



**GDAŃSK UNIVERSITY
OF TECHNOLOGY**

Ice Jam Flood Mitigation Methods

Tomasz Kolerski , PhD, DSc.

Civil and Environmental Engineering, Gdańsk University of Technology

Februray 2021



River Ice Research Engineering and Environmental Problems

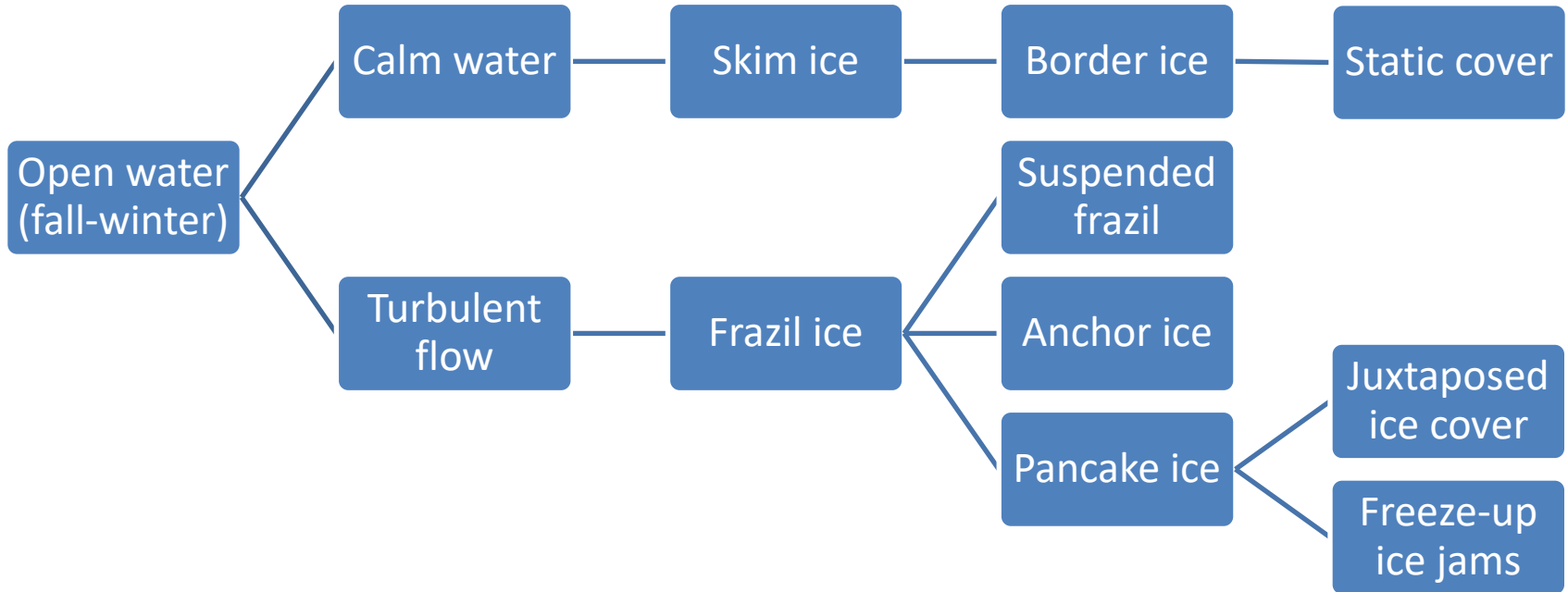
Ice formation can affect many fields of hydraulics, hydrology, civil engineering, ship design and ecology such as for example:

- Ice jamming and flood protection
- Ice damage on shoreline and onshore facilities
- Ice load on bridge and bridge piers
- Sediment transport problems
- Design of Icebreakers and arctic ships
- Habitat improvements projects and river restoration in cold regions



