

## **Keeyask Generation Project – Request to Install Additional Ice Boom Sections**

### **Description of Construction and Potential Environmental Effects**

The Keeyask Environmental Impact Statement indicated there would be one ice boom located approximately 3 km upstream of the powerhouse, the purpose of the ice boom is to initiate the development of an upstream ice cover.

Ice booms were installed in the Nelson River in 2013 and 2014, both booms were unsuccessful. Design modifications have occurred and it has been determined that multiple ice booms are required to ensure ice bridging occurs upstream of Gull Rapids. It is proposed that two ice booms are installed in the summer of 2015, see attached figure for locations.

#### **Background**

A critical requirement of the river management strategy for the Keeyask Generating Station Construction Project is the formation of a stable ice cover upstream of the construction site on Gull Lake. With a competent ice cover on Gull Lake early in the winter season, it will prevent significant amounts of frazil ice from passing through the rapids and forming a hanging ice dam at the entrance of Stephens Lake. A severe build up of frazil ice at the lake entrance causes water levels through the south channel of the rapids to rise where the primary construction activities are taking place.

A test ice boom was installed in Fall 2013 for a one year test period. The anchor system failed at the end of the spring breakup season (May 2014) due to a stronger than normal ice cover (due to cold winter and late spring) and the very high spring flows arriving from the south in late May.

Design modifications were incorporated to improve the effectiveness of the ice boom in developing a stable ice cover upstream of the construction site. This included a realignment of the boom to a location slightly upstream of the test location. The boom was installed in the summer of 2014. On November 10, 2014, there was a partial failure of the ice boom. This resulted in no stable ice cover formation upstream of Gull Rapids and portions of the Nelson River remained open from Gull Rapids to Split Lake until late January 2015. As a result the following took place to protect the project infrastructure:

- Powerhouse cofferdam top up, at first to a crest elevation of 151.8 m and this was later increased to 153 m (7 m more than the original design crest elevation);
- Extension of the north channel rock groin into the south channel of Gull Rapids to promote the formation of an upstream ice cover at one of the naturally occurring ice bridge locations, upstream ice cover still did not form as of Dec 2014 and early Jan 2015;
- Border ice cutting was attempted in Dec 2014 without the use of explosives, attempt was unsuccessful; and
- A subsequent attempt was made to mobilize a large piece of border ice to form the ice bridge and initiate the ice cover which utilized ice cutters and detonating cord (Jan 2015), this attempt was also unsuccessful.

Additional analysis of the hydraulic and ice conditions has occurred and it has been determined that two ice booms are required.

### **Description**

Two additional ice booms are proposed to be installed in the Nelson River at Caribou Island, one on the northeast side of the island and the other on the south side. Boom A will require 12 anchors and Boom B will require 26 anchors. The anchors will be 0.4 m in diameter.

Installation of the two booms will take approximately eight weeks commencing in mid-June. Drilling and grouting of the anchors will be conducted within a large diameter hollow pipe, which will extend to the river bed from above the water surface, to avoid the release of grout or drill cuttings to the river. Drilling operations will occur from a barge utilizing the existing barge landing.

### **Potential Environmental Effects and Mitigation**

The potential incremental effects of this proposed alteration are on the aquatic environment.

#### Water Quality

As noted above, drilling and grouting of the anchors will be conducted within a large diameter hollow pipe, which will extend to the river bed from above the water surface, to avoid the release of grout or drill cuttings to the river. Accidental introduction of fuels, oils, and other deleterious substances into the aquatic environment will be mitigated through the use of management measures, including:

- The contractor will prepare an Emergency Response Plan to respond to hazardous waste spills;
- Spent oils, lubricants and filters, etc. will be collected and disposed of at an approved location and in an appropriate manner;
- All materials and equipment shall be operated, maintained and stored in a manner that prevents any deleterious substance from entering the watercourse;
- All hazardous materials will be handled and stored in accordance with Manitoba Regulation 188/2001 "Storage and Handling of Petroleum Products and Allied Products Regulation" and Manitoba Hydro's "Petroleum Tank Code of Practice";
- Refuelling and equipment maintenance activities will occur at least 100 m away from a waterbody, or conducted in a manner to prevent the release of deleterious substances to a waterbody; and
- The contractor will have on-site at all times a spill response kit capable of recovering the largest possible spill on land or water, with staff trained in its deployment.

