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Ref.:	NWCC_TPcomparisons_HRM 2013oct05	(14 pages)
To:	**Chair & Members, North West Community Council, HRM**	
From:	S. M. Mandaville Post-Grad Dip., Professional Lake Manage. Chairman and Scientific Director	
Date:	October 05, 2013	
Subject:	Deep station total phosphorus (TP)- comparison with our hindcast models, Queen's University paleolimnology results, and with select historical data inclusive of HRM's synoptic sampling of 2006-2011 (shallow zone values may differ considerably)	

Please feel free to ask me any questions, and I will endeavour my level best to respond either via emails and/or in person at one of your meetings, if invited to do so. Formulated on an informal level. I hope all of you will find this submission of considerable interest.

<u>Kindly note</u>: The HRM's synoptic data on total phosphorus (TP) is cause for alarm in the case of some lakes. Several sampling values of HRM are far in excess of either the pre-cultural hindcast values or the pre-industrial diatom inference values. In select instances, there has been minimal change from the historical ranges (1970's to 2000's) though. In addition, the HRM's TP data for several lakes fluctuated more widely than historical data from other sources, but the causes are unknown. It could be as a result of contamination of samples or even errors in laboratory analyses since HRM never conducted inter-lab comparisons. Most credible scientists (including ourselves) routinely carry out sample splitting and send them to 2 to 3 different labs (one of the labs should be a federal lab) for comparisons. The sample splitting is carried out at random.

Suggested pragmatic action by the NWCC is on page-3.

A few of the lakes are highly coloured, hence our predictive modelling results may not be indicative of the true hindcast values. Presently, certain research is ongoing at a leading Ontario university to more accurately predict the TP values of such lakes, and we have collaborated with them. We eagerly await the modelling methodology for such lakes.

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This submission is based on the eighty (80) lakes and rivers per the HRM's synoptic sampling of 2006-2011. This submission includes `hindcast values' from our predictive modelling (i.e., values prior to any developments –plus- 0.173 kg/ha.yr in precipitation), Thiyake's diatom inference values on 51 lakes (the pre-1850's, i.e., the pre-industrial), summarized historical data, and the HRM's synoptic TP data of 2006-2011 reported in yearly columns.

We have completed certain research inclusive of predictive modelling of a massive two thousand (2,000) lakes/ponds within four (4) Nova Scotia counties. But to issue the results of all those lakes/ponds in this submission will be too unwieldy.

I have also not included the `biological inferences' of our studies of the phytoplankton, and of the zoobenthos.

As we find the volunteer time, we have also been submitting detailed analyses of select individual lakes to the relevant regulatory bodies as well.

First ever paleolimnological studies of lakes in HRM

Lead scientists from Ontario carried out the first ever paleolimnology of select lakes across Nova Scotia. The NSERC (Natural Sciences and Engineering Research Council of Canada) awarded a major 5-year grant to them. Several government agencies as well as our scientific group (the SWCSMH) collaborated (access the URL, http://post.queensu.ca/~pearl/maritimes/partners.html for the list of partners).

One of the outcomes was the superb MSc thesis (2009) of Ms. Thiyake Rajaratnam of Queen's University, Ontario. Thiyake's thesis developed a paleolimnological approach to assess changes in diatom assemblages (class Bacillariophyceae) from present-day lake sediments in comparison to those deposited before significant human impact (*ca*. pre-1850) from 51 Halifax (Nova Scotia, Canada) region lakes in conjunction with regional diatom-based transfer functions for pH and total phosphorus (TP).

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Suggested action by the NWCC

The NWCC may consider holding informal public sessions to develop partners in restoring the affected lakes. The goal should be to restore lakes to a maximum TP value of 1.5 times the hindcast values and/or 1.5 times the pre-1850's inferences but should not exceed the trigger ranges. The trigger range for most lakes listed here is 4-10 µg/l, with some lakes in the very stringent range of <4 µg/l. It will present varied challenges. CCME's fact sheet for the phosphorus guidance framework is http://documents.ccme.ca/download/en/205/

Total phosphorus (TP) trigger ranges for Canadian lakes and rivers (CCME, 2004)

Trophic status	TP (µg/l)
Ultra-oligotrophic	< 4
Oligotrophic	4-10
Mesotrophic	10-20
Meso-eutrophic	20-35
Eutrophic	35-100
Hyper-eutrophic	> 100

The CCME (2004) framework offers a tiered approach where phosphorus concentrations should not (i) exceed predefined 'trigger ranges'; and (ii) increase more than 50% over the baseline (reference) levels. The trigger ranges are based on the range of phosphorus concentrations in water that define the reference trophic status for a site (i.e., hindcast values). If the upper limit of the range is exceeded, or is likely to be exceeded, further assessment is required. When assessment suggests the likelihood of undesired change in the system, a management decision must be made.

