

MASSACHUSETTS WATER RESOURCES COMMISSION

JUNE

2021

# HYDROLOGIC CONDITIONS IN MASSACHUSETTS



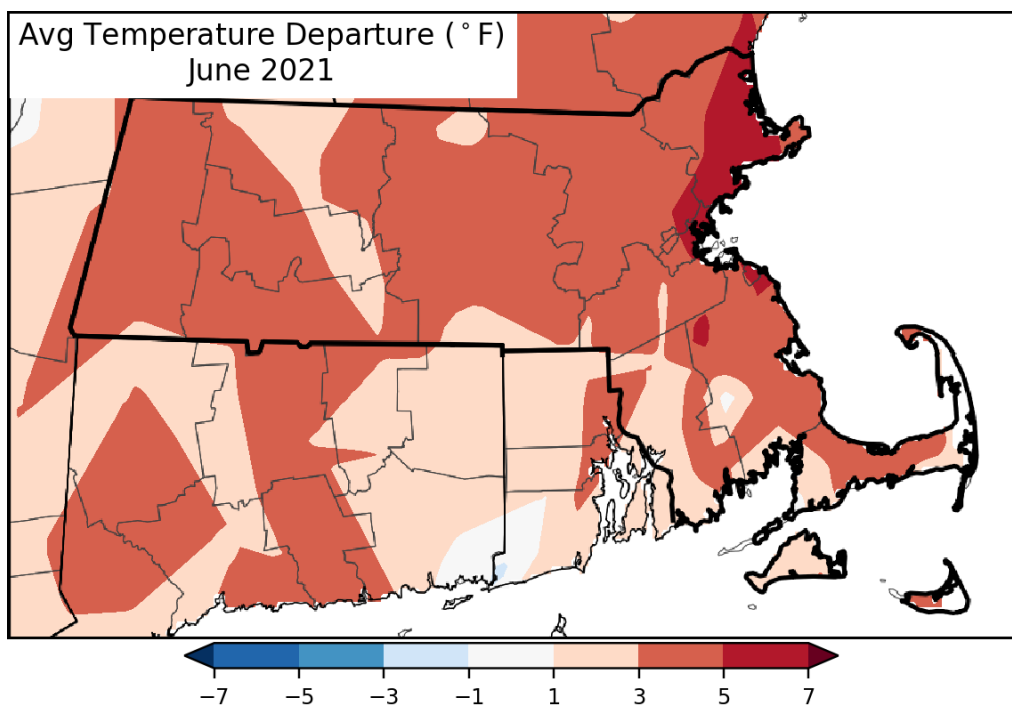
The Commonwealth of Massachusetts  
Charles D. Baker, Governor

Kathleen A. Theoharides, Secretary, Executive Office of Energy and Environmental Affairs

## JUNE 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were above normal.
- Monthly regional precipitation was below normal to normal. The June SPI Index Severity is at Level 1 for Cape Cod and the Islands Regions and Level 2 for the CT River Valley and Central Regions.
- Monthly median streamflows were above the 30th percentile for all parts of the state except for the CT River Valley, which is at Index Severity Level 1, and the Cape Cod Region, which is at Index Severity Level 3.
- Groundwater percentiles of individual wells varied across most regions. The Cape Cod Region is at Index Severity Level 1.
- Lakes & Impoundments levels were mostly above 30th percentile levels. The Western Region is low for this time of year.
- NOAA's July outlook projects above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.
- NOAA's 3-month outlook projects above-normal temperatures and above-normal precipitation.
- Appendices I and II provide additional precipitation data and information on the Massachusetts Drought Management Plan (DMP), respectively.

