5.4 DROUGHT

SECTION 5.4 DROUGHT

5.4.1 HAZARD DESCRIPTION

Drought is a temporary irregularity and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate. Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

There are four different ways that drought can be defined or grouped:

- Meteorological drought is a measure of departure of precipitation from normal. It is defined solely on the relative degree of dryness. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, reduced ground water or reservoir levels, and other parameters. It occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought is defined in terms of soil moisture deficiencies relative to water demands of plant life, primarily crops.
- Hydrological drought is associated with the effects of periods of precipitation shortfalls (including snowfall) on surface or subsurface water supply. It occurs when these water supplies are below normal. It is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
- Socioeconomic drought is associated with the supply and demand of an economic good with elements of meteorological, hydrological, and agricultural drought. This differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods depends on weather (for example water, forage, food grains, fish, and hydroelectric power). Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply (National Drought Mitigation Center, 2012).

Drought can produce a range of impacts that span many sectors of an economy and can reach beyond an area experiencing physical drought. This exists because water is integral to our ability to produce goods and provide services. Direct impacts of drought include reduced crop yield, increased fire hazard, reduced water levels, and damage to wildlife and fish habitat. The consequences of these impacts illustrate indirect impacts that include: reduction in crop, rangeland, and forest productivity that may result in reduced income for farmers and agribusiness, increased prices for food and timber, unemployment, reduced tax revenues due to reduced expenditures, increased crime, foreclosures, migration, and disaster relief programs. The many impacts of drought can be listed as economic, environmental, or social.

Economic impacts occur in agriculture and related sectors because of the reliance of these sectors on surface and subsurface water supplies. Environmental impacts are the result of damage to plant and animal species, wildlife habitat, and air and water quality, forest and grass fires, degradation of landscape quality, loss of biodiversity, and soil erosion. Social impacts involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief. A summary of potential impacts associated with drought are identified in Table 5.4-1. This table includes only some of the potential impacts of drought.

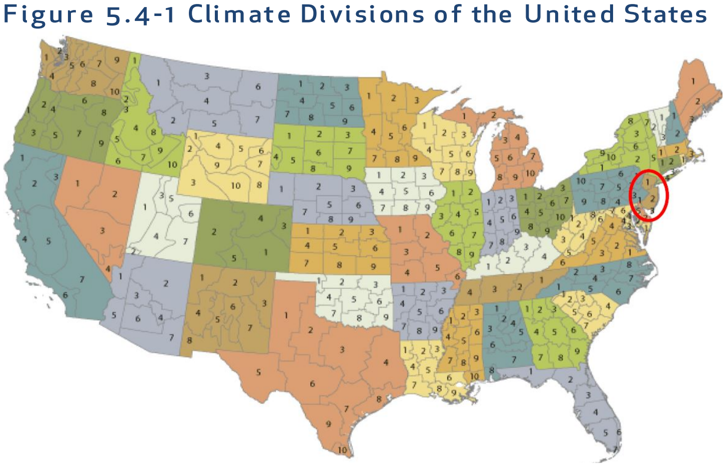
Table 5.4-1 Economic, Environmental, and Social Impacts of Drought

Economic	Environmental	Social
Loss of national economic growth, slowing down of economic development	Increased desertification - damage to animal species	Food shortages
Loss of national economic growth, slowing down of economic development	Reduction and degradation of fish and wildlife habitat	Loss of human life from food shortages, heat, suicides, violence
Damage to crop quality, less food production	Lack of feed and drinking water	Mental and physical stress
Increase in food prices	Disease	Water user conflicts
Increased importation of food (higher costs)	Increased vulnerability to predation	Political conflicts
Insect infestation	Loss of wildlife in some areas and too many in others	Social unrest
Plant disease	Increased stress to endangered species	Public dissatisfaction with government regarding drought response
Loss from dairy and livestock production	Damage to plant species, loss of biodiversity	Inequity in the distribution of drought relief
· Unavailability of water and feed for livestock which leads to high livestock mortality rates	Increased number and severity of fires	Loss of cultural sites
Disruption of reproduction cycles (breeding delays or unfilled pregnancies)	Wind and water erosion of soils	Reduced quality of life which leads to changes in lifestyle
Increased predation	Loss of wetlands	Increased poverty
Increased fire hazard - range fires and wildland fires	Increased groundwater depletion	Population migrations
Damage to fish habitat, loss from fishery production	Water quality effects	
Income loss for farmers and others affected	Increased number and severity of fires	
Unemployment from production declines	Air quality effects	
Loss to recreational and tourism industry		
Loss of hydroelectric power		
Loss of navigability of rivers and canals		

5.4.2 LOCATION

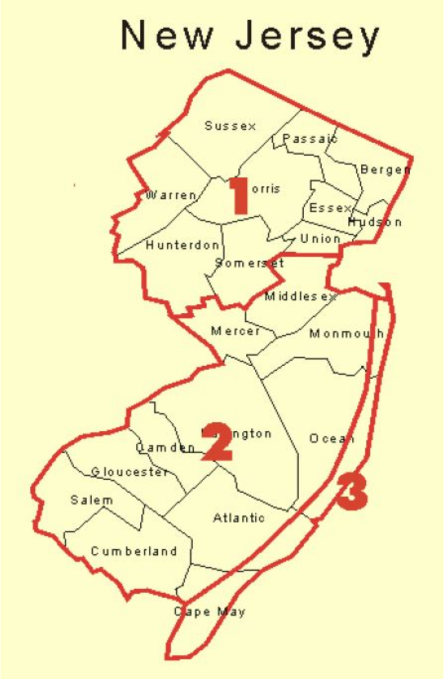
Climate divisions are regions within a state that are climatically homogenous. The National Oceanic and boundaries of these divisions typically coincide with the county boundaries, except in the western United States, where they are based largely on drainage basins. According to NOAA, New Jersey is made up of three climate divisions: Northern, Southern, and Coastal (NOAA, 2012). Figure 5.4-1 shows the climate divisions throughout the United States and Figure 5.4-2 shows the climate divisions of New Jersey.

Figure 5.4-1 Climate Divisions of the United States



Source: NOAA, 2012

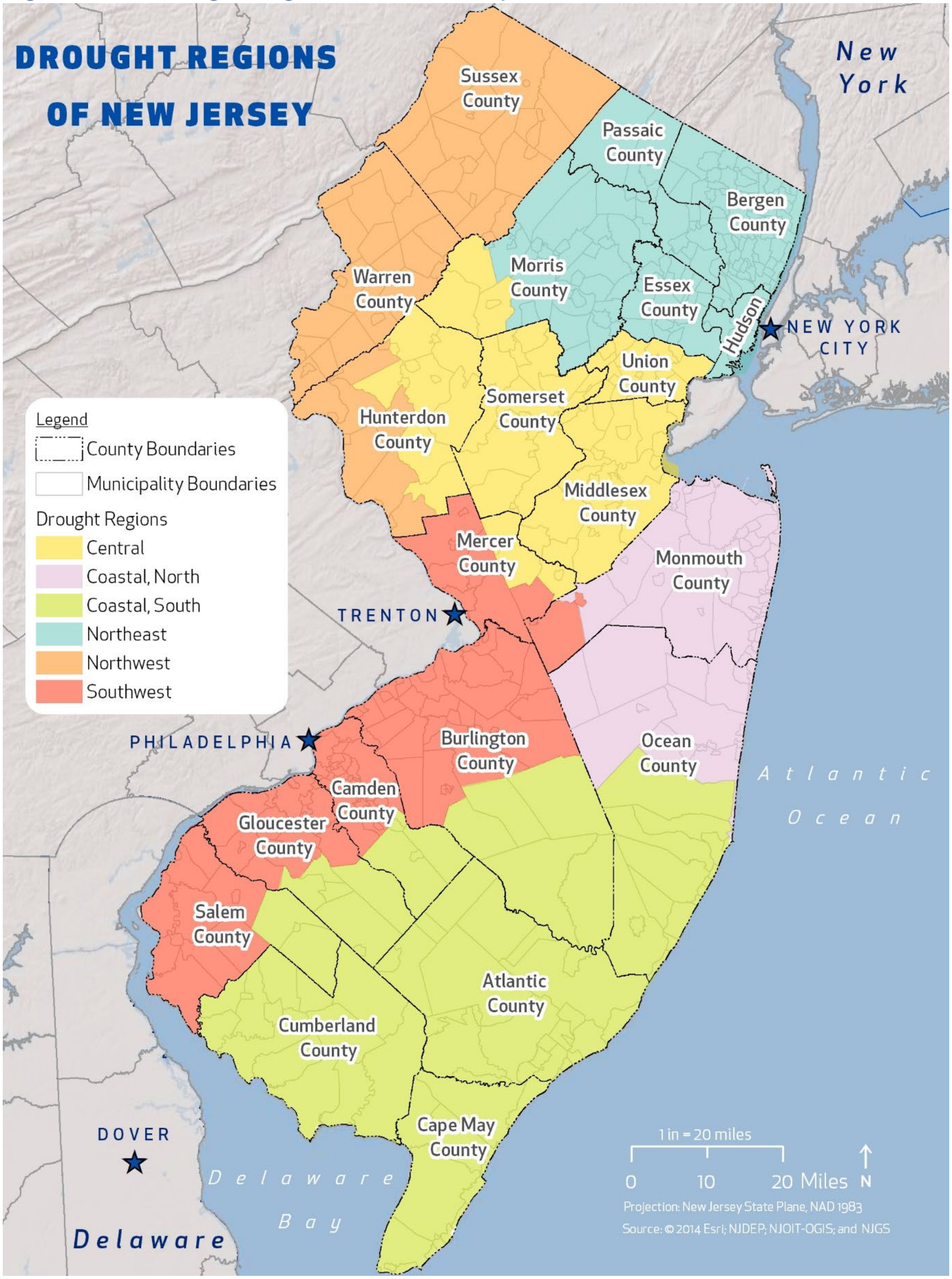
Figure 5.4-2 Climate Divisions of New Jersey



