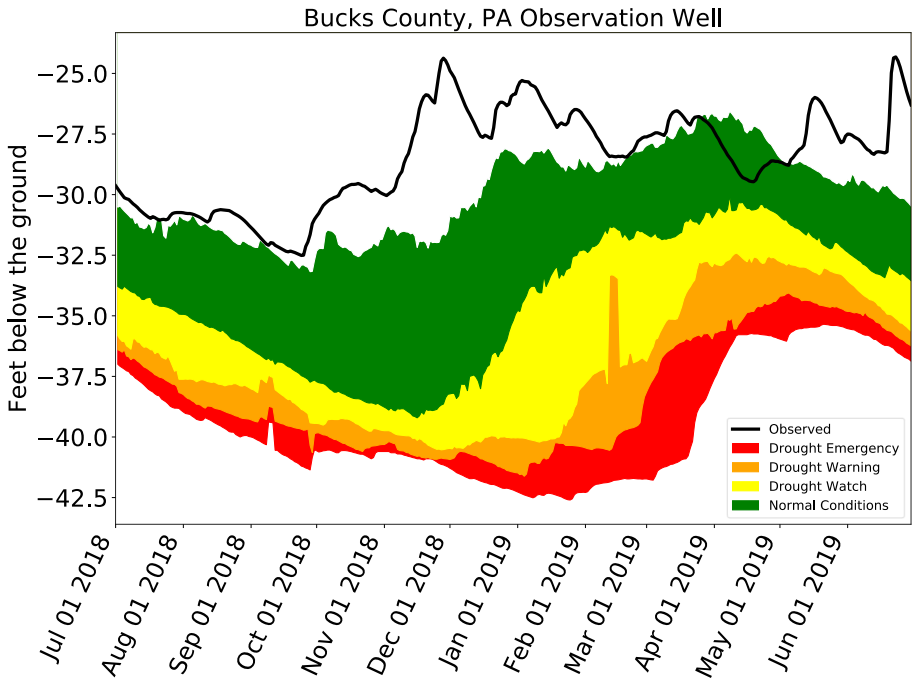


Figure 6. USGS well in Bucks Co., PA. July 2018-June 2019 Observed Daily Mean (black line) vs. Historical Statistics.

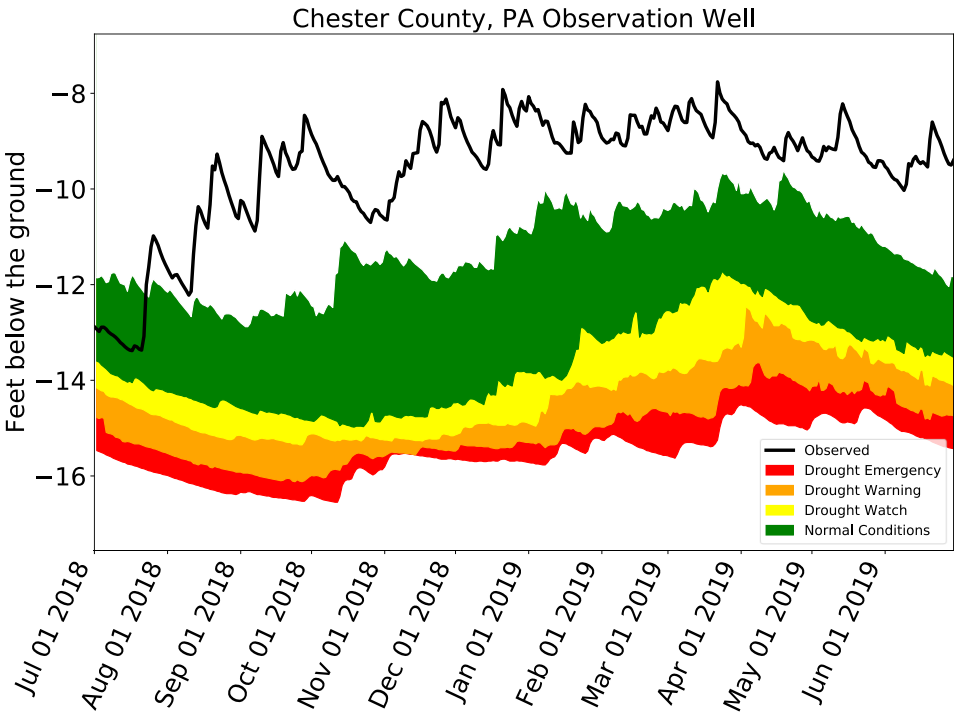


Figure 7. USGS well in Chester Co., PA. July 2018-June 2019 Observed Daily Mean (black line) vs. Historical Statistics.

New Jersey

The water level in the Cumberland County coastal plain well (Figure 8) was normal from July through September of 2018. The ground water level then increased to above normal for the remainder of the report period.

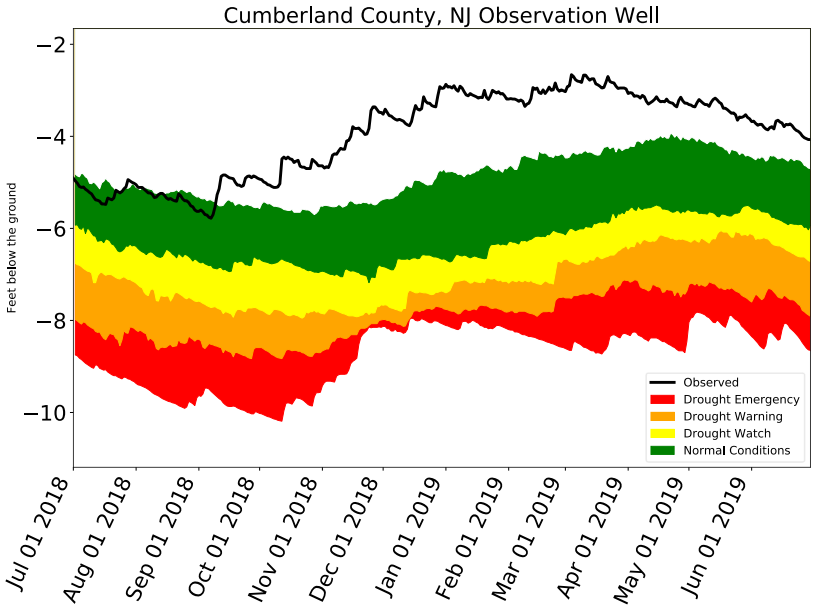


Figure 8. USGS well in Cumberland Co., NJ. July 2018-June 2019 Observed Daily Mean (black line) vs. Historical Statistics.

Delaware

Groundwater levels in Delaware (Figure 9) were similar to those in the rest of the basin, starting off below average. After October of 2018, levels greatly increased and remained above average for the remainder of the year, decreasing slightly towards the end of the period. The well finished out the report period around normal conditions.

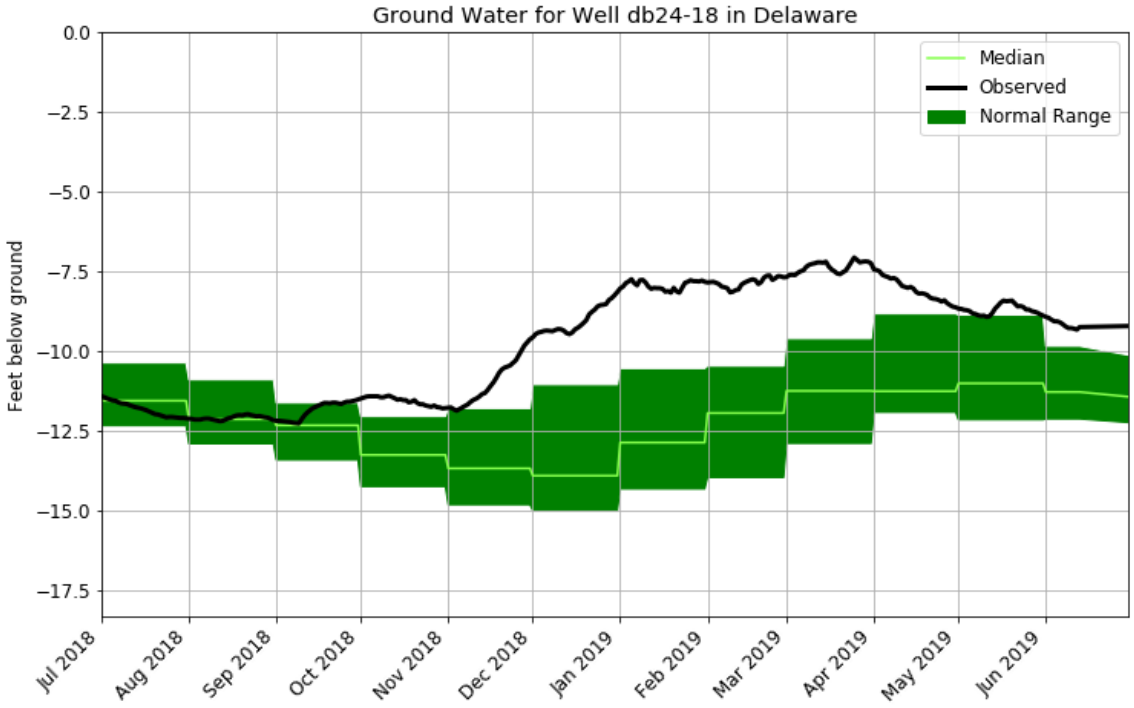


Figure 9. USGS well in New Castle County, DE. July 2018 – July 2019 Observed Depth. (Data Source: Delaware Geological Society)

New York

In the USGS well in the New York portion of the upper basin (Figure 10), water levels varied throughout the year, similar to the Wayne and Schuylkill County, PA wells. As with the other wells, groundwater levels were low at the start of the period, but quickly increased to above normal. The well had a slight decrease in water level in late spring.

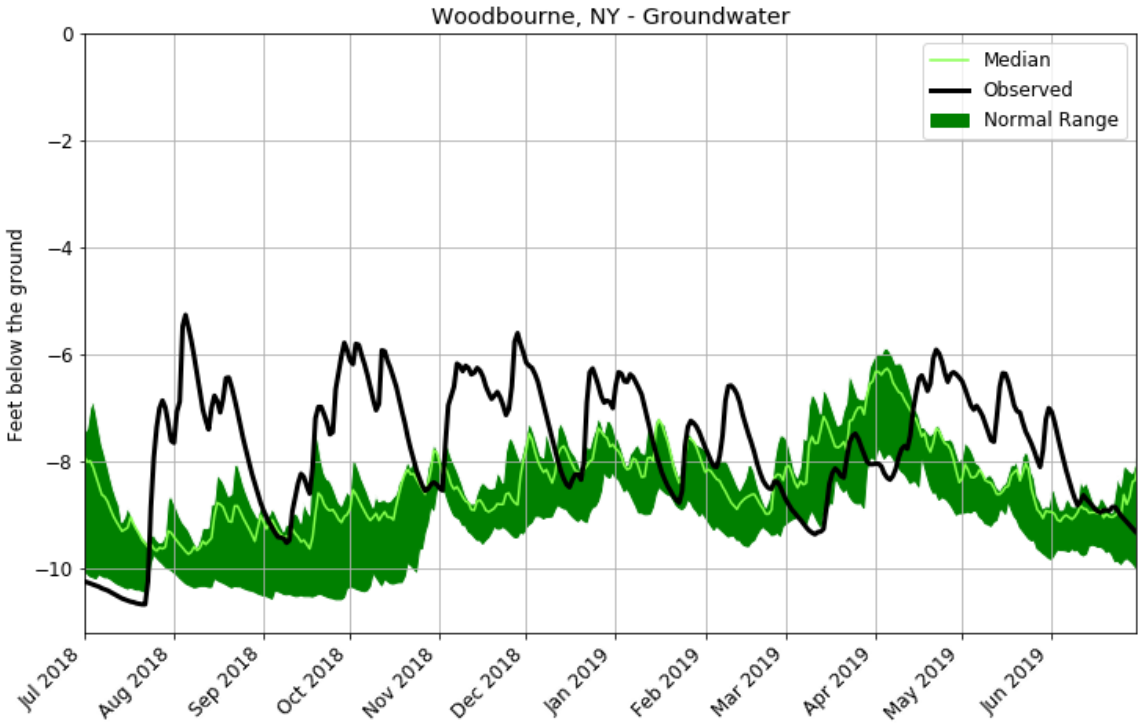
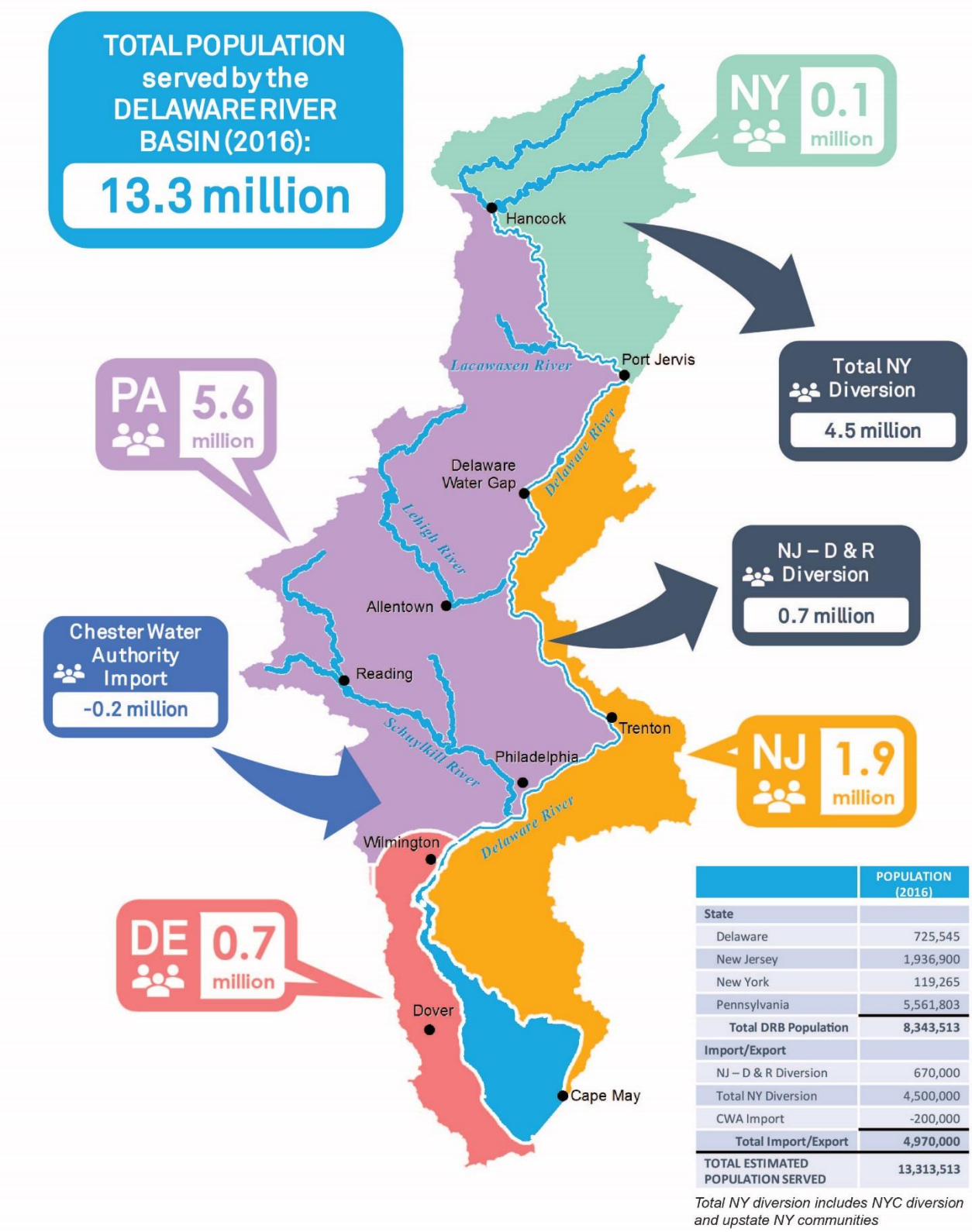


Figure 10: USGS well in Woodbourne, Sullivan County, NY. July 2018 – June 2019 Observed Depth. Data source: USGS.

B. Water Use and Sufficiency

i. Population Served

The Delaware River Basin (DRB) provides water to portions of the four states located in the basin: New York, New Jersey, Pennsylvania and Delaware. As of 2016, the total population served by DRB water is estimated at **13.3 million**. The total population served includes those within the Basin boundaries as well as populations of the basin states located outside of the DRB, which are served through exports. Estimates of population served through exports are based on daily use by “equivalent” populations outside the basin. Although water from the Basin is mixed with other sources for New York City, the “equivalent” population served for New York City is estimated by multiplying the DRB portion of the water supply by the 2016 population. A summary of the data below is presented graphically in Figure 11.



	POPULATION (2016)
State	
Delaware	725,545
New Jersey	1,936,900
New York	119,265
Pennsylvania	5,561,803
Total DRB Population	**8,343,513**
Import/Export	
NJ – D & R Diversion	670,000
Total NY Diversion	4,500,000
CWA Import	-200,000
Total Import/Export	**4,970,000**
TOTAL ESTIMATED POPULATION SERVED	**13,313,513**

Total NY diversion includes NYC diversion and upstate NY communities

Figure 11. Population Estimates for 2016 in the Delaware River Basin by State

ii. Water Withdrawals and Trends

Understanding water withdrawals, water use, and supply is integral to the management of water resources. In recent years, our understanding of the ways in which water is withdrawn and used has improved greatly, as have the underlying systems in place to manage the data, meaning that more timely and comprehensive assessments can be made. Figure 12 shows the basin-wide picture of water withdrawals, exports, and consumptive use, by sector, based on 2017 calendar year water use data; the data shown represent daily average withdrawals.

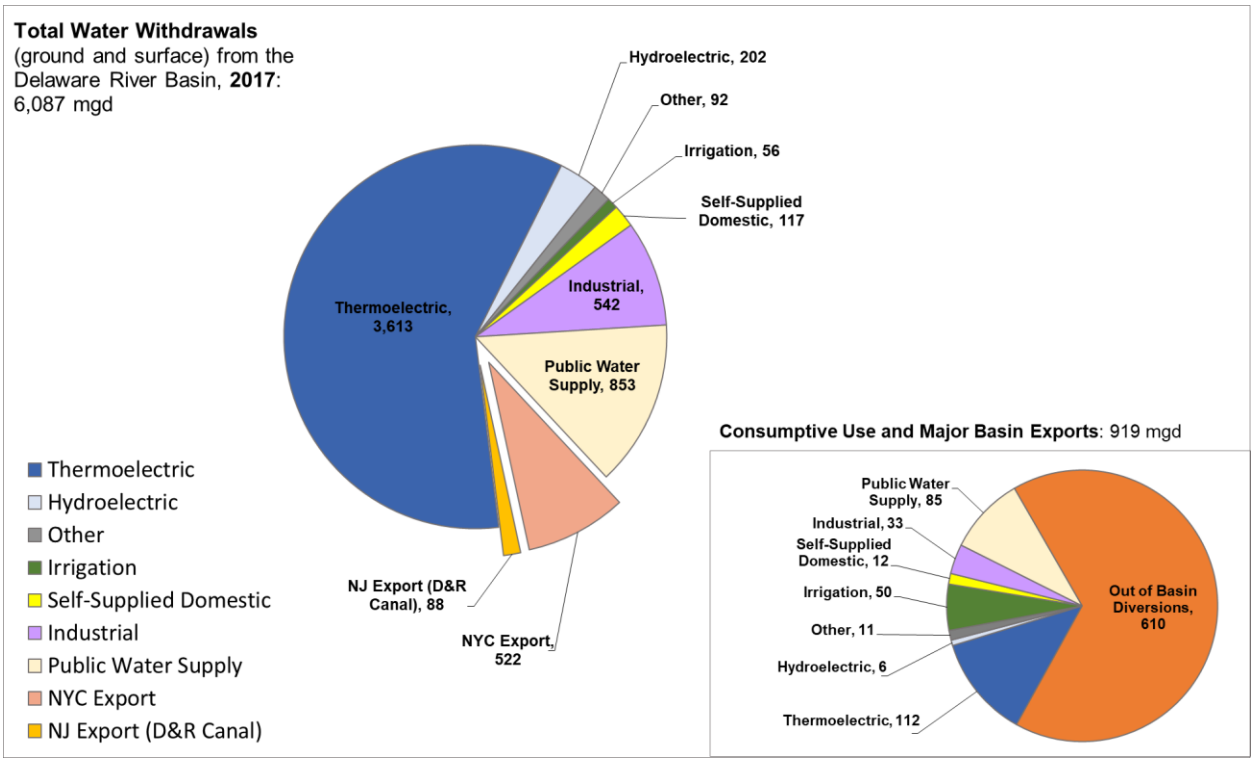


Figure 12. Total Water Withdrawals and Consumptive Use / Major Exports from the Basin 2017. (Note: for Self-supplied domestic estimates from other reporting years have been used as more recent data were not readily available.)

Key Delaware River Basin water use facts:

- Based on 2016 data, an estimated 13.3 million people rely on water from the Basin for their daily water needs (see Section 1.B.i). Approximately 8.3 million people live in the Basin, and the volume of exports to New York City and northeastern New Jersey is sufficient to supply water to an additional 5 million people;
- Based on 2017 data, total ground and surface water withdrawals from the Basin: 6,087 mgd (6.1 Billion gallons per day);
- Major Exports from the Basin: 610 mgd;
- Consumptive Use in the Basin: 309 mgd;
- Approximately 95% of all water used in the Basin is obtained from surface waters; and
- Three dominant use sectors account for over 80% of total water withdrawals; these sectors are: power generation ("Thermo," 59%), public water supply ("PWS," 14%), and industrial use ("Industrial," 9%).