### TEMPERATURE

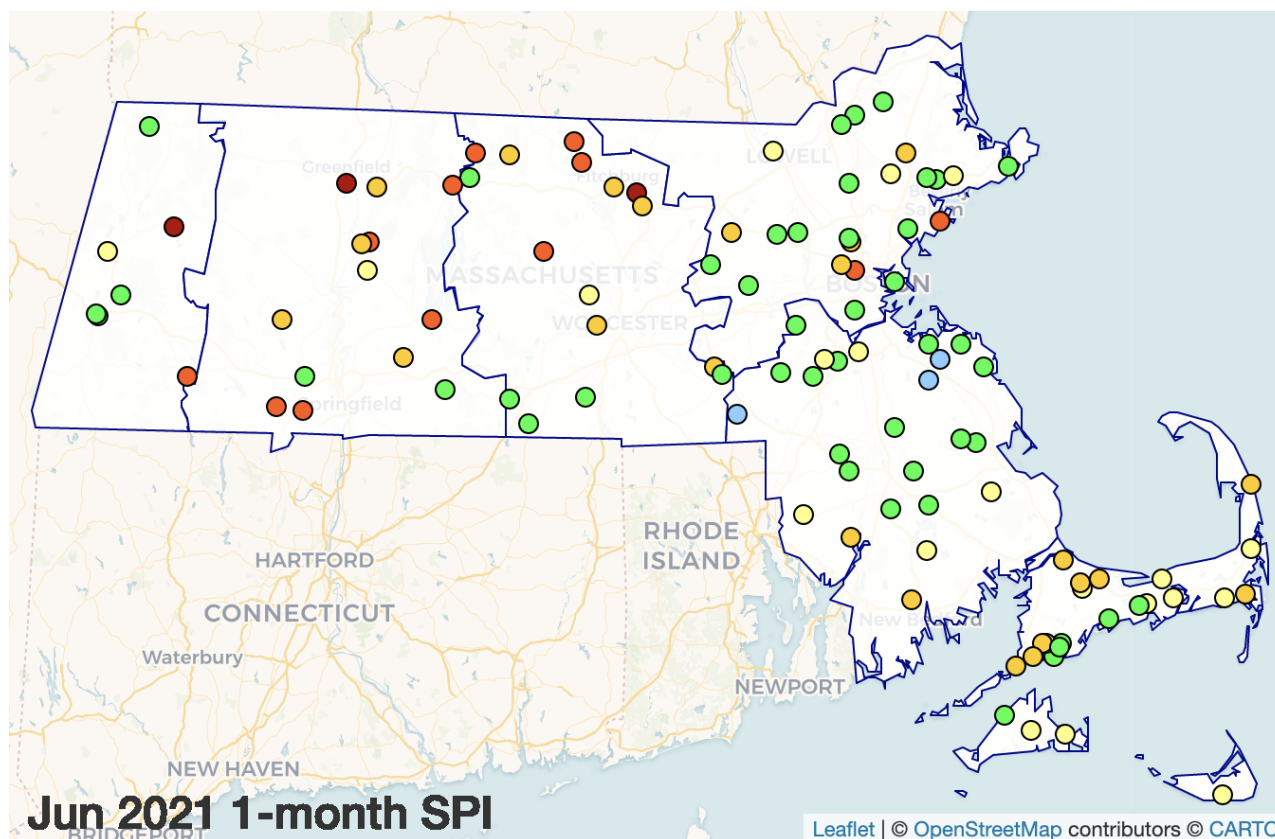


Monthly average temperatures were above normal for most of the state. According to the Northeast Regional Climate Center, Boston experienced its hottest June on record (6.4°F above normal) and Worcester experienced its second hottest June on record (4.8°F above normal).

<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

## PRECIPITATION

Precipitation varied across the state and within some regions. Precipitation was on the lower end of normal in the Western, Northeast, and Southeast Regions with most stations above the 30th percentile. The CT River Valley, Central, Cape Cod, and the Islands Regions received overall below normal amounts of rain and had most stations below the 30th percentile. Appendix I provides additional details for precipitation data, including longer look-back periods.



|                        |                       |                       |                        |                       |
|------------------------|-----------------------|-----------------------|------------------------|-----------------------|
| ● $\geq 0$ to $\leq 2$ | ● $> 2$ to $\leq 10$  | ● $> 10$ to $\leq 20$ | ● $> 20$ to $\leq 30$  | ● $> 30$ to $\leq 70$ |
| ● $> 70$ to $\leq 80$  | ● $> 80$ to $\leq 90$ | ● $> 90$ to $\leq 98$ | ● $> 98$ to $\leq 100$ |                       |

