__General comments:__ **The presented study is well designed and informative for regions, where different water bodies seem to exist and mix in ratios, which are unknown yet. Thematically the paper fits to HESS, although I see some points of weakness, mainly related to formulation (or omitting) of hard facts. I guess, with considerable revision, that manuscript has the potential to be of interest for a wide audience. In general, the manuscript should be shortened and particularly the geological part must be clarified for readers outside Australia. In the following, I give some specific remarks to points, where I see difficulties:**

We thank the reviewer for their time in closely reviewing our manuscript. We have aimed to address all concerns below.

Hydrographs in Figure 1 are not very informative, despite the information, that gw-tables are fluctuating. the legends of hydrographs are not explained and it becomes not obvious, why red texted hydrographs are representative for GAB contribution. Instead of showing relative depths of screen bottoms (bgs), it would be more distinctive, when depths would be given relative to msl., to explain the absolute depth.

We have now explained in the legend of Figure 1 why the 2 red text hydrographs show GAB contribution (the deeper piezometric head is higher than head from the shallower wells, indicating upward flow). We think that the hydrographs figure gives the reader a nice overview of the state of the groundwater system in the study area, in particular, areas that are affected by seasonal pumping and areas where the GAB may be contributing water. The NSW Government hydrograph data available only lists the below ground surface depth, however in the region that the hydrographs cover, there is very little elevation change (80 m change in elevation from the south-east to the north-west portions of the study area).

Hydrogeological setting The entire paragraph is very hard to understand, since local formation names are abundant and the hydrogeological context is not clear. Why are all these details necessary for the reader of the manuscript (e.g. lines 191-193)? Paleogeographic features are very difficult to understand. It would be of more importance to reduce the (doubtless interesting) geological context and focus on the formations, which are hydraulically relevant. Probably a stratigraphic table would help a lot, showing thickness, lithological composition and phreatic/confined conditions in each of the relevant formations.

The geological section has been shortened, with most of the second half (including old lines 191-193) removed. We have not included a stratigraphic table, only because the legend in Figure 2 shows a stratigraphic column by age and the cross sections in figure 2 show the depth of the different formations in the Jurassic and Triassic. However, we have cleaned the section up substantially (including removing most paleogeographic features) and have included some 36Cl data in the cross sections of Figure 2.

221 Water balance modeling for recharge That paragraph explains a series of MODFLOW attempts to define various sources for recharge. I believe, the paragraph is to long, since the basic and neccessary information are the outcoming numbers (ratios) for the different proposed sources. The authors use a unit (ML/a) which is unknown to me (Megalitres/year?)

This paragraph has undergone minor phrasing edits (eg line 198: “multiple plausible solutions” has replaced "there are numerous equivalent solutions…"); however, the bulk remains because it is core to the problem with respect to the issue of water balance modelling in the Namoi. ML/a is megalitres/year. We aimed to be consistent using "a" (annum) for year throughout the manuscript, because we referred to "ka" (kilo annum) when assessing the 36Cl residence times.

<u>Specific comments</u>

Line 302: what is the reason to use pmc and pMC?

We detailed both units (normalised pMC and de-normalised pmc) for completeness and to ensure our results were comparable with other study results reported only as pMC's without having to transform units or search information relating to the type of AMS used, or how the d13CDIC was obtained. However, the text has all data consistently as pmc following best practice for reporting groundwater 14C data (Plummer & Glynn 2013). pMC results are only presented in the Supplementary Table.

Line 358: which 2 processes are meant? ET leads to enrichment of all elements, leading eventually to Cc-saturation. Na/HCO3 increases only, when calcite precipitates.

This sentence has been removed now as part of streamlining the manuscript. Additionally, at lines 456-458 (where this old sentence would have been in the restructure) we have explained why we consider an evaporative enrichment in all elements.

Line 360: I suggest to be careful in interpreting Cl/Br ratio changes in these context. Cl/Br ratio will change only, when degree of evaporation results in supersaturation of the water in respect to halite, otherwise there is no change observable. Since Cc-precipitation is discussed, it might be worthwhile to compare Ca/Mg ratios and (Ca+Mg)/HCO3 ratios? Cl/Br ratio might change due to geological reasons...

This is an omission on our part. We should have mentioned the Cl/Br ratio in the context of the Cl v Cl/Br plot. It is not the Cl/Br ratio itself, but rather the trend when plotted against Cl that provides the evidence for our claim. However, in the restructure of the manuscript the original sentence at 358 ("the evaporative enrichment is also evident in the concentrations of F, Cl and Cl/Br") has been removed. We have instead made these data (presented in the new Figure 3) more relevant to the main groundwater mixing message that this manuscript conveys, rather than tangential processes. We had a look at Ca/Mg and (Ca+Mg)/HCO ratios but they revealed nothing additional.

line 390: delete charges. What means "closer"? compared to what?

Charges have been deleted. "Closer to seawater…" has been changed "more similar to seawater…" at line 382.

line 399-401: that sentence is not helpful, since the reader does not know which parameters you refer to. From Figs 3 and 4 it is not given, that 273314 resembles river water, it is obviously just fresh water.

This sentence has been removed as the parameters concerning the outlying sample are described in the separate results section at lines 383-399 (particularly line 397) now.

line 401 ff: from that moment it becomes highly difficult to follow: you refer to the only

sample from the Jurassic Fmt. Why is it strange to have fresh water in there? The base of the well is just above a Napperby fmt. Which indicators suggest recharge through a formation, which is even below Napperby? And which river is referred to? Why should Pilliga Sandstone contribute? The explanation lacks from facts, which give an overview about the hydraulic concept, which obviously led to the formulations. Latest here a regional W-E geological cross-section, showing Fmts. of GAB and their regional confined and phreatic conditions (piezometer heights) is urgently needed to understand the hydrogeological context of the region. In addition, it would also help, to (i) show Fmt. and (ii) add water table heights of the different aquifers in the cross-sections of Fig. 2. Situation becomes harder due to the jumping between formation names.

