Wetlands are important ecological niches in Canadian High Arctic environments but little is known of their hydrology and future response to climate warming. Here we examine the seasonal snowcover and pond hydrology of an extensive low-gradient wetland at Polar Bear Pass (75° 40' N 98° 30' W) from 2007-2010. This wildlife sanctuary (100 km²) is characterized by two large lakes and numerous tundra ponds and is bordered by rolling hills. Incised hillslope stream valleys provide an effective conduit for water and nutrients into the wetland, while late-lying snowbeds in the lee of slopes provide additional meltwater to adjacent wet meadows and ponds in the post-snowmelt season.

In arctic environments, snow remains one of the most important sources of water for wetlands. Terrain based end-of winter snowcover measurements (snow depth, density, SWE) together with direct and modelled estimates allowed the temporal and spatial patterns to be evaluated. During the post-snowmelt season the hydrologic regime (water table/budget) of typical ponds (small to large; hydrologically linked/not-linked; coarse/fine pond substrates) was assessed on a regular basis.

Inter-annual variability in spatial snowmelt patterns is evident at PBP and can be attributed to a non-uniform snowcover distribution and local microclimatic conditions. Pond water tables peak after snowmelt and then fluctuate in response to summer evaporation losses and rainfall/lateral inputs. Pond characteristics (substrate type; degree of connectivity) are critical in warm/dry years (e.g. some ponds dry out) but not in cool, high rainfall seasons - here elevated rainfall and runoff raise pond storage to near freschet levels.