

Delaware River
Basin Commission

**Water Resources
Program**

FY
2008-2013

Adopted July 16, 2008
Amended August, 2008

DRBC Water Resources Program 2008 - 2013

Authorization

The Delaware River Basin 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)

The Compact defines "project" as "...any work, service, or activity which is separately planned, financed or identified by the commission . . . for the conservation, utilization, control development or management of water resources" (§1.2.(g)).

Scope & Organization

The Water Resources Program (WRP) covers fiscal years (FY) 2008 through 2013 and is a strategic plan for DRBC program direction over the next six 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 describes conditions in the Basin, including hydrologic conditions, water use and sufficiency, water quality, and trends in climatic conditions that could affect long-range water resource planning in the Basin.

Section II notes the key issues that focus the Commission's programs, and summarizes the initiatives the Commission plans to undertake over the next six years.

DRBC Water Resources Program 2008 - 2013

TABLE OF CONTENTS

DRBC Water Resources Program FY 2008-2013

I. General Statement of Conditions in the Basin

- A. Hydrologic Conditions
- B. Water Use and Sufficiency
- C. Water Quality
- D. Climatic Condition: Adapting to Change

II. Water Resource Management Program Summary

A. Key Issues

B. Water Resource Management Program FY 2008 - 2013

- 1.0 Ensuring the Sustainable Supply of Suitable Quality Water
 - 1.1 Sustainable supply
 - 1.2 Flow Management
 - 1.3 Water Quality: Determining Quality & Meeting Standards
 - 1.4 Updating Program Rules and Standards
- 2.0 Waterway Corridor Management
 - 2.1 Flood mitigation
 - 2.2 Aquatic life & wildlife habitat improvement
- 3.0 Linking Land & Water Resource Management
 - 3.1 Collaborative Watershed Planning
- 4.0 Intergovernmental Relations
 - 4.1 Conflict Management
 - 4.2 Facility Planning
 - 4.3 Intergovernmental Coordination
- 5.0 Education & Outreach for Stewardship
 - 5.1 Reporting
 - 5.2 Public Information
 - 5.3 Technical Outreach
 - 5.4 Promoting Stewardship

C. Supplemental Materials

Table A: Schedule of Prospective Changes to DRBC Programs
and Regulations FY 2008 – 2013

Table B. Schedule of Modeling Projects FY 2008 – 2013

Table C. Schedule of Prospective Changes to Water Quality Standards
CY 2008-2010

DRBC Water Resources Program 2008 - 2013

I. GENERAL STATEMENT OF CONDITIONS IN THE BASIN

A. HYDROLOGIC CONDITIONS

Note: A comprehensive assessment of the hydrologic conditions for 2007 can be found in *Hydrologic Conditions in the Delaware River Basin, Annual Report 2007*. Reports are also available for previous years.

Re-cap 2001- 2007. A drought in 2001-2002 was followed by an extended period of above normal precipitation, flow, and storage in 2003 and 2004. Flooding from tropical storm Ivan in September of 2004 was eclipsed in April 2005 by a flood that produced the highest stage on the main stem Delaware since the record flood of 1955. Dry conditions returned in spring 2006, triggering statewide *drought watch* in Pennsylvania and New Jersey while reservoirs in the lower and upper basin maintained normal storage. The 2006 dry period ended when heavy rainfall in two events within a five-day span in late June caused the third major flood event in 21 months. Compared to the previous April, the June 2006 flooding was worse in sections of the upper basin and parts of the Schuylkill. For the remainder of 2006, precipitation remained in the normal to the above normal range, with the exception of December which, on average, was slightly drier than normal.

2007 Hydrologic Conditions: Continuing Extremes. The basin continued to experience hydrologic extremes. Normal hydrologic conditions persisted into early 2007 until a Nor'easter arrived on April 15-16, with a heavy mix of snow and rain on portions of the basin. While the river stayed within its banks, several tributaries, predominantly in the lower basin, experienced flooding. During the summer, stream and groundwater levels declined as the Basin once again experienced below normal rainfall. Although August brought a partial respite, dry conditions persisted through September. Conditions were drier in the southern portion of the Basin, graduating northward to normal conditions in the upper basin. By early October, the Long-Term Palmer Drought Severity Index (Palmer Index) indicated severe drought statewide in Delaware and in central and southern New Jersey. Rainfall deficits particularly impacted farmers in Delaware. In September a *drought disaster designation* was approved by the US Department of Agriculture making Delaware farmers eligible for low-interest emergency loans to offset significant crop losses caused by dry conditions during the 2007 growing season. As October drew to a close, a drought watch was in effect for all of Delaware and 14 counties in Pennsylvania. October 2007 was the warmest October on record for the Philadelphia region.

Above normal precipitation from late 2007 through early 2008 improved hydrologic conditions across much of the Basin. In response, Pennsylvania lifted its drought watch in mid-February 2008. In early March, the Basin was threatened with two back-to-back storms and the potential for main stem flooding. Although areas directly below the NYC reservoirs experienced minor to moderate tributary flooding, the storm only produced minor flooding along the main stem Delaware River. The last of the Basin's drought declarations ended on April 25 when a predominance of normal stream flows and groundwater levels prompted Delaware to lift its statewide drought watch. Although the U.S. Drought Monitor shows the intensity of drought in the central and southern portion of Delaware to be abnormally dry to moderate, conditions are forecast to improve through early summer.

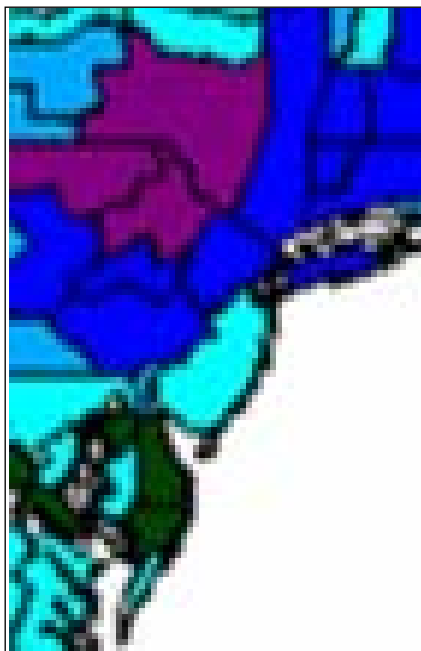
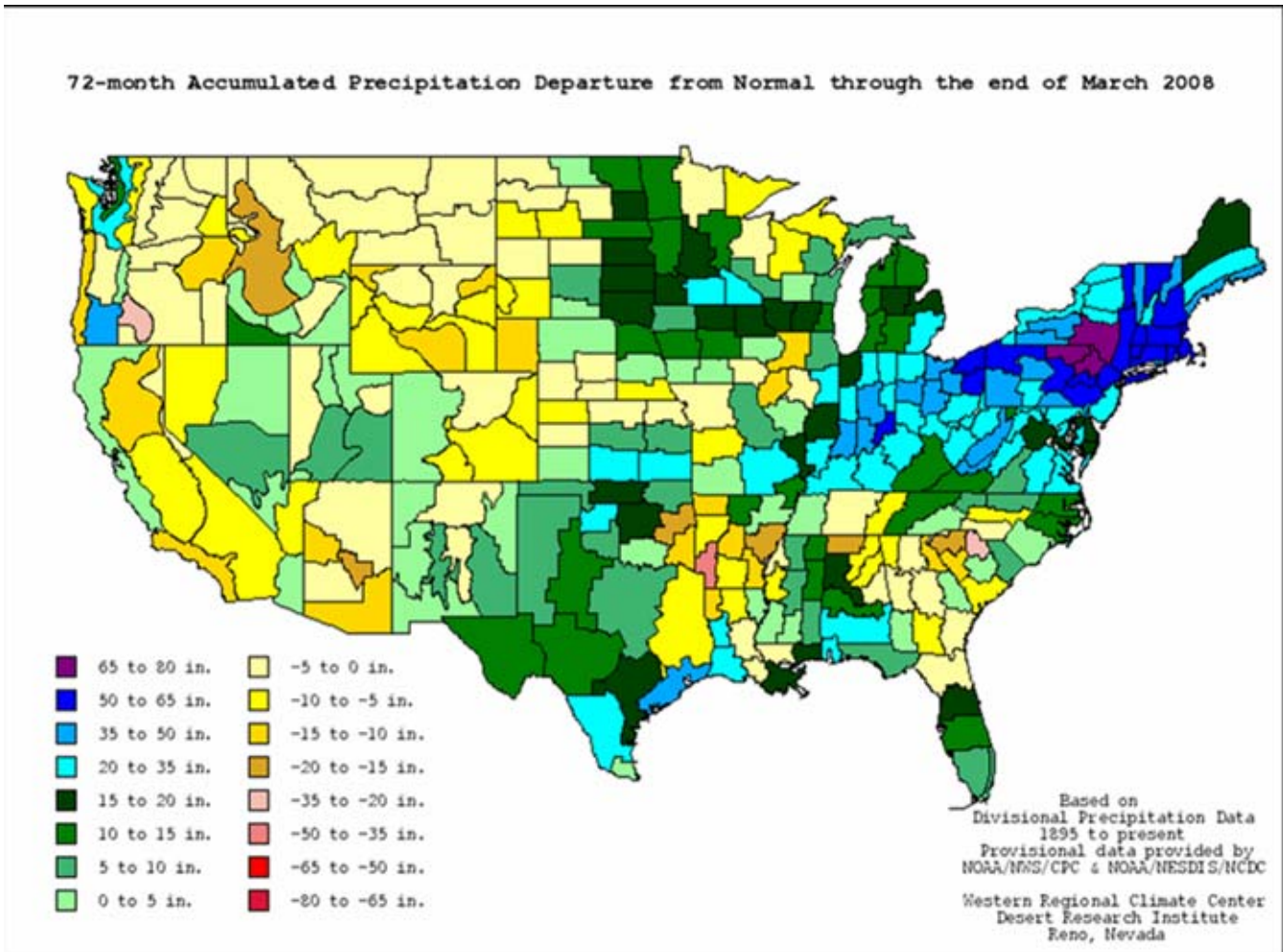
According to the Western Regional Climatic Center, precipitation departures above normal during the last six years (data from April 2002 through March 2008, Figure 1) across the Basin:

Upper Basin: 65-80 inches (70)
Central Basin: 50-65 inches (60)
Lower Basin: 20-35 inches (20)

Whether or not the variable precipitation and unseasonable temperatures will constitute a trend remains to be seen. Because hydrology defines the quantity, distribution, and timing of precipitation and runoff, an understanding of variability and trends in hydrologic conditions is essential to support effective water resource management.

