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August 31, 2017

Via E-mail: Sincock.Jennifer@epa.gov

Jennifer Sincock
Office of Standards, Assessment, and TMDLs
Water Protection Division
U.S. EPA Region III
1650 Arch Street (3WP30)
Philadelphia, PA 19103

Re: Indian Creek TMDL

Dear Jennifer:

I represent Lower Salford Township, Lower Salford Township Authority, Franconia Township and Franconia Sewer Authority in the above-referenced matter. As requested in your August 11, 2017 e-mail, I am providing you with comments on behalf of the aforementioned municipal entities to the draft report entitled "Preliminary Draft TMDL for Sediment in the Indian Creek Watershed, Montgomery County, PA – Existing Loads." Please be advised that the aforementioned entities reserve the right to submit additional comments if they deem appropriate.

Please call me with any questions. Thank you.

Sincerely,

HAMBURG, RUBIN, MULLIN,
MAXWELL & LUPIN

SAH:clp

Enclosure

Comments on the "Preliminary Draft TMDL for Sediment in the Indian Creek Watershed, Montgomery County, PA – Existing Loads," submitted on behalf of Lower Salford Township, Lower Salford Township Authority, Franconia Township and Franconia Sewer Authority.

1. The revised draft sediment portion of the Indian Creek TMDL ("Revised Draft TMDL") appears to be largely speculative. Other than the IBIs measured in the Indian Creek, which appear to be based on actual data on actual macrobenthos, the Revised Draft TMDL is based on speculative causes and modeled estimates. In fact, while EPA's Revised Draft TMDL presents graphs, numbers, calculations, and precise estimates of required TMDL targets, there appears to be no actual data on actual flows or on real suspended sediments or on real erosion in the Indian Creek and its watershed. In addition, it appears that neither EPA nor DEP actually know whether excess sediments (or excess phosphorus) is the cause of the low IBI in the Indian Creek. An analysis of available data, presented as our last comment, indicate that excess sediments (or phosphorus) are **not**, in fact, the cause of the low IBI. Adding to the highly speculative nature of this endeavor is the reference watershed approach, which does not appear to be based on any successful experience. Significantly, none of the estimates of sediment loading for either the Indian Creek or the reference watershed, or even land use within either watershed, have been verified with any measurements. Therefore, the stringency of the Revised Draft TMDL is based solely on model predictions. In turn, the model predictions are profoundly influenced by uncertain input data concerning land use and by unknown model performance and applicability to either watershed. By way of example, is the sediment loading in Indian Creek approximately 4300 tons per year, and is this loading really about three times the sediment loading of Birch Run? There are no firm data to support this conclusion. Is a 66% reduction in sediment necessary to make Indian Creek's macrobenthos as good as Birch Run's? Again, there is no way to know. Notwithstanding the numbers, calculations, and graphs in the Revised Draft TMDL, it is apparent that these numbers and the precisely calculated goals are just educated guesses. Although it was indicated that the GWLF model's predictions had been verified in other watersheds, it appears that no verification of model predications was done here.

