

## Review 1

Braided rivers can provide substantial recharge to regional aquifers, with flow exchange between surface water and groundwater occurring at a range of spatial and temporal scales. However, the difficulty of measuring and modelling these complex and dynamic river systems has hampered process understanding and the upscaling necessary to quantify these fluxes. This is due to an incomplete understanding of the hydrogeological structures which control river-groundwater exchange. This paper presents a new conceptualization of subsurface processes in braided rivers based on observations of the main losing reaches of three braided rivers in New Zealand. It is useful to understand the braided river systems.

Dear Reviewer

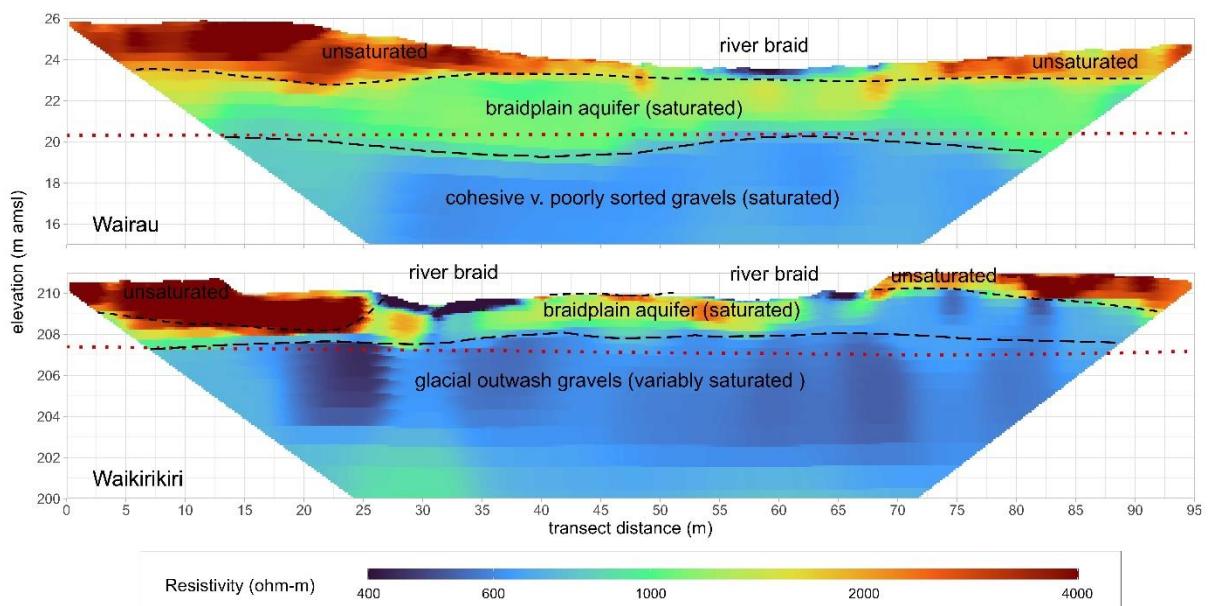
Thank you for your review of our article. We understand that we should improve some aspects of this article and are willing to address your comments in a revised version. Please find below answers to your questions and explanations on how we would address your comments. Our responses in blue refer to lines in the original document, and your comments are in black.

Scott Wilson (on behalf of the co-authors)

### Major issues:

1. Figure 9 in page 22, please explain that why the “glacial outwash gravels” are unsaturated?

There is an error on the text in Fig. 9 which should say “variably saturated”. We’ve corrected this, and have also modified Fig 9. to clarify the saturation status:



**Figure 9.** Subsurface resistivity collected by Electrical Resistivity Tomography (ERT) across Wairau and Waikirikiri river braids, looking downstream. Surfaces interpreted from the resistivity data are shown in black. An interpolated surface for the base of the BPA derived from drilling and bed data is shown in red.

