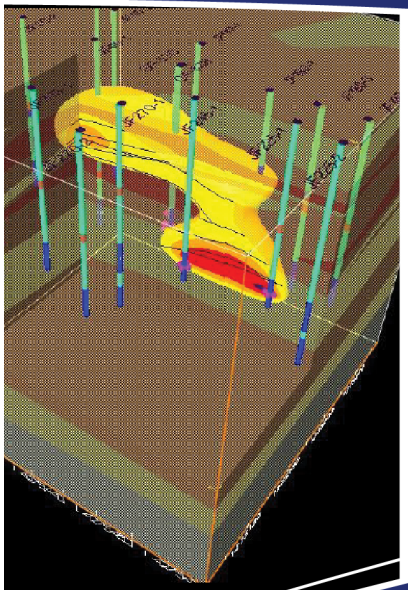


Adaptation to Weather Impacts Grasse River Superfund Site

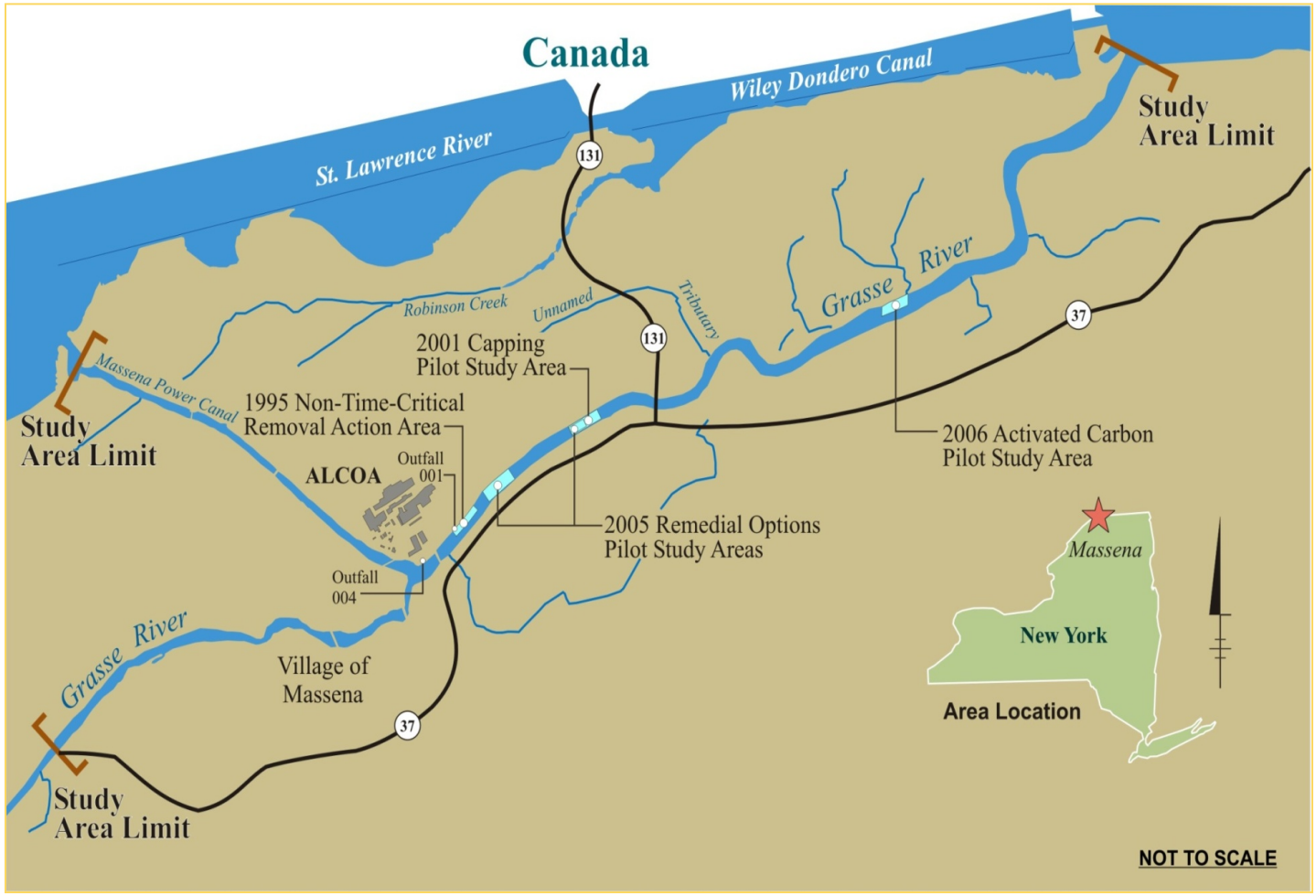
Young S. Chang

EPA Region 2 RPM

United States Environmental Protection Agency

Climate Change Adaptation Webinar 4/1/2015 cluin.org

Site Location & Background



- Located in Massena, NY bordering Canada
- Site is the lower 7.2 miles of the Grasse River
- Tributary to the St. Lawrence River
- PCBs in sediment and water column
- Fish Advisory: "Eat None"

