

Respect Our Lakes

UNDERSTANDING ICE RIDGES AND ICE PUSHES



What are ice heaves?

Ice heaves are sheets of ice that push against each other or against the shoreline. Ice heaves form when ice sheets expand due to rapid temperature fluctuations. Thermal expansion of the ice occurs when a period of very cold weather is followed by a rapid increase in temperature.

As the ice warms, it expands in a manner which can be calculated using the coefficient of thermal expansion (0.00005/degree C). If a lake is 4 km wide, the amount of expansion associated with a 20 degree increase in the temperature of the ice is calculated to be $.00005 \times 20 \text{ C} \times 4000 \text{ m}$ or 4 metres of expansion. If the thickness of the ice is not significant, the expansion is usually accommodated by the gradual formation of an ice ridge along the shoreline. In the case where the ice thickness is greater and has become firmly fastened to the lake bed near the shoreline, the ice cannot expand and large stresses are built up in the ice. At some point, the ice will fail and release a tremendous amount of energy. This usually is in the form of buckling of the ice in the middle of the lake, along the shoreline or by expanding onto the adjacent shoreline. This can cause bank heaves, trees to be pushed over by displacing their roots, or damage to property.



If the increase in temperature is gradual, the resulting stresses are dissipated by the “flow” of ice in a manner similar to the flow of glaciers. The ice slowly deforms without any associated cracking. Ice ridges are also less common in years with sufficient snow cover to insulate the ice from the temperature fluctuations.

What are ice quakes?

Ice quakes, also known as cryoseisms, is a seismic event that occurs naturally by the rapid movement of the ice occur when there is a sudden release of energy from ice under stress. As ice is formed under dropping temperatures, the stresses formed in the ice are released by cracking of the ice, producing some very eerie moaning sounds. As ice thickens and becomes stronger, dropping temperatures cause the ice to contract and crack with a roaring sound. This can be a frightening experience, although not dangerous, if you are on the ice when it happens. Because of the low tensile strength of ice, high stresses cannot develop in the ice and any shock wave produced from the cracking ice will not be significant.

What are ice pushes?

Ice pushes are when sheets of ice are pushed and piled onto shorelines from high wind events. Ice pushes tend to occur in the spring when the ice is melting and breaking up.

Ecological Benefits of ice ridges and ice pushes?

Ice heaves and ice pushes provide ecological benefits by creating a natural soil barrier that prevents nutrient loading into lakes by intercepting and cleaning overland flow. Shoreline vegetation is supplied with nutrients to thrive and further establish root networks that provide natural shoreline protection. Shoreline vegetation communities provide shade for spawning fish and important wildlife habitat.

Potential Damage

Ice heaves, ice pushes, and ice quakes can change the shoreline and cause significant structural damage to houses, other buildings, and infrastructure.

What You Can Do

Maintaining the health of Alberta's lakes is everyone's responsibility. Actions of individual lakeshore residents, decision makers and land users around the lake add up to make a huge difference. Here's how you can do your part:

- Learn to live with ice ridges and ice pushes by taking a natural approach to shoreline management. Minimize disturbance to lake shorelines and naturalize disturbed areas by planting native species, especially shrubs and trees, to reduce future erosion from ice ridges and ice pushes as well as contribute to enhanced nutrient uptake.
- Remove materials (decks, docks or other building materials) on or hanging over the lake bed.
- Get approvals -unauthorized modification of shorelines is illegal. Any projects involving shoreline modification will require permission under both the Public Lands Act and Water Act. The type of permission required will depend on the details of the project proposed.
- It's illegal to push soil into the water or onto the ice without prior approval.
- It's illegal to have tracked vehicles on the bed and shore without prior approval.
- Talk to your municipality to confirm what land is yours and what permissions you need from them.
- Property owners (which could be the municipality if an environmental/municipal reserve is present) may be tempted to remove ice sheets, re-grade, and re-seed each year, however this practice can result in shoreline recession and loss of lakefront property.
- Property owners may want to install retaining walls or rock riprap to protect shorelines, however these hard-armoring methods can reduce or destroy sensitive shoreline and habitat important to the health of the lake. They also have the potential to prevent public access along a shoreline. Poorly designed or constructed modifications can contribute to shoreline erosion problems.
- Using soft armoring techniques (sometimes called bio-engineering) instead involves creating a naturally occurring slope with a combination of natural elements which includes rock and vegetation. Soft techniques will absorb the energy of the waves along the shoreline reducing the potential of erosion, strengthen the shoreline long term, prevent ongoing maintenance, maintain and enhance natural habitat, filter nutrients and pollution from upland runoff and help improve water quality. Careful consideration of options to protect shorelines as well as the lake is very important.

Alberta Environment and Parks has lake information you may find useful in caring for the shoreline.

Search for the following terms on aep.alberta.ca:

[Respect Our Lakes](#)

[Caring for Shoreline Properties](#)

[Shoreline/Water body Modification: Facts at Your Fingertips](#)