Preliminary Assessment of 2014 Ice Jam Potential, Omaha District
January 21, 2014

The following narrative details the flood threat due to ice jam flooding within the Omaha District through the end of ice breakup season. Breakup ice jams have the potential to rapidly raise river stages several feet above open water stages for the same discharge, which is why it is important to remain cognizant of the threat posed by ice jams. Although it is too early to forecast specific areas of concern, some general assessments over broad areas can be made at this time.

Current Ice Jam Threat

There are several locations within the Omaha District that have experienced ice jam related flooding this winter season. These locations include the: Gallatin River near Gallatin Gateway, MT; Missouri River near Ponca, NE and Santee, NE; North Platte River near Lewellen, NE; Niobrara River, near Sparks, NE; and Clear Creek, near Golden, CO. None of these jams are currently in place.

Spring Breakup Ice Jam Threat

The two best indicators of assessing the potential ice jam flood threat at this point in the season are total snowfall and accumulated freezing degree days (AFDD). The current winter season has been slightly warmer than normal across the western half of the Omaha District, slightly lessening the risk of future ice jam formation. However, the eastern half of the District has been at or slightly below normal (see Figure 1 and Figure 2), indicating a greater likelihood of above normal river ice growth. The upper half of the basin has seen above normal precipitation over the past 6 months (see Figure 3) as well as over the past 60 days (see Figure 4). This would indicate that the upper portion of the basin had decent subsoil moisture entering the winter season, as well as an adequate amount of snow. The lower half of the basin however has been dry, particularly over the past 2 months. Without much snow on the ground, much of the Platte River basin and Missouri River tributaries below Gavins Point presently have a greatly reduced likelihood of ice jams this spring. Conversely, the Yellowstone River basin and the western Missouri River tributaries between Garrison and Oahe would appear to have a greater chance for snowmelt runoff and ice jams.