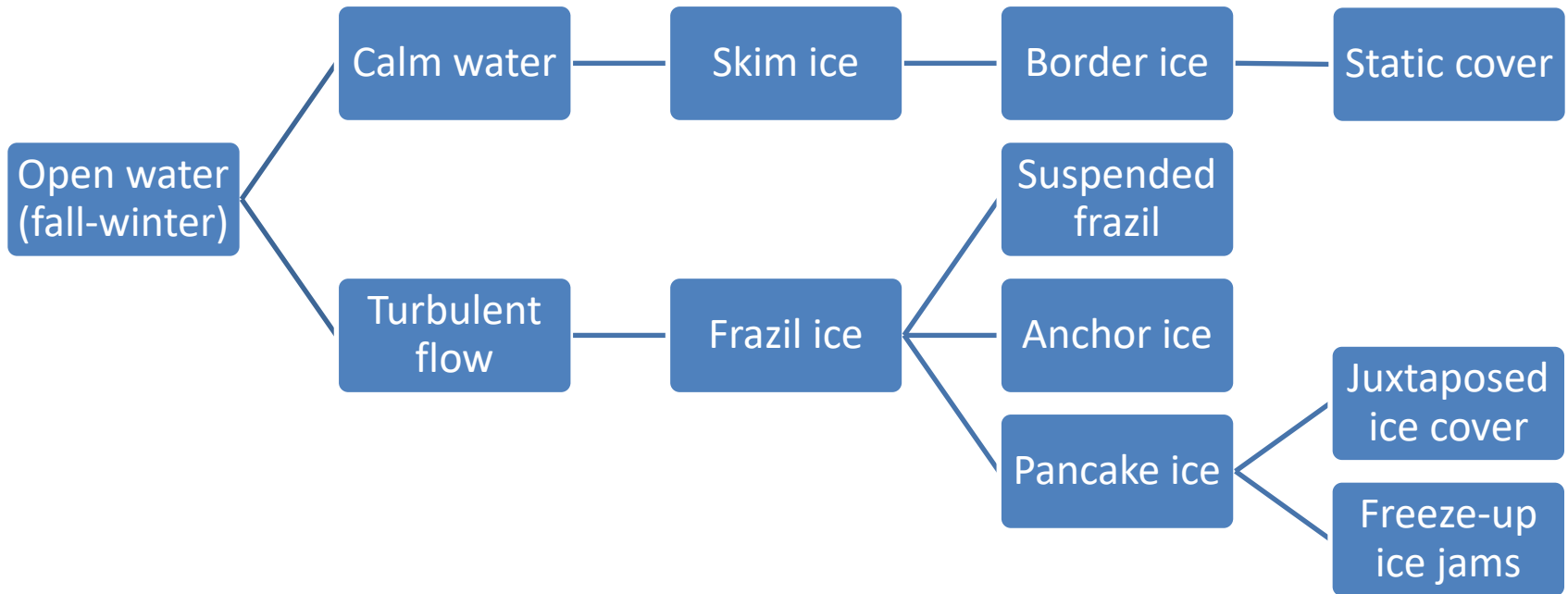


River ice formation processes



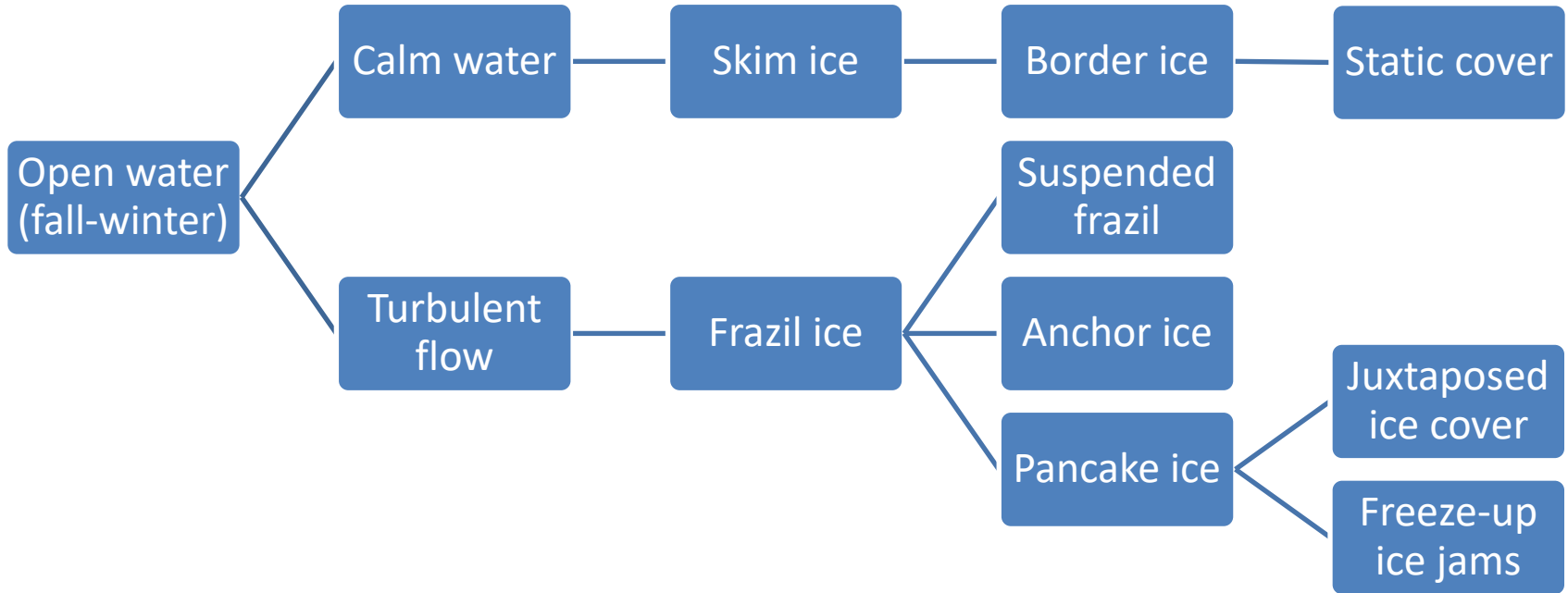


