

MASSACHUSETTS WATER RESOURCES COMMISSION

JULY 2022 HYDROLOGIC CONDITIONS IN MASSACHUSETTS



The Commonwealth of Massachusetts
Charles D. Baker, Governor

Bethany A. Card, Secretary, Executive Office of Energy and Environmental Affairs

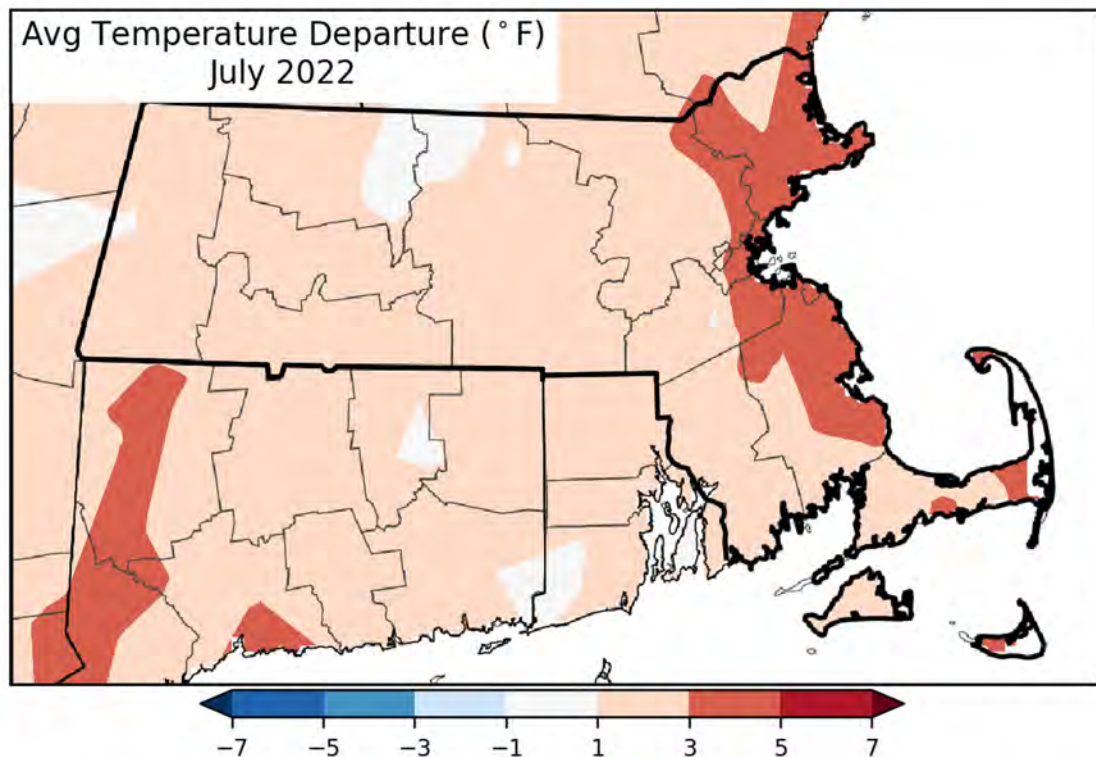
JULY 2022 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS

- Monthly average temperatures were mostly above normal.
- Precipitation was below normal for July for much of the state, particularly in the Cape Cod Region, ranging from Index Severity Levels (ISLs) 1 through 4. The Western and Central Regions were at ISL 0 with some areas below normal.
- Streamflow was mostly in the below-normal range. All Regions are at elevated ISLs with the Northeast and Southeast Regions the most severe at Level 3.
- Groundwater levels varied with more than half of the wells in the below-normal range across the state. The CTRV, Central, Northeast, and Islands Regions are at ISL 1.
- Lakes & Impoundments levels varied with some levels below normal. All Regions are at an elevated ISL except the Western Region.
- Keetch Byram Drought Index was elevated across the state with the Southeast Region the most severe at Level 3.
- The Evaporative Demand Drought Index 1-mos lookback was elevated across the state at the end of July with the majority of state at the highest level, Level 4.
- NOAA's August outlook shows likely chances for above-normal temperatures and chances leaning for below-normal precipitation.
- NOAA's 3-month outlook shows likely chances for above-normal temperatures and chances leaning for above-normal precipitation.
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP).