2. The reference watershed approach relies on an assumption that has only a minimal chance of being true in Southeastern Pennsylvania. That is, the reference watershed approach attempts to find a watershed that is similar to the impaired watershed in all respects, except for excess sediment loading. EPA asserts that Birch Run is a good reference watershed, one that is just like Indian Creek's watershed, "but for" greater sediment loading. However, a review of the history and geography of Southeastern Pennsylvania suggests that areas that were reasonably good for farming, were farmed and continue to be farmed or converted to residential areas. In contrast, those areas that were not ideal for farming were never farmed or farmed in previous centuries, and then abandoned and allowed to revert to forest. It is notable, then, that Birch Run's watershed is almost 40% forest, while Indian Creek's is only about 7% forest. In short, EPA assumes that the two watersheds are essentially identical, but differ in sediment loading, because their land uses are different. It is more likely that their land uses differ because the watersheds differ in critical ways (geology, soils, slopes, etc.), making the two watersheds not sufficiently comparable for the reference watershed approach. It is also noteworthy that the land distribution maps in the Revised Draft TMDL are inconsistent. For the Indian Creek, all agriculture is grouped together. Conversely, Birch Run divides agriculture into crop and pasture / hay (*see* Figure 4-2 and 4-3).
3. The goals of the Revised Draft TMDL may be impossible to achieve without some depopulation of the watershed, elimination of impervious surfaces, and/or watershed-wide elimination of intensive agriculture. EPA's previous attempt to develop a sediment TMDL was incorrectly calculated and resulted in an almost certainly impossible to achieve 95% reduction in sediments. Although the Revised Draft TMDL is somewhat less onerous, it still sets forth a potentially impossible target of 66% reduction. How exactly does EPA believe that 66% reduction in sediment loading is possible? Instead of unrealistically optimistic general suggestions (*e.g.*, rain gardens), specific, realistic suggestions are necessary to judge whether this TMDL can, in fact, be attained.
4. Using the watershed of an exceptional value stream like Birch Run as a reference watershed effectively makes its IBI (74) the target. The actual target for the IBI is

50, the threshold for non-impaired stream benthos. The reference watershed approach assumes that stringency of the Revised Draft TMDL, in terms of required reductions in sediment, is a function of IBI, and that these values scale linearly. Therefore, use of an exceptional value watershed, with an IBI of 74 as a target, makes the Revised Draft TMDL at least 2.2 times as stringent as may be necessary. *See* Table 1 below.

5. The EPA method double counts the same impacts for two different TMDLs, the sediment and phosphorus TMDLs. Since EPA asserts that both factors impair Indian Creek's macrobenthos, and that both factors warrant expensive remediation, there must be some mechanism to partition the impacts of excess phosphorus and those of too much sediment. Simplistically assuming that one-half of the impact on macrobenthos is due to each stressor makes the sediment TMDL at least twice as stringent as necessary. Along with the 2.2 fold error associated with using an exceptional value stream's watershed as a reference watershed, the necessary adjustment for two causal factors would reduce the necessary sediment reduction to about 15%. *See* Table 1 below. This reduction in sediments is in line with that required at other locations (*e.g.*, the Skippack).
6. The GWLF model used to estimate sediment loading in both the Indian Creek and reference watersheds is problematic in several respects. For one thing, this model includes loading of sediment from the watershed and loading of sediment from streambed and bank erosion. It is our understanding that the latter component was not included in other TMDLs generated by either EPA or DEP in the original TMDL calculations. This source of loading was also not used in the original Indian Creek calculations. Adding stream bank erosion makes the TMDL more stringent, by about 10% of the estimated 66% reduction necessary. Therefore, use of this new model and additional sediment loading penalizes Indian Creek compared to other watersheds.
7. The GWLF model is also problematic in that the EPA's contractor made no attempt to verify the model predictions for sediment inputs in either the reference stream or Indian Creek. Despite sediment loading being the crux of this TMDL, there was no attempt whatsoever to verify sediment loading. There was only a weak attempt to verify the model's predictions of flow; however, these

verifications were against downstream locations on much bigger streams where gauging stations were available. These flow models were not verified against flow, much less sediment loading, in either Birch Run or Indian Creek. Moreover, the model did a poor job of predicting high flows in these surrogate streams, and tended to significantly over-predict high flows. High flows are typically the most critical flows for instream and bank erosion. Therefore, these prediction errors may cause other significant errors in estimation of sediment loading. EPA's response to lack of verification was that undertaking an actual sediment study would be costly. EPA should take into consideration that undertaking unnecessary improvements, if based on less than ideal data, would also be costly to the residents of the local municipalities.