Due to the isolation of the drilling and grouting within the hollow pipe and management measures to avoid the accidental spills, no effects to water quality are expected.

## Aquatic Habitat and Fish

The river reach where the booms will be installed supports a variety of fish species. Thirty-seven species of fish were documented during fish community studies for the Keeyask Generation Project. The most common large-bodied species in the Nelson River between Birthday and Gull Rapids are Northern Pike (*Esox lucius*), Walleye (*Sander vitreus*), and White Sucker (*Catostomus commersonii*). The forage fish community consists primarily of spottail shiner (*Notropis hudsonius*), emerald shiner (*Notropis atherinoides*), trout-perch (*Percopsis omiscomaycus*), and rainbow smelt (*Osmerus mordax*). Lake Sturgeon (*Acipenser fulvescens*) occurs in this reach in relatively greater numbers than in most other locations on the Nelson River upstream of the Limestone Generating Station. Sturgeon is designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as “Endangered” in the Nelson River.

Mainstem habitat where the ice booms are to be installed may be used for foraging by large-bodied species such as Lake Whitefish (*Coregonus clupeaformis*), Walleye and White Sucker. Spawning by these species is not expected to occur in the immediate vicinity of the ice booms, since they are being installed primarily in a deep portion of the channel, away from shoals or rapids.

Habitat at or in the vicinity of the ice booms is also used by Lake Sturgeon. During the course of the ongoing acoustic telemetry study initiated in 2011, approximately 10% of adult and 5% of juvenile Lake Sturgeon tagged in Gull Lake were detected in river reaches extending approximately 1-2 km upstream and downstream of the two booms. This reach of the river is the furthest downstream area typically used by sturgeon inhabiting the Clark Lake to Gull Rapids reach of the Nelson River and, as such, there are fewer sturgeon than further upstream in Gull Lake. The proximity of sturgeon to the locations where anchors for the ice booms will be installed is not known. Deep channels to the north and south of Caribou Island are known to be used for foraging, and an area north of Caribou Island is known young-of-the-year rearing habitat. Water velocity in the river channel where the ice booms will be installed is too high to provide young-of-the-year habitat, refer to water velocity figure. There is no Lake Sturgeon spawning habitat in the vicinity of the proposed boom locations.

Work will be conducted during the DFO Northern Manitoba restricted activity timing window for instream works (Spring – April 15 to June 30; Summer – May 15 to July 15). These timing windows were established to protect sensitive spawning and incubation periods. Given that spawning habitat is not present at or in the vicinity of the proposed work sites and that mitigation measures will avoid sediment releases and effects to downstream water quality, work during this period is not expected to adversely affect sensitive life stages of fish.

Installation of the ice boom anchors will permanently alter a small amount of foraging habitat; however, the effect of a permanent alteration of 5 m<sup>2</sup> of offshore, moderate velocity (0.5-1.5 m/s) habitat to benthic invertebrate production is not measureable.

Installation of the ice boom anchors will require the drilling of holes in bedrock. Potential effects of underwater noise to fish can include tissue damage, temporary hearing loss, behavioural changes, or immediate death (Normandeau Associates, Inc. 2012). Typically, severe effects are associated with

impulsive sounds such as those associated with pile driving, related to both the peak level of the sound and the cumulative sound exposure (i.e., number of strikes) (Hedges 2011). Given that the proposed method of anchor installation, through the use of drilling, is not associated with impulsive sounds and peak noise levels are lower than pile driving where adverse effects have been documented, acute adverse effects are not expected. This is consistent with the BC Marine and Pile Driving Contractors Association and DFO (2003), which reported that underwater drilling does not generate shock waves and generally has little impact to fish or habitat.

The chronic effects of noise exposure are not well documented. However, fish in the area of the proposed booms have continuous areas of deep river channel habitat that permits ready access to areas away from the noise disturbance.

