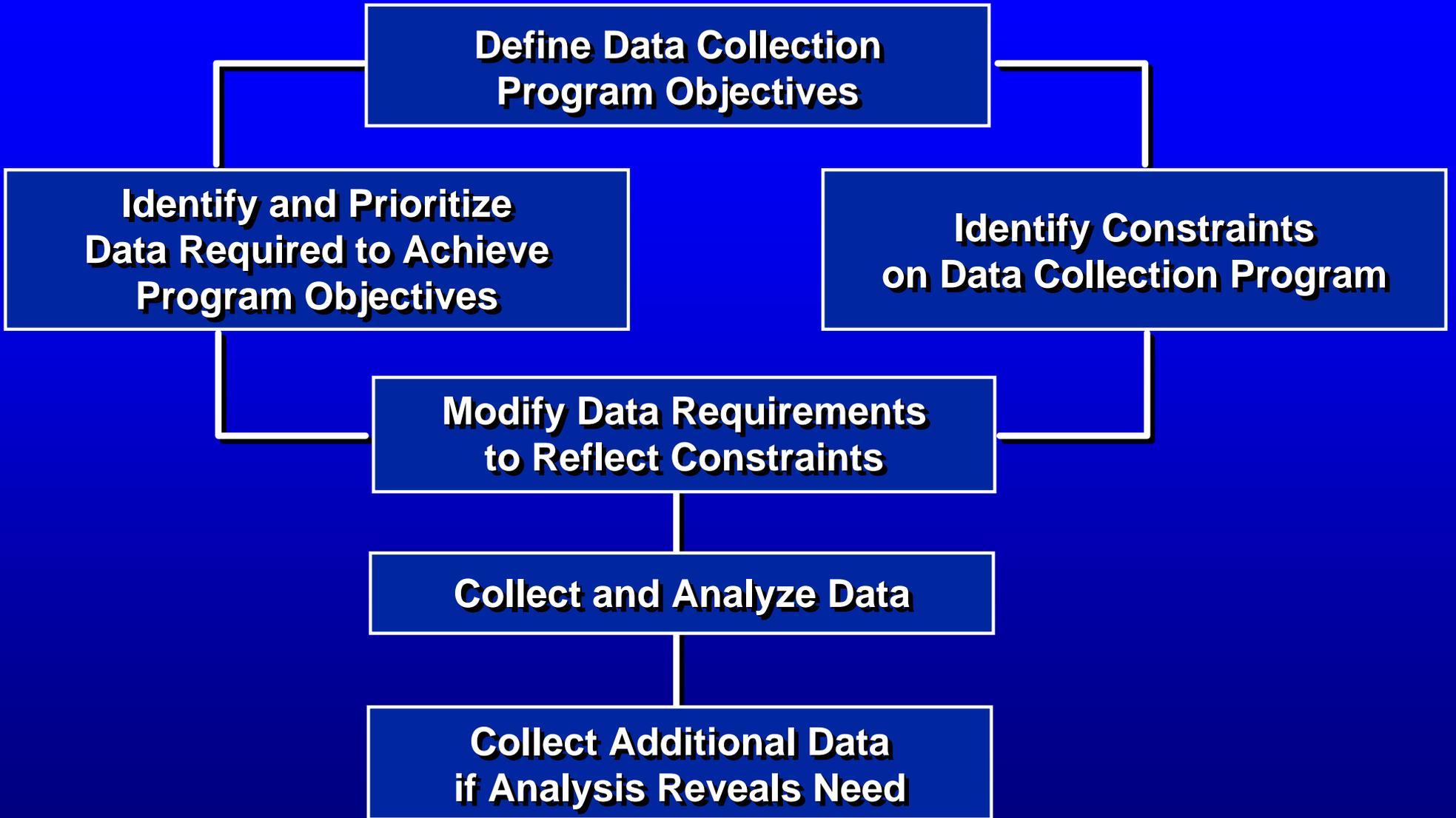


Ice Jam Data Collection

**Ice Engineering Research Division
US Army Cold Regions Research
and Engineering Laboratory**

Ice Jam Data Collection

- Why?
- What?
- When?
- Where?
- How?
- Who?



**Define Data Collection
Program Objectives**

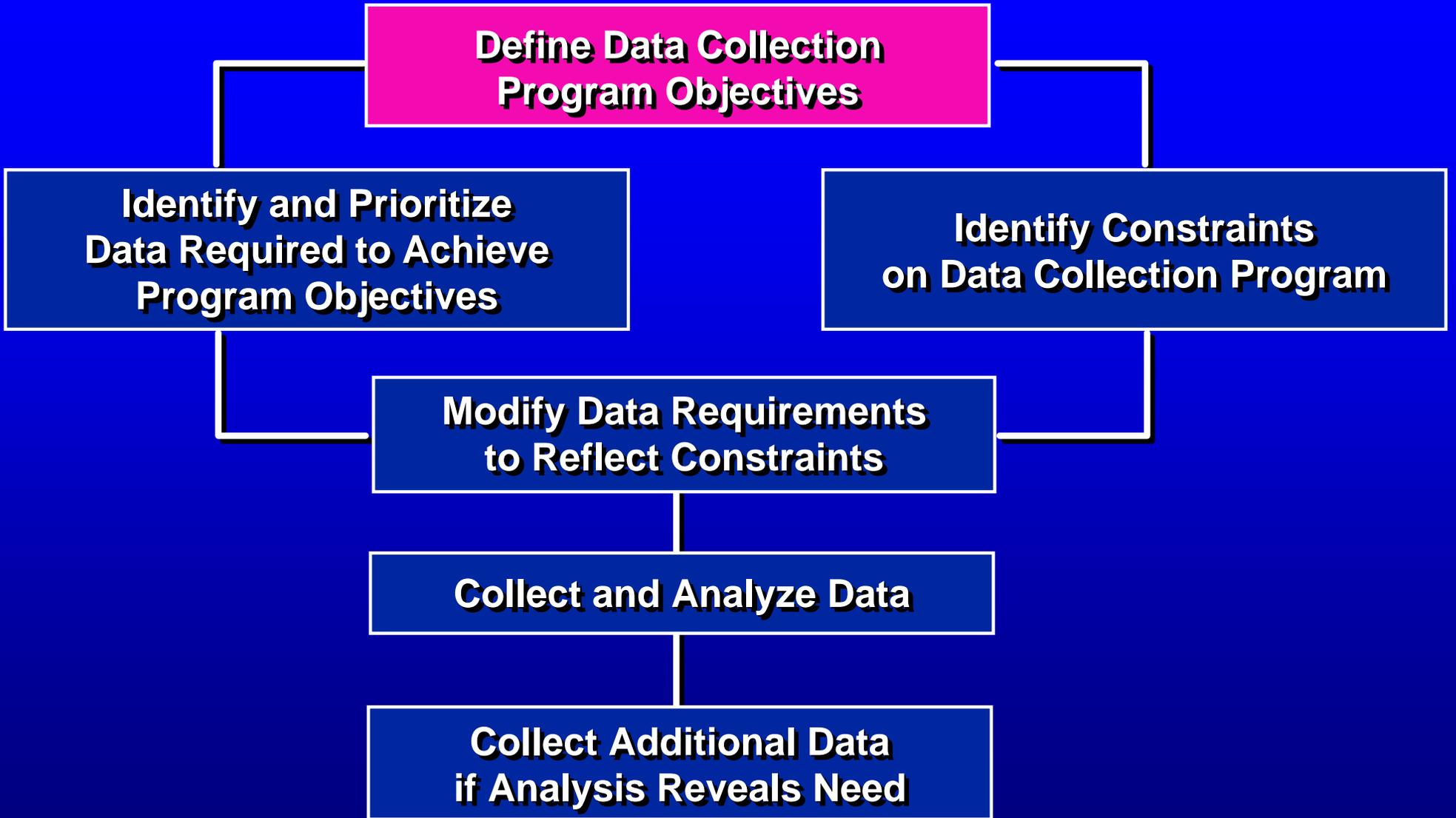
**Identify and Prioritize
Data Required to Achieve
Program Objectives**