History of Grasse River Development

- 1898 - 1903: Power Canal Construction
- 1902: Pittsburgh Reduction Company (Alcoa, Inc.) constructs aluminum plant in Massena
- Early 1900s: Lower Grasse River excavated, deepened and widened to support the increased flows from the Powerhouse

History of St. Lawrence River Development

- 1954: Construction of the Eisenhower Locks System and the Moses-Saunders Power Dam (FDR Project), US & Canadian development project of the St. Lawrence River
- 1958: FDR Project started supplying hydroelectric power to Alcoa plant and ceased operation of the Massena Power Canal/ Powerhouse

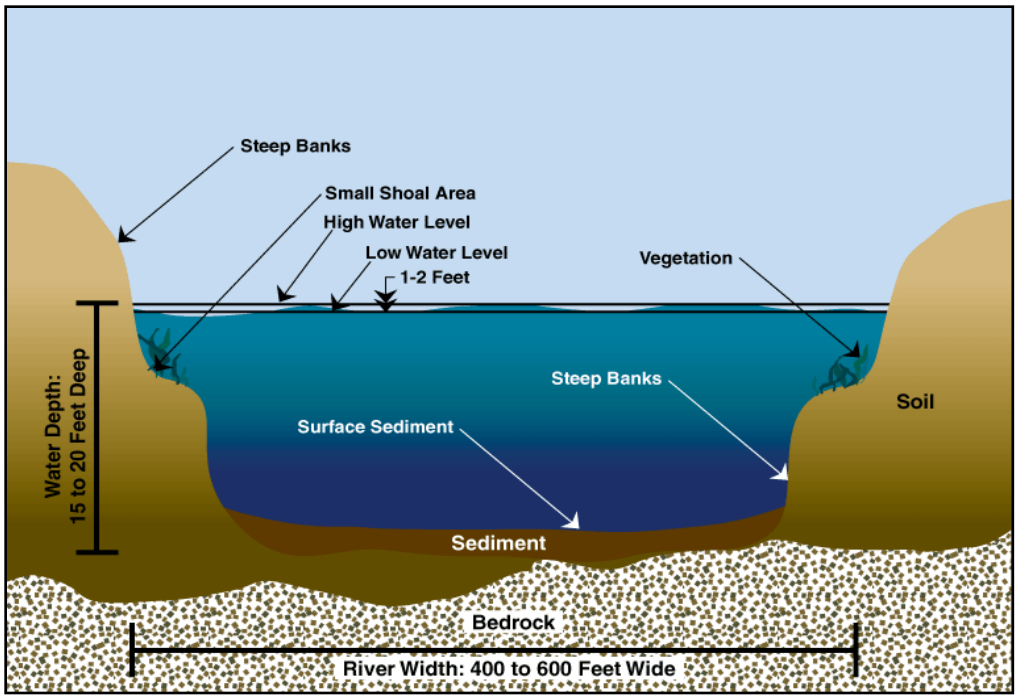
Typical Cross Section of Grasse River

The lower Grasse River has been greatly altered to carry much more flow:

- Deepened bank-to-bank to 15 to 25 feet
- Widened to 400 to 600 feet
- Hard bottom of bedrock, till and glacial clay

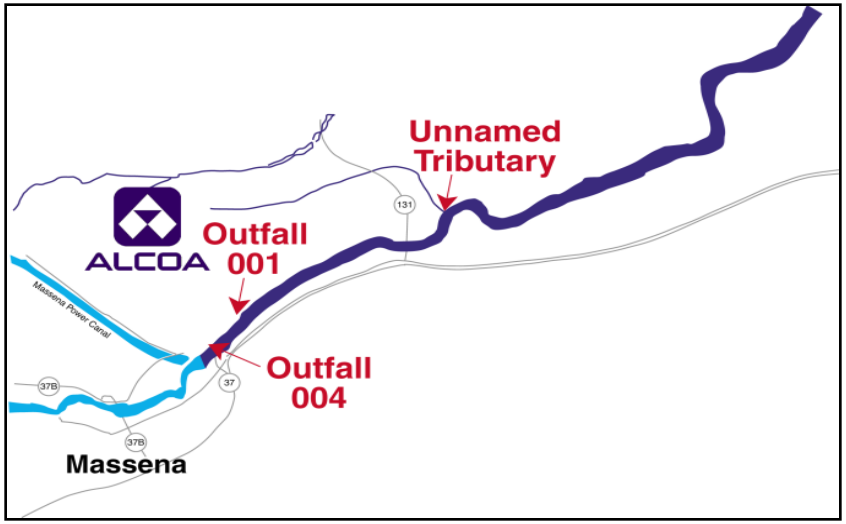
In 1958, when Power Canal stopped operating:

- Flow velocities in the river became very low
- Main channel began filling in with sediment



Site History

- Alcoa discharged wastewater containing PCBs
- Waste was discharged into the lower Grasse River through outfalls and Unnamed Tributary
- Mid-1970s, Alcoa stopped using oil containing PCBs
- Under the 1985 NYSDEC Order, Alcoa conducts remediation of the land based waste disposal areas, completed in 2001



Site History (cont'd)

- 1989: Administrative Order for the investigation, development of cleanup alternatives, and design and implementation of a remedial action
- 1991: Remedial investigation initiated
- 1995: Administrative Order Amendment, conduct Non-Time Critical Removal Action (NTCRA)
  - 3,000 cubic yards of sediment, boulders, and debris removed from Outfall 001 area
- From 1991 to 2010, numerous studies were conducted to define the extent of contamination and to develop the alternatives for cleanup
- Several pilot studies and demonstration projects of various technologies also conducted

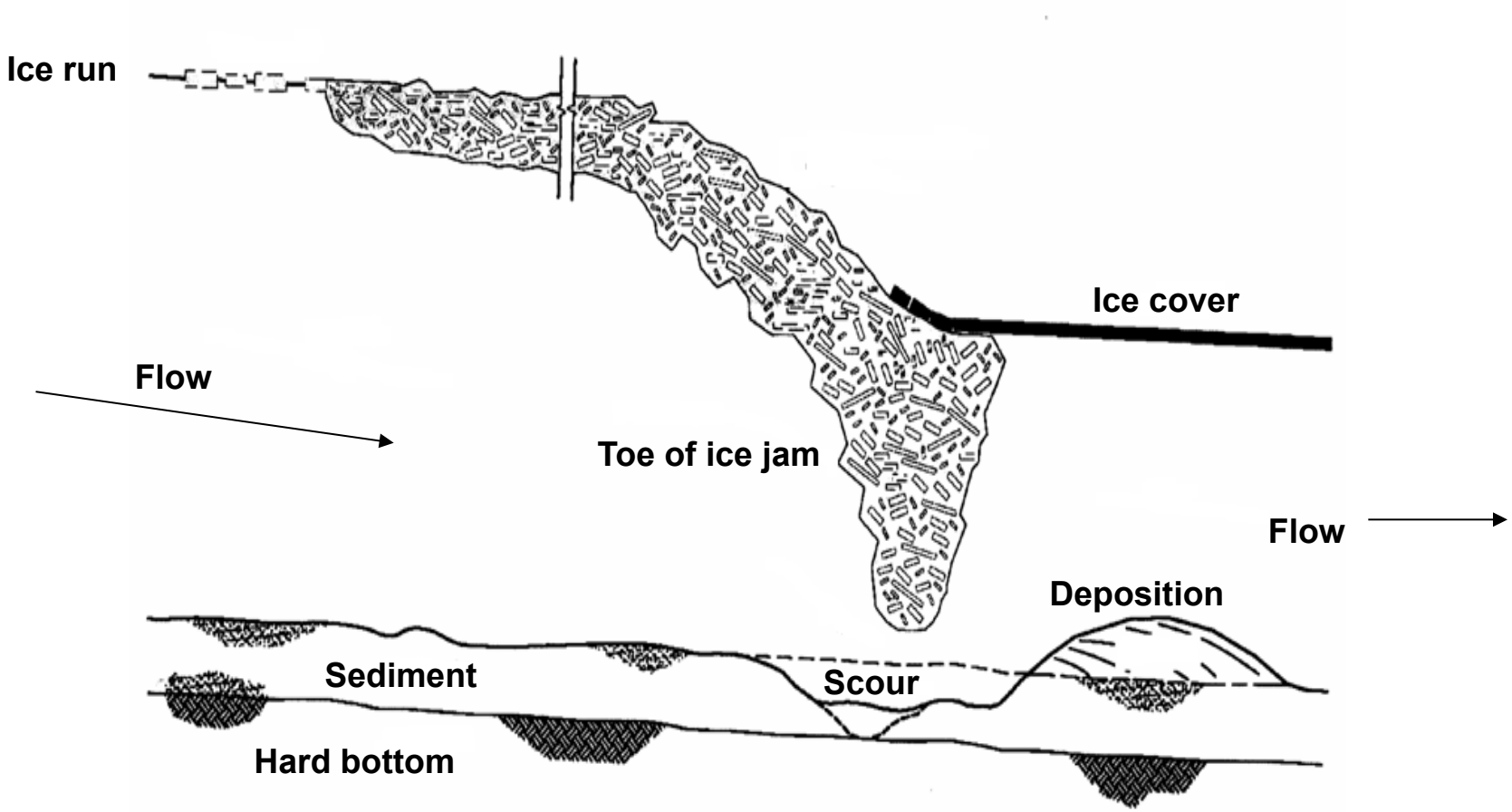
2001 Capping Pilot Study

- Capping material placed over 7 acre area to evaluate
