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PROBABILISTIC HYDROLOGIC OUTLOOK

NATIONAL WEATHER SERVICE EASTERN NORTH DAKOTA/GRAND FORKS ND

1035 AM CST Thu Mar 10 2022

...SPRING FLOOD AND WATER RESOURCES OUTLOOK...

...RED RIVER BASIN OUTLOOK FOR RIVER FLOOD POTENTIAL...

This outlook covers the Red River of the North  
and its Minnesota and North Dakota tributaries.

...GENERALLY MODERATE TO LOW END MAJOR FLOODING EXPECTED FOR MOST  
ACROSS THE BASIN...

\* This 90-day outlook covers the period from 3/14/2022 to 6/12/2022.

.OUTLOOK SUMMARY...

\* Probabilities for exceeding Major, Moderate, Minor Flood Stage...

Major Flooding...

There is a high risk (greater than 65 percent chance) of major  
flooding at Fargo/Moorhead, Oslo, and Pembina on the Red River. In

North Dakota, there is a high risk of major flooding at Harwood on the Sheyenne River and Abercrombie on the Wild Rice River.

There is a medium risk (35 to 65 percent chance) of major flooding at Grand Forks/East Grand Forks and Drayton on the Red River. In North Dakota, there is a medium risk of major flooding at Valley City, Kindred, and the West Fargo Diversion on the Sheyenne River.

There is a low risk (less than 35 percent chance) of major flooding elsewhere across the basin.

#### Moderate Flooding...

There is a high risk (greater than 65 percent chance) of moderate flooding at Wahpeton, Halstad, Grand Forks/East Grand Forks, and Drayton on the Red River. In Minnesota, there is a high risk of moderate flooding at Hendrum on the Wild Rice River. In North Dakota, there is a high risk of moderate flooding at Kindred and the West Fargo Diversion on the Sheyenne River, Enderlin and Mapleton on the Maple River, and Hillsboro on the Goose River.

In Minnesota, there is a medium risk (35 to 65 percent chance) of moderate flooding at Sabin on the South Branch Buffalo River, Hawley and Dilworth on the Buffalo River, Climax on the Sand Hill River, Crookston on the Red Lake River, and Hallock on the Two Rivers River. In North Dakota, there is a medium risk of moderate flooding at Lisbon on the Sheyenne River.

#### Minor Flooding...

There is a high risk (greater than 65 percent chance) of minor flooding at Hickson on the Red River. In Minnesota, there is a high

risk of minor flooding at Sabin on the South Branch Buffalo River, Dilworth on the Buffalo River, Climax on the Sand Hill River, Crookston on the Red Lake River, and Hallock on the Two Rivers River. In North Dakota, there is a high risk of minor flooding at Valley City and Lisbon on the Sheyenne River and Minto on the Forest River.

In Minnesota, there is a medium risk (35 to 65 percent chance) of minor flooding at Shelly on the Marsh River and Alvarado on the Snake River.

In Minnesota, there is a low risk (less than 35 percent) of minor flooding at Twin Valley on the Wild Rice River, High Landing on the Red Lake River, near Warren on the Snake River, and Roseau on the Roseau River. In North Dakota, there is a low risk of minor flooding at Walhalla and Neche on the Pembina River.

#### .OUTLOOK DISCUSSION...

Hydrologic and climate conditions which affect each of the several factors that significantly determine the timing and magnitude of spring snowmelt flooding within the Red River of the North are discussed below:

#### \* SNOWPACK CONDITIONS...

The current snowpack and associated water content is generally above normal. Since December 1, 2021, snowfall has been running near normal to above normal (roughly 90 to 140 percent of normal). However, there is some unevenness of the snowpack due to numerous blowing snow and blizzard events over the course of the winter redistributing the snow on the ground. Snow water content across the basin ranges from 2.0 to 5.0 inches which is generally in the 70th to

90th percentile range.

\* SOIL MOISTURE...

At the time of freeze-up, soil moisture was generally near normal across the basin (slightly above normal across the far south to slightly below normal across the far north). Timely precipitation last fall allowed for some recharging of the soil following months of drought conditions.

\* FROST DEPTHS...

