

# MASSACHUSETTS WATER RESOURCES COMMISSION

OCTOBER  
**2021**    **HYDROLOGIC CONDITIONS  
IN MASSACHUSETTS**



The Commonwealth of Massachusetts  
Charles D. Baker, Governor

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

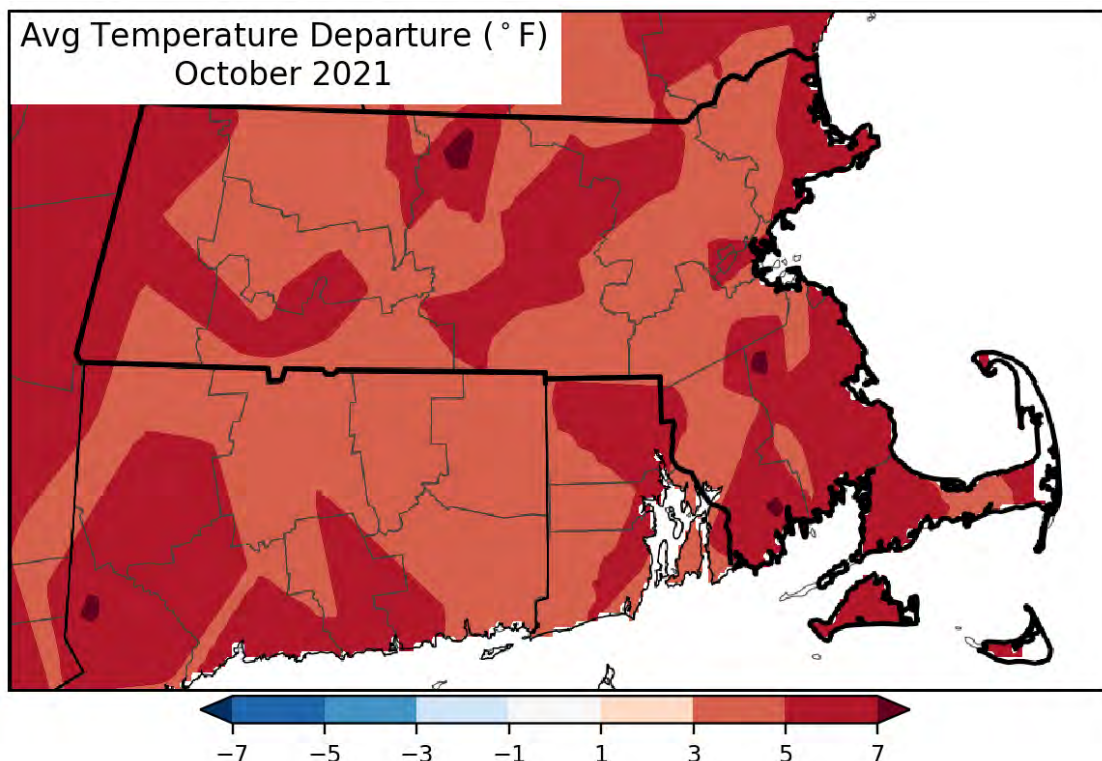
## OCTOBER 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were above normal.
- Monthly precipitation was above normal. The 1-month SPI Index Severity is at Level 0 for all regions.
- Streamflow was above normal across the state except for the Cape Cod region, which was normal. All regions are at Index Severity Level 0.
- Groundwater levels were high except for Nantucket and for a few wells that continue to recover on Cape Cod. All regions are at Index Severity Level 0.
- Lakes & Impoundments were normal to much above normal.
- NOAA's November outlook shows chances leaning towards above-normal temperatures and above-normal precipitation.
- NOAA's 3-month outlook shows chances leaning towards 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. According to the Northeast Regional Climate Center, the monthly average temperature at the Boston major climate site was 5.1° F above normal making it the 4<sup>th</sup> warmest October on record, and the monthly average temperature was 5.1° F above normal at the Worcester major climate site making it the 9th warmest October on record.

