IOWA DEPARTMENT OF NATURAL RESOURCES

WATER SUMMARY UPDATE

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A review of water resource trends from 2022

The year 2022 continued the trend of drought in Iowa, marking the third dry year in a row for the state. The year ended with only 27.34 inches of precipitation, just over 8 inches less than normal. Deficits were worst in the western third of Iowa, but the entire state was drier than normal. Stream flow was very low in parts of northwest Iowa, and remains a concern for 2023 in that part of the state, although some recovery has taken place over the last two months. Soil moisture and shallow groundwater have also shown some recent improvement. The US Drought Monitor showed substantial degradation in conditions over the past year, with large areas of D2 Moderate Drought and D3 Extreme Drought emerging during the spring and summer months. A small area of the most severe conditions, D4 Exceptional Drought, was introduced in northwest Iowa in September, and at the end of 2022 a small area remains in D4.

PRECIPITATION AND TEMPERATURE FOR 2022

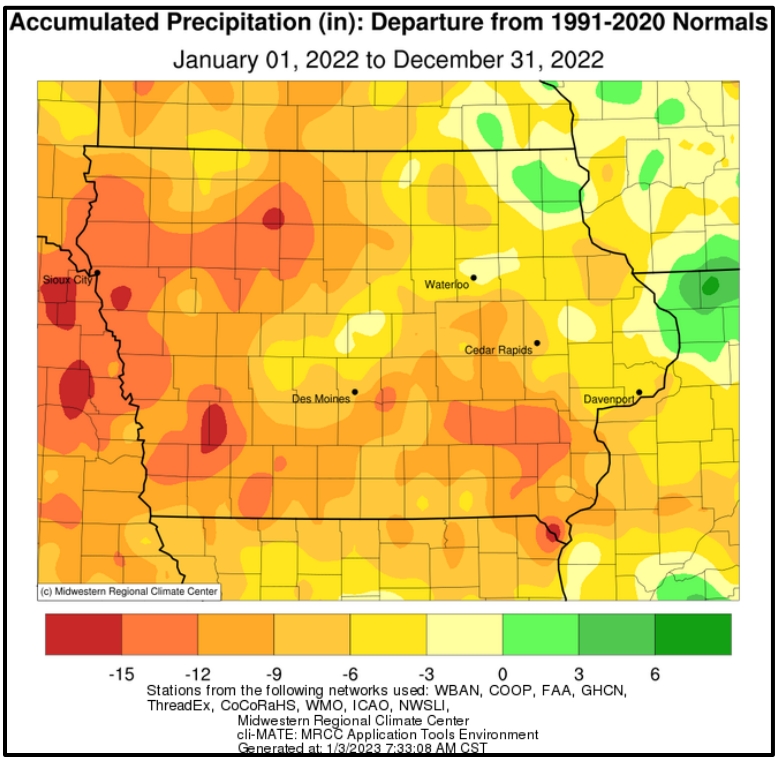
Based on 150 years of statewide observations, with December observations still in quality control, Iowa experienced its 25th driest year on record in 2022 with a preliminary statewide average total of 27.34 inches, 8.21 inches below normal. A drier year occurred in 2012, which is the 19th driest on record, during the last pervasive and widespread drought to impact Iowa. In 2022, precipitation was below normal for nine of the 12 months of the year and was significantly below normal during the growing season. The preliminary statewide average temperature was 47.4 degrees or 1.0 degree below normal, ranking 2022 as the 44th coldest year on record; 2019 was colder.

WINTER 2022: Precipitation for the three winter months of December, January and February (DJF) totaled 1.94 inches, 1.57 inches below normal. In terms of precipitation, DJF ranks as the 16th driest; 2002 was drier. The statewide average snowfall was 12.5 inches, 9.6 inches below normal, making it the 23rd least snowy winter in 135 years of records with 2002-2003 experiencing less snow.

SPRING 2022: Temperatures for the three spring months of March, April and May averaged 47.4 degrees, 0.9 degree below normal. Precipitation totaled 9.37 inches or 1.13 inches below normal.