DRBC Water Resources Program 2008 - 2013

Figure 1. 72-Month Accumulated Precipitation Departure



72 month Accumulated Precipitation Departures from Normal through the end of March 2008 for the Delaware River Basin

Upper Basin: 65-80 inches
Central Basin: 20-35 inches
Lower Basin: 15-35 inches

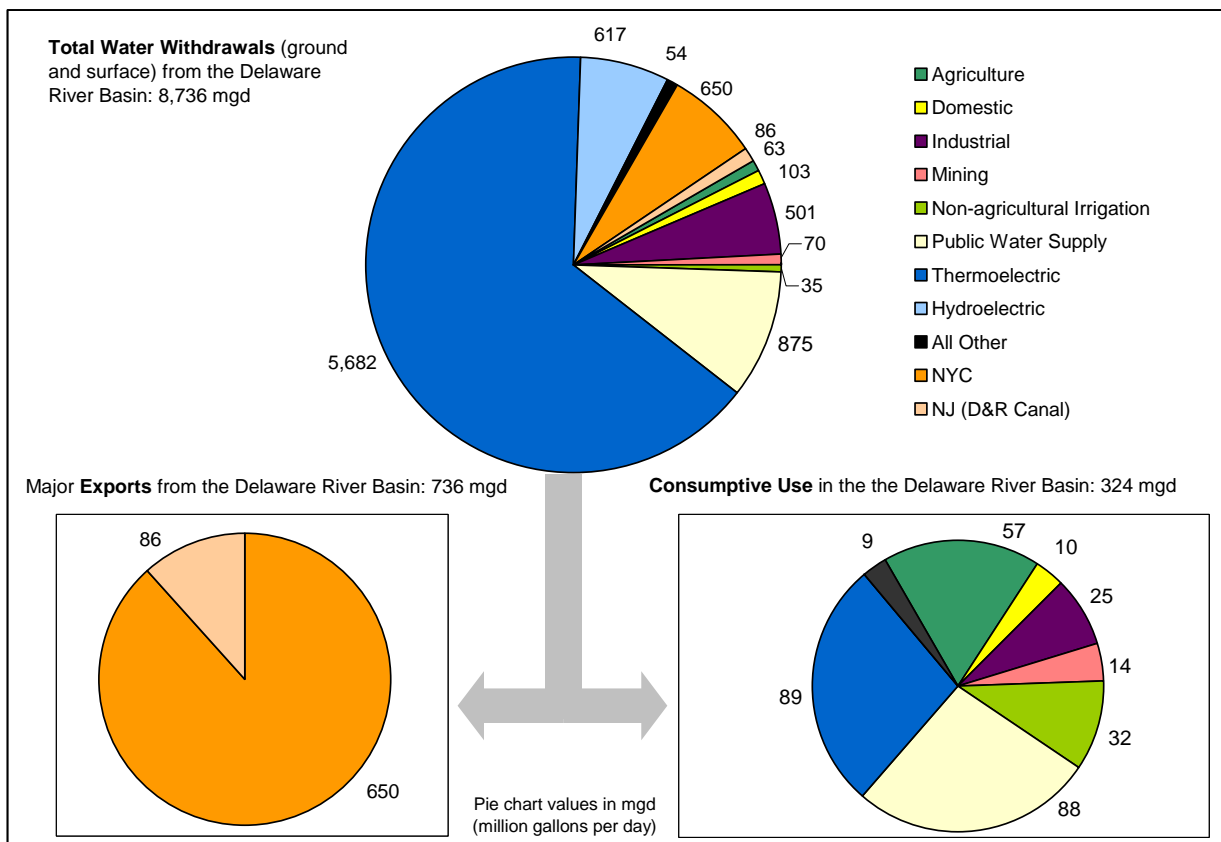
DRBC Water Resources Program 2008 - 2013

B. WATER USE & SUFFICIENCY

Water Use. Much work has been done in recent years to improve our understanding of water use and supply in the Basin and additional work is ongoing. Figure 2 shows the Basinwide picture of water withdrawals, exports and consumptive use. Some key findings of the recent studies show that:

- Approximately 15 million people rely on water from the Delaware Basin for their daily water needs. Approximately 7.8 million people live in the Delaware River basin and the volume of exports to New York City and northeastern New Jersey provide the equivalent of supply to an additional 7 million people.
- Over 90% of all water used in the Delaware River Basin is obtained from surface waters, driven largely by the power, public water and industrial sectors.
- The dominant use sectors are power generation (thermoelectric), public water supply (including exports) and industrial use. Collectively they account for approximately 90% of total withdrawals and total consumptive and depletive use in the Basin.
- Demand for water for thermoelectric power generation has risen steadily in recent decades posing the potential for significant additional future demand on water supplies.

Figure 2. Withdrawals, Consumptive Use and Major Exports from the Delaware River Basin



DRBC Water Resources Program 2008 - 2013

To continue to improve our understanding of water use and supply, it is essential that we collect current and comprehensive water use records to enable the proper assessment, planning and management of water resources. In some cases, surrogate information and assumptions have been used to generate demand data for current reporting efforts. Better reporting would enable a more accurate assessment and would better enable agricultural interests to be accounted for in allocation and water resource management decisions.

Sufficiency. In general, there is adequate supply of water to meet demand in the Basin and permitted exports from the Basin. Two areas of the Basin are included in special management programs to mitigate historical supply deficits and prevent future stress. NJDEP and USGS regularly monitor ground water levels in the affected aquifers of Critical Area 2 in southern New Jersey and reports indicate that in general ground water levels have improved. The Commission manages the Southeast Pennsylvania Ground Water Protected Area (GWPA) and Section II that follows reflects the Commission's plans to investigate conditions in the GWPA over the next few years.

The 2007 report of a multi-year investigation by the Army Corps of Engineers concluded that ground water withdrawals in northern New Castle County, Delaware, are diminishing local stream base flows and forming cones of depression. Pumping in Delaware is increasing ground water flow from Maryland and decreasing flow into New Jersey by about 10% each, and regional pumping has created overlapping cones of depression across the study area of the three states. This issue is currently being addressed by Delaware's Water Supply Coordinating Council (WSCC),

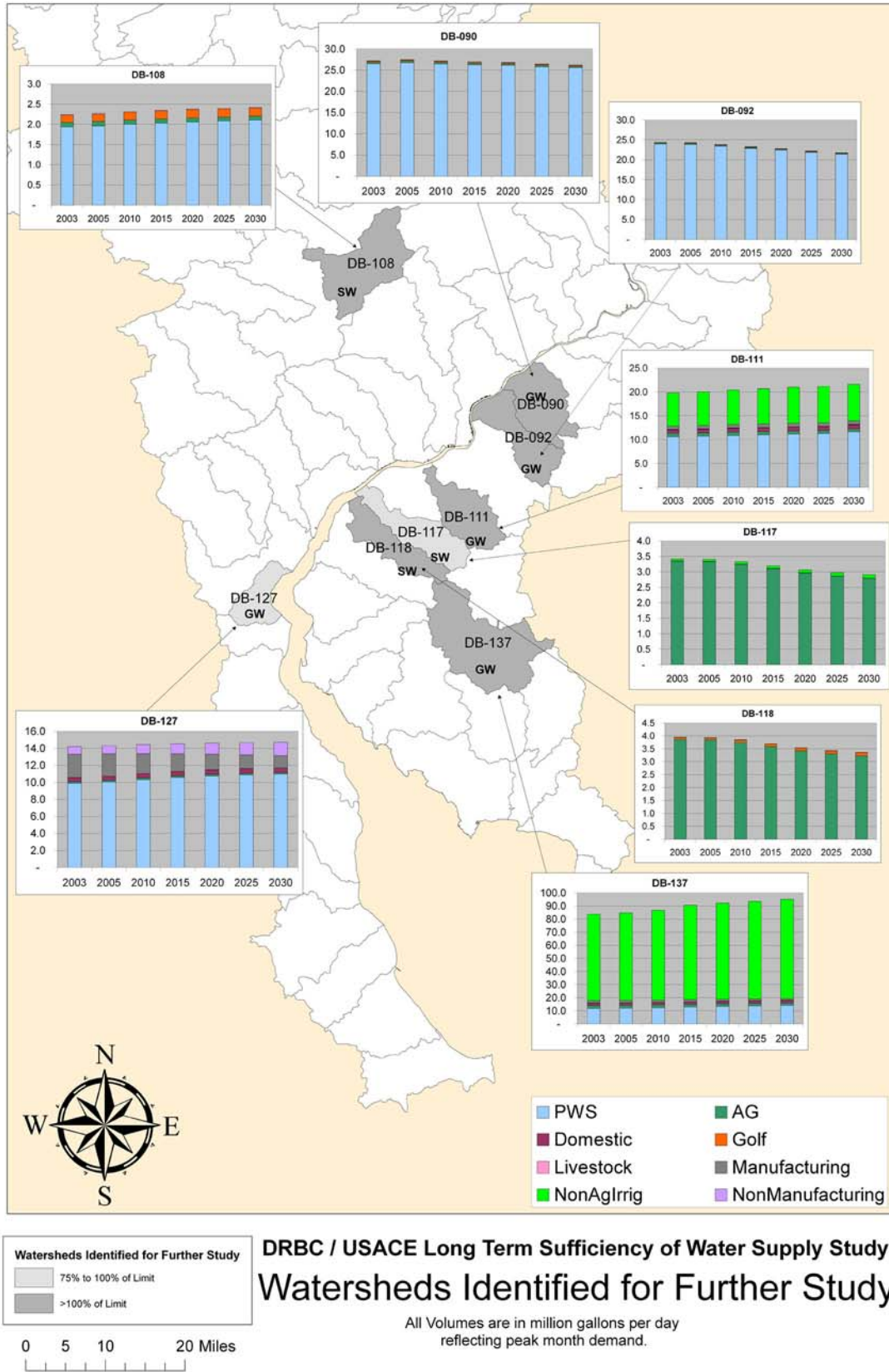
Recent analyses by the Commission and the Army Corps of Engineers indicates that several watersheds in the Basin might experience sufficiency problems during the planning horizon. These analyses are currently the subject of focused review by the Water Management Advisory Committee. Table 1 lists eight watersheds identified as having potential long-term sufficiency issues and worthy of more detailed analysis. Figure 3 shows the location of these watersheds. Progress of state water supply planning efforts is reviewed in Section B.1.1 on page 12.

