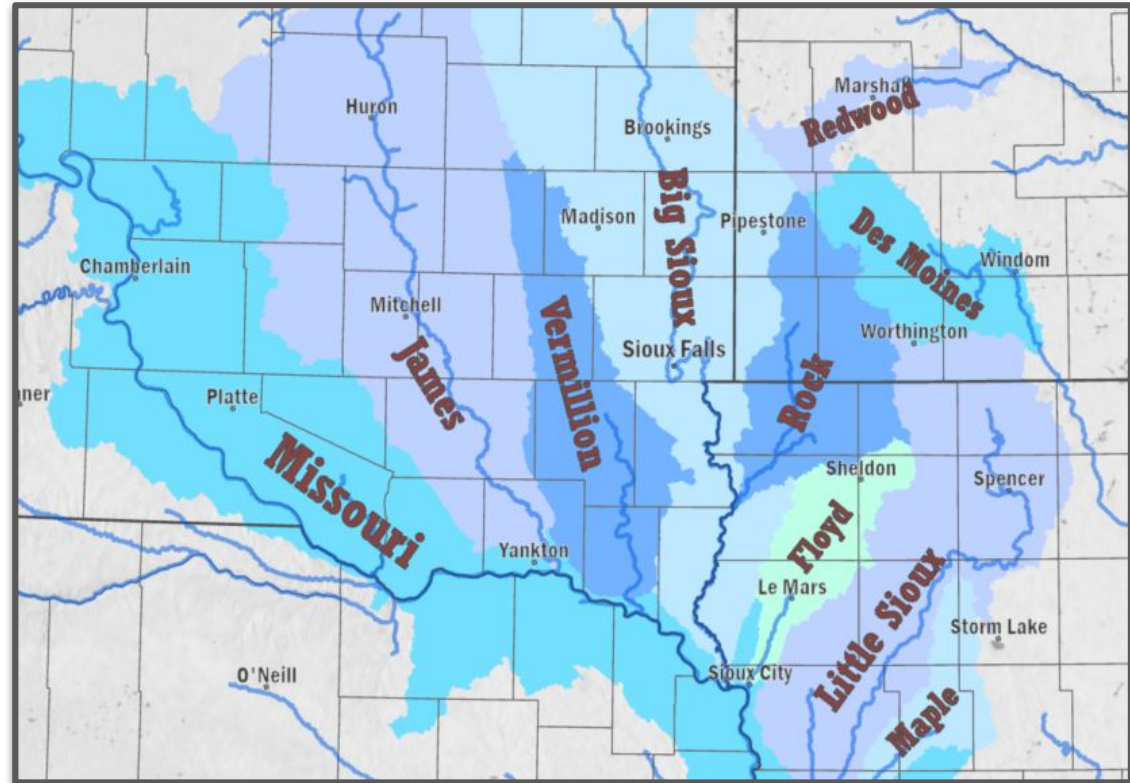




Spring 2023 Flood Outlook

90 Day Outlook thru June 9th
Issued: March 9th, 2023

Final Outlook





2023 Spring Flood Outlook (#3 of 3)

90 Day Outlook Valid through June 9th, 2023

Key Messages

- This most recent flood outlook again reflects slight increases in the flood risk given additional snowfall across the region. Ultimately, future precipitation events this spring will carry the most weight in determining the extent of any spring flooding.
- While an above average snowpack currently exists, antecedent drought conditions and low river levels allow for increased capacity of the river systems.
- The spring flood risk will be determined by several factors including snowpack, frost depth, river ice, soil moisture, antecedent river levels, and spring precipitation.
- Ice jams may also result in localized flooding.

	Short Term (Next 14 Days)	Long Term (through late May)
Snowpack/SWE	Below	Above
Frost Depth	Below	Below
River Ice	Below	Normal
Soil Moisture	Below	Below
River Levels	Below	Below
Precipitation Outlook	Above	Normal

