

MASSACHUSETTS WATER RESOURCES COMMISSION

APRIL 2021

HYDROLOGIC CONDITIONS
IN MASSACHUSETTS

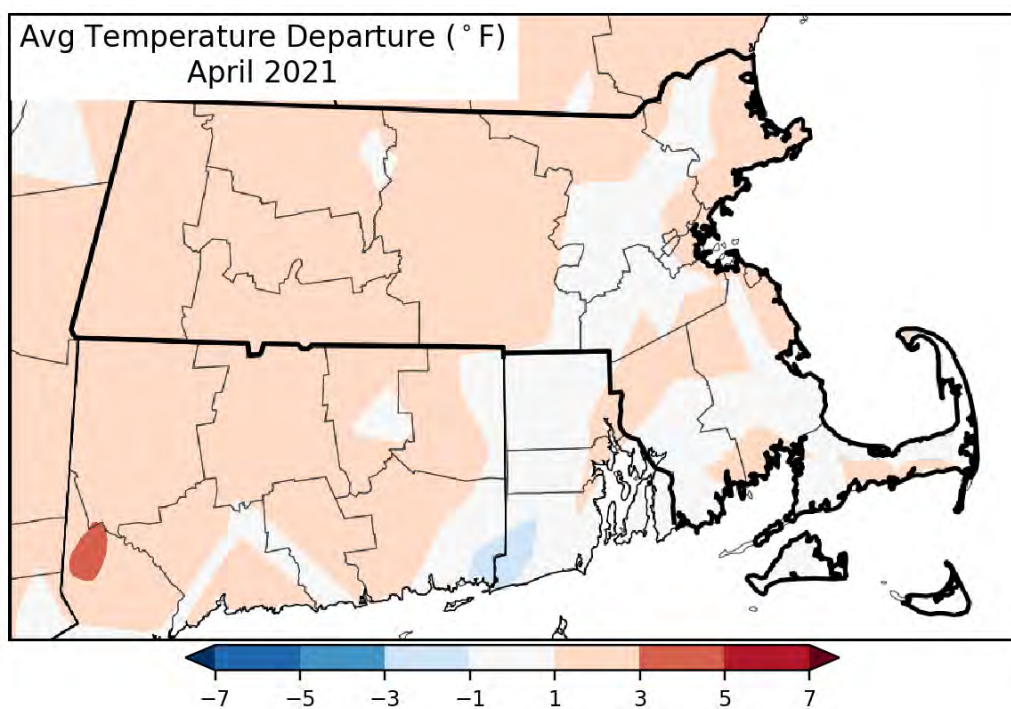


The Commonwealth of Massachusetts
Charles D. Baker, Governor
Kathleen A. Theoharides, Secretary, Executive Office of Energy and Environmental Affairs

APRIL 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were normal to above normal.
- Monthly regional precipitation was normal to slightly above normal.
- Monthly median streamflows were below normal in the Western, CT River Valley, Central, and Northeast Regions. These Regions are at Index Severity Level 1 (Northeast) and Level 2 (Western, CT River Valley, & Central). The Southeast Region's median of individual gages is at the 31st percentile.
- Groundwater percentiles of individual wells varied across regions. The Western Region is at Index Severity Level 1. Four other Regions (CT River Valley, Central, Southeast, and Cape Cod) have medians of individual well percentiles in the low to mid 30's.
- Lakes & Impoundments levels were mostly in the normal range. Two natural water bodies are low for this time of year, including one on the Cape.
- NOAA's May outlook projects equal chances for below-normal, normal, or above-normal temperatures and precipitation.
- NOAA's 3-month outlook projects above-normal temperatures and slight chances for above-normal precipitation.
- Appendices I and II provide additional precipitation data and information on the Massachusetts Drought Management Plan (DMP), respectively.

