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Ref.:	SEMO_ ProtectingOurLakes	(23 pages)
To:	**Mr. Richard MacLellan, Manager, SEMO, HRM**	
From:	**S. M. Mandaville Post-Grad Dip., Professional Lake Manage.** **Chair and Scientific Director**	
Date:	May 06, 2011	
Subject:	**Your invitation re "Protecting Our Lakes"**	

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A. Introduction

We respectfully request that this document be submitted as an attachment to any official report to the governing bodies of the HRM inclusive of the Regional Council's Standing Committees. We state this since in the past, staff and/or their paid consultants altered some of our submissions and/or wholly misinterpreted them; this sorry scenario transpired by certain municipal units even prior to amalgamation.

HRM and the former Halifax County had obtained a portion of this signatory's personal and our team's scientific research of lakes/ponds within HRM worth half-to-one (0.5-1) million dollars, mostly *pro bono*. The combined fiscal value of the research of this society and the signatory's personal IP, i.e., intellectual property, of the lakes/ponds within HRM is approximately in the three (3) million dollar range if conducted as paid scientist--consultants.

Our continuing research/studies:

We are an independent scientific society specializing in the biotic integrity and biodiversity of freshwaters and parts of the marine ecosystems with emphasis on phytoplankton, zoobenthos, phytobenthos, chironomid mentum deformities, and predictive modelling utilizing a range of published models and parameters (not phosphorus alone) worldwide. We are getting involved in paleolimnology as well, albeit at a slow pace.

We have now completed predictive modelling of several parameters of one thousand five hundred (1,500) lakes/ponds in four (4) counties of Nova Scotia, and most of HRM is covered.

Indeed, our `multivariate models' were able to predict some of the existing visible problems, e.g., weed infestations, in some lakes. As heads up, we had sent numerous cautionary emails and syntheses to provincial as well as municipal authorities but they seemed to have fallen on deaf ears.

We have received accolades from some leading international governments and scientific authorities. Select professional staff of HRM (and it's predecessor municipal units) and some of its leading consultants contacted us over the last two decades seeking our advice and our scientific studies, generally on a *pro bono* basis.

We also receive requests from stakeholders, outside of our membership, asking for our assistance, almost every year.

The scientists we cite in this submission are mostly among the stalwarts of international limnology!

“Among the limitations of relying solely on chemical and/or physical parameters to assess ecological health and sustainability is the fact that existing environmental quality guidelines (EQGs) only consider a toxic response to single chemicals, and therefore cannot account for the cumulative impacts from multiple chemical discharges (a “cocktail” of compounds) which may be coupled with physical changes in the environment.” (CCME, 2006: Developing Biocriteria as a Water Quality Assessment Tool: Canadian Council of Ministers of the Environment). For a summary discussion of biological analyses, see Section-G, page 21.

We applaud HRM for its concern of the recent phosphorus (TP) values. But it is conceivable that the values are artificially high and not reflected in the true `productivity’ of the lakes. In a similar scenario, kindly read an email that we received from one of our reputed Scientific Directors, Prof. Dr. Peter J. Dillon, who is a Fellow of the Royal Society of Canada among many other achievements (see Section-H, page 22).

There are thirteen (13) focused recommendations enunciated in Section-B for the HRM to implement without any further delay. Sections C to H inclusive provide basic scientific rationale. We provide web links primarily from our web sites.

In the PDF version of this submission, one can instantly launch the relevant web pages by clicking on the html links

B. Our thirteen (13) prime recommendations which fall under the domain of sound Governance and science-based watershed management:

1) Set up a Lakes Authority at HRM staffed with two (2) qualified, preferably applied limnologists.

Such an `authority' should be mandated to restore lakes on a pragmatic level following consultations with all `stakeholders', and not just with political appointees.

Examples of recent failures were the severe impacts on **Sandy Lake**, Hammonds Plains in the Glen Arbour area of the Sackville River watershed (*cf.* page 16), and at **Russell Lake**, Dartmouth of the Cow Bay River watershed (*cf.* http://lakes.chebucto.org/WATERSHEDS/COWBAYR/RUSSELL/assaults2000s.html). There were several other cases which we had summarized in Exhibit-B of our submission to Regional Planning on January 30, 2006.

While the subsequent pelagic sampling of **Sandy Lake** shows the TP values may have returned to lower levels, nonetheless, there may be signs of some damage to the ecosystem of the lake; in addition, increased algal blooms have been noted on occasions.

Of lately, increased nuisance algal blooms have also been identified, on occasions, at **Papermill Lake** in Bedford. Identification of the phytoplankton to the species level established that these could be of recent nature.

There are such cases with several other lakes across HRM.

Not all cases have been `bad news stories' though. Among numerous cases are the following:

We have observed considerable improvement in some lakes and cases like **McGrath Lake** in Terence Bay of the Terence Bay River watershed are a prime example of success stories.

At **Maynard Lake**, Dartmouth, as a result of multi-year community action, considerable reduction in bacteriological impacts has been noted. The biodiversity and the biotic integrity of the zoobenthos have been very encouraging based upon international protocols.