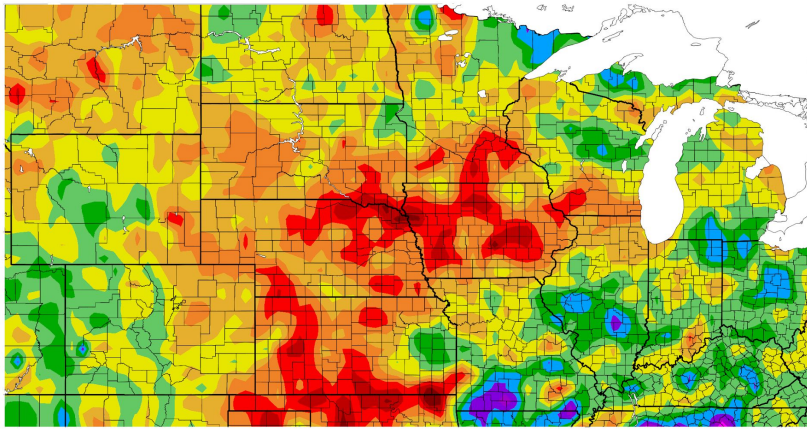
Impact (to Flood Risk)	Below Normal	Normal	Above Normal
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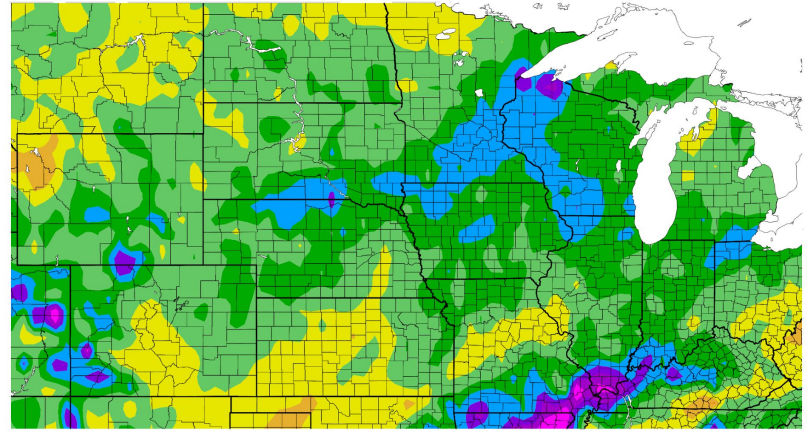
Departure From Normal Precipitation

2 Year - Departure From Normal Precipitation



Generated 3/7/2023 at HPRCC using provisional data. NOAA Regional Climate Centers

90 Day - Departure From Normal Precipitation



Generated 3/8/2023 at HPRCC using provisional data. NOAA Regional Climate Centers

- Precipitation over the past couple of years has been well below normal with drought conditions in place.
- Precipitation over the past 90 days has been above normal, although only a small percentage of the ongoing precipitation deficit.

Precipitation Departure From Normal (By Year)			
	2021	2022	2023 (Thru March 9th)
Huron	-3.04	-2.44	-0.07
Sioux Falls	-0.12	-3.04	+1.73
Sioux City	-6.31	-13.93	+0.93





Soil Moisture and Temperatures/Frost Depth

Impact Potential:

Short Term

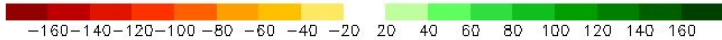
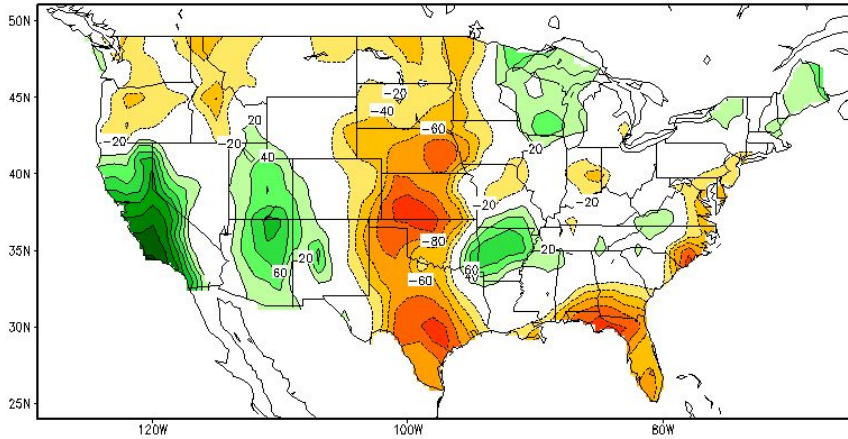
Below Normal