TEMPERATURE

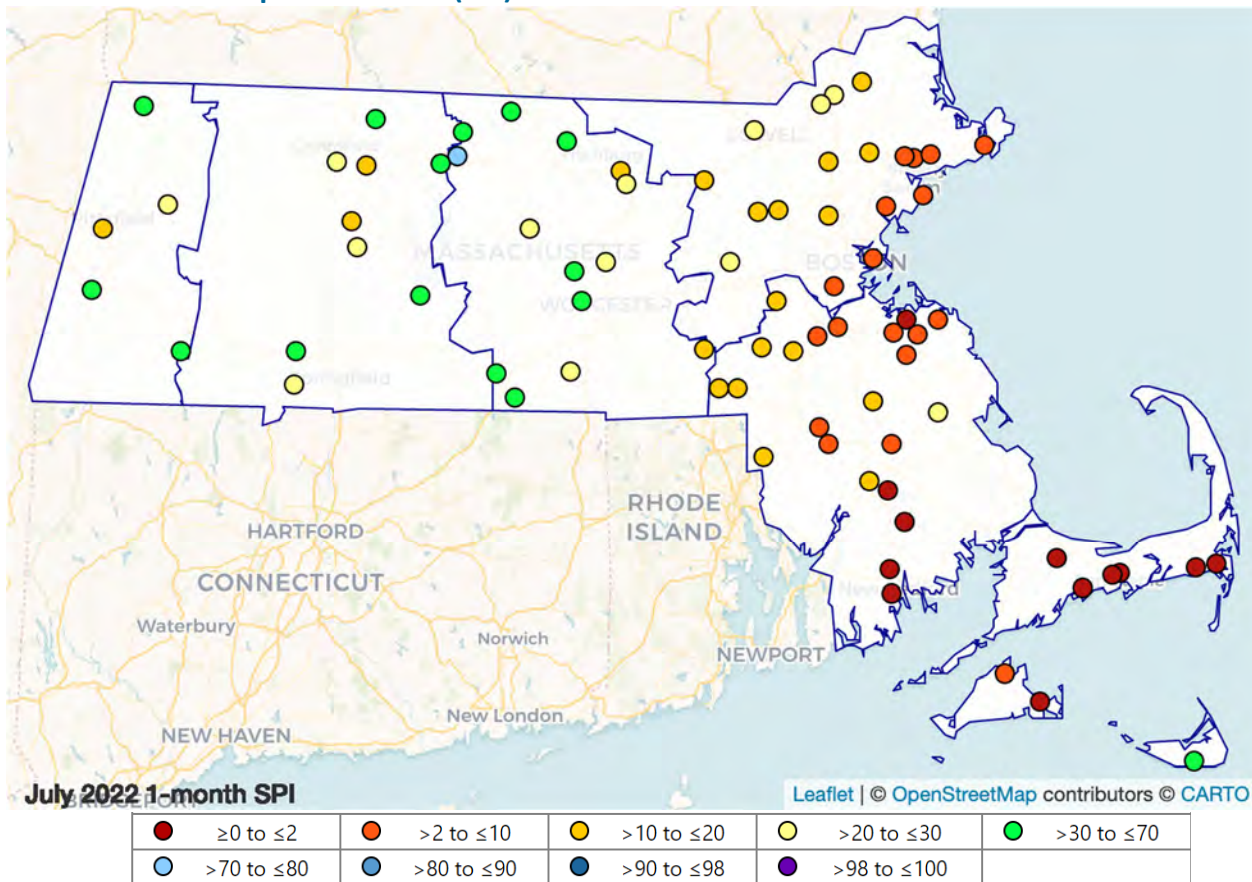
Monthly average temperatures were mostly above normal across the state. According to the Northeast Regional Climate Center, the Boston climate site had its 3rd warmest July and all-time month averaging 3.4°F above normal. The Worcester climate site had its 14th warmest July and all-time month averaging 2.5°F above normal.



