



# Ice Throw Guidelines

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# IEA Task 19 sub-committee



## And Collaborators



# Need

OVERVIEW MATRIX	Response-options	Moderate icing			Varying icing				Strong icing		
		DENMARK	NETHERLAND	UNITED-KINGDOM	GERMANY	CHINA	SWITZERLAND	AUSTRIA	FINLAND	CANADA	SWEDEN
Population density per km <sup>2</sup>		130	495	257	229	140	193	102	18	3	23
Assessment of the icing frequency and intensity of the location	Not at all										
	By synoptic consideration										
	Comparison heated/ unheated anemometer										
	Ice Sensor										
	Ice Map										
	Any other										
Definition of the extent of the danger zone for icefall/ icethrow	Not at all										
	Empiric formula										
	Risk assessment										
	Any other										
Which implications/ restrictions arise for the danger zone?	No restrictions										
	Signpostings										
	Confirmation for affected private land										
	Agreement to close public roads										
	Any other										
Is it allowed to operate the turbines with iced-up blades?	Yes										
	No										
	Both										
Is an automatic restart allowed after de icing or is an verification at the site required?	Yes										
	No										
	Not specified										
Which requirements are stipulated as to the detection of ice on the turbine	None										
	Manufactor solution (ice sensor, power curve)										
	Solution during standstill										
	Redundant system										
	Not specified										
Do authorities dictate/ prescribe the utilisation of a blade heating?	Yes										
	No										

