Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	0	46	1	6	15
Canfield-Bachmann, 1981 Natural Lake	0	45	1	5	13
Canfield-Bachmann, 1981 Artificial Lake	0	42	1	2	5
Rechow, 1979 General	0	39	1	-1	-3
Rechow, 1977 Anoxic	0	43	1	3	8
Rechow, 1977 water load<50m/year	N/A	N/A	N/A	N/A	N/A
Rechow, 1977 water load>50m/year	0	32	1	-8	-20
Walker, 1977 General	0	45	1	6	16
Vollenweider, 1982 Combined OECD	0	35	2	-4	-10
Dillon-Rigler-Kirchner	0	47	1	8	21
Vollenweider, 1982 Shallow Lake/Res.	0	29	1	-10	-25
Larsen-Mercier, 1976	0	45	1	6	16
Nurnberg, 1984 Oxic	0	47	1	7	18

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	15	78	Tw	11794	GSM
Canfield-Bachmann, 1981 Natural Lake	14	130	L	11551	GSM
Canfield-Bachmann, 1981 Artificial Lake	13	121	FIT	12459	GSM
Rechow, 1979 General	12	67	qs	13709	GSM
Rechow, 1977 Anoxic	15	72	FIT	12553	GSM
Rechow, 1977 water load<50m/year	N/A	N/A	N/A	N/A	N/A
Rechow, 1977 water load>50m/year	13	51	FIT	16938	GSM
Walker, 1977 General	12	83	FIT	11749	SPO
Vollenweider, 1982 Combined OECD	9	66	Tw	15698	ANN
Dillon-Rigler-Kirchner	16	79	P L qs p	11024	SPO
Vollenweider, 1982 Shallow Lake/Res.	8	54	Tw	19512	ANN
Larsen-Mercier, 1976	16	75	P Pin p	11723	SPO
Nurnberg, 1984 Oxic	14	84	L qs	11552	ANN

Water and Nutrient Outflow Module
Date: 4/4/2016 Scenario: 6
Average Annual Surface Total Phosphorus: 38.04mg/m^3
Annual Discharge: 2.23E+005 AF => 2.75E+008 m^3
Annual Outflow Loading: 22047.5 LB => 10000.7 kg

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 16
Total Phosphorus: 38.04 mg/m^3
Growing Season
Chlorophyll a: 26.54 mg/m^3
Secchi Disk Depth: 1.57 m
Carlson TSI Equations:
TSI (Total Phosphorus): 57 TSI (Chlorophyll a): 63 TSI (Secchi Disk Depth): 53

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 17

Total Phosphorus: 38.04 mg/m^3
Growing Season
Chlorophyll a: 26.54 mg/m^3
Secchi Disk Depth: 1.57 m

Wisconsin Statewide Prediction Equations:

	Natural Lakes		Impoundments	
	Stratified	Mixed	Stratified	Mixed
Secchi Disk Depth using Chlorophyll a:	1.3	0.9	1.3	0.9
Secchi Disk Depth using Total Phosphorus:	1.6	1.1	1.3	1.0
Chlorophyll a using Total Phosphorus:	10.5	13.9	19.9	14.7

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 18
Total Phosphorus: 38.04 mg/m^3
Growing Season
Chlorophyll a: 26.54 mg/m^3
Secchi Disk Depth: 1.57 m

Wisconsin Regional Prediction Equations:

		Stratified		Mixed	
	Region	Seepage	Drainage	Seepage	Drainage
Use Chlorophyll a To Predict	South	1.1	1.0	0.7	0.7
Secchi Disk Depth (m)	Central	1.8	1.1	0.5	No Data
	North	1.5	1.1	1.2	1.1
Use Total Phosphorus To	South	1.6	1.2	0.7	0.8
Predict Secchi Disk Depth (m)	Central	2.8	0.7	0.9	No Data
	North	2.1	1.5	1.4	1.1
Use Total Phosphorus To	South	10.2	21.7	13.8	17.1
Predict Chlorophyll a (mg/m^3))	Central	9.4	49.0	14.4	No Data
	North	7.4	12.2	11.8	11.2

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 19
Total Phosphorus: 38.04 mg/m^3
Growing Season
Chlorophyll a: 26.54 mg/m^3
Secchi Disk Depth: 1.57 m

Other Prediction Equations:
Rast and Lee, 1978:: Chlorophyll a = 8.7 mg/m^3 Secchi Disk Depth = 1.3 m
Bartsch and Gaksatter, 1978:: Chlorophyll a = 12.1 mg/m^3

User Defined: Chlorophyll a - Total Phosphorus Regression::
Use Total Phosphorus To Predict Chlorophyll a = 0.0 x 38.04^0.0 = 0.0 mg/m^3
Use Chlorophyll a To Predict Secchi Disk Depth = 0.0 x 26.54^0.0 = 0.0 m

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 20
Total Phosphorus: 38.04 mg/m^3
Growing Season
Chlorophyll a: 26.54 mg/m^3
Secchi Disk Depth: 1.57 m

Chlorophyll a Nuisance Frequency

Chla Mean Min: 5
Chla Mean Max: 100
Chla Mean Increment: 5
Chla Temporal CV: 0.62
Chla Nuisance Criterion: 20

Mean	Freq %	ml	z	v	w	x
5	0.5	1.4	2.546	0.016	0.541	0.005
10	7.7	2.1	1.428	0.144	0.678	0.077
15	21.9	2.5	0.774	0.296	0.795	0.219
20	37.8	2.8	0.310	0.380	0.907	0.378
25	52.0	3.0	-0.050	0.398	0.984	0.480
30	63.5	3.2	-0.344	0.376	0.897	0.365
35	72.3	3.4	-0.593	0.335	0.835	0.277
40	79.0	3.5	-0.808	0.288	0.788	0.210
45	84.1	3.6	-0.998	0.242	0.751	0.159
50	87.9	3.7	-1.168	0.202	0.720	0.121
55	90.7	3.8	-1.322	0.167	0.695	0.093
60	92.8	3.9	-1.462	0.137	0.673	0.072
65	94.4	4.0	-1.591	0.112	0.654	0.056
70	95.6	4.1	-1.711	0.092	0.637	0.044
75	96.6	4.1	-1.822	0.076	0.623	0.034
80	97.3	4.2	-1.926	0.062	0.609	0.027
85	97.8	4.3	-2.024	0.051	0.598	0.022
90	98.3	4.3	-2.116	0.043	0.587	0.017
95	98.6	4.4	-2.203	0.035	0.577	0.014
100	98.9	4.4	-2.286	0.029	0.568	0.011

Date: 3/17/2016 Scenario: 2014L-THIA

Lake Id: Big Blake Lake

Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 38.7 mg/m^3
Observed growing season mean phosphorus (GSM): 40.6 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		Loading (kg/ha-year)				**Loading (kg/year)**		
Row Crop AG	1023.8	0.50	1.00	3.00	24.8	207	414	1243
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.8	194	582	969
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	2	3	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	14	28	70
Wetlands	1496.3	0.10	0.10	0.10	3.6	61	61	61
Forest	10759.2	0.05	0.09	0.18	23.5	218	392	784
Lake Surface	208.0	0.10	0.30	1.00	1.5	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		**Low**	**Most Likely**	**High**	**Loading %**
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.5

TOTALS DATA

Description	**Low**	**Most Likely**	**High**	**Loading %**
Total Loading (lb)	1669.0	3682.4	8304.2	100.0
Total Loading (kg)	757.1	1670.3	3766.8	100.0
Areal Loading (lb/ac-year)	8.02	17.70	39.92	
Areal Loading (mg/m^2-year)	899.40	1984.34	4474.95	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1648.3	3608.6	8060.6	99.5
Total NPS Loading (kg)	747.7	1636.8	3656.3	99.5

Wisconsin Internal Load Estimator

Date: 3/17/2016 Scenario: 2

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 40.58 mg/m^3
Phosphorus Inflow Concentration: 100.8 mg/m^3
Areal External Loading: 1984.3 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.40
Observed Phosphorus Retention Coefficient: 0.60
Internal Load: -734 Lb -333 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia

Average Hypolimnetic Phosphorus Concentration: 44.82 mg/m^3
Hypolimnetic Volume: 44.08 acre-ft
Anoxia Sediment Area: 13.44 acres

Just Prior To The End of Stratification

Average Hypolimnetic Phosphorus Concentration: 55.8 mg/m^3
Hypolimnetic Volume: 44.08 acre-ft
Anoxia Sediment Area: 13.44 acres
Time Period of Stratification: 60 days
Sediment Phosphorus Release Rate: 0.2 mg/m^2-day 4.97E-004 lb/acre-day
Internal Load: 1 Lb 1 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia

Average Hypolimnetic Phosphorus Concentration: 44.82 mg/m^3
Hypolimnetic Volume: 44.08 acre-ft
Anoxia Sediment Area: 13.44 acres

Just Prior To The End of Stratification

Average Water Column Phosphorus Concentration: 57.6 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 13.44 acres
Time Period Between Observations: 14 days
Sediment Phosphorus Release Rate: 171.5 mg/m^2-day 4.66E-001 lb/acre-day
Internal Load: 288 Lb 131 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 13.44 acre
End of Anoxia Anoxic Sediment Area: 13.44 acre
Phosphorus Release Rate As Calculated In Method 2: 0.2 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: 0.2 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 85.8 mg/m^2-day
Period of Anoxia: 60 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	13	31	53

Internal Load: (kg) 6 14 24

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 3682 Lb 1670 kg

	Lb	kg	%
From A Complete Mass Budget:	-734	-333	-24.9
From Growing Season In Situ Phosphorus Increases:	1	1	0.0
From In Situ Phosphorus Increases In The Fall:	288	131	7.3
From Phosphorus Release Rate and Anoxic Area:	31	14	0.8

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	7	65	138

Osgood, 1988 Lake Mixing Index: 3.0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	-734	144.6	31
Internal Load (kg):	-333	65.6	14
External Load (Lb):	1669	3682	8304
External Load (kg):	757	1670	3767
Total Load (Lb):	935	3827	8335
Total Load (kg):	424	1736	3781

Phosphorus Prediction and Uncertainty Analysis Module

Date: 3/17/2016 Scenario: 3

Observed spring overturn total phosphorus (SPO): 38.7 mg/m^3

Observed growing season mean phosphorus (GSM): 40.6 mg/m^3

Back calculation for SPO total phosphorus: 39.09 mg/m^3

Back calculation GSM phosphorus: 40.99 mg/m^3

% Confidence Range: 70%

Nurenberg Model Input - Est. Gross Int. Loading: 65 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	25	56	127	15	37
Canfield-Bachmann, 1981 Natural Lake	35	69	136	28	69
Canfield-Bachmann, 1981 Artificial Lake	31	57	102	16	39
Rechow, 1979 General	26	56	127	15	37
Rechow, 1977 Anoxic	40	87	197	46	113
Rechow, 1977 water load<50m/year	30	66	149	25	62
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	34	75	170	36	93
Vollenweider, 1982 Combined OECD	27	53	102	13	33
Dillon-Rigler-Kirchner	24	53	119	14	36
Vollenweider, 1982 Shallow Lake/Res.	22	45	91	5	13
Larsen-Mercier, 1976	33	73	166	34	88
Nurnberg, 1984 Oxic	31	65	141	24	59

Lake Phosphorus Model	**Confidence** Lower	**Confidence** Upper	**Parameter** Fit?	**Back** Calculation	**Model** Type

	Bound	Bound		(kg/year)	
Walker, 1987 Reservoir	32	104	FIT	1219	GSM
Canfield-Bachmann, 1981 Natural Lake	21	199	FIT	893	GSM
Canfield-Bachmann, 1981 Artificial Lake	18	164	FIT	1051	GSM
Rechow, 1979 General	31	105	FIT	1215	GSM
Rechow, 1977 Anoxic	50	160	FIT	784	GSM
Rechow, 1977 water load<50m/year	36	123	P	1037	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	36	148	FIT	866	SPO
Vollenweider, 1982 Combined OECD	25	100	FIT	1202	ANN
Dillon-Rigler-Kirchner	30	97	P	1242	SPO
Vollenweider, 1982 Shallow Lake/Res.	21	85	FIT	1493	ANN
Larsen-Mercier, 1976	43	134	P Pin	890	SPO
Nurnberg, 1984 Oxic	34	122	P	1020	ANN

Expanded Trophic Response Module
Date: 3/17/2016 Scenario: 2
Total Phosphorus: 40.58 mg/m^3
Growing Season
Chlorophyll a: 26.55 mg/m^3
Secchi Disk Depth: 1.58 m

Chlorophyll a Nuisance Frequency
Chla Mean Min: 5
Chla Mean Max: 100
Chla Mean Increment: 5
Chla Temporal CV: 0.62
Chla Nuisance Criterion: 20

Mean	**Freq %**	**ml**	**z**	**v**	**w**	**x**
5	0.5	1.4	2.546	0.016	0.541	0.005
10	7.7	2.1	1.428	0.144	0.678	0.077
15	21.9	2.5	0.774	0.296	0.795	0.219
20	37.8	2.8	0.310	0.380	0.907	0.378
25	52.0	3.0	-0.050	0.398	0.984	0.480
30	63.5	3.2	-0.344	0.376	0.897	0.365
35	72.3	3.4	-0.593	0.335	0.835	0.277
40	79.0	3.5	-0.808	0.288	0.788	0.210
45	84.1	3.6	-0.998	0.242	0.751	0.159
50	87.9	3.7	-1.168	0.202	0.720	0.121
55	90.7	3.8	-1.322	0.167	0.695	0.093
60	92.8	3.9	-1.462	0.137	0.673	0.072
65	94.4	4.0	-1.591	0.112	0.654	0.056
70	95.6	4.1	-1.711	0.092	0.637	0.044
75	96.6	4.1	-1.822	0.076	0.623	0.034
80	97.3	4.2	-1.926	0.062	0.609	0.027
85	97.8	4.3	-2.024	0.051	0.598	0.022
90	98.3	4.3	-2.116	0.043	0.587	0.017
95	98.6	4.4	-2.203	0.035	0.577	0.014
100	98.9	4.4	-2.286	0.029	0.568	0.011

Date: 4/4/2016   Scenario: Big Blake 2014 L-THIA

Lake Id: Big Blake Lake

Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 38.7 mg/m^3
Observed growing season mean phosphorus (GSM): 40.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	1023.8	0.50	1.00	3.00	24.8	207	414	1243
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.8	194	582	969
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	2	3	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	14	28	70
Wetlands	1496.3	0.10	0.10	0.10	3.6	61	61	61
Forest	10759.2	0.05	0.09	0.18	23.5	218	392	784
Lake Surface	208.0	0.10	0.30	1.00	1.5	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.5

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	1669.0	3682.4	8304.2	100.0
Total Loading (kg)	757.1	1670.3	3766.8	100.0
Areal Loading (lb/ac-year)	8.02	17.70	39.92	
Areal Loading (mg/m^2-year)	899.40	1984.34	4474.95	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1648.3	3608.6	8060.6	99.5
Total NPS Loading (kg)	747.7	1636.8	3656.3	99.5

Wisconsin Internal Load Estimator
Date: 4/4/2016 Scenario: 15

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 38.04 mg/m^3
Phosphorus Inflow Concentration: 100.8 mg/m^3
Areal External Loading: 1984.3 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.40
Observed Phosphorus Retention Coefficient: 0.62
Internal Load: -827 Lb -375 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 55.8 mg/m^3
Hypolimnetic Volume: 901.8 acre-ft
Anoxia Sediment Area: 137.47 acres
Just Prior To The End of Stratification
Average Hypolimnetic Phosphorus Concentration: 55.8 mg/m^3
Hypolimnetic Volume: 901.8 acre-ft
Anoxia Sediment Area: 137.47 acres
Time Period of Stratification: 30 days
Sediment Phosphorus Release Rate: 0.0 mg/m^2-day 0.00E+000 lb/acre-day
Internal Load: 0 Lb 0 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 55.8 mg/m^3
Hypolimnetic Volume: 901.8 acre-ft
Anoxia Sediment Area: 137.47 acres
Just Prior To The End of Stratification
Average Water Column Phosphorus Concentration: 62.2 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 137.47 acres
Time Period Between Observations: 30 days
Sediment Phosphorus Release Rate: 4.9 mg/m^2-day 1.33E-002 lb/acre-day
Internal Load: 180 Lb 82 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 137.47 acre
End of Anoxia Anoxic Sediment Area: 137.47 acre
Phosphorus Release Rate As Calculated In Method 2: 0.0 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: 0.0 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 2.4 mg/m^2-day
Period of Anoxia: 14 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	31	73	126

Internal Load: (kg)	14	33	57

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 3682 Lb 1670 kg

	Lb	kg	%
From A Complete Mass Budget:	-827	-375	-29.0
From Growing Season In Situ Phosphorus Increases:	0	0	0.0
From In Situ Phosphorus Increases In The Fall:	180	82	4.7
From Phosphorus Release Rate and Anoxic Area:	73	33	2.0

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	5	63	139

Osgood, 1988 Lake Mixing Index: 3.0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	-827	89.9	73
Internal Load (kg):	-375	40.8	33
External Load (Lb):	1669	3682	8304
External Load (kg):	757	1670	3767
Total Load (Lb):	842	3772	8377
Total Load (kg):	382	1711	3800

Phosphorus Prediction and Uncertainty Analysis Module

Date: 4/4/2016 Scenario: 11

Observed spring overturn total phosphorus (SPO): 38.7 mg/m^3

Observed growing season mean phosphorus (GSM): 40.0 mg/m^3

Back calculation for SPO total phosphorus: 39.1 mg/m^3

Back calculation GSM phosphorus: 40.4 mg/m^3

% Confidence Range: 70%

Nurenberg Model Input - Est. Gross Int. Loading: 63 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	25	56	127	16	40
Canfield-Bachmann, 1981 Natural Lake	35	69	136	29	73
Canfield-Bachmann, 1981 Artificial Lake	31	57	102	17	43
Rechow, 1979 General	26	56	127	16	40
Rechow, 1977 Anoxic	40	87	197	47	118
Rechow, 1977 water load<50m/year	30	66	149	26	65
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	34	75	170	36	93
Vollenweider, 1982 Combined OECD	27	53	102	14	36
Dillon-Rigler-Kirchner	24	53	119	14	36
Vollenweider, 1982 Shallow Lake/Res.	22	45	91	6	15
Larsen-Mercier, 1976	33	73	166	34	88
Nurnberg, 1984 Oxic	31	64	141	24	60

Lake Phosphorus Model	**Confidence** Lower	**Confidence** Upper	**Parameter** Fit?	**Back** Calculation	**Model** Type

	Bound	Bound		(kg/year)	
Walker, 1987 Reservoir	32	104	FIT	1201	GSM
Canfield-Bachmann, 1981 Natural Lake	21	199	FIT	878	GSM
Canfield-Bachmann, 1981 Artificial Lake	18	164	FIT	1031	GSM
Rechow, 1979 General	31	105	FIT	1198	GSM
Rechow, 1977 Anoxic	50	160	FIT	772	GSM
Rechow, 1977 water load<50m/year	36	123	P	1022	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	36	148	FIT	866	SPO
Vollenweider, 1982 Combined OECD	25	100	FIT	1192	ANN
Dillon-Rigler-Kirchner	30	97	P	1242	SPO
Vollenweider, 1982 Shallow Lake/Res.	21	85	FIT	1481	ANN
Larsen-Mercier, 1976	43	134	P Pin	890	SPO
Nurnberg, 1984 Oxic	33	122	P	1007	ANN

Water and Nutrient Outflow Module
Date: 4/4/2016   Scenario: 9
Average Annual Surface Total Phosphorus: 30.04mg/m^3
Annual Discharge: 1.34E+004 AF => 1.66E+007 m^3
Annual Outflow Loading: 1050.9 LB =>   476.7 kg

Date: 4/4/2016 Scenario: 2015 Direct Drainage

Lake Id: Big Blake Lake

Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 550.0 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 366.7 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 159737.5 acre-ft/year
Areal Water Load <qs>: 768.0 ft/year
Lake Flushing Rate <p>: 85.33 1/year
Water Residence Time: 0.01 year
Observed spring overturn total phosphorus (SPO): 25.2 mg/m^3
Observed growing season mean phosphorus (GSM): 50 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		|---- Loading (kg/ha-year) ----|				|----- Loading (kg/year) ----|		
Row Crop AG	123.0	0.50	1.00	3.00	0.4	25	50	149
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	38.0	0.10	0.30	0.50	0.0	2	5	8
HD Urban (1/8 Ac)	19.0	1.00	1.50	2.00	0.1	8	12	15
MD Urban (1/4 Ac)	113.0	0.30	0.50	0.80	0.2	14	23	37
Rural Res (>1 Ac)	46.0	0.05	0.10	0.25	0.0	1	2	5
Wetlands	35.0	0.10	0.10	0.10	0.0	1	1	1
Forest	176.0	0.05	0.09	0.18	0.1	4	6	13
Lake Surface	208.0	0.10	0.30	1.00	0.2	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.1

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	139.2	24685.4	745.9	100.0
Total Loading (kg)	63.1	11197.2	338.4	100.0
Areal Loading (lb/ac-year)	0.67	118.68	3.59	
Areal Loading (mg/m^2-year)	75.02	13302.36	401.97	
Total PS Loading (lb)	0.0	24394.5	0.0	98.8

Total PS Loading (kg)	0.0	11065.3	0.0	98.8
Total NPS Loading (lb)	118.5	217.1	502.4	1.1
Total NPS Loading (kg)	53.7	98.5	227.9	1.1

Wisconsin Internal Load Estimator
Date: 4/4/2016   Scenario: 7

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 41.9 mg/m^3
Phosphorus Inflow Concentration: 56.8 mg/m^3
Areal External Loading: 13302.4 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.06
Observed Phosphorus Retention Coefficient: 0.26
Internal Load: -5016 Lb   -2275 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 25.6 mg/m^3
Hypolimnetic Volume: 215.66 acre-ft
Anoxia Sediment Area: 65.75 acres

Just Prior To The End of Stratification
Average Hypolimnetic Phosphorus Concentration: 73.6 mg/m^3
Hypolimnetic Volume: 662.03 acre-ft
Anoxia Sediment Area: 121.03 acres
Time Period of Stratification: 74 days
Sediment Phosphorus Release Rate: 1.9 mg/m^2-day   5.18E-003 lb/acre-day
Internal Load: 117 Lb   53 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 25.6 mg/m^3
Hypolimnetic Volume: 215.66 acre-ft
Anoxia Sediment Area: 65.75 acres

Just Prior To The End of Stratification
Average Water Column Phosphorus Concentration: 30.5 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 121.03 acres
Time Period Between Observations: 30 days
Sediment Phosphorus Release Rate: 5.6 mg/m^2-day   1.53E-002 lb/acre-day
Internal Load: 140 Lb   64 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 65.75 acre
End of Anoxia Anoxic Sediment Area: 121.03 acre
Phosphorus Release Rate As Calculated In Method 2: 1.9 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: 1.9 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 3.8 mg/m^2-day
Period of Anoxia: 74 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	113	263	451

Internal Load: (kg)	51	119	205

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 24685 Lb 11197 kg

	Lb	kg	%
From A Complete Mass Budget:	-5016	-2275	-25.5
From Growing Season In Situ Phosphorus Increases:	117	53	0.5
From In Situ Phosphorus Increases In The Fall:	140	64	0.6
From Phosphorus Release Rate and Anoxic Area:	263	119	1.1

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	0	0	0

Osgood, 1988 Lake Mixing Index: 0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	0	0	0
Internal Load (kg):	0	0	0
External Load (Lb):	0	0	0
External Load (kg):	0	0	0
Total Load (Lb):	0	0	0
Total Load (kg):	0	0	0

Wisconsin Internal Load Estimator

Date: 4/4/2016 Scenario: 8

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 41.9 mg/m^3
Phosphorus Inflow Concentration: 56.8 mg/m^3
Areal External Loading: 13302.4 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.06
Observed Phosphorus Retention Coefficient: 0.26
Internal Load: -5016 Lb -2275 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia

Average Hypolimnetic Phosphorus Concentration: 25.6 mg/m^3
Hypolimnetic Volume: 215.66 acre-ft
Anoxia Sediment Area: 65.75 acres

Just Prior To The End of Stratification

Average Hypolimnetic Phosphorus Concentration: 73.6 mg/m^3
Hypolimnetic Volume: 662.03 acre-ft
Anoxia Sediment Area: 121.03 acres
Time Period of Stratification: 74 days
Sediment Phosphorus Release Rate: 1.9 mg/m^2-day 5.18E-003 lb/acre-day
Internal Load: 117 Lb 53 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia

Average Hypolimnetic Phosphorus Concentration: 25.6 mg/m^3
Hypolimnetic Volume: 215.66 acre-ft
Anoxia Sediment Area: 65.75 acres

Just Prior To The End of Stratification
Average Water Column Phosphorus Concentration: 69.1 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 121.03 acres
Time Period Between Observations: 30 days
Sediment Phosphorus Release Rate: 13.5 mg/m^2-day   3.66E-002 lb/acre-day
Internal Load: 337 Lb   153 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area
Start of Anoxia Anoxic Sediment Area: 65.75 acre
End of Anoxia Anoxic Sediment Area: 121.03 acre
Phosphorus Release Rate As Calculated In Method 2: 1.9 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: 1.9 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 7.7 mg/m^2-day
Period of Anoxia: 74 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	113	263	451
Internal Load: (kg)	51	119	205