Source: National Weather Service (NWS) Climate Prediction Center (CPC), 2005

Drought regions allow New Jersey to respond to changing conditions without imposing restrictions on areas not experiencing water supply shortages. New Jersey is divided into six drought regions that are based on regional similarities in water supply sources and rainfall patterns (Hoffman and Domber, 2003). These regions were developed based upon hydro-geologic conditions, watershed boundaries, municipal boundaries, and water supply characteristics. Drought region boundaries are contiguous with municipal boundaries because during a water emergency, the primary enforcement mechanism for restrictions is municipal police forces.

Figure 5.4-3 Drought Regions of New Jersey



Source: New jersey Department of Environmental Protection (NJDEP) GWS, 2004

5.4.3 EXTENT

The extent (i.e., magnitude or severity) of drought can depend on the duration, intensity, geographic extent, and the regional water supply demands made by human activities and vegetation. The intensity of the impact from drought could be minor to total damage in a localized area or regional damage affecting human health and the economy. Generally, impacts of drought evolve gradually, and regions of maximum intensity change with time. The severity of a drought is determined by areal extent as well as intensity and duration. The frequency of a drought is determined by analyzing the intensity for a given duration, which allows determination of the probability or percent chance of a more severe event occurring in a given mean return period.

Drought Indices

A number of drought indices are available from United States Geological Survey (USGS) and the New Jersey Department of Environmental Protection (NJDEP) to assess the various impacts of dry conditions. However, the USGS indicators are not used by NJDEP to a significant extent. The State uses a multi-index system that takes advantage of some of these indices to determine the severity of a drought or extended period of dry conditions.

New Jersey Drought Indices

During the New Jersey droughts that occurred during 1998 and 1999, the NJDEP had difficulty comparing the severity of drought throughout the state. To improve monitoring and measurement of drought severity from region to region, NJDEP devised a unique set of indices specifically designed for the particular characteristics and needs of the State. These were implemented in January 2001. This new set of statewide indicators supplements the Palmer Drought Severity Index (PDSI) with the measurement of regional precipitation, stream-flow, reservoir levels, and groundwater levels. New Jersey currently measures the status of each indicator as near or above normal, moderately dry, severely dry, or extremely dry. The status is based on a statistical analysis of historical values with generally the driest 10% being classified as extremely dry, from 10% to 30% as severely dry, and 30% to 50% as moderately dry.

When there is less precipitation than normal, New Jersey experiences drought. However, a few dry days or even a month of dry weather does not create a water supply drought. It can take months of less than average rainfall to do this. The difference between the actual amount of precipitation measured during a month and the historical average for that month is either a negative or positive number, indicating a deficit or surplus. The monthly surplus or deficit can vary significantly from month-to-month and is not a good indicator of a water supply drought. A better method to use is a running 3-month total. This number is the surplus or deficit in a given month added to the values of the two previous months. To use the indicator on a daily basis, precipitation during the previous 90-day period is compared to the average in past years. This data comes from ONJSC and the NWS's Middle Atlantic River Forecast Center (Hoffman and Domber, 2003). Precipitation data is collected from NWS Cooperative Observing Program (COOP) Stations. COOP is a weather and climate observing network that is made up of more than 11,000 volunteers that take observations. Data collected support the NWS climate program and field observations. A COOP station is a site where observations are taken. Observers typically record temperature and precipitation daily and send those reports electronically to the NWS and NCDC (NWS, 2013). Approximately 30 of the stations are augmented by observations from Rutgers's New Jersey Weather and Climate Network and New Jersey Community Collaborative Rain, Hail, and Snow Network (Robinson, 2013).

The Groundwater Level Index is based on the number of consecutive months that groundwater levels are below normal (lowest 25% of period of record for the respective months). The United States Geological Survey (USGS) monitors groundwater levels in a network of monitoring wells throughout New

Jersey. Groundwater condition maps showing areas of above normal, normal, and below normal (monthly conditions compared to monthly normals) are provided by the USGS on a monthly basis.

The Stream Flow Index is based on the number of consecutive months that stream flow levels are below normal (lowest 25% of period of record for the respective months). The USGS monitors stream flow in a network of 111 gages throughout New Jersey. Stream flow conditions maps showing areas of above normal, normal and below normal (monthly conditions compared to monthly normals) are provided by the USGS on a monthly basis. In addition, USGS provides a table that describes the cumulative monthly stream flow condition as normal, above normal, or below normal (USGS).

New Jersey maintains a real-time groundwater level monitoring system consisting of seven observation wells throughout the state. The network, a cooperative between the USGS and NJDEP, uses satellite telemetry to provide observations in four-hour increments. Observations are available on the USGS website at http://water.usgs.gov/nj/nwis/current/?type=gw. The primary purpose of the network is to provide information regarding the status of wells throughout the state and to anticipate potential shortages (NJDEP 2002).

The Reservoir Index is based on the water levels of small, medium, and large index reservoirs across the state. The reservoir level relative to normal conditions will be considered. The NJDEP maintains a listing of current reservoir levels across the State and the Northeast. The current reservoir levels are available at http://www.njdrought.org/reservoir.html.

New Jersey also maintains a real time Regional Drought Indicator Status, showing the level of 90-day precipitation, 90-day stream flow, reservoir levels, the Delaware River Basin Commission reservoir levels, and the unconfined groundwater levels in terms of dryness indices. These indicators determine the Declared Drought Status for each drought region. The observations and status are available at http://www.njdrought.org/current.html.

National Drought Indices

Several indices developed by Wayne Palmer, the PDSI and Crop Moisture Index (CMI), as well as the Standardized Precipitation Index (SPI), are useful for describing the many scales of drought. Other indices include accumulated departure from normal stream flows, low-flow frequency estimates, and changes in water storage, groundwater levels and rates of decline, and lake levels. Most commonly used indices that are used to measure or identify the severity and classification of past and present droughts primarily include, but not limited to, the following:

The PDSI was developed in 1965 and indicates prolonged and abnormal moisture deficiency or excess. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. It can be used to help delineate disaster areas and indicate the availability of irrigation water supplies, reservoir levels, range conditions, amount of stock water, and potential intensity of forest fires.

The PDSI has become the semi-official drought index. It is the most effective in determining long-term droughts; it is not good with short-term forecasts. Table 5.4-2 lists the Palmer Classifications. A Palmer Classification of 0 is used as normal and drought is shown in terms of negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI also reflects excess precipitation using positive numbers.

Table 5.4-2 PDSI Classifications

Palmer Classifications	Description
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Source: National Drought Mitigation Center (NDMC) 2013

The CMI, developed by Wayne Palmer in 1968, can be used to measure the status of dryness or wetness affecting warm season crops and field activities. It gives the short-term or current status of purely agricultural drought or moisture surplus and can change rapidly from week to week (National Weather Service Climate Prediction Center, 2005). According to NOAA, the CMI responds more rapidly than the PDSI so it is more effective in calculating short-term abnormal dryness or wetness affecting agriculture. CMI is designed to indicate normal conditions at the beginning and end of the growing season; it uses the same levels as the Palmer Drought Severity Index.

The SPI is a probability index that considers only precipitation. It is based on the probability of recording a given amount of precipitation. The probabilities are standardized so that an index of zero indicates the median precipitation amount (half of the historical precipitation amounts are below the median, and half are above the median). The index is negative for drought, and positive for wet conditions. The SPI is computed by National Climatic Data Center (NCDC) for several time scales, ranging from one month to 24 months, to capture the various scales of both short-term and long-term drought.

