Current Water Conditions in Massachusetts
March 10, 2011

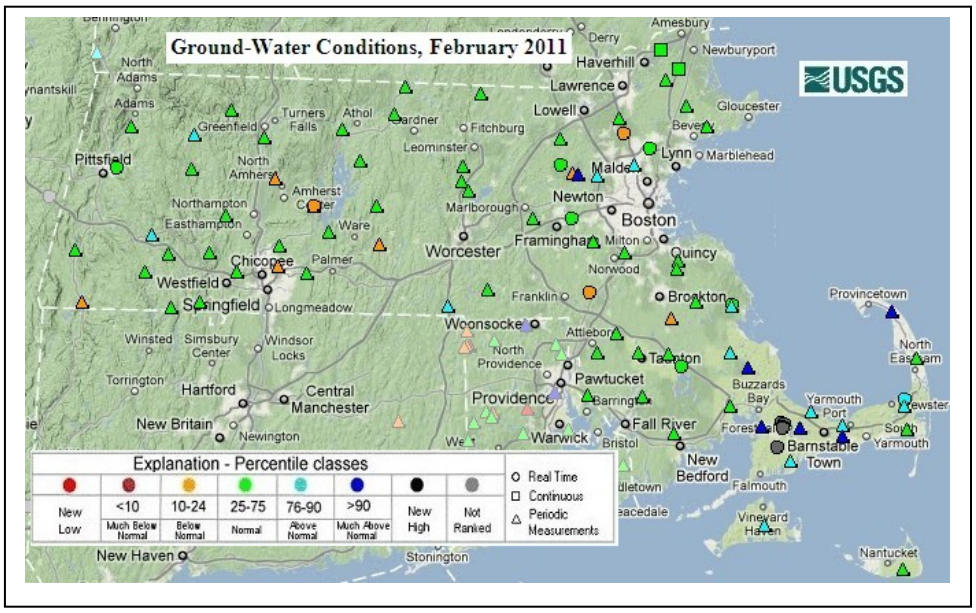
- February precipitation was above normal
- February streamflows were generally normal
- February ground-water levels were normal
- February reservoir levels were normal

Precipitation Conditions

Estimated February state-wide average precipitation was 4.15 inches, which is 127 percent of the long-term average for the month and most occurred at the beginning and end of the month. The regions of Massachusetts received between 146 (Northeast) and 108 percent (Cape Cod and Islands) of average precipitation during February. February 2011 was the 20th wettest February in the last 116 years in Massachusetts according to the National Climate Data Center. As of March 10th there has generally been about 0.1(Cape) to 3+ (Central and West) inches of liquid precipitation. This coupled with rain at the end of February, warm temperatures, and a melting snow pack has resulted in flooding along many rivers.
A table of February 2011 estimated precipitation statistics, based on precipitation data from the Department of Conservation and Recreation and National Weather Service precipitation monitoring networks, is attached. A map at the back of this report shows the distribution of February rainfall in Massachusetts.