TEMPERATURE

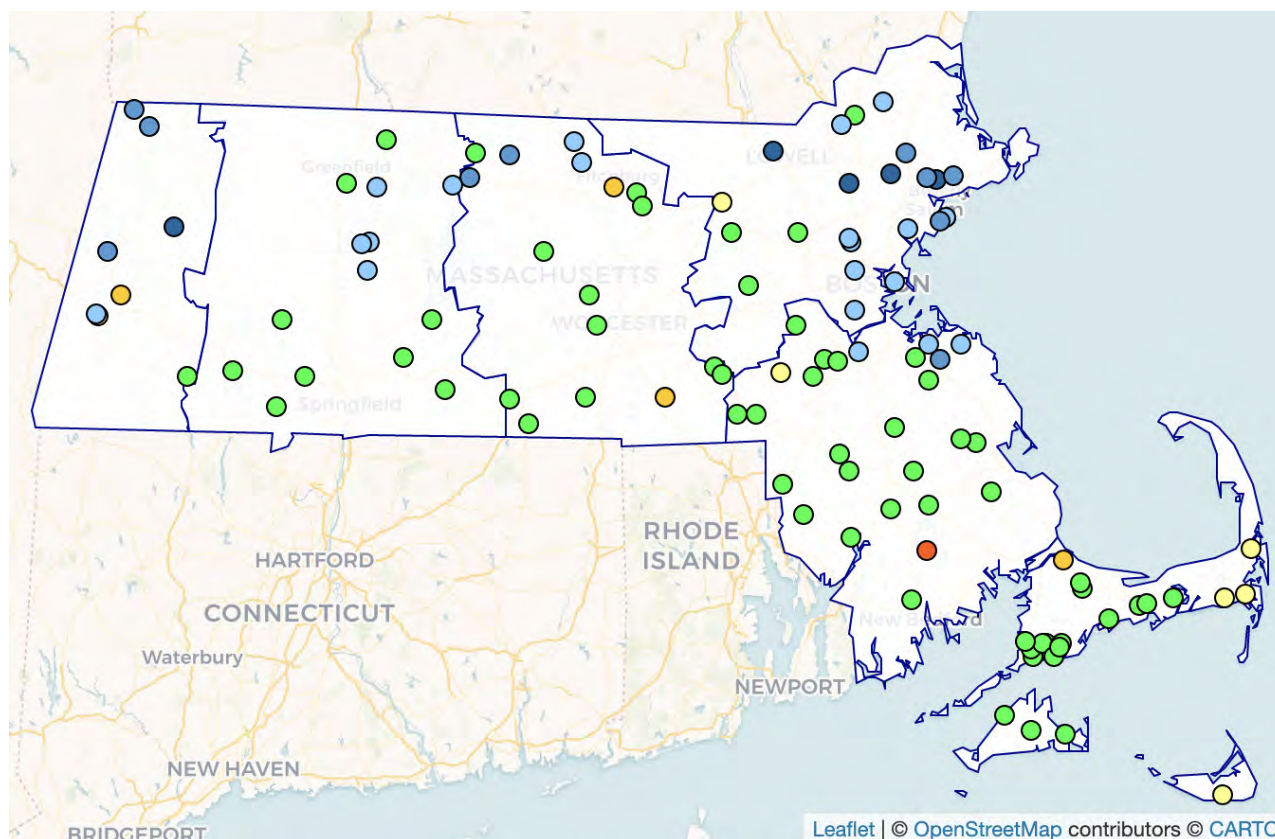


Monthly average temperatures were normal to above normal. According to the Northeast Regional Climate Center (NRCC), it was the 16th warmest April for the Boston climate site.

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

PRECIPITATION

April started out with a dry stretch, but starting mid month there were a series of snow and rainfall events. By the end of April, there were no Regions tripping the 1-mo look-back period index. Deficits still remain in other look-back periods including the 2-mos (Central, Southeast, Cape Cod at Level 1) and the 3-mos (CT River Valley and Central at Level 1). Appendix I provides additional details for precipitation data, including longer look-back periods.



● ≥ 0 to ≤ 2	● > 2 to ≤ 10	● > 10 to ≤ 20	● > 20 to ≤ 30	● > 30 to ≤ 70
● > 70 to ≤ 80	● > 80 to ≤ 90	● > 90 to ≤ 98	● > 98 to ≤ 100	

REGION	NUMBER OF SITES REPORTING	APRIL MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI* PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	8	4.08	0.57	79	46	33
CT RIVER VALLEY	14	4.11	0.39	61	30	46
CENTRAL	17	3.97	0.03	52	24	50
NORTHEAST	22	5.26	1.42	76	42	51
SOUTHEAST	27	4.17	-0.03	50	34	46
CAPE COD	18	3.60	-0.57	46	34	34
ISLANDS	4	3.46	-0.43	51	52	38