The pre-cultural (i.e., hindcast+0.173 kg/ha.yr precipitation) trophic status of our lakes is ultra-oligotrophic to oligotrophic. As lakes get enriched, they become more eutrophic.

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Thiyake's primary supervisor was Prof. John Smol Ph.D., FRSC. Prof. Smol is a recipient of several national and international scientific awards inclusive of the coveted Gerhard Herzberg Gold Medal in 2004. The Herzberg Gold Medal is awarded by the NSERC (Natural Sciences and Engineering Research Council of Canada) annually for both the sustained excellence and overall influence of research work conducted in Canada in the natural sciences or engineering disciplines. It has been awarded to only one person per year since its inception in 1991. He is a scientific director/advisor of our international group, the SWCSMH, as well.

"**Eutrophication** is the response in water due to overenrichment by nutrients, primarily phosphorus and nitrogen, and can occur under natural or manmade (anthropogenic) conditions. Manmade (or cultural) eutrophication, in the absence of control measures, proceeds at an accelerated rate compared to the natural phenomenon and is one of the main forms of water pollution. The resultant increase in fertility of affected lakes, reservoirs, slow-flowing rivers and certain coastal waters causes symptoms such as algal blooms (with potential toxicity in extreme cases), heavy growth of rooted aquatic plants (macrophytes), algal mats, deoxygenation and, in some cases, unpleasant odour, which often affects most of the vital uses of the water such as water supply, recreation, fisheries (both commercial and recreational), or aesthetics. In addition, lakes become unattractive for bathing, boating and other water oriented recreations. Most often economically and socially important species, such as salmonids decline or disappear and are replaced by coarser fish of reduced economic/social value." (from multiple literature. See our web page, http://lakes.chebucto.org/eutro.html).

Potential sources of phosphorus:- Phosphorus has been reduced or eliminated in most laundry detergents but there are several other sources as follows:- fertilizers (farm, golf course, residential); animal, pet and bird feces; sewage treatment plant discharges (STP's do not remove all phosphorus, and the discharge is highly biologically available more so than other sources); overflows/bypasses from STPs and pumping stations; septic system failures; package treatment plants (over long periods); cross connections between sanitary and storm sewer laterals; and certain industrial discharges. In some lakes, there could be internal loading, i.e., re-suspension, from bottom sediments as well.

……/5

		……. Deep station data (shallow zone values may differ considerably) …….									
#	Lake and the community (other relevant info)	SWCSMH's models	Queen's University Diatom inference values	Historical data (various sources) means & ranges (surf, arms depth & vw)		……..HRM's synoptic data……. means & ranges (1m depth)					
		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1	Albro Big (Dartmouth)	**2.8**	**4.90**	-	6.7 (2.5-13.5)	<2.0	7.3 (4-11)	10 (2-16)	6 (4-8)	23.7 (10-48)	8.7 (3-12)
2	Albro Little (Dartmouth)	**-**	**3.80**	-	5.7 (3-8)	2.0	5.7 (2-8)	21.7 (6-36)	9 (3-15)	25.3 (15-44)	9.3 (4-14)
3	Anderson (Bedford)	**-**	**6.03**	-	8.3 (2-15)	-	-	-	-	-	-
4	Banook (Dartmouth)	**-**	**5.75**	-	8.1 (5-10)	2.5 (2-3)	5.3 (3-8)	15.7 (8-30)	12 (12-12)	19.3 (2-44)	10.5 (8-13)
5	Barrett (Beaverbank)	**4.6**	**-**	-	15.0	3.0	13.5 (12-15)	15.7 (14-18)	8 (6-10)	17 (11-25)	10.7 (8-13)
6	Bayers (Halifax)	**5.6**	**4.47**	-	8.0 (3-14)	-	-	-	-	-	-
7	Bell (Dartmouth)	**2.2**	**4.79**	-	5.7 (2-9)	7.0	10.3 (3-17)	33.7 (3-70)	8.0	22.7 (20-25)	8 (6-10)
8	Bissett (Cole Harbour)	**3.7**	**5.13**	-	14.0 (3-24.1)	8.0	13.7 (11-15)	27.7 (11-40)	17.7 (15-20)	27.3 (12-49)	62.3 (17-145)
9	Black Duck Pd. (Lakeside)	**4.3**	**-**	-	-	-	5 (3-7)	14 (10-20)	11.7 (5-16)	34.0 (12-48)	11.7 (7-15)
10	Black Point Lake (high colour; Hubley)	**5.3**	**-**	-	13.9 (8.1-28.7)	-	11 (10-12)	12.3 (11-14)	27 (11-45)	19.3 (11-31)	11.5 (9-14)

