

MEMORANDUM

To: Bedford Watershed Advisory Board

From: Jennifer Weagle, Legislative Assistant

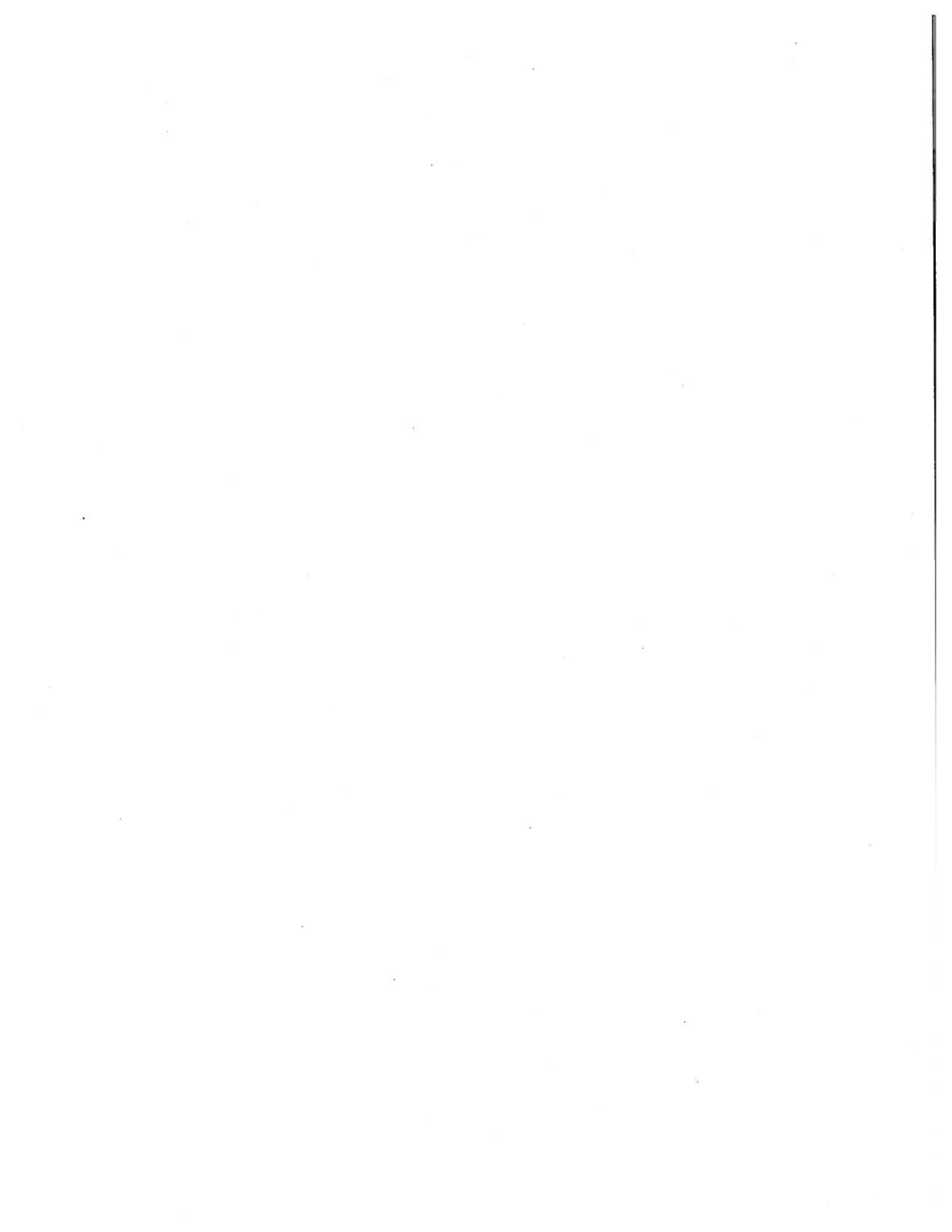
Date: March 26, 2013

Subject: Birch Cove Lakes Watershed Study Final Report – submissions

Attached are responses to questions forwarded to AECOM from Richard Hattin with regard to the Birch Cove Lakes Watershed Study final report.