Internal Load Comparison (Percentages are of the Total Estimate Load)
Total External Load: 24685 Lb   11197 kg

	Lb	kg	%
From A Complete Mass Budget:	-5016	-2275	-25.5
From Growing Season In Situ Phosphorus Increases:	117	53	0.5
From In Situ Phosphorus Increases In The Fall:	337	153	1.3
From Phosphorus Release Rate and Anoxic Area:	263	119	1.1

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	-11	54	2

Osgood, 1988 Lake Mixing Index: 3.0
Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	-5016	227.1	263
Internal Load (kg):	-2275	103.0	119
External Load (Lb):	139	24685	746
External Load (kg):	63	11197	338
Total Load (Lb):	-4877	24913	1009
Total Load (kg):	-2212	11300	458

Phosphorus Prediction and Uncertainty Analysis Module
Date: 4/4/2016   Scenario: 7
Observed spring overturn total phosphorus (SPO): 25.2 mg/m^3
Observed growing season mean phosphorus (GSM): 50.0 mg/m^3
Back calculation for SPO total phosphorus: 25.45 mg/m^3
Back calculation GSM phosphorus: 50.51 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 54 kg

Lake Phosphorus Model	Low Total P (mg/m^3)	Most Likely Total P (mg/m^3)	High Total P (mg/m^3)	Predicted -Observed (mg/m^3)	% Dif.
Walker, 1987 Reservoir	0	52	2	2	4
Canfield-Bachmann, 1981 Natural Lake	0	52	2	2	4
Canfield-Bachmann, 1981 Artificial Lake	0	47	2	-3	-6
Rechow, 1979 General	0	45	1	-5	-10
Rechow, 1977 Anoxic	0	50	2	0	0
Rechow, 1977 water load<50m/year	N/A	N/A	N/A	N/A	N/A
Rechow, 1977 water load>50m/year	0	41	1	-9	-18
Walker, 1977 General	0	51	2	26	103
Vollenweider, 1982 Combined OECD	1	39	2	1	3
Dillon-Rigler-Kirchner	0	53	2	28	111
Vollenweider, 1982 Shallow Lake/Res.	0	33	1	-5	-13
Larsen-Mercier, 1976	0	51	2	26	103
Nurnberg, 1984 Oxic	1	54	2	4	8

Lake Phosphorus Model	Confidence Lower Bound	Confidence Upper Bound	Parameter Fit?	Back Calculation (kg/year)	Model Type
Walker, 1987 Reservoir	17	88	Tw	10924	GSM
Canfield-Bachmann, 1981 Natural Lake	16	150	L	10639	GSM
Canfield-Bachmann, 1981 Artificial Lake	15	135	FIT	11743	GSM
Rechow, 1979 General	14	78	qs	12436	GSM
Rechow, 1977 Anoxic	17	84	FIT	11266	GSM
Rechow, 1977 water load<50m/year	N/A	N/A	N/A	N/A	N/A
Rechow, 1977 water load>50m/year	16	65	FIT	13842	GSM
Walker, 1977 General	14	93	FIT	5563	SPO
Vollenweider, 1982 Combined OECD	10	74	Tw	10815	ANN
Dillon-Rigler-Kirchner	18	89	P L qs p	5347	SPO
Vollenweider, 1982 Shallow Lake/Res.	9	62	Tw	13492	ANN
Larsen-Mercier, 1976	18	84	P Pin p	5557	SPO
Nurnberg, 1984 Oxic	16	96	L qs	10524	ANN

Water and Nutrient Outflow Module
Date: 4/4/2016 Scenario: 5
Average Annual Surface Total Phosphorus: 41.87mg/m^3
Annual Discharge: 1.60E+005 AF => 1.97E+008 m^3
Annual Outflow Loading: 17384.4 LB => 7885.5 kg

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 12
Total Phosphorus: 41.8 mg/m^3
Growing Season
Chlorophyll a: 46.78 mg/m^3
Secchi Disk Depth: 1.72 m
Carlson TSI Equations:
TSI (Total Phosphorus): 58 TSI (Chlorophyll a): 68 TSI (Secchi Disk Depth): 52

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 13

Total Phosphorus: 41.8 mg/m^3
Growing Season
Chlorophyll a: 46.78 mg/m^3
Secchi Disk Depth: 1.72 m

Wisconsin Statewide Prediction Equations:

	Natural Lakes		Impoundments	
	Stratified	Mixed	Stratified	Mixed
Secchi Disk Depth using Chlorophyll a:	1.0	0.7	1.1	0.7
Secchi Disk Depth using Total Phosphorus:	1.6	1.0	1.2	1.0
Chlorophyll a using Total Phosphorus:	11.1	14.8	21.9	15.7

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 14
Total Phosphorus: 41.8 mg/m^3
Growing Season
Chlorophyll a: 46.78 mg/m^3
Secchi Disk Depth: 1.72 m

Wisconsin Regional Prediction Equations:

		Stratified		Mixed	
	Region	Seepage	Drainage	Seepage	Drainage
Use Chlorophyll a To Predict	South	0.9	0.8	0.6	0.6
Secchi Disk Depth (m)	Central	1.5	0.8	0.2	No Data
	North	1.2	0.8	0.9	1.0
Use Total Phosphorus To	South	1.5	1.1	0.7	0.7
Predict Secchi Disk Depth (m)	Central	2.8	0.6	0.8	No Data
	North	2.0	1.4	1.4	1.0
Use Total Phosphorus To	South	10.8	24.3	14.9	18.5
Predict Chlorophyll a (mg/m^3))	Central	10.0	56.4	15.3	No Data
	North	7.5	13.1	12.4	11.4

Expanded Trophic Response Module
Date: 4/4/2016 Scenario: 15
Total Phosphorus: 41.8 mg/m^3
Growing Season
Chlorophyll a: 46.78 mg/m^3
Secchi Disk Depth: 1.72 m

Chlorophyll a Nuisance Frequency
Chla Mean Min: 5
Chla Mean Max: 100
Chla Mean Increment: 5
Chla Temporal CV: 0.62
Chla Nuisance Criterion: 20

Mean	Freq %	ml	z	v	w	x
5	0.5	1.4	2.546	0.016	0.541	0.005
10	7.7	2.1	1.428	0.144	0.678	0.077
15	21.9	2.5	0.774	0.296	0.795	0.219
20	37.8	2.8	0.310	0.380	0.907	0.378
25	52.0	3.0	-0.050	0.398	0.984	0.480
30	63.5	3.2	-0.344	0.376	0.897	0.365
35	72.3	3.4	-0.593	0.335	0.835	0.277

40	79.0	3.5	-0.808	0.288	0.788	0.210
45	84.1	3.6	-0.998	0.242	0.751	0.159
50	87.9	3.7	-1.168	0.202	0.720	0.121
55	90.7	3.8	-1.322	0.167	0.695	0.093
60	92.8	3.9	-1.462	0.137	0.673	0.072
65	94.4	4.0	-1.591	0.112	0.654	0.056
70	95.6	4.1	-1.711	0.092	0.637	0.044
75	96.6	4.1	-1.822	0.076	0.623	0.034
80	97.3	4.2	-1.926	0.062	0.609	0.027
85	97.8	4.3	-2.024	0.051	0.598	0.022
90	98.3	4.3	-2.116	0.043	0.587	0.017
95	98.6	4.4	-2.203	0.035	0.577	0.014
100	98.9	4.4	-2.286	0.029	0.568	0.011

Date: 3/18/2016   Scenario: 2015 L-THIA

Lake Id: Big Blake Lake

Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 25.2 mg/m^3
Observed growing season mean phosphorus (GSM): 50 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	**|---- Loading (kg/ha-year) ----|**				**|----- Loading (kg/year) ----|**		
Row Crop AG	1023.8	0.50	1.00	3.00	24.8	207	414	1243
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.8	194	582	969
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	2	3	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	14	28	70
Wetlands	1496.3	0.10	0.10	0.10	3.6	61	61	61
Forest	10759.2	0.05	0.09	0.18	23.5	218	392	784
Lake Surface	208.0	0.10	0.30	1.00	1.5	8	25	84

POINT SOURCE DATA

Point Sources	Water Load	Low	Most Likely	High	Loading %
	(m^3/year)	**(kg/year)**	**(kg/year)**	**(kg/year)**	

SEPTIC TANK DATA

Description		**Low**	**Most Likely**	**High**	**Loading %**
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.5

TOTALS DATA

Description	**Low**	**Most Likely**	**High**	**Loading %**
Total Loading (lb)	1669.0	3682.4	8304.2	100.0
Total Loading (kg)	757.1	1670.3	3766.8	100.0
Areal Loading (lb/ac-year)	8.02	17.70	39.92	
Areal Loading (mg/m^2-year)	899.40	1984.34	4474.95	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1648.3	3608.6	8060.6	99.5
Total NPS Loading (kg)	747.7	1636.8	3656.3	99.5

Wisconsin Internal Load Estimator
Date: 3/18/2016 Scenario: 4

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 41.87 mg/m^3
Phosphorus Inflow Concentration: 100.8 mg/m^3
Areal External Loading: 1984.3 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.40
Observed Phosphorus Retention Coefficient: 0.58
Internal Load: -687 Lb -312 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 56.8 mg/m^3
Hypolimnetic Volume: 31.72 acre-ft
Anoxia Sediment Area: 8.96 acres
Just Prior To The End of Stratification
Average Hypolimnetic Phosphorus Concentration: 73.6 mg/m^3
Hypolimnetic Volume: 7.46 acre-ft
Anoxia Sediment Area: 8.96 acres
Time Period of Stratification: 95 days
Sediment Phosphorus Release Rate: -0.4 mg/m^2-day -1.22E-003 lb/acre-day
Internal Load: -3 Lb -2 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 56.8 mg/m^3
Hypolimnetic Volume: 31.72 acre-ft
Anoxia Sediment Area: 8.96 acres
Just Prior To The End of Stratification
Average Water Column Phosphorus Concentration: 30.5 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 8.96 acres
Time Period Between Observations: 14 days
Sediment Phosphorus Release Rate: 134.4 mg/m^2-day 3.65E-001 lb/acre-day
Internal Load: 150 Lb 68 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 8.96 acre
End of Anoxia Anoxic Sediment Area: 8.96 acre
Phosphorus Release Rate As Calculated In Method 2: -0.4 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: -0.4 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 67.0 mg/m^2-day
Period of Anoxia: 95 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	14	32	56

Internal Load: (kg) 6 15 25

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 3682 Lb 1670 kg

	Lb	kg	%
From A Complete Mass Budget:	-687	-312	-22.9
From Growing Season In Situ Phosphorus Increases:	-3	-2	-0.1
From In Situ Phosphorus Increases In The Fall:	150	68	3.9
From Phosphorus Release Rate and Anoxic Area:	32	15	0.9

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	9	63	138

Osgood, 1988 Lake Mixing Index: 3.0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	-687	73.5	32
Internal Load (kg):	-312	33.3	15
External Load (Lb):	1669	3682	8304
External Load (kg):	757	1670	3767
Total Load (Lb):	982	3756	8337
Total Load (kg):	445	1704	3781

Phosphorus Prediction and Uncertainty Analysis Module

Date: 3/18/2016 Scenario: 4

Observed spring overturn total phosphorus (SPO): 25.2 mg/m^3

Observed growing season mean phosphorus (GSM): 50.0 mg/m^3

Back calculation for SPO total phosphorus: 25.45 mg/m^3

Back calculation GSM phosphorus: 50.51 mg/m^3

% Confidence Range: 70%

Nurenberg Model Input - Est. Gross Int. Loading: 63 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	25	56	127	6	12
Canfield-Bachmann, 1981 Natural Lake	35	69	136	19	38
Canfield-Bachmann, 1981 Artificial Lake	31	57	102	7	14
Rechow, 1979 General	26	56	127	6	12
Rechow, 1977 Anoxic	40	87	197	37	74
Rechow, 1977 water load<50m/year	30	66	149	16	32
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	34	75	170	50	198
Vollenweider, 1982 Combined OECD	27	53	102	15	40
Dillon-Rigler-Kirchner	24	53	119	28	111
Vollenweider, 1982 Shallow Lake/Res.	22	45	91	7	19
Larsen-Mercier, 1976	33	73	166	48	190
Nurnberg, 1984 Oxic	31	64	141	14	28

Lake Phosphorus Model	**Confidence** Lower	**Confidence** Upper	**Parameter** Fit?	**Back** Calculation	**Model** Type

	Bound	Bound		(kg/year)	
Walker, 1987 Reservoir	32	104	FIT	1502	GSM
Canfield-Bachmann, 1981 Natural Lake	21	199	FIT	1139	GSM
Canfield-Bachmann, 1981 Artificial Lake	18	164	FIT	1386	GSM
Rechow, 1979 General	31	105	FIT	1498	GSM
Rechow, 1977 Anoxic	50	160	FIT	966	GSM
Rechow, 1977 water load<50m/year	36	123	P	1278	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	36	148	FIT	564	SPO
Vollenweider, 1982 Combined OECD	25	100	FIT	1127	ANN
Dillon-Rigler-Kirchner	30	97	P	808	SPO
Vollenweider, 1982 Shallow Lake/Res.	21	85	FIT	1406	ANN
Larsen-Mercier, 1976	43	134	P Pin	579	SPO
Nurnberg, 1984 Oxic	33	122	P	1286	ANN

Water and Nutrient Outflow Module
Date: 3/18/2016 Scenario: 2
Average Annual Surface Total Phosphorus: 41.87mg/m^3
Annual Discharge: 1.34E+004 AF => 1.66E+007 m^3
Annual Outflow Loading: 1465.0 LB => 664.5 kg

Expanded Trophic Response Module
Date: 3/18/2016 Scenario: 3
Total Phosphorus: 41.87 mg/m^3
Growing Season
Chlorophyll a: 46.79 mg/m^3
Secchi Disk Depth: 1.52 m
Chlorophyll a Nuisance Frequency
Chla Mean Min: 5
Chla Mean Max: 100
Chla Mean Increment: 5
Chla Temporal CV: 0.62
Chla Nuisance Criterion: 20

Mean	Freq %	ml	z	v	w	x
5	0.5	1.4	2.546	0.016	0.541	0.005
10	7.7	2.1	1.428	0.144	0.678	0.077
15	21.9	2.5	0.774	0.296	0.795	0.219
20	37.8	2.8	0.310	0.380	0.907	0.378
25	52.0	3.0	-0.050	0.398	0.984	0.480
30	63.5	3.2	-0.344	0.376	0.897	0.365
35	72.3	3.4	-0.593	0.335	0.835	0.277
40	79.0	3.5	-0.808	0.288	0.788	0.210
45	84.1	3.6	-0.998	0.242	0.751	0.159
50	87.9	3.7	-1.168	0.202	0.720	0.121
55	90.7	3.8	-1.322	0.167	0.695	0.093
60	92.8	3.9	-1.462	0.137	0.673	0.072
65	94.4	4.0	-1.591	0.112	0.654	0.056
70	95.6	4.1	-1.711	0.092	0.637	0.044
75	96.6	4.1	-1.822	0.076	0.623	0.034
80	97.3	4.2	-1.926	0.062	0.609	0.027

85	97.8	4.3	-2.024	0.051	0.598	0.022
90	98.3	4.3	-2.116	0.043	0.587	0.017
95	98.6	4.4	-2.203	0.035	0.577	0.014
100	98.9	4.4	-2.286	0.029	0.568	0.011

Date: 4/4/2016 Scenario: Big Blake 2015 L-THIA

Lake Id: Big Blake Lake
Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 25.2 mg/m^3
Observed growing season mean phosphorus (GSM): 50.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely (Loading (kg/ha-year))	High	Loading %	Low	Most Likely (Loading (kg/year))	High
Row Crop AG	1023.8	0.50	1.00	3.00	24.8	207	414	1243
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.8	194	582	969
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	2	3	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	14	28	70
Wetlands	1496.3	0.10	0.10	0.10	3.6	61	61	61
Forest	10759.2	0.05	0.09	0.18	23.5	218	392	784
Lake Surface	208.0	0.10	0.30	1.00	1.5	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.5

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	1669.0	3682.4	8304.2	100.0
Total Loading (kg)	757.1	1670.3	3766.8	100.0
Areal Loading (lb/ac-year)	8.02	17.70	39.92	
Areal Loading (mg/m^2-year)	899.40	1984.34	4474.95	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1648.3	3608.6	8060.6	99.5
Total NPS Loading (kg)	747.7	1636.8	3656.3	99.5

Wisconsin Internal Load Estimator
Date: 4/4/2016 Scenario: 16

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 41.9 mg/m^3
Phosphorus Inflow Concentration: 100.8 mg/m^3
Areal External Loading: 1984.3 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.40
Observed Phosphorus Retention Coefficient: 0.58
Internal Load: -686 Lb -311 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 25.6 mg/m^3
Hypolimnetic Volume: 215.66 acre-ft
Anoxia Sediment Area: 65.75 acres
Just Prior To The End of Stratification
Average Hypolimnetic Phosphorus Concentration: 73.6 mg/m^3
Hypolimnetic Volume: 662.03 acre-ft
Anoxia Sediment Area: 121 acres
Time Period of Stratification: 74 days
Sediment Phosphorus Release Rate: 1.9 mg/m^2-day 5.18E-003 lb/acre-day
Internal Load: 117 Lb 53 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 25.6 mg/m^3
Hypolimnetic Volume: 215.66 acre-ft
Anoxia Sediment Area: 65.75 acres
Just Prior To The End of Stratification
Average Water Column Phosphorus Concentration: 69.1 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 121 acres
Time Period Between Observations: 30 days
Sediment Phosphorus Release Rate: 13.5 mg/m^2-day 3.66E-002 lb/acre-day
Internal Load: 337 Lb 153 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 65.75 acre
End of Anoxia Anoxic Sediment Area: 121 acre
Phosphorus Release Rate As Calculated In Method 2: 1.9 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: 1.9 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 7.7 mg/m^2-day
Period of Anoxia: 74 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	113	263	451

Internal Load: (kg)	51	119	205

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 3682 Lb 1670 kg

	Lb	kg	%
From A Complete Mass Budget:	-686	-311	-22.9
From Growing Season In Situ Phosphorus Increases:	117	53	3.1
From In Situ Phosphorus Increases In The Fall:	337	153	8.4
From Phosphorus Release Rate and Anoxic Area:	263	119	6.7

Predicted Water Column Total Phosphorus Concentration (ug/l)

Nurnberg+ 1984 Total Phosphorus Model:	Low	Most Likely	High
	9	67	144

Osgood, 1988 Lake Mixing Index: 3.0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	-686	227.1	263
Internal Load (kg):	-311	103.0	119
External Load (Lb):	1669	3682	8304
External Load (kg):	757	1670	3767
Total Load (Lb):	983	3910	8567
Total Load (kg):	446	1773	3886

Phosphorus Prediction and Uncertainty Analysis Module

Date: 4/4/2016 Scenario: 12

Observed spring overturn total phosphorus (SPO): 25.2 mg/m^3

Observed growing season mean phosphorus (GSM): 50.0 mg/m^3

Back calculation for SPO total phosphorus: 25.45 mg/m^3

Back calculation GSM phosphorus: 50.51 mg/m^3

% Confidence Range: 70%

Nurenberg Model Input - Est. Gross Int. Loading: 67 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	25	56	127	6	12
Canfield-Bachmann, 1981 Natural Lake	35	69	136	19	38
Canfield-Bachmann, 1981 Artificial Lake	31	57	102	7	14
Rechow, 1979 General	26	56	127	6	12
Rechow, 1977 Anoxic	40	87	197	37	74
Rechow, 1977 water load<50m/year	30	66	149	16	32
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	34	75	170	50	198
Vollenweider, 1982 Combined OECD	27	53	102	15	40
Dillon-Rigler-Kirchner	24	53	119	28	111
Vollenweider, 1982 Shallow Lake/Res.	22	45	91	7	19
Larsen-Mercier, 1976	33	73	166	48	190
Nurnberg, 1984 Oxic	32	65	141	15	30

Lake Phosphorus Model	**Confidence** Lower	**Confidence** Upper	**Parameter** Fit?	**Back** Calculation	**Model** Type

	Bound	Bound		(kg/year)	
Walker, 1987 Reservoir	32	104	FIT	1502	GSM
Canfield-Bachmann, 1981 Natural Lake	21	199	FIT	1139	GSM
Canfield-Bachmann, 1981 Artificial Lake	18	164	FIT	1386	GSM
Rechow, 1979 General	31	105	FIT	1498	GSM
Rechow, 1977 Anoxic	50	160	FIT	966	GSM
Rechow, 1977 water load<50m/year	36	123	P	1278	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	36	148	FIT	564	SPO
Vollenweider, 1982 Combined OECD	25	100	FIT	1127	ANN
Dillon-Rigler-Kirchner	30	97	P	808	SPO
Vollenweider, 1982 Shallow Lake/Res.	21	85	FIT	1406	ANN
Larsen-Mercier, 1976	43	134	P Pin	579	SPO
Nurnberg, 1984 Oxic	34	122	P	1279	ANN

Water and Nutrient Outflow Module

Date: 4/4/2016   Scenario: 10

Average Annual Surface Total Phosphorus: 41.87mg/m^3

Annual Discharge: 1.34E+004 AF => 1.66E+007 m^3

Annual Outflow Loading: 1465.0 LB =>   664.5 kg

Date: 7/26/2016 Scenario: Big Blake Lake combined direct drainage
Lake Id: Big Blake Lake
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 550.0 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 366.7 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 169846.7 acre-ft/year
Areal Water Load <qs>: 816.6 ft/year
Lake Flushing Rate <p>: 90.73 1/year
Water Residence Time: 0.01 year
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		|---- Loading (kg/ha-year) ----|				|----- Loading (kg/year) ----|		
Row Crop AG	123.0	0.50	1.00	3.00	0.5	25	50	149
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	38.0	0.10	0.30	0.50	0.0	2	5	8
HD Urban (1/8 Ac)	19.0	1.00	1.50	2.00	0.1	8	12	15
MD Urban (1/4 Ac)	113.0	0.30	0.50	0.80	0.2	14	23	37
Rural Res (>1 Ac)	46.0	0.05	0.10	0.25	0.0	1	2	5
Wetlands	35.0	0.10	0.10	0.10	0.0	1	1	1
Forest	176.0	0.05	0.09	0.18	0.1	4	6	13
Lake Surface	208.0	0.10	0.30	1.00	0.2	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.1

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	139.2	23580.3	745.9	100.0
Total Loading (kg)	63.1	10696.0	338.4	100.0
Areal Loading (lb/ac-year)	0.67	113.37	3.59	
Areal Loading (mg/m^2-year)	75.02	12706.86	401.97	
Total PS Loading (lb)	0.0	23289.4	0.0	98.8

Total PS Loading (kg)	0.0	10564.0	0.0	98.8
Total NPS Loading (lb)	118.5	217.1	502.4	1.2
Total NPS Loading (kg)	53.7	98.5	227.9	1.2

Wisconsin Internal Load Estimator
Date: 7/26/2016   Scenario: 24

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 49.85 mg/m^3
Phosphorus Inflow Concentration: 51.1 mg/m^3
Areal External Loading: 12706.9 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.06
Observed Phosphorus Retention Coefficient: 0.02
Internal Load: 769 Lb   349 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia

Average Hypolimnetic Phosphorus Concentration: 62.3 mg/m^3
Hypolimnetic Volume: 715.6 acre-ft
Anoxia Sediment Area: 120.4 acres

Just Prior To The End of Stratification

Average Hypolimnetic Phosphorus Concentration: 70 mg/m^3
Hypolimnetic Volume: 595.61 acre-ft
Anoxia Sediment Area: 108.82 acres
Time Period of Stratification: 50 days
Sediment Phosphorus Release Rate: -0.2 mg/m^2-day   -4.18E-004 lb/acre-day
Internal Load: -8 Lb   -4 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia

Average Hypolimnetic Phosphorus Concentration: 62.3 mg/m^3
Hypolimnetic Volume: 715.6 acre-ft
Anoxia Sediment Area: 120.4 acres

Just Prior To The End of Stratification

Average Water Column Phosphorus Concentration: 62.3 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 108.82 acres
Time Period Between Observations: 30 days
Sediment Phosphorus Release Rate: 6.4 mg/m^2-day   1.74E-002 lb/acre-day
Internal Load: 196 Lb   89 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 120.4 acre
End of Anoxia Anoxic Sediment Area: 108.82 acre
Phosphorus Release Rate As Calculated In Method 2: -0.2 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: -0.2 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 3.1 mg/m^2-day
Period of Anoxia: 50 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	93	218	374

Internal Load: (kg)	42	99	170

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 23580 Lb 10696 kg

	Lb	kg	%
From A Complete Mass Budget:	769	349	3.2
From Growing Season In Situ Phosphorus Increases:	-8	-4	0.0
From In Situ Phosphorus Increases In The Fall:	196	89	0.8
From Phosphorus Release Rate and Anoxic Area:	218	99	0.9

