

MASSACHUSETTS WATER RESOURCES COMMISSION

DECEMBER
2021 HYDROLOGIC CONDITIONS
IN MASSACHUSETTS



The Commonwealth of Massachusetts
Charles D. Baker, Governor

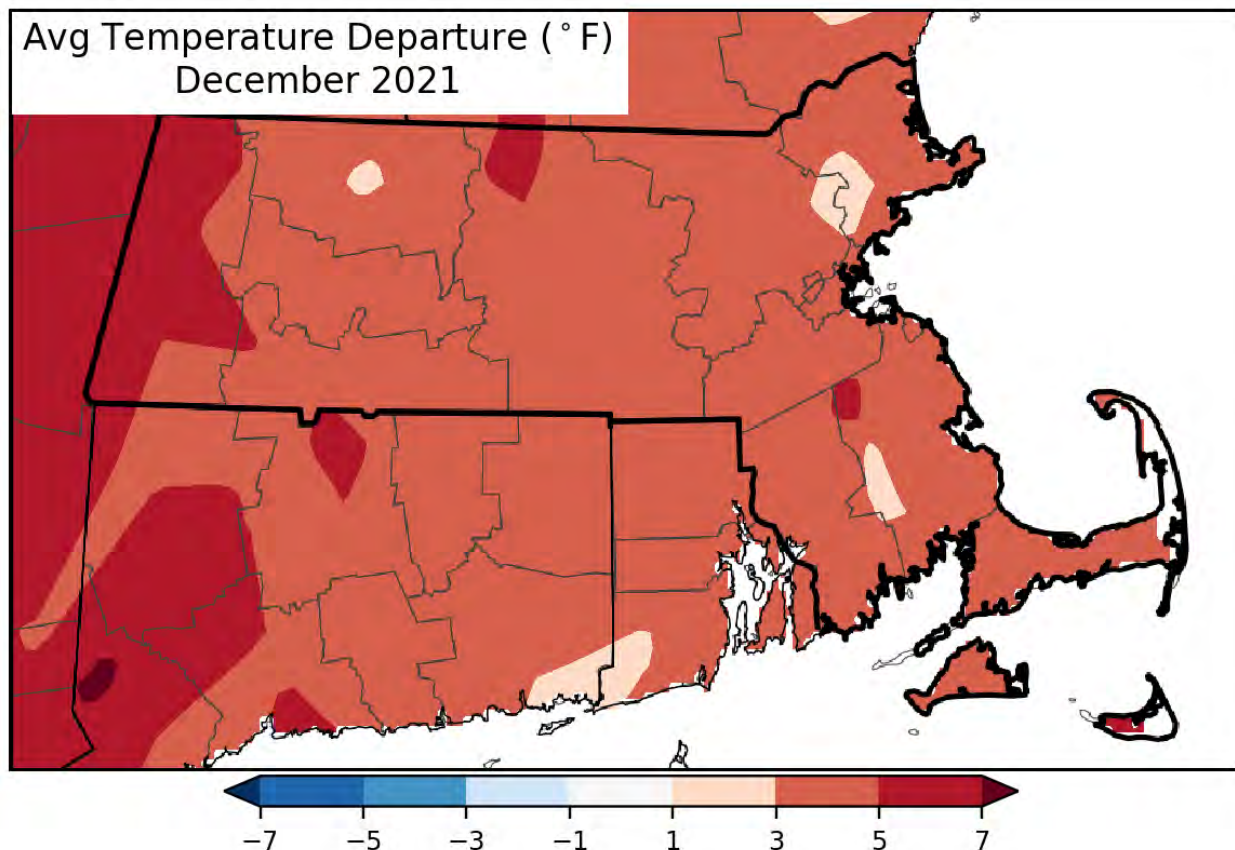
Kathleen A. Theoharides, Secretary, Executive Office of Energy and Environmental Affairs

DECEMBER 2021 HYDROLOGIC CONDITIONS SUMMARY OF CONDITIONS

- Monthly average temperatures were above normal.
- Monthly precipitation was below normal in the Northeast, Southeast, Cape Cod, and Islands regions. The Index Severity Level for the 1-mos SPI is 1, 2, 3, and 4 for these regions respectively.
- Snowfall is below normal for the season with minor snow cover at the end of the month in areas of the central and western parts of the state.
- Streamflow was normal to above normal across the state. All regions are at Index Severity Level 0.
- Groundwater levels were mostly in the normal to above-normal range across the State with some exceptions. All regions are at Index Severity Level 0.
- Lakes & Impoundments were mostly normal to above-normal.
- NOAA's January outlook shows equal chances of below-normal, normal, or above-normal temperatures and precipitation.
- NOAA's 3-month outlook shows chances for above-normal temperatures and equal chances of below-normal, normal, or above-normal precipitation.
- Appendices I and II provide additional precipitation data and information on the Massachusetts Drought Management Plan (DMP), respectively.