Also attached are the following email submissions received with regard to the study final report, with responses from AECOM:

- Email exchange between Scott McCallum, Paul Morgan and Russell Dmytriw, ending March 7, 2013 10:19 p.m.
- Email exchange between Richard Scott, Cameron Deacoff, Paul Morgan and Russell Dmytriw, ending March 7, 2013 1:56 p.m.
- Email exchange between Richard Scott, Cameron Deacoff and Paul Morgan ending March 4, 2013 3:30 p.m.



Questions for AECON regarding the Birch Cove Lakes Watershed Study.

Summary

AECON was hired to conduct a Watershed Study that covers all of the Watershed overseen by the BWAB, and models the water quality changes that development will bring to the overall Watershed. Specific tasks are identified in their SOW and in E-17 of the HRM Municipal Planning Strategy. A series of public meetings/consultations, field measurements and engineering analysis was carried out. Two reports have been rendered. This document provides a series of questions that may need further clarification as a result of review by BWAB.

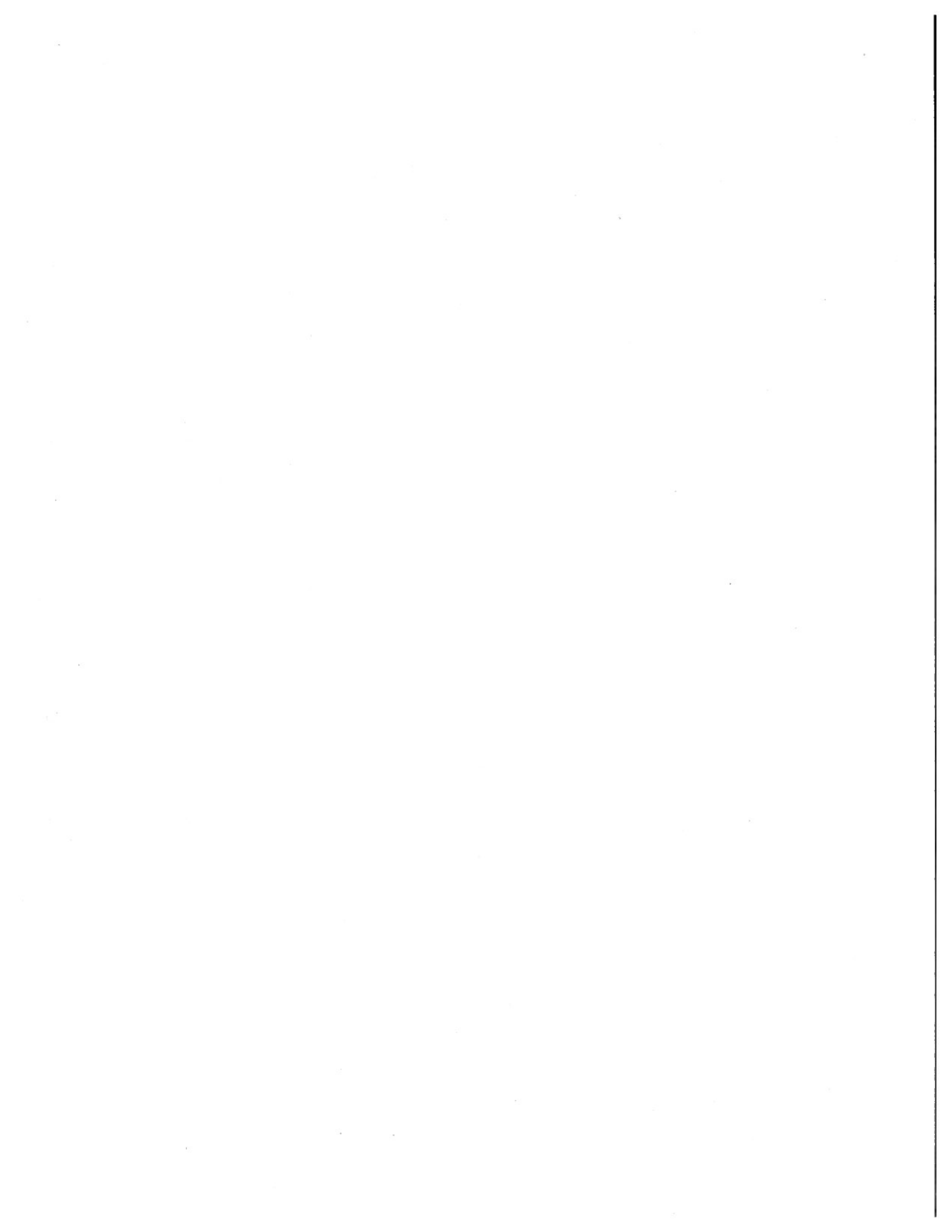
The structure of the questions is to identify the page, topic, and paragraph number. Assumptions may also be restated.

