

## ***Interactive comment on “Biogeochemical and suspended sediment responses to permafrost degradation in stream banks in Taylor Valley, Antarctica” by M. N. Gooseff et al.***

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Response to Reviewers: We thank two anonymous referees for carefully reviewing this manuscript and for providing valuable insights that will significantly strengthen this work. The following document details the authors' response to these reviews including clarifications and additional analyses that will be performed to improve this manuscript. Here we respond to the general comments. All minor/editorial comments from the reviewers will be fully incorporated into any future drafts of this manuscript.

Response to Referee 2: The first general comment from this referee was that the study should to be placed in a larger context. They suggest that we present the percentage

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of Antarctica that is comparable to Taylor Valley, the location described in this study, which may be impacted by similar thermokarst disturbances. The total percentage of Antarctica that is ice-free is <2% while the ice-free component of the McMurdo Dry Valleys is ~4,500 km<sup>2</sup> (Levy 2013) which is ~0.03% of the Antarctic continent. While this is a small fraction of the total continent, documenting these changes is important and relevant for a variety of reasons. First of all, due to their limited size and isolated nature, the McMurdo Dry Valleys (MDV) harbor unique endemic microbial communities in stream, lake, and soil habitats (Stanish et al. 2011, Van Horn et al 2013) and due to the cold, dry climate, this area is the best Martian analog on earth. Thus climate related changes, such as the thermokarst development described here, impact our ability to study these extremophiles under the conditions in which they have evolved and thus documenting these changes is vital for future work in this region. The MDV are also sentinels for change in the rest of Western Antarctica. The thermokarst described in this study caused a highly observable change in Crescent Stream that was easily noted by researchers. These changes suggest that other climate warming related changes are likely to occur in nearby ice-covered areas where change is less obvious. These rationale for the importance of this study will be emphasized in future drafts of this manuscript. Additionally, as suggested by the reviewer we will include an estimate of the length of the stream reach impacted by this disturbance which is the first of its kind noted in Taylor Valley (a fact that will also be emphasized in future drafts) and we will present this data as a fraction of the total stream length in the MDV that may be impacted by similar disturbances in the future. This referee also suggest that we use historical data to compare the East and West forks of Crescent stream to verify their pre-thermokarst similarity, strengthening the reference stream comparison approach that we have employed in this manuscript. While we strongly agree with the reviewer that this would be helpful, unfortunately, the data to make this comparison do not exist. The stream gage where the historical measurements on Crescent have been performed is downstream of the confluence of the East and West forks and to our knowledge no East Fork specific pre-thermokarst data exists for comparison. Fi-

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nally, referee 2 suggests that one of the limitations of the manuscript in its present form is the need for quantitative analyses of the impacts of the observed thermokarst on stream chemistry and sediment loads. To overcome this limitation we propose to perform Welch's unpaired 2 sample t-tests which are robust to unequal sample sizes to compare the above thermokarst data to the historic data set and the below thermokarst data to the historic data set. Additionally, paired sample tests will be performed with the above and below thermokarst data. These comparisons will be performed for each of the available solutes/analytes collected to quantify the impact of the thermokarst. Also, as suggested, we will compare the mean post thermokarst values for each analyte to the distribution of the historic data to inform the readers about the percentile of the historic data that the post disturbance data falls into.

Literature Cited: Levy, J. 2013. How big are the McMurdo Dry Valleys? Estimating ice-free area using Landsat image data. *Antarctic Science*, 25 (1), pgs. 119-120.

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