



## 5.4.4 Drought

This section provides a hazard profile and vulnerability assessment of the drought hazard for the Suffolk County HMP.

### Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, and probability of future occurrences for the drought hazard.

#### Description

Drought is a period characterized by long durations of below normal precipitation. 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 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 2002).

#### Extent

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 (NOAA 2000). The NYS DEC and the New York State Drought Management Task Force identifies droughts in the following four stages:

- **Drought Watch:** The least severe of the stages, a drought watch is declared when a drought is developing. Public water suppliers begin to conserve water and urge customers to reduce water use.



- **Drought Warning:** Voluntary water conservation is intensified. Public water suppliers and industries update and implement local drought contingency plans. Local agencies make plans in case of emergency declaration.
- **Drought Emergency:** The Governor may declare emergency. The Disaster Preparedness Commission coordinates response. Mandatory local/county water restrictions may be imposed. Communities may need to tap alternative water sources to avoid depleting water supplies, protect public health and provide for essential uses.
- **Drought Disaster:** Disaster plans are implemented. Water use is further restricted. The Governor may declare disaster and request federal disaster assistance. Emergency legislation may be enacted. The state provides equipment and technical assistance to communities (NYS DEC n.d.)

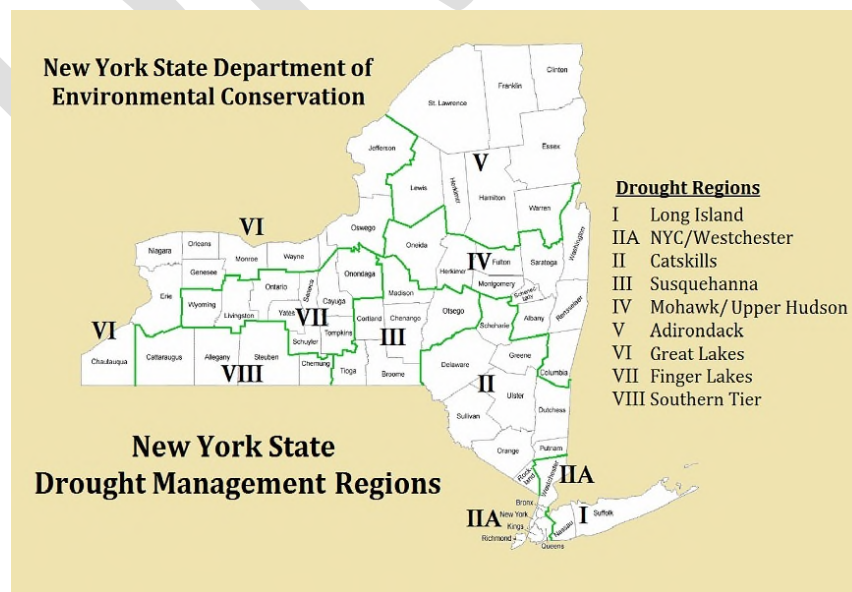
New York State uses two methodologies to determine the various drought stages. The Palmer Drought Index (PDI) is a commonly used drought indicator and is primarily based on soil conditions. These are typically the first indicators that a moisture deficit is present. These values range from -5 to +5 with positive values indicating wetter conditions and negative values representing drier conditions (NYS DHSES 2019).

The second methodology used by New York State was developed by the NYS DEC and is referred to as the State Drought Index (SDI). The SDI evaluates drought conditions on a more comprehensive basis by measuring whether numerous indicators reach dire thresholds. The data collected is compared against critical threshold values to show a normal or changeable drought condition. The indicators are weighted on a regional basis to reflect the unique circumstances of each drought management region (NYS DHSES 2019).

