

Response to reviewer comments on manuscript number:

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Anonymous Reviewer 2: Hydrol. Earth Syst. Sci. Discuss., 11, C231–C233, 2014

This is a highly correct paper on its results and conclusions, but with minor novelty apart of its local description of the case. The paper neglects stating the main question as well as the underlying hypothesis that guided the approach. Indeed, the reader is willing to quickly understand which are the main issues defining the specific study. This needs to be supplemented in the forthcoming revision.

We would like to extend our thanks to the reviewer for providing useful and detailed feedback on our paper. The main question of the paper was to investigate the relationships between flow rate, turbidity and nutrient delivery in the Owenabue catchment. Coupled with this we wished to investigate if particulate nutrient concentrations were associated with high flows or high turbidity events. Our result suggest that particulate nutrient concentrations are influenced by rapid increases in flow rate. To address the reviewer's comments, we have added the following paragraph to Section 1.

'In this paper, we investigate the relationships between flow rate, turbidity and nutrient delivery in the Owenabue catchment. Additionally, we analyse the contribution of particulate nutrient concentrations during high flow or high turbidity events and show that particulate transport of nutrient forms a significant portion of overall nutrient transport.'

A more detailed description of the hydrological pattern should be also appreciated, since hydrology (and in particular storm events) appear to be so much important for the nutrient dynamics.

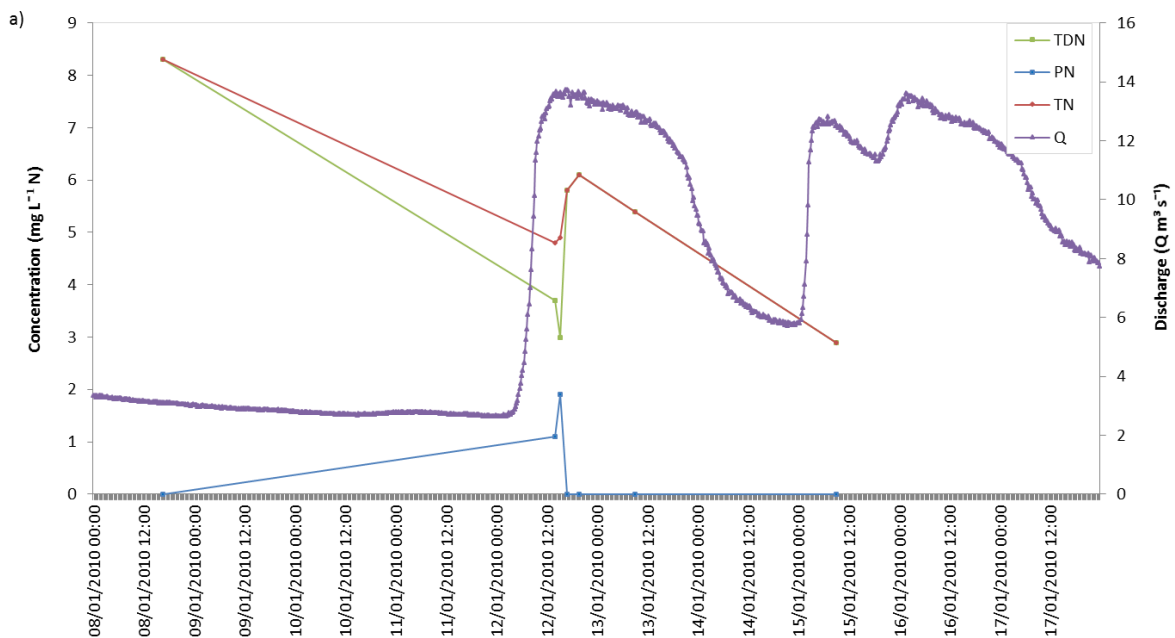
We have revised Section 4 to address the reviewers comment in relation to describing the hydrology. We have also updated Figure 4 (as recommended by the other reviewer) to show the hydrology associated with the event. Section 4 now reads as follows:

'Figure 2 shows the precipitation, flow hydrograph and turbidity signal for the monitoring period. Rainfall and river discharge are typically larger in the metrological Irish winter months of November to January and lower values are found for the July to September time period. Rainfall in 2011 (1014 mm) was greater than the annual rainfall in 2010 (859 mm) and both years were "drier" than the long term annual average (1208mm) following a very "wet" year in 2009 (1574mm).

Maximum total monthly rainfall over the monitoring period was 246.7mm in November 2009 while the lowest monthly total was 17.1mm in August 2010. The maximum daily discharge during the monitoring period was $16.3\text{m}^3\text{ s}^{-1}$ and was associated with high water levels due to prolonged rainfall during October and November 2009. Serious flooding was reported throughout the SWRBD during this period.