Table 1. Watersheds identified as having potential long-term sufficiency issues and worthy of more detailed analysis.

Watersheds Identified for Further Study	State	Potential Issue
DB 108 Perkiomen Creek below east branch	PA	SW – Public/NonAg irrigation
DB 090 Pennsauken/Pompeston Creek	NJ	GW - Public
DB 092 Cooper River	NJ	GW - Public
DB 111 Mantua Creek	NJ	GW - Public/Non Ag irrigation
DB 117 Raccoon/ Birch Creek	NJ	SW – Agriculture (based on Ag census)
DB 118 Oldmans Creek	NJ	SW – Agriculture (based on Ag census)
DB 127 Army Creek/ Red Lion Creek/ Dragon Run	DE	GW - Public/Non-manufacturing
DB 137 Maurice River above Sherman Ave bridge	NJ	GW - Non-Ag irrigation/Public

DRBC Water Resources Program 2008 - 2013

Figure 3. Location of Watersheds Identified for Further Study



DRBC Water Resources Program 2008 - 2013

C. WATER QUALITY

Water quality in the Delaware River Basin varies, with conditions generally better in headwaters and upstream areas than in downstream areas.

High water quality is recognized in the 197-mile non-tidal Delaware River, from Hancock, NY to Trenton, NJ that have been designated by the Commission as Special Protection Waters (SPW), as well as in many tributaries incorporated into anti-degradation programs of the States of Delaware, New Jersey, New York and Pennsylvania. Traditional water quality criteria-based programs are focused in the tidal river and Delaware Bay (Zones 2 through 6).

Designated uses for the River include: Aquatic life, Drinking water, Recreation, Fish Consumption and Shell fishing, although not all uses are designated in all ten water quality zones. Assessments completed in 2008 to determine support of the designated uses of the Delaware River are reported in the *2008 Delaware River and Bay Integrated List - Water Quality Assessment*. Unfortunately, water quality does not currently support all designated uses in many of the Basin's stream and river segments.

Figure 3 displays the DRBC WQM zones and final assessments. The non-tidal assessment units include DRBC Water Quality Management (WQM) Zones 1A, 1B, 1C, 1D, and 1E. The designated uses assessed in Zones 1A through 1E include aquatic life, drinking water, primary recreation, and fish consumption. WQM Zones 2, 3, 4, and 5 make up the tidal estuary portion of the Delaware River. Fish consumption, aquatic life, and recreation also apply to all the tidal zones. Drinking water use is only applicable to Zones 2 and 3. The Delaware Bay is designated as Zone 6. The assessed designated uses for the Bay include aquatic life, primary recreation, fish consumption, and shellfish consumption.

Table 2. 2008 Integrated Listing Category for DRBC WQM zones

Zone	Aquatic Life	Drinking Water	Recreation	Fish Consumption	Shell fishing	Final 2008 Assessment Category	Final 2006 Assessment Category
1A	NS	S	S	NS	NA	5	5
1B	ID	S	S	NS	NA	5	5
1C	ID	S	S	NS	NA	5	5
1D	ID	S	S	NS	NA	5	5
1E	NS	S	S	NS	NA	5	5
2	NS	S	S	NS	NA	5	5
3	S	S	S	NS	NA	4A	5
4	NS	NA	ID (below RM 81.8)/S	NS	NA	5	5
5	NS	NA	S	NS	NA	4A	5
6	S	NA	S	NS	S/SS/NS/ID	4A	5

S: The assessment unit supports the designated use.

SS: The assessment unit supports the designated use, but with special conditions.

NS: The assessment does not support the designated use.

NA: DRBC WQR does not contain applicable criteria for a parameter in the AU.

ID: Insufficient or unreliable data is present.

4A: A TMDL to address a specific segment/pollutant combination has been approved or established.

5: Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

Integrated Assessment Summary

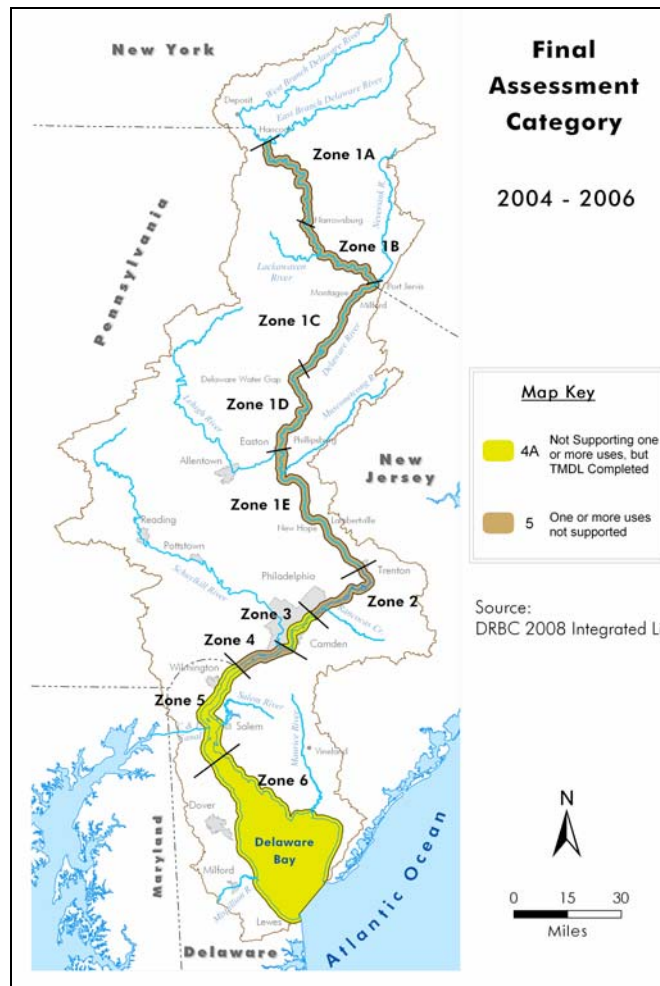
- Aquatic life is supported in Zones 3 and 6. Exceedences of pH (non-tidal zones) and temperature criteria (tidal zones) dominate the issues. Additionally, in Zone 5 approximately 17% of the samples assessed for DO did not meet the 24-hour average criteria.
- Drinking water use is supported in all designated zones.

DRBC Water Resources Program 2008 - 2013

- Primary contact recreation is supported in all applicable zones, except Zone 4 below RM 81.8 where there is insufficient data.
- Fish consumption is not supported in any zone. In most instances, the contaminants are PCBs and mercury. New York did not issue any fish advisories for the Delaware River. However, fish advisories due to mercury are listed for the reservoirs feeding the Delaware River. Pennsylvania has issued advisories for mercury for all of Zone 1. Recently compiled dioxin/furan data from fish tissue collected in 2004 and 2005 also support fish advisories in the tidal river (Greene 2008). PCBs remain the primary cancer risk driver, followed by dioxin and dioxin-like chemicals. Mercury levels in striped bass are moderately elevated and contribute to non-cancer health risks.
- Support of shell fishing varies within Zone 6.

The final assessments for 2008 by zone and designated use are shown in Table 2; the 2006 final assessment is included for comparison. The full report is available in .pdf format on the DRBC web site publications page.

Figure 4. Final Assessment Category for Delaware River and Bay



DRBC Water Resources Program 2008 - 2013

D. CLIMATIC CONDITIONS: ADAPTING TO CHANGE

There is potential for significant changes to water resources in the Basin due to changes in climate. At this point, however, uncertainty is high, and we can not accurately project the extent of prospective changes. Seven individual climate models predict that basin temperatures will increase, precipitation will stay the same or increase, and sea level will rise between 0.5m and 5m by 2100.

The majority of climate scientists think that the precipitation will come in fewer, more intense storms occurring in the winter months. This means a potential increase in flood events coupled with extended drought cycles. Increased temperatures will affect evapotranspiration rates and stream water quality. Turbidity levels will likely increase and dissolved oxygen decrease. Sea level rise may require increased river flows to repel salinity and/or costly modifications by water suppliers. Changes in seasonal flows, e.g. the timing of spring snow melt, could negatively affect migratory as well as resident species, and increase opportunities for invasive species. Changes in forest cover could leave headwaters vulnerable.

To improve our understanding of the impacts of climate change and develop an adaptive water management plan, we need: 1) the results of downscaled climate models, 2) development of new extreme endpoints and uncertainty factors, 3) information related to vulnerable biological communities in the Basin, and 4) models of flows and storage capacity for drought mitigation and salinity repulsion, and of additional void capacities to mitigate a potential increase in flooding; 5) identification of reasonable alternative management scenarios. When considering options, we need to assess how much progress can realistically be made through behavioral change, e.g., conservation and demand reduction, alteration of development patterns, and protection of headwaters, stream corridors, and other critical landscapes. In a larger context we also need to address the causes of climate change and develop adaptive actions to the anticipated impacts.

DRBC Water Resources Program 2008 - 2013

DRBC WATER RESOURCE MANAGEMENT PROGRAM FY 2008 - 2013

II. WATER RESOURCE MANAGEMENT PROGRAM: Summary of the activities and programs for FY 2008- 2013

A. KEY ISSUES

In the evaluation of work priorities over the next six years there are five key issues and a series of strategic questions to be addressed. The Water Resources Program will be used to shape a more detailed annual work plan that will include the allocation of resources and priorities for funding opportunities.

Sustainable Supply

- What is the current water availability and what are the current and future demand projections for each of the Basin's major watersheds?
- Is additional storage needed in specific areas of the Basin to provide adequate water supply during low flow periods?
- How can we account for the uncertainty regarding impacts of climate change on supply availability and demand?

Suitable Quality

- What are the greatest threats to existing water quality in the non-tidal Delaware and what programs are needed to address them?
- Which impairments in shared waters pose the greatest risk to humans and the environment and how can they be managed?
- Are the existing water quality standards adequate? Should uniform criteria be developed?