Though community action at **First Lake**, Lower Sackville has not yielded any significant improvement in either the bacteriological quality or in the hypolimnetic dissolved oxygen depletion. The latter symptom could be as a result of small hypolimniums in comparison with the epilimnium (see the OECD studies of the First World culminating with the final report by Vollenweider and Kerekes, 1982).

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2) **HRM’s paid consultant studies:- Provide the names of all the authors, their formal qualifications, credentials, and any independant international citations they received as `appendices’ in the studies.**

All studies should be placed on HRM’s website without any delays.

It is further necessary to insist on studies by authentic limnologists, whether theoretical and/or applied, where the issues being addressed have a direct relevance to freshwater quality, i.e., lakes, ponds, rivers.

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3) **Lake water sampling and the futility in tracking the incremental impacts of new developments, especially in shallow and/or coloured lakes which could be macrophyte driven (see also Section-F, page 19).**

Further, to reliably ascertain incremental inputs from new developments, outflows of major storm pipe outlets, in-situ devices (e.g., CDS, Stormceptor, Vortechnics), constructed wetland outlets, have to be monitored regularly, and pollutographs have to be developed.

Neither HRM nor its consultants have ever carried out this necessary sampling as far as we can fathom. If we are in error, then we respectfully request that HRM make those results available to the public via its web sites without any red tape.

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4) The CCME's (2004) policy on cultural eutrophication should be strictly adopted by HRM as a regulatory tool.

This policy is nothing new since the relevant science in it has been known from as far back as the 1980's to scientists who are `current' in research.

As the year-2004 CCME Policy on Phosphorus (TP) clearly narrates that, not adhering to the reference/background (i.e., the natural pre-development value) + 50% maximum increase concept, even if they fall within the reference trigger ranges, could result in significant changes to the `community structure'.

HRM's major shortcomings w.r.t. the threshold TP values of Lakes Russell, Morris, Kearney, and Papermill:

The HRM had made significant errors in assigning high threshold TP values of 15 µg/l for Russell and Morris Lakes, and 10 µg/l for Kearney and Papermill Lakes. HRM's deductions were out of line with the scientific thought even then. HRM failed to ascertain pre-cultural concentrations based on either predictive models and/or on paleolimnological inference models.

The **Province of Quebec** has a formal policy in line with what we stated: kindly access http://lakes.chebucto.org/TPMODELS/Quebec/phosphore-eco-regions_selection.pdf to view extracts of same.

The **Province of Ontario** has been planning to adopt same but has been greatly delayed.

Hence, there are precedents in Canada. Incidentally, the CCME as well as the Quebec standards are the direct application of the Ontario research headed by Prof. Dr. Peter J. Dillon who is also a Scientific Director of our group.

The **Swedish Government** endorses a maximum of twice the background levels of phosphorus and nitrogen as a national target (Holdren *et al*., 2001, NALMS).

5) Enact a Lawn Fertilizer Bylaw restricting use of phosphorus containing fertilizers similar or superior to the City of Minneapolis as extensively noted by the UNEP’s committees.

Other municipal units in North America are also showing interest.

Access http://lakes.chebucto.org/TPMODELS/NOTES/minneapolis_lawn-fertilizer.html for same.

---

6) Shallow Lakes: Kindly take into account that the limnology of shallow lakes can be quite different from deep lakes. Most standards and other aspects are based on research on deep lakes (see also Section-F, page 19).

Most lakes within HRM are shallow. Shallow lakes are defined as lakes where the euphotic zone extends over the bottom. Simply, the euphotic zone is defined as the depth at which the light intensity of the photosynthetically active spectrum (400-700 nm) equals 1% of the subsurface light intensity.

(Wetzel, 2001: Limnology. Lake and River Ecosystems. Third Ed. Academic Press; OECD research: Vollenweider and Kerekes, 1982; and http://lakes.chebucto.org/shallow.html):

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7) Recommendation: Buffer Strips, sound technical sizing, and protection in perpetuity; and do not allow walkways to be constructed within such buffers (see Section-E, page 17)

Buffer strips do not remove any appreciable amount of pollutants entering lakes via stormwater discharges. But they could be of some value only if they are maintained in their natural state in perpetuity.

We request that HRM enact a bylaw where walkways are wholly banned in buffer strips even if the local community supports such walkways. Pollution does not discriminate between developers and the general public.

The sizing of buffers has to be based on **technical factors** which have to include at the least, slope of the land, K (soil erodibility index), and RCN (Runoff Curve Number). The USDA had developed a regression analysis based on these parameters. We have not tested the efficacy in Nova Scotia yet.

The Regional Plan's emulation of the standards of the NS Dept. of Natural Resources of 20 metres is not based on science and is only a generality.

Alternately, follow the precautionary approach as recommended in research by Environment Canada, and legislate a minimum buffer of one hundred (100) metres around lakes and rivers, where possible, for the long term protection (see page 17). A `buffer' also implies that no walkways be built on them either.

