

***Brightsand Lake Water Quality Report
2004 – 2007***

Prepared for
The Brightsand Lake Watershed Association

Monitoring and Assessment Branch
Stewardship Division
July 2008

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1.0 Introduction and Background

1.1 General Description, Geography and Hydrogeology of Brightsand Lake

Brightsand Lake is located approximately 25 km east of St. Walberg, Saskatchewan (Figure 1). The lake is 9.5 km long, 4.5 km wide with a surface area of approximately 32 square km. Brightsand Lake has a mean depth of approximately 8.5 m and a maximum depth of approximately 15 m (SERM 1992).

The Brightsand Regional Park is located along the northeastern shoreline of the lake and is a popular recreational area offering many attractions including: boating, fishing, swimming, golf, and hiking. In addition to the park, there are several local communities surround the lake including Evergreen Brightsand, Mowrey Beach, Eastview Beach, Diamond Willow, Sunny Acres, and Crystal Bay Sunset.

Brightsand Lake tends to experience fluctuations in water level depending on climate variability, which affects both the quantity of surface and ground water and evaporation from the lake. Despite the decreasing average water level from 1974 to 2008, variability in evaporation and precipitation over time makes it difficult to predict the future water levels on Brightsand Lake (Figure 2). It is important to note that lakes (especially those without control structures) tend to fluctuate naturally over time in response to the variability in climate.

Brightsand Lake is located within the Boreal Transition ecoregion in Saskatchewan. The bedrock in the area is silt and clay shale dating from the late Cretaceous age (Acton et al. 1998). Within this ecoregion the bedrock and both the surficial and glacial aquifers influence the lakes and influence their ecological and chemical characteristics.

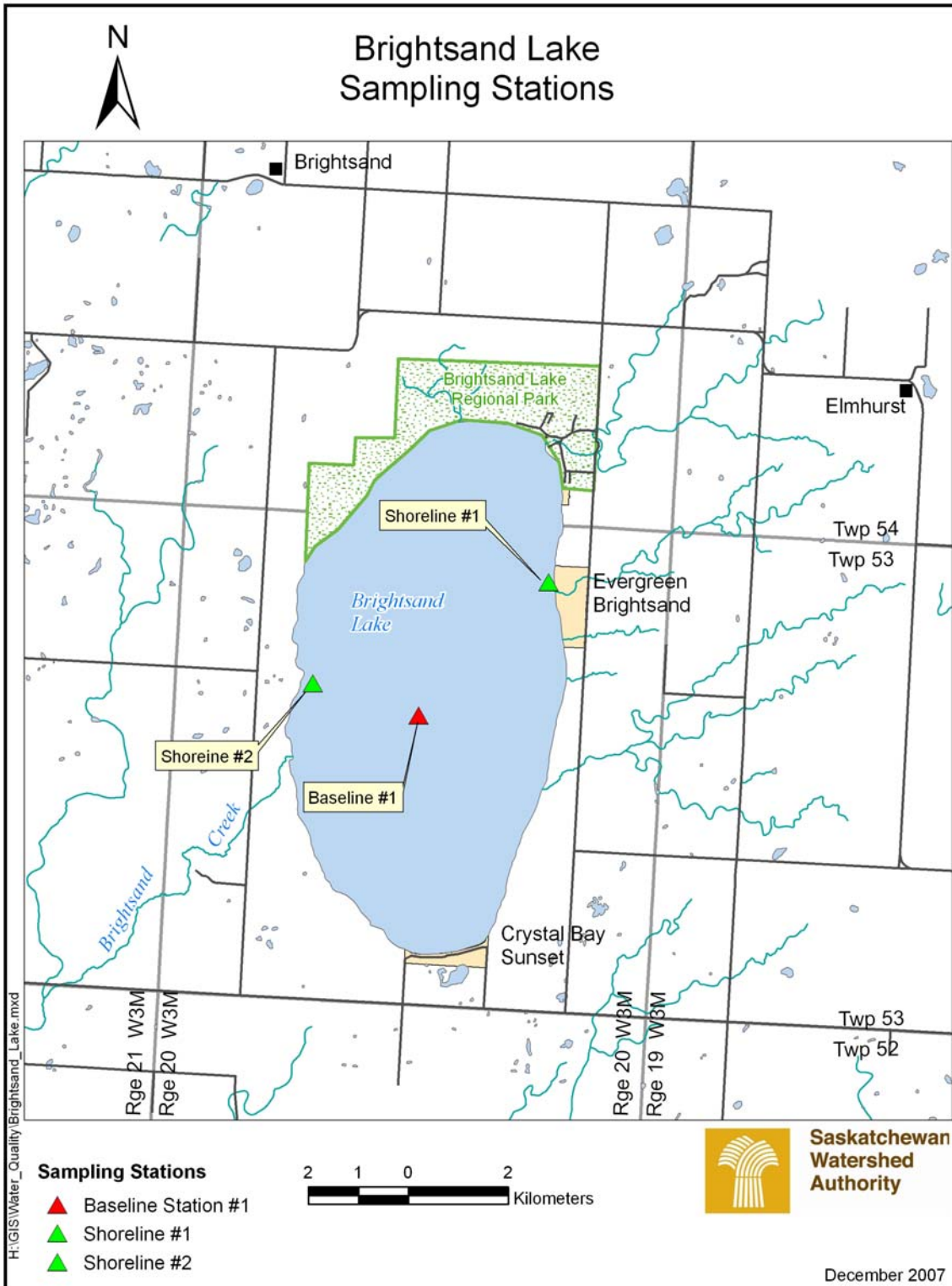


Figure 1: Map of Brightsand Lake 2004 - 2007 sampling stations.

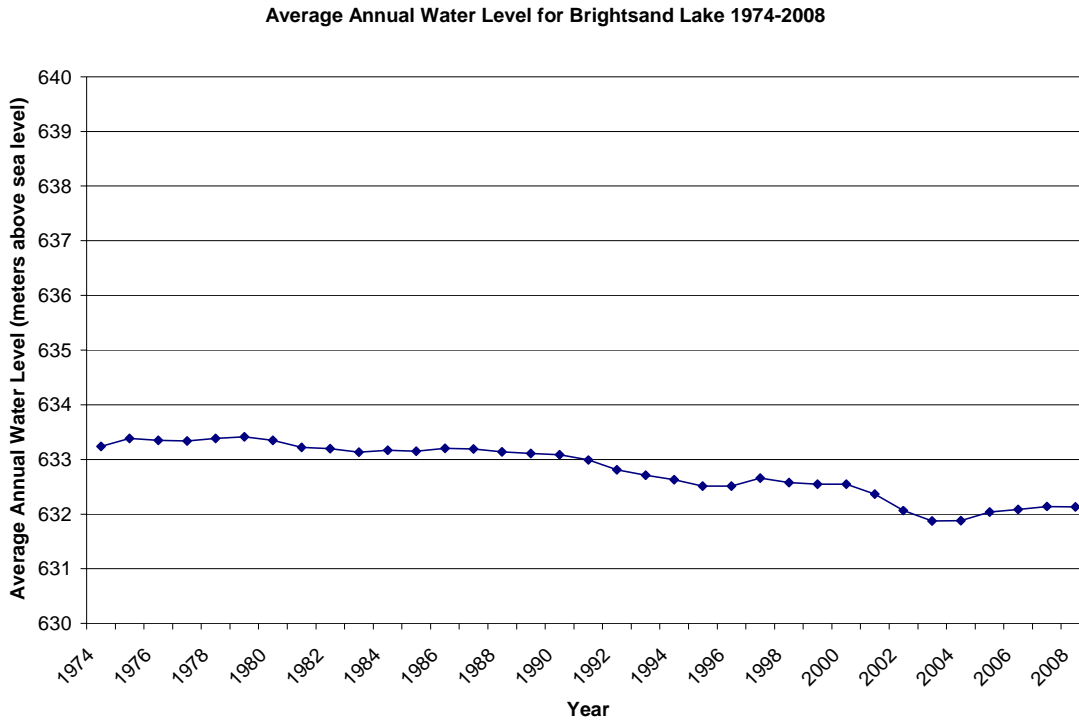


Figure 2: Average annual water levels in meters above sea level for Brightsand Lake, Saskatchewan (1974-2008).

