US Army Corps of Engineers®

Ice Engineering

U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire

Ice Jams, Winter 1996–97

Rivers, streams, and lakes in cold regions freeze during winter months. Ice jams may form during initial ice cover formation (freezeup jams) or when ice cover breaks up (breakup jams). Both freezeup and breakup jams cause backwater flooding and damage to low-lying areas and municipal structures (Fig. 1).

Costly damages to riverine communities are a direct result of these ice jams, which often leave little time for engineers and state officials to prepare for flooding and evacuate the communities or structures to be affected by rapidly rising waters. Ice jams can cause an estimated $100 million in damages annually in the United States. Roads may be flooded and closed to traffic, or bridges weakened or destroyed, limiting emergency and medical relief to the affected areas. The potential exists for death or serious injury due to jam and flood conditions, or during evacuations.

Engineers and state officials work together to prevent damages due to ice jams, and many are working to anticipate future measures required to prevent serious ice jams from forming. These efforts depend upon accurate and reliable ice jam data. The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Jam Database is a compilation of freezeup and breakup ice jam events in the United States (White 1996). Currently, there are more than 10,500 entries in the database, dating from 1780. CRREL's Ice Jam Database is a reliable resource used to research previous ice jams and to predict and assess conditions that may increase the probability of an ice jam formation. The Ice Jam Database is also used to document steps taken by engineers and relief officials in previous years when confronted with ice jam conditions during emergency situations.

This issue provides a brief summary of ice jam data for water year 1997 (1 October 1996 through 30 September 1997) collected in the CRREL Ice Jam Database. Currently, there are 157 ice jam entries in the database for water year 1997 (Fig. 2). Most of these were retrieved from daily bulletins and reports detailing field conditions observed by the National Weather Service (NWS). CRREL and other Corps personnel also provided data. Of the 1997 ice jam events, 39.5% have some reported damages.

Figure 1. Ice jam on the Connecticut River in Charlestown, New Hampshire, near the Charlestown wastewater treatment plant.

When did the 1997 ice jams occur?

The highest percentage of the 1997 ice jams occurred in February (40%), followed by 24% in January (Fig. 3). The first week of January brought above-normal temperatures over most of the northern United States (http://water.usgs.gov/nwc/NWC/html/back_issues/wy97/). The unseasonably warm temperatures caused early snowmelt and ice breakup. Also, the Eastern Great

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Abstract

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Figure 2. 1997 ice jams.

Lakes Region experienced heavy rainfalls from 23 to 30 January. At that time the ground was frozen, forcing much of the rain and snowmelt to run off into the river and stream systems.

During February 1997, flooding due to ice jams was severe across the Eastern Great Lakes Region and the Mid-Continent North Region because of heavy rains, snowmelt, and frozen or saturated ground contributing to runoff. Ice jams were also reported in the Mid-Atlantic Region, the Intermountain West Region, the Western Great Lakes Region, and in New England and New York. All six regions experienced unseasonably warm temperatures combined with heavy rainfall from 19–26 February.

Where did the 1997 ice jams occur?

Ice jams during water year 1997 occurred in 20 different states, with Montana, Nebraska, Iowa, New York, and North Dakota reporting ice jams most frequently (Fig. 4 and 5).

