Low Flow Related Impacts in the Upper Colorado River Basin

By Donna Woudenberg, National Drought Mitigation Center NWS Advanced Hydrologic Prediction Service

The National Weather Service's Advanced Hydrologic Prediction Service (AHPS) currently provides forecast information related to flooding and flooding impacts on rivers throughout the United States (Figure a; see On the Web box). The web page provides current observations and forecasts of river stages and potential impacts associated with different flood stages for over 4,000 gauge sites across the U.S.

Historically, this website has only provided flood impacts, but not impacts of low flows. However, lack of water in a stream or river may also have negative consequences. This is particularly true in the arid and semi-arid western U.S. Water shortages can affect many segments of society including industry, agriculture, energy, recreation, environment, and government. Therefore, a similar system for low flow/stage forecasting is being created for several river basins, including the Upper Colorado River Basin.

Through a new collaborative effort among NWS, the NDMC, and water users and managers, the current AHPS river forecasting system will be enhanced to forecast low river level warnings for many stations, and to include information on current and potential future impacts of low flows on a variety of sectors. Impacts information is collected from agencies at federal, state, and local levels and from other stakeholders. The Upper Colorado River Basin is the sixth U.S. river basin to be targeted in this effort, including the North Platte River basin in Wyoming and northern Colorado. There are plans to provide nationwide low-flow forecast coverage.