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		……. Deep station data (shallow zone values may differ considerably) …….									
#	Lake and the community (other relevant info)	SWCSMH's models	Queen's University Diatom inference values	Historical data (various sources) means & ranges (surf, arms depth & vw)		……..HRM's synoptic data…… means & ranges (1m depth)					
		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
11	Charles (Dartmouth)	**4.7**	**4.79**	9.9 (6-36)	12.8 (6-44.4)	<2.5 (<2-3)	10.7 (8-14)	9.3 (5-14)	12.3 (8-20)	19.3 (3-39)	6.5 (4-9)
12	Chocolate (Halifax)	**-**	**20.42**	-	6.6 (2-25)	-	3.5 (2-5)	7.0	14.3 (5-27)	12.3 (8-15)	6 (2-10)
13	Cranberry (Dartmouth)	**3.3**	**9.33**	34 (13.1-48)	15.9 (1-45.5)	-	9 (8-10)	25.3 (19-32)	17.7 (11-22)	28.3 (20-44)	28.7 (8-50)
14	Dent's Punch Bowl (Cowie Hill)	**-**	**-**	-	-	-	15.7 (7-26)	16.3 (13-22)	23.7 (12-30)	24.7 (20-28)	14.3 (9-19)
15	Desaid (Dartmouth)	**-**	**-**	-	-	-	12 (8-23)	42.5 (25-60)	15 (9-19)	14.7 (7-28)	8 (6-10)
16	Drain (Middle Sackville)	**4.8**	**-**	-	29.6 (15-55)	-	41.5 (25-58)	108.7 (71-180)	108.3 (55-210)	70.7 (52-96)	33 (30-37)
17	Duck (coloured; Beaverbank)	**4.0**	**-**	-	?	21 (20-22)	100.5 (21-180)	28.3 (25-30)	29.7 (19-45)	53 (41-72)	35.7 (30-39)
18	Echo (very high colour; Lake Echo)	**4.3**	**-**	-	6.4 (6.4-35.1)	11 (8-14)	9.3 (9-10)	12 (4-17)	15 (12-20)	27 (13-48)	13.7 (11-18)

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		……. Deep station data (shallow zone values may differ considerably) …….									
#	Lake and the community (other relevant info)	SWCSMH's models	Queen's University Diatom inference values	Historical data (various sources) means & ranges (surf, arms depth & vw)		……..……..HRM's synoptic data…… means & ranges (1m depth)					
		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
19	Fenerty (Beaverbank)	**4.7**	**-**	10 (5-20)	15.4 (13-19)	13.5 (5-22)	11.5 (9-14)	27 (15-36)	24 (17-30)	30 (26-35)	18 (15-20)
20	First (Lower Sackville)	**2.6**	**5.89**	10 (5-20)	7.8 (3-18.1)	<2.0	5.3 (4-6)	14 (9-21)	10.7 (5-19)	21.3 (9-46)	7.8 (6-11)
21	First Chain (Halifax)	**-**	**4.07**	-	9.7 (2-23)	-	4.0	7.3 (5-9)	11.7 (4-21)	8.7 (6-13)	7.0
22	Fletchers (Fall River)	**3.6**	**2.09**	11.4 (5-20)	8.4 (3-11)	<2.0	8.7 (5-12)	8 (5-12)	11.7 (9-16)	16 (7-30)	9.0
23	Fraser (Timberlea)	**5.7**	**7.94**	-	8.5 (3-16)	-	-	-	-	-	-
24	Frenchman (Dartmouth)	**-**	**4.37**	-	18.7 (2-42)	-	10 (6-16)	38 (20-70)	22.7 (9-45)	25.3 (14-42)	11.7 (5-17)
25	Frog Pd. (Jollimore)	**-**	**4.90**	-	9.0 (2-22)	-	11.3 (8-16)	14.7 (10-17)	19 (11-23)	29.7 (17-45)	10.5 (10-11)
26	Governor (Timberlea)	**5.0**	**11.48**	-	20.42 (5-32)	6.5 (2-11)	7.7 (5-10)	15.3 (13-18)	14.3 (11-19)	31.3 (17-56)	15.3 (4-28)