| REGION          | NUMBER OF SITES REPORTING | JUNE MONTHLY AVERAGE (IN) | DEPARTURE FROM HISTORICAL (IN) | SPI* PERCENTILE 1-MONTH | SPI PERCENTILE 3-MONTH | SPI PERCENTILE 6-MONTH |
|-----------------|---------------------------|---------------------------|--------------------------------|-------------------------|------------------------|------------------------|
| WESTERN         | 7                         | 3.35                      | -1.13                          | 35                      | 60                     | 36                     |
| CT RIVER VALLEY | 13                        | 2.09                      | -1.99                          | 11                      | 46                     | 23                     |
| CENTRAL         | 16                        | 2.00                      | -1.98                          | 16                      | 55                     | 27                     |
| NORTHEAST       | 24                        | 2.60                      | -1.00                          | 38                      | 72                     | 44                     |
| SOUTHEAST       | 25                        | 3.16                      | -0.60                          | 48                      | 57                     | 33                     |
| CAPE COD        | 20                        | 1.82                      | -1.61                          | 22                      | 40                     | 19                     |
| ISLANDS         | 4                         | 1.61                      | -1.38                          | 29                      | 44                     | 25                     |

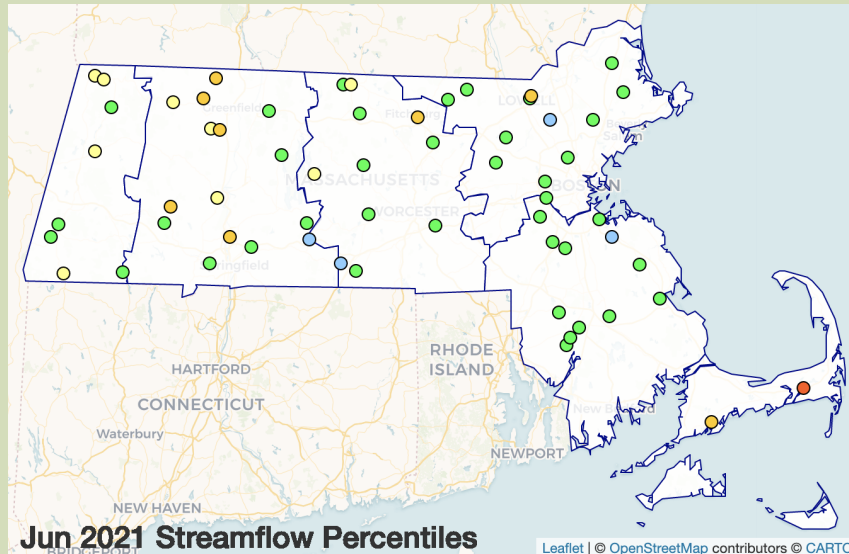
| DMP Index Severity Levels |   |   |   |
|---------------------------|---|---|---|
| 1                         | 2 | 3 | 4 |

\*SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation, in standard deviations, from long-term precipitation averages.

## STREAMFLOW

Rain at the end of May with some June precipitation kept regional medians above the 30th percentile except for the CT River Valley Region, which is at Index Severity Level 1, and the Cape Cod Region which is at Index Severity Level 3.

### Median Monthly Streamflow Percentiles



Jun 2021 Streamflow Percentiles

Leaflet | © OpenStreetMap contributors © CARTO

|                        |                       |                       |                        |                       |
|------------------------|-----------------------|-----------------------|------------------------|-----------------------|
| ● $\geq 0$ to $\leq 2$ | ● $> 2$ to $\leq 10$  | ● $> 10$ to $\leq 20$ | ● $> 20$ to $\leq 30$  | ● $> 30$ to $\leq 70$ |
| ● $> 70$ to $\leq 80$  | ● $> 80$ to $\leq 90$ | ● $> 90$ to $\leq 98$ | ● $> 98$ to $\leq 100$ |                       |

| REGION          | TOTAL GAGES REPORTING FOR JUN | $\geq 0$ TO $\leq 2$ PERCENTILE | $> 2$ TO $\leq 10$ PERCENTILE | $> 10$ TO $\leq 20$ PERCENTILE | $> 20$ TO $\leq 30$ PERCENTILE | $> 90$ PERCENTILE | MEDIAN OF INDIVIDUAL GAGE PERCENTILES |
|-----------------|-------------------------------|---------------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------|---------------------------------------|
| WESTERN         | 8                             | 0                               | 0                             | 0                              | 4                              | 0                 | 33                                    |
| CT RIVER VALLEY | 15                            | 0                               | 0                             | 5                              | 3                              | 0                 | 28                                    |
| CENTRAL         | 11                            | 0                               | 0                             | 1                              | 2                              | 0                 | 39                                    |
| NORTHEAST       | 13                            | 0                               | 0                             | 1                              | 0                              | 0                 | 55                                    |
| SOUTHEAST       | 12                            | 0                               | 0                             | 0                              | 0                              | 0                 | 56                                    |
| CAPE COD        | 2                             | 0                               | 1                             | 1                              | 0                              | 0                 | 10                                    |

**Note:** Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

| DMP Index Severity Levels |   |   |   |
|---------------------------|---|---|---|
| 1                         | 2 | 3 | 4 |

### Time Series of the Percent of Gages at Their Respective Percentile Flows for Average Daily Streamflows Compared to Historical Values

Streamflow is monitored by the Commonwealth of Massachusetts and United States Geological Survey cooperative stream gaging program.