Current frost depth values are generally deeper than normal at most locations. Cold conditions throughout January and much of February allowed for deep frost penetration in most areas. Frost depth values range from 20 to nearly 60 inches across the basin with the deepest frost across the northern half of the basin.

\* RIVER FLOWS...

Base streamflows are near normal for this time of year. The Red River and most of its tributaries are currently flowing at 25 to 75 percent of normal. Slightly higher than normal flows are seen in the far southern basin with slightly lower than normal flows near the International border.

\* RIVER ICE...

River ice and lake ice is running slightly thicker than normal due to the extended cold periods throughout January and February.

\* FACTORS YET TO BE DETERMINED...

- Further snowpack growth,

- Rate of snowmelt/thaw,
- Heavy rain on snow or frozen ground during thaw or peak flood,
- Heavy rain on ice-covered rivers causing short-term ice jams.

\* SHORT TERM WEATHER FORECAST...

A few more cold days will give way to a warm up this weekend. Although temperatures will still be slightly below normal (normal high temperatures are around the 30 degree mark this time of year), it will definitely feel warmer than it has recently. Conditions continue to warm up even more next week with daytime highs possibly above the freezing mark. A few minor systems look to bring the potential for some light precipitation over the course of the next week.

\* LONG TERM CLIMATE OUTLOOK...

Climate outlooks for mid to late March indicate increased chances for above normal temperatures and possibly below normal precipitation. As we shift into spring, the overall climate outlooks indicate equal chances for below, normal, or above temperatures and precipitation (i.e, no strong signal in any direction).

.NEXT SPRING FLOOD OUTLOOK...

No additional spring flood outlooks are scheduled at this time.

.FLOOD OUTLOOK PROBABILITIES TABLES...

The following message has two sections: the first gives the

current and normal/historical chances of river locations reaching their minor, moderate, and major flood category. The second gives the current chances of river locations rising above river stages listed.

...Red River Long-Range Probabilistic Outlook by Flood Category...

Valid from March 14, 2022 to June 12, 2022

In Table 1 below, the current (CS) and historical (HS), or normal, probabilities of exceeding minor, moderate, and major flood stages are listed for the valid time period.

CS values indicate the probability of reaching a flood category based on current conditions.

HS values indicate the probability of reaching a flood category based on historical, or normal, conditions.

When the value of CS is greater than HS, the probability of exceeding that level is higher than normal. When the value of CS is less than HS, the probability of exceeding that level is lower than normal.

...Table 1--Probabilities for Minor, Moderate, and Major Flooding

Valid Period: 03/14/2022 - 06/12/2022

: Current and Historical  
: Chances of Exceeding  
: Flood Categories

: as a Percentage (%)

Categorical :

Flood Stages (FT) : Minor Moderate Major

Location	Minor	Mod	Major	:	CS HS	CS HS	CS HS
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Red River of the North.....

WAHPETON	11.0	13.0	15.0	:	>95 64	76 34	26 18
HICKSON	30.0	34.0	38.0	:	77 28	23 16	<5 <5
FARGO	18.0	25.0	30.0	:	>95 84	>95 41	92 27
HALSTAD	26.0	32.0	37.5	:	>95 35	88 19	28 11
GRAND FORKS	28.0	40.0	46.0	:	>95 60	>95 31	37 11
OSLO	26.0	30.0	36.0	:	>95 64	>95 57	78 18
DRAYTON	32.0	38.0	42.0	:	>95 48	>95 33	31 13
PEMBINA	39.0	44.0	49.0	:	>95 52	>95 43	85 22

: Current and Historical

: Chances of Exceeding

: Flood Categories

: as a Percentage (%)

Categorical :

Flood Stages (FT) : Minor Moderate Major

Location	Minor	Mod	Major	:	CS HS	CS HS	CS HS
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Minnesota Tributaries.....