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

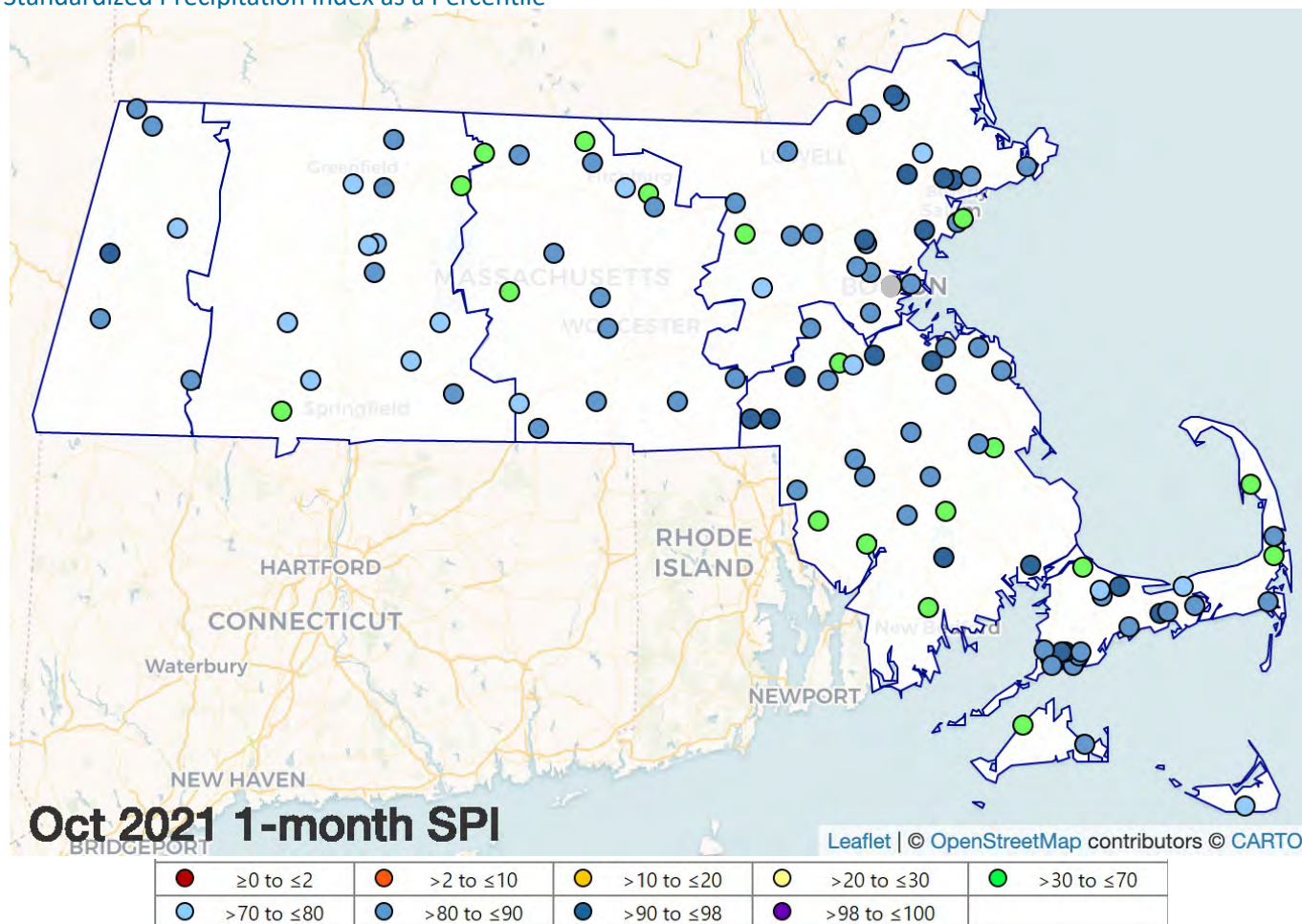




## PRECIPITATION

October precipitation was above normal throughout most of the state. The October 1-month SPI Index Severity is at Level 0 for all regions. Storms at the beginning and end of the month brought heavy rain to much of the state with a relatively dry period in between. A nor'easter October 26-28 not only brought heavy rain but also strong and damaging winds to Massachusetts, especially the Southeastern, Cape, and Islands regions. Appendix I provides additional details for precipitation data, including longer look-back periods.

