

MASSACHUSETTS WATER RESOURCES COMMISSION



# HYDROLOGIC CONDITIONS IN MASSACHUSETTS

JULY  
2023

The Commonwealth of Massachusetts

*Maura T. Healey, Governor*

*Rebecca L. Tepper, Secretary  
Executive Office of Energy and Environmental Affairs*



# JULY 2023 HYDROLOGIC CONDITIONS

## SUMMARY OF CONDITIONS



- Monthly average temperatures were mostly above normal.
- Precipitation was much above normal except for the Cape Cod and Islands Regions, where it was normal.



- Crop Moisture Index showed wet, abnormally moist, and normal conditions across the state at the end of the month. The 1-month and 2-month EDDI maps showed normal to below normal except for the Cape Cod and Islands Regions which were above to much above normal.



- The Keetch-Byram Drought Index showed normal soil moisture conditions at the end of the month for much of the state except for the Southeast, Cape Cod, and Islands Regions, which are at Index Severity Level (ISL) 1.



- Streamflow was much above normal except for the Cape Cod Region where it was normal.



- Groundwater was below normal to above normal. Regional medians of individual well percentiles were in the above-normal range except for Cape Cod which was normal and the Islands, which is at ISL 2.



- Lake and impoundment levels were above their 30th percentile and/or were at or near 100% full.



- NOAA's August outlook shows chances leaning for below-normal temperatures and above-normal precipitation.

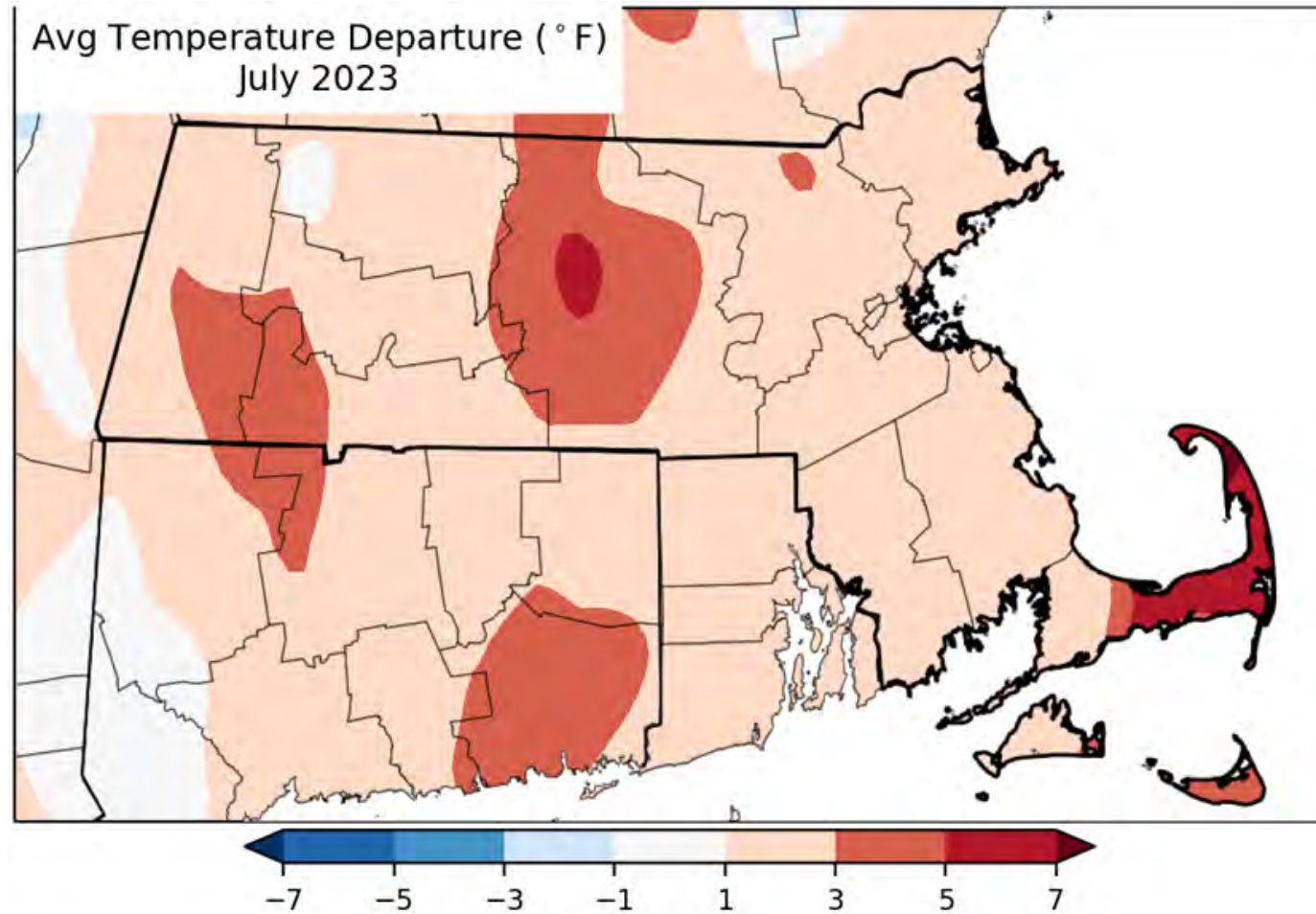


- NOAA's 3-month outlook shows chances likely for above-normal temperatures and equal chances for below-normal, normal, or above-normal precipitation.
- Appendix II provides information on the Massachusetts Drought Management Plan (DMP) including ISL thresholds used in this report.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 08/08/2023. 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>

Monthly average temperatures were normal to above normal. According to the Northeast Regional Climate Center (NRCC), Massachusetts had its 3rd warmest July for average temperatures.