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	2	48	2

Osgood, 1988 Lake Mixing Index: 3.0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	769	94.0	218
Internal Load (kg):	349	42.7	99
External Load (Lb):	139	23580	746
External Load (kg):	63	10696	338
Total Load (Lb):	908	23674	964
Total Load (kg):	412	10739	437

Phosphorus Prediction and Uncertainty Analysis Module

Date: 7/26/2016 Scenario: 18

Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3

Observed growing season mean phosphorus (GSM): 57.0 mg/m^3

Back calculation for SPO total phosphorus: 37.14 mg/m^3

Back calculation GSM phosphorus: 57.24 mg/m^3

% Confidence Range: 70%

Nurenberg Model Input - Est. Gross Int. Loading: 48 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	0	47	1	-10	-18
Canfield-Bachmann, 1981 Natural Lake	0	47	2	-10	-18
Canfield-Bachmann, 1981 Artificial Lake	0	43	2	-14	-25
Rechow, 1979 General	0	41	1	-16	-28
Rechow, 1977 Anoxic	0	45	1	-12	-21
Rechow, 1977 water load<50m/year	N/A	N/A	N/A	N/A	N/A
Rechow, 1977 water load>50m/year	0	36	1	-21	-37
Walker, 1977 General	0	46	1	9	24
Vollenweider, 1982 Combined OECD	1	36	2	-11	-23
Dillon-Rigler-Kirchner	0	48	2	11	30
Vollenweider, 1982 Shallow Lake/Res.	0	30	1	-17	-36
Larsen-Mercier, 1976	0	46	1	9	24
Nurnberg, 1984 Oxic	1	48	2	-9	-16

Lake Phosphorus Model	**Confidence** Lower	**Confidence** Upper	**Parameter** Fit?	**Back** Calculation	**Model** Type

	Bound	Bound		(kg/year)	
Walker, 1987 Reservoir	16	80	Tw	12997	GSM
Canfield-Bachmann, 1981 Natural Lake	15	135	L	12877	GSM
Canfield-Bachmann, 1981 Artificial Lake	13	124	FIT	14320	GSM
Rechow, 1979 General	13	71	qs	14949	GSM
Rechow, 1977 Anoxic	15	76	FIT	13573	GSM
Rechow, 1977 water load<50m/year	N/A	N/A	N/A	N/A	N/A
Rechow, 1977 water load>50m/year	14	57	FIT	16923	GSM
Walker, 1977 General	13	84	FIT	8609	SPO
Vollenweider, 1982 Combined OECD	10	68	Tw	14943	ANN
Dillon-Rigler-Kirchner	16	81	P L qs p	8226	SPO
Vollenweider, 1982 Shallow Lake/Res.	8	56	Tw	18320	ANN
Larsen-Mercier, 1976	16	77	P Pin p	8598	SPO
Nurnberg, 1984 Oxic	14	86	L qs	12655	ANN

Date: 7/26/2016   Scenario: Big Blake Lake combined L-THIA

Lake Id: Big Blake Lake

Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre **(ac)**	Low	Most Likely **|---- Loading (kg/ha-year) ----|**	High	Loading %	Low	Most Likely **|----- Loading (kg/year) ----|**	High
Row Crop AG	1023.8	0.50	1.00	3.00	24.8	207	414	1243
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.8	194	582	969
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	2	3	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	14	28	70
Wetlands	1496.3	0.10	0.10	0.10	3.6	61	61	61
Forest	10759.2	0.05	0.09	0.18	23.5	218	392	784
Lake Surface	208.0	0.10	0.30	1.00	1.5	8	25	84

POINT SOURCE DATA

Point Sources	Water Load **(m^3/year)**	Low **(kg/year)**	Most Likely **(kg/year)**	High **(kg/year)**	Loading %

SEPTIC TANK DATA

Description		**Low**	**Most Likely**	**High**	**Loading %**
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.5

TOTALS DATA

Description	**Low**	**Most Likely**	**High**	**Loading %**
Total Loading (lb)	1669.0	3682.4	8304.2	100.0
Total Loading (kg)	757.1	1670.3	3766.8	100.0
Areal Loading (lb/ac-year)	8.02	17.70	39.92	
Areal Loading (mg/m^2-year)	899.40	1984.34	4474.95	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1648.3	3608.6	8060.6	99.5
Total NPS Loading (kg)	747.7	1636.8	3656.3	99.5

Wisconsin Internal Load Estimator
Date: 7/26/2016 Scenario: 23

Method 1 - A Complete Total Phosphorus Mass Budget

Method 1 - A Complete Total Phosphorus Mass Budget 49.85 mg/m^3
Phosphorus Inflow Concentration: 100.8 mg/m^3
Areal External Loading: 1984.3 mg/m^2-year
Predicted Phosphorus Retention Coefficient: 0.40
Observed Phosphorus Retention Coefficient: 0.51
Internal Load: -396 Lb -179 kg

Method 2 - From Growing Season In Situ Phosphorus Increases

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 62.3 mg/m^3
Hypolimnetic Volume: 715.6 acre-ft
Anoxia Sediment Area: 120.04 acres
Just Prior To The End of Stratification
Average Hypolimnetic Phosphorus Concentration: 70.0 mg/m^3
Hypolimnetic Volume: 595.61 acre-ft
Anoxia Sediment Area: 108.82 acres
Time Period of Stratification: 50 days
Sediment Phosphorus Release Rate: -0.2 mg/m^2-day -4.19E-004 lb/acre-day
Internal Load: -8 Lb -4 kg

Method 3 - From In Situ Phosphorus Increases In The Fall

Start of Anoxia
Average Hypolimnetic Phosphorus Concentration: 62.3 mg/m^3
Hypolimnetic Volume: 715.6 acre-ft
Anoxia Sediment Area: 120.04 acres
Just Prior To The End of Stratification
Average Water Column Phosphorus Concentration: 85 mg/m^3
Lake Volume: 1872.0 acre-ft
Anoxia Sediment Area Just Before Turnover: 108.82 acres
Time Period Between Observations: 30 days
Sediment Phosphorus Release Rate: 10.2 mg/m^2-day 2.77E-002 lb/acre-day
Internal Load: 311 Lb 141 kg

Method 4 - From Phosphorus Release Rate and Anoxic Area

Start of Anoxia Anoxic Sediment Area: 120.04 acre
End of Anoxia Anoxic Sediment Area: 108.82 acre
Phosphorus Release Rate As Calculated In Method 2: -0.2 mg/m^2-day
Phosphorus Release Rate As Calculated In Method 3: -0.2 mg/m^2-day
Average of Methods 2 and 3 Release Rates: 5.0 mg/m^2-day
Period of Anoxia: 50 days
Default Areal Sediment Phosphorus Release Rates:

	Low	Most Likely	High
	6	14	24
Internal Load: (Lb)	93	218	373

	Low	Most Likely	High
Internal Load: (kg)	42	99	169

Internal Load Comparison (Percentages are of the Total Estimate Load)

Total External Load: 3682 Lb 1670 kg

	Lb	kg	%
From A Complete Mass Budget:	-396	-179	-12.0
From Growing Season In Situ Phosphorus Increases:	-8	-4	-0.2
From In Situ Phosphorus Increases In The Fall:	311	141	7.8
From Phosphorus Release Rate and Anoxic Area:	218	99	5.6

Predicted Water Column Total Phosphorus Concentration (ug/l)

	Low	Most Likely	High
Nurnberg+ 1984 Total Phosphorus Model:	17	65	143

Osgood, 1988 Lake Mixing Index: 3.0

Phosphorus Loading Summary:

	Low	Most Likely	High
Internal Load (Lb):	-396	151.8	218
Internal Load (kg):	-179	68.9	99
External Load (Lb):	1669	3682	8304
External Load (kg):	757	1670	3767
Total Load (Lb):	1273	3834	8522
Total Load (kg):	578	1739	3866

Phosphorus Prediction and Uncertainty Analysis Module

Date: 7/26/2016 Scenario: 17

Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3

Observed growing season mean phosphorus (GSM): 57.0 mg/m^3

Back calculation for SPO total phosphorus: 37.14 mg/m^3

Back calculation GSM phosphorus: 57.24 mg/m^3

% Confidence Range: 70%

Nurenberg Model Input - Est. Gross Int. Loading: 65 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	25	56	127	-1	-2
Canfield-Bachmann, 1981 Natural Lake	35	69	136	12	21
Canfield-Bachmann, 1981 Artificial Lake	31	57	102	0	0
Rechow, 1979 General	26	56	127	-1	-2
Rechow, 1977 Anoxic	40	87	197	30	53
Rechow, 1977 water load<50m/year	30	66	149	9	16
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	34	75	170	38	103
Vollenweider, 1982 Combined OECD	27	53	102	6	13
Dillon-Rigler-Kirchner	24	53	119	16	43
Vollenweider, 1982 Shallow Lake/Res.	22	45	91	-2	-4
Larsen-Mercier, 1976	33	73	166	36	98
Nurnberg, 1984 Oxic	31	65	141	8	14

Lake Phosphorus Model	**Confidence** Lower	**Confidence** Upper	**Parameter** Fit?	**Back** Calculation	**Model** Type

	Bound	Bound		(kg/year)	
Walker, 1987 Reservoir	32	104	FIT	1702	GSM
Canfield-Bachmann, 1981 Natural Lake	21	199	FIT	1318	GSM
Canfield-Bachmann, 1981 Artificial Lake	18	164	FIT	1641	GSM
Rechow, 1979 General	31	105	FIT	1697	GSM
Rechow, 1977 Anoxic	50	160	FIT	1094	GSM
Rechow, 1977 water load<50m/year	36	123	P	1448	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	36	148	FIT	823	SPO
Vollenweider, 1982 Combined OECD	25	100	FIT	1469	ANN
Dillon-Rigler-Kirchner	30	97	P	1180	SPO
Vollenweider, 1982 Shallow Lake/Res.	21	85	FIT	1801	ANN
Larsen-Mercier, 1976	43	134	P Pin	845	SPO
Nurnberg, 1984 Oxic	34	122	P	1468	ANN

Water and Nutrient Outflow Module
Date: 7/26/2016   Scenario: 13
Average Annual Surface Total Phosphorus: 49.8mg/m^3
Annual Discharge: 1.34E+004 AF => 1.66E+007 m^3
Annual Outflow Loading: 1742.3 LB =>   790.3 kg

Date: 7/26/2016 Scenario: L-THIA combined 15% reduction
Lake Id: Big Blake Lake
Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
% NPS Change: -15%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	1023.8	0.50	1.00	3.00	24.7	176	352	1057
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.7	165	494	824
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	1	2	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	12	24	60
Wetlands	1496.3	0.10	0.10	0.10	3.6	51	51	51
Forest	10759.2	0.05	0.09	0.18	23.4	185	333	666
Lake Surface	208.0	0.10	0.30	1.00	1.8	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.6

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	1421.8	3141.1	7095.1	100.0
Total Loading (kg)	644.9	1424.8	3218.3	100.0
Areal Loading (lb/ac-year)	6.84	15.10	34.11	
Areal Loading (mg/m^2-year)	766.16	1692.66	3823.39	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1401.0	3067.3	6851.6	99.4
Total NPS Loading (kg)	635.5	1391.3	3107.8	99.4

Phosphorus Prediction and Uncertainty Analysis Module
Date: 7/26/2016   Scenario: 21
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
Back calculation for SPO total phosphorus: 37.14 mg/m^3
Back calculation GSM phosphorus: 57.24 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 65 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	23	50	114	-7	-12
Canfield-Bachmann, 1981 Natural Lake	30	60	120	3	5
Canfield-Bachmann, 1981 Artificial Lake	27	51	91	-6	-11
Rechow, 1979 General	22	48	109	-9	-16
Rechow, 1977 Anoxic	34	75	168	18	32
Rechow, 1977 water load<50m/year	25	56	127	-1	-2
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	29	64	145	27	73
Vollenweider, 1982 Combined OECD	24	46	90	-1	-2
Dillon-Rigler-Kirchner	20	45	101	8	22
Vollenweider, 1982 Shallow Lake/Res.	19	39	80	-8	-17
Larsen-Mercier, 1976	28	63	141	26	71
Nurnberg, 1984 Oxic	27	56	121	-1	-2

Lake Phosphorus Model	**Confidence** Lower Bound	**Confidence** Upper Bound	**Parameter** Fit?	**Back** Calculation (kg/year)	**Model** Type
Walker, 1987 Reservoir	28	93	FIT	1623	GSM
Canfield-Bachmann, 1981 Natural Lake	19	173	FIT	1318	GSM
Canfield-Bachmann, 1981 Artificial Lake	16	147	FIT	1641	GSM
Rechow, 1979 General	26	90	FIT	1697	GSM
Rechow, 1977 Anoxic	43	137	FIT	1094	GSM
Rechow, 1977 water load<50m/year	31	105	FIT	1448	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	31	126	FIT	823	SPO
Vollenweider, 1982 Combined OECD	22	87	FIT	1469	ANN
Dillon-Rigler-Kirchner	26	82	P	1180	SPO
Vollenweider, 1982 Shallow Lake/Res.	19	74	FIT	1801	ANN
Larsen-Mercier, 1976	37	114	P Pin	845	SPO
Nurnberg, 1984 Oxic	29	105	FIT	1468	ANN

Date: 7/26/2016 Scenario: L-THIA combined 20% reduction
Lake Id: Big Blake Lake
Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
% NPS Change: -20%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	1023.8	0.50	1.00	3.00	24.7	166	331	994
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.6	155	465	776
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	1	2	3
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	11	22	56
Wetlands	1496.3	0.10	0.10	0.10	3.6	48	48	48
Forest	10759.2	0.05	0.09	0.18	23.3	174	314	627
Lake Surface	208.0	0.10	0.30	1.00	1.9	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		**Low**	**Most Likely**	**High**	**Loading %**
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.6

TOTALS DATA

Description	**Low**	**Most Likely**	**High**	**Loading %**
Total Loading (lb)	1339.4	2960.7	6692.1	100.0
Total Loading (kg)	607.5	1342.9	3035.5	100.0
Areal Loading (lb/ac-year)	6.44	14.23	32.17	
Areal Loading (mg/m^2-year)	721.75	1595.43	3606.21	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1318.6	2886.9	6448.5	99.4
Total NPS Loading (kg)	598.1	1309.5	2925.0	99.4

Phosphorus Prediction and Uncertainty Analysis Module
Date: 7/26/2016   Scenario: 22
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
Back calculation for SPO total phosphorus: 37.14 mg/m^3
Back calculation GSM phosphorus: 57.24 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 65 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	22	48	109	-9	-16
Canfield-Bachmann, 1981 Natural Lake	28	57	114	0	0
Canfield-Bachmann, 1981 Artificial Lake	26	48	88	-9	-16
Rechow, 1979 General	20	45	102	-12	-21
Rechow, 1977 Anoxic	32	70	159	13	23
Rechow, 1977 water load<50m/year	24	53	120	-4	-7
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	27	61	137	24	65
Vollenweider, 1982 Combined OECD	23	44	86	-3	-6
Dillon-Rigler-Kirchner	19	42	96	5	14
Vollenweider, 1982 Shallow Lake/Res.	18	37	76	-10	-21
Larsen-Mercier, 1976	27	59	133	22	60
Nurnberg, 1984 Oxic	26	53	114	-4	-7

Lake Phosphorus Model	**Confidence** Lower Bound	**Confidence** Upper Bound	**Parameter** Fit?	**Back** Calculation (kg/year)	**Model** Type
Walker, 1987 Reservoir	27	89	FIT	1595	GSM
Canfield-Bachmann, 1981 Natural Lake	18	164	FIT	1318	GSM
Canfield-Bachmann, 1981 Artificial Lake	15	138	FIT	1641	GSM
Rechow, 1979 General	24	84	FIT	1697	GSM
Rechow, 1977 Anoxic	41	129	FIT	1094	GSM
Rechow, 1977 water load<50m/year	29	99	FIT	1448	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	29	120	FIT	823	SPO
Vollenweider, 1982 Combined OECD	21	83	FIT	1469	ANN
Dillon-Rigler-Kirchner	24	78	P	1180	SPO
Vollenweider, 1982 Shallow Lake/Res.	18	71	FIT	1801	ANN
Larsen-Mercier, 1976	35	107	P Pin	845	SPO
Nurnberg, 1984 Oxic	28	99	FIT	1468	ANN

Date: 7/26/2016 Scenario: L-THIA direct 30% reduction
Lake Id: Big Blake Lake
Watershed Id: 1

Hydrologic and Morphometric Data

Tributary Drainage Area: 20066.1 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 13377.4 acre-ft
Lake Surface Area <As>: 208.0 acre
Lake Volume <V>: 1872.0 acre-ft
Lake Mean Depth <z>: 9.0 ft
Precipitation - Evaporation: 3.3 in.
Hydraulic Loading: 13434.6 acre-ft/year
Areal Water Load <qs>: 64.6 ft/year
Lake Flushing Rate <p>: 7.18 1/year
Water Residence Time: 0.14 year
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
% NPS Change: -30%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre (ac)	Low	Most Likely	High	Loading %	Low	Most Likely	High
		|---- Loading (kg/ha-year) ----|				|----- Loading (kg/year) ----|		
Row Crop AG	1023.8	0.50	1.00	3.00	24.6	145	290	870
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	4790.6	0.10	0.30	0.50	34.5	136	407	679
HD Urban (1/8 Ac)	4.3	1.00	1.50	2.00	0.2	1	2	2
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	691.9	0.05	0.10	0.25	1.7	10	20	49
Wetlands	1496.3	0.10	0.10	0.10	3.6	42	42	42
Forest	10759.2	0.05	0.09	0.18	23.3	152	274	549
Lake Surface	208.0	0.10	0.30	1.00	2.1	8	25	84

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	164.4				
% Phosphorus Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.99	8.22	26.30	0.7

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	1174.5	2599.8	5886.0	100.0
Total Loading (kg)	532.8	1179.3	2669.9	100.0
Areal Loading (lb/ac-year)	5.65	12.50	28.30	
Areal Loading (mg/m^2-year)	632.93	1400.97	3171.84	
Total PS Loading (lb)	0.0	0.0	0.0	0.0

Total PS Loading (kg)	0.0	0.0	0.0	0.0
Total NPS Loading (lb)	1153.8	2526.0	5642.5	99.3
Total NPS Loading (kg)	523.4	1145.8	2559.4	99.3

Phosphorus Prediction and Uncertainty Analysis Module
Date: 7/26/2016   Scenario: 23
Observed spring overturn total phosphorus (SPO): 36.8 mg/m^3
Observed growing season mean phosphorus (GSM): 57.0 mg/m^3
Back calculation for SPO total phosphorus: 37.14 mg/m^3
Back calculation GSM phosphorus: 57.24 mg/m^3
% Confidence Range: 70%
Nurenberg Model Input - Est. Gross Int. Loading: 65 kg

Lake Phosphorus Model	**Low** Total P (mg/m^3)	**Most Likely** Total P (mg/m^3)	**High** Total P (mg/m^3)	**Predicted** -Observed (mg/m^3)	**% Dif.**
Walker, 1987 Reservoir	20	44	99	-13	-23
Canfield-Bachmann, 1981 Natural Lake	25	51	103	-6	-11
Canfield-Bachmann, 1981 Artificial Lake	23	44	80	-13	-23
Rechow, 1979 General	18	40	90	-17	-30
Rechow, 1977 Anoxic	28	62	140	5	9
Rechow, 1977 water load<50m/year	21	47	106	-10	-18
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	24	53	121	16	43
Vollenweider, 1982 Combined OECD	21	39	77	-8	-17
Dillon-Rigler-Kirchner	17	37	84	0	0
Vollenweider, 1982 Shallow Lake/Res.	16	33	68	-14	-30
Larsen-Mercier, 1976	23	52	117	15	41
Nurnberg, 1984 Oxic	23	47	101	-10	-18

Lake Phosphorus Model	**Confidence** Lower Bound	**Confidence** Upper Bound	**Parameter** Fit?	**Back** Calculation (kg/year)	**Model** Type
Walker, 1987 Reservoir	25	81	FIT	1537	GSM
Canfield-Bachmann, 1981 Natural Lake	16	147	FIT	1318	GSM
Canfield-Bachmann, 1981 Artificial Lake	14	127	FIT	1641	GSM
Rechow, 1979 General	22	75	FIT	1697	GSM
Rechow, 1977 Anoxic	36	114	FIT	1094	GSM
Rechow, 1977 water load<50m/year	26	87	FIT	1448	GSM
Rechow, 1977 water load>50m/year	N/A	N/A	N/A	N/A	N/A
Walker, 1977 General	26	105	FIT	823	SPO
Vollenweider, 1982 Combined OECD	19	74	FIT	1469	ANN
Dillon-Rigler-Kirchner	21	68	P	1180	SPO
Vollenweider, 1982 Shallow Lake/Res.	16	63	FIT	1801	ANN
Larsen-Mercier, 1976	30	94	P Pin	845	SPO
Nurnberg, 1984 Oxic	24	88	FIT	1468	ANN

Appendix J

Sediment Core Data and Paleolimnoligical Study of Big Blake Lake Report

Total Phosphorus Results Pink = air spike

Sample ID	Raw Result (mg P/L)	Dilution Factor	Final Result (mg P/L)
DI Blank	-0.005		
Chk Stnd 0.096 ppm P	0.084		
Chk Stnd 0.288 ppm P	0.260		
Cal Stnd 0.50 ppm P	0.449		
DI Blank	-0.006		
21 Dup Blake 1A - 10 cm TP	0.342	5373.48	1.84
22 Blake 1A - 13 cm TP	0.293	5809.08	1.70
23 Blake 1A - 16 cm TP	0.257	5749.28	1.48
24 Blake 1A - 19 cm TP	0.261	5465.21	1.43
25 Blake 1A - 21 cm TP	0.271	5303.36	1.44
26 Blake 1A - 23 cm TP	0.230	5522.54	1.27
27 Blake 1A - 25 cm TP	0.240	5233.57	1.26
28 Blake 1A - 27 cm TP	0.224	5597.01	1.25
29 Blake 1A - 29 cm TP	0.260	5737.58	1.49
30 Dup Blake 1A - 29 cm TP	0.317	5750.04	1.82
31 Blake 1A - 31 cm TP	0.220	5699.87	1.26
32 Blake 1A - 33 cm TP	0.248	5541.35	1.37
33 Blake 1A - 37 cm TP	0.231	5633.14	1.30
34 Blake 1A - 39 cm TP	0.233	5571.53	1.30
35 Blank 2 Blake TP	0.019		
LFB 3 - Blake	0.181		
Spike 29 Blake 1A - 29 cm TP	0.429		
rep 35 Blank 2 Blake TP	0.020		
DI Blank	-0.006		
Chk Stnd 0.096 ppm P	0.0835		
Chk Stnd 0.288 ppm P	0.2577		
Cal Stnd 0.50 ppm P	0.4498		
DI Blank	-0.0058		
inst rep 28 Blake 1A - 27 cm TP	0.2233	5597.01	1.25
inst rep 34 Blake 1A - 39 cm TP	0.2361	5571.53	1.32
AS 25 Blake 1A - 21 cm TP	0.2518	5303.36	1.34
DI Blank	-0.0053		

Sample ID	Result (mg P/g)	Instrument Rep
18 Blake 1A - 1 cm TP	2.29	
19 Blake 1A - 7 cm TP	1.80	
20 Blake 1A - 10 cm TP	1.88	
22 Blake 1A - 13 cm TP	1.70	
23 Blake 1A - 16 cm TP	1.48	
24 Blake 1A - 19 cm TP	1.43	
25 Blake 1A - 21 cm TP	1.34	
26 Blake 1A - 23 cm TP	1.27	
27 Blake 1A - 25 cm TP	1.26	
28 Blake 1A - 27 cm TP	1.25	1.25
29 Blake 1A - 29 cm TP	1.49	
30 Dup Blake 1A - 29 cm TP	1.82	
31 Blake 1A - 31 cm TP	1.26	