River ice formation processes



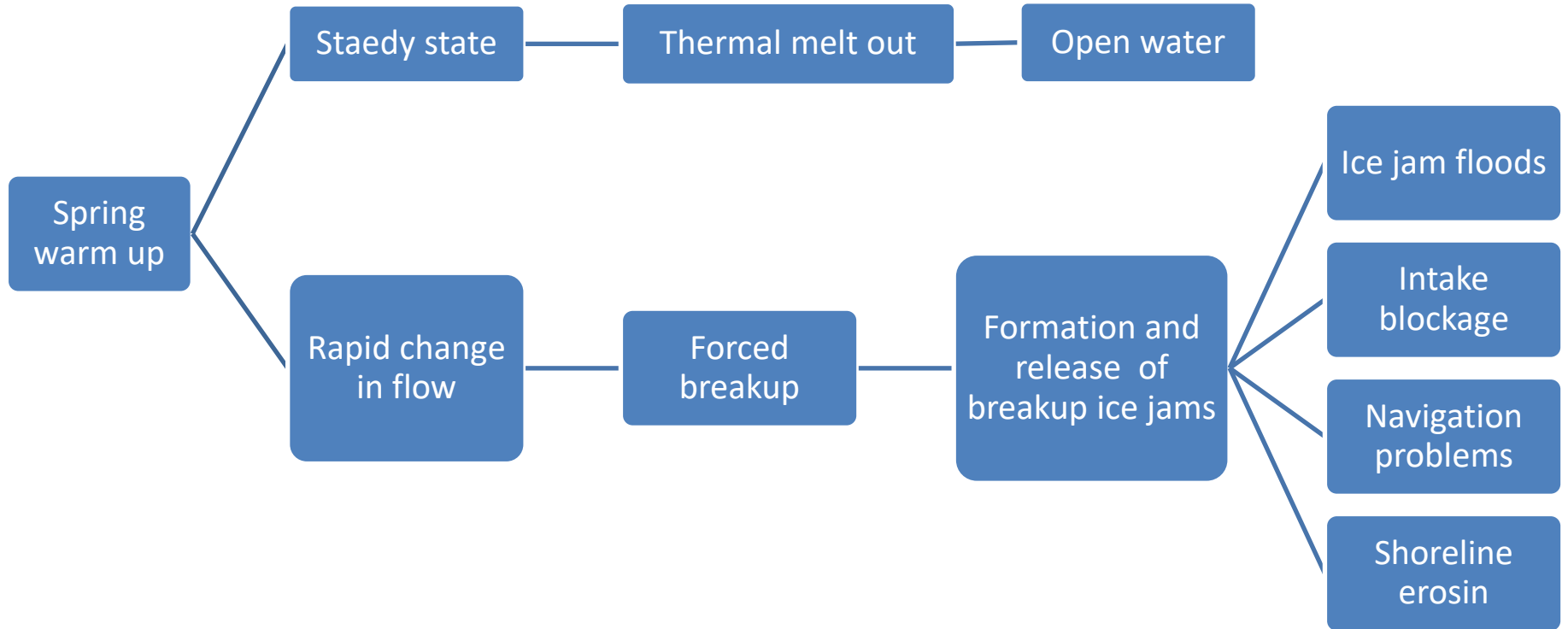