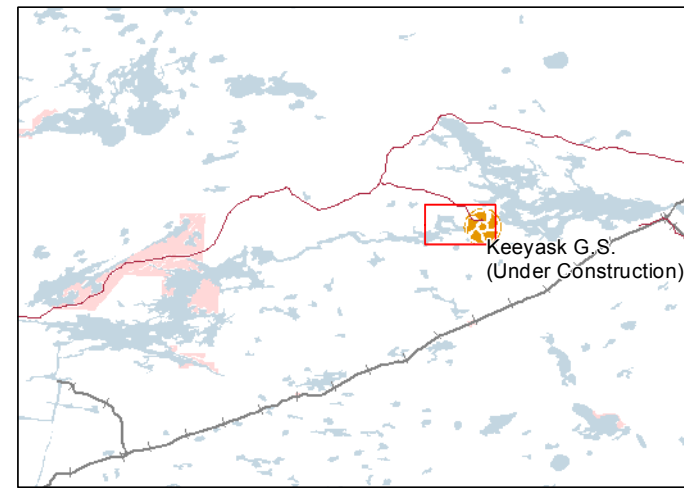
In conclusion, the proposed installation of ice booms is not expected to result in acute injury or mortality of fish in the vicinity of the ice booms. Fish may be temporarily displaced to nearby habitat if they are disturbed by the noise from the drilling.