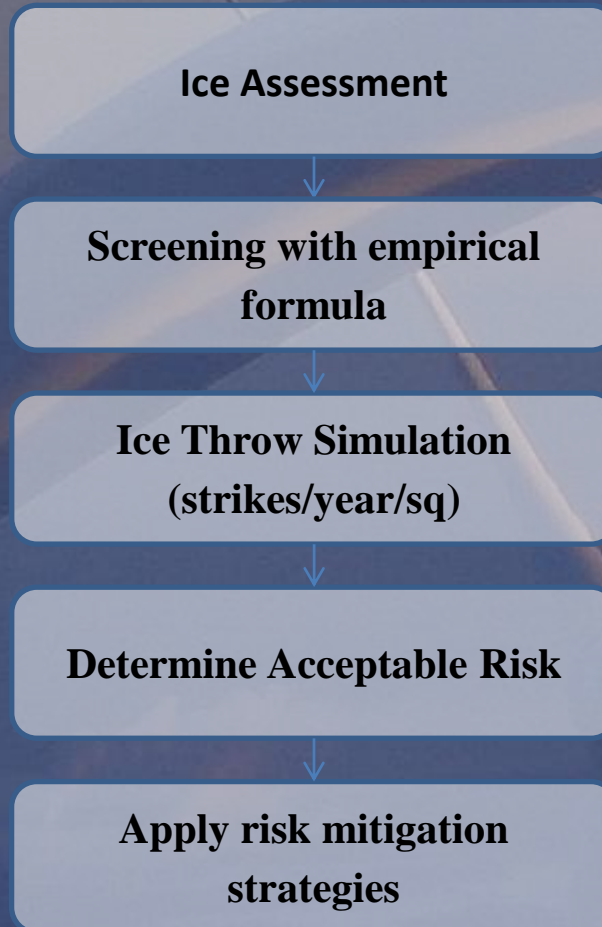
Krenn, A., et al. WinterWind 2014



# Objective

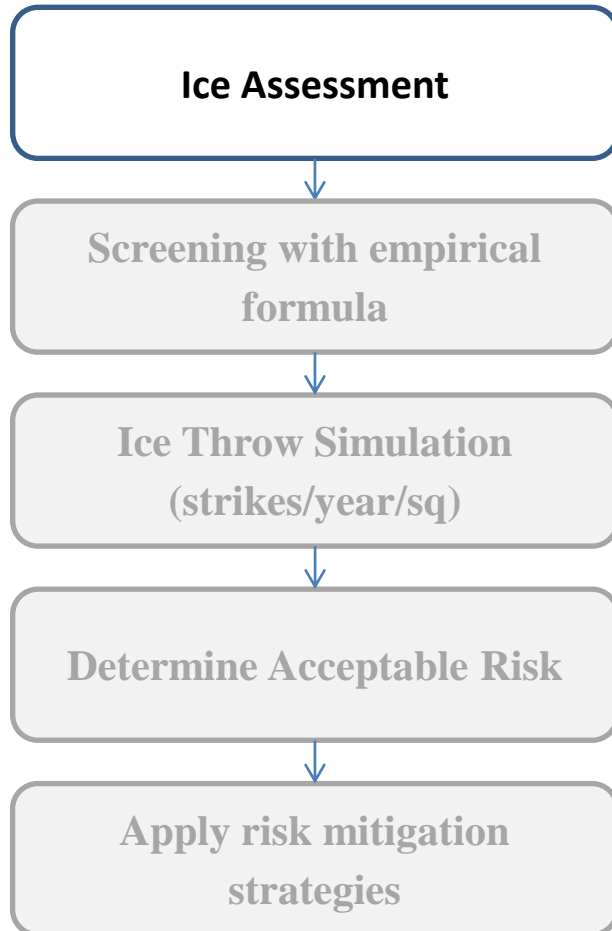
Propose a standardised approach to assessing the risk of ice throw and implementing risk mitigation strategies

# During Project Development



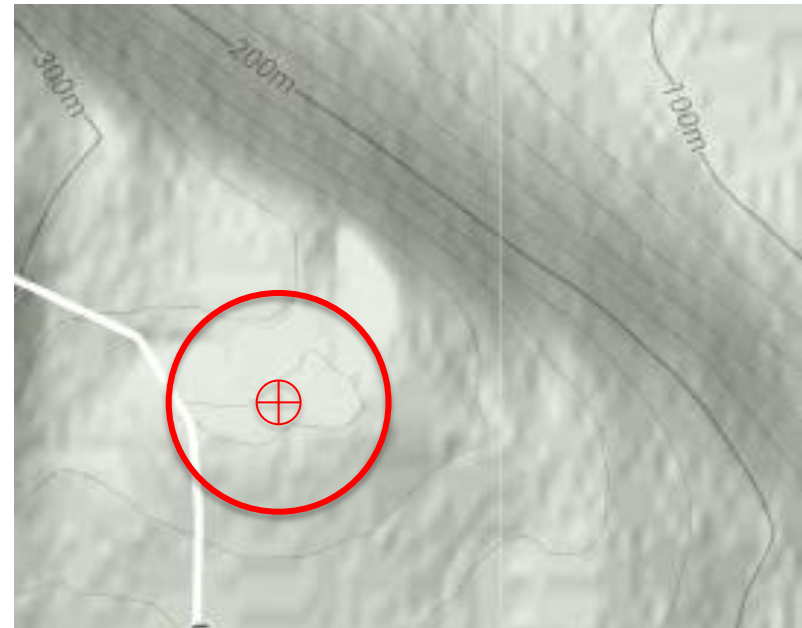
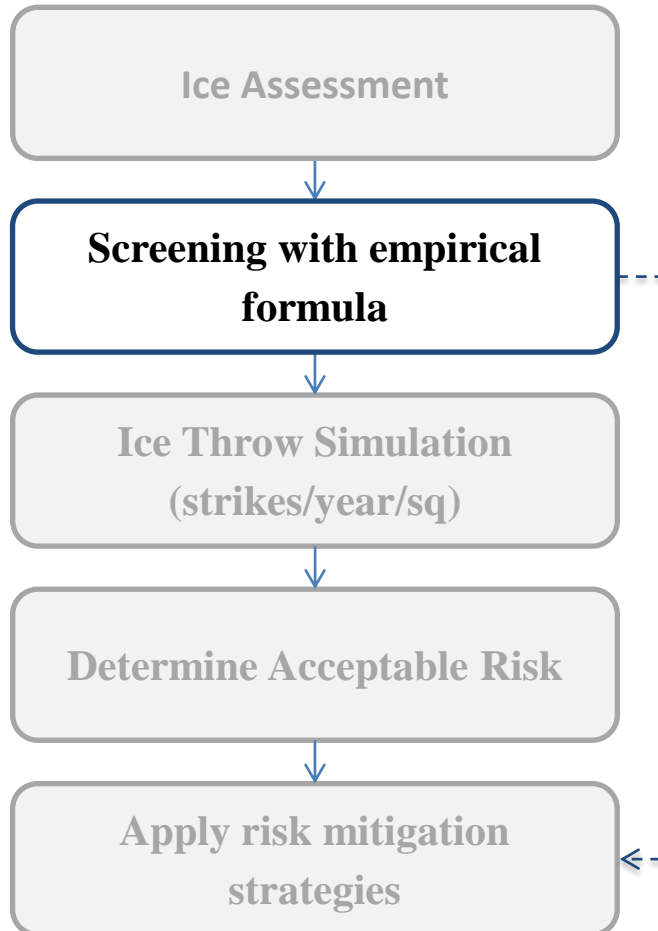