Long Term

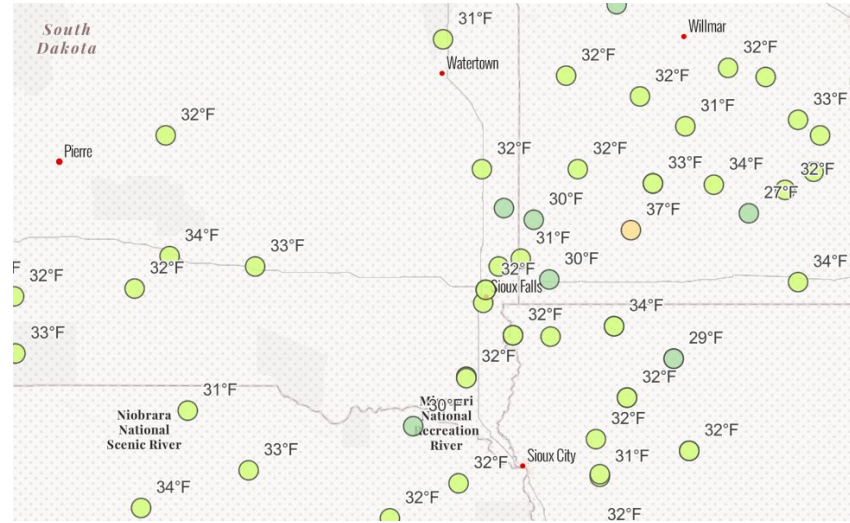
Below Normal

Calculated Soil Moisture Anomaly (mm)
MAR 07, 2023

Soil Moisture Anomaly



Shallow Soil Temperature
(Between 2-8 inches)



- Ground conditions remain abnormally dry, especially for southwest Minnesota, western Iowa, and much of Nebraska. Soil moisture deficits are generally in the lowest 30th percentile of climatology.
- Warmer ground temperatures and shallow frost depths may allow moisture to more easily penetrate the soil, limiting runoff into rivers.

Sioux Falls Soil Temperature/Frost Depth as of March 9th			
	2 in	4 in	8 in
Soil Temp	32°	32°	32°
Frost Depth	10 inches		





Antecedent River Conditions

Impact Potential:

Short Term

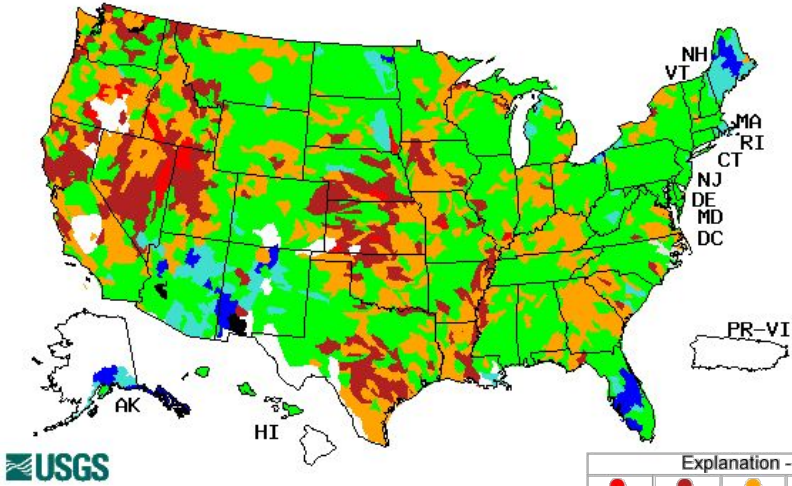
Below Normal

Long Term

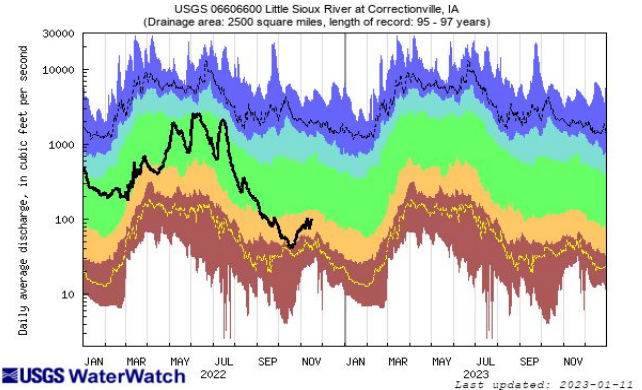
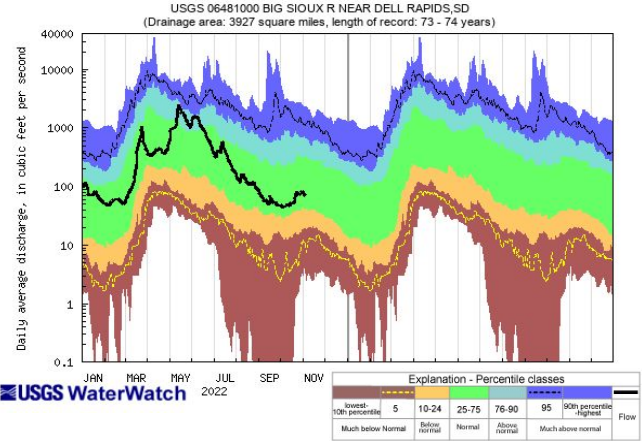
Below Normal

Streamflow Percent of Normal
(Going Into Winter 2022-2023)

October 2022



Explanation - Percentile classes						
	●	●	●	●	●	●
	<10	10-24	25-75	76-90	>90	
Low	Much below normal	Below normal	Normal	Above normal	Much above normal	High



- River levels and streamflows going into winter were near or below normal across much of the region.
- These low antecedent river levels will allow for extra capacity of spring snowmelt and rainfall compared to a normal spring season.