**Location**

New York State is divided into nine drought management regions based roughly on drainage basin and county lines. The NYS DEC monitors precipitation, lake and reservoir levels, stream flow, and groundwater level on a monthly basis in each region and more frequently during periods of drought. The NYS DEC uses this data to assess the condition of each region, which can range from “normal” to “drought disaster” (NYS DHSES 2019). Suffolk County is identified as NYS DEC Drought Management Region 1, the Long Island Drought Region (Figure 5.4.4-1).

**Figure 5.4.4-1. NYS DEC Drought Management Regions of New York State**



Source: NYS DEC n.d.b





When a drought occurs, the agricultural industry is most at risk in terms of economic impact and damage. In Suffolk County, agriculture is focused on the eastern end of the County. According to the 2017 Census of Agriculture, Suffolk County is home to over 550 farms, covering 30,000 acres. Roughly 40% of that land is irrigated (USDA 2017).

### Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with drought events throughout New York State and Suffolk County. 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.

### FEMA Major Disasters and Emergency Declarations

Between 1954 and 2020, FEMA declared that New York State experienced one drought-related disaster (DR) or emergency (EM) classified as one or a combination of the following disaster types: water shortage (DR-204, 1965) Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Suffolk County was declared as a disaster area for this drought-related event (FEMA 2020).

### USDA Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2014 and 2020, Suffolk County has been included in the following three USDA disaster declarations in relation to drought:

- S3775: 2014, Drought
- S3928: 2015, Drought
- S4045: 2016, Drought; Wind, high winds; Fire, wildfire; Heat, excessive heat, high temp; Insects (USDA 2020)

USDA causes of loss are another method that can be used to track the impact of drought on agriculture in Suffolk County. In 2014, losses to the corn crop from drought totaled \$5,203. In 2015, losses to the corn crop from drought totaled \$9,336.75. In 2016, losses to all other crops from drought totaled \$22,298. No other losses from drought were reported through 2020 (USDA 2020).

For the 2020 HMP, known drought events that have impacted Suffolk County between 2013 and 2020 are identified in Table 5.4.4-1. Events identified in the 2014 HMP are included in Appendix E.



Table 5.4.4-1. Drought Events Between 2013 and 2020

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Location	Description
September 10, 2013 – April 1, 2014	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from September 10 – October 21, 2013, D1 or “moderate drought” status from October 22, 2013 – January 20, 2014, and D0 or “abnormally dry” status from January 21 – March 31, 2014. The USDA declared agricultural disaster S3775 for drought in 2014.
July 1 – December 15, 2014	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from July 1 – September 22, 2014, D1 or “moderate drought” status from September 23 – December 1, 2014, and D0 or “abnormally dry” status from December 2 – December 15, 2014. Surveys reported that New York growers lost more than 70% of crops in 2014. The USDA declared agricultural disaster S3775 for drought in 2014.
May 5, 2015 – February 22, 2016	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from May 5 – May 18, 2015, D1 or “moderate drought” status from May 19, 2015 – January 25, 2016, and D0 or “abnormally dry” status from January 26 – February 22, 2016. The USDA declared agricultural disaster S3928 for drought in 2015.
April 19, 2016 – April 3, 2017	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from April 19 - June 20, 2016, D1 or “moderate drought” status from June 21 – July 25, 2016, D2 or “severe drought” status from July 26, 2016 – January 16, 2017, D1 or “moderate drought” status from January 17 – March 20, 2017, and D0 or “abnormally dry” status from March 21 - April 3, 2017. New York was placed under a drought watch on July 15, 2016. Shallow marshes impacted goose hunting in New York State. Drought strained water supplies in the County. Shallow wells throughout the Northeast began to dry. The Suffolk County Water Authority requested water conservation. New York dairy farmers struggled. The drought resulted in smaller but sweeter apples in the state. The USDA declared agricultural disaster S4045 for drought in 2016.
July 4 - October 30, 2017	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from July 4 – October 30, 2017.

