Dear Dr Ort,

Thank you very much for your helpful comments. It is essential for use to further improve the manuscript. Please see our response below.

Response to Dr Ort's Comments

C1: Only one river catchment. Why do the authors only present one hypothetical river catchment? I understand it is for the sake of comparability with another study, but a more general discussion on how the topology of a river network may influence the optimal placement of monitoring stations would add value to the paper. One or two other (hypothetical) river catchments of different structure would be valuable – or a discussion on why the presented river network is covering all (most) typical real world cases.

A1: Thank you for all your comments. We only consider one river catchment (network) but for bidirectional water flows which is an important aspect that we wanted to study. We believe the inlet and outlet nodes for bidirectional water flows are different. The optimal deployment solutions for these two water flows are also quite different. As suggested, we will discuss how multiple river catchments can be considered.

C2: Number of monitoring stations. As far as I can see, there is no discussion/justification for the choice of number of monitoring locations. Only the case with three monitoring locations is presented. Why not make it more general (maybe also in combination with the point above, the number of required monitoring stations is likely to depend on size of the river network and number of branches)? Or at least provide a justification for the selection of three locations (costs?), which would help the reader to understand this selection better.

A2: In practical water quality monitoring, the number of monitoring stations is mainly restricted by the total costs of building and running the infrastructure as well as the practical requirement for the application. The reasons for selecting 3 stations are that: 1) we are not expecting a detection rate of 100% at all times; 2) for comparative analysis, we need to list all the optimal solutions (i.e. as the reviewer has pointed out, there are C_{12}^{3} =220 combinations of all deployment solutions) and show all optimal deployment solutions on the Pareto frontier (so it is easier to use smaller numbers). We will of course add a discussion to justify the choice of 3 stations, and factors that affect the number of monitoring stations.

C3: Criteria for combinations of monitoring stations. For river network A, 13 combinations of three monitoring locations are presented in table 3. Are these all combinations tested by the authors? I tried finding a corresponding explanation, but did not find one in the text. For river network B, 9 combinations are listed (table 5) and they differ from the combinations tested for river network A. For the bidirectional river network, it is a number of 10, again different combinations (table 6). Also for assessing the effect of different detection thresholds, the combinations tested differ (table 19). Only for the comparison of different probability ratios, the same combinations are compared (table 7). Without an explanation and without knowing if these are all tested combinations (and why almost all are different selections), the choice seems arbitrary. If there was a pre-selection step for the identification of the most suitable(?) combinations for each scenario, then this should be written somewhere. Otherwise it hampers understanding how the authors reach their main conclusion " [: : :] bidirectional water flows in a river system have a significant effect on the optimum design of water quality monitoring network and the deployment result is quite different from the same river system with a unidirectional water flow."

A3: A selection of 3 out of 12 potential monitoring locations is a combination issue and there are totally C_{12}^{3}=220 different combinations (or deployment solutions). The 13 combinations in Table 3 are the Pareto frontier combinations obtained by our MOPSO algorithm. These 13 combinations are the potential optimal deployment solutions out of 220, which means no other deployment solutions can be better (minimal pollution detection time and maximal pollution detection probability) than the 13. We have also developed an enumeration search method to verify these Pareto frontier deployment solutions and confirmed that our algorithm can get the same full Pareto frontier as the enumeration search method. We will add an explanation of Pareto frontier as well as test and compare the optimal results to the results of enumeration search method. We will also add further explanation of why we get different optimal deployment solutions (combinations) with different pollution detection thresholds and different flow directions.

C4: Aspects of pollution detection. Pollution detection probability and detection time are addressed. Implicitly, I think the authors also wish to identify location of pollution. If yes, I believe this third aspect would warrant more explanation.

A4: Identification of pollution location was well discussed in the literature. It depends on the flow directions, position of the monitoring station which detect pollution events and the adjacent upstream monitoring location. So, we did not discuss it in our paper.

