

MASSACHUSETTS WATER RESOURCES COMMISSION

HYDROLOGIC CONDITIONS IN MASSACHUSETTS

NOVEMBER
2023

The Commonwealth of Massachusetts

Maura T. Healey, Governor

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



NOVEMBER 2023 HYDROLOGIC CONDITIONS

SUMMARY OF CONDITIONS



- Monthly average temperatures were below normal.



- Precipitation was below normal. All regions are at an elevated Index Severity Level (ISL) at the 2-month. There was no snow cover remaining at the end of November.



- Crop Moisture Index showed Abnormally Moist and Slightly Dry/Favorably Moist conditions across the state at the end of the month. The 1-month and 2-month Evaporative Demand Drought Index maps showed normal to above normal.



- The Keetch-Byram Drought Index showed normal soil moisture conditions at the end of the month.



- Streamflow was mostly normal.



- Groundwater was below normal to above normal. The Islands Region is the only region elevated at ISL 2.



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



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



- NOAA's 3-month outlook shows chances leaning for above-normal temperatures and above-normal precipitation.

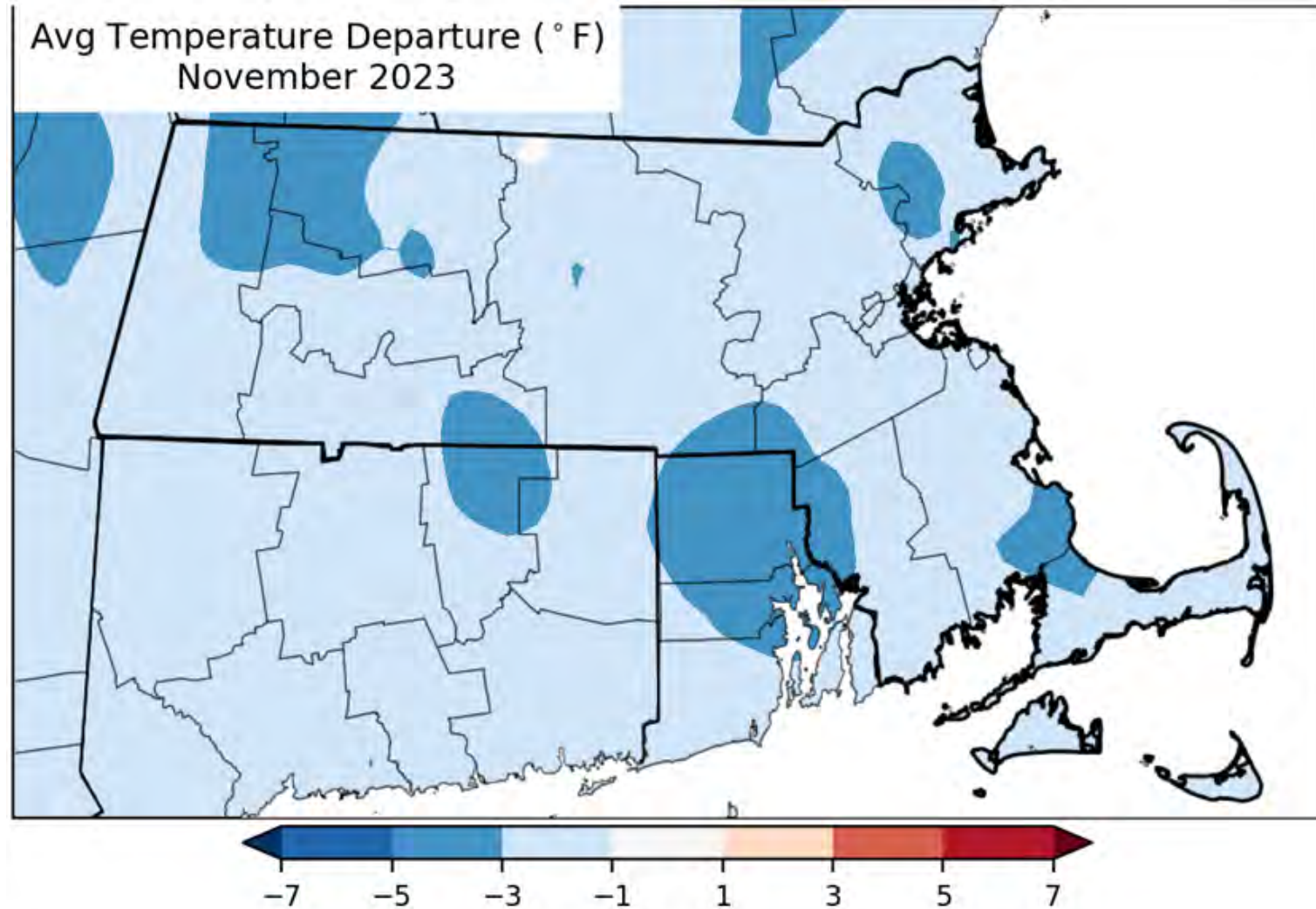


- Appendix II provides information on the Massachusetts Drought Management Plan (DMP) including ISL thresholds used in this report.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 12/13/2023. 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 below normal. However, according to the Northeast Regional Climate Center (NRCC), Massachusetts still had its 7th warmest autumn (September – November) on record.