PRECIPITATION

July precipitation varied across the state. The Western and Central Regions were at the normal Index Severity Level despite areas of below-normal precipitation. The remaining Regions were below normal especially in the eastern portions of the state and particularly Cape Cod. The 1-mos SPI for the Cape Cod Region is in the first percentile and the average rainfall for the Region was only 0.35 inches. According to preliminary analysis by the National Weather Service, Hyannis, Boston, Blue Hill had their 1st, 4th, and 4th driest July on record, respectively. Combined with previous months deficits, all Regions are showing elevated Index Severity Levels for one or more look-back periods. In addition to the table below, Appendix I provides all look-back periods.

Standardized Precipitation Index (SPI) as a Percentile



REGION	NUMBER OF SITES REPORTING	JULY MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	5	3.65	-0.81	45	17	46
CTRV	9	2.99	-1.11	27	11	26
CENTRAL	14	3.19	-0.78	34	14	33
NORTHEAST	19	1.39	-2.09	12	6	9
SOUTHEAST	23	1.16	-2.37	7	7	14
CAPE COD	6	0.35	-2.48	1	20	14
ISLANDS	3	1.13	-1.56	3	52	28

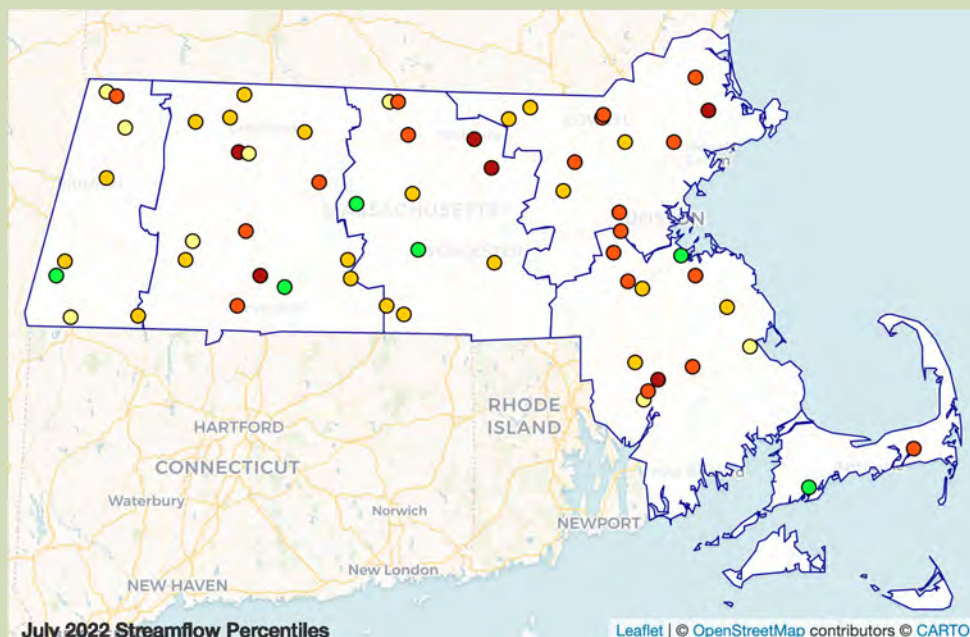
SPI is the Standardized Precipitation Index used in the Drought Management Plan (DMP) expressed here as a percentile and represents the variation, in standard deviations, from long-term precipitation averages.

DMP Index Severity Levels			
1	2	3	4

STREAMFLOW

Median Monthly Streamflow Percentiles Compared to Historical Values

During July, most percentiles of individual streamflow gages were in the below-normal range with some gages in the 0-2nd percentile range in the CTRV, Central, Northeast, and Southeast Regions. Regional monthly streamflow medians were below normal and all Regions are at an elevated Index Severity Level.