Snow Depth and Snow Water Equivalent (SWE)

Impact Potential:

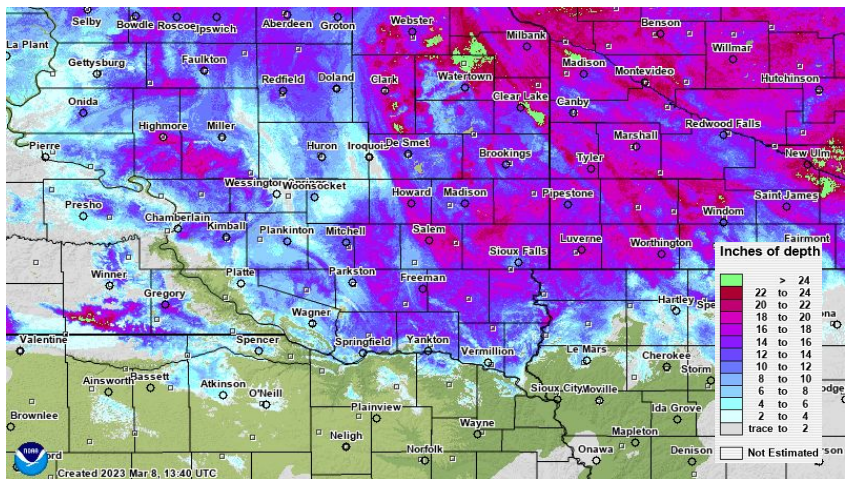
Short Term

Below Normal

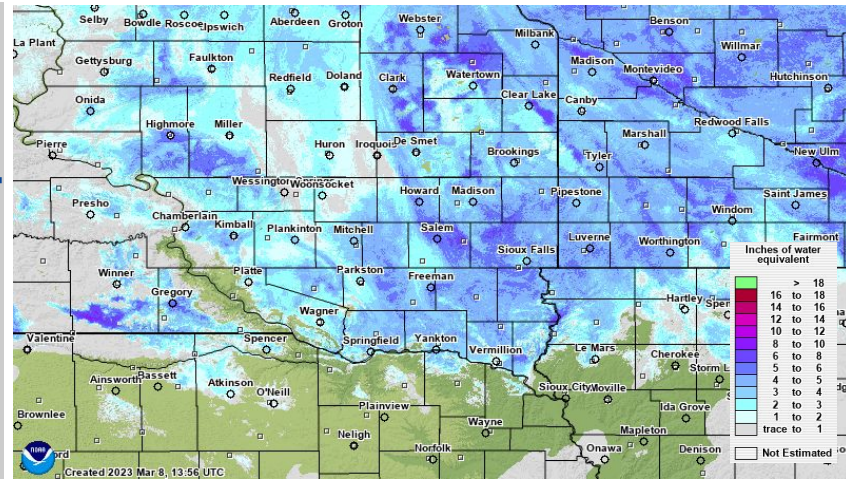
Long Term

Above Normal

Snow Depth



Snow Water Equivalent



- Snow depth is currently highest along and north of a corridor from Yankton to Rock Rapids to Windom. Within this broad area, depths from 10 to 20 inches exist. These images do not include snow from March 9th.
- This area of greatest snow depth is currently carrying as much as 3 to 4+ inches of liquid water (table to the right does not include most recent snow event for Tyndall/Mitchell/Marshall).
- These values of snow water equivalent (SWE) are well above normal.

Local Measurements as of 3/6 (except Sioux Falls 3/9)		
	SWE	Snow Depth
Sioux Falls, SD	2.6"	8"
Marshall, MN	2.2"	8"
Tyndall, SD	2.1"	5"
Mitchell, SD	3.5"	12"