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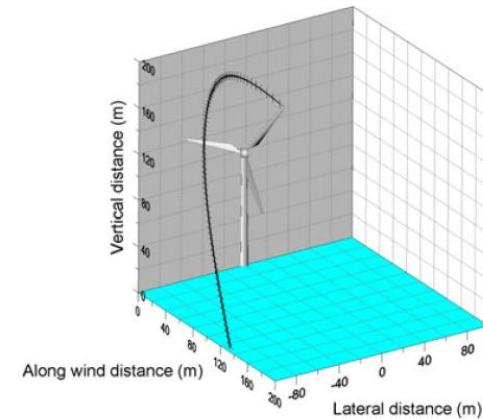
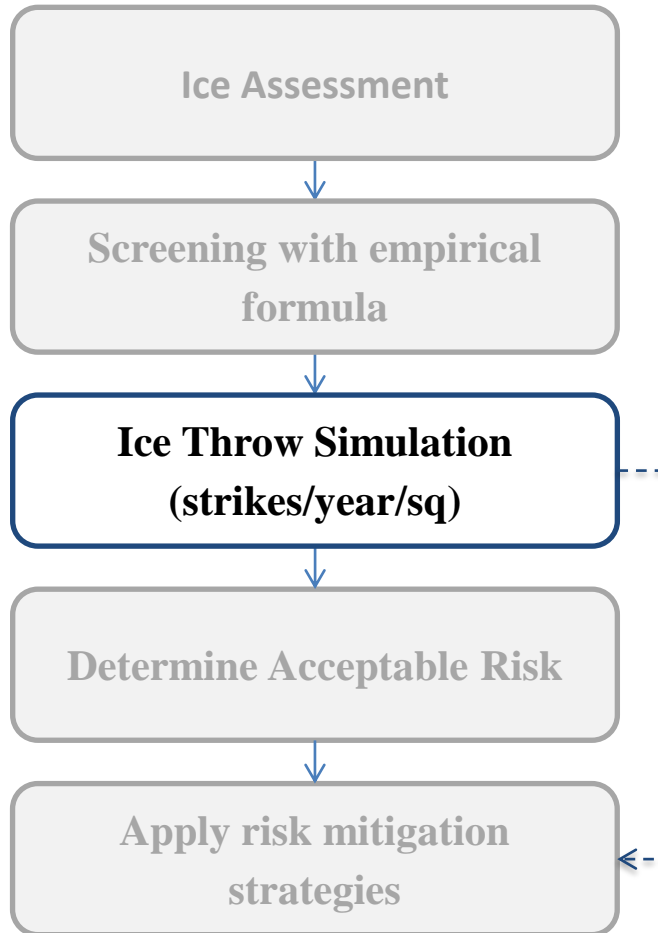