## **References**

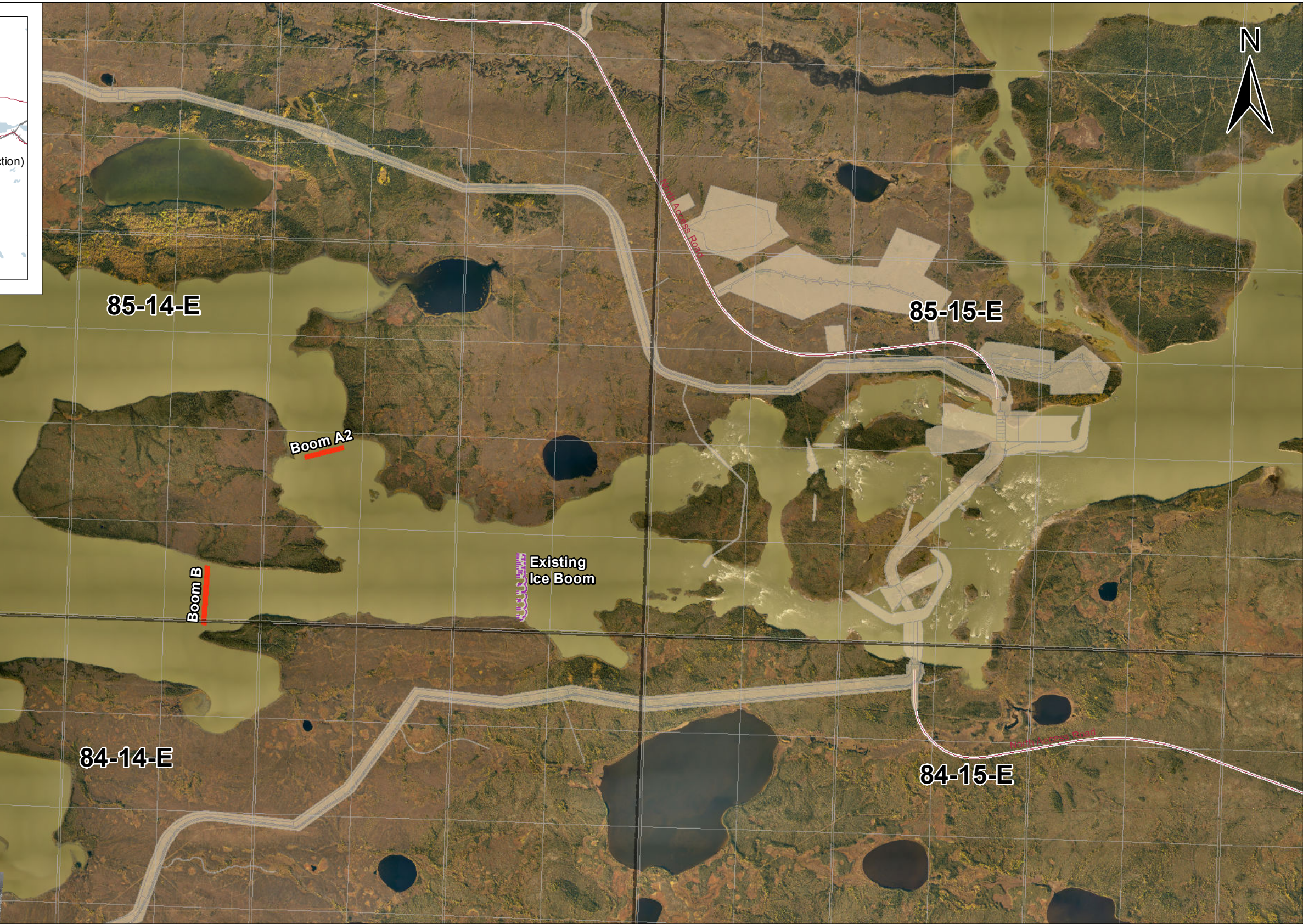
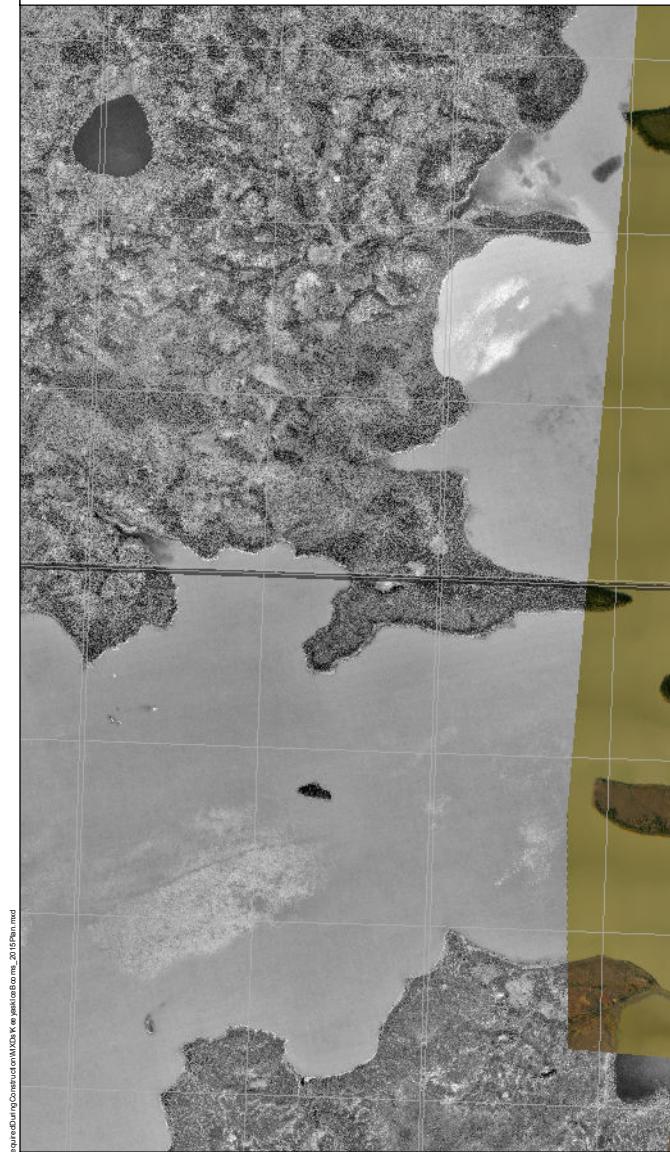
- BC Marine and Pile Driving Contractors Association and Fisheries and Oceans Canada (DFO). 2003. Best management practices for pile driving and related operations. 9 pp.
- Hedges, C.J. 2011. Hydroacoustic impacts on fish from pile installation. Research Results Digest 363. National cooperative Highway Research Program. October 2011. 26 pp.
- Normandeau Associates, Inc. 2012. Effects of Noise on Fish, Fisheries, and Invertebrates in the U.S. Atlantic and Arctic from Energy Industry Sound-Generating Activities. A Literature Synthesis for the U.S. Dept. of the Interior, Bureau of Ocean Energy Management. Contract # M11PC00031. 135 pp.