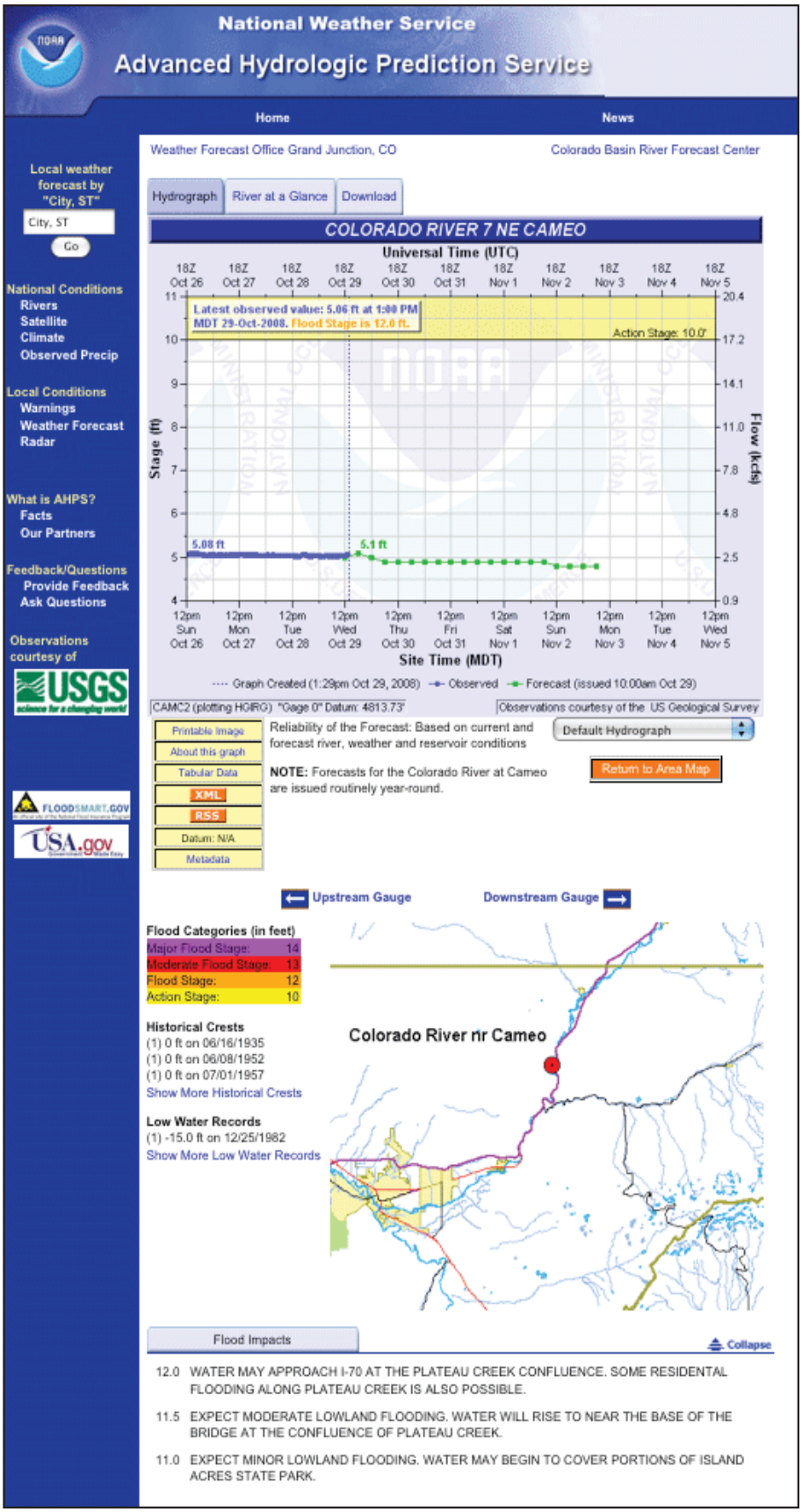

Figure 14a: NOAA-NWS Advanced Hydrologic Prediction Service website, showing the observed and forecasted streamflows for the Colorado River near Cameo, CO. Below the map, one can see the impacts associated with different flood stages. This project seeks to add impacts from low flows for 164 gauge location sin the Upper Colorado River Basin.

Potential Low-flow Impacts

Impacts can be categorized within three major sectors: economic, environmental, and social.

Economic impacts include losses to agricultural and livestock producers, businesses and industries, the energy sector and water suppliers.

- *Agricultural producers*: restrictions on irrigation water supplies, more expensive irrigation water, need for new or supplemental water sources, water rights shut off – this may result in lower production and the cascading effect of higher food prices.
- *Livestock producers*: need for new or supplemental water sources or a need to decrease herd size.
- *Fishery producers*: damage to fish habitat or loss of fish and other aquatic organisms.
- *Businesses and industries:* rafting and fishing outfits may have decreased business, the transportation industry may face impaired navigability, hydroelectric and water cooled power plants may experience a decrease in production, and water suppliers may need to provide new or supplemental water.

Fort Laramie Forecast Point, Wyoming

Flow (cfs)	Stage (ft)	Impacts	Timing/Other Considerations	Information Sources
40		Irrigation releases for crops become sporadic; some fields may not receive full allotment of water	Late summer	Brian Artery, District Manager, Platte County Conservation District
20		Recreation opportunities very limited, boat ramps at Greyrocks Reservoir are likely to be inaccessible	Late summer	
10		Irrigation releases cease; crops will require alternative irrigation water supply		
10		Conditions are not favorable for aquatic life; fish and other aquatic organisms begin to die		
10		Conditions are not favorable for livestock and wildlife water, livestock producers must implement alternative livestock water supply		