TCE met mast,  
Mt Needle, QC

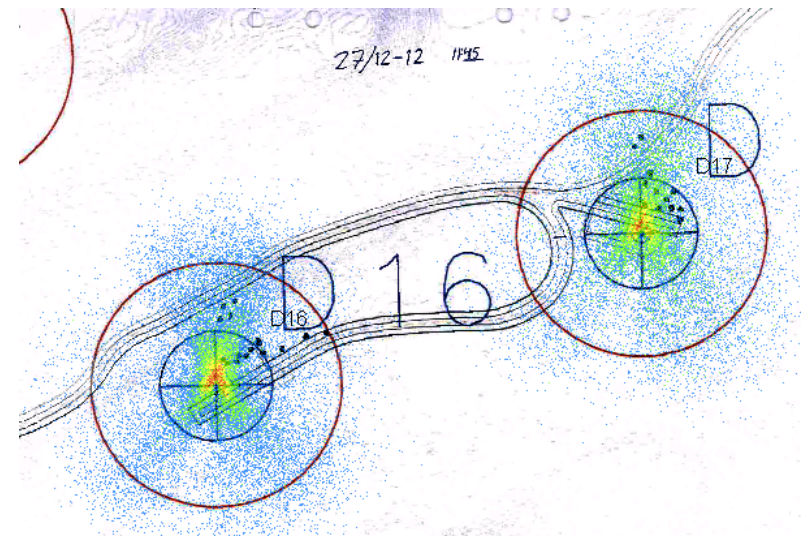
# During Project Development



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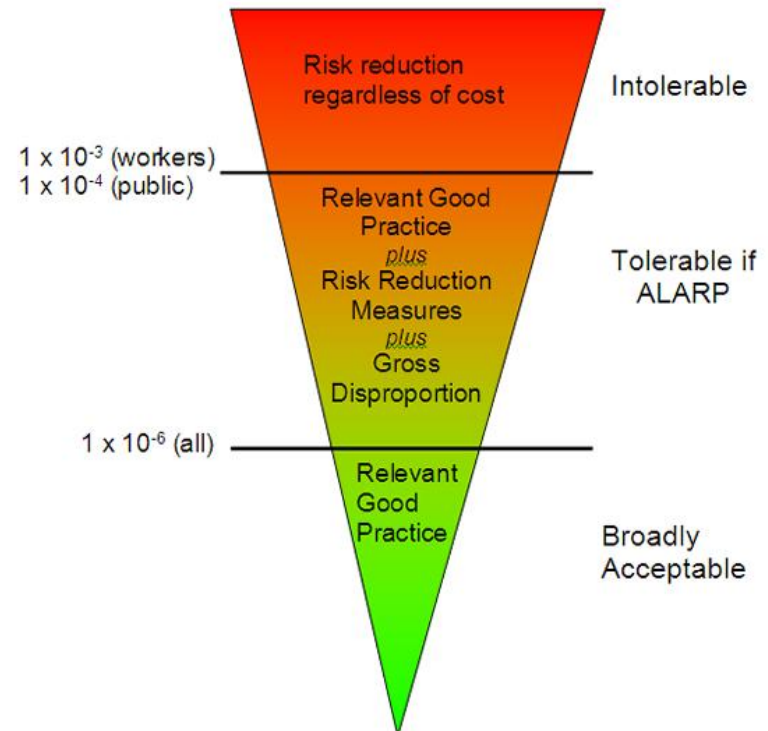
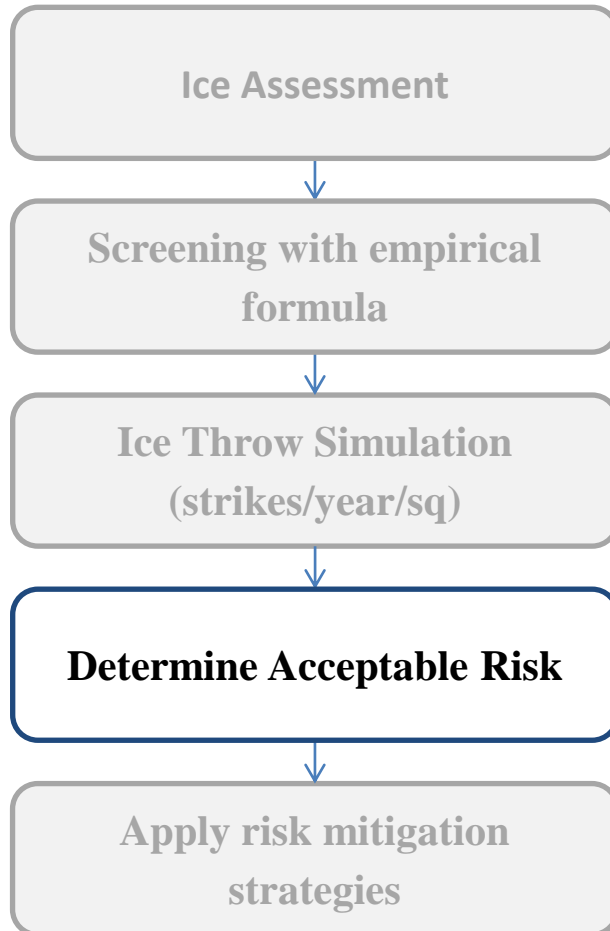
Biswas et al., 2011



