



**NATIONAL  
WEATHER  
SERVICE**

# NWS Grand Forks Spring Flood Outlook

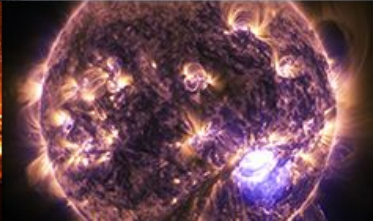
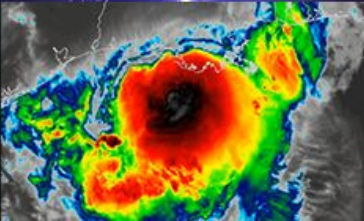
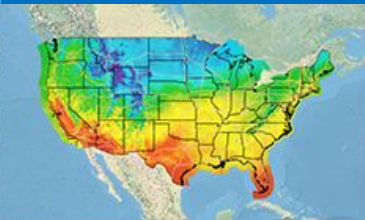
**Amanda Lee**

Service Hydrologist  
NWS Grand Forks

**Jim Kaiser**

Warning Coordination Meteorologist  
NWS Grand Forks

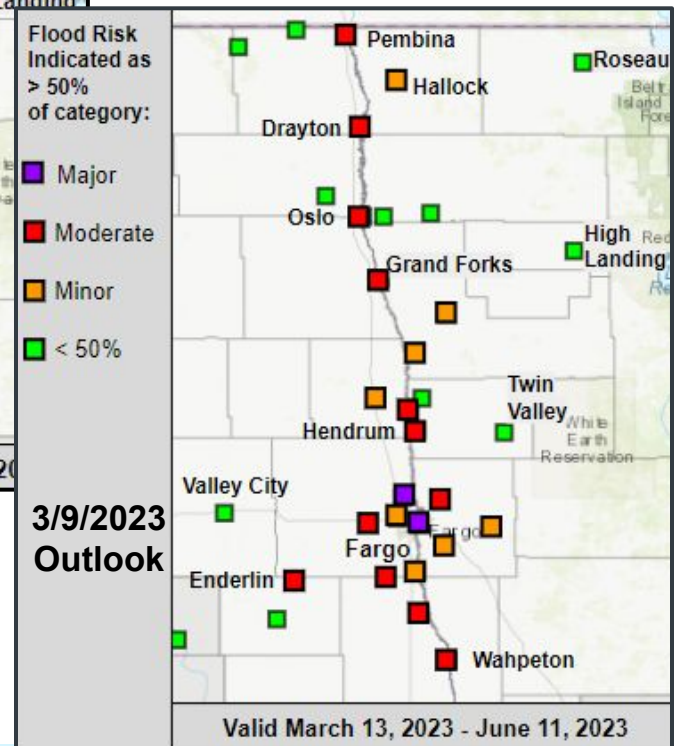
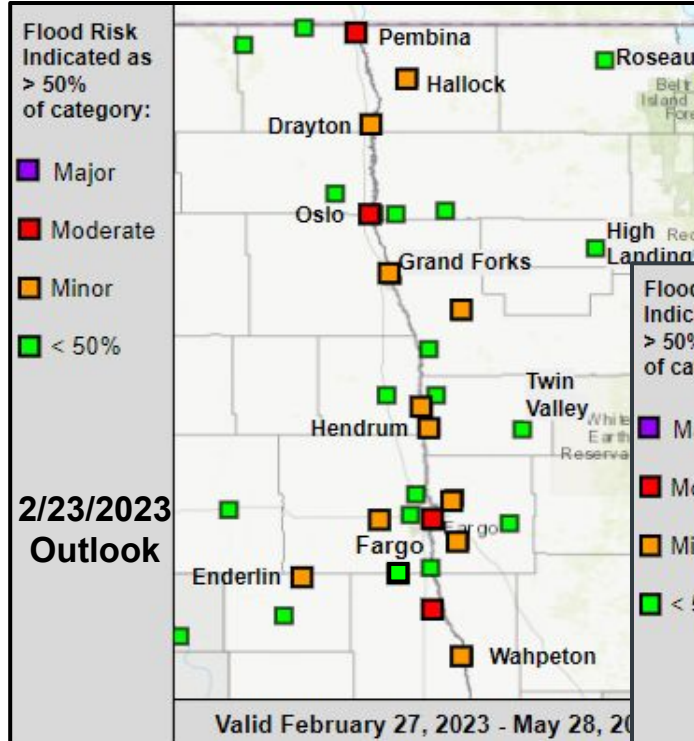
March 9, 2023










# Key Message

The risk for significant (moderate or higher) spring flooding has increased and is now near or above long-term historical averages across the basin.





# Key Points

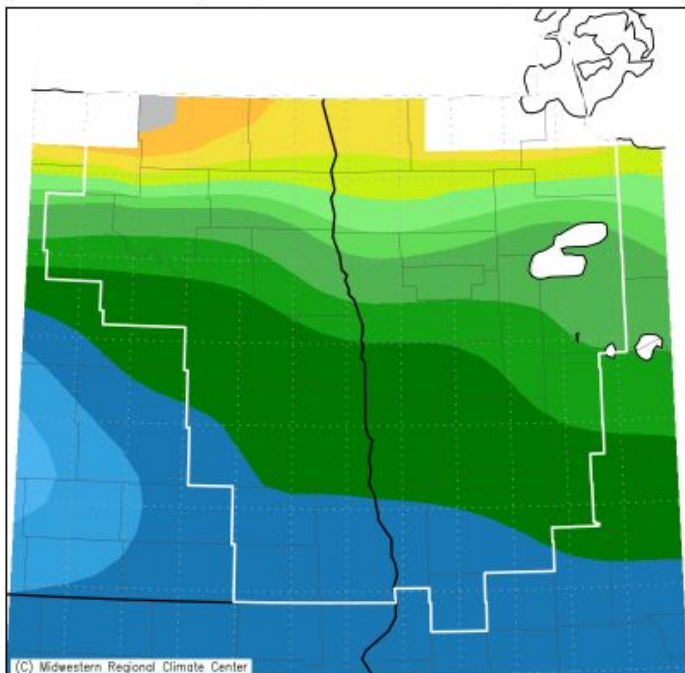
- Risk of moderate to isolated major spring flooding (50% probability) has increased for much of the mainstem Red River and southeastern North Dakota tributaries. Minor flooding is depicted for most of the Minnesota tributaries.
  - Below normal soil moisture and near normal streamflows heading into freeze-up.
  - Normal to above normal snowfall and precipitation has occurred since freeze-up.
  - **Snowmelt timing/thaw cycle, along with any additional snow and/or rain this spring, will be the most important factors contributing to the spring flood risk.**
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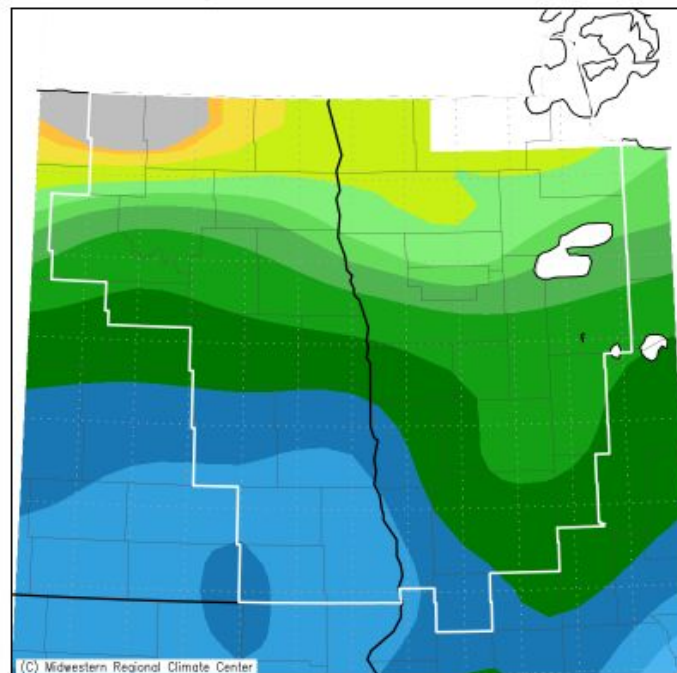
# Since February 23rd Outlook



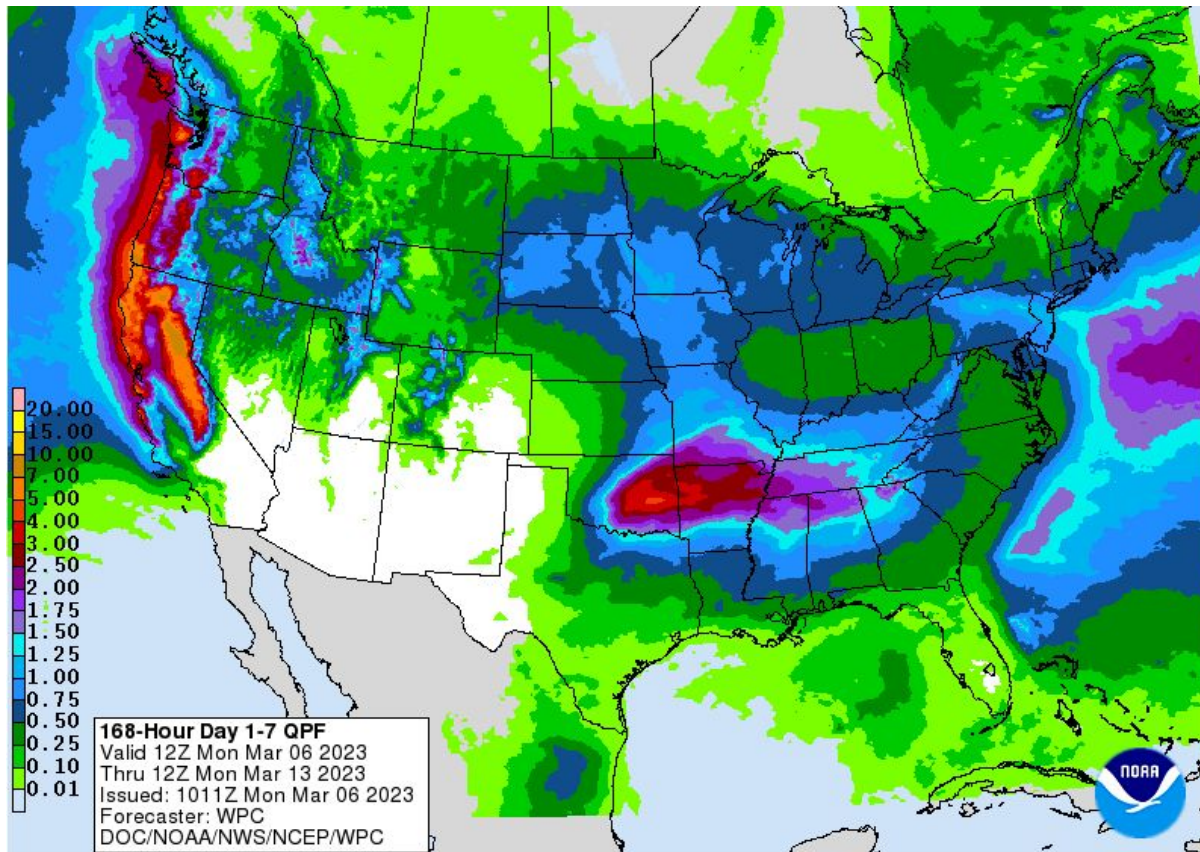
Accumulated Snowfall (in)  
February 23, 2023 to March 9, 2023



Accumulated Precipitation (in)  
February 23, 2023 to March 9, 2023



# Forecast Precipitation in this Outlook (7 days beginning 6 am Monday, March 6th)





## Red River of the North Spring Flooding?

### Spring

- Thaw Cycle
- Heavy Rains

### Fall

- Fall Moisture
- Base Streamflow

### Winter

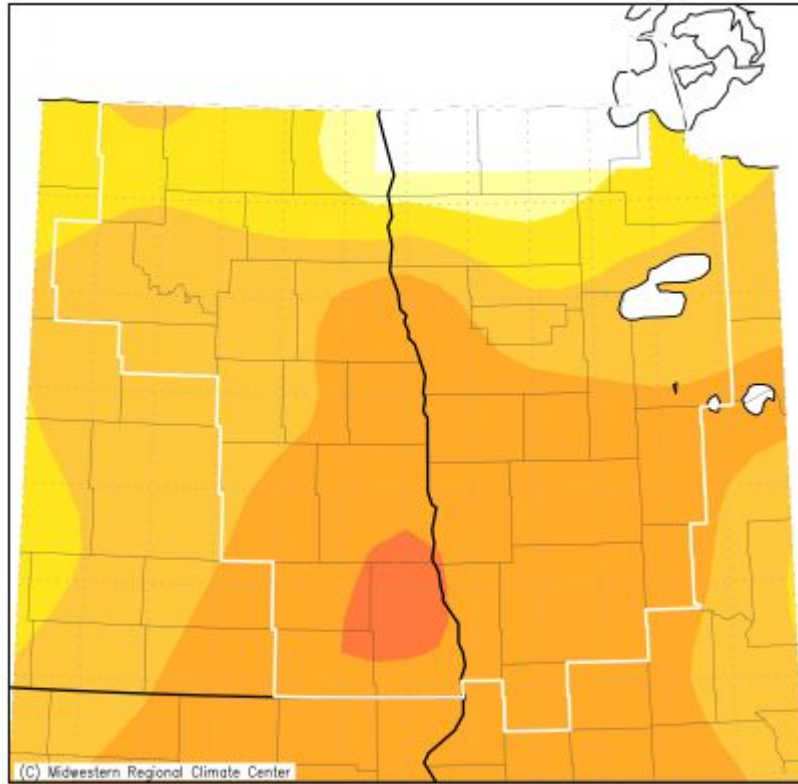
- Frost Depth
- Snowpack
- Snow Water Content

[Bluemle: Factors Affecting Flooding in the Red River Valley, 1997]



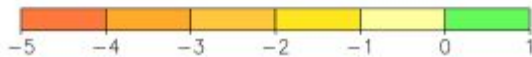


# Accumulated Precipitation (in): Departure from Mean September 1, 2022 to November 30, 2022

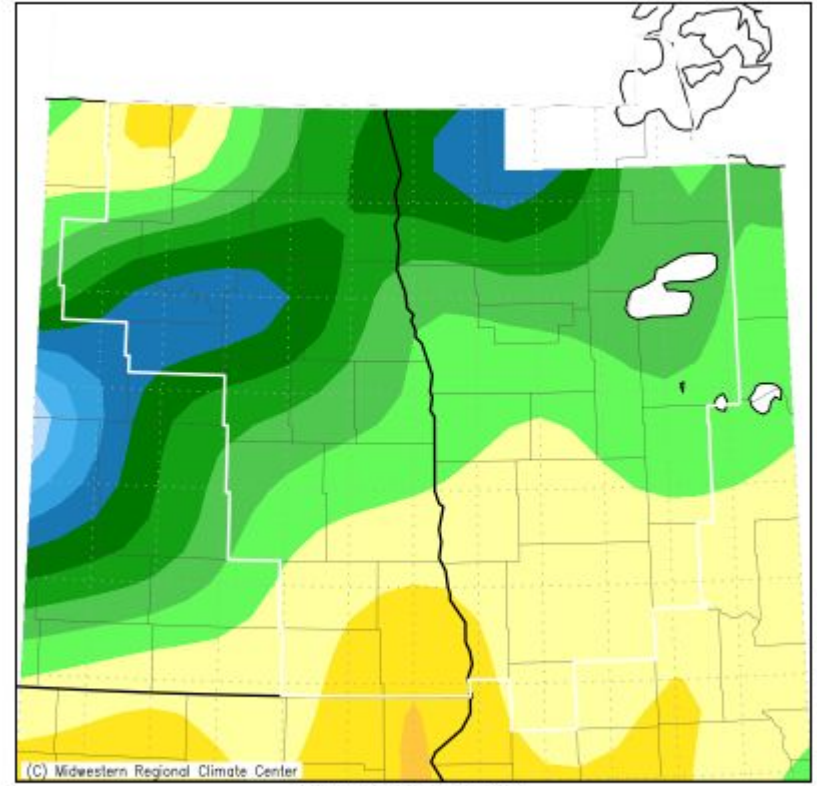


(C) Midwestern Regional Climate Center

Mean period is 1991–2020.