32 Blake 1A - 33 cm TP	1.37	
33 Blake 1A - 37 cm TP	1.30	
34 Blake 1A - 39 cm TP	1.30	1.32

Extractable Phosphorus

Sample ID	Result mg P/L	Dilution Factor	Final Result mg P/g
DI Blank	0.0027		
Chk Stnd 0.096 ppm P	0.0850		
Cal Stnd 0.20 ppm P	0.1628		
Chk Stnd 0.288 ppm P	0.2534		
DI Blank	0.0039		
21 Blake Lake 9-10 cm Ex-P	0.0312	2236.07	0.07
22 Blake Lake 12-13 cm Ex-P	0.0197	2197.26	0.04
23 Blake Lake 15-16 cm Ex-P	0.0213	2227.42	0.05
24 Blake Lake 18-19 cm Ex-P	0.0216	2149.48	0.05
25 Blake Lake 20-21 cm Ex-P	0.0228	2039.90	0.05
26 Blake Lake 22-23 cm Ex-P	0.0235	2094.91	0.05
27 Blake Lake 24-25 cm Ex-P	0.0233	2026.10	0.05
28 Blake Lake 26-27 cm Ex-P	0.0216	2239.91	0.05
29 Blake Lake 28-29 cm Ex-P	0.0483	1945.69	0.09
30 DUP Blake Lake 28-29 cm Ex-P	0.0516	2073.20	0.11
31 Blake Lake 30-31 cm Ex-P	0.0222	2220.26	0.05
32 Blake Lake 32-33 cm Ex-P	0.0215	2101.00	0.05
33 Blake Lake 36-37 cm Ex-P	0.0208	2201.19	0.05
34 Blake Lake 38-39 cm Ex-P	0.0201	2336.21	0.05
35 DUP Blake Lake 38-39 cm Ex-P	0.0198	2207.05	0.04
1 Blank - Bone Ex-P	0.0251		0.00
LFB 2	0.1831		0.00
Spike 22 Blake 12-13 cm Ex-P	0.1929		0.00
DI Blank	0.0039		0.00
Chk Stnd 0.096 ppm P	0.0865		0.00
Cal Stnd 0.20 ppm P	0.1640		0.00
Chk Stnd 0.288 ppm P	0.2552		0.00
DI Blank	0.0043		0.00
inst rep 23 Blake Lake 15-16 cm Ex-P	0.0217	2227.42	0.05
inst rep 32 Blake Lake 32-33 cm Ex-P	0.0207	2101.00	0.04
AS 28 Blake Lake 26-27 cm Ex-P	0.0219	2239.91	0.05

Sample ID	Result mg P/g	Instrument Replicate
19 Blake Lake 0-1 cm Ex-P	0.06	
20 Blake Lake 6-7 cm Ex-P	0.04	
21 Blake Lake 9-10 cm Ex-P	0.07	
22 Blake Lake 12-13 cm Ex-P	0.04	
23 Blake Lake 15-16 cm Ex-P	0.05	0.05
24 Blake Lake 18-19 cm Ex-P	0.05	

25 Blake Lake 20-21 cm Ex-P	0.05	
26 Blake Lake 22-23 cm Ex-P	0.05	
27 Blake Lake 24-25 cm Ex-P	0.05	
28 Blake Lake 26-27 cm Ex-P	0.05	
29 Blake Lake 28-29 cm Ex-P	0.09	
31 Blake Lake 30-31 cm Ex-P	0.05	
32 Blake Lake 32-33 cm Ex-P	0.05	0.04
33 Blake Lake 36-37 cm Ex-P	0.05	
34 Blake Lake 38-39 cm Ex-P	0.05	

NaOH Phosphorus

Sample ID	Raw Result	Background Color	Raw Result	Dilution Factor	Final Result
	mg P/L	(file 140813z.fdt)	minus color		mg P/g
			mg P/L		
DI Blank	0.00				
1 Blank 1 - Bone NaOH-P	0.00	0.00	0.00		
Chk Stnd 0.096 ppm P	0.08				
Cal Stnd 0.20 ppm P	0.19				
Chk Stnd 0.288 ppm P	0.26				
DI Blank	0.00				
21 Blake Lake 9-10 cm NaOH-P	0.10	0.00	0.10	2736.77	0.28
22 Blake Lake 12-13 cm NaOH-P	0.06	0.00	0.06	2786.77	0.16
23 Blake Lake 15-16 cm NaOH-P	0.05	0.00	0.05	2803.92	0.13
24 Blake Lake 18-19 cm NaOH-P	0.05	0.00	0.05	2698.74	0.13
25 Blake Lake 20-21 cm NaOH-P	0.05	0.00	0.05	2585.90	0.13
26 Blake Lake 22-23 cm NaOH-P	0.05	0.00	0.05	2635.45	0.14
27 Blake Lake 24-25 cm NaOH-P	0.05	0.00	0.05	2594.24	0.12
28 Blake Lake 26-27 cm NaOH-P	0.05	0.00	0.05	2822.99	0.14
29 Blake Lake 28-29 cm NaOH-P	0.20	0.00	0.20	2430.87	0.49
30 DUP Blake Lake 28-29 cm NaOH-P	0.19	0.00	0.19	2646.08	0.50
31 Blake Lake 30-31 cm NaOH-P	0.05	0.00	0.05	2823.75	0.13
32 Blake Lake 32-33 cm NaOH-P	0.05	0.00	0.05	2658.78	0.13
33 Blake Lake 36-37 cm NaOH-P	0.05	0.00	0.05	2806.63	0.15
34 Blake Lake 38-39 cm NaOH-P	0.05	0.00	0.05	3054.09	0.15
35 DUP Blake Lake 38-39 cm NaOH-P	0.05	0.00	0.05	2807.89	0.15
DI Blank	0.00				
Chk Stnd 0.096 ppm P	0.09				
Cal Stnd 0.20 ppm P	0.20				
Chk Stnd 0.288 ppm P	0.27				
DI Blank	0.00				
inst rep 26 Blake Lake 22-23 cm NaOH-P	0.05	0.00	0.05	2635.45	0.14

Sample ID	Final Result mg P/g	Inst dup
19 Blake Lake 0-1 cm NaOH-P	0.42	
20 Blake Lake 6-7 cm NaOH-P	0.19	
21 Blake Lake 9-10 cm NaOH-P	0.28	
22 Blake Lake 12-13 cm NaOH-P	0.16	
23 Blake Lake 15-16 cm NaOH-P	0.13	
24 Blake Lake 18-19 cm NaOH-P	0.13	
25 Blake Lake 20-21 cm NaOH-P	0.13	
26 Blake Lake 22-23 cm NaOH-P	0.14	0.14
27 Blake Lake 24-25 cm NaOH-P	0.12	
28 Blake Lake 26-27 cm NaOH-P	0.14	
29 Blake Lake 28-29 cm NaOH-P	0.49	
31 Blake Lake 30-31 cm NaOH-P	0.13	
32 Blake Lake 32-33 cm NaOH-P	0.13	
33 Blake Lake 36-37 cm NaOH-P	0.15	
34 Blake Lake 38-39 cm NaOH-P	0.15	

HCL Phosphorus

Sample ID	Raw Result mg P/L	Dilution Factor	Final Result mg P/g
DI Blank	0.00	X	X
1 Blank 1 HCl-P	0.00	X	X
Chk Stnd 0.096 ppm P	0.09	X	X
Cal Stnd 0.20 ppm P	0.20	X	X
Chk Stnd 0.288 ppm P	0.27	X	X
DI Blank	0.00	X	X
21 Blake Lake 9-10 cm HCl-P	0.21	2948.70	0.63
22 Blake Lake 12-13 cm HCl-P	0.04	2926.27	0.13
23 Blake Lake 15-16 cm HCl-P	0.04	2954.14	0.12
24 Blake Lake 18-19 cm HCl-P	0.04	2884.81	0.12
25 Blake Lake 20-21 cm HCl-P	0.05	2662.21	0.12
26 Blake Lake 22-23 cm HCl-P	0.05	2641.00	0.13
27 Blake Lake 24-25 cm HCl-P	0.05	2555.17	0.12
28 Blake Lake 26-27 cm HCl-P	0.04	2942.36	0.13
29 Blake Lake 28-29 cm HCl-P	0.07	2556.33	0.17
30 DUP Blake Lake 28-29 cm HCl-P	0.05	2712.10	0.14
31 Blake Lake 30-31 cm HCl-P	0.04	2951.18	0.11
32 Blake Lake 32-33 cm HCl-P	0.04	2761.52	0.10
33 Blake Lake 36-37 cm HCl-P	0.04	2877.07	0.10
34 Blake Lake 38-39 cm HCl-P	0.03	3334.41	0.11
35 DUP Blake Lake 38-39 cm HCl-P	0.04	2797.93	0.11
LFB 2	0.17	X	X
Spike 33 Blake 36-37 cm HCl-P	0.21	X	X
DI Blank	0.00	X	X
DI Blank	0.00	X	X

Chk Stnd 0.096 ppm P	0.09	X	X
Cal Stnd 0.20 ppm P	0.20	X	X
Chk Stnd 0.288 ppm P	0.27	X	X
DI Blank	0.00	X	X
inst rep 26 Blake Lake 22-23 cm HCl-P	0.05	2641.00	0.13
inst rep 33 Blake Lake 36-37 cm HCl-P	0.04	2877.07	0.11

Sample ID	Final Result	Inst dup
	mg P/g	
19 Blake Lake 0-1 cm HCl-P	0.13	
20 Blake Lake 6-7 cm HCl-P	0.11	
21 Blake Lake 9-10 cm HCl-P	0.63	
22 Blake Lake 12-13 cm HCl-P	0.13	
23 Blake Lake 15-16 cm HCl-P	0.12	
24 Blake Lake 18-19 cm HCl-P	0.12	
25 Blake Lake 20-21 cm HCl-P	0.12	
26 Blake Lake 22-23 cm HCl-P	0.13	0.13
27 Blake Lake 24-25 cm HCl-P	0.12	
28 Blake Lake 26-27 cm HCl-P	0.13	
29 Blake Lake 28-29 cm HCl-P	0.17	
31 Blake Lake 30-31 cm HCl-P	0.11	
32 Blake Lake 32-33 cm HCl-P	0.10	
33 Blake Lake 36-37 cm HCl-P	0.10	0.11
34 Blake Lake 38-39 cm HCl-P	0.11	

Loss on Ignition

NOTE: perform LOI starting with deepest sample first, then work your way up the core to prevent sample contamination

Project:	Polk County	**Core:**	Blake Lake 1A**	**Collection:**	Sep-13	**Analysis:**	25-Mar-14	**Analyst:**
	MBE		Blake Lake 1B				3-Apr-14	E. Mittag
Sample ID	**Interval Top**	**Interval Bottom**	**Crucible #**	**Crucible Wt.**	**Wet Wt.**	**Dry Wt.**	**550 °C Wt.**	**1000 °C Wt.**
Blake Lake 1A	0.0	1.0	J-54	4.7136	7.7048	4.8009	4.7648	4.7611
Blake Lake 1A	1.0	2.0	J-52	4.9470	8.0229	5.0519	5.0092	5.0044
Blake Lake 1A	2.0	3.0	J-51	4.7555	7.7065	4.8654	4.8215	4.8157
Blake Lake 1A	3.0	4.0	J-48	4.6109	7.6625	4.7265	4.6798	4.6741
Blake Lake 1A	4.0	5.0	J-47	4.7787	7.7108	4.8974	4.8469	4.8422
Blake Lake 1A	5.0	6.0	J-44	4.7551	7.7185	4.8776	4.8255	4.8205
Blake Lake 1A	6.0	7.0	J-42	4.6789	7.6768	4.8128	4.7548	4.7502
Blake Lake 1A	7.0	8.0	J-41	5.0405	8.0750	5.1779	5.1178	5.1143
Blake Lake 1A	8.0	9.0	J-40	4.9132	8.0192	5.0517	4.9896	4.9862
Blake Lake 1A	9.0	10.0	J-39	5.1117	8.1889	5.2550	5.1920	5.1885
Blake Lake 1A	10.0	11.0	J-38	5.4476	8.4442	5.5871	5.5257	5.5222

Blake Lake 1A	11.0	12.0	J-37	4.9481	7.9976	5.0953	5.0294	5.0259
Blake Lake 1A	12.0	13.0	J-33	4.6898	7.7308	4.8311	4.7670	4.7637
Blake Lake 1A	13.0	14.0	J-32	5.2260	8.2856	5.3738	5.3103	5.3066
Blake Lake 1A	14.0	15.0	J-31	4.7909	7.7088	4.9411	4.8789	4.8751
Blake Lake 1A	15.0	16.0	J-30	4.8975	7.8849	5.0527	4.9905	4.9865
Blake Lake 1A	16.0	17.0	J-29	5.0841	8.0633	5.2465	5.1823	5.1780
Blake Lake 1A	17.0	18.0	J-25	5.3197	8.3695	5.4899	5.4243	5.4197
Blake Lake 1A	18.0	19.0	J-24	4.4116	7.4483	4.5855	4.5193	4.5145
Blake Lake 1A	19.0	20.0	J-22	5.0919	8.0854	5.2605	5.1963	5.1917
Blake Lake 1A	20.0	21.0	J-20	5.2462	8.2754	5.4184	5.3529	5.3481
Blake Lake 1A	21.0	22.0	J-19	5.1120	8.1591	5.2901	5.2227	5.2176
Blake Lake 1A	22.0	23.0	J-18	4.8268	7.7119	4.9970	4.9325	4.9279
Blake Lake 1A	23.0	24.0	J-17	4.7822	7.7319	4.9530	4.8877	4.8830
Blake Lake 1A	24.0	25.0	J-15	4.4877	7.4792	4.6646	4.5966	4.5922
Blake Lake 1A	25.0	26.0	J-14	4.5932	7.5065	4.7654	4.6984	4.6942
Blake Lake 1A	26.0	27.0	J-13	4.7927	7.7868	4.9668	4.8980	4.8938
Blake Lake 1A	27.0	28.0	J-5	4.8564	7.8067	5.0234	4.9554	4.9511
Blake Lake 1A	28.0	29.0	S-36	4.9589	7.9997	5.1286	5.0580	5.0531
Blake Lake 1A	29.0	30.0	S-35	4.6747	7.6412	4.8384	4.7687	4.7637
Blake Lake 1A	30.0	31.0	S-34	5.2051	8.2079	5.3697	5.2984	5.2938
Blake Lake 1A	31.0	32.0	S-29	4.8526	7.8019	5.0081	4.9386	4.9344
Blake Lake 1A	32.0	33.0	S-26	5.1389	8.1274	5.2926	5.2208	5.2164
Blake Lake 1A	33.0	34.0	S-25	4.9443	7.9798	5.0940	5.0207	5.0164
Blake Lake 1A	34.0	35.0	S-24	4.9494	7.9313	5.0913	5.0190	5.0149
Blake Lake 1A	35.0	36.0	S-23	5.0792	8.0265	5.2120	5.1406	5.1373
Blake Lake 1A	36.0	37.0	S-21	4.6429	7.6725	4.7768	4.7042	4.7004
Blake Lake 1A	37.0	38.0	S-20	4.9967	7.9396	5.1272	5.0579	5.0540
Blake Lake 1A	38.0	39.0	S-17	4.9566	7.9827	5.0894	5.0185	5.0143
Blake Lake 1A	39.0	40.0	S-16	5.0162	8.0097	5.1482	5.0782	5.0744
Blake Lake 1A	40.0	41.0	S-13	5.1001	8.1485	5.2329	5.1614	5.1574
Blake Lake 1A	41.0	42.0	S-12	5.1588	8.1543	5.2885	5.2182	5.2144
Blake Lake 1A	42.0	43.0	S-11	5.1106	8.1251	5.2450	5.1717	5.1681
Blake Lake 1A	43.0	44.0	S-7	5.0386	7.9983	5.1680	5.0969	5.0934
Blake Lake 1A	44.0	45.0	S-5	4.8530	7.8725	4.9905	4.9152	4.9116
Blake Lake 1A	46.0	47.0	S-34	5.2051	8.2765	5.3767	5.2815	5.2767
Blake Lake 1A	48.0	49.0	S-29	4.8527	7.9009	5.0196	4.9275	4.9226
Blake Lake 1A	50.0	51.0	Z-52	4.6798	7.6408	4.8427	4.7535	4.7492
Blake Lake 1A	52.0	53.0	S-26	5.1389	8.1716	5.3002	5.2149	5.2103
Blake Lake 1A	54.0	55.0	S-25	4.9444	7.9169	5.1081	5.0227	5.0181
Blake Lake 1A	56.0	57.0	Z-29	5.3850	8.2815	5.5437	5.4581	5.4542
Blake Lake 1A	58.0	59.0	S-24	4.9495	7.9046	5.1158	5.0294	5.0253
Blake Lake 1A	60.0	61.0	S-23	5.0790	8.0071	5.2490	5.1624	5.1580
Blake Lake 1A	62.0	63.0	Z-37	4.8189	7.8538	5.0078	4.9146	4.9100
Blake Lake 1A	64.0	65.0	S-21	4.6429	7.6384	4.8275	4.7390	4.7343
Blake Lake 1A	66.0	67.0	S-20	4.9966	7.9651	5.1826	5.0943	5.0895
Blake Lake 1A	68.0	69.0	Z-27	4.9684	7.9441	5.1591	5.0661	5.0612
Blake Lake 1A	70.0	71.0	S-16	5.0164	8.0806	5.2091	5.1158	5.1108
Blake Lake 1A	72.0	73.0	S-13	5.1001	8.1430	5.2895	5.1982	5.1934
Blake Lake 1A	74.0	75.0	Z-26	4.8084	7.8514	5.0025	4.9092	4.9044
Blake Lake 1A	76.0	77.0	S-12	5.1589	8.2109	5.3630	5.2695	5.2646

Blake Lake 1A	78.0	79.0	S-7	5.0387	8.0460	5.2378	5.1476	5.1425
Blake Lake 1A	80.0	81.0	Z-39	4.6828	7.6358	4.8679	4.7825	4.7774
Blake Lake 1A	82.0	83.0	S-5	4.8530	7.8650	5.0490	4.9633	4.9584
Blake Lake 1A	84.0	85.0	Z-55	4.8741	7.8325	5.0712	4.9856	4.9806
Blake Lake 1A	86.0	87.0	Z-59	4.7860	7.7288	4.9901	4.9009	4.8960
Blake Lake 1A	88.0	89.0	Z-24	4.8646	7.8962	5.0658	4.9771	4.9721
Blake Lake 1A	90.0	91.0	Z-47	5.2157	8.2468	5.4250	5.3327	5.3275
Blake Lake 1A	92.0	93.0	Z-44	4.9861	7.9505	5.2050	5.1146	5.1088
Blake Lake 1A	94.0	95.0	Z-10	4.9096	7.9547	5.1431	5.0508	5.0444
Blake Lake 1A	96.0	97.0	Z-43	4.9438	7.9804	5.1770	5.0846	5.0784
Blake Lake 1A	98.0	99.0	Z-34	4.9366	7.9912	5.1616	5.0648	5.0592
Blake Lake 1A	100.0	101.0	Z-60	4.9902	7.9320	5.2148	5.1228	5.1169
Blake Lake 1A	102.0	103.0	Z-9	4.6881	7.7483	4.9322	4.8359	4.8297
Blake Lake 1A	104.0	105.0	Z-51	5.0863	8.0602	5.3239	5.2292	5.2231
Blake Lake 1A	106.0	107.0	Z-11	4.9071	7.9330	5.1297	5.0375	5.0323
Blake Lake 1A	108.0	109.0	Z-38	4.9131	7.9457	5.1384	5.0463	5.0405
Blake Lake 1A	110.0	111.0	Z-6	5.0461	8.0197	5.2729	5.1820	5.1762
Blake Lake 1A	112.0	113.0	Z-16	4.6458	7.6271	4.8712	4.7813	4.7754
Blake Lake 1A	114.0	115.0	Z-8	4.7436	7.7185	4.9638	4.8745	4.8685
Blake Lake 1A	116.0	117.0	Z-56	4.7358	7.7388	4.9464	4.8555	4.8495
Blake Lake 1A	118.0	119.0	Z-49	4.8541	7.8241	5.0638	4.9729	4.9668
Blake Lake 1A	120.0	121.0	Z-53	4.8660	7.7489	5.0584	4.9686	4.9638
Blake Lake 1A	122.0	123.0	Z-21	5.0237	8.0362	5.2249	5.1332	5.1284
Blake Lake 1A	124.0	125.0	Z-23	4.9936	7.9917	5.1936	5.1038	5.0987
Blake Lake 1A	126.0	127.0	Z-57	4.8729	7.8889	5.0843	4.9928	4.9872
Blake Lake 1A	128.0	129.0	Z-4	4.6124	7.5957	4.8148	4.7234	4.7181
Blake Lake 1A	130.0	131.0	Z-42	4.8919	7.7758	5.0854	4.9992	4.9940
Blake Lake 1A	132.0	133.0	B-44	4.8007	7.8049	5.0009	4.9097	4.9045
Blake Lake 1A	134.0	135.0	B-52	4.6251	7.5928	4.8326	4.7424	4.7368
Blake Lake 1A	136.0	137.0	B-36	4.5418	7.5242	4.7473	4.6582	4.6528
Blake Lake 1A	138.0	139.0	B-53	5.4701	8.4113	5.6742	5.5858	5.5804
Blake Lake 1A	140.0	141.0	B-43	5.3801	8.2951	5.5780	5.4868	5.4815
Blake Lake 1A	142.0	143.0	B-15	5.3245	8.2453	5.5304	5.4389	5.4336
Blake Lake 1A	144.0	145.0	B-26	4.7378	7.6670	4.9559	4.8646	4.8589
Blake Lake 1A	146.0	147.0	B-17	5.5182	8.4741	5.7412	5.6471	5.6412
Blake Lake 1A	148.0	149.0	B-11	5.0749	7.9484	5.3038	5.2125	5.2067
Blake Lake 1A	150.0	151.0	B-33	5.0259	8.0486	5.2695	5.1687	5.1628
Blake Lake 1A	152.0	153.0	B-5	4.8944	7.8585	5.1414	5.0384	5.0319
Blake Lake 1B	1.0	2.0	B-53	5.4697	8.5233	5.5736	5.5338	5.5265
Blake Lake 1B	3.0	4.0	B-50	5.3828	8.3420	5.4932	5.4504	5.4436
Blake Lake 1B	5.0	6.0	B-48	5.3359	8.3911	5.4527	5.4032	5.3996
Blake Lake 1B	7.0	8.0	B-44	4.8000	7.8795	4.9395	4.8796	4.8746
Blake Lake 1B	9.0	10.0	B-43	5.3803	8.3482	5.5223	5.4633	5.4575
Blake Lake 1B	11.0	12.0	B-41	4.9919	7.9732	5.1350	5.0747	5.0710
Blake Lake 1B	13.0	14.0	B-36	4.5412	7.5066	4.6881	4.6259	4.6223
Blake Lake 1B	15.0	16.0	B-35	4.9763	7.9756	5.1249	5.0627	5.0591
Blake Lake 1B	17.0	18.0	B-24	4.7888	7.7446	4.9462	4.8848	4.8806
Blake Lake 1B	19.0	20.0	B-33	5.0255	8.0913	5.1945	5.1306	5.1259
Blake Lake 1B	21.0	22.0	B-31	5.6499	8.6976	5.8232	5.7577	5.7530
Blake Lake 1B	23.0	24.0	B-30	5.3380	8.3906	5.5153	5.4485	5.4430

Blake Lake 1B	25.0	26.0	B-28	5.5218	8.5645	5.7010	5.6319	5.6272
Blake Lake 1B	27.0	28.0	B-26	4.7378	7.7571	4.9102	4.8423	4.8378
Blake Lake 1B	29.0	30.0	B-17	5.5180	8.5475	5.6805	5.6098	5.6053
Blake Lake 1B	31.0	32.0	B-16	5.4115	8.4835	5.5596	5.4871	5.4831
Blake Lake 1B	33.0	34.0	B-15	5.3243	8.3185	5.4578	5.3878	5.3842
Blake Lake 1B	35.0	36.0	B-11	5.0746	8.0154	5.2102	5.1409	5.1369
Blake Lake 1B	37.0	38.0	B-9	4.6847	7.6344	4.8151	4.7461	4.7420
Blake Lake 1B	39.0	40.0	B-5	4.8939	7.8904	5.0244	4.9563	4.9523
Blake Lake 1B	41.0	42.0	B-3	5.0986	8.0344	5.2366	5.1689	5.1652
Blake Lake 1B	43.0	44.0	B-2	4.7288	7.7329	4.8576	4.7872	4.7836

** Every other interval of core 1A subsectioned for pigments, starting with interval 1-2 cm. Every other interval of second half of core also subsectioned for pigments (i.e. every interval that is LOI'ed)