Hutton et al., 2013



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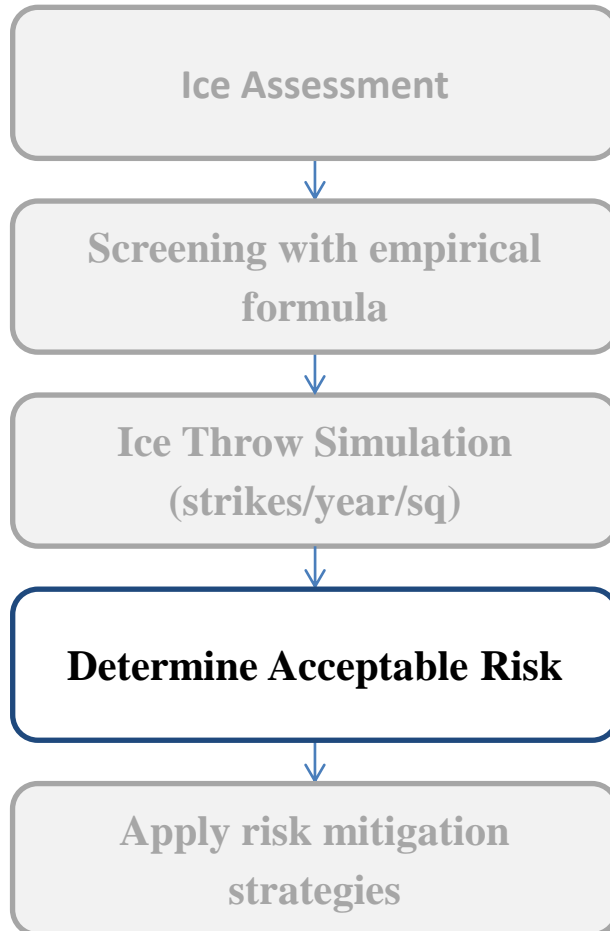


TOR: Tolerability of Risk

ALARP: As Low As Reasonably Practicable

Source: [www.railssa.com](http://www.railssa.com)