  - Various Cap Materials & Designs (alone and combo)
    - 1:1 sand/topsoil mixture
    - Granulated bentonite
    - AquaBlok™
  - Alternative Placement Techniques (alone and combo)
    - Surface and subsurface placement w/ mechanical clamshell
    - Subsurface placement via tremie
    - Surface placement w/ pneumatic broadcasting (bentonite only)
- Evaluate cap coverage effectiveness, extent of entrainment, water quality impacts, benthic organism recolonization and cost

Discovery of Weather Impact

- During post CPS implementation monitoring, discovered loss of some capping material and underlying sediment
- Even though extensive information had been gathered on the site regarding sediment and cap stability under various flow conditions, including low frequency high flow event, “ice jam” related scouring were not known previously
- Before the discovery in 2003, EPA Region 2 was getting ready to finalize the proposed plan.
- **After the discovery – back to the drawing board**.

Profile of Ice Jam



March 2003 Ice Run Photo: Grasse River

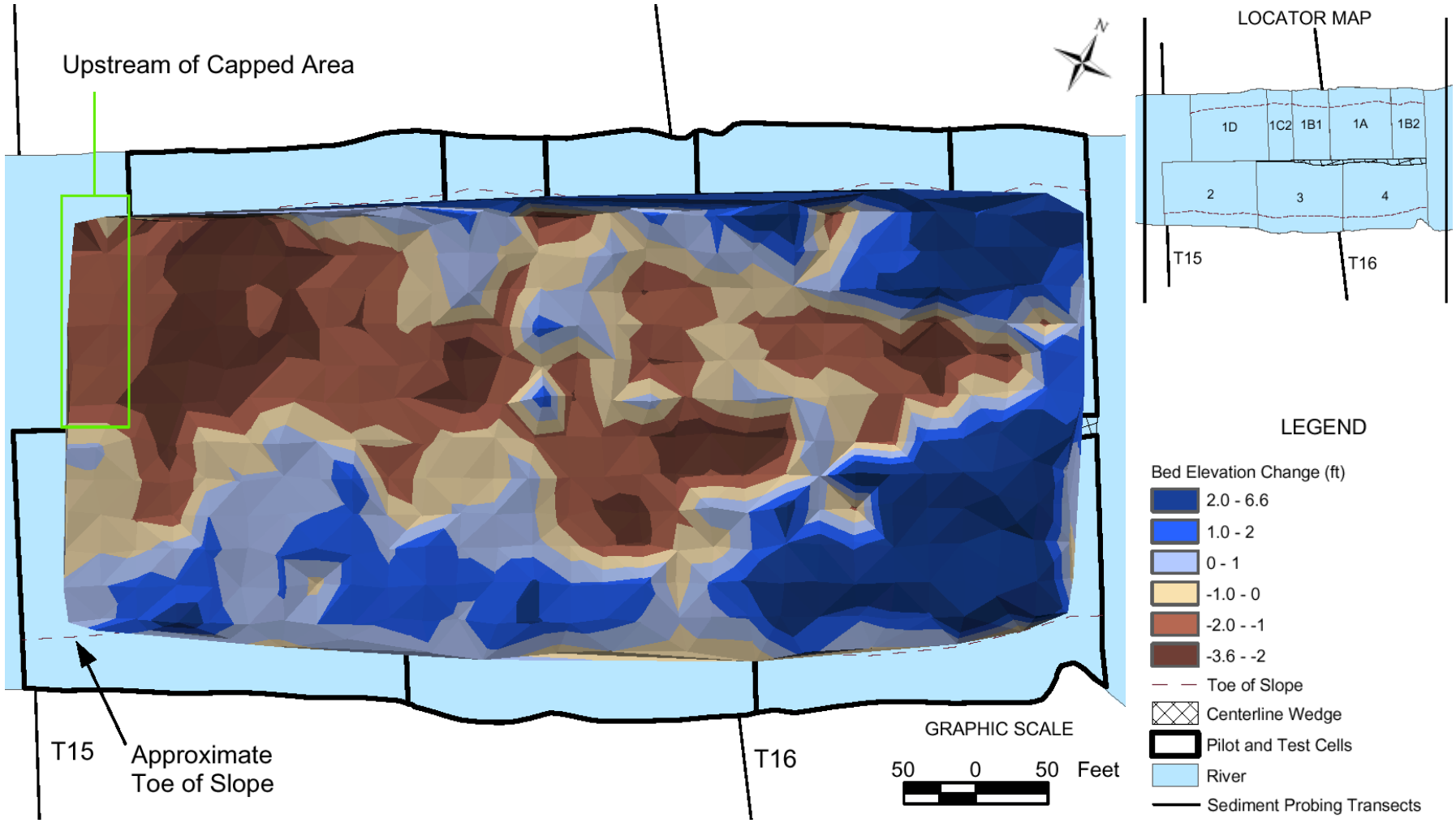
Studies Conducted to Understand Ice Jam Related Resuspension