# Accumulated Snowfall (in): Departure from Mean September 1, 2022 to November 30, 2022

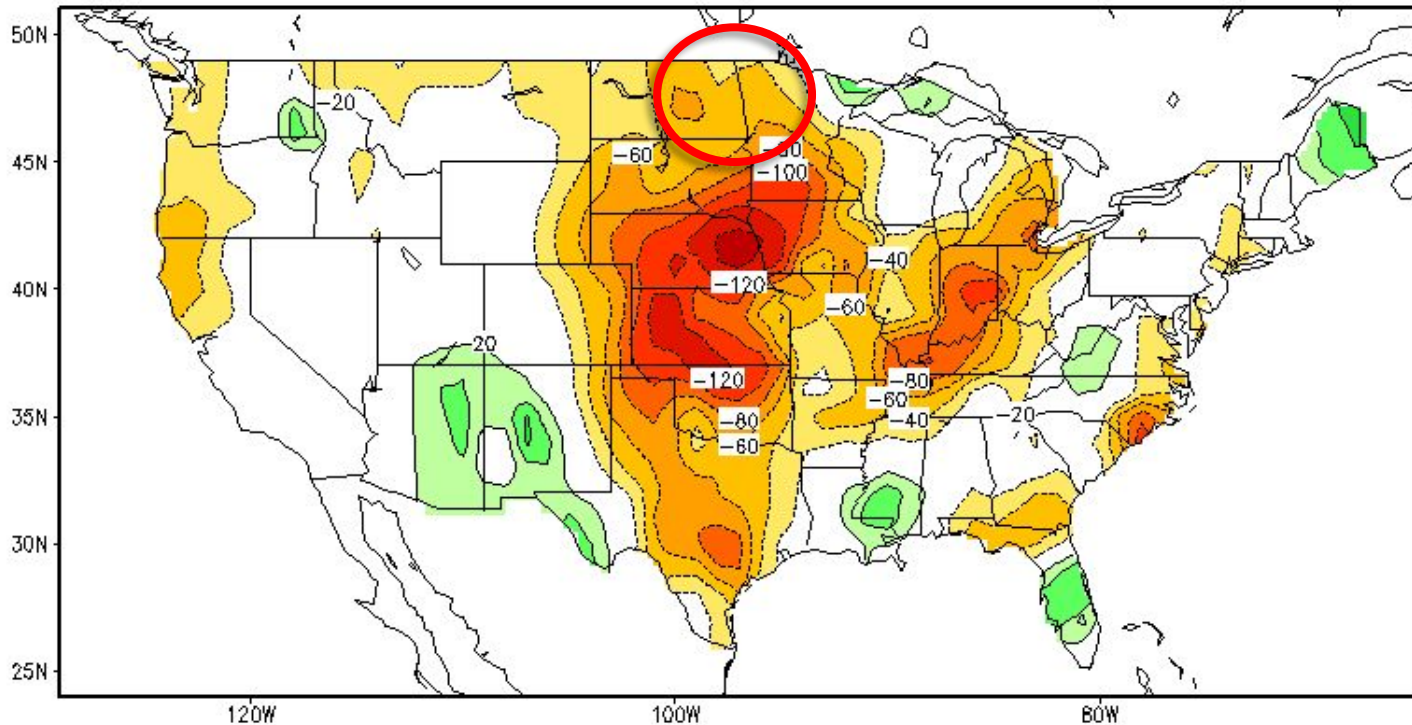


(C) Midwestern Regional Climate Center

Mean period is 1991–2020.



# Calculated Soil Moisture Anomaly (mm) DEC, 2022



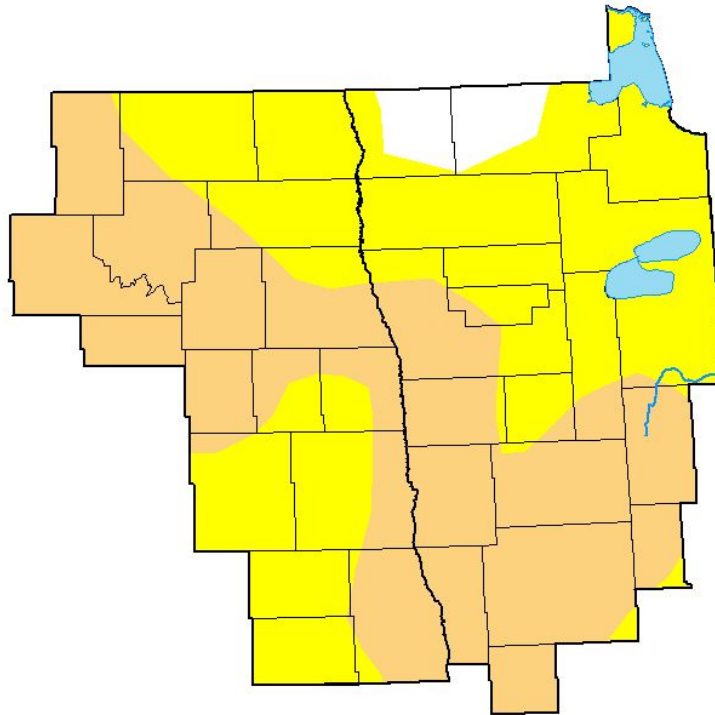










# U.S. Drought Monitor

## Grand Forks, ND WFO

**March 7, 2023**  
 (Released Thursday, Mar. 9, 2023)  
 Valid 7 a.m. EST



***Intensity:***

-  None
-  D0 Abnormally Dry
-  D1 Moderate Drought
-  D2 Severe Drought
-  D3 Extreme Drought
-  D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>*

***Author:***

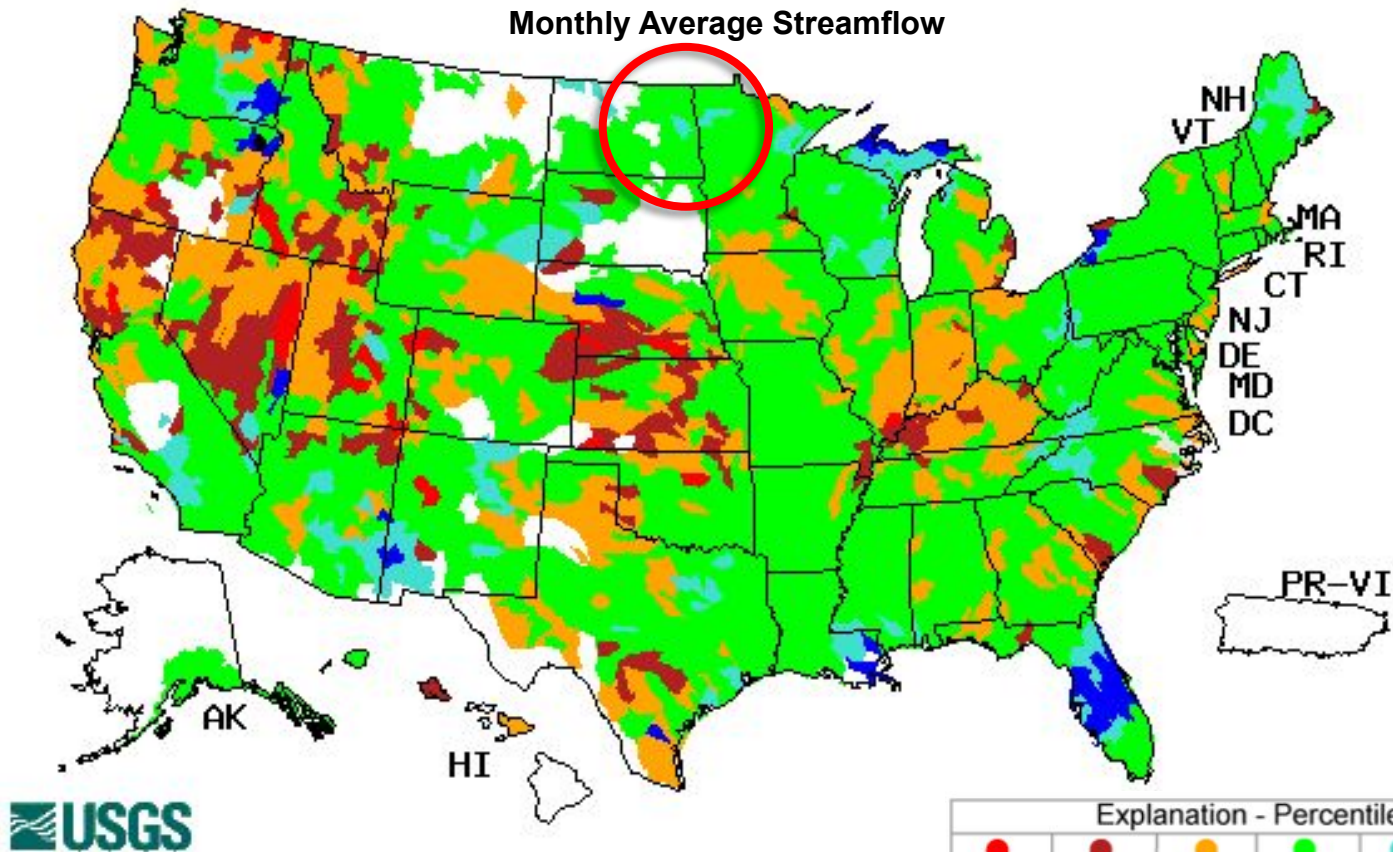
Deborah Bathke  
 National Drought Mitigation Center



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)



November 2022  
Monthly Average Streamflow



Explanation - Percentile classes

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





## Red River of the North Spring Flooding?

### Spring

- Thaw Cycle
- Heavy Rains

### Fall

- ~~Fall Moisture~~
- Base Streamflow ✓

### Winter

- Frost Depth
- Snowpack
- Snow Water Content

[Bluemle: Factors Affecting Flooding in the Red River Valley, 1997]





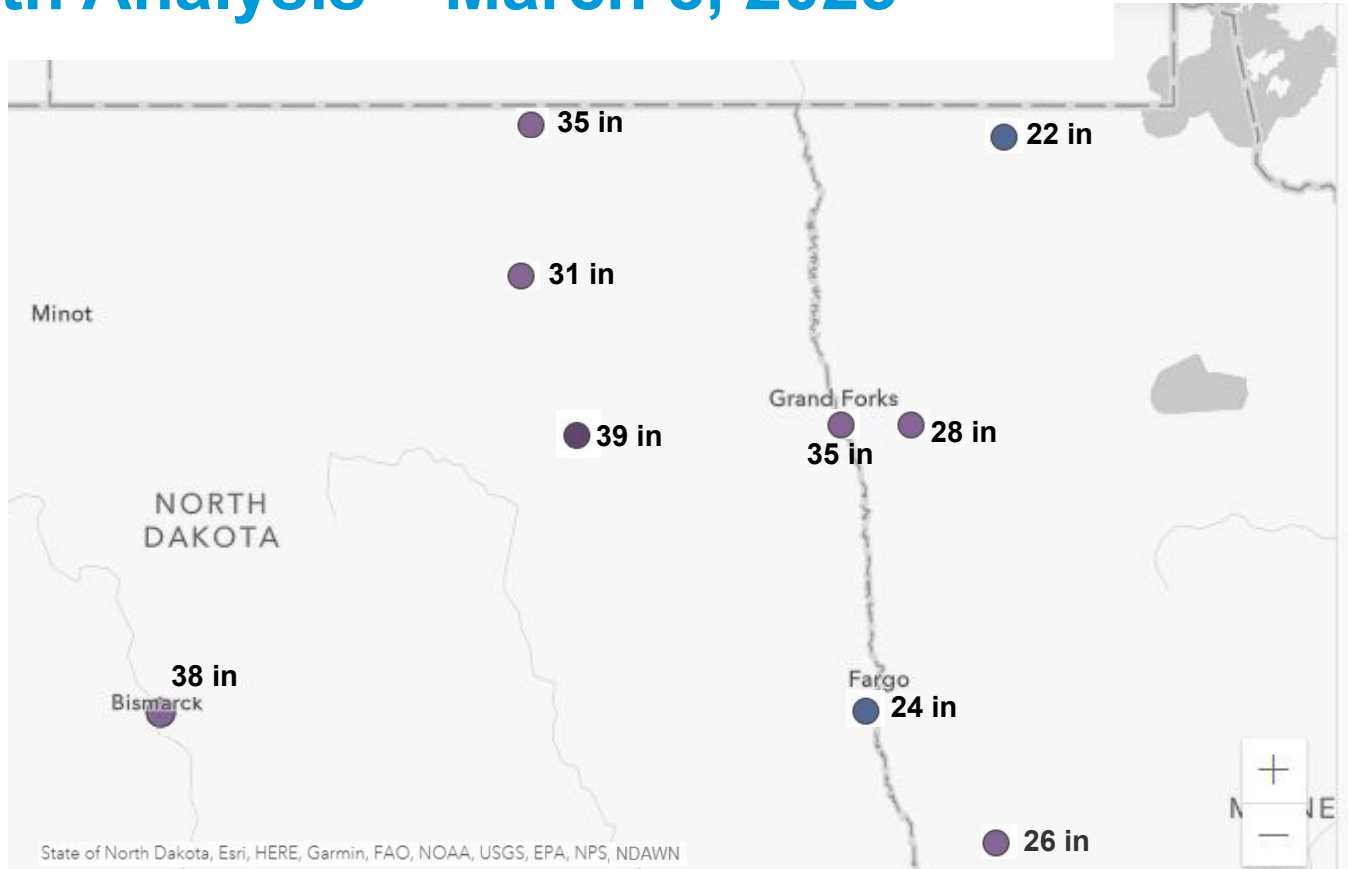
# Frost Depth Analysis – March 8, 2023



## Soil Frost Depth (Inches)

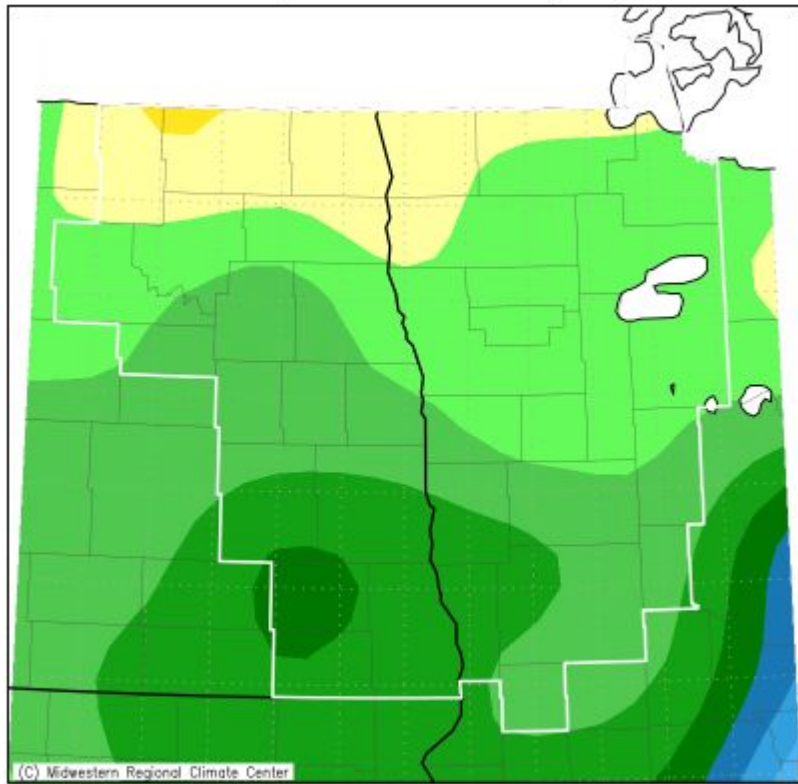
### FrostDepth

- > 36" - 60"
- > 24" - 36"
- > 12" - 24"
- > 6" - 12"
- > 0" - 6"
- 0"





Accumulated Precipitation (in): Departure from Mean  
December 1, 2022 to February 28, 2023

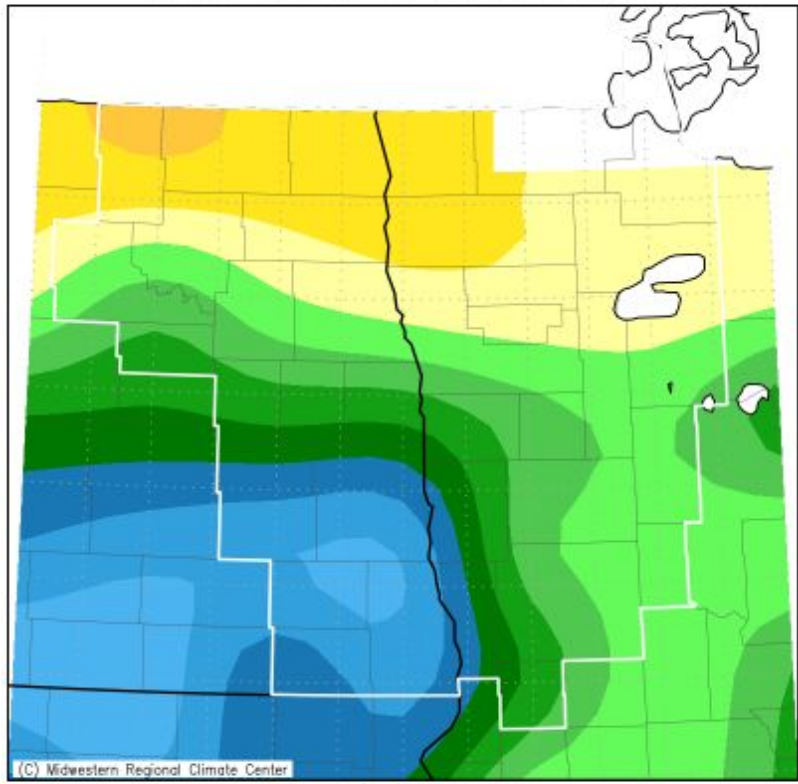


(C) Midwestern Regional Climate Center

Mean period is 1991-2020.