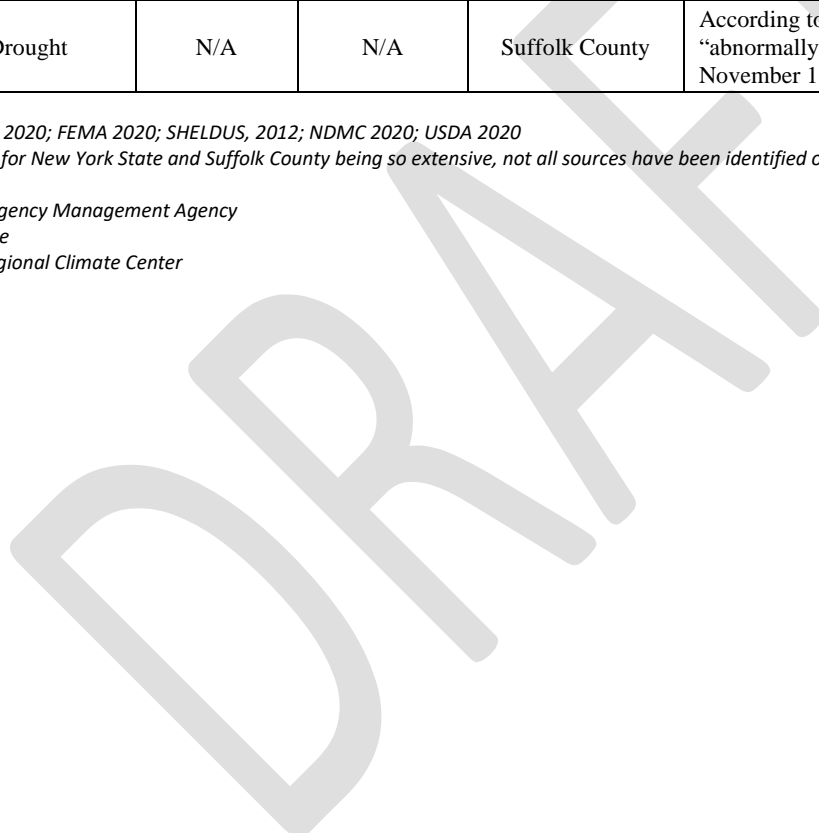


Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Location	Description
January 2 – February 12, 2017	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from January 2 – February 12, 2018. New York State was under a drought watch.
July 10 – October 1, 2018	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from July 10 – October 1, 2018. Lawns showed browning where no irrigation had taken place. Dry and hot conditions began to stress crops throughout the state.
September 24 – November 11, 2019	Drought	N/A	N/A	Suffolk County	According to the U.S. Drought Monitor, conditions held at a D0, or “abnormally dry” status across Suffolk County from September 24 – November 11, 2019.

Sources: NRCC, 2013; NOAA-NCEI 2020; FEMA 2020; SHELDUS, 2012; NDMC 2020; USDA 2020

Note: With drought documentation for New York State and Suffolk County being so extensive, not all sources have been identified or researched. Therefore, Table 5.4.4-1 may not include all events that have occurred in the County.

FEMA Federal Emergency Management Agency  
 N/A Not Applicable  
 NRCC Northeast Regional Climate Center





Probability of Future Occurrences

It is estimated that Suffolk County will continue to experience direct and indirect impacts of drought and its impacts on occasion, with the secondary effects causing potential disruption or damage to agricultural activities and creating shortages in water supply within communities.

In Section 5.3, the identified hazards of concern for Suffolk County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for drought in Suffolk County is considered ‘occasional’ (hazard event that occurs less frequently than once in 10 years) in Table 5.3-3).

Climate Change Impacts

According to the 2019 New York State HMP update, climate change increases the potential for drought and can make drought more severe and long-lasting. There is an expectation that droughts, specifically seasonal summer droughts, could become more common as a result of climate change. It is less clear what impacts climate change will have on “multi-year” droughts (NYS DHSES 2019).