The Keetch-Byram Drought Index (KBDI) is a drought index designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The index increases each day without rain and decreases when it rains. The scale ranges from 0 (no moisture deficit) to 800 (maximum drought possible). The range of the index is determined by assuming that there is eight inches of moisture that is readily available to the vegetation in saturated soil. For different soil types, the depth of soil required to hold eight inches of moisture varies. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. The drying of organic material in the soil can lead to increased difficulty in fire suppression. The Precipitation Index is a comparison of measured precipitation amounts (in inches) to historic normal precipitation. Cumulative amounts for 3-, 6- and 12-month periods are factored into the drought determination. Data is available on the New Jersey Forest Fire Service website at http://www.nj.gov/dep/parksandforests/fire/firedanger- restrictions.html.

Watches, Warnings, and Emergencies

During periods of drought, the NJDEP may issue drought watches, drought warnings or a water emergency. A drought watch is an administrative designation made by the NJDEP when drought or other factors begin to adversely affect water supply conditions. A watch indicates that conditions are dry but not significantly. During a drought watch, the NJDEP closely monitors drought indicators and consults with affected water suppliers. The watch designation is used to alert the public about deteriorating conditions, while reminding water supply professionals to keep watch on conditions and update contingency plans (NJDEP, 2011).

A drought warning represents a non-emergency phase of managing available water supplies during the developing stages of drought and falls between the watch and emergency levels of drought response. Under a drought warning, the NJDEP commissioner may order water purveyors to develop alternative sources of water or transfer water between areas of the State with relatively more water to those with less (NJDEP, 2011).

A water emergency (or drought emergency) can only be declared by the Governor. During a water emergency, a phased approach to restricting water consumption is typically initiated. The NJDEP addresses these emergencies through a multi-phase approach that may include water use restrictions.

Planning for Drought

In 2017 the New Jersey Department of Environmental Protections created the New Jersey Water Supply Plan. This Plan is meant to help enhance the management of New Jersey's water supply, and can be a tool used to help monitor and plan for drought occurrences.

Goals and actions addressed in the Plan could have a direct impact on mitigating against the potential occurrence of drought. Statewide strategies for water conservation that are addressed in the Plan include public education and outreach, reducing non-revenue water losses and per capita water usage, reducing excessive outdoor water use, implementing rate-making and billing that reflect the true cost of water and encouraging indoor retrofits and reclaiming water for beneficial reuse.

The Plan also has a section dedicated to addressing planning for drought and an uncertain future. In order to monitor drought in New Jersey, NJDEP monitors various water supplies throughout the six different drought regions (see Figure 5.4-3). When water demand threatens existing water supplies, NJDEP can designate a drought watch or drought warning condition to help avert excessive water use. To better assess when there is threat of drought, the Plan recommends that the Water Supply Management Decision Support Tool be used to evaluate where there are areas of water supply deficit.

The plan summarizes that despite New Jersey facing some water supply challenges, there is sufficient water available to meet the population's needs into the future as long as actions are taken to manage the State's water supply. Therefore, using the goals and actions provided in this plan can help address sustaining the State's water supply, while also preventing drought.

Drought Management: Decision Support Tool to Balance Water Supply

As referenced in the New Jersey Water Supply Plan, the DEP conducted an evaluation of the State's interconnected water supply infrastructure in 2005. The result of this evaluation, formally known as the "Interconnection Study – Mitigation of Water Supply Emergencies" (Statewide Interconnection Study) found that if water transfers had been initiated sooner during past droughts, all but two of the past five water emergencies since the 1960's could have been avoided. The report recommended use of the Water Supply Management Decision Support Tool (WSMDT) to evaluate and, if necessary, initiate communication and earlier transfers of water from areas with adequate supply to areas of deficit. The WSMDST was designed to predict the likelihood of reaching drought conditions within a specified time frame given a range of meteorological and hydrologic conditions. The general objective of the WSMDST is to specify transfers of water, using available interconnection capacities, to mitigate excessive depletion of water supplies in a single water system or drought region.

5.4.4 PREVIOUS OCCURRENCES AND LOSSES

Historically in New Jersey there have been several severe drought periods. Major droughts occurred in the State from 1929 to 1932, 1949 to 1950, 1953 to 1955, 1961 to 1966, 1980 to 1981, 1998 to 2002, and 2016 to 2017 (USGS, 1989; Robinson, 2013, NJDEP, 2017).

Many sources provided historical information regarding previous occurrences and losses associated with drought events throughout the State of New Jersey. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

The most recent significant drought occurred from October 2016 to April 2017. During this time period a drought condition was declared for 14 counties in the State. These counties include Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union and Warren. Cape May and Cumberland Counties were the only two counties that a drought condition was not declared for (NJDEP, 2016).

The 2014 Plan discussed drought events that occurred in New Jersey from January 1, 2010 to December 31, 2012. For this Plan update, drought events that occurred in the State since 2012 are also included.

Table 5.4-3 Drought Incidents in New Jersey

Date(s) of Event	Counties Affected	Description
May 1929 to 10/1/1932	Statewide	The drought was the second most severe drought in New Jersey history. This regional drought affected most states in the Northeast. Stream flow deficits at gaging stations where data were analyzed had recurrence intervals greater than 25 years. In the Delaware River, the decreased volume of freshwater flow enabled saline water to move upriver from the Delaware Bay to the Camden area and endanger freshwater supplies
February 1949 to 10/1/1950	Hackensack and Passaic Rivers	The drought was much less widespread than the 1929 to 1932 drought. This drought was most severe in northeastern New Jersey, where it had a recurrence interval greater than 10 years. The driest June on record at most gaging stations throughout New Jersey was in 1949. The average statewide precipitation for the month was 0.2 inch, which was 3.6 inches less than normal.
May 1953 to July 1955	Statewide	The drought had recurrence intervals of about 15 years in northern and southern New Jersey, and five to 25 years in the south-central part of the State. Crop yields were decreased because the drought began in May.

Date(s) of Event	Counties Affected	Description
June 1961 to 8/1/1966	Statewide	This event was the longest and most severe of the five previous droughts. Stream flow deficits were greatest in northern New Jersey; which had a recurrence interval exceeding 50 years. In the rest of the State, the recurrence interval ranged from 25 to 50 years. The recurrence interval of the stream flow deficit for the main-stem Delaware River was estimated to be much greater than 100 years. Water conservation was widely practiced, and a state of emergency was declared by the governor on June 12, 1965, for most of northeastern New Jersey. On July 12, 1965, the Delaware River Basin Commission declared a drought emergency and decreased diversions from the Delaware River basin by New York City and New Jersey. In August 1965, the President declared the Delaware River basin a federal drought-disaster area.
June 1980 to April 1981	Statewide	The drought was nearly statewide and had recurrence intervals that ranged from 10 to 25 years except in a few isolated areas. A ban on nonessential water use for 372 municipalities was ordered by the governor in January 1981. Boonton Reservoir, completed in 1904, had record-low water levels at the end of January 1981.
July 1984 to 8/1/1985	Statewide	The drought had a recurrence interval that ranged from 10 to 20 years in the northern and east-central parts of the State and from four to nine years in the north-central and southwestern parts. On January 23, 1985, the Delaware River Basin Commission declared the basin to be in a drought-warning condition. On April 17, 1985, the governor declared a state of emergency for 93 municipalities in northeastern New Jersey.
December 1998	Camden, Cumberland, Eastern Gloucester, Hunterdon, Mercer, Middlesex, Morris, Northwestern Burlington, Salem, Somerset, Sussex, Warren, Western Atlantic, Western Cape May, Western Monmouth, and Western Ocean Atlantic, Eastern Cape May, Eastern Monmouth, Eastern Ocean,	State forestry service extinguished 42 small wildfires the weekend of December 5 and 6. Grain farmers suffered serious losses of corn and late season crops. Reservoir levels fell. Saltwater line of Delaware River was at River Mile 85. This was 11 miles farther upstream than normal and increased corrosion control costs of industries.
January 1999	Camden, Cumberland, Eastern Atlantic, Eastern Cape May, Eastern Monmouth, Eastern Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Northwestern Burlington, Salem, Somerset, Sussex, Warren, Western Atlantic, Western Cape May, Western Monmouth, and Western Ocean	On January 5, the Delaware River Basin Commission issued a conditional drought emergency. Heavy precipitation on January 3rd gave the area a temporary reprieve from going straight into a drought emergency.