1. p16, Climate Change, Para 4. HRM is taking a 100 year risk approach to climate change but this project is only looking at 20 years. There is no consideration in the modeling to increased storm frequency, decreased septic field efficiency and flooding issues. Report could indicate the design margins needed for 100 yr horizon. *Stormwater infrastructure design recommendations are outside of the project scope.*
2. p21, Bedrock Geology, para 1. Report is adamant that there is no further ARD remains in the watershed. Since ARD is underneath, how is this conclusion reached. What liability does AECON incur if this information is relied upon by excavation contractors and found to be false? *Based on available geology maps, the report states "Within the Birch Cove Lakes watershed, almost no terrain underlain by ARD-generating rock remains undeveloped and so future ARD is unlikely to be a significant concern with additional development" As a watershed study, the report is unlikely to guide contractor practices.*
3. p23, Groundwater recharge, para4. 75% of the area is covered by exposed bedrock or thinly covered bedrock. This will influence the selection of phosphate transport coefficient, but does not seem to be considered. *Exposed bedrock and soil covered bedrock are assigned phosphorus export coefficients different from, for example, forested terrain or developed land.*
4. p34, Trophic status, para 2-6. The descriptions of the different states is not sufficient to evaluate the changes in state. *In this report, changes in trophic state are gauged by total phosphorus concentrations; physical descriptions are not sufficient to differentiate trophic states.* Comment: the term dystrophic does not appear to have associated scientific parameters. Please provide. *Dystrophic is a descriptive, qualitative term rather than a quantitative term associated with specific parameters. Dystrophic is further defined in the report glossary.*
5. p37, Data Sources, para1. Does a deterioration of water quality correspond to a change in the trophic status of a lake? *Since each trophic state includes a range of phosphorus concentrations, a slight deterioration of water quality will not necessarily lead to change in trophic status. However, continued deterioration of water quality due to ongoing phosphorus inputs will typically lead to a change in trophic state.*

6. p 41 - 47, General Water Quality, para 1 onwards. This section comments on the likely cause of the current water quality measurements and thus point sources. Are these point sources included in the LCM? If not, why not. (eg Kearney lake Gateway Quarry, Kearney lake runoff from Kearney Lake Road, Papermill Lake run off from Hwy 102). *These sources are factored into the LCM model by assigning specific phosphorus coefficients to each land use (quarry, highway, etc.).* What is the likely source of Washmill Lake contamination? *Based on 11 samples, Washmill Lake has a median total phosphorus concentration of 8 $\mu\text{g/L}$, placing it in the oligotrophic range. Apart from slightly elevated chloride levels, possibly from road runoff and ocean spray deposition, this lake does not appear to be contaminated.*
7. p49. Relationship between Trophic Status indicators. Para 3. Figure 11 indicates that there is no relationship between TSS and Phosphorus in PML and KL. Why are you using Secchi disc data to predict phosphorus loading effects? *Secchi depth was not measured during this study and is not used to predict phosphorus loading effects. Rather, Secchi depths are used only for illustrative purposes: "Because additional phosphorus loads can result in increased plant and algal growth, study of the relationships between total phosphorus and chlorophyll α and Secchi Depth may provide some insight into how these lakes might "look" with increased phosphorus concentrations."*
8. p68. Constraints Map. The legend indicates ARD as a very dark blue. Confirm that this only applies to the Southern end of Watershed. It seems to appear to the west of Horseshoe lake. *We confirm that acid-producing Halifax Formation rocks are confined to the southern end of the watershed. The dark band west of Horseshoe Lake portrays a transmission line corridor.*
9. p69. Watercourse setbacks and Buffers. Para 1. Can the DEM provide a map showing slopes greater than 20% for the area. *At the watershed scale, these areas are difficult to discern but slopes greater than 20% are shown on Figure 22.*
10. p78. Results, para 4. Horseshoe Lake is a significant data outlier that requires further investigation. What level of point source Phosphorus would be needed to have the model match the actual results? (kg/yr). *To estimate the contribution of a hypothetical point source, lake bathymetry would be needed so that lake volume can be calculated. Unfortunately, this information is not currently available.*
11. p79. Results, para 2. You state that the retention of phosphorus in the larger lakes is essential to maintaining the trophic states of the lake. You have also indicated that McQuade lake has not come into phosphorus equilibrium. I assume that when it does reach equilibrium, its phosphate retention factor will decrease significantly. What indication do you have that the larger lakes can still be modeled with a phosphate retention factor of .5 to .6? *The retention factor is applied to the soil in which the septic system is placed, rather than the lake. As phosphorus adsorption sites on the soil particles are occupied and compounds that might otherwise react with phosphorus to form a precipitate are used up, the retention factor decreases,*