DRBC tracks withdrawals and water use in these three dominant water-using sectors closely. Currently, data for these key sectors extend through calendar year 2017 and provide a monthly time series of data spanning a period of over 20 years. Although Figures 13 and 14 contain some data gaps, an overall pattern and trend in water withdrawals and consumptive use is apparent. The public water supply sector displays

neutral trends in total water withdrawn as well as water consumptively used; this is primarily attributed to the influence of conservation practices neutralizing population increases. The industrial sector displays a historically decreasing trend with some fluctuations, likely the result of facilities entering or exiting the industrial sector. The thermoelectric sector displays an overall decreasing trend in total water withdrawals with an increasing trend in consumptive use.

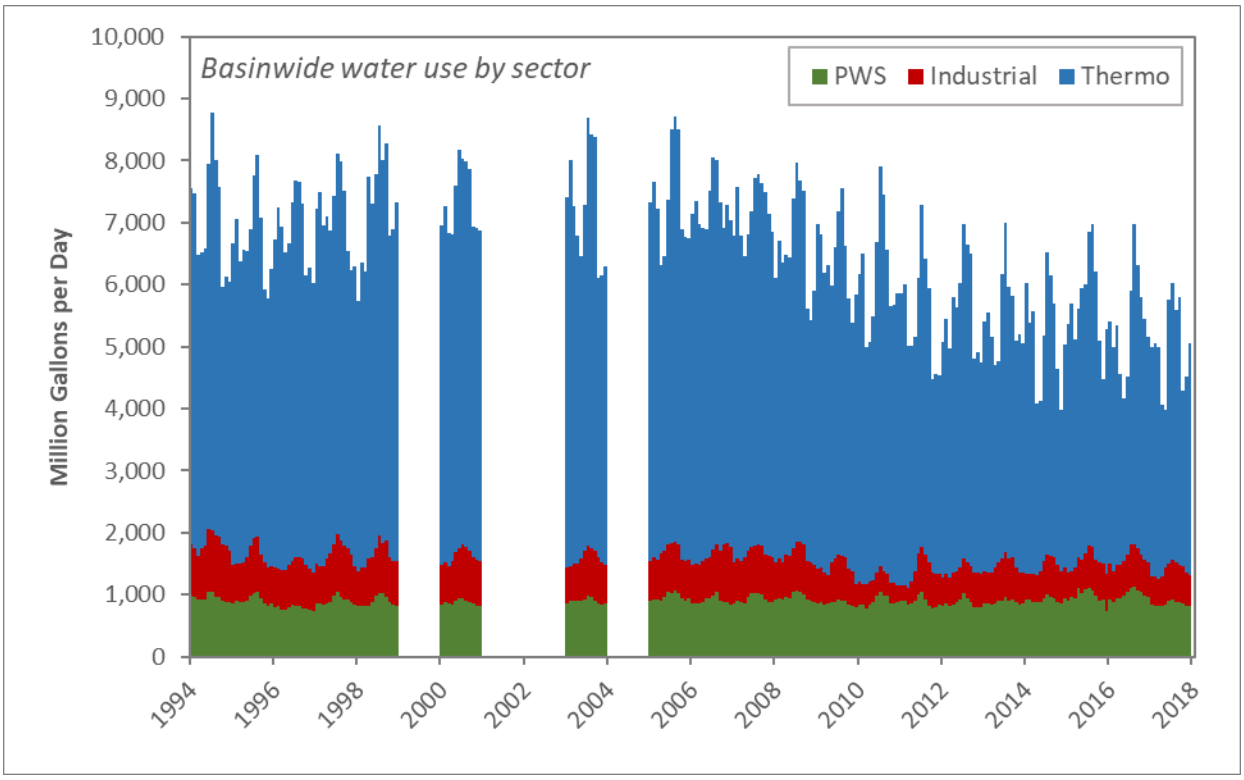


Figure 13. Monthly Water Withdrawals for Three Key Sectors in the Delaware River Basin. No data are shown for months where data were incomplete to avoid visually skewing the trends.

iii. Cumulative Thermoelectric Withdrawals and Consumptive Use

Water withdrawals for thermoelectric power generation are primarily used for cooling purposes. The cooling process is typically achieved by either highly evaporative cooling towers or a once-through cooling process that uses a condenser to absorb heat. The two types of cooling use water in different ways. Evaporative cooling towers require a smaller volume of withdrawal but consume most of the water (typically >90% consumptive use). Once-through cooling requires much greater volumes of water at the intake, but the rate of loss to evaporation is very small (typically <1%). In terms of total consumptive use per energy unit (gallons per MWh), cooling towers have higher consumptive use factors. On average, cooling towers use 453 gal/MWh, while once-through systems use 307 gal/MWh. A decline in withdrawals for thermoelectric power generation over the past several years is evident in Figure 13 and is a result of plant closings, or decreased production, at facilities with once-through cooling systems.

However, the need for energy production in the Basin continues to increase and other (smaller) facilities have come online to meet demand. The new facilities use evaporative cooling, which withdraws a lesser volume but evaporates a greater percentage of the withdrawal. Figure 15 shows the resulting increasing trend in consumptive water use, despite a decrease in overall water withdrawn for the thermoelectric power generating sector.

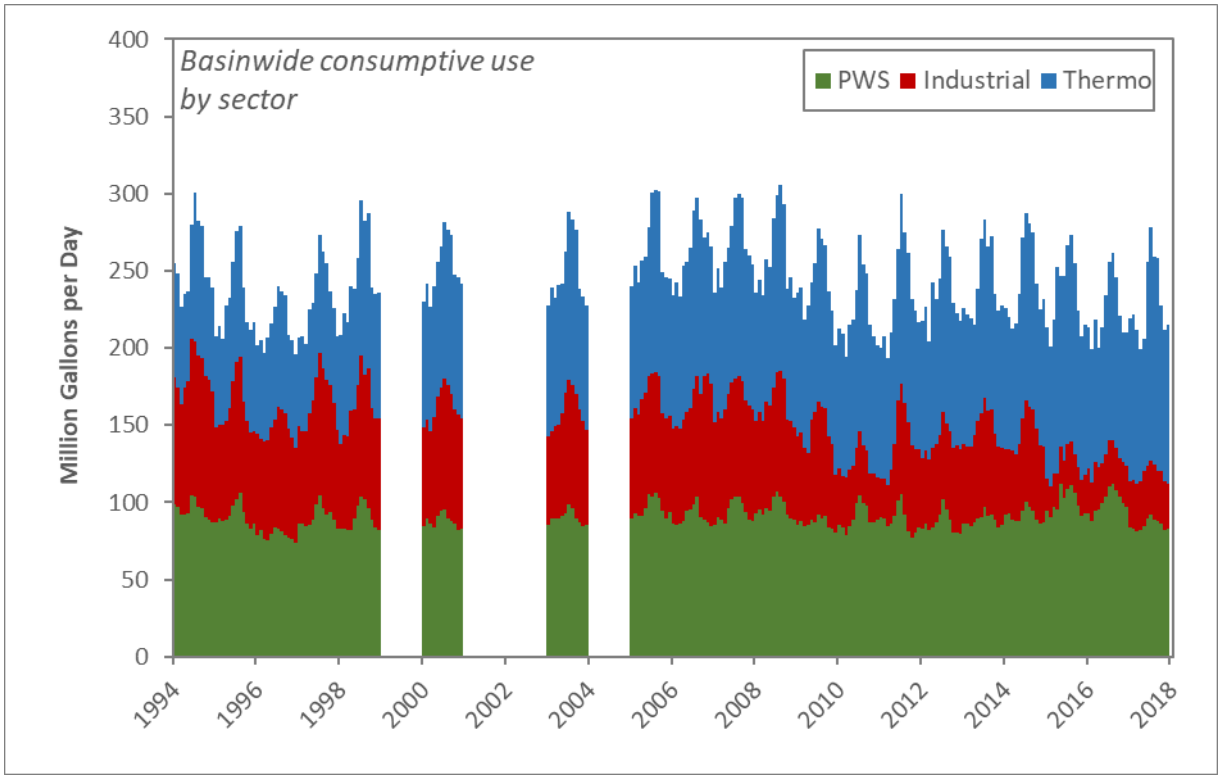


Figure 14. Monthly Consumptive Water Use for Three Key Sectors in the Delaware River Basin. No data are shown for months where data were incomplete to avoid visually skewing the trends.

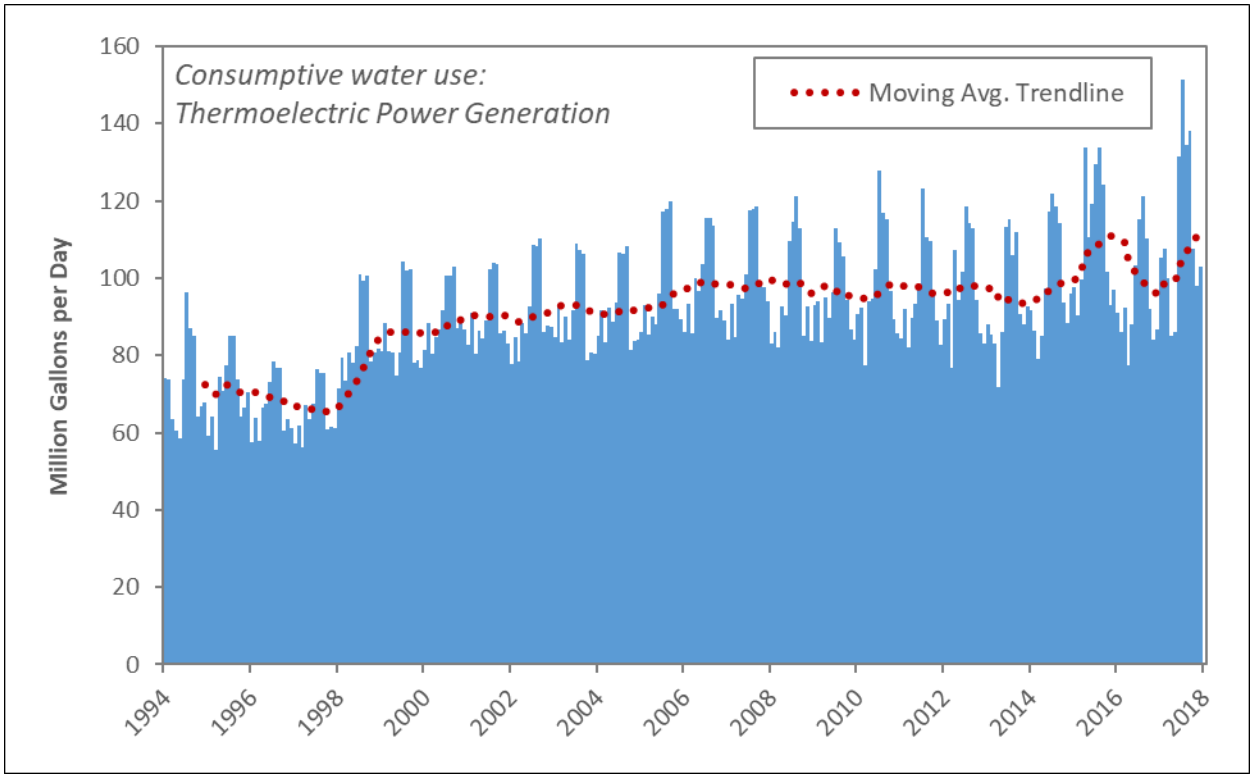


Figure 15. Trend in Monthly Consumptive Use for Thermoelectric Power Generation in 1994-2017. The trendline is calculated as a 12-month moving average.

Increases in demand for withdrawals for thermoelectric power generation are likely to occur in the future. Any new capacity is likely to be cooled using evaporative methods (e.g., cooling towers) as required under USEPA regulations, potentially increasing consumptive water use further.

iv. Public Water Supply Withdrawals

Historic data for public water supply (PWS) withdrawals show a neutral trend (see Figure 16) largely driven by water conservation measures in the form of changes in plumbing codes, enacted in the early 1990s, which require use of more efficient plumbing fixtures and fittings. In addition, education and awareness of water conservation practices have played a role in decreasing water use for this sector despite increases in population (shown by the red line in Figure 16). Although neutral in the aggregate, withdrawals have increased in several systems where there are population growth regions (i.e., where water conservation practices cannot offset the more rapid increase in population). Over the past 30 years, DRBC has been a leader in enacting regulations to promote water conservation in the areas of source and service metering, leak detection and repair, plumbing fixtures and fittings, and water rate structures. The trend shown in Figure 16 indicates that these regulations have been successful and have contributed to flat trends in PWS water withdrawals. Figure 16 also shows the consumptive use portion (light green) of the total withdrawals; the non-consumptive portion (dark green) reflects those volumes returned to the basin after withdrawal. (Note that DRBC does not receive or calculate consumptive use data for the public water sector, but rather uses a basinwide "consumptive use factor" of 10% for public water supply systems).

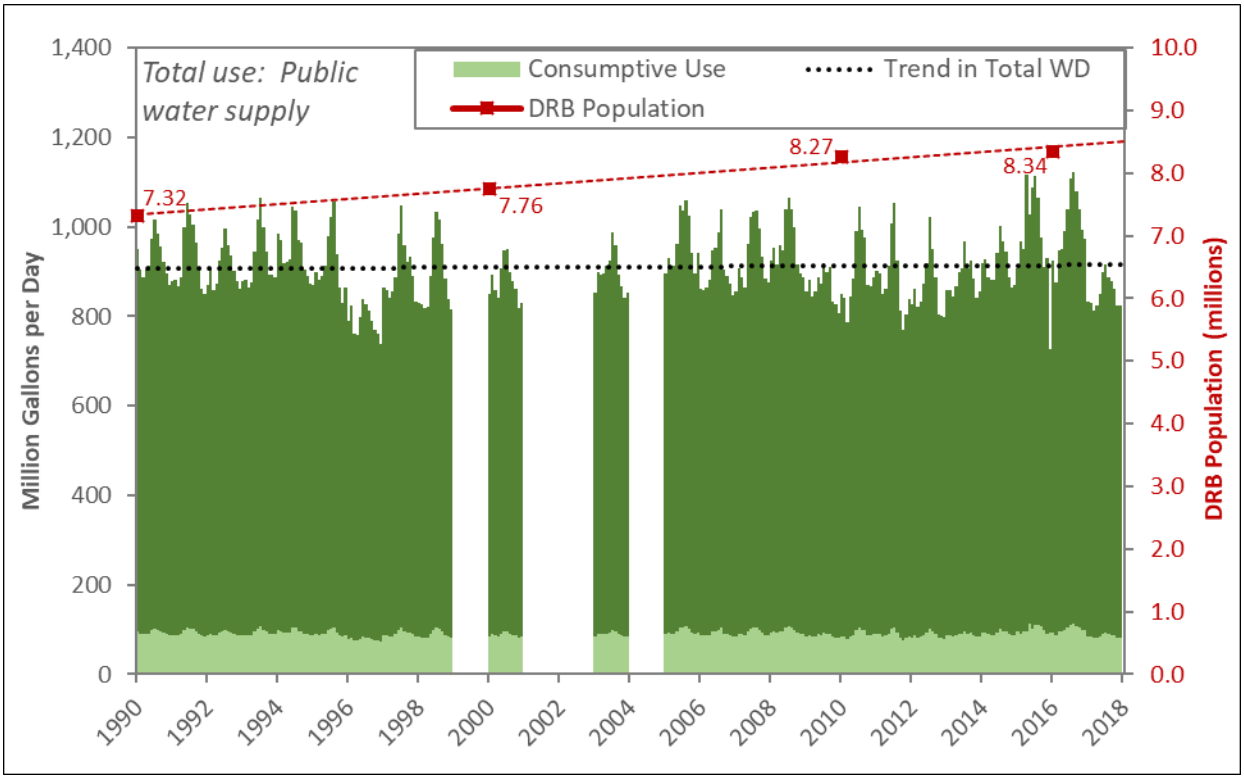


Figure 16. Monthly withdrawals of Public Water Systems in the Basin 1990-2017. No data are shown for months where data were incomplete to avoid skewing the displayed trend line. The population values are reflective of the population residing within the Basin boundary, not the population served.

In 2009, as part of DRBC's effort to ensure its regulations reflect the latest thinking in the field of water efficiency, the Commission amended its Comprehensive Plan and Water Code to implement an updated water audit approach to identify and manage water loss in the basin, in partnership with Basin water purveyors. The approach is consistent with the International Water Association (IWA) and American Water Works Association (AWWA) Water Audit Methodology and is considered a best management practice in

water loss control. The revised regulations require PWS systems to conduct an annual water audit to help identify water losses, particularly water lost due to leaky infrastructure. DRBC performed multiple outreach efforts, and the audit became a mandatory requirement in 2012. Nearly three hundred water audits were available for analysis for CY2018. Collectively, the audit data indicates that approximately 798 million gallons per day (MGD) of water was put into distribution systems in the Delaware River Basin. *Non-revenue water* is a key term used in the AWWA water audit methodology to quantify water losses and unbilled water consumption. Non-revenue water is water that has been treated and pressurized and enters the distribution system but generates no revenue for the water purveyor. Water losses can be real losses (through leaks, also referred to as physical losses) or apparent losses (for example, through theft or metering inaccuracies). Based on the CY2018 reported data, an estimated 164 MGD was reported as physically lost from distribution systems in the DRB along with an estimated 28 MGD reported as apparent losses and 21 MGD of unbilled authorized consumption for a total of 213 MGD of non-revenue water reported in CY2018. This non-revenue water has an estimated annual value of $126 million to water utilities in the DRB and represents a significant opportunity to improve the efficiency of public water supply in the basin. Figure 17 shows a summary of the 2018 results of data collection under the DRBC water audit program.

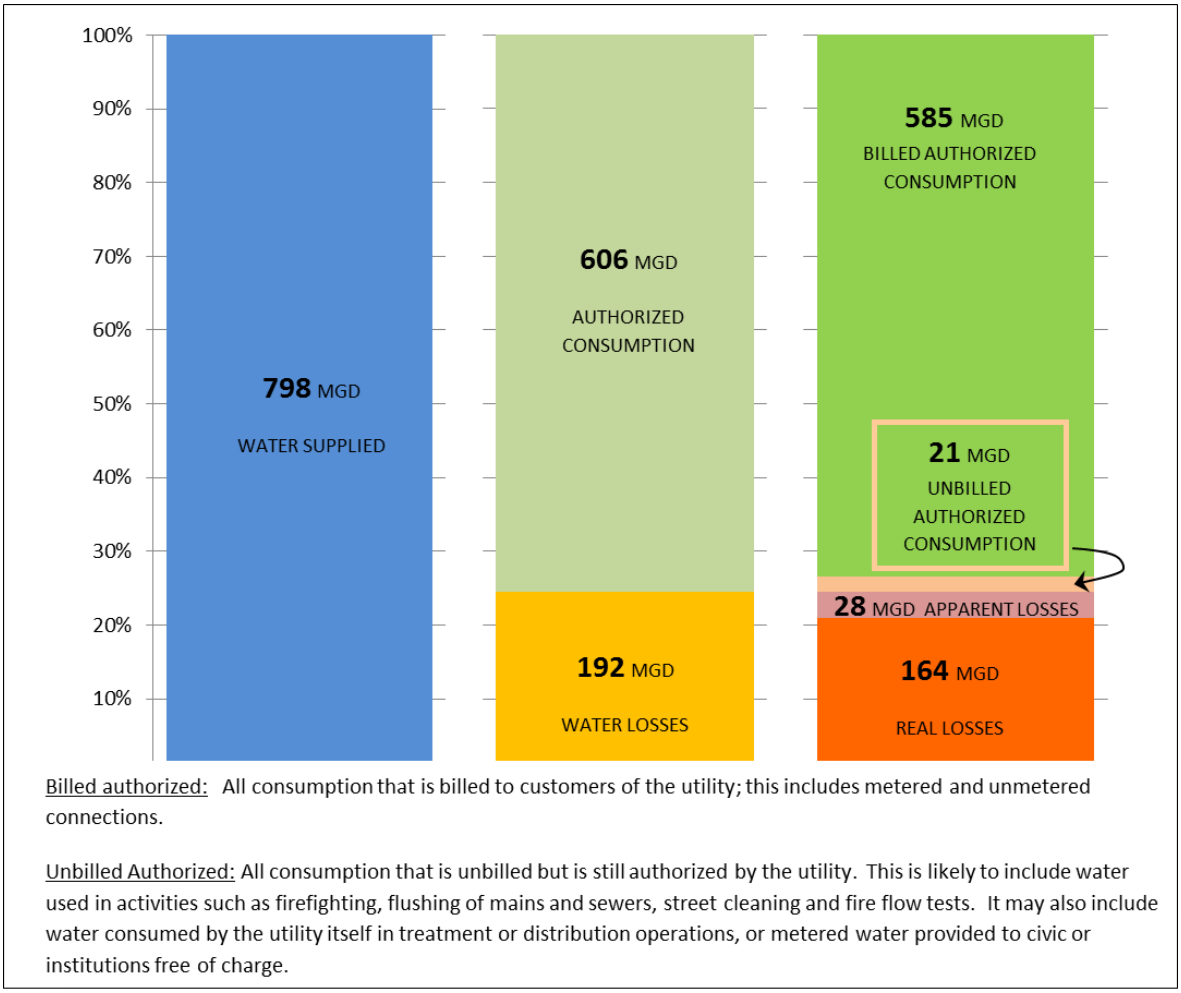


Figure 17. DRBC water audit program summary (CY2018); aggregate of 294 individual water system audits.

Data collection under the DRBC's water audit program marks a significant step in a long-term effort to improve water efficiency and promote best practices in water loss control for Basin water purveyors. During the first few years of the program, the emphasis will be on ensuring that water purveyors build confidence

in the data submitted in the water audit. Developing and providing accurate data to the water audit process will result in a clearer understanding of the causes of water loss and is a vital first step in the process. Furthermore, the water audit emphasizes the importance of calibrating source meters to ensure accurate measurement of water withdrawn. This also helps improve the accuracy of reported withdrawals of water to state agencies and DRBC for use in other water use studies and assessments. It is anticipated that a focus on this issue will result in an improved efficiency of public water supply systems, saving both water resources and money.

v. Industrial Withdrawals

Historic data for industrial withdrawals show a decline from levels in the early 1990's (Figure 18). The closing of the Bethlehem Steel plant in Bethlehem, PA, in 1995 contributed significantly to the overall decline in water use for this sector as it was the Basin's largest industrial water user. Over the past decade, industrial water use has declined slightly despite numerous facilities changing hands. Several large refineries in the Basin have seen a lot of turnover in recent years. Refineries that were idle are once again in production and have returned to more normal operations with water withdrawal data returning to previous levels.