Date(s) of Event	Counties Affected	Description
July 1999	Camden, Cumberland, Eastern Atlantic, Eastern Cape May, Eastern Monmouth, Eastern Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Northwestern Burlington, Salem, Somerset, Sussex, Warren, Western Atlantic, Western Cape May, Western Monmouth, and Western Ocean	Through July 13, there were 44 forest fires in the state. Many shallow wells in northwest ran dry. Rivers and streams had 25% of normal flow. In an effort to maintain a flow of Delaware River, the Delaware River Basin Commission increased releases from the upstate New York reservoirs as well as Beltzville and Blue Marsh Lakes in Pennsylvania. Plant corrosion issues resulted from brackish water. Salt line along Delaware River was 12 miles farther north than usual. Livestock feed crops were at a near-total loss.
August to September 1999	Camden, Cumberland, Eastern Atlantic, Eastern Cape May, Eastern Monmouth, Eastern Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Northwestern Burlington, Salem, Somerset, Sussex, Warren, Western Atlantic, Western Cape May, Western Monmouth, and Western Ocean	Crops were greatly affected, especially grain and forage crops in the northern part of the state. Crop losses were estimated at $80 million. Older wells failed in the northwest particularly Hunterdon and Sussex Counties. Field corn losses in the northern part of the state averaged between 10% and 75%. Many farms were close to total disaster. Livestock dealers auctioned off animals because they did not have enough food to feed them. The upstream advancing salt front along the lower Delaware River stressed fish and wildlife. Some groundwater supplies were also contaminated with the saltier water and had to be treated.
November 2001	Bergen, Camden, Cumberland, Atlantic, Cape May, Monmouth, Ocean, Essex, Hudson, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Burlington, Passaic, Salem, Somerset, Sussex, Warren	The combined storage in the 13 major water supply reservoirs serving northeast New Jersey was 35.3 billion gallons, which was 43.9% capacity. This storage was 4.7 billion gallons less than one month prior and 23.4 billion gallons less than one year prior. Sussex and Atlantic County shallow wells were drying up while permits for deeper wells were increasing. Twenty-five residents in Wawayanda (Sussex County) ran out of water. Winter crops such as rye and grasses were struggling. On a county weighted average, monthly precipitation totals ranged from 0.7 inches in Cape May County to 1.2 inches in Sussex and Warren Counties. All were less than 31% normal.
December 2001	Camden, Cumberland, Eastern Atlantic, Eastern Cape May, Eastern Monmouth, Eastern Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Northwestern Burlington, Salem, Somerset, Sussex, Warren, Western Atlantic, Western Cape May, Western Monmouth, and Western Ocean	Rainfall was below average for the previous six consecutive months, which yielded an average deficit of 10.36 inches. The combined storage in the 13 major water supply reservoirs serving northeast New Jersey was 47.4% capacity, which was 30% below normal. Current levels stopped declining, comparable to the 1998 to 1999 drought levels. Capacities in the individual systems at the end of the month were Newark Reservoirs at 44.2% (percent capacity) Jersey City Reservoirs at 53.1% North Jersey District at 44.5%, and United Water of New Jersey at 53.6%.

Date(s) of Event	Counties Affected	Description
January - February 2002	Bergen, Passaic, Essex, Hudson, Union, Camden, Cumberland, Atlantic, Cape May, Monmouth, Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Burlington, Salem, Somerset, Sussex, Warren	Northern New Jersey reservoirs were at 42.9% of capacity rather than typical 80% capacity. Issues of saltwater intrusion and corrosion became an issue for industries. Water treatment costs for municipalities that depend on the river for their water supply became an issue. Precipitation was 50% of normal. The combined storage of three major reservoirs serving northeast New Jersey was at 44% capacity, or 36% below normal. In February, dry weather continued, the drop in stream flow and groundwater levels reduced levels in the New York State reservoirs. This forced the NJDEP to continue the drought warning for all New Jersey counties except Union, Middlesex and Somerset Counties. Unseasonably dry weather in February exacerbated the drought and forced several individual counties to declare water emergencies, especially in the northeast. Four northern New Jersey reservoirs remained at 43% capacity, half the normal level.
March to July 2002	Camden, Cumberland, Eastern Atlantic, Eastern Cape May, Eastern Monmouth, Eastern Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Northwestern Burlington, Salem, Somerset, Sussex, Warren, Western Atlantic, Western Cape May, Western Monmouth, and Western Ocean	Northern reservoirs were at 40% capacity. Most surface streams were 25% normal. Five- hundred wells throughout state needed replacement. Between October and March, the Forest Service responded to 1,116 wildfires. Many streams and ponds used to fight fires were dry. Incidences of salt water infiltrating wells occurred. Consequently many wells became brackish and unusable. The governor estimated the drought cost farmers approximately $125 million. Crop revenue in some areas was reduced more than 50%.
August – September 2002	Bergen, Passaic, Essex, Hudson, Union, Camden, Cumberland, Atlantic, Cape May, Monmouth, Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Burlington, Salem, Somerset, Sussex, Warren	The majority of the streams monitored had stream-flows in the 10 to 24 percentile, which was well below normal. The combined storage in the 13 major reservoirs serving Northeast New Jersey was 67.7% capacity, which was 10% to 15% below normal. Capacities of reservoirs on September 30 were: Newark Reservoirs at 55.0% (percent capacity) Jersey City Reservoirs at 62.5%, North Jersey District at 67.6%, and United Water of New Jersey at 61.8%
October 2002	Statewide	Many New Jersey farmers suffered losses of 50% or more, notably in commodities such as corn and soybean. Combined farming losses approximately $125 million.
September 2005	Camden, Cumberland, Atlantic, Cape May, Monmouth, Ocean, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Burlington, Salem, Somerset, Southeastern Burlington, Sussex, Warren, and Western Atlantic	Due to the lack of precipitation, caused rain from a storm to build on power lines. Rains in late September led to 9,000 homes and businesses mainly in Atlantic and Cape May Counties losing power. The heat scorched and damaged many agricultural plants. A statewide drought watch was declared on September 13, 2005. Rains in late September led to resuming normal conditions on October 14, 2005.
May to July 2006	Statewide	A statewide drought watch was declared on May 8, 2006. Significant precipitation in June led to lifting the drought watch on July 3, 2006.

Date(s) of Event	Counties Affected	Description
August to October 2010	Statewide	On August 5, the NJDEP issued a drought watch for northeast New Jersey including Morris County. On a statewide average, August 2010 was the 15th driest August on record (dating back to 1895) with 2.37 inches of rain. The meteorological summer was the 10th driest (8.65 inches) on record dating back to 1895 in New Jersey and was also the driest summer since 1966. At the Atlantic City International Airport, it was the fourth driest August (1.09 inches) and fifth driest meteorological summer (5.92 inches) on record. In Trenton, it was the third driest August (0.80 inches) and fifth driest meteorological summer (5.90 inches) on record.
March to May 2012	Coastal Climate Division	Lowest PDSI of -3.29 in April
September 2015 to March 2016	Statewide	A drought watch was issued that impacted more than two-thirds of New Jersey's Population.
October 2016 to April 2017	Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union and Warren Counties	Drought conditions were the worst faced by New Jersey in 14 years.

Source: NJDEP; NRCC, 2013; Hardison 1968; NJDEP 1983; NOAA-NCDC 2017

5.4.4.1 FEDERAL DISASTERS (FEMA AND USDA)

Agriculture-related drought disasters are quite common. One-half to two-thirds of the counties in the United States have been designated as disaster areas in each of the past several years. The USDA Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Table 5.4-4 presents USDA declared drought and excessive heat events impacting the State.

Table 5.4-5 lists known drought events that have affected New Jersey and were declared a FEMA disaster. This table provides information on the FEMA disaster declarations for drought, including disaster number, disaster type, declaration and incident dates, and counties included in the declaration. Each FEMA declared disaster was Statewide.

Table 5.4-4 USDA Drought-Related Disaster Declarations 2012 to 2017

Incidence Period	Event Type	USDA Designation Number	Counties Included in Disaster
June 2012	Drought, Excessive Heat	S3427	Passaic, and Sussex
June 28, 2012 to November 9, 2012	Drought, High Winds, Hail, Excessive Heat, Excessive Rain, Flash Flood, Hurricane Sandy, Snowstorm, and Nor'Easter	S3487	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Mercer, Monmouth, Morris, Ocean, Passaic, Salem, Sussex, and Warren
August 15, 2014	Drought	S3759	Sussex and Passaic

Incidence Period	Event Type	USDA Designation Number	Counties Included in Disaster
April 1, 2015 to September 29, 2015	Drought, Heat, Excessive Heat, High Temperature	S3930	Atlantic, Burlington, Camden, Essex, Cumberland, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union and Warren
July 16, 2015 to September 29, 2015	Drought, Heat, Excessive Heat, High Temperature	S3932	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, Salem
April 1, 2016 to September 19, 2016	Combined effects of freeze, excessive heat, and drought	S4071	Atlantic, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Salem, Somerset, Union,
November 15, 2016	Drought	S4114	Sussex
May 1 2016 to December 10, 2016	Drought, Heat, Excessive Heat, High Temperature, Frist	S4165	Hunterdon, Mercer, Warren, Burlington