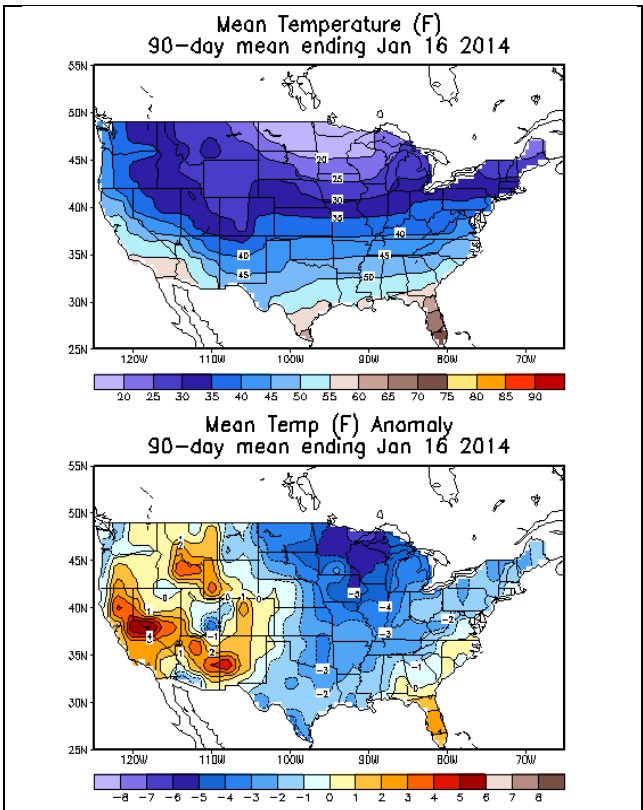

Figure 1. 90-Day Temperature and Deviation from Norm

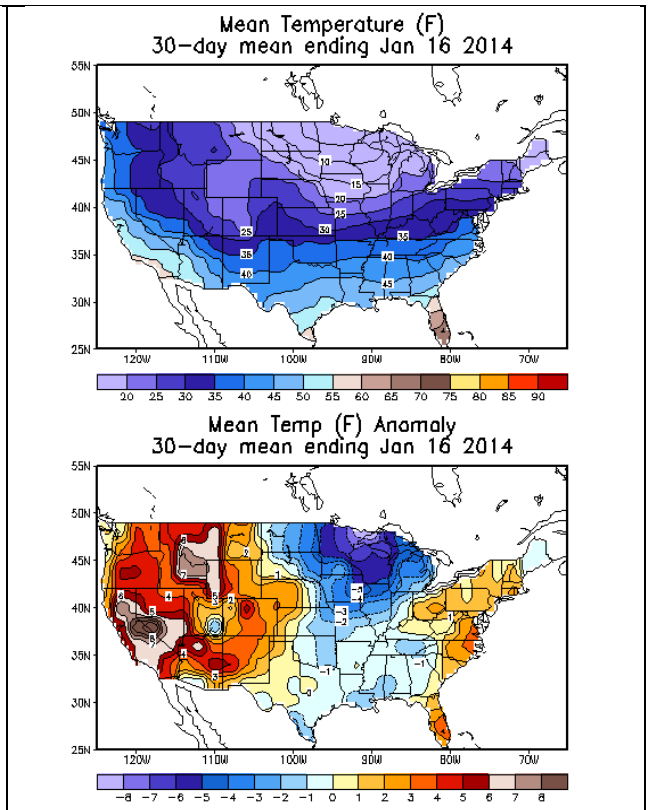

Figure 2. 30-Day Temperature and Deviation from Norm

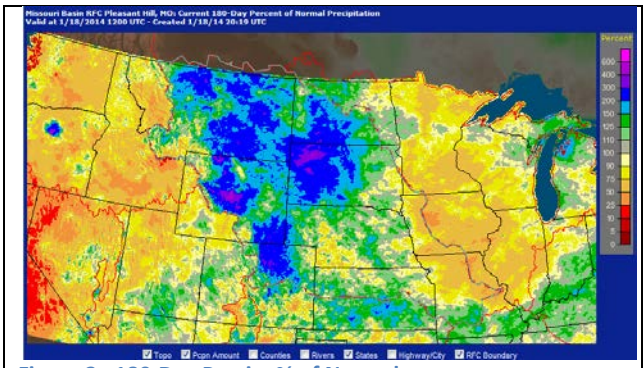

Figure 3. 180-Day Precip, % of Normal

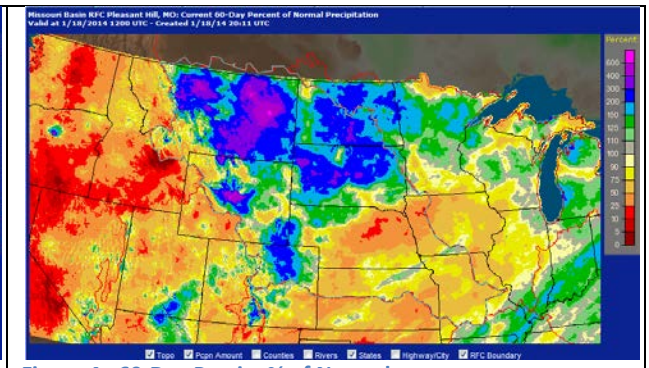

Figure 4. 60-Day Precip, % of Normal

The next 30-60 days will be the greatest indicator of the ice jam threat throughout the basin however. In looking at the current 1-month precipitation forecast (see Figure 5), the outlook calls for an equal chance for above or below normal precipitation throughout the entire District. The 1-month temperature outlook calls for an equal chance of above or below normal temperatures throughout the southern and western portions of the District, with below normal temperatures forecast for northeastern South Dakota and much of North Dakota (see Figure 6).

Likewise, the three month outlook provides an equal chance of above or below normal precipitation across the entire District (see Figure 7). The three-month temperature outlook calls for an equal chance

of above or below normal temperatures with the exception of northeastern Montana, northeastern South Dakota and all of North Dakota.