8. The methods used by DEP and EPA to assign causality are not rigorous and may be biased to identification of problems (phosphorus, sediments) that are amenable to those agencies' solutions. DEP's method for identifying causes of impairment is professional judgment based on its expertise at the time of the assessment. In addition to basing very expensive regulation on professional judgement, EPA also assumes that DEP's assessment of "siltation" as a cause is equivalent to too much sediment loading. In southeastern Pennsylvania streams, "siltation" does not mean excess sources of sediments from the watershed, as interpreted by EPA. Rather, siltation as a cause is applied to impaired streams that show evidence of unstable bottoms and unstable banks. These effects are more usually caused by too high of flows, not too much sediments. Notably, neither DEP nor EPA routinely consider too much water as a cause of stream impairment, and too much water may be the dominant stressor in Indian Creek.
9. The EPA assumes that sediments from stream bank erosion and from inflows of sediment from the watershed have identical effects and, thus, can be added together in the estimation of a TMDL. While these two factors do have some similar effects on some stream processes (*e.g.*, high suspended sediments during storms), their effects on stream geomorphology are different and, in some cases, antagonistic. Thus, inputs of sediment loading from the watershed to the stream add sediment to the stream channel, causing accretion of the stream bottom and channel filling. In contrast, stream bank erosion and channel incision reduce

sediment from the bottom, and cause channel deepening. In turn, these two processes have opposite effects on the stream's interaction with adjacent wetlands and floodplains, and with the local groundwater table.

Table 1. Error Analysis. Total Sediment Loading in Indian Creek and Reference Watershed and Necessary Reductions versus Assumptions

a. Estimated by interpolation

Indian Creek Sediment Loading (tons/year)	Reference Watershed Loading (tons/year)	Necessary Reduction (%)	Error: Proposed Reduction / Sufficient Reduction
4,275	1,439	66.3%	As proposed in Draft TMDL
Error 1. De facto IBI goal of 74 versus DEP goal of 50			
4,275	2,985[a]	30%	2.2
Error 2: Double counting same impacts as due to phosphorus and sediments. Assume sediment impacts 1/2 of whole, so only need 1/2 reduction for sediments			
4,275	2,857	33%	2.0
Error 3. Instream Erosion not counted for other TMDLs			
2,991[b]	1,266[b]	58%	1.2
Error 1 and Error 2. De facto IBI goal of 40, 1/2 distance to no impairment, IBI of 50			
4,275	3,630[a]	15%	4.4
Error 1, 2, and 3. Error 1 and 2 divided by Error 3			
		13%	5.1

b. From Table 5.4 of draft TMDL document, with streambank erosion subtracted from total.

10. To expand upon the above comments, there appears to be a strong likelihood the EPA has misidentified the cause of impairment in the Indian Creek.

    A crucial problem with EPA's TMDL for sediments in the Indian Creek is that the underlying cause or causes of impairment have not been rigorously determined. Notably, DEP's methods of cause determination effectively ignore Urban Stream Syndrome ("USS"). USS describes the well-known, and widespread degradation of streams that coincides with urban development. *See references below.* The actual causal mechanism or mechanisms underlying USS are not firmly established and may vary from location to location. For example, USS could be due to various kinds of pollution (nutrients, pesticides and toxins, heat, even light) associated with urban development. Alternately, USS could be due to physical changes to the hydrologic cycle. Increasing amounts of impervious surfaces make stream flows flashier, with higher high flows and lower drought flows. Research suggests that the primary impacts are due to the higher flows associated with increasing amounts of impervious surfaces and efficient storm water conveyance systems. These two factors are succinctly described as too much water too soon, or simply too much water. In turn, the mechanisms by which too much water actually cause impacts on macrobenthos are not known.