allowing more phosphorus into the lake. This has been clarified in the text. Is Phosphorus consumed when retained by the bottom? Phosphorus is "taken out of action". It is covered by sediment and/or rendered nonreactive and thus becomes unavailable for biological processes.

12. p91. SWMM, para 1. When applying the 80%/20% rule for TSS/TP, were these factors applied to all of the surficial areas of the sub watershed, or just to selected land types? *They were applied to all new developments.* Are there other techniques besides wet ponds, that can provide similar efficiencies and can they be implemented in this environment? *Yes, HRM's Stormwater Management Guidelines (Dillon Consulting Ltd., 2006) describe a variety of measures than can be used.*
13. p91. SWMM results, para 3. Should refer to table 24 and figure 24. *Thanks – changes made.*
14. p92, Table 24, para 1. you quote 4.48 and 10.48 as results from the flow modeling in a 100 yr storm. Where does this show in the Table 24? *This is not shown in the table, but rather refers to "a small crossing at Highway 102 in the Paper Mill subwatershed upstream of Paper Mill Lake". This was provided to illustrate the degree of change that may be expected under certain circumstances.*
15. p92. SWMM results, para 3, Should read Table 24. *Thanks again – changes made.*
16. p95. SWMM results of Water Quality, para 1. It is unclear how the SWMM model is applicable to predicting TP as a function of TSS, when previous data has indicated there is no correlation. Or is there another mechanism in place which is not discussed? Please clarify. *The SWM model assigns a value for the phosphorus adsorbed to the suspended solid particle. The model then predicts TSS in runoff – as TSS concentration rises, so does phosphorus concentration. Does the model compensate for increased drainage /flow rates as the water level increases? Yes, increases in flows, TSS and phosphorus loadings are factored into the model.*
17. p99. TSS SWMM results. Table 26 shows no agreement between measured and baseline model, contrary to para 1 comments. Challenges the quantitative credibility of the SWMM. *Both the measured and the modeled TSS levels are very low; at these concentrations, both analytical and modeling accuracy tends to decrease. Nevertheless, for this particular parameter the modeled results agree rather well with the measured values.*
18. p102, TP SWMM results. Table 28. The table shows that there are only 7 of the 15 lakes that are within 20% modeling agreement, with errors as high as 400% (Horseshoe Lake). The hidden assumption is that the scenarios need a 50% reduction in TP to make these numbers. *It is the LCM rather than the SWMM that is used to predict phosphorus concentrations. The SWMM has been adapted to predict phosphorus concentrations but is better applied to predicting changes to stormwater flows resulting from development. That a certain measure of agreement is noted between the two models lends support to the LCM results. The SWMM is not designed to be a stand-alone predictor of phosphorus loading.*



Weagle, Jennifer

From: Dmytriw, Russell [REDACTED]
Sent: March-07-13 10:19 AM
To: Morgan, Paul
Cc: Deacoff, Cameron; MacKenzie, Kenda; Dmytriw, Russell
Subject: RE: AECOM Birch Cove Lakes watershed study

Hello Paul. Thank you for these comments from Mr. Scott MacCallum. Our initial responses are provided in red below.