Accumulated Precipitation (in): Departure from Mean  
March 1, 2023 to March 9, 2023



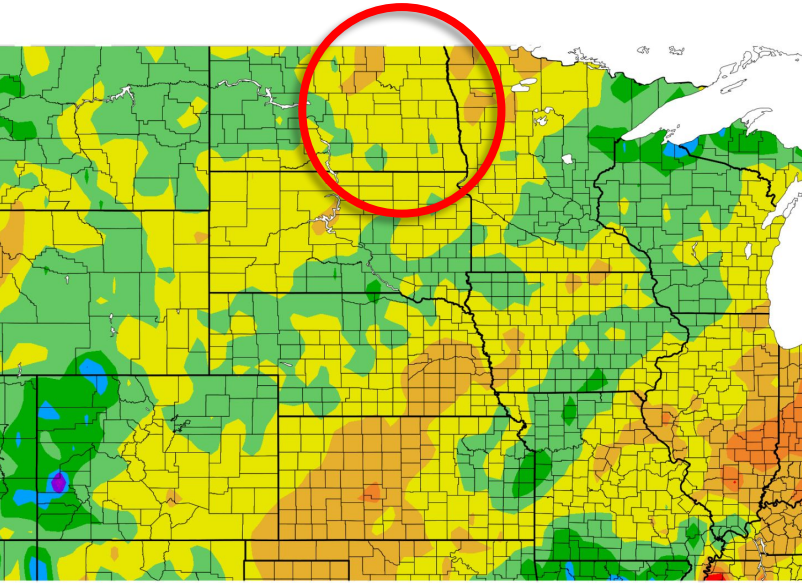
(C) Midwestern Regional Climate Center

Mean period is 1991-2020.



# Departure from Normal Precipitation (in)

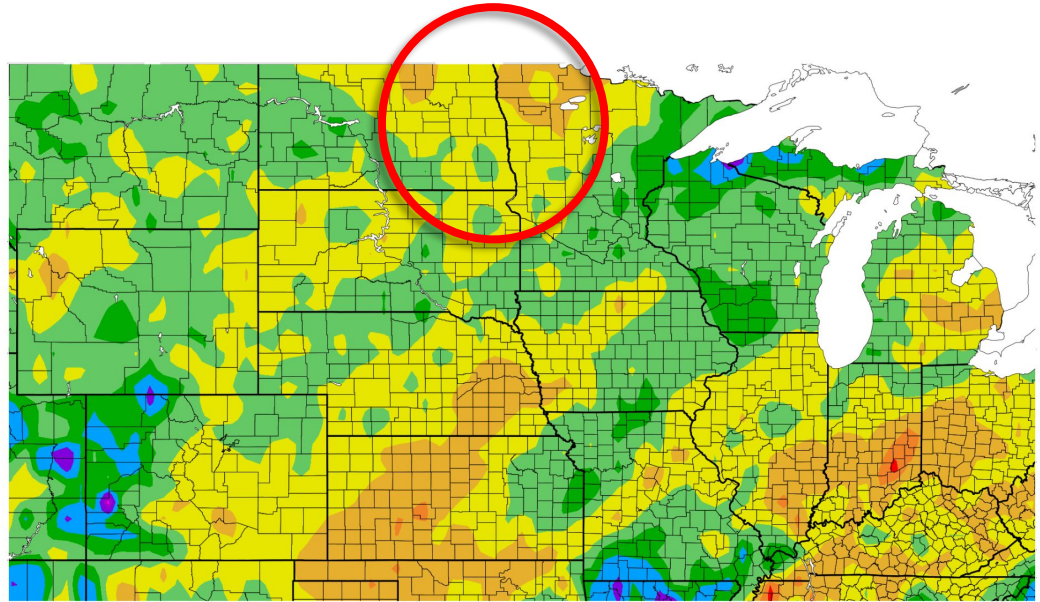
10/1/2022 – 2/20/2023



and 2/21/2023 at HPRCC using provisional data. NOAA Re

# Departure from Normal Precipitation (in)

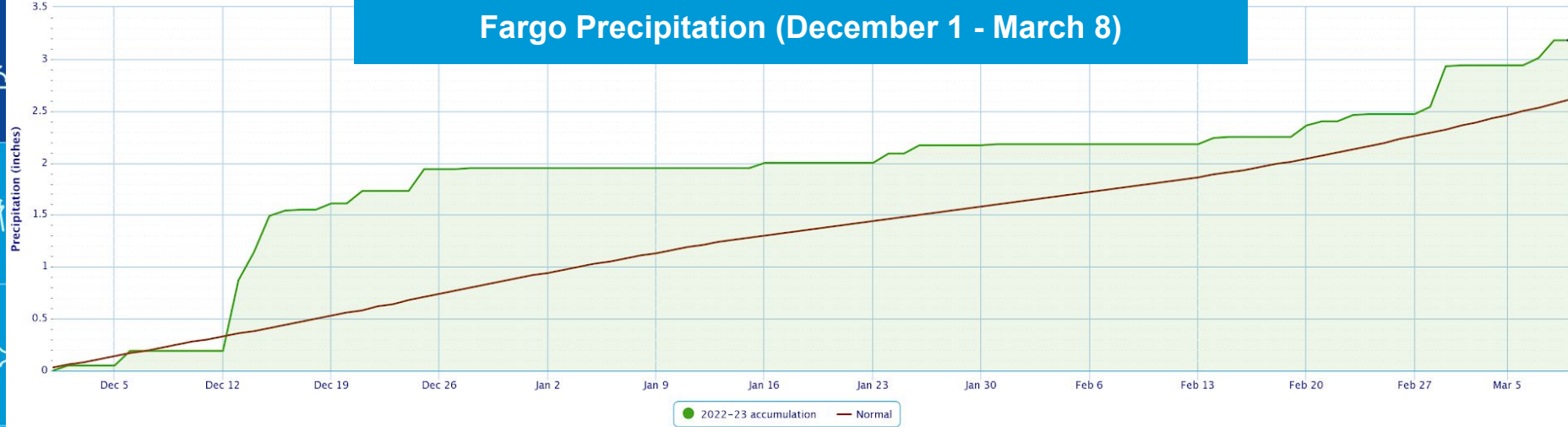
10/1/2022 – 3/8/2023



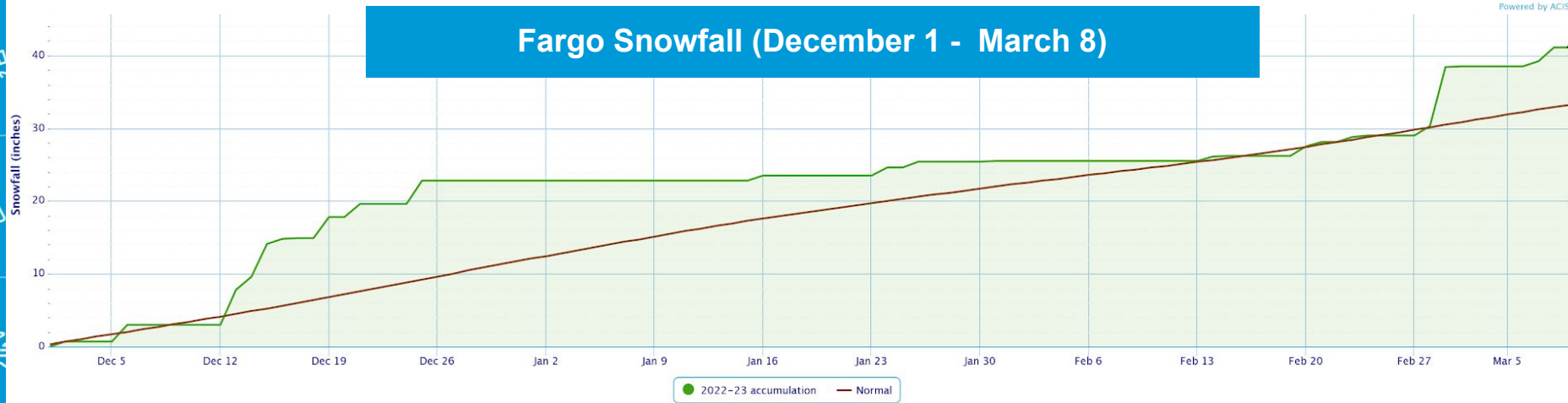
Generated 3/9/2023 at HPRCC using provisional data. NOAA Regional Climate Centers



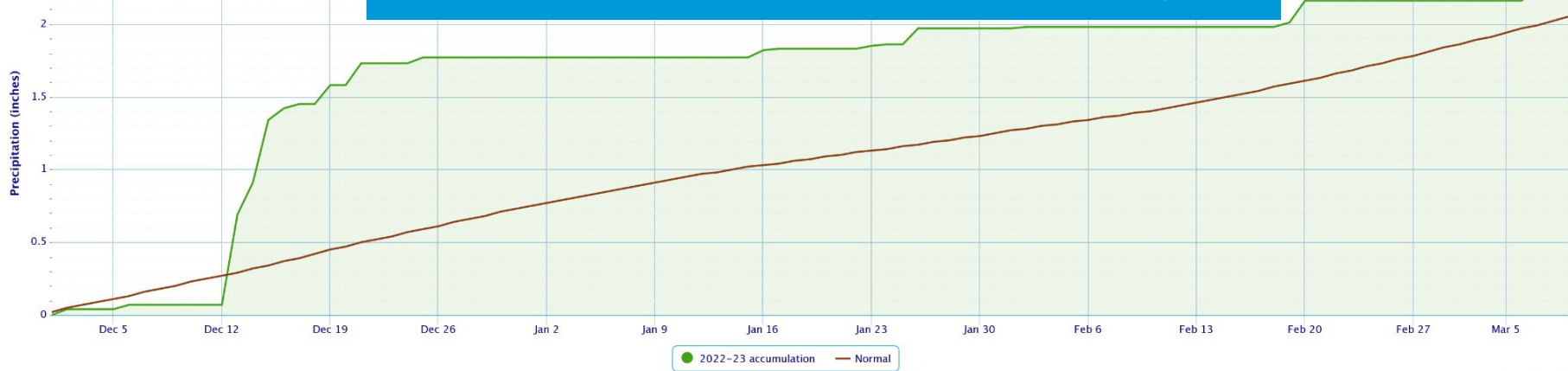
## Fargo Precipitation (December 1 - March 8)



## Fargo Snowfall (December 1 - March 8)

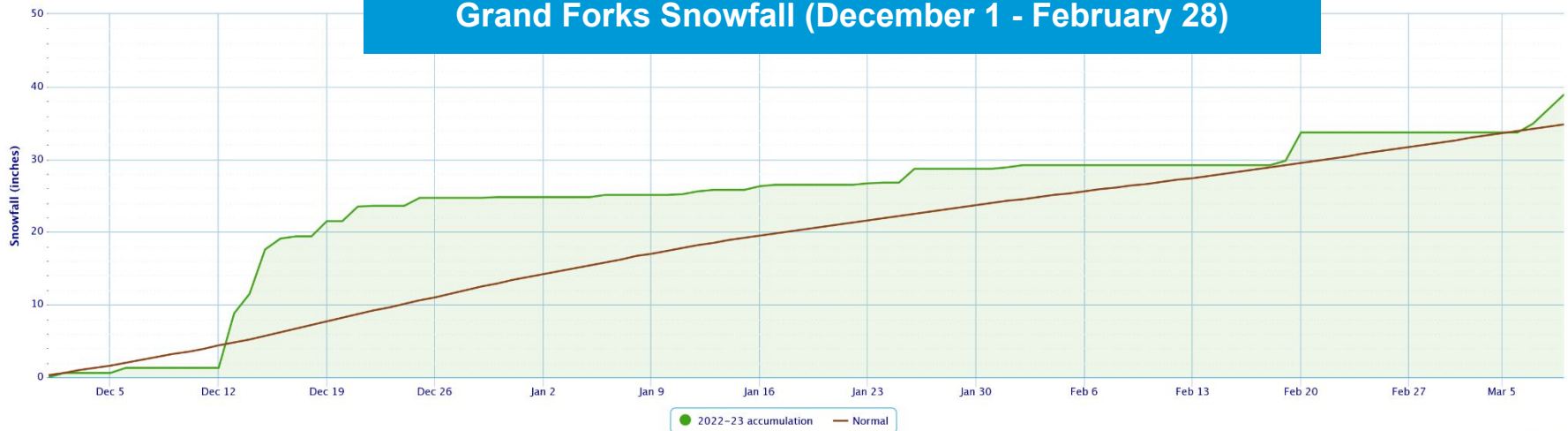


## Grand Forks Precipitation (December 1 - February 28)



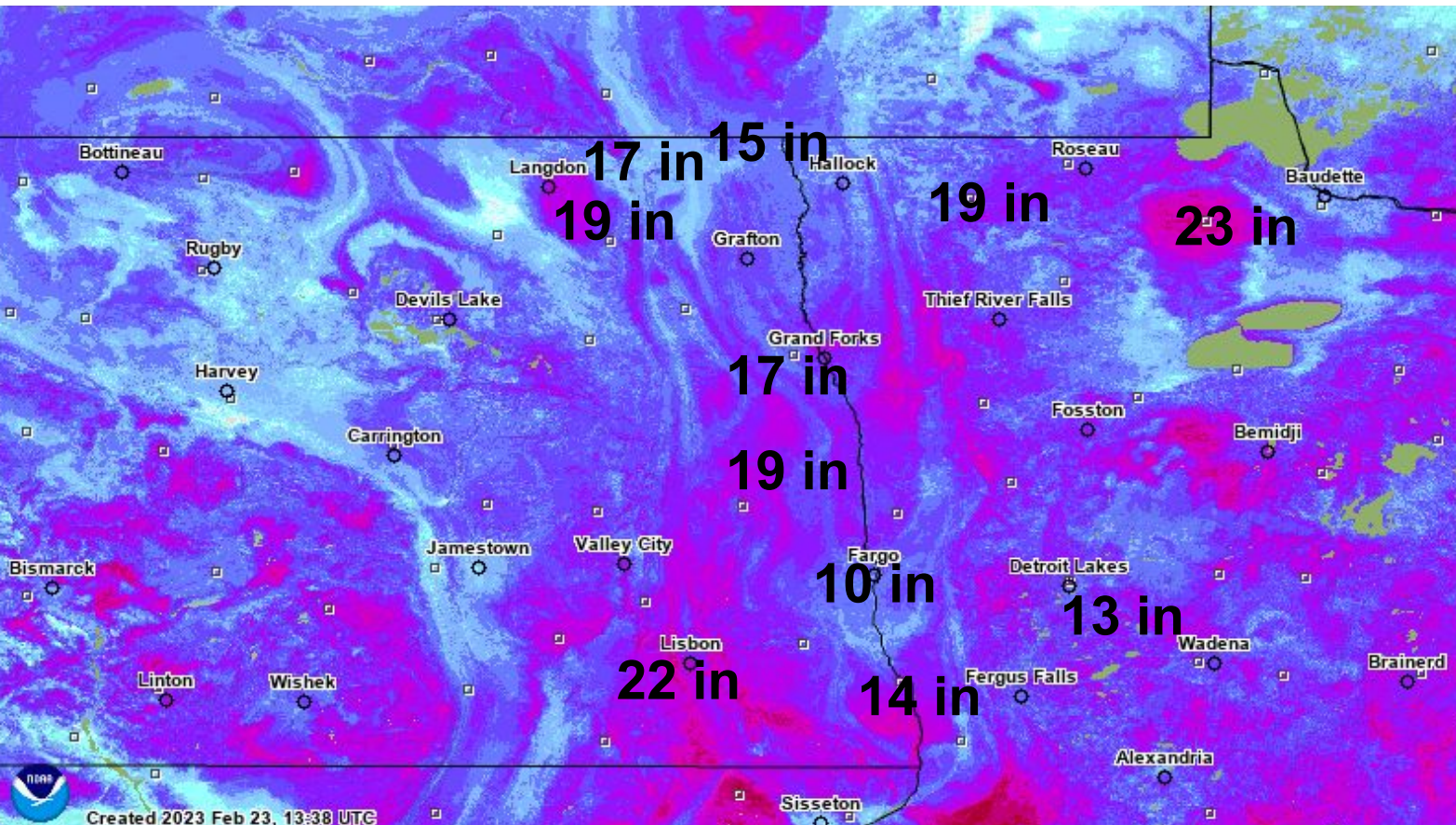
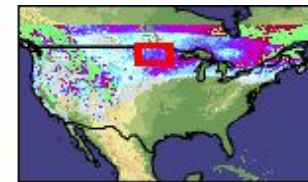
Powered by ACIS