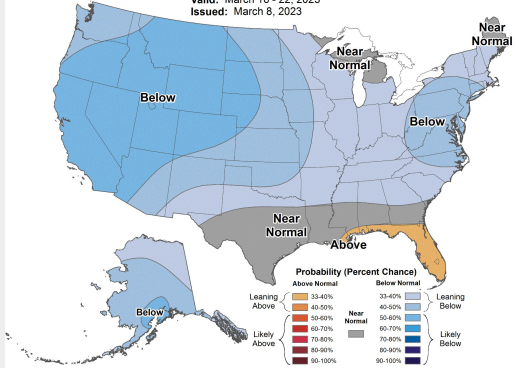


Precipitation and Temperature Outlook

Temperature

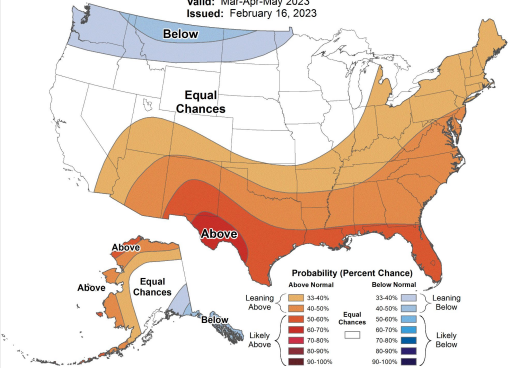
8-14 Day Temperature Outlook

Valid: March 16 - 22, 2023
Issued: March 8, 2023



Seasonal Temperature Outlook

Valid: Mar-Apr-May 2023
Issued: February 16, 2023



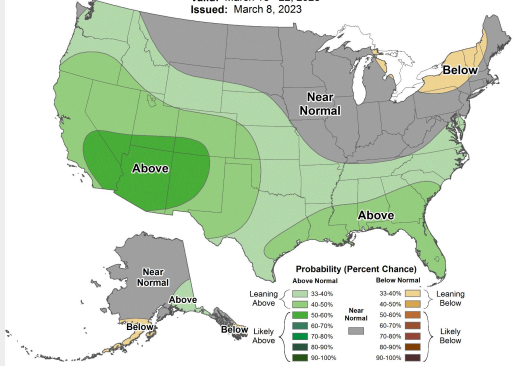
→ In the near term (next 2 weeks), below normal temperatures are favored keeping the potential for rapid snowmelt low. Near normal precipitation is expected.

→ Medium range outlooks for the latter half of March favor below normal temperatures, with near to below normal precipitation.

Precipitation

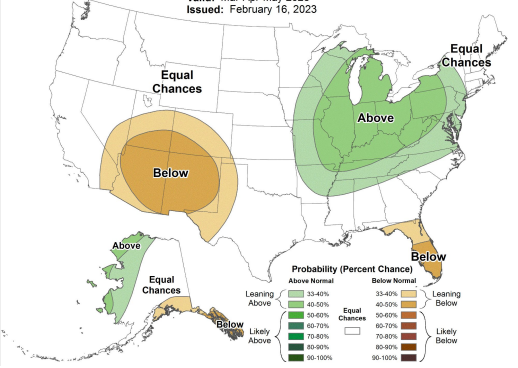
8-14 Day Precipitation Outlook

Valid: March 16 - 22, 2023
Issued: March 8, 2023



Seasonal Precipitation Outlook

Valid: Mar-Apr-May 2023
Issued: February 16, 2023



→ Seasonal outlooks for March through May have equal odds of above/below/near normal precipitation and temperatures.