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8) Carry out DNA fingerprinting before making public statements on the fecal sources. HRM and Halifax Water have been making unscientific comments on fecal sources, alas!

Bacterial Source Tracking (BST) is a state-of-the-art methodology that is being used in advanced jurisdictions to determine the sources of fecal bacteria in environmental samples (e.g. from human, livestock, or wildlife origins).

Access http://lakes.chebucto.org/H-2/bst.html

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9) Mandate total stormwater treatment systems capable of removing the myriad of post-development stressors, not silt/soils and phosphorus alone, in new major developments. Such systems also need maintenance as needed to be effective.

An example of such a system is depicted below although it is not guaranteed to remove all incremental stressors in perpetuity. Costs have to be borne by a `proponent’.

In an extreme case, HRM has to insist on the installation of lakeshore interceptors of all storm discharges and treat them in a modified sewage treatment plant prior to discharge into any freshwater courses. Costs have to be borne by the prime beneficiaries, i.e., the `proponents’ of any incremental developments**!**

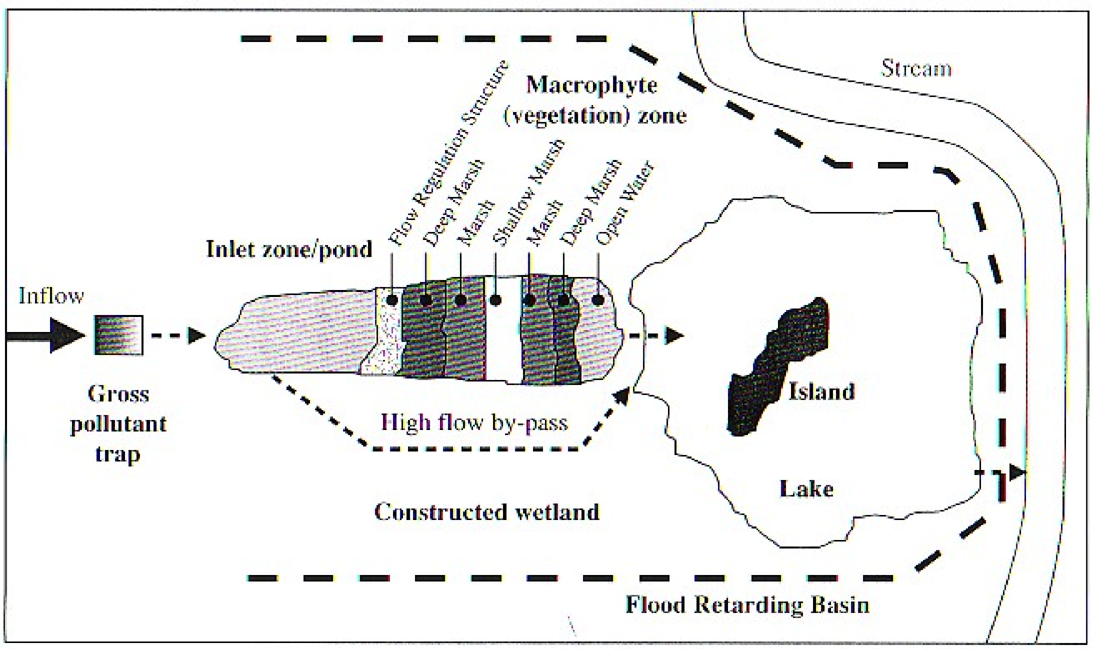

Figure 1: Modular elements in an integrated stormwater management system

10) Investigate the endocrine disrupting compounds (EDCs) in the effluents of sewage treatment plants (STP) discharging into lakes and rivers.

Our scientists along with other international scientists believe that fish might be the first to absorb any dangerous chemicals that might later affect humans.

Impacts on fish: There is evidence elsewhere that the synthetic estrogen, ethinyl estradiol (EE2), used in birth control pills is causing the feminization of male fish in these downstream waters. Some male fish are actually producing eggs. There are other EDC's of concern as well.

Impacts on humans: A recent survey of cancer in Hardy County, where some residents get drinking water from the South Branch of the Potomac River in Washington, found rates of cancer of the liver, gallbladder, ovaries and uterus that were higher than the state average. All four cancers can in some cases grow faster in the presence of estrogen or chemicals that mimic it, cancer experts said.

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11) Enforce the Halifax County's Topsoil Removal Bylaw of allowing a maximum 50 mg/l of suspended solids in any grab sample at the outlets of all new developments which should include even residential developments.

Not adhering to it in a consistent manner should result, perhaps, in the cessation of further development in the particular subdivision or project. The sampling has to be conducted at the stormwater outlets prior to discharge into lakes and streams.

The Russell Lake West never appeared to adhere to this and we have seen the negative results over the recent years (view the photographs in our web page, http://lakes.chebucto.org/WATERSHEDS/COWBAYR/RUSSELL/assaults2000s.html which were supplied by local stakeholders to us).

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12) Implement `Indicator thresholds for anthropogenic stressors of freshwater lakes in Nova Scotia' as one of the tools for assessing lake water quality.