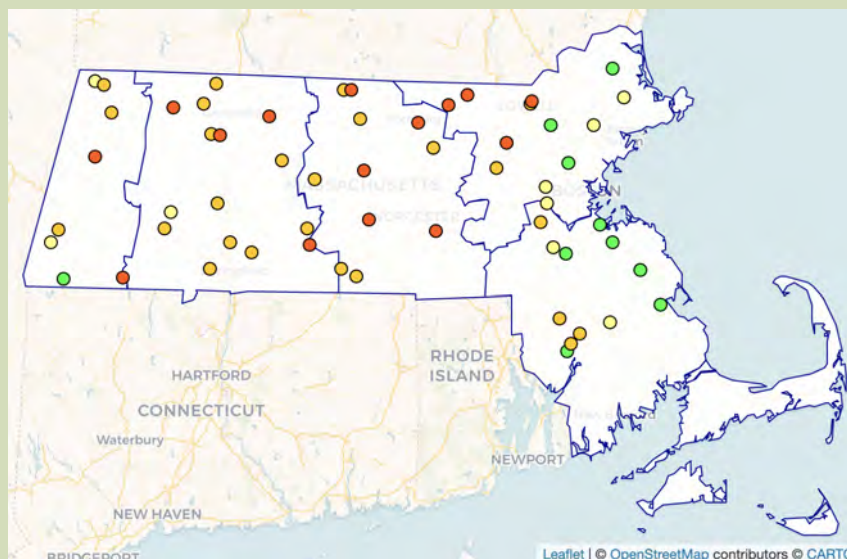
DMP Index Severity Levels			
1	2	3	4

*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

Streamflow varied throughout April. The dry stretch at the beginning of the month resulted in below - normal flows at most gages across the state. Precipitation starting mid-month improved streamflow, but not enough to prevent regional percentiles from tripping index thresholds. The Western, CT River Valley, and Central Regions are at Drought Index Severity Level 2, and the Northeast Region is at Level 1. The Southeast Region median of individual gages is at the 31st percentile, just missing the Level 1 index threshold.

Median Monthly Streamflow Percentiles



● ≥ 0 to ≤ 2	● > 2 to ≤ 10	● > 10 to ≤ 20	● > 20 to ≤ 30	● > 30 to ≤ 70
● > 70 to ≤ 80	● > 80 to ≤ 90	● > 90 to ≤ 98	● > 98 to ≤ 100	

REGION	TOTAL GAGES REPORTING FOR APR	≥ 0 TO ≤ 2 PERCENTILE	> 2 TO ≤ 10 PERCENTILE	> 10 TO ≤ 20 PERCENTILE	> 20 TO ≤ 30 PERCENTILE	> 90 PERCENTILE	MEDIAN OF INDIVIDUAL GAGE PERCENTILES
WESTERN	8	0	0	5	2	0	16
CT RIVER VALLEY	15	0	4	10	1	0	16
CENTRAL	11	0	4	7	0	0	11
NORTHEAST	13	0	3	3	4	0	24
SOUTHEAST	12	0	0	4	2	0	31

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

DMP Index Severity Levels			
1	2	3	4

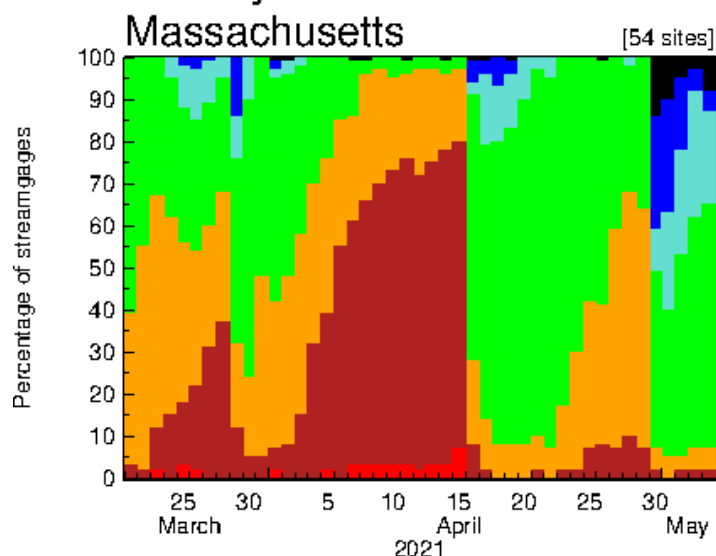
Time Series of the Percent of Gages at Their Respective Percentile Flows for Average Daily Streamflows Compared to Historical Values

