Ice Sustainability on the Rink

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INTRODUCTION

Canada has the most indoor ice rinks in the world — about 2,800 indoor rinks and 5,000 outdoor; second in the world is the United States (CRFC 2005; Statistica 2025). Considering the population difference between Canada (~40 million) and the United States (~342 million), it is clear that Canadians love spending time on the ice. To keep rinks in good condition, the ice is shaved several times a day to keep it in a safe and suitable condition to allow skaters to have a good time. Most of this shaved ice layer ends up either in a melt pit that goes to drain or outside an arena in a designated area for the discarded snow that eventually melts (Figure 1) and goes to the closest storm sewer when spring decides to show up — sometime between March and May. Is there a potential method to reuse the scrapped ice and save on overall water use and contribute to water sustainability? There are few examples in Canada of arenas utilizing rainwater or reusing scrapped ice for resurfacing an arena, such as the Scott Seaman Sports Rink, DeWinton, Alberta, Canada. However, it appears that few arenas have dove into this potential sustainability opportunity.

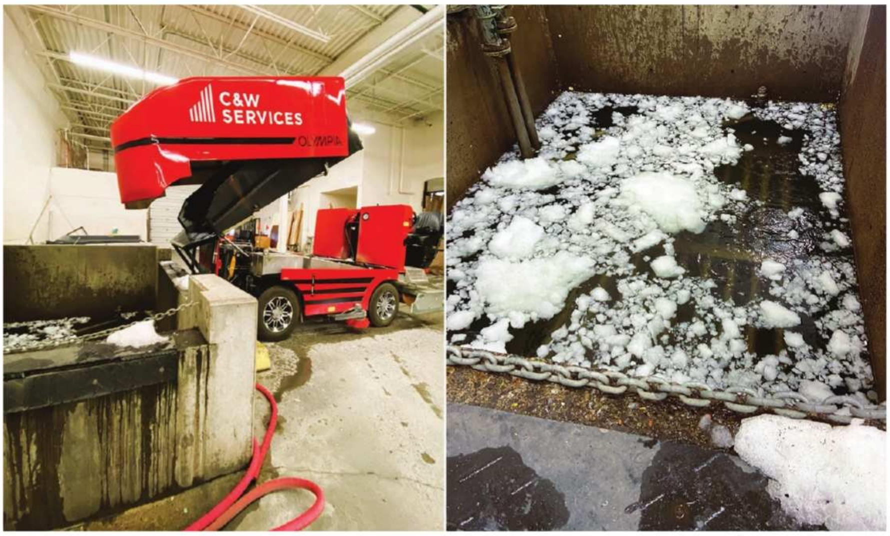

Figure 1: Loading the melt pit after scrapping the ice sheets.

Carleton's Facilities Management and Planning staff along with Carleton's Athletics staff were interested to know if there was an opportunity to reuse waste ice collected from the arena ice to contribute to water sustainability at Carleton University. Carleton University has two ice sheets that are in active use year-round for hockey, figure skating, skating lessons, and general public use during open skate times. Each ice sheet is typically resurfaced more than 12 times/day, and over the year this uses approximately 3,000 m^3 (3 million litres) of water. Working with Dr. Onita Basu and two undergraduate students (Alicia Allen and Alix Timbert), the first goal was to characterize the water and approach the topic as a greywater initiative. Then, they could determine treatment objectives, and design a testing process to confirm if objectives could be met before proceeding to a full-scale design.

Important parameters to monitor are total dissolved solids (TDS), turbidity, colour, and the potential presence of bacteria. Samples were collected over the summer of 2025 with melt water showing total dissolved solids ranging from 60 to 980 mg/L; post-filtration TDS levels dropped to an average of 44 mg/L with one high value of 95 mg/L (Table 1). TDS reported is the final TDS after Granulated Activated Carbon (GAC) filtration and/or post 1.5–5-micron filtration.

> *Is there a potential method to reuse the scrapped ice and save on overall water use and contribute to water sustainability?*

Table 1: Water quality characterization pre- and post-treatment

Water Quality Parameter	Melt Pit Water Quality Average (Range)	Treated Water*
Total Dissolved Solids (mg/L)	200 (60–980)	44 (5–95)
Turbidity (NTU)	2.7 (2.2–3.7)	1.4 (0.86–1.8)
Colour (PtCO)	22 (20–26)	8.7 (4–13)
Bacteria (CFU/100 mL)	511 (20–1000)	Non-detect (+)
*Treated Water refers to multiple treatment steps (+) non-detect after UV-C treatment		

Figure 2: Images of treated melt pit water with and without heating. The unheated ice layer contains a high dissolved oxygen layer, which results in air bubbles.

Recommendations on TDS for ice rink quality are indicated as less than (100-80 mg/L), as some recent reports indicate that too low a TDS may embrittle the ice and indicate that values greater >20 mg/L may also be desired (International Hockey Federation 2024; Hutchins 2025). Although, no clear recommendations appear to exist for turbidity, colour or bacterial levels for ice making, it is assumed that low turbidity and low colour levels are recommended to ensure a clean and pristine look of the ice quality. From a safety perspective, low bacterial levels are recommended for recycling of the ice sheet water.

In addition to water quality testing of the melt pit water both pre- and post-filtration, it was also important to see how it would freeze and what characteristics it would have. To complete this the collected and treated water was then further cast into ice blocks for visual observation and was conducted to gain an understanding of its colour or turbidity levels to ensure there would be no concerns from a visual quality perspective. To cast the sheets of ice, it was also imperative to preheat the water and ensure that there was a low dissolved oxygen level present in the water before freezing, otherwise there is a high risk of air bubble formation (Figure 2). The ice is also built in layers with an initial base layer on a concrete pad followed by a second layer commonly painted white for improved visibility, a sealing layer followed by a fourth layer for logos, and then the effective skating layer that is regularly skimmed and resurface by the ice resurfacer. For the bench scale testing, we simplified the process to two ice sheets with a base level of 8 mm with coloured tape over-top to represent the painted line followed by a second ice layer of 5 mm. As can be observed in Figure 2, the treated water produced good test ice samples with clear visibility to the tape beneath.

> *Bench scale testing of the used ice rink water demonstrated that the water was able to be recycled for reuse, meeting water quality standards and appearance standards for skating ice.*

CONCLUSIONS

Carleton's Facilities Management and Athletics staff wanted to know if reusing its ice rink water was a feasible solution towards water sustainability on campus. Bench scale testing of the used ice rink water demonstrated that the water was able to be recycled for reuse, meeting water quality standards and appearance standards for skating ice. Moving forward, the Carleton Facilities team will be implementing the recycled melt pit water at full scale with its two ice sheets.

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