

## ***Interactive comment on “Landscape scale remediation reduces concentrations of suspended sediment and associated nutrients in alluvial gullies of a Great Barrier Reef catchment: evidence from a novel intensive monitoring approach” by Nicholas J. C. Doriean et al.***

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GENERAL COMMENTS FROM PETER HAIRSINE:

General Comments 1. “This manuscript addresses a clear knowledge gap: the evaluation of a remediation technique for alluvial gullies in a tropical setting.”

RESPONSE: Acknowledge.

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The authors acknowledge this positive comment and have undertaken specific reconsideration to address the other key points raised by Peter Hairsine (see below).

SPECIFIC COMMENTS FROM PETER HAIRSINE:

Specific Comment 1. “The primary conclusion is given as “The multiple lines of evidence from this water quality study indicate the application of intensive landscape-scale remediation on actively eroding alluvial gullies has the potential to reduce average suspended sediment concentrations by more than 80%.” This conclusion is made on the basis of a comparison of 2 wet seasons of suspended sediment measurement using 4 different types of water samplers for a single control (3.3 hectares catchment area) and single treated catchment (13.7 hectares catchment area) - noting that 3 treatment catchment areas are labelled in figure 1.” The recent review of gully remediation efficacy of Bartley et al. (2020) demonstrates other similar studies have combined multi-year monitoring, pre-treatment measurement and replication in a range of settings. No study was found to provide a “gold standard” BACI, multi-decadal and replicated study but conclusions and attribution were normal reduced as a result.”

RESPONSE: Clarify.

The authors thank Peter for notifying the authors of the recent study completed by his colleagues (Bartley et al., 2020). This manuscript was submitted to HESS prior to the publication of the Review article Peter mentions. The authors will include the findings of the review in the revised manuscript literature review.

Specific Comment 2. “I looked for “multiple lines of evidence” but only found the suspended sediment sampling with 4 devices arranged side by side.”

RESPONSE: Acknowledge/Clarify.

For context, Peter is referring to Line 460 “The multiple lines of evidence from this water quality study indicate the application of intensive landscape-scale remediation on actively eroding alluvial gullies has the potential to reduce average suspended sediment

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concentrations by more than 80%.” In this statement the authors are referring to the collection of water quality data using different monitoring methods (i.e., four different methods for collecting water quality data) to assess the effect of gully remediation on water quality. Each of the water quality monitoring methods used collect a sample in a manner that is independent compared to the others, thus, evidence is provided by four separate lines of data gathering. Furthermore, the use of different water quality analyses provides further relevant lines of evidence, that are complimentary to the separate collection methods, (i.e., suspended sediment concentration, particle size distribution, and nutrient and carbon analyses). The authors acknowledge that the term “multiple lines of evidence” may mislead some readers to thinking that complimentary data (i.e., Lidar soil loss estimates) are referenced here. Thus, the authors will revise the text to state “The water quality data collected during this study, using multiple monitoring methods, indicate the application of intensive landscape-scale remediation on actively eroding alluvial gullies has the potential to reduce average suspended sediment concentrations by more than 80%.”

Specific Comment 3. “The two years of sampling does not enable any assessment of whether the hydrological forcing can be interpreted in terms of long term rainfall variability. Furthermore this sampling does not necessarily represent the long term (decades) performance of the remediation measures.”

RESPONSE: Acknowledge.

The authors agree with Peter in that there is a need for more monitoring data, over longer time scales, to evaluate the effects of long term stressors (i.e., rainfall variability and backwater flooding effects). The authors infer this sentiment in the final statement of the conclusion section Line 477: “ However, more information is needed, particularly sediment load estimates and information on remediation longevity over decadal timescales.” The authors believe this important point should also be mentioned in the Abstract and will include a statement that emphasises the relatively short timescale that the study was conducted over (i.e., two years) and how more monitoring data is

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needed to assess the long term durability of the remediation measures used.

Specific Comment 4. “The difference in performance between the control and treatment gullies is well summarised in terms of the suspended sediment concentrations and the particle size distributions. The difference between these measures is then attributed to the treatment effect. While this step is intuitive, it is not formally supported given the many limitations of the methodology as noted above.”

RESPONSE: Clarify.

The aim of the study was to determine if gully water quality conditions were improved by landscape-scale remediation using water quality monitoring methods that employ sampling processes that are unique from one another. This was done so that limitations of one or more of the monitoring methods used could be accounted for when evaluating the effectiveness of the remediation measures. The water quality of the overland flow waters draining into the Remediated and Control gullies from their respective catchments is relatively similar. The overland flow water represents the major transport mechanism for suspended sediment within the gully system. Thus, the lower concentrations of suspended sediment and associated nutrients and carbon in the Remediated gully compared to the Control gully can only be attributed to the reduction in sediment and nutrient sources (i.e., erodible soil) from within the gully itself. This is not an intuitive assessment, rather, it is an interpretation of the data gathered. Furthermore, the authors shall provide a before and after digital elevation map (DEM) of the remediated gully that demonstrates how erosion of the gully system has been greatly reduced. This complimentary line of evidence will further support the conclusions made regarding the effectiveness of the remediation measures used at the Remediated gully.

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