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		

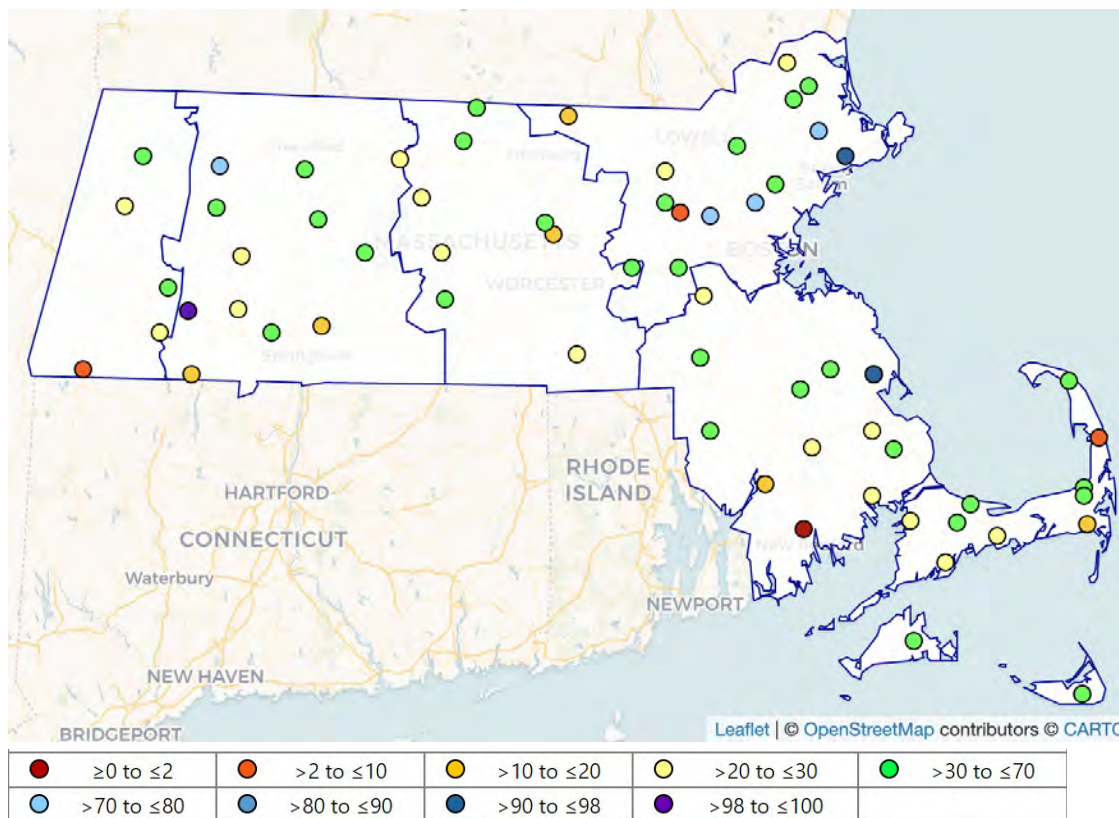
Last 45 Days



GROUNDWATER

Groundwater percentiles varied across Regions. Only the Western Region tripped an index threshold and is at Index Severity Level 1. However, several other regions have medians of individual well percentiles in the low to mid 30's (CT River Valley, Central, Southeast, and Cape Cod). While all Regions have individual wells below the 30th percentile except the Islands, three Regions (CT River Valley, Northeast, Southeast) also have individual wells above the 90th percentile.