……/8

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		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
27	Half Mile (high colour; Timberlea)	**5.4**	**-**	-	-	-	17 (17-17)	24 (18-30)	25.7 (20-37)	23.3 (15-28)	30 (17-47)
28	Hubley Big (high colour; Hubley)	**4.2**	**-**	-	10.7 (6-13.7)	25 (24-26)	11.5 (11-12)	13.7 (8-18)	14.3 (11-16)	15.3 (12-19)	15.3 (13-19)
29	Kearney (Halifax)	**4.1**	**5.25**	-	6.8 (1-16)	6.0	7 (5-9)	9.3 (8-11)	5.5 (4-7)	7 (5-9)	10.5 (8-13)
30	Kidston (high colour; Spryfield)	**4.9**	**-**	-	5.0	-	12.7 (11-16)	13 (10-18)	17 (10-24)	29 (10-62)	10.7 (7-13)
31	Kinsac (Windsor Jnctn.)	**1.3**	**2.63**	8.3 (5-20)	10.7 (3-21)	3.0	10 (8-12)	14 (10-19)	14.7 (12-20)	21.3 (10-40)	8.7 (7-11)
32	Lamont (Dartmouth)	**2.9**	**7.76**	-	7.0 (1-14)	-	-	-	-	-	-
33	Little Springfield (Middle Sackville)	**5.0**	**4.57**	-	7.6 (2-14)						
34	Lisle (Middle Sackville)	**3.7**	**-**	-	-	52 (37-67)	57 (22-92)	38.5 (31-46)	-	-	53.5 (29-78)
35	Long (high colour; Halifax)	**4.7**	**5.37**	-	7.3 (2-20)	2.5 (<2-3)	5.3 (5-6)	10 (5-13)	14 (6-22)	14.7 (11-21)	9.3 (5-15)

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		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
36	Long Pd. (very high colour; Herring Cove)	**5.5**	**-**	-	-	-	12.7 (9-15)	15.7 (6-25)	27 (10-39)	20 (14-30)	17 (13-23)
37	Loon (Westphal)	**2.5**	**7.94**	12.5 (5-16)	7.3 (2-15)	-	16 (4-38)	12.7 (6-17)	12.3 (6-20)	21.7 (10-43)	13 (11-15)
38	Lovett (Lakeside)	**4.1**	**-**	-	-	-	10 (9-11)	12.3 (8-18)	11.7 (8-14)	29 (13-60)	11 (5-18)
39	Major (Preston)	**-**	**4.79**	-	8.2 (3-16)	-	-	-	-	-	-
40	Maynard (Dartmouth)	**-**	**3.72**	-	7.8 (5-12)	12.0	6 (6-6)	12 (6-21)	8.7 (7-12)	32.3 (22-46)	8.3 (4-13)
41	McCabe (very high colour; Lucasville)	**6.3**	**6.03**	-	4.0	-	-	18.3 (5-41)	24 (10-50)	17.5 (17-18)	11.5 (6-17)
42	McIntosh Run @Mouth (very high colour; Herring Cove)	**-**	**-**	-	-	6 (2-10)	11 (10-13)	13 (4-18)	22 (12-32)	19 (7-39)	14.3 (12-17)
43	McIntosh Run @Roaches Pd. (very high colour; Herring Cove)	**-**	**-**	-	-	-	10 (10-10)	17.7 (13-21)	30.0	15.3 (11-21)	18 (14-25)