●	≥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 GAGES REPORTING	≥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	1	3	3	0	21
CTRV	15	2	3	7	2	0	13
CENTRAL	11	2	2	4	1	0	12
NORTHEAST	12	1	7	4	0	0	7
SOUTHEAST	12	1	5	3	2	0	10
CAPE COD	2	0	1	0	0	0	17

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

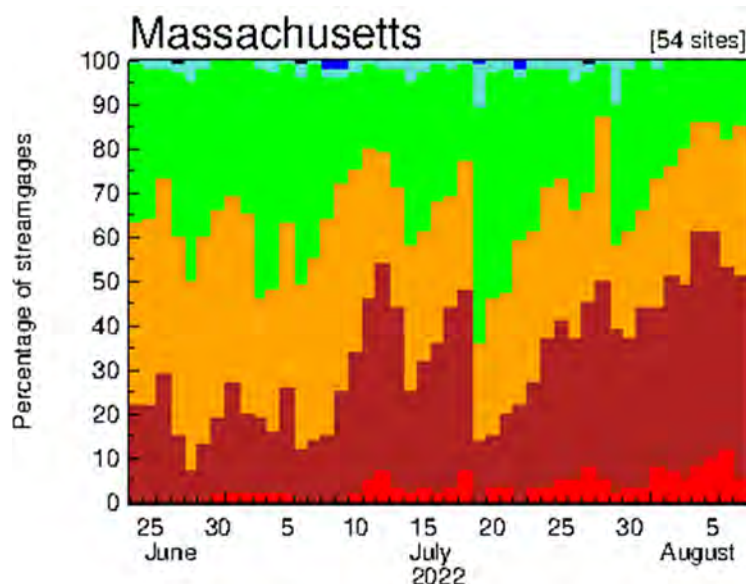
DMP Index Severity Levels			
1	2	3	4

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>

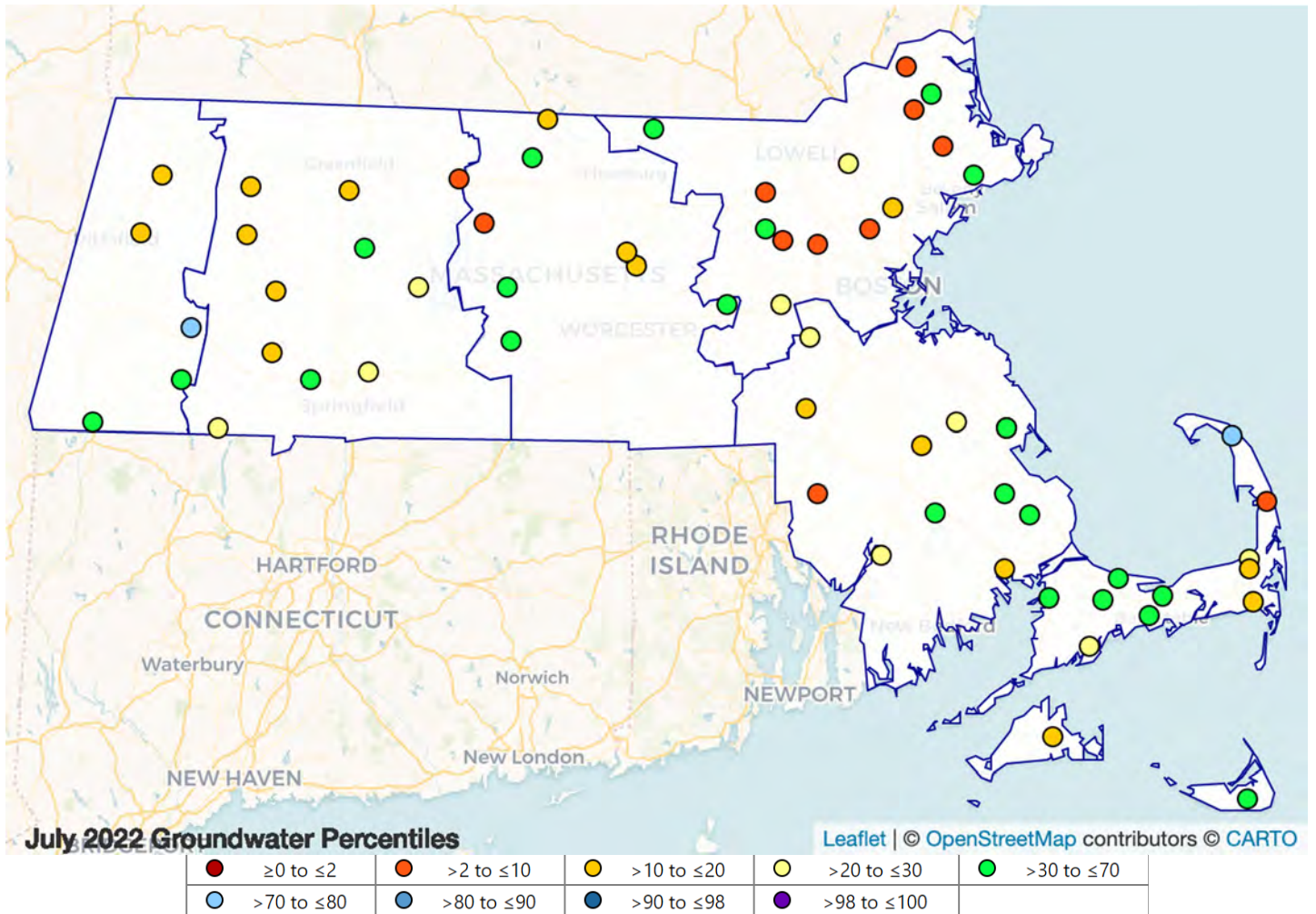
Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