Ground-Water Levels

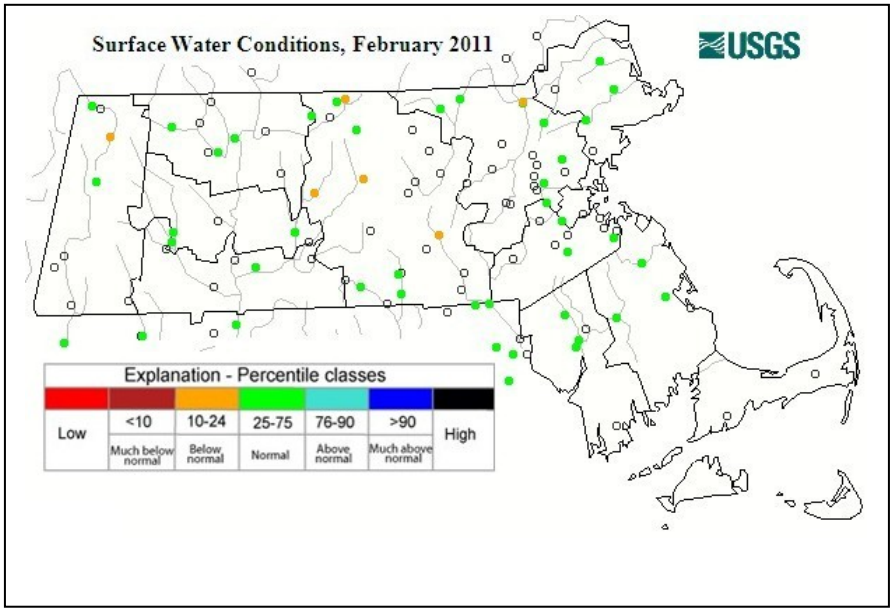
Ground-water levels reported by the United States Geological Survey (USGS) at the end of February were above normal and much above normal on Cape Cod and generally normal across the rest of the State. This assessment of ground-water levels is based on 89 wells in Massachusetts with 10 or more years of record. An assessment of ground-water conditions in the Massachusetts drought regions is shown in a table at the end of this report.

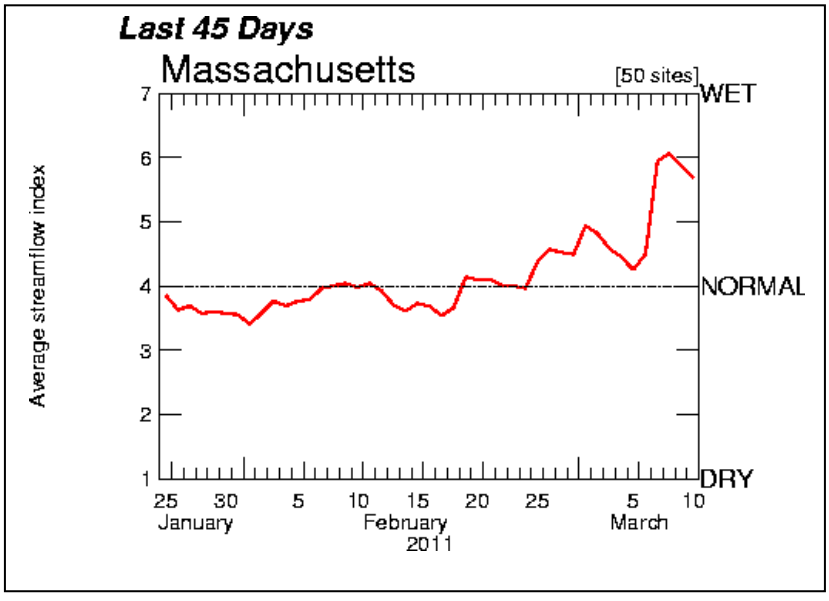


The USGS Groundwater Conditions for the end of February 2011 can be viewed at the web site: http://ma.water.usgs.gov/water_statement/2011_09/index.html

Streamflow

Average February 2011 streamflows that are monitored by the Commonwealth of Massachusetts and United States Geological Survey (USGS) cooperative stream gaging program were generally normal throughout the State. A few scattered rivers and streams were slightly below normal for the month. As shown in a table at the end of this report MA DCR has listed the drought regions of Massachusetts as having normal, and no data (Cape Cod and Islands) surface-water conditions for February. The graph below depicts a composite daily streamflow relative to normal streamflow for Massachusetts for the period of January 24 to March 9, 2011. Generally flows were a little below normal to normal during the 1st part of the month. Starting in late February and continuing into early March flows have increased as a result of several warm precipitation events and a melting snow pack. Many rivers and streams went above flood stage during the 2nd week of March. The graph is a composite of 50 real-time gages across the state with a long period of record.