1.2 Lake Stewardship & the Brightsand Lake Watershed Association

The Brightsand Lake Watershed Association (BLWA) participated in Saskatchewan Watershed Authority’s *Lake Stewardship Program* from 2004 to April 2008. The *Lake Stewardship Program* focused on supporting activities, projects and public education at lakes with active stewardship groups and volunteers. In addition to providing resources and support, Saskatchewan Watershed Authority carried out water quality monitoring of Brightsand Lake, which included technical support and interpretation of water quality to the BLWA.

The BLWA is an important advocate on behalf of the health of Brightsand Lake and the surrounding upland area. Incorporated as a non-profit organization, the group takes part in activities and projects which promote education and awareness regarding Brightsand Lake’s aquatic and terrestrial health. More specifically, the BLWA sends informational packages to each resident living in a residential community or resort village around the lake. The informational packages provided by the BLWA often contain several useful articles regarding Brightsand Lake’s water quality, activities of the BLWA, permits required for shoreline alteration and shoreline protection.

The BLWA’s has a vision to “...protect fish and their habitat; restore and maintain the shoreline and riparian areas and monitor and protect water quality while increasing local user’s knowledge of the lake. Ultimately (the BLWA wants to), encourage sustainable use and management of Brightsand Lake now and in the future.”

2.0 Water Quality Sampling

In 2004, Saskatchewan Watershed Authority initiated water quality monitoring of Brightsand Lake with the objective of establishing baseline information and then using the information to educate local users. Saskatchewan Watershed Authority sampled Brightsand Lake on three occasions during the summer of 2004, six times a year as intended by the program in 2005 and 2006, and twice in the winter of 2007. Water quality monitoring was suspended in 2007 with the intention of resuming sampling in 2011; however, in April 2008, sampling was permanently cancelled as the *Lake Stewardship Program* was discontinued.

Historically, Brightsand Lake was sampled by Saskatchewan Environment (Ministry of the Environment) in 1991, 1992, 1996, and 2000. The data collected by Saskatchewan Environment did not include analysis or collection of heavy metals, herbicides, dissolved oxygen, or winter samples (with exception of the one sample taken in the winter of March 1992).

The water quality data collected thus far has lead to a better understanding of Brightsand Lake's water quality characteristics and has provided a basis of information from which to make more informed decisions regarding the management and activities in and around the lake.

2.1 Water Quality Frequency and Sampling Sites

The standard lake sampling schedule for Saskatchewan Watershed Authority's *Lake Stewardship Program* included two winter (January to March) and four summer samples (May to October) per year. Sample sites were divided into *Baseline Stations* and *Shoreline Stations* (Figure 1).

Baseline Station: Baseline stations are generally deep, centrally located sites chosen to represent water quality conditions typical of Brightsand Lake. Certain parameters (i.e. dissolved oxygen and temperature) are recorded at intervals throughout the depth at the site. Baseline stations are sampled on all six sample dates during the year. Water quality results from baseline stations are used to calculate the Water Quality Index (WQI) score as this location is not easily influenced by localized changes in water quality.

Shoreline Stations: Shoreline stations are monitored to determine the effects (if any) of local influences on water quality. Together, Saskatchewan Watershed Authority and the BLWA selected the shoreline stations (Figure 1). Sampled only during open water, the water quality results for these shoreline stations are compared to Saskatchewan's *Surface Water Quality Objectives for Recreation and Aesthetics* (Interim Edition, July 2006).

2.2 Water Quality Index: Assessing General Water Quality

The Water Quality Index (WQI) is a tool which provides a means of assessing the overall quality of lake water in Saskatchewan. To calculate the WQI, results from water quality sampling are compared to provincial objectives for specific water uses including irrigation, recreation and the protection of aquatic life. The WQI combines key chemical and biological aspects of water quality (including major ions, nutrients, heavy metals, herbicides, bacteria, dissolved oxygen, and pH) to define overall water quality and summarize these parameters in a single score.

A single score for each year allows easy comparison of general lake water quality trends over time and identifies parameters considered important to overall lake health. The WQI score is based on whether parameters meet their objectives and takes into account the magnitude and frequency of excursions. Deviation from objective values does not necessarily indicate poor lake health or that water quality is worsening. Certain parameters (*e.g.* arsenic, chloride, and pH) may naturally exceed the WQI objectives in Saskatchewan lakes due to geologic and hydrologic characteristics of the drainage basin and lake. The WQI does not differentiate ‘natural-source deviation’ from exceedances which are a result of human influences. As such, it is important to examine lake water quality over time in order to determine if human activity may be impacting lake water quality.¹

The WQI requires at least three samples per year and a minimum of four parameters to calculate the final score. Samples are considered to be in the same year if they were taken at any point from ice off in the spring until late in the following winter. Therefore, years lacking a sufficient number of samples for the calculation of the WQI were combined with an adjacent year in effort to utilize all of the data and increase the robustness of the final score. For instance, the single winter sample taken in March 1992 was combined with data collected in 1991 which prior to the amalgamation, had no representative winter sample. Similarly, the two winter samples taken in 2007 were combined with data from 2006, as they could not be used to calculate a 2007 WQI score independently.

2.3 Assessing Shoreline Water Quality

Brightsand Lake’s shoreline stations are located on the shore of Evergreen Brightsand (Station No. 1) and on the west shoreline (Station No. 2; Figure 1). Shorelines at Brightsand Lake were measured in 2005 and 2006. Water quality measurements at shoreline sampling stations were compared to Saskatchewan’s *Surface Water Quality Objectives for Recreation and Aesthetics* (SE 2006). A WQI index score is not calculated for shoreline stations because some parameters required for the index (*i.e.* metals) are not measured at shoreline stations. Secondly, shoreline water quality is much more indicative of the local water quality conditions than that of the entire lake.

3.0 Water Quality Results and Discussion

3.1 Baseline Station Summary

The WQI scores for Brightsand Lake’s baseline are categorized as *good* and remained consistent over the sampling period from 1991 – 2006 with exception of the score in 2000 (Figure 3). The consistency in both the frequency and magnitude of the parameters identified as “exceeding” the WQI index indicates that these exceedances may not be due to human influences, but rather to natural processes, and may not impair the ecology of Brightsand Lake. Only four parameters

¹ For a more comprehensive explanation about the Water Quality Index (WQI) or the parameters used to determine WQI scores, please refer to the “Lake Stewardship Water Quality Guide” online at www.swa.ca.

(pH, chromium, phosphorus, arsenic) exceeded objectives in the WQI. The WQI score in 2000 is artificially elevated due to the lack of winter sampling (only sampled in July and September) and absence of heavy metal testing including arsenic.