** Core extended to reach background. LOI for these intervals started on 4/3/2014

Core	Top	Base	Wt. Cruc.	Wt. Wet	Wt. 100	Wt. 500	Wt. 1000	Volume	Wet (g/cc)	Dry (g/cc)	Dry/ Wet	Org/ Wet	% Organic	% CaCO3	% Inorg.
Blake 1A	0.0	1.0	4.714	7.705	4.801	4.765	4.761	2.949	1.014	0.030	0.029	0.012	41.352	9.638	49.011
Blake 1A	1.0	2.0	4.947	8.023	5.052	5.009	5.004	3.025	1.017	0.035	0.034	0.014	40.705	10.405	48.889
Blake 1A	2.0	3.0	4.756	7.707	4.865	4.822	4.816	2.898	1.018	0.038	0.037	0.015	39.945	12.001	48.054
Blake 1A	3.0	4.0	4.611	7.663	4.727	4.680	4.674	2.996	1.019	0.039	0.038	0.015	40.398	11.213	48.389
Blake 1A	4.0	5.0	4.779	7.711	4.897	4.847	4.842	2.876	1.020	0.041	0.040	0.017	42.544	9.004	48.452
Blake 1A	5.0	6.0	4.755	7.719	4.878	4.826	4.821	2.905	1.020	0.042	0.041	0.018	42.531	9.282	48.188
Blake 1A	6.0	7.0	4.679	7.677	4.813	4.755	4.750	2.934	1.022	0.046	0.045	0.019	43.316	7.812	48.872
Blake 1A	7.0	8.0	5.041	8.075	5.178	5.118	5.114	2.970	1.022	0.046	0.045	0.020	43.741	5.793	50.467
Blake 1A	8.0	9.0	4.913	8.019	5.052	4.990	4.986	3.041	1.021	0.046	0.045	0.020	44.838	5.582	49.580
Blake 1A	9.0	10.0	5.112	8.189	5.255	5.192	5.189	3.010	1.022	0.048	0.047	0.020	43.964	5.554	50.482
Blake 1A	10.0	11.0	5.448	8.444	5.587	5.526	5.522	2.931	1.022	0.048	0.047	0.020	44.014	5.705	50.280
Blake 1A	11.0	12.0	4.948	7.998	5.095	5.029	5.026	2.981	1.023	0.049	0.048	0.022	44.769	5.407	49.824
Blake 1A	12.0	13.0	4.690	7.731	4.831	4.767	4.764	2.975	1.022	0.047	0.046	0.021	45.364	5.311	49.325
Blake 1A	13.0	14.0	5.226	8.286	5.374	5.310	5.307	2.989	1.024	0.049	0.048	0.021	42.963	5.693	51.344
Blake 1A	14.0	15.0	4.791	7.709	4.941	4.879	4.875	2.846	1.025	0.053	0.051	0.021	41.411	5.753	52.835
Blake 1A	15.0	16.0	4.898	7.885	5.053	4.991	4.987	2.912	1.026	0.053	0.052	0.021	40.077	5.861	54.062
Blake 1A	16.0	17.0	5.084	8.063	5.247	5.182	5.178	2.900	1.027	0.056	0.055	0.022	39.532	6.021	54.447
Blake 1A	17.0	18.0	5.320	8.370	5.490	5.424	5.420	2.967	1.028	0.057	0.056	0.022	38.543	6.146	55.311
Blake 1A	18.0	19.0	4.412	7.448	4.586	4.519	4.515	2.951	1.029	0.059	0.057	0.022	38.068	6.277	55.655
Blake 1A	19.0	20.0	5.092	8.085	5.261	5.196	5.192	2.911	1.028	0.058	0.056	0.021	38.078	6.204	55.717
Blake 1A	20.0	21.0	5.246	8.275	5.418	5.353	5.348	2.945	1.029	0.058	0.057	0.022	38.037	6.339	55.624
Blake 1A	21.0	22.0	5.112	8.159	5.290	5.223	5.218	2.960	1.029	0.060	0.058	0.022	37.844	6.512	55.644
Blake 1A	22.0	23.0	4.827	7.712	4.997	4.933	4.928	2.801	1.030	0.061	0.059	0.022	37.897	6.146	55.957
Blake 1A	23.0	24.0	4.782	7.732	4.953	4.888	4.883	2.866	1.029	0.060	0.058	0.022	38.232	6.257	55.511
Blake 1A	24.0	25.0	4.488	7.479	4.665	4.597	4.592	2.905	1.030	0.061	0.059	0.023	38.440	5.656	55.904
Blake 1A	25.0	26.0	4.593	7.507	4.765	4.698	4.694	2.829	1.030	0.061	0.059	0.023	38.908	5.546	55.545
Blake 1A	26.0	27.0	4.793	7.787	4.967	4.898	4.894	2.910	1.029	0.060	0.058	0.023	39.518	5.486	54.997
Blake 1A	27.0	28.0	4.856	7.807	5.023	4.955	4.951	2.870	1.028	0.058	0.057	0.023	40.719	5.855	53.426
Blake 1A	28.0	29.0	4.959	8.000	5.129	5.058	5.053	2.959	1.028	0.057	0.056	0.023	41.603	6.566	51.831
Blake 1A	29.0	30.0	4.675	7.641	4.838	4.769	4.764	2.889	1.027	0.057	0.055	0.023	42.578	6.946	50.476
Blake 1A	30.0	31.0	5.205	8.208	5.370	5.298	5.294	2.925	1.027	0.056	0.055	0.024	43.317	6.355	50.328
Blake 1A	31.0	32.0	4.853	7.802	5.008	4.939	4.934	2.876	1.025	0.054	0.053	0.024	44.695	6.142	49.163
Blake 1A	32.0	33.0	5.139	8.127	5.293	5.221	5.216	2.917	1.025	0.053	0.051	0.024	46.714	6.510	46.776
Blake 1A	33.0	34.0	4.944	7.980	5.094	5.021	5.016	2.967	1.023	0.050	0.049	0.024	48.965	6.532	44.504
Blake 1A	34.0	35.0	4.949	7.931	5.091	5.019	5.015	2.918	1.022	0.049	0.048	0.024	50.951	6.570	42.478
Blake 1A	35.0	36.0	5.079	8.027	5.212	5.141	5.137	2.889	1.020	0.046	0.045	0.024	53.765	5.651	40.584
Blake 1A	36.0	37.0	4.643	7.673	4.777	4.704	4.700	2.971	1.020	0.045	0.044	0.024	54.220	6.453	39.327
Blake 1A	37.0	38.0	4.997	7.940	5.127	5.058	5.054	2.885	1.020	0.045	0.044	0.024	53.103	6.796	40.101
Blake 1A	38.0	39.0	4.957	7.983	5.089	5.019	5.014	2.968	1.020	0.045	0.044	0.023	53.389	7.192	39.420
Blake 1A	39.0	40.0	5.016	8.010	5.148	5.078	5.074	2.935	1.020	0.045	0.044	0.023	53.030	6.546	40.423
Blake 1A	40.0	41.0	5.100	8.149	5.233	5.161	5.157	2.990	1.020	0.044	0.044	0.023	53.840	6.849	39.310

Blake 1A	41.0	42.0	5.159	8.154	5.289	5.218	5.214	2.939	1.019	0.044	0.043	0.023	54.202	6.662	39.136
Blake 1A	42.0	43.0	5.111	8.125	5.245	5.172	5.168	2.956	1.020	0.045	0.045	0.024	54.539	6.091	39.370
Blake 1A	43.0	44.0	5.039	7.998	5.168	5.097	5.093	2.903	1.020	0.045	0.044	0.024	54.946	6.151	38.903
Blake 1A	44.0	45.0	4.853	7.873	4.991	4.915	4.912	2.960	1.020	0.046	0.046	0.025	54.764	5.954	39.283
Blake 1A	46.0	47.0	5.205	8.277	5.377	5.282	5.277	2.997	1.025	0.057	0.056	0.031	55.478	6.361	38.161
Blake 1A	48.0	49.0	4.853	7.901	5.020	4.928	4.923	2.976	1.024	0.056	0.055	0.030	55.183	6.676	38.141
Blake 1A	50.0	51.0	4.680	7.641	4.843	4.754	4.749	2.890	1.025	0.056	0.055	0.030	54.758	6.003	39.240
Blake 1A	52.0	53.0	5.139	8.172	5.300	5.215	5.210	2.961	1.024	0.054	0.053	0.028	52.883	6.485	40.632
Blake 1A	54.0	55.0	4.944	7.917	5.108	5.023	5.018	2.900	1.025	0.056	0.055	0.029	52.169	6.390	41.441
Blake 1A	56.0	57.0	5.385	8.282	5.544	5.458	5.454	2.827	1.025	0.056	0.055	0.030	53.938	5.588	40.473
Blake 1A	58.0	59.0	4.950	7.905	5.116	5.029	5.025	2.881	1.026	0.058	0.056	0.029	51.954	5.606	42.439
Blake 1A	60.0	61.0	5.079	8.007	5.249	5.162	5.158	2.852	1.027	0.060	0.058	0.030	50.941	5.886	43.173
Blake 1A	62.0	63.0	4.819	7.854	5.008	4.915	4.910	2.949	1.029	0.064	0.062	0.031	49.338	5.538	45.124
Blake 1A	64.0	65.0	4.643	7.638	4.828	4.739	4.734	2.911	1.029	0.063	0.062	0.030	47.941	5.790	46.269
Blake 1A	66.0	67.0	4.997	7.965	5.183	5.094	5.090	2.883	1.030	0.065	0.063	0.030	47.473	5.868	46.658
Blake 1A	68.0	69.0	4.968	7.944	5.159	5.066	5.061	2.889	1.030	0.066	0.064	0.031	48.768	5.843	45.389
Blake 1A	70.0	71.0	5.016	8.081	5.209	5.116	5.111	2.976	1.030	0.065	0.063	0.030	48.417	5.900	45.682
Blake 1A	72.0	73.0	5.100	8.143	5.290	5.198	5.193	2.956	1.029	0.064	0.062	0.030	48.205	5.763	46.032
Blake 1A	74.0	75.0	4.808	7.851	5.003	4.909	4.904	2.954	1.030	0.066	0.064	0.031	48.068	5.623	46.309
Blake 1A	76.0	77.0	5.159	8.211	5.363	5.270	5.265	2.957	1.032	0.069	0.067	0.031	45.811	5.459	48.730
Blake 1A	78.0	79.0	5.039	8.046	5.238	5.148	5.143	2.914	1.032	0.068	0.066	0.030	45.304	5.825	48.871
Blake 1A	80.0	81.0	4.683	7.636	4.868	4.783	4.777	2.867	1.030	0.065	0.063	0.029	46.137	6.265	47.597
Blake 1A	82.0	83.0	4.853	7.865	5.049	4.963	4.958	2.919	1.032	0.067	0.065	0.028	43.724	5.685	50.591
Blake 1A	84.0	85.0	4.874	7.833	5.071	4.986	4.981	2.865	1.033	0.069	0.067	0.029	43.430	5.769	50.802
Blake 1A	86.0	87.0	4.786	7.729	4.990	4.901	4.896	2.846	1.034	0.072	0.069	0.030	43.704	5.459	50.837
Blake 1A	88.0	89.0	4.865	7.896	5.066	4.977	4.972	2.937	1.032	0.069	0.066	0.029	44.085	5.651	50.263
Blake 1A	90.0	91.0	5.216	8.247	5.425	5.333	5.328	2.933	1.033	0.071	0.069	0.030	44.099	5.650	50.251
Blake 1A	92.0	93.0	4.986	7.951	5.205	5.115	5.109	2.859	1.037	0.077	0.074	0.030	41.297	6.025	52.677
Blake 1A	94.0	95.0	4.910	7.955	5.143	5.051	5.044	2.932	1.039	0.080	0.077	0.030	39.529	6.233	54.238
Blake 1A	96.0	97.0	4.944	7.980	5.177	5.085	5.078	2.923	1.039	0.080	0.077	0.030	39.623	6.046	54.332
Blake 1A	98.0	99.0	4.937	7.991	5.162	5.065	5.059	2.948	1.036	0.076	0.074	0.032	43.022	5.660	51.318
Blake 1A	100.0	101.0	4.990	7.932	5.215	5.123	5.117	2.834	1.038	0.079	0.076	0.031	40.962	5.974	53.065
Blake 1A	102.0	103.0	4.688	7.748	4.932	4.836	4.830	2.942	1.040	0.083	0.080	0.031	39.451	5.776	54.773
Blake 1A	104.0	105.0	5.086	8.060	5.324	5.229	5.223	2.859	1.040	0.083	0.080	0.032	39.857	5.838	54.305
Blake 1A	106.0	107.0	4.907	7.933	5.130	5.038	5.032	2.919	1.037	0.076	0.074	0.030	41.420	5.312	53.268
Blake 1A	108.0	109.0	4.913	7.946	5.138	5.046	5.041	2.924	1.037	0.077	0.074	0.030	40.879	5.854	53.267
Blake 1A	110.0	111.0	5.046	8.020	5.273	5.182	5.176	2.864	1.038	0.079	0.076	0.031	40.079	5.815	54.105
Blake 1A	112.0	113.0	4.646	7.627	4.871	4.781	4.775	2.872	1.038	0.078	0.076	0.030	39.885	5.952	54.163
Blake 1A	114.0	115.0	4.744	7.719	4.964	4.875	4.869	2.869	1.037	0.077	0.074	0.030	40.554	6.196	53.250
Blake 1A	116.0	117.0	4.736	7.739	4.946	4.856	4.850	2.903	1.034	0.073	0.070	0.030	43.162	6.479	50.359
Blake 1A	118.0	119.0	4.854	7.824	5.064	4.973	4.967	2.871	1.034	0.073	0.071	0.031	43.348	6.615	50.037
Blake 1A	120.0	121.0	4.866	7.749	5.058	4.969	4.964	2.794	1.032	0.069	0.067	0.031	46.674	5.673	47.653
Blake 1A	122.0	123.0	5.024	8.036	5.225	5.133	5.128	2.919	1.032	0.069	0.067	0.030	45.577	5.425	48.998
Blake 1A	124.0	125.0	4.994	7.992	5.194	5.104	5.099	2.904	1.032	0.069	0.067	0.030	44.900	5.799	49.301
Blake 1A	126.0	127.0	4.873	7.889	5.084	4.993	4.987	2.916	1.034	0.072	0.070	0.030	43.283	6.024	50.693
Blake 1A	128.0	129.0	4.612	7.596	4.815	4.723	4.718	2.889	1.033	0.070	0.068	0.031	45.158	5.955	48.887
Blake 1A	130.0	131.0	4.892	7.776	5.085	4.999	4.994	2.793	1.033	0.069	0.067	0.030	44.548	6.111	49.341
Blake 1A	132.0	133.0	4.801	7.805	5.001	4.910	4.905	2.911	1.032	0.069	0.067	0.030	45.554	5.906	48.539
Blake 1A	134.0	135.0	4.625	7.593	4.833	4.742	4.737	2.870	1.034	0.072	0.070	0.030	43.470	6.137	50.393
Blake 1A	136.0	137.0	4.542	7.524	4.747	4.658	4.653	2.885	1.034	0.071	0.069	0.030	43.358	5.975	50.667
Blake 1A	138.0	139.0	5.470	8.411	5.674	5.586	5.580	2.845	1.034	0.072	0.069	0.030	43.312	6.016	50.671
Blake 1A	140.0	141.0	5.380	8.295	5.578	5.487	5.482	2.823	1.033	0.070	0.068	0.031	46.084	6.090	47.826
Blake 1A	142.0	143.0	5.325	8.245	5.530	5.439	5.434	2.824	1.034	0.073	0.070	0.031	44.439	5.853	49.708
Blake 1A	144.0	145.0	4.738	7.667	4.956	4.865	4.859	2.825	1.037	0.077	0.074	0.031	41.862	5.943	52.195
Blake 1A	146.0	147.0	5.518	8.474	5.741	5.647	5.641	2.850	1.037	0.078	0.075	0.032	42.197	6.016	51.786
Blake 1A	148.0	149.0	5.075	7.948	5.304	5.213	5.207	2.763	1.040	0.083	0.080	0.032	39.886	5.762	54.352
Blake 1A	150.0	151.0	5.026	8.049	5.270	5.169	5.163	2.906	1.040	0.084	0.081	0.033	41.379	5.508	53.113
Blake 1A	152.0	153.0	4.894	7.859	5.141	5.038	5.032	2.846	1.041	0.087	0.083	0.035	41.700	5.984	52.315
Blake 1B	1.0	2.0	5.4697	8.5233	5.5736	5.5338	5.5265	3.003	1.0168	0.0346	0.0340	0.0130	38.31	15.98	45.72

Blake 1B	3.0	4.0	5.3828	8.3420	5.4932	5.4504	5.4436	2.905	1.0187	0.0380	0.0373	0.0145	38.77	14.01	47.23
Blake 1B	5.0	6.0	5.3359	8.3911	5.4527	5.4032	5.3996	3.000	1.0184	0.0389	0.0382	0.0162	42.38	7.01	50.61
Blake 1B	7.0	8.0	4.8000	7.8795	4.9395	4.8796	4.8746	3.013	1.0221	0.0463	0.0453	0.0195	42.94	8.15	48.91
Blake 1B	9.0	10.0	5.3803	8.3482	5.5223	5.4633	5.4575	2.900	1.0234	0.0490	0.0478	0.0199	41.55	9.29	49.16
Blake 1B	11.0	12.0	4.9919	7.9732	5.1350	5.0747	5.0710	2.913	1.0234	0.0491	0.0480	0.0202	42.14	5.88	51.98
Blake 1B	13.0	14.0	4.5412	7.5066	4.6881	4.6259	4.6223	2.895	1.0243	0.0507	0.0495	0.0210	42.34	5.57	52.09
Blake 1B	15.0	16.0	4.9763	7.9756	5.1249	5.0627	5.0591	2.928	1.0244	0.0508	0.0495	0.0207	41.86	5.51	52.63
Blake 1B	17.0	18.0	4.7888	7.7446	4.9462	4.8848	4.8806	2.879	1.0267	0.0547	0.0533	0.0208	39.01	6.07	54.92
Blake 1B	19.0	20.0	5.0255	8.0913	5.1945	5.1306	5.1259	2.983	1.0278	0.0567	0.0551	0.0208	37.81	6.32	55.87
Blake 1B	21.0	22.0	5.6499	8.6976	5.8232	5.7577	5.7530	2.962	1.0289	0.0585	0.0569	0.0215	37.80	6.17	56.04
Blake 1B	23.0	24.0	5.3380	8.3906	5.5153	5.4485	5.4430	2.965	1.0295	0.0598	0.0581	0.0219	37.68	7.05	55.27
Blake 1B	25.0	26.0	5.5218	8.5645	5.7010	5.6319	5.6272	2.955	1.0297	0.0606	0.0589	0.0227	38.56	5.96	55.48
Blake 1B	27.0	28.0	4.7378	7.7571	4.9102	4.8423	4.8378	2.935	1.0287	0.0587	0.0571	0.0225	39.39	5.94	54.68
Blake 1B	29.0	30.0	5.5180	8.5475	5.6805	5.6098	5.6053	2.953	1.0259	0.0550	0.0536	0.0233	43.51	6.30	50.20
Blake 1B	31.0	32.0	5.4115	8.4835	5.5596	5.4871	5.4831	3.005	1.0223	0.0493	0.0482	0.0236	48.95	6.14	44.90
Blake 1B	33.0	34.0	5.3243	8.3185	5.4578	5.3878	5.3842	2.935	1.0202	0.0455	0.0446	0.0234	52.43	6.13	41.43
Blake 1B	35.0	36.0	5.0746	8.0154	5.2102	5.1409	5.1369	2.880	1.0211	0.0471	0.0461	0.0236	51.11	6.71	42.19
Blake 1B	37.0	38.0	4.6847	7.6344	4.8151	4.7461	4.7420	2.892	1.0200	0.0451	0.0442	0.0234	52.91	7.15	39.94
Blake 1B	39.0	40.0	4.8939	7.8904	5.0244	4.9563	4.9523	2.939	1.0196	0.0444	0.0436	0.0227	52.18	6.97	40.85
Blake 1B	41.0	42.0	5.0986	8.0344	5.2366	5.1689	5.1652	2.873	1.0219	0.0480	0.0470	0.0231	49.06	6.10	44.85
Blake 1B	43.0	44.0	4.7288	7.7329	4.8576	4.7872	4.7836	2.948	1.0190	0.0437	0.0429	0.0234	54.66	6.36	38.99

Blake SiO2

Blue = no consistent increase in concentration

Sample ID	mg/g SiO2	mg/g SiO2	mg/g SiO2
	3 hour	4 hour	5 hour
Blake Lake 1A 1 cm	99.09	99.65	101.35
Blake Lake 1A 7 cm	89.91	92.29	94.30
Blake Lake 1A 10 cm	93.27	95.28	96.35
Blake Lake 1A 13 cm	116.23	118.17	119.82
Blake Lake 1A 16 cm	131.21	140.97	140.85
Blake Lake 1A 19 cm	133.50	141.50	142.50
Blake Lake 1A 21 cm	127.82	133.27	132.29
Blake Lake 1A 23 cm	114.55	117.63	121.05
Blake Lake 1A 25 cm	106.83	109.85	111.21
Blake Lake 1A 27 cm	115.05	119.39	121.19
Blake Lake 1A 29 cm	130.91	133.19	136.68
Blake Lake 1A 31 cm	126.67	130.39	132.32
Blake Lake 1A 33 cm	138.38	141.57	141.76
Blake Lake 1A 37 cm	124.18	126.04	128.21
Blake Lake 1A 39 cm	129.64	131.11	132.34

Conc Method				mg/g SiO2	Depth		g/cm2 yr	g/cm2 yr		wt % BSi	mg/cm2 yr
(1)-slope, (0)-mean	slope	int	ave	conc	0.00	Date	sed rate	flux SiO2	Adj depth	wt % BSi	flux SiO2
1.00	1.129723	95.50967	100.03	95.51	1	2012.6	0.0271	0.0026		9.5510	2.5883
1.00	2.194486	83.38963	92.17	83.39	7	2003.0	0.0203	0.0017		8.3390	1.6928
1.00	1.539541	88.81138	94.97	88.81	10	1995.3	0.0174	0.0015		8.8811	1.5453
1.00	1.795961	110.8926	118.08	110.89	13	1986.7	0.0159	0.0018		11.0893	1.7632
0.00	4.819435	118.3968	137.67	137.67	16	1976.0	0.0137	0.0019		13.7675	1.8861

1.00	4.502345	121.1578	139.17	121.16	19	1963.4	0.0133	0.0016		12.1158	1.6114
0.00	2.237543	122.1749	131.13	131.13	21	1954.3	0.0128	0.0017		13.1125	1.6784
1.00	3.249714	104.742	117.74	104.74	23	1944.6	0.0123	0.0013		10.4742	1.2883
1.00	2.191588	100.5315	109.30	100.53	25	1933.8	0.0110	0.0011		10.0532	1.1058
1.00	3.066938	106.2773	118.55	106.28	27	1922.5	0.0105	0.0011		10.6277	1.1159
1.00	2.885729	122.0546	133.60	122.05	29	1910.7	0.0097	0.0012		12.2055	1.1839
1.00	2.823704	118.4994	129.79	118.50	31	1897.5	0.0081	0.0010		11.8499	0.9598
1.00	1.689403	133.8121	140.57	133.81	33	1882.3	0.0067	0.0009		13.3812	0.8965
1.00	2.015708	118.0819	126.14	118.08	37	1852.5	0.0080	0.0009		11.8082	0.9447
1.00	1.345813	125.648	131.03	125.65	39	1838.1	0.0057	0.0007		12.5648	0.7162
										g/100g sed	

Blake Isotopes

Sample	$d^{15}N_{AIR}$	$d^{13}C_{VPDB}$	mgN	mgC	%N	%C	C/N
BL2009	1.0	-27.9	236.68	1960.28	2.55	21.13	9.7
BL2003	1.0	-28.6	230.84	1862.27	2.75	22.15	9.4
BL1995	0.9	-29.2	231.26	1845.85	2.85	22.72	9.3
BL1987	0.7	-28.9	264.97	2142.73	2.74	22.12	9.4
BL1976	0.5	-28.7	228.16	1831.74	2.58	20.72	9.4
BL1963	0.4	-29.1	228.33	1828.88	2.61	20.89	9.3
BL1954	0.5	-29.6	220.84	1758.54	2.48	19.75	9.3
BL1945	0.8	-29.3	219.59	1782.76	2.44	19.82	9.5
BL1934	2.0	-29.3	222.68	1813.73	2.46	20.08	9.5
BL1923	-0.5	-28.3	229.58	1906.88	2.41	20.01	9.7
BL1911	-0.6	-28.5	211.69	1753.87	2.44	20.24	9.7
BL1898	-0.7	-28.7	237.83	1995.70	2.65	22.27	9.8
BL1882	-0.8	-29.3	219.72	1859.64	2.65	22.40	9.9
BL1866	-0.8	-29.1	243.54	2080.46	2.90	24.77	10.0
BL1853	-0.8	-29.3	245.61	2103.34	2.97	25.41	10.0
BL1838	-1.1	-28.8	306.54	2636.81	3.22	27.71	10.0
BL1815	-1.1	-28.8	303.54	2611.37	3.36	28.87	10.0

Pigment Concentrations

Pigment Concentration Calculation

Section Depth (cm)	Fuco	Sed_A	Sed_B	Sed_C	Aphan	Sudan	Myxo	Allo	Diato	Lut_Zea
3--4	31.05304689	0	0	0	31.0671932	2033.642	0	165.2800014	145.0380153	346.3910559
7--8	16.23168075	0	0	0	15.95638466	2279.2495	0	150.825612	109.0869187	305.9735523
9--10	14.93172187	0	0	0	20.86694268	2188.342	0	152.3186126	125.5025163	298.3519497
13-14	14.79421133	0	0	0	0	2503.256	0	140.5416088	128.8175258	334.7567215
15-16	8.576819604	0	0	0	0	1990.8615	0	107.7368038	108.4051535	267.7994922
19-20	9.785285356	0	0	0	0	1765.331	0	74.24860318	92.19123306	165.257122
21-22	7.713588821	0	0	0	0	1931.0385	0	64.64289253	75.26281473	119.5296858
23-24	7.653929162	0	0	0	0	1877.7605	0	73.68978982	95.85646179	168.0574846
25-26	6.749317382	0	0	0	0	2258.229	0	71.23994882	96.26756804	165.2329143