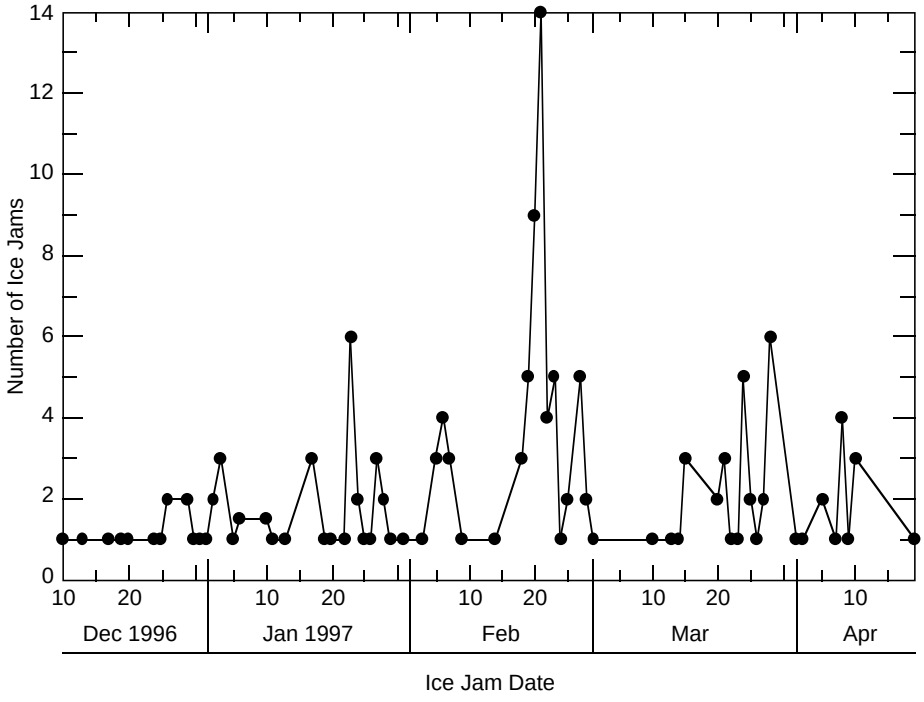

Figure 3. Number of ice jams per jam date for water year 1997.

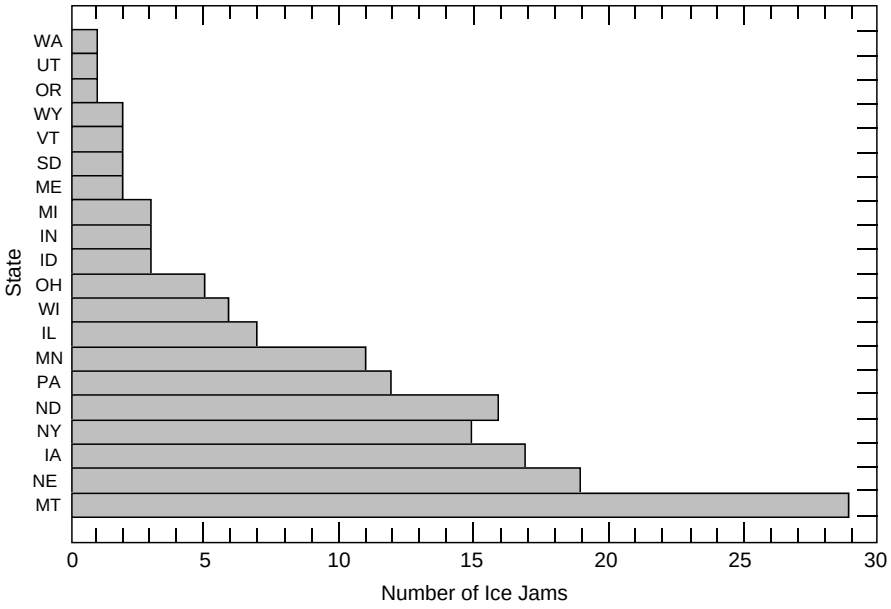

Figure 4. Number of ice jams per state for water year 1997.

Montana experienced 29 ice jams, the highest number per state for 1997.* Forty-five percent of Montana's ice jams occurred along the Yellowstone River. In January, ice jams along the Yellowstone River near Billings caused an estimated $40,000–50,000 in damages due to residential flooding alone, though these figures were not high enough to qualify the state for federal disaster aid (Crisp 1997).