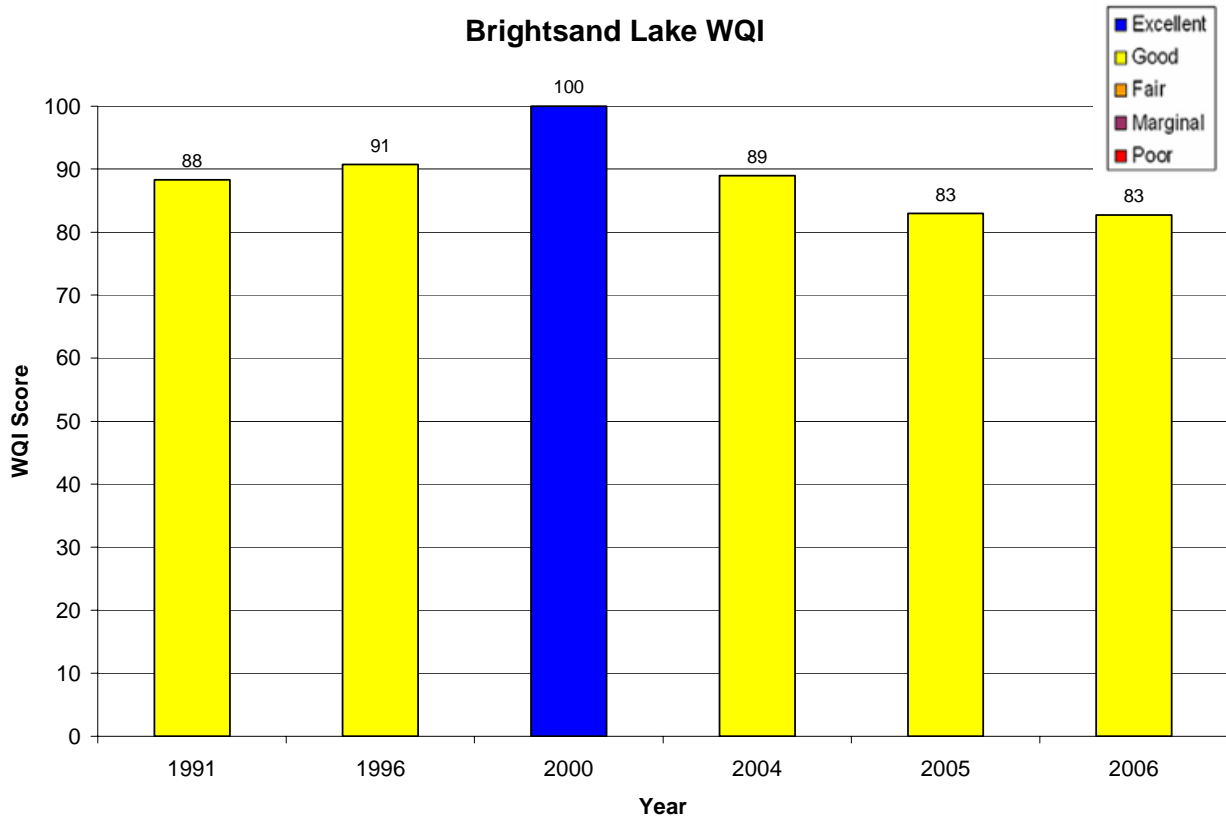


Figure 3: Water Quality Index (WQI) scores for Brightsand Lake - Baseline Station 1991-2007.

Note: Two winter samples collected in 2007 contribute to the 2006 WQI score, as it was not possible to provide a score for 2007 based on only two samples. Similarly, a single winter sample from 1992 was calculated with the 1991 WQI score.

3.2 Parameters that Exceeded WQI Objectives

pH

pH is an important water quality parameter that affects chemical and biological reactions within lakes. Extremes in pH or rapid changes in pH can negatively impact aquatic life. Saskatchewan lakes demonstrate a variety of pH levels from basic to acidic. Not atypical to other lakes in the province Brightsand Lake is considered slightly alkaline with salts present as a result of discharge from bedrock aquifers (Acton et al. 1998). In Brightsand Lake, pH is the only parameter which consistently exceeds the WQI objective of pH 6.5-9.0. Since 1991, Brightsand Lake's baseline pH ranged from pH 8.9-9.5.

Metals

Given that Saskatchewan is rich in many minerals, it is not unusual to find metals in surface water. Arsenic, mercury, chromium, and aluminum are natural elements found in soil and bedrock. They may enter surface water supplies through natural rock weathering, discharge of industrial wastewater, agricultural pollution, and dissolution in rain, snow, or groundwater.

Sampling results from 2004-2007 showed frequent arsenic exceedances at Brightsand Lake baseline. Arsenic (when tested) consistently exceeded the provincial objective for the protection of aquatic life (5 µg/L) and ranged from 7-10 µg/L. Consistent exceedances in metals such as arsenic are likely a result of groundwater influences to the lake and is present in other lakes monitored through the *Lake Stewardship Program* (see Figure 4).

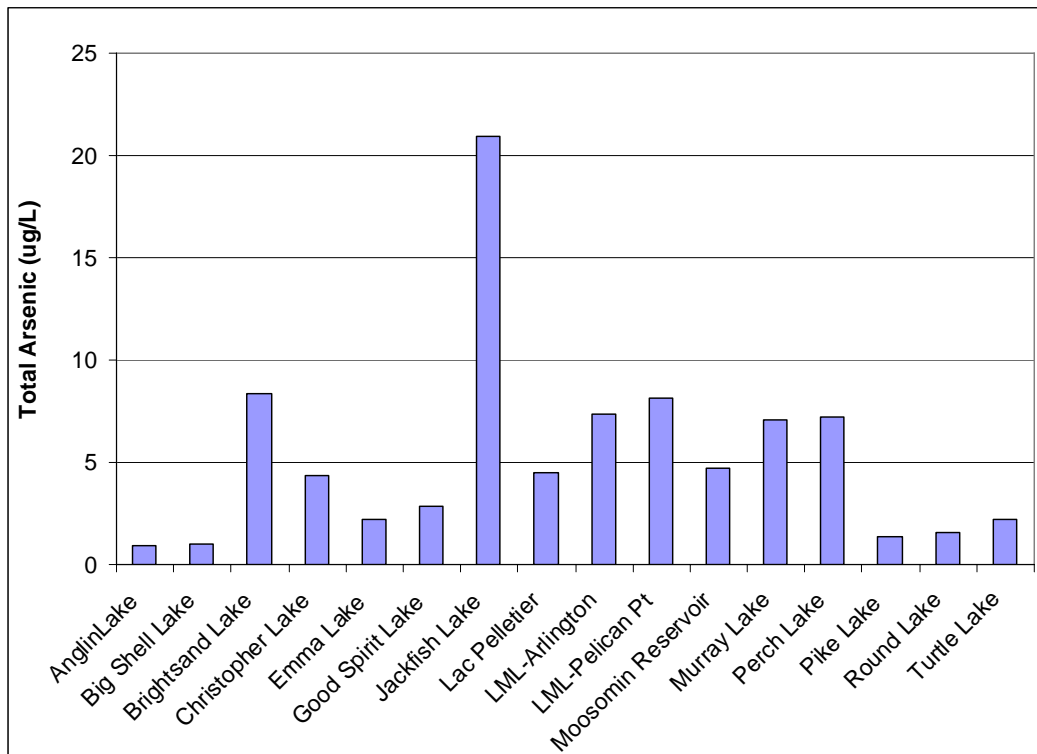


Figure 4: Average concentration of arsenic in lakes tested through the *Lake Stewardship Program*. Note: LML = Last Mountain Lake.

Chromium exceeded the WQI objective of 0.001 mg/L on two occasions with a concentration of 0.003 mg/L. Due to its low frequency of occurrence and the small magnitude of exceedance, it is not considered a negative influence on the water quality of Brightsand Lake.

Nutrients

Nutrients are essential for the growth and survival of all organisms. The amount of nutrients in a system influence how much life it can support. In aquatic systems nutrients can come from a variety of sources. Increased nutrients can potentially lead to a variety of problems including algal or macrophyte growth (plants anchored to the bottom of the lake); however, it is important

to note that total phosphorus is variable and changes seasonally. As a result of their importance, key nutrients including total phosphorus were monitored as part of the *Lake Stewardship Program*. Total phosphorus was exceeded in a total of seven samples; however, the maximum value recorded was 0.15 mg/L which is just slightly above the target value of 0.10 mg/L.

3.3 Remaining Parameters Measured for the WQI

Parameters which contribute to the water quality of Brightsand Lake but did not exceed the WQI objectives include chloride, mercury, total ammonia, dissolved oxygen, sodium, herbicides (2'4-D, MCPA), aluminum, sulphate, fecal coliform bacteria, nitrate and Chlorophyll *a*. For a complete description of each parameter and their contribution to water quality see the [Lake Stewardship Water Quality Guide](#), which you can find on our website www.swa.ca.

3.4 Field Measurements

Surface water quality parameters measured at Brightsand Lake baseline station include five important field measurements which provide a better understanding of the lake's water quality. The WQI utilizes values for dissolved oxygen (DO) and temperature; however the remaining parameters (specific conductivity, turbidity, and Secchi disk depth) are of value when further assessing water quality for the protection of aquatic life.

Dissolved Oxygen

Dissolved oxygen affects both chemical processes and biological organisms within the lake. For example, certain fish species are sensitive to low levels of dissolved oxygen and may experience stress or death due to lack of oxygen in the water. For the WQI, the objective is 5.5 mg/L of dissolved oxygen for the protection of aquatic life. Dissolved oxygen concentrations are variable based on time, weather, and temperature. Profile measurements for dissolved oxygen in Brightsand Lake indicate that it is well oxygenated throughout the year with exception of the deepest meter in both late summer and mid to late winter. Dissolved oxygen concentrations tend to decrease near lake bottom due to decomposition.

Temperature

This parameter is measured because of the direct/indirect influence it has on other parameters such as dissolved oxygen and specific conductivity. Temperature can influence the spatial distribution of fish (i.e. cold water vs. warm water species) and plant growth. Ranging seasonally, temperature values observed at the baseline in Brightsand Lake from 2004-2007 varies from 0.1 to 20.8°C.

Specific Conductivity

Conductivity is a measure of water's ability to conduct an electrical current, which depends on the concentration of dissolved ions in solution. Specific conductivity is calculated using the conductivity of the water (concentration of specific ions) and the lake temperature. Influenced by geology and soil composition, Brightsand Lake's specific conductivity ranged from 868 - 1136 µS/cm (1991, 1992, and 2004 to 2007).