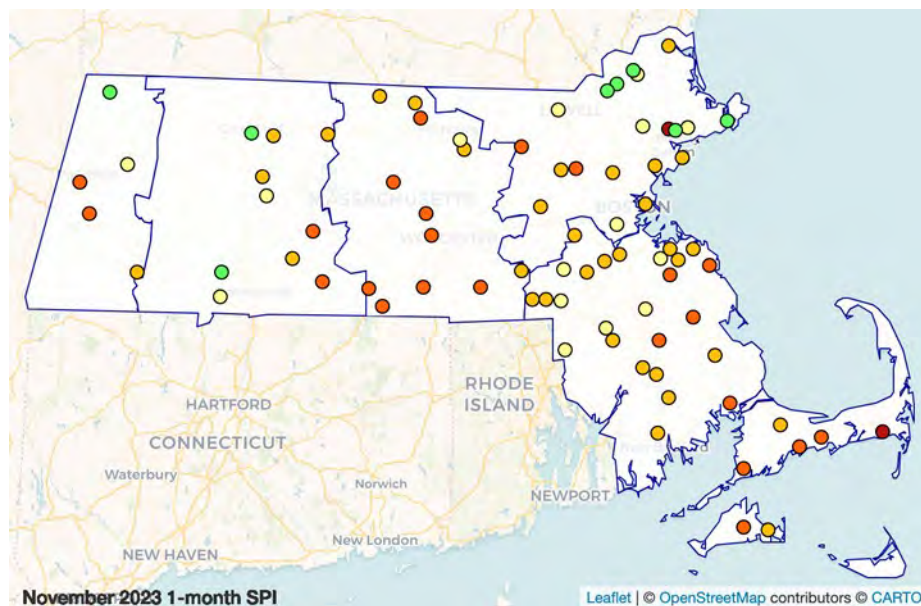
<http://www.nrcc.cornell.edu/regional/monthly/monthly.html>





STANDARDIZED PRECIPITATION INDEX (SPI) AS A PERCENTILE

November precipitation was below normal. In addition to the table below, Appendix I provides all the 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	NOVEMBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	5	1.94	-1.73	12	36	87
CTRV	10	1.95	-1.67	19	63	92
CENTRAL	13	1.68	-2.33	8	66	97
NORTHEAST	20	2.25	-1.73	21	45	97
SOUTHEAST	26	2.13	-2.16	15	46	81
CAPE COD	5	1.68	-2.50	8	30	65
ISLANDS	2	1.47	-2.66	11	42	52

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

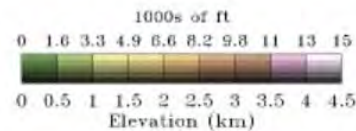
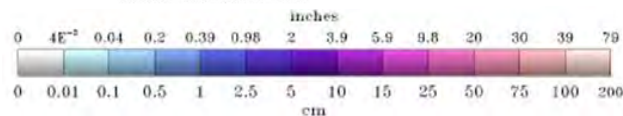
SNOW COVER

At the end of November, there was no remaining snow cover in Massachusetts. However, according to the NRCC, the Worcester climate site set a new Daily Snowfall Record for November 21st: 2.0" breaking the previous record of 1.9" in 1978. <http://www.nrcc.cornell.edu/regional/monthly/monthly.html>

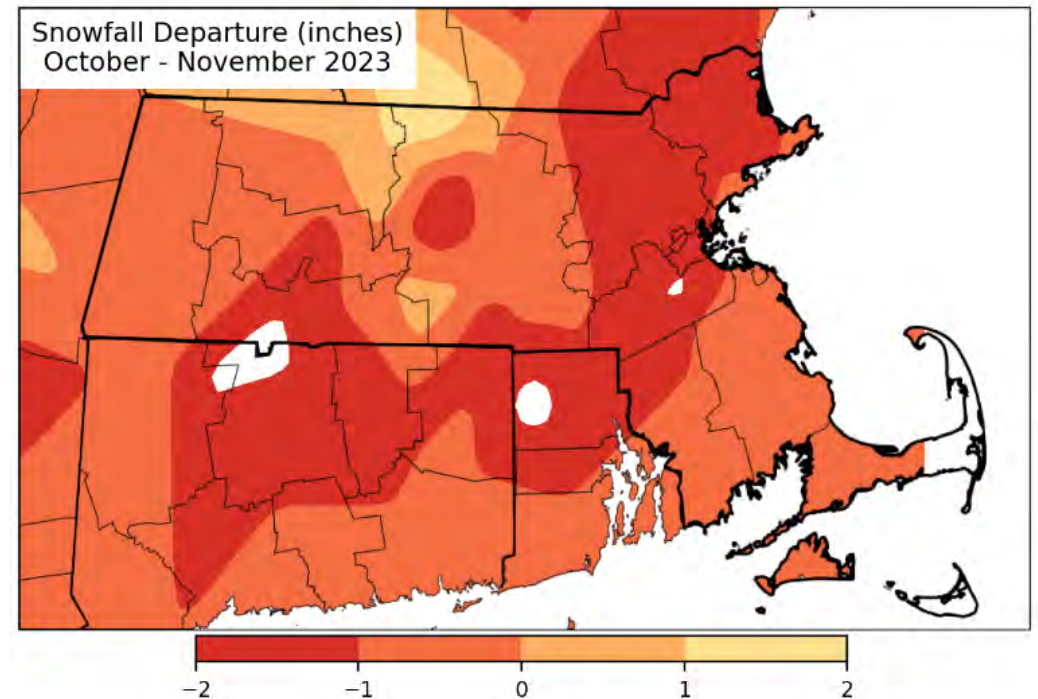


Snow Water Equivalent

2023-11-30 06 UTC



SEASON-TO-DATE SNOWFALL DEPARTURE



CROP MOISTURE INDEX (CMI)

Weekly values for the period ending November 25, 2023 from NOAA's National Weather Service Climate Prediction Center were in the Slightly Dry/Favorably Moist range in the western climate division and Abnormally Moist in the central and coastal climate divisions.