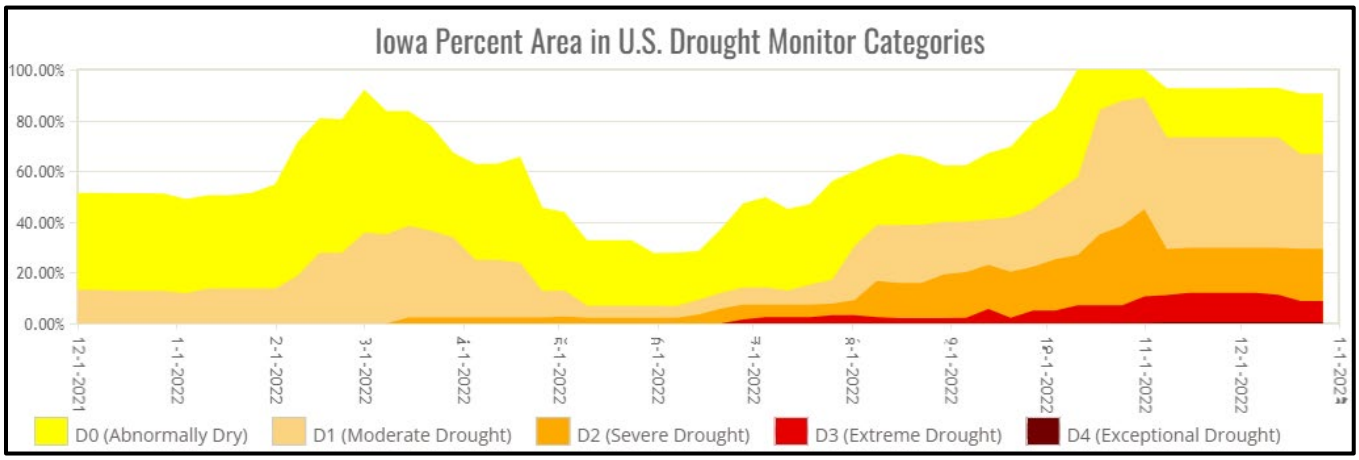
SUMMER 2022: Temperatures for the three summer months of June, July and August averaged 72.6 degrees, which is 1.2 degrees above normal. Precipitation totaled 10.18 inches or 3.38 inches below normal.

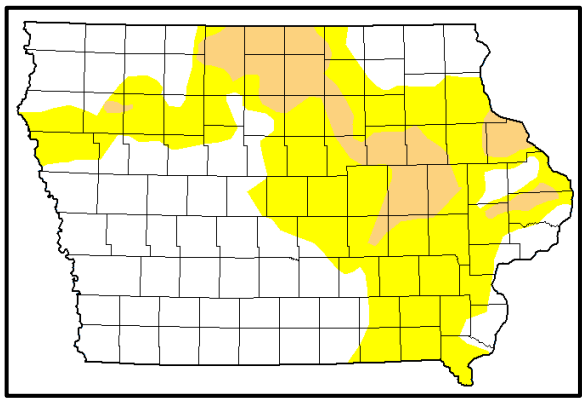
FALL 2022: Temperatures over the three autumn months (September, October and November) averaged 50.8 degrees or 0.3 degree above normal while precipitation totaled 4.77 inches, 3.22 inches below normal.

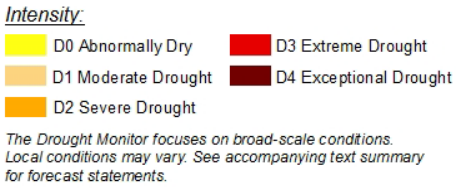


DROUGHT MONITOR FOR 2022

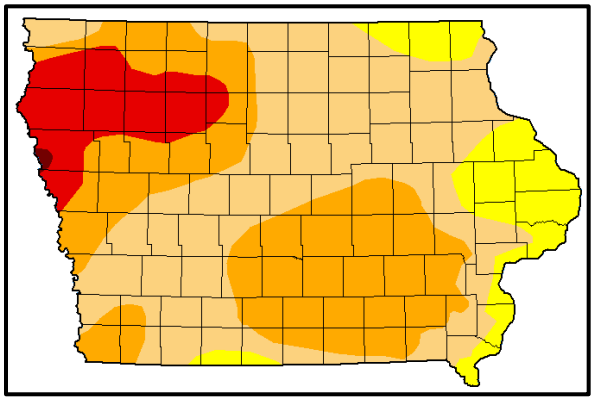
Iowa began 2022 with about half the state in some form of dryness or drought, but only 12 percent rated as D1 Moderate Drought. Conditions remained generally steady until March, when D2 Severe Drought was introduced in NW Iowa. Through the spring months drought and dryness designations were removed from much of the state, and on June 7 over 70 percent of Iowa was without drought designation. However, on June 28 D3 Extreme Drought was introduced in NW Iowa, and on September 6 a small area of D4 Exceptional Drought pushed across the Missouri River into Iowa. Conditions continued to deteriorate into November, with drought designations reaching their peak on November 1, when 10 percent of Iowa was designated in D3, 34 percent in D2, and 44 percent in D1. D4 conditions, the most severe of the USDM designations, have appeared in Iowa only twice. The first was during the 2012-2013 drought, and the second was in 2022. The year ended with 0.57 percent of Iowa in D4. The highest D4 coverage in Iowa, 2.5 percent, occurred ten years ago, in the fall of 2012.