## Grand Forks Snowfall (December 1 - February 28)

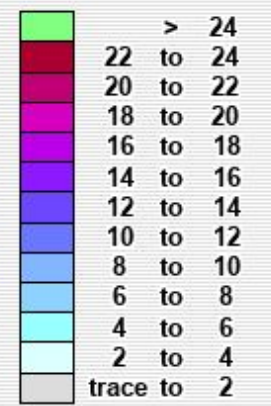




# Modeled Snow Depth - February 23, 2023

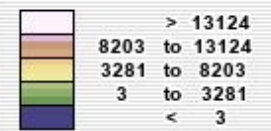


## Inches of depth



Not Estimated

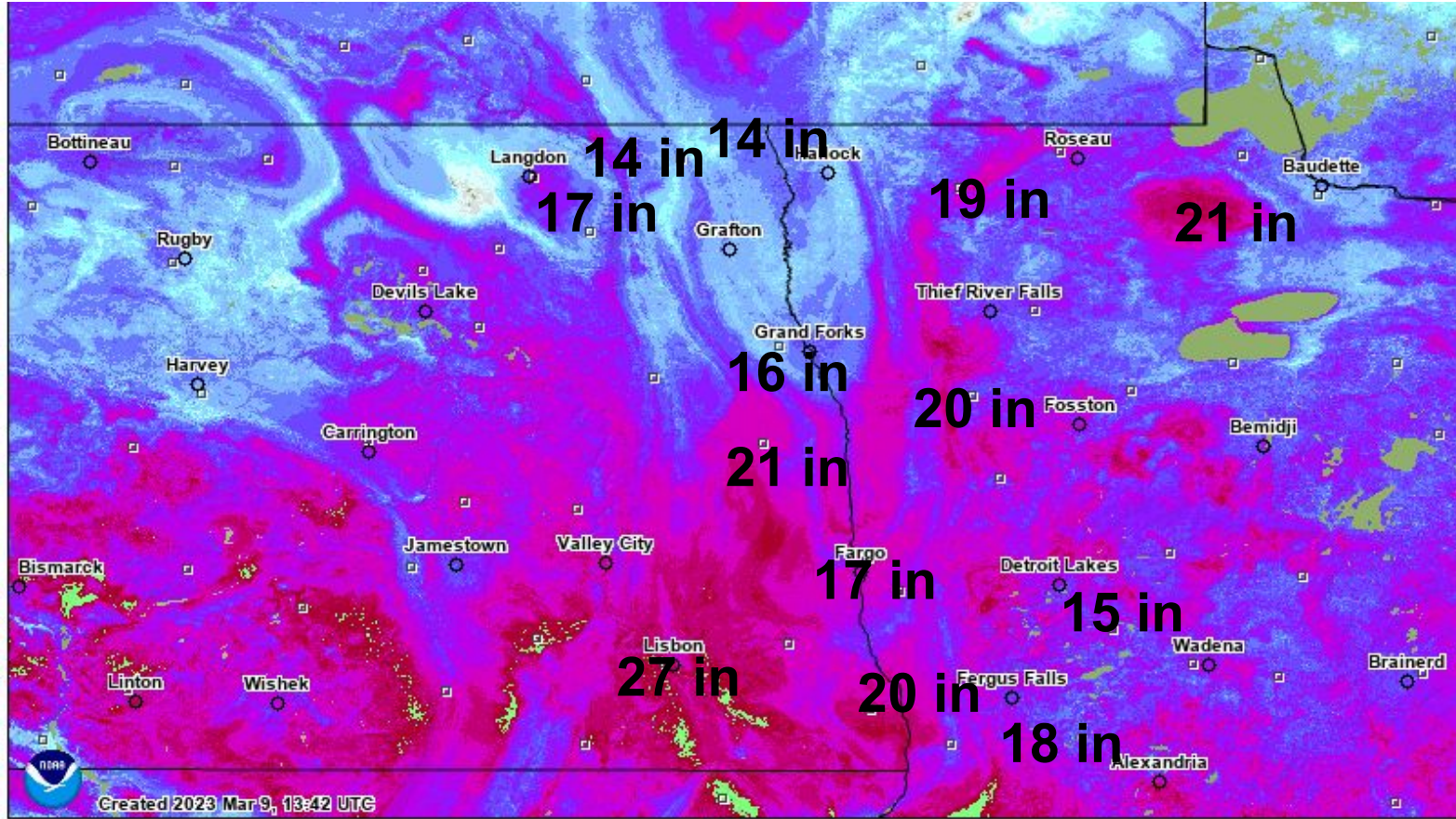
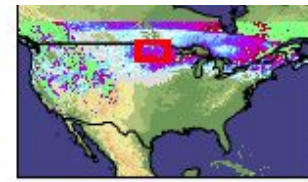
## Elevation in feet



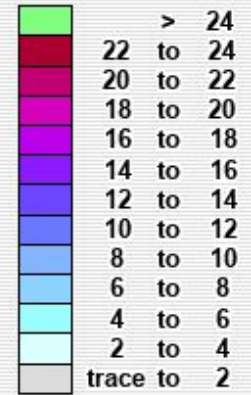
278.1 m

Created 2023 Feb 23, 13:38 UTC

# Modeled Snow Depth - March 9, 2023



## Inches of depth



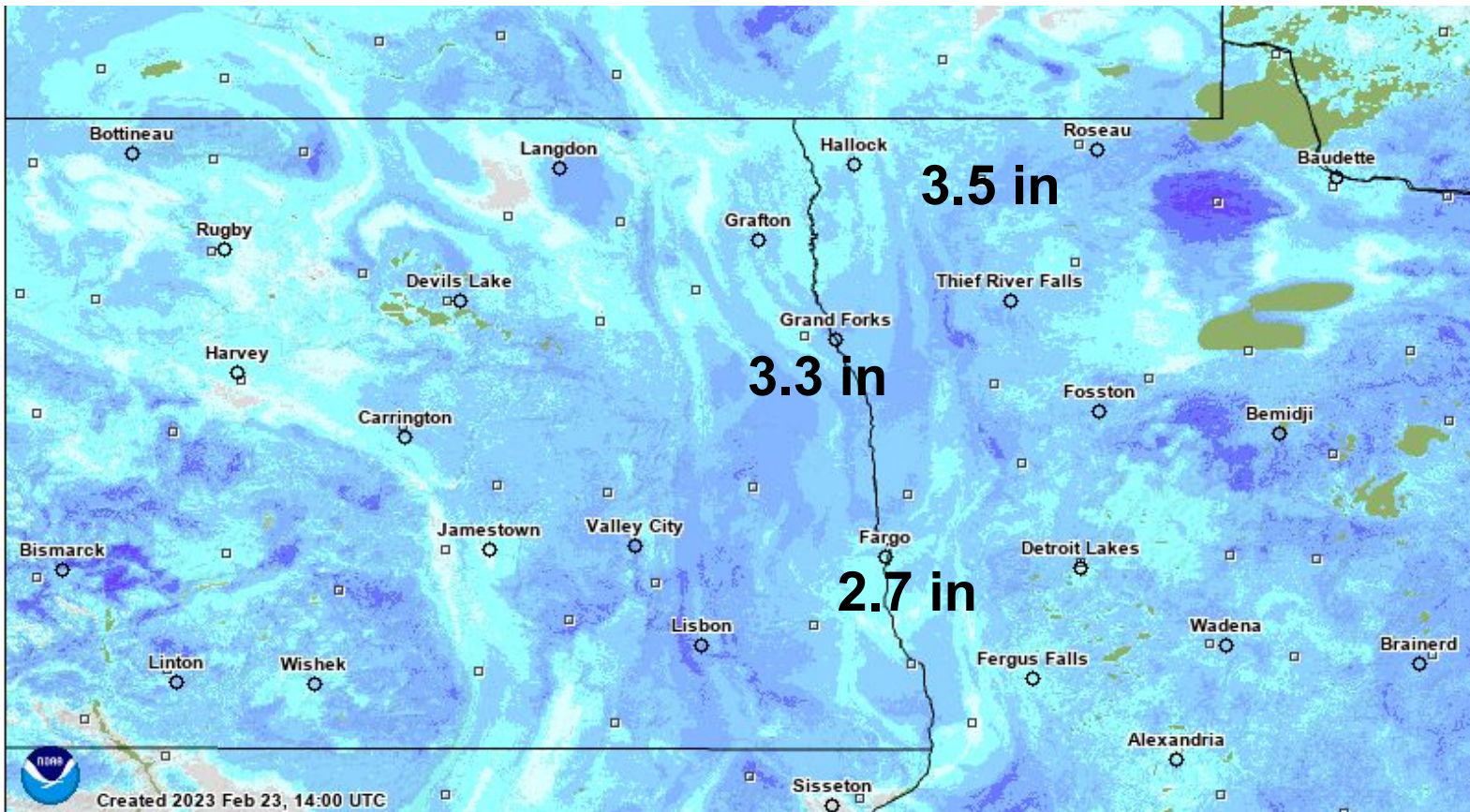
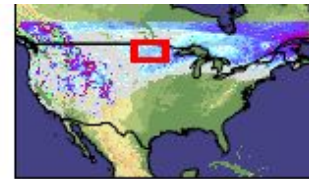
Not Estimated

## Elevation in feet

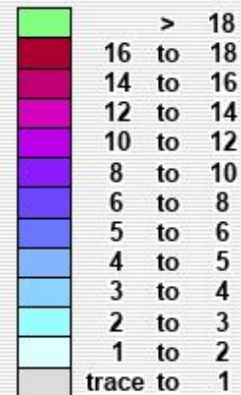


Created 2023 Mar 9, 13:42 UTC

# Modeled Snow Water Equivalent - February 23, 2023



Inches of water equivalent

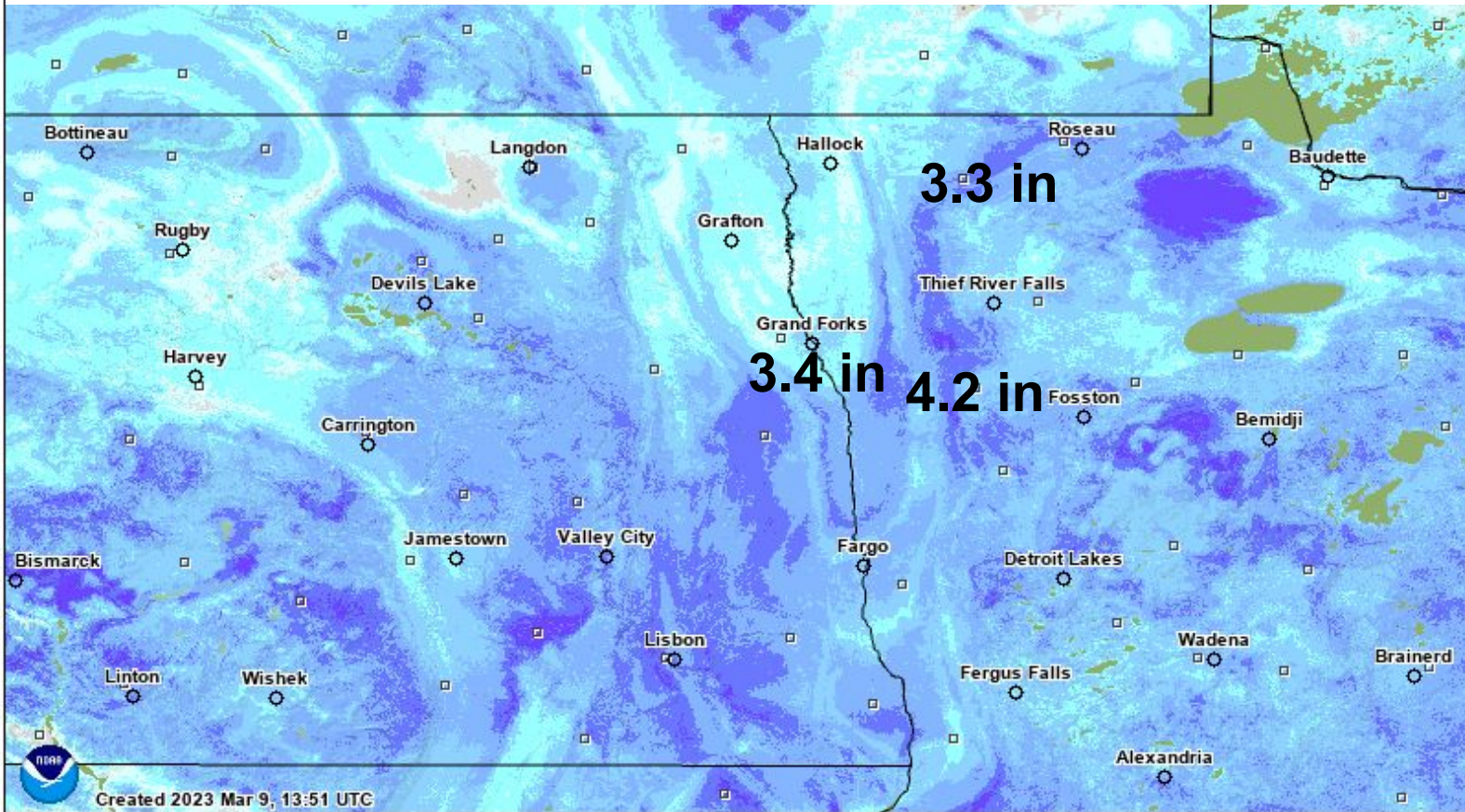
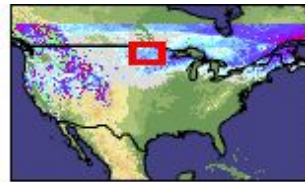