Turbidity

Turbidity is a measure of water clarity. A reduction in water clarity may be caused by solids suspended in the water, including sediment (e.g. during lake overturn) and plankton (small plants and animals). Other sources of turbidity (or lack of water clarity) which are commonly seen closer to shore include shoreline erosion (due to ice scour or wave action from wind or boat traffic), waste discharge, urban runoff, algal growth, sediment disruption from human activities or bottom feeding organisms. An increase in turbidity decreases light penetration because the particles floating in the water either absorb or scatter the light (Wetzel 2001). For recreational purposes, the surface water objective for turbidity is less than 50 NTU. Turbidity is low (meaning good light penetration and clarity) in Brightsand Lake with values between 0.45 NTU and 1.6 NTU.

Secchi Disk Depth

Secchi disk depth is a direct measure of water transparency and, like turbidity, is affected by suspended sediment, plankton, and water colour. Easily measured with a marked disk and measured rope, the Secchi disk depth can assist in determining the photic zone (area in which light penetrates the water column) of the lake. The photic zone is an important measurement because it indicates the depth of water that algae and plants can live. At Brightsand Lake baseline, the Secchi disk reading ranged from 2.5 to 4.5 m.

3.5 Shoreline Stations

Shoreline sampling stations at Brightsand Lake have similar water quality values to the baseline station.

Secchi Disk Depth

The Saskatchewan *Surface Water Quality Objectives* (2006), state that for bathing waters the Secchi disk depth should be at least 1.2 m. Water clarity (Secchi depth) was not measured at shoreline stations of Brightsand Lake because the bottom of the lake was visible at depths greater than 1.2 m.

Bacteria

Escherichia coli (*E. coli*) are species of bacteria normally found in the lower intestines of animals and people. *Escherichia coli* are commonly detected in surface water because people, pets, livestock, birds, and wild animals come into contact with the water. Shoreline samples from Brightsand Lake commonly show some level of *E. coli*; however, levels often remain less than 10 counts/100 mL. Regardless of the origin, it is always advisable for humans to take steps to minimize contamination (i.e. proper septic tank maintenance and keeping pets out of the water). The recreational guideline (SE 2006) for *E.coli* is based on greater sampling frequency than that undertaken in the present study. However, all samples from the shoreline stations in Brightsand Lake were below the guideline on the days they were collected.

Turbidity

For recreational purposes, the surface water objective for turbidity is less than 50 NTU. Field turbidity values collected near shore in Brightsand Lake remained well below the recreation objective.

Chlorophyll *a*

The relative amount of algae in surface water is assessed by measuring Chlorophyll *a* (the primary pigment that plants and algae use to convert sunlight into energy for growth). Chlorophyll *a* is an indicator of the productivity of the lake. Lakes high in nutrients tend to have more algae or macrophyte growth. Brightsand Lake's shoreline stations ranged from 0.98-6.82 µg/L and were therefore far below <50 µg/L objective for Chlorophyll *a*. In general, shoreline stations tend to have higher algae concentrations than baseline stations due to factors such as wind and wave action as well as warmer temperatures which may cause floating algae to collect or start growing closer to shore.

4.0 Recommendations

Brightsand Lake has been sampled through the *Lake Stewardship Program* for almost four complete years. Though the program ceased in 2008, the information collected thus far provides lake users, residents, managers and other interested parties with an increased understanding of Brightsand Lake's water quality. Saskatchewan Watershed Authority encourages the group to continue educating themselves and other lake users about the water quality of Brightsand Lake and how to protect it.

To maintain the water quality of Brightsand Lake, it is recommended that recreational users and upland stakeholders minimize nutrient additions to the lake. Fertilizer use and disruption of natural vegetation and shoreline should be kept to a minimum. Enhancement of shoreline buffer zones to slow erosion and slow the flow of surface runoff to Brightsand Lake will help reduce the amount of nutrients and other contaminants entering the lake.

The Saskatchewan Watershed Authority encourages the continuation of public education and outreach by the *Brightsand Lake Watershed Association* to teach lake users and stakeholders to follow healthy shoreline living practices such as those outlined in *On the Living Edge – Your Handbook for Waterfront Living* (Kipp & Gallaway 2003).

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Data Tables

2004 – 2007

Brightsand Lake Baseline 2004			
Parameters	June 9		
Nutrients (mg/L)	Surface	Integrated	Bottom
Dissolved Organic Carbon	135.4	135.7	134.3
Nitrate, as Nitrogen	<0.04	<0.04	0.17
Ammonia, as Nitrogen	0.04	0.04	0.03
Total Kjeldahl Nitrogen	1.0	0.9	1.0
Total Phosphorus	0.07	0.07	0.07
Ortho-Phosphate, as P	0.06	0.06	0.05
Solids (mg/L)			
Total Dissolved	963	962	956
Suspended, Fixed	1	2	1
Suspended, Volatile	2	3	3
Suspended, Total	3	5	4
Bacteria (orgs/100 mL)			
Fecal Coliform	<10	<10	<10
Fecal Streptococci	<10	<10	<10
Total Coliform	<10	<10	10
Major Ions (mg/L)			
Alkalinity, Total	629	628	627
Alkalinity, Phenol	67	67	67
Bicarbonate	604	603	601
Calcium	7	7	6
Carbonate	80.4	80.4	80.4
Chloride	4.0	4.0	4.1
Hardness, Total	553	553	542
Magnesium	130	130	128
Potassium	20	20	20
Sodium	63	63	62
Sulphate	54.8	54.7	54.6
Other			
Chlorophyll <i>a</i> (µg/L)	0.89	1.11	1.70
Specific Conductivity (µS/cm)	1,042	1,041	1,043
pH (pH units)	9	9	9
Turbidity (NTU)	1.1	1.8	1.9
Biochemical Oxygen Demand (mg/L)	<2	<2	<2
Chemical Oxygen Demand (mg/L)	29.3	32.5	31.8
Metals			
Preserved Mercury (µg/L)	<0.02	<0.02	<0.02
Aluminum (mg/L)	<0.02	<0.02	<0.02
Arsenic (mg/L)	0.007	0.007	0.007

Table 1: Brightsand Lake Baseline 2004

Brightsand Lake Baseline 2004			
Parameters	July 13		
	Surface	Integrated	Bottom
Nutrients (mg/L)			
Dissolved Organic Carbon	12.7	13.0	13.0
Nitrate, as Nitrogen	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.04	<0.02	0.02
Total Kjeldahl Nitrogen	0.8	0.8	1.1
Total Phosphorus	0.07	0.07	0.08
Ortho-Phosphate, as P	0.06	0.06	0.06
Solids (mg/L)			
Total Dissolved	954	954	954
Suspended, Fixed	1	1	1
Suspended, Volatile	2	2	2
Suspended, Total	3	3	3
Bacteria (orgs/100 mL)			
Fecal Coliform	<10	<10	<10
Fecal Streptococci	<10	<10	10
Total Coliform	<10	<10	<10
Major Ions (mg/L)			
Alkalinity, Total	626	626	626
Alkalinity, Phenol	64	63	63
Bicarbonate	608	610	610
Calcium	6	6	6
Carbonate	76.8	75.6	75.6
Chloride	4	4	4.1
Hardness, Total	530	530	530
Magnesium	125	125	125
Potassium	19	19	19
Sodium	60	60	60
Sulphate	54.8	54.7	54.7
Other			
Chlorophyll <i>a</i> (µg/L)	1.11	1.63	1.70
Specific Conductivity (µS/cm)	1,041	1,043	1,043
pH (pH units)	9	9	9
Turbidity (NTU)	0.93	1.10	1.10
Biochemical Oxygen Demand (mg/L)	<2	<2	<2
Chemical Oxygen Demand (mg/L)	36.2	27.2	34.8
Metals			
Preserved Mercury (µg/L)	<0.02	<0.02	<0.02
Aluminum (mg/L)	<0.02	<0.02	<0.02
Arsenic (mg/L)	0.007	0.007	0.007