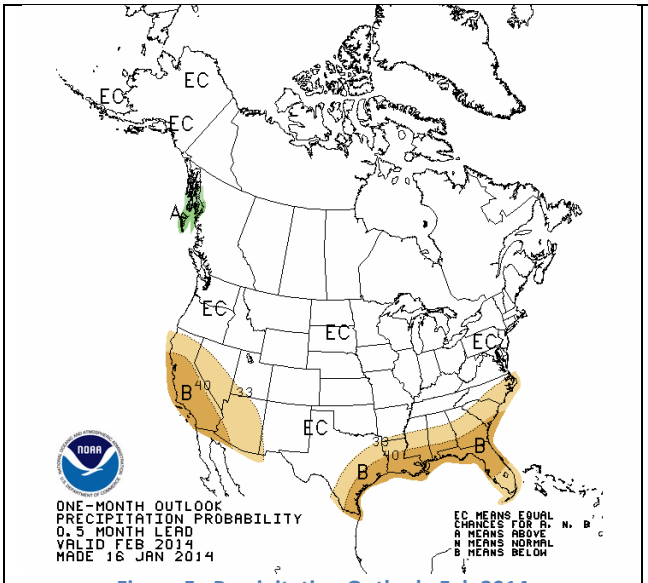

Figure 5. Precipitation Outlook, Feb 2014

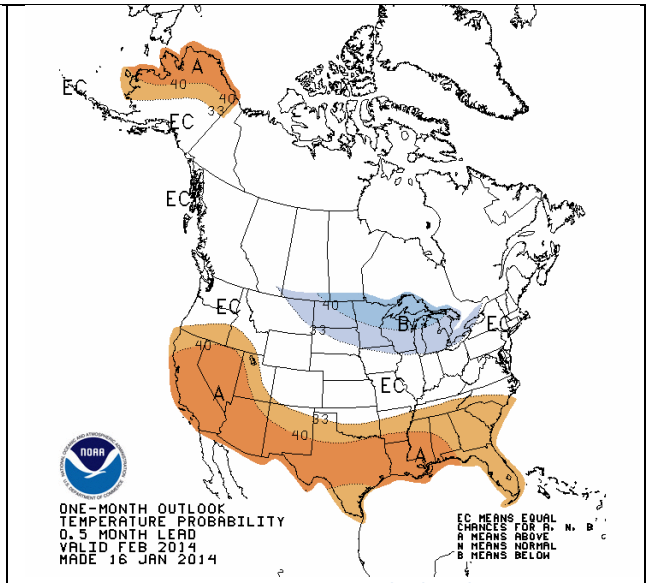

Figure 6. Temperature Outlook, Feb 2014

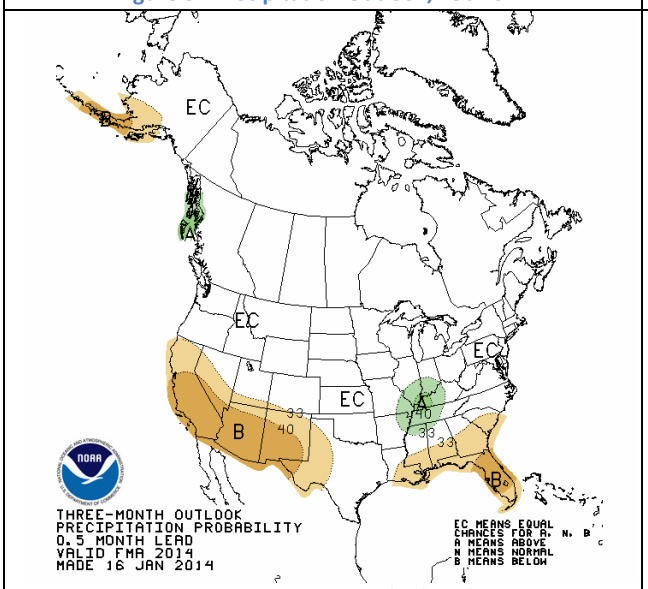

Figure 7. Precipitation Outlook, Feb-Apr

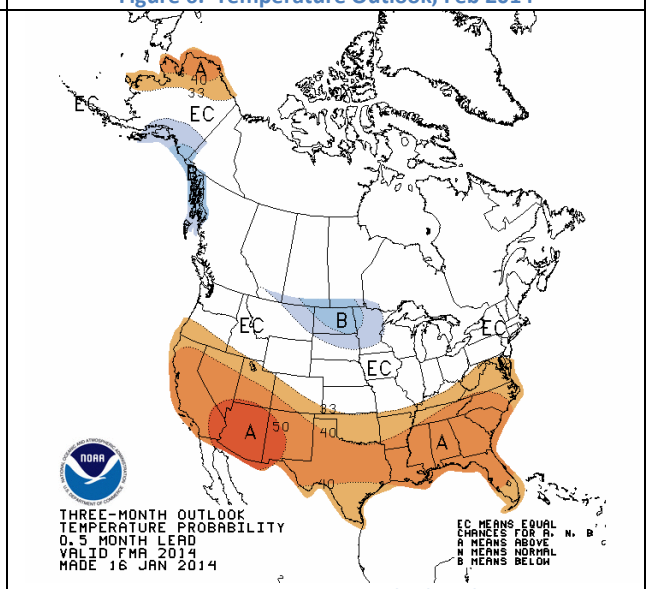

Figure 8. Temperature Outlook, Feb-Apr

Based on these forecasts, it would appear at this time that the greatest threat of future ice jam flooding within Omaha District will be across most of North Dakota and portions of northeastern Montana and northern South Dakota.