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

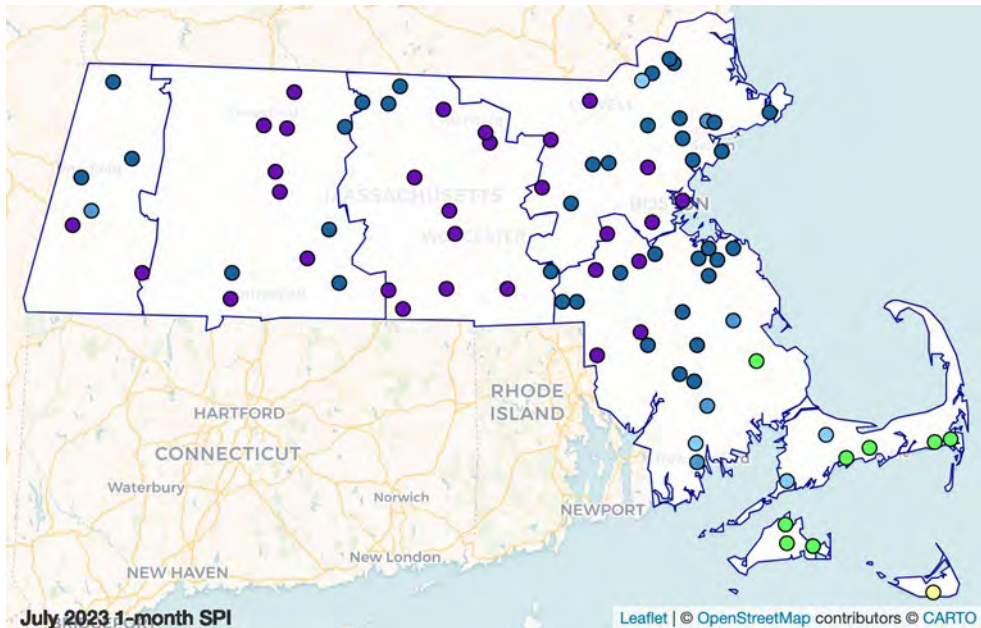






## STANDARDIZED PRECIPITATION INDEX (SPI) AS A PERCENTILE

July precipitation was much above normal except for the Cape Cod and Islands Regions where it was normal. An individual station on Nantucket was below normal. According to the NRCC, Massachusetts had its fourth wettest July, the Boston climate site had its second wettest July, and the Worcester climate site had its second wettest July. In addition to the table below, Appendix I provides all the look-back periods.



<span style="color: red;">●</span> $\geq 0$ to $\leq 2$	<span style="color: orange;">●</span> $> 2$ to $\leq 10$	<span style="color: yellow;">●</span> $> 10$ to $\leq 20$	<span style="color: lightyellow;">●</span> $> 20$ to $\leq 30$	<span style="color: green;">●</span> $> 30$ to $\leq 70$
<span style="color: lightblue;">●</span> $> 70$ to $\leq 80$	<span style="color: blue;">●</span> $> 80$ to $\leq 90$	<span style="color: darkblue;">●</span> $> 90$ to $\leq 98$	<span style="color: purple;">●</span> $> 98$ to $\leq 100$	

REGION	NUMBER OF SITES REPORTING	DECEMBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI* PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	8	4.50	1.01	54	40	36
CT RIVER VALLEY	15	5.85	2.02	86	83	56
CENTRAL	20	6.81	2.80	92	86	57
NORTHEAST	27	5.99	2.02	86	80	50
SOUTHEAST	36	7.16	2.75	88	82	41
CAPE COD	19	7.57	2.90	88	57	11
ISLANDS	5	6.81	2.50	85	72	14

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

DMP Index Severity Levels			
1	2	3	4

## CROP MOISTURE INDEX (CMI)

Weekly values for the period ending July 29, 2023 from NOAA's National Weather Service Climate Prediction Center were in the Abnormally Moist range in the western climate division, in the Wet range in the central climate division, and in the Slightly Dry/Favorably Moist/normal range in the coastal climate division.