Sincerely,

Russell Dmytriw, P.Ge.
Senior Project Manager, Environment
russell.dmytriw@aecom.com

AECOM

1701 Hollis Street SH400
PO Box 576 CRO
Halifax, NS B3J 3M8
[REDACTED]

From: Morgan, Paul [mailto:morganp@Halifax.CA]
Sent: Wednesday, March 06, 2013 4:26 PM
To: Dmytriw, Russell
Cc: Deacoff, Cameron; MacKenzie, Kenda
Subject: FW: AECOM Birch Cove Lakes watershed study

Hi Russell: Comments from Scott MacCallum of Clayton Developments for your consideration.

From: Morgan, Paul
Sent: March-06-13 4:19 PM
To: 'Scott MacCallum'
Subject: RE: AECOM Birch Cove Lakes watershed study

Scott: Attachment B of the staff report is the executive summary of the final report which contained water quality numbers. Your comments will be forwarded to the consultant and BWAB for their deliberation.

From: Scott MacCallum [REDACTED]
Sent: March-06-13 4:11 PM
To: Morgan, Paul
Cc: [REDACTED]
Subject: RE: AECOM Birch Cove Lakes watershed study

Paul,

We reviewed the package and did not find anything regarding modeling numbers for either water quantity or quality. The attachment included with the HRM report was only the preliminary report (this was released months ago) which was basically a summary of background information and outlining of proposed Water Quality Objectives for the

development area. Was there a technical memo that should have been provided? The Draft Final Report dated January 2013 is available on the website at the link provided.

The HRM report summarized the modeling results but there were none attached to the overall package.

We made the following observations while reading the reports:

- A summary of pumping test data and aquifer properties was to be prepared for the final report This summary is presented in the report and appendices.
- A Water Budget was to be prepared for the study area; 6% of precipitation as recharge, 94% precipitation leaves area as surface runoff The water budget is presented in the report and appendices.
- Trophic state of Kearney Lake is oligotrophic, while in numerous locations throughout the text it states that it is mesotrophic, i.e. it is in pretty good shape with low total phosphorous levels (< 10ug/L TP) This error will be corrected in the report text and in the Executive Summary.
- No time horizon was stated for the modeling. The HRM summary report mentions "long term" modeling results but does not qualify what "long term" means; 5, 10, 30 years. The modeling results predict changes to water quality upon completion of the various build out scenarios. The timing of build out will presumably depend on many variables, for example market conditions, developer schedules, HRM planning objectives, etc.
- Biggest impact on improving the water quality into Kearney Lake is the removal of septic tanks around McQuade Lake which would result in better quality water entering Black Duck Brook, the discharge from McQuade Lake. Comment addressed to HRM.
- AECOM assumes that the stormwater quality can be improved using the assumption that stormwater management facilities with efficiencies of 80% TSS removal and 50% TP removal are utilized, how were these targets calculated? The 80%/50% values are taken from HRM's Stormwater Management Guidelines (Dillon, 2006: extended wet pond best management practice). Please note they are not "targets" in any sense. These numbers are used in the model to understand the effect that stormwater management practices would have on water quality if the practices achieved these removal rates.

We have decided not to attend the meeting tonight, we feel that a great deal of information is still missing considering the original terms of reference for the scope of work.

Thanks
Scott

From: Morgan, Paul [<mailto:morganp@Halifax.CA>]
Sent: February-26-13 11:51 AM
To: Scott MacCallum
Subject: RE: AECOM Birch Cove Lakes watershed study

I would expect discussion but I doubt it will be heated.

From: Scott MacCallum [REDACTED]
Sent: February-26-13 11:48 AM
To: Morgan, Paul
Subject: RE: AECOM Birch Cove Lakes watershed study

Thanks Paul,
Do you anticipate a heated discussion with the BWAB group with results from the AECOM report?

From: Morgan, Paul [<mailto:morganp@Halifax.CA>]
Sent: February-26-13 10:57 AM
To: Scott MacCallum
Subject: AECOM Birch Cove Lakes watershed study

Hi Scott: Message below f.y.i.

Good afternoon,

The agenda and reports have been posted to the web for the March 6th Bedford Watershed Advisory Board-hosted public meeting, and can be viewed at the following link:

<http://www.halifax.ca/boardscom/bwac/Agendas.html>

The meeting details are as follows:

Date: Wednesday, March 6, 2013

Time: 7:00 p.m.