It should be pointed out that these are preliminary forecasts generalized over a broad area, and temperature and snowfall data should continue to be monitored throughout the basin for the remainder of the winter season up through breakup in order to better predict where the greatest

threats of ice jam flooding may occur. Areas that experience significantly colder than normal temperatures for a week or more during February or early March will warrant the most attention.

Lower Platte River Ice Jam Threat Assessment
January 21, 2014

Background. A request from the State of Nebraska was received by Emergency Management personnel on January 8, 2014, requesting technical assistance to determine potential advance measures that may be needed to alleviate the risk of flooding due to potential ice jams along the lower Platte River.

Analysis of Conditions To-Date. The two greatest factors in determining the potential for ice jams to form are 1) the strength and thickness of ice; and 2) the volume of water available to enter the river. Each of these factors will be addressed in the following paragraphs.

Strength and Thickness of Ice. Ice thickness and strength can be a major determining factor in the formation of ice jams. Historic observations have shown that ice jams on the lower Platte River are more likely once the average ice thickness exceeds 15-18 inches. Ice that has shown little or no evidence of decay is more resistant to breaking up as stages increase, but once that ice breaks up, it is more likely to lead to a competent ice jam, should one form. Ice thickness measurements taken by the Papio-Missouri River NRD on January 7 showed an average ice thickness of 12.5 inches upstream of Highway 64 and 11 inches near Beacon View. These thicknesses were slightly less than average thicknesses at the same locations a week earlier. The most recent ice reports entered in the Nebraska DNR Ice Reporting network indicate that there are relatively few portions of open water on area rivers.

Based on current conditions, it can be concluded that the present condition of Platte River ice is not of sufficient thickness to pose a threat to ice jam formation; however, ice thickness is slightly greater than average for this time of year and should continue to be monitored for additional growth.

Volume of Water Available. The volume of water available to runoff into the Platte River is a major factor in determining if the ice cover breaks up and causes an ice jam. As a general rule of thumb, a stage increase of 1.5 to 3 times the ice thickness is required lift and break up an ice cover. Assuming the current ice cover is 20 inches, this leads to roughly a 2.5 to 5 foot increase in stage needed to break up the current ice cover.

Precipitation in the lower Platte basin has been well below normal this winter season (since November 1). Streamflows are running at normal to below normal throughout most of the lower Platte basin. Snowpack has been non-existent in the lower Platte River basin over the past week.

Based on current conditions, it can be concluded that the present condition of water available to cause breakup of Platte River ice is below average.

Short-Term Threat Level. As demonstrated above, current conditions show that the Platte River ice is not of thickness to pose a threat to ice jam formation, and the volume of water available to break up the existing ice cover is minimal. There are factors that may increase the threat of ice jams over portions of Nebraska in the next several weeks.

Temperature Forecast. The current 7-day forecast issued by NWS-Valley calls for above normal temperatures turning to below normal temperatures by the end of the MLK weekend. Temperatures for the rest of the month appear to have about an equal chance for being above or below normal (Figure 9 and Figure 10). However, a slight change in the forecast could easily put the lower Platte basin solidly in either above or below normal temperatures. Temperatures for February appear to have an equal chance for being above or below normal (Figure 6). The 45-day forecast by private weather forecaster Accuweather.com calls for normal to slightly below normal temperatures through mid-February, with above normal temperatures the remainder of February.