Flow Management

- What instream flow regimes are needed to support habitat needs and endangered species populations?
- What seasonal flows are needed to support estuarine biological communities (e.g., oysters), maintain the salinity standard for drinking water intakes, and provide the calculated low flow for wastewater assimilation?
- What are the impacts of the FFMP on water supply, flooding, aquatic life, and recreation?
- How can we account for the uncertainty of climatic changes on flow regimes?

Flood Mitigation

- What contribution or mitigating effects do basin reservoirs have on flooding?
- How can basin-wide flood mitigation best be accomplished? Do we need additional flood storage or can the existing system function with the addition of county and municipal hazard mitigation plans and their implementation?

Watershed Management

- What watershed management policies can be put in place to protect human water needs and instream flow regimes on unregulated streams?
- What are the best mechanisms for partnership with municipalities, counties and state entities to develop meaningful watershed programs?

DRBC Water Resources Program 2008 - 2013

B. WATER RESOURCE MANAGEMENT PROGRAM

Section

- 1.0 **Ensuring the Sustainable Supply Of Suitable Quality Water**
- 1.1 Water Supply: Availability & Demand Forecasting.
- 1.2 Flow Management for Supply and Ecological Needs
- 1.3 Determining Water Quality & Meeting Standards: Criteria-Based Programs, Anti-Degradation, Water Quality Administration
- 1.4 Prospective Changes to DRBC Program Rules and Regulations

1.1 WATER AVAILABILITY & DEMAND FORECASTING

Water Supply Planning. The DRBC and the Army Corps of Engineers are collaborating on an assessment of water demand and supply Basin-wide which is due for release in 2008. Estimates of current demand and projections of future water demand to the 2030 time horizon have been developed and compared to estimations of water availability. The study has identified several watersheds and locations on some of the Basin's larger rivers where demand is placing pressure on available supplies; many of these demand are anticipated to increase over the forecast period. Future water supply studies are likely to include an investigation of the effectiveness of the southeastern Pennsylvania Ground Water Protected Area (GWPA) program. This will build upon a recent evaluation of water demands compared to the withdrawal limit for each of the GWPA's 76 sub-basins which identified that, although the area as a whole has seen a reduction in water demand, some sub-basins are operating close to or above their potentially stressed limit. One of the purposes of future study will be to assess how the analysis would look if each water user were to increase their use of water up to their allocated amount.

State Planning Efforts. Water supply planning is ongoing in Delaware, New Jersey and Pennsylvania in addition to DRBC's own efforts. Delaware has taken a regional approach to water supply planning, through its Water Supply Coordinating Council (WSCC) which initially focused on expanding water supplies in northern New Castle County. Ten projects were identified for development to help ensure demand would be met through 2020, this includes the 317 million gallon Newark Reservoir, the first in Delaware for over 70 years, which came online in 2006. Currently, eight projects have been completed with the remaining two underway. Once all projects are online, an additional 2 billion gallons of storage will be available for northern New Castle County. It is anticipated that this additional supply will resolve the potential sufficiency issue identified in Watershed DB-127 in Table 1. In 2003, legislation directed the WSCC to expand water supply planning to three other key areas of the state, southern New Castle County, central Kent County and coastal Sussex County. Planning work in these areas is currently underway and on schedule for completion by the end of 2009. Results of a multi-year study of ground water availability conducted by the Army Corps of Engineers indicate that groundwater withdrawals in Delaware affect the aquifer systems in Maryland and New Jersey. DRBC will continue to work with the WSCC and NJDEP/NJGS to recommend measures to monitor aquifer conditions and manage withdrawals as appropriate.

New Jersey is planning to release its latest Statewide Water Supply Plan in 2008. New Jersey's assessment will include a comparison of consumptive and depletive water demands versus water availability using the low flow margin method (a measure based on September median flow minus 7Q10). The plan will also include an assessment of water demand versus infrastructure capacity. Two scenarios of future water demand have been developed, one is a projection to the year 2020 and the other is a "full allocation" scenario, where water demand is modeled based on water allocation permit limits.

Act 220 legislation in Pennsylvania led to the creation of a new State Water Plan which is due for release in 2008. At the heart of the plan is a GIS-based water budget assessment which evaluates the water balance at over 10,000 "pour points" across the state. Net water withdrawals (water withdrawn minus discharges) are compared to an availability threshold of 50% (30% in carbonate areas) of the 7Q10 value. A number of watersheds have been identified statewide (six in the Delaware River Basin portion of the state) for closer scrutiny in the "final verification" phase. These watersheds will be evaluated for potential

DRBC Water Resources Program 2008 - 2013

consideration as Critical Water Planning Areas. Watersheds receiving such designation will require a Critical Area Resource Plan to be developed, which will identify the exact nature of the supply-demand imbalance and will identify potential mitigation strategies.

Conservation and Water Efficiency. In addition to implementing its ongoing water conservation program, the DRBC and its Water Management Advisory Committee (WMAC) developed an approach to deliver staged improvements in accounting for water loss in distribution system based on the methodology proposed by the American Water Works Association (AWWA). Full implementation of changes to water loss accounting could be accomplished by 2012, with attention given to the role of the states and DRBC in receiving and assessing information from water suppliers. Additional areas of study in coming years include compiling information on innovative water pricing structures which provide an incentive for water conservation yet provide stable revenues for water purveyors, and water reuse to provide additional tools for improving water use efficiency. See Supplemental Table A for a schedule of prospective changes to DRBC programs and regulations.

1.2 FLOW MANAGEMENT

The main stem of the Delaware River is the longest un-dammed river east of the Mississippi. However, there are dams on several large tributaries that regulate flow to the River through conservation releases, flood control and water supply functions. Activities that affect flows include: releases, diversions and spillway flows from water supply and multipurpose reservoirs on tributaries, water diversions from tributaries and the river, and water withdrawals from interconnected ground water sources. Low flows may impact ecosystems and reduce the assimilative capacity of the river for wastewater discharges. High flows may cause loss of life and property as well as alter the riparian corridor and habitat for aquatic populations.

Reservoir Operations. The regulations for the major tributary reservoirs are included in the DRBC Water Code. In September 2007, the Decree Parties agreed to a Flexible Flow Management Program (FFMP), providing a framework to manage releases from New York City's Delaware Basin reservoirs. The intent of the FFMP is to use the Cannonsville, Pepacton, and Neversink reservoirs for multiple, competing uses, including water supply and drought mitigation, spill mitigation, protection of the tailwater fishery, habitat needs in the basin, and recreation. A central feature of the FFMP is the elimination of the previously employed use of temperature and flow "banking" to provide flows for fisheries. Instead, conservation releases are based on reservoirs storage levels, resulting in larger releases when water is abundant and smaller releases when storage is at or below normal, more closely approximating natural flow regimes.

The discharge mitigation component of the new Flexible Flow Management Program (FFMP) is intended to reduce the likelihood of spills from the three New York City reservoirs by considering the potential runoff contribution from the snow pack during the spring thaw. Specific void targets are not part of the program, since the intended purpose of the reservoirs is water supply. A Flood Analysis Model is being developed which will be used to assess impacts of reservoir operation on downstream flooding during the September 2004, April 2005, and June 2006 floods. The model will likely be completed in early 2009 and will be used to determine the extent to which changes to the storage levels in the 15 major reservoirs (NYC and lower basin) can be used to mitigate flooding on the main stem. The OASIS model will be used to analyze the impacts of changed storage levels on water supply and ecology. Changes to the NYC River Basin reservoirs operations will need unanimous consent of the decree parties.

DRBC Water Resources Program 2008 - 2013

Ecological Flows. The issue of ecological flows in both the Delaware River and its tributaries remain a concern in the basin, Emphasis is being placed on improving our understanding of the natural flow regime of the river-to-bay and the ability of our modeling tools to evaluate these issues. The Subcommittee of Ecological Flows (SEF) of the Regulated Flow Advisory Committee (RFAC) has been a critical forum for providing the scientific foundation and the coordinated assessments to make progress with upper basin cold water fisheries. The States have pursued eco-regional analysis of cold and warm water tributary conditions and instream assemblages. USGS, USF&WS, and USGS are supporting work on the endangered Dwarf Wedgemussel (DWM). To the extent that study results identify the relative importance of flow regimes to the DWM health, such data may be useful for future instream habitat assessments by DRBC and the Decree Parties. Changes to the NYC Delaware Basin Reservoirs operations are contained in the *Reservoir Operation* discussion above. The DRBC has developed changes to the Water Code to reflect the decree party FFMP.

Freshwater inflow requirements for estuary populations, such as oysters, 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 target was set to ensure adequate fresh water flows to protect drinking water intakes in the tidal river. Predictions of long-term diminution of snow pack and melt as a regional effect of climate change might have implications for flow management alternatives to meet this target. The protection of instream flow needs may require adjustments to allocation and discharge permitting criteria, particularly if flow targets are adjusted.

Flow Modeling. An understanding of water supply, storage and flow regimes are 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 in the basin. In particular, the models are used to assess the operations of water supply, flood control, power generation and recreation reservoirs, the impacts of such operations on basin resources, their ability to meet intended and multiple objective uses, and the effectiveness of conservation releases. In 2009, DRBC will have a Flood Analysis model developed by the US Army Corps of Engineers, NOAA, National Weather Service and US Geological Survey. See also Supplemental Table B for a summary of all proposed modeling activities.

Program/Project	Products/Outputs	Year	Funding Sources
Reassessment Study	Analyses and Reports to support Decree Party decision-making	2011	Decree Parties
Flood Analysis Model	Support for FFMP and Flood Mitigation Task Force. Model to assess impacts of reservoir operations on flooding	2009	State Contributions Federal Agency In-Kind
OASIS UPDATE	Support for surface water supply studies. OASIS inflow file update – extend inflow file with historical data from October 2000 to September 2006, to support coordinated drought analyses with Flood Analysis Model	2008-2009	WSF
DSS Improvement	Support for FFMP assessments. Model links to evaluate impact of reservoir operations on habitats	2008	ACoE Sec. 22
Dwarf Wedgemussel Study	Habitat requirements report	2008	PPL and ACoE

DRBC Water Resources Program 2008 - 2013

1.3 DETERMINING WATER QUALITY & MEETING STANDARDS: CRITERIA-BASED PROGRAMS, ANTI-DEGRADATION, WATER QUALITY ADMINISTRATION

Keeping the Clean Water Clean. The Delaware Basin is unique in having many miles of high quality waterways in the midst of the densely populated Mid-Atlantic metropolitan area. It provides an enormous benefit to the citizens and workers of the Basin and presents a management challenge to maintain existing water quality in a region of substantial population change. The Commission will continue to implement the Special Protection Waters (SPW) program to maintain existing water quality in the non-tidal river. Modeling and assessment efforts in SPW areas is expected to form a foundation for collaborative watershed management efforts, such as those for the Tri-State area and the Lower Delaware described in Section 3.0.