In mid-February, Miles City experienced a jam that flooded several homes and threatened a dike. Near the end of March, high water and ice movement had weakened the Highway 242 bridge over Cottonwood Creek near Malta. Roadways were flooded near Glasgow on the Milk River. Flooding had also occurred near Harlem in Blaine County because of rapidly rising water levels from tributaries and jamming on the Milk River. Ice jams persisted from Saco to Nashua in March.

The state of Nebraska experienced a total of 19 reported ice jams. Twenty-six percent of these occurred along the Elkhorn River near Beemer, Hooper, Norfolk, Waterloo, and West Point. Twenty-one percent of Nebraska's ice jams occurred along the Loup River. Much of the damage was limited to minor lowland flooding and localized overflows in the Columbus, Fullerton, Genoa, and Palmer areas. Ninety-five percent of Nebraska's ice jams occurred during February.

Few of Iowa's 17 ice jams caused severe or extensive damage or flooding. Though the Iowa River accounted for 23.5% of the state's ice jams, none of these reported damages. All other ice jams caused only minor lowland and agricultural flooding in the state. Most of Iowa's ice jams occurred in February and March.

In New York, only 2 of the 15 ice jams documented reported damages. The Ausable River jammed near Ausable Forks and caused the flooding of fields. Along Cazenovia Creek in the vicinity of Ebenezer, some flooding occurred near the West Seneca Senior High School, and several evacuations occurred because of an ice jam in late January. No other damages were reported. Although ice jam formation along the Mohawk River accounted for 33% of New York's 1997 ice jams, no specific damages were reported.

Only 4 of North Dakota's 13 ice jams had reported damages. Only jamming along the Little Missouri River caused any extensive damage. South of Watford City there was

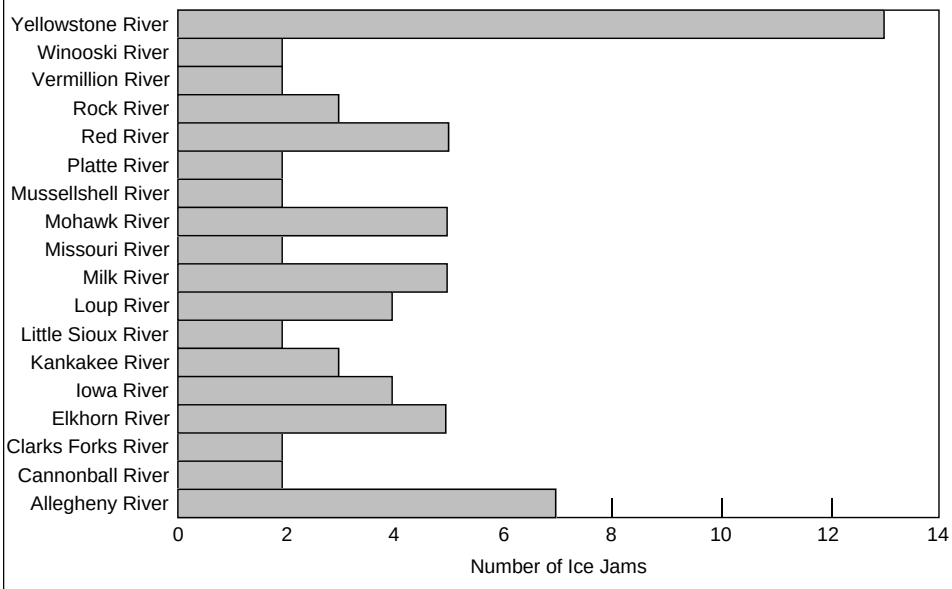

Figure 5. Number of ice jams per river having more than one jam in water year 1997.

*A field visit to Montana, coordinated with local NWS officials, provided material in addition to that available from typical sources. Prior to this trip, Montana ranked fourth with North Dakota for number of reported jams per state, with 13 ice jams.

significant flooding in the Theodore Roosevelt campground along the scenic route. Severe flooding also occurred along the Red River at Tyler. Controlled water releases from Lake Traverse were required to relieve flooding potential (Beatty 1997). This flooding occurred in early April after warm daytime temperatures and rain, followed by unseasonably cold temperatures.