**Identify Constraints
on Data Collection Program**

**Modify Data Requirements
to Reflect Constraints**

Collect and Analyze Data

**Collect Additional Data
if Analysis Reveals Need**



Typical Ice Jam Data Collection Program Objectives

- **Assess emergency conditions**
- **Evaluate emergency response measures**
- **After-event damage assessment**
- **Identify ice jam characteristics**
- **Develop stage-frequency curve**
- **Validate ice-covered models (numerical or physical)**
- **Develop ice jam mitigation or control measures**

Objective:

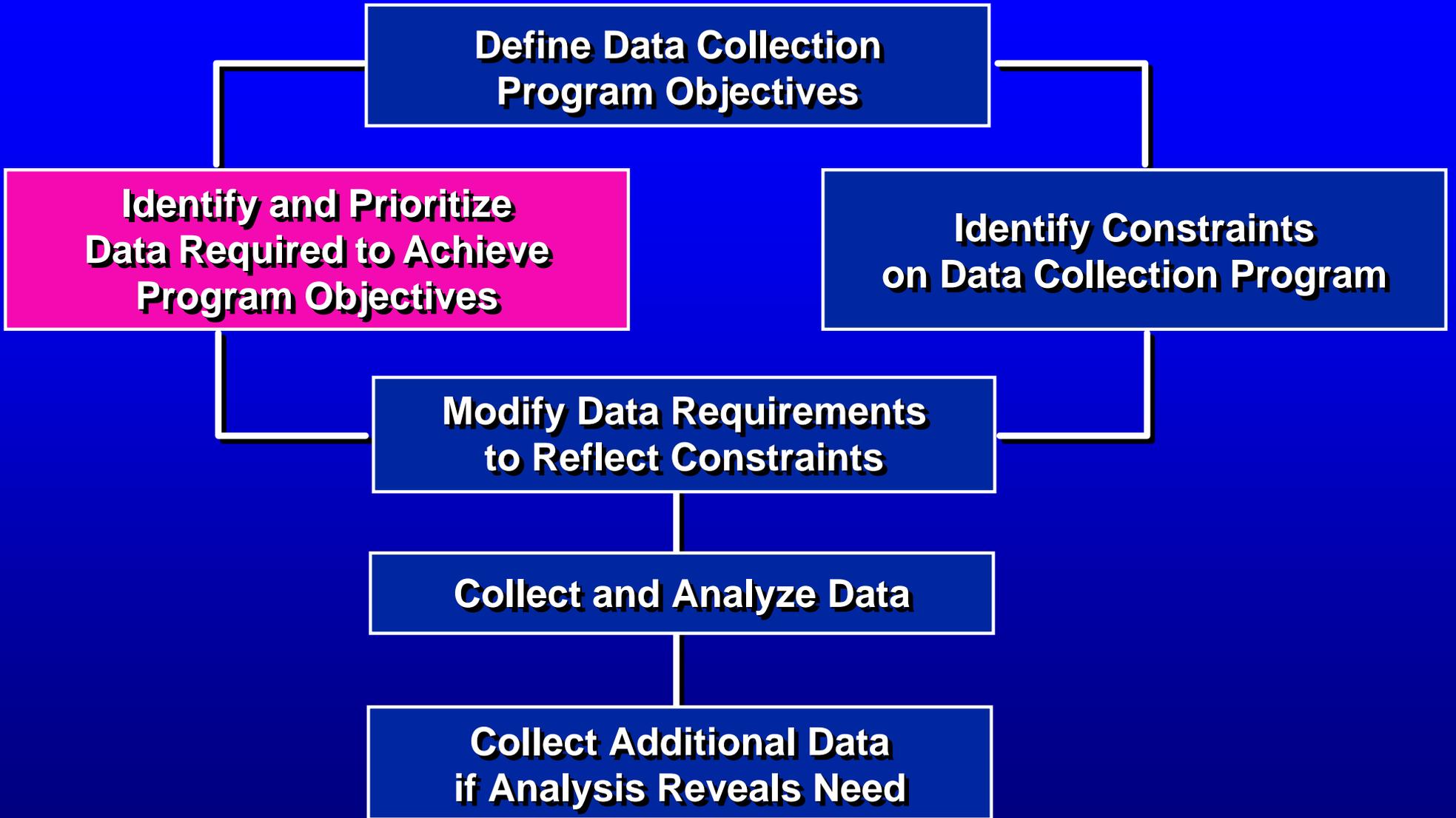
Emergency Response or Advance Measures

Ice jam data collection should provide information on:

- **Scope and effects of present ice jam**
- **Potential for ice jam growing**

Based on information, emergency response team should be able to predict:

- **Possible flood areas**
- **Likelihood that jam will progress**
- **Stages expected under different ice jam scenarios**
- **Potential success of mitigation measures**



Example:

Scope of present jam:

- **Location of jam toe and head**
- **Downstream ice conditions**
- **Upstream ice conditions**
- **Stage and changes in stage**
- **Discharge and changes in discharge**
- **Weather**
- **Flooded areas and areas of potential flooding**



Example:
potential for jam progression:

- **Upstream ice supply
(volume, condition of ice)**
- **Downstream ice conditions**
- **River hydraulics, geometry**
- **Discharge forecast**
- **Weather forecast**

For known ice jam site, monitoring throughout the winter season can provide valuable information.

