Specific Comments

58 there are better references to use here (eg Fleckensten et al. 2010, Gonzalez-Pinzon et al. 2015, Magliozzi et al. (2018) etc). Previous review papers have all pointed to the need to address groundwater-surface water exchange with multiple techniques and scales

63 This definition of hyporheic exchange is inconsistent with the traditional definition of previous authors (eg Boano et al. 2014), which refer to hyporheic exchange as being return flow to the river along localised flowpaths. The definition provided here includes unidirectional exchange through the hyporheic zone (also undefined). With this in mind, the text would be greatly improved by dedicating a section to terminology and the difficulties in applying terms to braided rivers. Refer to the review by Magliozzi et al. (2018) which discusses hyporheic exchange at different scales.

107 its worth pointing out that preferential flow paths occur at multiple scales

112-113 this lack of knowledge about hyporheic exchange relates to the lack of conceptual understanding of how braided rivers function in the subsurface, hence definitions are problematic in this setting

114 they may be dry at the surface, but there could still be subsurface (hyporheic) flow between reaches due to sediment heterogeneity and large lateral and downstream elevation changes

133 land encroachment and containment through flood engineering could be added to this list

165 it's the clast-supported gravels which act as preferential flowpaths. OFGs are an extreme type of clast-supported gravel

191-192 I disagree with this statement. The main reason for measuring during low flow conditions is to avoid errors caused by river flow recession. In many rivers the hourly flow recession rate greatly exceeds the rate of leakage to groundwater. By measuring at low flow, the error caused by the time difference between concurrent surveys, and the time difference due to downstream flow propagation are both minimised.

331 Equilibrium radon concentrations in groundwater hosted by alluvial gravels tend to be quite variable because of the spatial variability in mineralogy and water-rock interaction. This variability limits the utility of Rn-222 method

354 The alkalinity section is generic and not specific to braided rivers

390 The temperature section could be improved by treating the data collection via different scales using DTS, heat probes, remote sensing, and time series. With respect to modelling, note that temperature data is extremely difficult to model within an alluvial aquifer because of interference from the surface temperature gradient, and uncertainty around the thermal buffering effect of the gravel medium. Also, because braided rivers and associated gravels are highly dynamic, heat transfer within heterogeneous medium can be highly non-linear.

438 This section should include a discussion on the importance of conceptualisation, since the relationship between rivers and the regional groundwater table can be connected, disconnected, or transitional (see eg Brunner et al 2009)

459-461 The previous comment on conceptualisation relates to how Darcy's law is applied. Are the piezometer measurements in the hyporheic zone, a perched aquifer, or the regional aquifer? Is the river hydraulically connected to either of those aquifers?

504 use the term ‘parafluvial hyporheic zone’ for consistency

513 The paper could be greatly improved by adding more discussion on measurement scales, particularly when it comes to hydraulic conductivity. Many of the measurement techniques listed in this and prior section pose a challenge of how to upscaling the results for the purposes of quantification. There is a significant challenge to scaling up measurements made in braided rivers.

570-573 Braided river deposits are known to be highly anisotropic because of stratification and particle imbrication. This section could be improved by focusing less on bulk hydraulic property measurements, and focussing more on methods for determining anisotropy since the vertical hydraulic conductivity component is the controlling variable for river leakage.

591-593 I think the only study listed here which is dynamic is Wohling et al 2018 (I could be wrong)

615 The real advantage of modelling is its ability to integrate a diversity of data types at a range of temporal and spatial scales

628 Most of the general comments I’ve made could be addressed in this section. E.g. the comment referenced to Lovett in 666-667 provides a starting point for discussing the need for improved conceptualisation of braided river hydrology

655-716 This section is applicable to all rivers, apart from 688-691 which is more specific to braided rivers. The paper would be greatly improved by severely trimming this section down and focussing more on issues specific to braided rivers

718 At this stage the paper starts to get messy as it’s the third time that some approaches are discussed. This section could be moved to earlier in the paper and revised to focus on the context for measurement approaches. Some approaches can help with conceptual understanding, and some can be used for quantification of exchanges.

720-724 This is the first discussion about conceptual understanding, but a conceptual understanding should be the starting point for knowing which methods to apply, and how to interpret the results. This highlights another opportunity for this paper: many of the methods cannot be used for quantification, but they can help us with process understanding. This distinction is not clear in the paper.

732-773 This section would be better integrated into the relevant measurement sections on measurement methods.

775-787 This section would be better placed in the methods section

789-796 There are a number of modelling problems specific to braided rivers, to list a few:

- River morphology is constantly changing. A transient change in model structure is not a feature captured by groundwater models, although scripting (eg PyFlow) provides the potential for this to be achieved
- The braided river bedform cannot be adequately characterised with the existing Modflow SFR functions
- To simulate the dynamic nature of a subsurface braided river hydrology requires a fully coupled model (alluded to in 789-796)