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

CLIMATE DIVISION	CROP MOISTURE INDEX
<b>WESTERN</b>	1.57
<b>CENTRAL</b>	2.38
<b>COASTAL</b>	0.56

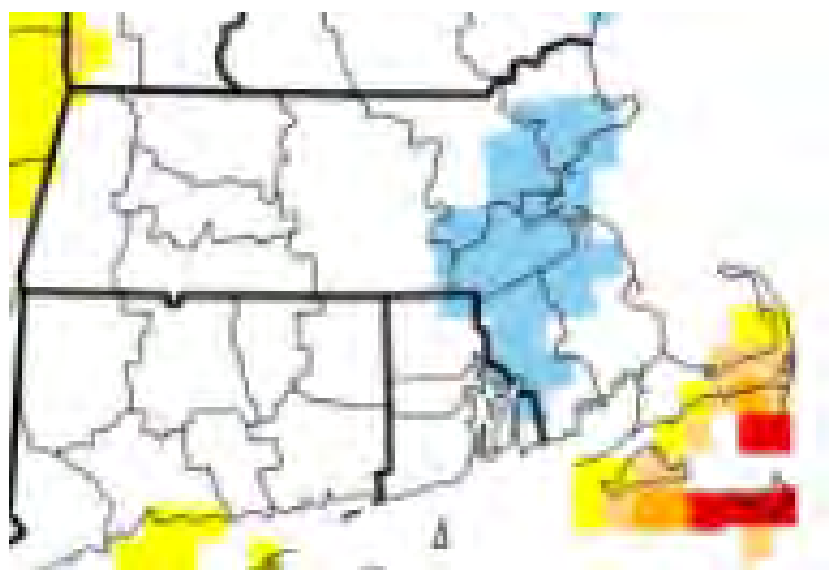




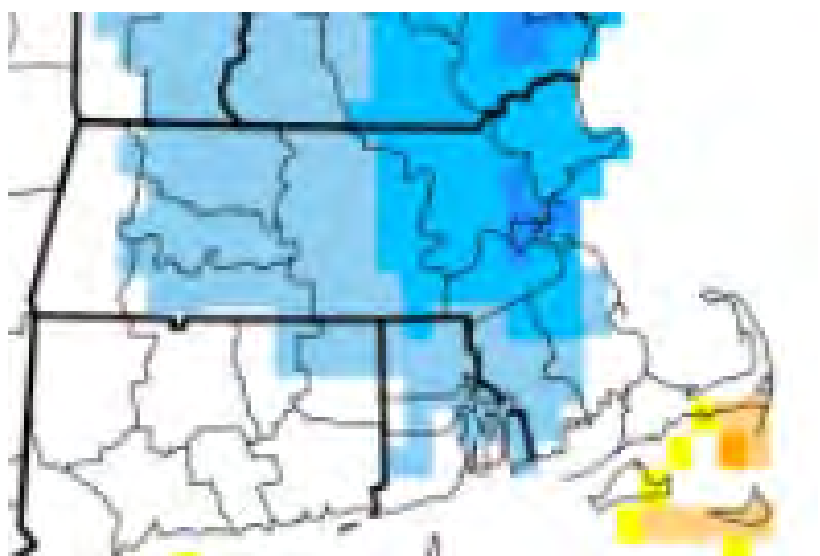
# EVAPORATIVE DEMAND DROUGHT INDEX (EDDI)

The 1-month and 2-month EDDI categories for July 30, 2023 were normal to below normal except for the Cape Cod and Islands Regions which were above to much above normal.

1-month EDDI

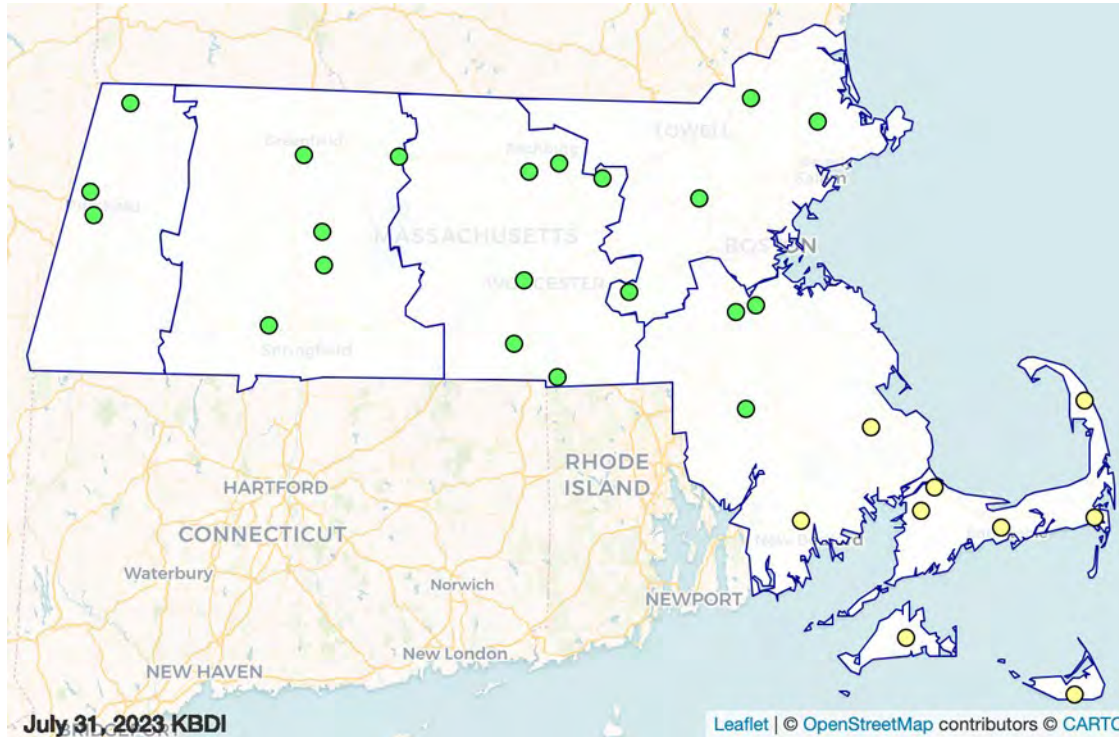


2-month EDDI



Generated by NOAA/ESRL/Physical Sciences Laboratory

At the end of July, Keetch Byram Drought Index (KBDI) values were elevated in the Southeast, Cape Cod, and Islands Regions, which are all at ISL 1.



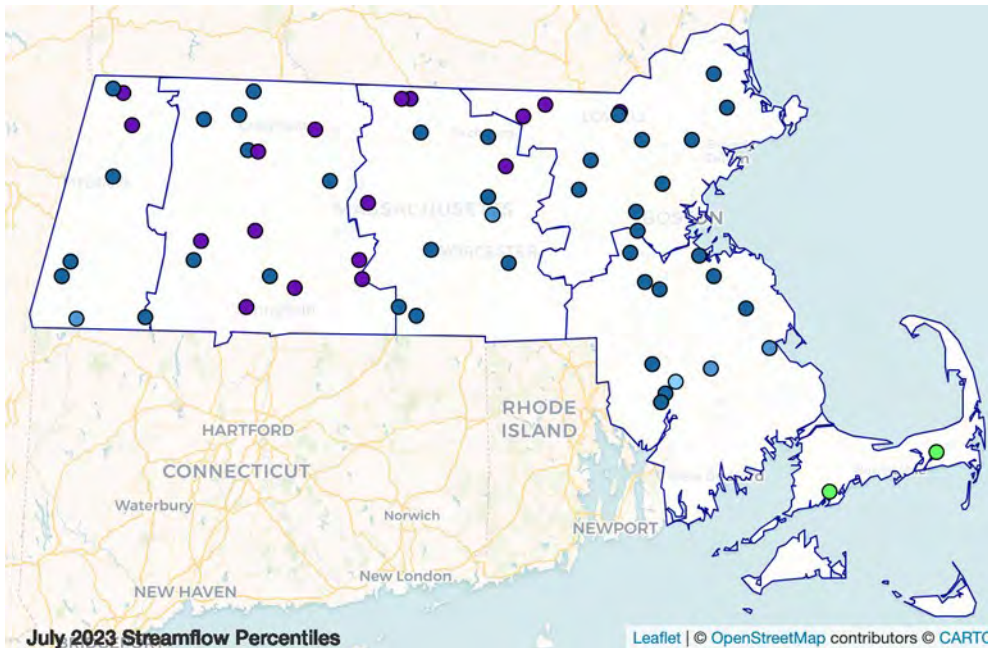
REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	3	118
CTRV	5	113
CENTRAL	6	86
NORTHEAST	4	92
SOUTHEAST	5	213
CAPE COD	5	322
ISLANDS	2	210

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 $< 200$

During July, percentiles of individual streamflow gages were above normal to much above normal except the gages on Cape Cod, which were normal.