The River Owenabue exhibits a flashy hydrograph as seen in Figure 2 with suspended sediment concentrations and sediment associated nutrient concentrations responding quickly to high flow events. Typical events involve a rapid increase in flow rate early in the event, driven by the small catchment and steep catchment hill slopes. The time to peak of a typical event is of the order of hours. At the monthly scale, monthly discharge was observed to be greater than monthly rainfall for 8 months over the monitoring period, indicating that the catchment was regularly saturated. Detailed analysis of the catchment hydrology in relation to sediment transport is presented in Harrington & Harrington (2012).

The sampling programme resulted in a representative range of the flow regime being sampled. The minimum, average and maximum flow rates over which samples were collected were $0.27 \text{ m}^3 \text{ s}^{-1}$, $3.22 \text{ m}^3 \text{ s}^{-1}$ and $16.66 \text{ m}^3 \text{ s}^{-1}$ respectively compared with the equivalent values of the continuous record during the monitoring period of $0.27 \text{ m}^3 \text{ s}^{-1}$, $2.31 \text{ m}^3 \text{ s}^{-1}$ and $19.59 \text{ m}^3 \text{ s}^{-1}$.



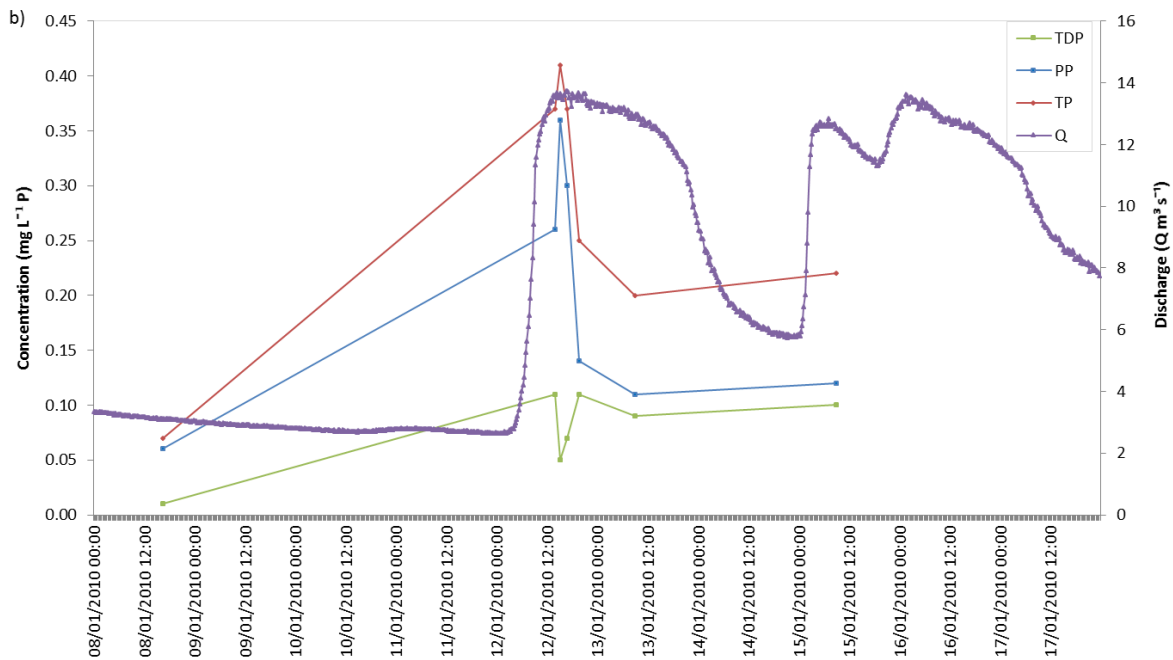


Fig 4. Discharge and (a) nitrogen and (b) phosphorus concentrations during a storm event from January 2010.

Finally, patterns need to be compared with others elsewhere; the comparison is by now restricted to very similar systems, and it remains unanswered whether the behaviour is or not singular.

Comparing the patterns across different catchment would be very interesting and informative. However, it is difficult to compare yields and patterns of sediment/nutrient dynamics in catchments that differ in terms of climate, geology, hydrology, and land use and management etc. Such a comparison would require a detailed study of the catchment characteristic of each catchment in the comparison and it is, we believe, beyond the current scope of this paper, but offers potential for future work.

The writing is sometimes unclear. I provide comments on specific sections of the paper.

110- L3 Why “enriching” nutrients?

We have removed the word ‘enriching’ from the sentence.

L12 Better “determination between

We have amended the sentence as shown below to clarify:

‘High concentrations of phosphorus were associated with increased discharge rates and the coefficient of determination (r^2) between most forms of phosphorus and both discharge and suspended sediment concentrations were observed to be greater than 0.5.’

L22 Awkward sentence “a potential eutrophication risk to the river where phosphorus was found to be the limiting nutrient”

We have rewritten the sentence as follows:

‘While total nitrogen and total phosphorus levels were similar to other European catchments, levels of bio-available phosphorus were elevated indicating a potential risk of eutrophication within the river.’

L25 reducing temperature, productivity, density, the mass of benthic communities. You mean that nutrients decrease productivity? and the mass of benthic (not benthic) communities? This is certainly against usual knowledge.