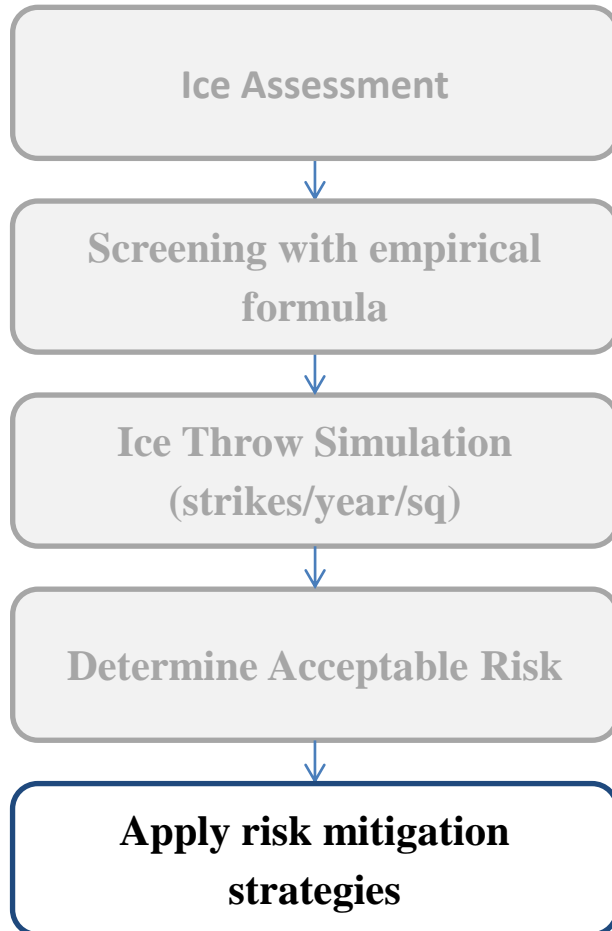
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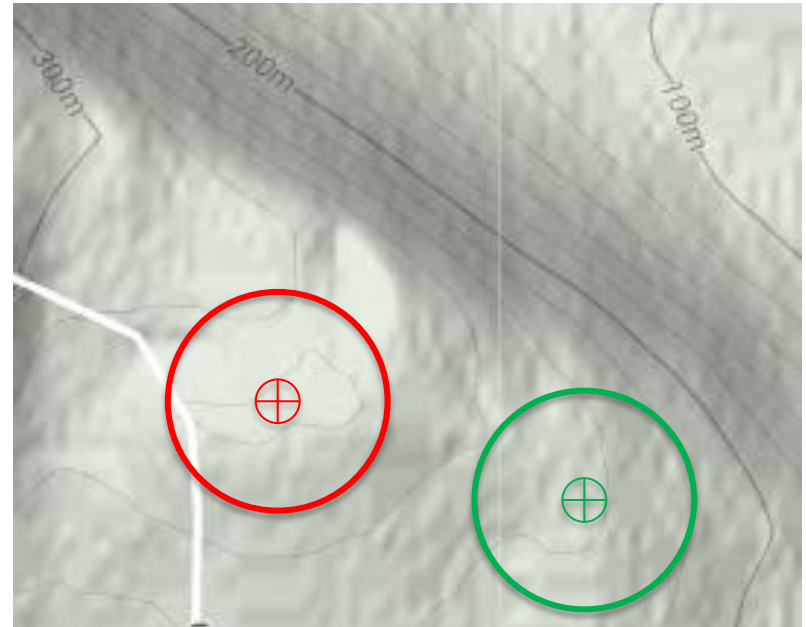
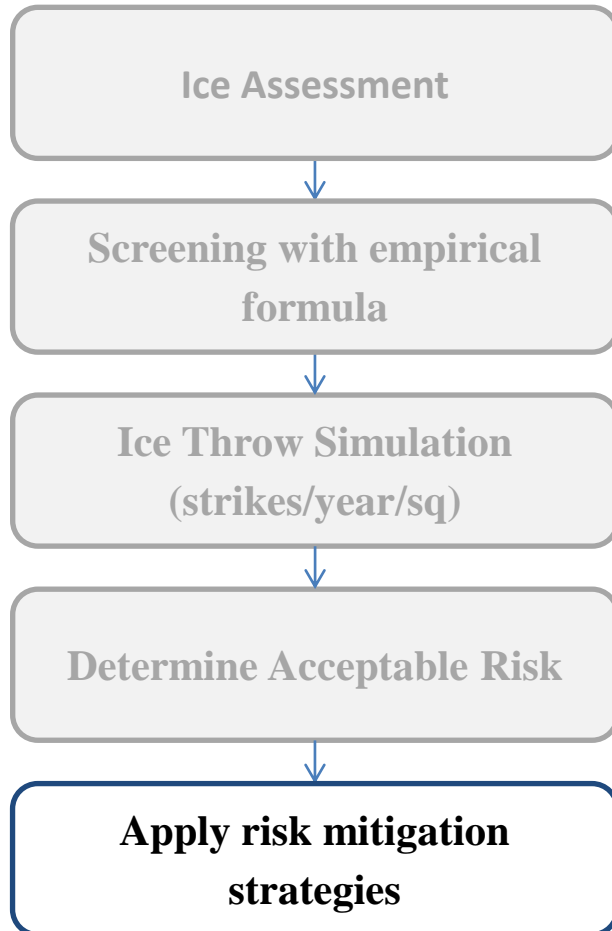
Installation/activity	DSB zone definition	Acceptance criteria
Kindergarten	Outside outer zone	$< 10^{-7}$
Café/bakery, ski lifts, houses	Outer zone	$< 10^{-6}$
Public roads, path/walkways, scattered houses	Middle zone	$< 10^{-5}$
Ski tracks, hiking areas	Inner zone (part of facility)	$< 10^{-4}$