KEY:

1 = New record low for day
2 = < 10th percentile
3 = 10th – 24th percentile
4 = 25th – 74th percentile
5 = 75th – 89th percentile
6 = ≥ 90th percentile
7 = New record high for day

Water Supply Reservoir Levels

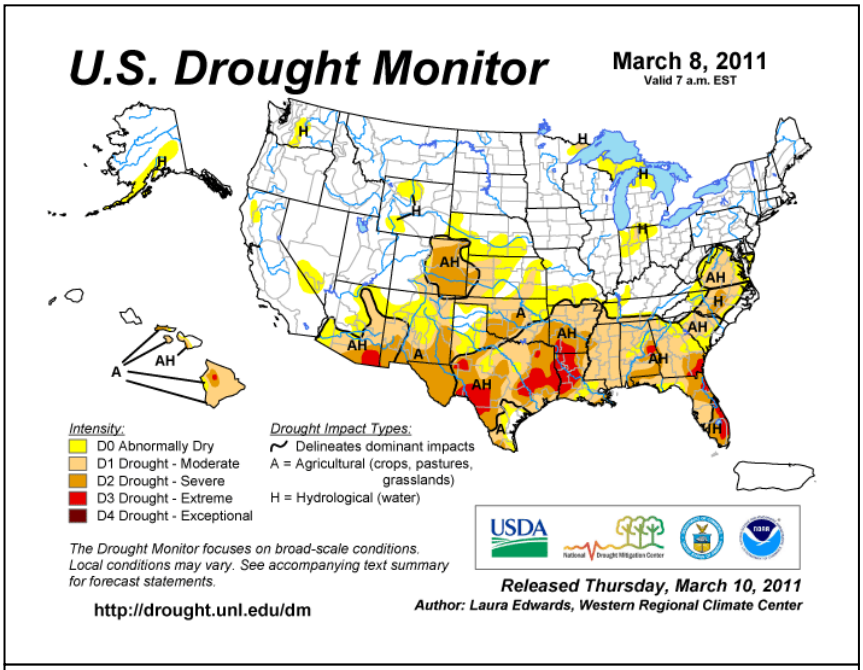
Surface water reservoir percent-full values for water supply sources provided by water suppliers are listed below. The reservoir percent-full values listed are for the end of February. Reservoirs are generally normal for this time of year.

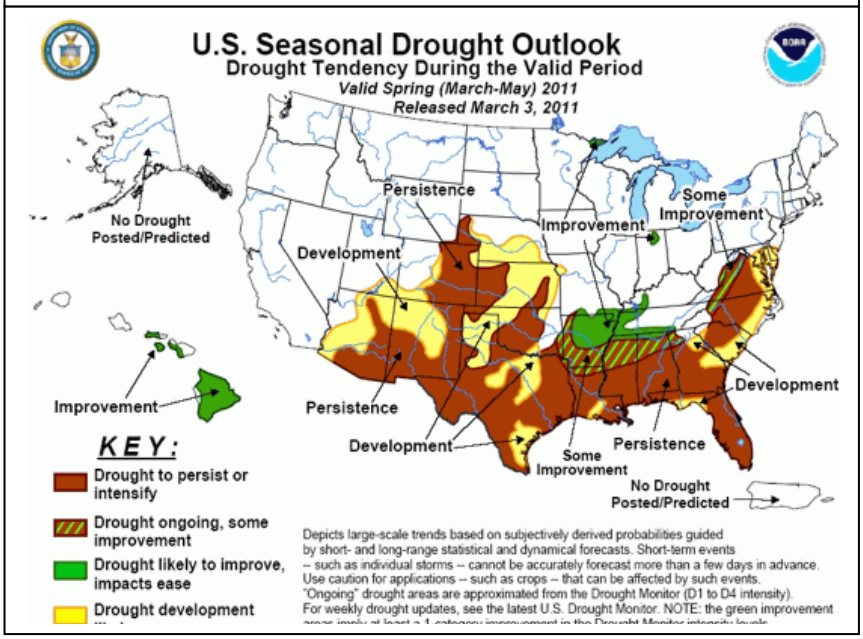
February / March 2011 Massachusetts Reservoir Status