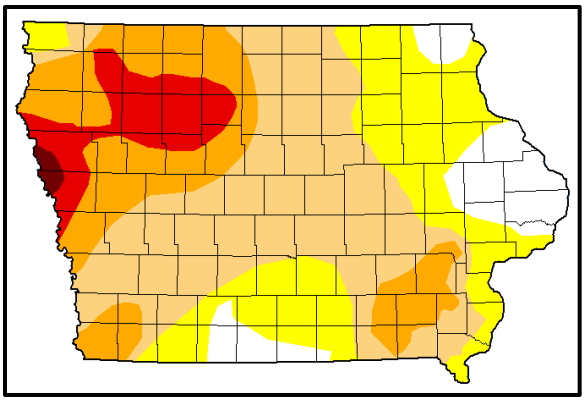




Start of 2022 Conditions



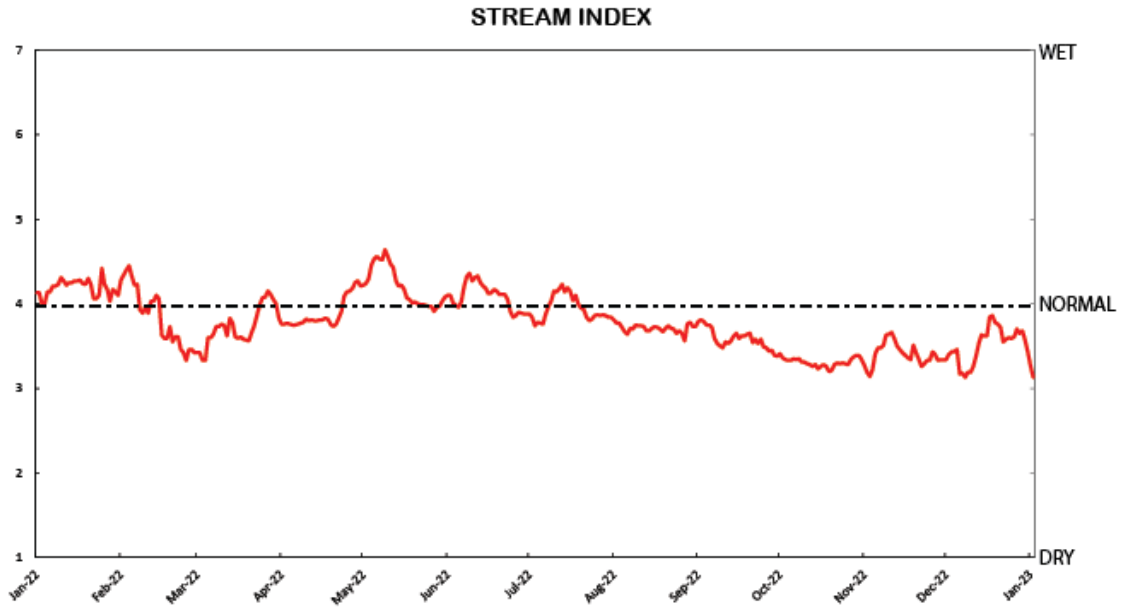
Peak Overall Coverage in 2022 – Nov. 1



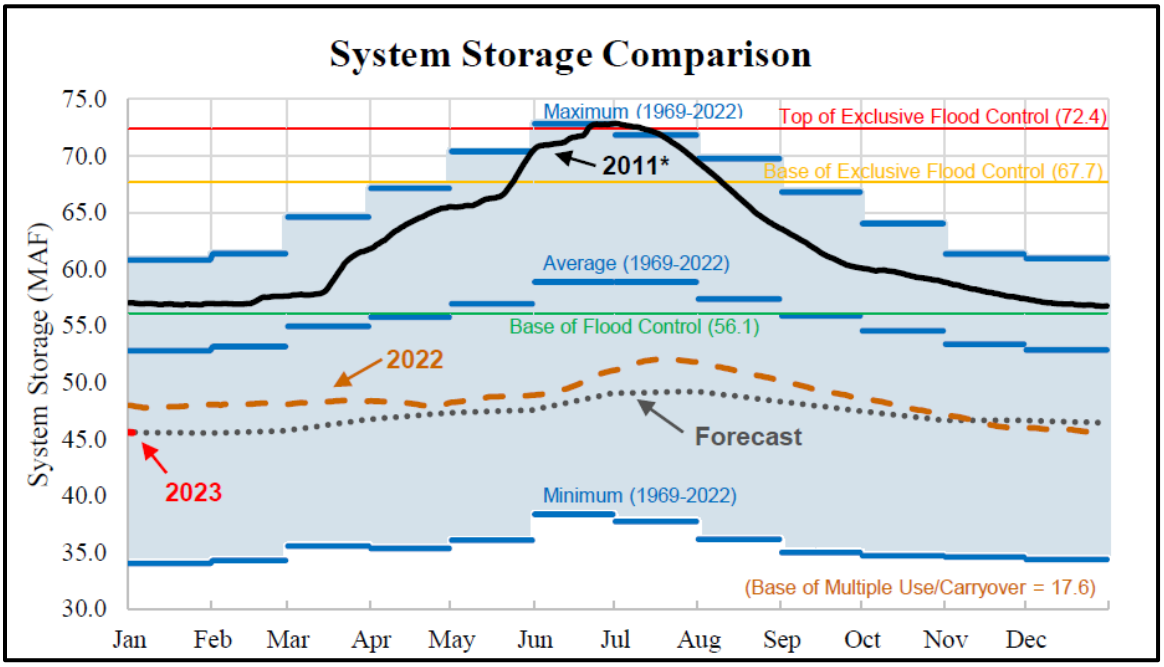
End of 2022 Conditions

2022 RUNOFF AND STREAMFLOW

Stream Index is a measure of the average streamflow at any time when compared to normal flow for that same time. This allows for a snapshot of the overall streamflow conditions over the year. The Stream Index for 2022 reflects the slightly above-normal conditions at the end of 2021 carrying forward into the start of 2022, and then slight increase for spring runoff followed by declining flows during the dry summer fall. Toward the end of 2022 average stream flows in Iowa were below normal.