- **Freezeup process**
- **Stable ice cover growth and decay**
- **Breakup mechanisms**
- **Jam initiation and progress**

Monitoring During Breakup

Objective

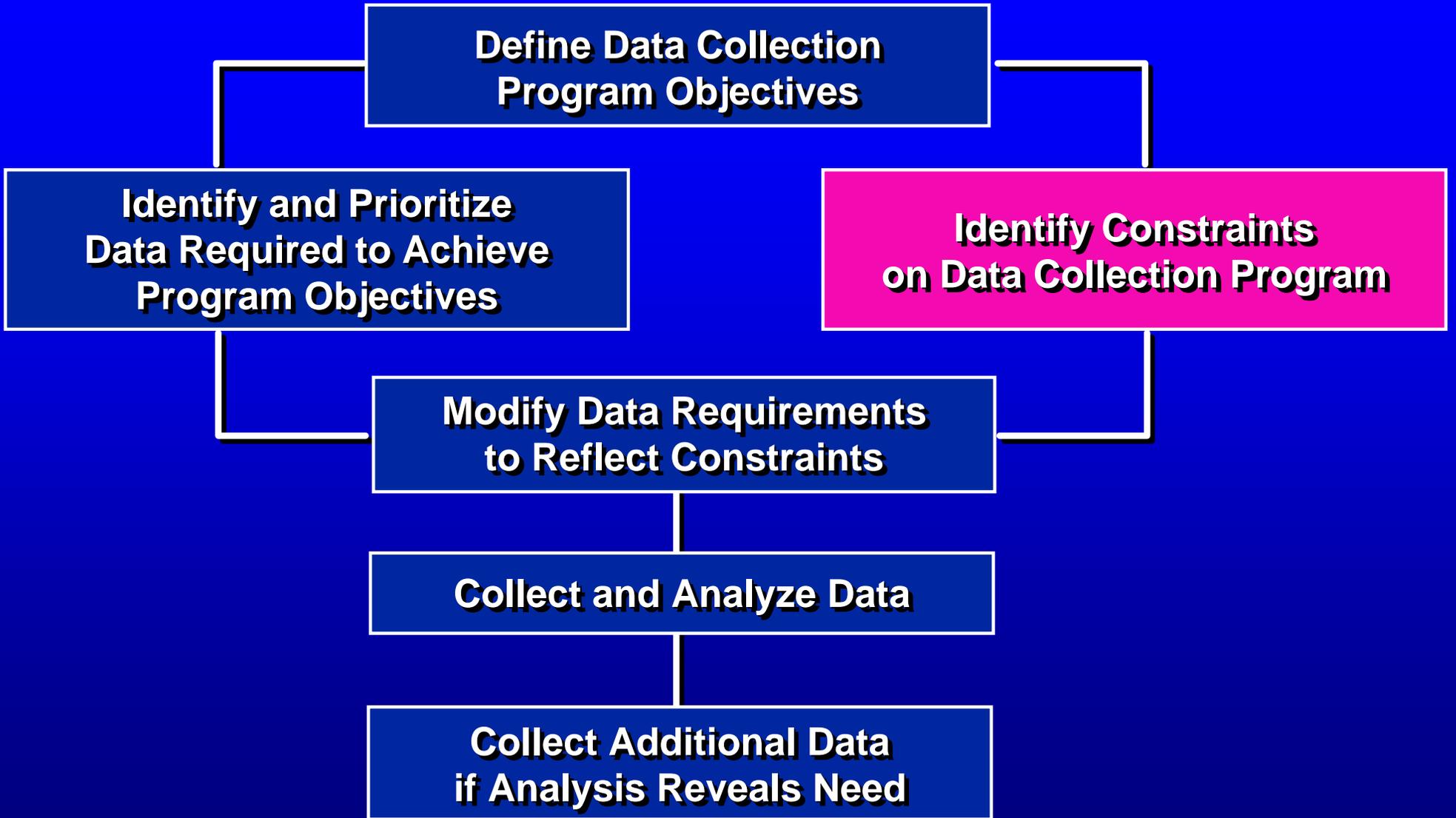
- **To understand breakup and jamming process**
- **To aid in ice jam warning/mitigation**

Frequency

- **Hourly to continuous**
- **Log book or call-in as required**

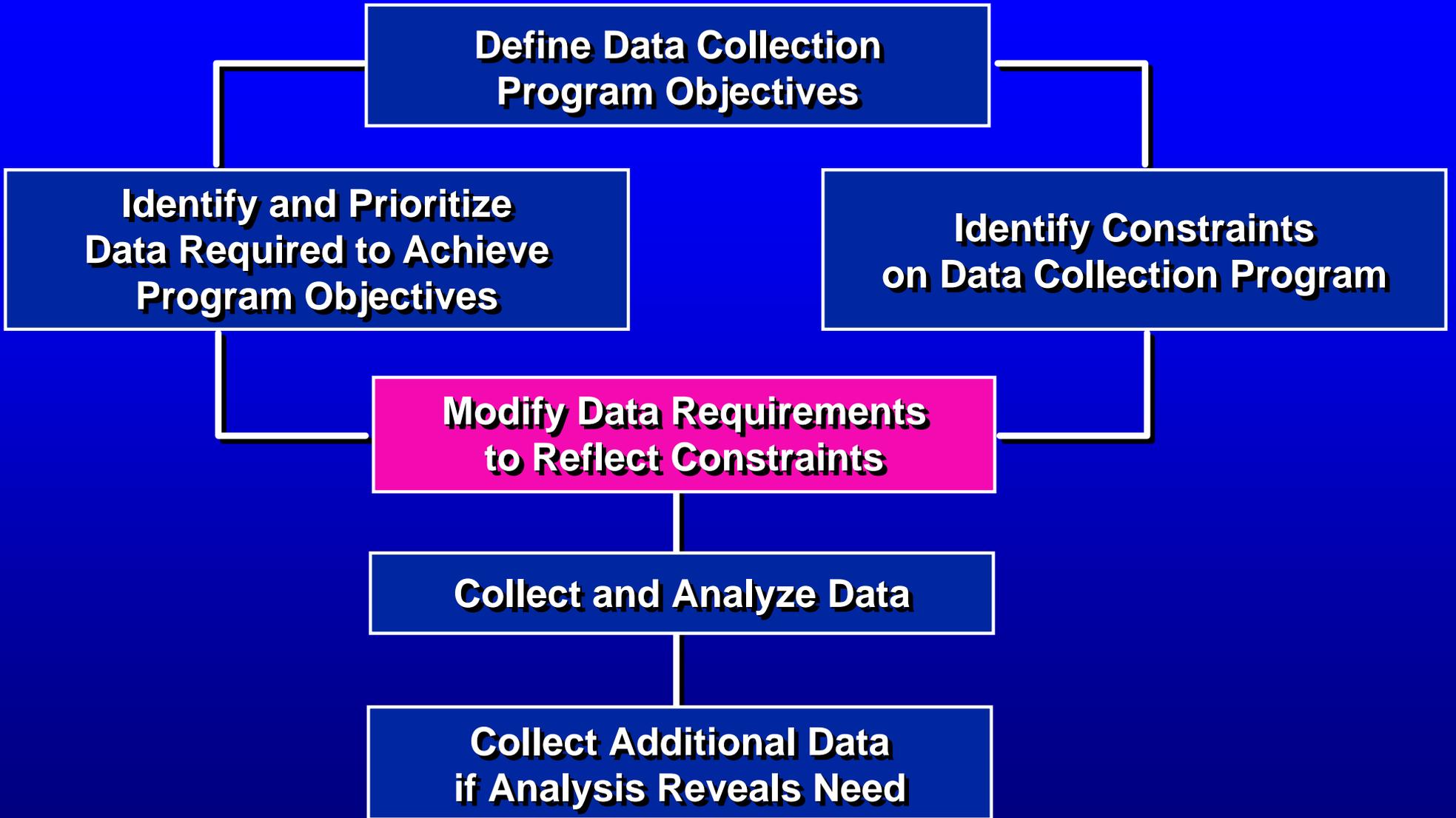
Parameters

- **Character of ice (e.g., solid, broken, weak, strong)**
- **Stage and discharge**
- **Breakup process (e.g., timing, locations)**
- **Ice piece size and thickness**
- **Movement (e.g., free or constricted movement)**
- **Upstream/downstream ice conditions**
- **Water temperature**
- **Weather forecast (precipitation, runoff)**