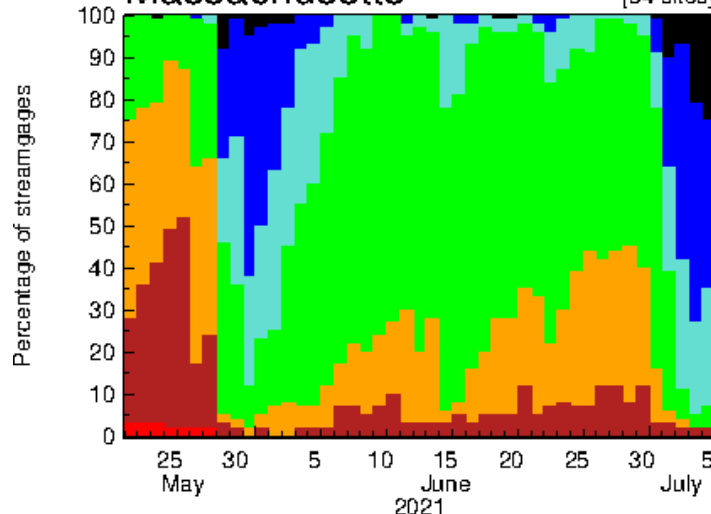
<https://waterdata.usgs.gov/nwis/sw>

| Explanation - Percentile classes |                   |              |        |              |                   |      |         |
|----------------------------------|-------------------|--------------|--------|--------------|-------------------|------|---------|
| Low                              | $< 10$            | 10-24        | 25-75  | 76-90        | $> 90$            | High | No Data |
|                                  | Much below normal | Below normal | Normal | Above normal | Much above normal |      |         |

### Last 45 Days

#### Massachusetts

[54 sites]