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		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
44	MicMac (Dartmouth)	**-**	**2.29**	-	8.4 (4-12.7)	<2.0 (<2-2)	6.7 (6-8)	11.5 (8-15)	12.5 (12-13)	32 (12-52)	13 (8-18)
45	Miller (Fall River)	**4.2**	**7.94**	<10 (5-10)	6.7 (3-12)	-	-	-	-	-	10.7 (7-13)
46	Morris (mean of north & south basins; Dartmouth)	**3.4**	**3.89**	-	16.4 (7-100)	<5.0 (<2-8)	10.3 (10-11)	13.2 (7.5-18.5)	15.8 (4-37)	14.8 (7.5-28.5)	22 (11-33)
47	Nine Mile River @Hwy 103 (very high colour; Timberlea)	**-**	**-**	-	-	28.5 (28-29)	34 (19-53)	71 (20-130)	69.3 (42-104)	59 (30-88)	50.3 (42-64)
48	Nine Mile River @Mouth (very high colour; Shad Bay)	**-**	**-**	-	-	-	17.3 (15-22)	21.7 (19-25)	25.3 (18-31)	23.3 (10-37)	18.7 (16-22)
49	Oathill (Dartmouth)	**3.6**	**11.22**	-	9.6 (2-18.9)	3 (3-3)	14.7 (8-23)	18.3 (16-20)	20.3 (10-36)	40 (23-51)	20 (10-27)
50	Papermill (Bedford)	**4.6**	**4.37**	-	8.5 (3.9-16)	6.5 (6-7)	4.3 (4-5)	8.7 (7-10)	7.5 (6-9)	10 (2-18)	8 (7-9)

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		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
51	Penhorn (Dartmouth)	**2.3**	**5.37**	-	5.8 (1-14)	2.0	9.7 (4-18)	13 (6-21)	11.7 (5-19)	22 (20-25)	11.3 (6-19)
52	Pockwock (Hammonds Plains)	**3.2**	**2.29**	-	4 (2-7)	-	-	-	-	-	-
53	Porters-Upper (very high colour)	**5.6**	**-**	-	-	5.5 (3-8)	6 (5-7)	10.3 (7-15)	14 (8-26)	25.7 (10-56)	12.3 (9-17)
54	Porters-Lower	**4.6**		-	10.2 (7.6-17.4)						
55	Powder Mill (Waverley)	**2.3**	**6.61**	10 (<5-35)	7.3 (5-13)	<2.0	10.7 (9-14)	9.7 (8-12)	9 (7-11)	21.7 (7-50)	8 (4-11)
56	Powers Pd. (Herring Cove)	**5.5**	**5.89**	-	7.8 (3-12)	-	-	-	-	-	-
57	Red Bridge Pd. (Dartmouth)	**-**	**-**	-	-	-	39 (21-67)	28.3 (17-43)	53.7 (20-84)	26.3 (6-39)	29.3 (8-61)
58	Rocky (Bedford)	**2.9**	**6.76**	8.2 (5-10)	6.1 (2-8.7)	3.0	12 (8-17)	20.3 (18-25)	22 (12-30)	26 (11-50)	10.3 (8-15)

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		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
59	Russell (Dartmouth)	**4.7**	**23.44**	55.5 (0-144)	20.9 (7-39)	<6.5 (<2-11)	13.3 (12-14)	9.5 (7-12)	12 (3-20)	6.5 (5-8)	18 (17-19)
60	Sackville River @Mouth, below Fish Hatchery (high colour; Bedford)	**-**	**-**	-	-	8 (4-12)	9.7 (7-11)	16.7 (12-23)	11 (9-13)	34.3 (4-70)	12.7 (13-15)
61	Sandy (Bedford)	**6.3**	**8.91**	-	10.5 (5-18)	9.0	13 (6-20)	14.7 (11-21)	15 (8-25)	24 (10-43)	8 (6-17)
62	Sandy (Glen Arbour)	**3.2**	**-**	Pre-development (1996):- 4.3 (3.8-4.7)	11.24 (3.6-21.3)	5 (2-8)	17 (3-42)	21.3 (15-32)	8.3 (4-14)	9 (5-14)	9.7 (5-16)
63	Second (Sackville/Windsor Jnct.)	**4.3**	**7.24**	9.1 (0.5-11.5)	9.4 (2-14)	<2.0	5.5 (3-8)	10.3 (7-13)	12 (7-16)	26.7 (8-60)	8.7 (4-14)
64	Second Chain (Halifax)	**-**	**4.37**	-	11 (2-27)	-	-	-	-	-	-
65	Settle (Dartmouth)	**3.2**	**7.94**	-	15.0 (3-34)	22.5 (20-25)	14.3 (9-24)	24 (15-38)	30 (22-39)	45.7 (21-82)	33 (17-45)