Typical Ice Jam Data Collection Constraints

- **Safety**
- **Time/Budget**
- **Geographic area**
- **Personnel/Equipment**
- **Access**
- **Weather**

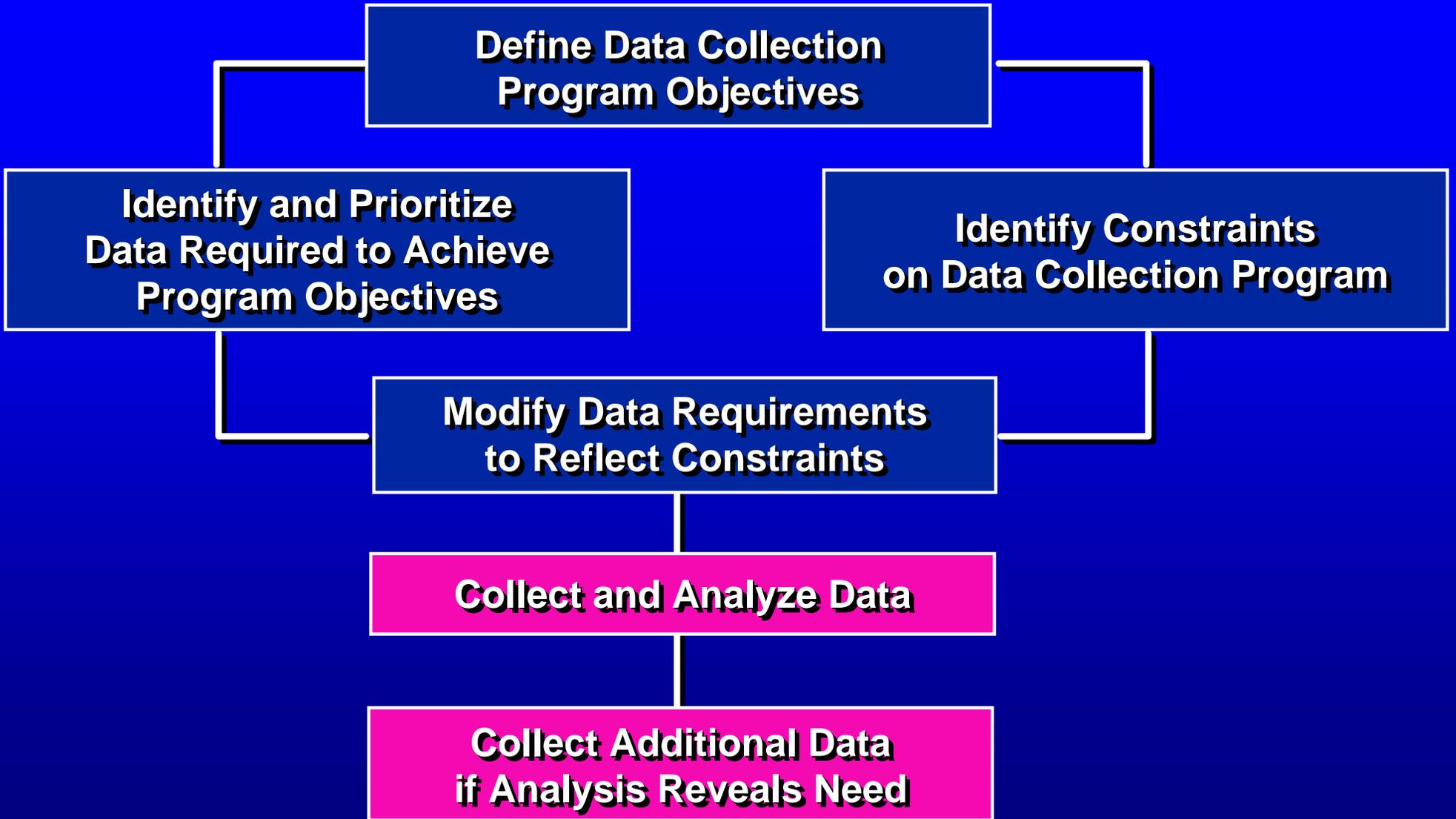


Example: monitoring during breakup

Constraints: budget, weather, time

Parameters obtainable:

- **Character of ice - visual inspection and measurement of recently deposited ice blocks**
- **Stage, discharge - local USGS gage if possible, otherwise set up staff gage**
- **Breakup process - windshield survey**
- **Upstream/downstream ice conditions - windshield survey, contact authorities**
- **Weather forecast - NWS**



Define Data Collection Program Objectives

Identify and Prioritize Data Required to Achieve Program Objectives

Identify Constraints on Data Collection Program

Modify Data Requirements to Reflect Constraints

Collect and Analyze Data

Collect Additional Data if Analysis Reveals Need

Data Collection

- **Background data collection**
 - historical or archived records
- **Field data collection**

Background Data Collection

- **Ice records**
- **Historical ice and stage data**
- **River geometry**
- **River hydraulics**
- **Hydrology**
- **Meteorology**
- **Flooded areas**
- **Past flood-fighting measures**
- **Potential flow control**

Sources of Background Information

- **CRREL and Corps reports**
- **Topographic/GIS mapping**
- **USGS gage data**
- **NWS forecasts**
- **Historical ice jam and open water flood data (stages, flood areas)**
- **CRREL ice jam database**
- **Technical reports**
- **Local civil defense unit reports**
- **State emergency agency reports**
- **Newspaper/TV accounts**
- **Photographic/videotape**
- **Anecdotal records**

Nebraska Ice Reporting

<http://nrcent2.nrc.state.ne.us/cgi-win/icejam97.exe>

- [Enter and Modify Data \(password required\)](#)
- [Display Information from Nebraska Ice Reporting Forms](#)
- [Listing of Reporting Sites](#)
- [Nebraska Emergency Management Agency Ice Summaries](#)
- [CRREL Ice Information](#)
- [Other Ice Related Information](#)