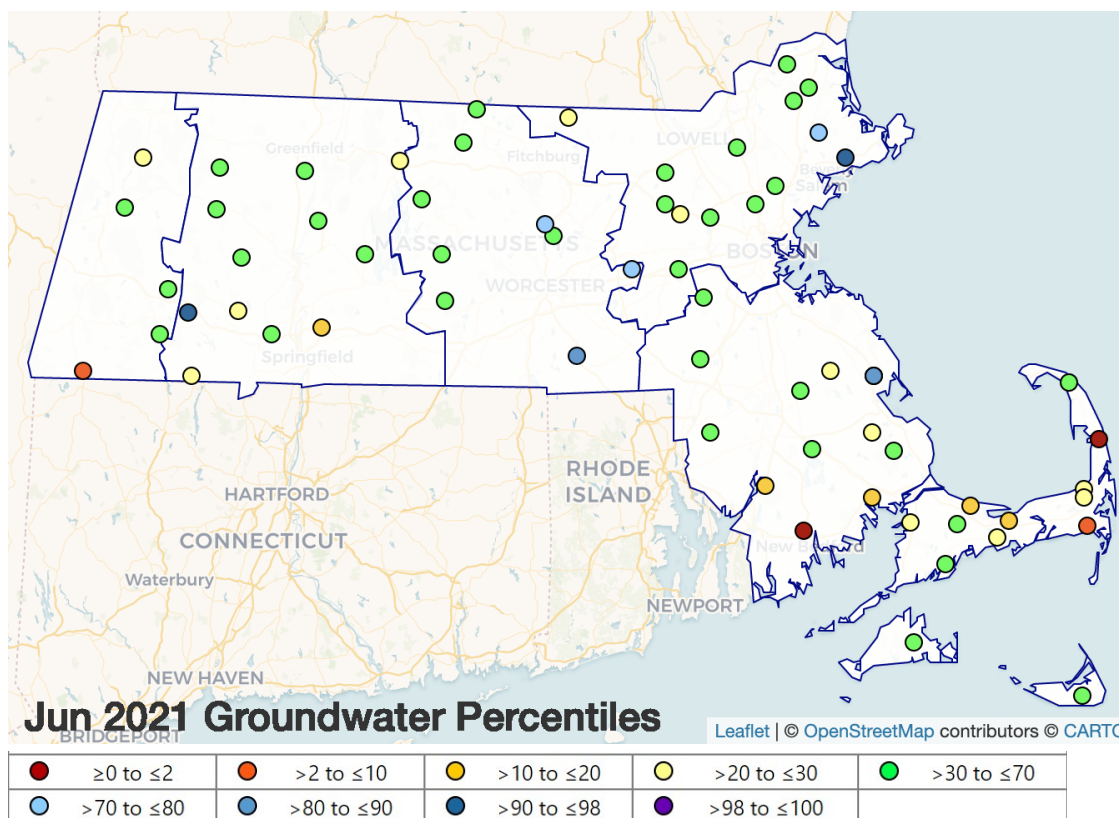




# GROUNDWATER

Groundwater percentiles varied across the state and within some regions. The median of individual well percentiles showed improvement in most regions from May. The Cape Cod Region didn't show much improvement and remains at Index Severity Level 1.

## End of Month Groundwater Compared to Historical in the Climate Response Network



| REGION          | TOTAL WELLS REPORTING FOR JUN | $\geq 0$ TO $\leq 2$ PERCENTILE | $> 2$ TO $\leq 10$ PERCENTILE | $> 10$ TO $\leq 20$ PERCENTILE | $> 20$ TO $\leq 30$ PERCENTILE | $> 90$ PERCENTILE | MEDIAN OF INDIVIDUAL WELL PERCENTILES |
|-----------------|-------------------------------|---------------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------|---------------------------------------|
| WESTERN         | 5                             | 0                               | 1                             | 0                              | 1                              | 0                 | 43                                    |
| CT RIVER VALLEY | 12                            | 0                               | 0                             | 1                              | 3                              | 1                 | 43                                    |
| CENTRAL         | 9                             | 0                               | 0                             | 0                              | 0                              | 0                 | 61                                    |
| NORTHEAST       | 14                            | 0                               | 0                             | 0                              | 2                              | 1                 | 61                                    |
| SOUTHEAST       | 13                            | 1                               | 0                             | 2                              | 2                              | 0                 | 36                                    |
| CAPE COD        | 11                            | 1                               | 1                             | 2                              | 4                              | 0                 | 23                                    |
| ISLANDS         | 2                             | 0                               | 0                             | 0                              | 0                              | 0                 | 39                                    |

| DMP Index Severity Levels |   |   |   |
|---------------------------|---|---|---|
| 1                         | 2 | 3 | 4 |

## LAKE AND IMPOUNDMENTS

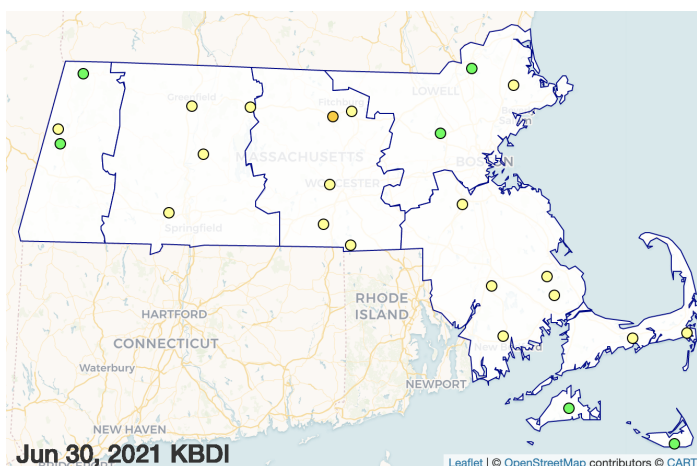
| REGION          | TOTAL REPORTING | MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL |
|-----------------|-----------------|--|
| WESTERN         | 2               | 97% & 95%  |
| CT RIVER VALLEY | 2               | 35   |
| CENTRAL         | 2               | 43   |
| NORTHEAST       | 6               | 37   |
| SOUTHEAST       | 1               | 64   |
| CAPE COD        | 1               | 11   |

DMP Index Severity Levels do not necessarily reflect water supply status.