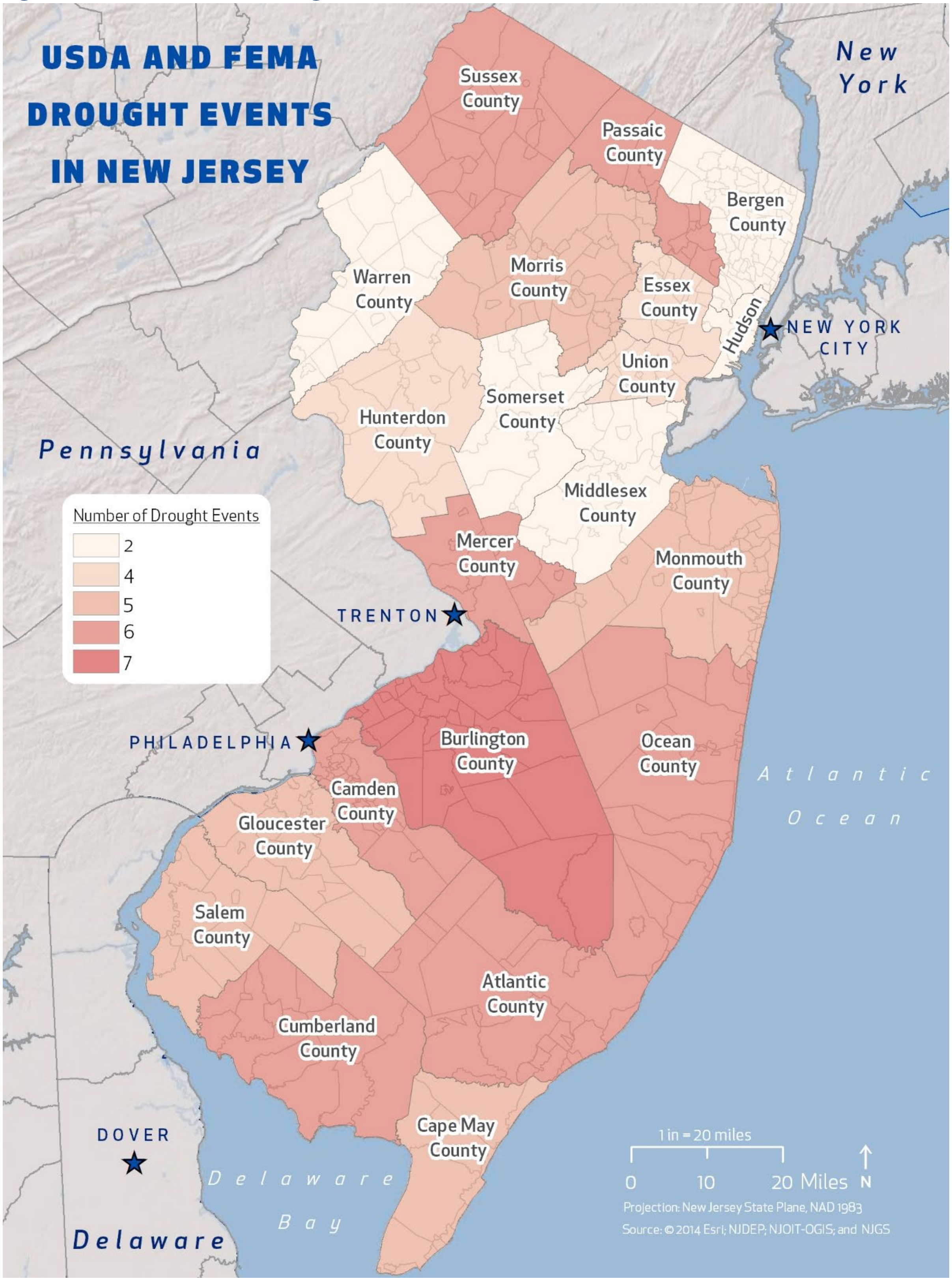
Source: USDA, 2013

Table 5.4-5 FEMA Drought-Related Disaster Declarations 1954 to 2017

Disaster Number	Disaster Type	Declaration Date	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	Impacted Number of Counties
DR-205	Water Shortage	8/18/1965	8/18/1965	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
DR-1694	Severe Storms and Inland and Coastal Flooding	10/19/1980	10/19/1980	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21

Source: FEMA, 2017

Figure 5.4-4 FEMA and USDA Drought-Related Disaster Declarations



Source: FEMA, 2017; USDA, 2017

5.4.5 PROBABILITY OF FUTURE OCCURRENCES

Based upon risk factors for past occurrences, it is likely that droughts can occur across New Jersey in the future. In addition, as projected temperatures increase, the probability for future droughts will likely increase as well. Therefore, it is likely that droughts will occur in New Jersey of varied severity in the future.

5.4.5.1 POTENTIAL EFFECTS OF CLIMATE CHANGE

Nearly every region in the country is facing some increased risk of seasonal drought. Climate change can significantly affect the sustainability of water supplies in the future. As parts of the United States get drier, the amount and quality of water available will likely decrease, impacting people's health and food supplies.

A report by the National Resources Defense Council (NRDC) found that 1,100 counties (one-third of all counties in the contiguous 48 states) face higher risks of water shortages by mid-century as a result of climate change. More than 400 of these counties will face extremely high risks of water shortages.

The NRDC states that global warming is projected to alter precipitation patterns, increase the frequency and intensity of major storm events, and increase the flood risk throughout the United States, particularly the midwest and the northeast. Between 2000 and 2009, approximately 30% to 60% of the United States experienced drought conditions at any one time. However, both northern and southern New Jersey have become wetter over the past century. Northern New Jersey's 1971-2000 precipitation average was over 5" (12%) greater than the average from 1895-1970. Southern New Jersey became 2" (5%) wetter late in the 20th century (Office of New Jersey State Climatologist). Average annual precipitation is projected to increase in the region by 5% by the 2020s and up to 10% by the 2050s. Most of the additional precipitation is expected to come during the winter months (New York City Panel on Climate Change [NYCPCC] 2009).

Drought conditions across the country have varied since records began in 1895. The 1930s and 1950s saw the most widespread droughts, while the last 50 years have generally been wetter than average (Figure 5.4-5).

5.4.6 IMPACT ANALYSIS

5.4.6.1 SEVERITY AND WARNING TIME

According to NOAA, the severity of a drought depends on the degree of moisture deficiency, the duration, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts. Droughts are not usually associated with direct impacts on people or property, but they can have significant impacts on agriculture, which can impact people indirectly. When measuring the severity of droughts, analysts typically look at economic impacts on a planning area.

Unlike most disasters, droughts normally occur slowly but last a long time. On average, the nationwide annual impacts of drought are greater than the impacts of any other natural hazard. They are estimated to be between $6 billion and $8 billion annually in the United States and affect primarily the agriculture, transportation, recreation and tourism, forestry, and energy sectors. Social and environmental impacts are also significant, although it is difficult to put a dollar value on these impacts.

Drought affects groundwater sources, but generally not as quickly as surface water supplies. Groundwater supplies generally take longer to recover. Reduced precipitation during a drought means that groundwater supplies are not replenished at a normal rate. This can lead to a reduction in groundwater levels and problems such as reduced pumping capacity or wells going dry. Shallow wells are more susceptible than deep wells. Reduced replenishment of groundwater affects streams also.

Much of the flow in streams comes from groundwater, especially during the summer when there is less precipitation and after snowmelt ends. Reduced groundwater levels mean that even less water will enter streams when steam flows are lowest.

A drought directly or indirectly impacts all people in affected areas. A drought can result in farmers not being able to plant crops or the failure of already planted crops. This results in loss of work for farm workers and those in related food processing jobs. Other water-dependent industries are commonly forced to shut down all or a portion of their facilities, resulting in further layoffs. A drought can harm recreational companies that use water (e.g., swimming pools, water parks, and river rafting companies) as well as landscape and nursery businesses because people will not invest in new plants if water is not available to sustain them.

As per the NDMC, droughts are climatic patterns that occur over long periods of time. Only generalized warning can take place due to the numerous variables that scientists have not pieced together well enough to make accurate and precise predictions.

The NDMC states that empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of many causes, often synergistic in nature; these include global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation.

Scientists at this time do not know how to predict drought more than one month in advance for most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depends on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on the global scale.