96-1

SPECIAL REPORT



Ice Jam Flooding and Mitigation Lower Platte River Basin, Nebraska

Kathleen D. White and Roger L. Kay

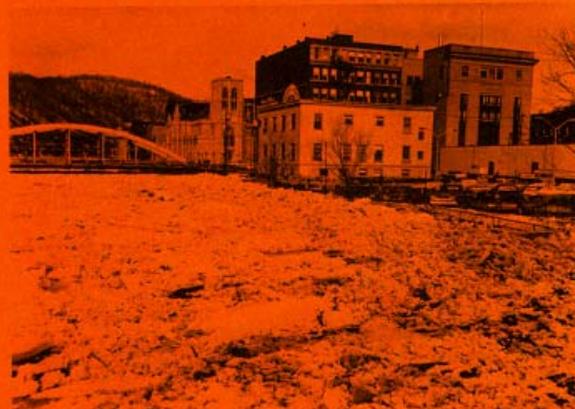
January 1996

CRREL and Corps Reports



US Army Corps
of Engineers
Pittsburgh District

Local Ice Related Flood Problem Investigation Detailed Project Report



Allegheny River
Oil City, Pennsylvania

29

AFTER-ACTION REPORT

ICE CONDITIONS

WINTER 1965-1966



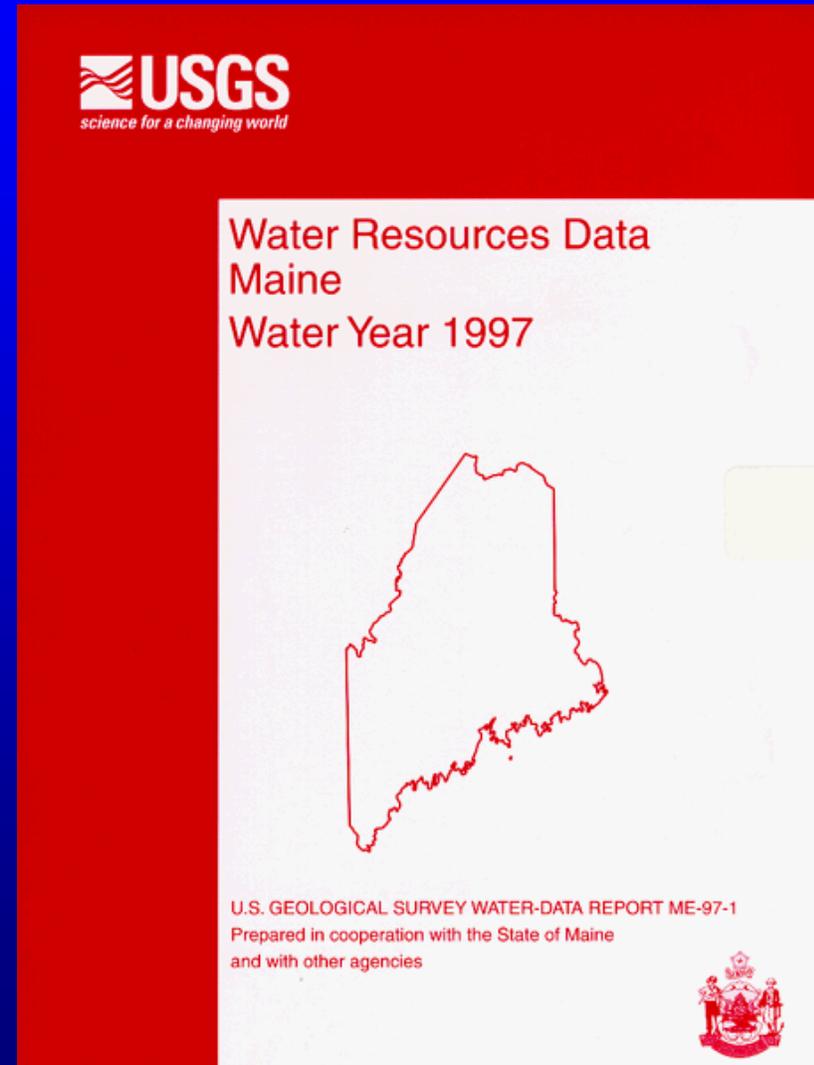
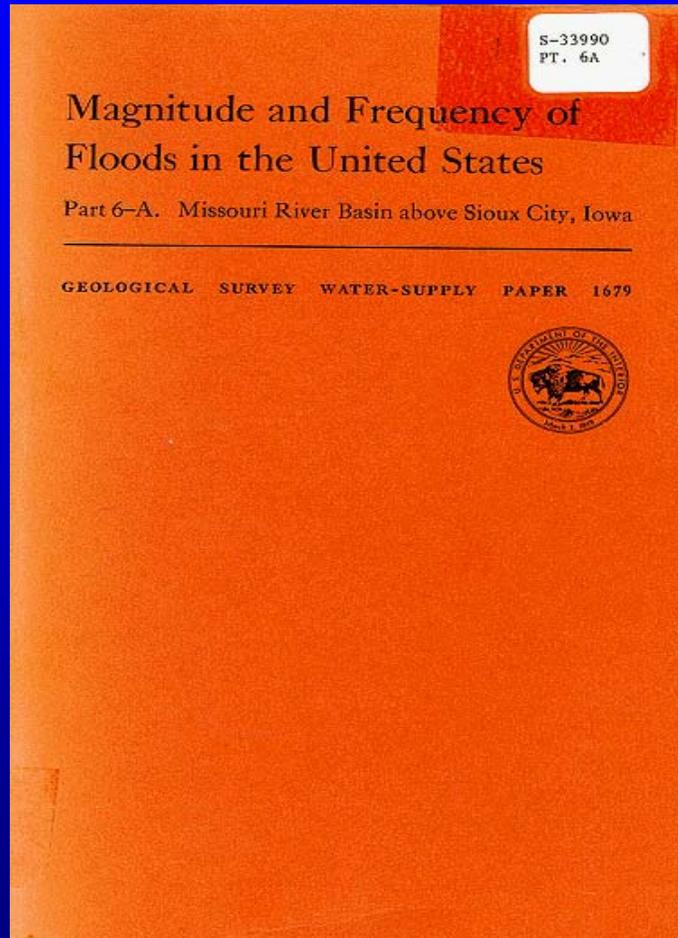
U. S. ARMY ENGINEER DISTRICT, ROCK ISLAND