### Standardized Precipitation Index as a Percentile



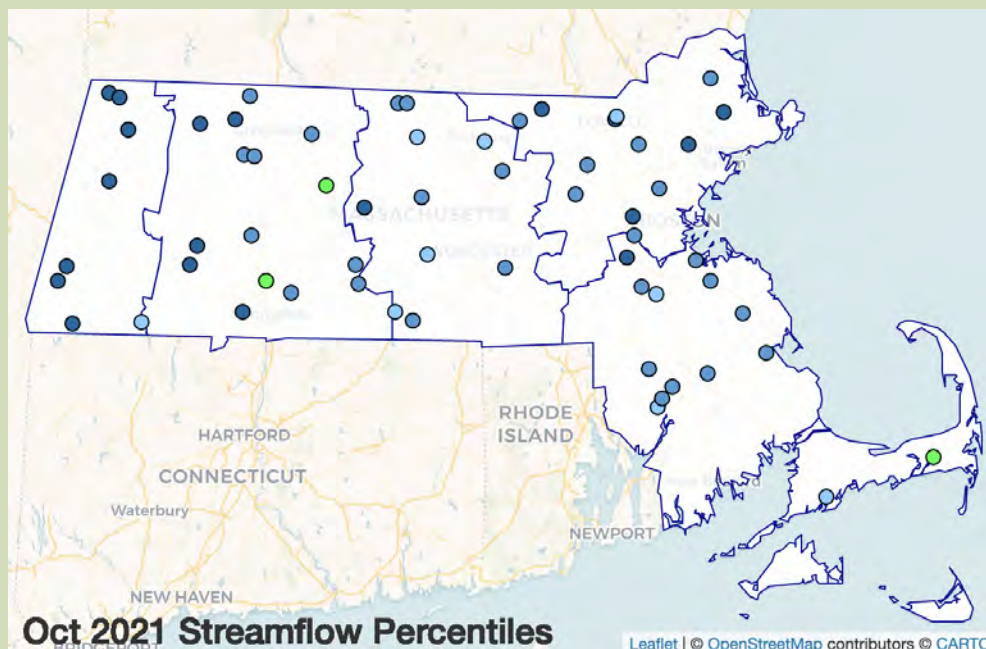
REGION	NUMBER OF SITES REPORTING	OCTOBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI* PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	6	7.24	3.06	87	90	99
CTRV	13	5.93	2.00	76	79	96
CENTRAL	16	6.38	2.06	84	91	98
NORTHEAST	26	6.99	3.07	86	96	99
SOUTHEAST	27	7.24	2.92	85	95	98
CAPE COD	21	8.16	3.36	88	95	91
ISLANDS	3	5.90	1.81	80	88	86

DMP Index Severity Levels			
1	2	3	4

## STREAMFLOW

Streamflow was above normal during much of October for most of the state. All regional monthly streamflow medians were above the 80th percentile except for the Cape Cod region, which was in the normal range. All regions are at Index Severity Level 0.

### Median Monthly Streamflow Percentiles Compared to Historical Values



● $\geq 0$ 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 OCT	$\geq 0$ 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	0	7	94
CTRV	15	0	0	0	0	5	86
CENTRAL	11	0	0	0	0	1	84
NORTHEAST	13	0	0	0	0	5	88
SOUTHEAST	12	0	0	0	0	1	83
CAPE COD	2	0	0	0	0	0	53