In Region 4, it is estimated that temperatures will increase by 4.1°F to 5.7°F by the 2050s and 5.3°F to 8.8°F by the 2080s (middle range estimate, baseline of 54.6°F). Precipitation totals will increase between 4 and 11% by the 2050s and 5 to 13% by the 2080s (middle range estimate, baseline of 49.7 inches) (NYSERDA 2014). Table 5.4.4-2 displays the projected seasonal precipitation change for the New York City and Long Island ClimAID Region (NYSERDA 2011).

Table 5.4.4-2. Projected Seasonal Precipitation Change in Region 4, 2050s (% change)

Winter	Spring	Summer	Fall
0 to +15	0 to +10	-5 to +10	-5 to +10

Source: NYSERDA 2011

Extreme heat events are likely to increase throughout New York State, and short-duration warm season droughts will become more common. With the increase in temperatures, heat waves (defined as three or more consecutive days with maximum temperatures at or above 90 °F) will become more frequent and intense. Summer droughts are projected to increase under these conditions, affecting water supply, agriculture, ecosystems, and energy projects (NYSERDA 2014).

By the end of the 21<sup>st</sup> century, the number of droughts is likely to increase, as the effect of higher temperatures on evaporation is likely to outweigh the increase in precipitation. Droughts in the northeast United States have been associated with local and remote modes of multi-year ocean-atmosphere variability that are unpredictable and may change with climate change. Changes in distribution of precipitation throughout the year and in timing of snowmelt could increase frequency of droughts (NYSERDA 2011).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following discusses Suffolk County’s vulnerability, in a qualitative nature, to the drought hazard.

Impact on Life, Health and Safety

The entire population of Suffolk County is exposed to drought events (population of 1,488,179 people, according to the 2014-2018 American Community Survey population estimates). Drought conditions can cause a shortage



of potable water for human consumption, both in quantity and quality. A decrease in available water may also impact power generation and availability to residents.

Public health impacts may include an increase in heat-related illnesses, waterborne illnesses, recreational risks, limited food availability, and reduced living conditions. Vulnerable populations could be particularly susceptible to the drought hazard and cascading impacts due to age, health conditions, and limited ability to mobilize to shelter, cooling and medical resources. Other possible impacts to health due to drought include increased recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term (CDC 2020). Furthermore, the Centers for Disease Control and Prevention’s (CDC) 2016 Social Vulnerability Index (SVI) ranks U.S. Census tracts on socioeconomic status, household composition and disability, minority status and language, and housing and transportation. Suffolk County’s overall score is 0.2318, indicating that its communities have low vulnerability (CDC 2016). The CDC SVI map shows that vulnerability is fairly distributed throughout the County but is generally concentrated in the interior and southern coastal jurisdictions.

There are 39 Community Water Supplies and 254 Non-Community Water Supplies in Suffolk County (Suffolk County 2020). The Suffolk County Water Authority covers the majority of the County. Additionally, there are more than 1,100 active public water supply wells in Suffolk County and private wells provide water resources to approximately 50,000 homes in the County (Suffolk County 2020). According to the Long Island Water Districts ArcGIS portal, there are 10 major water districts in Suffolk County:

- Greenport Water
- Ocean Bay Park Water Company
- Shelter Islands Heights
- Village of Saltaire
- Suffolk County Water Authority
- Greenlawn Water District
- Dix Hills Water District
- Hampton Bays Water District
- Riverhead Water District
- South Huntington Water District (Esri n.d.)

Projections indicate that water demand will continue to increase for the communities in Suffolk County, which could become strained during a drought event. Surface water supplies are affected more quickly during droughts than groundwater sources; however, groundwater supplies generally take longer to recover. Diverse water supplies could help to protect and mitigate against the impacts of drought events.