GROUNDWATER

Percentiles of individual groundwater wells varied across the state; more than half of the wells were below normal and only two were above normal. All regions are at an elevated Index Severity Level except the Western and Cape Cod Regions.

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



REGION	NUMBER OF WELLS REPORTING	≥ 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	0	2	0	0	41
CTRV	11	0	1	5	3	0	19
CENTRAL	8	0	1	3	0	0	27
NORTHEAST	14	0	7	1	2	0	12
SOUTHEAST	12	0	1	3	3	0	22
CAPE COD	11	0	1	2	2	0	31
ISLANDS	2	0	0	1	0	0	25

DMP Index Severity Levels			
1	2	3	4

LAKE AND IMPOUNDMENTS

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	31st
CTRV	2	23rd
CENTRAL	4	23rd
NORTHEAST	5	7th
SOUTHEAST	2	7th
CAPE COD	1	16th

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

At the end of July, lake and impoundment levels varied across the state with many levels below their 30th percentile. All Regions are at an elevated Index Severity Level except the Western Region, which is at the low end of normal.

DMP Index Severity Levels			
1	2	3	4

REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	3	348
CTRV	6	454
CENTRAL	6	589
NORTHEAST	3	563
SOUTHEAST	8	619
CAPE COD	5	491
ISLANDS	2	393

KEETCH BYRAM DROUGHT INDEX (KBDI)

At the end of July, KBDI values were elevated across the State. All Regions are at an elevated Index Severity Level.

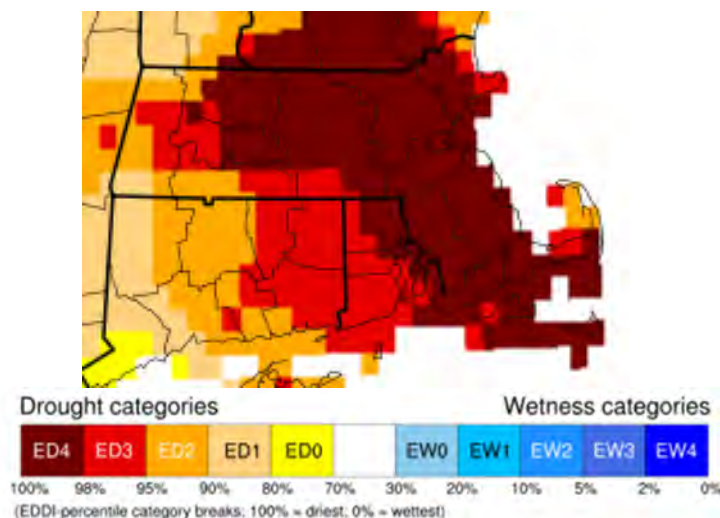
EVAPOTRANSPIRATION (ET) INDEX

Crop Moisture Index (CMI) - 2019 Drought Management Plan

At the end of July CMI values were in the Slightly Dry/Favorably Moist range in the western parts of the State, Abnormally Dry in the central parts, and excessively dry in the coastal parts. The Western Region is at Index Severity Level 0, the CTRV and Central Regions at Level 1, and the Northeast, Southeast, Cape Cod, and Islands Regions at Level 2.