## 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	NUMBER OF GAGES REPORTING	$\geq 0$ 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	98
CTRV	15	0	0	0	0	16	99
CENTRAL	12	0	0	0	0	11	98
NORTHEAST	13	0	0	0	0	13	97
SOUTHEAST	12	0	0	0	0	9	93
CAPE COD	2	0	0	0	0	0	58

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

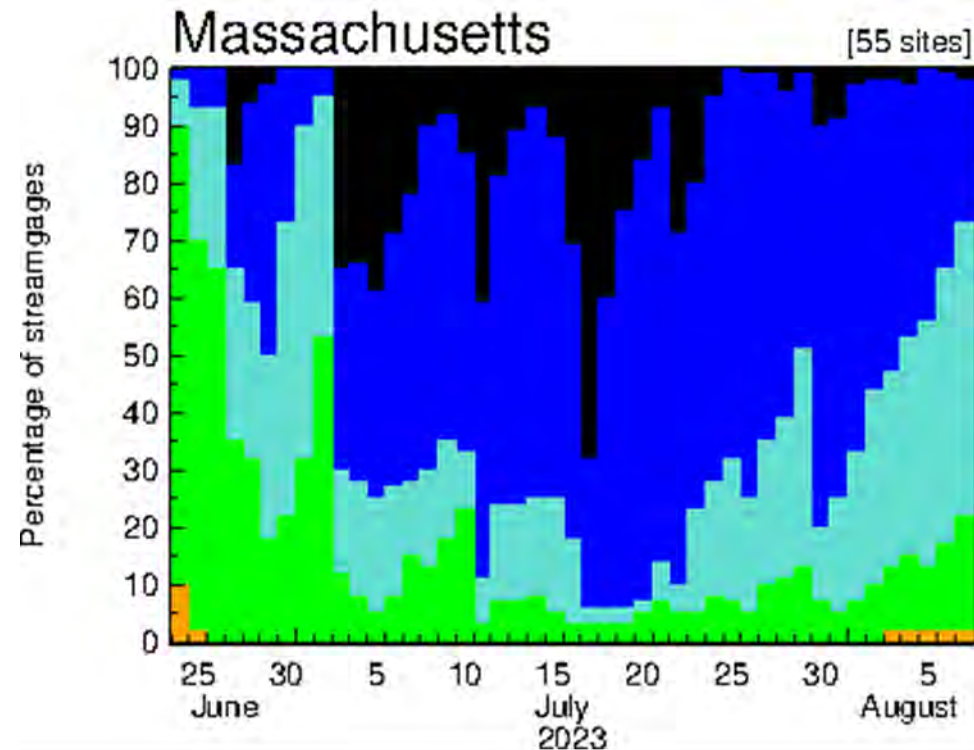
DMP Index Severity Levels			
1	2	3	4



# USGS TIME SERIES OF THE PERCENT OF GAGES AT THEIR RESPECTIVE PERCENTILE FLOWS FOR AVERAGE DAILY STREAMFLOWS COMPARED TO HISTORICAL VALUES

<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		



Storm events throughout July caused both urban/drainage flooding and stream/river flooding.

A search of the Local Storm Report App database on the Iowa State University Iowa Environmental Mesonet website produced 333 storm reports for Massachusetts over 12 days in July. Of these reports, 142 were reports of urban floods or flash floods.

River/stream flooding also occurred during July. The July 9-10<sup>th</sup> event resulted in flooding along the Connecticut River and other rivers and streams in Berkshire, Franklin, Hampshire, and Hampden Counties. The Albany E-5 report Appendix E3 Monthly Summary of River Crests Above Flood lists minor flood levels at: the East Branch of the Housatonic on 7/10, & the Hoosic River at Williamstown on 7/10, and, in addition on 7/16, the West Branch of the Farmington River. The Boston/Norton E-5 report lists rivers reaching flood stage: Connecticut at Montague 7/10, Deerfield at West Deerfield 7/10, and Deerfield at Charlemont 7/10. An observation of the Northeast River Forecast Center website on July 12<sup>th</sup> showed the Connecticut River at Northampton reaching flood stage on 7/11.



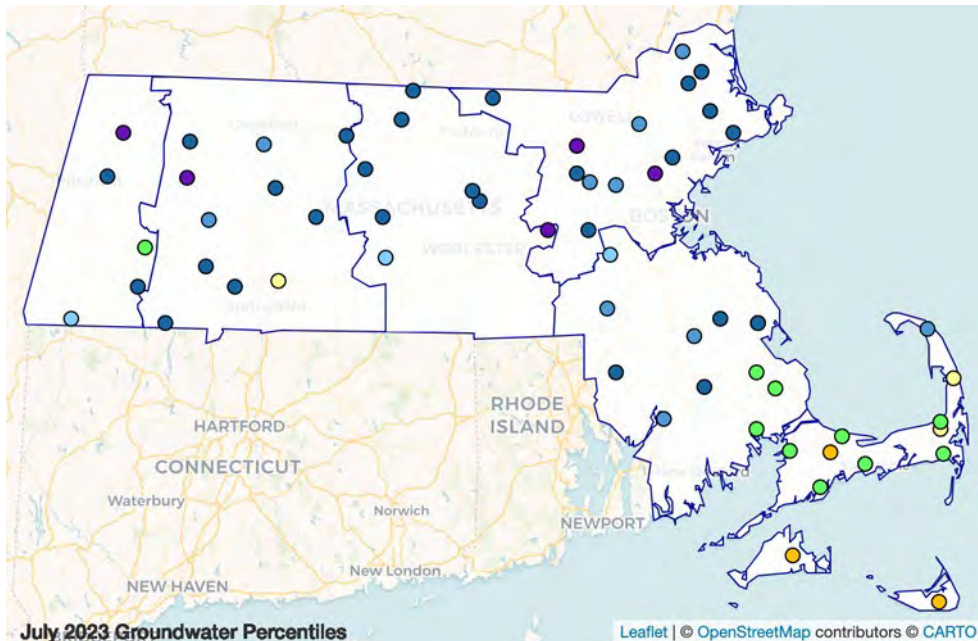
Image: Courtesy of NASA/JPL-Caltech

<https://mesonet.agron.iastate.edu/vtec/search.php#eventsbypoint/-93.6530/41.5300>



July groundwater levels ranged from below normal to much above normal. Regional medians were in the much above-normal range except for the Cape Cod Region, which was in the normal range, and the Islands Region, which is at ISL 2.