- Review
  - Photographic Documentation of 2002-2003 ice formation and breakup
  - Hydrometeorological conditions
  - Historic information pertaining to occurrence of past ice jams in the river, including interviews
- Geophysical surveys of river bottom
- Sediment samples for physical and chemical characterization
- River bank soils for PCB analysis
- Manual sediment probing
- Underwater videography

Studies Conducted to Understand Ice Jam Related Resuspension (cont'd)

- Numerical DynaRICE modeling the 2003 ice scour event and turbulence generated underneath the toe of the ice jam
- Hindcasting analysis of river flows and ice thicknesses for past winters
- Tree scarring surveys
- Stratigraphic analysis of sediment core with cesium dating
- Collect high-resolution sediment core

Bed Elevation Change in the Capping Pilot Study Area



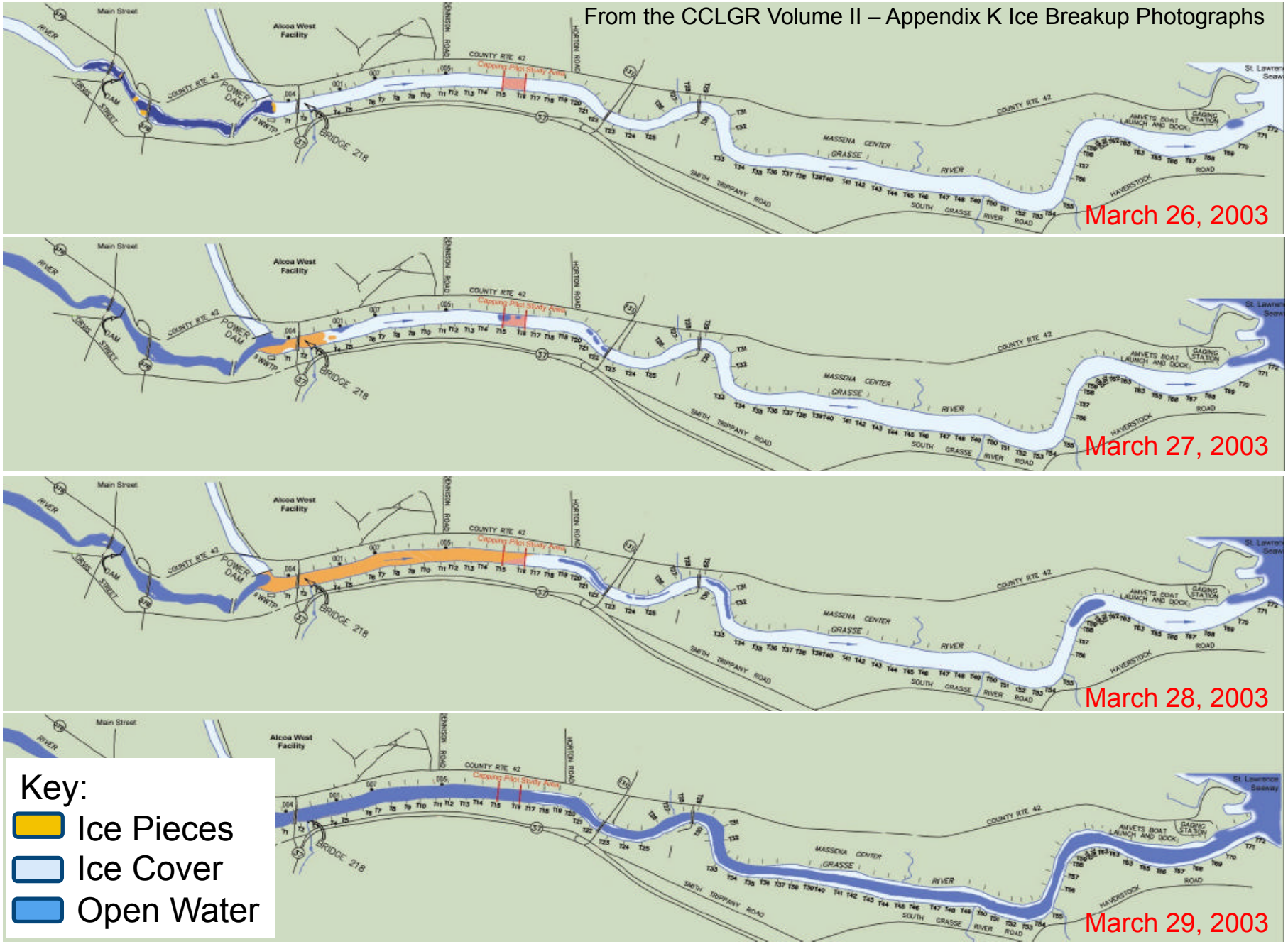
*Values represent average change measured at each grid node in May 2003

