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PROBABILISTIC HYDROLOGIC OUTLOOK
NATIONAL WEATHER SERVICE EASTERN NORTH DAKOTA/GRAND FORKS ND
1029 AM CDT Thu Mar 23 2023

...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.

...MODERATE TO MAJOR SPRING FLOODING IS EXPECTED ACROSS MUCH OF THE
RED RIVER OF THE NORTH BASIN...

* This 90-day outlook covers the period from 3/27/2023 to 6/25/2023.

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

There is a medium risk (35 to 65 percent chance) of major
flooding at Halstad and Pembina on the Red River.

Elsewhere, there is a low risk (less than 35 percent chance) of
major flooding 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,
Drayton, and Pembina on the Red River. In North Dakota, there is a
high risk of moderate flooding at Kindred on the Sheyenne River,
Enderlin and Mapleton on the Maple River, and Hillsboro on the Goose
River. In Minnesota, there is a high risk of moderate flooding at
Sabin on the South Branch Buffalo River, Hawley and Dilworth on the
Buffalo River, and Hendrum on the Wild Rice River.

In North Dakota, there is a medium risk (35 to 65 percent chance)
of moderate flooding at the West Fargo Diversion on the Sheyenne
River. In Minnesota, there is a medium risk of moderate flooding at
Climax on the Sand Hill 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 Shelly on the Marsh River, Crockston on
the Red Lake River, and Hallock on the Two Rivers River.

There is a medium risk (35 to 65 percent chance) of minor flooding at Minto on the Forest 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:

* FALL PRECIPITATION AND SOIL MOISTURE...

Fall precipitation was below normal across the basin, driest across the lower Sheyenne basin and southern Red River Valley. Soil moisture heading into freeze-up was lower than normal with moderate drought conditions persisting across much of the southern and central portions of the basin with abnormally dry conditions across the north.

* RIVER FLOWS...

Base streamflows are near normal for this time of year.

* FROST DEPTHS...

Frost depths are currently running near normal to deeper than normal. Deepest across northeastern North Dakota (30-40 inches) while shallower and more variable across southeastern North Dakota and much of the Minnesota portion of the basin (20-30 inches).

* SNOWPACK CONDITIONS...

After a wet and snowy beginning to winter, January and early February brought less than normal snowfall and precipitation to the basin. A more active pattern returned for the second half of February and continued into March. Total snowfall is above normal for most areas, especially across the Devils Lake and Sheyenne basins (~30-40 inches above normal). Associated water content ranges from around 2.0 inches across the far northern basin to 4.0 to 6.0 inches (or even higher) much of the rest of the basin.

* 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...

Below normal temperatures are expected to continue through the end of March with near normal precipitation. Note that normal high temperatures for late March into mid-April range from the upper 30s to low 50s.

* LONG TERM CLIMATE OUTLOOK...

Climate outlooks indicate below normal temperatures continuing into April with no strong signal either way for above, below, or near normal precipitation.

.NEXT SPRING FLOOD OUTLOOK...

This will be the last probabilistic outlook for the 2023 spring snowmelt season.

.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 27, 2023 to June 25, 2023

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: 03/27/2023 - 06/25/2023

Location	Categorical			: Current and Historical					
	Flood Stages (FT)			: Chances of Exceeding					
	Minor	Mod	Major	: >95		: 81		: >95	
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Red River of the North.....									
WHPETON	11.0	13.0	15.0	>95	65	78	37	28	18
HICKSON	30.0	34.0	38.0	81	30	25	16	<5	<5
FARGO	18.0	25.0	30.0	>95	85	>95	41	94	27
HALSTAD	26.0	32.0	37.5	>95	39	>95	23	61	12
GRAND FORKS	28.0	40.0	46.0	>95	59	>95	33	34	11
OSLO	26.0	30.0	36.0	>95	66	>95	57	66	18
DRAYTON	32.0	38.0	42.0	>95	49	>95	34	21	12
PEMBINA	39.0	44.0	49.0	>95	52	>95	43	62	22

Location	Categorical			: Current and Historical					
	Flood Stages (FT)			: Chances of Exceeding					
	Minor	Mod	Major	: >95		: 81		: >95	
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Red River of the North.....									
WHPETON	11.0	13.0	15.0	>95	65	78	37	28	18
HICKSON	30.0	34.0	38.0	81	30	25	16	<5	<5
FARGO	18.0	25.0	30.0	>95	85	>95	41	94	27
HALSTAD	26.0	32.0	37.5	>95	39	>95	23	61	12
GRAND FORKS	28.0	40.0	46.0	>95	59	>95	33	34	11
OSLO	26.0	30.0	36.0	>95	66	>95	57	66	18
DRAYTON	32.0	38.0	42.0	>95	49	>95	34	21	12
PEMBINA	39.0	44.0	49.0	>95	52	>95	43	62	22

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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 65 18 <5 <5
  HAWLEY         8.0   9.0  11.0 : >95 38 84 23 6 <5
  DILWORTH      13.0  20.0  26.0 : >95 69 82 23 <5 <5
  TWIN VALLEY   10.0  12.0  14.0 : 23 19 <5 7 <5 <5
  HENDRUM       20.0  28.0  32.0 : >95 56 91 23 16 7
  SHELLY        14.0  20.0  23.0 : 70 27 7 10 <5 <5
  CLIMAX        20.0  25.0  30.0 : 95 26 50 12 13 8
  HIGH LANDING  12.0  12.5  13.0 : <5 12 <5 9 <5 7
  CROOKSTON     15.0  20.0  23.0 : 85 54 28 28 6 9
  ABOVE WARREN  67.0  71.0  75.0 : 11 11 <5 <5 <5 <5
  ALVARADO      106.0 108.0 110.0 : 23 28 11 17 <5 <5
  HALLOCK       802.0 806.0 810.0 : 75 60 33 42 <5 11
  ROSEAU        16.0  18.0  19.0 : 8 24 <5 14 <5 8