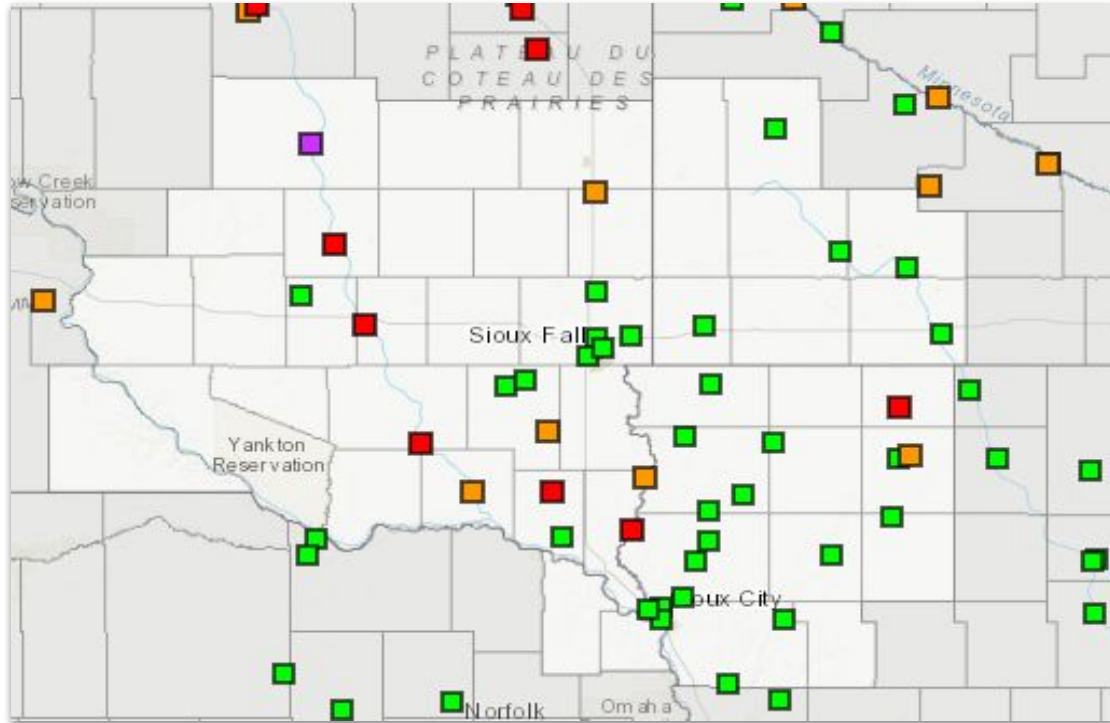


Scenario #1 - Most Likely

90 Day Outlook Valid through June 9th, 2023

- In a spring characterized by normal snowmelt and precipitation, a **below to near normal river flood risk** is expected over the next 90 days.
- Recent winter storms have added several inches of snow depth, and corresponding water equivalent. As a result, **risk for river flooding has increased in some locations**, specifically portions of the James and Big/Little Sioux basins.
- This ‘Most Likely’ scenario does not account for ice jams, which would be more localized in nature.
- Urban street flooding may also be common in areas with blocked storm drains.

Most Likely Flood Scenario (50% Chance)

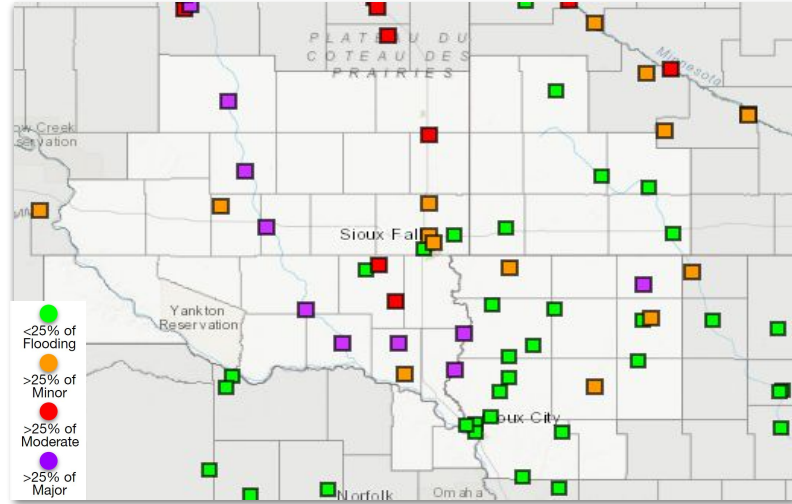




Less Likely Flood Scenarios

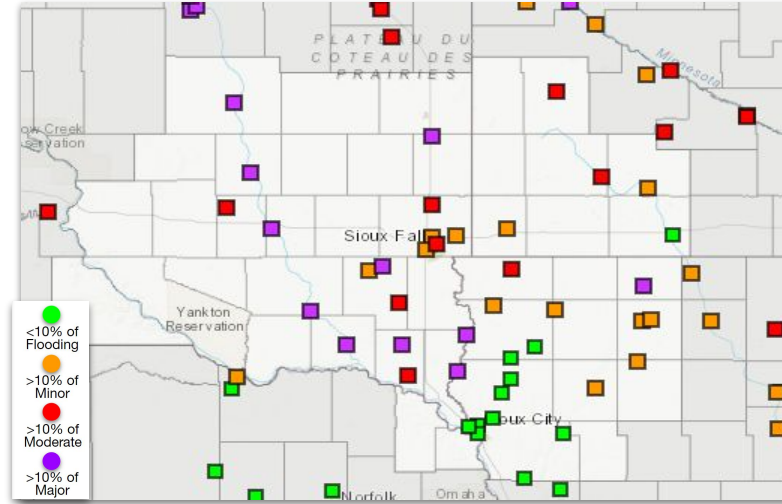
90 Day Outlook Valid through June 9th, 2023

Scenario #2 - Less Likely (25% Chance)



- **Scenario #2 (25% Chance)** could include additional snowfall, rapid snowmelt, OR a moderate rain event on existing snowpack.
- This would result in a larger coverage of minor to moderate flooding, with localized major flooding, particularly in the James and lower Big Sioux Rivers.

Scenario #3 - Least Likely (10% Chance)



- **Scenario #3 (10% Chance)** could include additional snowfall, rapid snowmelt AND a moderate to heavy rain event on existing snowpack.
- This would result in fairly widespread moderate to major flooding across much of southeast SD and more localized portions of northwest IA and southwest MN.