TEMPERATURE

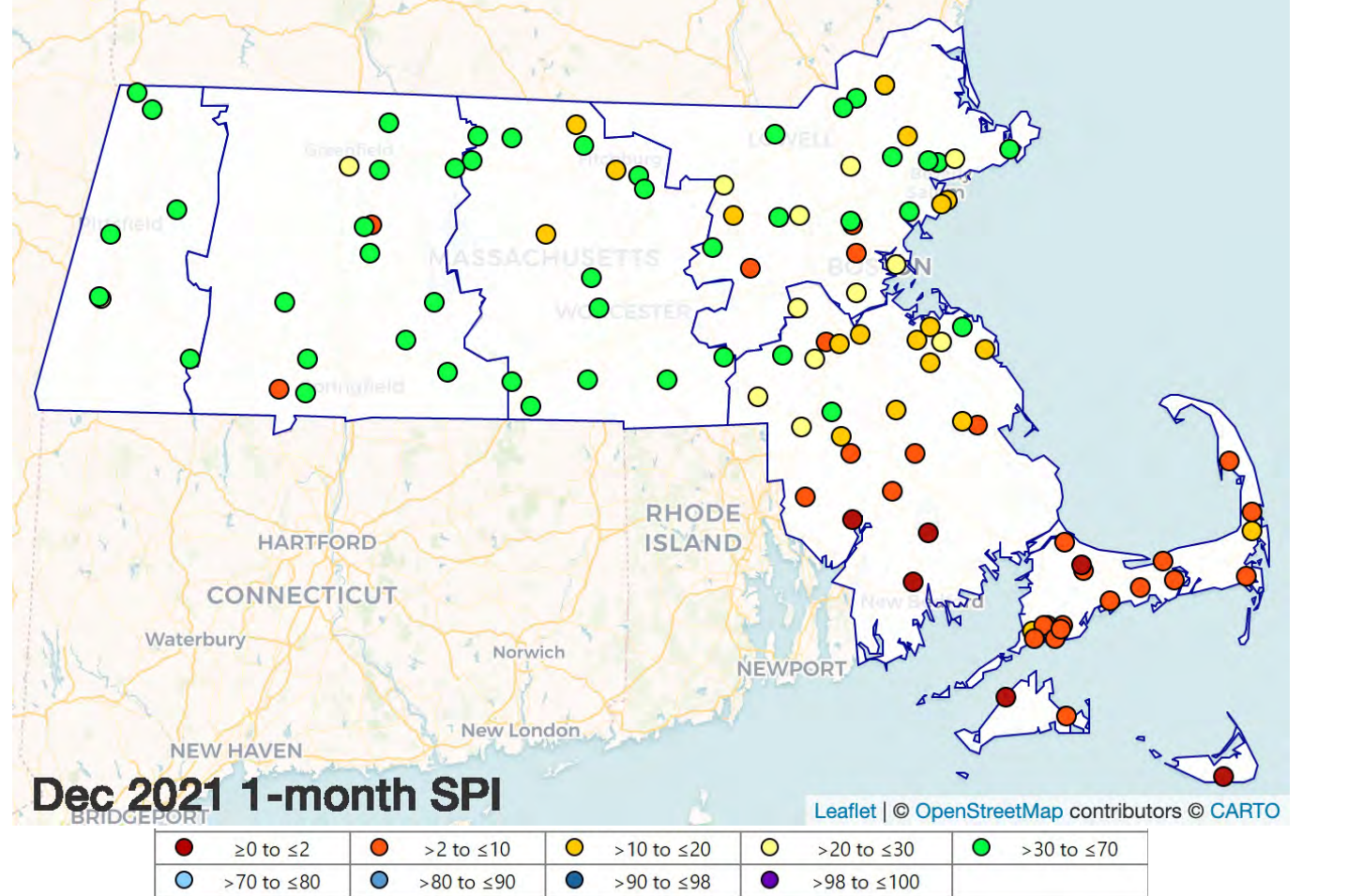
Monthly average temperatures were above normal. According to the Northeast Regional Climate Center, it was the 7th warmest December on record for the Worcester climate site, and the 14th warmest for the Boston site.



