The revised version of the manuscript “A hydrological framework for persistent pools along non- perennial rivers”, by Sarah A. Bourke *et al*. clearly improves the previous versions. There are still a number of small issues that should be improved before publication.

Thank you for taking the time to review or revised manuscript. We are pleased that you consider there to be only minor revisions required prior to publication. Note that the line numbers provided by the reviewer do not directly match with either the clean or marked-up versions of the revised manuscript. The reviewer also mentions Figure 14, which doesn’t exist in the current draft. It seems the reviewer may have been looking at a superseded version. We have nonetheless done our best to address these comments and thereby improve the manuscript prior to publication.

Line 95: “... where the shallow, unconfined aquifer does not support year-round flow” this is unclear and does not apply to all the types of persistent pools.

Text removed.

Lines 96-98: “the general case of a non-perennial river along an alluvial channel (inundated and/or flowing during contemporary flood events) within valley-fill sediments deposited over bedrock” this excludes the perched pools directly carved in impermeable bedrock.

L100-101: Text added to account for perched pools over impermeable bedrock: …”where tributaries flow either across the bedrock or the valley-fill sediments”

Table 1:
- Hydrochemical characteristics of perched water: enrichment in nutrients such as nitrogen, phosphorus, and dissolved organic matter, which are attributed to both the concentration by water evaporation and the accumulation of leaves and other types of organic matters, may contribute to the eutrophication of the pool water.

Text to this effect added in Table 1 Row 1, Column 2, Hydrochemical characteristics of perched pools.

- Susceptibility to stressors of perched water: Drinking animals (cattle) or riparian vegetation transpiration can dry out the pool.

Text to this effect added in Table 1 Row 1, Column 3, Susceptibility to stressors of perched pools.

- Caption: The meaning of the variables in the equations is not indicated here. Transpiration by the riparian vegetation should be taken into account or mentioned, particularly where the extent of this vegetation is large in comparison with the pool area.

These variables are now defined in the text at the bottom below Table 1. E is the evapotraspiration rate, and therefore includes transpiration directly from the pool. Transpiration by riparian vegetation from the alluvium adjacent to the pool would be considered as a withdrawal from the alluvial groundwater store rather than a water loss from the pool directly. The possibility that this may need to be accounted for is now explicitly described in Section 4.2 L433-435.

Line 114: “if the pool is directly carved in the impervious bedrock or there is a low-permeability layer...”

Text updated.

Line 149: The regional gradient of the river (from the headwaters to the catchment outlet) is not relevant for the pool hydraulics.

It is not clear what the reviewer is referring to here, the regional hydraulic gradient is not explicitly mentioned in this version of the manuscript as controlling the pool water balance directly. There is mention of the recession of groundwater in the alluvium be controlled in part by hydraulic gradients at Line 172, which is accurate. No change made.

Line 383: Transpiration by the riparian vegetation should be taken into account or mentioned, particularly where the extent of this vegetation is large in comparison with the pool area.

As mentioned above, transpiration by extensive riparian vegetation constitutes a water loss from the groundwater store. The possibility that this may need to be accounted for is now explicitly described in Section 4.2 L428-429.

Line 387: conversion of water levels to both pool water volume and area requires knowledge of pool bathymetry.
Text added accordingly (L419)

Line 388: between h_p, A and V_will change during...
The relationship between h_p, A and V is controlled by bathymetry and doesn't change unless the bathymetry changes (for example due to a major flood event that redistributes sediments) The reviewer is likely referring to the role of *A* in controlling the relationship between h_p and V as water levels recede. The reduction in A as water levels recede is now explicitly identified at L421.

Line 449: Evaporation is the only output that involves isotopic fractionation; transpiration and outflow do not modify the isotopy of the pool water.
This is an unfortunate misconception. It is true that transpiration and outflow are not associated with fractionation, and the isotopic composition (or solute concentrations) of these loss terms will be the same as the pool itself at the time and location of water loss. However, these terms are important components of the pool water balance that need to be accounted for to avoid errors in the interpretation of isotopic data from pools. This point is described in detail in the discussion (Figure 13 and associated text).

Line 510: Some short description of the geology of these reliefs (Ranges, spurs and hillslopes) would be necessary here.
Text added at L547: …(consisting of bedrock and dykes described below)…

Line 573: are these perched pools?
It is unclear what the reviewer is referring to here at this line number (or in adjacent text). No change made.

Line 591: Figure 10a
Line 592 Figure 10b
Line 617: Figure 11a
It is not clear what issue the reviewer is attempting to identify here, these figure references appear to be accurate in the current version of the paper. No change made.

Line 618: This topography and the section on figure 11 suggest that this pool could also be considered a 'topographic low' one.

Figure 11 is describes Howie's Hole. The dominant hydraulic controls on the location of this pool are the contact between permeable and impermeable rock and the catchment constriction, as described. No change made.

Line 629: Figure 11b
Line 645: Figure 11c
This figure references appear correct, no change made

Line 650: may through-flow from alluvium in the upper part of the water fall seep along it?
It is not clear what the reviewer is referring to here. No change made.

Figure 11a: The horizontal scale of the graph is lacking.
Figure 11a is a photo. No change made.

Line 666: What is BIF? Brockman Iron Formation?

In the current draft, BIF is only mentioned in Table 3 where it is defined as Banded Iron Formation. No change made.

Line 672: Channel scour physically depends on gradient and depth of the flowing water.
The meaning of this comment is not entirely clear. Hydraulic gradients are important controls on scour because they control the flow rate. Flow rates can also increase if the area is restricted, as is the case where there is catchment constriction (which is what we are describing). The importance on enhanced flow rates for creating scour is described at L714. Text here updated to explicitly mention the increase in depth.

Line 677: Figure 12b
Line 689: Figure 12c
These figure references appear to be correct. No change made.

Line 693: "... isotopic values began to enrich suggesting that evaporation became less compensated by decreased inputs from groundwater..."
This suggested text is grammatically unclear. Existing text identifies the decreased inputs in groundwater, consistent with the reviewers suggestion. Evaporation didn't change and we see no reason to complicate the sentence by mentioning it. No change made.

Line 694: Figure 12d
Line 696: Figure 12e
These figure references appear to be correct. No change made.

Figure 11: This should be Figure 12. Dots are too small in the legends of figures b) and c)
Figures appear to be numbered correctly. Symbologies enlarged in Figs 11b and 11c.

Line 744: evaporation and riparian vegetation transpiration rates.
Meaning of comment unclear. May be referring to comments on Ben's Oasis at L786 – transpiration rates now explicitly mentioned in this sentence.

Figure 13: This example is insufficiently explained and it is not necessary for the paper. $m^3 d^{-1}$ are not volume but flow units.

As per our response to the reviewers comment above, the point here is that water balance components should be adequately accounted for to avoid misinterpretation of measured hydrochemical data. It is clear from the reviewer comments that our point did not come across with the text as written. The accompanying text has therefore been extensively revised for clarity and completeness (L905-931).

Volume units on Fig 31a have been corrected to m^3.

Figure 14: This figure is inconsistent and redundant. The 'Topographically... pool' is too small for observing the structure. The 'Throughflow... pool' looks really as a 'Topographically controlled...' pool.

There is no Figure 14 in the current version of the paper