Not Estimated

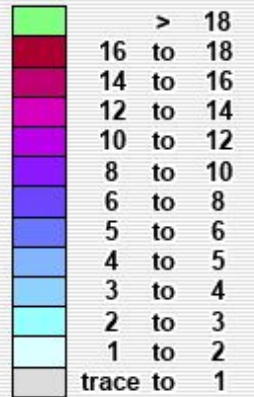
Elevation in feet



# Modeled Snow Water Equivalent - March 9, 2023

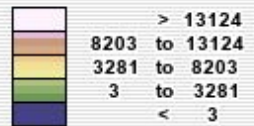


Inches of water equivalent



Not Estimated

Elevation in feet

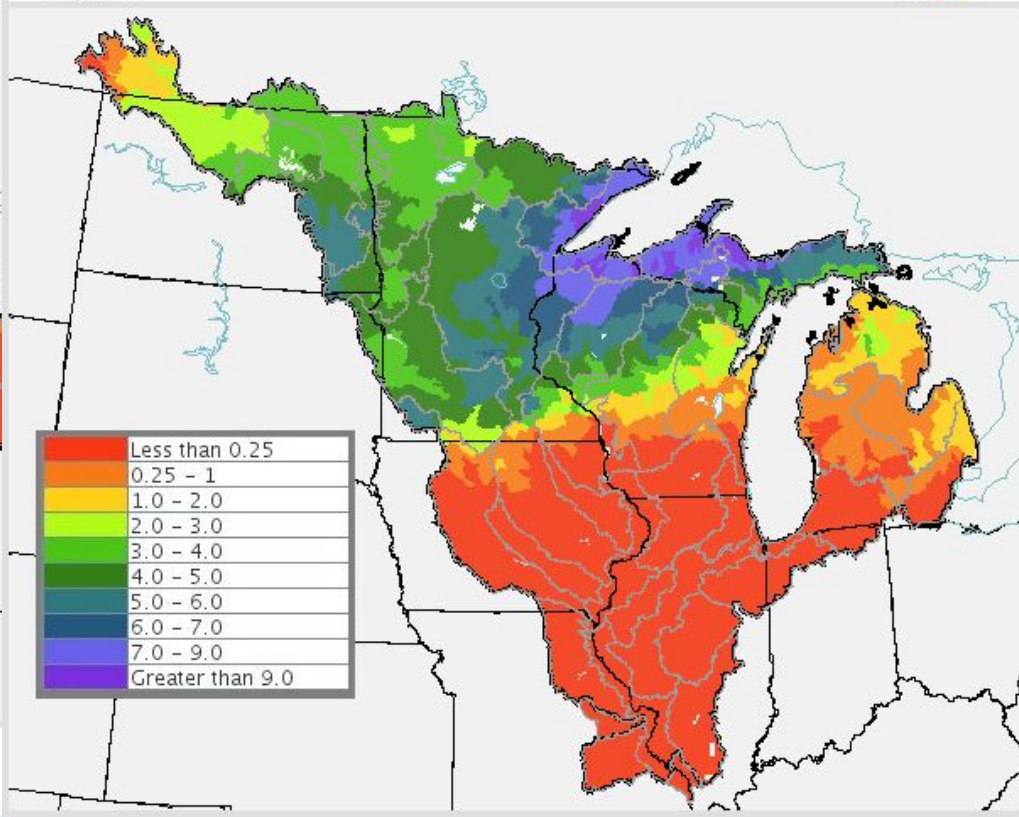
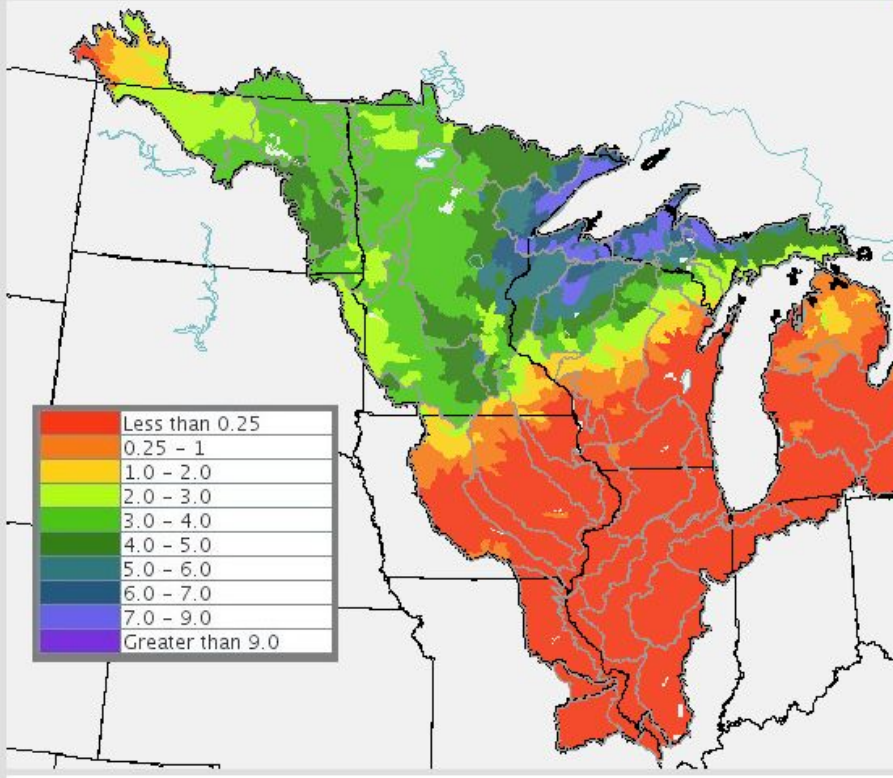




North Central River Forecast Center  
 Model Simulated Snow Water Equivalent  
 Valid for 02/20/2023 12 GMT



North Central River Forecast Center  
 Model Simulated Snow Water Equivalent  
 Valid for 03/06/2023 12 GMT





## Red River of the North Spring Flooding?

### Spring

- Thaw Cycle
- Heavy Rains

### Fall

- ~~Fall Moisture~~
- Base Streamflow ✓

### Winter (thus far)

- Frost Depth ✓
- Snowpack ✓
- Snow Water Content ✓

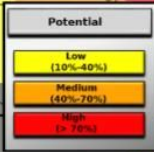
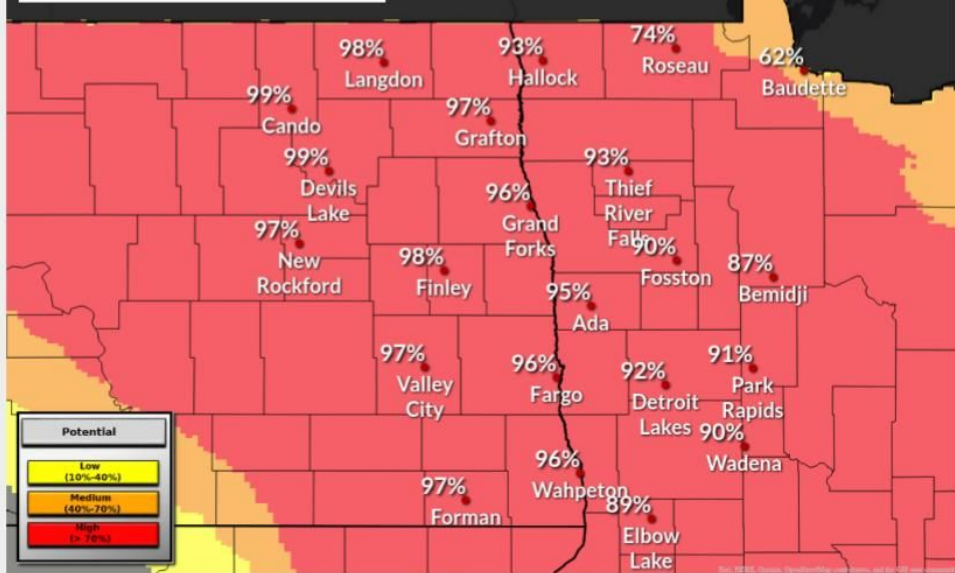
[Bluemle: Factors Affecting Flooding in the Red River Valley, 1997]



# Winter Impacts: Sat-Sun

Timing:		Impacts	Expected			
Today	Fri	Sat	Sun	Mon	Tue	Wed
Mar 09	Mar 10	Mar 11	Mar 12	Mar 13	Mar 14	Mar 15

## Potential for 4" or Greater



## WHAT IS KNOWN

- Impacts from accumulating snowfall and gusty winds are expected Saturday into Sunday, affecting eastern North Dakota & northwestern Minnesota.



## WHAT HAS CHANGED

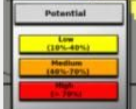
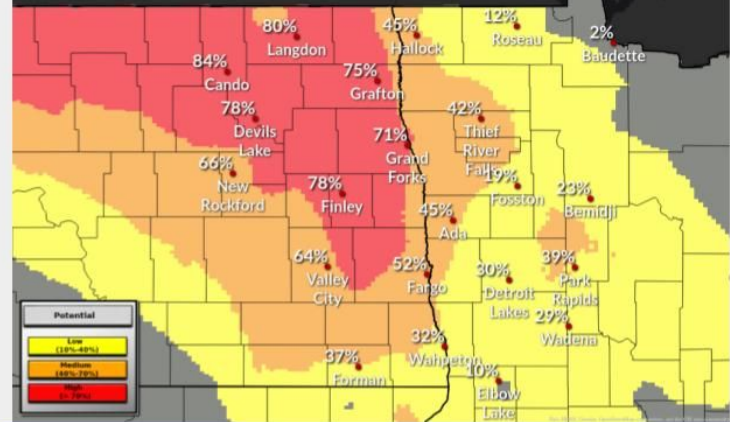
- The potential for significant winter impacts continues to increase.



## WHAT YOU CAN DO...

- Monitor the forecast for updates.
- Prepare for travel impacts this weekend.

## Potential for 8" or Greater



National Weather Service | Grand Forks



@NWSGrandForks



weather.gov/fgf





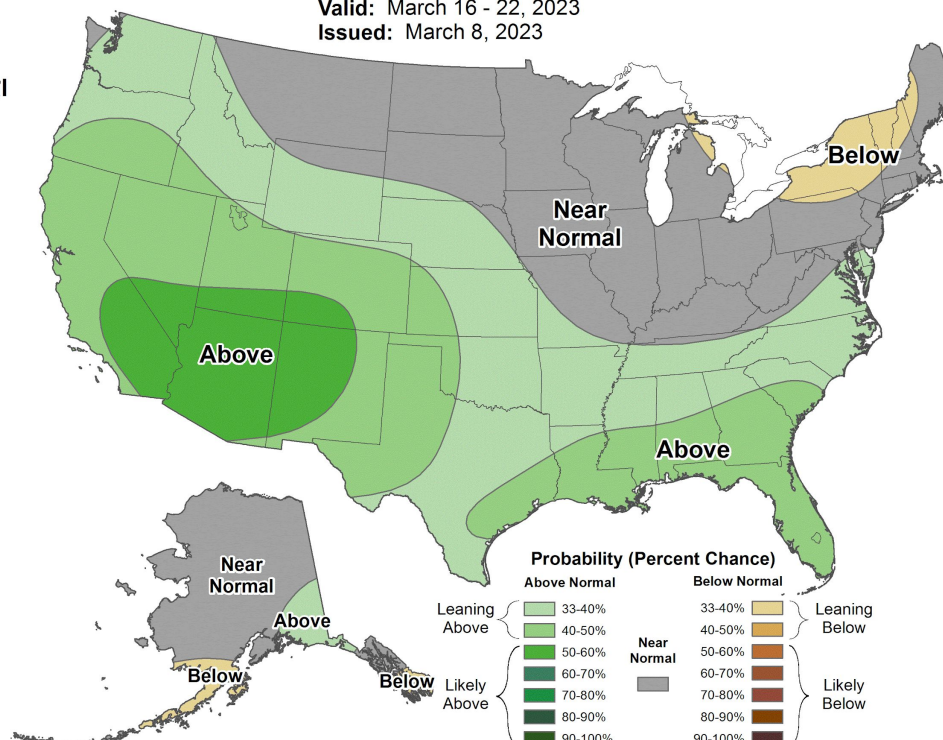
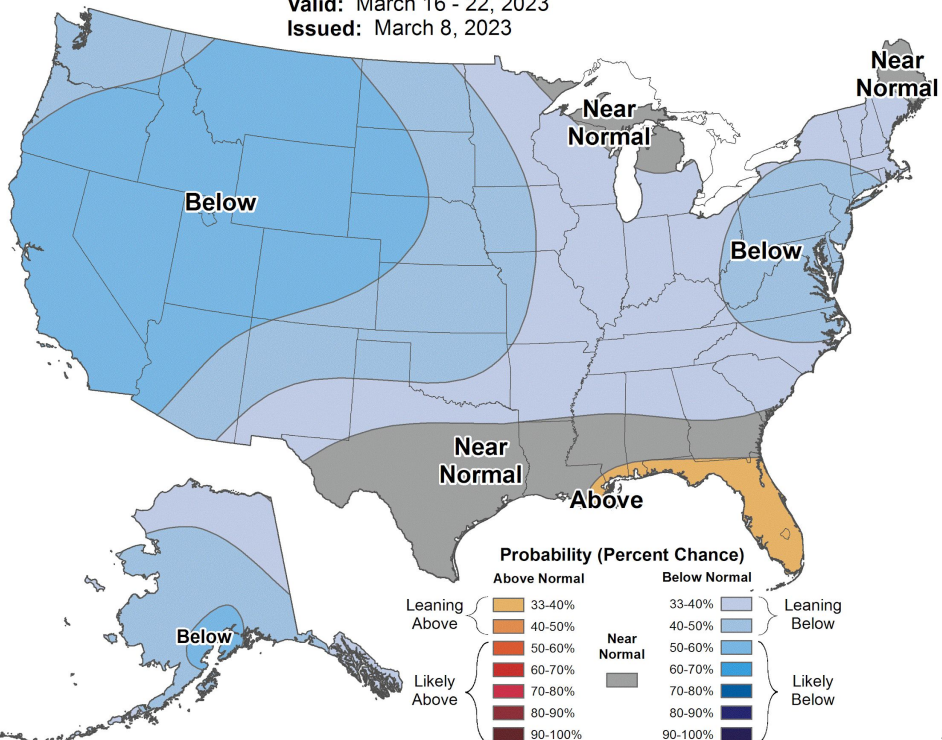
# 8-14 Day Temperature Outlook

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



# 8-14 Day Precipitation Outlook

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



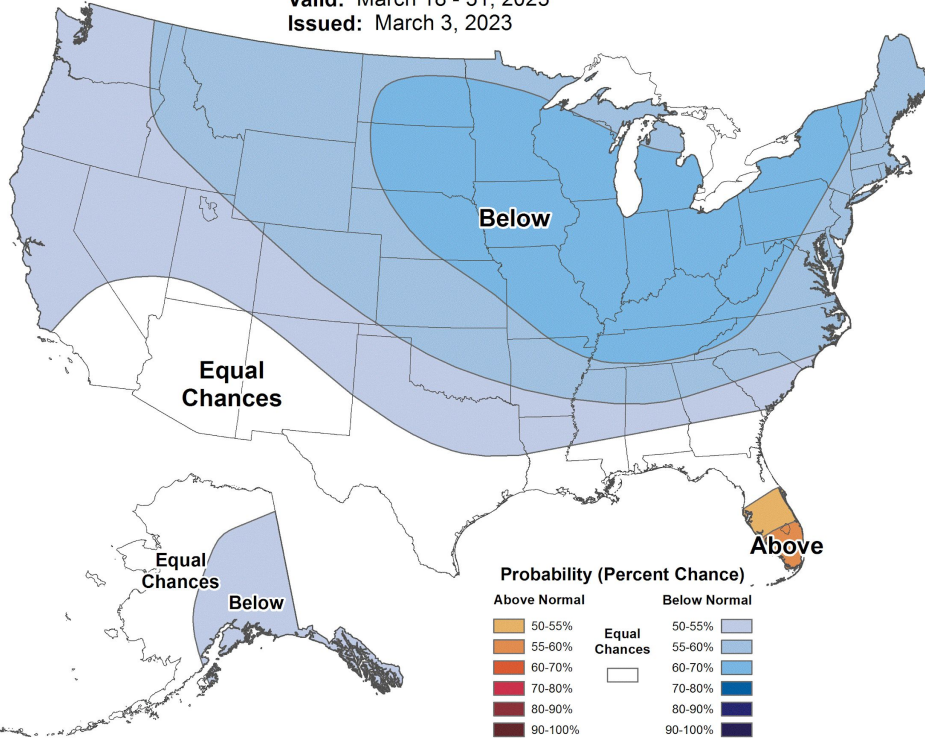




# Weeks 3-4 Temperature Outlook



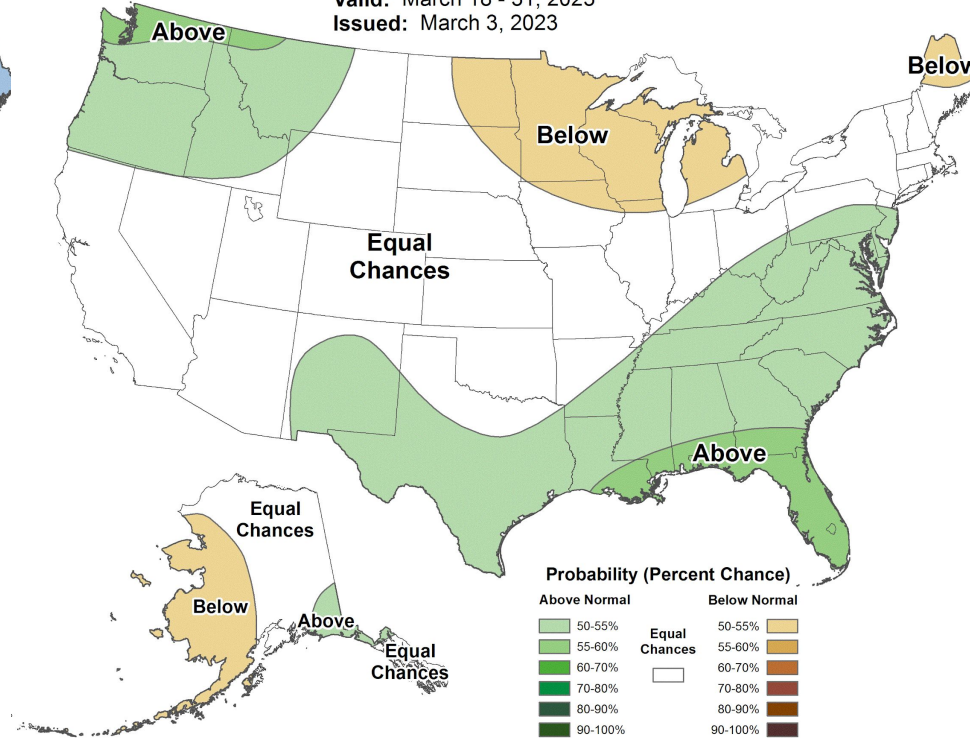
Valid: March 18 - 31, 2023  
Issued: March 3, 2023



