State of New Jersey
Department of Environmental Protection

NEW JERSEY WATER SUPPLY PLAN 2017–2022

APPENDIX E

REGIONAL WATER SUPPLY RESOURCE ASSESSMENTS

INTRODUCTION

In chapter 7 of the New Jersey Water Supply Plan Draft 2017 – 2022 policy item #7 states "[s]upport detailed regional hydrologic assessments to assess the status and sustainability of the resource and identify feasible water supply alternatives that protect New Jersey's natural resources." Additionally, the 1996 NJSWSP and the subsequent Action Plan of 2003-04 identified the need for conducting additional regional water supply assessments. NJDEP has made substantial progress advancing some of the highest priority assessments, as listed below, over the past decade. This appendix provides a detailed summary of these ongoing assessments as well as related published findings and reports (see below under References/Resources).

- Areas of Critical Water Supply Concern (Critical Area) No's 1 and 2
- Sustainable Water Supply for Cape May County
- Northeast Study – The Development of Safe Yield Model Input Streamflows for Surface Water Reservoir Systems in the Passaic and Hackensack River Basins at Stream Gaging Stations and Ungaged Sites, Water Years 1922-2007, Phase 2
- Mullica-Great Egg Harbor Groundwater Model
- Lower-Maurice and Cohansey River Basins, Cumberland County

CRITICAL AREA 1

Water levels in four confined aquifers in the New Jersey Coastal Plain within Water Supply Critical Area, the Wenonah-Mount Laurel (MLW), the Upper and Middle Potomac-Raritan-Magothy (PRM), and Englishtown aquifer system, have recovered as a result of reductions in groundwater withdrawals initiated by the State in the late 1980s. Due to increased water demands resulting from increased development in Monmouth, Ocean, and Middlesex Counties, five base and nine alternate management models were designed for these aquifers to evaluate the effects of a potential reallocation of part of the Critical Area 1 withdrawal reductions. The change in withdrawals and associated aquifer water level changes for 1988-2003 were evaluated. Generally, withdrawals decreased 25 to 30 MGD, and water levels increased 0 to 80 ft.

The Regional Aquifer-System Analysis (RASA) groundwater flow model of the New Jersey Coastal Plain developed by the USGS was used to simulate groundwater flow and optimize withdrawals using the Groundwater Management Process (GWM) for the MODFLOW model. Results of the model were used to evaluate the effects of several possible water supply management options in order to provide the information to water managers.

Based on the model assessment of existing (1999) and full allocation diversion rates, no additional water is being made available from the existing wells in the Upper and Middle PRM, Englishtown and MLW aquifers. If wells were to be located in ideal locations, a very small amount (less than 1 MGD) of additional water may be available, but not enough to make a difference. Based on the study, the Department does not intend to make changes to critical area 1 aquifer allocated amounts at this time (to increase or implement further reductions). However, the NJDEP continues to evaluate opportunities to meet some local water supply needs using CA-1 water in those aquifers where such, limited withdrawals would not have significant resource impacts or be inconsistent with the intent of the CA-1 protection objectives. These determinations will be made on a case-by-case basis. For additional information on the study results, please refer to Spitz, Watt, and dePaul (2008) and Spitz (2009).

CRITICAL AREA 2

Based upon the low groundwater levels measured in 1983 by the USGS, the NJDEP determined that three aquifers, the Upper, Middle and Lower Potomac-Raritan-Magothy, were so depleted in southern New Jersey that designation of an area of critical water supply concern was warranted. Continued decline of water levels in these confined aquifers posed a threat of serious adverse effects to the water supply in some areas, including the depletion of groundwater supplies, saltwater intrusion, and reduction of groundwater flow to streams. Therefore in January 1993, by administrative order, the NJDEP designated Water Supply Critical Area 2 located in Burlington, Camden, Gloucester, and Atlantic; and small portions of Ocean, Salem, and Cumberland Counties.

The designation of Critical Area 2 required reductions in the withdrawals from the PRM aquifer system within the delineated area. Reductions were implemented starting in 1993. Within the depleted zone, groundwater withdrawals for public supply were reduced by an average of 22 percent in the Upper, Middle, and Lower Potomac-Raritan-Magothy aquifers. Within the threatened margin, withdrawals were limited to the maximum annual rate between 1983 and 1991. New water supply allocations (with the exception of temporary construction dewatering and groundwater remediation activities) were prohibited pursuant to the Water Supply Management Act. Specific alternative water supply measures initiated in Critical Area 2 included the Tri-County pipeline and Water Allocation Credit Receiving Area.

The USGS, in cooperation with the NJDEP, used an existing Regional Aquifer-System Analysis (RASA) flow model of the New Jersey Coastal Plain to analyze the groundwater flow system and provide information needed by water managers to make allocation decisions regarding the water supply. Model runs evaluated the hydrologic effects of 2003 reported withdrawal data as well as the effects that would have resulted had withdrawals reached full allocation (also known as base allocation; a purveyor's portion of the safe or dependable yield of the water resource). While not at the same magnitude of the Critical Area 1 water level rebound, data for Critical Area 2 showed significant improvement over pre-designation levels. For example, two monitoring locations in Burlington and Camden counties show recoveries in water levels in the unconsolidated and middle portions of the PRM aquifer to approximately 50% of pre-1970 levels. Based on the study results, the NJDEP does not intend to make changes to PRM allocated amounts at this time (to increase or implement further reductions). For additional information, please refer to Spitz and DePaul (2008)

SUSTAINABLE WATER SUPPLY FOR CAPE MAY COUNTY

The New Jersey Legislature enacted P.L. 2001 c. 165 pertaining to the water supply of the Pinelands and Cape May County. The focus of the legislation for Cape May County was to assess the status of the water supply and develop strategies for providing a sustainable supply to meet current and future demand scenarios that minimize adverse impact to natural systems. Groundwater is the primary source of water in Cape May County. Increasing demands for water in the county for public supply and agricultural irrigation has placed significant stress on the aquifer systems (saltwater intrusion) and water-dependent ecological resources. The USGS, in coordination with the NJDEP, embarked on an analysis of the county's water supply, that included, the status of aquifers, future needs, and potential strategies for meeting demands. The USGS has identified several potential strategies that provide a sustainable supply to meet the county's anticipated needs. Scenarios under consideration include either singly or in combination, locating a series of centrally located "spine" wells, conjunctive use of well systems, injection of treated wastewater to help hinder saltwater intrusion expansion of existing desalination facility in Cape May City, construction of additional desalinization facility(ies), and more efficient use of existing diversion sources and resources. The final report is in Lacombe and others (2009).

