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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Working backwards from streambed thermal anomalies: hydrogeologic controls on preferential brook trout spawning habitat in a coastal stream" *by* Martin A. Briggs et al.

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Thank you for your review of this manuscript. As mentioned in our reply to Reviewer #1, the public comment period for HESS-D extends until March 15. However, it seemed prudent to develop a roadmap for our revision now, in case the Reviewer has any further specific feedback that could help us shape a more clear paper. After the comment period ends, we will also follow up with a detailed record of revisions made to an updated version of this manuscript. As you note, the inclusion of various interdisciplinary methods in one paper is challenging, and we need to do a better job at clarifying the

underlying goals and story. This can start with an updated title, for which we suggest: "Hydrogeochemical Controls on Brook Trout Spawning Habitat in a Coastal Stream". This new title puts the emphasis on understanding the structural controls on why some discharges are oxygen rich along this coastal stream, yet most are oxygen poor. Trout utilize the former for spawning, as the eggs need dissolved oxygen to survive and properly develop. This relationship between trout spawning and bed sediment oxygen is already known, and discussed in several of the references we cite, so that point alone is not the focus of this research. We realize this was not made clear in the previously submitted draft, particularly by our original Objective 1 which indicated a larger statistical analysis of discharge zone chemistry. Instead we focus on a subset of discharge zones that trout directly utilize to move beyond shallow streambed chemistry and determine their larger structural controls. The strengths of this paper are in generating transferable hydrogeological understanding of trout habitat. Figure 1a displays the conceptual understanding developed during this multi-year study where trout utilized more localized groundwater flowpaths that remain oxygen-rich for spawning in discrete patches on meander bends. Perhaps as it appears early in the manuscript this model seems obvious, but it took the combined geophysical, thermal, chemical, and fish observational data to reveal this. We used fiber-optic heat tracing to spatially map 40+ focused groundwater discharge zones found along 2 km of streambed, and then sample a subset of the largest for shallow pore water chemistry for comparison to the n=3 locations where trout are known to repeatedly spawn. Although this discharge chemical data is presented in Table 1, the Reviewer is correct in that the spawn vs non-spawn discharges were not summarized and compared. We now understand this summary comparison is needed, and this will be included as new Table 2. In terms of the Figures lacking spatial reference, we can indicate directly on Figure 2 where the heat traces of Figure 4 were collected, and use the same common "downstream distance" from the upper end of the stream as Figure 7. This will be helpful to the reader. We could also name the various groundwater discharge zones by this same downstream distance reference- do you think that would be helpful? Right now they have a

numerical naming scheme developed in previous published hydrological research from this stream. The radar data Figure 5 does not have a downstream distance specified, as the speed the radar floated down river varies somewhat, so the data stream is not linear in space along the images. However major discharge zones were marked directly on the record during acquisition and those are shown in the Figure (eg “Loc 15”). This can be better explained. In regards to Figure 6, which shows thousands of individually modeled vertical seepage fluxes, we tried box plots as the reviewer suggested. However, removing the time component does not allow direct comparison to the time variable discharge record that may specifically impact more local groundwater flowpaths (rather than regional). We will revisit these plots for clarity. Overall we will strive to clarify which methods were used where, when, and for what purpose. We thank the Reviewer for their time invested to help us make this a better and more useful paper.

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