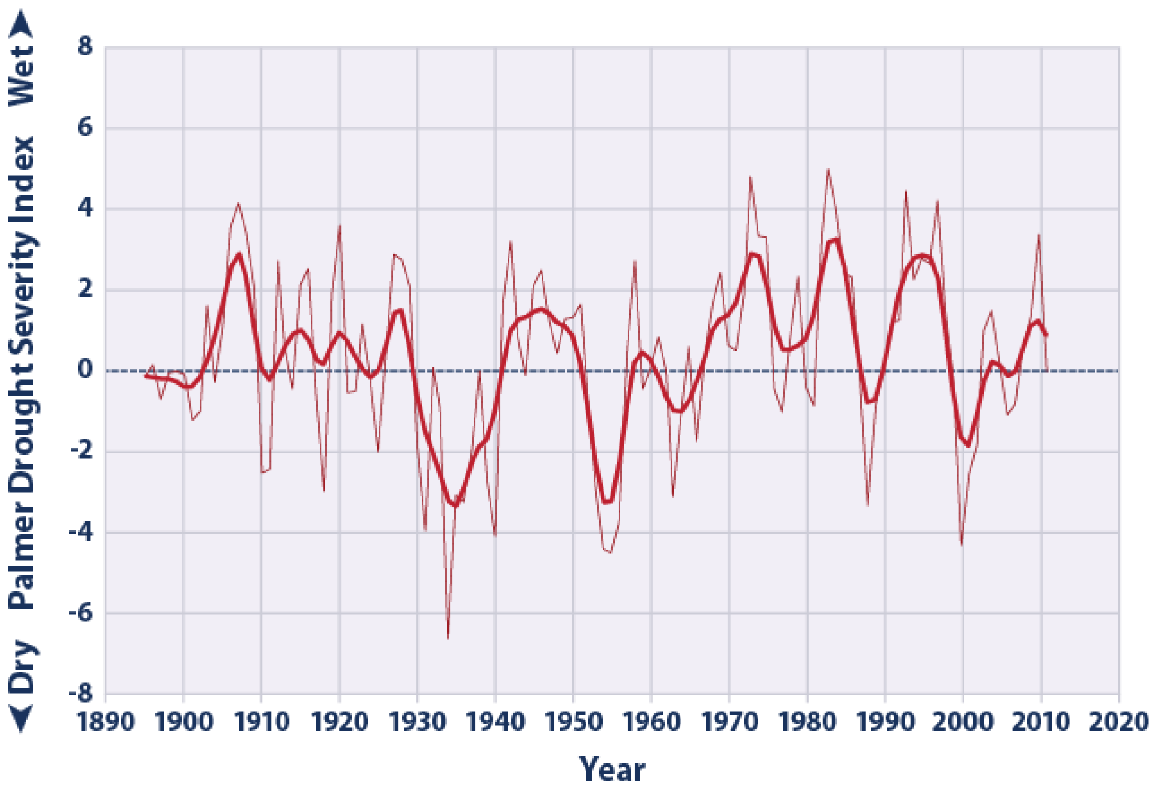
5.4.6.2 SECONDARY HAZARDS

Droughts may have devastating effects on communities and the surrounding environment. The amount of devastation depends on the strength and duration of a drought event. One impact of drought is its impact on water supply. When drought conditions persist with little to no relief, water restrictions may be put into place by local or state governments. These restrictions can include watering of lawns, washing cars, etc. In exceptional drought conditions, watering of lawns and crops may not be an option. If crops are not able to receive water, farmland will dry out and crops will die. This can lead to crop shortages, which, in turn, increases the price of food (North Carolina State University, 2013).

Droughts also have the potential to lead to water pollution due to the lack of rain water to dilute any chemicals in water sources. Contaminated water supplies may be harmful to plans and animals. If water is not getting into the soils, the ground will dry up and become unstable. Unstable soils increase the risk of erosion and loss of top soil (North Carolina State University, 2013).

The impacts on public health from drought can be severe which includes increase in heat-related illnesses, waterborne illnesses, recreational risks, limited food availability, and reduced living conditions. Those individuals who rely on water, such as farmers, may experience financial-related stress. Decreased amounts and quality of water during drought events have the potential to reduce the availability of electricity (hydropower, coal-burning and nuclear) (North Carolina State University, 2013).

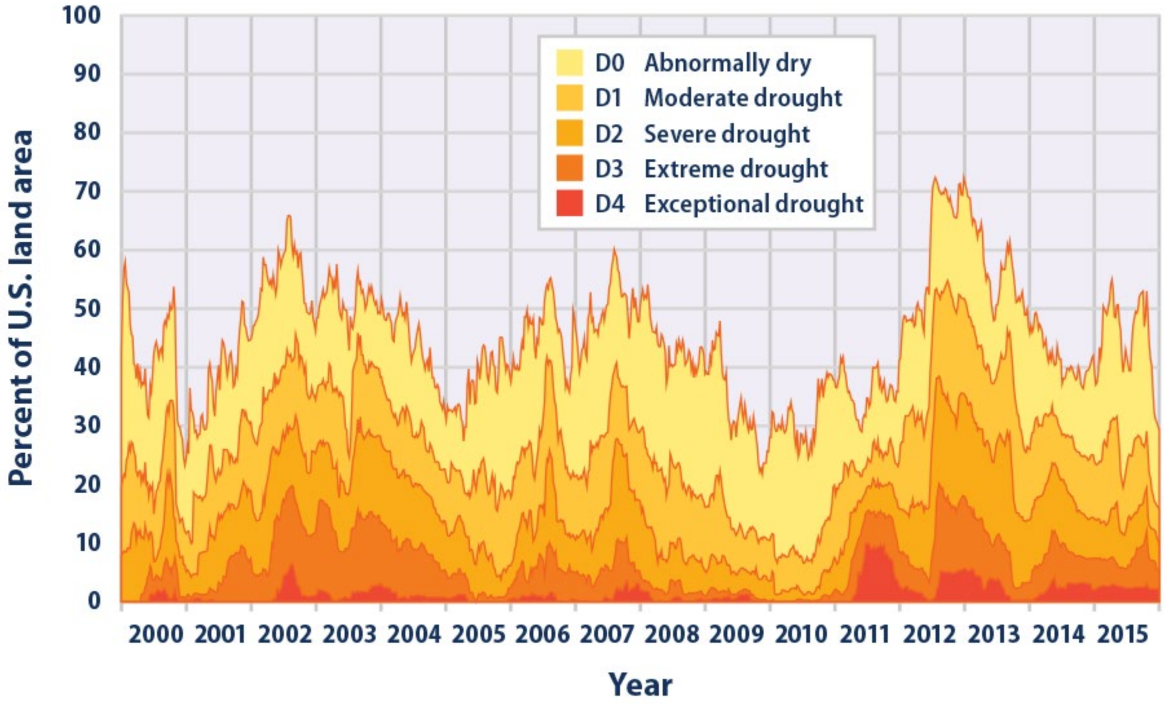
Figure 5.4-5 Average Drought Conditions in the Contiguous 48 States, 1895 to 2012



Source: United States Environmental Protection Agency (EPA) 2013
Note: This figure shows annual values of the Palmer Drought Severity Index, averaged over the entire area of the contiguous United States Positive values represent wetter-than-average conditions, while negative values represent drier-than-average conditions. A value between -2 and -3 indicates a moderate drought, -3 to -4 is severe drought, and -4 or below is extreme drought. The thicker line is a nine-year weighted average.

Over the period from 2000 through 2012, roughly 30% to 70% of the United States experienced conditions that were at least abnormally dry at any given time. High drought years occurred in 2002, 2003, 2007, and 2012, while 2001, 2005, 2009, and 2010 were relatively low drought years. Both drought figures indicate that in 2012, the United States experienced the driest conditions in more than a decade. During the latter half of 2012, more than half of the United States was covered by moderate or greater drought (Figure 5.4-6). In several states, 2012 was among the driest years on record.