CORPS OF ENGINEERS
CLOCK TOWER BUILDING
ROCK ISLAND, ILLINOIS

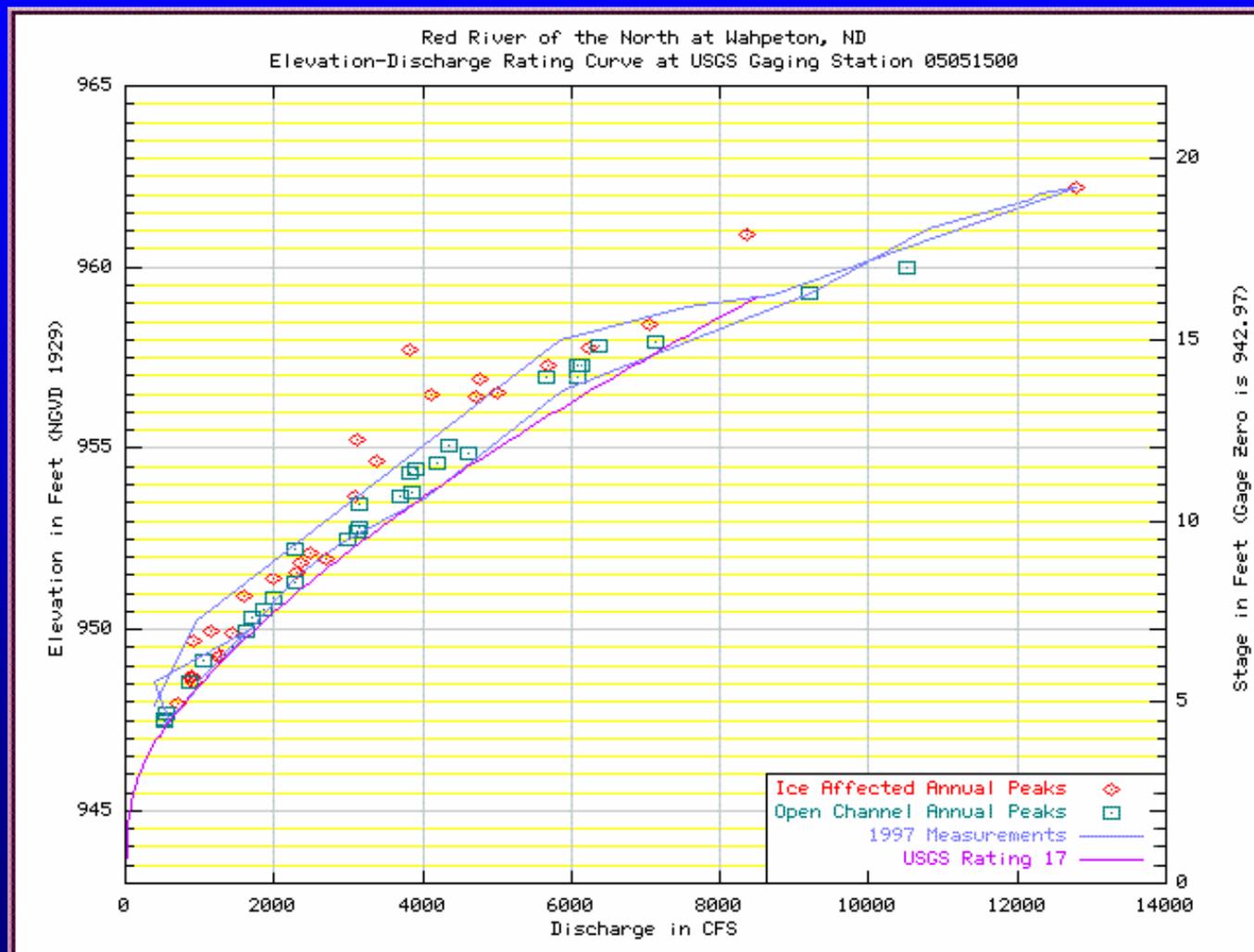
AUGUST 1967

22

USGS Reports and Real-Time Data



Historical stage and discharge records



National Weather Service products

204
RWUS42 KMLI 171710
FLSMLI
IAZ099-MOZ010-191800-

FLOOD STATEMENT...DES MOINES RIVER IN SOUTHEAST IOWA
NATIONAL WEATHER SERVICE QUAD CITIES IA IL
1110 AM CST SAT FEB 17 1996

CONTINUED **ICE JAMMING ON THE DES MOINES RIVER** IS CAUSING MINOR FLOODING FROM JUST UPSTREAM OF ST FRANCISVILLE MISSOURI...TO THE MOUTH OF THE RIVER NEAR KEOKUK IOWA.

LOCATION	FLOOD STAGE	STAGE TODAY	FORECAST
ST FRANCISVILLE	18	21.4	CRESTED AT 22.9 FEET YESTERDAY AFTERNOON. CONTINUE TO FALL.ICE ACTION MAY CAUSE ONE TO THREE FOOT FLUCTUATIONS THE NEXT FEW DAYS.

MAINLY NUISANCE FLOODING OF LOW-LYING AGRICULTURAL LAND ADJACENT TO THE RIVER IS EXPECTED. HOWEVER...PERSONS LIVING NEAR OR HAVING INTERESTS ALONG THE LOWER REACHES OF THE DES MOINES RIVER SHOULD MONITOR RIVER LEVELS OVER THE NEXT FEW DAYS.
BOEHMKE

CRREL Ice Jam Database/Archive

- **Database available on web**

<http://www.crrel.usace.army.mil/>

- **Archive contains paper copies/photos/video**

Aerial photographs



Topographic mapping



Local newspapers

Day News

FOR THE UPPER CONNECTICUT RIVER VALLEY

THE WEATHER
15. Increased
20s. Tuesday
Precipitation

Wednesday

VOLUME 24, NUMBER 1

Copyright 1975, by
Mail Address: 100



ICY PREDICAMENT — Ice floes which reached the bottom span of the temporary bridge to White River Junction over the White River caused town officials to close the bridge from 7 to 9 p.m. Tuesday.

The river water receded this morning but ice clogs still present a problem after two days of warm temperatures and rain. (News photo — John Griesamer)

Ice Jam Prompts Closing Of WRJ Span; Bridge Opened After White River Drops

By MARGARET NELSON

WHITE RIVER JCT. — Town officials and Civil Defense Director Robert W. Morancy met this morning with representatives from the Army Corps of Engineers after ice floe pressure forced closing of the "temporary" bridge across the White River Tuesday between 7 and 9 p.m.

Town Manager Ralph W. Lehman said the bridge was ordered closed when swollen waters pushed an ice floe

against the bottom span of the bridge.

The bridge, which connects downtown White River Junction with Rte. 14, was opened after the river receded.

Morancy said ice striking the piling caused vibrations in the span.

"The bridge was under a great deal of stress," he said. "It was shaking and trembling, so we closed it at that time. The water crested at flood level and did not recede more than two feet."

Lehman and Morancy inspected the White River and the Connecticut River for ice jams, and Morancy said they would discuss methods of breaking up other river ice jams with Army Engineers to prevent further problems.

The flood water reached River Street in Hartford Tuesday night. Morancy said that the Civil Defense officials told residents in the area they might have to evacuate. No such action was necessary

although waters still remained high this morning, he said.

Lehman said the town has no plans to replace the "temporary" bridge, which was installed after a section of the bridge was washed out in 1964. He pointed out the town had constructed a \$1.5 million delta structure up the river which caused considerable traffic to be deflected from the White River Junction area.

"We kind of think of the temporary bridge as a permanent bridge," Lehman said.

Historical records, books



*The powerhouse and dam of the North Channel on the Fox River, near Dayton, Illinois, where frazil ice jams occur.
(Photo, June 1961, by R.W. Gerdel.)*



Frazil ice jam on the Fox River after warm weather and rain opened channel, February 1961. (Photo by R.W. Gerdel.)

SAFETY

- **Ice jam data collection hazards require extra consideration:**
 - **cold air, water**
 - **instability of ice cover**
 - **normal water hazards amplified**



SAFETY

Volunteer observers should not attempt to make measurements or other observations from the surface of the ice

- The thickness and stability of ice covers and ice jams can vary widely in a very short distance, particularly in a river with a moveable bed

Volunteer observers should not collect data alone.

- Always let someone know where you are going and when you expect to return.

Capabilities of data collection team members must be assessed (e.g., can they swim, health issues) when designing a field data collection program.

Safely Working on the Ice

Minimize the actual time spent on the ice.

- **Organize data collection beforehand**
- **Be familiar with instruments**

Always work in pairs on the ice.

- **Each member should be aware of rescue methods and be capable of using them**

Monitor ice conditions.