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

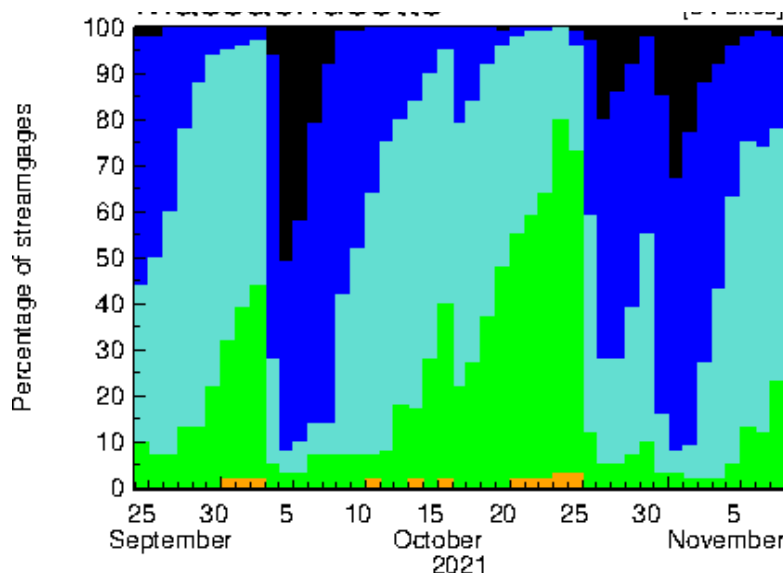
DMP Index Severity Levels			
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### Time Series of the Percent of Gages at Their Respective Percentile Flows for Average Daily Streamflows Compared to Historical Values

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

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

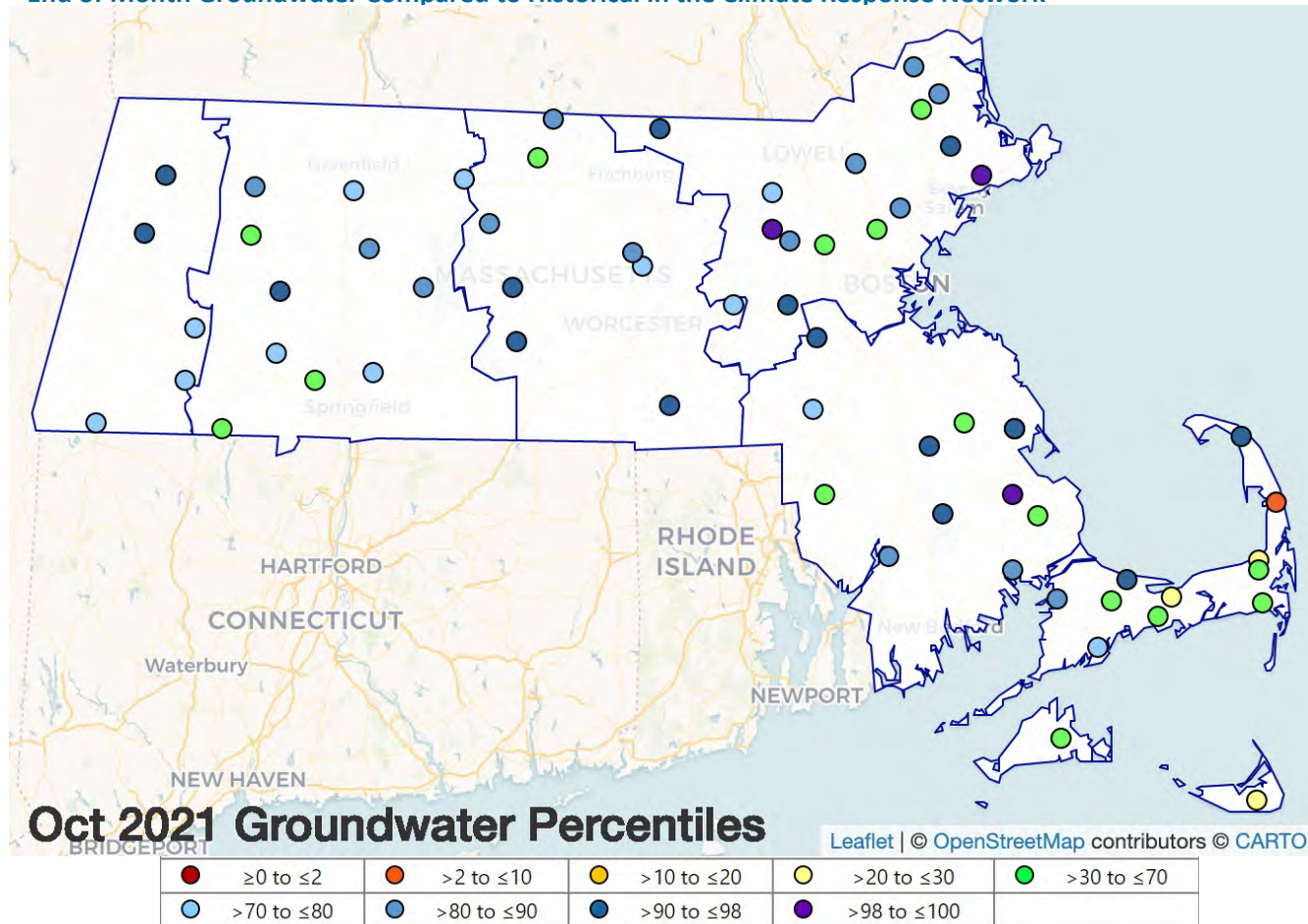
Explanation - Percentile classes							
Low	$< 10$	10-24	25-75	76-90	$> 90$	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