Evaporative Demand Drought Index (EDDI) - proposed 2022 Drought Management Plan

The 1-month EDDI shows elevated ET across the state with most of the state at the highest level, Level 4.

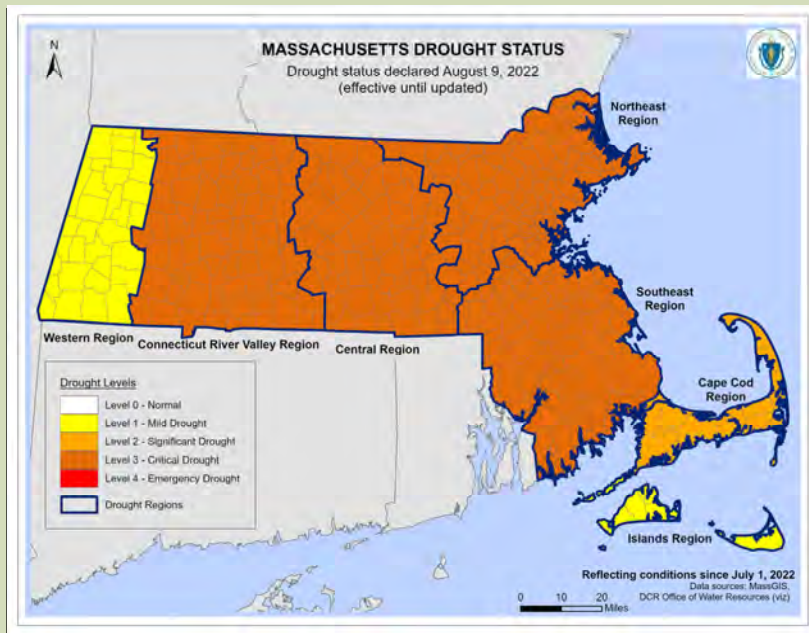


Map dated July 31st

SNOWFALL

Reported seasonally.

DROUGHT CONDITIONS AND FORECASTS



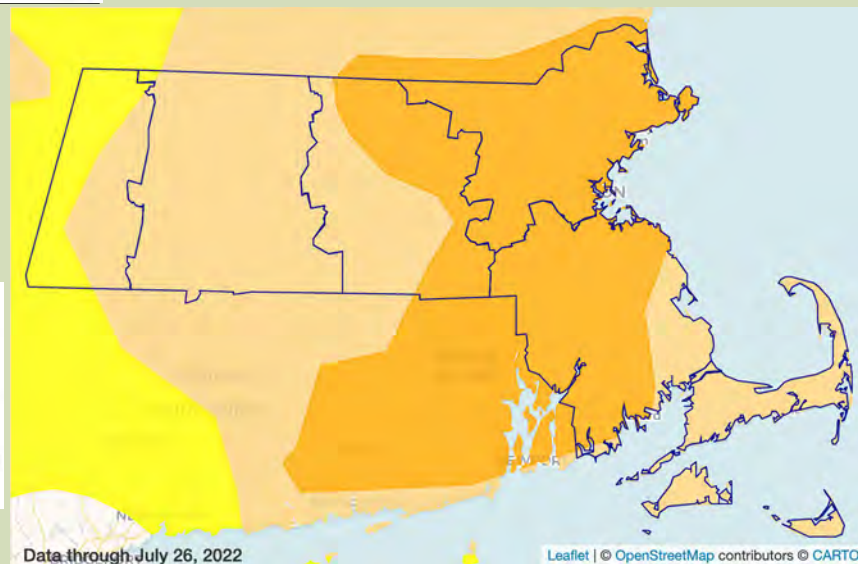
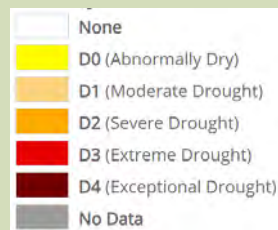
Massachusetts Drought Status

On August 9, 2022 Massachusetts Energy and Environmental Affairs Secretary Bethany A. Card declared a Level 1-Mild Drought in the Western and Islands Regions and a Level 2-Significant Drought in the Cape Region, and a Level 3-Critical Drought in the Central, Northeast, and Southeast Regions. This status remains in effect until further updates.