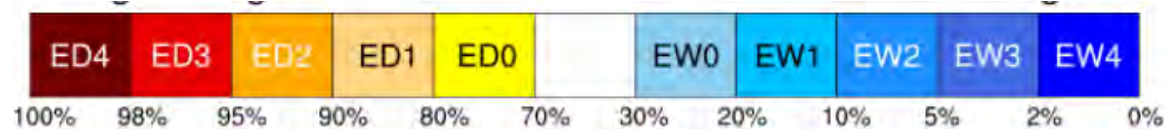
https://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

CLIMATE DIVISION	CROP MOISTURE INDEX
WESTERN	0.84
CENTRAL	1.15
COASTAL	1.06

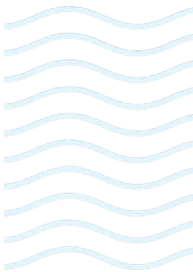


EVAPORATIVE DEMAND DROUGHT INDEX (EDDI)

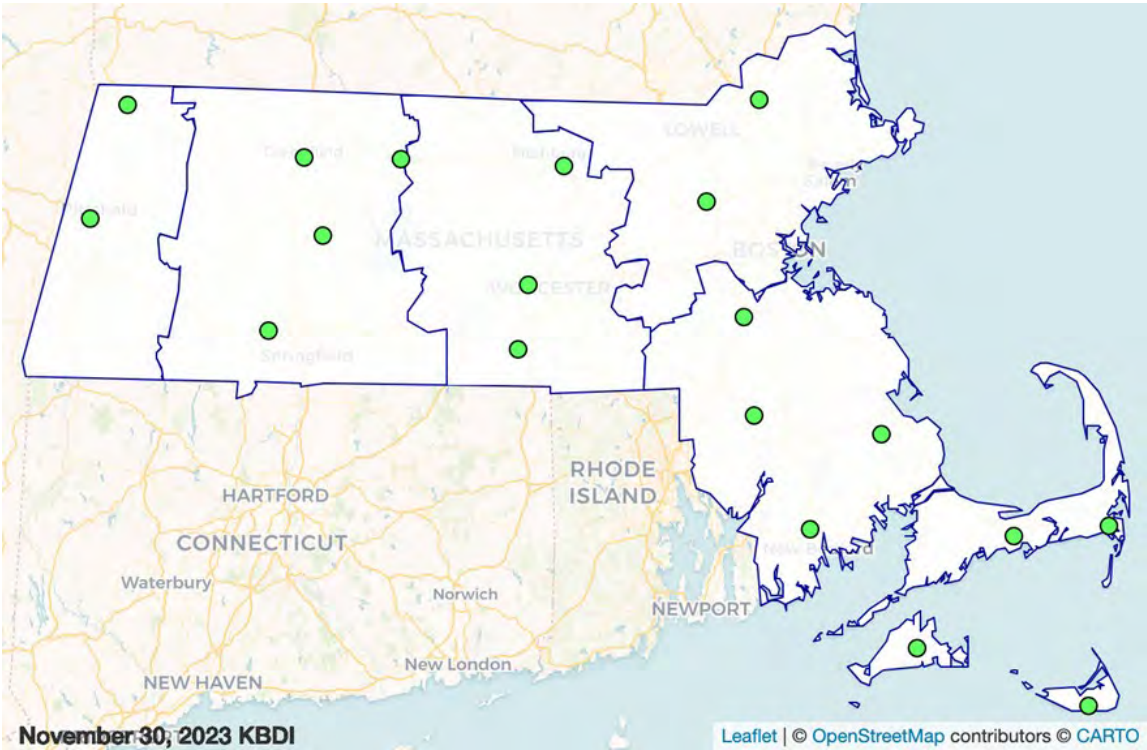
The 1-month and 2-month EDDI categories for November 30, 2023 were normal to above normal.



Generated by NOAA/ESRL/Physical Sciences Laboratory



At the end of November, the Keetch Byram Drought Index (KBDI) was in the normal range in all Regions.



REGION	NUMBER OF SITES REPORTING	HIGHEST OF SITE VALUES
WESTERN	2	0
CTRV	4	1
CENTRAL	3	1
NORTHEAST	2	0
SOUTHEAST	4	3
CAPE COD	2	78
ISLANDS	2	93

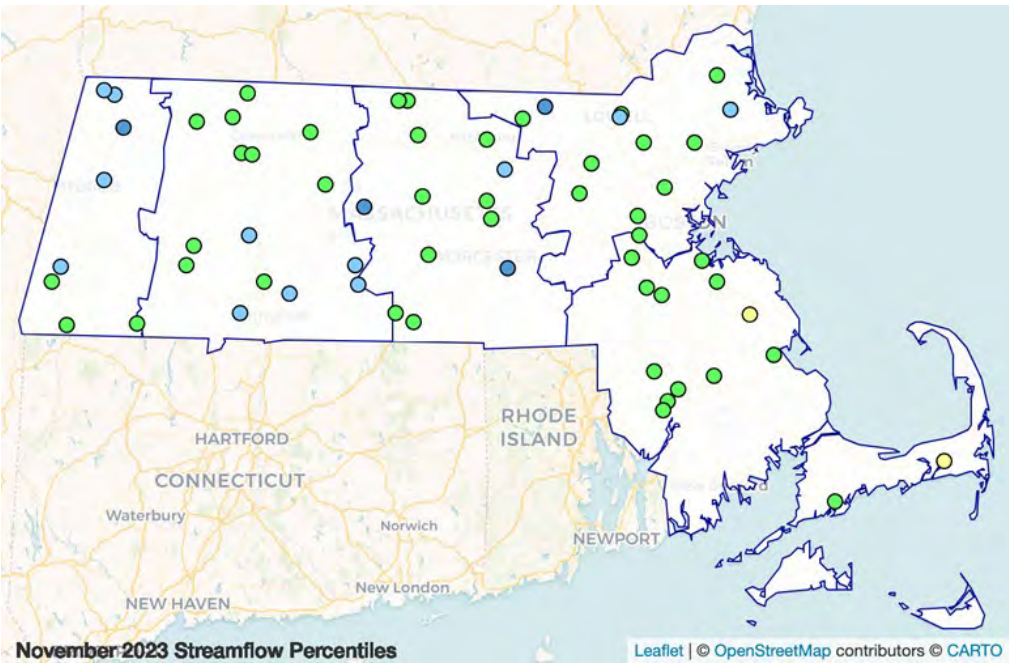
DMP Index Severity Levels			
1	2	3	4

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



During November, streamflow was mostly normal across the state with several individual gages in the Western to Northeast regions in the above-normal range and two gages in the Southeast and Cape Cod regions in the below-normal range.