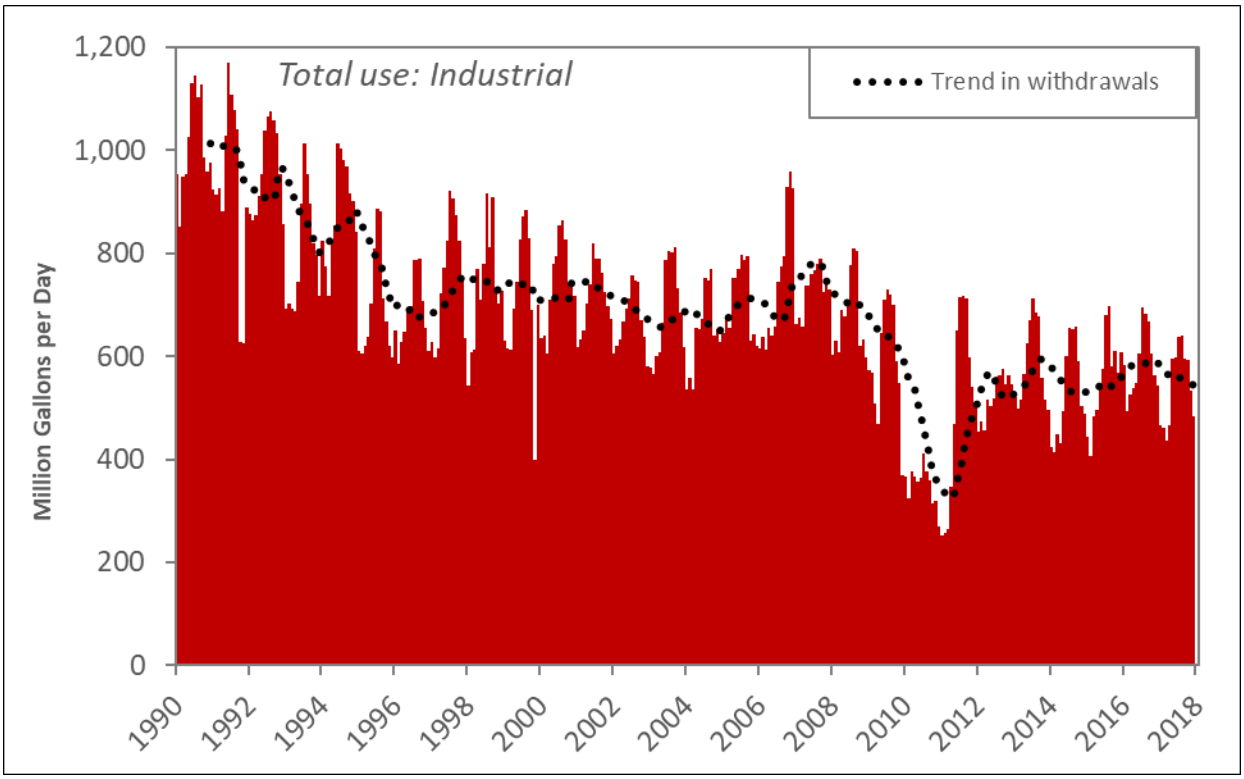


Figure 18. Monthly Industrial Water Withdrawals 1990 – 2017. The trendline is calculated as a 12-month moving average.

vi. Seasonal Variation in Withdrawals and Consumptive Use

The monthly data, shown in Figures 13, 14, 15, 16, and 18, highlight the extent to which water withdrawals and consumptive uses vary seasonally. Thermoelectric power generation experiences peaks in the summer months as a consequence of increased power demand for residential and commercial cooling. Simultaneously, public water suppliers experience peak demands in the summer months when lawn-watering and other outside uses are greatest. This highlights the need for including accurate seasonal (peak) considerations—including ecological (instream) needs—in long-range supply sufficiency assessments.

vii. Ecological (Instream) Flow Needs

Water supply planning in the basin generally has not taken into account the instream flow needs of aquatic communities principally due to a scarcity of specific quantitative information, especially regarding the relationship of flow to ecological needs. Understanding instream flow needs is important to protect key ecological communities for the range of habitats in the Delaware River Basin and may be informative for the Commission to plan to meet future water needs for all uses. In December 2013, the Commission and The Nature Conservancy (TNC) completed a year-long study on basin-wide ecosystem flow recommendations for subwatersheds of the Delaware River. The Commission is currently reviewing options to implement the TNC recommendations. The USGS WaterSMART study also includes an ecological flows component.

viii. Conditions in Special Groundwater Management Areas

Two areas of the Basin are included in special management programs to mitigate historical groundwater supply issues and prevent future stress. The Commission manages the Southeast Pennsylvania Groundwater Protected Area (SEPA GWPA) on behalf of the Commonwealth of Pennsylvania, and New Jersey manages Critical Area 2 in the Potomac-Raritan-Magothy (PRM) aquifer system in southwestern New Jersey (Figure 19).

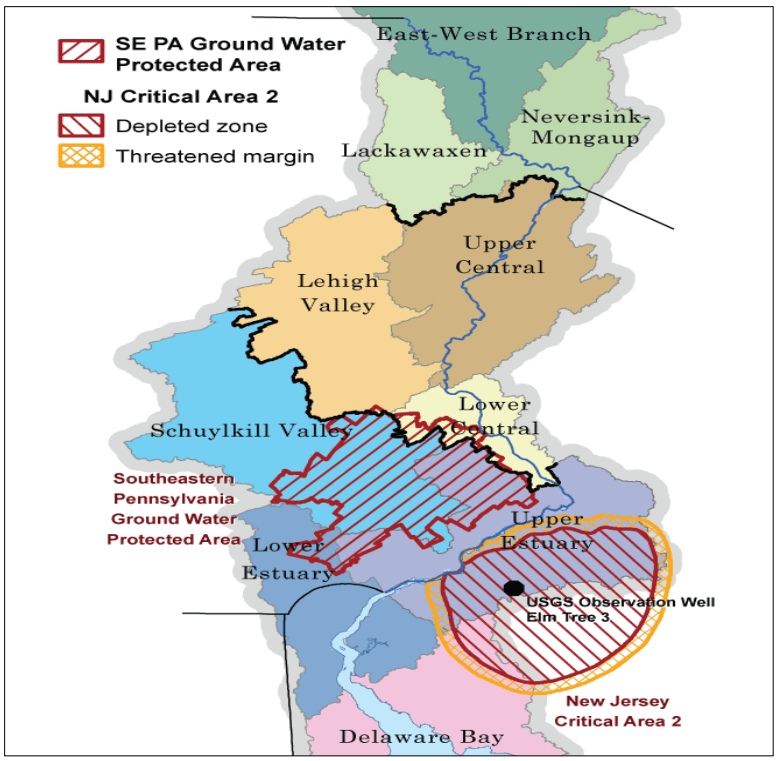


Figure 19. Groundwater Management Areas in the Delaware River Basin.

Southeast Pennsylvania Groundwater Protected Area.

The SEPA GWPA is an area of 1200 sq. mi. that includes 76 subbasins closely managed by DRBC regarding groundwater withdrawals, well interferences, and municipal water supply planning. Withdrawal limits have been established for each of the subbasins. Based on an analysis by DRBC using groundwater withdrawal data provided by the PADEP:

Presently, cumulative allocations in some SEPA GWPA subbasins exceed the recommended sub-basin withdrawal limit (Figure 20). In order to plan for future development and an increased demand on

groundwater resources, subbasin stress determinations will be made based on docket and SEPA GWPA permit allocations. The Commission will continue to update subbasin usage with current PADEP water withdrawal data and continue to lower cumulative docket/permit allocations to below their respective subbasin withdrawal limits.

Use in three (3) subbasins is currently between fifty (50%) and seventy-five (75%) of their subbasin withdrawal limits. One (1) subbasin is above their withdrawal limit. Subbasin (29) has historically been above its withdrawal limit because a major withdrawal from a quarry reservoir is counted as a groundwater withdrawal by PADEP. A second subbasin (4) has historically vacillated between non-stressed, potentially stressed and above the withdrawal limit. Most of the change in water use in subbasin 4 is attributable to the Eureka Stone Quarry. For any new withdrawal in a "potentially stressed" subbasin, SEPA GWPA regulations provide alternative programs geared toward increasing the groundwater recharge to the underlying formation or that conserve overall groundwater use.

Over the period from 2000 to 2017, cumulative groundwater use in the SEPA GWPA has decreased (Figure 21). This is likely to be partially attributable to improved water conservation, as noted above, and also due to infrastructure changes, notably the Point Pleasant, PA, diversion of surface water from the Delaware River to offset groundwater use by communities in Bucks and Montgomery counties. Figure 21 shows groundwater withdrawal data provided by the PADEP covering the years 1987 through 2017. The groundwater withdrawal data reported in the graph are from facilities that submitted data to the PADEP.

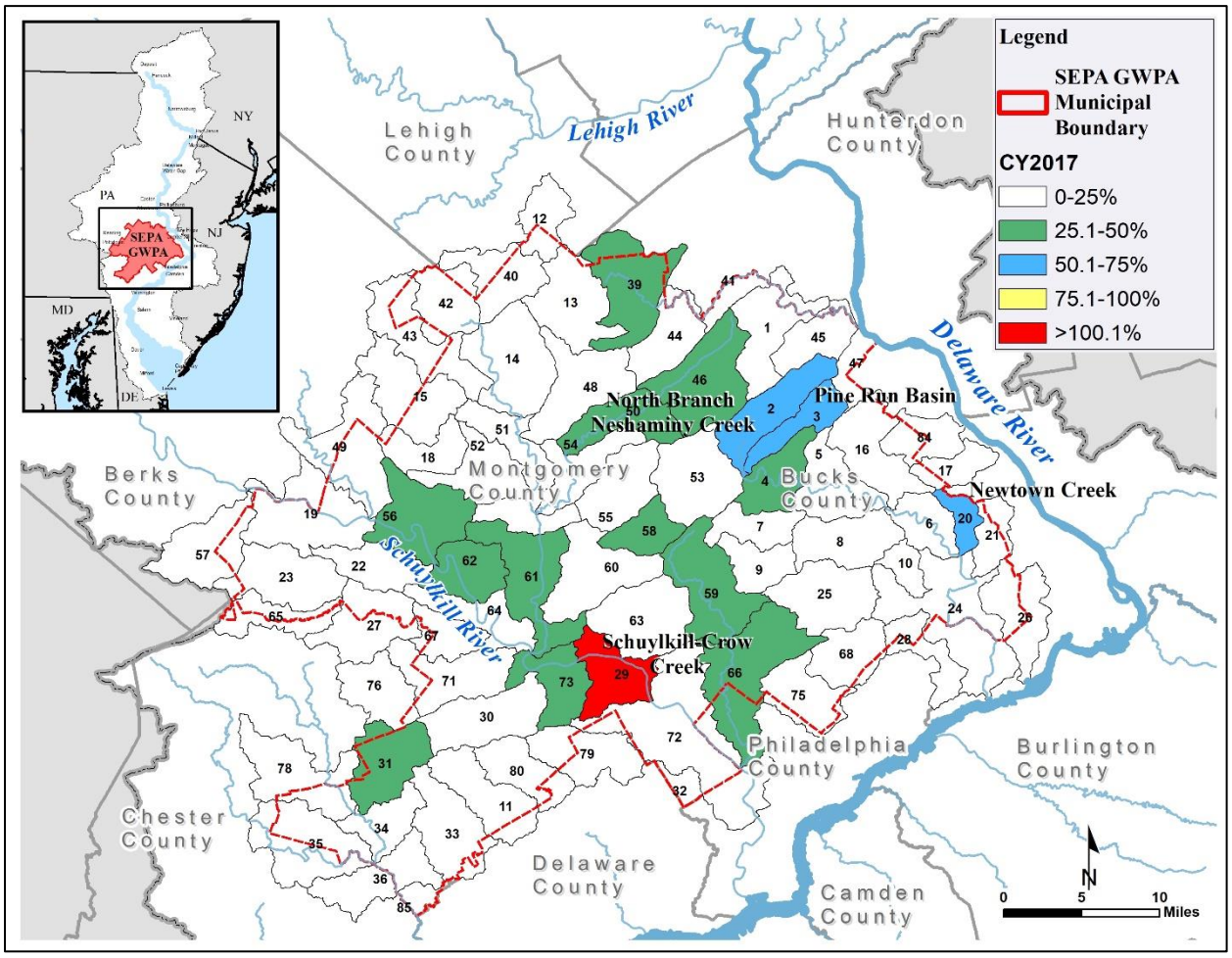


Figure 20. Three (blue) subbasins are currently between 50.1% and 75% of the withdrawal limit; and one subbasin (red), where a major withdrawal from a quarry reservoir is counted as a groundwater withdrawal by PADEP, is above its withdrawal limit.

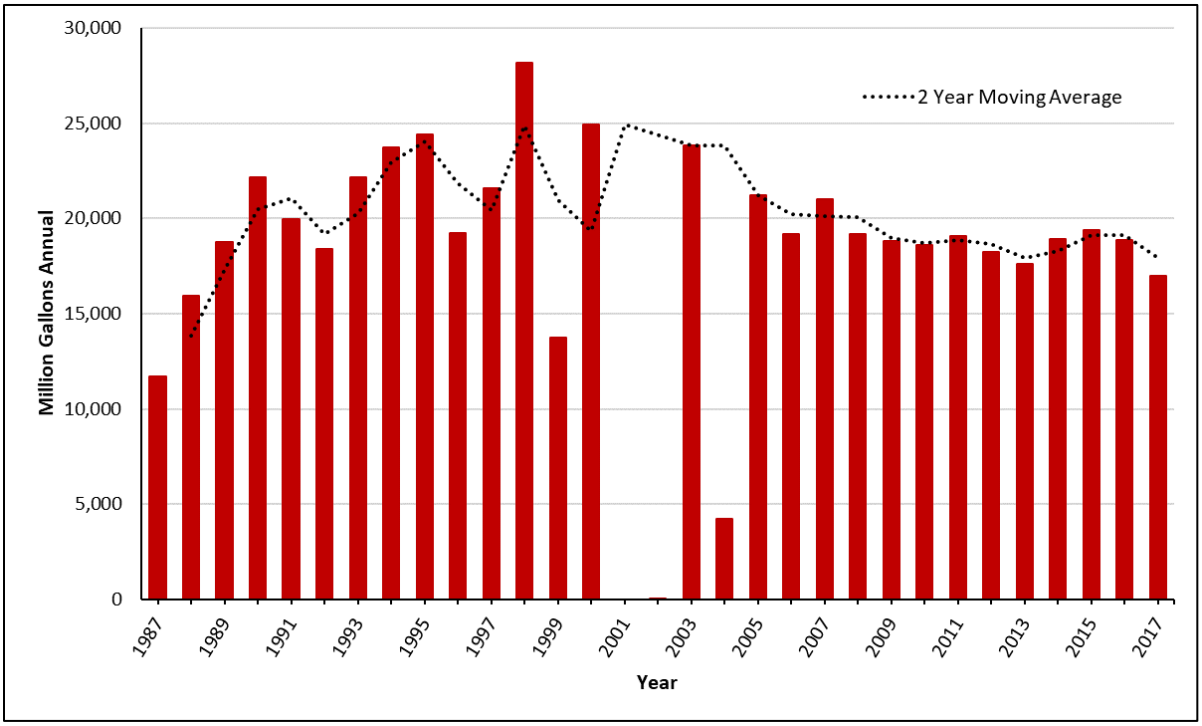


Figure 21. Withdrawals in the PA Groundwater Protected Area from 1987-2017 generally show slight reductions in the period from the late-1990s to 2017.

New Jersey Critical Area 2

NJDEP and USGS regularly monitor groundwater levels in the affected aquifers of Critical Area 2 (CA2) in southern New Jersey, and assessments indicate that withdrawals have significantly decreased beginning with the program's inception in 1996 (Figure 22), resulting in concurrent rebounding of groundwater levels in most monitoring wells (Figure 23). The surface water diversion/treatment facility on the Delaware River in Delran, Burlington County, owned and operated by the New Jersey American Water Company, was chosen as the regional water supply alternative for Critical Area 2. The Tri-County Water Supply Project remains the primary water source to meet growing water demands in the region. The downward trend that is visible in Figure 22 is primarily the result of major infrastructure improvements to allow areas that were previously solely reliable on local Potomac-Raritan-Magothy (PRM) withdrawals to tap into the regional solution of the Delaware River Tri-County project, which is primarily a surface water withdrawal. In addition, water conservation and indoor plumbing efficiencies as well as economic and business trends add to the overall downward trend in water withdrawals.

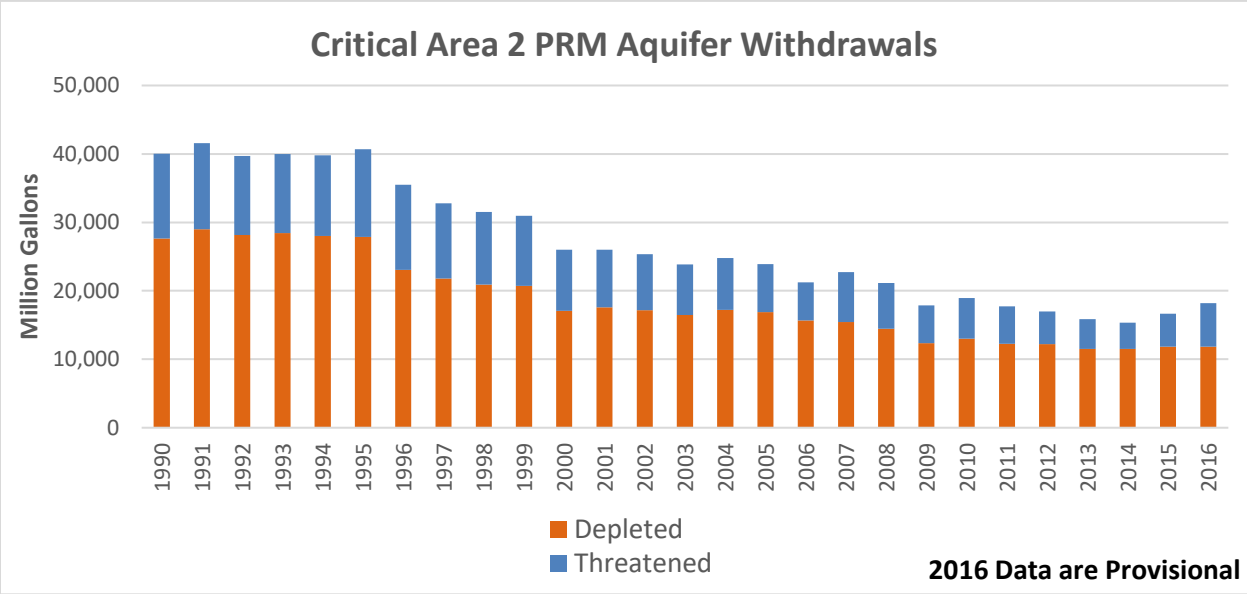


Figure 22. Withdrawals from the PRM 1990-2016 show significant reductions since the inception of Critical Area 2 management in 1996. Source: I. Snook, NJDEP, Oct 2018.

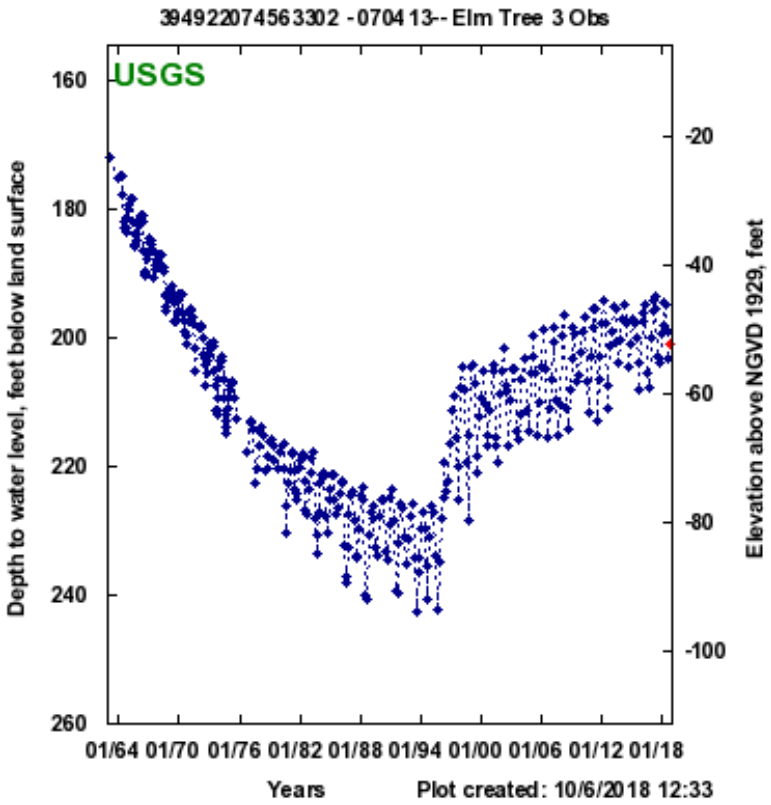


Figure 23. Example of rebounding groundwater levels in the upper PRM of NJ Critical Area 2 since program inception in 1996. Elm Tree 3 observation well Burlington Co., NJ. Source: USGS, Sept. 2018.

ix. Areas of Concern: PRM and Bayshore Watersheds

The 2007 report of a multi-year investigation by the USACE concluded that groundwater withdrawals in northern New Castle County, Delaware, were reducing local stream base flows and forming cones of depression. Pumping in Delaware is increasing groundwater flow from Maryland and decreasing flow into New Jersey by about 10% each[1], and regional pumping has created overlapping cones of depression across the study area of the three states.