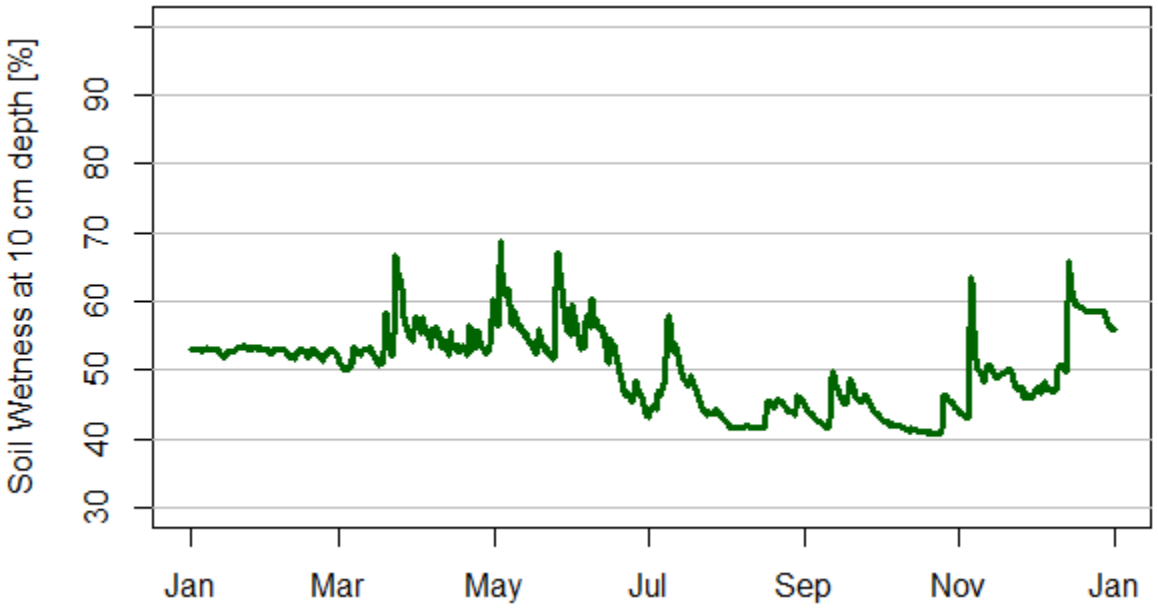


In the Missouri River basin, a dry and warm 2022 resulted in continued soil moisture deficits and persistent drought. The December 1 runoff forecast from the Corps indicates 19.0 Million Acre Feet (MAF) of runoff above Sioux city for 2022, with 11 out of the 12 months for the year with below normal runoff. Water conservation measures continue with all designated flood storage (16.3 MAF) in addition to 9 MAF of conservation storage available to store spring and summer runoff in the year ahead. The January 1 runoff forecast for 2023 is 20.8 MAF. This is 81% of average, and is due the extremely dry soils in the upper basin and average snowpack so far this season. The Corps is predicting that service level for 2023 navigation season is likely to be below full service, possibly minimum service. They year 2023 started with less water in storage than 2022, and that trend is expected to continue for most of the upcoming year.



2022 SOIL MOISTURE

The figure below shows soil wetness at 10 centimeter depth for the state of Iowa for 2022. The wetness of spring rainfall can be seen from March through June, and then the dry summer weather combined with the evapotranspiration from the crop growth months drop the soil moisture levels starting in July. Soil moisture rises again in November due to rainfall along with much lower rates of evapotranspiration after the growing season. The wetness of December also shows up in this graph, which indicates that the soil moisture levels to start 2023 are slightly improved over the levels to start 2022. This data is obtained from the High Resolution Rapid Refresh model, using horizontal grid spacing of 3km and hourly temporal resolution.



2022 SHALLOW GROUNDWATER