Corps response

In 1997, the U.S. Army Corps of Engineers provided technical as well as financial and mechanical resources to communities affected by ice jams and subsequent flooding. CRREL provided recommendations, referrals, on-site observations, and points of contact to the Corps of Engineers New England Division and the Districts of Chicago and Omaha.

CRREL also had a more direct influence on the mitigation of ice jam situations. On 28 January 1997, Steven Daly, a Research Hydraulic Engineer with CRREL's Ice Engineering Research Division, traveled to the site of an ice jam on the Walhonding River in Warsaw, Ohio. Daly advised town officials and the contracted blaster on methods and techniques to alleviate the ice jam's threat. Jam sites along the river were surveyed and possible short- and long-term solutions for ice jam flooding were presented soon after (Daly 1997). CRREL also presented ice jam mitigation workshops in several states in connection with Corps and other Federal agencies.

How is this information helpful?

This overview of 1997 ice jams is the second in an annual series of reports on ice jam summaries. Each water year, the Ice Jam Database and Ice Jam Archive will be updated to provide the most current accessible literature and data concerning ice jams for that year. The historical data found in the Ice Jam Database is crucial in emergency situations when information about river gage stations or previous jam locations is necessary for the prevention or alleviation of ice jam hazards.

In particular, weather conditions surrounding ice jams can be the most important factor when predicting ice jam formation conditions. If the meteorological and hydrological conditions surrounding previous ice jams are known at certain river locations, it may be possible to predict or even prevent ice jam formation, and to prepare a community for its impact.

CRREL's Ice Jam Archive can be used as a source of historical data as it is a collection of hard copies of data and summary information used in this report and for water years dating before 1997. These resources include NWS reports, newspaper articles, and other reports, which can be photocopied or checked out for research purposes.

References

Beatty, R.J. (1997) USACE CENCS Situation Reports. U.S. Army Corps of Engineers, 121900ZAPR97, No. 25; 141900ZAPR97, No. 27.

Crisp, D. (1997) Flood victims get little help. *Billings Gazette*, Billings, Montana, 8 January, p. 5C.

Daly, S.F. (1997) Trip report. Unpublished memorandum for Chief, Ice Engineering Research Division (IERD). Ice Jam Archives, CRREL, Hanover, New Hampshire, 4 February.

White, K.D. (1996) A new Ice Jam Database. *Water Resources Bulletin*, 32(2): 341–348.

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Please send any information for inclusion in the Ice Jam Database and Ice Jam Archive to Lourie Herrin, IERD, CRREL, 72 Lyme Road, Hanover, New Hampshire 03755-1290. Photocopies of originals can be made and returned.

The CRREL Ice Jam Database is available via the CRREL Home Page (http://www.usace.army.mil/crrel/icejam).

This issue of the Ice Engineering Information Exchange Bulletin *was written by Erika K. Peterson, Engineering Technician, Lourie Herrin, Research Program Assistant, and Kate White, Research Hydraulic Engineer, Ice Engineering Research Division (IERD), CRREL, and was edited by Gioia Cattabriga and laid out by John D. Severance of CRREL's Technical Information Branch.*

Ice Engineering Information Exchange Bulletin

The *Ice Engineering Information Exchange Bulletin* is published in accordance with AR 25-30 as one of the information exchange functions of the Corps of Engineers. It is primarily intended to be a forum whereby information on ice engineering work done or managed by Corps field offices can be disseminated to other Corps offices, other U.S. Government agencies, and the engineering community in general. The purpose of the *Ice Engineering Information Exchange Bulletin* is information exchange and not the promulgation of Corps policy; thus, guidance on recommended practice in any given area should be sought through appropriate channels or in other documents. This bulletin's contents are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

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