Figure 5.4-6 Percentage of United States Under Drought Conditions 2000 to 2015



Source: EPA, 2016

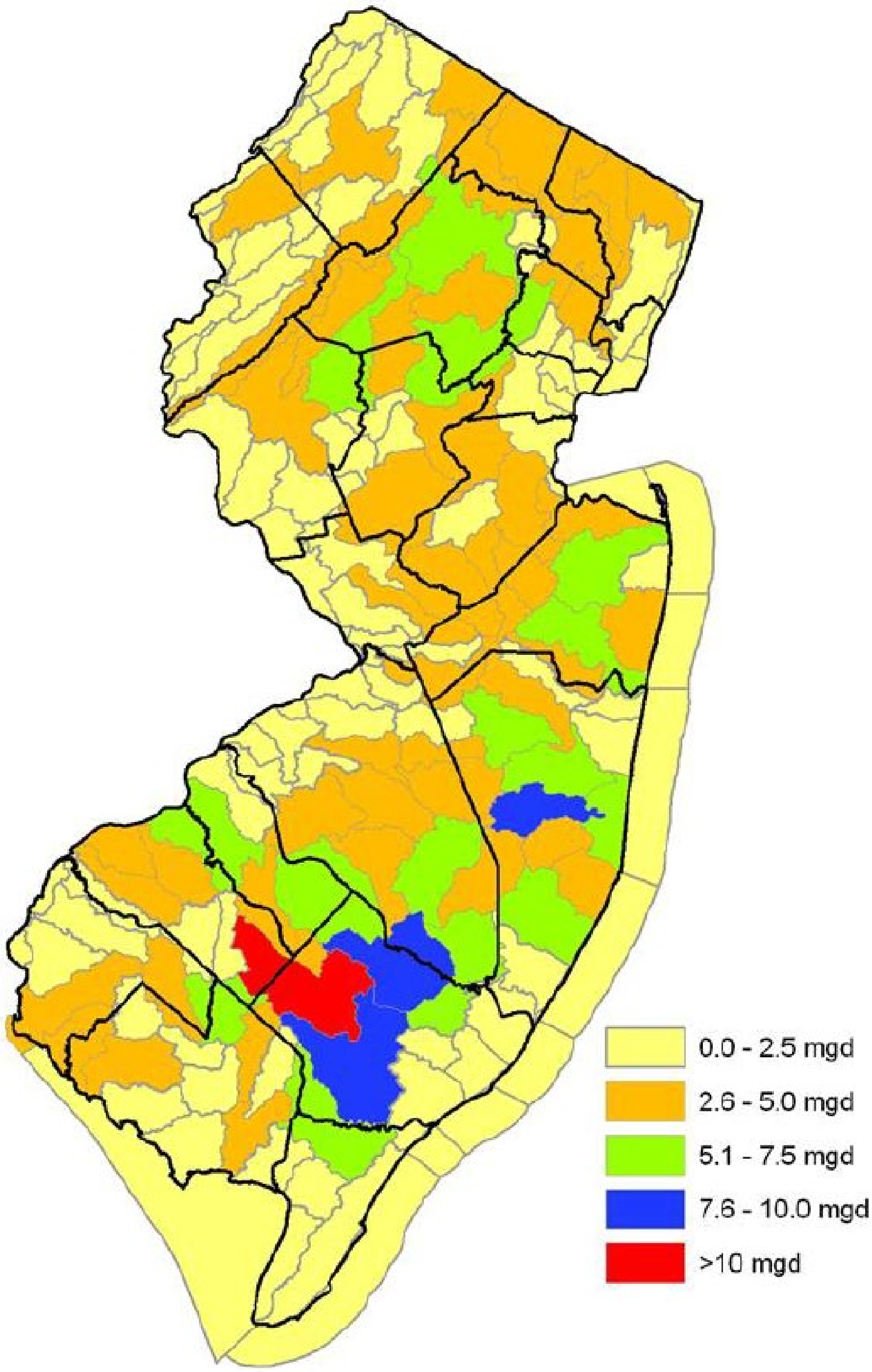
Note: This figure shows the percentage of United States under drought conditions from 2000 through 2015. This figure uses the United States Drought Monitor classification system, which is described above. This figure includes all 50 states and Puerto Rico.

5.4.6.3 ENVIRONMENTAL IMPACTS

New Jersey's water supply is essential to the quality of living in the State. Drought has the potential to impact the State's water supply. New Jersey relies on reservoirs and groundwater as the main sources of water. Water supply in New Jersey is regional and the importance of the water supply type by region is shown in Figure 5.4-8 below.

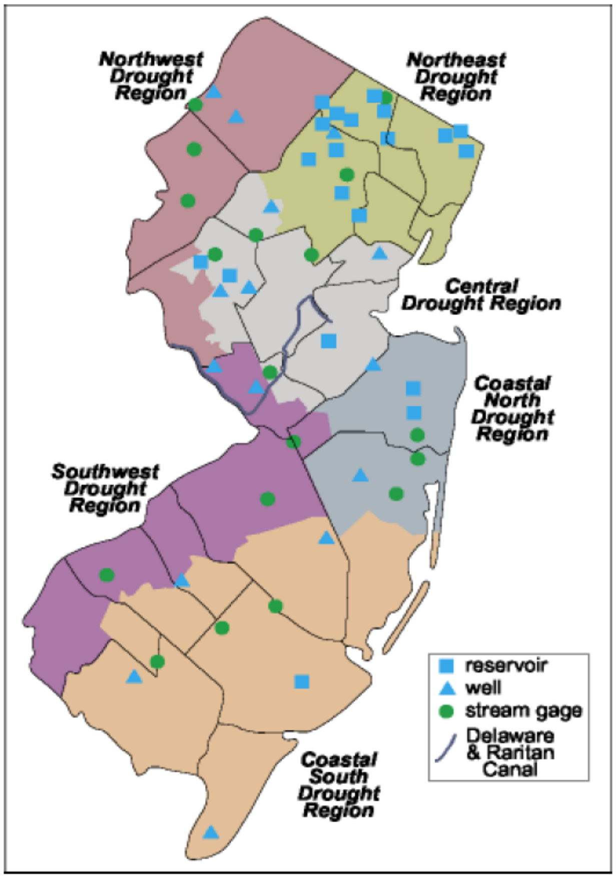
New Jersey has created a water storage system that helps reduce the water supply's vulnerability to drought. The system of reservoirs allows for collection and storage of water for use during dry periods. However, the majority of these reservoirs are located in the northern part of the state and the major source of water in the southern part of the state is unconfined groundwater, mostly associated with the Kirkwood–Cohansey aquifer. Figure 5.4-8 illustrates major and minor water supply sources within the drought Regions in New Jersey. The major sources of water supply in southern part of the State have the potential to be vulnerable to prolonged periods of drought, since there are a limited number of reservoirs to back up the groundwater supply.

Figure 5.4-7 Total Unconfined Groundwater and Surface Water Available for Depletive and Consumptive Use by HUC11.



Source: NJ Water Supply Plan 2017

Figure 5.4-8 Drought Regions, Water-Supply Reservoirs, Monitoring Wells and Stream Gages in New Jersey



Drought Region	Reservoirs: New Jersey	Reservoirs: DE River Basin	Rivers	Unconfined Ground Water
Northeast	major	none	major	minor
Central	major	major	major	minor
Coastal North	major	none	minor	major
Coastal South	minor	none	minor	major
Northwest	minor	minor	major	major
Southwest	none	major	minor	major

■ major ■ minor □ none

Source: NJGS 2003

5.4.7 VULNERABILITY ASSESSMENT

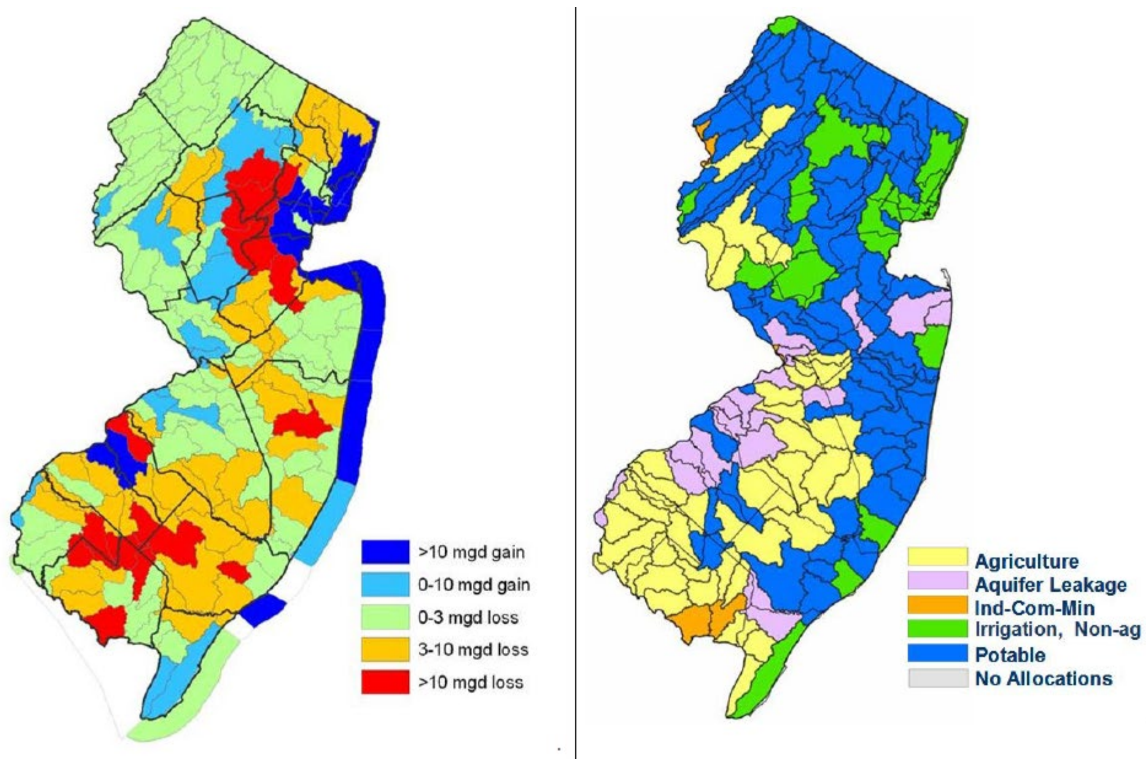
To understand risk, the assets exposed and vulnerable to the hazard areas are identified. For the drought hazard the entire State of New Jersey is exposed. A consequence analysis for this hazard was also conducted and presented in Section 9 (Consequence Analysis). Impacts on the public, responders, continuity of operations, delivery of services; property, facilities, and infrastructure; and the environment, economic condition of the State, and the public confidence in the State's governance is discussed in Section 9 in accordance with Emergency Management Accreditation Program (EMAP) standards. This section addresses assessing vulnerability and estimating potential losses by jurisdiction within New Jersey and to State facilities.