The year began with shallow aquifer conditions under slight drought stress in central and north-central Iowa, but otherwise normal conditions were observed across the rest of the state. In early-spring the shallow aquifers of two areas began to exhibit some degree of aquifer stress, including in northwest Iowa around the Big Sioux and Rock Rivers, Floyd River, Ocheyedan and Upper Little Sioux Rivers, Lower Little Sioux and Maple Rivers, Lower Des Moines and Raccoon Rivers, and in east-central to southeast Iowa around the Lower Iowa and Cedar Rivers. By late summer the aquifer stress had extended into the southwest and northern parts of the state. By early-fall the below normal, moderate, or severe drought conditions had further expanded across the western two-thirds of the state. The growing dry area resulted in increased water stress and vulnerability to declining shallow groundwater levels. As the fall season progressed the areal extent of the drought changed little but the accumulative impacts resulted in still greater vulnerability to declining shallow groundwater levels. During this period the intensified stress was corroborated by various well and pump contractors who reported that they were unable to meet demand for drilling new wells and dropping well pumps deeper in existing wells. Groundwater levels in northwest Iowa began to improve in late-fall following significant precipitation and by the end of the year conditions were greatly improved and the shallow groundwater levels across most of the state are now inferred to be substantially recovering.

Monthly Conditions: December 2022

DROUGHT MONITOR FOR DECEMBER 2022

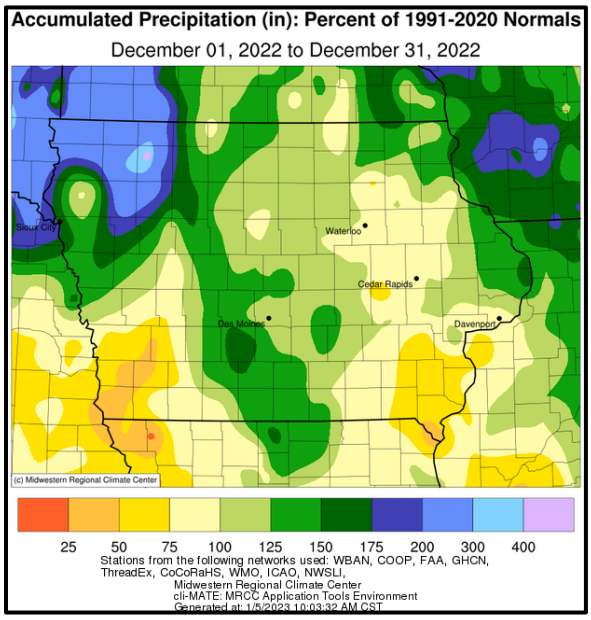
Overall drought and dryness in Iowa improved slightly in December, but much of the state remains in Drought and abnormally dry conditions remained largely unchanged through the month. Above normal precipitation in northwest Iowa lead to improvement in conditions in that part of the state, with reduction in the area designated as D3 Exceptional Drought.