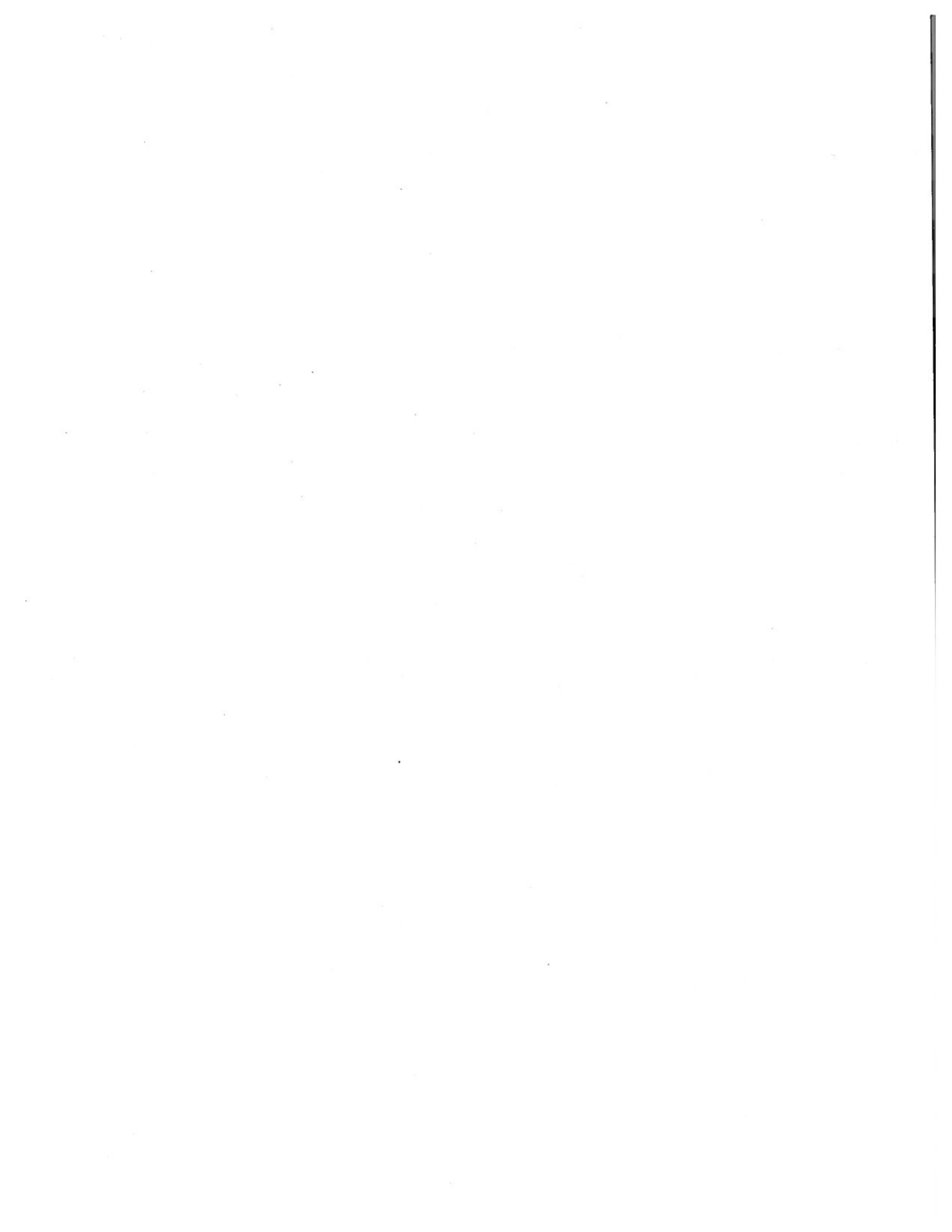
Location: Boardroom, Canada Games Centre, 26 Thomas Raddall Drive, Halifax

BWAB members, I will be mailing you hard copies of the agenda and staff report this afternoon. Due to the substantial size and intricacy of maps, etc. in the AECOM study, we ask that you review the study online via the link provided on the agenda. Please let me know if this causes any difficulties.

Regards,

Jennifer Weagle
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Weagle, Jennifer

From: Dmytriw, Russell [REDACTED]
Sent: March-07-13 1:56 PM
To: Morgan, Paul
Cc: Deacoff, Cameron; Dmytriw, Russell
Subject: RE: AECOM Report

Hello Paul - a last word on Rick Scott's comment - it appears that Environment Canada has changed the way they report evaporation data, which may account for our oversight. The units reported on the data table are "mm" not "mm/day". These evaporation numbers are low but our thinking was this it was due to the cool coastal climate. The text below is from their website - but you have to dig for it.