## END OF MONTH GROUNDWATER COMPARED TO HISTORICAL IN THE CLIMATE RESPONSE NETWORK WELLS



● $\geq 0$ 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 WELLS REPORTING FOR JUL	$\geq 0$ 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	1	3	98
CTRV	12	0	0	0	0	10	95
CENTRAL	9	0	0	0	0	8	100
NORTHEAST	14	0	0	0	0	13	98
SOUTHEAST	13	1	0	0	0	6	88
CAPE COD	11	1	1	2	3	0	26
ISLANDS	2	0	0	0	0	0	37

DMP Index Severity Levels			
1	2	3	4

At the end of July, reporting lake and impoundment levels were above their 30th percentile and/or were at or near 100% full.

REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	No reports	-
CTRV	2	89th
CENTRAL	2	100th
NORTHEAST	4	95th
SOUTHEAST	2	88th
CAPE COD	1	40th

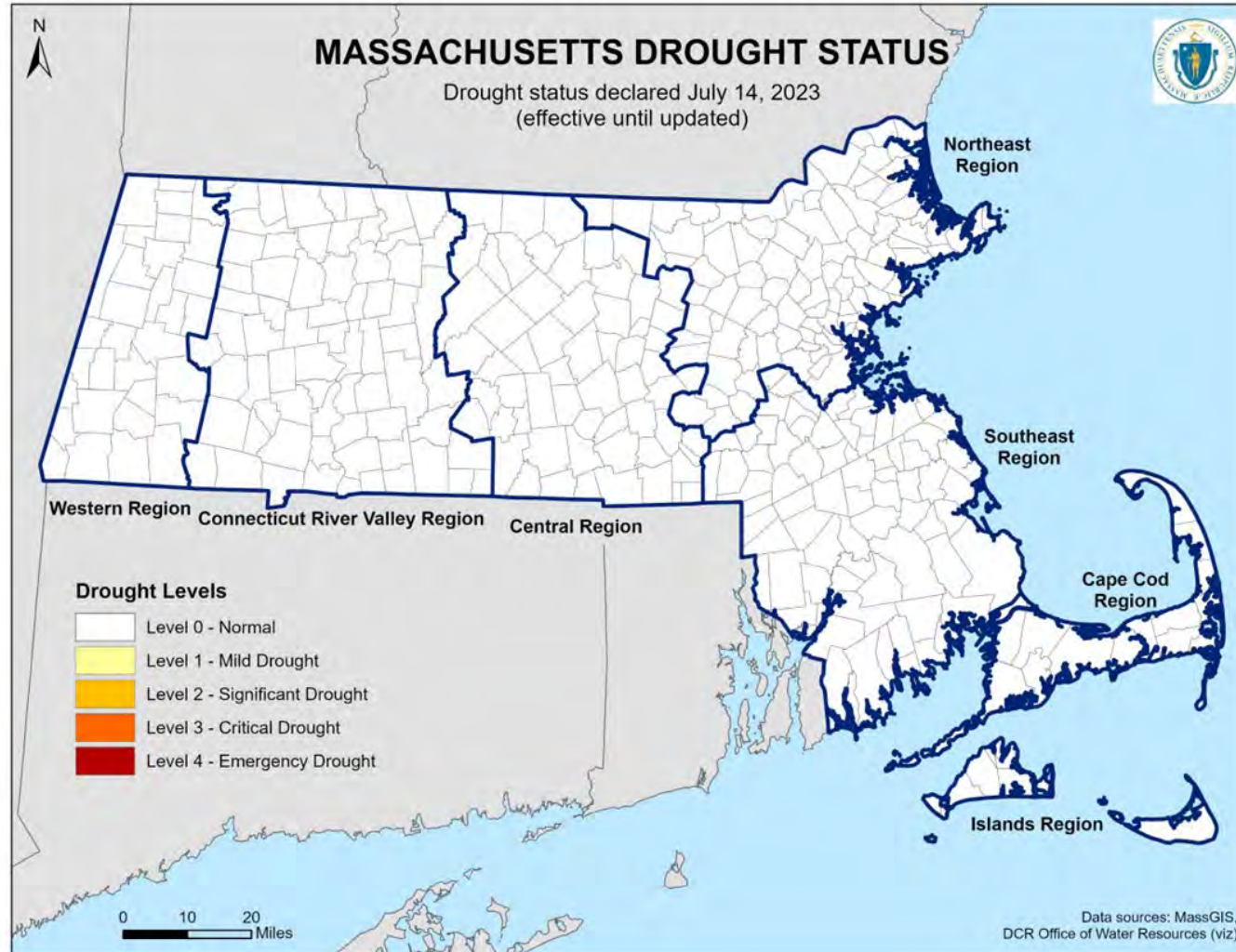
DMP Index Severity Levels do not necessarily reflect water supply status.