#### Impact on General Building Stock

No structures are anticipated to be directly affected by a drought event. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. The Central Pine Barrens is located within three of the County’s jurisdictions (Towns of Brookhaven, Riverhead, and Southampton). The Pine Barrens is a large forested area of approximately 105,000 acres and has an extensive history and ongoing risk of frequent wildfires (Central Pine Barrens Joint Planning & Policy Commission 2020).

Risk to life and property is greatest in those areas where forested areas such as the Central Pine Barrens adjoin urbanized areas (high density residential, commercial and industrial) also known as the wildfire urban interface (WUI). Therefore, all assets in and adjacent to, the WUI zone, including population, structures, critical facilities,



lifelines, and businesses are considered vulnerable to wildfire. Refer to Section 5.4.16 for the Wildfire risk assessment.

Impact on Critical Facilities

Water supply facilities may be affected by short supplies of water. As mentioned, drought events generally do not impact buildings; however, droughts have the potential to impact agriculture-related facilities and critical facilities that are associated with potable water supplies. Also, those critical facilities in and adjacent to the WUI zone around the Central Pine Barrens are considered vulnerable to wildfire. Refer to Section 5.4.16 for the Wildfire risk assessment.

Impact on the Economy

Drought can produce a range of impacts that span many economic sectors and can reach beyond an area experiencing physical drought. As previously discussed, water withdrawals are not only used for potable water but for use in the commercial/industrial/mining sectors and power generation. When a state of water emergency is declared by the State (when a potential or actual water shortage endangers the public health, safety and welfare), the New York Department of Environmental Conservation may impose mandatory water restrictions and require specific actions to be taken by water suppliers.

A prolonged drought can have serious direct and indirect economic impacts on a community. As noted in the 2019 New York State Hazard Mitigation Plan, Suffolk County does not have reported damages from drought events (NYS DHSES 2019). However, economic impacts that could occur include the following:

- Decreased land prices
- Loss to industries directly dependent on agricultural production (e.g., machinery and
- Fertilizer manufacturers, food processors, dairies, etc.)
- Unemployment from drought-related declines in production
- Strain on financial institutions (foreclosures, more credit risk, capital shortfalls)
- Revenue losses to Federal, State, and Local governments (from reduced tax base)
- Reduction of economic development
- Fewer agricultural producers (due to bankruptcies, new occupations)
- Rural population loss.

Based on the 2017 Census of Agriculture, there were 560 farms in Suffolk County, with 30,032 acres of total land in farms. This is a -4.3% change in the number of farms reported since 2007. The average farm size was 54 acres. Table 5.4.4-3 shows the acreage of agricultural land exposed to the drought hazard.

Table 5.4.4-3. Agricultural Land in Suffolk County in 2017

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Harvested Cropland (acres)	Total Irrigated Cropland (acres)
560	30,032	23,139	19,486	12,121

Source: USDA 2017

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. For example, wineries contribute to local tourism in the County, attracting approximately 1.3 million visitors annually (Suffolk County 2013). Droughts could not





only impact the ability of wineries to produce goods, but also to provide an aesthetically pleasing experience for customers. In addition, droughts in another area could impact the food supply/price of food for residents in the County.

### **Impact on the Environment**

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Drought can impact the environment because it can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (NOAA 2020). Droughts will also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness.

### **Cascading Impacts to Other Hazards**

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Drought may trigger wildfires in the County. As discussed in earlier sections, drought can lead to increasing temperatures and evaporation of moisture, which are ideal dry conditions for wildfire events to occur. Dry, hot, and windy weather combined with dry vegetation is more susceptible to sparking wildfires when met with a spark created by humans or natural events, such as lightning (National Integrated Drought Information System 2020).

Drought can also exacerbate the shrinking of expansive soils, which is a soil type dependent on the amount of available water. Periods of drought will cause these soils to dry up, shrink, and potentially create cracks. This will ultimately affect structures built on and surrounding these expansive soil hazard areas.