The requirements for a variably saturated zone to form in the sediments underlying the BPA are described in the paragraph at line 172. For clarification, we will include the following explanation in the text at line 342:

Our explanation for the presence of this variably saturated zone is that the glacial outwash gravels are stratified, and vertical infiltration to the regional aquifer is limited by the lower permeability horizons of silt and clay. The presence of higher permeability horizons within the stratified postglacial sequence allows water to move laterally away from the recharge zone at a rate that exceeds vertical infiltration, enabling unsaturated or variably saturated conditions to form.

And how about the braidplain aquifer? Saturated or unsaturated?

We've added a sentence at line 154 to clarify the BPA saturation status:

For a perennially flowing river, the BPA will retain some degree of saturation, although unsaturated conditions may occur in the case of intermittent or ephemeral rivers if there are prolonged periods with no river flow.

Can you compare the ERT results with your borehole surveys in Fig. 4.

The contact at the base of the BPA shown on Fig 9 represents the unconformity revealed in drill core e.g. on Fig 4, and is described in section 5.1, including the grainsize distribution of the two units (Fig 5). While the locations of the ERT profiles don't exactly match the coring locations (Fig 3), there is structural and lateral consistency in both the coring and ERT data. We've added an interpolated surface to Figure 9 (see red line in the figure above), which has been derived by kriging intercepts of BPA base within the contemporary braidplain (in Fig 3). The sentence at line 457 has been modified for clarity:

These profiles reveal the contact between the braidplain aquifer and underlying sediments (the unconformities shown in Fig. 4) at elevations consistent with drillhole coring. For comparison, the elevation of the same unconformity, derived by kriging intercepts of the BPA base within the contemporary braidplain (Figure 3), is shown in red on Figure 9.

2. In Fig. 10 at page 23, can you explain that what is the "DTS" and "A-DTS"?

These acronyms are explained in 4.1 (lines 298-299), and are also evident in the section 5.5 title. If the editor prefers, we can change the caption to:

Figure 10. Vertical (a) distributed temperature sensing (DTS) and (b) active-distributed temperature sensing (A-DTS) surveys carried out on the south bank of the Wairau River on w27. The river temperature over the period of the surveys is shown in (c) along with temperatures measured by DTS at 4 and 9 m depth. SWL=static water level measurements over the survey period

#### Minor issues:

These issues are specific to correct use of language. We agree with some of these changes, although we do disagree with some of them:

1. Line 17: "including:" should be changed to "including". changed
2. Line 26: "hyporheic" should be changed to "the hyporheic". not changed
3. Line 27: "exchange" should be changed to "the exchange". not changed
4. Line 28: "Exchange" should be changed to "The exchange". not changed
5. Line 30: "aquifer" should be changed to "aquifers". not changed
6. Line 55: "scale" should be changed to "scales". not changed

7. Line 95: "net" should be changed to "a net". changed
8. Line 100: "reach" should be changed to "reaches". not changed
9. Line 147: "recognises" should be changed to "recognizes". not changed
10. Line 190: "result" should be changed to "results". not changed
11. Line 218: "enables" should be changed to "enable". changed
12. Line 282: "are" should be changed to "were". changed
13. Line 291: "underling" should be changed to "underlying". changed
14. Line 301: "on" should be changed to "in". changed
15. Line 304: "insufficient" should be changed to "an insufficient". not changed
16. Line 331: "on Fig. 3" should be changed to "in Fig. 3". changed
17. Line 351: "on Fig. 4" should be changed to "in Fig. 4". changed
18. Line 351: "on Fig. 10" should be changed to "in Fig. 10". changed
19. Line 415: "are approximately" should be changed to "is approximately". not changed
20. Line 416: "condition" should be changed to "conditions". not changed
21. Line 441: "notable" should be changed to "a notable". changed
22. Line 446: "in the near surface" should be changed to "at the near surface". Changed to " in the near-surface, which improved"
23. Line 474: "in the 1960's" should be changed to "in the 1960s". changed
24. Line 501: "on Fig. 1" should be changed to "in Fig. 1". changed
25. Line 515: "losing water" should be changed to "lose water". changed to "be losing water"
26. Line 517: "therefore interpretation" should be changed to " therefore an interpretation". not changed
27. Line 550: "hyporheic exchange" should be changed to "the hyporheic exchange". not changed