DMP Index Severity Levels			
1	2	3	4





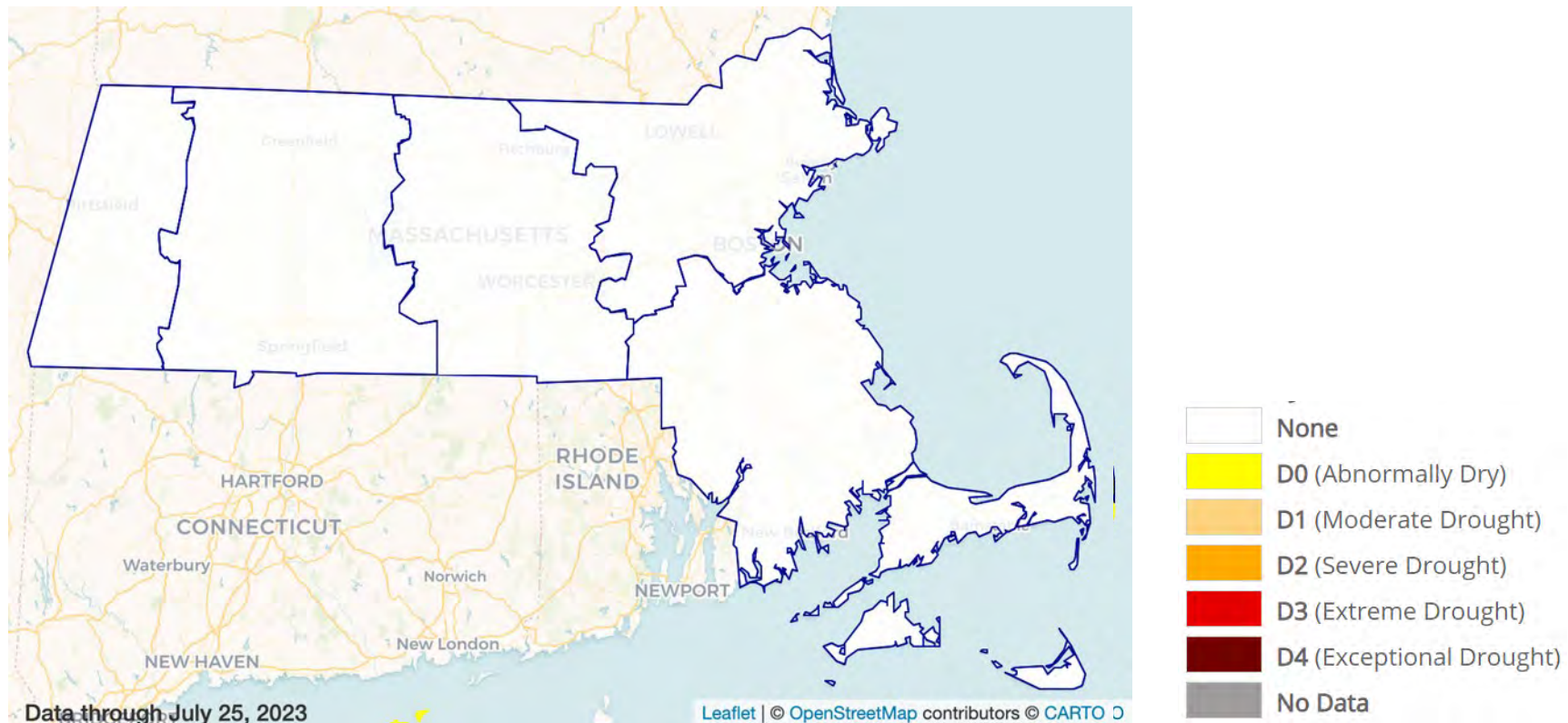
## MASSACHUSETTS DROUGHT STATUS



# U.S. DROUGHT MONITOR (USDM)

At the end of July, the USDM showed no areas of drought.

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



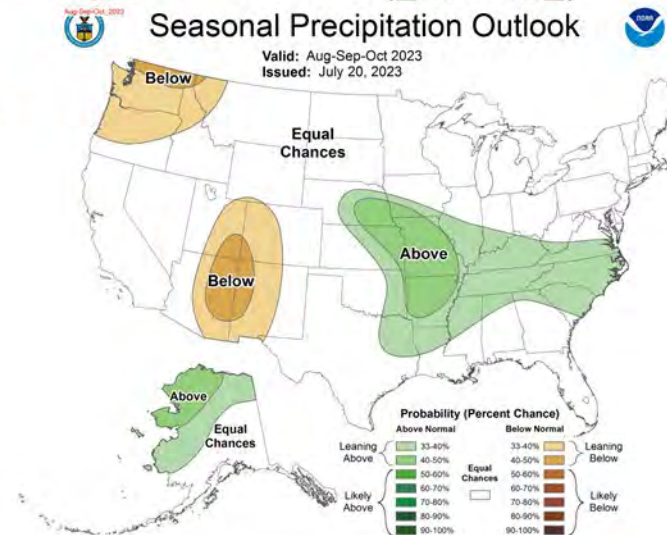
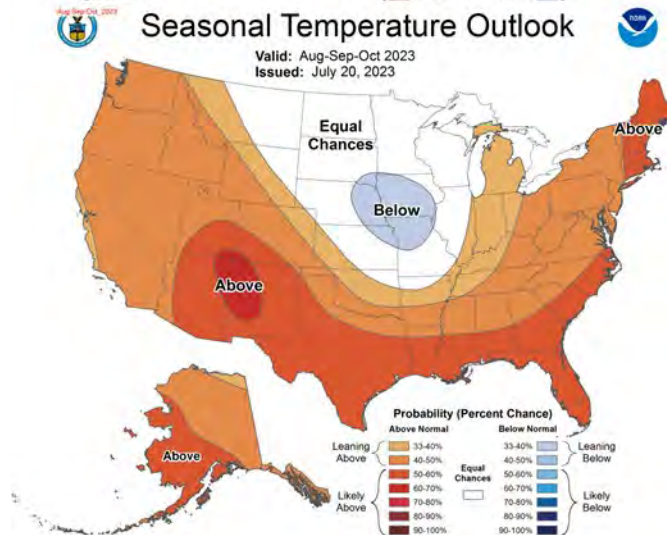
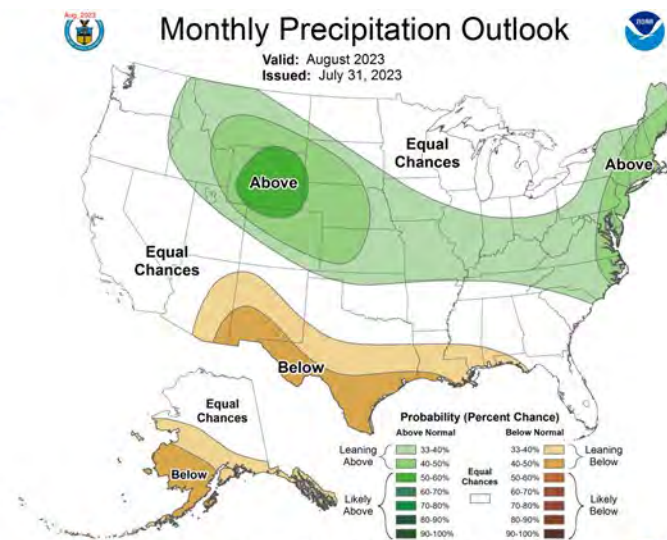
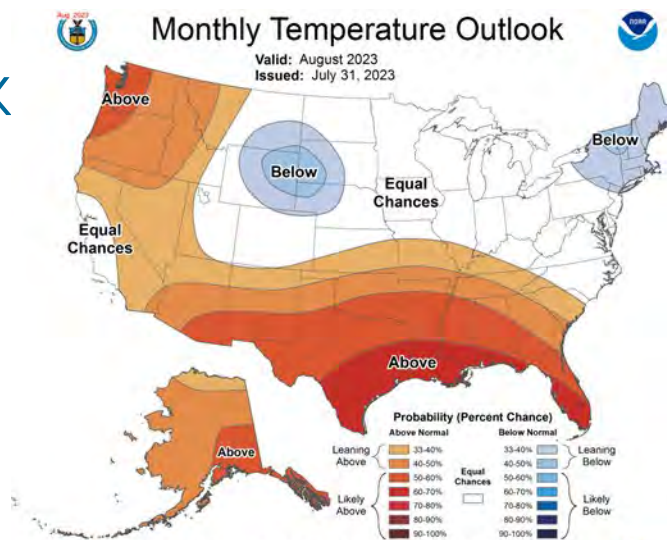