27-28	6.639704746	0	0	0	0	1866.0985	0	58.10296324	81.80850198	140.6015416
29-30	6.239291583	0	0	0	0	1938.6375	0	58.01942953	86.710069	153.1762884
31-32	6.898390742	0	0	0	0	2349.456	0	68.62846661	97.56205971	170.2668582
33-34	5.465112021	0	0	0	0	2418.328	0	66.74730412	102.6774829	187.4170604
37-38	7.105396212	0	0	0	0	2507.8765	0	79.02034796	110.0501576	277.1742728
39-40	5.487616739	0	0	0	0	2506.572	0	75.64882819	112.9473764	291.3088454

Section Depth (cm)	**Cantha**	**Chl_b**	**Chl_a**	**Chl_ap**	**Echine**	**Phaeo_B**	**Pheo_A**	**B-car**
3--4	101.8612939	86.8640816	193.6905125	58.58793327	133.1891678	255.4396553	503.4950594	234.8576189
7--8	93.10083593	85.88730042	146.6324351	65.65988627	89.12257651	302.3738112	399.0457666	161.3827107
9--10	98.31300553	79.15388796	122.441363	77.37080592	69.59611006	354.0516822	359.9081981	173.1601279
13-14	86.66311399	62.14422556	104.800885	56.2767122	66.68149547	393.0385042	321.6619958	149.5933369
15-16	66.17696647	40.1859009	70.81229185	51.2343688	60.23659518	295.3423489	276.6241978	126.5623428
19-20	55.28773154	25.50968018	49.59990873	48.76496941	29.50491039	190.3890077	196.8961091	77.65956031
21-22	40.62700188	0	34.65839533	35.8544822	24.90395851	156.2175323	175.0488962	63.59606489
23-24	48.78952408	0	43.54428829	52.64894407	32.39957365	210.4559294	208.5989589	85.44994708
25-26	48.86675133	0	41.12949395	50.11976977	22.47298516	198.4478955	195.4768151	69.78222721
27-28	37.93632252	0	41.43544861	46.49472402	18.06183909	201.2163641	196.9350825	63.65618219
29-30	34.14198586	0	39.19820728	43.83912933	12.04124915	144.5142112	164.7173782	44.21560043
31-32	40.70779296	0	47.71767378	48.38472006	9.9627709	182.4068577	210.6088148	53.76543482
33-34	36.67238291	0	44.4178075	48.59760953	13.71828112	151.2010145	208.4274376	56.81158176
37-38	37.1481098	0	45.9015381	48.29368851	11.81837933	119.1250108	148.8755486	40.86214023
39-40	33.15764724	0	44.2585933	50.74563444	11.55359655	114.6740602	184.6214742	56.80870491

Blake Final Dating

Detector	209Po (dpm)	210Po (dpm)	Bkg Date	% Efficiency	Eff Date
1	0.0025	0.0004	2/4/2014	16.9	2/10/2014
2	0.0022	0.0002	1/8/2014	17.1	1/13/2014
3	0.0057	0.0003	1/8/2014	16.7	1/13/2014
4	0.0009	0.0003	1/8/2014	17.1	1/13/2014
5	0.0022	0.0003	1/8/2014	17.6	1/16/2014
6	0.0007	0.0004	1/8/2014	17.5	1/16/2014
7	0.0026	0.0001	1/8/2014	17.4	1/16/2014
8	0.0042	0.0002	1/8/2014	17.2	1/16/2014
9	0.0011	0.0003	12/29/2013	17.1	1/2/2014
10	0.0049	0.0005	12/29/2013	16.3	1/2/2014
11	0.0022	0.0003	12/29/2013	16.9	1/2/2014
12	0.0012	0.0003	12/29/2013	17.3	1/2/2014
13	0.0041	0.0003	12/29/2013	17.4	1/2/2014
14	0.0059	0.0002	12/29/2013	17.5	1/3/2014
15	0.0028	0.0002	12/29/2013	15.0	1/3/2014
16	0.0025	0.0002	12/29/2013	17.4	1/3/2014
17	0.0005	0.0001	12/29/2013	17.2	1/3/2014
18	0.0002	0.0002	12/29/2013	17.6	1/3/2014
19	0.0005	0.0003	12/29/2013	17.3	1/3/2014
20	0.0005	0.0002	12/29/2013	16.9	1/3/2014
21	0.0005	0.0001	12/29/2013	16.7	1/13/2014
22	0.0003	0.0004	2/14/2014	16.2	2/17/2014
23	0.0006	0.0002	12/29/2013	17.1	1/13/2014
24	0.0007	0.0003	12/29/2013	17.0	1/13/2014

Top of Interval (cm)	Base of Interval (cm)	Cum. Dry Mass (g/cm2)	Unsup. Activity (pCi/g)	Error of Unsup. Act. (±s.d.)	Cum. Act. below Int. (pCi/cm2)	Age: Base of Int. (yr)	Error of Age (±s.d.)	Date A.D.	Sediment Accum. (g/cm2 yr)	Error of Sed. Accum. (±s.d.)
0	1	0.0296	20.0457	0.7845	17.1822	1.09	0.95	2012.6	0.0271	0.00119
3	4	0.1364	17.4268	0.6574	15.2353	4.95	0.99	2008.7	0.0278	0.00120
6	7	0.2662	20.1816	0.7332	12.7348	10.71	1.06	2003.0	0.0203	0.00087
9	10	0.4070	18.7028	0.6766	10.0328	18.37	1.20	1995.3	0.0174	0.00080
12	13	0.5496	15.6833	0.5364	7.6589	27.04	1.33	1986.7	0.0159	0.00076
15	16	0.7037	13.2561	0.4966	5.4990	37.68	1.57	1976.0	0.0137	0.00075
18	19	0.8748	9.2778	0.3524	3.7070	50.34	1.11	1963.4	0.0133	0.00059
20	21	0.9920	7.3179	0.3012	2.7952	59.41	1.16	1954.3	0.0128	0.00061
22	23	1.1124	5.6695	0.2491	2.0665	69.11	1.20	1944.6	0.0123	0.00061
24	25	1.2341	4.5804	0.1613	1.4775	79.88	1.35	1933.8	0.0110	0.00051
26	27	1.3543	3.3771	0.1172	1.0378	91.22	1.41	1922.5	0.0105	0.00050
28	29	1.4703	2.5410	0.1025	0.7202	102.96	1.53	1910.7	0.0097	0.00052
30	31	1.5834	2.0331	0.0903	0.4765	116.22	1.92	1897.5	0.0081	0.00052
32	33	1.6906	1.5572	0.0635	0.2973	131.37	2.58	1882.3	0.0067	0.00052
34	35	1.7899	1.1132	0.0435	0.1763	148.15	3.72	1865.5	0.0057	0.00060
36	37	1.8818	0.5042	0.0307	0.1175	161.18	4.04	1852.5	0.0080	0.00102
38	39	1.9714	0.4655	0.0333	0.0749	175.64	6.23	1838.1	0.0057	0.00104
41	42	2.1044	0.2113	0.0255	0.0365	198.72	8.01	1815.0	0.0061	0.00151
44	45	2.2415	0.0967	0.0226	0.0183	220.90	12.62	1792.8	0.0066	0.00270
Supported Pb-210: 0.438 ± 0.0144 pCi/g							Cum. Unsup. Pb-210: 17.7756 pCi/cm2			
Number of Supported Samples: 5							Unsup. Pb-210 Flux: 0.5736 pCi/cm2 yr			

Diatom Data

			slide		
Nr	P(1) or B (0)	Code		# > 1%	max abund
7	1		Aulacoseira ambigua	15	0.170
8	1		Aulacoseira granulata	15	0.278
37	1		Fragilaria crotonensis	8	0.090
93			Staurosira construens	15	0.418
98			Staurosira venter	15	0.198
103			Staurosirella pinnata	15	0.135
			% planktonic		

Blake-10001a	Blake-10003a	Blake-10004	Blake-10004a	Blake-10005a	Blake-10006a	Blake-10007a
1	7	10	13	16	19	21
2012.6	2003.0	1995.3	1986.7	1976.0	1963.4	1954.3

0.0700	0.0850	0.0325	0.0450	0.0725	0.0950	0.1325
0.2425	0.1725	0.1400	0.2150	0.2775	0.2475	0.2025
0.0900	0.0100	0.0500	0.0175	0.0200	0.0100	0.0025
0.0950	0.1600	0.1475	0.1200	0.1250	0.1125	0.0975
0.0875	0.1150	0.0675	0.1275	0.1025	0.1025	0.1625
0.0500	0.0500	0.1350	0.0350	0.0450	0.0425	0.0400
0.508	0.370	0.375	0.395	0.465	0.485	0.468

Blake-10008a	Blake-10009a	Blake-10010a	Blake-10011a	Blake-10012a	Blake-10013a	Blake-10014	Blake-10015
23	25	27	29	31	33	37	39
1944.6	1933.8	1922.5	1910.7	1897.5	1882.3	1852.5	1838.1
0.0900	0.1000	0.1150	0.1700	0.1275	0.1250	0.0250	0.0400
0.1925	0.1000	0.0875	0.0800	0.0775	0.0550	0.0175	0.0350
0.0050	0.0125	0.0025	0.0200	0.0000	0.0025	0.0000	0.0000
0.1850	0.2075	0.3350	0.2675	0.3150	0.3625	0.4025	0.4175
0.1150	0.1625	0.1825	0.1425	0.1475	0.1425	0.1975	0.1800
0.0700	0.0650	0.0300	0.0675	0.0625	0.0825	0.0825	0.0600
0.405	0.283	0.263	0.318	0.248	0.213	0.065	0.093

Reconstructed Phosphorus

Name	WA_Inv	WA_Cla	WAT_Inv	WAT_Cla	WA_Inv_X	WA_Cla_X	WAT_Inv_X	WAT_Cla_X	log TP	TP (ug/l)	RMSEP
2013	1.71794	1.73872	1.78557	1.81006	1.72061	1.73961	1.76717	1.78316	1.71794	52.23240223	0.206927
2003	1.69103	1.70636	1.76425	1.78568	1.69415	1.7082	1.7415	1.7546	1.69103	49.0941788	
1995	1.56788	1.55834	1.65234	1.65768	1.57452	1.56669	1.61293	1.61216	1.56788	36.97260066	
1987	1.73153	1.75505	1.80181	1.82864	1.73397	1.7554	1.77721	1.7942	1.73153	53.89270719	
1976	1.79057	1.82602	1.85156	1.88553	1.79205	1.82416	1.83569	1.85909	1.79057	61.74047978	
1963	1.78058	1.81401	1.83531	1.86694	1.78252	1.81288	1.81561	1.83682	1.78058	60.33648416	
1954	1.73937	1.76448	1.79023	1.81538	1.74311	1.76624	1.77038	1.78664	1.73937	54.87442721	
1945	1.68066	1.69391	1.75385	1.77378	1.6843	1.69653	1.72347	1.73472	1.68066	47.93580224	
1934	1.55687	1.54509	1.61219	1.61176	1.56195	1.55163	1.58546	1.58177	1.55687	36.0470725	
1923	1.53859	1.52312	1.6005	1.59839	1.54346	1.5296	1.5795	1.57505	1.53859	34.56129444	
1911	1.53368	1.51722	1.57774	1.57237	1.53943	1.52491	1.54437	1.53626	1.53368	34.17275556	
1898	1.49003	1.46475	1.54771	1.53802	1.498	1.47584	1.50347	1.4909	1.49003	30.9050891	
1882	1.46273	1.43194	1.50611	1.49044	1.46861	1.44098	1.48307	1.46831	1.46273	29.02217791	
1853	1.35137	1.29808	1.41002	1.38054	1.36126	1.31388	1.37803	1.35181	1.35137	22.45794428	
1838	1.38529	1.33884	1.44375	1.41913	1.39402	1.35267	1.41018	1.38744	1.38529	24.28231004	

Sediment Total Phosphorus

Depth (cm)	Date (AD)	total Sed P Result (mg P/g)	sed rate (g/cm2 yr)	Total sed P flux (mg/cm2 yr)
1	2012.6	2.29	0.0271	0.0621
7	2003.0	1.80	0.0203	0.0366
10	1995.3	1.88	0.0174	0.0327
13	1986.7	1.70	0.0159	0.0271
16	1976.0	1.48	0.0137	0.0202
19	1963.4	1.43	0.0133	0.0190
21	1954.3	1.34	0.0128	0.0171
23	1944.6	1.27	0.0123	0.0156
25	1933.8	1.26	0.0110	0.0138
27	1922.5	1.25	0.0105	0.0131
29	1910.7	1.49	0.0097	0.0145

29 dup	1910.7	1.82	0.0097	0.0177
31	1897.5	1.26	0.0081	0.0102
33	1882.3	1.37	0.0067	0.0092
37	1852.5	1.30	0.0080	0.0104
39	1838.1	1.30	0.0057	0.0074

Sediment Phosphorus Flux

Phosphorus Fractions

Date	mg Ex-P/g	mg TP/g	mg NaOH-P/g	mg HCl P/g	mg Organic P/g
2013	0.06	2.29	0.42	0.13	1.68
2003	0.04	1.80	0.19	0.11	1.46
1995	0.07	1.88	0.28	0.63	0.90
1987	0.04	1.70	0.16	0.13	1.37
1976	0.05	1.48	0.13	0.12	1.18
1963	0.05	1.43	0.13	0.12	1.13
1954	0.05	1.34	0.13	0.12	1.03
1945	0.05	1.27	0.14	0.13	0.96
1934	0.05	1.26	0.12	0.12	0.97
1923	0.05	1.25	0.14	0.13	0.93
1911	0.09	1.49	0.49	0.17	0.74
1898	0.05	1.26	0.13	0.11	0.97
1882	0.05	1.37	0.13	0.10	1.10
1853	0.05	1.30	0.15	0.10	1.01
1838	0.05	1.30	0.15	0.11	1.00

Sediment Phosphorus Flux

Phosphorus Flux

Date	mg Ex-P/g	mg TP/g	mg NaOH-P/g	mg HCl P/g	mg Organic P/g	sed rate g/cm2 yr
2013	0.06	2.29	0.42	0.13	1.68	0.0271
2003	0.04	1.80	0.19	0.11	1.46	0.0203
1995	0.07	1.88	0.28	0.63	0.90	0.0174
1987	0.04	1.70	0.16	0.13	1.37	0.0159
1976	0.05	1.48	0.13	0.12	1.18	0.0137
1963	0.05	1.43	0.13	0.12	1.13	0.0133
1954	0.05	1.34	0.13	0.12	1.03	0.0128
1945	0.05	1.27	0.14	0.13	0.96	0.0123
1934	0.05	1.26	0.12	0.12	0.97	0.0110
1923	0.05	1.25	0.14	0.13	0.93	0.0105
1911	0.09	1.49	0.49	0.17	0.74	0.0097
1898	0.05	1.26	0.13	0.11	0.97	0.0081
1882	0.05	1.37	0.13	0.10	1.10	0.0067
1853	0.05	1.30	0.15	0.10	1.01	0.0080
1838	0.05	1.30	0.15	0.11	1.00	0.0057

Date	flux Ex-P g/cm2 yr	flux TP g/cm2 yr	flux NaOH-P g/cm2 yr	flux HCl-P g/cm2 yr	flux Organic-P g/cm2 yr
2013	1.60985E-06	6.20845E-05	1.13356E-05	3.62876E-06	4.55103E-05
2003	8.33204E-07	3.66147E-05	3.8756E-06	2.26136E-06	2.96446E-05
1995	1.21431E-06	3.27099E-05	4.85584E-06	1.09253E-05	1.57145E-05
1987	6.88806E-07	2.70982E-05	2.60204E-06	2.04452E-06	2.17629E-05
1976	6.49159E-07	2.02421E-05	1.77583E-06	1.65198E-06	1.61651E-05
1963	6.16475E-07	1.89774E-05	1.7419E-06	1.54669E-06	1.50723E-05
1954	5.95872E-07	1.70957E-05	1.71068E-06	1.55197E-06	1.32372E-05
1945	6.04683E-07	1.5643E-05	1.66152E-06	1.53842E-06	1.18383E-05
1934	5.20291E-07	1.38423E-05	1.36234E-06	1.31549E-06	1.06442E-05
1923	5.13961E-07	1.31442E-05	1.44206E-06	1.37887E-06	9.80931E-06
1911	9.12385E-07	1.44812E-05	4.74094E-06	1.61563E-06	7.21223E-06
1898	3.99642E-07	1.01781E-05	1.03484E-06	8.64029E-07	7.87957E-06
1882	3.02142E-07	9.20172E-06	9.03535E-07	6.49814E-07	7.34623E-06
1853	3.66912E-07	1.04178E-05	1.16046E-06	8.16765E-07	8.07361E-06
1838	2.67713E-07	7.40679E-06	8.53338E-07	6.04681E-07	5.68106E-06

Zooplankton

Date	*Chydorus brevilabris*	*Bosmina longirostris* complex	*Camptocercus sp.*	*Alona sp*	*Acropersus harpae*	*Daphnia longirostris* complex	*Daphnia* ephippium	*Eurycecus sp.*	*Alonella pulchella*	*Total Cladocera*
2012	193	12	2	27			4			238
2003	189	9	2	14	1		1		1	217
1995	85	4		5			3			97
1986	292	13		28	1			1		335
1976	157	2	1	17	9		9	4		199
1963	370	63		15	1			13	16	478
1954	258	3		40	5		8	6		320
1944	298	11	1	49	1		8	6		374
1933	169	5	4	18	4		7		2	209
1922	287	9		24	5		6	2	5	338
1910	276	15	8	58	11		5	8		381
1897	89	26	1	22		3	3	18	1	163
1882	189	14	7	59	10		3	8	3	293
1852	116	13	4	32			1	6		172
1838	239	25	16	31	10	4	9	6	3	343

Macrophytes

Date	*Ceratophyllum demersum*	*Potamogeton sp*	*Najas flexilis*	*Potamogeton pusillus*	*Vallisneria americana*	*Chara sp*	*Potamogeton crispus*	*Total Native Macrophytes*
2012	2						4	2
2003	5						5	5
1995	1						6	1
1986	5	7					2	12
1976	24	2						26
1963	40		3					43
1954	14	2						16
1944	11	3				1		15
1933	28	7	2	1				38
1922	18	4	2					24

1910	35	26	1	3	2			67
1897	41	5						46
1882	38	11						49
1852	26	3						29
1838	33	4	1					38

Chironomids

Date	Chironomus	Procladius	Cryptochironomus	Crictopus/Orthocladius	Dicrotendipes	Cladotanytarsus mancus gr.	Endochironomus tendens-type	Glyptotendipes	Microtendipes pedellus-type	Tanystarsus s. lat.	Chaoborus manible	Total Littoral Chironomids	Total Profundal Chironomids
2012												0	0
2003	4	1										0	5
1995	5	2								1		1	7
1986	1	1			1					1		2	2
1976	5							2				2	5
1963	2	1		1	2			3		1		6	3
1954	7	2	2		5			2		2		9	11
1944	2				2	2					1	4	2
1933	1	2						2				2	3
1922	2	3				3	2	4				9	5
1910	1					2						2	1
1897	3	9		1	7	5			1		2	13	12
1882												0	0
1852	2	6		1	1	2		1	4			8	8
1838	7	9		1	3	2	4				5	9	16

A Paleolimnological Study of Big Blake Lake, Polk County, Wisconsin

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August, 2016

Please cite this report as:

Williamson, J., Edlund, M. B., and Ramstack Hobbs, J., and Burge, D. R. L. 2016. A Paleolimnological Study of Big Blake Lake, Polk County, Wisconsin. Final Report to Big Blake Lake Protection and Rehabilitation District. Polk County Land and Water Resources Department, Balsam Lake, WI

Executive Summary

1. Paired sediment cores were recovered from the northern basin of Big Blake Lake, Polk County, Wisconsin, in September 2013 and analyzed to reconstruct a historical record of sedimentation, ecological change, and water quality from the early 1800s to present. Management concerns for Big Blake Lake are centered on the prevalence of *Potamogeton crispus*, cyanobacterial blooms, elevated nutrient levels, response to and prevention of aquatic invasives, and sustaining high quality recreational and fishing opportunities in the lake.
2. Sediment cores were subjected to multiple analyses including radioisotopic dating with Pb-210 to establish a date-depth relationship and sedimentation rates for the core site, loss-on-ignition to determine major sediment constituents, biogenic silica to estimate historical diatom productivity, diatom communities to identify ecological changes and estimate historical water column phosphorus, extraction and determination of sediment phosphorus fractions to determine past nutrient loading and threat of internal loading, and analysis of macrofossils including chironomid head capsules, zooplankton fossils, aquatic macrophyte remains to identify ecological shifts that have occurred in Big Blake Lake.
3. Sedimentation rates in the lake increased following Euroamerican settlement, and current sedimentation rates are approximately five times greater than pre-settlement levels.
4. Loss-on-ignition analysis showed that inorganics are the predominant fraction of Big Blake Lake sediments followed by organic components and then carbonates. Inorganic components show increased accumulation after 1900, likely reflecting changes in sediment loading following logging, land clearance, and development of the shoreline, while organic constituents decreased.
5. Biogenic silica concentrations in the cores, a marker of diatom algae abundance, are high compared to most lakes in the Midwest and represent 8-14% of the dry weight of Big Blake Lake sediment. Accumulation rates of biogenic silica show diatom growth has increased in the last two decades.
6. The concentration and accumulation rates of phosphorus (P) fractions in the Big Blake Lake sediment core show general increases toward the top of the core. Organic P is the most abundant in the top few cm of sediment. NaOH-extractable P and exchangeable P also increase in the top few centimeters of the core providing a readily available source of P during period of internal loading. Internal loading appears to be more significant in recent decades when bottom water go anoxic during *Potamogeton crispus* senescence and periodic breakdowns of stratification throughout the summer months which can initiate cyanobacteria blooms.
7. The diatom communities preserved in Big Blake Lake's sediment are dominated by six species. A significant diatom community shift occurs in the 1920-30s, a time when cottage and resort communities were expanding and agricultural practices were likely shifting in the region. This time period shows a decrease in the planktonic mesotrophic indicator *Aulacoseira ambigua* and benthic diatoms *Staurosira construens* and *S. venter* coincident with an increase in the dominance of the eutrophic species *Aulacoseira granulata*.
8. Estimates of historical total phosphorus (TP) were generated using a diatom-TP model based on species environmental relationships in 89 Minnesota lakes. The model suggests that Big Blake Lake has shifted from a mesotrophic lake to a eutrophic system. Diatom-

inferred TP estimates increase following European settlement, increase further in the 1940s to peak levels in the 1960s through present day. Modeled TP estimates for the last ten years (49-52 µg/l) are similar to monitored values taken during the growing season (40-80 µg/l TP) when cyanobacterial blooms can occur. Diatom reconstructed TP values are almost identical to the mean annual TP levels based on a comprehensive monitoring program from 2013-2015 (49.9 µg/l), and predictions modeled using the Wisconsin Lakes Modeling Suite (43-50 µg/l).

9. Pigment analysis of different algae groups showed that algae, including cyanobacteria, have increased in recent decades. Evidence suggests that nitrogen-fixing, and possibly toxic, forms of cyanobacteria (via aphanizophyll), have increased dramatically over the last three decades.
10. Analysis of zooplankton remains shows a general decrease in cladocerans since the 1960s and 1970s. There is a sharp reduction in both *Eurycercus sp*. and *Alona sp*. since the 1960s. These species are often associated with aquatic plants in the littoral zones of ponds and lakes in North America and Europe and their decline corresponds to decline of the native aquatic plant community in Big Blake Lake since the 1960s.
11. Chironomid head capsules shows sharp decrease in littoral species after the 1950s similar to changes in zooplankton composition, again reflecting changes in ecosystem quality associated with the loss of the native aquatic plant community.
12. Aquatic macrophyte fossils show a loss in both species richness and total number of indigenous species since the 1960s. Fossils of the aquatic invasive species *Potamogeton crispus* appear in the 1980s.
13. Paleolimnology-based management recommendations and additional analysis are provided in the Big Blake Lake comprehensive Lake Management Plan.

Acknowledgments

We thank the Big Blake Lake Protection and Rehabilitation District for funding this study; Jim Maxwell (Big Blake Lake) and Katelin Holm (Polk County Land & Water Resources Department) for assistance in fieldwork, and Dan Engstrom, Erin Mittag, Michele Natarajan, Erin Mortenson, and Alaina Fedie of the St. Croix Watershed Reseach Station for coordinated lab analysis.

Introduction

Lakes are prominent features in the glaciated landscape of the Upper Midwest. They are valued resources for recreation, fisheries, wildlife, and leisure for lakeshore owners. Water management concerns have been raised about the state of lakes and how to best manage them due to current, historical, and future land and resource use that is certain to see further change. To develop effective management plans it is important to determine the natural state of a lake and have an understanding of the timing and magnitude of historical ecological changes that have occurred. We can estimate past conditions and natural variability through the use of paleolimnological techniques to identify the timing of ecological change, and determine the rates of change and recovery. Linking this information to historical land-use changes and known environmental impacts helps target management options.