MEDIAN MONTHLY STREAMFLOW PERCENTILES COMPARED TO HISTORICAL VALUES



● ≥ 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	0	0	0	0	73
CTRV	15	0	0	0	0	0	69
CENTRAL	13	0	0	0	0	0	65
NORTHEAST	13	0	0	0	0	0	63
SOUTHEAST	12	0	0	0	1	0	47
CAPE COD	2	0	0	0	1	0	37

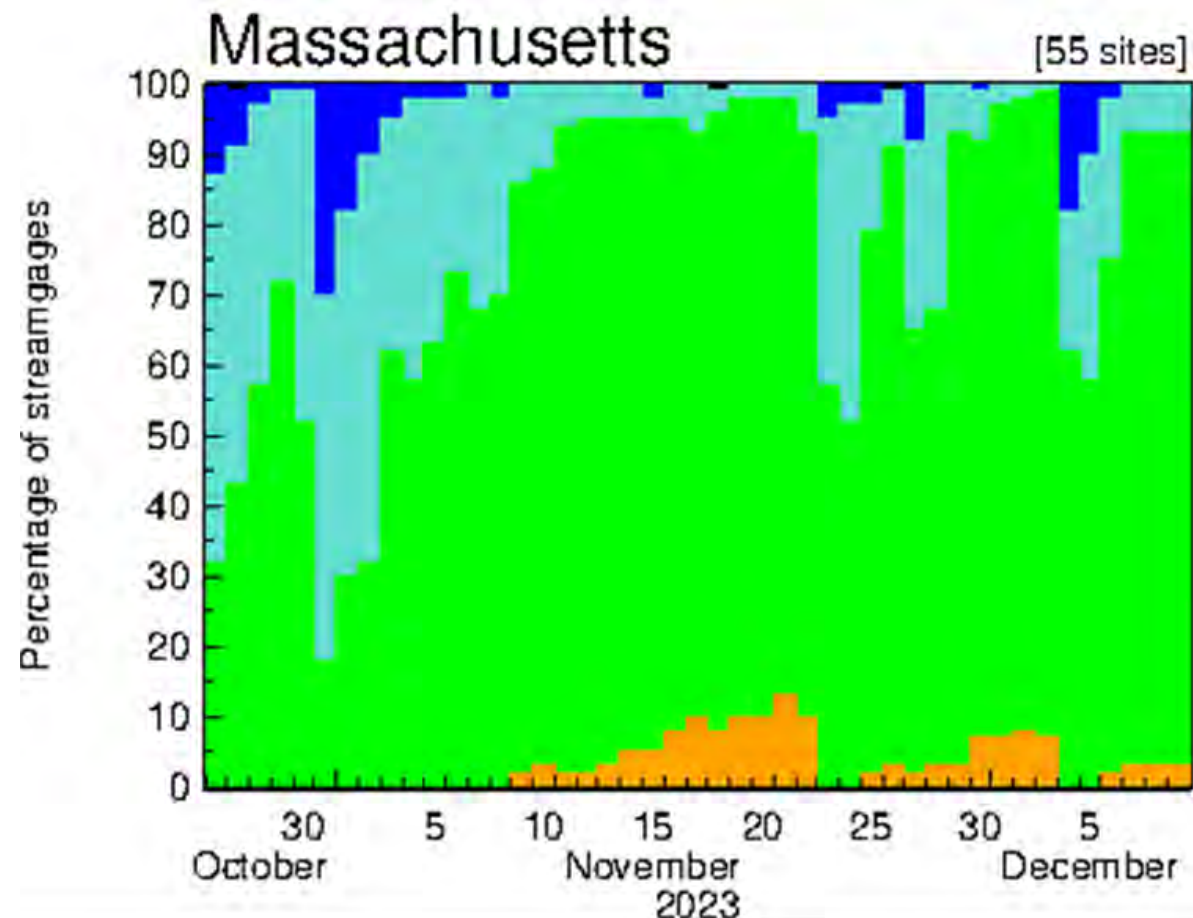
Note: Not all gages report in all months due to ice, beaver dams or other conditions. Streamflow index is not applicable to the Islands.

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		



A search of the Local Storm Report App database on the Iowa State University Iowa Environmental Mesonet website produced only snow and freezing rain totals and no reports of flooding. There were no flood warnings issued for Massachusetts by NWS during November.

The November Monthly Flood Report from the Albany NWS Office did not report any flooding.

Norton/Boston NWS E-5 Monthly Report of Hydrologic Conditions indicated that no flooding occurred in the service area during November.