(http://lakes.chebucto.org/WATERSHEDS/MANDELL/referencelakesinAtlanticCanada.html)

Table 1 **Reference lake types used as indicator thresholds for anthropogenic stressors of urban lakes** (cf. Mandell, 1994)

	Type 1 *Beaverskin Lake* *thin till*	*Type 2* *Bluehill Pond South* *thick till*	*Type 3* *Pebblelogitch* *dystrophic*
pH	5.40	6.92	4.30
conductivity (µsiemens)	24.00	35.00	34.00
colour (Hazen units)	5.00	22.00	87.00
alkalinity (µeq/l)	2.00	5.60	-25.50
total phosphorus (mg/l)	0.003	0.004	0.013
total nitrogen (mg/l)	0.23	0.23	0.32
sodium (mg/l)	2.59	2.90	2.80
chloride (mg/l)	4.24	4.90	3.90
sulphate (mg/l)	1.92	3.20	2.20
calcium (mg/l)	0.33	2.80	0.39
magnesium (mg/l)	0.34	0.50	0.37
potassium (mg/l)	0.23	0.60	0.27
turbidity (JTUs)	0.30	0.30	0.63
chlorophyll-a (mg/m^3)	1.38	1.20	1.80
DOC (mg/l)	2.00	2.00	11.90
fecal coliform (count/100ml)	18.00	18.00	18.00

13) Consultations regarding lake and river management should not be confined to appointed committees and boards alone.

Widely advertised round table discussions should take place similar to the modus operandi followed by select scientific authorities. In this manner, HRM may be able to build meaningful partnerships with those that it is supposed to serve in any enlightened democracy.

Appointed advisory boards/committees may not represent the overall public, they only represent the members who are part of such entities.

C. Scientific definition of trophic status and many Government officials and their consultants are making significant errors!

"Trophy of a lake refers to the rate at which organic matter is supplied by or to the lake per unit time." (Wetzel, 2001. Limnology. Lake and River Ecosystems. Third Ed. Academic Press).

Trophy, then, is an expression of the combined effects of organic matter to the lake. As developed originally and as largely used today, the trophic concept (e.g., TP, Cha, SD, and TN) refers to the limnetic (i.e., open water or pelagic) zone-planktonic portion of the lake ecosystem. The littoral flora and its often dominating supply of autochthonous organic matter to the system, were, and usually still are, ignored.

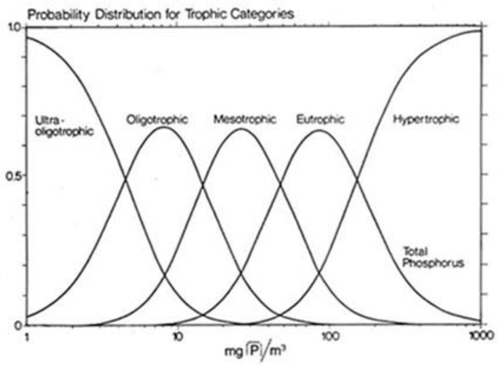
Probability Distribution diagrams (*cf.* OECD research: Janus and Vollenweider, 1981; Vollenweider and Kerekes, 1982):

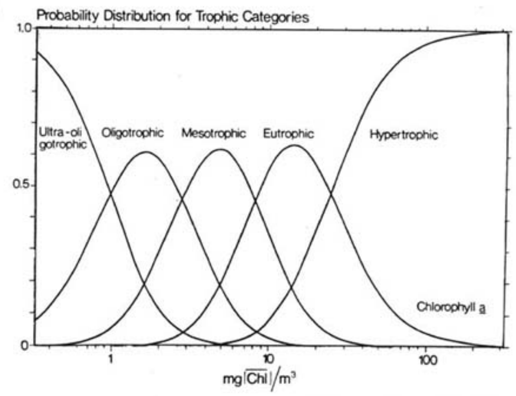
What emerged from the assessment of all information available, however, led to the conclusion that there is no possibility of defining strict boundary values between trophic categories. Whilst the progression from oligo- to eutrophy is a gliding one- as has been stressed many times in literature- any one combination of trophic factors, in terms of trophic category allocation, can only be used in a probabilistic sense. Objective reasons exist for the uncertainty of classifying a given lake in different categories by two or more investigators, depending on the management of that body of water.

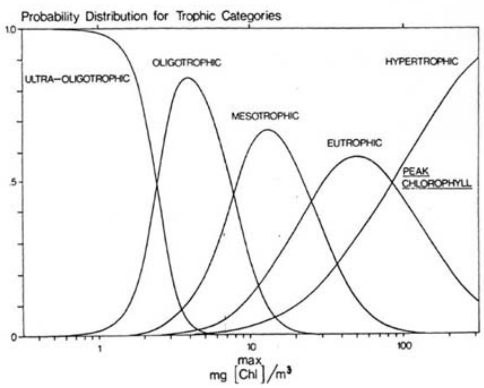
Average conditions, expressed by "average nutrient concentrations", "average biomass values", "average transparency" do not necessarily express the degree of variability, particularly with regard to peak levels, frequency of their occurrence, and their qualitative nature (type of phytoplankton).