Big Blake Lake (WBIC 2627000) is located in the Town of Georgetown in central Polk County, Wisconsin (T35N, R16W, S22, 26, and 27, Fig. 1). The lake has a surface area of 217 acres, a maximum depth of 4.3 meters (14 feet), and a mean depth of 2.7 meters (9 feet). The Big Blake Lake watershed is part of the Upper Apple River watershed in the St. Croix River Basin. The watershed (or drainage area) of Big Blake Lake is approximately 15,369 acres. The watershed to lake area ratio is approximately 70:1. The lake is classified as a drainage lake, meaning that it is fed primarily by inflowing streams or rivers. The Straight River flows in from the southeast via Big Round and Little Blake Lake and an unnamed creek that drains from Lost Lake flows in on the north side of the lake. Fox Creek flows out of the lake at the northwest end. Big Blake Lake is also designated as an Area of Special Natural Resource Interest (ASNRI) and as a Public Rights Feature (PRF). Significant public access and use opportunities are available on Big Blake Lake. There is a resort located on Big Blake Lake on the northwest side (Sherrards Resort). Big Blake Lake has two public boat landings, one which provides parking for seven car-trailer units and a carry-in launch.

With any lake management plan it is important to have a basic understanding of natural fluctuations within the system. Long-term water quality data sets on the order of 30 to 50 years are generally not available for most of the country and Big Blake Lake is no exception. Incomplete water quality data have been collected intermittently from Big Blake Lake since 2000. Most of the data sets do not include chlorophyll a or total phosphorus TSI averages and there are large stretches of time where no data have been collected. The most recent data suggest that Big Blake Lake is eutrophic; however, the large lag times between sampling events make these data inconclusive. The most recent water quality study on Big Blake Lake was completed in 2004 by Aquatic Engineering, Inc. to determine management recommendations to protect and improve water quality on Big Blake Lake. Northern Lake Service, Inc. also completed a study in 1979 and the DNR Office of Inland Lake Renewal completed a study in 1981. The Wisconsin state phosphorus standard of 30 µg/L was exceeded in both of these reports. The highest readings of total phosphorus in the reports were 69 µg/L and 95 µg/L. The highest reading for chlorophyll a concentrations was 55 µg/L (Williamson, unpublished data). The 1981 DNR Office of Inland Lake Renewal study further concluded that sediment was a major source of the total phosphorus load to Big Blake Lake.

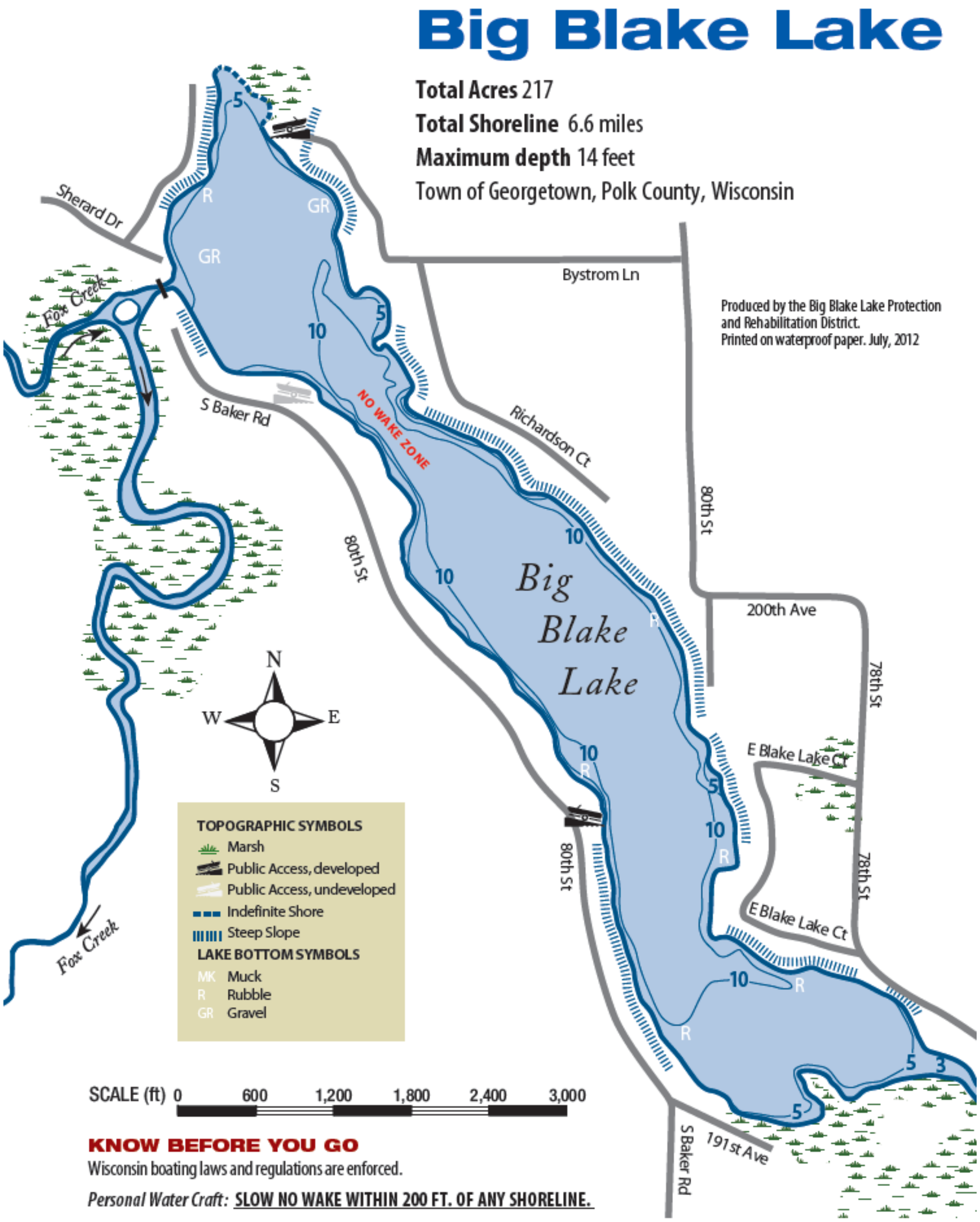


Figure 1. Map of Big Blake Lake.

In addition to inadequate water quality data, there is a lack of ecological data and biological monitoring for the lake, a problem that is not unique to Blake Lake. Monitoring of aquatic macrophytes has been carried out since 2006 by the Polk County Land & Water Resources Department (LWRD), and two of the three main goals in the Blake Lake Aquatic Invasive Species Management Plan address preserving and protecting native plant functions and reducing curly-leaf pondweed. Algae and zooplankton data are absent.

The primary aim of this project was to use paleolimnological analysis of a dated sediment core to reconstruct changes in the lake condition over the last 150-200 years using multiple lines of evidence including biogeochemistry, sediment accumulation, zooplankton fossils, chironomid head capsules, aquatic macrophyte remains, and diatom remains as biological indicators. In an effort to further understand presettlement conditions, and historical lake response to land use and past management, the paleolimnological study uses diatom remains to model changes in water column TP. Diatoms often make up the main types of algae in a lake and therefore changes in diatom community structure are symptomatic of algal changes in response to water quality. Diatoms have been widely used to interpret environmental conditions in lakes (Dixit et al., 1992). Many species are sensitive to specific water conditions and are useful as bioindicators. Over the past 25 years, statistical methods have been developed to estimate quantitative environmental parameters from diatom assemblages. These methods are statistically robust and ecologically sound. In the states of Minnesota and Wisconsin, diatom analysis has been used as one line of evidence for developing nutrient criteria (Heiskary and Wilson 2008), lake-specific nutrient standards (Edlund and Ramstack 2007), and prioritizing management actions (Edlund et al. 2008).

In addition, we further characterize changes in algal productivity and nutrient availability using biogeochemical analyses of the cores. Biogenic silica (BSi) is a component of two major algal groups—the diatoms and chrysophytes. The amount of BSi preserved in sediments and its accumulation rate represent a straightforward measure of algal productivity through time that is particularly responsive to nutrient inputs (Edlund et al. 2009). Fossilized algae pigments were analyzed in order to investigate changes in the composition of algae as well as total algae production. Zooplankton fossils, chironomid head capsules, and aquatic macrophyte remains were analyzed to characterized habitat changes and the faunal and food web response to such changes. We also characterized the total phosphorus and phosphorus fractions in the core to understand the historical sources of P to the lake, the distribution of P and P fractions within the cores, and to assess the relative capability (or lack of capability, i.e. internal loading) of the lake to sequester phosphorus in its sediments.

Figure 2. Sediment core recovered from Big Blake Lake in September 2013

Methods

Coring

A pair of sediment cores, each measuring approximately 1.6 m in length, was recovered from the north basin of Big Blake Lake (45°30’11.68”N, 92°20’10.24”W) on 12 September 2013 (Fig. 2). The cores were recovered from 3 meters of water using a piston corer consisting of a 6.5 cm diameter polycarbonate tube outfitted with a piston and operated with rigid drive rods working from an anchored boat on the lake surface (Wright 1991). The core was transported to shore where the uppermost 45 cm of the core were vertically extruded and sectioned in 1.0-cm increments. The remaining core material was stabilized, transported back to the laboratory and further sectioned in 2-cm increments to 154 cm core depth for core one and 155 cm core depth for core two. Paired cores were taken to ensure we had sufficient material for all planned analyses.

Isotopic Dating and Geochemistry

The sediment core was analyzed for ^{210}Pb activity to determine age and sediment accumulation rates for the past 150 to 200 years. Lead-210 activity was measured from its daughter product, ^{210}Po, which is considered to be in secular equilibrium with the parent isotope. Aliquots of freeze-dried sediment were spiked with a known quantity of ^{209}Po as an internal yield tracer and the isotopes distilled at 550°C after treatment with concentrated HCl. Polonium isotopes were then directly plated onto silver planchets from a 0.5 N HCl solution. Activity was measured for 1-3 x 10^5 s using an Ortec alpha spectrometry system. Supported ^{210}Pb was estimated by mean activity in the lowest core samples and subtracted from upcore activity to calculate unsupported ^{210}Pb. Core dates and sedimentation rates were calculated using the constant rate of supply model (Appleby and Oldfield 1978, Appleby 2001). Dating and sedimentation errors represented first-order propagation of counting uncertainty (Binford 1990).

Bulk-density (dry mass per volume of fresh sediment), water content, organic content, and carbonate content of sediments were determined by standard loss-on-ignition techniques (Dean 1974). Weighed sediment subsamples were dried at 105°C for 24 hr to determine water content and dry bulk density, then heated at 550°C and 1000°C to calculate organic and carbonate content from post-ignition weight loss, respectively. These data were used in combination with ^{210}Pb dating to calculate sedimentation rates (mg cm^{-2} yr^{-1}) for each core and its sediment constituents.

Sediment phosphorus fractions were analyzed following the sequential extraction procedures in Engstrom (2005) and Engstrom and Wright (1984). Extracts were analyzed colorimetrically on a Lachat QuikChem 8000 flow injection autoanalyzer. Measured sediment P concentrations were also converted to flux using bulk sedimentation rates in each core. In addition to total phosphorus in cores, sediment fractions include the refractory forms HCl-P and Organic-P and the labile or readily exchangeable forms of NaOH-P and "exchangeable P (Ex-P)."

Biogenic silica (BSi), a proxy for historical diatom and chrysophyte algal productivity, was measured using weighed subsamples (30 mg) from each primary core, which were digested for BSi analysis using 40 mL of 1% (w/v) Na_2CO_3 solution heated at 85°C in a reciprocating water bath for five hours (DeMaster 1979, Conley and Schelske 2001). A 0.5 g aliquot of supernatant was removed from each sample at 3, 4, and 5 hr. After cooling and neutralization with 4.5 g of 0.021N HCl solution, dissolved silica was measured colorimetrically on a Lachat QuikChem 8000 flow injection autoanalyzer as molybdate reactive silica (McKnight 1991).

Diatom Analysis

Diatoms were used in this study to provide a timeline of changes in the Big Blake Lake algal community and estimates of historical water column total phosphorus concentrations. The analytical steps are as follows: Diatoms and chrysophyte cysts were prepared by placing approximately 50 mg freeze dried core material in a 50 cm^3 polycarbonate centrifuge tube and adding 2-5 drops of 10% v/v HCl solution to dissolve carbonates. Organic material was subsequently oxidized by adding 10 ml of 30% H_2O_2 and heating for 3 hr in an 85°C water bath. After cooling the samples were centrifuged and rinsed 4-6 times with deionized water to remove oxidation byproducts. Material was then transferred to 22x22 mm square #1 coverglasses. Coverglasses were permanently attached to microscope slides using Zrax mounting medium (Ramstack et al. 2008). Diatoms were identified along measured random transects to the lowest taxonomic level under 1000-1250X magnification (full immersion optics of NA>1.3). A minimum of 400 valves was counted in each sample. Identification of diatoms relied on floras and monographs such as Hustedt (1927-1966, 1930), Patrick and Reimer (1966, 1975), Krammer and Lange-Bertalot (1986-1991), Reavie and Smol (1998), Camburn and Charles (2000), and Fallu et al. (2000). All diatom counts were converted to percentage abundances by species or taxon; abundances are reported relative to total diatom counts in each sample.

A stratigraphy of predominant diatoms (species with greater than or equal to 5% relative abundance in one or more core depths) was plotted against core date. Relationships among diatom communities within the sediment core were explored using constrained cluster analysis (CONISS) and the unconstrained ordination method of Detrended Correspondence Analysis (DCA), in the software package R (R Core Team 2014). Core depths/dates were plotted in ordinate space and their relationships and variability used to identify periods of change, sample groups, and ecological variability among core samples. A general rule for interpreting a DCA is that samples that plot closer to one another have more similar diatom assemblages.

Downcore diatom communities were also used to reconstruct historical epilimnetic phosphorus levels. A transfer function for reconstructing historical logTP was developed earlier based on the relationship between modern diatom communities and modern environmental variables in 89 Minnesota lakes (Ramstack et al. 2003, Edlund and Ramstack 2006) using weighted averaging (WA) regression with inverse deshrinking and bootstrap error estimation (C2 software; Juggins 2003). Reconstructed estimates of logTP (diatom-inferred TP, or DI-TP) for each downcore sample were determined by taking the logTP optimum of each species, weighting it by its abundance in that sample, and determining the average of the combined weighted species optima. Data are presented as both logTP values and as backtransformed values, to TP in µg/l or ppb.

Analysis of Chitinous and Vegetative Remains

Chironomid head capsules and zooplankton remains were analyzed along with aquatic macrophyte remains to assess ecosystem level changes in Big Blake Lake such as habitat loss, changes in fisheries, and colonization by invasive species. Wet sediment samples (2 cm^3) were first disaggregated in hot water. Samples were then sieved through a 125 µm (no.120) standard soil test sieve and specimens picked out using a fine forceps under a stereo microscope at 25X magnification. Samples were either slide mounted or identified in a Borgorov counting chamber under magnification appropriate for each taxon. All specimens picked from the samples were identified to the lowest taxonomic using available taxonomic literature (e.g., Brooks et al. 2007, Crow and Hellquist 2000, Korosi and Smol 2012). Predominant species were stratigraphically plotted against core date. Autecology of individual taxa was investigated, and species groups with similar ecological niches were used to infer ecological change.

Algal Pigment Analysis

Carotenoids, chlorophylls, and derivatives were extracted (4°C, dark, N2) from freeze-dried sediments according to Leavitt et al. (1989), measured on a Hewlett-Packard model 1050 high performance liquid chromatography system, and are reported relative to total organic carbon (TOC; Hall et al. 1999).

Results and Discussion

Core Dating and Sedimentation Rates

The Big Blake Lake core showed a monotonic decrease in Pb-210 inventory to supported levels below 45 cm core depth. Using the date-depth relationship, 20 cm down the core represents approximately 1960 and sediments deposited deeper than 33 cm are dated before 1880. Sedimentation rates in Big Blake Lake began increasing immediately after European settlement and continue to increase upcore. Modern sedimentation rates are approximately four times greater than pre-1900 rates (Figure 3). Pre-settlement sedimentation rates in Big Blake Lake were approximately 0.007 g/cm^2 yr compared to 0.028 g/cm^2 yr since the 1990s. Increases in sedimentation rates are common in Midwestern lakes following logging, land clearance for agriculture, and changes in land use/cover.

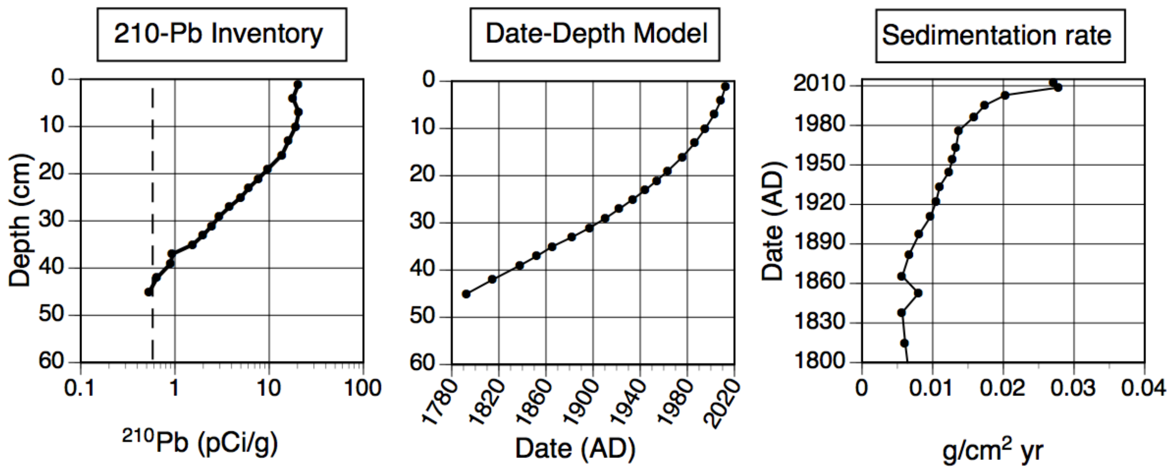


Fig. 3 Pb-210 inventory, date-depth model, and historical sedimentation rates for Big Blake Lake.

Loss-on-ignition

Sediments in Big Blake Lake have shifted from being dominated by the organic fraction (pre-settlement; 54.7% organic matter) to being dominated by the inorganic fraction (present day; 45.7% inorganic matter) (Figure 4). Carbonates rise from 6.4% of the sediment fraction in pre-settlement and increase to 16% in recent sediments; carbonates commonly increase in sediments as a consequence of greater plant and algae production in a lake (carbonates are precipitated as a result of photosynthesis). Inorganics notably increased in accumulation to a peak in the 1940s before dropping slightly until 1980 before increasing in most recent times. Increases in inorganics around 1900 are generally an erosional signal of logging and land clearance associated with settlement in the region.

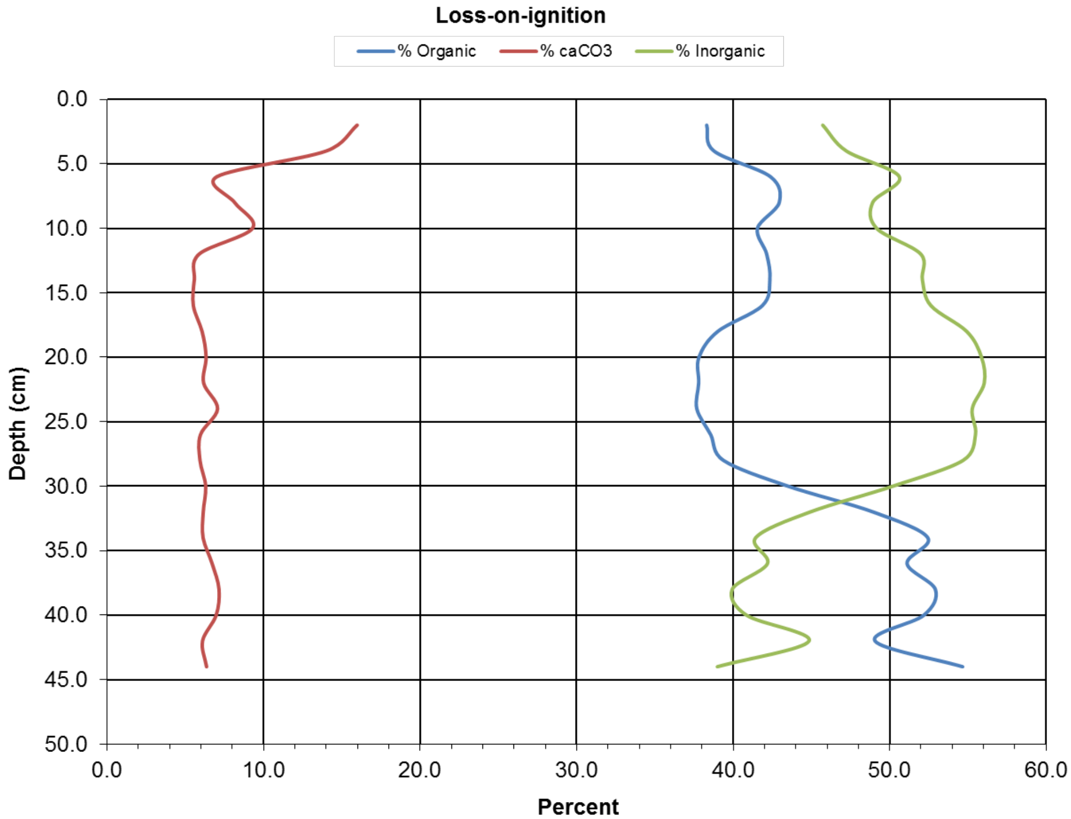


Fig. 4. Loss-on-ignition

Biogenic Silica (BSi)

Biogenic silica composed 8.3-13.7% of the dry weight of Big Blake Lake sediment, with the lowest values in the 1990s to present day (as BSi content is diluted by carbonates) and the highest values from pre-settlement to the 1880s (Figure 5). Upcore decreases in BSi were noted in the top 6 cm of sediment. Big Blake Lake has relatively high levels of BSi, most lakes have from 2-4% biogenic silica by weight. When BSi is presented as accumulation rates, the flux of BSi increases in the 1930s to the top of the Big Blake Lake core. Modern accumulation rates of biogenic silica are almost 70% greater than in pre-European settlement times likely reflecting greater diatom algae productivity in recent decades.

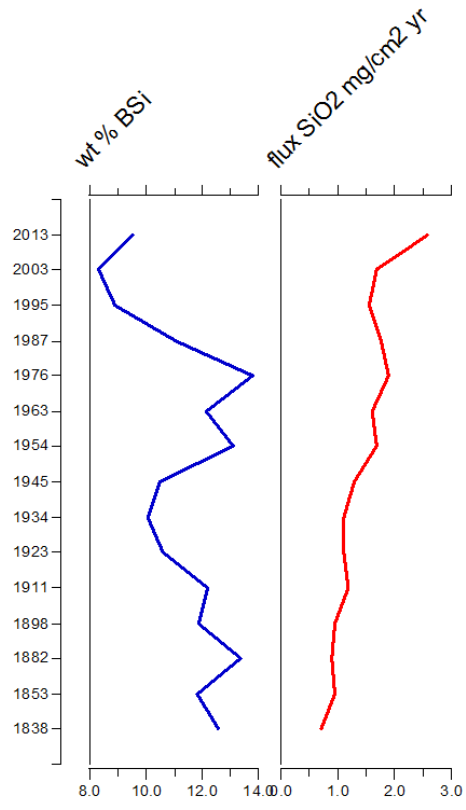
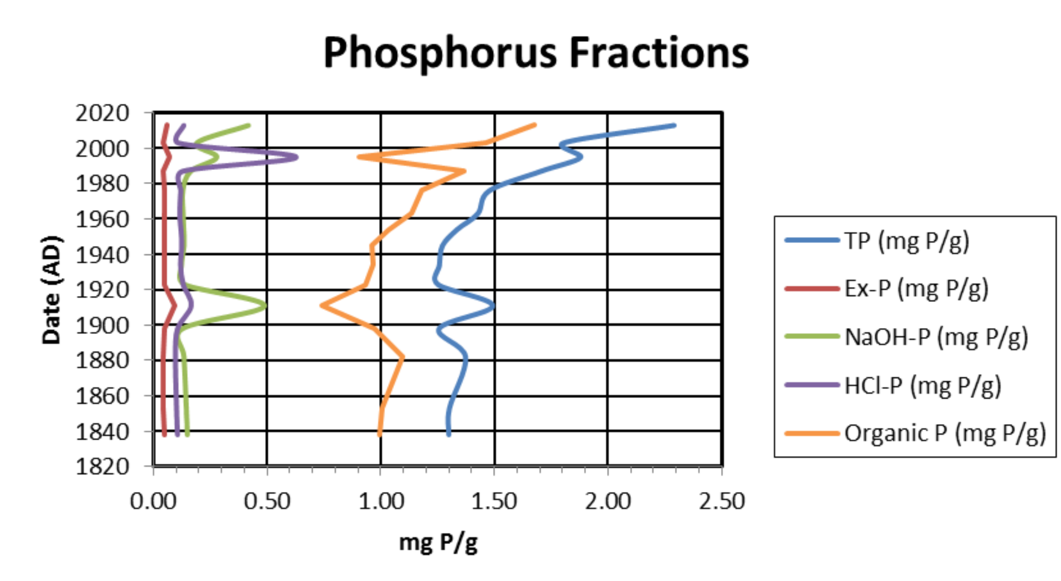


Fig. 5 Biogenic silica content (percent dry weight) and accumulation rate (mg/cm^2 yr-^{1})

Sediment Phosphorus Fractions

Total phosphorus in Big Blake Lake sediment ranged from 1.3 to 2.3 mg P/g with increasing amounts moving upcore and the highest values at the core top (Figure 6). The organic-P made up the largest proportion of the fractions followed by NaOH-P and HCl-P fractions. We must consider the potential mobility and possibility of exchange of P with the water column in the distribution and abundance of the refractory (HCl-P, Org-P) and labile/exchangeable P (Ex-P, NaOH-P). In Big Blake Lake, an active pool of labile P forms is strongly distributed in the top 4 cm of the core suggesting that while Big Blake Lake can efficiently bury P in its sediments (one of only two ways for a lake to rid itself of excess P burdens—the other being the outflow), there is a ready pool of P to fuel internal loading during certain times of the year.