- **Size and water level of open leads**
- **Water level in drilled holes**
- **If water level rises, leave the ice**
- **Locate and monitor cracks**

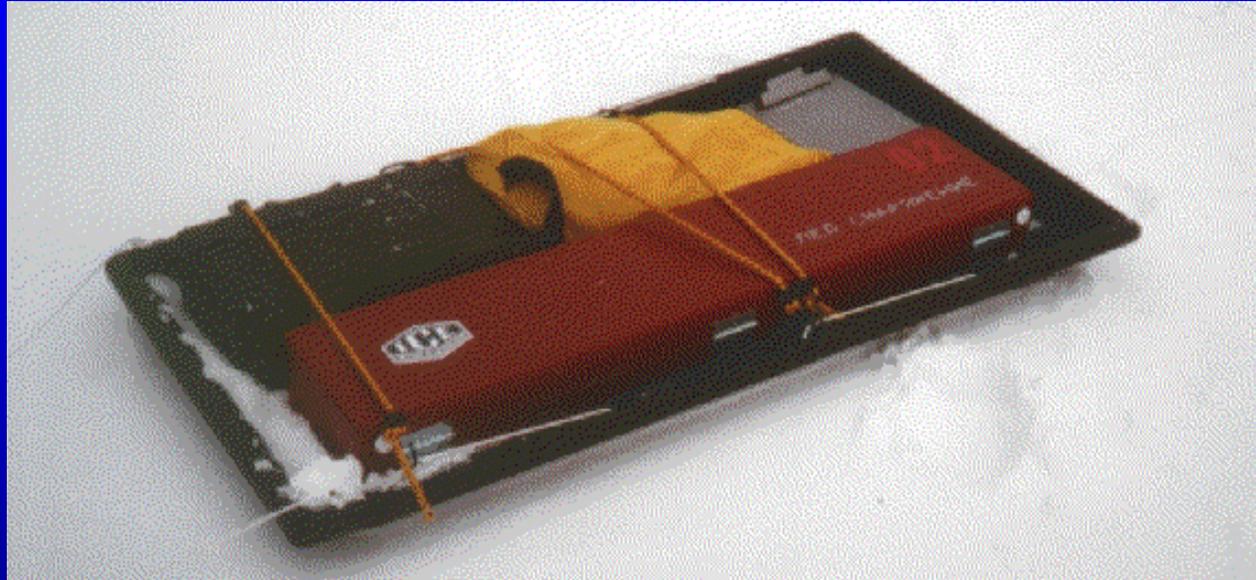
Measure ice thickness.

- **Drill holes at regular intervals**

Walk only in the footsteps of the leader.

Keep distance between people moving on the ice.

Minimize time spent on the ice



**Example: all equipment necessary
loaded on tote sled**



Walk only in the footsteps of others



Always work in pairs
Check the ice
Keep distance

Field Data Collection

Type of ice jam

- **Freezeup**
- **Breakup**
- **Predominant ice type**
- **Ice piece size**
- **Jam formation observed?**

***Location and extent of jam,
jam progression***

Jam toe



Head of jam

Upstream ice supply

- **Volume of ice (length, thickness)**



high frazil concentrations

vs.

low frazil concentrations



Upstream ice supply

- **Condition of ice (e.g., competent, weak, jam)**



Downstream ice conditions

- **Length**
- **Thickness**
- **Condition**
- **Open water areas**
- **Likelihood of jamming downstream**

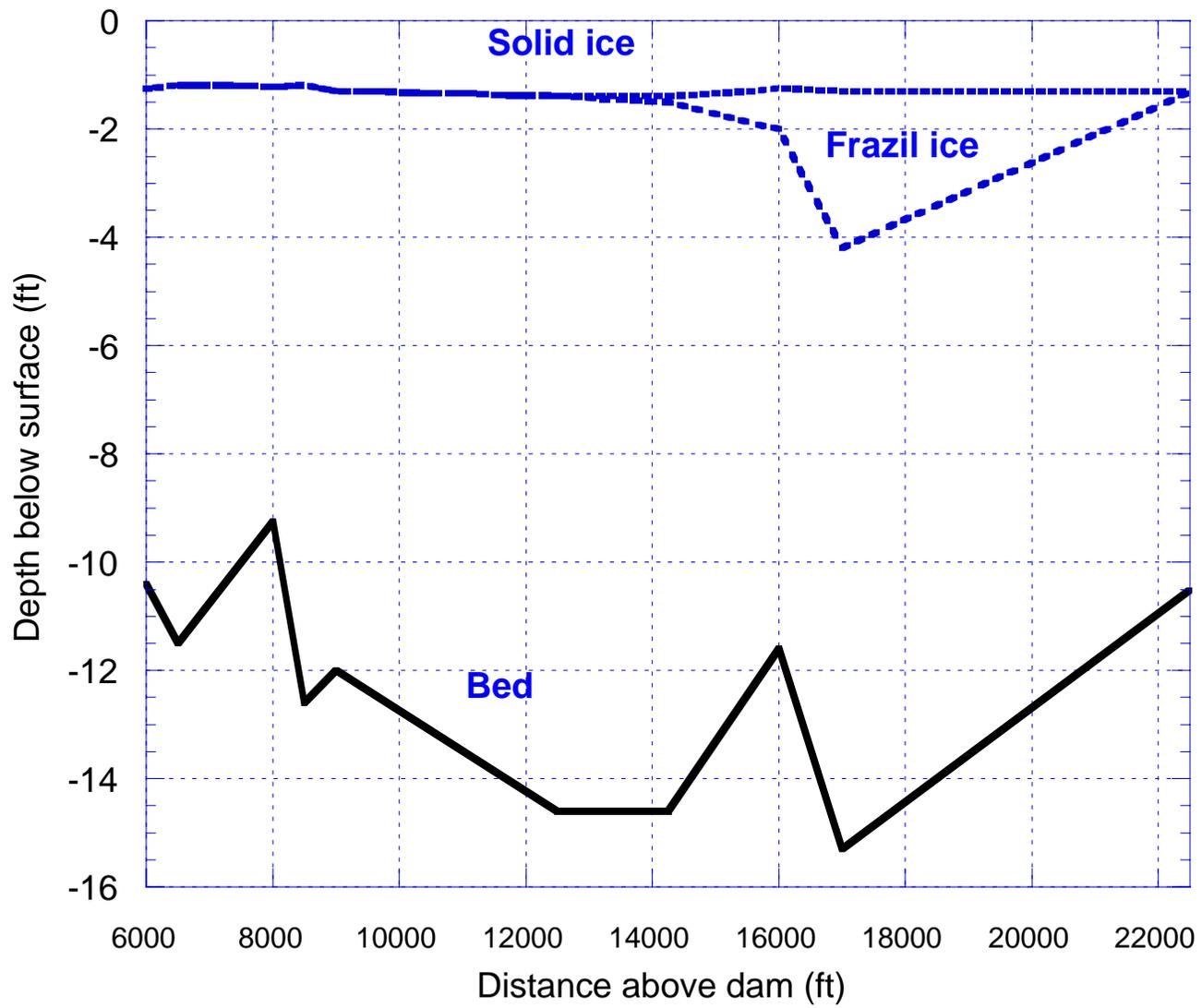
Discharge

- **Event discharge**
- **Present and forecast discharge**
- **Potential for flow control**



Ice thickness

- **Seasonal USGS measurements available?**
- **Direct measurements**
- **Indirect measurement (e.g., ice blocks left on shore, tree scars, ice collars, high water marks)**