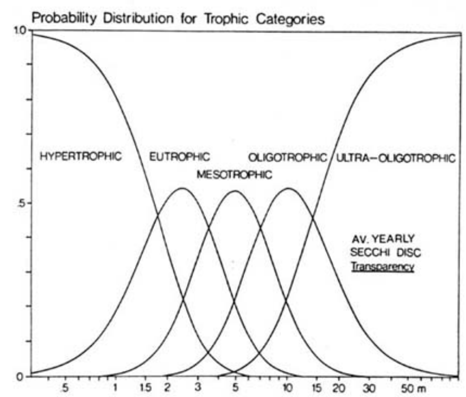
From the management viewpoint, such situations and their frequency are as important as average conditions.

For this reason, prediction uncertainties must be accounted for. This can be achieved with the probability distribution for the main components: average lake phosphorus, average and peak chlorophyll concentrations, and average yearly Secchi disk transparency as shown below along with one of our case histories:-





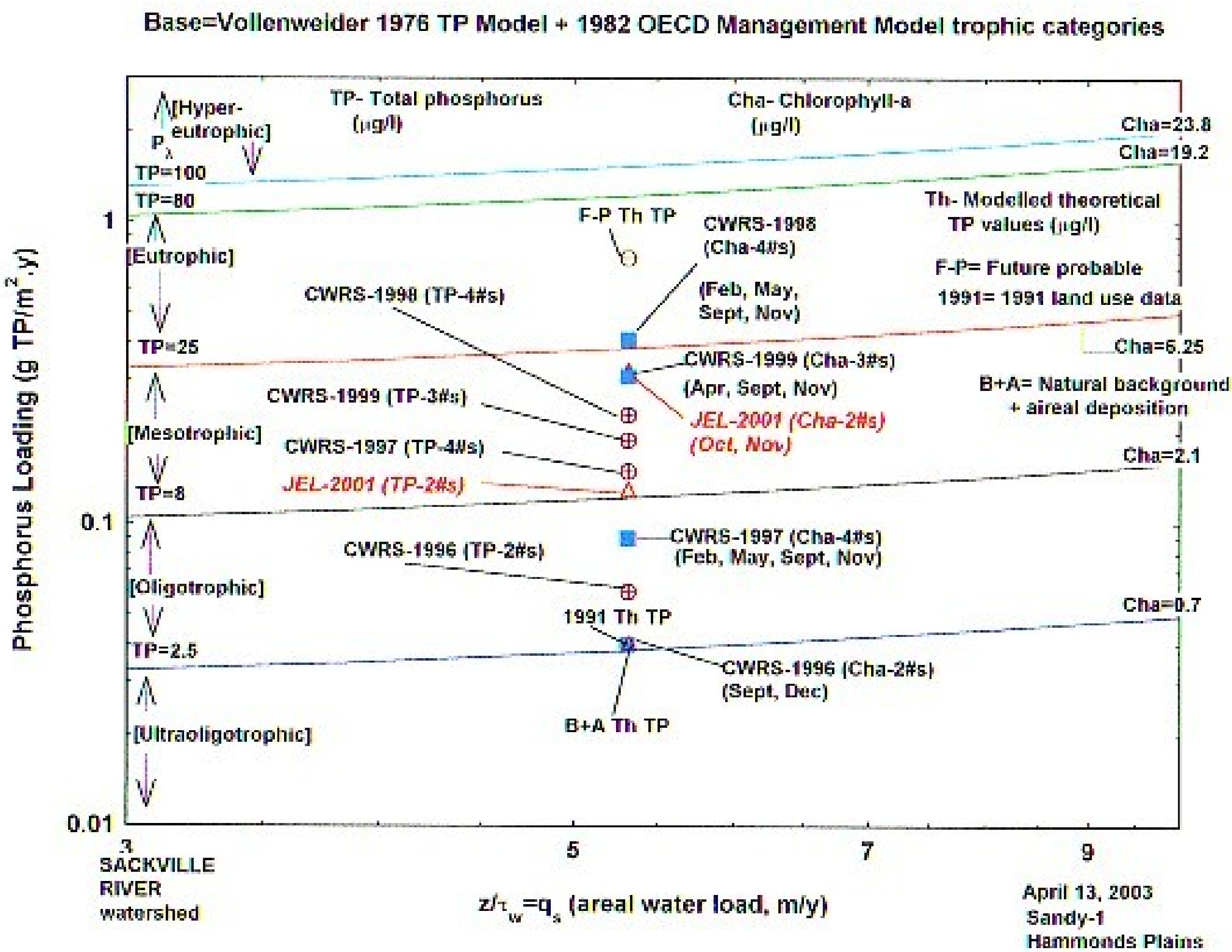




Percentage Probability Classification of 1990 lake trophic states based on the "OECD" probability distribution curves. Classifications based on yearly averages for total phosphorus, chlorophyll a and Secchi disc readings. UO= Ultraoligotrophic, O= Oligotrophic, M= Mesotrophic, E= Eutrophic and HE= Hypereutrophic.