According to the Revised Draft TMDL and EPA's comments at the August 3, 2017 meeting, the agency is assuming that too much water impacts macrobenthos in exactly the same way as too much sediment from the watershed. There is some support for this hypothesis if too much water is sufficient to cause stream bank and stream bottom erosion. In this case, both too much water and too much sediment can cause periods of high suspended sediments and, after storms, areas of deposited silt and sand in the stream bottom. On the other hand, these two putative causes have antagonistic effects on other stream factors. Too much water causes stream bottom incision and once incised, deepening of the channel and reduced linkages with streamside wetlands and floodplains. Too much sediment causes opposite effects. In addition, too much water causes potential impacts on macrobenthos that are just different from those caused by too much sediments. Thus, high stream flows disturb macrobenthos habitat: rolling stones gather no macroinvertebrates as well as no moss. There is also evidence that some macroinvertebrates require steadier, more reliable flows than those found in flashier urban stream ecosystems.

Identification of the actual cause of impairment is critical because there are some BMPs, such as buffer strips and contour plowing, which could significantly reduce too much sediments without significantly affecting too much water.

The potential importance of USS impacts on Pennsylvania streams are well illustrated in a recent DEP draft guidance (DEP 2015) that, ironically, completely ignores USS. The draft guidance was intended to demonstrate significant causal linkages between excessive phosphorus and degradation of stream macrobenthos. However, the data provided in that document are much more persuasive in demonstrating that USS, rather than phosphorus, is paramount to IBI in Pennsylvania streams. Specifically, the dataset included in that document also contained information on the percentage of the watershed that is impervious surface, along with some other watershed factors (percent of forest) and in-stream phosphorus concentrations. Plotting macrobenthos IBI versus the percent of the watershed that is impervious produces a much stronger relationship than that observed between phosphorus and macrobenthos. *See figure below.* Birch Run was not included in DEP (2015) original data, so the percent impervious surface of its watershed was obtained from USGS Streamstats program. Also note that 1% impervious surface was added to all values to allow log transformation for watersheds with 0% impervious surfaces. As can be seen from the figure below, Birch Run and Indian Creek behave like other Pennsylvania streams in terms of their IBIs' response to impervious surfaces.

The relative importance of these impervious surfaces and water concentrations of phosphorus can be tested statistically. That is, stepwise regression analysis was allowed to choose which factors best predicted macrobenthos IBI: (1) the percent of the watershed that is impervious, (2) phosphorous concentrations, or (3) both. The stepwise regression showed that once effects of impervious surfaces were considered, there was no additional benefit, in predicting observed IBI, of adding observed phosphorus concentrations to the regression. The statistical inference of these results is that impervious surfaces alone are driving macrobenthos IBI; phosphorus is either not a factor or its effects on macrobenthos IBI are too small to be noticed.

Thus, these statistical analyses of DEP's own data on Pennsylvania streams, have two very important conclusions. First, USS is an important factor, arguably the only important factor affecting macrobenthos in southeastern Pennsylvania streams. Secondly, DEP methods do not see the importance of this factor, probably because DEP is focused on other putative, but likely less significant impacts (phosphorus and sediments).

The same statistical method and same DEP data can be used to address whether too much sediments from the watershed are important to the stream IBI. Although percent of watershed that is agricultural land is not readily available from the data provided by DEP (2015), the amount can be roughly estimated as the percent of land not classified as either forest or urban/residential land. After this value was obtained, the step-wise regression was run with IBI as the dependent variable, and the percent impervious surface and percent potential agricultural land were used as potential predictor variables. The statistical analysis again showed that impervious surface alone was sufficient to predict macrobenthos IBI; adding amounts of potential agricultural land in the watershed did not improve the prediction

These results are affected by the following uncertainty. The analysis assumes that the land not classified as either forest or residential is agricultural, and the analysis also assumes that agricultural land, on average, exports the same amounts of sediments to the streams. In fact, the non-forest and non-residential land could be non-agricultural lands such as open spaces, and agricultural areas will vary significantly in their sediment loading depending on physical factors (*e.g.*, slopes, length-slopes) and agricultural practices (*e.g.*, row crops versus hay/clover). Nonetheless, most of these streams are from Southeast Pennsylvania, so the ratio of agricultural land to non-forest and non-residential land should be reasonably consistent.