Delaware

Critical water resource issues in the Rancocas, Piney Point, Cheswold, Federalsburg, Frederica, and Columbia aquifers of Kent County, DE have driven state capital funding for a multi-year program in Delaware. The program's goal is to improve groundwater monitoring and includes the collection of detailed, baseline hydrologic information to inform near-term (e.g., 10 year) management options (see Figure 24). Monitoring wells were installed and equipped with water level sensors in multiple aquifers at 10 sites and two rounds of groundwater quality sampling of these wells have been completed. Two USGS stream gaging stations have been re-activated. Initial results of this effort have been published (https://www.dgs.udel.edu/publications/ofr53-kent-county-groundwater-monitoring-project-results-subsurface-exploration). A focused monitoring effort is underway to study the Columbia aquifer in the east Dover area where increased pumping for irrigation and the City of Dover are causing concerns for increased drawdown and saltwater intrusion. In this area, salinity sensors were installed in 14 wells, five streams, and two groundwater fed irrigation ponds and are providing information on the duration, intensity and frequency of saline water incursion. The project is a collaborative effort of the Delaware Geological Survey (DGS), Delaware Department of Natural Resources and Environmental Control (DNREC), the Governor's Water Supply Coordinating Council (WSCC), and the USGS. It is providing critical information on salt-water intrusion and groundwater quality conditions, yields, and pumping interactions to improve planning and provide options for managing growing water demand and sea-level rise in this region.

New Jersey beyond Critical Area 2

NJDEP released the New Jersey Water Supply Plan (NJWSP) 2017-2022 in October 2017, which improves the management and protection of the State's water supplies. The Plan is a critical document which emphasizes the need to balance traditional water use with water resource protection, while outlining a range of policy options to achieve that balance amid an array of competing interests and issues. The 2017-2022 NJWSP differs from preceding plans as it is designed to allow for continuous technical and policy updates, as ongoing water resource evaluations, water use data, and more refined water demand projections become available. Using the NJWaTr Database, which is used to determine water budgets for the 151 HUC11 watersheds existing throughout NJ and to evaluate confined aquifer and surface water reservoir diversion rates, the State's future water supply planning efforts will be streamlined. In coordination with the extensive surface water, groundwater and drought monitoring systems and assessment tools, water supply planning at this scale represents significant advancements from those provided in previous frameworks. NJDEP signed a 10 year Flexible Flow Management Program in October 2017 which allows NJ to maintain and allocate a Delaware and Raritan Canal diversion of 80 mgd during declared drought emergency. Additionally, the agreement called for a study to be conducted to evaluate the further increase in the diversion during drought. This diversion plays a critical role in meeting New Jersey's current and future water supply needs, while enhancing water system resiliency in the Central, Coastal North and Northeast drought regions of New Jersey. NJDEP reports that saltwater intrusion is currently being observed in several observation wells located along the Delaware Bay in the Cohansey and Estuarine Sand Aquifers in Lower and Middle Townships in Cape May County. In response to increasing chloride concentrations in a public supply well located approximately 2 miles to the east of the Delaware Bay and completed in the Cohansey Aquifer DEP lowered allowable withdrawal rates in the well initiated the investigation into the

[1] USACE 2007 report on results of groundwater modeling of the Potomac aquifer:
Updated Draft Groundwater Model Production Run Report, Upper New Castle County Delaware.
Prepared for DE DNREC by USACE Philadelphia District; Feb. 2007.

saltwater intrusion in the area. Recent hydrogeologic and water quality data suggest eastward migration of salty water from the Delaware Bay towards pumping centers, thus threatening the ability of those wells to meet demands. A slight increase in chloride concentrations over time was noticed in two other production wells located in the vicinity of the abovementioned production well. The New Jersey Geologic and Water Survey (NJGWS) in cooperation with local water purveyors, has collected hydrogeologic and water quality data to help clarify the saltwater intrusion issue in the area. Although the zone of saltwater contamination in the Cohansey and Estuarine sand aquifers is delineated along the Delaware Bay, it is difficult to trace the movement of saltwater inland at this time and more studies are needed. Local water purveyors have been collecting monthly groundwater elevations and quarterly water-quality data (sodium and chloride concentrations) in the established network of observations and production wells for the past 5 years. These data have been used as part of NJDEP's efforts to effectively manage the water supplies of Cape May County.

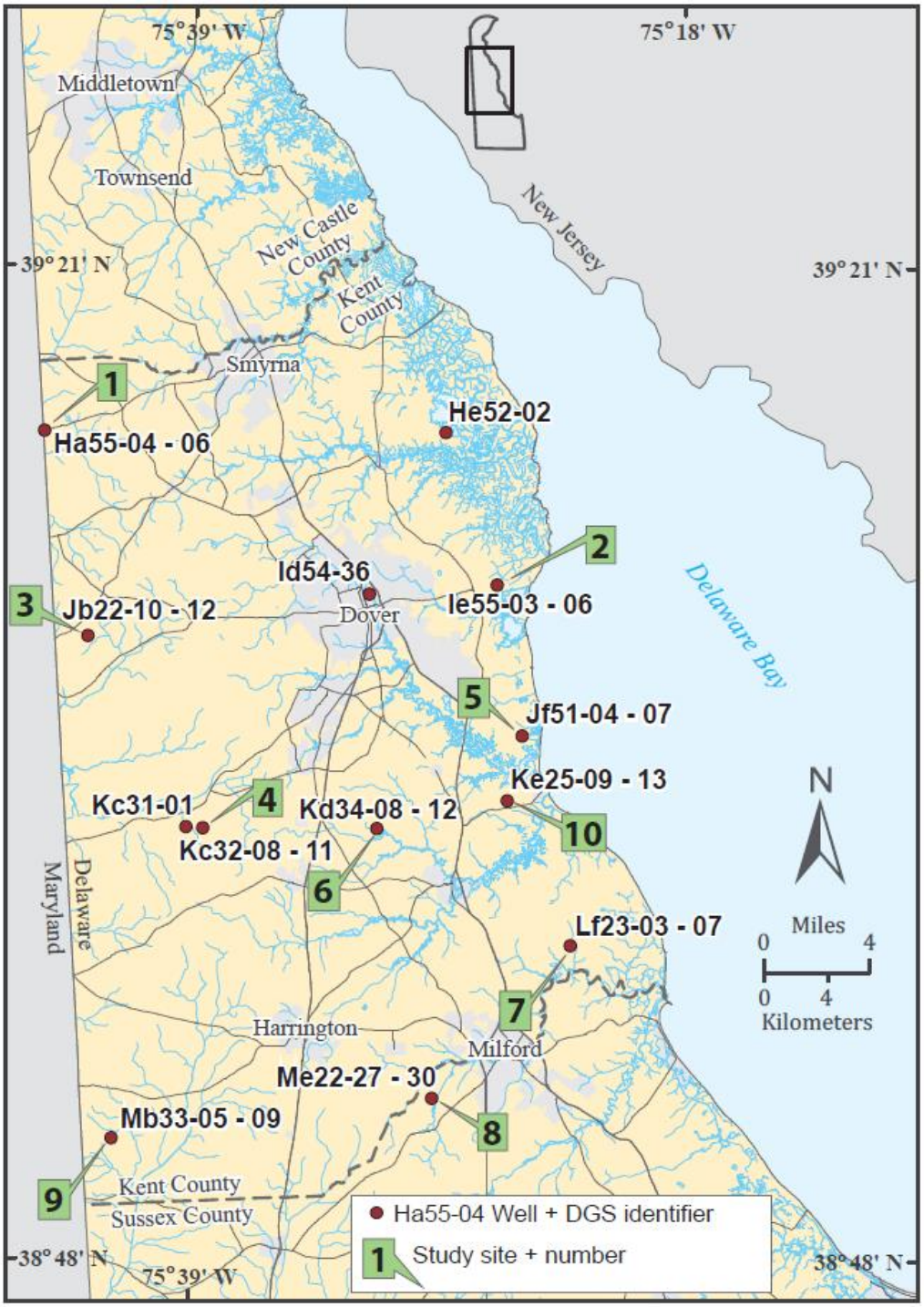


Figure 24. Monitoring sites for Groundwater and Saline Water Intrusion Monitoring Network Infrastructure Improvements: Kent County, Delaware. Source: S. Andres, DGS, Nov. 2019.

Bayshore Supply Alternatives.

A limited number of water supply alternatives are available for this area. Non-critical, confined aquifers are one option, but these may be limited depending on the magnitude of the diversion (e.g., Piney Point, Mt. Laurel-Wenonah) or by water quality problems (e.g., salt water in the Mt. Laurel-Wenonah). New Jersey American Water's tri-county pipeline, originally developed as an alternative source of water for the stressed

municipalities in Critical Area 2, has now been extended through much of Gloucester County, including Logan, Harrison, East Greenwich, Woolwich, Pitman, and Elk Townships.

x. National Groundwater Monitoring Network

The National Ground-Water Monitoring Network (NGWMN) is a consortium of state and local agencies and the USGS that was established to create a single point of access for scientists, engineers, policy makers, and the public to view and acquire important physical and chemical data on the nation's groundwater resources. NJDEP has contributed data to the NGWMN since 2011. Its network consists of 150 shallow wells designed to provide information on three land uses (urban, agricultural, and undeveloped) and are monitored for 177 analytes on a 3-year cycle. DGS became a data provider in early 2016. The network will ultimately allow users to view groundwater data across state lines to observe trends in groundwater quality and availability in a local, regional or national context. NGWMN resources are managed by the USGS Center for Integrated Data Analytics and can be accessed at http://cida.usgs.gov/ngwmn/.

xi. General Statement of Basin Supply Sufficiency

Under normal hydrologic conditions, and in accordance with current DRBC drought management plans and docket requirements (conservation releases, pass-by flows, consumptive use make-up, etc.), there is an adequate supply of water to meet flow objectives, in-basin water withdrawal demands and out-of-basin diversions. Under below normal hydrologic conditions and corresponding low stream flows (e.g., 7-day average, one-in-ten-years (7Q10)), in-basin water withdrawal demands, streamflow objectives and out-of-basin demands can generally be met. Under a repeat of the drought of record, analyses indicate that current streamflow objectives at Montague and Trenton, NJ and current out-of-basin diversions under the DRBC drought management plans can generally be met under current conditions. Potential changes in: in-basin withdrawal demands, streamflow objectives and climate change (including sea level rise) are currently being evaluated to assess future water supply sustainability.

Furthermore, groundwater in both NJ Critical Area 2 and the SEPA Groundwater Protected Area remains under close scrutiny, and conjunctive use of surface water is both recommended and, in some locations, necessary. More in-depth analysis and investigation is needed to provide a detailed forecast of supply adequacy during a repeat of the drought of record, under modified operating restrictions, or under different climatic conditions. The Commission proposes over the next three years to prepare a supply assessment under various scenarios and make recommendations for a Sustainable Water Future through 2060.

The US Army Corps of Engineers (USACE) has highlighted potential structural inadequacies in the Blue Marsh and Beltzville Reservoirs, issues that will need to be addressed. The stored water is released to maintain minimum flows immediately below the reservoirs (conservation releases) and to support flow objectives (e.g., Delaware River at Trenton). DRBC is responsible for the annual debt service and a portion of operation and maintenance costs. These costs are reimbursed from the DRBC water supply charging program.

C. Surface Water Quality

i. Surface Water Quality Assessment

Two major water quality assessments describe the water quality of the Delaware River Basin: The *2019 State of the Basin*, and the *2018 Delaware River and Bay Water Quality Assessment Report*. These two reports complement each other by utilizing different approaches to assess water quality. During the first quarter of 2018, DRBC completed the 2018 Delaware River and Bay Water Quality Assessment Report. That report was finalized and posted on the Commission's web site in October 2018.

Table C1. Comparison of Water Quality Assessment Reports

Comparison	2019 State of the Basin	2018 Delaware River and Bay Water Quality Assessment
Evaluation Method	Use of Indicators	Compare observations to DRBC Criteria
Assessment	Current status, long term trends, future predictions	Supporting or not supporting designated uses
Term	Expanded data window for current status, full period of record for long term trends	5-Year data window
Extent	Entire basin	Mainstem Delaware River only

ii. State of the Basin 2019: Water Quality

The Water Quality chapter of the State of the Basin 2019 report provided an assessment of water quality indicators for the entire basin, with special emphasis on the estuary. The State of the Basin differed from, and complemented, the 2018 Water Quality Assessment Report, in that it focused on metrics for which no criteria have been developed and evaluated long term trends. The State of the Basin 2019 is available at DRBC's website (https://www.nj.gov/drbc/library/documents/SOTBreport_july2019.pdf).

iii. 2018 Delaware River and Bay Water Quality Assessment

Figure 25. Delaware River Basin Water Quality Zones

The Water Quality Assessment (previously called the Integrated Assessment) performed by DRBC focuses on the mainstem Delaware River, comparing observations to water quality criteria to determine whether water quality is sufficient to support designated uses as described in the Water Code. Designated uses for the River include: Aquatic life, Public Water Supply, Recreation, Fish Consumption, and Shellfish Consumption, although not all uses are designated in all water quality zones (see Figure 25). Assessments to determine support of the designated uses of the Delaware River are reported in the 2018 Delaware River and Bay Water Quality Assessment at:

https://www.nj.gov/drbc/quality/reports/wq-assessment-rpts.html

General Statement of Basin Water Quality

Overall, the majority of observations meet water quality criteria in the Delaware River and Bay.

Aquatic Life

Support of the aquatic life designated use is assessed by evaluation of dissolved oxygen, pH, turbidity, temperature, TDS, alkalinity, toxic pollutants, and biology. The majority of observations met water quality standards. Additional detail on select portions of the assessment in support of Aquatic Life is provided below:

Conventional Pollutants

- **Dissolved Oxygen.** The vast majority of the measurements met criteria. All criteria were met in Zones 1C, 1D, 1E, 3, and 4. All seasonal mean criteria were met in Zones 2 through 5. The majority of observations met minimum or 24-hour mean criteria in all Zones.
- **pH.** Most pH observations met criteria, however daily maximum values routinely exceeded the maximum criterion of 8.5.
- **Turbidity.** The majority of observations met criteria for turbidity in all Zones.
- **Temperature**. As noted in previous assessments, temperature criteria in Zones 1A through 1E are clearly oriented toward determining compliance of thermal mixing zones for point discharges. In Zones 3 through 6, the majority of observations met criteria. In Zone 2, approximately 92.8% of observations met criteria. Atmospheric temperatures and meteorological conditions are strong drivers of water temperature.

Toxic Pollutants

- **Copper.** Data showed multiple exceedances in Zone 5 of the chronic freshwater criterion for copper using the DRBC regulatory hardness of 74 mg/L CaCO3 in the hardness-based criteria equation but not more than one exceedance in three years when site specific hardness are used. Multiple exceedances of DRBC acute and chronic marine stream quality objectives were observed for copper in Zones 5 and 6. Assessment is complicated by factors such as field sampling and analytical issues with contamination, the applicability of DRBC's freshwater or marine criteria, a need to assess revisions to the current freshwater and marine criteria, and the influence of other water quality attributes that influence the partitioning and toxicity of copper. Coordination among basin states and agencies should continue to ensure the use of the most appropriate methods and procedures for the conduct of monitoring studies for copper in the Basin, and the harmonization of water quality criteria and assessment methodologies in all Zones.

- ***A*luminum.** Data showed numerous exceedances of aluminum acute and chronic freshwater objectives for the support of aquatic life in Zone 4 over multiple years. With enhanced monitoring in 2017, the chronic criterion was exceeded in Zones 2, 3 and 5 and acute criterion was exceeded in Zone 5. However, supplemental assessment with EPA proposed Multiple Linear Regression (MLR) based criterion calculations did not confirm acute exceedances (https://www.epa.gov/wqc/2017-draft-aquatic-lifecriteria-aluminum-freshwater). Chronic exceedances were indicated by MLR using sample specific pH, DOC and hardness in Zones 4 and 5. Coordination among basin states and agencies should continue to ensure the use of the most appropriate methods and procedures for the conduct of monitoring studies in the Basin, and the harmonization of water quality criteria and assessment methodologies for aluminum.

Public Water Supply

Support of the Public Water Supply designated use is assessed by evaluating TDS, Hardness, Chlorides, Odor, Phenols, Sodium, Turbidity, Systemic Toxicants, Carcinogens, and Drinking Water Closures. The majority of observations met water quality standards.

Recreation

Section 101(a)(2) of the Clean Water Act sets, as a national goal, attainment of water quality that protects fish and wildlife and provides for recreation. In the Delaware River, recreation is the designated use for all zones except for Zone 3 and the upper portion of Zone 4. Zone 3 and the upper portion of Zone 4, above River Mile 81.8, are designated as recreation - secondary contact, while the lower portion of Zone 4, below River Mile 81.8, is designated for primary contact recreation. Primary contact recreation is supported in Zone 1C, 2, 5, and 6. Secondary contact recreation is supported in Zones 3 and the upper portion of Zone 4. Zones 1A, 1B, 1D, 1E, and the lower portion of Zone 4 had insufficient data to assess.

DRBC is in the midst of a special study to assess the likelihood of achieving water quality that would support recreation in Zones 3 and upper 4. DRBC expects results from this effort in 2020, and identification of follow-up actions that will support both safety and increased recreational opportunities in the future.

Fish Consumption

While working to reduce toxic pollutants that bioaccumulate, "advisories" containing meal advice for consumers of recreationally-caught fish and shellfish are issued to minimize the risk to human health. While the DRBC does not issue fish consumption advisories, DRBC staff work with Basin states to provide data to use in developing state-issued advisories. The fish consumption designated use applies to all DRBC WQM Zones. The assessment criterion is based primarily on the presence of the Basin states' fish consumption advisories in the mainstem Delaware River and Bay for the assessment period. The presence of fish consumption advisories results in an assessment of "not supporting the designated use." Advisories were issued for each assessment unit. There is no assessment unit without an advisory, so the use is not supported in any zone. However, it is important to note improvements in the advisories. For example, New Jersey and Delaware have revised advisories in the Delaware Estuary from PA/DE Border to C&D Canal (River Mile 80-58) to allow three meals per year for all fin fish including white perch and channel catfish. Before 2015, no consumption was advised. Similarly, PA revised advisories from 'Do not eat' to six meals per year for sections from Trenton, NJ, to Morrisville, PA, bridge to PA/DE border for carp in 2016. Those less stringent fish consumption advisories are due to lower PCB concentrations in fish tissue.

EPA approved a total maximum daily load (TMDL) for PCBs for Zones 2 through 5 in December 2003, and a second PCB TMDL for Zone 6 in December 2006. TMDLs are expected to be revised by USEPA in the near future based on documentation prepared by DRBC staff.

Shellfish Consumption

Shellfish consumption, as a DRBC designated use, only applies to DRBC Zone 6. For the 2018 assessment, approved harvesting areas were considered to be supporting the use. Prohibited waters were considered to be not supporting the use. Assessment units classified as special restricted and seasonally restricted are considered to be supported, but with special conditions. In total for the 2018 assessment, 615 mi^2 are in full support (79% of zone 6), 44 mi^2 are supporting with special conditions (11%), and 123 mi^2 are not supporting the shellfish consumption use (16%).

Antidegradation: DRBC Special Protection Waters

In recent years, three major advancements have been achieved in the Special Protection Waters program:

- The Lower Delaware Measurable Change Assessment 2009-2011 (DRBC 2016) was completed. This was DRBC's first assessment of measurable change since site-specific existing water quality (EWQ) targets were established in DRBC rules. Methods for determination of

measurable change were successfully applied, showing that water quality has not degraded and, in many cases, has improved. Only chlorides and specific conductance exceeded water quality targets at almost all sites, but both are still far better than water quality standards. The cause for this increase is believed to be winter road salting. Notable water quality improvements were observed in the Delaware, Lehigh and Musconetcong Rivers, where nutrient concentrations declined. This publication is available online at http://www.nj.gov/drbc/library/documents/LowerDel_EWQrpt_2016/LDel_EWQrpt_2016_entire.pdf and as a story map at http://drbc.maps.arcgis.com/apps/MapSeries/index.html?appid=e63f5f1320794666a7def165ff9ae0e4

- Site-specific EWQ targets have been developed for all Upper, Middle and Lower Delaware sites. There are currently 85 Delaware River and tributary sites. EWQ is documented in the Existing Water Quality Atlas of the Delaware River Special Protection Waters (DRBC 2016). Data were compiled from the DRBC/NPS Special Protection Waters (SPW) monitoring results; three USGS water quality investigations (Hickman and Fisher 2008; Siemion and Murdoch 2010; and Senior in press); and state monitoring results from PADEP, NJDEP and NYSDEC. This publication is available online at http://www.nj.gov/drbc/programs/quality/spw_ewq-atlas.html.
- Water quality models have been developed, calibrated, and are utilized for watershed-wide cumulative evaluations of wastewater projects for four regions: the Lower Delaware; the Lehigh River watershed; the Brodhead Creek watershed; and the Neversink River watershed. These models are regularly updated and used for No Measurable Change evaluations of new or expanding wastewater facilities in DRBC's permitting process.

D. Population and Landscape

The following statistics are based on the 2010 US Census; the county population figures are for 2016, are not corrected for the Basin boundary and should be considered provisional. The next full census will be undertaken in 2020.

The following statistics are based on the U.S. Census Bureau, 2000 Census, 2010 Census, and 2012-2016 American Community Survey 5-Year Estimates. The county population figures for 2016, discussed below, are adjusted to the Basin boundary.