Figure provided courtesy of Alcoa

Ice Investigation Results

- Ice jams can occur in upper 1.8 miles of river
- Ice jams can scour and redistribute PCB contaminated sediment
  - Scour is caused by increased flow and turbulence under the toe of an ice jam, not ice itself
  - Not all sediments in the upper 2-mile stretch will scour during an ice jam event
  - Frequency seems to be about once every 8-10 years
  - Near-shore shallow sediments not significantly effected

From the CCLGR Volume II – Appendix K Ice Breakup Photographs



Ice Breakup Photo

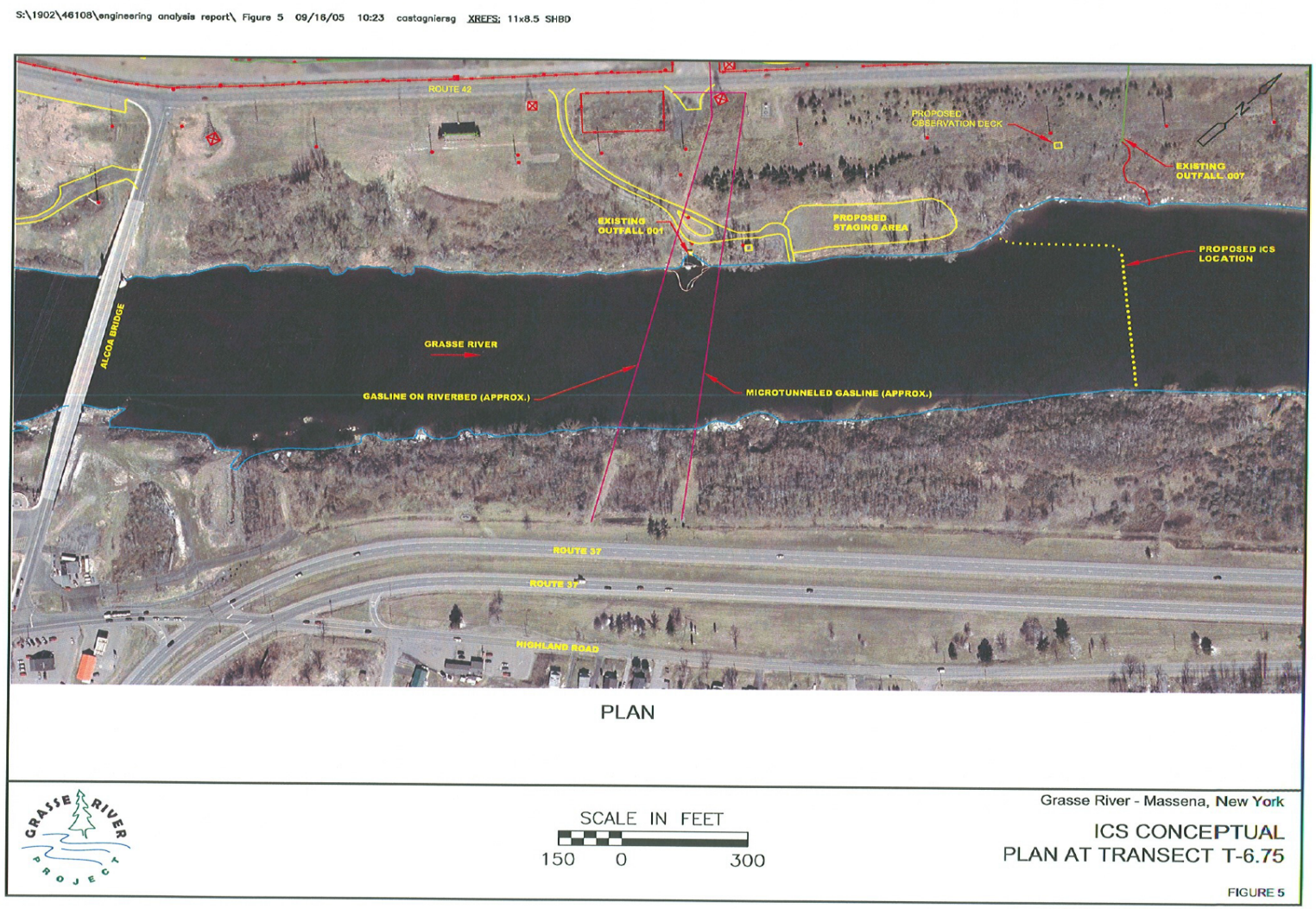
Note:
A. Ice is piled up approximately 4 feet above the water level in MC.
B. Remaining shoreline ice along leading edge of ice buildup.