Lake Evaporation normals for the 1971 to 2000 period were calculated as means of daily means for a given station. This in effect is a measure of the rate of evaporation per day rather than a measure of total evaporation as was calculated in previous normals. To make the 1971 to 2000 lake evaporation normal values comparable to previous calculations, multiply the 1971to 2000 value by the number of days for a given month to obtain an equivalent estimate.

Sincerely,

Russell Dmytriw, P.Geo.
Senior Project Manager, Environment
[REDACTED]

1701 Hollis Street SH400
PO Box 576 CRO
Halifax, NS B3J 3M8
[REDACTED]
[REDACTED]

-----Original Message-----

From: Dmytriw, Russell
Sent: Wednesday, March 06, 2013 11:12 AM
To: Morgan, Paul
Cc: Deacoff, Cameron; Dmytriw, Russell
Subject: FW: AECOM Report

Hello Paul - to follow up on Rick Scott's comment below, we attach a spreadsheet showing re-calculated phosphorus concentrations based on the revised lake evaporation rates. As anticipated, there is no change to the trophic status of any of the lakes. However, while certain results do not change, some of the result must be revised upwards by 0.001 ug/L. I will make these changes in the final report.

Sincerely,

Russell Dmytriw, P.Geo.
Senior Project Manager, Environment
[REDACTED]

1701 Hollis Street SH400
PO Box 576 CRO
Halifax, NS B3J 3M8
[REDACTED]

-----Original Message-----

From: Dmytriw, Russell
Sent: Wednesday, March 06, 2013 9:34 AM
To: Morgan, Paul
Cc: Deacoff, Cameron; Dmytriw, Russell
Subject: RE: AECOM Report

Hello Paul - Yes - I'll bring the laptop and projector. If convenient, it might be prudent to bring a second projector in case there is trouble.

With respect to Rick Scott's observation below - he is correct in how the numbers were used. However, it appears that evaporation rate is a minor component of the equations in the model, compared to surface water flows through the system. Our first impression is that the results are not likely to change. Dennis is currently working through the model to see if there are any differences so that modifications can be made if required.

Sincerely,

Russell Dmytriw, P.Geo.
Senior Project Manager, Environment
[REDACTED]

1701 Hollis Street SH400
PO Box 576 CRO
Halifax, NS B3J 3M8
[REDACTED]

-----Original Message-----

From: Morgan, Paul [<mailto:morganp@Halifax.CA>]
Sent: Tuesday, March 05, 2013 12:20 PM
To: Dmytriw, Russell
Subject: FW: AECOM Report

Hi Russell: Further comments from Rick Scott below. With regard to tomorrow's presentation, I will bring a sound system and a screen, if needed (I will be checking this afternoon to see if one is available). Will you be bringing a lap top and projector?

-----Original Message-----

From: Deacoff, Cameron
Sent: March-05-13 12:15 PM
To: Morgan, Paul
Subject: FW: AECOM Report

Follow-up comments for Russell.

-----Original Message-----

From: Richard Scott [REDACTED]
Sent: March-05-13 12:06 PM
To: Deacoff, Cameron
Subject: AECOM Report

Cameron,

My last email mentioned evaporation amounts quoted in the document and the lack of appropriate units. I took time to look at the spreadsheets contained in Appendix J to see what value was subsequently applied to the phosphorus modeling. It appears that the total of the daily longterm averages by month, 0.0167 m/yr was used and not the extrapolated value of 0.512 as required. Although this apparent error should not affect TP estimates for headwater lakes, it may have an effect on estimates for water bodies located further down in a chain of lakes. A water balance would obviously be affected if the value used for the P modelling was adopted for it as well.