River ice formation processes



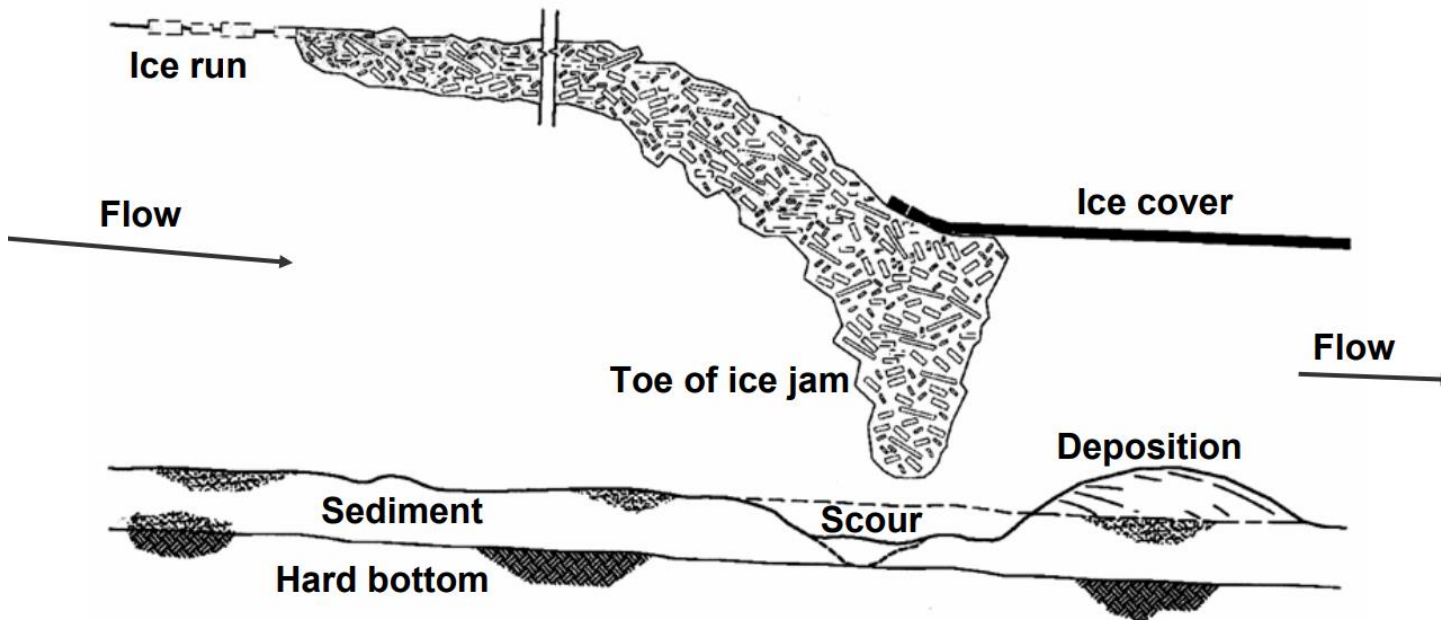
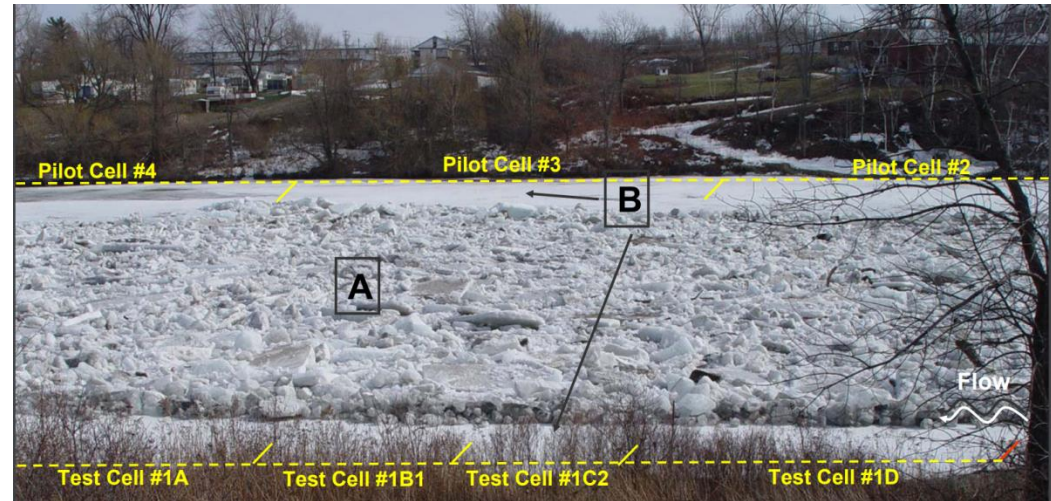


