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Constructed wetlands (CW) act as nitrogen (N) sinks and reactors facilitating a number of physical, chemical and biological processes. The N removal efficiency of through-flowing water in such systems when used to treat municipal wastewater is variable. Their overall removal efficiencies do not specifically explain which N species have been removed by physical attenuation, and by biological assimilation or transformation to other forms. A wider understanding of how N removal occurs would help elucidate how losses of N and associated gases from CW impact on water and air quality. The objective of this study is to investigate the C and N cycling processes in the porewater of soils immediately adjacent, up-gradient and down-gradient to helophyte —vegetated CW cells. The CW site (0.32 ha in size, containing 3 cells treating municipal waste) is part of a 5-cell Integrated Constructed Wetland (ICW) located in Dunhill village, Waterford, Ireland. Multilevel piezometers (0.025 m inner diameter; 1 m screen interval at base) were installed in the CW at two depths: 2 m below ground level, (bgl), representative of shallow groundwater, and at 5 m bgl representative of deeper groundwater. Water table depths were 0.9010.06 and 1.3410.07 m (mean SEM) bg] in shallow and deep groundwater, respectively. Starting in Nov-2013 to present, groundwater samples were collected bi-weekly for geochemistry and C and N species analyses following USEPA Low Flow sampling procedures. Dissolved greenhouse gases (N,O, CO_2 and CH_4) were extracted using a headspace equilibration method. Denitrified NZ was measured using Membrane Inlet Mass Spectrometry. Groundwater nitrate (NO_3^--N) and nitrite (NO_2^--N) concentrations were <0.5 mg/L at both screened depths. The concentrations of ammonium (NH_4^+-N) significantly decreased with depth: shallow (10.1+2.5 mg N/L) and deep groundwater (2.1+0.5 mg N/L). Mean N_30 was higher in shallow (2.90/0.6 ug NIL) than in deep groundwater (0.52+0.1 ug NIL). Mean denitrified N1 was lower in the shallow groundwater (0.4010.2 mg N/L) than the deep groundwater (0.64+2 mg N/L). Mean dissolved organic C was higher in shallow (16+11 mg/L) rather than in deep groundwater (12+3 mg/L), but mean CO, and CH_4 were higher in deep groundwater (137138; 2.210.7 mg C/L) than in shallow equivalents (97+16; 2.0+0.5 mg C/L). Initial geochemistry results indicate that groundwater adjacent to the CW is microbially dynamic, contributing to the attenuation of compounds such as $NH4^+$ in groundwater recharge.