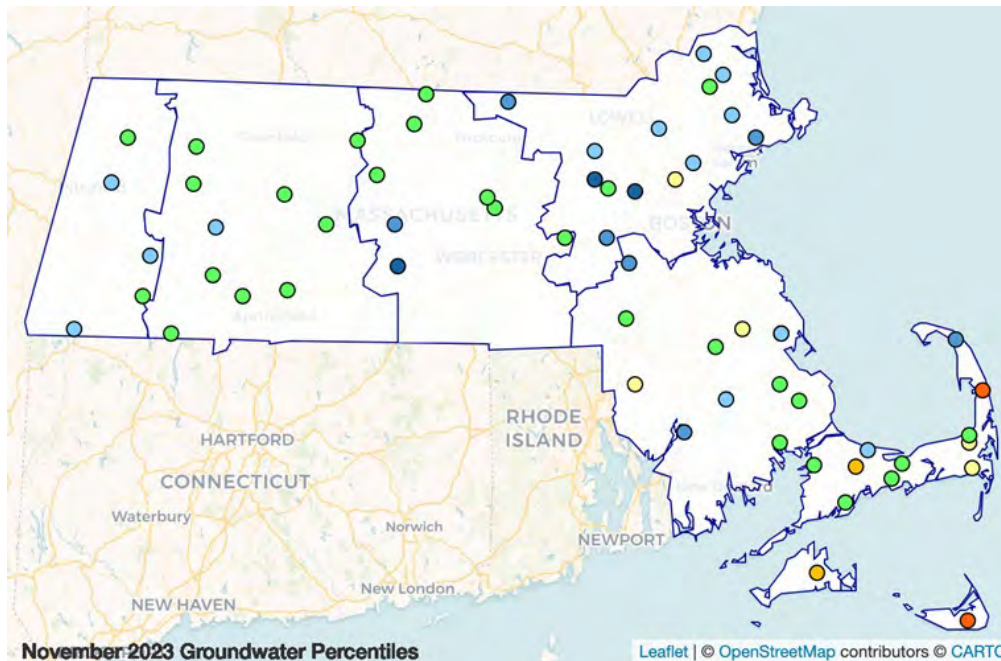
Image: Courtesy of NASA/JPL-Caltech

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



November groundwater levels ranged from below normal to much above normal. Regional medians were in the normal to above-normal range in all Regions except for the Islands, which is at ISL 2.

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



● ≥ 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 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	0	0	0	75
CTRV	10	0	0	0	0	0	60
CENTRAL	8	0	0	0	0	1	62
NORTHEAST	14	0	0	0	1	2	76
SOUTHEAST	12	0	0	0	2	0	58
CAPE COD	11	0	1	1	2	0	47
ISLANDS	2	0	1	1	0	0	12

DMP Index Severity Levels			
1	2	3	4

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

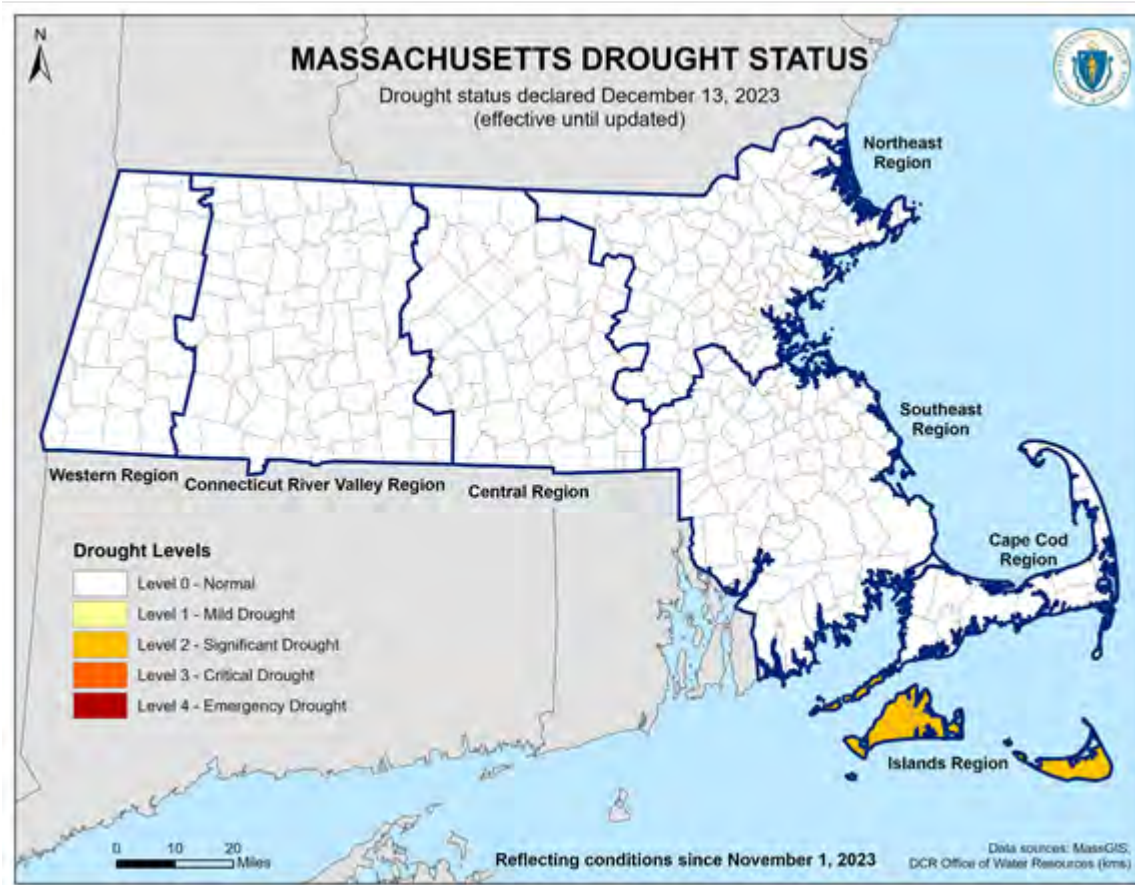
REGION	NUMBER OF SITES REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	0	
CTRV	2	80th
CENTRAL	4	70th
NORTHEAST	4	84th
SOUTHEAST	2	66th
CAPE COD	1	33rd