The inclusion of nutrient concentrations in this sentence was not correct. We have removed the reference to nutrients in the sentence and corrected the spelling of benthic.

111-L13 non-point pollution to the surface- You mean surface waters?

Thank you, we have corrected the error.

113-L25 and ff. “The objective for the 2015 to 2021 reporting period is to improve river water quality. The poor status of the river can be attributed to the results of the macroinvertebrate tests rather than the physio-chemical testing”- This sounds contradictory. Probably you confuse the ecological status with the chemical status. The following sentence suggests you do not provide credibility to the biological status. In my opinion you need to refine this- the WFD is precisely requiring the different endpoints to be jointly considered.

The Owenabue (Owenboy) has six water body units. Two main water body units cover the catchment. The biological and other supporting element we refer to in the text are set out in the ‘Lower Lee Owenboy Water Management Unit Action Plan’ an appendix to Anon (2010). The table below is adapted from this source for the two main water body units.

	Biological Elements	Supporting Elements			
Member State Code	Macroinvertebrates (Q)	Physio-chemical	Ecological	Objective	Date objective to be achieved
SW_19_1584	P	H	P	GES	2021
SW_19_1968	M	H	G	GES	2021

P = Poor, M = Medium, G = Good, H = High, GES = ‘Good Ecological Status’

Based on the above, we are satisfied with the paragraph in the paper relaying the current status of the Owenabue catchment in relation to the biological status compared to the physio-chemical status. We would be happy to discuss this further if necessary.

114-discharge by the staff of the Office of Public Work - this is not necessary

Noted and amended in the paper.

L15 Why Whatman GFC filters, 1.2m pore size were used? This is confusing regarding the comments at the introduction on the pore size. An explanation is required for this choice. Which were the fractions filtered and which were not- please describe in the text.

1.2 µm pore size filters were used to maintain consistency between the suspended sediment testing procedure and the particulate portion of nutrients. Dissolved nutrient parameters were based on the filtrate. We have amended the sentence as follows:

'Whatman GFC filters, 1.2 µm pore size, were used to filter the water samples to determine dissolved nutrient parameters. This provided analytical consistency between the suspended sediment analysis and the chemical analysis.'

L17 Define the method PhosVer3 Acid Persulfate Digestion/Photometric Method 8190. Stating that it is equivalent to USEPA Method 365.2 does not help much. Provide references.

L25- Equal for Cadmium Reduction Method 8171/Photometric

To address the above two comments we propose to amend P114 L17 to P118 L3 as follows:

'The nutrient parameters monitored were: total phosphorus (TP), particulate phosphorus (PP), total reactive phosphate orthophosphate (TRP), soluble reactive phosphorus (SRP), total dissolved phosphorus (TDP), total nitrogen (TN), particulate nitrogen (PN), total inorganic nitrogen (TIN), dissolved inorganic nitrogen (DIN) and total dissolved nitrogen (TDN).

Testing methodologies were as detailed in American Public Health Association (Eaton, 2005), namely persulphate digestion (TP, TDP, TN, TDN), ascorbic acid (TRP, SRP) and cadmium reduction (DIN, TIN). PN was calculated as the difference between TN and TDN and PP is the difference between TP and TDP. As an accuracy check, standard samples were included in the analysis of all chemical constituents.'

118 curves instead of cures.

Thank you, this error has been corrected.

120 L7 and ff- As stated, N:P stoichiometry is useful to predict P or N limitation, and this might be extensive not only to phytoplankton, but also for the other primary producers probably important in the river: biofilms, and even some plants. It is also clear that other factors are indeed important in affecting the primary producers' growth: hydrology, light, temperature needs to be included in the prediction of eutrophy, and references need to be included.

We acknowledge the role other factors play in the eutrophication of the river. We have not added detailed discussion, as we feel the focus should be on the importance of P in the context of the study and the WFD. We have however amended the paragraph as below to include the other producers as mentioned by the reviewer.

'N:P stoichiometry is widely used to define P or N limitation for plankton growth, which leads to eutrophication. A molecular N:P ratio greater than 16 (Redfield Ratio) indicates P to be the limiting nutrient, while N: P ratios lower than 16 indicate N to be the limiting nutrient. The mean N: P ratio of the Owenabue River for the entire study period was 43, indicating that plankton, biofilm and plant growth and thus eutrophication in the Owenabue River is controlled by P inputs, rather than N inputs. This is important in the context of the WFD where rivers must achieve good status by 2015 and the Owenabue River has been identified as being at risk of not meeting this target based on both point source pollution from wastewater treatment plants and diffuse sources such as septic tanks which have a high P content.'

Figures are in general of poor quality. Axes labels and numbering cannot be properly read. Figure 1 is tiny, and several others are hardly readable.

Thank you. We will discuss potential improvement of the figures with the Editor. We can provide the figures in editable format such as .docx or we can accommodate any other specific requirements.