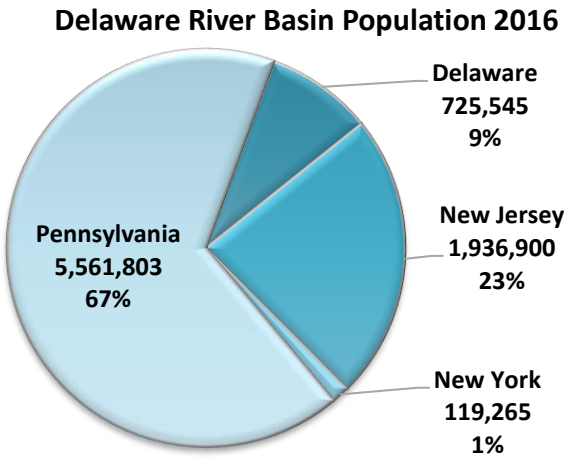


Figure 26. Basin Population 2016. Pennsylvania accounts for approximately two-thirds of the basin's population. (Note: An additional 5 million people outside of the basin who rely on basin water supplies are not included in this figure).

The total 2016 population in the Basin is 8.34 million people. Figure 26 shows the portion of the Basin population by state.

- The population of the Basin increased by nearly one half million people, from 7.76 million in 2000 to nearly 8.25 million in 2010 (an increase of 6.3%).
- Between 2010 and 2016, the counties within or straddling the Basin added an additional 93,479 people.
- Continued population growth at 6.3% per decade will mean an increase of 35.7% to 11.2 million people by 2060.
- The greatest concentration of developed land (and population density) continues to be in the Lower Region of the Basin - the greater Trenton-Philadelphia-Camden-Wilmington area.

Between 2010 and 2016, the population in four Basin counties increased by 10,000 or more, including Philadelphia, Montgomery, and Chester in Pennsylvania and New Castle County in Delaware. Growth in Kent County, Delaware, is entirely dependent on groundwater, whereas the other growing counties have greater availability of water supply infrastructure and conjunctive use of source supplies.

Portions of DRB Counties with the Largest Population Growth from 2010 to 2016

State	County	2010	2016	Change	% Change
PA	Philadelphia	1,526,006	1,559,938	33,932	2.2%
PA	Montgomery	799,881	815,876	15,995	2.0%
DE	New Castle	517,111	530,081	12,970	2.5%
PA	Chester	454,501	466,616	12,115	2.7%
PA	Lehigh	349,497	358,792	9,295	2.7%
DE	Kent	138,752	147,650	8,897	6.4%

Similarly, between 2010 and 2016, eleven Basin counties decreased in population by more than 1,000 people: five in New Jersey, four in Pennsylvania and two in New York. Pike County, PA, which in previous years was one of the fastest growing counties in PA and the Basin, is losing population. Also, unlike their counterparts across the Bay in Delaware, the New Jersey Bayshore counties (Cape May and Salem) are losing population.

Portions of DRB Counties with the Largest Population Loss from 2010 to 2016

State	County	2010	2016	Change	% Change
PA	Monroe	169,842	167,126	-2,716	-1.6%
NJ	Camden	444,167	441,967	-2,200	-0.5%
NJ	Sussex	76,876	74,903	-1,974	-2.6%
NJ	Warren	108,692	107,095	-1,597	-1.5%
NY	Sullivan	66,398	64,808	-1,590	-2.4%
NJ	Salem	66,083	64,504	-1,579	-2.4%
PA	Wayne	50,828	49,363	-1,465	-2.9%
PA	Schuylkill	85,402	84,143	-1,260	-1.5%
PA	Pike	57,369	56,210	-1,159	-2.0%
NJ	Cumberland	156,437	155,348	-1,089	-0.7%
NY	Delaware	33,290	32,237	-1,053	-3.2%

Landscape change occurs very gradually across the Basin but is nonetheless worth tracking since landscape conditions can affect water resources. In the years between 1996 and 2010, the landscape has changed, although not dramatically in the aggregate. Net changes are summarized below, and regional shifts in land cover are illustrated in Figure 27.

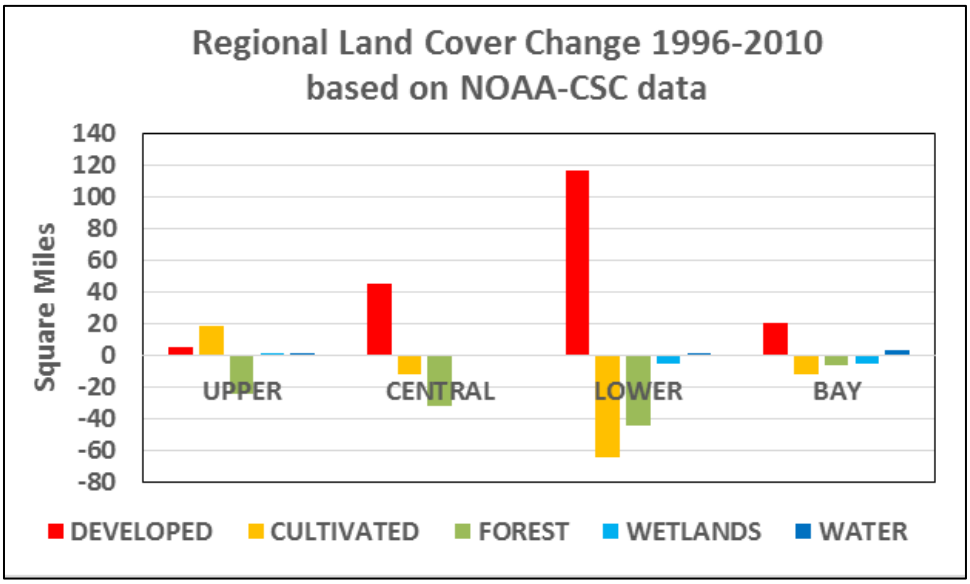


Figure 27. Regional Net Change in Land Cover 1996-2010 illustrates the magnitude of change and the net gains/losses in land cover in the four basin regions. Forest loss was experienced across the basin. Based on analysis of satellite imagery from NOAA Coastal Services Center.

- Developed land now covers nearly 2100 square miles, more than 16% of the Basin.
- Natural landscapes (e.g., forests and wetlands) cover slightly less than 60% of the landscape.
- Forested land, once a dominant feature, now accounts for less than half of the Basin land cover and decreased by more than 100 square miles (approx. 68,460 acres) between 1996 and 2010. Continued loss of forest, crucial to sustaining water quality and availability, could have a negative impact on the long-term condition of the Basin's water resources.
- Changes in wetlands appear to be less dramatic since no-net-loss policies have minimized losses from development activity. However, coastal wetlands face the threat of erosion and inundation from rising sea levels, effects exacerbated by their inability to migrate inland when trapped by existing developed land.
- Cultivated (agricultural and transitional scrub shrub landscapes) land experienced a net decrease during the period in all but the Upper region of the Basin.

Changes in species composition can be expected with changes in climatic conditions, including the transitioning of coastal freshwater wetlands to salt marsh and the loss of once-dominant forest species—such as hemlock and oak—from infestation and disease supported by warmer temperatures. The overall effects of these changes on water resources remain to be examined.

Estimates of future population will drive both direct (potable supply) and indirect (energy-related, industrial) needs for water. Estimates of future land use/land cover and its implications for future water supply needs will be developed as part of the USGS National WaterSMART program and integrated into the Sustainable Water Future 2060 project.

E. Emergent Issues

i. Hydraulic Fracturing

Hydraulic fracturing in the Marcellus Shale and other formations in the Delaware River Basin could affect water resources. Work Program tasks related to hydraulic fracturing activity are found in the Special Section of Section II.

ii. Linear Infrastructure (Pipelines, Electric Transmission Lines)

The development of natural gas outside of the Delaware River Basin (Basin) has resulted in the modification and/or expansion of existing natural gas pipelines in the Basin and the construction of new natural gas transmission pipelines and supporting infrastructure (e.g., compressor stations) in and through the Basin. The Commission has received, reviewed, and approved several applications in recent years, and additional transmission lines are proposed. Several transmission lines are proposed to convey the liquid by-products from the gas wells to refineries and markets in the Basin. In addition to the natural gas transmission lines, the Basin has experienced the reconstruction and or expansion of electric transmission lines. In part, the replacement of the existing infrastructure is due to its age, the need to improve delivery system reliability and redundancy, and to meet the growing demand of the Northeast United States.

iii. Other Energy Issues

Certain energy generation and transmission also introduce the potential for impacts to water resources. Among the projects that come under jurisdiction of the DRBC are:

- The transition from once-through to evaporative cooling as existing or new power stations add capacity is expected to add to consumptive use of water.
- The emergence of dry cooling as a technology option for power generation, which could reduce consumptive use.
- New natural gas power plants that are being proposed throughout the northeastern U.S. to take advantage of cheaper, more regional sources of natural gas.
- If nuclear power facilities in the Basin were to shut down, reduce capacity or close that could result in a large reduction in water withdrawals and consumptive use.
- Liquefied Natural Gas (LNG) proposals that would convert natural gas from regional or other locations into a liquid form for local use, and/or export to other areas of the country or overseas.

iv. Changing Climate

The availability of water resources in the Basin may change as the result of shifting regional weather patterns. While the science continues to evolve, climate models predict that Basin temperatures will increase, annual precipitation amounts may stay the same or increase, and sea levels are expected to rise. Higher temperatures in winter will result in precipitation more likely occurring as rain rather than snow and higher evapotranspiration rates. With less water being stored in snowpack, winter flows increase, and spring flows decrease, altering the seasonal cycle of streamflow. The current increased temperatures may also affect stream water quality. Turbidity levels will likely increase, and dissolved oxygen levels decrease. Sea level rise may require increased releases from storage to augment river flows to repel salinity and/or costly modifications by water suppliers to treat increases in dissolved solids. Climate change may also affect instream flow and temperature conditions for aquatic biota. Work Program tasks related to water supply planning under future (2060) conditions, including potential climate change, are found in Section II.

v. Perfluorinated Compounds

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a diverse group of compounds that have varying degrees of persistence, toxicity and bioaccumulation in the environment. They are found in a variety of industrial and household products such as stain repellant textiles, fire-fighting foams and paper coatings. They have unique properties to repel both water and oil. While there is still much to be learned about the effects of PFAS on human and ecological health, exposure from drinking water is a concern. In November 2016, EPA issued a revised health advisory for Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS), the most extensively produced and studied of the PFAS[1]. The New Jersey Department of Environmental Protection (NJDEP) has issued a drinking water standard for Perfluorononanoic acid (PFNA) of .013 parts per billion (ppb). NJ's Drinking Water Quality Institute, an advisory panel, has released recommended drinking water standards of 0.013 ppb for PFOS and 0.014 ppb for PFOA. These recommended standards are in NJ's review and approval process, which involves stakeholder outreach and public meetings. In January 2019 NJDEP issued interim groundwater standards of 0.01 ppb for PFOA and PFOS, which will be replaced after the review and approval process. Pennsylvania has created an action team to address concerns about PFAS. These substances have been detected in drinking water wells in Basin states. PFOS has also been detected in fish tissue in the Basin. Available data for surface water show PFOA and PFOS levels are below current EPA and Basin state human health advisory levels in segments of the Delaware River designated as drinking water sources. PFAS are contaminants of emerging concern that warrant further study. DRBC staff and the Toxics Advisory Committee (TAC) continue to review and assess PFAS in the Delaware River. For additional information, see Contaminants of Emerging Concern on the DRBC website at: http://www.nj.gov/drbc/quality/reports/cecs.html .

vi. Atlantic sturgeon (Acipenser oxyrinchus)

Effective in April 2012, four geographically distinct populations of Atlantic sturgeon, including those of the New York Bight—which includes the Delaware River—were listed as endangered. Mature Atlantic sturgeon migrate from the sea to fresh water in advance of spawning, and juveniles remain in fresh water for several years. Once abundant in the tidal Delaware River, spawning adults are believed to currently number fewer than 300. The Endangered Species Act requires species listed as endangered to receive the full protection under the Act to prevent extinction, including a prohibition against "take," which includes harassing, harming, pursuing, wounding, killing, trapping, capturing, or collecting. In August 2017, critical habitat for Atlantic sturgeon in the Delaware River was designated as the entire tidal river from the head of the tide at Trenton, NJ to the head of Delaware Bay. As part of the designated use studies, ichthyoplankton studies are planned in the tidal river to further examine the spawning and rearing habitat, and an assessment of the levels of protection provided by various dissolved oxygen concentration to life stages of the Atlantic sturgeon is also planned.

vii. Increasing Chloride Trends

Over the past several years fresh water instream monitoring has shown an upward trend in chloride concentrations in the freshwater of the nontidal Delaware River, a trend common to areas of the U.S. with significant roadway de-icing activity. While concentrations are still below criteria for drinking water and aquatic life use, the trend is of concern. Studies in NY, MD and VT indicated as early as 2005 that chloride concentrations in winter could increase as much as a hundred-fold over summertime levels in unimpacted forest streams, and that mean annual levels increase as a function of impervious surface—sometimes exceeding tolerance for freshwater life in suburban and urban streams.[2] Additional monitoring and investigation into sources, mitigation measures, and de-icing alternatives to salt and brine are needed.

viii. Micro Plastics

[1] See EPA Fact Sheet 800-F-16-003 https://www.epa.gov/sites/production/files/201606/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf

2 Kaushai, S.S., P. Groffman et al. "Increased salinization of fresh water in the northeastern US," Proceedings of the National Academy of Sciences of the US (PNAS) Vol. 102 No. 38, Sept.20, 2005. http://www.pnas.org/content/102/38/13517.long. Accessed 11/28/2017.

Plastic is perhaps the most prevalent type of debris found in our oceans and large lakes. Plastic debris can come in all shapes and sizes, but those that are less than five millimeters in length (or about the size of a sesame seed) are called “microplastics.” Eventually, larger plastics degrade into microplastics and include originally manufactured products such as microbeads found in cosmetics and personal care products (such as toothpaste), industrial scrubbers used for abrasive blast cleaning, and resin pellets used in the plastic manufacturing process. ‘Microfibers’ are another type of microplastic that are generated from washing synthetic clothing made of polyester and nylon (petroleum-based materials). These tiny particles easily pass through water filtration systems and end up in receiving waters, posing a potential threat to aquatic life.

Microbeads are not a recent problem, but probably first appeared in personal care products about fifty years ago, with plastics increasingly replacing natural ingredients. As recently as 2012, this issue was still relatively unknown, with an abundance of products containing plastic microbeads on the market and not a lot of awareness on the part of consumers. On December 28, 2015, President Obama signed the *Microbead-Free Waters Act of 2015*, banning plastic microbeads in cosmetics and personal care products.

As an emerging field of study, not much is known about microplastics and their impacts yet. The NOAA Marine Debris Program is leading efforts within NOAA to research this topic. Standardized field methods for collecting sediment, sand, and surface-water microplastic samples have been developed and continue to undergo testing. Eventually, field and laboratory protocols will allow for global comparisons of the amount of microplastics released into the environment, which is the first step in determining the final distribution, impacts, and fate of this debris. USGS in partnership with National Park Service units in the Basin are conducting a research project that includes sampling in the Delaware River and Bay. The funded project is titled “*Occurrence and Potential Risk of Microplastics in Lake Mead & the Delaware River.”*

Funded by Delaware Sea Grant, researchers at the University of Delaware are investigating the abundance and type of microplastics in water collected at 5 sites along Delaware Bay in Delaware and New Jersey. Preliminary results indicate a higher concentration of filament microplastics near industrial areas and higher concentrations of smaller microplastics (0.3mm-1mm) near Cherry Island landfill in Wilmington and Bombay Hook, although microplastics at Cherry Island were three times more likely to be larger (1-5mm) in size than smaller (0.3-1mm). Study results will inform project partners at the Delaware Department of Natural Resources and Environmental Control (DNREC) who are developing a strategy to investigate the extent and implications of microplastics in the Delaware Bay, as well as state water quality regulators concerned about the potential impact for fisheries, including oysters. The impacts on human health are not fully studied or known.

In 2018, DRBC received a two-year grant from the Delaware Watershed Conservation Fund to monitor for microplastics and model loadings of microplastics in the upper Delaware River Estuary. This project will provide greater detail into how microplastics are distributed in this section of the Basin and which source tributaries are introducing the most microplastics. DRBC will collect samples from four sites in the upper Delaware River Estuary and ten tributary sites. As the non-tidal Delaware River is the largest loading into the estuary, samples will also be collected at the head of tide in Trenton, NJ. Samples will be collected in summer and fall 2019 and will be analyzed by Temple University for microplastic concentrations. Data collected during microplastic monitoring efforts will be used to model microplastic dynamics in the estuary. These models will allow us to identify high plastic-loading tributaries, which will be targeted for cleanup efforts.

ix. Cyanobacteria

During summer 2019, cyanobacteria blooms were noted in several impoundments draining to tributaries and ultimately the Delaware River. Fate and degradation of cyanotoxins are not well understood. DRBC will continue to coordinate with advisory committees and other stakeholders to determine what if any strategies or follow-up steps are warranted.

II. Water Resource Management

Summary of the activities and programs constituting the work plan for FY 2019-2021

A. Goals and Priorities

The key water resource goals of the DRBC are:

- An adequate and sustainable supply of water for the Basin.
- Clean and healthy water resources throughout the Basin.
- Reduction of losses and impacts in areas prone to flooding within the Basin.

Commission Focus Areas

1. Water Quantity
   - Perform modeling analyses for 2060 Sustainable Water Resources, including climate change considerations and pilot studies of Lehigh and Schuylkill watersheds. Begin pilot for the Brandywine watershed.
   - Support Decree Parties as they evolve the Flexible Flow Management Program (FFMP) and perform studies as specified in FFMP2017. This will include use of the DRB - Planning Support Tool, the 1-D Toxi5 model, the hydrodynamic 3-D EFDC model, the Habitat Assessment Tool (known as the DSS), as well as facilitation of discussions regarding alternative and scenario development, screening, and selection and justification of those proposed for decision-making discussions. Lead discussion and perform analyses on optimizing storage for the FFMP2017 studies.
   - Begin a multi-year evaluation of additional storage and/or optimizing operations at F.E. Walter reservoir with the USACE.
   - Work with the USACE on a Planning Assistance to States (PAS) grant to modify the existing HEC-HMS model (hydrologic) in the DRB. The revised model will be used in planning studies, including those for FFMP2017, to evaluate the impacts of predicted changes to precipitation, temperature, evapotranspiration and snowpack on water supplies and flow management.
   - Initiate study to identify new storage opportunities to meet future needs.
   - Manage DRBC storage for salinity repulsion and monitor hydrologic conditions that may require Commission action.
   - Coordinate drought management actions with States, reservoir operators and facilities with consumptive use replacement requirements.
   - Develop Instream Flow Policy process in collaboration with state and federal agencies.
   - Develop updated water efficiency standards using USEPA WaterSense standards and/or Energy Star Certification.
   - Use 3D Hydrodynamic model to evaluate effectiveness of flow management goals for salinity repulsion under future sea level rise predictions and flow management alternatives, for both the FFMP2017 studies and the 2060 study.

2. Water Quality
   - Conduct studies to determine the attainable aquatic life designated uses and dissolved oxygen criteria to support those uses in Zones 3, 4, and the upper portion of Zone 5 as outlined in Resolution 2017-4.
   - Implement water quality program (monitoring, assessment, and modeling) supported by EPA Section 106 grant in the Special Protection Waters (SPW) and Delaware Estuary.
   - Collaborate with EPA and the Basin states to implement PCB TMDLs throughout tidal system; establish Stage 2 TMDLs and revised implementation requirements.
   - Develop and calibrate eutrophication model of tidal river and estuary, including collection of necessary data.
   - Determine load and wasteload allocations necessary to achieve attainable aquatic life uses.

- Continue coordination with a workgroup to identify early actions to reduce oxygen depleting discharges as described in Resolution 2017-4.
- Complete coordination with advisory committees to recommend updates to DRBC water quality regulations for the main stem for key parameters, such as ammonia.

3. Regulatory Function
   - Review applications and issue dockets/permits for projects under DRBC lead.
   - Develop/update and implement the One Permit Program and associated administrative agreements (AAs) for collaborative permitting and technical coordination of state NPDES permits and water withdrawals.
   - Enforce conditions of dockets/permits through compliance program.

4. Collaborate with regional/state watershed partners: Partnership for the Delaware Estuary, Schuylkill Action Network, Christina Basin, Common Waters, Coalition for the Delaware River Watershed, National Park Service Wild and Scenic Rivers program, Delaware River Basin Conservation Fund through US Fish and Wildlife Service, and state and federal committees/councils.

5. Agency Fiscal Management
   - Water Withdrawal and Discharge Project Fees: Continue to implement the annual monitoring and coordination fee program. Update the fee structure for review of project applications and coordination with state permitting programs.
   - Re-establish and/or maintain signatory party contributions.

B. Water Resource Management Work Program

Special Section: Hydraulic Fracturing

DRBC staff will support the development and advancement of hydraulic fracturing regulations consistent with leadership on this matter at the Commissioner level including, the following activities as directed:

1. **Hydraulic Fracturing Regulation**
   Based on Commissioner level leadership, staff will continue to review and revise the rules and advance the process to support Commissioner's action on the pending hydraulic fracturing regulations.

2. **Comment and Response Document**
   Staff is preparing a Comment and Response Document that addresses public comments made on the draft hydraulic fracturing regulations.

3. **Program Implementation**
   Pending Commission action, staff will implement the program using the approved regulations and existing related rules and policy.

Section 1: Ensuring the Sustainable Supply of Suitable Quality Water

1.1 Water Supply Strategy: Forecasting and Planning

1.1.1 Water Supply Planning for a Sustainable Water Future 2060

Building on the water use and demand evaluation work in past reporting efforts, the Commission will integrate efforts to prepare a detailed and comprehensive analysis of water demand, availability, and sufficiency through 2060. Past analyses, as well as recent condition reporting (see Conditions Section I of this Program), have identified areas where stress is evident and investigations are needed to identify additional areas of concern. Assessment of surface flows, aquifer conditions, anthropogenic supply needs, permitted allocations, and ecological needs will be compiled to identify long-term sustainability concerns and suggest appropriate action. Existing models along with innovative methodologies for integrating models will be employed for the assessment and to determine areas where additional storage may be needed.