NORTHEAST STUDY – The Development of Safe Yield Model Input Streamflows for Surface Water Reservoir Systems in the Passaic and Hackensack River Basins at Stream Gaging Stations and Un-gaged Sites, Water Years 1922-2010

As the population has increased, stresses on the State's water resources also have increased. The population increase and the associated land use changes have resulted in increased withdrawals of both surface and groundwater to meet water supply demands. These changes have also increased the amount of wastewater discharged from treatment facilities, and have increased the amount of impervious surface area and resulting stormwater flows. These anthropogenic effects have modified streamflow in many streams throughout the State and may impact the safe yield of the reservoir systems in the Passaic and Hackensack River Basins that provide more than 50% of the water supply for the northeastern area of New Jersey.

One of the basic requirements for analyzing the reliability of a surface water supply system is to determine the safe yield of the system for the drought-of-record. The NJDEP is developing a safe yield model with the RiverWare Hydrologic Modeling Software which is supported and maintained by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at the University of Colorado. RiverWare is a deterministic accounting model that adds and subtracts flows with operational conditions designated for reservoir and pump storage facilities. The model would be used to simulate streamflow and determine reservoir safe yields under present day conditions. For most surface water supply systems in New Jersey, the 1960's drought has been considered the drought-of-record but may not be the drought-of-record for all surface water systems in the Passaic and Hackensack River Basins. The period of record to be simulated will be from water year 1922 through water year 2010 in order to determine which drought years are the droughts of record for the various water supply systems in the Northeast.

The RiverWare Model will eventually help estimate the safe yields of the following surface water reservoir systems: Wanaque Water System of the North Jersey District Water Supply Commission, which is also partially owned by Suez New Jersey; Hackensack River 4- Reservoir System which is operated by Suez New Jersey and Suez New York; Passaic Valley Water Commission Passaic River and Point View Reservoir System; City of Newark Pequannock River Reservoir System; Jersey City Boonton Reservoir and Splitrock Reservoir System which is operated by Suez New Jersey; New Jersey American Water Company Canoe Brook and Cedar Ridge Reservoir System and the Borough of Butler Reservoir System. The RiverWare Model will focus on simulating the flow and storage of water at key locations that characterize these surface water reservoir systems.

A key input to the model is reconstructed or natural flows at specified model control points for the period being modeled. The purpose of reconstructing flows is to remove past human impacts on streamflow and develop flows that reflect the streamflow absent human influences, to the extent possible. The reconstructed streamflows are sometimes referred to as natural streamflow but in most cases, all human impacts cannot be accounted for and the reconstructed flow is only an estimate of natural flows. With present day water demands and reservoir operations used as another input into the model, the impact of past droughts on water supply systems can be simulated under present day conditions to establish system safe yields.

The model can also be used to simulate current operations and identify opportunities to coordinate operations which have the potential to increase net availability for all the systems in the basins. This type of analysis can also be used to optimize pumping and transfers and reduce costs and better manage risks.

The NJDEP contracted with the USGS to perform the stream reconstruction analysis for the Passaic and Hackensack River Basins for water years 1922 - 2010 and to document a methodology for this process. The USGS had delivered the reconstructed flows and is working on the methodology report.

MULLICA-GREAT EGG HARBOR GROUNDWATER MODEL

Under contract with the USGS, this project developed a model to assess the interaction between surficial and confined aquifers in the Atlantic County Region. The model has enabled the NJDEP to evaluate impacts associated with diversions from affected aquifers and provides a tool to help maximize water supply within the resource constraints of the region. For example, the tool helped the NJDEP evaluate the potential for conjunctive use of aquifers to take advantage of seasonal water availability. The project was completed in with a publication by Pope and others (2012).

LOWER-MAURICE AND COHANSEY RIVER BASINS, CUMBERLAND COUNTY

The Lower-Maurice and Cohansey River basins are areas in southern New Jersey where the water supply demand and interest in maintaining aquatic ecosystems may result in insufficient water availability, especially during dry periods. These basins are primarily in Cumberland County and include the municipalities of Vineland, Bridgeton, and Millville. The major source of groundwater in the lower Maurice and Cohansey River basins area is the unconfined Kirkwood-Cohansey aquifer system. The confined Piney Point aquifer is also present, but its usage is substantially less than the Kirkwood-Cohansey in this area. Other Coastal Plain aquifers contain salt water, locally have insufficient permeability to sustain significant yields, or do not exist in the area.

The unconfined groundwater system generally supplies from 60 to 80 percent of the stream baseflow each year. A groundwater flow model of the Lower Maurice and Cohansey River Basins is needed in order to adequately simulate the effects of withdrawals from Kirkwood-Cohansey aquifer system on streamflow. The research was completed by the publication of Cauller and Carlton (2006) and is now being used by the NJDEP used to identify various water supply strategies for the region.

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NORTHEAST STUDY

Currently underway.

MULLICA-GREAT EGG HARBOR

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