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

DMP Index Severity Levels			
1	2	3	4



MASSACHUSETTS DROUGHT STATUS

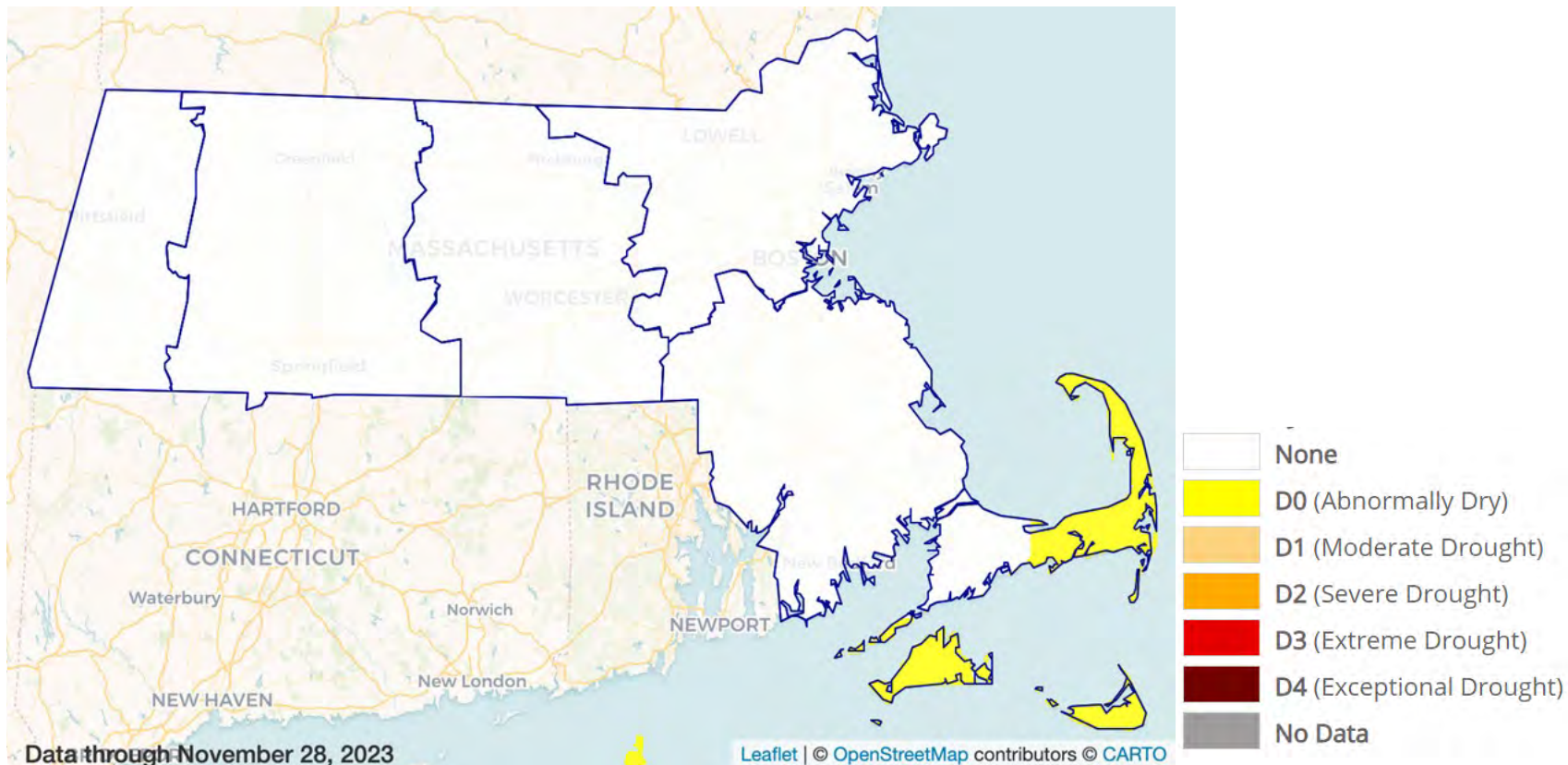


On December 13, 2023, Massachusetts Energy and Environmental Affairs (EEA) Secretary Rebecca L. Tepper declared that starting from November 1, 2023, the Islands Region is at Level 2 Significant Drought. This status remains in effect until further updated.

U.S. DROUGHT MONITOR (USDM)

At the end of November, the USDM showed areas of D0 on the Islands and mid-Mid to the Outer Cape. These areas of drought were introduced on the November 14th map.

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

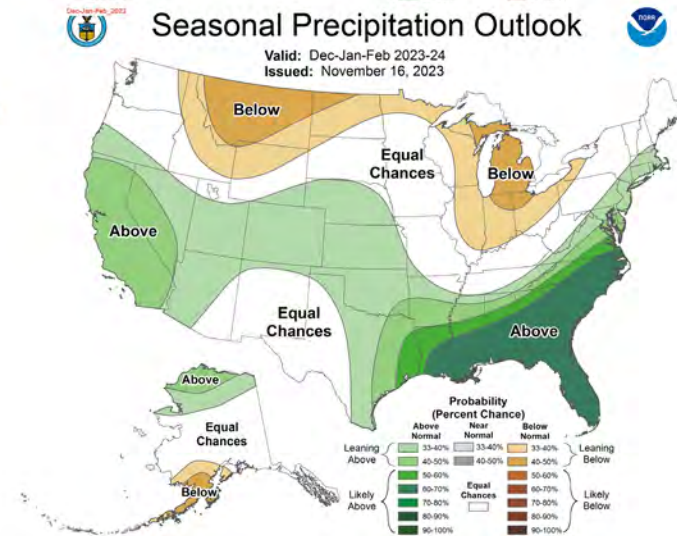
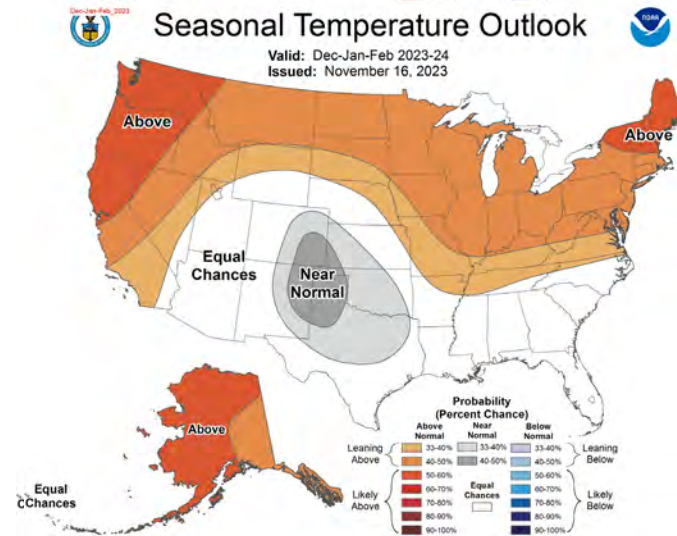
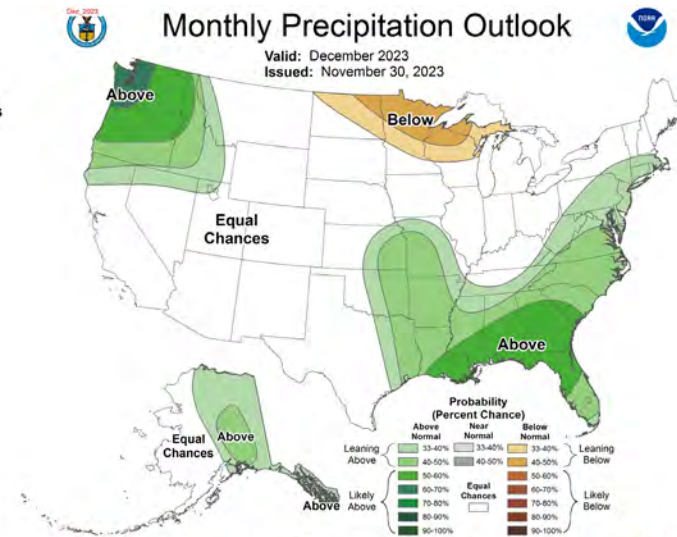
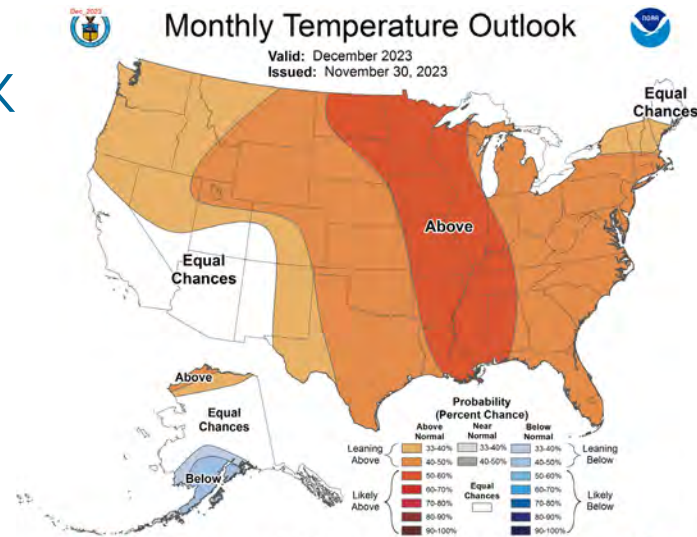