The work plan includes:

- Water demand projections for the public water supply, thermoelectric and industrial sectors out to 2060.
- Analysis of the water audits and recommendations for future actions.
- Assessment of water use records across all sectors.
- Assessment of instream flow needs for key ecological communities within the DRB.
- Assessment of water availability during a repeat of the drought of the 1960's, the Basin's drought planning benchmark.
- Assessment of water availability with predicted future climate trends.
- Identification of additional information and tools necessary to forecast future condition (demand, supply, climate) scenarios, including those for the FFMP2017 studies.
- Ongoing assessment of special groundwater management areas within the Basin.
- Consideration of need for groundwater withdrawal limits in areas outside of protection areas (e.g., GWPA).
- Review of the adequacy of supply storage facilities to meet future water use and in-stream needs.

While most tasks are included in Section 1.1 of the work program, others (e.g., those related to flow modeling or agency coordination), are described in other sections of the document as appropriate.

In Fiscal Year 2019, Congress provided the Water Availability and Use Science Program (WAUSP) with additional resources to pilot Integrated Water Availability Assessments (IWAAs). In response, the WAUSP selected 10 new projects across the U.S. that will help to support development of National and Regional IWAAs. The DRB was selected as one of the ten IWAA projects. Multiple USGS Water Science Centers within the Delaware River Basin (DRB) will work with Basin stakeholders to develop a holistic workplan addressing potential impacts of the drought of record under current supply and demand conditions. Additional deliverables include a model to predict daily withdrawal for public supply water use, improved predictions of streamflow during drought periods, improved water-quality modeling processes, and evaluating the utility of National scale models to inform local water management. Commission staff will engage when and where appropriate on this project.

1.1.2 Supporting and Coordinating with State Water Supply Planning and Allocation

DRBC works closely with the states through the DRBC Water Management Advisory Committee and by serving on committees organized by the states for water supply planning and management. Basin states continue to improve their data collection efforts, which are critical for well-informed planning and management.

As reflected in the updated administrative agreements between the Commission and the states of New Jersey (2015) and New York (2016), the Commission is cooperating with the state permitting/allocation programs for the groundwater and surface water withdrawals in those states. DRBC administers a special program for the Southeastern Pennsylvania Groundwater Protected Area (SEPA GWPA, see Section 1.3.2) on behalf of the Commonwealth of Pennsylvania. New York's water supply law (see primarily NY Environmental Conservation Law, Article 15, Titles 15, 16 and 33) was amended on August 16, 2011 (Laws of New York, Chapter 401), with most of the statutory amendments effective as of February 15, 2012. The amendments expand the permit program to include withdrawals for purposes beyond public water supply, such as those for commercial, manufacturing, industrial, and other purposes, and limit the permit program to only include systems with capacity to withdraw 100,000 gallons per day or more. Previously, permits were required for any volume of withdrawals for public supply. The revised rule indicates that since the NYSDEC, as a voting member of the DRBC, is integrally involved with the DRBC's water withdrawal approval processes, that if a water withdrawal occurs in the jurisdiction of the DRBC and the water withdrawal is approved by DRBC, as applicable, then the water withdrawal is exempt from the permit requirements of the rule.

1.1.3 Surface Water Charging Program

DRBC administers an ongoing Surface Water Charging Program, for water withdrawals, which includes on-line registration, reporting and invoicing, and provides resources through a Water Supply Storage Fund (WSSF). The WSSF is used to fund the cost-share debt service and joint use operations and maintenance of Blue Marsh and Beltzville Reservoirs, facilities where DRBC holds water supply storage. This storage is used to ensure freshwater flows into the estuary during periods of low flow. The WSSF is also used to provide the local cost-sharing support for approximately a dozen USGS streamflow and water quality gages, used for flow management, water quality assessments, and flood forecasting by the NWS.

1.1.4 Facility Planning

The Commission has considerable powers of oversight relating to major facilities and projects affecting water resources in the Basin, and "…for the determination of project priorities, pursuant to the requirements of the comprehensive plan and [the] water resources program."

The Commission will focus on several aspects of facility planning in the next three years:

- Review of basin-wide storage capacity and ability to meet projected water use and in-stream needs.
- Coordination with the USACE on the development of Corps Water Management System (CWMS) models (HEC-HMS and HEC-RESSIM) and several proposed potential studies.
- F.E. Walter Re-evaluation Study – the Commission will work with the USACE and NYCDEP to reevaluate the current services provided by F.E. Walter Reservoir, including past and present operational plans; evaluate the existing demands for services from interested stakeholders, including flood control, water supply, water quality and recreation; evaluate future demands for services; and evaluate existing infrastructure to support the current and future demand for services. The reevaluation will consider the project's authorized purpose along with the public and environmental resource needs of the lake, Lehigh River and Delaware River Basin. The effort will result in improved sustainability of our infrastructure system through collaborative planning efforts supporting flood risk management and associated environmental, water supply, and recreation opportunities. Possible solutions may include

operational changes and/or proposed structural changes to the dam infrastructure to support the coexistence of the competing demands.
- Explore opportunities for the optimization of storage including the desired outcomes.

1.1.4.1 Beltzville and Blue Marsh Reservoirs

The Commission owns water supply storage in two federal reservoirs, Beltzville (Lehigh River Watershed) and Blue Marsh (Schuylkill River Watershed), and is responsible for their annual debt service and a portion of their operation and maintenance costs. The Commission will continue to use water in these reservoirs for water supply needs, including support of the Trenton Effective Flow Objective.

As of November 2019, the Commission has directed the USACE to provide a recurring daily release of 9 cfs (5.85 MGD) from the water supply pool (DRBC's storage) at Blue Marsh Reservoir for water supply purposes. This is in addition to the applicable daily conservation release, which comes from the water quality pool. The Commission can request additional releases from the water supply pool to satisfy the Trenton flow objective as necessary.

As of November 2019, the Commission has not directed the USACE to provide a recurring daily release from the water supply pool (DRBC's storage) at Beltzville Reservoir. The Commission can request additional releases from the water supply pool to satisfy the Trenton flow objective as necessary.

1.1.4.2 Storage Study

Evaluating future storage needs in relationship to future water demands (both consumptive and non-consumptive uses), climate change (from changes in precipitation and temperature), and sea level rise is part of the Water Supply Planning for a Sustainable Water Future in Section 1.1.1. Separate from the F.E. Walter Study or the FFMP2017 studies, DRBC is initiating a related study to provide planning, cost estimating and feasibility analysis and to inventory and evaluate options for additional storage to meet potential water supply and flow management needs in the Delaware River Basin. A Request for Proposals (RFP) was issued in the first quarter of 2020.

DRBC WATER RESOURCES PROGRAM
1.1 Water Supply Strategy

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Sustainable Water Future	Modeling analysis for Sustainable Water Supply 2060 Strategy	2020-2022	General Fund, PA Act 220
	Evaluation of basin-wide and regional water use, projections of future needs, supply alternatives	2020-2022	
	Modeling to determine areas where additional storage may be needed	2020-2022	
	Strategies for supply sufficiency through 2060	2020-2022	
Support of State Programs	Coordination and support of Basin state water supply programs	On-going	General Fund
Surface Water Charging Program	Program administration, on-line registration and reporting, invoicing	On-going	WSSF
Facility Planning	F.E. Walter Re-evaluation Study	2020-2022	WSSF
	Initiate a contract/study to review and consider options for developing additional or new storage to meet future needs	2020-2022	WSSF
	Explore options for optimizing existing storage for the above study as well as the FFMP 2017 study	2020	General Fund
	USACE PAS grant – HEC-HMS model	2020-2020	In-kind services

1.2 Multi-objective Flow Management

The main stem of the Delaware River is the longest un-dammed river east of the Mississippi, 152 miles of which are designated under the Wild and Scenic Rivers Act. However, dams on several large tributaries, which store water in reservoirs, regulate flow to the river through conservation releases. These facilities also provide flood mitigation, water supply, and instream flow augmentation. In addition to precipitation, snowmelt and groundwater seeps, activities that affect instream flows include: releases and diversions from water supply and multipurpose reservoirs on tributaries, inter-basin water transfers from tributaries and the river, and water withdrawals from surface waters and interconnected groundwater sources. Low flows may impact habitat and wildlife and reduce the assimilative capacity of the river for wastewater discharges. High flows may cause loss of life and property, but they are also a part of the natural hydrologic cycle. High flows and flooding events move sediment, provide inputs of coarse particulate organic matter that feed organisms at the base of the food chain, and periodically alter the river morphology and riparian corridor, which contribute to habitat and species diversity. Seasonal high flows also provide environmental cues that trigger spawning and lifecycle events for myriad species dependent on this river (e.g., American shad, oysters, mussels, and Atlantic sturgeon).

1.2.1 Reservoir Operations

DRBC staff work with and use forecasts from the National Weather Service (Philadelphia and Binghamton, Weather Forecast Offices; Mid-Atlantic River Forecast Center) to develop better flood warning products as well as useful forecast information of low flows for use in the determination of directed releases to meet the Trenton Effective Flow Objective. If requested, DRBC will provide technical review of new procedures being developed by the Delaware River Master for the calculation of releases from the New York City reservoirs to meet the Montague Flow Objective (design modernizations). Staff will also evaluate the accounting methodology for the balancing adjustment and use of reserved water from the excess release quantity to meet the Trenton Effective Flow Objective.

1.2.1.1 Flow Management.

Releases of water from the three New York City reservoirs (Pepacton, Cannonsville, and Neversink), located in the headwaters of the Delaware River Basin, out-of-Basin diversions, and main stem flow objectives are managed in accordance with procedures unanimously agreed to by parties to the 1954 Supreme Court Decree (New York State, Pennsylvania, New Jersey, Delaware, and the City of New York).

The Flexible Flow Management Program (FFMP) Agreement, a two-part, 10-year agreement signed by all the Parties, is known as FFMP 2017. The program and associated operating plan are intended to protect fisheries habitat downstream of the New York City Delaware Basin reservoirs, provide some flood mitigation, and include the Commission's drought management plans, designed to repel the upstream movement of salt water in the Delaware Estuary without increasing the risks to the Basin's water supplies. The agreement states the intent of the Parties to study various aspects of flow management over the first five years and make adaptive changes to the operating plan as information becomes available and if comparable protection of existing resources is likely to be maintained under new operational programs. Key issues to be studied include salinity repulsion, out-of-basin diversions and opportunities to increase storage. DRBC's Regulated Flow Advisory Committee and its Subcommittee on Ecological Flows serve as venues for public input and dialogue with the Decree Parties regarding different aspects of the program (see Section 4.4.2).

The Commission will continue to manage and coordinate releases from Commission storage (Beltzville and Blue Marsh) to satisfy the Trenton Effective Flow Objective.

The Commission will continue to manage and coordinate the replacement of consumptive use for electrical generating or cogenerating facilities who consumptively use more than 100,000 gallons per day during a critical hydrologic condition in accordance with Resolution 2018-5. This is done primarily by requiring

releases from Merrill Creek Reservoir, the Mongaup reservoir system and importations from the Susquehanna River Basin.

The Commission intends to evaluate the proposals of the Decree Parties to determine the impacts on how the Commission's water supply storage in Beltzville and Blue Marsh Reservoirs may be affected. DRBC staff will utilize its existing and developing models for the evaluations (see Section 1.2.3).

1.2.1.2 Commission Storage (Blue Marsh and Beltzville)

Commission staff is in the process of reviewing the purpose, use and inclusion of Blue Marsh and Beltzville Reservoirs in the Comprehensive Plan. In addition, other related Commission actions, such as dockets and resolutions, are being compiled and reviewed so that their intended use and the current status can be evaluated. The findings will be prepared for Commissioner review.

1.2.1.3 Docket Mandated Storage

Commission staff will conduct reviews for projects where the Commission has required releases from storage to make up for consumptive use. The reviews will focus on the projects' relationship to the Comprehensive Plan. Other related Commission actions, such as dockets and resolutions, will be reviewed and compiled so that their intended use and the current status can be evaluated. The findings will be prepared for Commissioner review.

1.2.1.4 Consumptive Use Policy for Power Producers

During FY2018 Commission staff developed, and the Commission approved, a consumptive use policy (Resolution 2018-5) that formalizes the Commission's existing policy as it relates to the consumptive use make-up requirements of electrical generating or cogenerating facilities who consumptively use more than 100,000 gallons per day. Staff is implementing the policy for new power generation dockets and for existing dockets as they are renewed.

1.2.2 Ecological Flows

Several initiatives are underway to better identify the ecological flow needs of the Basin. For the Subcommittee on Ecological Flows, DRBC staff will work with stakeholders on use of the Upper Delaware River Riverine Environmental Flow Decision Support System (REF-DSS).

1.2.2.1 Non-tidal Mainstem and Tributaries

In April 2012, the Commission and The Nature Conservancy (TNC) began a study to develop basin-wide ecosystem flow recommendations that can be implemented within the subwatersheds of the Delaware River (Management Step 1). The study was completed in December 2013. The study area focused on all tributary rivers and streams in the Appalachian Plateau, Ridge and Valley, New England, and Piedmont Physiographic Provinces, but did not include the streams of the Coastal Plain Physiographic Province. The project also summarized information about flow-sensitive species, communities, and ecological processes for the non-tidal mainstem Delaware River as far downstream as Trenton. The resultant recommendations could be an important component in policy development. Such a policy could address pass-by requirements for water withdrawals, conservation release requirements for reservoirs, consumptive use mitigation triggers, and flow targets. The recommendations may also help the Commission and other Basin partners in the planning, design (location and size), and operation of future water supply storage facilities. In FY2017, the Commission categorized all the existing surface water withdrawals in the DRB. Future policy development in will likely utilize these data relative to the stream setting withdrawals occur in, the type of water withdrawal, and the inventory of surface water withdrawals that currently have pass-by requirements.

In 2019, DRBC received a grant from the Delaware Watershed Conservation Fund (DWCF) to create a web-based habitat model for the Upper Delaware River. This project will build upon existing models that measure habitat changes resulting from regulated flow and temperature mitigation efforts in the upper Delaware River Basin. The updated habitat models resulting from this effort will be used by DRBC's Subcommittee on Ecological Flows and other resource stakeholders to evaluate how reservoir release and flow management protocols affect available habitat. The new models will be expandable, accommodating new research and additional species, and will be able to be used for other parts of the Delaware River.

1.2.2.2 Estuary

Freshwater inflow requirements for estuary populations, such as oysters and Atlantic sturgeon spawning, are a part of ongoing research by DRBC partners. For both instream and estuary flow needs, the seasonal components affecting both flow and temperature are currently the principal elements of concern. The Trenton flow objective was set to ensure adequate fresh water flows to protect drinking water intakes in the tidal river. Predictions indicate long-term diminution of snow pack and melt as a regional effect of climate change, which may have implications for flow management alternatives to meet the flow objective. The protection of instream flow needs may require adjustments to allocation and discharge permitting criteria, particularly if flow targets are adjusted.

1.2.3 Flow Management Modeling

An understanding of water supply, storage, and flow regimes is essential for managing the water resources of the Basin. DRBC continues to develop and use modeling tools to aid in the evaluation of water resources management and associated risks in the Basin. The models are used to assess reservoir operations for water supply, flood mitigation, power generation and recreation, the impacts of such operations on Basin resources, the ability of reservoirs to meet intended and multiple objective uses, and the effectiveness of conservation releases. DRBC's Planning Support Tool (DRB-PST) is a daily flow model used to assess flow management options in the Basin. DRBC has been working to update DRB-PST with improved code to simulate reservoir operations, add reservoir operations not previously modeled and include components of FFMP2017 and options to simulate other programs, such as REV1. The impacts to upper Basin habitat related to the flow management programs will be evaluated with REF-DSS. DRBC will be using these models for the 2060 study as well as the FFMP2017 studies.

DRBC worked with the USACE Philadelphia District to compare salinity (chloride) predictions from the Commission's 1-D model (DYNHYD5/TOXI5) and the Corps' 3-D model (CH3Dz) and found that the models produced comparable results. The 1-D model has been linked to DRB-PST. The linked models will be used for refined screening of alternatives to evaluate scenarios to determine how flow objectives and reservoir operations impact salinity levels in the estuary. Salinity (specific conductivity) monitors have been added to three existing National Ocean Service Physical Oceanographic Real-Time System Stations at Lewes, Cape May and Chesapeake City. Continuous salinity data from those three stations will be used to enhance the reliability of models for the Delaware Estuary.

See also Supplemental Table B for a summary of all proposed modeling activities.

1.2.3.1 Hydrologic Reports

A summary of hydrologic conditions in the Basin including precipitation, streamflow, reservoir storage, groundwater levels, and the river mile location of the 7-day average 250 mg/l chloride concentration are prepared weekly, monthly, quarterly and annually. These reports are posted on the DRBC website. In addition, the salt front and combined NYC storage graphs will be updated and posted daily on the website (in progress).

DRBC WATER RESOURCES PROGRAM
1.2 Multi-objective Flow Management

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Flow Management	Comprehensive study of flow management scenarios/alternatives and their impacts on salinity control and lower Basin storage, under current and future conditions, including sea level rise.	On-going	General Fund
	Collaborate with USACE (in-kind services) on the modifications to HEC-HMS for use as a planning tool for climate change assessments using DRB-PST and EFDC.	On-going	General Fund
DRB-PST	On-going improvements to DRB-PST (Planning Support Tool) in support of comprehensive study as well as use for the Decree Parties (individually, jointly or for the FFMP2017 studies)	On-going	General Fund
Salinity Model	Continue to improve and use the PST/DYNHYD-TOXI5 Linkage. Develop capabilities for the 3D EFDC model for sea level rise analyses.	2020-2021	General Fund / PA Grant / WPF Grant
Hydrologic Reports, Event Summaries	Reports – post on website	On-going	General Fund
Evaluate Reservoir Operations	Blue Marsh, Beltzville, Power sector and Brandywine evaluations	2020-2022	General Fund
	Provide assistance to USACE (in-kind services) for the FE Walter Study	On-going	General Fund
Consumptive Use Replacement	Implement Consumptive Use Policy for Power Producers	On-going	General Fund

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Reservoir Operations	Direct releases for Trenton as needed	On-going	General Fund
	Work with the NWS to develop better low flow evaluation products for better directed release calculations	2020-2022	General Fund
Instream Flow Management Step 2	Develop pass-by flow, conservation release, consumptive use mitigation trigger policy (part of Sustainable Water Future 2060)	2021-2022	General Fund

1.3 Water Supply Management: Conservation, Special Area Management and Permitting

1.3.1 Water Conservation and Loss Accounting

DRBC's water conservation program incorporates a wide range of elements, including but not limited to requirements for metering, leak detection and repair programs, water conservation plans, water conservation performance standards for plumbing fixtures, and a water audit requirement to deliver staged improvements in accounting for water loss in distribution system based on the methodology proposed by the American Water Works Association (AWWA). The rule requires water suppliers to submit water audits annually. This information is used to inform water use analyses and improve water supply planning. Analysis of the results of this program are being used in the development of performance metrics. Additional areas of investigation may include compiling information on innovative water pricing structures, which could provide an incentive for water conservation, as well as stable revenues for water purveyors, and on water reuse to provide additional tools for improving water use efficiency.

In FY 2020, staff will develop and distribute a water conservation survey targeted for public water supply utilities operating in the Basin. The water conservation survey will enable the Commission to assess the current status of conservation-oriented best management practices being implemented by the public water supply utilities.

1.3.2 Water Efficiency Standards

Staff is reviewing the potential implementation of updated water efficiency standards developed by USEPA WaterSense standards and Energy Star for inclusion in the DRBC Water Conservation Program. WaterSense is a voluntary partnership program sponsored by the USEPA, which provides a label for water-efficient products and a resource for helping you save water. According to USEPA, "the WaterSense label makes it simple to find water-efficient products, new homes, and programs that meet EPA's criteria for efficiency and performance. WaterSense-labeled products and services are certified to use at least 20 percent less water, save energy, and perform as well as or better than regular models. WaterSense partners with manufacturers, retailers and distributors, homebuilders, irrigation professionals, and utilities to bring WaterSense to your community. Our partnerships encourage innovation in manufacturing and support sustainable jobs for American workers." Over the next few years staff will review the potential water and cost savings from the WaterSense program as well as the basin-wide benefits of water use reduction to the public water sector.

1.3.3 Groundwater Management and Special Management Areas

Southeast PA Groundwater Protected Area (SEPA GWPA)

The Commission will focus efforts on the subbasins of the SEPA GWPA where use assessments indicate subbasins are potentially stressed or near their withdrawal limit. The Commission will continue to monitor conditions and work with docket holders and permittees to find realistic supply solutions and to ensure that allocations support sustainability in the GWPA. The Commission also plans to enhance its tracking of groundwater level conditions and increase its use of annual hydrogeologic reports submitted by docket/permit holders. This information and program status report will be used to provide a more comprehensive analysis of groundwater levels across the GWPA.

1.3.4 Dockets and Permitting

DRBC's regulatory activities remain important for water supply management and planning. In order to eliminate unnecessary redundancy and to streamline project reviews, updated administrative agreements between the Commission and the states of New Jersey and Delaware were executed in December 2009 (NJ) and July 2010 (DE), with minor amendments made to both in May 2013. On March 11, 2015, the Commission adopted Resolution No 2015-4 directing the Executive Director to initiate rulemaking to amend the Commission's Rules of Practice and Procedure to establish the One Permit Program (Rule). The Commission published a draft rule in May 2015 and held a public hearing in June 2015. The Commission approved the Rule in December 2015. The Resolution also authorized the Executive Director to enter into an administrative agreement with the NJDEP. In March 2015, an Administrative Agreement (AA) between DRBC and NJDEP was executed. Upon approval of the One Permit Program Rule, the One Permit Program portion of the AA was activated. In March 2016, an Administrative Agreement (AA) between DRBC and NYDEC was executed. The Commission expects to enter into an AA with PADEP. DRBC will continue to support state partners in their permitting programs through data collection, assessment, and planning, and will issue water supply dockets in accordance with Administrative Agreements and special area management programs. The DRBC database will be updated to incorporate state permit conditions.