Note: The Roseau numbers consider the flow through its diversion

SABIN	13.0	15.0	19.0	:	>95 60	70 17	<5 <5
HAWLEY	8.0	9.0	11.0	:	77 39	41 23	<5 <5
DILWORTH	13.0	20.0	26.0	:	>95 71	76 21	<5 <5
TWIN VALLEY	10.0	12.0	14.0	:	16 17	<5 <5	<5 <5
HENDRUM	20.0	28.0	32.0	:	>95 54	77 22	10 7
SHELLY	14.0	20.0	23.0	:	45 28	<5 11	<5 6

CLIMAX	20.0	25.0	30.0	:	93	25	46	12	13	8
HIGH LANDING	12.0	12.5	13.0	:	5	8	<5	<5	<5	<5
CROOKSTON	15.0	20.0	23.0	:	>95	53	52	28	20	9
ABOVE WARREN	67.0	71.0	75.0	:	16	11	<5	<5	<5	<5
ALVARADO	106.0	108.0	110.0	:	40	28	22	17	<5	<5
HALLOCK	802.0	806.0	810.0	:	>95	62	91	42	11	10
ROSEAU	16.0	18.0	19.0	:	27	24	11	14	<5	9

: Current and Historical  
: Chances of Exceeding  
: Flood Categories  
: as a Percentage (%)

Categorical :

Flood Stages (FT) : Minor Moderate Major

Location	Minor	Mod	Major	:	CS	HS	CS	HS	CS	HS
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North Dakota Tributaries.....

ABERCROMBIE	10.0	12.0	18.0	:	>95	42	>95	34	78	20
VALLEY CITY	15.0	16.0	17.0	:	48	10	36	7	31	6
LISBON	15.0	17.0	19.0	:	74	11	35	10	20	7
KINDRED	16.0	19.0	20.5	:	>95	21	82	11	37	10
WEST FARGO DVRSN	18.0	20.0	21.0	:	93	12	55	11	49	10
HARWOOD	84.0	86.0	91.0	:	>95	26	>95	21	57	10
ENDERLIN	9.5	12.0	14.0	:	>95	26	>95	11	24	<5
MAPLETON	18.0	21.0	23.0	:	>95	38	>95	18	14	5
HILLSBORO	10.0	13.0	16.0	:	>95	19	82	10	8	<5
MINTO	6.0	8.0	11.0	:	89	25	5	7	<5	<5
WALHALLA	11.0	16.0	18.0	:	17	21	<5	<5	<5	<5
NECHE	18.0	19.0	20.5	:	26	27	21	26	12	20

LEGEND:



CS = Conditional Simulation (Outlook for current conditions)  
 HS = Historical Simulation ( " " normal conditions)  
 FT = Feet (above gage zero datum)

...Red River Long-Range Probabilistic Outlook by River Stage...

Valid from March 14, 2022 to June 12, 2022

LOCATION	95%	90%	75%	50%	25%	10%	05%
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Red River of the North.....							
WAHPETON	11.9	12.0	13.0	13.7	15.1	16.5	17.1
HICKSON	28.1	28.7	30.2	32.3	33.9	35.5	36.3
FARGO	29.1	30.7	32.0	33.6	35.0	37.0	39.0
HALSTAD	30.0	31.5	33.4	35.9	37.9	39.1	39.5
GRAND FORKS	41.6	42.5	43.7	45.2	46.9	49.6	52.4
OSLO	35.2	35.6	36.1	36.7	37.4	38.5	39.7
DRAYTON	39.8	40.3	40.6	41.5	42.2	43.5	44.5
PEMBINA	47.6	48.6	49.7	50.8	51.9	53.2	53.8
Minnesota Tribs:	95%	90%	75%	50%	25%	10%	05%
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South Fork Buffalo River.....							
SABIN	14.0	14.4	14.9	15.6	16.1	17.4	17.9
Buffalo River.....							
HAWLEY	7.3	7.5	8.1	8.9	9.6	10.3	10.8
DILWORTH	17.8	19.3	20.2	21.3	22.3	23.8	24.2
Wild Rice River.....							