From the CCLGR Volume II – Appendix K Ice Breakup Photographs

Ice Control Options Evaluated

- Structural options
  - Pier-type ice control structure (ICS) at various locations
  - Evaluated both numerical modeling and physical modeling study at the USACE Cold Regions Research and Engineering Laboratory in New Hampshire.
  - Placement of Armored Cap Design during 2005 pilot study
- Non-structural option
  - Ice Breaking Demonstration Project
  - Consideration of Ice Booms to Retain Ice

ICS Conceptual Plan at T6.75



Modeled Ice Control Structure

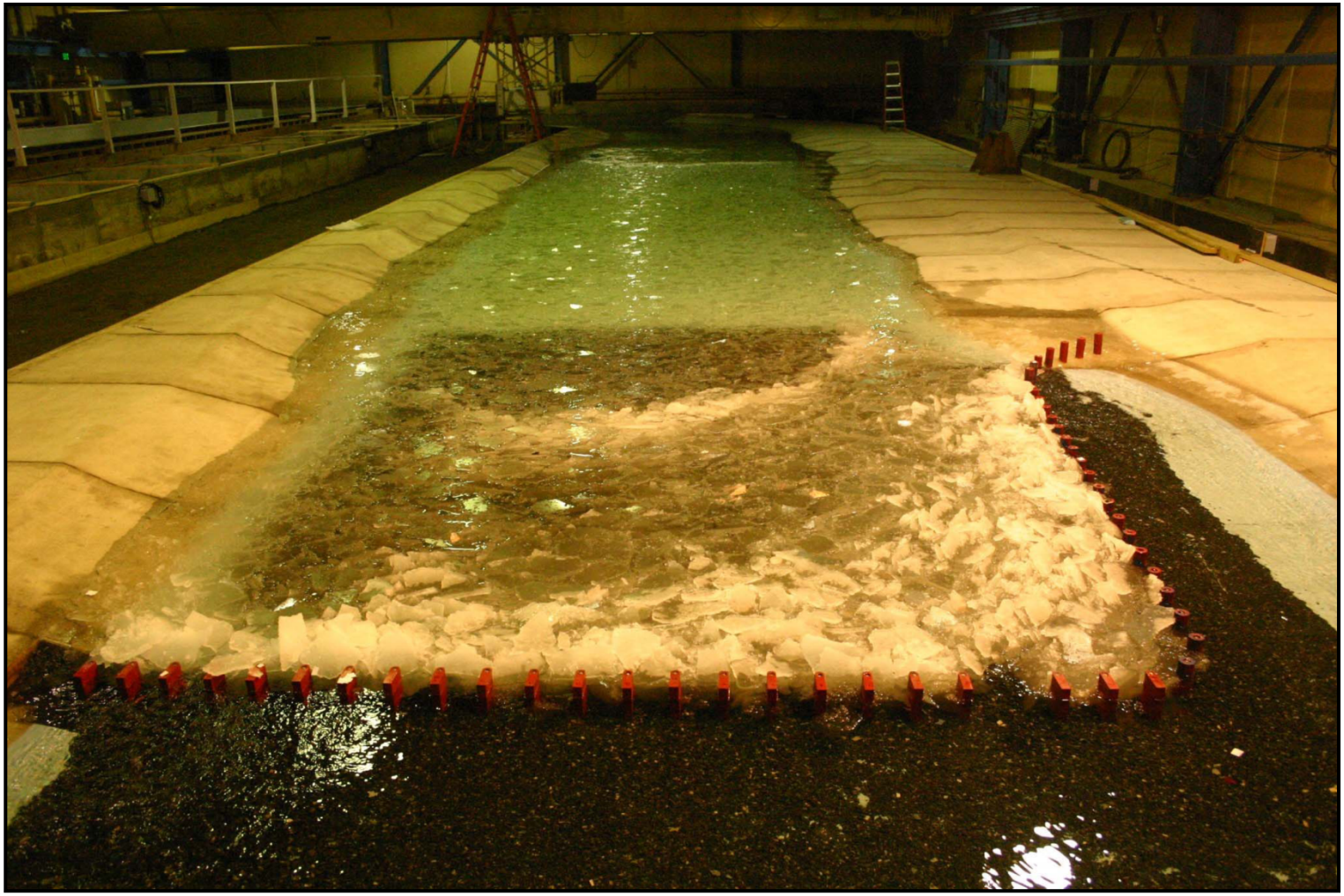


Figure 2.19 from the Grasse River T6.75 Ice Control Structure Basis of Design Report (Alcoa, 2009)

2007 Ice Breaking Demonstration Project