## GROUNDWATER

Percentiles of individual groundwater wells continued to be high throughout much of the state. The regional medians of individual well percentiles were much above normal for all regions except the Islands and Cape Cod, which were in the normal range. While there are still some wells on Cape Cod that are below normal, they have started to recover. All regions are at Index Severity Level 0.

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



REGION	TOTAL WELLS REPORTING FOR OCT	$\geq 0$ 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	0	0	0	2	79
CTRV	11	0	0	0	0	1	76
CENTRAL	9	0	0	0	0	3	84
NORTHEAST	14	0	0	0	0	5	88
SOUTHEAST	12	0	0	0	0	5	85
CAPE COD	11	0	1	0	2	2	53
ISLANDS	2	0	0	0	1	0	31

DMP Index Severity Levels			
1	2	3	4



## LAKE AND IMPOUNDMENTS

REGION	TOTAL REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	2	100
CTRV	2	89
CENTRAL	3	92
NORTHEAST	6	100
SOUTHEAST	2	100% full
CAPE COD	2	56

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

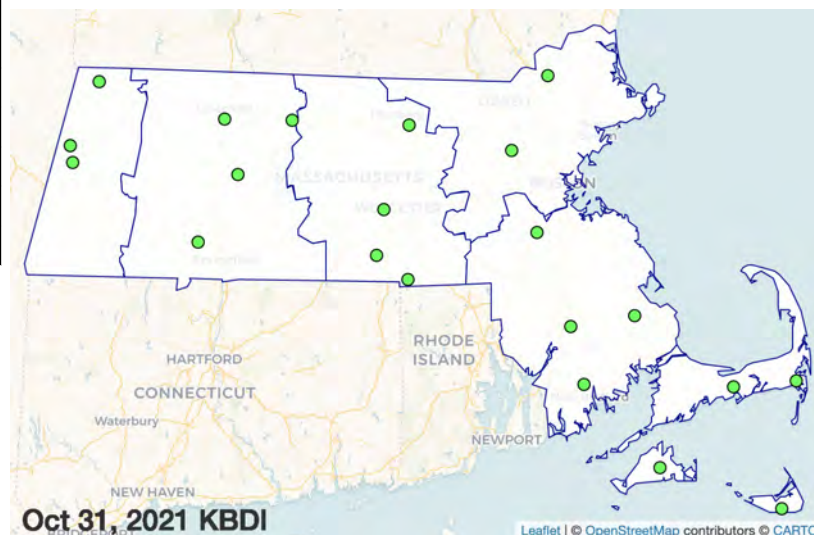
DMP Index Severity Levels			
1	2	3	4

At the end of October, most lake and impoundment levels were much greater than their 30th percentile values or 100% full. All regions are at Index Severity Level 0.

## KEETCH BYRAM DROUGHT INDEX (KBDI)

At the end of October, KBDI values were below 200. All regions are at Index Severity Level 0.

REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	3	3
CTRV	4	0
CENTRAL	4	4
NORTHEAST	2	0
SOUTHEAST	4	0
CAPE COD	2	0
ISLANDS	2	0



DMP Index Severity Levels			
1	2	3	4

Point Values - KBDI Range				
● $\geq 700$ to $\leq 800$	● $\geq 600$ to $< 700$	● $\geq 400$ to $< 600$	● $\geq 200$ to $< 400$	● $\geq 0$ to $< 200$

## CROP MOISTURE INDEX (CMI)

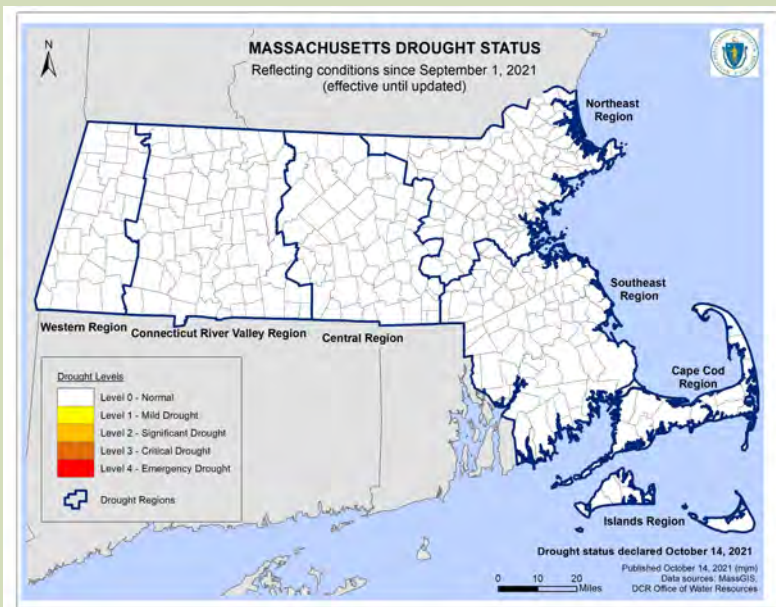
CMI weekly values for the week ending October 30th were all above 3.0 in the Excessively Wet range: 3.15 in the western area, 3.31 in the central area, and 4.39 in the coastal area. All MA drought regions are at Index Severity Level 0.

[https://www.cpc.ncep.noaa.gov/products/monitoring\\_and\\_data/drought.shtml](https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml)

## SNOWFALL

Due to high temperatures, no snowfall was recorded in October. Historically, some snow has fallen in the state during the month of October.

Snowfall Departure: <https://www.nrcc.cornell.edu/regional/monthly/monthly.html>



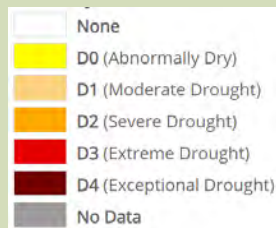
## Massachusetts Drought Status

On October 14, 2021 Massachusetts Energy and Environmental Affairs (EEA) Secretary Kathleen Theoharides declared Level 0-Normal Conditions in the Cape Cod Region as well as the Western, Connecticut River Valley, Central, Northeast, Southeast, and Islands Regions. This status remains in effect until further updates.

## U.S. Drought Monitor (USDM)

At the end of October, the USDM showed no drought conditions in Massachusetts.

USDM maps are produced by the National Drought Mitigation Center (NDMC). For methods, weekly updates, and past maps see: <https://droughtmonitor.unl.edu>



Data through October 26, 2021; map released October 28, 2021



## NOAA Climate Prediction Center

### Temperature and Precipitation Outlook

**November:** The outlook released 10/31 shows a 40-50% probability of above-normal temperatures and a 33-40% probability of above-normal precipitation.

**November through January:** The outlook released 10/21 shows a 40-50% probability of above-normal temperatures, and a 33-40% probability of above-normal precipitation. <https://www.cpc.ncep.noaa.gov/>

### Monthly and Seasonal Drought Outlook

The monthly outlook for November released on 10/31 shows no drought development in the state. The seasonal outlook released on 10/21 and valid through January shows no drought development in the state.

