Interactive comment on "Verification of filter efficiency of horizontal roughing filter by Weglin's design criteria and Artificial Neural Network" *by* B. Mukhopadhay et al.

B. Mukhopadhay et al.

Anonymous Reviewers 1 :

1. In the current state, the document misleads the reader to what were the objectives of the study. The claims in the document are not adequately referenced and are presented in a rather speculative manner. I am sure that all the statements and claims made in the study can be duly supported by empirical information.

Ans. Introduction part of the paper has reference that are available related to the study. As the field and scope of study is relatively new it was hard to get reliable and reasonable references related to the study.

2. The study objectives may require to be streamlined to what is achievable and per-

missible in context of the available data. This effort will help improve the articulation of every aspect of the document.

Ans. Attempted to improve the articulation by streamlining the objective in the abstract, introduction and conclusion.

Specific comments:

1. The abstract would need to be revised to better highlight of the methodology, findings and recommendations/conclusions of the study. For example, it is not clear from the abstract that the study is based in pilotplant experimentation, and it is not clearly indicated what the three models used in the study were and which criteria was used for comparison (MSE, STDV etc). In the results section of the abstract it is not clear how the authors concluded that the results from the experimental set-up were coherent with the neural model (MSE experimental setup vs. MSE model?) and incoherent to Weglins criteria. Since the objective of the study is to highlight these differences, some figures of criteria used in the abstract would help readers follow the remaining of the document.

Ans. Page 1,Line 5-8 has stated the objectives of the study in the abstract. Line 8-10 explains the methodology of the study along with the criteria by which the SSF-HRF setup was validated.

2. There are a lot of statements in the introduction that would need to be referenced. For example the criteria for operation of HRF could be referenced. A review of what conventional treatment is and its objectives would help improve the introduction section of the paper. It is not clear for instance what the authors see as the difference between plain sedimentation and prolonged storage used as pre-treatment prior to conventional treatment. As found in many text books, conventional treatment refers to the train sequence of chemical coagulation/flocculation, sedimentation, rapid sand filtration and disinfection. From the definition of the authors it is understood that conventional treatment involves always plain sedimentation and/or prolonged storage which is not the

case. The description of the experimental set-up needs to be improved. An interesting question to the authors. Was the pilot plant run during the 70 days without cleaning??The formulation of the 1/3-2/3filtration theory described by Wegelin seams to follow reasonably the descriptions found in many text books. It could be improved by using appropriate tools of Ms-word to present mathematical formulas. Also there is mistake in formula 2. There is a missing i (counter) between C and inlet.

Ans. The question of the reviewer about running of the pilot plant for 70 days with out cleaning was answered in the Introduction part of the paper. See Page6,Line.1-4.The corrections were made to the Eqn.2 and proper reference was given to the statements.

3. In my opinion, most of the information provided in paragraph 2.1 of the methodology section should better be placed in the introduction or background section. The information on building and training the ANN model in the methodology section should be streamlined to focus only on what were the procedures to build the model used in this study (e.g. length of the dataset, which data was used for training of the model and for validation).

Ans. Corrected accordingly. See Section 1.2 and 2.2.

4. The statement "from table it is observed that HRF effluent has met the required level of SS concentration" ...in the methodology section should better be placed in the results section of the manuscript. Also an indication of what the required level is should be mentioned and eventually referenced.

Ans. Corrected accordingly.

5. Table 1, is not referenced in any part of the text. It is also not clear from where this table came from. From literature or from practical results attained by the authors.

Ans. Table 1 referred properly in Page 6, Line 30-31

6. In the text (methodology) it is stated that the pilot plant was operated for a dry period and a rainy period. It is not clear from data presented in Table 2 which data corresponds

to which period. It would help a lot if a horizontal line separating the two sets of data was included. Also it is not clear to which model the results of the third column of table 2 refer. Are those the results of the Wegelins Model of the ANN model.Where are the results of the prediction by the other (comparative) model?

Ans. Corrected accordingly.See Table 2.a & 2.b.

7. Fig 2 could be improved to match to the statement made in the methodology section that "the pilot plant was provided with an under drainage system to "...What kind of under drain system was used?

