553 The risk of surface-water intrusion into shallow wells is another uncertainty. Yapiyev et al (2023) used LCE to flag wells influenced by lakes, gravel pits, or peatland drainage in Finland, showing that shallow unconfined aquifers—even where recharge is largely diffuse—can still experience focused incursions from nearby surface waters. Lyons et al (2025) demonstrated that isotope similarity between wells and ponds may indicate up to 80–95 % surface-water contribution, even when microbial assemblages remain distinct. Their study underscores that physicochemical indicators alone may not fully capture intrusion dynamics. Applying similar isotopic and microbiological screening in the Okefenokee system could thus constrain both recharge mode and contamination vulnerability.

563 Time-series analysis should also be extended, both temporally and spatially, to refine hydraulic parameters and diagnose feedbacks. Joint analyses of swamp stage, river discharge, and aquifer response could reveal lags or threshold behavior akin to the precipitation–recharge hysteresis documented by Cuthbert et al (2019). Environmental tracers spanning different timescales— tritium/helium, noble gases, etc.—could estimate the residence time of water beneath the swamp; young apparent ages would corroborate rapid vertical exchange. The presence of any older component, as seen in many fossil-water systems (Jasechko *et al* 2017), would imply partial isolation and limited flushing.

572 Modern groundwater has been shown to penetrate deeper under heavy pumping (Thaw *et al* 2022), suggesting that intensified withdrawals near the Okefenokee margin could draw swamp-derived water—and its solute or microbial load—further into the Floridan system than natural gradients alone would allow. This reinforces the need to couple isotopic and hydraulic observations with pumping-stress analyses to quantify intrusion risk.

578 At the broader scale, recent global syntheses indicate that groundwater–surface-water coupling is stronger than previously represented in models (Berghuijs *et al* 2022), emphasizing that even subtle diffuse fluxes can integrate into substantial cross-system exchange. Our assumption of a two-endmember isotope mix may therefore oversimplify reality: minor paleowater components or seasonal isotopic shifts could contribute. More frequent sampling—quarterly or event-based—would help determine whether swamp–aquifer exchange varies seasonally or during extreme wet–dry transitions.

585 A major limitation remains the absence of direct evapotranspiration measurements within the swamp. Eddy-covariance data would constrain the largest flux term in the water budget and reduce uncertainty in the residual attributed to groundwater loss. Without such constraints, swamp-specific budgets remain underdetermined. Despite these open questions, the fundamental conclusion remains robust: the Okefenokee Swamp and the Floridan Aquifer are hydraulically and chemically interconnected, but