1.3.5 Compliance

Staff will continue annual reviews of DRBC-required data submission, such as the Water Audit Reports. Pre-emptive correspondence and notification systems will continue for docket expiration dates and data/report submittal date reminders.

DRBC WATER RESOURCES PROGRAM
1.3 Water Supply Management

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Water Conservation and Loss Accounting	Assess data inputs from Water Audit submissions	Ongoing	General Fund
	Develop performance metrics for water loss accounting	2020-2022	
	Evaluate and develop updated water efficiency standards using USEPA WaterSense standards and/or Energy Star Certification	2020-2022	General Fund
Southeastern PA Groundwater Protected Area	Evaluate water use in subbasins of SEPA GWPA against allocation and supply limits	Yearly	PA SEPA GWPA
Water Supply Dockets	Review and process water supply dockets in accordance with AAs	Ongoing	Project Review Fees
	Update DRBC database to incorporate state allocation permit conditions	Ongoing	General Fund
Compliance	Track construction start/completion forms, monitoring requirements, docket expirations	Ongoing	General Fund

1.4 Determining Water Quality and Meeting Standards: Criteria-Based Programs, Anti-Degradation and Water Quality Administration

Note: Details on Aquatic Life, including ecosystem needs and restoration, are in Section 2.3.

1.4.1 Special Protection Waters

The Delaware River Basin is unique in having many miles of high-quality waterways in the midst of the densely populated Mid-Atlantic metropolitan area. They provide an enormous benefit to the citizens and workers of the Basin yet present a management challenge to maintain existing high-water quality in a region that continues to grow. The Commission will continue to work with the states and federal agencies, including the National Park Service (NPS), in the implementation of the Special Protection Waters (SPW) program to maintain no measurable change to existing water quality (EWQ) in the non-tidal river. Implementation includes management through the DRBC dockets and state NPDES permits (including coordination of programs) and monitoring programs to obtain data to assess any changes to EWQ.

Commission staff recently completed a report evaluating monitoring data to assess measurable changes to EWQ in the Lower Delaware River, and they also prepared an atlas of Existing Water Quality data for the Upper and Middle Delaware River and its tributaries. The EWQ targets are statistically-defined numeric

targets for selected water quality constituents, principally nutrients and conventional parameters. These site-specific water quality targets will improve the ability of DRBC and the states to implement Special Protection Waters permit review and assessment of measurable change.

Over the next three years, the following tasks are anticipated to capitalize upon the achievements described above:

- Periodic updates of the EWQ Atlas as new information become available.
- Proposed updates of water quality regulations as needed.
- Continued development and publication of SPW outreach and educational materials, including interactive maps, web applications to view and retrieve SPW data; and improved operating procedures for monitoring and assessment of the SPW region.

1.4.2 Criteria Based Program

DRBC's criteria-based program will continue to focus efforts on the assessment of water quality and support of project review.

1.4.2.1 Monitoring Programs to Assess Criteria

1.4.2.1.1 Long Term Delaware Estuary Water Quality Monitoring.
The long-term Delaware Estuary Water Quality monitoring program conducted by the Commission (formerly known as the Boat Run) was extended in 2017 to a year-round effort resulting in 12 sampling events at 22 stations. This program provides data to assess compliance with Commission water quality criteria and data on nutrient concentrations and potential effects. DRBC continues to employ rotational monitoring to ensure that all criteria are periodically assessed.

1.4.2.1.2 Dissolved Oxygen Criteria Updates
Although the worst of the dissolved oxygen problems have been addressed in the Delaware Estuary, dissolved oxygen conditions remain a concern. While current conditions typically meet the 1967 dissolved oxygen criteria, mid-summer dissolved oxygen is, at times, only 50% or less of full saturation levels in the areas around the Ben Franklin Bridge.

DRBC will continue working with co-regulators and the Water Quality Advisory Committee to define the highest attainable aquatic life use and supporting Dissolved Oxygen criteria in estuary Zones 3 to 5 as outlined in Resolution 2017-4, adopted on September 13, 2017.

1.4.2.1.3 Nutrient Criteria Development.
The Delaware Estuary has both high loadings and high concentrations of nutrients relative to other estuaries in the United States. The effects from these high nutrients are not well-understood, but monitoring in the estuary shows signs of poor ecological health, including a persistent summer dissolved oxygen sag in the urban corridor of the estuary. The Delaware River Basin Commission serves as the lead agency for developing nutrient and/or nutrient-related criteria for the Delaware Estuary.

DRBC is continuing its efforts to develop an Estuary Eutrophication Model using resources obtained through a grant under the Delaware Watershed Research Fund. Completion and calibration of this model will ultimately allow assessment of the attainability of wasteload allocations that will support the adoption of revised designated uses and associated dissolved oxygen criteria, and nutrient criteria, if needed.

1.4.2.1.4 Polychlorinated Biphenyls (PCBs).
A polychlorinated biphenyl (PCB) is any of the 209 configurations of this organochloride molecule with 1 to 10 chlorine atoms attached to two phenyl rings. PCBs were widely used as dielectric and coolant fluids, for example in transformers, capacitors, and electric motors. Based on evidence that PCBs are persistent in the environment and can cause numerous health effects in the immune, reproductive, nervous, and endocrine systems of animals and humans, their manufacture and distribution were banned, but their use

continues. Fish consumption advisories, ranging from limited to no fish consumption, are issued by three states for the Delaware Estuary because of elevated levels of PCBs in fish. Managing PCBs in the Basin is a major DRBC program. The Commission coordinates its activities to monitor and manage PCBs with the States of New Jersey, Delaware and Pennsylvania, and EPA Regions II and III, especially for incorporating PCB monitoring and Pollutant Minimization Plan (PMP) development and implementation in NPDES permits. Currently, approximately 94 dischargers are monitoring and/or implementing PMPs. Dischargers continue their submission of monitoring information to DRBC where it is housed in an Access database specifically developed for PCB data. This monitoring information is utilized in evaluating the temporal and spatial trends of PCB loadings and the effectiveness of Pollutant Minimization Plan (PMPs) in reducing PCBs. PCB loadings from traditional point source discharges achieved 64% reduction since 2005 based on 2013 effluent data. More aggressive, 71% load reductions were observed from the top ten-point source discharges during the same time period, and a 76% reduction was achieved from the top ten-point source discharges based on effluent data for year 2016.

The Commission will continue the implementation of the Stage 1 and Stage 2 PCB TMDLs, including:

- Ongoing point source data review and assessment
- Evaluation of Pollutant Minimization Plans (PMPs)
- Implementation of the Action Level requirement of the Stage 2 TMDLs in NPDES permits once established
- Support to U.S. EPA Regions II and III as they establish Stage 2 TMDLs for Zones 2 – 6, and assistance to EPA/states in the implementation the TMDLs.

As resources permit, ambient water samples will be collected at 22 stations in Zones 2-6 for analyses of PCBs, dioxin/furans, pesticides, and PFCs. Collected information will be assessed and compared with previously collected data to identify trends and to assess the effect of PCB reductions already achieved.

1.4.2.1.5 Metals

DRBC will be studying areas of elevated concentrations of metals and evidence of criteria exceedances. In addition, the Commission will coordinate with basin states, EPA, and stakeholders on criteria development, monitoring and assessment of metals focusing attention on bioavailability of the following:

- **Copper.** Copper (Cu) is a naturally occurring trace element found in surface waters and, while essential to virtually all plants and animals, it can be toxic to aquatic life even in low concentrations. DRBC continues to monitor the parameters needed for input to the Biotic Ligand Model to assess water chemistry influence on copper toxicity.
- **Aluminum**. Natural sources of aluminum include weathering of rocks. It is the most common metal in the earth's crust. Other sources include mining, industrial processes and wastewater treatment with alum.

Aluminum is a non-essential metal that can inhibit respiration by binding to ion channels, interfering with essential element uptake, or by accumulating on gills. DRBC will monitor DOC, pH and hardness for use in Multiple Linear Regression (MLR) to assess water chemistry influence on aluminum toxicity.

1.4.2.1.6 Chronic Toxicity

Chronic toxicity is caused by repeated or long-term exposure to low doses of a toxic substance. In 2000, the Commission determined that the assimilative capacity of Zones 2-5 for chronic toxicity had been exceeded. Based on the chronic toxicity studies of ambient river water from the tidal Delaware River undertaken by the DRBC in 2000 and 2001, Zone 5 is currently listed as a Category 3 water for chronic toxicity (From EPA Guidance, Category 3 means insufficient or no data and information to determine if any designated use is attained). Work will focus data collection in the main stem of the river and bay to provide additional data to help address ambient water toxicity issues as recommended by the Ambient Toxicity Subcommittee of the Toxics Advisory Committee (TAC). The specific objectives of these studies are to assess if toxicity is present in water samples as measured by laboratory-controlled methods for short-term chronic toxicity.

1.4.2.2 Contaminants of Emerging Concern.

The DRBC continues to cooperate with basin states, EPA and academics on a prioritized list of pharmaceuticals and personal care products, as well as perfluoroalkyl and polyfluoroalkyl substances (PFASs) and polybrominated diphenyl ethers, for further evaluation of sources, fate, and effects in water column, sediments, and biota:

http://www.state.nj.us/drbc/library/documents/contaminants-of-emerging-concernAug2013rev.pdf

1.4.2.2.1 Dioxins and Furans

Dioxins/furans, by-products of industrial processes, are commonly regarded as toxic and persistent organic pollutants. Dioxins/furans are contaminants of concern contributing to fish advisories in the Delaware Estuary. There are 75 different dioxins and 135 different furans. DRBC has adopted water quality criteria for the most toxic compound: 2,3,7,8-TCDD. Dioxin/furan concentrations in fish tissue are currently being addressed through fish consumption advisories and other environmental management approaches in the Delaware Estuary. DRBC is coordinating with states and other agencies through the Toxic Advisory Committee (TAC) to assess these contaminants through the use of Toxic Equivalency Factors, which relate the individual dioxins and furans to 2,3,7,8 – TCDD. This involves periodic monitoring for these contaminants in fish tissue and sediments.

1.4.3 Water Quality Modeling

In the non-tidal river, model development will also continue with the ongoing calibration and validation of QUAL2K models for the Lower Delaware River, Lehigh River, Neversink River, Brodhead Creek and smaller tributaries throughout FY 2019 to 2021. All models will be continually refined, recalibrated, or validated as more effluent or ambient data are available. Utilization of updated models in no measurable change evaluations of new or expanding discharges will reduce uncertainties.

In the estuary, under the guidance of the model expert panel, a 3-D EFDC hydrodynamic model is being developed. This hydrodynamic model will be linked with the WASP8 eutrophication model. The WASP model was initially developed in the 1970s and is one of the most widely used water quality models in the United States and throughout the world. A WASP model is capable of handling multiple pollutant types including nutrients and eutrophication. The most recent version, WASP8, will be used as a tool to develop feasible scenarios of controlling nutrients loads into Delaware River Estuary and Bay to achieve higher dissolved oxygen concentrations to support higher designated use and for other elements of the Commission's Nutrient Criteria Strategy. See Supplemental Table B for a summary of ongoing and proposed modeling activities.

Near field modeling efforts to support permitting actions (DRBC dockets and/or NPDES permits) for acute mixing zones, heat dissipation areas, and/or TDS mixing zones will continue as needed in FY 2020 – 2022.

1.4.4 Water Quality Dockets and Permitting

DRBC's regulatory activities remain important for water quality management. In order to eliminate unnecessary redundancy and to streamline project reviews, updated administrative agreements between the Commission and the states of New Jersey and Delaware were executed in December 2009 (NJ) and July 2010 (DE), with minor amendments made to both in May 2013. On March 11, 2015, the Commission adopted Resolution No 2015-4 directing the Executive Director to initiate rulemaking to amend the Commission's Rules of Practice and Procedure to establish the One Permit Program (Rule). The Commission published a draft rule in May 2015 and held a public hearing in June 2015. The Commission approved the Rule in December 2015. Upon approval of the Rule, the One Permit Program portion of the AA was activated. In March 2016, an Administrative Agreement (AA) between DRBC and NYDEC was executed. The Commission plans to enter into an AA with PADEP in the near future. DRBC will continue to support state partners in their permitting programs through data collection, assessment, mixing zone

analyses, no measurable change evaluations, and other modeling and will issue water quality dockets in accordance with Administrative Agreements and special area management programs, with continued emphasis on cooperative efforts to implement DRBC standards in shared waters. The DRBC database will be updated to incorporate state permit conditions.

1.4.5 Water Quality Assessment Report

DRBC biennially reports on the conditions of main stem river water quality relative to criteria in accordance with EPA guidelines for 305 (b) reporting. The finalized 2018 report is posted on the Commission's web site. Results are described in Section 1.C. Updated Water Quality Assessment Reports will be published in 2020 and 2022.

1.4.6 Compliance

Staff will continue annual reviews of DRBC-required data submission, such as the annual effluent monitoring reports (AEMRs). Pre-emptive correspondence and notification systems will be continued for docket expiration dates and data/report submittal date reminders.

DRBC WATER RESOURCES PROGRAM
1.4 Determining Water Quality and Meeting Standards: Criteria-based Programs, Anti-degradation, Water Quality Administration

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Water Quality Standards	Update water quality policy and standards for ammonia	2021-2022	General Fund
	Update designated uses for aquatic life in the estuary to reflect the highest attainable uses.	2021-2022	General Fund, Delaware Watershed Research Fund Grant, NJ grant, PA grant
Delaware Estuary Water Quality Monitoring (formerly Boat Run Survey)	Perform rotating monitoring plan to ensure periodic assessment of all parameters (criteria)	Ongoing	EPA §106
	Data in WQX	Ongoing	EPA §106
	Perform 305(b) Water Quality Assessment	Ongoing every even numbered year (Next 2020)	EPA §106
	Perform technical assessments in support of State of the Estuary and Basin Reports	Ongoing every 5 years	General Fund
Estuary Nutrients	Ambient monitoring for nutrient parameters including tributary nutrient monitoring	Ongoing	EPA §106, Delaware Watershed

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
			Research Fund Grant
	Continue point source nutrient monitoring in accordance with Resolution for the Minutes adopted September 13, 2017	2019-Spring 2020	EPA §106
Chronic Toxicity	Ambient surveys and trend analysis of effluent data	2020-2021	EPA §106
PCBs	Evaluate PMPs and point source monitoring data	Ongoing	EPA §106
	Support EPA in establishing Stage 2 TMDLs	pending EPA schedule	General Fund
	Continue implementation of Stage 2 TMDLs	Ongoing	General Fund, EPA §106
Toxics (Ammonia, metals and emerging contaminants)	Coordination with TAC; recommended criteria revision	2020-2022	General Fund, EPA §106
Water Quality Dockets	Changes to Water Quality regulation and Rules of Practice and Procedure, as required	2020-2022	General Fund
	Review and processing of water quality dockets per AAs	Ongoing	Project Review Fees
Water Quality Assessment Report	Prepare assessment for EPA and states	2020	EPA 106 Grant/General Fund
Compliance	Construction start/completion forms, monitoring requirements, annual effluent monitoring reports, docket expirations	Ongoing	General Fund
Eutrophication Model for Delaware Estuary	Development of a state of the art 3-D hydrodynamic and eutrophication model. Data collection for model calibration.	2020-2022	EPA §106, Delaware Watershed Research Fund Grant, PA CZM, NJ Grant, General Fund
	Model calibration and validation for CBOD reallocation, potentially NBOD and/or ammonia allocations, and other nutrient parameters.	2020-2022	

Section 2: Waterway Corridor Management

2.1 Flood Warning and Loss Reduction

Flood loss reduction is a shared responsibility among federal, state, and local agencies and organizations in the Delaware River Basin. DRBC's activities involve coordination, education, planning and permitting. DRBC's Flood Advisory Committee (FAC), currently inactive, brings together government and non-governmental stakeholders across jurisdictional boundaries and facilitates coordination among agencies to improve the Basin's flood warning system and mitigate flood losses.

2.1.1 Flood Mitigation Task Force Recommendations

In August 2017, DRBC submitted a proposal under Section 7001 of Water Resources Reform and Development Act (WRRDA) to the USACE for the development of a Comprehensive Flood Mitigation Study of the Delaware River Basin. The proposed study would further the work of Basin stakeholders in the development and implementation of flood mitigation strategies and result in an Integrated Water Resource Management Program for the Basin that addresses the multiple goals and objectives for the use of water and water resource infrastructure within the Basin, including drought management, habitat protection and flood mitigation. With the USACE CWMS suite, re-evaluate the scenarios from the Flood Analysis Model for Irene in 2011 and Diane in 1955.

2.1.2 Flood Warning and Preparedness

DRBC serves on the Mid-Atlantic River Forecast Center Customer Advisory Board, working to improve NWS products related to flood forecasting and warnings in the DRB and nationwide. As a continuation of previous Education and Outreach Efforts, DRBC has created a flood resources portal which makes the information more accessible and focuses on flood warning products, preparedness and DRB flood issues.

2.1.3 Flood Mitigation

DRBC will be actively engaged with the federal entities to monitor the development of robust scientific information to support flood mitigation for the Basin. Up-to-date and regionally relevant information on changes in expected precipitation patterns, climate, and land use patterns, for example, may have a significant impact on how to prepare for storm events and manage floodplains.

DRBC WATER RESOURCES PROGRAM
2.1 Flood Warning and Loss Reduction

Program/Projects	Products/Outputs	Fiscal Year	Funding Sources
Flood Warning Products and Messages	Use USACE CWMS products to evaluate flood mitigation for additional storm events. Use for evaluation of high precipitation events in the climate model precipitation record	2020	General Fund
	Collaborate with Mid-Atlantic River Forecast Center and NWS for improvements and expansion of flood warning products for the DRB	2020-2022	General Fund
Flood plain dockets	Review and processing of flood plain dockets	Ongoing	Project Review Fees

2.2 Enhanced Recreation

DRBC staff participate on the steering committee for the Delaware River Sojourn, which plans an annual paddling trip on the river focused on promoting river recreation and environmental stewardship.

DRBC staff has initiated a review of the status of the recreational protected use in the Delaware Estuary in Zones 3 and upper 4. Staff provided a presentation at the July 2018 Water Quality Advisory Committee (WQAC) meeting, and a briefing at the September 2018 Commission meeting. Staff performed enhanced bacterial monitoring during summer 2019, collecting additional shore-based samples at sites likely to be used for recreation. Staff will report on the results from that monitoring and continue coordination with the Water Quality Advisory Committee.

DRBC will review plans for enhanced fisheries protection from Beltzville Reservoir when a proposal is developed by the Pennsylvania Fish and Boat Commission (PAFBC). There is a proposed potential USACE study that would re-evaluate F. E. Walter Reservoir's services including flood control, water supply, water quality and recreation and existing infrastructure and operations to support the current and future demand for services. DRBC will work with the USACE in scoping, coordinating and evaluating the impacts of the potential options.

2.3 Aquatic Life and Wildlife Habitat Improvement

2.3.1 Ecosystem Needs

DRBC intends to remain involved in the development and expansion of creative funding opportunities, such as the Delaware River Basin Conservation Act, which was authorized by Congress in 2016. DRBC will continue to increase the understanding of ecosystem needs and habitat conditions in the Basin through ambient water quality monitoring, fluvial geomorphologic assessments, and macroinvertebrate and periphyton surveys conducted in partnership with federal and state agencies. Commission staff continues to monitor macroinvertebrates, algae and habitat of the non-tidal Delaware River, working to improve DRBC's existing macroinvertebrate Index of Biological Integrity (IBI) for assessing the aquatic life use of the Delaware River. See also Section 1.2.2. for Ecological Flows.

2.3.2 Ecosystem Restoration

PPL Martins Creek NRDA**:** The Commission has agreed to function as the recipient and distributor of certain funds required to be expended as a result of the damages resulting from the 2005 Ash Slurry Spill from the PPL Martins Creek facility, located in Lower Mount Bethel Township, Northampton County, Pennsylvania. The Natural Resource Damage Assessment (NRDA) was developed for the spill by PADEP in consultation with the NJDEP, PA Fish and Boat Commission, and DRBC. With the settlement agreement ratified in 2016, the Commission is managing the funds for restoration projects located entirely within Pennsylvania and those defined as "mussel restoration projects," which may be located in Pennsylvania and/or New Jersey. The Pennsylvania restoration projects currently consist of dam removals on the Bushkill Creek. The Commission has entered into an agreement with a local watershed organization, The Wildlands Conservancy, who is taking the lead role in removal of the identified dams located within Pennsylvania. Wildlands is responsible for all design, permitting, administrative and construction costs. DRBC staff is overseeing performance under the Settlement agreement to ensure that the deliverables are carried out in a timely manner and are consistent with the Settlement terms.

2.3.3 Regional Sediment Management

The USACE and USEPA have led a group of agencies in the development of a Regional Sediment Management (RSM) Plan as recommended in the *Water Resources Plan for the Delaware River Basin 2004* (Basin Plan, Objective 2.3.F.) Two Teams have been created: the RSM Workgroup Implementation Team will work with agencies and other entities to oversee the beneficial re-use of dredged material; the Regional Dredging Team will work to address water quality issues during the dredging process and at dredged material placement sites. DRBC staff will continue participation in both teams.

DRBC WATER RESOURCES PROGRAM
2.3 Aquatic Life and Wildlife Habitat Improvement

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Ecosystem Needs	Review data and create an Index of Biological Integrity	2020-2022	General Fund
Ecosystem Restoration	Manage distribution of funds for PPL Martins Creek NRDA projects	2020-2022	PPL NRDA settlement via PADEP
Regional Sediment Management	Participation in RSM Implementation and Regional Dredging Teams	2020-2022	General Fund

Section 3: Linking Land and Water Resource Management

3.1 Integrated Resource Management and Watershed Partnerships

3.1.1 Watershed Management Partnerships

DRBC is involved in watershed management efforts that include watersheds overlapping two or more states as well as projects within a single Basin state, typically as pilot programs for larger multi-jurisdictional management efforts or when those projects have an effect on the Basin. Staff is involved with collaborative partnerships in these watersheds:

- **Christina Watershed.** DRBC is a founding member of the Christina Basin Clean Water Partnership, which was established in the 1990s to improve source water quality in the 300-sq. mi. interstate watershed. DRBC participates in activities and provides support as the Partnership continues implementation of its long-term clean water strategy.