PRECIPITATION

November precipitation was below normal in the Northeast, Southeast, Cape Cod, and Islands regions. The 1-month SPI Index Severity is at Level 1 for the Northeast region; at Level 2 for the Southeast; at Level 3 for Cape Cod; and Level 4 for the Islands. These regions along with the CTRV and Central regions are showing deficits at the 2-mos look-back period as well. Appendix I provides additional details for precipitation data, including longer look-back periods.

Standardized Precipitation Index as a Percentile



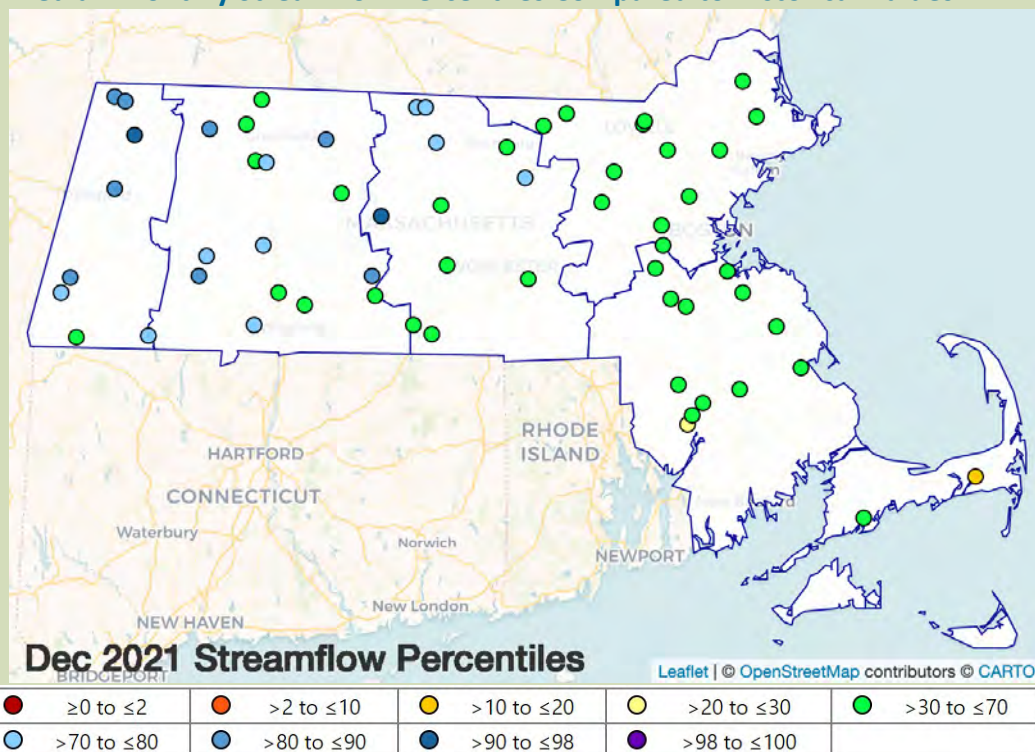
REGION	NUMBER OF SITES REPORTING	DECEMBER MONTHLY AVERAGE (IN)	DEPARTURE FROM HISTORICAL (IN)	SPI* PERCENTILE 1-MONTH	SPI PERCENTILE 3-MONTH	SPI PERCENTILE 6-MONTH
WESTERN	7	3.67	0.23	63	71	98
CTRV	14	3.60	-0.17	48	52	94
CENTRAL	16	3.42	-0.61	43	52	97
NORTHEAST	26	2.98	-0.95	24	49	98
SOUTHEAST	26	2.31	-2.06	18	38	93
CAPE COD	18	1.80	-2.78	5	33	84
ISLANDS	3	1.42	-2.95	2	14	70

DMP Index Severity Levels			
1	2	3	4

STREAMFLOW

Streamflow was normal to above-normal during December for most of the state. Regional monthly streamflow medians were above the 70th percentile for the Western and Connecticut River Valley regions. All regions are at Index Severity Level 0.