	Percentage Probability Classification														
	Based on Total Phosphorus					Based on Chlorophyll a					Based on Secchi Disc				
Lake	UO	O	M	E	HE	UO	O	M	E	HE	UO	O	M	E	HE
1 Albro	5%	55%	36%	4%	0%	51%	44%	5%	0%	0%	3%	34%	50%	11%	2%
2 Banook	14	66	18	2	0	59	38	3	0	0	0	12	50	35	3
3 Beaverbank	2	37	55	6	0	22	61	17	0	0	0	4	37	51	8
4 Bell	32	61	7	0	0	74	24	2	0	0	2	27	53	16	2
5 Bissett	0	17	65	18	0	0	14	62	24	0	0	0	4	38	58
6 Chocolate	35	60	5	0	0	93	7	0	0	0	32	54	14	0	0
7 First	4	46	46	4	0	0	19	63	18	0	0	0	13	52	35
8 Hubley Big	4	47	45	4	0	8	55	34	3	0	0	3	33	51	13
9 Kearney	22	65	13	0	0	93	7	0	0	0	2	31	51	13	3
10 Kinsac	4	46	46	4	0	8	55	34	3	0	0	8	45	40	7
11 Loon	22	65	13	0	0	82	18	0	0	0	-	-	-	-	-
12 Maynard	17	65	15	3	0	21	61	18	0	0	2	31	51	13	3
13 MicMac	4	47	45	4	0	5	50	42	3	0	2	19	53	24	2
14 Miller	22	65	13	0	0	63	34	3	0	0	0	8	45	40	7
15 Morris	4	46	46	4	0	22	61	17	0	0	0	3	33	51	13
16 Nicholson	14	66	18	2	0	34	56	10	0	0	-	-	-	-	-
17 Oathill	2	43	51	4	0	3	33	56	8	0	0	12	50	33	5
18 Papermill	19	65	14	2	0	22	61	17	0	0	0	8	45	40	7
19 Portuguese Cove	2	43	51	4	0	20	60	20	0	0	0	0	13	52	35
20 Rocky	17	65	15	3	0	59	38	3	0	0	6	44	44	6	0
21 Sandy	5	55	38	2	0	25	60	15	0	0	0	12	50	33	5
22 Second	5	55	36	4	0	20	60	20	0	0	2	19	53	24	2
23 Settle	0	20	65	15	0	0	11	58	29	2	0	0	4	38	58
24 Springfield	4	54	39	3	0	22	61	17	0	0	0	8	45	40	7
25 Third	35	60	5	0	0	20	60	20	0	0	0	12	50	35	3
26 Tucker	10	63	26	1	0	3	33	56	8	0	0	3	35	51	11
27 Williams	17	65	15	3	0	20	60	20	0	0	6	44	44	6	0

D. Sandy Lake model with field data (4th vers.)



E. Environment Canada's interim narrative on regression analysis between stream buffer widths and average TN and TP concentrations.

Environment Canada Environnement Canada

Environmental Conservation Branch
45 Alderney Drive, 16th Floor
Dartmouth, Nova Scotia
B2Y 2N6

March 13, 2003

Mr. Shalom Mandaville
Chairman and Scientific Director
Soil & Water Conservation Society of Metro Halifax
310-4 Lakefront Road
Dartmouth, Nova Scotia
B2Y 3C4

Dear Mr. Mandaville:

In response to your request with regards to some past work on nutrient impacts of land use activities near to aquatic systems, I am providing you with the following information.

A number of years ago, I undertook a small Geographic Information System based study to investigate the geospatial relationship between land use and river nutrient concentrations in Prince Edward Island. This work subdivided the drainage basins of a number of streams into a series of corridors around the stream channel (100m, 250m, 500m, 1Km) and then used the GIS to calculate land use characteristics within each of these corridors. The land use mapping employed was based on 1:50,000 scale land cover characteristics (21 classes) derived from Landsat images collected circa 1987. The twenty-one classes were roll into a "protected" layer (cover types expected to control nutrient supply to aquatic systems) and a "delivery" layer (cover types provide limited nutrient supply protection to aquatic systems) and a subsequent "supply index" (Delivery/Protected) was calculated for each corridor. Regression analysis between the supply index and average nitrogen concentration in the stream indicated a significant relationship for the 100m and 250m corridors based on approximately 30 streams. No correlation was observed for the supply index and total phosphorus concentration.

Although this work provided some interesting preliminary insights into the potential importance of 100m and 250m buffer strips in controlling nutrient supply to aquatic systems, it was not completed and has not been adequately peer reviewed. As such, the work provides an indication of the importance of buffer

strip protection, but would require more detailed analysis to provide definitive evidence on the optimal buffer strip width.
Through the Model Forest Program and in particular the Fundy Model Forest, there have been on-going studies to investigate different harvesting practices on water quality. Some of this work has been published, while other studies are still underway. I would suggest that you contact the Fundy Model Forest office to get information on their work.