Breakup process





Ice jam formation





- Non-structural – artificial breakup
 - Ice blasting
 - Excavators; dredging machines
 - Ice breakers (vessels or hoovers)
- Structural measures
 - Ice control structures
 - Ice booms





Non-structural ice control methods

Ice blasting

- Has been used to remove ice jams and as artificial breakup prior to the ice breakup period in spring
- Usually implemented as a last resort





GD AŃSK UNIVERSITY
OF TECHNOLOGY

FACULTY OF CIVIL AND ENVIRONMENTAL
ENGINEERING

Non-structural ice control methods

Ice removal by means of excavators



Barge mounted excavators

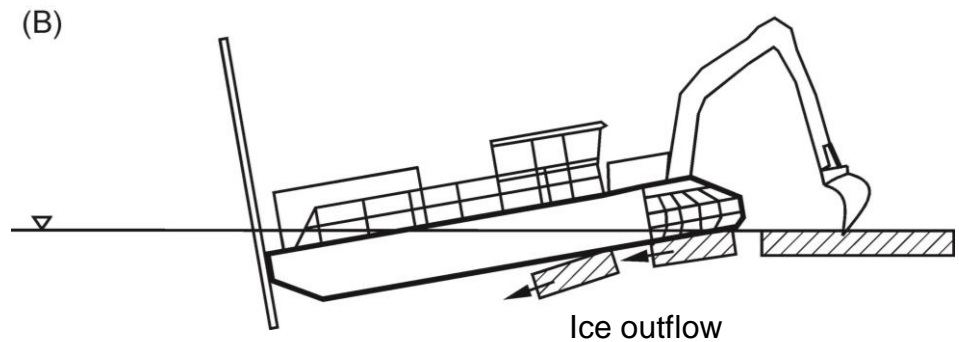
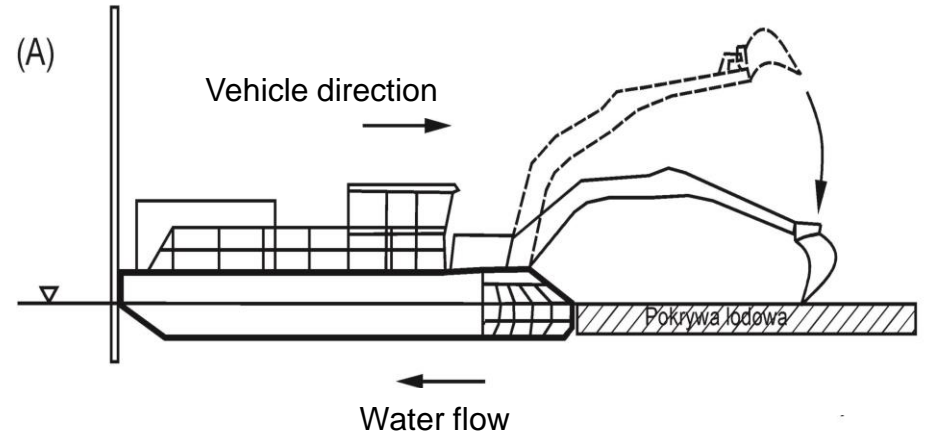
Amphibious excavator



**GDAŃSK UNIVERSITY
OF TECHNOLOGY**

FACULTY OF CIVIL AND ENVIRONMENTAL
ENGINEERING

Non-structural ice control methods amphibious excavator (Amphibex)