Chance of Exceeding Stage at Location

90 Day Outlook Valid through June 9th, 2023

	Chance of Exceeding Stage...					Flood Stage		
	75%	50%	25%	10%	5%	Minor	Moderate	Major
Floyd River								
Floyd at Sheldon	7.5	8.2	10	12.2	14.1	12	14	16
Floyd at Alton	7.2	8.3	9.6	11.1	13.4	12	16	18
Floyd at Le Mars	13.1	14.9	16.1	17.1	19.7	20	21	24
Floyd at Struble	5.8	7	8.1	9.7	11.4	14	15	16
Floyd at Merrill	2.4	3.4	4.8	5.8	9.5	12	14	16
Floyd at James	10.6	11.4	12.8	13.7	17.7	26	30	34
Little Sioux River								
Little Sioux at Milford	13	14.4	16.2	17.7	18	12	14	16
Little Sioux at Spencer	9.6	10.7	12	13.1	13.2	10	14	16
Ocheyedan at Spencer	4.9	6.1	7.9	8.6	9	8	9.5	10.5
Little Sioux at Linn Grove	11.5	14.4	16.1	18.2	18.7	18	19.5	21
Little Sioux at Cherokee	12.9	15.2	17.5	18.1	19.3	17	21	24
Little Sioux at Correctionville	9.9	12.1	14.1	15	17.8	19	21	23
Little Sioux at Turin	12.2	14.6	16.1	17.6	22.8	25	28	34.5
West Fork at Hornick	11.5	13.8	15.5	17.7	19.5	20	22	26.5
Perry Creek at Sioux City	8.6	9.2	9.9	10.1	11	24	26	28
Maple River								
Maple at Mapleton	6.4	7.4	8.3	9	16	21	22	23

Columns are river stage values for each 'Chance of Exceeding' percentage

Example: the Floyd River at Sheldon has a 50% of exceeding 8.2 ft, a 25% chance of exceeding 10.0 ft and a 10% chance of exceeding 12.2 ft.

Below Flood Stage
Minor Flood Stage
Moderate Flood Stage
Major Flood Stage





Chance of Exceeding Stage at Location

90 Day Outlook Valid through June 9th, 2023

	Chance of Exceeding Stage...					Flood Stage		
	75%	50%	25%	10%	5%	Minor	Moderate	Major
Big Sioux River								
Big Sioux at Brookings	9.2	9.7	11.2	12	12.4	9	10.5	12
Big Sioux at Dell Rapids	10.6	11.8	13.2	14.6	15.9	12	14	15
Big Sioux at Sioux Falls	11.2	11.9	12.9	14.7	17.1	12	15	17
Skunk Creek at Sioux Falls	7.9	8.8	10.5	12.8	14.4	11.5	15	17
Big Sioux at North Cliff	13.4	14.8	17	20.9	23.8	16	18	31
Split Rock at Corson	5	6	8	9.5	12.5	8.5	11	14
Big Sioux at Hawarden	21.1	23.1	27.2	29.2	31.1	20.5	24	27
Big Sioux at Akron	16.8	18.3	21	22	22.4	16	18	20
Big Sioux at Sioux City	20.3	22.4	26	28.9	30.1	32	38	41

	75%	50%	25%	10%	5%	Minor	Moderate	Major
Rock River								
Rock at Luverne	7.1	7.7	8.6	11.1	12.2	10	12	14
Rock at Rock Rapids	11.9	12.4	14.9	16.8	19.2	13	16	19
Rock at Rock Valley	12.3	13.1	14.7	16.4	17.3	16	17	19

	75%	50%	25%	10%	5%	Minor	Moderate	Major
Missouri River								
Missouri at Sioux City	14.3	16.6	20.8	26.4	34.4	30	33	36

	Chance of Exceeding Stage...					Flood Stage		
	75%	50%	25%	10%	5%	Minor	Moderate	Major
James River								
James at Huron	14.4	15.3	18.4	20.9	24	11	13	15
James at Forestburg	13.4	14.3	16.8	20.5	22.2	12	14	16
James at Mitchell	18.7	20.1	22.7	25.5	26	17	20	22
Firesteel Creek at Mount Vernon	4.6	6.3	9	12.9	15.9	8	13	15
James at Scotland	12.1	14.3	16.8	20	20.9	13	14	16
James at Yankton	8.9	12.3	16.8	23.9	26.4	12	14	16