Median Monthly Streamflow Percentiles Compared to Historical Values



REGION	TOTAL GAGES REPORTING FOR DEC	≥ 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	1	84
CTRV	15	0	0	0	0	0	74
CENTRAL	11	0	0	0	0	1	61
NORTHEAST	13	0	0	0	0	0	63
SOUTHEAST	12	0	0	0	1	0	43
CAPE COD	2	0	0	1	0	0	38

Note: Not all gages report in all months due to ice, beaver dams or other

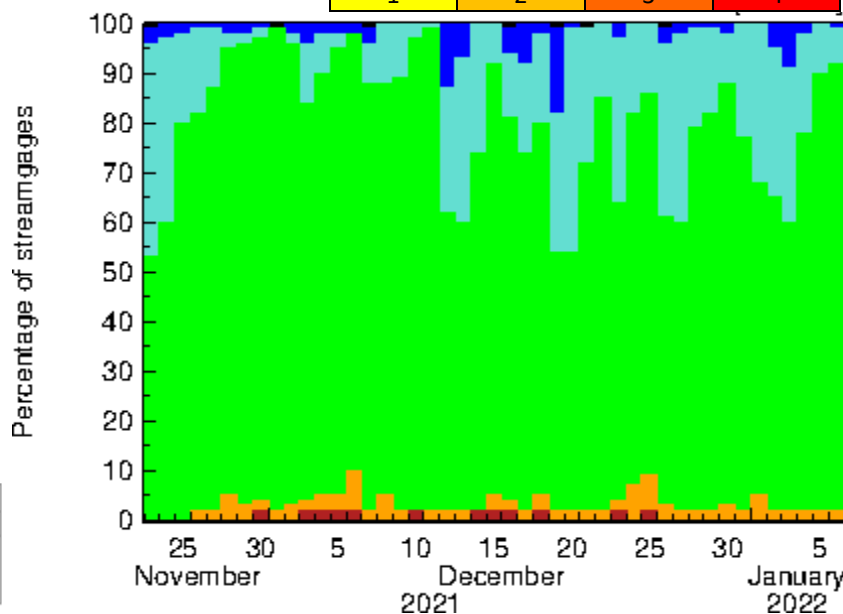
DMP Index Severity Levels			
1	2	3	4

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>

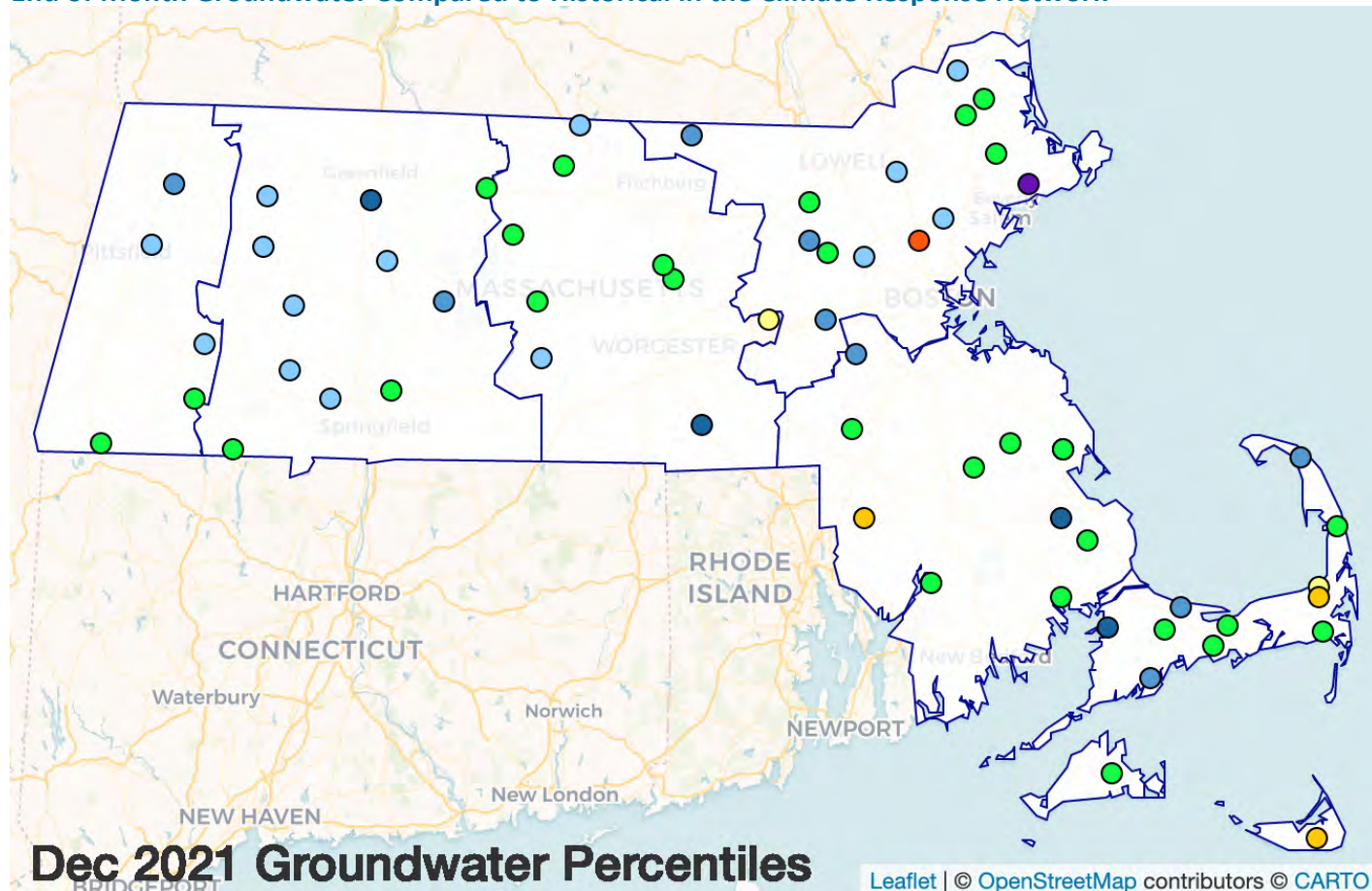
Explanation - Percentile classes							
Low	< 10	10-24	25-75	76-90	> 90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