……/13

		……. Deep station data (shallow zone values may differ considerably) …….									
#	Lake and the community (other relevant info)	SWCSMH's models	Queen's University Diatom inference values	Historical data (various sources) means & ranges (surf, arms depth & vw)		……..HRM's synoptic data……. means & ranges (1m depth)					
		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
66	Sheldrake (very high colour; Hubley)	**4.7**	**4.68**	-	20.2 (12-27)	21 (12-30)	18.3 (14-23)	22.7 (16-28)	25.7 (17-33)	29.3 (14-37)	27 (20-33)
67	Shubie Grand (Wellington)	**3.1**	**5.50**	7.7 (2.3-12.3)	7.7 (4.3-18.5)	-	4 (3-5)	7.0	10.3 (7-13)	23.3 (4-60)	4.5 (3-6)
68	Soldier (Wellington)	**4.2**	**6.61**	5 (<5-25)	10 (3-16.3)	-	-	-	-	-	-
69	Smelt Brook (very high colour; Dartmouth)	**-**	**-**	-	-	13.0	8.7 (7-14)	51.5 (23-80)	17 (11-21)	33.3 (12-72)	14.3 (8-23)
70	Springfield (Middle Sackville)	**3.1**	**5.01**	14.0 (5-25.5)	7.0 (2-12.4)	6.5 (4-9)	9 (9-9)	20.7 (17-23)	15.7 (6-30)	20.3 (10-41)	7.3 (4-10)
71	Stillwater (Hubley)	**4.9**	**-**	-	8.0	14.5 (10-19)	11 (6-15)	11 (9-13)	11.7 (7-15)	17.7 (15-22)	12 (8-17)

……/14

		……. Deep station data (shallow zone values may differ considerably) …….									
#	Lake and the community (other relevant info)	SWCSMH's models	Queen's University Diatom inference values	Historical data (various sources) means & ranges (surf, arms depth & vw)		……..HRM's synoptic data……. means & ranges (1m depth)					
		Hindcast values (+0.173 kg/ha.yr precipitation)	Pre-1850's (Bottom layer of core)	1970's	1980's-2000's	2006	2007	2008	2009	2010	2011
		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
72	Third (Windsor Jnctn.)	**3.0**	**12.02**	5.6 (2.5-13.1)	6.2 (3.5-10.0)	<2.0	7 (6-8)	11.7 (8-15)	6.5 (3-10)	22.3 (8-50)	6.7 (4-9)
73	Thomas (mean of north & south basins; Waverley)	**3.9**	**3.39**	10.4 (5-20)	7.4 (3-12.6)	<2.0	10.3 (8-13)	8 (3-11)	13.5 (8-20)	24 (10-51)	7.3 (5-10)
74	The Mill (Three Mile Pd.; very high colour; Timberlea)	**-**	**-**	-	-	-	14.3 (8-24)	12.3 (10-16)	12 (8-16)	15.3 (14-18)	13.3 (11-15)
75	Topsail (Dartmouth)	**2.5**	**4.79**	-	9 (3-14)	-	-	-	-	-	-
76	Tucker (Beaverbank)	**4.0**	**-**	-	6.4 (3-12.8)	4.0	8 (7-9)	10.3 (3-14)	9.3 (6-12)	18 (10-32)	9.3 (8-11)
77	Whimsical (Halifax)	**-**	**13.80**	-	9.3 (3-16)	3 (2-4)	12.3 (10-16)	16.3 (14-18)	14.3 (11-20)	21 (15-24)	12 (6-16)
78	William (Waverley)	**3.5**	**8.51**	10.6 (5-11.2)	7.4 (4-12)	<2.0	6.7 (6-7)	10.7 (8-13)	9 (7-11)	21.3 (12-32)	6 (4-7)
79	Williams (Jollimore)	**3.9**	**4.07**	10.0	8.3 (2-12)	3.0	7.3 (5-11)	8.5 (7-10)	17 (10-24)	15.3 (13-17)	10 (8-12)
80	Winder (North Preston)	**5.7**	**-**	-	1002.5 (300-1630)	400 (360-440)	130 (100-180)	116 (88-150)	99 (59-152)	81.3 (53-130)	77.3 (42-128)