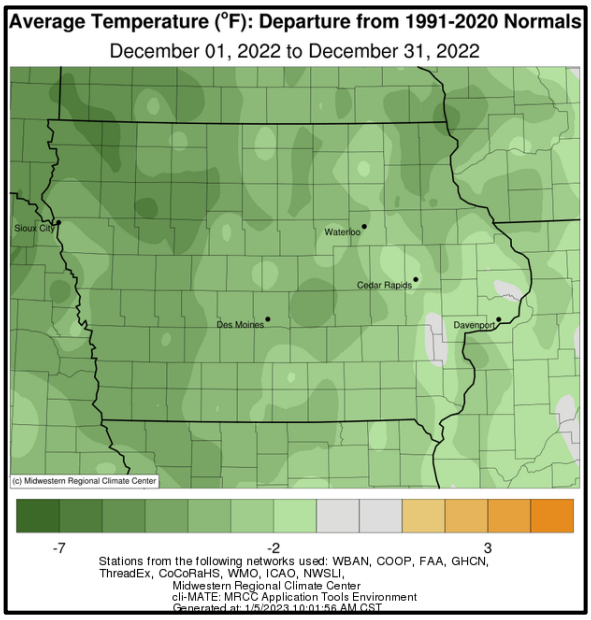
PRELIMINARY PRECIPITATION AND TEMPERATURE FOR DECEMBER 2022

December temperatures averaged 21.0 degrees or four degrees below normal, while precipitation averaged 1.73 inches or 0.40 inch more than normal. A colder December occurred in 2013 while a wetter one was last recorded in 2018.

December marked the second month in a row and only the third month of 2022 with above-average precipitation for the state, with widespread rainfall early in the month. Stations across northern, central and south-central Iowa reported above normal precipitation, with the wettest conditions across the drought-stricken northwest. Pockets of southwestern and southeastern Iowa experienced the driest conditions with deficits approaching an inch at several stations. Monthly precipitation totals ranged from 0.46 inch at Hastings to 2.93 inches at Primghar. The preliminary statewide average snowfall was 7.8 inches, 0.4 inch below normal.

Monthly average temperatures were below normal statewide, with the coldest conditions reported across northwestern Iowa where departures were up to six degrees colder than average. Donnellson reported the month's high temperature of 67 degrees on the 29th, on average 34 degrees above normal. Sibley reported the month's low temperature of -20 degrees on the 22nd, 29 degrees below normal.





SHALLOW GROUNDWATER FOR DECEMBER 2022

December shallow groundwater level conditions have greatly improved since the fall months. Shallow groundwater levels across most of the state are inferred to be substantially recovering to recovered, especially for areas in northwest, south-central, and southeast Iowa which had been experiencing drought stress, but

which now appear by-and-large to be relieved. Below normal dry conditions do persist in a north-to-south strip extending across north-central to south-central Iowa, including parts of Upper Des Moines River, Lower Des Moines River and Raccoon River, and Skunk River and Lower Des Moines River hydrologic units. In lieu of a direct shallow groundwater monitoring network the USGS's 28-day average stream baseflow statistical trends are used as an indicator of longer-term water level changes in shallow aquifers.

STREAMFLOW CONDITIONS FOR DECEMBER 2022

During December, streamflow conditions improved slightly across the state. Flows that were much below-normal improved to below-normal or normal. The Raccoon, Boone, Des Moines, Nishnabotna, Lower Iowa, and Chariton Rivers remained below normal in December. Flow in the East Fork Des Moines River moved into the much below normal category since the previous water summary.

ADDITIONAL INFORMATION

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