Impaired Waters. Significant stretches of the rivers and streams in the Basin are impacted by pollutants to the point where they do not support their designated uses. Causes and sources of impairment vary throughout the Basin (See Sec I.C, Table 2). The list of pollutants includes oxygen demanding materials, and toxics, such as organochlorines, PCBs and mercury that result in fish consumption advisories. The current priority is the clean-up of PCBs in the estuary and at upstream sites affecting the estuary.

DRBC monitoring and assessment programs will continue to focus efforts on the determination of water quality and measures needed to meet existing standards through our criteria-based and anti-degradation programs. While traditional physical/chemical approaches will continue, increasing emphasis will be placed on establishing methodologies for assessing ecosystem health appropriate for the large river system. Specific species of concern will be addressed through other programs and activities (see Section 2.0). The development of biocriteria is an issue that will require resources for monitoring and assessment in coming years.

DRBC will continue its central role in establishing and implementing TMDLs for toxic and conventional pollutants in the shared waters, and identifying major sources of the contaminants of concern. TMDLs have already been established for PCBs in the estuary. Commission staff is currently developing a Stage 2 TMDL for PCBs for Zones 2-6. Under its regulations, DRBC has also determined that the estuary has been impaired for carbonaceous oxygen demand, whole effluent toxicity and volatile organic compounds, and has established assimilative capacity for those parameters authorizing the Executive Director to issue allocations. DRBC will continue to work with the states to provide consistent information related to human health through fish tissue analysis that form the basis for state consumption advisories.

Data Management. The EPA's decision to migrate from the STORET data management system and outdated platform to WQX (Water Quality Exchange) may significantly impact the agency's data management and data sharing efforts. The new system will allow use of an agency's own data system and permit interface with EPA via XML generation tools. DRBC is currently using DE DNREC to upload its Boat Run data to WQX. DRBC will be working with NJDEP regarding use of a new monitoring data base to access WQX for other Commission data. Currently, there are many uncertainties, making it impossible to anticipate the magnitude of influence on DRBC data management & collaborative efforts for data sharing among states and EPA.

Project Review. DRBC's regulatory activities remain important for both water supply and water quality management. Administrative agreements with state and federal agencies are undergoing review and revisions to eliminate unnecessary redundancy in the review system (See Section 4.0) DRBC expects to continue to support state partners in their permitting programs through data collection, assessment, mixing zone analysis, and other modeling; and to improve cooperative efforts to enforce DRBC standards to meet requirements in shared waters.

DRBC Water Resources Program 2008 - 2013

Monitoring. In the non-tidal river, the Scenic Rivers Monitoring Program will continue yearly until 2012. This effort will provide a 4 to 5 year data base for establishing Interstate Control Points and Boundary Control Points for the Upper Delaware and Middle Delaware portions of the Special Protection Waters. From 2009 to 2012, monitoring will be reinitiated in the Lower Delaware portion of the Special Protection Waters to assess any measurable change to existing water quality.

The long term monitoring program conducted by the Commission (Boat Run Survey) will continue with 10 surveys planned at 22 stations in the tidal river and bay. This program provides data to assess compliance with Commission water quality criteria, and also provides data on nutrient concentrations and potential effects. Staff recently completed development of a nutrient strategy for the tidal river and bay that calls for increasing monitoring of the phytoplankton community and development of a eutrophication model. In 2008 Delaware Bay was selected as one of three pilot sites to test and improve the National Monitoring Network for US coastal waters and tributaries. As a result of the gap analysis, \$100,000 in monitoring improvements in the estuary will be realized in FY 2009, including enhanced real-time and nutrient monitoring.

Monitoring for a suite of emerging contaminants will continue in 2009 with sampling at 6 additional sites in the mainstem river or tributaries. In 2008, six sites in the tidal river were sampled for PBDEs, perfluorinated chemicals, pharmaceuticals, steroids, carbamate pesticides and nonylphenol.

Modeling. In the non-tidal river, model development will also continue with the calibration and validation of QUAL2K models for the Lower Delaware and Tri-state Area in 2009 and 2010. A water quality model for the Lehigh River will also be developed and calibrated. This latter effort will be coordinated with the model development effort of the Corps of Engineers that is scheduled for completion in 2009.

In the estuary, model development will focus on PCB homolog models to support the Stage 2 TMDLs, eutrophication models to support the Commission's nutrient strategy, and hydrodynamic modeling to support oyster restoration and evaluations of salinity intrusion due to reservoir operations. See also Supplemental Table B for a summary of all ongoing and proposed modeling activities

Program/Project	Products/Outputs	Year	Funding Sources
Scenic Rivers Monitoring Program	Data and report	2009 – 2012	Section 106 and NPS
	Report on changes to EWQ	2013	GF
Lower Delaware Model	Report on initial model setup and calibration	2009	Section 106 and GF
Tri-State Model	Model calibration report	2010	Section 106 and GF
Boat Run Survey	Data and report	yearly	Section 106
Estuary monitoring	Improved nutrient & realtime monitoring to complement the objectives of the National Monitoring Network.	2009	USGS
Fish Tissue Monitoring	Data and report	2009, 2011, 2013	Section 106
Stage 2 TMDLs	Revised TMDLs for Zones 2 – 6 and supporting documentation	2010	GF and Section 104(b)
Eutrophication Model for Delaware Estuary	Report on model calibration/validation	2011	None identified
Emerging contaminant monitoring	Data from screening surveys	2009 - 2010	Section 106

DRBC Water Resources Program 2008 - 2013

1.4 UPDATING PROGRAM RULES AND STANDARDS

In cooperation with its advisory committees and state partners, DRBC will initiate review of its existing water quality standards for the purposes of proposing revised standards where appropriate. Initial efforts will focus on toxics criteria for human health, pH, and temperature, with subsequent review of bacteria, ammonia and DO criteria. Through the biological subcommittee to the Water Quality Advisory Committee, suitable approaches will be investigated, for developing biological metrics and biocriteria. When reviews of the previously mentioned criteria are completed, a broad examination of other existing criteria will be performed to determine which should be targeted for re-evaluation. An evaluation of the overall architecture of the water quality regulations will also be performed to produce a more coherent and refined structure. Important policy decisions pertaining to criteria will require early input from the commissioners; an appropriate forum with Commissioners will be convened for discussion and guidance. See Supplemental Table C for a more detailed schedule of activities related to updating water quality standards. See also Supplemental Table A for a summary of all prospective program rule and administrative changes.

Section

- 2.0 WATERWAY CORRIDOR MANAGEMENT**
- 2.1 Flood Warning & Loss Reduction
- 2.2 Recreation Enhancement
- 2.3 Aquatic Life and Wildlife Habitat Improvement

2.1 FLOOD WARNING & LOSS REDUCTION

Increasing storm activity in 2004 through 2006 has served as a reminder of the damage that flood waters can inflict. Between mid-September 2004 and late June 2006, three major floods caused severe and repeated damage to thousands of structures, and disrupted the lives of tens of thousands of people along the main stem Delaware River and several tributaries. The flooding was the worst since the record flood of 1955. While we do not yet know for certain how or if storm patterns are changing in response to climate change, the past few years have demonstrated that floods follow no predictable pattern. Climate change research appears to be pointing to more extreme precipitation cycles, whether they are wet or dry.

Rainfall records over the past 100 years indicated that average annual rainfall in the Basin has increased on average by 4.5 inches. In addition, according to the Western Regional Climatic Center, during the last six years (data from April 2002 through March 2008), precipitation has exceeded normal amounts across the Basin:

- Upper Basin: 65-80 inches above normal
- Central Basin: 50-65 inches above normal
- Lower Basin : 20-35 inches above normal
- Extreme Lower Estuary (Delaware): 15-30 inches above normal

DRBC has coordinated flood prediction and warning, and promoted the need for improved community hazard mitigation planning in the basin. The agency's strength is its capacity to provide organization across the multiple layers of governmental institutions associated with flood preparedness and mitigation.

Additional data and assessment efforts may be required to assess vulnerability to flooding, to set indices for aquatic and riparian ecosystem health, to evaluate sediment transport, to improve stormwater and other land management practices, and to support of all-hazards mitigation planning.

Interstate Flood Mitigation. The 2004-2006 flooding events have resulted in renewed emphasis on investigating opportunities and implementing actions to mitigate the impacts of flooding on basin communities. Although each Basin state is working individually to address and mitigate flooding, it has been determined that a comprehensive long-term flood loss reduction and flood mitigation strategy needs to be developed through a coordinated watershed approach.

At the direction of the governors of the four Basin states, the DRBC commissioners at their September 27, 2006 meeting directed commission staff to convene a Delaware River Basin Interstate Flood Mitigation Task Force. One of the strengths of the DRBC is its ability to bring together various

DRBC Water Resources Program 2008 - 2013

government and non-governmental stakeholders across jurisdictional boundaries for the shared interest of the watershed. To that end, a 31-member task force representing a broad array of government interests (both legislative and executive) as well as private sector and non-profit perspectives was convened in late 2006. The Task Force crafted and public-participated an action agenda in a nine month time. The final report transmitted to the four Governors in July 2007 took the form of an action agenda consisting of 45 consensus-based recommendations focused on a more proactive and systematic approach to flood mitigation within the Delaware River Basin. Since that time an impressive array of activities is underway in six priority management areas encompassed by the action agenda: reservoir operations, structural and non-structural mitigation, stormwater management, floodplain mapping, floodplain regulation, and flood warning. Notable projects for which DRBC is lead or co-sponsor are as follows:

- In conjunction with USGS, ACOE and NWS development of Flood Analysis Model.
- In conjunction with ACOE, development of digital Flood Inundation Maps
- In conjunction with NOAA/NWS, upgrade to the Delaware River Flood Warning System. (\$235,000 in new federal funds; Sponsor: Dent, Holt, Lautenberg and Menendez)
- In conjunction with USGS and ACOE, recalculation of flood frequencies for the Delaware River.
- In conjunction with Nature Conservancy, development of Flood Museum and Resource Center in Easton, PA.
- In conjunction with NJDEP and NJOEM, development of a Multi-Jurisdictional Flood Mitigation Plan for the Non-Tidal N.J. Section of the Delaware River Basin
- In conjunction with Supreme Court Decree Parties, development of a Flexible Flow Management Reservoir Operations Plan and Comprehensive Reassessment Study process.
- In conjunction with New York City, deployment of “snow pillows” to facilitate assessment of snow pack storage and FFMP Reservoir Operations.