Rick

Revised Calculation of Evaporation and TP Concentrations in Birch Cove

06-Mar-13

D. Gregor.

Month	Avge Daily rate (mm)	No. of Days per month	Evaporation	
			per month (mm)	per month
May	2.9	31	89.9	
June	3.4	30	102	
July	3.6	31	111.6	
August	3.2	31	99.2	
September	2.3	30	69	
October	1.3	31	40.3	
Total (mm/year)			512	
Total (m/year)				0.0512

Lake	TP (original) Existing	TP Corrected for Revised Evaporation		TP (original) Scenario 2	TP Corrected for Revised Evaporation		TP (original) Scenario 3	TP Corrected for Revised Evaporation		TP (original) Scenario 4	TP Corrected for Revised Evaporation	
		Rate Existing	Rate Scenario 2		Rate Scenario 2	Rate Scenario 3		Rate Scenario 3	Rate Scenario 4		Rate Scenario 4	
Ash	0.002	nc	nc	0.002	nc	0.003	0.004	0.002	nc	0.002	nc	0.027
Charlies	0.004	nc	nc	0.004	nc	0.027	0.028	0.026	0.028	0.026	0.027	0.027
Cranberry	0.004	nc	nc	0.003	nc	0.004	nc	0.004	nc	0.004	nc	nc
Crane	0.003	nc	nc	0.003	nc	0.003	nc	0.003	nc	0.003	nc	nc
Flat	0.003	nc	nc	0.003	nc	0.003	nc	0.003	nc	0.003	nc	nc
Fox	0.003	nc	nc	0.003	nc	0.026	0.028	0.026	0.028	0.003	nc	nc
Hobsons	0.006	nc	nc	0.006	nc	0.006	nc	0.006	nc	0.004	0.006	0.006
Horseshoe	0.004	nc	nc	0.004	nc	0.004	nc	0.004	nc	0.004	nc	nc
McQuade	0.013	0.014	0.078	0.076	0.078	0.076	0.08	0.076	0.08	0.076	0.078	0.078
Quarry	0.001	nc	nc	0.001	nc	0.005	nc	0.005	nc	0.003	nc	nc
Susie	0.004	nc	nc	0.004	nc	0.007	nc	0.006	nc	0.006	nc	nc
Three Finger	0.005	nc	nc	0.005	nc	0.005	nc	0.005	nc	0.005	nc	nc
Washmill	0.006	nc	nc	0.006	nc	0.013	0.014	0.013	0.014	0.012	0.013	0.013
Kearney	0.008	nc	nc	0.012	nc	0.014	0.015	0.014	0.015	0.014	nc	nc
Paper Mill	0.008	0.009	nc	0.015	nc	0.016	0.017	0.016	0.017	0.016	0.017	0.017

nc = no change

Weagle, Jennifer

From: Deacoff, Cameron
Sent: March-04-13 3:30 PM
To: Morgan, Paul
Subject: Re: AECOM Birch Cove Lakes Study

Yes, by all means!

----- Original Message -----

From: Morgan, Paul
Sent: Monday, March 04, 2013 03:27 PM Atlantic Standard Time
To: Deacoff, Cameron
Subject: RE: AECOM Birch Cove Lakes Study

Hi Cameron: Do you think that I should forward Rick's comments to Russell?

-----Original Message-----

From: Deacoff, Cameron
Sent: March-04-13 3:24 PM
To: Morgan, Paul
Subject: Fw: AECOM Birch Cove Lakes Study

Fyi

----- Original Message -----

From: Richard Scott [REDACTED]
Sent: Monday, March 04, 2013 02:48 PM Atlantic Standard Time
To: Deacoff, Cameron
Subject: AECOM Birch Cove Lakes Study

Cameron,

I wasn't aware of this study until I came across it when visiting the Lakes and Rivers website when looking for lake survey data. Coincidentally, someone had approached me a day after seeing it to give them a quick overview of the findings.

Seeing as the version posted to the website was a draft final report, my comments below may have already been addressed in the final version.

1. The executive summary and specific sections of the main report state that three of the study lakes (Kearney, Papermill, Washmill) are mesotrophic while the mean TP data indicates them to be oligotrophic.
2. Table 3 and 2-8 contain monthly figures for evaporation. Without the correct units these data are misleading. The numbers quoted are average daily amounts in mm and not monthly and subsequently yearly totals. A percent of the annual total amount calculated using the data in Table 3 would have been applied to the Phosphorus model. I'm assuming the converted total and not that given in the table was used in this regard.
3. I've always considered the spelling of Quarry Lake to be with a "y" and not "ie". Both spellings can be found in the report (picky, pickie!).

Does it look like I have extra time on my hands?

Regards
Rick