Table 2: Brightsand Lake Baseline 2004

Brightsand Lake Baseline 2004			
Parameters	August 18		
Nutrients (mg/L)	Surface	Integrated	Bottom
Dissolved Organic Carbon	12.5	12.7	12.8
Nitrate, as Nitrogen	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.05	0.04	0.09
Total Kjeldahl Nitrogen	0.9	0.9	0.9
Total Phosphorus	0.08	0.11	0.09
Ortho-Phosphate, as P	0.07	0.08	0.07
Solids (mg/L)			
Total Dissolved	953	956	958
Suspended, Fixed	1	2	1
Suspended, Volatile	3	3	3
Suspended, Total	3	5	4
Bacteria (orgs/100 mL)			
Fecal Coliform	<10	<10	<10
Fecal Streptococci	<10	10	30
Total Coliform	<10	<10	<10
Major Ions (mg/L)			
Alkalinity, Total	630	628	630
Alkalinity, Phenol	70	70	70
Bicarbonate	598	595	598
Calcium	6	6	6
Carbonate	84	84	84
Chloride	4.6	4.6	4.6
Hardness, Total	534	546	546
Magnesium	126	129	129
Potassium	19	20	20
Sodium	62	63	63
Sulphate	53.5	54.0	53.6
Other			
Chlorophyll <i>a</i> (µg/L)	4.96	4.59	4.59
Conductivity (µS/cm)	1,044	1,046	1,044
pH (pH units)	9.1	9.1	9.1
Turbidity (NTU)	1.3	1.3	1.4
Biochemical Oxygen Demand (mg/L)	<2	<2	<2
Chemical Oxygen Demand (mg/L)	29.6	34.8	31.6

Table 3: Brightsand Lake Baseline 2004

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2004			
Depth (m)	Dissolved Oxygen (mg/L)	Water Temperature (°C)	Specific Conductivity (µS/cm)
June 6, 2004			
0	9.19	12.9	1,255
1	9.06	12.8	1,000
2	8.80	12.8	1,004
3	8.82	12.7	1,003
4	8.76	12.5	1,006
5	8.62	12.5	1,006
6	8.63	12.5	1,007
7	8.40	12.4	1,007
8	8.44	12.4	1,010
9	8.53	12.3	1,011
10	8.98	12.1	1,010
11	8.75	12.0	1,011
11.7	5.00	11.0	1,053
July 13, 2004			
0	9.21	20.8	1,066
1	7.66	19.1	1,065
2	7.37	18.0	1,006
3	7.56	17.6	1,063
4	7.25	17.5	1,062
5	7.30	17.4	1,062
6	7.43	17.3	1,063
7	7.38	17.3	1,063
8	6.94	17.2	1,062
9	7.35	17.2	1,063
10	7.36	16.9	1,063
11	6.63	16.8	1,064
11.4	0.23	16.2	1,067

Table 4: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2004

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2004			
Depth (m)	Dissolved Oxygen (mg/L)	Water Temperature (°C)	Specific Conductivity (µS/cm)
August 18, 2004			
0	7.54	18.3	1,056
1	7.55	18.3	1,056
2	7.51	18.3	1,056
3	7.59	18.3	1,057
4	7.98	18.3	1,057
5	7.46	18.3	1,056
6	7.44	18.3	1,056
7	7.42	18.3	1,056
8	7.38	18.3	1,056
9	7.48	18.3	1,056
10	7.45	18.4	1,056
11	7.41	18.3	1,056
11.8	7.17	18.3	1,056

Table 5: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2004

Field Measurements Brightsand Baseline 2004			
Field Data	June 9	July 13	August 18
Surface Parameters			
Air Temperature (°C)	n/a	n/a	n/a
Water Temperature (°C)	12.9	20.8	18.3
Dissolved Oxygen (mg/L)	9.19	9.21	7.54
pH (pH units)	9.20	9.08	9.00
Specific Conductivity (µS/cm)	1,255	1,066	1,056
Secchi Disk (meters)	2.0	4.1	2.0
Turbidity (NTU)	1.13	1.10	1.16

Table 6: Field Measurements Brightsand Baseline 2004

Brightsand Lake Baseline Surface Sample 2005						
Parameters	Feb 1	Mar 15	Jun 13	July 13	Aug 22	Sept 13
Nutrients (mg/L)						
Dissolved Organic Carbon	14.3	14.8	15.7	13.8	15.0	13.0
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.06	0.03	0.05	<0.02	0.03	<0.04
Total Kjeldahl Nitrogen	1.0	1.0	0.8	0.8	1.1	1.1
Total Phosphorus	0.11	0.11	0.06	0.06	0.08	0.10
Ortho-Phosphate, as P	0.11	0.11	0.08	0.07	0.08	0.07
Silicon, soluble (mg/L)	n/a	n/a	6.6	6.6	7.9	8.0
Solids (mg/L)						
Total Dissolved	1,038	1,055	943	940	949	962
Suspended, Fixed	<1	1	2	1	1	1
Suspended, Volatile	2	1	2	2	3	4
Suspended, Total	2	2	4	2	4	5
Bacteria (orgs/100 mL)						
Fecal Coliform	<10	<10	<10	<10	<10	<10
Total Coliform	<10	<10	<10	<10	10	<10
Major Ions (mg/L)						
Alkalinity, Total	674	684	614	616	620	618
Alkalinity, Phenol	68	68	62	64	66	66
Bicarbonate	656	669	598	595	595	593
Calcium	7	7	7	7	7	7
Carbonate	81.6	81.6	74.4	76.8	79.2	79.2
Chloride	3.9	3.9	4.0	3.8	4.1	4.3
Hardness, Total	590	598	528	528	536	553
Magnesium	139	141	124	124	126	130
Potassium	21	22	19	19	20	20
Sodium	68	70	61	61	62	65
Sulphate	61.0	60.6	55.5	53.4	55.7	63.0
Other						
Chlorophyll <i>a</i> (µg/L)	3.41	1.19	1.70	<2.00	11.04	6.89
Specific Conductivity (µS/cm)	1,111	1,136	1,027	1,031	1,038	1,035
pH (pH units)	9.0	9.0	9.0	9.0	9.0	9.0
Turbidity (NTU)	0.83	0.57	1.10	0.60	1.30	3.30
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	36.5	31.8	27.8	27.7	36.4	40.4

Table 7: Brightsand Lake Baseline Surface Sample 2005

Brightsand Lake Baseline Bottom Sample 2005		
Parameters	February 1	March 15
Nutrients (mg/L)		
Dissolved Organic Carbon	13.8	14.0
Nitrate, as Nitrogen	<0.04	<0.04
Ammonia, as Nitrogen	0.17	0.37
Total Kjeldahl Nitrogen	1.1	1.4
Total Phosphorus	0.12	0.13
Ortho-Phosphate, as P	0.12	0.13
Solids (mg/L)		
Total Dissolved	1,041	1,058
Suspended, Fixed	<1	1
Suspended, Volatile	1	2
Suspended, Total	2	3
Bacteria (orgs/100 mL)		
Fecal Coliform	<10	<10
Total Coliform	<10	<10
Major Ions (mg/L)		
Alkalinity, Total	670	676
Alkalinity, Phenol	62	54
Bicarbonate	666	693
Calcium	7	7
Carbonate	74.4	64.8
Chloride	3.9	3.8
Hardness, Total	594	594
Magnesium	140	140
Potassium	21	21
Sodium	68	69
Sulphate	60.3	59.7
Other		
Chlorophyll <i>a</i> (µg/L)	3.41	5.26
Specific Conductivity (µS/cm)	1,113	1,143
pH (pH units)	9.0	8.9
Turbidity (NTU)	0.85	1.80
Biochemical Oxygen Demand (mg/L)	<2	<2
Chemical Oxygen Demand (mg/L)	36.3	39.2

Table 8: Brightsand Lake Baseline Bottom Sample 2005

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2005						
Depth (m)	Dissolved Oxygen		Specific Conductivity (μS/cm)	Water Temperature ($^{\circ}$C)	Turbidity (NTU)	pH (pH units)
	(mg/L)	(% sat.)				
February 1, 2005						
0	11.25	79.2	1,041	0.3	1.03	9.43
1	10.94	77.8	1,043	0.2		
2	11.30	76.9	1,039	0.2		
3	11.26	78.4	1,037	0.3		
4	11.03	77.3	1,035	0.3		
5	11.17	76.5	1,037	0.3		
6	10.94	76.8	1,035	0.4		
7	10.89	73.8	1,026	0.7		
8	10.16	73.2	1,022	1.0		
9	9.29	70.0	1,009	1.7		
10	6.13	56.9	1,008	2.3		
11	2.21	19.7	1,018	2.9		
11.5	1.38	4.0	1,014	3.1		
March 15, 2005						
0	9.11	62.1	1,148	0.2	0.55	9.33
1	9.19	64.0	1,146	0.2		
2	9.20	63.8	1,145	0.5		
3	9.19	64.7	1,148	0.5		
4	9.04	62.6	1,148	0.6		
5	9.01	62.9	1,148	0.7		
6	8.73	62.0	1,145	1.0		
7	8.27	59.5	1,150	1.2		
8	8.20	52.8	1,148	1.6		
9	6.33	45.9	1,161	2.2		
10	1.93	18.3	1,187	3.0		
11	1.03	4.9	1,189	3.7		
11.5	0.53	3.3	1,183	3.9		