GROUNDWATER

Percentiles of individual groundwater wells were in the normal to above-normal range throughout much of the state with some exceptions in the eastern half of the state. All regions are at Index Severity Level 0.

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



● ≥ 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 WELLS REPORTING FOR DEC	≥ 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	79
CTRV	11	0	0	0	0	1	76
CENTRAL	9	0	0	0	1	1	66
NORTHEAST	14	0	1	0	0	1	73
SOUTHEAST	11	0	0	1	0	1	61
CAPE COD	11	0	0	1	1	1	58
ISLANDS	2	0	0	1	0	0	31

DMP Index Severity Levels			
1	2	3	4

LAKEs AND IMPOUNDMENTS

REGION	TOTAL REPORTING	MEDIAN OF INDIVIDUAL PERCENTILES OR PERCENT FULL
WESTERN	1	82
CTRV	2	88
CENTRAL	4	72
NORTHEAST	6	89
SOUTHEAST	1	99.9% full
CAPE COD	1	47

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

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

DMP Index Severity Levels			
1	2	3	4

KEETCH BYRAM DROUGHT INDEX (KBDI)

Provided April through November.

CROP MOISTURE INDEX (CMI)

Provided April through November.

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

SNOWFALL

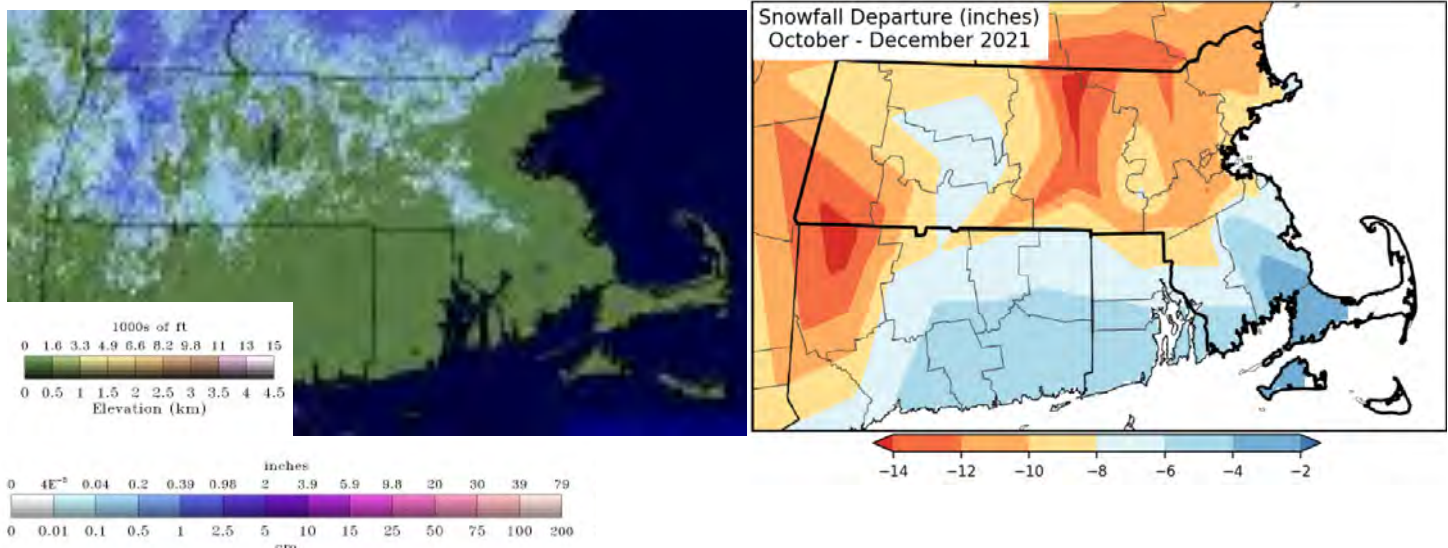
At the end of December snowfall was below normal for the season with some minor snow cover in areas of the central and western parts of the state.