Reservoir/City or Town	Percent Full	Reservoir/City or Town	Percent Full
Quabbin	89.9	Beverly/Salem	94.8
Worcester	91	Lynn	67.4
Cobble Mt./ Springfield	76	Taunton/New Bedford/Assawompsett	99

Note: NA Indicates data not available for this report

Drought Indices/Forecasts





US Drought Monitor

The National Drought Mitigation Center's (NDMC's) March 8, 2011 Drought Monitor Map for the United States shown at right indicates no drought conditions in Massachusetts.

Standardized Precipitation Index (SPI)

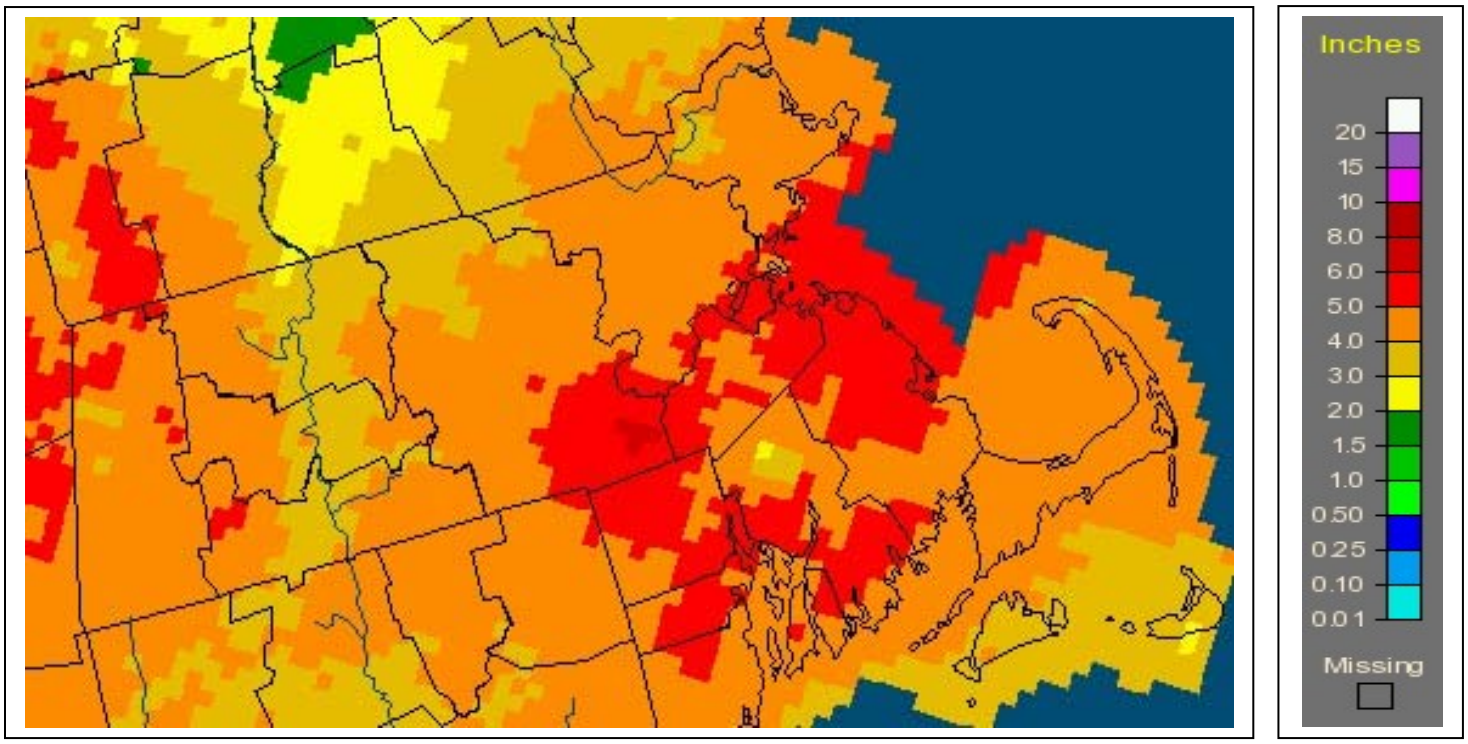
The Western Regional Climate Center's (Desert Research Institute, University and Community College System of Nevada) 1-, 3-, and 6-Month Standardized Precipitation Index values across Massachusetts at the end of February were moderately wet, normal/very wet (west), and normal (east) to very wet (west). The 12-month values ranged from normal (west) to very wet (east). Massachusetts SPI values for the drought regions are all normal.