U.S. Drought Monitor (USDM)

At the end of July, the USDM showed areas of D0, D1, and D2 drought conditions in Massachusetts. These are equivalent to Massachusetts Drought Levels 1, 2, and 3 respectively.

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



NOAA Climate Prediction Center

Temperature and Precipitation Outlook

August: The outlook issued 7/31 shows a 50-60% chance of above-normal temperatures. For precipitation, there is a 33-40% chance of below-normal precipitation.

August through October: The outlook issued 7/21 shows a 60-70% chance of above-normal temperatures and a 33-40% chance for above-normal precipitation. <https://www.cpc.ncep.noaa.gov/>

Monthly and Seasonal Drought Outlook

The monthly outlook for August released on 7/31 shows drought persisting across the state. The seasonal outlook for August through October issued on 7/31 shows drought removal likely in the western half of the state, and drought remaining but improving in the eastern half.

<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 8/08/2022. Additional information, previous reports, and the Massachusetts Drought Dashboard with weekly updates to the drought indices can be found at: <https://www.mass.gov/drought-monitoring>

APPENDIX I – ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index—July 2022 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	5	45	21	17	46	32	72	81	70
CTRV	9	27	15	11	26	12	43	69	60
CENTRAL	14	34	23	14	33	20	62	83	72
NORTHEAST	19	12	13	6	9	5	43	76	77
SOUTHEAST	23	7	21	7	14	6	41	59	55
CAPE COD	6	1	27	20	14	9	68	42	30
ISLANDS	3	3	54	52	28	10	24	21	32

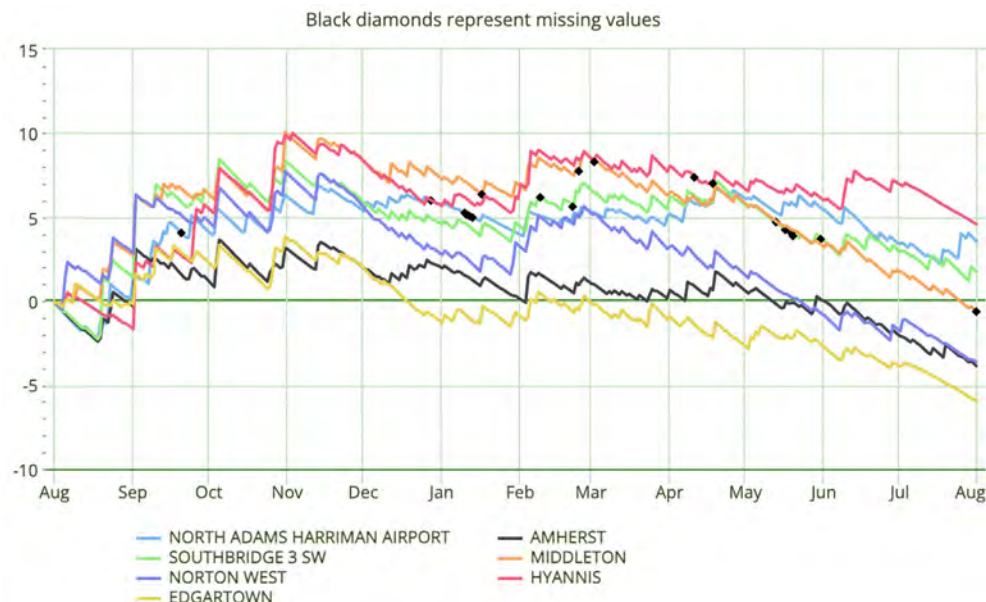
DMP Index Severity Levels			
1	2	3	4

Percent of Average Historical Precipitation—July 2022

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	JULY AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	5	4.46	3.65	-0.81	82%
CTRV	9	4.10	2.99	-1.11	73%
CENTRAL	14	3.97	3.19	-0.78	80%
NORTHEAST	19	3.48	1.39	-2.09	40%
SOUTHEAST	23	3.53	1.16	-2.37	33%
CAPE COD	6	2.83	0.35	-2.48	12%
ISLANDS	3	2.69	1.13	-1.56	42%

Accumulated Precipitation Departure from Normal in Inches

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