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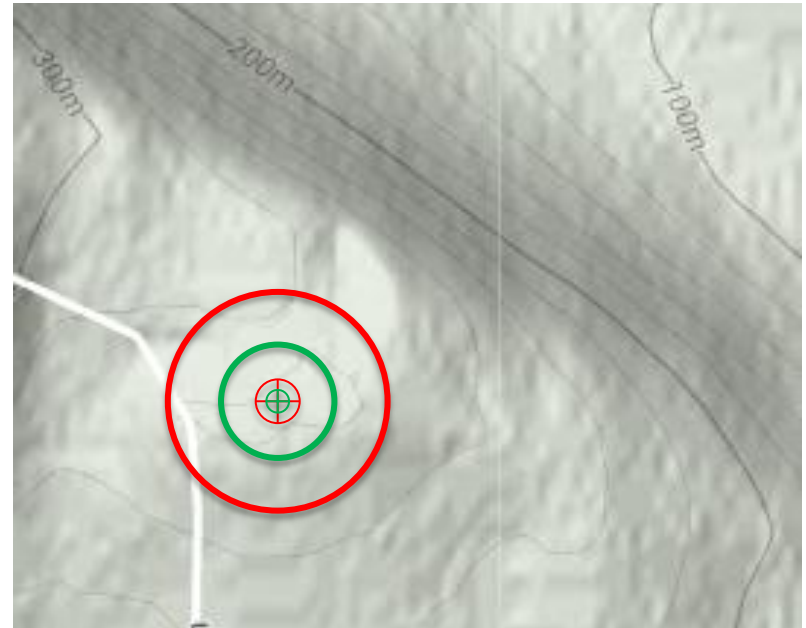
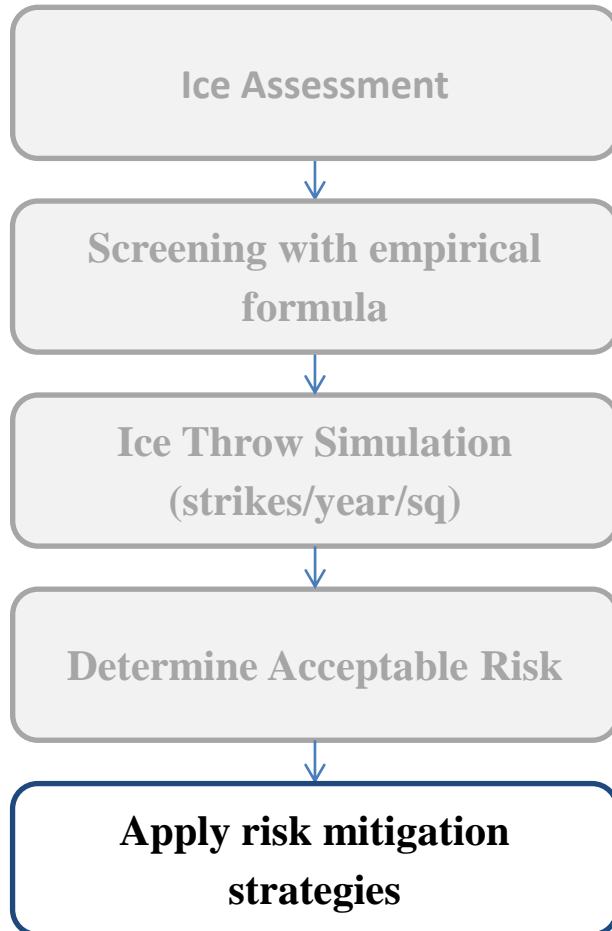


# During Project Development





# During Project Development



# Operation & Maintenance



Scandinavian Terrain Vehicles AB



Caribou Wind Park LP



# Conclusion

The background of the slide features a photograph of a wind farm. In the foreground, a large, dark-colored wind turbine blade is visible, extending from the bottom left towards the right. The blade has several small, dark rectangular markings along its length. In the background, several other wind turbines are visible, standing on a grassy hillside. The sky is overcast and grey.

- A standard framework to assess and mitigate risk
- Next step: write detailed guidelines
- Input welcome!

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Thank you

TCE