- **Schuylkill River Watershed.** DRBC is a founding member of the Schuylkill Action Network (SAN), a collaboration among federal, state, and regional agencies for local implementation of source water protection projects. DRBC serves on the Executive Steering and Planning Committees to oversee Work Groups that prepare and execute projects to improve the management of stormwater, agricultural activities, wastewater discharges, and mining reclamation. In addition, a portion of the Schuylkill River Restoration Fund (see below) is directed to projects identified through SAN as priority source water protection projects.

- **Common Waters.** DRBC is a member of the Common Waters collaborative, which is led by the Pinchot Institute and dedicated to protection of the headwaters of the Delaware River Basin, a drinking water source for millions of users.

- **Coalition for the Delaware River Watershed.** This is a coalition of non-governmental organizations created to achieve greater national recognition and funding for the Basin. DRBC's involvement is limited to general assistance and participation in the annual Forum.

- **Delaware River Watershed Initiative.** This initiative has brought significant financial resources to bear in eight geographic areas (watershed "clusters") in the Basin through the support of the William Penn Foundation (WPF). DRBC is involved in an advisory committee that provides oversight for mapping and modeling future growth (DRB Land Use Dynamics) led by Shippensburg University. Several SAN projects in two Schuylkill "clusters" are supported by WPF funds through this initiative. Projects are also supported in Brandywine-Christina Basin and Poconos-Kittatinny cluster located in the Basin headwaters.

3.1.2 Watershed Restoration

The Schuylkill River Restoration Fund, a unique public/private partnership, provides grants to local governments and non-profit organizations for projects that improve the quality of water in the Schuylkill watershed. The grants focus on three major sources of pollution: stormwater run-off, agricultural pollution, and abandoned mine drainage. DRBC participates in the steering committee that reviews proposals, selects projects for funding, and oversees program direction and expansion. The Executive Director is responsible for approving the distribution of Exelon Generation LLC's contributions to the SRRF.

3.1.3 Delaware Valley Early Warning System

The Delaware Valley Early Warning System (EWS) is an integrated monitoring, communication, and notification system used to provide advanced warning of water quality events to water suppliers and industrial intake operators in the Schuylkill and Delaware River watersheds. The EWS was initially deployed in 2004 and by 2008 had grown to include over 250 users in 47 different organizations within the EWS coverage area. The Commission is one of many EWS partners, which include 23 water treatment plants (WTPs) from 12 utilities in Pennsylvania and 5 WTPs from 5 utilities in New Jersey, along with PA DEP, NJ DEP, US EPA, USGS, US Coast Guard, County Health Departments, and over 25 industries. The EWS provides advanced warning of water quality events, web-based tools for determining proper event response, and a strong partnership between water users and emergency responders in the Schuylkill and Delaware River watersheds. The Commission currently serves as the "banker" for handling the annual administrative/user fees.

3.2 High Value Water Resource Landscapes

DRBC promotes sound practices of watershed management in the Basin (Compact §7.1). The Basin Plan goals regarding watershed management include:

- Preserving and restoring natural hydrologic cycles through improved stormwater management
- Maintaining and restoring the function of High Value Water Resource Landscapes
- The integration of water resource considerations into land use planning and growth management

The protection of water resources is incorporated into all DRBC programs, regulations, and permit conditions.

DRBC WATER RESOURCES PROGRAM
3.0 Linking Land and Water Resource Management

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Christina Clean Water Partnership	Continued participation to meet Long Term goal of restoring the water quality of all watershed streams to designated uses	Ongoing	General Fund
Delaware River Watershed Initiative	Participation in steering committees and workgroups as needed	Ongoing	General Fund
Coalition for the Delaware River Watershed	General assistance and participation in the annual Forum	Ongoing	General Fund
Schuylkill Action Network	Participation in the facilitation and oversight of watershed improvement projects for source water protection	Ongoing	General Fund
Common Waters	Participate with the Pinchot Institute for protection of the headwaters of the Delaware River Basin	Ongoing	General Fund
Watershed Restoration: Schuylkill River Restoration Fund	Annual review and recommendations of projects for funding	Ongoing	General Fund

Section 4: Institutional Coordination and Cooperation

4.1 Intergovernmental Coordination

4.1.1 Federal and Interagency Collaborative Partnerships.

It is important that the activities and authorities of the Commission and of the multiple federal, state, and local governmental agency efforts to manage the water resources of the Basin are conducted in a coordinated and supportive fashion. Collaboration among state and interstate agencies across Basin boundaries encourages the exchange of information, ideas, and experience and supports initiatives of benefit to member agencies and to water resources management generally. The Commission is involved in several federal/state initiatives that not only stimulate positive environmental outcomes in the Basin, but also help shape water policy on regional and national scales. Other activities are focused on improving coordination and collaboration generally among federal and state agencies with authorities within the Basin, as well as with regional entities. This includes many ongoing as well as special initiatives.

- **Delaware Estuary Program.** Participation in multiple committees (Steering Committee, Estuary Implementation (EIC), Science and Technical Advisory Committee(STAC)), as well as special projects (State of the Estuary) and events (biennial Science Conference). DRBC assisted with the update of the Comprehensive Conservation Management Plan (CCMP) for the Delaware Estuary, which was completed in FY2019. DRBC will continue to submit annual updates to the CCMP goal/strategy progress tracking tool.
- **Upper Delaware Council.** DRBC is a non-voting member of the Council which encourages collaboration among municipalities in the Upper Delaware Scenic River corridor and reviews actions for conformity with the area-wide Management Plan.
- **Fish and Wildlife Management Cooperative -- Delaware River Basin**. DRBC participates as a non-voting liaison to this Cooperative, which deals primarily with fishery management issues. DRBC also assists the Cooperative with field work as well as giving guidance on Basin issues and initiatives.
- **Special Protection Waters (SPW) Monitoring Program.** This long-standing comprehensive water quality monitoring program (formerly referred to as Scenic Rivers Monitoring Program) is a collaborative partnership between the DRBC and National Park Service (NPS) on the Upper and Middle Delaware designations.
- **Lower Delaware Wild and Scenic Partnership River.** DRBC is a management committee member for implementation for the Lower Delaware Wild and Scenic Management Plan. DRBC has a collaborative relationship with NPS. DRBC conducts water quality monitoring and assessment in support of the Lower Delaware.
- **Office of the Delaware River Master.** DRBC coordinates with the Office of the Delaware River Master on flow related issues and negotiations regarding the Decree Parties.
- **USFWS Delaware River Restoration Program.** The Delaware River Basin Conservation Act, signed into law in December 2016, emphasized the need for Federal, State, local governments and regional organizations to come together to identify, prioritize and implement restoration activities within the Basin. The Act established the Delaware River Basin Restoration Program of which DRBC is a partner. DRBC is an active participant in the implementation of appropriated funds including review and approval of grant applications to the fund, which is administered by National Fish and Wildlife Foundation (NFWF).

4.1.2 State-DRBC Coordination.

Actions and activities to improve coordination with agencies of the Basin states include:

- **Update DRBC-State Administrative Agreements.** On March 11, 2015, the Commission adopted Resolution No 2015-4 directing the Executive Director to initiate rulemaking to amend the Commission's Rules of Practice and Procedure to establish the One Permit Program (Rule). The Commission published a draft Rule in May 2015 and held a public hearing in June 2015. The Commission approved the Rule in December 2015. Since passing the Rule, DRBC has executed Administrative Agreements with New Jersey and New York. DRBC is prepared to enter into an agreement with Pennsylvania whenever the Commonwealth is ready.
- **State Advisory Committees.** DRBC participates in the New Jersey Water Supply Advisory Council, NJDEP Water Monitoring Council, and serves as a legislated member of the New Jersey Clean Water Council and the Delaware Water Supply Coordinating Council. DRBC also serves on the Drought Management Task Force for Pennsylvania.

4.2 Data Sharing and Management

Maintaining a Geographic Information System (GIS), along with gathering, processing, and mapping new data, is crucial for water resource management programs and projects within and external to DRBC. Staff will continue to provide interactive maps on the DRBC web site to allow for continued public access to information and water resources data. Maintaining the Commission's Integrated Database, which includes water charging, water use, communications, and project review information, is also vital to implementing core Commission programs. Staff will continue efforts to assimilate data from the four Basin states and maintain datasets to support analysis at the Basin scale. The Commission's library and central files contain hard copies of the Commission's dockets and applicant information, vital to day-to-day operations and serves as the mechanism to capture and log official Commission actions.

4.3 Agency Funding

The Basin Plan acknowledges the necessity of securing adequate resources to support water resource management, as well as the challenge of doing so. DRBC management works to secure funding for ongoing agency support as well as for special projects. Staff efforts will focus on the following:

- Project/user Fees: Update and maintain fee structures for the regulatory program
- Re-establish and/or Maintain Signatory Party Contributions

4.4 Associations and Internal Advisory Committees

This category includes both voluntary partnerships with national and international organizations and committees assembled by DRBC for expert advice and support for the development and implementation of DRBC programs.

4.4.1 Associations

DRBC remains a partner in the Association of Clean Water Administrators (ACWA), the Interstate Council of Water Policy (ICWP) and the American Water Resources Association (AWRA). As water resource management faces the growing challenges associated with a changing climate, a challenging fiscal future, infrastructure needs, and shifting political environments, involvement with these partners will be of increasing benefit to DRBC.

4.4.2 DRBC Internal Advisory Committees

Continuing a long-standing practice, advisory committees aid the Commission in policy and standards development. Committees for flow, flood, toxics, monitoring, water quality, and water management meet on a regular basis. All administrative needs are met by DRBC staff, including the development of agendas, arrangement of venues, communicating with members, and processing formal meeting minutes. Staff also coordinates internally on issues that cut across the interests or expertise of more than one committee. Major focus issues for the Advisory Committees and subcommittees include:

- **Water Quality Advisory Committee.** The WQAC will be focusing on a review of nutrient issues in the estuary, the review of designated use and associated criteria for Zones 3-5, and the implementation of recommended revisions to ammonia and temperature criteria. Also, work is underway to: a.) develop a eutrophication model to test alternative water quality management scenarios and b.) facilitate outreach regarding management options. Work of an expert panel to consult on dissolved oxygen needs of estuarine aquatic communities will continue.
- **Regulated Flows Advisory Committee**. The RFAC serves as a vehicle for public input into the Flexible Flow Management Program and will continue to focus on reservoir operations, instream flow needs, and flooding. RFAC will be used to work with the public on, and convey information about the FFMP 2017 studies
- **Subcommittee of Ecological Flows**. The SEF will continue to focus on review of the Thermal Mitigation and Rapid Flow Change Guidelines for the banks provided by FFMP 2017. In addition, SEF will be charged with additional tasks to assess habitat issues.
- **Flood Advisory Committee.** The FAC is currently inactive due to lack of staff resources.
- **Monitoring Advisory and Coordination Committee**. The MACC will review and offer recommendations for the improvement of Basin monitoring activities and will seek to enhance coordination among the parties with respect to monitoring programs and data sharing.
- **Toxics Advisory Committee**. The TAC will be focusing on the review of new and existing toxics criteria including ammonia and emerging contaminants.
- **Water Management Advisory Committee**. The WMAC will continue to focus on the results of the water loss accounting program, groundwater management and supply sufficiency. The committee will also review work on ecological flows as it progresses.
- **Advisory Committee on Climate Change**. The ACCC is a new advisory committee (formed December 2019) and will provide the Commission and the Delaware River Basin community with vital expertise, information, and advice as we endeavor to maintain and improve streamflows, water quality, habitat, wetlands, and watersheds in the face of changing hydrologic conditions and sea level rise.

4.5 Utilizing Planning and Regulatory Authority

The Commission's planning and regulatory authority is used to facilitate, coordinate, and effect cooperation among water resource efforts across the Basin. Staff efforts to improve and direct the efficiency of DRBC programs include preparation of tools to guide resource allocation in accordance with Commissioner priorities. Based upon the mandate of the Compact and the goals of the Basin Plan, the Water Resources Program notes the current conditions and needs of the basin, the scope of DRBC programs, and the expected milestones to be achieved for a three-fiscal year time horizon. The DRBC Budget details the receipt and distribution of financial resources in order to carry out the associated fiscal year activities.

- **Water Resources Program**. A prospective, multi-year program prepared annually.
- **DRBC Budget.** Prepared annually.

DRBC WATER RESOURCES PROGRAM
4.0 Institutional Coordination and Cooperation

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Federal and Interagency Collaborative Partnerships			
USFWS Delaware River Restoration Program	Partner participant in the implementation of appropriated funds	2020-2022	General Fund
Delaware Estuary Program	Participate in multiple committees (Steering, EIC, STAC) and in implementation of the revised CCMP	Ongoing	General Fund
Upper Delaware Council	Ex-Officio Non-voting Member; 4 meetings per year	Ongoing	General Fund
Lower Delaware Wild and Scenic Steering Committee	Voting member, monthly conference call, quarterly management council meetings	Ongoing	General Fund
Fish and Wildlife Management Cooperative	Coordination, management plans	Ongoing	General Fund
State – DRBC Coordination			
Revise/Update DRBC-State Administrative Agreements	Update and maintain DRBC-State Administrative Agreements	2020-2022	General Fund
Delaware Water Supply Coordinating Council	Meetings as scheduled, typically quarterly	Ongoing	General Fund
Pennsylvania Drought Task Force	Meetings scheduled as needed	On-going	General Fund
NJ Clean Water Council, permanent legislated member	Monthly meetings, periodic chairmanship, annual public hearing	Ongoing	General Fund
NJ Water Supply Advisory Council	Meetings as scheduled, typically monthly	Ongoing	General Fund
NJ Water Monitoring Coordinating Council	Meetings as scheduled	Ongoing	General Fund
Data and Funding			
Data Sharing and Management	IT systems update and maintenance, GIS data assembly, processing and distribution	Ongoing	General Fund

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Securing Funding	Meetings with federal and state legislators, state agency managers. Outreach to basin community.	Ongoing	General Fund
Associations			
ACWA	Contribute to discourse on national water policy, federal legislation and support for gaging infrastructure, and the development of federal decision support tools for water resource decisions	Ongoing	General Fund
AWRA			
ICWP			
DRBC Advisory Committees			
DRBC Advisory Committees	Meetings as scheduled and/or necessary	Ongoing	General Fund
DRBC Strategic Documents			
Water Resources Program	Prepared annually	Ongoing	General Fund
DRBC Budget	Prepared annually	Ongoing	General Fund

Section 5: Education and Outreach for Stewardship

5.1 Reporting

Many DRBC projects and programs have individual reporting elements. These are included as products and outputs for the fiscal year of their scheduled delivery. There are also routine reporting activities that require more significant resources for coordination, integration and production. Among these are:

- **State of the Basin Report.** By resolution, DRBC is to compile an "indicators" report every five years to review current trends and conditions in the Delaware River Basin. The most recent report was published in early FY2020.
- **DRBC Annual Report.** Required by the Compact, this report reviews programs, activities, products, and milestones achieved during a calendar year.

5.2 Public Information

DRBC staff responds in a timely manner to inquiries and requests from the public, federal/state/local government officials, regulated community, students, educators, and the news media. This includes hosting visits by international delegations who wish to learn from Commission staff about water resource management at the river basin scale. DRBC also produces various publications and materials about the Basin and water resource management issues.

The DRBC's website continues to be the primary communications tool with its emphasis on providing information that is accurate, up-to-date, and presented in a user-friendly manner. The DRBC website makes extensive use of links to external government and other sites where additional information is available. Listserv capabilities allow DRBC to provide subject-specific information via email to recipients who have subscribed on the website to receive updates. The DRBC uses several social media tools (Twitter, YouTube, and Flickr) to share news on Commission activities and related information. In addition, the website is used for on-line project applications and reporting.

In 2019, through a grant from the William Penn Foundation, DRBC launched a public outreach campaign designed to 1) provide Basin water-related organizations with a broader public exposure; 2) increase awareness of the DRB and the critical role it plays in their local water resources; and 3) provide a mechanism for the DRB community to contribute to a collective evaluation of the Basin's waters. Called "Our Shared Waters", the program includes an online component (Facebook, websites and social/digital advertising), increased participation at community events, and experiential opportunities for Basin residents to get out on the Delaware River. Our Shared Waters is funded to run through October 2020.

5.3 Technical Outreach

In order to keep current on technical issues and to share information with peers and various stakeholders, DRBC staff members attend and/or participate in regional, state, and national conferences and workshops throughout the year hosted by other government agencies, professional groups, or other organizations. DRBC periodically hosts workshops on timely issues. The DRBC website is used to supplement this information exchange.

5.4 Promoting Stewardship

Commission staff communicates information in various formats and, as funding allows, participates in a variety of events, workshops, and conferences throughout the Basin to raise public awareness about water resource issues affecting the watershed and the need for stewardship. DRBC continues to support the Delaware River Sojourn through its active membership on the steering committee.

DRBC WATER RESOURCES PROGRAM
5.0 Education and Outreach for stewardship

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Reporting			
State of the Basin Report	Indicators report – post on web & present findings whenever appropriate	2020	General Fund
DRBC Annual Report	Report – post on web; limited paper copies	Ongoing	General Fund
Public Information			
Provide Timely Information to the Public	Clear, consistent message on water resource issues and DRBC activities; produce various handouts	Ongoing	General Fund
Media/External Relations	Clear, consistent message on water resource issues and DRBC activities; timely responses	Ongoing	General Fund
Our Shared Waters	Educating the public and decisionmakers about the current state of the Basin and the opportunities available to support its continued sustainability	2020-2021	WPF
Website	New features, improvements, updated information	Ongoing	General Fund
Host Foreign Delegation Visits	Information exchange	Ongoing	General Fund
Technical Outreach			
Conference Attendance and Presentations	Information exchange	Ongoing	General Fund
Social Media	Information exchange	Ongoing	General Fund

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Stewardship Events			
Community Events	Delaware River Sojourn, Lambertville Shad Festival, EarthFest, HydroMania, Coast Days, educator training, etc.	Ongoing	General Fund
Event Follow-up	Information on website	Ongoing	General Fund

SUPPLEMENTAL TABLE A: Summary of Prospective Changes to DRBC Programs and Regulations

Management Topic	Program/Project	Products/Outputs	FY 2020	FY 2021	FY 2022
Hydraulic Fracturing	Project Review	Hydraulic Fracturing Regulations	Evaluation, Rulemaking and Comment Response Document as directed		
Rules of Practice & Procedure	Project Review	Update Rules of Practice and Procedure as necessary	Evaluation and rulemaking as directed		
	Legal	Reorganize and include all Commission rules into federal code	Evaluation and rulemaking as directed		
Water Supply	Planning and Update to CP	Update Comprehensive Plan	Water Inventory, Water Budget and Needs Assessments, Water Supply Options		Initiate Comprehensive Plan Update
		Update Existing Facilities Inventory			
Flow Management	Ecological Flow Requirements	Update Water Code to include pass-by flows, conservation releases, and consumptive use mitigation trigger policies	Technical Review and Analysis		Policy Options, Recommendations, Rule-development and proposal, as appropriate
Water Quality	WQ Criteria	Stage 2 PCB TMDLs	Stage II Report; EPA to Establish TMDLs		
		DO (Zones 3-5) (WQAC Coordination)	Model Development	Model Calibration and Evaluation; Designated Use and DO Criteria Recommendations in 2021	
		Nutrients (Zones 2-6) (WQAC Coordination)	Model Calibration and Evaluation	Model Development	Recommendations
		Revised ammonia criteria (TAC Coordination)	TAC Recommendations	Rulemaking Process and Adoption beyond 2022	

Management Topic	Program/Project	Products/Outputs	FY 2020	FY 2021	FY 2022
		Revised bacteria criteria (WQAC Coordination)	Review recommendations for nationwide standards by EPA, and coordinate with states.		Rulemaking Process and Adoption beyond 2022
Interagency Project Review Coordination	Project Review Permit Streamlining	Alignment with partner agencies to One Permit Program, where appropriate.	Implement Administrative Agreements (AA).		
	Regulations and Rules of Practice and Procedure	Update Articles 3 and 4 of Water Code and Rules of Practice and Procedure for clarity and consistency with AAs.	Updating of Water Quality Regulations, Water Code, and Rules of Practice and Procedure.		
	Project Review Fees	Update project review fee schedule as directed by Commissioners	As necessary		

* Note: order of prospective changes follows the format in the Water Resources Program – Section II

SUPPLEMENTAL TABLE B: Summary of Modeling Projects

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Flow Management	Use of and incorporation of various upgrades into DRB-PST model to support the evaluation of water supply management options, salinity intrusion, and support Decree Party negotiations	On-going	General Fund
Flow Management	Updated HEC-HMS model for the DRB (USACE PAS program)	2020-2021	USACE DRBC in-kind
Water Supply Planning	Identify water availability tool and assess against Drought of Record	On-going	General Fund
	Use of USGS-WATER and/or HEC-HMS with PST for macro-scale sustainability analyses	On-going	General Fund, WSSF
Emergency Response	Real time one-dimensional flow and transport model	Daily	General Fund
	Water quality model	As needed	
Lower Delaware River and Tributaries Model	Model refinement and validation	As needed	EPA §106, General Fund
Brodhead Model	Model refinement and validation	As needed	General Fund
Neversink Model	Model refinement and validation	As needed	General Fund,
Lehigh River Model	Model refinement and validation	As needed	General Fund
Eutrophication Model for Delaware Estuary	Development of a state of the art 3-D hydrodynamic and eutrophication model. Data collection for model calibration	2020-2021	EPA §106, Delaware Watershed Research Fund, PA Grant, NJ Grant
	Model calibration and validation for CBOD, NBOD and ammonia allocations, and other nutrient requirements	2020-2021	EPA §106, General Fund, NJ Grant
CORMIX mixing zone models	Project Review and NPDES permit support	As needed	Project Review Fees