NWS/NOAA's Climate Prediction Center

The U.S. Seasonal Drought Outlook dated March 3, 2011, predicts no tendency for drought conditions to develop in Massachusetts through May 2011.

Extended Forecasts

Showers and rain are forecast for today through late Saturday and may start as snow in western MA. Heaviest rain will occur Thursday night into Friday. Two to 3 inches is possible across western sections with 1-2 inches for the rest of the State. There is a possibility that some of the western and eastern rivers that flooded at the beginning of the week could flood again late this week. Sunday and Monday should be sunny with temperatures in the high 40's. The National Weather Service Climate Prediction Center's extended 6 to 10-day forecast is for above normal temperatures and normal rainfall. The 8 to 14-day and 1-month forecasts are for above normal rainfall and temperatures and normal temperature and rainfall respectively. The NWS Climate Prediction Center Information can be found at: http://www.cpc.noaa.gov/index.php



http://water.weather.gov/precip/

TOTAL RAINFALL
FEBRUARY 2011

GENERAL WATER CONDITIONS IN MASSACHUSETTS - FEBRUARY 2011

EOEEA and MEMA DROUGHT MANAGEMENT PLAN REGIONS

Massachusetts Regions	Surface-Water Conditions	Ground-Water Conditions
Cape and Islands	ND	Above Normal
Southeast	Normal	Normal
Northeast	Normal	Normal
Central	Normal	Normal
Connecticut River	Normal	Normal
Western	Normal	Normal

Note: Surface- and ground-water conditions for individual streamflow-gaging stations and wells may differ from general conditions. ND, no data

Weather Ramblings ---Richard A. Lovett for National Geographic News Published March 2, 2011

On February 14 the sun erupted with the largest solar flare seen in four years—big enough to interfere with radio communications and GPS signals for airplanes on long-distance flights. As solar storms go, the Valentine's Day flare was actually modest. But the burst of activity is only the start of the upcoming solar maximum, due to peak in the next couple of years. "The sun has an activity cycle, much like hurricane season," Tom Bogdan, director of the Space Weather Prediction Center in Boulder, Colorado, said earlier this month at a meeting of the American Association for the Advancement of Science in Washington, D.C. "It's been hibernating for four or five years, not doing much of anything." Now the sun is waking up, and even though the upcoming solar maximum may see a record

low in the overall amount of activity, the individual events could be very powerful. In fact, the biggest solar storm on record happened in 1859, during a solar maximum about the same size as the one we're entering, according to NASA. That storm has been dubbed the Carrington Event, after British astronomer Richard Carrington, who witnessed the megaflare and was the first to realize the link between activity on the sun and geomagnetic disturbances on Earth. During the Carrington Event, northern lights were reported as far south as Cuba and Honolulu, while southern lights were seen as far north as Santiago, Chile. (See pictures of auroras generated by the Valentine's Day solar flare.) The flares were so powerful that "people in the northeastern U.S. could read newspaper print just from the light of the aurora," Daniel Baker, of the University of Colorado's Laboratory for Atmospheric and Space Physics, said at a geophysics meeting last December. In addition, the geomagnetic disturbances were strong enough that U.S. telegraph operators reported sparks leaping from their equipment—some bad enough to set fires, said Ed Cliver, a space physicist at the U.S. Air Force Research Laboratory in Bedford, Massachusetts. In 1859, such reports were mostly curiosities. But if something similar happened today, the world's high-tech infrastructure could grind to a halt. "What's at stake," the Space Weather Prediction Center's Bogdan said, "are the advanced technologies that underlie virtually every aspect of our lives."