<http://www.cpc.ncep.noaa.gov/products/Drought>

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 11/09/2021. Additional information, previous reports, and drought management information can be found at: <https://www.mass.gov/water-data-tracking>

## APPENDIX I – ADDITIONAL PRECIPITATION DATA

### Standardized Precipitation Index October 2021 as percentiles

REGION	NUMBER OF SITES	1-mo*	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo*
WESTERN	6	87	94	90	99	97	95	78	84
CTRV	13	76	78	79	96	93	92	73	83
CENTRAL	16	84	94	91	98	95	95	81	93
NORTHEAST	26	86	96	96	99	98	97	87	94
SOUTHEAST	27	85	94	95	98	96	96	82	92
CAPE COD	21	88	98	95	91	83	82	39	78
ISLANDS	3	80	89	88	86	81	80	54	89

DMP Index Severity Levels			
1	2	3	4

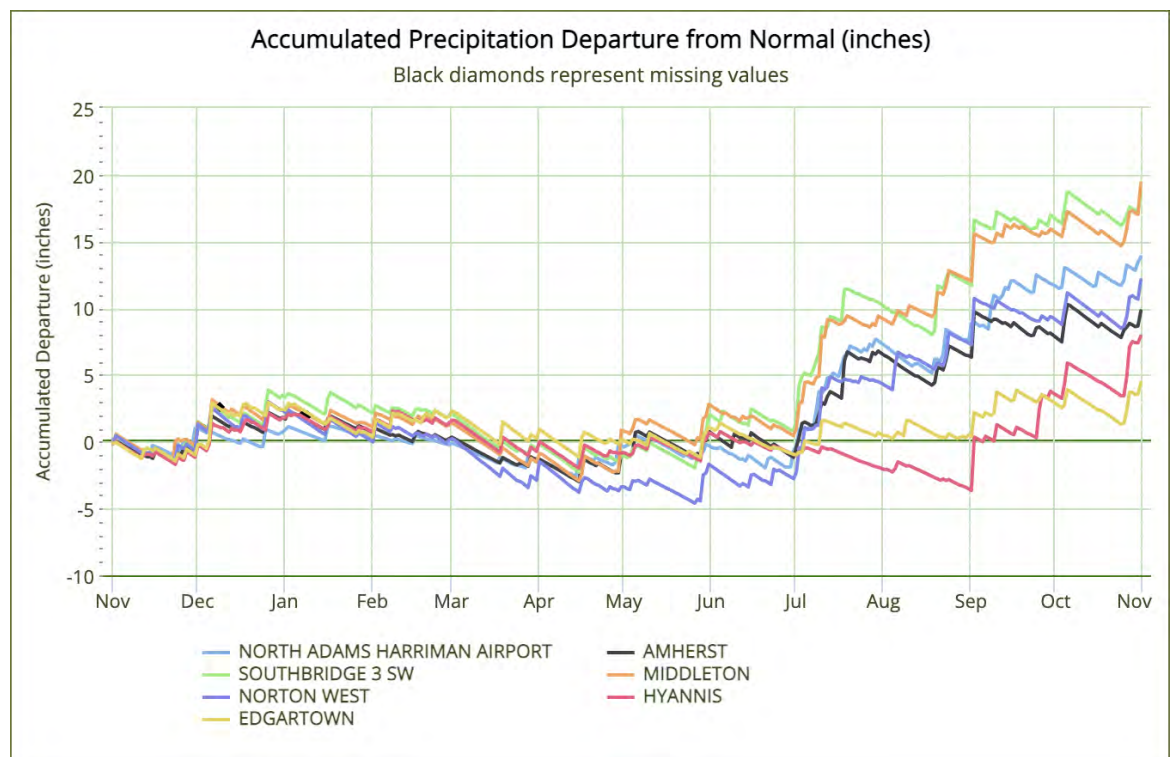
### Percent of Average Historical Precipitation October 2021

REGION	NUMBER OF SITES	HISTORICAL AVERAGE	OCTOBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	6	4.18	7.24	3.06	173%
CTRV	13	3.93	5.93	2.00	151%
CENTRAL	16	4.32	6.38	2.06	148%
NORTHEAST	26	3.92	6.99	3.07	178%
SOUTHEAST	27	4.32	7.24	2.92	168%
CAPE COD	21	4.80	8.16	3.36	170%
ISLANDS	3	4.09	5.90	1.81	144%

### Accumulated Precipitation Departure

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	$\leq -4.0$