End of Month Groundwater Compared to Historical in the Climate Response Network's Automated Wells



REGION	TOTAL WELLS REPORTING FOR APR	≥0 TO ≤2 PERCENTILE	>2 TO ≤10 PERCENTILE	>10 TO ≤20 PERCENTILE	>20 TO ≤30 PERCENTILE	>90 PERCENTILE	MEDIAN OF INDIVIDUAL WELL PERCENTILES
WESTERN	5	0	1	0	2	0	25
CT RIVER VALLEY	12	0	0	2	3	1	32
CENTRAL	9	0	0	1	3	0	36
NORTHEAST	14	0	1	1	2	1	42
SOUTHEAST	13	1	0	1	4	1	31
CAPE COD	10	0	1	0	4	0	31
ISLANDS	2	0	0	0	0	0	49

DMP Index Severity Levels			
1	2	3	4

LAKES AND IMPOUNDMENTS

REGION	TOTAL REPORTING FOR APRIL	MEDIAN OF INDIVIDUAL PERCENTILES or PERCENT FULL	DMP INDEX SEVERITY
WESTERN	2	100% & 100% full	0
CT RIVER VALLEY	2	57	0
CENTRAL	5	29*	0
NORTHEAST	6	56	0
SOUTHEAST	1	98% full	0
CAPE COD	1	6	3

At the end of April, most lakes and impoundments were greater than their 30th percentile value and many reservoirs were just below to above 100% full. *In the Central Region, one natural waterbody was low at the 15th percentile, while the reservoirs ranged from 97.2% to over 100% full.

DMP Index Severity Levels			
1	2	3	4

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

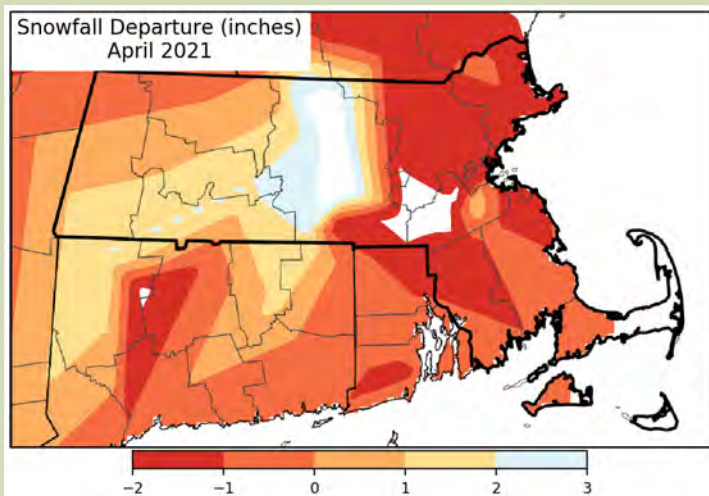
KEETCH BYRAM DROUGHT INDEX (KBDI)

KBDI is provided seasonally.

CROP MOISTURE INDEX (CMI)

CMI is provided seasonally.

SNOWFALL

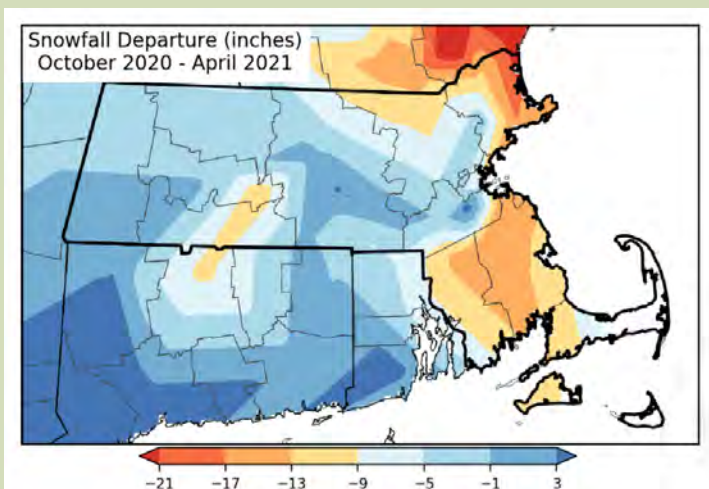


April snowfall was variable and ranged from below normal to above normal. Season-to-date snowfall totals are near to below normal across the state.