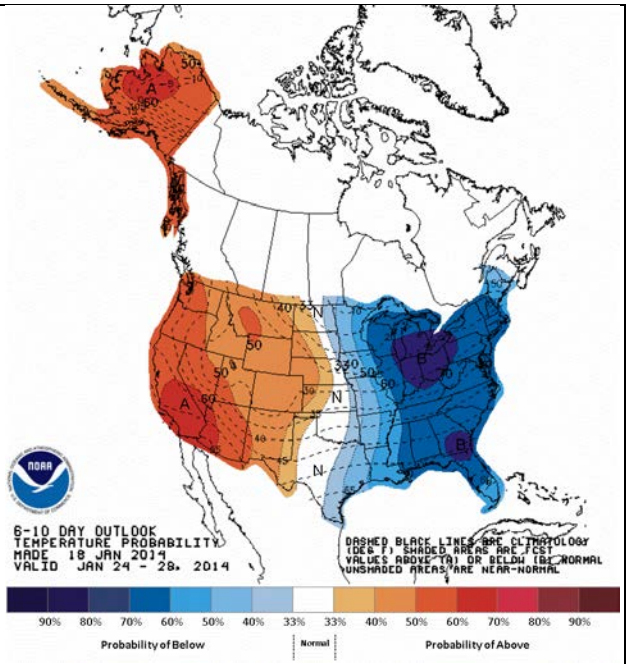

Figure 9. 6-10 Day Temp Forecast (18-Jan)

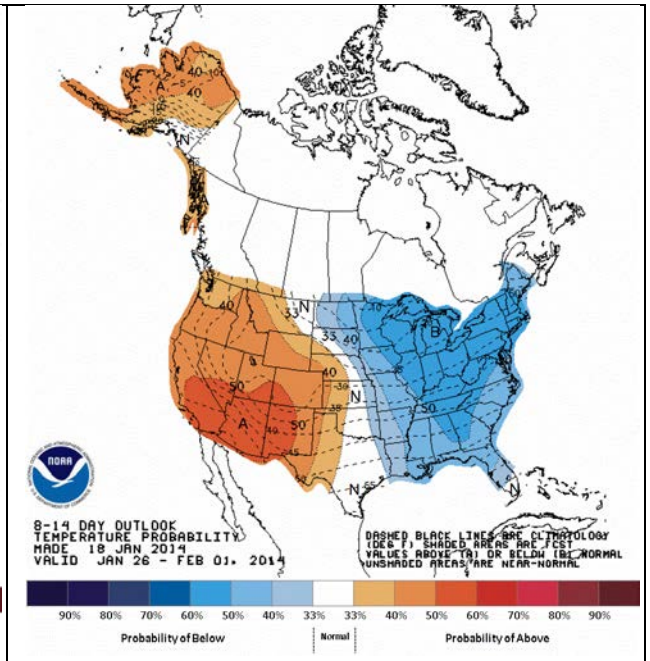

Figure 10. 8-14 Day Temp Forecast (18-Jan)

Precipitation Forecast. The current 7-day forecast issued by the National Weather Service at Valley indicates little or no chance of precipitation. Precipitation for the rest of the month appears to likely continue to be below normal (Figure 11 and Figure 12). The NOAA forecast for February presently calls for an equal chance of above or below normal precipitation (Figure 5). The private weather forecaster Accuweather.com calls for about 10 inches of snow over the next 45 days (all in the next 30 days).

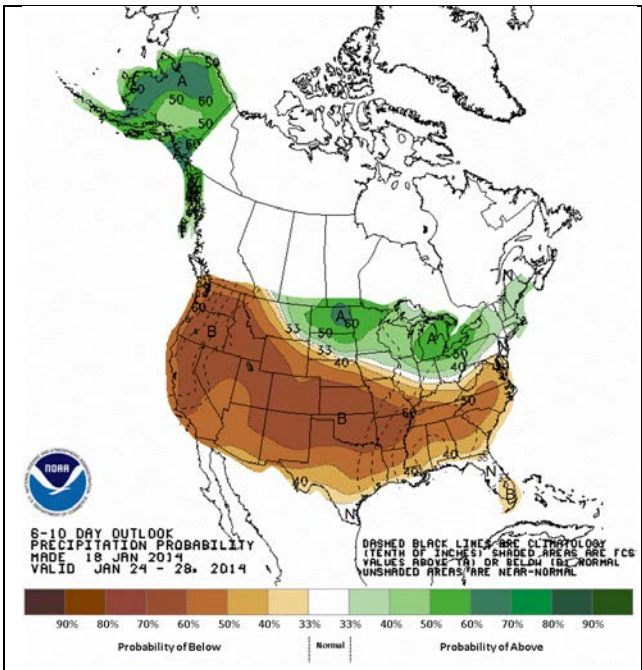

Figure 11. 6-10 Day Precip Forecast (18Jan)