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

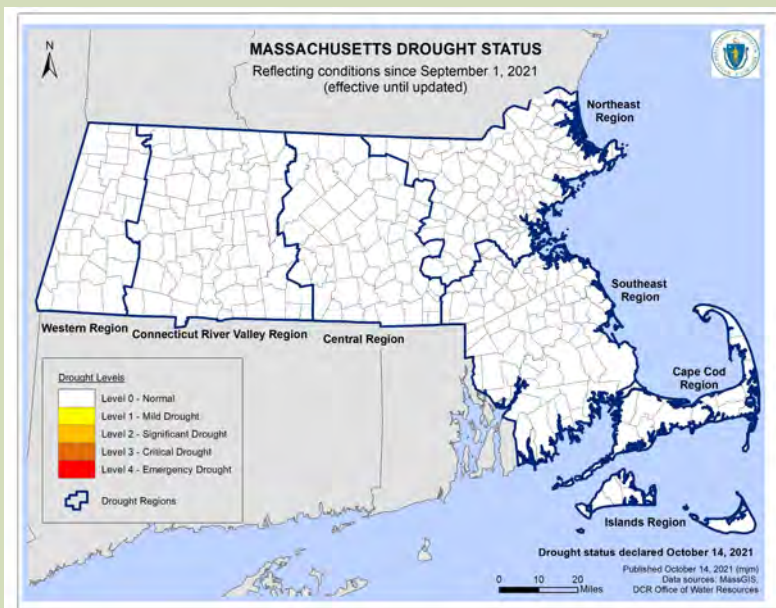
<https://www.nohrsc.noaa.gov/technology/>

Snowfall Departure:

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



DROUGHT CONDITIONS AND FORECASTS



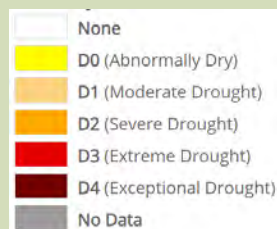
Massachusetts Drought Status

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, South-east, and Islands Regions. This status remains in effect until further updates.

U.S. Drought Monitor (USDM)

At the end of December, 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>



NOAA Climate Prediction Center

Temperature and Precipitation Outlook

January: The outlook issued 12/31 shows equal chances of below-normal, normal, or above-normal temperatures and precipitation.

January through March: The outlook issued 12/16 shows 40-50% chances in the western half of the state for above-normal temperatures, 50-60% chances in the eastern half for above-normal temperatures, and equal chances of below-normal, normal, or above-normal precipitation for the entire state. <https://www.cpc.ncep.noaa.gov/>

Monthly and Seasonal Drought Outlook

The monthly outlook for January released on 12/31 shows no drought development in the state. The seasonal outlook released on 12/31 and valid through March shows no drought development in the state.