Ans. Actually Fig.2 do not show the drainage channel due to lack of scope but has identified it by the outlet part.

8. The results and discussion section should be improved. There is not a single reference of the results found by wegelins model which are further compared to those of the ANN model. At least it is not clear where they are. Values of MSE, r CE and STDEV obtained from Wegelins model are presented in table 4 but it is not clear from where they came from.

Ans. Corrected accordingly. See Page 11, Line 1-11

9. In a study like this it is always helpful to represent the results of your models graphically. Normally fitting curves are used in which results obtained by models are fitted toresults obtained experimentally to evaluate how results from the models deviate from practical results. This would help interpretation of the findings from the authors.

Ans. Authors do not include as many readers do not like such fitting curves due to clumsiness observed in such diagrams.

10. During development of ANN models, a portion of data is used for training of the model and a portion for validation. This is correctly stated and used by the authors but there is no indication whatsoever in the text or tables, of which data was used for training and which was used for validation and what the criteria used for selection.

Ans. Already mentioned in Table 3.

11. Authors are encouraged to refer also to related work previously published in the same or similar subjects. There are very few peer-reviewed references on similar work done by other researchers in the same or similar subjects. A quick search on internet has revealed the following possibility: Verification of Wegelin8217;s design criteria for horizontal flow roughing filters (HRFs) with alternative filter material" by GM Ochieng and FAO Otieno. Water SA, Vol. 32 No 1, pp. 105-110. This can be accessed through: `http://www.wrc.org.za`. A reference to the Standard Methods is needed in the reference list. Authors should bear in mind that not all readers knows the Standard methods (of what?) and also that there are many standard methods and editions.

Ans. Corrected as much as possible.

Anonymous Reviewer 2

The abstract indicates a general objective to estimate the performance by using Wegelins design criteria whereas in fact the objective is to compare Wegelins model and performance predicted by different Artificial Neural Networks. It then indicates that the motive is to reduce the Slow Sand load in the raw water, which is wrongly stated as it refers to the reduction of the load of suspended solids or turbidity to improve the performance of a Slow Sand Filter. On the other hand the article does not clarify the latter issue.

Ans. The erroneous parts were removed and proper and concised abstract were added.

The introduction has a number of unclear and even inadequate statements. For example the fact that surface water is polluted is not because it is exposed to the weather but because it may receive surface runoff, waste water and people may use it directly for defecation. Just imagine that if you step outside in the rain exposing yourself to the weather you would get contaminated. Another issue is that shallow groundwater

may contain bacteriological pollution which may require treatment for example by SSF. Another important limitation is that no clear review has been made concerning multi stage filtration (MSF) and even horizontal roughing filtration (HRF). A quick search on internet shows a diverse picture. In Latin America HRF is not used. Here the systems are mostly using the cheaper alternative of upflow roughing filtration (upflow gravel filtration) (Visscher, 2006). Whereas according to Jayalath and Padmasiri (1996) in Sri Lanka HRF is a common pre-treatment system. Also a better description of the study of Wegelin would have been useful for the readers as this study is based on research using water that is mixed with kaoline. This does not reflect the real life situations in roughing filters which is affected by biological processes that are not reflected in the work of Wegelin. Galvis (1996) for example indicates that the results of Wegelins work show that efficiencies per unit filter length >0.001 cm-1 would be possible only when filtration rates of <2 mh-1, preferably <1mh-1, are applied and the total filter length should be of the order of several meters to obtain significant total removals. He also stresses that in practice, other ambient or operational factors are not considered in the theoretical analysis.

Ans. Added related and reliable references in the required regions of the paper.

Another remarkable issue is that when describing artificial neural networks no reference is made to recent articles that report on the positive application of such networks to support performance monitoring and optimization in for example Fernandez and Galvis, 1998; and Baxter et al 2002. A better review of the literature would have provided the opportunity to put the findings more in perspective because no doubt Artificial Neural Networks have a great potential for optimization of water treatment systems. They can also be useful for design purposes if used to interpret the data of longer term pilot testing.

Ans. Nearly 10 papers were cited in the paper about the application of ANN in hydrology. Though the paper uses neuro-genetic models which are not exactly same but a couple version of ANN.