# TEMPERATURE AND PRECIPITATION OUTLOOK

**August:** The outlook issued 7/31 shows a 33-40% chance of below-normal temperatures, and a 40-50% chance for above-normal precipitation.

**August through October:** The seasonal outlook issued 7/20 shows a 50-60% chance of above-normal temperatures and equal chances for above-normal, normal, or below-normal precipitation.

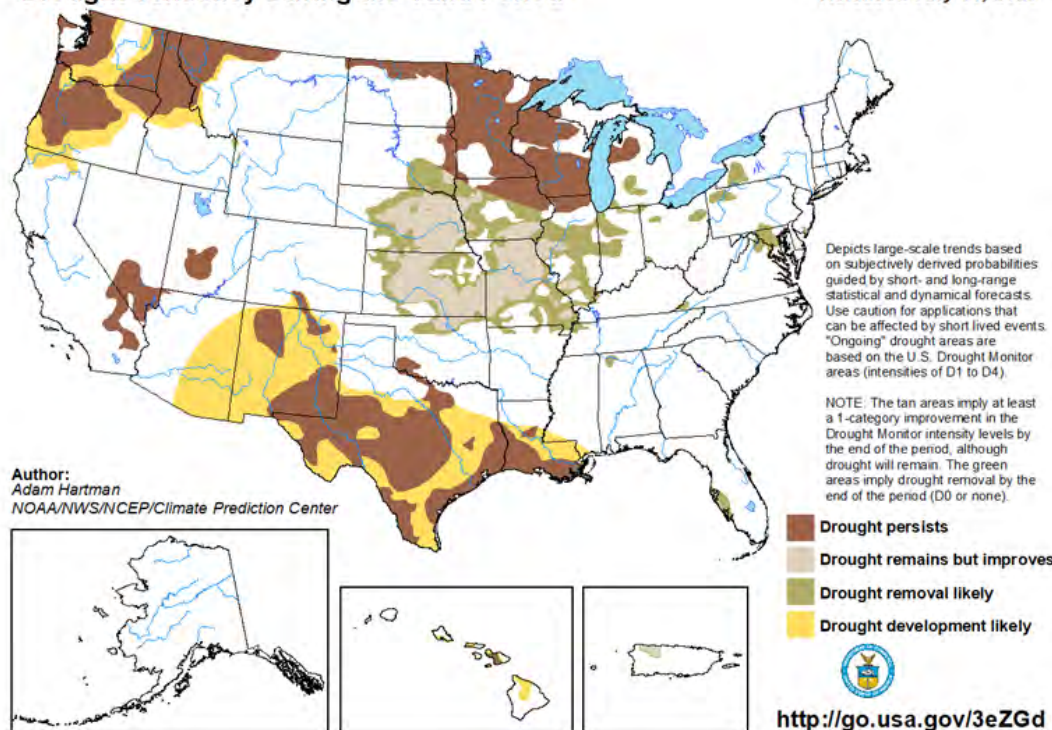
<https://www.cpc.ncep.noaa.gov/>



## U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

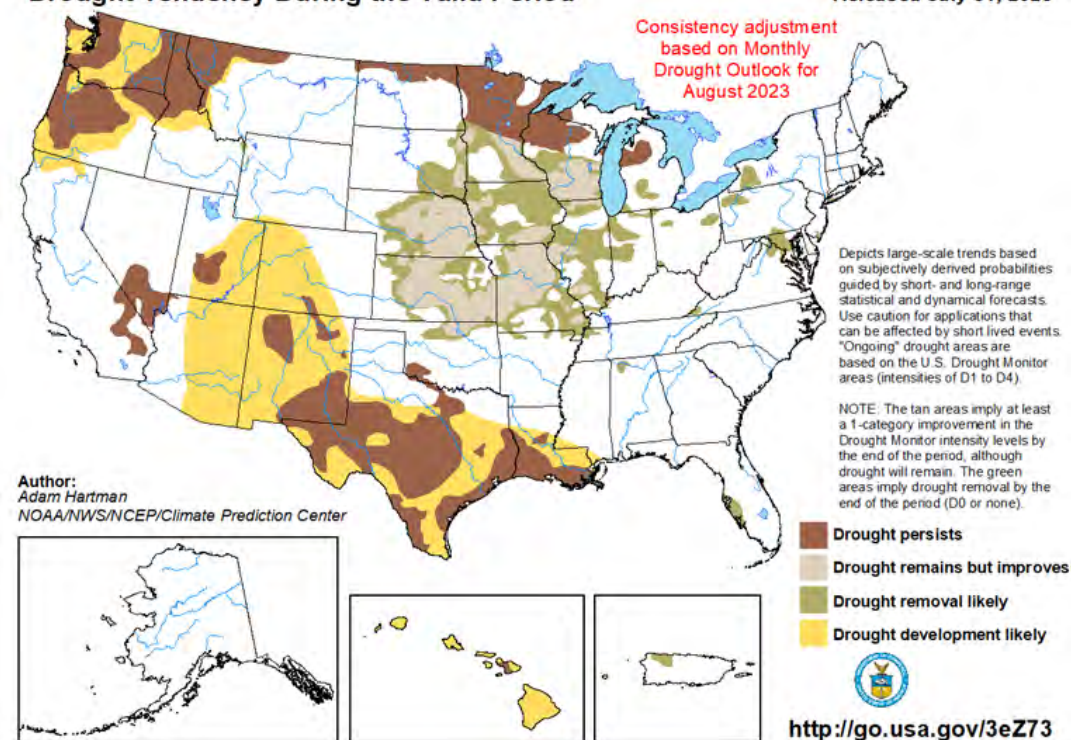
Valid for August 2023  
Released July 31, 2023



## U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for August 1 - October 31, 2023  
Released July 31, 2023



## MONTHLY AND SEASONAL DROUGHT OUTLOOK

The monthly outlook for August released on 7/31 shows no drought development in Massachusetts.

The seasonal outlook for August through October issued on 7/31 shows no drought development in Massachusetts.

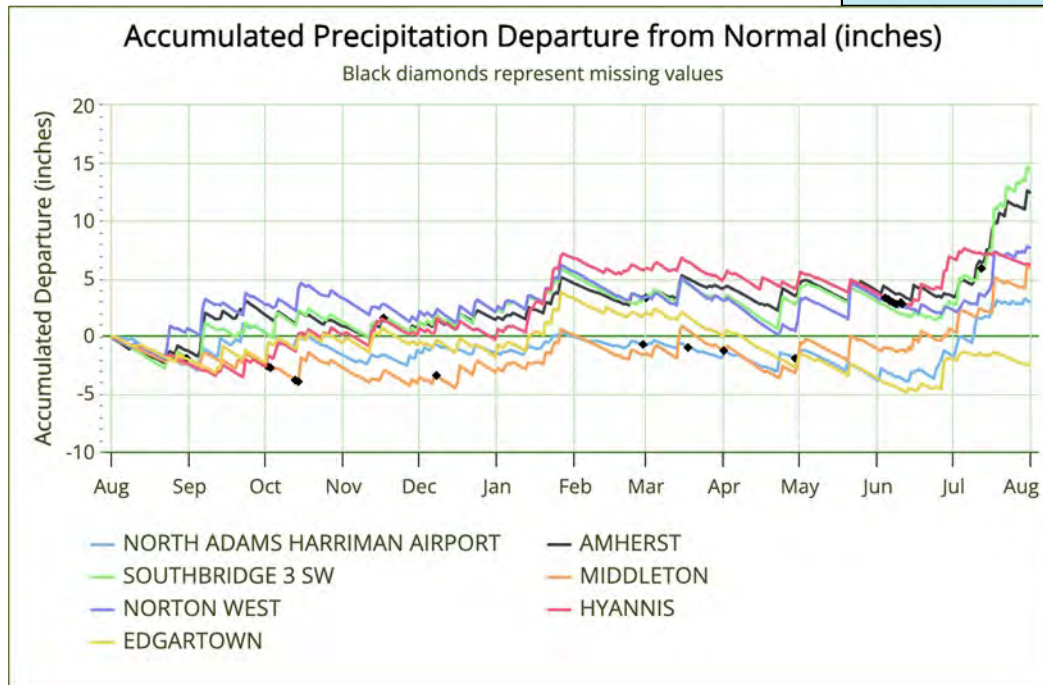
<http://www.cpc.ncep.noaa.gov/products/Drought>



# ADDITIONAL PRECIPITATION DATA

## Standardized Precipitation Index— July 2023 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	6	96	95	86	83	89	83	83	86
CTRV	11	99	95	88	90	93	85	71	83