# Weeks 3-4 Precipitation Outlook



Valid: March 18 - 31, 2023  
Issued: March 3, 2023

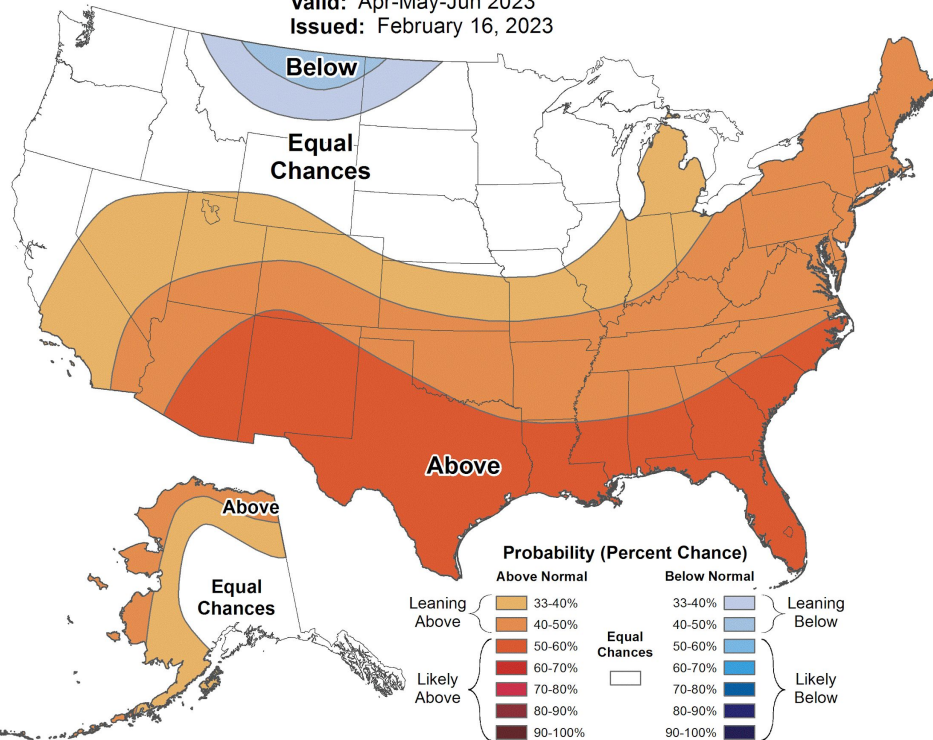




# Seasonal Temperature Outlook

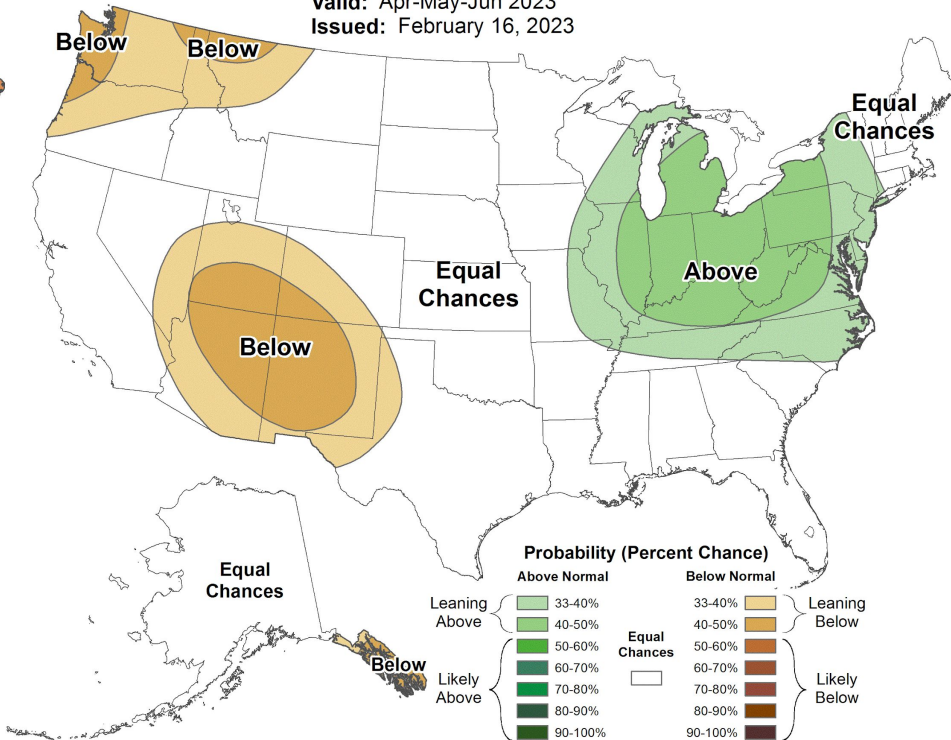


Valid: Apr-May-Jun 2023  
Issued: February 16, 2023



# Seasonal Precipitation Outlook

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





## Red River of the North Spring Flooding?

### Spring

- Thaw Cycle ?
- Heavy Rains ?

### Fall

- ~~Fall Moisture~~
- Base Streamflow ✓

### Winter (thus far)

- Frost Depth ✓
- Snowpack ✓
- Snow Water Content ✓

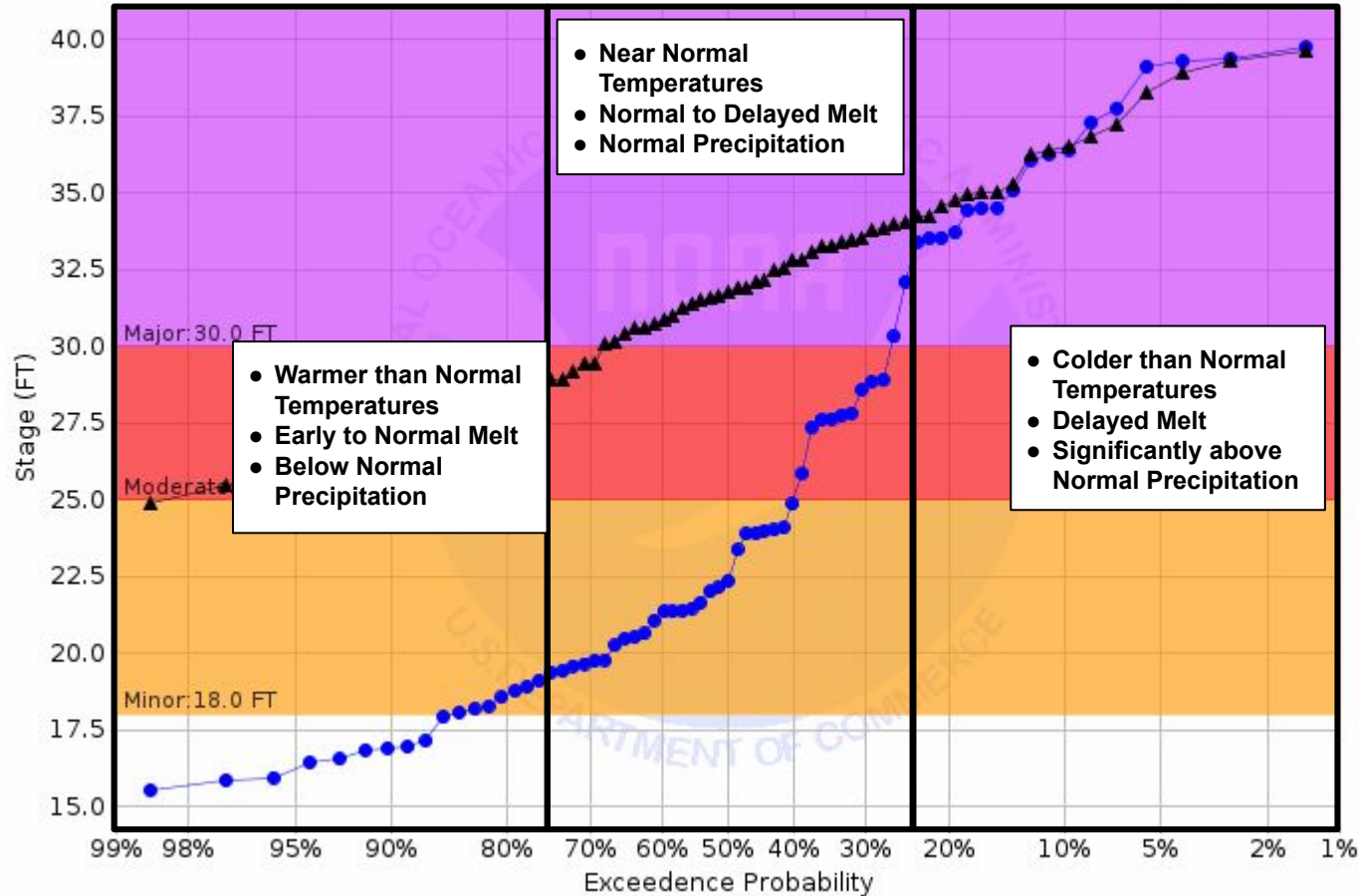
[Bluemle: Factors Affecting Flooding in the Red River Valley, 1997]



# Chance of Exceeding River Stage at Red River of the North at Fargo WTP (FGON8)

Forecast for the period 03/13/2023 - 06/11/2023

This is a conditional simulation based on the conditions as of 03/06/2023



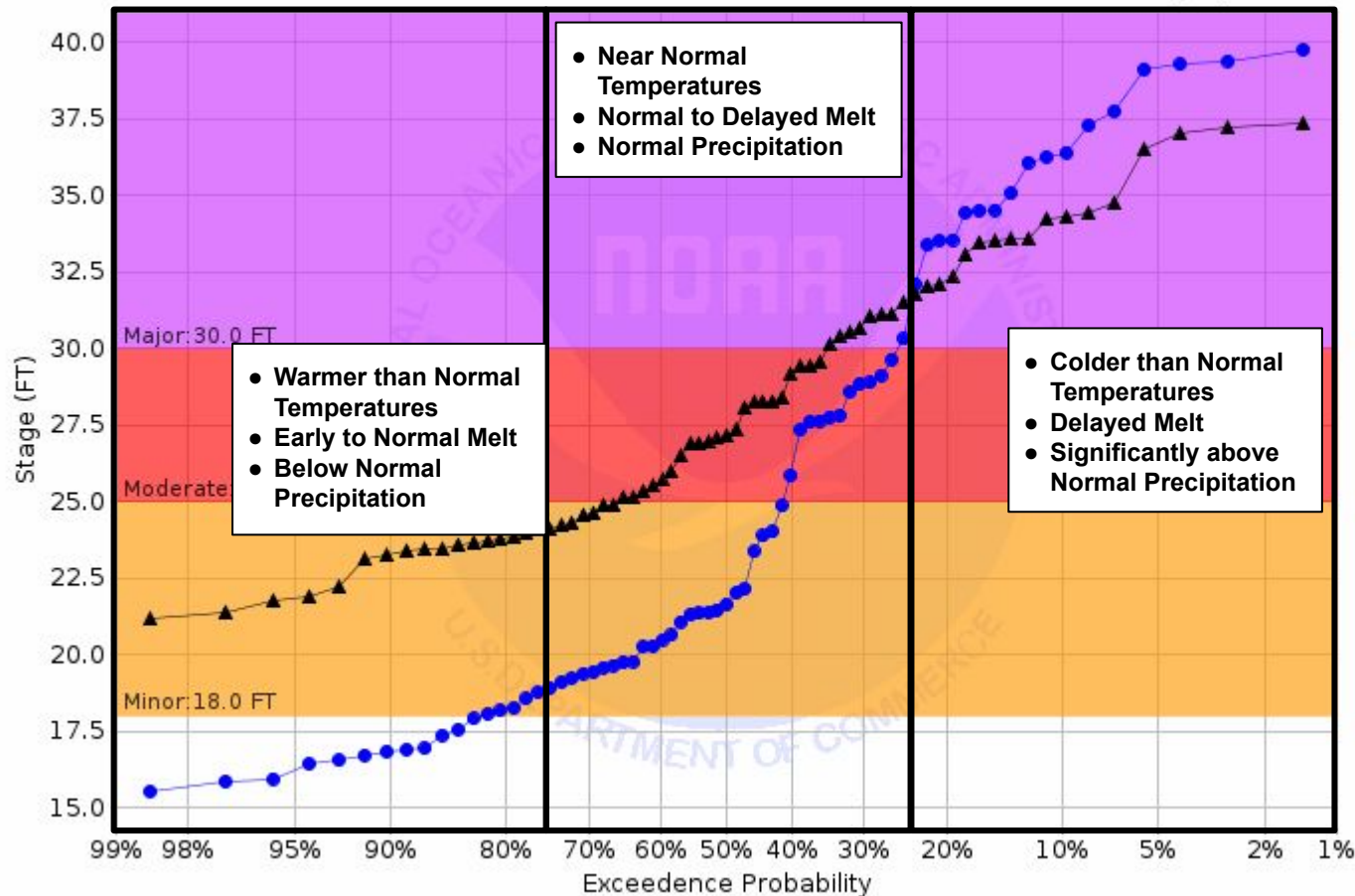
## Fargo/ Moorhead (March 9th)



# Chance of Exceeding River Stage at Red River of the North at Fargo WTP (FGON8)

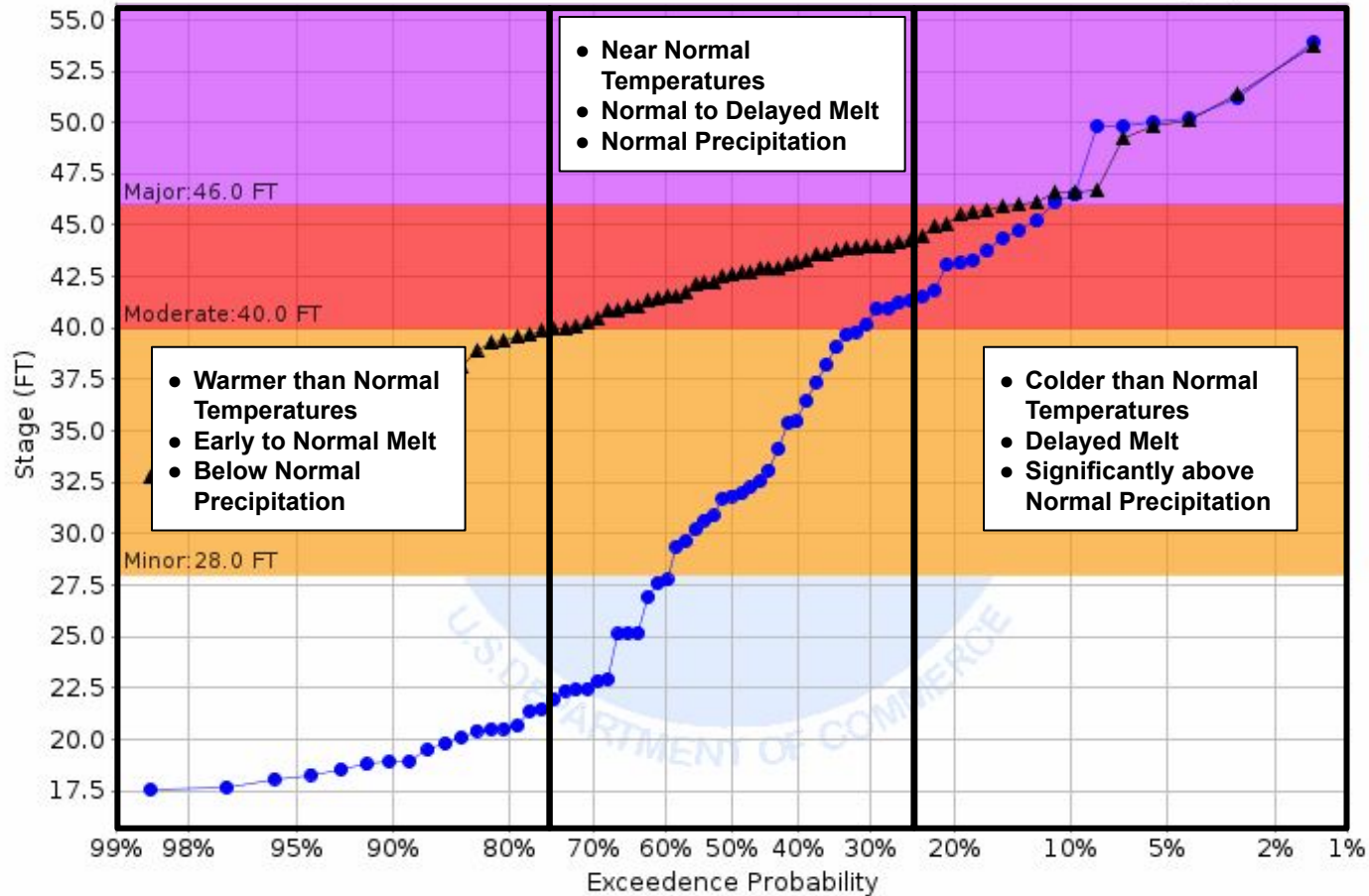
Forecast for the period 02/27/2023 - 05/28/2023