Flood modeling. A Flood Analysis Model is being developed which will be used to assess impacts of reservoir operation on downstream flooding during the September 2004, April 2005, and June 2006 floods. The model will likely be completed in early 2009 and will be used to determine the extent to which changes to the storage levels in the 15 major reservoirs (NYC and lower basin) can be used to mitigate flooding on the main stem. The OASIS model will be used to analyze the impacts of changed storage levels on water supply and ecology. In the Coming years, the DRBC will use the combined results to develop a flood mitigation program in the Water Code similar to the Drought Program. Changes to the NYC River Basin reservoirs operations will need unanimous consent of the decree parties. See also Supplemental Table B for a summary of all ongoing and proposed modeling activities.

The Flood Advisory Committee (FAC) and the Regulated Flow Advisory Committee (RFAC) will continue to be integral to the coordination of high-flow related initiatives. See Supplemental Table A for a schedule of prospective changes to DRBC program rules.

Program/Project	Products/Outputs	Year	Funding Sources
ACOE Multi-jurisdictional Study	I.D. Flood Prone Areas Update Stage Damage Data Solution Matrix for Priority Areas	2008	ACoE: General Expense
NJ Four County Flood Mitigation Plan	HAZUS Assessments Repetitive Loss Properties Workshops Compendium of Local Mitigations Strategies Final Four County Plan	2007/2008	FEMA: Hazard Mitigation
ACOE Flood Forecast Inundation Maps	Flood Forecast Inundation Maps	2008/2009	ACoE Sec. 22

DRBC Water Resources Program 2008 - 2013

NOAA-NWS Flood Warning Enhancements	Inventory and Evaluation of Gages Harden Key Gages Recommend New Forecast Points Make Inundation Maps available in AHPS Establish E&O Program	2008	NOAA Appropriation
NOAA-NWS Flood Warning Enhancements	Continue to implement Flood Warning recommendations of the Interstate Basin Task Force	2009-2013	NOAA Appropriation
DRBC Floodplain Regulations	Evaluate and update current regulations based on current floodplain management guidance. The new regulations should apply to both freshwater, estuarine and saline waterways in the basin and should be applicable to all floodplain development.	2009/2010	General Fund
Establish a Repetitive Loss Strategy (Priority Areas for Acquisition, Elevation, and Flood-proofing)	Support State, County and Municipal Mitigation Projects	2008-2013	General Fund
High Hazard Dam Emergency Action Plan (EAP) Documents	Coordinate and ensure that EAP documents for all large impoundments are available for emergency management purposes.	2009	General Fund
Flood Analysis Model	Quantify effects of potential voids in the basin reservoirs	2009	State Contribution, Federal Agency In-Kind
Reservoir Operating Plan	Develop an Interoperable Reservoir Operating Plan that includes Potential Flood Mitigation by All Major Reservoirs	2010	General Fund
Coordination through DRBC Flood Advisory Committee (FAC)	Coordination among federal, state, regional and local agencies	2008 - 2013	General Fund, Agency In-Kind
Education and Outreach	Develop a Coordinated Education, Outreach and Training Program aimed at County/Local Emergency Managers	2008-2013	NOAA Appropriation

DRBC Water Resources Program 2008 - 2013

2.2 AQUATIC LIFE AND WILDLIFE HABITAT IMPROVEMENT

Ecosystem needs. National emphasis on improving water quality for the protection of aquatic and riparian habitat as well as specific species of concern necessitates increased efforts at DRBC to investigate the physical, biological and chemical conditions that contribute to the health of ecological communities. This emphasis is expected to increase, rather than to wane. An efficient use of public-private partnerships, such as that embodied in SEF, the Regulated Flow Advisory Committee's Subcommittee on Ecological Flows and the Partnership for the Delaware Estuary, will be the most effective way to leverage talent and funds to meet ecosystem protection goals. The groundbreaking work of SEF with the USGS Decision Support System model will continue to facilitate adaptive management of ecological resources below New York City's Upper Basin reservoirs, particularly the federally-endangered Dwarf Wedgemussel. DRBC is also closely coordinating with the Partnership for the Delaware Estuary Program (PDE) on habitat identification and improvement efforts. DRBC will continue to be an active member of the Bi-state Oyster Revitalization Task Force and to support PDE efforts to improve habitat for specific species of concern, such as oysters, horseshoe crabs and anadromous fish, through collaborative efforts with the Fish & Wildlife Management Cooperative, the US Fish & Wildlife Service, and the Army Corps of Engineers. DRBC intends to remain involved in the development and expansion of creative funding opportunities, such as those offered through the National Fish & Wildlife Foundation.

DRBC will continue to increase understanding of ecosystem needs and habitat conditions in the basin through ambient water quality monitoring, fluvial geomorphologic assessments, and surveys for biocriteria development conducted in partnership with federal and state agencies. In the estuary and tidal reaches, increasing emphasis will be placed on establishing linkages among benthic, pelagic, and physical conditions & processes, consistent with the recommendations of the federal Ocean Action Plan and the proceedings of the Delaware Estuary Science Conference 2005.

Additional efforts will be made to support partners' sub-basin scale initiatives that evaluate landscape function and natural resource services such as those provided by the estuarine wetlands fringe around Delaware Bay. More information about ecosystem condition and function is necessary to be able to protect and preserve the integrity of the basin's natural communities. Stressor identification through watershed evaluation may prove to be an important next step in this effort (see also section 3.0). DRBC participates when feasible in basin-wide or regional efforts to identify and manage non-native species that can stress ecosystem function. See Supplemental Table A for a summary of prospective changes to DRBC program rules and Supplemental Table C for a more detailed schedule of tasks related to the development of biocriteria and other prospective changes to water quality standards.

Program/Project	Products/Outputs	Year	Funding Sources
Dwarf Wedgemussel Study Phase 2 - Univ. of Mass. Outputs	Final Habitat Requirements Report	FY 2008, FY 2009	PPL, ACOE, Sec. 22 / In-kind
Delaware River Biocriteria	Biocriteria Strategy	FY 2009 to FY 2010	\$106
Delaware River Biocriteria	Revised Biocriteria	FY 2011 to FY 2012	\$106
Delaware River Fish and Wildlife Management Cooperative	Technical Support	on-going; FY 2008 to FY 2013	General Fund

DRBC Water Resources Program 2008 - 2013

Section

- 3.0 LINKING LAND & WATER RESOURCE MANAGEMENT**
- 3.1 Collaborative Watershed Planning
- 3.2 Promoting sound practices

3.1 COLLABORATIVE WATERSHED PLANNING

DRBC promotes sound practices of watershed management in the Basin (Compact §7.1). DRBC watershed management efforts include watersheds that involve two or more states as well as projects within a single basin state, typically as pilot programs for larger multi-jurisdictional management efforts. Staff is performing watershed management including collaborative partnerships in the:

- Christina Basin (PA and DE) ,
- Contributing watersheds draining to the Tri-State Bend within the Special Protection Waters program area (PA, NY, and NJ),
- Upper Wissahickon Creek (Montgomery County, PA),
- Six riverfront towns along the Lower Delaware River (Hunterdon County, NJ),
- Schuylkill River watershed (PA), and
- Pocono Creek and Brodhead Creek watersheds (Monroe County, PA).

The Pocono Creek project is a water resources sustainability study being performed with EPA-ORD to establish relationships between ground water and stream base flow, and to develop tools for sustainable water resource management at the local community level. The project is a collaborative effort with EPA-ORD, USGS and local partners to establish a scientific foundation for development of water resource policies that are transferred to local communities through social marketing techniques. Watershed management efforts are expected to be ongoing for many years. In addition, DRBC will remain an active partner with the Upper Delaware Council, the Middle Delaware Advisory Committee and the Schuylkill Action Network (SAN), among others.

3.2 PROMOTING SOUND PRACTICES

The Basin Plan's goals regarding watershed management include:

- preserving and restoring natural hydrologic cycles through improved stormwater management;
- maintaining and restoring the function of valuable water resource landscapes, such as wetlands and aquifer recharge areas;
- the integration of water resource considerations into land use planning and growth management

DRBC promotes sound watershed management practices, and has developed *Guidelines for Integrated Resource Planning (IRP)* as a tool for communities in the Ground Water Protected Area of southeast Pennsylvania to maintain water supply and stream flows in areas where aquifers have been subjected to depletion. The Swamp-Scioto Creek sub-watershed in the Perkiomen watershed is being piloted for an IRP. In addition, DRBC is beginning a pilot *Integrated Water Resources Plan (IWRP)* on the Schuylkill River watershed for PADEP. The IWRP will demonstrate how multiple water resource programs (e.g., stormwater, wastewater, water supply, flood mitigation, etc.) can be aligned for more efficient use of monetary and human resources to manage the common resource.

DRBC is the logical regional entity for performing basin and regional scale assessments and for providing tools to improve watershed management. Work at a number of watershed scales (see list of Collaborative Watershed Management projects above) has promoted sound land uses aimed at retaining or restoring the hydrologic integrity of the watershed.