CENTRAL	14	99	98	95	88	95	92	87	90
NORTHEAST	21	95	96	92	85	89	81	69	84
SOUTHEAST	24	97	91	88	69	80	84	71	76
CAPE COD	6	65	77	64	40	76	81	83	64
ISLANDS	4	50	58	38	5	38	41	26	20



DMP Index Severity Levels			
1	2	3	4

## Accumulated Precipitation Departure from 30-Year Normals 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/>

## ADDITIONAL PRECIPITATION DATA (CONT.)

## Percent of Average Historical Precipitation—July 2023

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	JULY AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	6	4.59	9.93	5.34	216%
CTRV	11	4.23	11.56	7.33	273%
CENTRAL	14	4.05	11.17	7.12	276%
NORTHEAST	21	3.52	8.63	5.11	245%
SOUTHEAST	24	3.60	8.13	4.53	226%
CAPE COD	6	2.86	3.01	0.15	105%
ISLANDS	4	2.65	2.08	-0.57	78%



# 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.

## 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	$\leq -4.0$

## 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



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**Massachusetts Water Resources Commission**

**Executive Office of Energy and Environmental Affairs**

[www.mass.gov/conservemawater](http://www.mass.gov/conservemawater)

[www.mass.gov/drought-management](http://www.mass.gov/drought-management)