Peatland degradation due to human activities is contributing to rising atmospheric CO2 levels. Restoring the carbon (C) sink function in degraded peatlands and preventing further stored C losses is a key climate mitigation strategy, given the global scale of peatland disturbance. Active restoration at a post-extraction peatland in Canada has been shown to successfully re-establish net CO2 uptake rates similar to undisturbed peatlands within a decade or two. However, lower than expected CH4 emissions suggest recovery of belowground C cycling processes may lag behind recovery of the surface net flux. Using closed chamber measurements over a warm season, we determined that restored Sphagnum, which covers two thirds of the site, was a net zero source of CH4. Emissions from the restored site were primarily attributed to vascular plant substrate inputs, measured as acetate, and plant-mediated transport. The carbon isotopic fractionation factor for CH4 and CO2 in the restored former peat field pore water exhibited α < 1.060 even deeper in the cutover peat profile (0.8 m depth), evidence of a dominance in acetoclastic methane production. In contrast, isotopic fractionation in the former drainage ditches showed a balance of acetoclastic and hydrogenotrophic methanogenesis deeper in the profile, indicative of some bulk peat C turnover. This study shows that the legacy of substrate quality in the cutover peat in reducing CH4 production and thus emission, can aid in reducing the climate warming impact of newly restored peatlands.