DRBC Water Resources Program 2008 - 2013

Program/Project	Products/Outputs	Year	Funding Sources
Christina Clean Water Partnership	<ol style="list-style-type: none"> 1. Final Report for Targeted Watershed Initiative Grant. 2. Continued bi-state coordination and program development to meet Partnership's Long Term goal of restoring all streams' water quality to designated uses by 2015 	<p>2008</p> <p>2008-13</p>	EPA TWIG
Pocono Creek Framework for Sustainable Watershed Management	<ol style="list-style-type: none"> 1. Technical Studies and Final report 2. Development of Management Strategies 3. Watershed Community Event "Trout Trails and Tales" 4. Development of partnership for Brodhead Watershed/Monroe County 	<p>2008</p> <p>2008</p> <p>2008</p> <p>2008-09</p>	<p>EPA ORD</p> <p>EPA ORD</p>
Upper Wissahickon Creek Special Area Management Plan (SAMP)	Preparation of SAMP as a Pilot Critical Area Resource Plan (CARP) and critique of the public process and guidance document.	2008 - 09	PADEP
Pilot Integrated Water Resources Plan (IWRP) for the Schuylkill River watershed	<ol style="list-style-type: none"> 1. Perform scoping study for IWRP for Schuylkill River 2. Model Assessment and Application 3. Sub-Basin pilot IWRP 4. Upper Schuylkill Act 167 Plan 5. Lower Schuylkill Act 167 Plan 	<p>2008 - 09</p> <p>2009 – 10</p> <p>2010 – 11</p> <p>2011 – 13</p> <p>2013 +</p>	<p>PADEP</p> <p>PADEP</p> <p>PADEP</p> <p>PADEP</p> <p>PADEP</p>

DRBC Water Resources Program 2008 - 2013

Section

- 4.0 INTERGOVERNMENTAL RELATIONS**
- 4.1 Conflict Management
- 4.2 Facility Planning
- 4.3 Intergovernmental Coordination

4.1 CONFLICT MANAGEMENT

Perhaps the most unique of DRBC's many functions is support for the states, federal government, and parties to the 1954 Supreme Court Decree for the avoidance and resolution of jurisdictional conflicts. DRBC remains the forum for discussion and arbitration of inter-jurisdictional issues associated with the regulation of withdrawals and diversions, water allocation, flow management, pollution prevention, flood mitigation, and endangered species protection.

4.2 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." One of the initial tasks will be to evaluate the "proposed reservoir enhancement projects," presently part of the Comprehensive Plan, against the current need for regional flood control and for supply enhancement. DRBC staff will be working with Supreme Court Decree Parties on a multi-year "Reassessment Study of the Operations of Selected Delaware River Basin Reservoirs". The objectives of the Study will be: (a) to identify current issues and concerns related to continued operations under the 1983 Good Faith Agreement; (b) to identify alternatives for Basin reservoir operations, to optimize the system of usage of waters of the Basin for water supply management under routine and drought conditions and for flood mitigation, fisheries management, and overall ecological protection of the River system, while maintaining Decree Party, while maintaining Decree Party equity established by the Decree; and (c) to establish recommendations for improved water management planning in the Basin.

Program/Project	Products/Outputs	Year	Funding Sources
ACOE Multi-jurisdictional Study	Water Supply Deficiency Assessments Identification of Region Scale Projects	2008	ACoE: General Expense
State Water Supply Plans	Water Conservation Options Identification of Critical Areas Identification of Interconnection Options	2008 - 2010	States
Reassessment Study	Analysis and Reports to support Decree Party decision-making	2011	Decree Parties

4.3 INTERGOVERNMENTAL COORDINATION

Federal and State Intergovernmental Coordination. 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. The Commission serves as an appropriate forum and catalyst for much of that coordination to occur.

DRBC Water Resources Program 2008 - 2013

The coordinating effort begins at the planning stage, where DRBC is involved with several federal agencies, including the EPA, USGS, National Park Service and the Army Corps of Engineers in the review, modification, and coordination of the agencies' respective strategic plans. An initial Federal forum was held in 2007 to discuss common goals among the federal agencies operating in the Basin. A second forum was held on May 15, 2008 to focus on coordinating approaches and activities relating to monitoring, flood control and water supply.

Coordination with state agencies is achieved through a variety of methods. One, the Memoranda of Agreement/Understanding between the DRBC and the states, is critical for coordinating the review and approval of water resource projects in the Basin. The current agreements are dated and are currently under review and analysis. The shared goal is to amend the agreements to:

- effectuate intergovernmental cooperation;
- minimize the duplication of state and Commission staff review to the extent possible;
- ensure the compliance with approved Basin-wide requirements;
- continue and enhance the early notification of the public and other concerned interests of proposed projects in the Basin; and
- clarify the relationship and process of the state and Commission review of projects subject to review by the Commission under section 3.8 of the *Compact*.

Commission and state staff have reviewed the relative and related statutory and regulatory authorities of the Commission and the state agencies, the review procedures being practiced by the Commission and the state agencies concerning projects subject to review by the Commission under section 3.8 of the Compact, and the coordination practices between the state agencies and the Commission in the review of these projects. These evaluations have been coordinated with the Water Quality and Water Management Advisory Committees. By January 2009, a draft generic revised agreement will be developed for review and by December 2009, revised agreements will be negotiated with each of the four states. Commission staff will continue to coordinate and seek the advice of the DRBC advisory committees (see Advisory Committees, below).

Program/Project	Products/Outputs	Year	Funding Sources
Revise/Update DRBC/state Project Coordination Agreements	Draft Generic revised DRBC/state Agreements	December 2008	General Fund
Revise/Update DRBC/state Project Coordination Agreements	4 Revised DRBC/state Project Coordination Agreements	July 2009	General Fund

Intrabasin Coordination. Much staff time is devoted to participating in partnership efforts for the estuary, for watershed initiatives, for National Park resource management, and for issues of regional and national importance. These efforts are often focused on linking the fiscal and administrative capacities of multiple partners on very specific environmental protection and improvement outcomes. Examples include the Upper Delaware Council, the Delaware Estuary Program, the Christina Clean Water Partnership, the Schuylkill Action Network, the Delaware Greenway Partnership, Delaware Bay National Water Quality Pilot Program, and the Mid-Atlantic Regional Ocean Observation System.

Program/Project	Products/Outputs	Year	Funding Sources
Upper Delaware Council	Ex-Officio Member; 6 meetings per year	Ongoing	General Fund
Delaware Estuary Program	Participate in multiple committees (Steering, EIC, STAC)	Ongoing	General Fund

DRBC Water Resources Program 2008 - 2013

Oyster Restoration Task Force	Plant 500,000 bushels of shell per year to enhance recruitment and habitat	Ongoing	General Fund
Christina Clean Water Partnership	See details in Sec. 3 Watershed Management		EPA TWIG
Schuylkill Action Network	Participation in Steering (bi-annual), Planning Committee (monthly) and workgroups (as necessary)	Ongoing	General Fund
Delaware Greenway Partnership	Coordination with Lower Delaware Management Committee and SPW	Ongoing	General Fund
Delaware Bay, National Pilot	Gap analysis report	2008	General Fund
MACOORA – Mid-Atlantic Coastal and Ocean Observing Regional Association	Board Member; local coastal inundation forecast; current maps for improved search and rescue; 3-D temperatures for fisheries issues; circulation data for beaches and low DO as components of an Integrated Coastal Observing System	2009 and 2010	General Fund

Interbasin/National Coordination. 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. DRBC remains a partner in the Association of State & Interstate Water Pollution Control Administrators (ASIWPCA) and in the Interstate Council of Water Policy (ICWP). As water resource management faces the growing challenges associated with a changing climate, a challenging fiscal future and infrastructure needs and shifting political environments, involvement with these partners will be of increasing benefit to DRBC. DRBC will continue to strengthen coordination with its sister agencies (SRBC, etc.) through collaboration and communication on projects, policies, funding and issues of common interest

Internal Advisory Committees. Six major advisory committees presently aid the Commission in policy and standards development. Committees for flow, flood, toxics, monitoring, water quality and water management meet quarterly, monthly or as needed. 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.

Changes in water resource management foci may require the reconsideration of existing committee structure or the establishment of additional committees or subcommittees. For example, the need for assessing instream ecosystem flow needs resulted in the establishment of the Subcommittee on Ecological Flows (SEF). In addition to narrative and activity tables for each issue section, Supplemental Table A is an overview of prospective program rule changes that may involve Advisory Committee input. Supplemental Table C is a schedule of prospective changes to water quality standards and actions relevant to the toxics and water quality committees.

DRBC Water Resources Program 2008 - 2013

Section

- 5.0 **EDUCATION & OUTREACH for STEWARDSHIP**
- 5.1 Reporting
- 5.2 Public Information
- 5.3 Technical Outreach
- 5.4 Promoting Stewardship

5.1 REPORTING

Many DRBC projects have individual reporting elements. These are included as products and outputs for the fiscal year of their scheduled delivery. See, for example, the Water Supply Study and DelTrip Annual Progress Report. 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 environmental goals and indicators report every five years. The first report will be published in calendar year 2008 and coordinated with the Partnership for the Delaware Estuary's *State of the Estuary* report. A second condition report will be compiled for publication in 2013.

Estuary Monitoring Report. A report on Delaware Estuary water quality and living resources is prepared every five years; the next report is due in 2009.

Integrated List. DRBC biennially reports on the conditions of main stem river water quality relative to criteria in accordance with EPA guidelines for 305 (b) reporting.

Annual Hydrologic Report. A summary of hydrologic conditions in the basin including precipitation, stream flow, reservoir storage, ground water level and the location of 180 mg/l at river mile 95.

DRBC Annual Report. Required by the Compact, this report reviews programs, activities, products and milestones achieved during a calendar year.

Water Resources Program & Annual Work Plan. Based upon the mandate of the Compact and the goals of the Basin Plan, this strategic plan notes the direction of policy, the scope of DRBC programs, and the expected milestones to be achieved for a six fiscal year time horizon. The annual work plan for each year, extracted from the WRP, explains in greater detail planned activities and allotment of resources necessary for those tasks. The Ten Elements Plan, a strategic monitoring program will be reviewed each year for consistency and support of the Water Resources Program and implementation through the Annual Work Plan.

5.2 PUBLIC INFORMATION

DRBC staff responds in a timely manner to media and public inquiries and requests. 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 Internet is now a major communications tool and the DRBC maintains an expanding web site with an emphasis on providing information that is accurate, up-to-date, and presented in a user-friendly manner. The DRBC web site makes extensive use of links to other external government and other sites where additional information is available. The importance of the DRBC web site as an information tool the public turns to in increasing numbers, especially during times of flooding and drought, is reflected in the number of visits to the home page, which totaled a monthly record of over 16,000 during June 2006 when major flooding occurred along the Delaware River. A future project for consideration is making the on-line Basin Plan more interactive by including links to additional information on topics throughout the document.

