Development of the oil sands has led to increasing atmospheric N deposition, with values as high as 17 kg N ha-1 yr-1; regional background levels <2 kg N ha-1 yr-1. To examine responses to N deposition, over five years, we experimentally applied N (as NH4NO3) to a poor fen near Mariana Lake, Alberta, at rates of 0, 5, 10, 15, 20, and 25 kg N ha-1 yr-1, plus controls (no water or N addition). We collected surface pore water from all plots several times a year throughout the 5 year experiment. Over the 5 years of the study, porewater NH4+-N, NO3--N, and DON concentrations at the top of the poor fen water table were unaffected by N addition (p = 0.06, 0.30, 0.16, respectively). However, porewater NH4+-N, NO3--N, and DON concentrations were substantially higher in 2011 than in 2012-2015 (Fig. 11). Water addition alone had no significant effect on porewater concentrations of NH4+-N, NO3--N, or DON (p > 0.99).

We hypothesized that as N deposition increases to a level that exceeds the capacity of the fen vegetation to take up N, net N mineralization in surface peat would be inhibited by higher NH4+-N availability, net nitrification would be stimulated by higher NH4+-N availability, and concentrations of DIN in porewater at the top of the water table would increase, as DIN bypasses interception by the ground layer vegetation. None of these hypotheses was supported with nitrogen being immediately taken up by vegetation. It is unclear if longer term study would reveal similar responses.