Yours sincerely,

Geoff Howell
Manager, Ecosystem Science and Information Division

F. Shallow Lakes

(Wetzel, 2001: Limnology. Lake and River Ecosystems. Third Ed. Academic Press; OECD research: Vollenweider and Kerekes, 1982; and http://lakes.chebucto.org/shallow.html):

Traditionally, limnology is mostly concerned with lakes that stratify in summer. The impact of macrophytes on the community is relatively small in such lakes, as plant growth is restricted to a relatively narrow marginal zone.

These lakes are not expected to stratify for long periods in summer. This type of lake, where the entire water column is frequently mixed, is also referred to as polymictic. The intense sediment-water interaction and the potentially large impact of aquatic vegetation makes the functioning of shallow lakes different from that of their deep counterparts in many aspects.

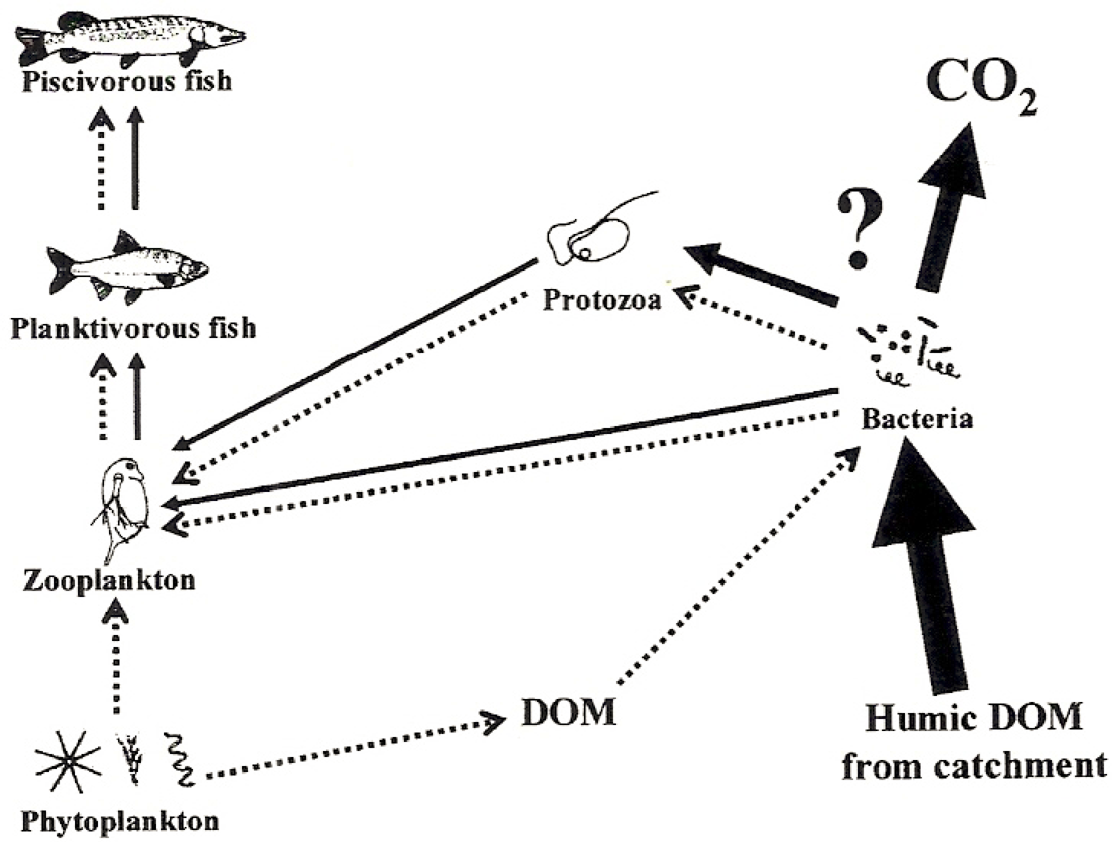
Shallow lakes are defined as lakes where the euphotic zone extends over the bottom. Simply, the euphotic zone is defined as the depth at which the light intensity of the photosynthetically active spectrum (400-700 nm) equals 1% of the subsurface light intensity.

Typology of (northern) lakes based on metabolic balance and ecosystem stoichiometry (Jones, 2005. Verh. Internat. Verein. Limnol.):

The humic content of waters (allochthonous loading of organic matter) should be seen as a primary characteristic of natural waters while the degree of nutrient enrichment should be seen as a secondary modifier. All lakes receive some allochthonous loading of humic organic matter and have some inherent heterotrophic metabolic capacity.

Net heterotrophy is arguably the "natural" condition of most northern lakes, with net autotrophy arising only because of anthropogenic impact on catchments. The natural development of many lakes (atleast of boreal lakes) is to become more dilute but richer in DOC and, by inference, more strongly net heterotrophic.