Table 9: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2005

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2005						
Depth (m)	Dissolved Oxygen		Specific Conductivity (μ S/cm)	Water Temperature ($^{\circ}$ C)	Turbidity (NTU)	pH (pH units)
	(mg/L)	(% sat.)				
June 13, 2005						
0	9.36	93.8	1,036	14.8	1.90	9.11
1	9.39	92.2	1,045	14.7		
2	9.53	93.9	1,046	14.7		
3	9.60	94.9	1,046	14.7		
4	9.55	93.5	1,051	14.6		
5	9.59	94.6	1,050	14.6		
6	9.59	94.5	1,049	14.5		
7	9.11	93.1	1,052	14.4		
8	9.50	92.2	1,056	14.3		
9	9.70	93.7	1,052	14.0		
10	9.90	91.6	1,050	12.4		
11	9.86	92.3	1,050	12.3		
11.5	7.29	67.7	1,067	11.9		
July 13, 2005						
0	8.05	89.6	1,017	20.1	0.29	9.121
1	8.04	88.8	1,021	20.0		
2	7.74	85.6	1,021	20.0		
3	7.90	87.2	1,021	19.9		
4	7.86	86.6	1,021	19.9		
5	8.00	88.4	1,021	19.9		
6	7.97	85.2	1,021	19.8		
7	7.69	85.9	1,021	19.8		
8	7.92	87.3	1,021	19.8		
9	7.89	87.0	1,021	19.8		
10	7.80	86.7	1,021	19.7		
11	7.83	85.7	1,022	19.5		
11.5	6.55	71.1	1,023	18.8		

Table 10: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2005

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Lake - Baseline 2005						
Depth (m)	Dissolved Oxygen		Specific Conductivity (μ S/cm)	Water Temperature ($^{\circ}$ C)	Turbidity (NTU)	pH (pH units)
	(mg/L)	(% sat.)				
August 22, 2005						
0	9.86	n/a	1,015	16.6	1.25	8.90
1	9.75	n/a	1,015	16.5		
2	9.82	n/a	1,015	16.4		
3	9.80	n/a	1,015	16.4		
4	9.79	n/a	1,014	16.3		
5	9.86	n/a	1,013	16.2		
6	9.79	n/a	1,014	16.2		
7	9.82	n/a	1,014	16.0		
8	9.82	n/a	1,015	15.9		
9	9.79	n/a	1,013	15.9		
10	9.76	n/a	1,015	15.9		
11	9.74	n/a	1,014	15.8		
11.5	9.57	n/a	1,013	15.8		
September 13, 2005						
0	9.29	n/a	1,269	13.7	2.29	9.13
1	9.42	n/a	1,265	13.8		
2	9.38	n/a	1,260	13.9		
3	9.40	n/a	1,260	13.9		
4	9.39	n/a	1,260	13.9		
5	9.39	n/a	1,260	13.9		
6	9.30	n/a	1,260	13.9		
7	9.37	n/a	1,260	13.9		
8	9.37	n/a	1,260	13.9		
9	9.30	n/a	1,260	13.9		
10	9.34	n/a	1,260	13.9		
11	9.33	n/a	1,263	13.8		
12	9.35	n/a	1,262	13.8		
13	9.30	n/a	1,263	13.8		

Table 11: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Lake - Baseline 2005

Brightsand Lake Baseline Surface Sample 2005				
	June 13	July 13	August 22	September 13
Metals				
Aluminum (mg/L)	<0.005	<0.005	<0.005	<0.005
Arsenic (µg/L)	9.1	7.4	7.7	9.3
Barium (mg/L)	0.008	0.008	0.008	0.008
Beryllium (mg/L)	<0.001	<0.001	<0.001	<0.001
Boron (mg/L)	0.23	0.23	0.23	0.23
Cadmium (mg/L)	<0.001	<0.001	<0.001	<0.001
Chromium (mg/L)	<0.001	<0.001	0.003	0.23
Cobalt (mg/L)	<0.001	<0.001	<0.001	<0.001
Copper (mg/L)	<0.001	<0.001	<0.001	<0.001
Iron (mg/L)	<0.001	<0.001	<0.001	0.002
Lead (mg/L)	<0.002	<0.002	<0.002	<0.002
Manganese (mg/L)	<0.001	0.001	0.002	0.002
Mercury (µg/L)	<0.05	<0.05	<0.001	<0.05
Molybdenum (mg/L)	0.001	<0.001	<0.001	0.002
Nickel (mg/L)	<0.001	<0.001	<0.001	<0.001
Silver (mg/L)	<0.001	<0.001	<0.001	<0.001
Strontium (mg/L)	0.011	0.011	0.010	0.011
Titanium (mg/L)	<0.001	<0.001	<0.001	<0.001
Vanadium (mg/L)	<0.001	<0.001	<0.001	<0.001
Zinc (mg/L)	<0.005	<0.005	<0.005	<0.005
Zirconium (mg/L)	<0.001	<0.001	<0.001	<0.001
Herbicides				
2,4,5-T	<0.5	<0.5	<0.5	<0.5
2,4,25-TP	<0.5	<0.5	<0.5	<0.5
2,4-D	<0.5	<0.5	<0.5	<0.5
Bromoxynil (Buctril)	<0.5	<0.5	<0.5	<0.5
Dicamba (Banvel)	<0.5	<0.5	<0.5	<0.5
Diclofop-methyl (Hoe Grass)	<1	<1	<1	<1
MCPA	<0.5	<0.5	<0.5	<0.5

Table 12: Brightsand Lake Baseline Surface Sample 2005

Brightsand Lake Shoreline Station No. 1 2005				
Parameters	June 13	July 13	August 22	Sept 13
Nutrients (mg/L)				
Dissolved Organic Carbon	15.9	13.9	14.4	12.9
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.07	<0.02	0.02	<0.02
Total Kjeldahl Nitrogen	1.0	0.9	1.2	0.9
Total Phosphorus	0.08	0.07	0.08	0.09
Ortho-Phosphate, as P	0.09	0.07	0.08	0.08
Solids (mg/L)				
Total Dissolved	936	n/a	n/a	n/a
Suspended, Fixed	5	2	2	1
Suspended, Volatile	3	2	3	4
Suspended, Total	8	4	5	5
Bacteria (orgs/100 mL)				
Fecal Coliform	10	<10	<10	<10
Total Coliform	20	10	10	10
Major Ions (mg/L)				
Alkalinity, Total	610	n/a	n/a	n/a
Alkalinity, Phenol	62	n/a	n/a	n/a
Bicarbonate	593	n/a	n/a	n/a
Calcium	7	n/a	n/a	n/a
Carbonate	74.4	n/a	n/a	n/a
Chloride	3.9	n/a	n/a	n/a
Hardness, Total	520	n/a	n/a	n/a
Magnesium	122	n/a	n/a	n/a
Potassium	19	n/a	n/a	n/a
Sodium	60	n/a	n/a	n/a
Sulphate	56.7	n/a	n/a	n/a
Other				
Chlorophyll <i>a</i> (µg/L)	3.41	<2.00	2.84	4.59
Specific Conductivity (µS/cm)	1,018	n/a	n/a	n/a
Turbidity (NTU)	3.4	1.2	2.3	2.6
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	33.0	28.6	35.8	36.4
Field Measurements				
Water Temperature (°C)	14.9	20.6	19.4	12.9
pH (pH units)	9.13	9.15	8.84	9.00
Conductivity (µS/cm)	1,051	1,071	1,028	1,282
Dissolved Oxygen (mg/L)	9.71	8.01	9.58	10.00
Dissolved Oxygen (% sat.)	94.2	89.4	n/a	n/a