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

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: Categorical
:
: Flood Stages (FT) : Minor Moderate Major
: Minor Mod Major : CS HS CS HS CS HS
Location           :
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North Dakota Tributaries.....
  ABERCROMBIE    10.0  12.0  18.0 : >95 46 >95 36 70 20
  VALLEY CITY    15.0  16.0  17.0 : 17 10 16 7 12 6
  LISBON         15.0  17.0  19.0 : 32 11 15 10 8 7
  KINDRED        16.0  19.0  20.5 : >95 22 69 11 25 10
  WEST FARGO DVRSN 18.0  20.0  21.0 : 74 12 41 11 31 10
  HARWOOD        84.0  86.0  91.0 : >95 27 >95 21 81 10
  ENDERLIN       9.5  12.0  14.0 : >95 25 82 11 6 <5
  MAPLETON       18.0  21.0  23.0 : >95 41 >95 18 16 5
  HILLSBORO     10.0  13.0  16.0 : 95 19 74 10 <5 <5
  MINTO          6.0   8.0  11.0 : 39 25 <5 7 <5 <5
  WALHALLA      11.0  16.0  18.0 : 8 21 <5 <5 <5 <5
  NECHE         18.0  19.0  20.5 : 19 27 13 26 6 20

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LEGEND:

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

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

Valid from March 27, 2023 to June 25, 2023

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LOCATION          95%   90%   75%   50%   25%   10%   05%
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Red River of the North.....
  WAHPETON      11.9  12.1  13.1  14.3  15.3  16.4  16.8
  HICKSON       27.5  28.1  30.4  32.6  34.0  35.4  36.3
  FARGO         29.5  30.7  32.7  34.2  36.4  37.8  38.6
  HALSTAD       32.5  33.7  35.7  38.2  39.5  39.9  40.2
  GRAND FORKS   41.0  41.8  42.9  44.4  46.5  49.2  50.0
  OSLO          35.0  35.3  35.7  36.3  37.3  38.4  38.7
  DRAYTON       38.6  39.5  40.1  40.8  41.8  42.9  43.5

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PEMBINA	45.6	46.8	47.7	49.6	50.9	52.3	52.8
Minnesota Tribs:	95%	90%	75%	50%	25%	10%	05%
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South Fork Buffalo River.....							
SABIN	14.0	14.4	14.8	15.3	15.8	16.4	16.8
Buffalo River.....							
HAWLEY	8.2	8.7	9.1	9.8	10.3	10.8	11.2
DILWORTH	19.3	19.8	20.6	21.6	22.5	23.3	23.9
Wild Rice River.....							
TWIN VALLEY	6.8	7.2	7.8	8.9	9.6	11.0	11.9
HENDRUM	26.7	28.1	29.1	30.5	31.7	32.5	33.1
Marsh River.....							
SHELLY	10.9	12.4	13.5	15.1	17.3	19.5	20.2
Sand Hill River.....							
CLIMAX	19.9	20.7	22.7	24.9	28.3	30.7	32.1
Red Lake River.....							
HIGH LANDING	7.0	7.3	8.3	9.3	9.5	11.4	11.8
CROOKSTON	13.8	14.2	15.7	17.9	20.1	22.4	23.5
Snake River.....							
ABOVE WARREN	63.4	63.7	64.1	64.9	65.7	67.3	68.1
ALVARADO	100.1	100.8	102.0	103.5	105.6	108.1	108.6
Two Rivers River.....							
HALLOCK	800.3	800.6	802.0	804.1	807.1	808.3	809.0
Roseau River..... considering the flow through the Roseau diversion							
ROSEAU	8.0	8.5	9.3	10.6	13.2	15.6	17.0
North Dakota Tribs:	95%	90%	75%	50%	25%	10%	05%
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Wild Rice River.....							
ABERCROMBIE	15.7	16.1	17.5	19.2	21.8	24.0	25.0
Sheyenne River.....							
VALLEY CITY	11.6	12.0	12.6	13.3	14.3	18.0	19.5
LISBON	12.0	12.6	13.2	13.9	15.2	18.5	20.1
KINDRED	16.8	17.2	18.3	19.6	20.5	21.2	21.2
WEST FARGO DVRSN	16.5	17.2	17.6	19.3	21.3	21.3	21.3
HARWOOD	89.3	90.1	91.1	91.5	91.8	92.1	92.2
Maple River.....							
ENDERLIN	11.4	11.6	12.3	12.9	13.2	13.8	14.2
MAPLETON	21.0	21.6	22.0	22.4	22.8	23.2	23.7
Goose River.....							
HILLSBORO	9.8	11.6	13.0	13.9	14.4	15.1	15.6
Forest River.....							
MINTO	4.3	4.6	5.2	5.7	6.5	7.1	7.2
Pembina River.....							
WALHALLA	5.4	5.7	6.2	6.9	8.3	10.4	11.3
NECHE	9.1	9.8	11.3	12.7	16.7	19.6	20.5

.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

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 or 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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