This is a conditional simulation based on the conditions as of 02/20/2023

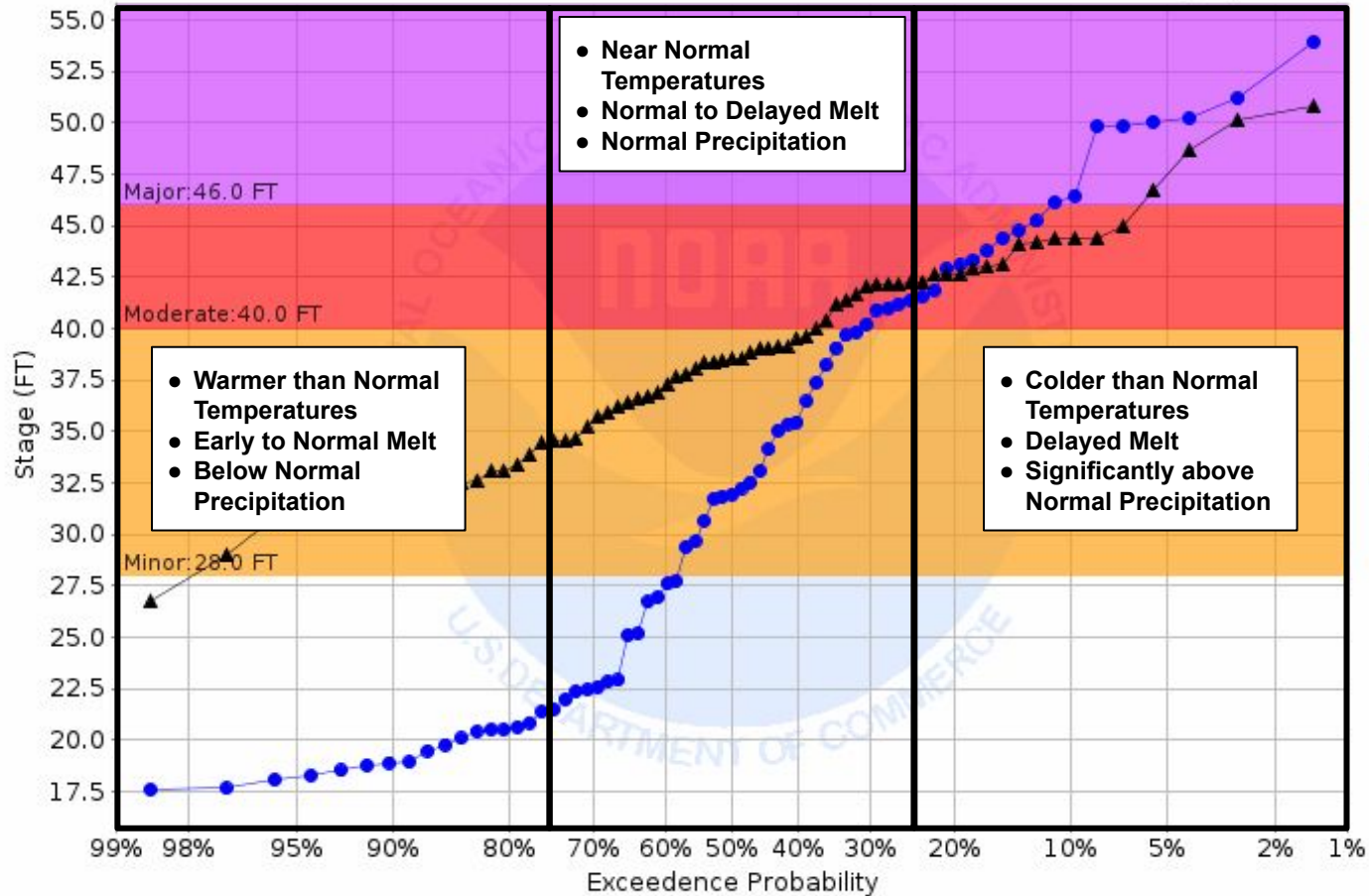


## Fargo/ Moorhead (February 23rd)

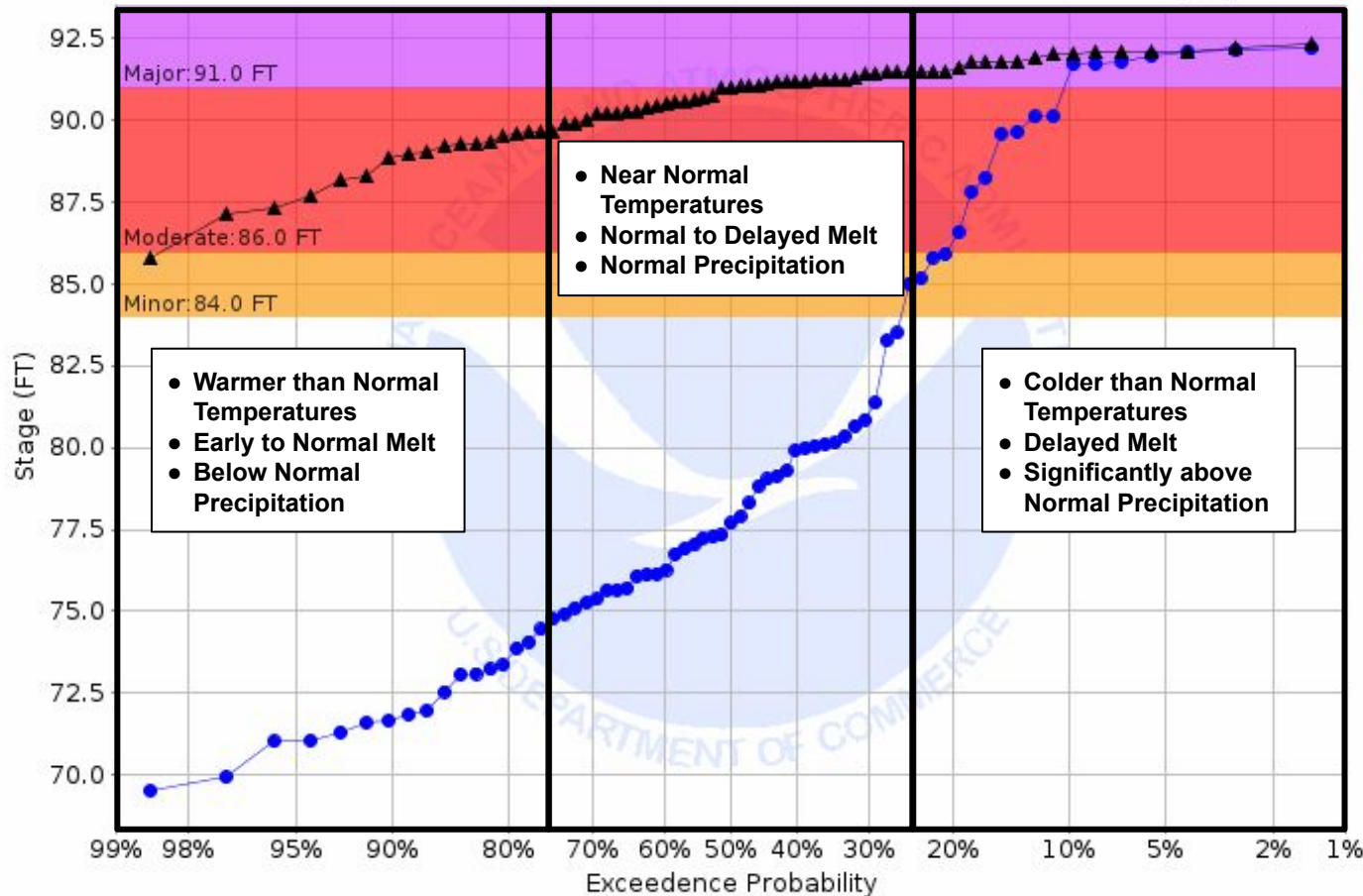




## Grand Forks/ East Grand Forks (March 9th)



# Grand Forks/ East Grand Forks (February 23)



## Harwood (March 9th)



Valid March 13, 2023 - June 11, 2023

RED RIVER MAINSTEM	95%	90%	75%	50%	25%	10%	5%
Wahpeton	11.7	11.7	12.2	13.2	14.9	15.7	16.8
Hickson	25.8	26.0	27.4	30.0	33.3	35.1	36.1
Fargo	25.7	27.2	28.9	31.8	34.0	36.5	38.5
Halstad	28.0	29.9	32.3	35.3	38.3	39.5	40.0
Grand Forks	36.6	37.4	40.0	42.6	44.2	46.6	49.9
Oslo	33.9	34.1	34.7	35.6	36.3	37.3	38.6
Drayton	34.6	35.5	38.0	40.0	41.0	42.2	43.3
Pembina	41.6	43.0	45.7	47.8	49.9	51.8	52.5
NORTH DAKOTA TRIBUTARIES	95%	90%	75%	50%	25%	10%	5%
Wild Rice River							
Abercrombie	13.0	13.8	15.2	17.4	20.0	22.6	24.1
Sheyenne River							
Valley City	10.4	11.7	12.4	13.3	14.2	16.3	18.7
Lisbon	11.3	12.0	13.4	14.1	15.1	18.9	19.7
Kindred	15.2	16.1	17.8	19.2	19.9	21.1	21.2
West Fargo Diversion	15.1	15.2	17.2	19.2	19.9	21.3	21.3
Harwood	87.5	88.9	89.5	91.0	91.5	92.0	92.1
Maple River							
Enderlin	11.3	11.4	11.9	12.6	13.0	14.0	14.4
Mapleton	21.0	21.2	21.7	22.0	22.4	23.1	23.5
Goose River							
Hillsboro	7.8	8.6	10.1	12.2	13.6	14.7	15.4
Forest River							
Minto	4.0	4.2	4.6	5.2	6.2	7.0	7.2
Pembina River							
Walhalla	5.1	5.4	6.0	6.7	8.2	10.4	12.2
Neche	8.3	9.5	10.5	12.2	15.5	19.6	20.9

March 9th

**Legend:**  
 Below Flood Stage  
 Minor  
 Moderate  
 Major  
 \*Flood of Record\*



Valid February 27, 2023 - May 28, 2023

RED RIVER MAINSTEM	95%	90%	75%	50%	25%	10%	5%
Wahpeton	11.1	11.3	11.7	12.0	13.7	15.0	15.8
Hickson	21.7	23.0	24.7	26.5	31.1	34.1	34.7
Fargo	21.9	23.3	24.1	27.2	31.5	34.3	36.7
Halstad	21.7	22.2	24.2	28.1	33.3	36.3	39.1
Grand Forks	31.0	32.1	34.5	38.5	42.2	44.4	47.5
Oslo	31.3	32.1	33.4	34.4	35.4	36.3	37.7
Drayton	29.9	30.8	32.1	36.3	40.0	40.8	42.1
Pembina	37.2	38.1	40.5	44.8	48.2	50.2	51.5
NORTH DAKOTA TRIBUTARIES	95%	90%	75%	50%	25%	10%	5%
Wild Rice River							
Abercrombie	8.5	9.5	10.8	13.3	17.3	19.0	21.9
Sheyenne River							
Valley City	8.0	8.5	9.6	11.6	12.6	13.6	14.4
Lisbon	8.1	8.3	10.0	11.6	13.5	14.8	17.3
Kindred	11.2	12.0	13.1	15.5	17.5	19.8	20.8
West Fargo Diversion	12.5	13.0	13.0	15.1	17.2	19.8	21.3
Harwood	78.8	79.3	80.7	83.4	89.5	91.2	91.8
Maple River							
Enderlin	8.8	9.2	10.4	11.0	11.8	12.7	13.6
Mapleton	15.8	16.8	18.6	19.8	21.6	22.3	22.8
Goose River							
Hillsboro	5.6	6.0	7.8	9.6	12.2	14.0	14.6
Forest River							
Minto	3.4	3.6	4.1	4.8	5.8	6.4	6.9
Pembina River							
Walhalla	4.6	5.0	5.6	6.3	8.1	11.1	12.0
Neche	7.1	8.2	9.6	11.4	15.3	20.3	20.9

February 23rd

**Legend:**  
 Below Flood Stage  
 Minor  
 Moderate  
 Major  
 \*Flood of Record\*





Valid March 13, 2023 - June 11, 2023

MINNESOTA TRIBUTARIES	95%	90%	75%	50%	25%	10%	5%
South Fork Buffalo River							
Sabin	13.5	13.9	14.3	14.9	15.4	16.3	16.7
Buffalo River							
Hawley	6.8	7.3	7.8	8.6	9.5	10.3	10.6
Dilworth	16.8	18.1	18.9	20.3	21.6	22.8	23.3
Wild Rice River							
Twin Valley	6.2	6.5	7.3	8.3	9.2	10.8	11.6
Hendrum	24.1	25.9	27.1	28.7	30.5	31.8	32.5
Marsh River							
Shelly	10.3	11.0	11.5	13.0	14.7	17.3	19.1
Sand Hill River							
Climax	15.6	16.7	19.3	21.7	25.4	29.0	31.3
Red Lake River							
High Landing	6.1	6.7	7.3	8.2	9.4	10.6	11.9
Crookston	11.5	12.1	13.8	15.8	18.6	22.2	23.8
Snake River							
Above Warren	62.6	62.7	63.2	63.9	64.5	66.4	67.3
Alvarado	98.4	98.7	99.7	101.9	104.1	107.5	108.3
Two Rivers River							
Hallock	799.3	800.2	801.7	803.5	806.0	808.3	809.2
Roseau River							
Roseau	8.1	8.3	9.0	9.9	12.0	15.7	17.6

## March 9th

**Legend:**  
 Below Flood Stage  
 Minor  
 Moderate  
 Major  
 \*Flood of Record\*





Valid February 27, 2023 - May 28, 2023

MINNESOTA TRIBUTARIES	95%	90%	75%	50%	25%	10%	5%
South Fork Buffalo River							
Sabin	13.0	13.2	13.6	14.2	15.0	15.8	16.2
Buffalo River							
Hawley	5.4	5.7	6.3	7.4	8.9	9.5	10.1
Dilworth	14.1	14.3	16.3	17.7	20.1	21.7	22.3
Wild Rice River							
Twin Valley	5.4	5.8	6.5	7.6	8.6	9.8	10.8
Hendrum	19.4	20.0	21.8	24.8	28.0	29.4	31.6
Marsh River							
Shelly	9.4	9.9	10.8	11.6	13.0	16.3	17.3
Sand Hill River							
Climax	11.9	11.9	12.6	16.0	20.4	23.9	27.8
Red Lake River							
High Landing	5.9	6.4	7.1	8.3	9.4	10.5	11.7
Crookston	11.2	11.8	13.5	15.8	18.4	20.9	22.5
Snake River							
Above Warren	62.3	62.5	62.8	63.5	64.4	65.1	66.4
Alvarado	98.0	98.5	99.0	101.1	103.0	104.8	106.5
Two Rivers River							
Hallock	799.1	799.6	800.6	803.8	806.4	808.0	808.7
Roseau River							
Roseau	7.6	7.9	8.5	10.1	12.6	14.5	15.5