It is an anomaly to have such fresh water in this sample because the well screen is 207 m bgs and in the GAB Jurassic formation. All other studies that have taken samples at this depth in the GAB have had water that is more representative of the GAB, ie higher TDS. We don't have particular indicators that suggest recharge through the Digby into the Napperby, however this was our hypothesis because of the fresh water 207 m bgs, and the contact between the Namoi River and the Digby Fmt to the south of our study area.
The Namoi River is referred to. This is the only river in our study area and it is in direct contact at the surface with the Digby Fmt to the south of our specific study area. The Pilliga Sandstone should contribute because the sample is taken from the Pilliga SS. "Overlying Pilliga SS" has been changed to "Pilliga SS" to try to make that clearer (line 472).
We have changed 'This suggests' to 'We hypothesise' (line 469) because the first sentence did not necessarily suggest the second.
Figure 2 provides a cross section of the geology and piezometer height, as well as a geological map that shows the Digby Fmt outcropping to the south of the study area, where it is in contact with the Namoi River.
The formations are shown in the cross section of figure 2. Water table heights change over time due to floods and the intensive pumping in the study area. We have included the standing water level at the time of sampling in the Supplementary Information.
A paragraph at lines 467-477 now aims to describe all the above better.

line 407 ff: again, why do the authors claim for contact between that river and deeper Triassic Fmt.? According to Fig. 2: Napperby is the uppermost Triassic. Where is that river situated and why is the river the only option of fresh-water supply? Are these ideas consistent with hydraulic?

At the depth that these samples are situated at, and given the regional data for the quality of the GAB groundwater, the river is the primary source of fresh water. We claim contact between the river and deeper Triassic formations because the river contacts the deeper Digby to the east of the study site, which is consistent with the groundwater flowpaths in the region. This then is important because deeper mixing between the GAB groundwater and the water of the Namoi River is an important consideration in water balance models of the catchment. This is all clarified at lines 467-477 now.

Line 412f. : To be very critically: I don't see clear indications for that statement from Figs. 3 and 4. Major elements in samples >80 m (blue) spread over the entire range and only a few blue samples fall in the same region as GAB analyses from Radke et al. (2000). Is there a geographic link?

We interpret the spread of samples from the shallow, intermediate and deep, and the mixing between them over the entire range of Figs 3 and 4 to be indicative of the mixing occurring throughout the groundwater system. Most of the blue samples in new Figures 3 and 4 fall in the same region as GAB samples. That the deeper blue samples cluster more with the GAB samples than the red or green indicates to us that the deeper groundwater is experiencing greater mixing with the GAB in some places, which is then mixing in varying proportions with the more shallow groundwater, up until the very shallow groundwater is comprised entirely of itself at the other end of the mixing trend. We acknowledge that the blue (deep) samples are spread over a large range, this to us indicates significant mixing throughout the entire vertical groundwater profile. There is no specific geographic link that we have been able to identify.

Line 517f. : Why is not a sample chosen, which was not evaporated at all or even better, a recent rainfall sample, giving the precise input signal for Cl and 3H?

Choosing a more evaporated end-member makes our calculations even more conservative, as it ensures we aren't overestimating the GAB contribution. Rainfall and recharged shallow groundwater do not usually have the same Cl composition, generally Cl is higher in the shallow groundwater. Additionally, we chose the groundwater sample with the highest ^{3}H activity, as an indicator of recent surface infiltration.

lines 521-523: I do not understand the reason of that thought: "...to consider overall transport of Cl from shallow groundwater."

This sentence has been changed to "Thus, the use of the evaporated sample as our end-member represents a conservative approach when considering the mixing components from both the LNA and the GAB" (line 567-569) so that it is clearer.

line 532/fig. 8: Actually these percentages are calculated on Cl-mixing approach only. Within the description, "multiple geochemical tracers and major ion data" are mentioned. Which exactly were used and how does the respective results fit to the described Cl-mixing? According to that figure, it strikes, that heterogeneity of GAB contribution might be related to structural features or any other elements that provide preferential flow? Are there any tectonic lineaments or other indications, which could be responsible for the different contributions from the GAB?

Cl- only was used for this percentage based assessment of GAB contribution, but the other major tracers were used to qualitatively show GAB contribution to the alluvial groundwater. We used the multiple tracers approach to constrain GAB discharge and used the Cl ion to estimate a percentage. For example, we consider samples with [Cl] < 31 mg/L. 3H activities above our detection limit (> 0.04 TU) and/or 14C > 90 pmc to be 100% modern (< 70 a) flood recharge (for example: 36001-1&2, 25329-1, 30345-1, 25332-1, 25327-1&2). Samples that were recovered from generally deeper piezometers along the B-B' section in figure 2 show higher [Cl] that coincide with 3H below or very close to the detection limit, 14C contents generally < 5 pmc and, most importantly, 36Cl/Cl below 58 ($x10^{-15}$). There are no other indications that could be responsible for different contributions from the GAB.

Lines 619-621: That sentence is very vegetarian, it gives no information at all. Please prevent to use such phrases, instead of describing which reason will result in which effect.

This sentence in the conclusion has been removed.