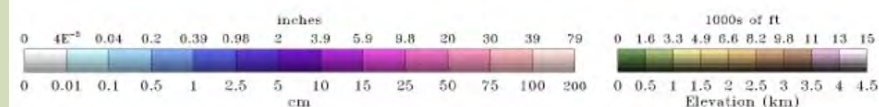
<http://www.nrcc.cornell.edu/>

Modeled Snow Water Equivalent at the End of the Month in Inches

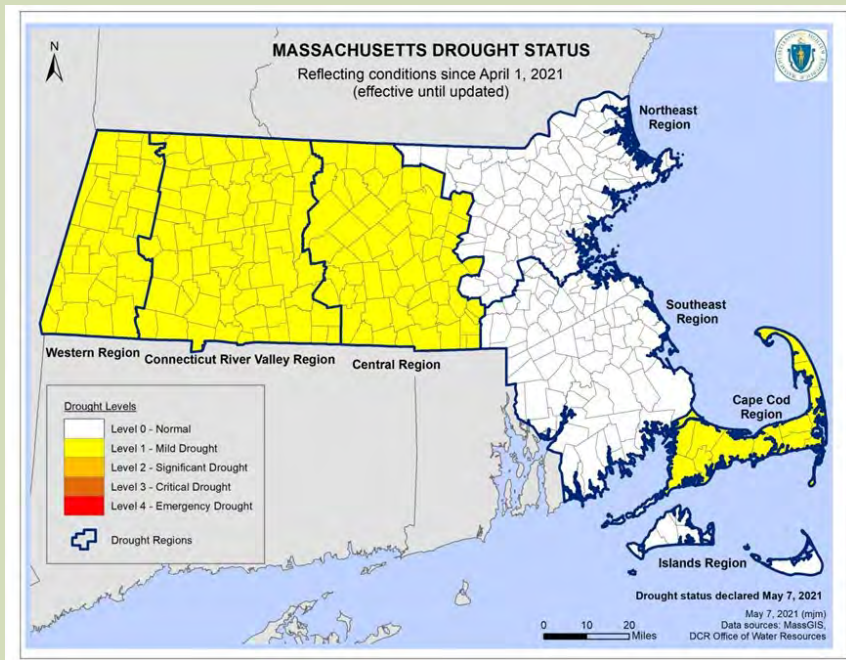
<https://www.nohrsc.noaa.gov/technology/>



Snow Water Equivalent
2021-04-30 06 UTC



DROUGHT CONDITIONS AND FORECASTS



Massachusetts Drought Status

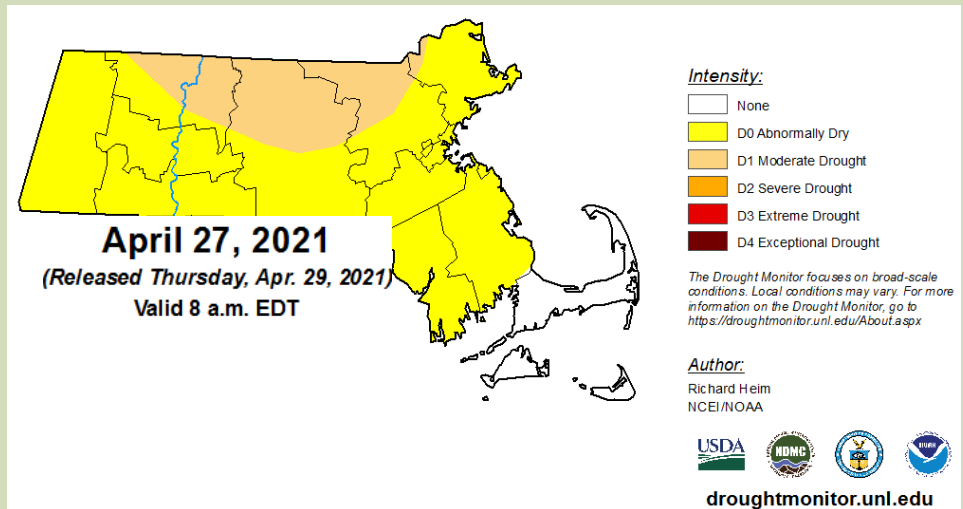
In effect from April 1, 2021 until updated, on May 7, 2021 Massachusetts Energy and Environmental Affairs (EEA) Secretary Kathleen Theoharides declared a Level 1-Mild Drought in the Western, Connecticut River Valley, Central, and Cape Cod Regions and Level 0-Normal Conditions in the Northeast, Southeast, and Islands Regions.

Data through Apr. 27, 2021; map released Apr. 29, 2021

U.S. Drought Monitor (USDM)

At the end of April, the USDM showed areas of D0 and D1 across the State except for the Cape and Islands. The first April USDM map showed only D0, but D1 was introduced in the second week along with some more areas of D0. The map then stayed mostly the same through the remainder of April.