Table 13: Brightsand Lake Shoreline Station No. 1 2005

Brightsand Lake Shoreline Station No. 2 2005			
Parameters	July 13	August 22	September 13
Nutrients (mg/L)			
Dissolved Organic Carbon	13.9	14.6	12.7
Nitrate, as Nitrogen	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	<0.02	0.03	0.02
Total Kjeldahl Nitrogen	0.9	1.0	1.0
Total Phosphorus	0.07	0.08	0.09
Ortho-Phosphate, as P	0.08	n/a	0.07
Solids (mg/L)			
Total Dissolved	936	n/a	n/a
Suspended, Fixed	1	1	3
Suspended, Volatile	2	3	3
Suspended, Total	3	3	6
Bacteria (orgs/100 mL)			
Fecal Coliform	<10	20	10
Total Coliform	<10	30	<10
Major Ions (mg/L)			
Alkalinity, Total	0.07	n/a	n/a
Alkalinity, Phenol	0.08	n/a	n/a
Bicarbonate	588	n/a	n/a
Calcium	7	n/a	n/a
Carbonate	79.2	n/a	n/a
Chloride	3.7	n/a	n/a
Hardness, Total	532	n/a	n/a
Magnesium	125	n/a	n/a
Potassium	19	n/a	n/a
Sodium	61	n/a	n/a
Sulphate	53.4	n/a	n/a
Other			
Chlorophyll <i>a</i> (µg/L)	<2.00	4.40	2.96
Specific Conductivity (µS/cm)	1,027	n/a	n/a
Turbidity (NTU)	1.1	1.6	3.4
Biochemical Oxygen Demand (mg/L)	<2	<2	<2
Chemical Oxygen Demand (mg/L)	30.7	36.7	37.0
Field Measurements			
Water Temperature (°C)	21.1	17.6	11.1
pH (pH units)	9.00	8.82	9.05
Conductivity (µS/cm)	1,023	1,003	1,326
Dissolved Oxygen (mg/L)	8.00	10.21	10.14
Dissolved Oxygen (% sat.)	89.9	n/a	n/a

Table 14: Brightsand Lake Shoreline Station No. 2 2005

Brightsand Lake Baseline Surface Sampling 2006						
Parameters	Jan 17	Mar 31	July 5	Aug 2	Aug 23	Oct 3
Nutrients (mg/L)						
Dissolved Organic Carbon	15.4	17.4	12.6	13.4	13.7	14.7
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.03	0.04	0.03	0.03	<0.02	0.02
Total Kjeldahl Nitrogen	0.9	0.9	0.8	1.2	0.8	1.1
Total Phosphorus	0.08	0.09	0.06	0.08	0.12	0.09
Ortho-Phosphate, as P	0.09	0.09	0.06	0.06	0.07	n/a
Phosphorous	0.02	0.03	<0.01	0.01	0.01	0.02
Silicon, soluble	8.2	8.0	7.2	8.0	8.7	8.8
Solids (mg/L)						
Total Dissolved	1,008	1,021	934	925	935	927
Suspended, Fixed	1	<1	2	2	<1	1
Suspended, Volatile	2	2	2	2	4	3
Suspended, Total	2	2	3	4	4	4
Bacteria (orgs/100 mL)						
E. Coli	<1	<1	<1	<1	<10	<10
Total Coliform	<1	1	1	1,500	228	<10
Major Ions (mg/L)						
Alkalinity, Total	662	672	616	618	620	616
Alkalinity, Phenol	66	70	62	68	72	70
Bicarbonate	647	649	600	588	581	581
Calcium	7	7	7	7	7	6
Carbonate	79.2	84.0	74.4	81.6	86.4	84.0
Chloride	4.3	4.3	3.9	3.8	4.0	4.1
Hardness, Total	545	561	508	503	524	509
Magnesium	128	132	119	118	123	120
Potassium	20	20	18	18	19	18
Sodium	64	65	58	58	61	60
Sulphate	58.4	59.7	53.6	50.7	53.7	54.0
Other						
Chlorophyll <i>a</i> (µg/L)	3.34	4.59	1.78	3.41	3.76	<0.20
Specific Conductivity (µS/cm)	1,112	1,114	1,030	1,029	1,013	1,041
pH (pH units)	9.0	9.0	9.0	9.0	9.1	9.0
Turbidity (NTU)	1.00	0.74	1.00	1.60	1.40	1.40
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	36.1	41.9	33.0	36.1	32.6	35.7

Table 15: Brightsand Lake Baseline Surface Sampling 2006

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2006				
Depth (m)	Dissolved Oxygen		Conductivity ($\mu\text{S/cm}$)	Water Temperature ($^{\circ}\text{C}$)
	(mg/L)	(% sat.)		
January 17, 2006				
0	12.33	86.2	1,234	0.3
1	11.88	82.4	1,143	0.3
2	11.63	80.9	1,134	0.4
3	11.52	80.6	1,133	0.5
4	11.43	80.5	1,133	0.5
5	11.30	78.6	1,133	0.5
6	11.39	74.3	1,133	0.5
7	11.30	79.3	1,139	0.5
8	10.95	77.9	1,140	0.8
9	10.10	72.9	1,139	1.2
10	9.34	68.0	1,145	1.6
11	7.88	41.1	n/a	2.8
March 31, 2006				
0	11.56	79.9	1,056	0.2
1	11.32	80.7	1,054	0.2
2	11.76	82.4	1,058	0.4
3	11.93	84.2	1,056	0.6
4	11.50	80.3	1,056	0.7
5	11.65	82.3	1,058	0.8
6	11.20	79.0	1,054	1.0
7	10.05	68.1	1,052	1.2
8	9.71	60.7	1,056	1.3
9	9.01	58.7	934*	1.4
10	7.10	47.7	n/a	2.0
11	4.93	38.3	n/a	3.0

* in sediment

Table 16: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2006

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2006				
Depth (m)	Dissolved Oxygen		Specific Conductivity (μS/cm)	Water Temperature ($^{\circ}$C)
	(mg/L)	(% sat.)		
July 5, 2006				
0	6.67	n/a	1,092	19.9
1	6.64	n/a	1,091	19.9
2	6.65	n/a	1,086	19.8
3	6.67	n/a	1,092	19.8
4	6.72	n/a	1,093	19.8
5	6.71	n/a	1,093	19.8
6	6.73	n/a	1,093	19.8
7	6.75	n/a	1,092	19.8
8	6.72	n/a	1,092	19.8
9	6.72	n/a	1,094	19.7
10	6.72	n/a	1,094	19.7
11	6.78	n/a	1,088	19.7
12	6.76	n/a	1,093	19.7
13	6.77	n/a	1,092	19.6
August 2, 2006				
0	8.26	n/a	1,097	20.6
1	8.23	n/a	1,097	20.5
2	8.45	n/a	1,097	20.4
3	8.49	n/a	1,097	20.3
4	8.45	n/a	1,097	20.3
5	8.50	n/a	1,096	20.2
6	8.41	n/a	1,096	20.2
7	8.36	n/a	1,096	20.2
8	8.27	n/a	1,096	20.1
9	8.28	n/a	1,096	20.1
10	8.18	n/a	1,097	20.1
11	8.16	n/a	1,097	20.1
August 23, 2006				
0	8.94	n/a	1035	19.2
Too windy and rough to complete profile				

Table 17: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2006

Brightsand Lake Baseline Surface Sample Metal Parameters 2006						
Parameters	Jan 17	Mar 21	July 5	Aug 2	Aug 23	Oct 3
Metals (mg/L)						
Mercury ($\mu\text{g/L}$)	<0.05	<0.05	<0.001	<0.05	<0.05	0.001
Aluminum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic ($\mu\text{g/L}$)	8.6	10.0	8.2	8.2	8.9	9.1
Barium	0.008	0.008	0.009	0.008	0.008	0.006
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	0.26	0.24	0.23	0.23	0.24	0.23
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	0.003	<0.001	0.23	<0.001	<0.001
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	<0.001	<0.001	<0.001	<0.001	0.024	<0.001
Iron	<0.001	<0.001	0.001	0.002	0.008	<0.001
Lead	<0.002	<0.002	<0.002	<0.002	0.004	<0.001
Manganese	<0.001	0.001	0.002	0.002	0.002	<0.002
Molybdenum	0.004	<0.001	<0.001	0.002	0.002	0.002
Nickel	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	0.012	0.012	0.012	0.011	0.011	<0.001
Titanium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	<0.005	<0.005	<0.005	<0.005	0.018	<0.005
Zirconium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Herbicides ($\mu\text{g/L}$)						
2,4,5-T	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,5-TP (silvex)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoxynil (Buctril)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dicamba (Banvel)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diclofop-methyl (HoeGrass)	<1	<1	<1	<1	<1	<1
MCPA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Picloram (Tordon)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 18: Brightsand Lake Baseline Surface Sample Metal Parameters 2006