TWIN VALLEY	6.1	6.4	7.1	8.2	9.3	10.7	11.8
HENDRUM	25.1	27.0	28.1	29.6	31.0	32.0	32.8
Marsh River.....							
SHELLY	10.4	11.1	12.2	13.6	15.6	18.2	19.3
Sand Hill River.....							
CLIMAX	19.0	20.7	21.9	24.3	27.2	30.8	33.4
Red Lake River.....							
HIGH LANDING	7.3	7.5	8.3	9.2	10.8	11.6	12.0
CROOKSTON	15.8	16.1	17.8	20.1	22.5	25.3	27.0
Snake River.....							
ABOVE WARREN	63.8	64.1	64.3	65.0	65.8	68.2	69.4
ALVARADO	101.8	102.4	103.5	105.3	107.8	109.2	109.9
Two Rivers River.....							
HALLOCK	804.9	806.3	807.0	807.8	808.9	810.1	811.3
Roseau River..... considering the flow through the Roseau diversion							
ROSEAU	11.9	12.7	13.6	14.9	16.0	18.1	18.9
North Dakota Tribs:	95%	90%	75%	50%	25%	10%	05%
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Wild Rice River.....							
ABERCROMBIE	16.1	17.0	18.2	19.8	21.3	23.6	25.5
Sheyenne River.....							
VALLEY CITY	12.6	13.1	13.5	14.7	18.0	20.2	23.2
LISBON	13.6	14.3	15.0	15.9	17.9	21.4	24.8
KINDRED	17.5	18.7	19.5	20.2	20.8	21.2	21.2
WEST FARGO DVRSN	17.2	18.5	19.3	20.8	21.3	21.3	21.3
HARWOOD	88.9	89.4	90.3	91.1	91.7	92.1	92.2
Maple River.....							
ENDERLIN	12.2	12.3	12.8	13.4	13.9	14.8	15.4
MAPLETON	21.0	21.3	21.6	22.1	22.7	23.4	23.8
Goose River.....							

HILLSBORO	11.1	11.8	13.3	14.0	14.7	15.5	16.2
Forest River.....							
MINTO	5.5	6.0	6.4	6.8	7.3	7.9	8.1
Pembina River.....							
WALHALLA	5.6	6.1	6.7	7.8	9.6	12.0	12.9
NECHE	11.0	11.6	13.3	15.6	18.0	20.9	21.3

.THE OUTLOOK PRODUCTION PROCESS...

This long range probabilistic outlook is based on a series of peak river levels or crests taken from the forecast hydrograph results of the NWS Community Hydrologic Prediction System (CHPS). The model is run for multiple scenarios starting at current river levels and soil conditions using 69 years (1949-2018) of past precipitation and temperature conditions that were experienced for those past years during the time-frame of the outlook period. These crests can then be ranked from lowest to highest and assigned an exceedance probability. For example, for a series of 50 years, the lowest ranked crest has 49 crests above it and since 95 percent of the crests are above it, it is assigned a 95 percent probability of exceedance (POE).

A YouTube video on "How to Interpret River Outlook Products" is at:

[www.youtube.com/watch?v=pSoEgvsnpv4](http://www.youtube.com/watch?v=pSoEgvsnpv4)

The probabilities can be used for risk management by using them as an indication of the range of crests that may be expected during the valid period of the outlook. By providing a range of peak river level probabilities, the NWS is contributing to the area's Decision Support Services that help with long-range flood planning and

response readiness. This outlook is a part of NOAA's National Weather Service's AHPS (Advanced Hydrologic Prediction Services).

#### .ADDITIONAL INFORMATION SOURCES...

The AHPS Long-Range Probabilistic Hydrologic Outlooks are issued each month typically between the first and second Friday after mid-month. However, Spring Flood and Water Resources Outlooks are issued several times leading up to the spring melt period, usually on Thursdays beginning in late February or early March and ending in early April, depending on the spring flooding conditions.

This outlook is also presented as graphs of the probability of stage exceedance for the full period and for weekly intervals during the period. These graphs, along with explanations for interpreting them, are available from the NWS Grand Forks AHPS web page:

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

then click on the "Rivers and Lakes" tab above the map.

Current river conditions for all river forecast points in the Red River of the North and Devils/Stump Lake basins are also available on our website, as well as 7-day forecasts when river levels at forecast points are in or near flood.

Additional Probabilistic Hydrologic Outlooks will be issued monthly throughout the rest of the year during the later part of the month or as conditions warrant.

Refer to the separate Devils Lake Probabilistic Hydrologic Outlook for Devils and Stump Lakes Probability of Exceedance levels and low-water non-exceedance levels.

If you have any questions, contact the NWS at 701-772-0720.

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