TEMPERATURE AND PRECIPITATION OUTLOOK

December: The outlook issued 11/30 shows a 40-50% chance of above-normal temperatures and a 33-40% chance of above-normal precipitation.

December through February: The seasonal outlook issued 11/16 shows a 40-50% chance of above-normal temperatures and a 33-40% chance of above-normal precipitation.

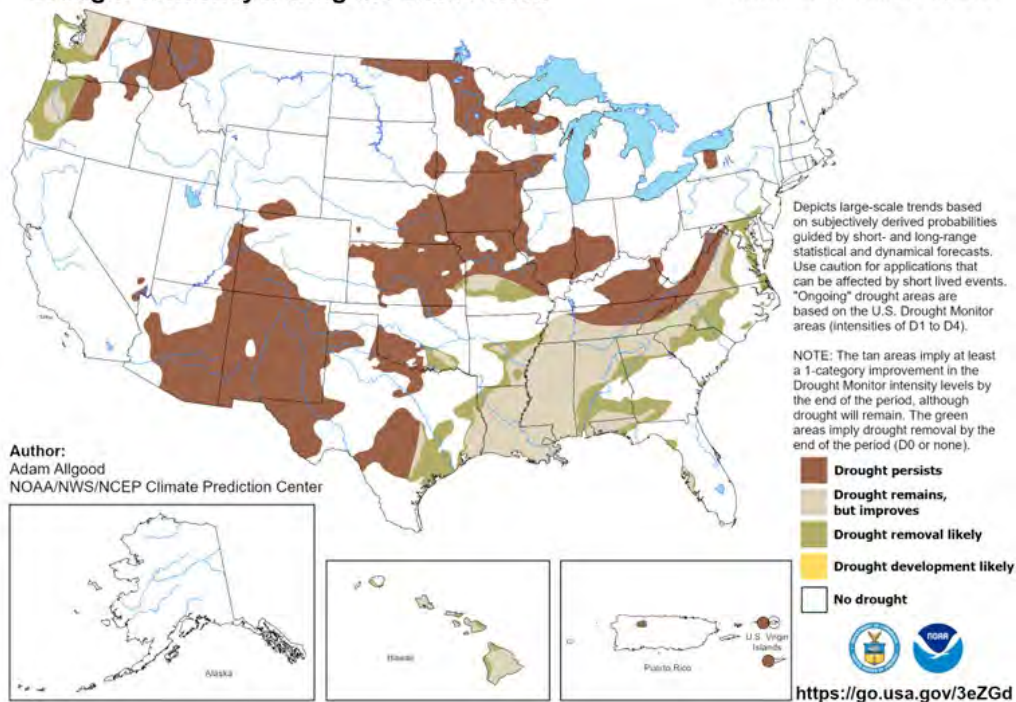
<https://www.cpc.ncep.noaa.gov/>



U.S. Monthly Drought Outlook

Drought Tendency During the Valid Period

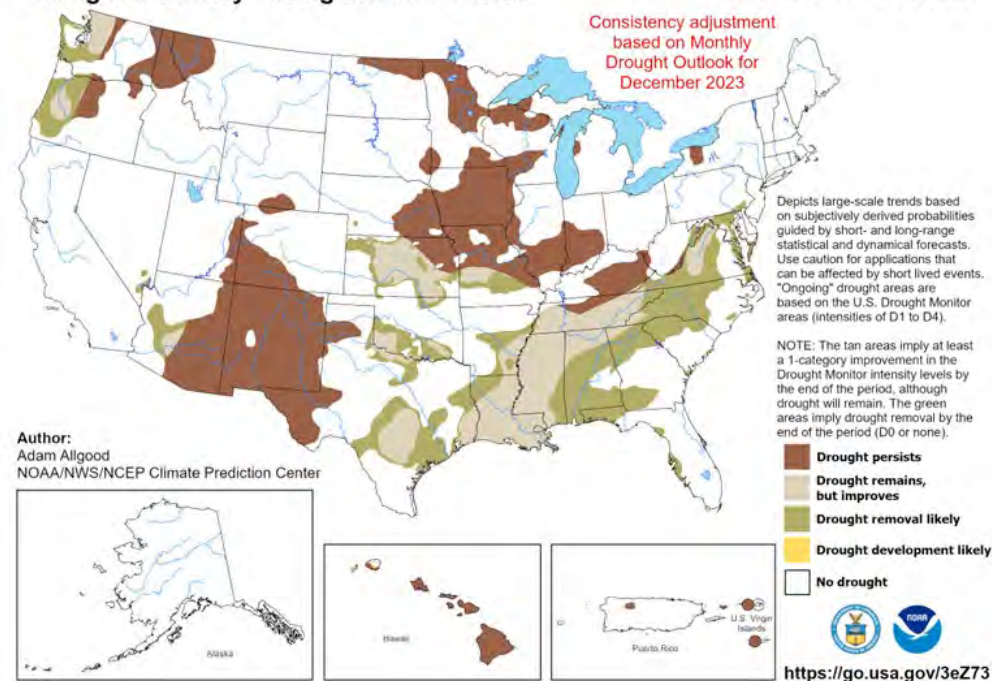
Valid for December 2023
Released November 30, 2023



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for December 1, 2023 - February 29, 2024
Released November 30, 2023



MONTHLY AND SEASONAL DROUGHT OUTLOOK

The monthly outlook for December released on 11/30 shows no drought development in Massachusetts.

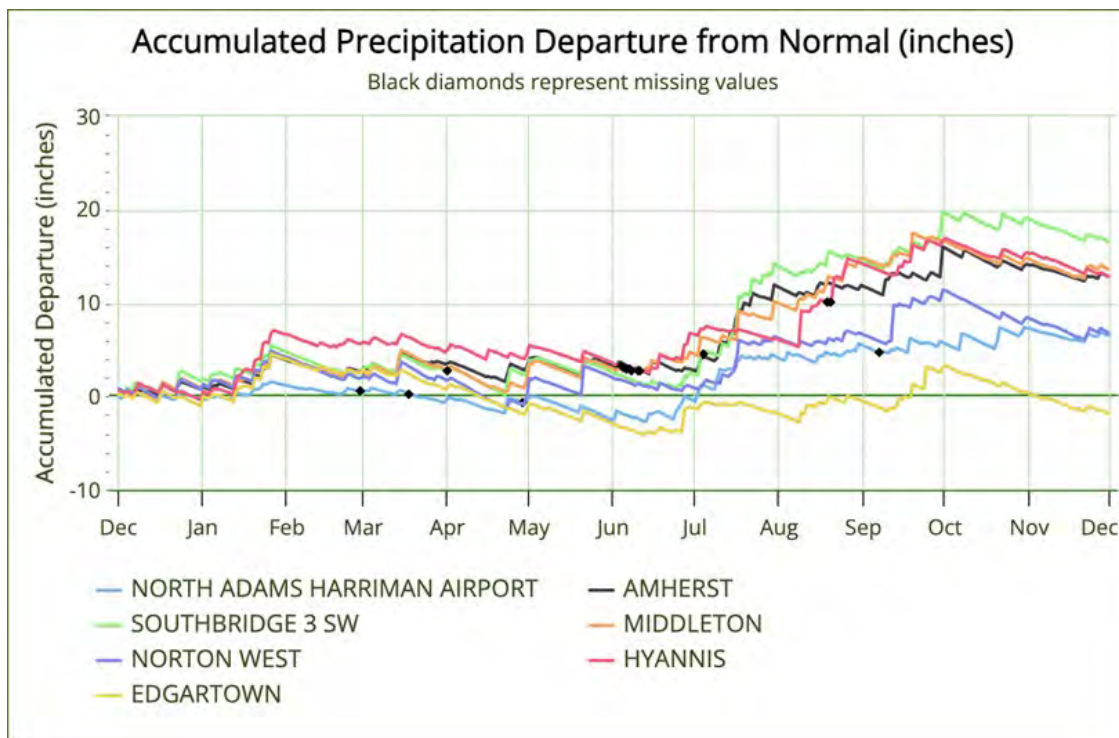
The seasonal outlook for December through February issued on 11/30 shows no drought development in Massachusetts.

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

ADDITIONAL PRECIPITATION DATA

Standardized Precipitation Index—
November 2023 as percentiles

REGION	NUMBER OF SITES	1-mo	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo
WESTERN	5	12	28	36	87	81	83	65	87
CTRV	10	19	23	63	92	90	91	71	84
CENTRAL	13	8	14	66	97	94	96	84	94
NORTHEAST	20	21	18	45	97	95	95	58	85
SOUTHEAST	26	15	10	46	81	79	82	55	81
CAPE COD	5	8	6	30	65	53	74	61	85
ISLANDS	2	11	3	42	52	17	34	11	37



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—November 2023

REGION	NUMBER OF SITES REPORTING	HISTORICAL AVERAGE	NOVEMBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	5	3.67	1.94	-1.73	53%
CTRV	10	3.62	1.95	-1.67	54%
CENTRAL	13	4.01	1.68	-2.33	42%
NORTHEAST	20	3.98	2.25	-1.73	57%
SOUTHEAST	26	4.29	2.13	-2.16	50%
CAPE COD	5	4.18	1.68	-2.50	40%
ISLANDS	2	4.13	1.47	-2.66	36%

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	≤ 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

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



Massachusetts Water Resources Commission

Executive Office of Energy and Environmental Affairs

www.mass.gov/conservemawater

www.mass.gov/drought-management