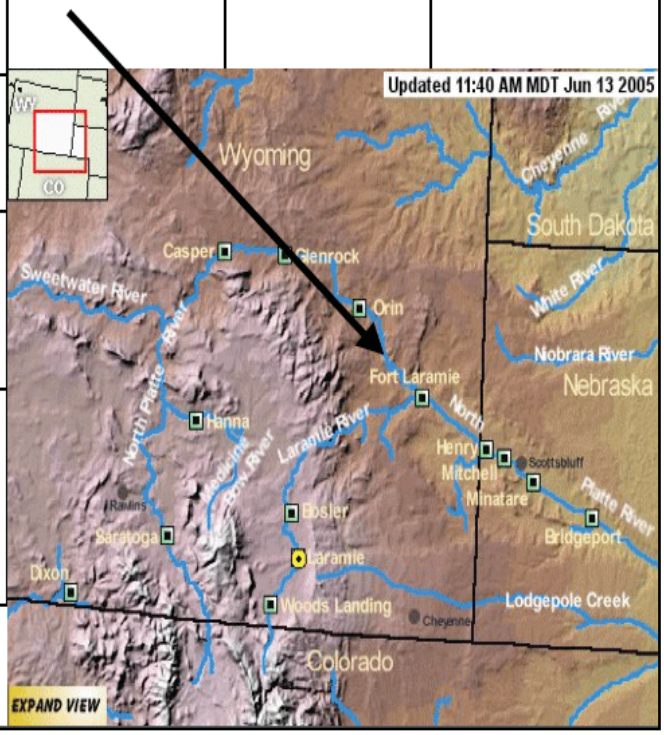

Figure 14b: Impacts associated with low flows for the Fort Laramie forecast point in the North Platte River Basin in Wyoming. This is an example of the type of information Dr. Woudenberg is seeking from water users in the Upper Colorado River Basin.

Environmental impacts include reductions in surface and groundwater quantity and quality and resultant damage to animal species and plant communities.

- *Animals/fish communities*: habitat is reduced and/or degraded and food sources and drinking water are reduced, potentially leading to increased mortality rates from lack of food and/or water, disease, or increased vulnerability to predation. Endangered species may be especially vulnerable.
- *Plant communities*: loss of biodiversity and diminished aesthetics.

Social impacts include health risks, conflicts over water, increased inequity and public dissatisfaction.

- *Health-related impacts:* increased pollutant concentrations in drinking water and reduced fire fighting capability.
- *Water user conflicts*: local, state, regional, national, and international levels may see increased competition for water supplies.
- *Water providers may have to find alternate sources*, which may lead to losses of cultural sites, public dissatisfaction with government response, or perceptions of inequity (based on socioeconomic status, ethnicity, age, gender, or seniority) in receipt of water supplies or relief.

We Need Your Help!

To assist in collecting information for the project, the National Weather Service has partnered with the National Drought Mitigation Center. The NDMC will collect information from local experts on potential impacts associated with low river levels near each of 164 selected AHPS sites in the Upper Colorado River Basin (see On the Web Box). Figure 14b shows an example of the low-flow impacts associated with the Fort Laramie streamflow forecast point in the North Platte River Basin, an earlier project. The NDMC needs information from you about the following:

- **What are the typical impacts of low river levels?**
- **At what stages/flows do these impacts occur?**
- **Is there a specific time of year when the impacts will occur?**
- **Are there any other considerations that should be noted?**

These responses will be organized into a database for incorporation into the current AHPS system. It is expected that this work will provide valuable advance information for government and public sectors to help them better prepare for and respond to water shortages in the future. You can find a form to submit low flow impacts for specific gauges in the Upper Colorado River Basin on the WWA website at: http://wwa.colorado.edu/forecasts_and_outlooks/Nov2008_focus.html.

On the Web

- For additional information about specific gauges in the Upper Colorado River Basin and to download a form to submit low flow impacts, see http://wwa.colorado.edu/forecasts_and_outlooks/Nov2008_focus.html. For further information, please contact:Donna Woudenberg, Ph.D, NDMC, (402) 472-8287, dwoudenberg2@unl.edu
- For more information on the National Drought Mitigation Center, please see: http://drought.unl.edu
- For more information on the NOAA/NWS Advanced Hydrologic Prediction Service (AHPS), please see: http://www.weather.gov/ah
  –From this site, you can choose the “River Observations” tab or the “River Forecast” tab on the top of the map. Click on a region of the country to zoom in, then click on a gauge to see the observations, forecast and impacts related to each gauge location.