At the end of June, most lakes and impoundments were greater than their 30th percentile value. In the Western Region, one system was on the low side of normal at approximately 97% full, and the other was low for this time of year at 95% full; the overall regional Index Severity Level is 2, but this doesn't necessarily reflect water supply status. The pond on Cape Cod is at the 11th percentile.

| DMP Index Severity Levels |   |   |   |
|---------------------------|---|---|---|
| 1                         | 2 | 3 | 4 |

## KEETCH BYRAM DROUGHT INDEX (KBDI)



| Point Values - KBDI Range |                |                |                |              |
|---------------------------|----------------|----------------|----------------|--------------|
| ● ≥700 to ≤800            | ● ≥600 to <700 | ● ≥400 to <600 | ● ≥200 to <400 | ● ≥0 to <200 |

| REGION          | NUMBER OF SITES REPORTING | HIGHEST OF SITE VALUES |
|-----------------|---------------------------|------------------------|
| WESTERN         | 3                         | 231                    |
| CT RIVER VALLEY | 4                         | 351                    |
| CENTRAL         | 5                         | 417                    |
| NORTHEAST       | 3                         | 360                    |
| SOUTHEAST       | 5                         | 281                    |
| CAPE COD        | 2                         | 219                    |
| ISLANDS         | 2                         | 184                    |

| DMP Index Severity Levels |   |   |   |
|---------------------------|---|---|---|
| 1                         | 2 | 3 | 4 |

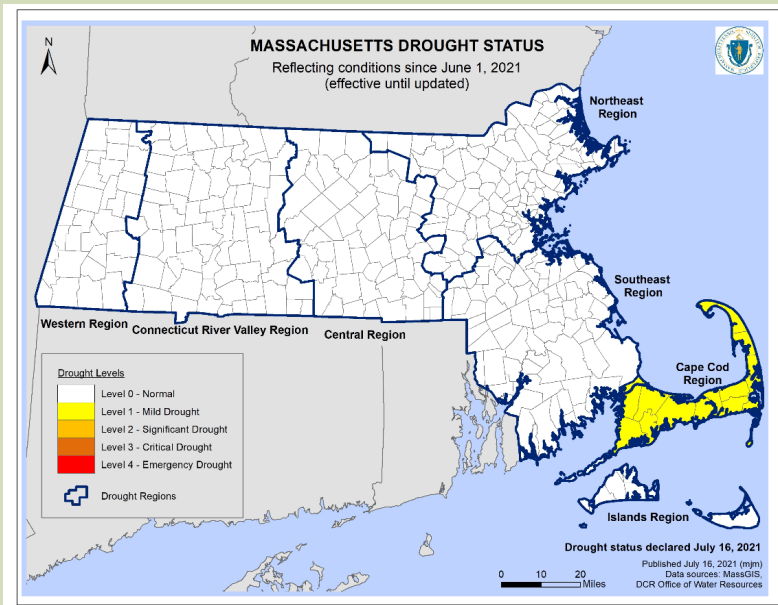
## CROP MOISTURE INDEX (CMI)

CMI weekly values for the period ending June 26th ranged from -0.07 to 0.00 (Slightly Dry/Favorably Moist) across the state. All regions are at Index Severity Level 0.

## SNOWFALL

Snowfall is provided seasonally.

# DROUGHT CONDITIONS AND FORECASTS



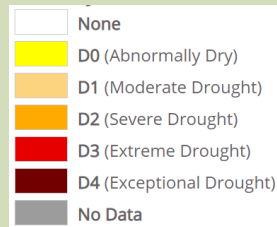
## Massachusetts Drought Status

In effect from June 1, 2021 until updated, on July 19, 2021 Massachusetts Energy and Environmental Affairs (EEA) Secretary Kathleen Theoharides declared a Level 1-Mild Drought in the Cape Cod Region and Level 0-Normal Conditions in the Western, Connecticut River Valley, Central, Northeast, Southeast, and Islands Regions.