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Keeyask G.S.  
(Under Construction)



85-14-E

85-15-E

Boom A2

Existing Ice Boom

Boom B

84-14-E

84-15-E



<b>DATA SOURCE:</b> Manitoba Hydro; Government of Manitoba; Government of Canada; Imagery - 2010 Keeyask 10cm and 1999 Gull 1M (Black and White)		
<b>CREATED BY:</b> Manitoba Hydro -GIS Studies		
<b>COORDINATE SYSTEM:</b> UTM NAD 1983 Z15N	<b>DATE CREATED:</b> 22-MAY-15	<b>REVISION DATE:</b> 22-MAY-15
<b>VERSION NO.:</b> 1.0	<b>QA/QC:</b>	

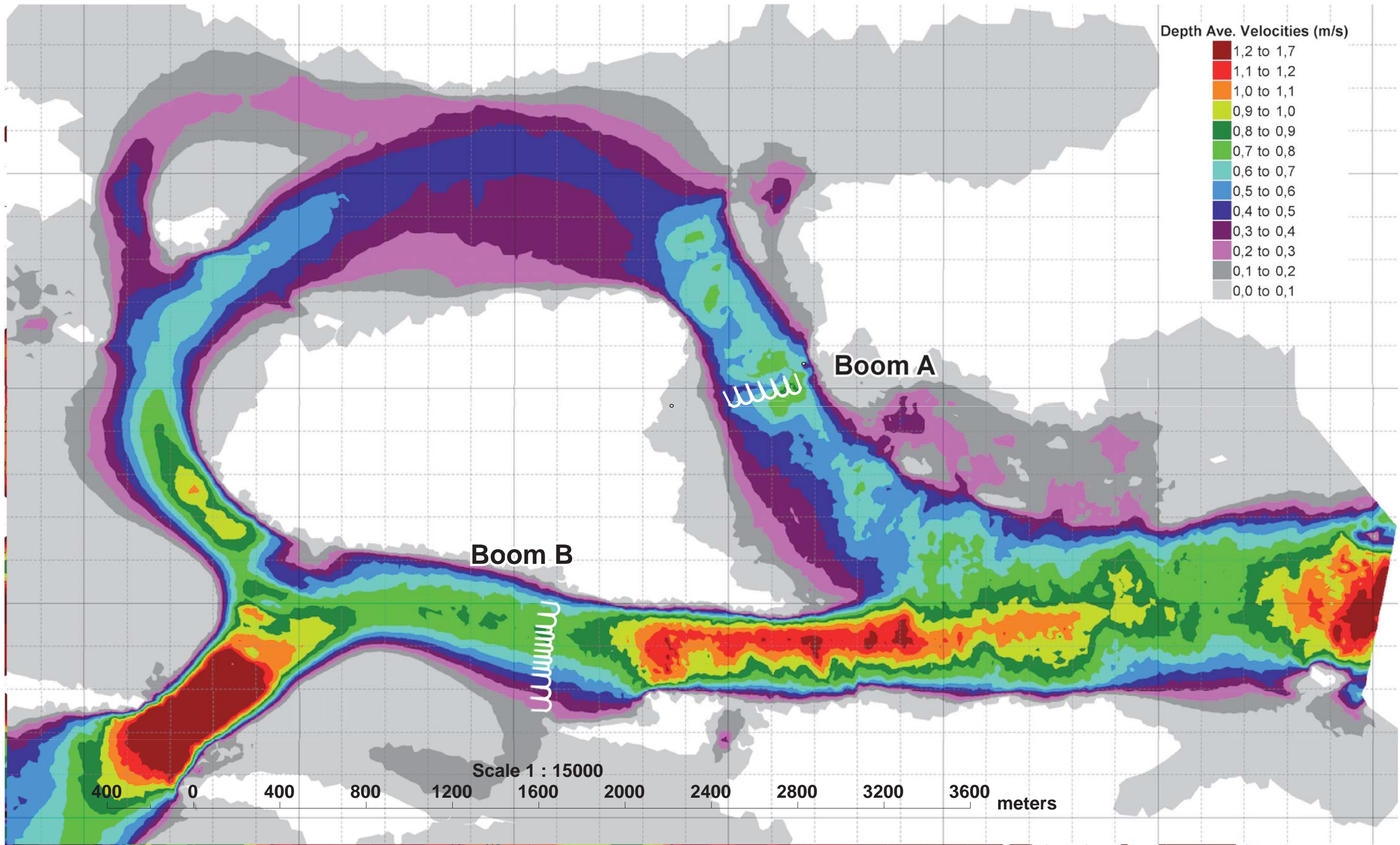
**Legend**

- Ice Boom - Proposed (Approximate Location)
- Ice Boom - Existing
- Infrastructure
- Section Grid
- Township Range Grid

**2015 Ice Boom Locations**

**DRAFT: For Discussion Purposes Only**





Water Velocities - 95th Percentile Flow