### **Future Changes That May Impact Vulnerability**

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Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Any areas of growth could be potentially impacted by droughts because the entire planning area is exposed and vulnerable.

### **Projected Development**

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As discussed in Section 4, areas targeted for future growth and development have been identified across Suffolk County. Future growth could impact the amount of potable water available due to a drain on the available water resources. Other areas that could be impacted include agriculture and recreational facilities such as golf courses, farms, and nurseries. New development sites will not be exempt from following restrictions placed on the County during a period of drought. Therefore, understanding the source water and supplier for new development sites gives insight about current restrictions and potential risk for future drought events. The County areas targeted for potential future growth and development in the next five (5) years have been identified across the County at the municipal level. Refer to the jurisdictional annexes in Volume II of this HMP.

### **Projected Changes in Population**

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According to the Suffolk County Economic Development and Planning Department's February 2017 Annual Report update, the population of the County is growing. The report indicates that slow population growth is expected to continue in the future, but it is important to note that the population is aging (Suffolk County 2017). Since vulnerable populations (i.e., persons over 65) are increasing throughout the County, it can be assumed that the number of persons at greater risk of impacts from drought is increasing. Additionally, the 2015 Suffolk County Comprehensive Water Resources Management Plan outlines projected water demand for the towns in



the County (refer to Table 5.4.4-4). This plan projects a 17.7% increase in water needs for only the towns, which suggests that other areas throughout the County will also see an increase in water demand by 2030.

Table 5.4.4-4. Projected Water Demand in Suffolk County

Jurisdiction	2013 Pumpage (mgd)	Projected 2030 Pumpage (mgd)
Babylon (T)	27.6	29.1
Brookhaven (T)	65.7	81.9
East Hampton (T)	6.4	11.5
Huntington (T)	38.8	41.4
Islip (T)	41.6	43.8
Riverhead (T)	7.6	12.7
Shelter Island (T)	0.1	1.8
Smithtown (T)	22.7	24.9
Southampton (T)	15	17.2
Southold (T)	2.8	4.6
<b>Total</b>	<b>228.3</b>	<b>268.8</b>

Source: Suffolk County 2015

Furthermore, visitors and tourists of the County will continue to occur, driving potential growth throughout the County and the amenities provided by the municipalities. This may place more strain on the available water supply to support a growing population and a potential increase in tourists.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures. Additionally, the State is projected to experience more frequent droughts which may affect the availability of water supplies, primarily placing an increased stress on the population and their available potable water. A decrease in water supply, or increase in water supply demand, may increase the County’s vulnerability to structural fire and wildfire events. Critical water-related service sectors may need to adjust management practices and actively manage resources to accommodate for future changes.

Climate change is beginning to affect both people and resources in New York State, and these impacts are

Droughts can cause deficits in surface and groundwater used for drinking water. The New York State Water Resources Institute at Cornell University conducted a vulnerability assessment of drinking water supplies and climate change. To assess water supplies in New York State, it was assumed that long-term average supply will remain the same, but the duration and/or frequency of dry periods may increase. Both types of water supplies, surface water and groundwater, were divided into three categories: sensitive to short droughts (two to three months), sensitive to moderate and longer droughts (greater than six months), and relatively sensitive to any droughts. Major reservoir systems are presumed to have moderate sensitivity to drought because there is a likelihood of decreases in summer and fall water availability (NYSERDA 2011). The greatest likelihood of future water shortages is likely to occur on small water systems.



### Vulnerability Change Since the 2014 HMP

When examining the change in the County's vulnerability to drought events from the 2014 HMP to this update, it is important to look at each entity that is exposed and vulnerable. Updated population data was referenced to determine the number of persons at risk of drought events compared to 2010 census data used in the 2014 HMP (i.e., American Community Survey 2018 5-Year Estimates). Furthermore, updated 2017 agricultural census data was used to assess the change in the number of farms operated throughout the County instead of the 2007 data used in the 2014 HMP.

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