Instead of EPA's identified cause of too much sediment, the predominance of too much water as a likely causal factor suggests several important factors. First, since the TMDL target and TMDL compliance are both based on model predictions, Indian Creek watershed could effectively achieve the TMDL by, for example, outlawing row crops. However, the benefits to macrobenthos IBI would likely be meager. On the other hand, BMPs that focus on reductions of too much water might yield more benefit to the macrobenthos, but, based on modeling of sediment loads, not achieve TMDL targets for sediment reduction.

For obvious reasons, correctly identifying the cause of the problem is essential to effectively solving that problem.

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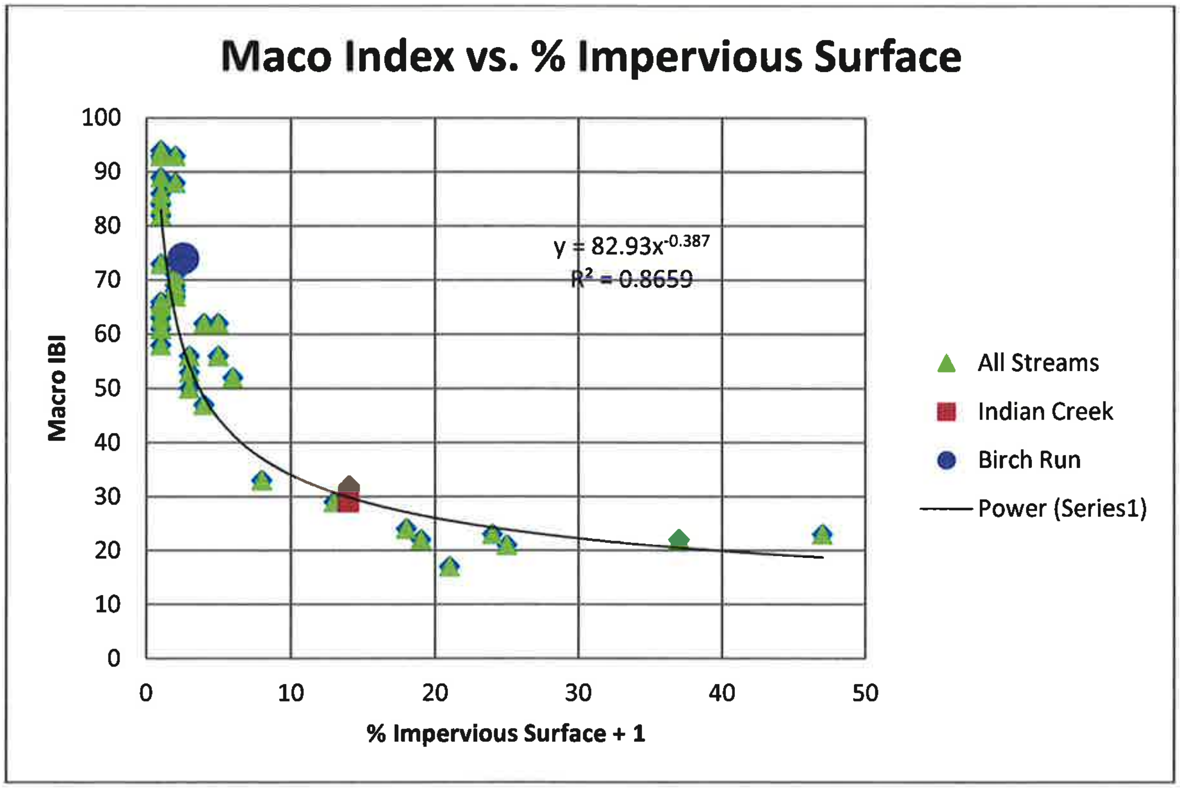
Maco Index vs. % Impervious Surface
Macro IBI
% Impervious Surface + 1
y = 82.93x^-0.387
R² = 0.8659
All Streams
Indian Creek
Birch Run
Power (Series1)
0
10
20
30
40
50
60
70
80
90
100
0
10
20
30
40
50