Brightsand Lake Shoreline Station No. 1 2006				
Parameters	July 5	August 2	August 23	October 3
Nutrients (mg/L)				
Dissolved Organic Carbon	12.7	13.4	13.6	14.2
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.05	0.03	0.02	0.03
Total Kjeldahl Nitrogen	0.9	1.2	1.4	1.1
Total Phosphorus	0.07	0.06	0.13	0.09
Ortho-Phosphate, as P	0.06	0.06	0.07	0.09
Solids (mg/L)				
Suspended, Fixed	4	2	15	1
Suspended, Volatile	3	1	8	2
Suspended, Total	7	3	23	3
Bacteria (orgs/100 mL)				
E. Coli	<1	<1	20	<10
Total Coliform	20	4,884	833	<10
Other				
Chlorophyll <i>a</i> (µg/L)	1.70	2.30	6.82	0.98
Turbidity (NTU)	1.7	1.3	5.1	1.2
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	36.8	38.5	39.4	34.5
Field Measurements				
Air Temperature (°C)	31 ⁺	22	20	6
Water Temperature (°C)	23.6	21.3	20.2	11.3
pH (pH units)	9.00	9.17	9.09	9.25
Specific Conductivity (µS/cm)	1,073	1,008	1,044	1,022
Dissolved Oxygen (mg/L)	6.35	7.57	9.00	9.15
Turbidity (NTU)	3.26	1.16	2.70	1.37
Wind Speed (km/hr)	20-30	5	25-30	2-5
Cloud Cover (%)	25	75	10	0
Total Depth (ft)	3.00	0.75	3.60	1.50

Table 19: Brightsand Lake Shoreline Station No. 1 2006

Brightsand Lake Shoreline Station No. 2 2006				
Parameters	July 5	August 2	August 23	October 3
Nutrients (mg/L)				
Dissolved Organic Carbon	12.5	12.9	13.5	15.3
Nitrate, as Nitrogen	<0.04	<0.04	<0.04	<0.04
Ammonia, as Nitrogen	0.03	0.03	<0.02	0.02
Total Kjeldahl Nitrogen	1.4	0.9	0.9	1.0
Total Phosphorus	0.07	0.07	0.12	0.09
Ortho-Phosphate, as P	0.07	0.06	0.07	0.09
Solids (mg/L)				
Suspended, Fixed	2	6	<1	<1
Suspended, Volatile	2	3	4	3
Suspended, Total	4	9	4	3
Bacteria (orgs/100 mL)				
<i>E. coli</i>	<1	<1	<10	<10
Total Coliform	5	1,259	309	<10
Other				
Chlorophyll <i>a</i> (µg/L)	1.85	4.09	4.55	0.98
Turbidity (N.T.U.)	1.4	1.2	1.5	1.2
Biochemical Oxygen Demand (mg/L)	<2	<2	<2	<2
Chemical Oxygen Demand (mg/L)	35.6	40.0	36.0	38.7
Field Measurements				
Air Temperature (°C)	31	21	20	5.8
Water Temperature (°C)	20.2	20.5	19.1	11.2
pH (pH units)	9.01	9.16	9.10	9.28
Specific Conductivity (µS/cm)	1,094	1,047	1,041	1,022
Dissolved Oxygen (mg/L)	6.64	8.24	9.01	10.39
Turbidity (NTU)	n/a	1.64	3.02	1.38
Wind Speed (km/hr)	20-30	<5	25-30	2-5
Cloud Cover (%)	25	10	10	0
Total Depth (m)	1.83	~1.00	1.75	4.75

Table 20: Brightsand Lake Shoreline Station No. 2 2006

Brightsand Lake Baseline Surface Sample 2007		
Parameters	February 20	March 21
Nutrients (mg/L)		
Dissolved Organic Carbon	16.6	15.8
Nitrate, as Nitrogen	<0.04	<0.04
Ammonia, as Nitrogen	0.06	0.07
Total Kjeldahl Nitrogen	1.2	1.0
Total Phosphorus	0.11	0.07
Ortho-Phosphate, as P	0.11	n/a
Phosphorus	<0.01	<0.01
Silicon, Soluble	9.6	9.6
Solids (mg/L)		
Total Dissolved	1,030	1,035
Suspended, Fixed	<1	<1
Suspended, Volatile	1	1
Suspended, Total	1	1
Bacteria (orgs/100 mL)		
<i>E. coli</i>	<1	<1
Total Coliform	<1	<1
Major Ions (mg/L)		
Alkalinity, Total	672	674
Alkalinity, Phenol	74	68
Bicarbonate	639	656
Calcium	8	7
Carbonate	88.8	81.6
Chloride	4.3	4.5
Hardness, Total	601	582
Magnesium	141	137
Potassium	21	21
Sodium	68	68
Sulphate	59.7	60.1
Other		
Chlorophyll <i>a</i> (µg/L)	<0.20	1.19
Conductivity (µS/cm)	1,108	1,116
pH (pH units)	9.0	9.0
Turbidity (NTU)	0.54	0.45
Biochemical Oxygen Demand (mg/L)	<2	<2
Chemical Oxygen Demand (mg/L)	34.6	39.9

Table 21: Brightsand Lake Baseline Surface Sample 2007

Field Measurements Brightsand Baseline 2007		
Field Data		
Time	15:25	13:30
Air Temperature (°C)	-9	-5
pH (pH units)	9.491	9.546
Turbidity (NTU)	0.06	0.00
Wind Speed (km/hr)	0-5	15
Cloud Cover (%)	100	0
Ice Depth (cm)	63	66

Table 22: Field Measurements Brightsand Baseline 2007

Dissolved Oxygen, Temperature and Conductivity Profiles Brightsand Baseline 2007			
Depth (m)	Dissolved Oxygen (mg/L)	Specific Conductivity (μS/cm)	Water Temperature ($^{\circ}$C)
February 20, 2007			
1.0	13.05	n/a	0.1
2.0	12.75	1,007	0.5
3.0	11.78	1,077	0.3
4.0	11.31	1,100	0.4
5.0	10.75	1,097	0.6
6.0	10.74	1,095	0.8
7.0	10.24	1,091	1.2
8.0	10.10	1,088	1.7
9.0	8.32	1,078	2.5
10.0	3.25	1,085	3.2
11.0	2.73	1,096	3.4
11.5	0.91	1,109	4.0
March 21, 2007			
0	n/a	n/a	0.2
1.0	11.72	1,121	0.1
2.0	11.50	1,123	0.1
3.0	10.85	1,121	0.2
4.0	10.76	1,115	0.4
5.0	10.62	1,114	0.6
6.0	10.57	1,112	0.8
7.0	10.54	1,112	1.0
8.0	9.52	1,109	1.3
9.0	8.88	1,108	1.8
10.0	8.25	1,105	2.3
11.0	5.74	1,100	3.1
12.0	0.70	1,108	3.5
13.0	0.25	1,134	4.0

Table 23: Dissolved Oxygen, Temperature, and Conductivity Profiles Brightsand Baseline 2007

Brightsand Lake Baseline Surface Sample Metal Parameters 2007		
Parameters	February 20	March 21
Metals (mg/L)		
Mercury (µg/L)	<0.05	<0.05
Aluminum	<0.005	<0.005
Arsenic (µg/L)	10	9.8
Barium	0.008	0.009
Beryllium	<0.001	<0.001
Boron	0.25	0.25
Cadmium	<0.001	<0.001
Chromium	<0.001	<0.001
Cobalt	<0.001	<0.001
Copper	<0.001	<0.001
Iron	0.001	<0.001
Lead	0.002	<0.002
Manganese	<0.001	<0.001
Molybdenum	0.002	0.002
Nickel	<0.001	<0.001
Silver	<0.001	<0.001
Strontium	0.012	0.012
Titanium	<0.001	<0.001
Vanadium	<0.001	<0.001
Zinc	<0.005	<0.005
Zirconium	<0.001	<0.001
Herbicides (µg/L)		
2,4,5-T	<0.5	<0.5
2,4,5-TP (silvex)	<0.5	<0.5
2,4-D	<0.5	<0.5
Bromoxynil (Buctril)	<0.5	<0.5
Dicamba (Banvel)	<0.5	<0.5
Diclofop-methyl (HoeGrass)	<1	<1
MCPA	<0.5	<0.5
Picloram (Tordon)	<1	<1

Table 24: Brightsand Lake Baseline Surface Sample Metal Parameters 2007