Solar Flare Would Rupture Earth's "Cyber Cocoon"To begin with, the University of Colorado's Baker said, electrical disturbances as strong as those that took down telegraph machines—"the Internet of the era"—would be far more disruptive. (See "The Sun—Living With a Stormy Star" in *National Geographic* magazine.)Solar storms aimed at Earth come in three stages, not all of which occur in any given storm.First, high-energy sunlight, mostly x-rays and ultraviolet light, ionizes Earth's upper atmosphere, interfering with radio communications. Next comes a radiation storm, potentially dangerous to unprotected astronauts.Finally comes a coronal mass ejection, or CME, a slower moving cloud of charged particles that can take several days to reach Earth's atmosphere. When a CME hits, the solar particles can interact with Earth's magnetic field to produce powerful electromagnetic fluctuations. (Related: "Magnetic-Shield Cracks Found; Big Solar Storms Expected.")"We live in a cyber cocoon enveloping the Earth," Baker said. "Imagine what the consequences might be."Of particular concern are disruptions to global positioning systems (GPS), which have become ubiquitous in cell phones, airplanes, and automobiles, Baker said. A $13 billion business in 2003, the GPS industry is predicted to grow to nearly $1 trillion by 2017.In addition, Baker said, satellite communications—also essential to many daily activities—would be at risk from solar storms."Every time you purchase a gallon of gas with your credit card, that's a satellite transaction," he said. But the big fear is what might happen to the electrical grid, since power surges caused by solar particles could blow out giant transformers. Such transformers can take a long time to replace, especially if hundreds are destroyed at once, said Baker, who is a co-author of a National Research Council report on solar-storm risks. The U.S. Air Force Research Laboratory's Cliver agrees: "They don't have a lot of these on the shelf," he said. The eastern half of the U.S. is particularly vulnerable, because the power infrastructure is highly interconnected, so failures could easily cascade like chains of dominoes. "Imagine large cities without power for a week, a month, or a year," Baker said. "The losses could be $1 to $2 trillion, and the effects could be felt for years." Even if the latest solar maximum doesn't bring a Carrington-level event, smaller storms have been known to affect power and communications. The "Halloween storms" of 2003, for instance, interfered with satellite communications, produced a brief power outage in Sweden, and lighted up the skies with ghostly auroras as far south as Florida and Texas. (Also see "'Nightmare' Star Flares Dim Odds for Alien Life?")

Buffing Up Space-Weather Predictions One solution is to rebuild the aging power grid to be less vulnerable to solar disruptions. Another is better forecasting. Scientists using the new Solar Dynamics Observatory spacecraft are hoping to get a better understanding of how the sun behaves as it moves deeper into its next maximum and begins generating bigger storms. (See some of SDO's first sun pictures.) These studies may help scientists predict when and where solar flares might appear and whether a given storm is pointed at Earth. "Improved predictions will provide more accurate forecasts, so [officials] can take mitigating actions," said Rodney Viereck, a physicist at the Space Weather Prediction Center. Even now, the center's Bogdan said, the most damaging emissions from big storms travel slowly enough to be detected by sun-watching satellites well before the particles strike Earth. "That gives us [about] 20 hours to determine what actions we need to take," Viereck said. In a pinch, power companies could protect valuable transformers by taking them offline before the storm strikes. That would produce local blackouts, but they wouldn't last for long. "The good news is that these storms tend to pass after a couple of hours," Bogdan added. Meanwhile, scientists are scrambling to learn everything they can about the sun in an effort to produce even longer-range forecasts. According to Vierick, space-weather predictions have some catching up to do: "We're back where weather forecasters were 50 years ago."