DRBC Water Resources Program 2008 - 2013

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 also hosts workshops on timely issues, such as implementation of pollutant minimization plans (PMPs) for PCBs and Special Protection Water regulations, to assist the regulated community to better understand commission programs and requirements. The DRBC web site also is used to supplement this information exchange.

5.4 PROMOTING STEWARDSHIP

Commission staff participates in events throughout the basin to raise public awareness about water resource issues affecting the watershed and the need for stewardship. This includes participation at large-scale community environmental fairs attended by thousands of visitors as well as much smaller events. DRBC places a priority on reaching out to educators and students, as evidenced by staff participation in school events, teacher training workshops, Water Snapshot (a commission-led program), and continued development of *Ed. Web* on the commission's web site. DRBC continues to support the Delaware River Sojourn by participating on the steering committee and maintaining the sojourn web site.

Program/Project	Products/Outputs	Year	Funding Sources
State of Basin Report	Report & electronic database	2008, 2013	General Fund
Monitoring Report	Data collection & assembly	2009	EPA Section 106 Grant
Integrated List Narrative Report	Prepare assessment for states, coord.; layman's report	2008, 2010, 2012	EPA Section 106 Grant
Annual Hydrologic Report, Event Summaries	Report – post on web; limited paper copies	2008, 2009, 2010, 2011, 2012, 2013	General Fund
DRBC Annual Report	Report – post on web; limited paper copies	2008, 2009, 2010, 2011, 2012, 2013	General Fund
Provide timely information to the public	Clear, consistent message on water resources issues & DRBC activities; produce various handouts	2008, 2009, 2010, 2011, 2012, 2013	General Fund
Media/external relations	Clear, consistent message on water resources issues & DRBC activities; timely responses	2008, 2009, 2010, 2011, 2012, 2013	General Fund
Web Site	Redesigned web site	2009	General Fund
	New features, improvements, ongoing maintenance	2008, 2009, 2010, 2011, 2012, 2013	General Fund
Host Foreign Delegation Visits	Information exchange	2008, 2009, 2010, 2011, 2012, 2013	General Fund
Conference Attendance & Presentations	Information exchange	2008, 2009, 2010, 2011, 2012, 2013	General Fund

DRBC Water Resources Program 2008 - 2013

Workshops	SPW workshops	2009	General Fund
	PCB PMP workshops	2009	General Fund
	PDE science conference	2009	General Fund
	Flood mitigation workshop for emergency management officials	2009(subsequent years, funding permitted)	General Fund
Community Events	Delaware River Sojourn (DRBC hosts web site), Bay Day, Coast Days, RiverFest, Shad Festival, HydroMania, EarthFest, educator training, misc.	2008, 2009, 2010, 2011, 2012, 2013	General Fund
Event Follow-up	Information on web site	2008, 2009, 2010, 2011, 2012, 2013	General Fund

SUPPLEMENTAL MATERIALS

**Table A: SCHEDULE OF PROSPECTIVE CHANGES TO DRBC PROGRAMS
AND REGULATIONS**

Table B: SCHEDULE OF MODELING PROJECTS FY 2008 – 2013

Table C: SCHEDULE OF PROSPECTIVE CHANGES TO WATER QUALITY STANDARDS

SUPPLEMENTAL TABLE A: SUMMARY OF PROSPECTIVE CHANGES TO DRBC PROGRAMS AND REGULATIONS

Management Topic	Program/Project	Products/Outputs	FY 2008	FY 2009	FY 2010 - 2011	FY 2012 - 2013	
Water Supply	Water Conservation	Changes to WC Article 2: Conservation (§ 2.1.6) and Metering (§2.5)	WMAC Recs., & Public review	Rule Change Adoption			
Flow Management	Drought Operations	Changes to WC Article 2: Diversion Schedule (§ 2.5.3 et seq.) to support FFMP	FFMP adoption		Rule Adoption		
Water Quality	SPW- Lower	Designation of Lower Delaware	Designation	Guidance Manual			
	WQ Criteria	Revised PCB Criteria	Proposal		Rule Adoption		
		Ammonia criteria	Proposal				
		Nutrients	Prepare Strategy & Background documents	Proposal			
		Biocriteria			Establish Reference Condition	Guidance Manual	
		pH (Zone 1)					
		DO (Zone 5)					
	Temperature						
	Toxics	Criteria extension to Zones 1 & 6	Policy Options	TAC review			
Basin-wide Standards	Policy determination	Policy Options	WQAC review				
Flood Mitigation	Flood Plain Regulations	Changes to WC Article 2: Flood Damage Reduction (§ 2.100) AM Art. 6: FP Regulations		Develop & Review Policy Options, FAC review	Proposals & FAC Review	Rule Adoption	
Enforcement & Penalties	All Relevant Programs	Revisions to Rules of Practice & Procedure; Amendments to WQ Regulations		Rule Change Adoption			
Administrative Updates	Water Code	Structural Changes	Draft	Final			
	Water Supply Charges	Changes to AM Art. 5					
Key: WC – Water Code AM – Administrative Manual							

DRAFT
DRBC Water Resource Program FY 2008 - 2013

SUPPLEMENTAL TABLE B: SUMMARY OF MODELING PROJECTS

Program/Project	Products/Outputs	Fiscal Year	Funding Sources
Supply Management	OASIS inflow file update – extend inflow file with historical data from October 2000 to September 2006, to support coordinated drought analyses with Flood Analysis Model	2009	WSF
Reservoir Operations	DSS model Improvements – support evaluation of impacts of reservoir operations on habitats	2009	ACoE Sec. 22
Decision Support System (DSS)	Model setup at DRBC	2009	GF
Flow Management – FFMP Support	Flood Analysis Model - to assess impacts of reservoir operations on flooding	2009	State Contributions Federal Agency In-Kind
Flow management – reservoir operations	OASIS – support evaluation of alternative reservoir operations for DRBC and Decree Parties	ongoing	GF
Flow management – chloride intrusion	OASIS (linked to 1-D estuary chloride model) to support evaluation of chloride intrusion during low flows	as needed	GF
Emergency Response	Real time one-dimensional flow and transport model	Yearly (as needed)	GF
SPW - Lower Delaware Model	Report on initial model setup and calibration. Permit review tool.	2009	Section 106 and GF
SPW -Tri-State Model	Model calibration report	2010	Section 106 and GF
Schuylkill IWRP	Schuylkill Models for IWRP	2010	PADEP
Lehigh	Lehigh WQ Model. Permit review tool.	TBD*	None identified
PCB Stage 2 TMDL Modeling	Revised TMDLs for Zones 2 – 6 and supporting documentation.	2010	GF and Section 104(b)
Eutrophication Model for Delaware Estuary	3-dimensional Hydrodynamic Model	2011	None identified
	Report on model calibration/validation for nutrient strategy	post 2013	None identified
	Upgrade model for BOD reallocation and NBOD Allocation.	post 2013	Project Review Fees/GF
CORMIX mixing zone models	Project Review and NPDES permit support	Yearly	Project Review Fees

*Coordination with the COE needed.

SUPPLEMENTAL TABLE C: SCHEDULE OF PROSPECTIVE CHANGES TO WATER QUALITY STANDARDS CY 2008-2010

REGULATION AREA	CRITERIA	ACTION	PARTICIPANTS	FFY 2008				FFY 2009				FFY 2010				FFY 2011	
				1st Q CY 2008	2nd Q CY 2008	3rd Q CY 2008	4th Q CY 2008	1st Q CY 2009	2nd Q CY 2009	3rd Q CY 2009	4th Q CY 2009	1st Q CY 2010	2nd Q CY 2010	3rd Q CY 2010	4th Q CY 2010	Beyond CY 2010	
Special Protection Waters		Propose Lower Delaware SPW regs for adoption	DRBC	→	Completed												
Nutrient Strategy	Nutrients	Develop and Coordinate Nutrient Strategy	DRBC, WQAC, MAC	→	Completed												
		Nutrient Monitoring & Modeling	DRBC														
		Advisory Committee recommends nutrient criteria for adoption	DRBC														
Flexible Flow Management Plan		Develop FFMP	Decree Parties	Completed													
		Propose FFMP for adoption	DRBC	→													
Criteria review and revision	PCBs	Revised PCB Criteria	DRBC, TAC, Toxics Criteria Subcommittee	Completed													
		Develop Water Quality Standards Implementation Plan	DRBC, EPA	→													
		Propose WQSIP for Adoption	DRBC			→											
	Toxics	Revise Human Health and Aquatic Life Toxics Criteria	DRBC, TAC					→									
		Advisory Committee recommends revised toxics criteria for adoption	DRBC										→				
	pH	Revise pH Criteria	DRBC, WQAC					→									
		Advisory Committee recommends revised pH criteria for adoption	DRBC										→				
	Temperature	Revise Temperature Criteria	DRBC, WQAC					→									
		Advisory Committee recommends revised temperature criteria for adoption	DRBC										→				
	Ammonia	Revise Ammonia Criteria	DRBC, WQAC					→									
		Advisory Committee recommends revised ammonia criteria for adoption	DRBC										→				
	Bacteria	Develop Bacterial Criteria	DRBC, WQAC										→				
		Advisory Committee recommends revised bacterial criteria for adoption	DRBC											→			
	DO	Revise DO Criteria	DRBC, WQAC										→				
		Advisory Committee recommends revised DO Criteria for adoption	DRBC											→			
	Biocriteria	Develop Biocriteria	DRBC, WQAC, Bio Subcommittee														→
		Advisory Committee recommends biocriteria for adoption	DRBC														
			General Review of Water Quality Standards	DRBC, WQAC													
			Prioritization for revision of other water quality standards	DRBC													
	Water Quality Standards Architecture		Develop a reformatted DRBC WQS document	DRBC, WQAC													
		Propose reformatted standards document for adoption	DRBC														
Water Quality Policy Decisions		Basin-wide Standards	DRBC														
		Stacked Tributaries	DRBC														
		Extension of Toxics Criteria to Zones 1 & 6	DRBC														
	Note:	The "Advisory Committee recommends revised criteria" action includes basis & background and time for public participation.															