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



NOAA Climate Prediction Center

Temperature and Precipitation Outlook

May: The outlook released 4/30 shows equal chances of below-normal, normal, or above-normal temperatures and equal chances of below-normal, normal, or above-normal precipitation.

May through July: The outlook released 4/15 projects a 60-70% chance 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 May released on 4/30 shows drought persisting in the north central part of the State. The seasonal outlook released on 4/15 and valid through July shows drought removal likely in the north central part of the

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 April 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	8	79	60	46	33	31	10	18	67
CT RIVER VALLEY	14	61	34	30	46	44	24	27	81
CENTRAL	17	52	23	24	50	41	24	46	86
NORTHEAST	22	76	41	42	51	33	22	45	68
SOUTHEAST	27	50	22	34	46	31	27	42	79
CAPE COD	18	46	24	34	34	13	5	29	41
ISLANDS	4	51	34	52	38	16	11	52	72

DMP Index Severity Levels			
1	2	3	4

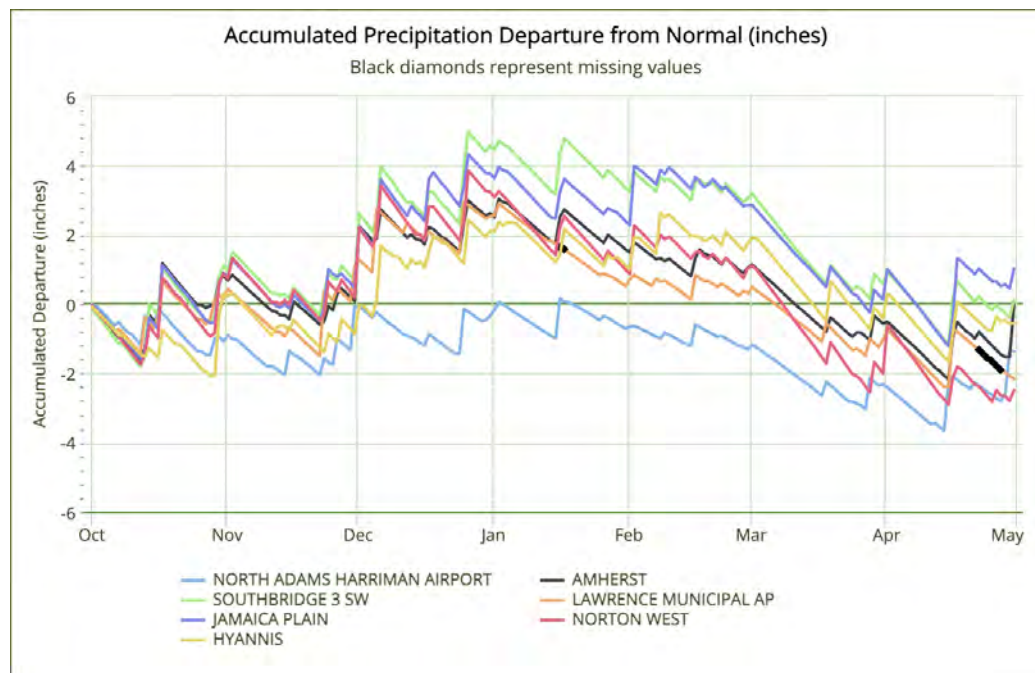
Percent of Average Historical Precipitation April 2021

REGION	NUMBER OF SITES	HISTORICAL AVERAGE	APRIL AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	8	3.51	4.08	0.57	116%
CT RIVER VALLEY	14	3.72	4.11	0.39	110%
CENTRAL	17	3.94	3.97	0.03	101%
NORTHEAST	22	3.84	5.26	1.42	137%
SOUTHEAST	27	4.20	4.17	-0.03	99%
CAPE COD	18	4.17	3.60	-0.57	86%
ISLANDS	4	3.89	3.46	-0.43	89%

Accumulated Precipitation

Departure starting at the beginning of Water Year 2021 (Oct. 1, 2020) through April.

<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	≤ 30 and > 20				200-400	≤ -1.0 and > -2.0
2	≤ 20 and > 10				400-600	≤ -2.0 and > -3.0
3	≤ 10 and > 2				600-700	≤ -3.0 and > -4.0
4	≤ 2				700-800	≤ -4.0