Too many conclusions about net heterotrophy of lakes are based on the "icefree" or "growing" seasons. When continued respiration during winter conditions is taken into account, even quite eutrophic lakes can be net heterotrophic on an annual basis. This is particularly apparent in lakes with winter ice cover in which considerable under-ice accumulation of CO2 can take place, giving rise to a large springtime CO2 pulse to the atmosphere when the water degasses after ice-melt.


Piscivorous fish
Planktivorous fish
Zooplankton
Phytoplankton
Protozoa
DOM
Bacteria
?
CO_2
Humic DOM
from catchment

G. Chemical vs Biological monitoring in limnology

"Chemical measurements are like taking snapshots of the ecosystem, whereas biological measurements are like making a videotape."
……. (Rosenberg *et al* ; EMAN Protocol; and Bull. Entomol. Soc. Can. 1998. 30(4):144-152.)

By ignoring the all important biological limnology, the majority of studies carried out to date for the HRM as well as for its former municipal units have failed to accurately describe the symptoms and prevent the problems.

"Pollution is a semi-nebulous term used to describe changes in the physical, chemical or biological characteristics of water, air or soil, that can affect the health, survival, or activities of living entities. Organisms respond to pollution usually in one of two ways, acutely or chronically. Acute effects result in serious injury to, or death of, the organism shortly after exposure to high concentrations of a pollutant. Chronic effects are realized following exposure to low concentrations of a pollutant, the results of which appear over time, often as serious diseases (e.g. cancers)".
………….(Williams and Feltmate, 1992. Aquatic Insects. CAB International.)

Excellent undergrad/grad reference in limnology; also includes reference tables for the more advanced professional: Mackie, G.L. 2004. Applied Aquatic Ecosystem Concepts. Second Ed. Kendall/Hunt Publishing Company. 784 pp. ISBN 0-7575-0883-9.

Also refer to http://lakes.chebucto.org/ZOOBENTH/BENTHOS/benthos.html

H. Phosphorus analytical inaccuracies (an email from one of our Scientific Directors, Prof. Dr. Peter Dillon, also a Fellow of the Royal Society of Canada)

From: Prof. Peter Dillon FRSC, Trent Univ., Ontario (also Scientist-Emeritus, Dorset Centre, Ontario Ministry of Environment-OME)

Sent: Monday, November 14, 2005 11:00AM
To: Shalom M. Mandaville
Cc: Prof. John Smol FRSC (PEARL- Queens Univ.); John K. Underwood PhD (former limnologist-NSEL); NSELWater Line

Hello Shalom

However, in the interim, I will try to clarify a few points, just to be sure that we are all on the same page. What I originally said was that P measurements reported by many labs in the '60's and '70's were often suspect. I know this for a fact as I conducted blind QA/QC tests on the Ont Min Envir in the mid-70's and, quite bluntly, our lab failed miserably. Results were too high most of the time, often 2 to 5x the real value. I also carried out some testing on other govt. labs with poor results. Detection limits in most labs were often 0.01 or 0.02 mg/L, i.e. 10 or 20 ug/L, which is of course useless if your study site has 5 ug/L.

Part of the problem was that the focus before this was on waste effluents (our OME started as the Water Resources Commission and was responsible for sewage treatment in Ontario and did virtually nothing else - the OME only began in 1971 or 1972). Also, most good chemical work was being done on oceanography then and good results were achieved, but the oceans don't have a few ug/L TP as many lakes do, so those labs didn't have to push detection limits down.

By about 1977 or 78, OME was producing good TP results for my studies – we had set up a low-level P lab specifically for my work at Dorset and Sudbury. However, the rest of the Ministry was getting along with much poorer results than we were achieving - better than the early '70's but still not great.

In the early '80's the Great Lakes group pushed for low level P analyses as we had done earlier, and finally the Ministry lab acceded and switched to comparable methods for the rest of the Ontario work. I believe that similar situations existed in most labs.

There are probably a few exceptions, but bear in mind that most govt. labs have large numbers of samples to analyze and low-level P was, at that time, very labour-intensive -this pre-dated standard use of auto-analyzers.

I'm sure that John Underwood would agree that P analyses in the '60's and much of the '70's were often inaccurate, often imprecise. We all, ofcourse, went through the same thing with SO4 analyses - the first of our data that I use are from 1980 - prior to that the data are quite useless unless the water had very low DOC, e.g. precipitation data are good, almost all lakes and streams are not.

There is a certain amount of art to P analyses. Unlike some trace elements, contamination is commonplace as P is ubiquitous in the environment, in the labs, etc.

I still routinely see consultant's documents reporting P levels that I know are ridiculous. A few years ago, I was involved in a study with a group that was contesting a consultant's report (one of the biggest environmental consulting companies in the country) and it was obvious that the company's P analyses were nonsense. It was very simple to demonstrate this and their whole argument went out the window. As I'm sure you are aware, few consulting companies do their own analyses any more - its now, in a way, centralized in just a few companies or done for fees by govt. or academic labs.

If you have any other questions, I'd be glad to address them.

Sincerely
Peter Dillon
bcc'd to govt. offices, consultants. etc.