**GDAŃSK UNIVERSITY
OF TECHNOLOGY**

FACULTY OF CIVIL AND ENVIRONMENTAL
ENGINEERING

Non-structural ice control methods

Ice breakers

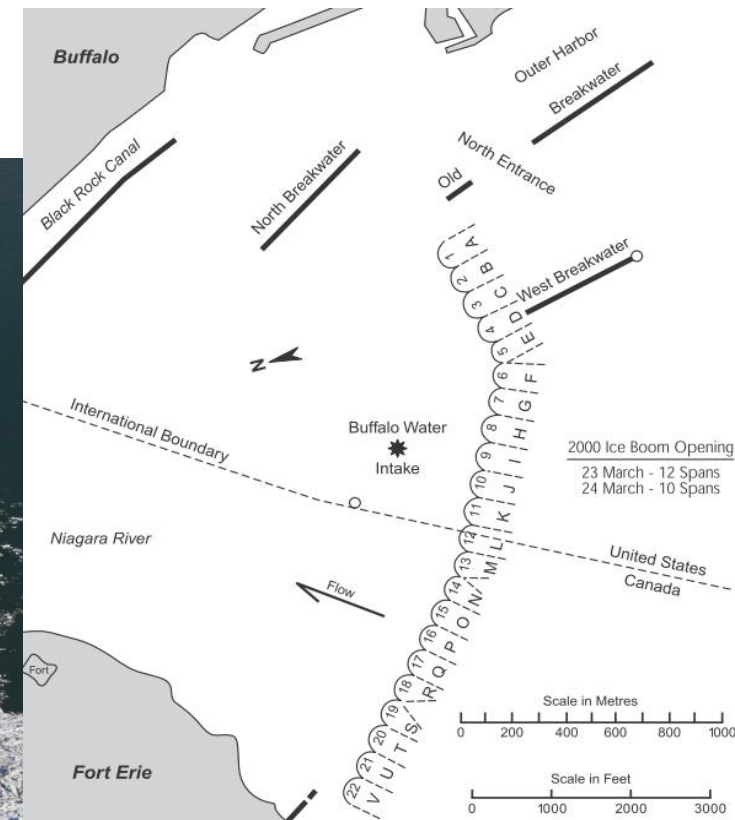




Structural ice jam mitigation methods

Ice booms

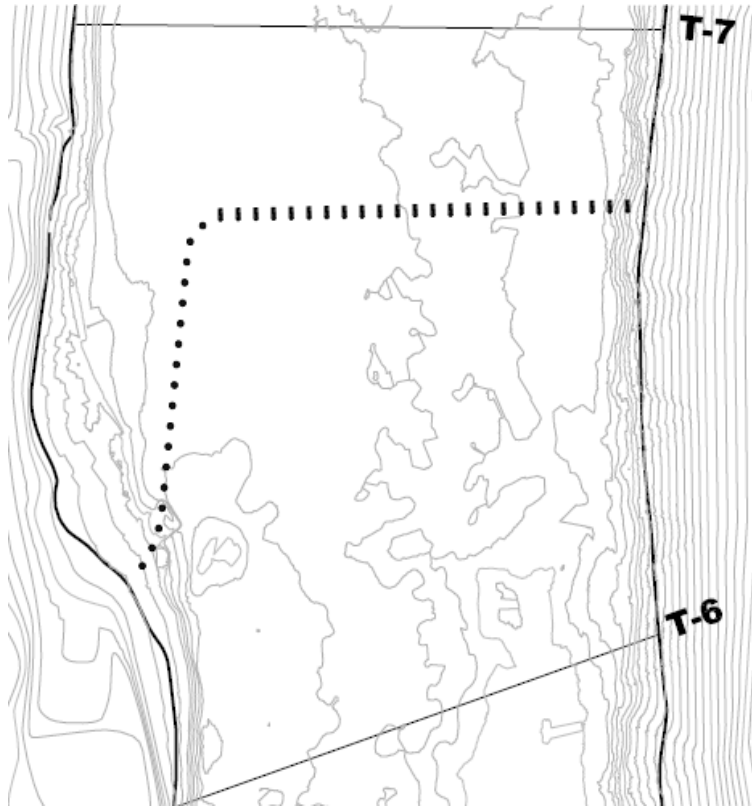
- Barrier which will stop ice and allow water to flow
- Dynamic ice cover will build up upstream
- There are conditional factors for ice stoppage
 - Critical Froude number,
 - Erosion velocity
 - Critical ice load





Structural ice jam mitigation methods

Ice control structures



Pier-type ICS,
ICS will stop ice run unconditionally
Ice leakage may occur

Grasse River, Massena NY





**GDAŃSK UNIVERSITY
OF TECHNOLOGY**

FACULTY OF CIVIL AND ENVIRONMENTAL
ENGINEERING



**GDAŃSK UNIVERSITY
OF TECHNOLOGY**

**HISTORY IS WISDOM
FUTURE IS CHALLENGE**