C5: SWMM model. The suitability of the SWMM model maybe open for discussion. A brief discussion of advantages and drawbacks of using a 1D or 2D model would support the decision to use SWMM (depending on river width/mixing/curves/confluents and type of sample collection across the river section). It appears as if the application of SWMM was ok for the main purpose/aspect of this work.

A5: Thanks for your suggestion. We will add a brief discussion to support the decision of using SWMM.

Q6: Threshold considerations. It seems evident that a detection threshold higher than the actual pollutant concentration affects detection probability and time. However, this is primarily a sensor sensitivity issue and not a monitoring station placement aspect. In analytical chemistry this is discussed with the terms limit of detection and limit of quantification and is a well-known phenomenon. I suggest not presenting this as one of the main conclusions.

A6: Our original consideration for different detection thresholds is to verify how far the detection threshold can affect the optimal deployment solutions. However just as referee commented that a detection threshold higher than pollutant concentration can obviously affect detection probability and time. So, we will not present this as one of the main conclusions.

C7: Conclusions. Summarizing the above, I think the informational content and novelty of the paper would gain if points 1, 2 and 3 could be addressed and corresponding findings would strengthen the conclusions.

A7: We will carefully address points 1,2 and 3 according to your comments above in the revised version.

C8: Terminology: I am not sure what the authors mean with "accumulation" (page 16 line 17 and page 17 line 7). Is it really accumulation (as for pollutants related to particulate matter – e.g. sedimentation – or in fat tissue of organisms) or is it the overlap of pollution from different sources (increasing the concentration if they coincide in space and time)? This comment also applies to the interpretation of figure 7 (right panel).

A8: We accept your suggestion. The word "accumulation" is not suitable here to explain the progress of concentration increasing. We will use "reach" to replace "accumulate" in the revised version.

C9: There are many similar tables and figures. Many of them could be combined to facilitate comparison and minimizing the number (e.g. figures 1 and 3, side by side; tables 3, 5 and 6 could be combined similar to tables 7 and 10). Mainly the large number of similarly appearing tables interrupts the reading flow. Particularly tables 2, 4, 8 and 9 and the description algorithms could be transferred to SI. The readability of tables 2, 4, 8 and 9 would gain if “INF” was replaced with e.g. a “-“ or nothing at all (explaining it in the caption).

A9: We accept your suggestion. We will use “-” to replace “INF” in tables 2, 4, 8 and 9 to improve the readability. As the editor’s suggestion, we will move these tables to Supporting Information. We will also use SI units throughout the paper.

C10: Please label all multi-panel figures properly and provide meaningful captions (e.g. the caption of figure 7 seems wrong, describing another figure).

A10: The original labels for multi-panel figures were lost in our paper due to the inappropriate latex label we used. We have solved this issue.

C11: Please check language carefully, I noted some typos, grammatical mistakes, but the list is likely incomplete.

A11: Thank you very much for your kindly help in grammar checking. We have checked language carefully and corrected all the typos and grammatical mistakes.

C12: Cited literature: Some pertinent general (books) and more specific (also from wastewater sewer system water quality monitoring) literature seems missing. Instead of proposing potential citations myself (which is often seen as a means of promoting certain articles by reviewers/editors; see link below*) I kindly ask the authors to perform a more exhaustive literature search. If the authors wish, I am happy to provide relevant pieces of work that I am aware of on their request.

A12: We will take a more exhaustive literature search and carefully read the recommended link provided by the referee.

C13: Additional: I made a series of comments/suggestions in the attached PDF which the authors may find helpful to further improve the manuscript.

A13: We should say thanks for your great contribution and efforts for our paper. We are improving our paper according to the comments and suggestions in the attached PDF.

C14: It would be helpful if the manuscript came with unique line numbers (rather than restarting numbering at each page). This would facilitate efficient referencing of comments.

A14: We checked the original latex templet provided by HESS and found that It may be the format requirement of HESS and the number is automatically reset to 1 at each page.