5.4.7.1 ASSESSING VULNERABILITY BY JURISDICTION

Drought impacts cross jurisdictional boundaries and primarily impact the population's water supply and the agricultural industry. Buildings are not anticipated to be directly affected by a drought, and all are expected to be operational during a drought event.

The New Jersey Water Supply Plan identifies depletive and consumptive loss from unconfined groundwater and surface water sources at peak use rates and compares this loss with the primary causes of depletive and consumptive loss at peak use rates. Figure 5.4-9 illustrates this comparison below.

Figure 5.4-9 Depletive and Consumptive Loss from Unconfined Groundwater and Surface Water Sources (LEFT) and Primary Causes of Depletive and Consumptive Loss at Peak Use Rates (RIGHT)



Source: NJ Water Supply Plan 2017

At the time of this Plan update, 20 of New Jersey's 21 counties have hazard mitigation plans, of which 19 profiled the drought hazard. Refer to Table 5.1-2 in Section 5.1 State Risk Assessment Overview. Of the eight counties that ranked their hazards of concern, four categorized the hazards into high/medium/low rankings and ranked drought hazard medium to low. If drought was not ranked by a local HMP, the jurisdictions identified their most significant hazards using other methods.

To estimate land exposure to drought, agricultural land acreage was used. Table 5.4-6 lists the counties that have the greatest acreage of farmland across the State, which include: Burlington, Cumberland, Gloucester, Hunterdon, Monmouth, Salem, Sussex, and Warren. These counties also have the greatest number of farms.

Table 5.4-6 Agricultural Statistics for New Jersey

COUNTY	NUMBER OF FARMS	% OF TOTAL FARMS IN STATE	LAND IN FARMS (acres)	MARKET VALUE OF PRODUCTS SOLD	% OF STATE TOTAL
Atlantic	402	4.43%	29,479	$ 125,440,000	12.46%
Bergen	60	0.66%	1432	$ 5,196,000	0.52%
Burlington	838	9.24%	95,899	$ 100,887,000	10.02%
Camden	175	1.93%	7,143	$ 16,017,000	1.59%
Cape May	152	1.68%	7,352	$ 8,027,000	0.80%
Cumberland	583	6.43%	64,526	$ 170,362,000	16.92%
Essex	13	0.14%	128	$ 1,930,000	0.19%
Gloucester	584	6.44%	43,265	$ 87,690,000	8.71%
Hudson	N/A	N/A	N/A	N/A	N/A
Hunterdon	1,447	15.95%	96,025	$ 67,206,000	6.67%
Mercer	272	3.00%	19,744	$ 19,729,000	1.96%
Middlesex	198	2.18%	17,261	$ 29,251,000	2.90%
Monmouth	823	9.07%	38,961	$ 84,411,000	8.38%
Morris	366	4.03%	14,458	$ 28,387,000	2.82%
Ocean	178	1.96%	7,969	$ 11,550,000	1.15%
Passaic	78	0.86%	1,454	$ 3,436,000	0.34%
Salem	825	9.09%	101,847	$ 111,993,000	11.12%
Somerset	400	4.41%	34,735	$ 23,206,000	2.30%
Sussex	885	9.76%	61,033	$ 18,654,000	1.85%
Union	8	0.09%	96	$ 2,359,000	0.23%
Warren	784	8.64%	72,250	$ 91,205,000	9.06%
State Total	9,071		715,057	$ 1,006,936,000	

Source: USDA, 2012

As development continues in New Jersey, the demand for water will increase as well. While New Jersey is not particularly prone to extreme instances of drought, increased demand has the potential to exacerbate moderate or severe droughts. New development in the southern portion of the State could increase the vulnerability to drought events, in terms of water supply. This is because the major source of water in southern New Jersey is the unconfined Kirkwood-Cohansey aquifer with a limited number of reservoirs for the collection and storage of back-up supply. As indicated in Table 4-7 (Population Growth Projections by County) in Section 4 (State Profile), New Jersey is anticipated to grow by 4. 87% through 2024. Growth in population will increase demand for water and may make the area increasingly vulnerable to the direct and indirect water supply impacts associated with drought.

5.4.7.2 ESTIMATING POTENTIAL LOSSES BY JURISDICTION

Drought events impact the economy, including loss of business function and damage and loss of inventory. Industries that rely on water for business may be impacted the hardest (e.g., landscaping businesses). Even though most businesses will still be operational, they may be impacted aesthetically. These aesthetic impacts are most significant to the recreation and tourism industry.

The agricultural industry is most at risk. Damaged and dead crops are also vulnerable to wildland fires which can spread easily during periods of drought. A prolonged drought event could have significant impacts to the State's economy, particularly in counties that have large amounts of agricultural lands. While agriculture is not the primary commodity for New Jersey, it is significant enough to impact the State should a prolonged drought occur. Damage or complete loss of a crop will have direct economic impacts on the agricultural industry in New Jersey. Refer to table 5.4-6 for detailed statistics on the agricultural industry's influence on New Jersey's economy.

5.4.7.3 ASSESSING VULNERABILITY TO STATE FACILITIES

Drought events generally do not impact buildings. No structures are anticipated to be directly affected by a drought, and all are expected to be operational during a drought event. However, droughts contribute to conditions conducive to wildfires. Risk to life and property is greatest in areas where forested areas adjoin urbanized areas (high-density residential, commercial, and industrial), known as the wildland-urban interface (WUI). Therefore, all state facilities in and adjacent to the WUI zone are considered vulnerable to wildfire. Section 5.12 describes the wildland fire hazard in the State.

However, water supply facilities may be affected by short supplies of water. In total, 51 potable water facilities were identified as critical across the State (refer to Table 5.1-12 in the State Risk Assessment Overview section). Table 5.4-7 summarizes the number of public community wells, intakes, and water treatment plants in each county as provided by NJDEP. Morris and Ocean Counties have the highest number of critical water facilities. Each have over 300 of the aforementioned facility types.

Table 5.4-7 Summary of the Wells, Intakes, and Treatment Plants in New Jersey by County

County	Number of Wells	Number of Intakes	Number of Treatment Plants	Total
Atlantic	110	2	49	161
Bergen	148	1	83	232
Burlington	154	5	80	239
Camden	148	0	42	190
Cape May	74	0	37	111
Cumberland	66	0	37	103
Essex	73	2	30	105
Gloucester	120	0	68	188
Hudson	0	0	1	1
Hunterdon	67	2	41	110
Mercer	46	1	25	72
Middlesex	93	3	25	121
Monmouth	114	6	57	177
Morris	226	4	118	348
Ocean	241	1	93	335
Passaic	66	9	33	108
Salem	52	2	18	72
Somerset	25	4	12	41
Sussex	170	3	91	264
Union	45	1	22	68
Warren	45	0	20	65

County	Number of Wells	Number of Intakes	Number of Treatment Plants	Total
Total	2,083	46	982	3,111

Source: NJDEP 2013

Additionally, droughts contribute to conditions conducive to wildfires. All state buildings, critical facilities, and infrastructure in and adjacent to the wildfire hazard areas are considered vulnerable to wildfire. Please refer to Section 5.12 (Wildfire) regarding the wildfire hazard in the State.

As development continues in New Jersey, the demand for water will increase as well. While New Jersey is not particularly prone to extreme instances of drought, increased demand has the potential to exacerbate moderate or severe instances. New state facilities in the southern part of the State could be vulnerable to drought events, since the major source of water currently is the unconfined Kirkwood-Cohansey aquifer with a limited number of reservoirs for the collection and storage of back up supply.

5.4.7.4 ESTIMATING POTENTIAL LOSSES TO STATE FACILITIES

As mentioned, drought events generally do not impact buildings, however they have the potential to impact agriculture-related facilities and critical facilities that are associated with potable water supplies. As discussed in Section 5.1 Risk Assessment Overview, the replacement cost value for critical facilities was not available for the Plan update.

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