	75%	50%	25%	10%	5%	Minor	Moderate	Major
Vermillion River								
W FK Vermillion at Parker	3.5	4.4	6.2	9	10.1	9	10	11
E FK Vermillion at Parker	9.7	11.1	14.7	18	18.1	12	14	16
Vermillion at Davis	10	12.2	14.1	14.9	15.1	11	13	15
Vermillion at Wakonda	12.1	16.1	17.4	17.7	17.8	14	15.5	17
Vermillion at Vermillion	11.4	15.6	20.9	27.3	28.3	21	22	30

	75%	50%	25%	10%	5%	Minor	Moderate	Major
Redwood River								
Redwood River at Marshall	10.4	11.1	13	15.2	17.4	14	15	16.5

	75%	50%	25%	10%	5%	Minor	Moderate	Major
West Fork of Des Moines River								
Des Moines at Avoca	1421.7	1422.7	1424.4	1426.4	1426.9	1425	1426	1428
Des Moines above Windom	14.5	16.4	17.6	19	19.8	19	21	25
Des Moines at Jackson	9.5	10.2	10.8	11.5	11.8	12	12.5	14



Flood Outlook Summary

90 Day Outlook Valid through June 9th, 2023

Key Messages

- The risk for spring river flooding is **highest along portions of the James, Vermillion, and Big Sioux Rivers and generally reflects a near to slightly above normal risk** compared to historical simulations. Most waterways across northwest Iowa carry a below normal spring river flood risk with the exception of the Little Sioux River near Milford.
- The flood risk has increased slightly over the last outlook due to recent precipitation events.
- Less likely scenarios of significant additional snowfall, a rapid snowmelt, and/or a heavy rain event would increase the flood risk further.
- Ice jams may also result in more localized flooding. Urban street flooding may occur in locations with blocked storm drains.

	90 Day Flood Risk*
Missouri	BELOW NORMAL
James	ABOVE NORMAL
Vermillion	NORMAL
Big Sioux	ABOVE NORMAL
Rock	BELOW NORMAL
Floyd	BELOW NORMAL
Little Sioux	BELOW NORMAL
West Fork of Des Moines	NORMAL
Redwood	NORMAL

*Outlook for normal snowmelt and precipitation (in the absence of heavy rain and/or ice jams) for the next 90 days





Flood and Outlook Resources

National Weather Service - Sioux Falls

weather.gov/fsd

NWS Sioux Falls Flooding Resource Page

weather.gov/fsd/flooding

Advanced Hydrologic Prediction Service Page

water.weather.gov/ahps/index.php?wfo=FSD

Snow Depth/SWE Information (NOHRSC)

nohrsc.noaa.gov/interactive/html/map.html

Climate Prediction Center Outlooks

cpc.ncep.noaa.gov/

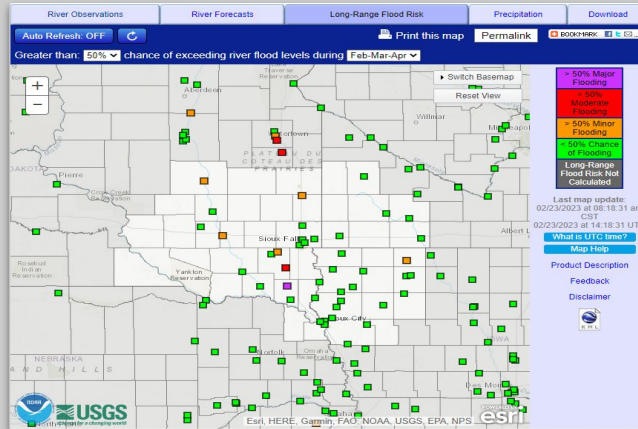
USGS National Water Dashboard

dashboard.waterdata.usgs.gov/

Flood Safety Information

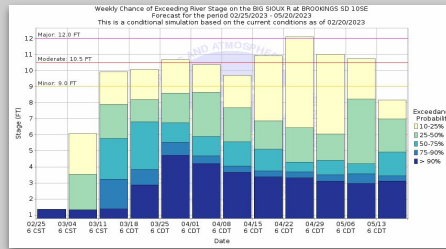
weather.gov/safety/flood

Additional Flood Outlook Info: weather.gov/ahps2/long_range.php?wfo=FSD

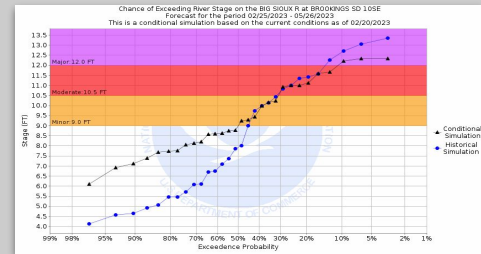


Flood Outlooks By River Point

- 1) Click river point of interest
- 2) Under “Probability Information”, choose desired information



Weekly Chance of Exceeding Levels



Chance of Exceeding Levels During Entire Period