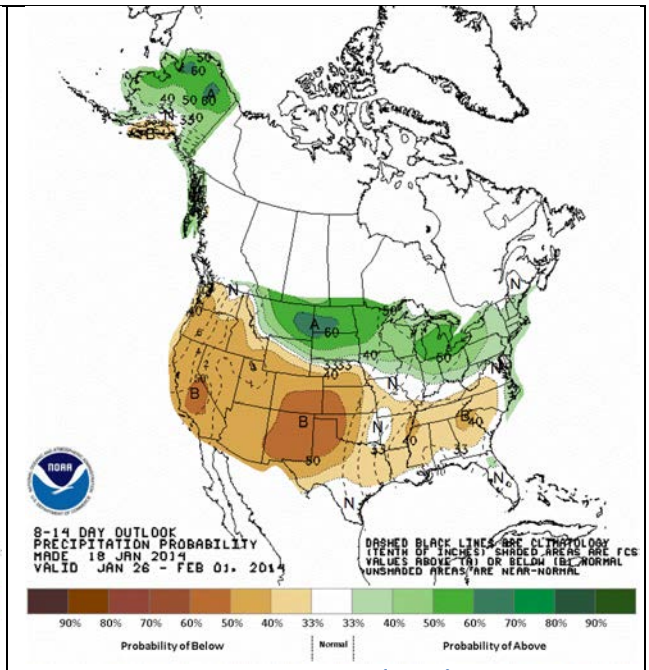

Figure 12. 8-14 Day Precip Forecast (18Jan)

Predictive Models. Predicting ice jams is, at best, an inexact science. Several attempts to develop ice jam predictive models have been made, including one on the Platte River (White and Kay, 1994). This model predicts the potential for ice jam formation on the Platte River based on temperature data at Columbus and discharge at the North Bend gage. The model predicts the formation of an ice jam when the AFDD exceeds 400 AND the discharge at North Bend exceeds 6,000 cfs or $0.39*JD^{1.96}$, whichever is greater, where JD is the current water year Julian Date (1 = October 1). While it is easy to compute AFDD, it is difficult to assess discharge at North Bend, as the gage is ice-affected during the winter (when there is an ice cover) and real-time discharge data is not available from the USGS. Based on temperatures and measured flow this winter season, it is possible that flow at North Bend will exceed the discharge threshold this season, while the AFDD threshold will very likely be met, meaning there is a chance that an ice jam may form on the Platte River.

In order to overcome the limitations of this predictive model, another model (Kay, 2007) was developed to determine the likely date and value of peak discharge at the North Bend gage. The model determines the date of maximum discharge based on temperature and snowfall data at the National Weather Service-Valley office, while the estimate of discharge is a function of temperature data and the number of days between peak AFDD and peak discharge. Utilizing NWS and Accuweather.com forecasts through March 4, the model indicates a greater than 50% chance of ice breakup on the Platte River occurring in the first week of March. However, the model also indicates a low risk of damaging ice jam floods due to continued lack of sufficient snowpack to generate runoff.

Based on the current forecast, the threat of ice breakup will be elevated over the period of late February to early March for the Platte, Loup and Elkhorn basins. However, there appears to be a low risk of ice jam formation based on current and forecasted precipitation amounts in the form of snow.

Summary of Conclusions and Recommendations.

1) The current condition of ice on the Platte River does not presently pose a significant risk of ice jam formation. However, continued normal to below normal temperatures will lead to an increase in ice thickness and ice strength;

2) The present lack of snow cover greatly diminishes the risk of ice jam formation in the near-term. The lack of snow cover on the existing ice cover will lead to greater than average thermal growth of the ice cover during the forecasted upcoming cold spells. However, this greater than normal thermal growth of ice thickness may be offset by sunny conditions, as continued to exposure to solar radiation will hasten the decay of the ice cover during upcoming forecasted warm spells;

3) Beyond this week, forecast trends point to normal to slightly below normal temperatures for the next month. There is no clear indication of whether precipitation will be above or below normal beyond the next 2 weeks. Long-range forecasts should continue to be monitored for possible changing conditions;

4) It is not recommended to begin implementing plans for any ice jam mitigation strategies at this time, beyond continued monitoring of ice conditions. However, based on uncertainty in long-range forecasts, particularly for precipitation, it is highly recommended to issue another forecast of ice jam potential in another week and revisit the need for implementing ice jam mitigation strategies at that point.