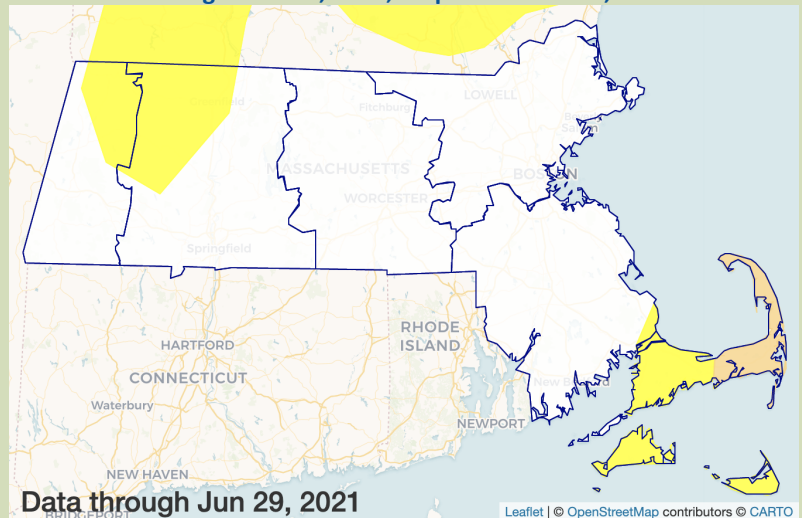
## U.S. Drought Monitor (USDM)

At the end of June, the USDM showed an area of D1 across the mid to outer Cape, and areas of D0 from the mid to upper Cape, the Islands, and northern portions of the Western and CT River Valley Regions.

June started with D0 on the outer Cape and Nantucket and during the first part of the June the USDM expanded D0 on the Cape and Islands. In mid-June D1 was introduced on the outer Cape and D0 was introduced in northern portions of the Western and CT River Valley



Data through June 29, 2021; map released Jul 1, 2021



## NOAA Climate Prediction Center

### Temperature and Precipitation Outlook

**July:** The outlook released 6/30 shows a 60-70% probability of above-normal temperatures and equal chances of below-normal, normal, or above-normal precipitation.

**July through September:** The outlook released 6/17 shows a 60-70% probability of above-normal temperatures, and a 40-50% probability of above-normal precipitation. <https://www.cpc.ncep.noaa.gov/>

### Monthly and Seasonal Drought Outlook

The monthly outlook for July released on 6/30 shows no drought development in the state and “drought removal likely” for the area of D1 on the mid to outer Cape. The seasonal outlook released on 6/17 and valid through September shows no drought development in the state and “drought removal likely” for the area of D1 on the mid to outer Cape.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Additional information, previous reports, and drought management information can be found at: <https://www.mass.gov/water-data-tracking>

DCR Precipitation Reports are available at <https://www.mass.gov/service-details/precipitation-composite-estimates-1> and <https://www.mass.gov/service-details/standardized-precipitation-index-spi-0>

## APPENDIX I – ADDITIONAL PRECIPITATION DATA

### Standardized Precipitation Index June 2021 (expressed as percentiles)

| REGION          | NUMBER OF SITES | 1-mo* | 2-mo | 3-mo | 6-mo | 9-mo | 12-mo | 24-mo | 36-mo* |
|-----------------|-----------------|-------|------|------|------|------|-------|-------|--------|
| WESTERN         | 7               | 35    | 52   | 60   | 36   | 40   | 29    | 35    | 72     |
| CT RIVER VALLEY | 13              | 11    | 34   | 46   | 23   | 46   | 37    | 27    | 80     |
| CENTRAL         | 16              | 16    | 50   | 55   | 27   | 58   | 42    | 46    | 88     |
| NORTHEAST       | 24              | 38    | 63   | 72   | 44   | 57   | 43    | 49    | 80     |
| SOUTHEAST       | 25              | 48    | 62   | 57   | 33   | 54   | 30    | 45    | 81     |
| CAPE COD        | 20              | 22    | 47   | 40   | 19   | 31   | 10    | 24    | 46     |
| ISLANDS         | 4               | 29    | 48   | 44   | 25   | 40   | 11    | 37    | 75     |

| DMP Index Severity Levels |   |   |   |
|---------------------------|---|---|---|
| 1                         | 2 | 3 | 4 |