This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary. Analysis reflects automated calculations done 1/07/2022. 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—December 2021 as percentiles

REGION	NUMBER OF SITES	1-mo*	2-mo	3-mo	6-mo	9-mo	12-mo	24-mo	36-mo*
WESTERN	7	63	43	71	98	98	94	75	79
CTRV	14	48	26	52	94	93	85	61	75
CENTRAL	16	43	19	52	97	95	87	75	83
NORTHEAST	26	24	13	49	98	97	94	77	86
SOUTHEAST	26	18	5	38	93	93	81	68	78
CAPE COD	18	5	6	33	84	74	59	22	61
ISLANDS	3	2	3	14	70	62	42	22	68

DMP Index Severity Levels			
1	2	3	4

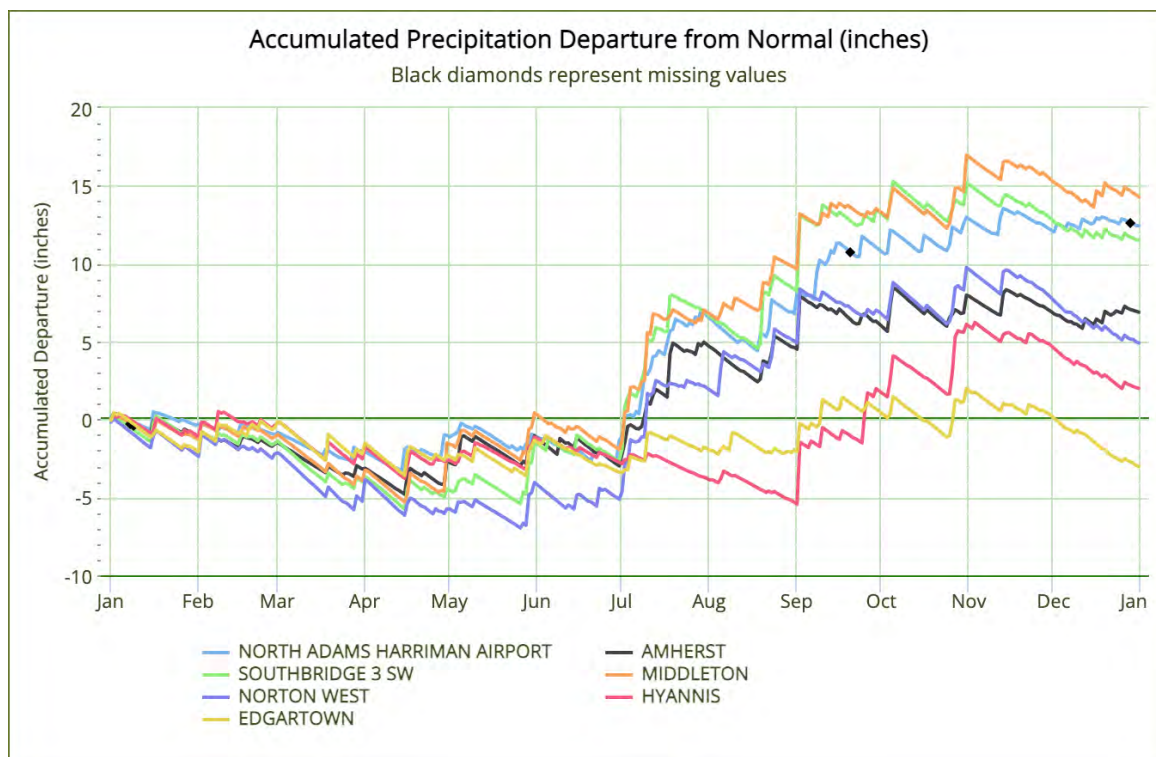
Percent of Average Historical Precipitation—December 2021

REGION	NUMBER OF SITES	HISTORICAL AVERAGE	DECEMBER AVERAGE (IN)	DEPARTURE FROM HISTORICAL AVERAGE (IN)	PERCENT OF NORMAL
WESTERN	7	3.44	3.67	0.23	107%
CTRV	14	3.77	3.60	-0.17	95%
CENTRAL	16	4.03	3.42	-0.61	85%
NORTHEAST	26	3.93	2.98	-0.95	76%
SOUTHEAST	26	4.37	2.31	-2.06	53%
CAPE COD	18	4.58	1.80	-2.78	39%
ISLANDS	3	4.37	1.42	-2.95	32%

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	≤ 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