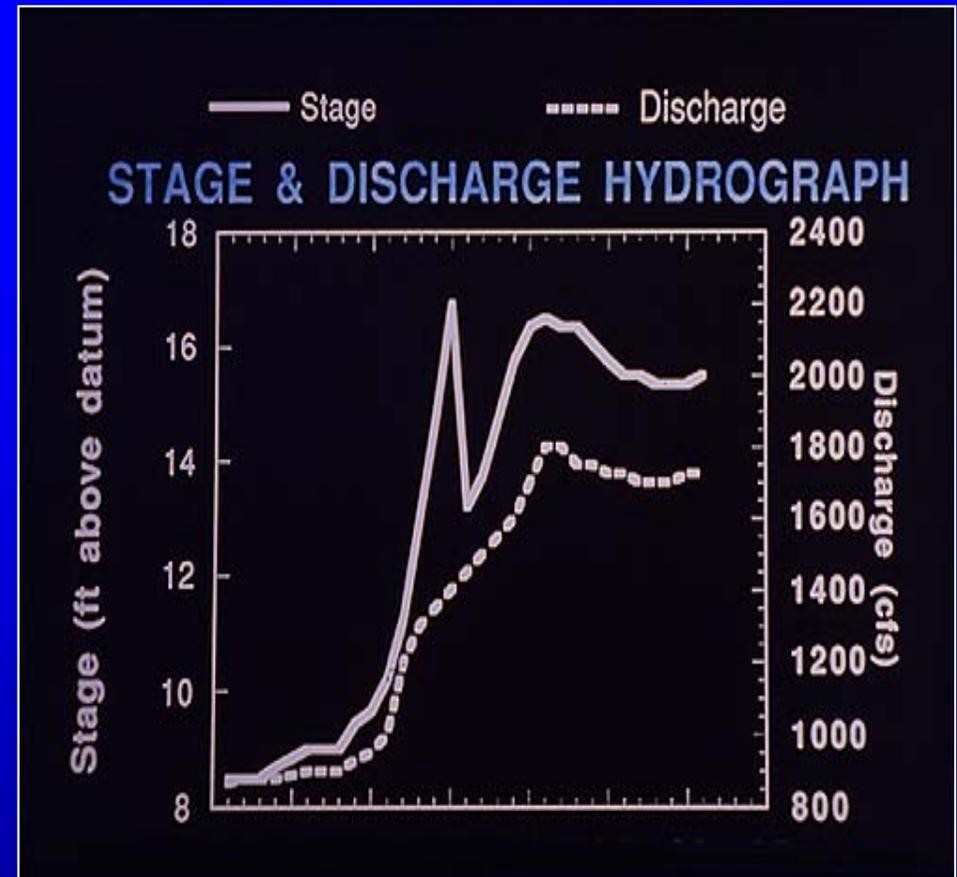
Ice thickness, competence



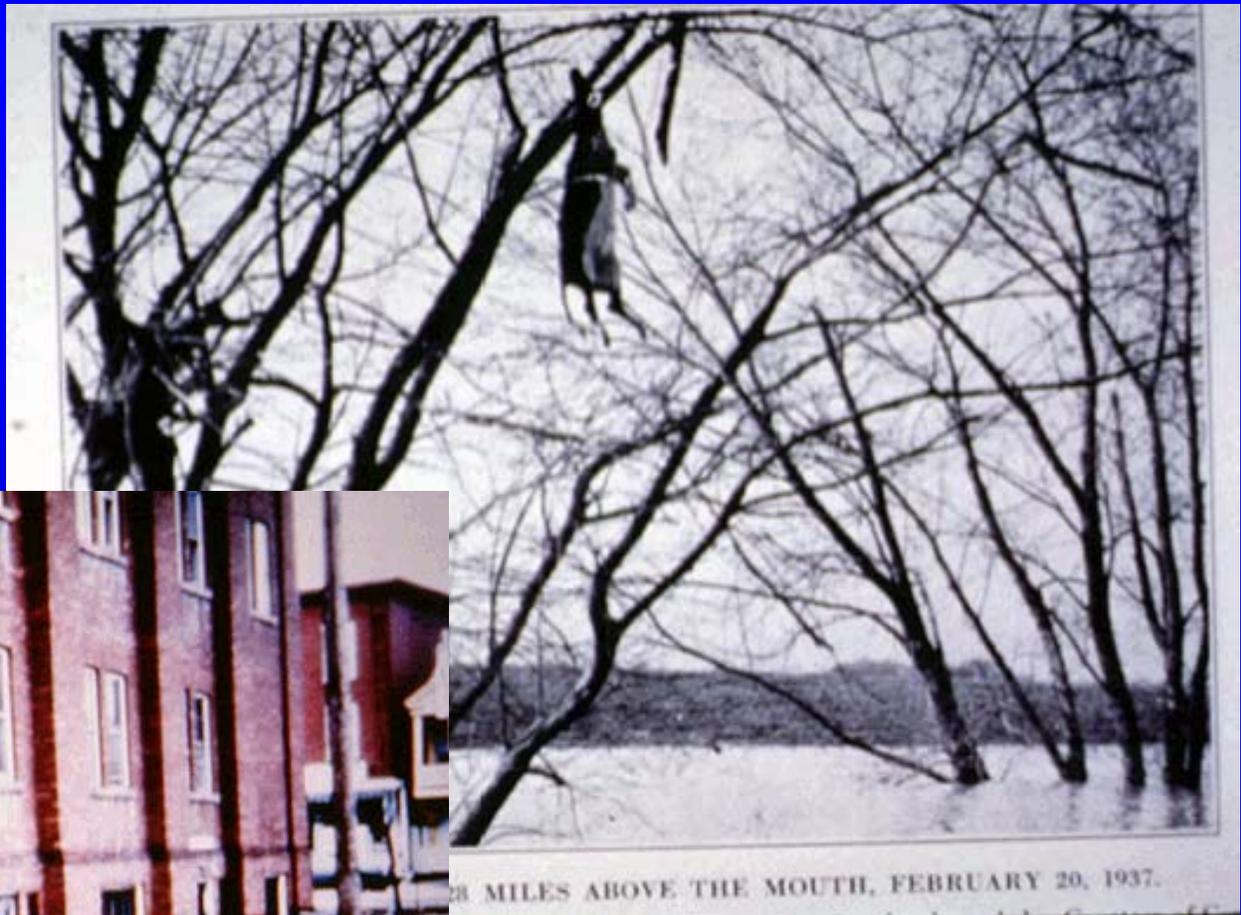
Water / ice stage

- **Present stage**
- **Rate of change in stage**
- **Potential flooded areas**
- **Direct measurements**
- **Indirect**

(e.g., high-water marks, ice collars, tree scars)



High water marks





Ice collars





*Tree scars,
old and new*



Air temperature

- **Present**
- **Forecast**

Water temperature

- **Present**
- **Forecast**

Last But Not Least

**Remember to send your
ice event information to
CRREL for inclusion in the
Ice Jam Database and Ice
Jam Archives!**

lourieh@crrel.usace.army.mil

V: 603-646-4378

F: 603-646-4477