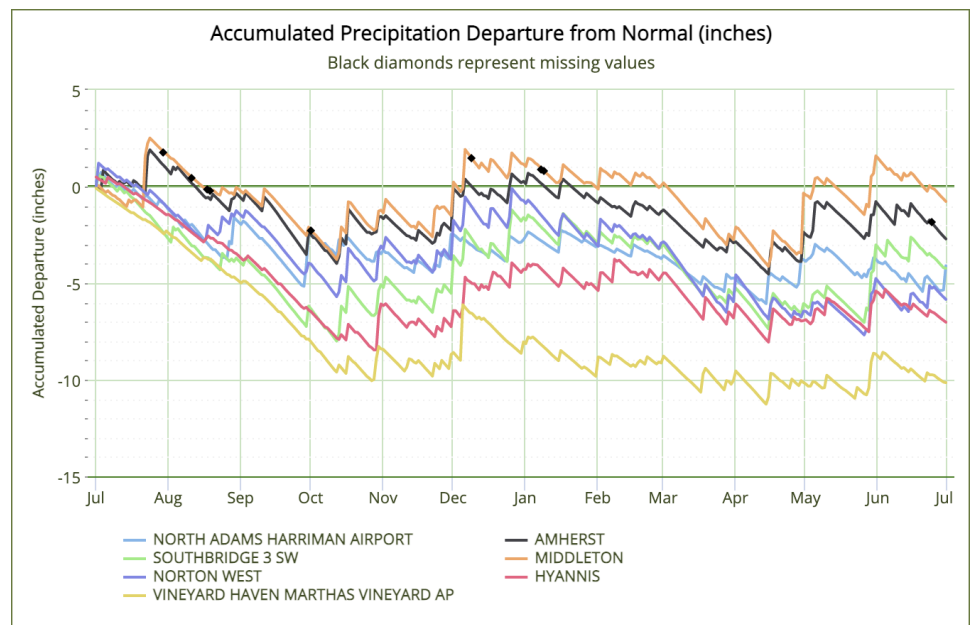
### Percent of Average Historical Precipitation June 2021

| REGION          | NUMBER OF SITES | HISTORICAL AVERAGE | JUNE AVERAGE (IN) | DEPARTURE FROM HISTORICAL AVERAGE (IN) | PERCENT OF NORMAL |
|-----------------|-----------------|--------------------|-------------------|--|-------------------|
| WESTERN         | 7               | 4.48               | 3.35              | -1.13                                  | 75%               |
| CT RIVER VALLEY | 13              | 4.08               | 2.09              | -1.99                                  | 51%               |
| CENTRAL         | 16              | 3.98               | 2.00              | -1.98                                  | 50%               |
| NORTHEAST       | 24              | 3.60               | 2.60              | -1.00                                  | 72%               |
| SOUTHEAST       | 25              | 3.76               | 3.16              | -0.60                                  | 84%               |
| CAPE COD        | 20              | 3.43               | 1.82              | -1.61                                  | 53%               |
| ISLANDS         | 4               | 2.99               | 1.61              | -1.38                                  | 54%               |

**Accumulated Precipitation Departure** shows the previous 12 months (July 2020 — June 2021).

Graph does not consider starting condition's wetness/dryness; does not show summer heat waves with high evapotranspiration; only one station per Drought Region is shown.

<https://xmacis.rcc-acis.org/>





## APPENDIX II – DROUGHT MANAGEMENT PLAN INFORMATION

The Massachusetts Drought Management Plan (DMP) can be found at <https://www.mass.gov/doc/massachusetts-drought-management-plan/download>. The document provides details on the Drought Indices, how Drought Levels are determined, and actions associated with each drought level.

### Drought Levels (Section 3.1 of the DMP)

- Level 0** Normal
- Level 1** Mild Drought
- Level 2** Significant Drought
- Level 3** Critical Drought
- Level 4** Emergency Drought

### Index Severity Levels (Section 3.4 of the DMP)

| SEVERITY LEVEL | STANDARDIZED PRECIPITATION INDEX (SPI) | STREAMFLOW | LAKES AND IMPOUNDMENTS | GROUNDWATER | KEETCH-BRYAM DROUGHT INDEX (KBDI) | CROP MOISTURE INDEX      |
|----------------|--|------------|------------------------|-------------|-----------------------------------|--------------------------|
| 0              | > 30th percentile                      |            |                        |             | < 200                             | > -1.0                   |
| 1              | $\leq 30$ and $> 20$                   |            |                        |             | 200-400                           | $\leq -1.0$ and $> -2.0$ |
| 2              | $\leq 20$ and $> 10$                   |            |                        |             | 400-600                           | $\leq -2.0$ and $> -3.0$ |
| 3              | $\leq 10$ and $> 2$                    |            |                        |             | 600-700                           | $\leq -3.0$ and $> -4.0$ |
| 4              | $\leq 2$                               |            |                        |             | 700-800                           | $\leq -4.0$              |