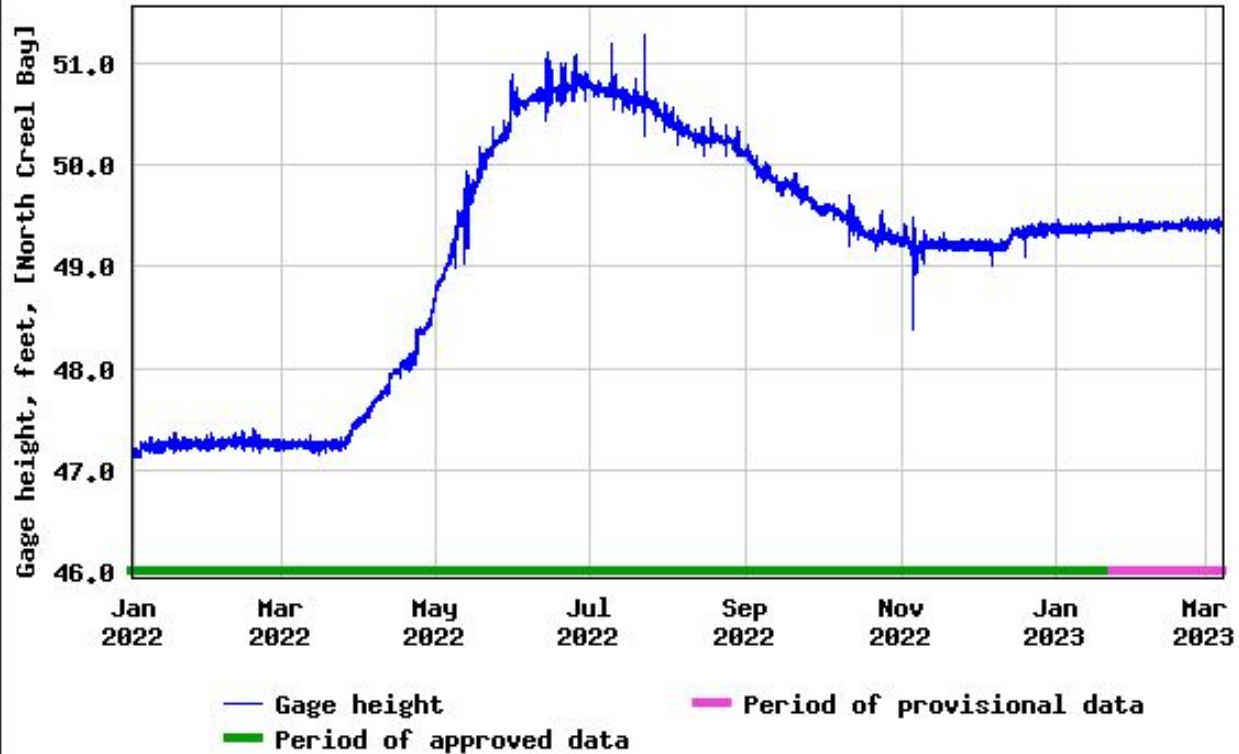
February 23rd

**Legend:**  
 Below Flood Stage  
 Minor  
 Moderate  
 Major  
 \*Flood of Record\*





## USGS 05056500 DEVILS LAKE NR DEVILS LAKE, ND

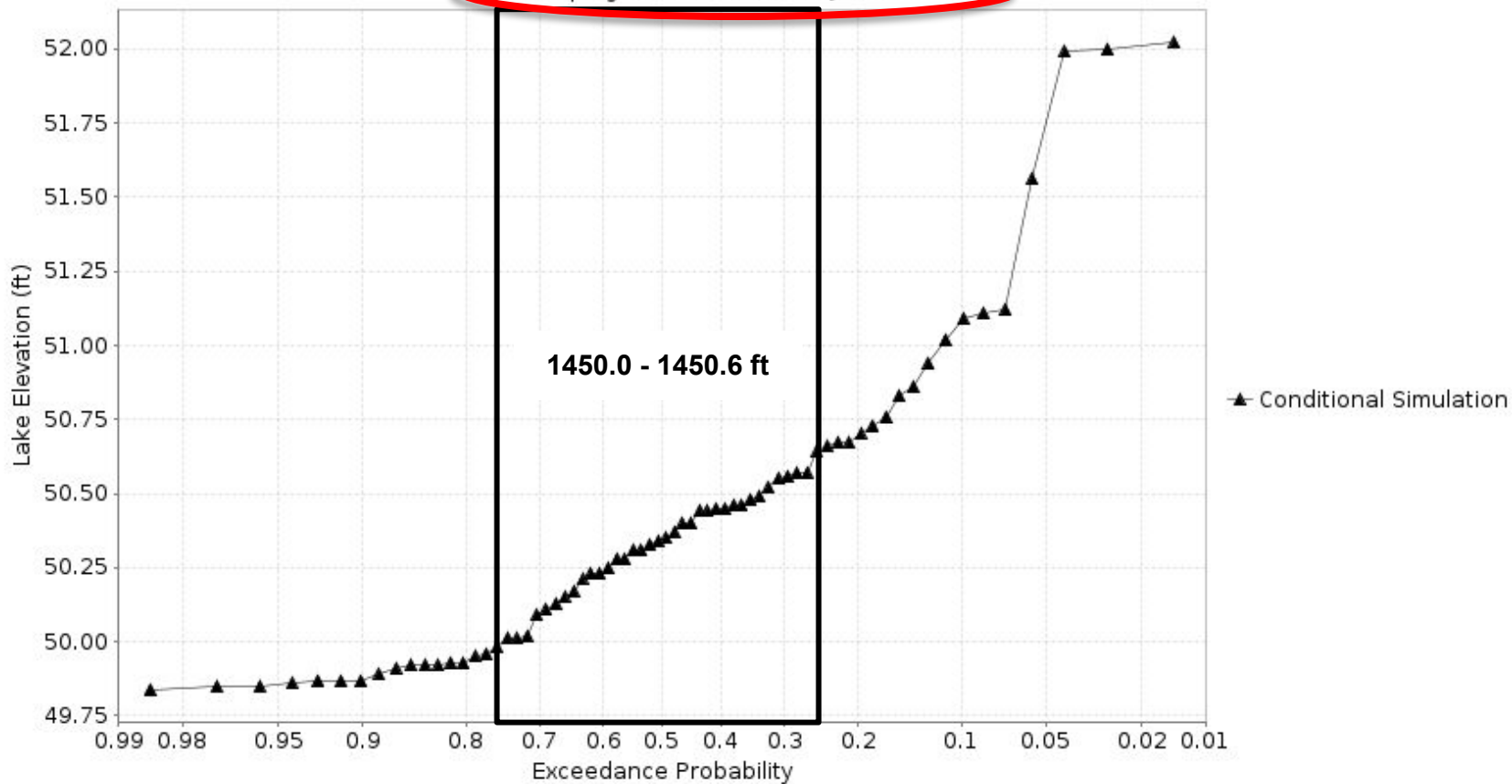


Probability of Rising to High Lake Levels on the Devils Lake at Devils Lake 5SW-Creel Bay (DCBN8)

Forecast for the period 03/06/2023 - 09/30/2023

This is a conditional simulation based on the conditions as of 03/06/2023

Pumping schedule : 350cfs Jun 1 - Nov 10



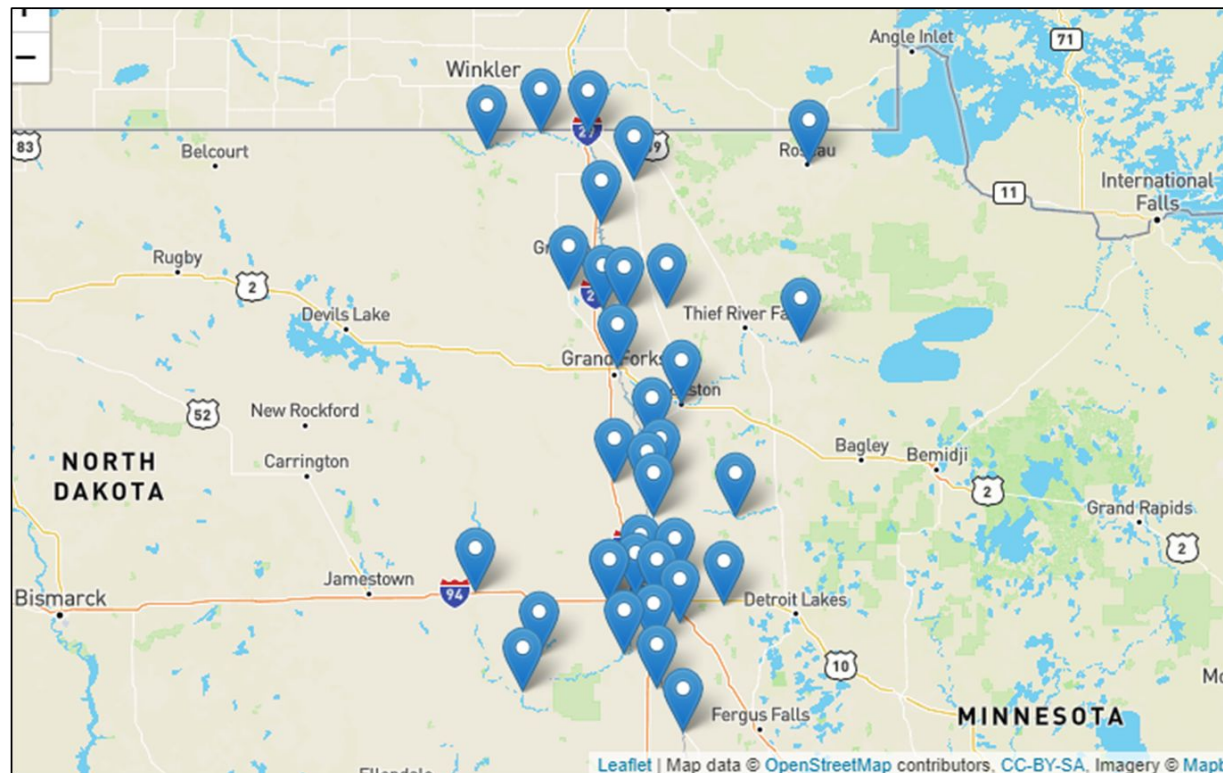


## Probabilistic Flood Outlook Summary (PFOS)

- Same probabilistic data, just in a different format
- Includes all Red River mainstem and tributary forecast points
- At a glance, relates current risk to:
  - flood categories
  - recent crests
  - floods of record

## Use the map below to view forecast point PFOS Graphics

(click a site marker below, then click on the image to expand)



[www.weather.gov/fgf/PFOS](http://www.weather.gov/fgf/PFOS)





# Probabilistic Flood Outlook Summary (PFOS)

Please provide feedback!

[amanda.lee@noaa.gov](mailto:amanda.lee@noaa.gov)

or

Survey link via website

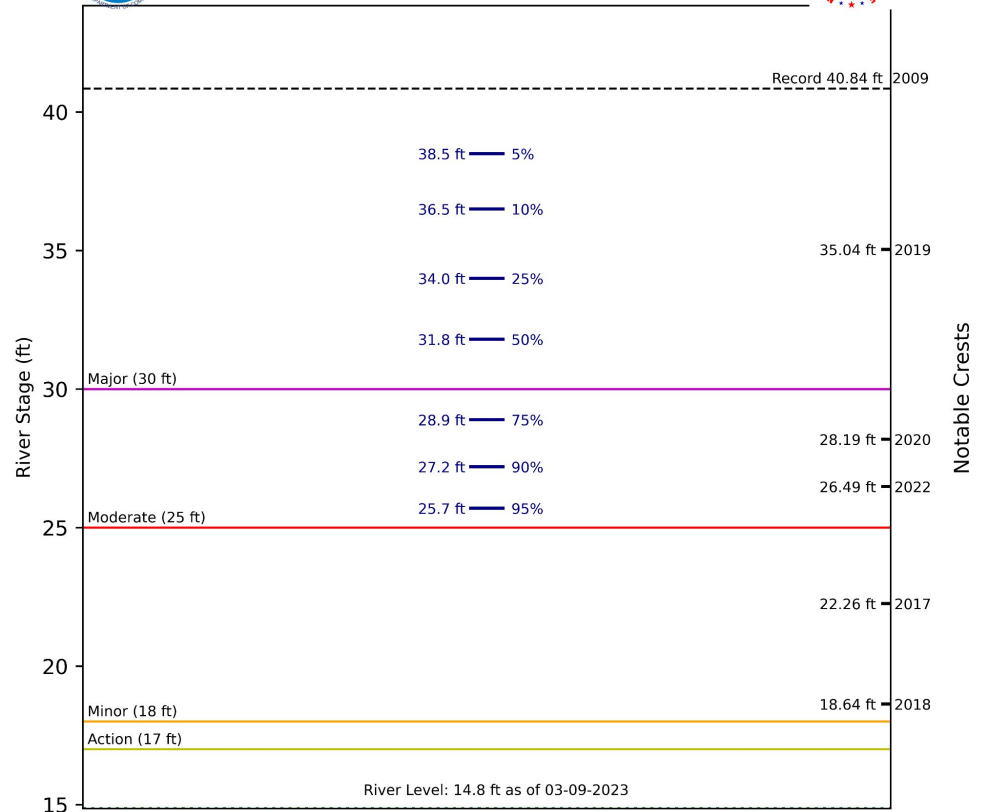
[www.weather.gov/fgf/PFOS](http://www.weather.gov/fgf/PFOS)



2023 Spring Flood Outlook for Red River at Fargo

Valid 03-13-2023 through 06-11-2023

% Chance of reaching or exceeding this level



\*This outlook graphic shows the most likely river stage range based on the latest forecast. There is a 5% chance of values higher than depicted here.  
\*\*Figure created on 03-09-2023

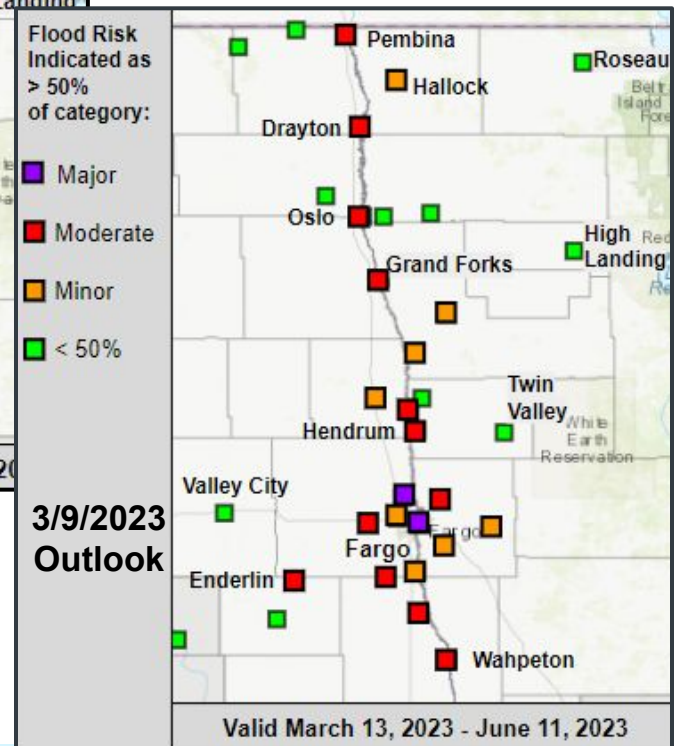
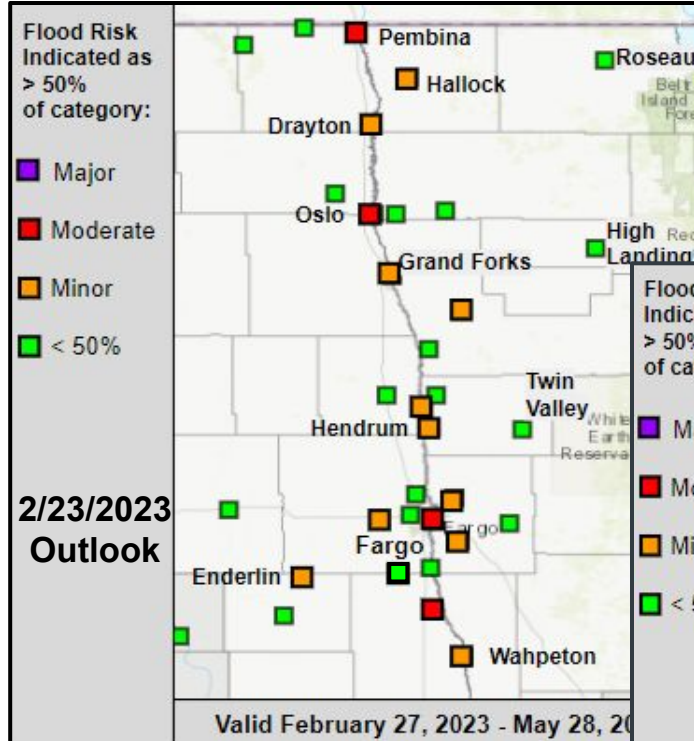






# Key Message

The risk for significant (moderate or higher) spring flooding has increased and is now near or above long-term historical averages across the basin.





# Upcoming 2023 Probabilistic Outlooks:

Thursday, March 23<sup>rd</sup>

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