Ice breaking start at Reynolds along St. Lawrence River

Ice breaking mid-Grasse River

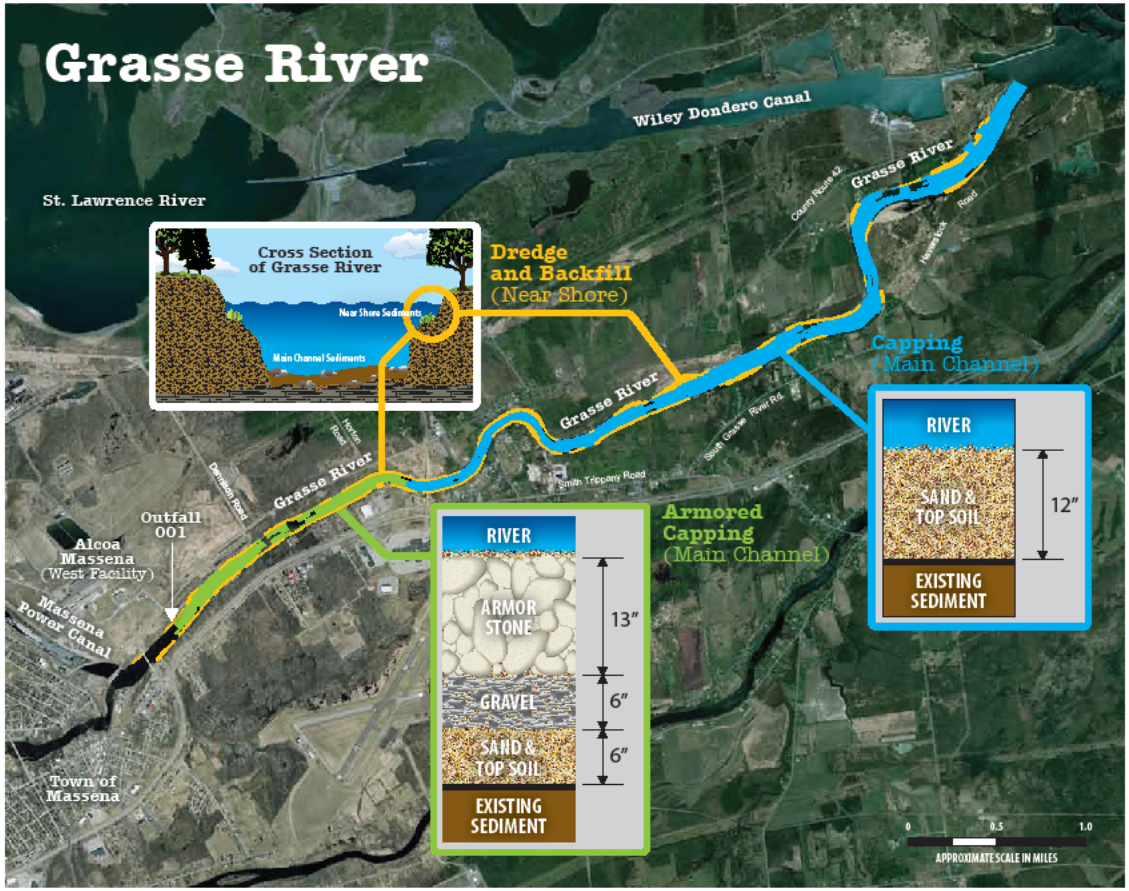
Haverstock looking downstream refreezing

Pictures from Aecom and Alcoa

Impacts to the Remedy

- The Proposed Plan was released in September 2012
  - Scour due to 2003 Ice Jam event caused nine additional years of RI/FS and 3 different pilot studies/ demonstration project conducted
  - Pre-2003 draft proposed plan had capping component but it did not take scouring due to ice jam event into consideration
- Selected remedy of 2013 also has capping components, but the cap in the upper two mile will be armored to protect chemical isolation cap and the underlying sediment

Selected Remedy



Questions