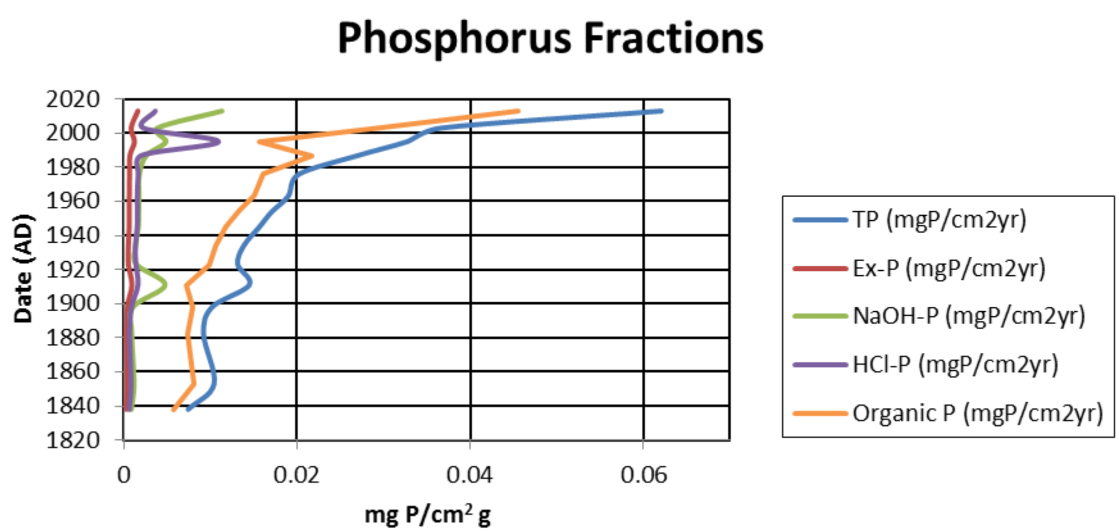


Fig. 6 Sediment phosphorus fractions in Big Blake Lake core including total phosphorus (TP), exchangeable P (Ex-P, NaOH extractable P (NaOH-P), HCl extractable P (HCl-P), and organic P (Org-P)

Accumulation rates of organic P and total P in the cores increase after 1900 to levels that are almost five-fold higher than pre-European settlement (Figure 6). There are less dramatic increases in the other fractions of P; however, NaOH-P and Ex-P may be a limited but active pool of P available to the water column. The greatest flux of labile P occurs in the top few centimeters of the core. This pool of P is important given the propensity for the lake to have anoxic bottom waters in mid-summer following senescence of *Potamogeton crispus* by early summer, which releases additional labile P from the sediments to fuel frequent cyanobacterial blooms.

Diatom Communities and TP reconstructions

In the Big Blake Lake core there were over 110 diatom species noted. In pre-European settlement samples, benthic or epiphytic (living on the bottom or on plants) species such as *Staurosira construens* and *S. venter* were dominant. After the 1940s planktonic species that live in the water column such as *Aulacoseira granulata* and *Fragilaria crotonensis* dominate the samples.

Several analyses were run to determine how the diatom communities in each level were related to each other and develop stratigraphic groupings. The first shows an ordination biplot from detrended correspondence analysis (DCA) that shows how the core samples cluster based on similarity of diatom assemblage (Figure 7). Note that the presettlement samples are grouped on the left of axis 1, undergo a rapid shift to the right on axis 1 between 1923 and 1954, and then remain to the right on axis 1, but vary more on axis 2 from 1954 to present.

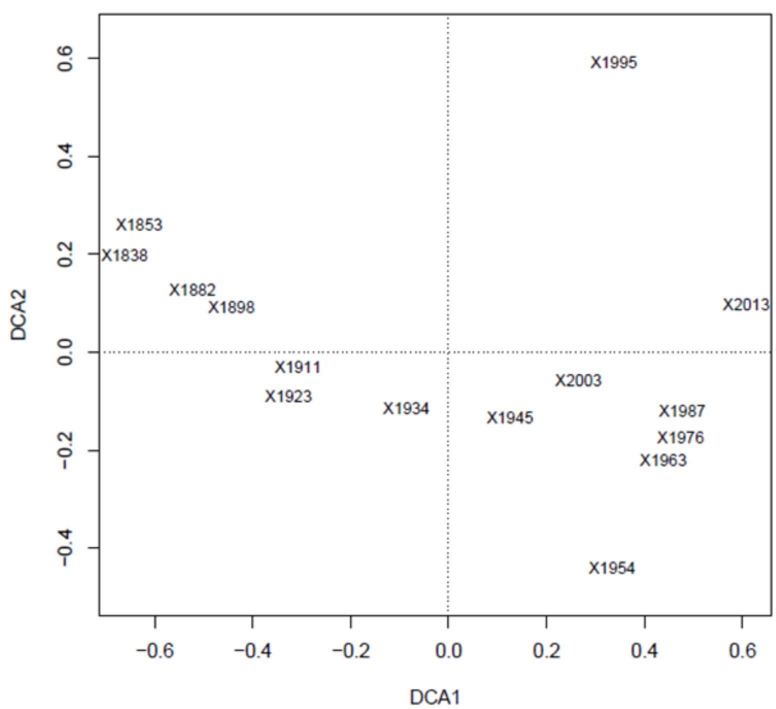


Fig. 7 Detrended Correspondence Analysis (DCA) of the diatom community from the Big Blake Lake sediment core by dated core level. Core levels that plot closer together are generally more similar.

A constrained cluster analysis was also run and confirms the DCA results (Figure 8). These results suggest that the major significant breaks among diatom assemblages occur between 1924 and 1934, 1945 to 1954, and 1987 to present day. Similarly, the diatom community show major changes from the 1890s to the 1960s along Axis 1 of the DCA plot; and change over the last sixty years along Axis 2. This may suggest that the lake has been experiencing multiple stressors over many decades.

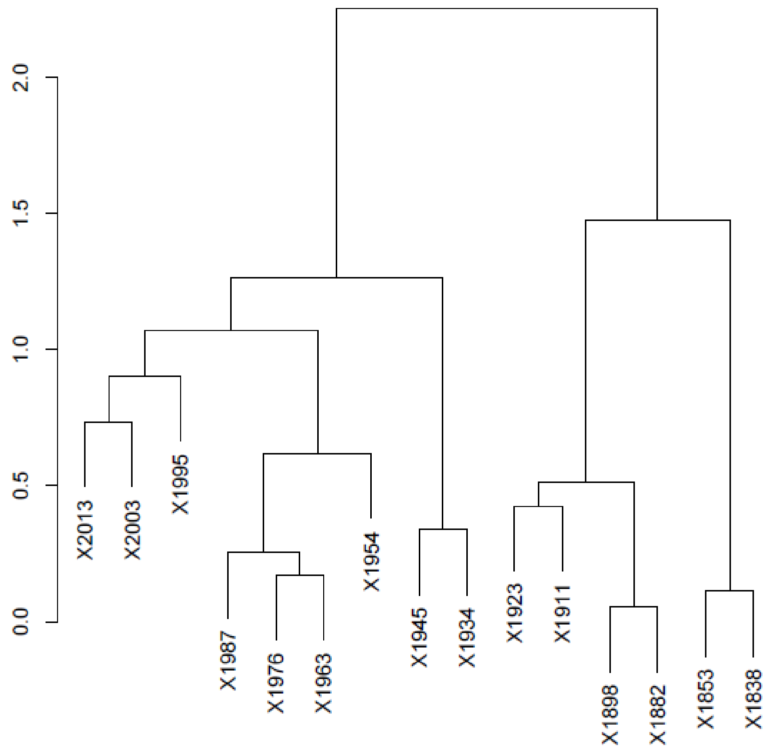


Fig. 8 Constrained Cluster Analysis of diatom communities by dated core level from the Big Blake Lake sediment core based on Euclidean distance.

Changes in the abundance of predominant diatoms can be seen in a stratigraphic diagram of the core (Figure 9). The shifts in diatoms communities can clearly be seen in the increases in *Aulacoseira granulata*, *Fragilaria crotonensis*, and the benthic *Staurosirella pinnata* and decreases in *Staurosira construens*, *S. venter*, and the mesotrophic species *Aulacoseira ambigua*. The sharp increase in *Fragilaria crotonensis* sets the very top of the core apart from the rest of the core, but there has clearly been changes thoughout the modern history of Big Blake Lake.

The common diatoms near the bottom of the Big Blake Lake core are indicative of a mesotrophic midwestern lake, while diatom communities at the top imply a eutrophic condition (Figure 10). The two *Staurosira* species, abundant in the bottom of the core, are both non-motile species that are likely benthic or epiphytic species that often form small colonies. The two *Aulacoseira* species are indicative of strong mixing of the lake. *Aulacoseira ambigua*, which decreases towards the top of the core, is more indicative of a mesotrophic lake; while *A. granulata*, which increases towards the top of the core, is more indicative of a shallow eutrophic lake. The sharp increase in *Fragilaria crotonensis* near the top of the core is an indication that the lake has continued to eutrophy over time.

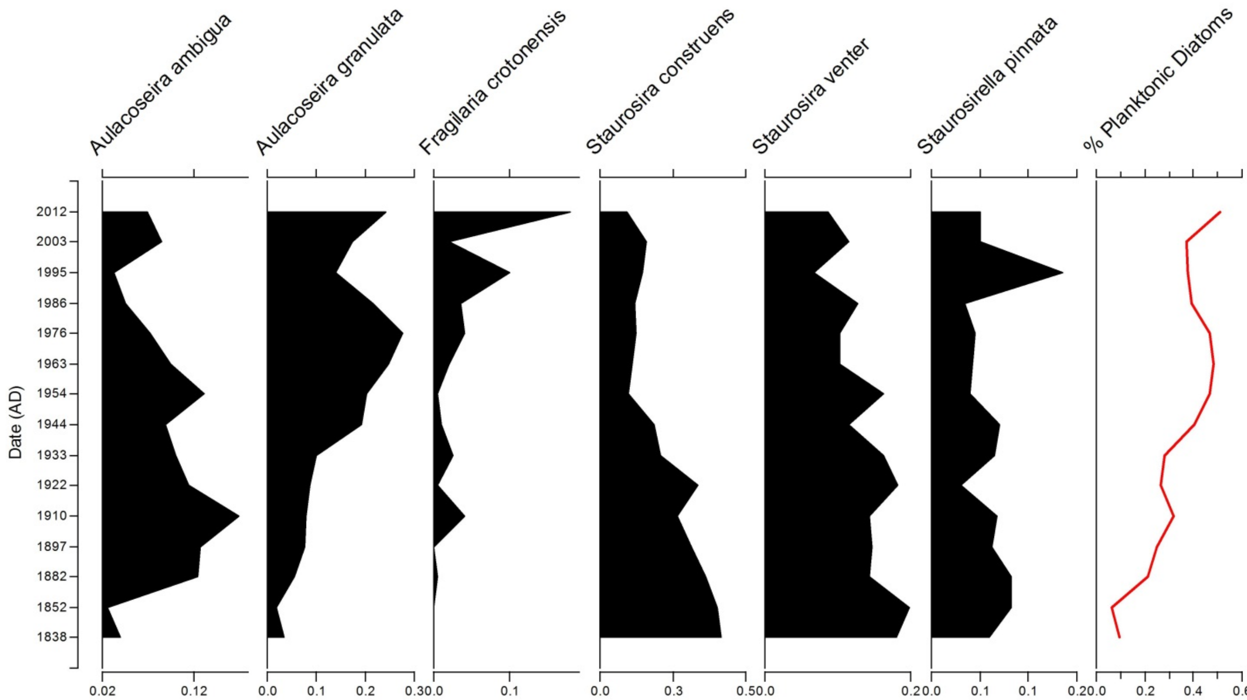


Fig. 9 Downcore distribution by core date of predominant diatoms in the Big Blake Lake sediment core. Diatom abundances are given relative to total diatom count.

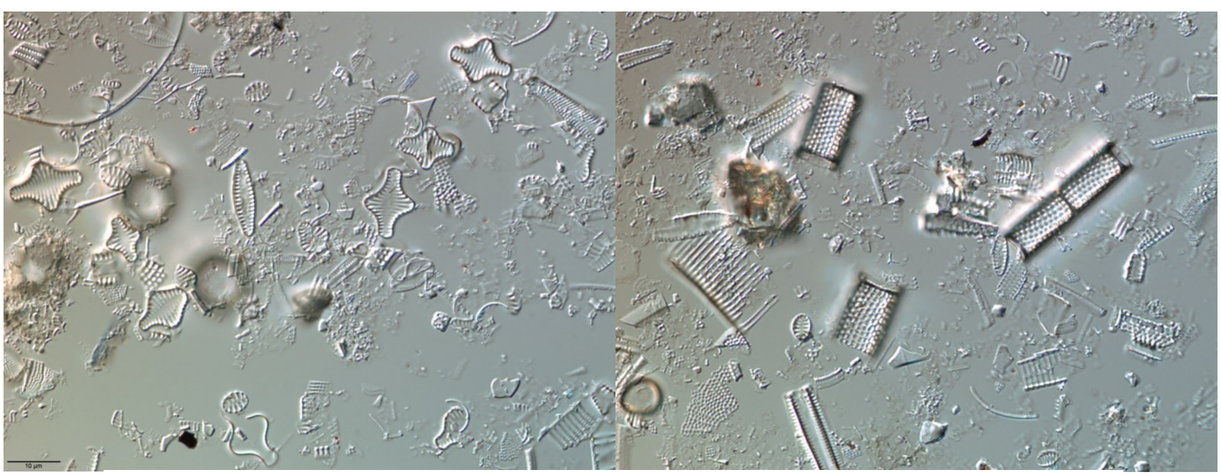
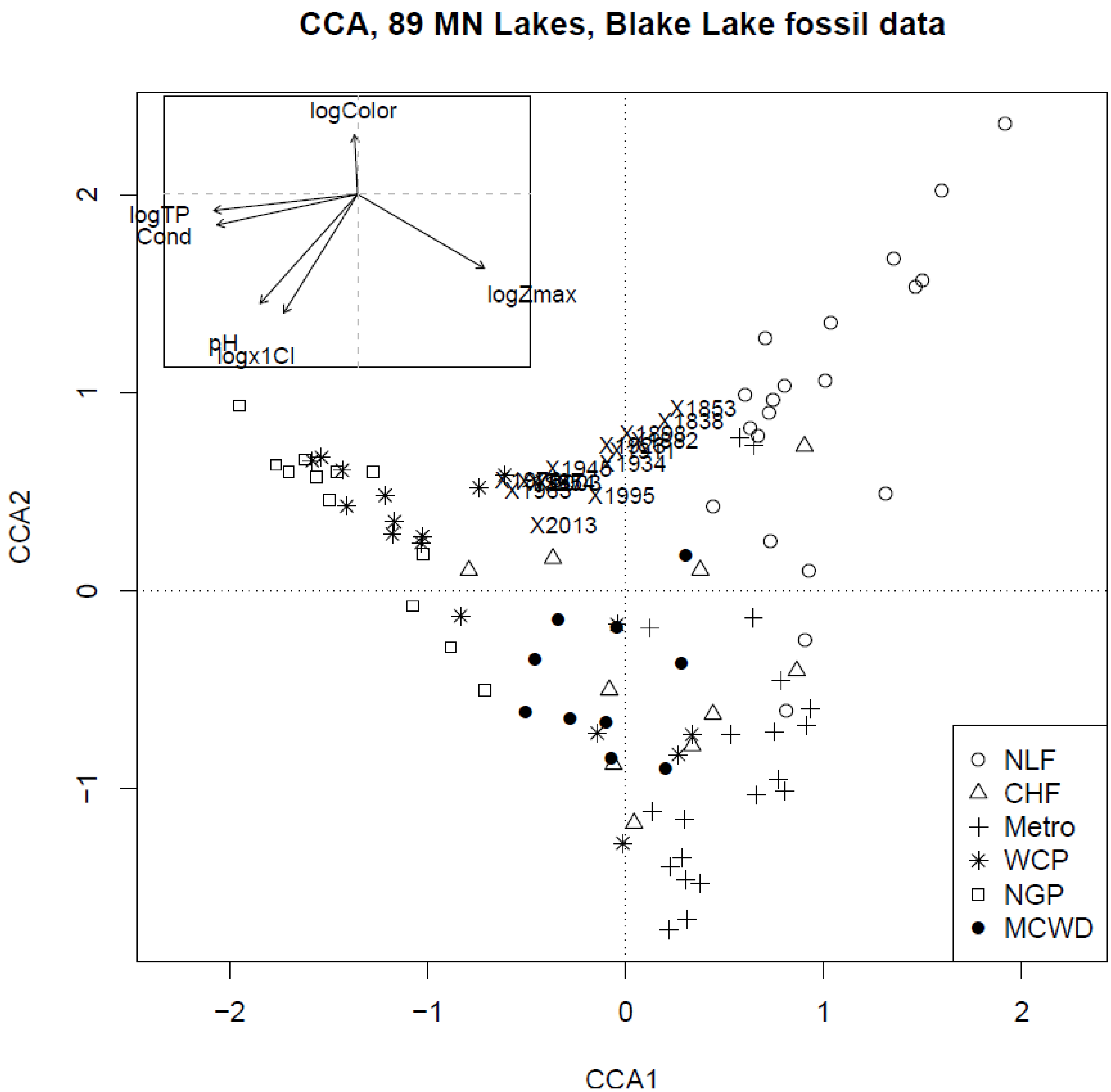


Fig. 10 Diatom communities for the Big Blake Lake sediment core circa 1852 (left) and 2012 (right).

The diatom communities were also used to reconstruct historical TP levels in Big Blake Lake. Many factors can contribute to changes in diatom communities (pH, light penetration, and habitat availability), and in order for a diatom-inferred total phosphorus (TP) reconstruction to be meaningful, changes in the diatom community assemblage over time should be primarily driven by changes in TP concentrations. One way to evaluate TP as a driver of change in Big Blake Lake is to project the core sections on the MN calibration set that we used to reconstruct TP to determine if changes in the diatom assemblage in the core correlate with the TP gradient in the model (Figure 11; Juggins et al. 2013).

Another way to evaluate the strength of a TP reconstruction is to determine the amount of variance in the diatom data that can be accounted for by the TP reconstruction. This can be calculated by the variance explained by the first axis of an ordination of the sediment assemblages constrained to diatom-inferred TP, divided by the variation explained by an unconstrained ordination of the sediment assemblages (known as the lambda r/lambda p score; Juggins et al. 2013). In Big Blake Lake, this analysis shows that the fraction of the maximum explainable variation in the diatom data that can be explained by TP is very high (= 0.9291). The high score from this analysis, coupled with the strong correlation with the logTP axis in the passive plot (Figure 11), suggests that TP has been a significant driver of diatom community change in this lake and therefore therefore we can be confident in the TP reconstruction.



The TP reconstruction on Big Blake Lake suggests that the lake has gone from a mesotrophic state to a eutrophic state, with levels starting to increase immediately after Euroamerican settlement (Figure 12). Diatom-inferred TP also suggests a sharp increase in TP after 1940. A final way to evaluate the strength of the TP reconstructions is to compare TP results with measured TP levels generated through regular lake monitoring programs. Monitored TP from 2012 to 2015 ranged from 23 to 135 ppb TP with notably higher levels in late summer and fall that were associated with cyanobacterial blooms.

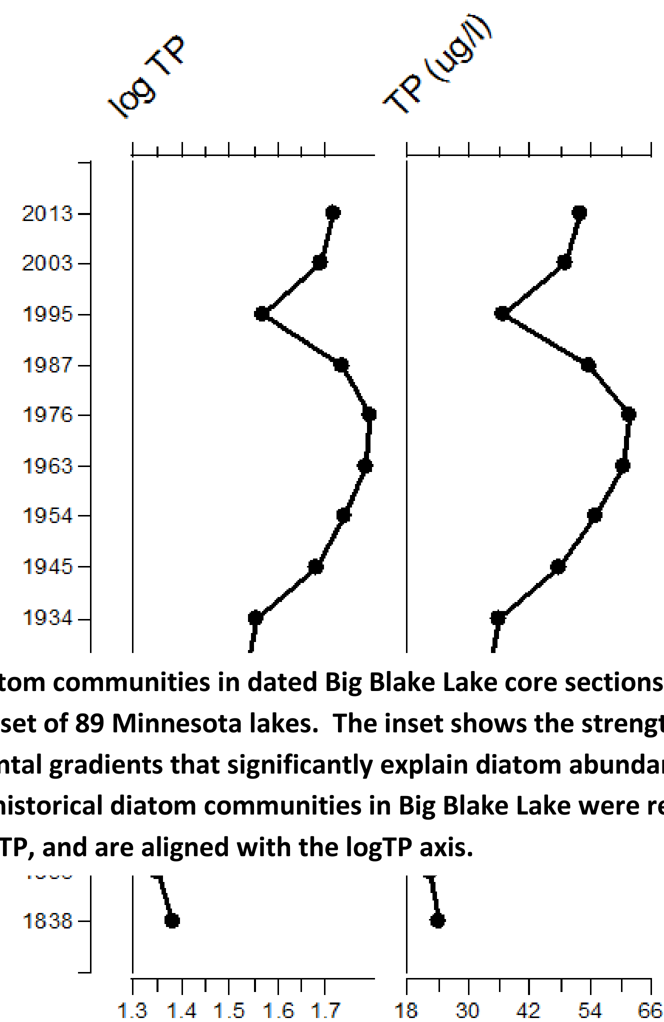


Fig. 11. Diatom communities in dated Big Blake Lake core sections passively plotted onto the calibration set of 89 Minnesota lakes. The inset shows the strength and direction of environmental gradients that significantly explain diatom abundance in the calibration set lakes. The historical diatom communities in Big Blake Lake were responding strongly to changes in TP, and are aligned with the logTP axis.

Fig. 12. Historical diatom-inferred TP levels for Big Blake Lake. Model reconstructions (left panel) are in log TP units (model error estimate is 0.2069 logTP units; RMSEP). The back transformed diatom-inferred TP levels are given in the right panel in the more commonly reported units of µg/l or ppb.

Historical Algal Communities

The algae consist of many biological groups of organisms that do not represent a single lineage on the evolutionary tree of life, but are linked by function—the algae generally are small, photosynthetic, and do not have organized tissues similar to higher plants (flowers and trees). From an ecological perspective the algae are critical to the functioning of the earth (algae account for about 50% of the photosynthesis—hence the oxygen we breathe) and form the base of the food web in most lake and river systems. The different algal groups are separated based on their cell structure (bacterial type or prokaryotes—the Cyanobacteria; or true cells or eukaryotes—the rest of the algal groups), storage products (starch, lipids, proteins), pigments, cell wall or membrane structure, cellular organization, and life history types. The types of algae present in a lake are influenced by environmental and biogeographical factors like climate, phosphorus, nitrogen, and silica concentrations and ratios, pH, grazing, substrate, and other factors in the lake basin. Lakes that have been heavily impacted with nutrients most often are dominated by blue-green algae for the greater part of the open water season with spring and winter the only periods where other algal groups might dominate.

Algal pigments were quantified in fifteen core sections to determine the historical concentration or production of different algal groups (Figure 13). Total algal production, as measured by betacarotene and chlorophyll *a*, showed that overall production was relatively low until the 1940s with sharp increases after the 1960s. The diatoms and most of the cyanobacterial groups followed this same pattern, with the exception of aphanizophyll which was not present until the 1980s.

Cyanobacterial groups were present throughout the length of the core, dating back to the 1800s. Cyanobacteria or blue-green algae are a natural and normal part of the algal flora in all lakes, but they tend to flourish in nutrient-rich waters, and may cause nuisance or harmful algal blooms. Pigments from the cyanobacteria are differentiated into various types that are associated with specific subgroups of blue-green algae (e.g., canthaxanthin, lutein-zeaxanthin, etc.), and there is evidence that pigments associated with potentially toxic, nitrogen-fixing forms (aphanizophyll) have become much more abundant in the lake in recent times. The recent dramatic increase in abundance of aphanizophyll in Big Blake Lake suggests that conditions were not conducive to support nuisance blooms of cyanobacteria until late in the 20th century. Evidence would also support that recent nutrient increases due to watershed development and the introduction of *Potamogeton crispus* have exacerbated cyanobacteria growth so that blooms are more prevalent than in the past.

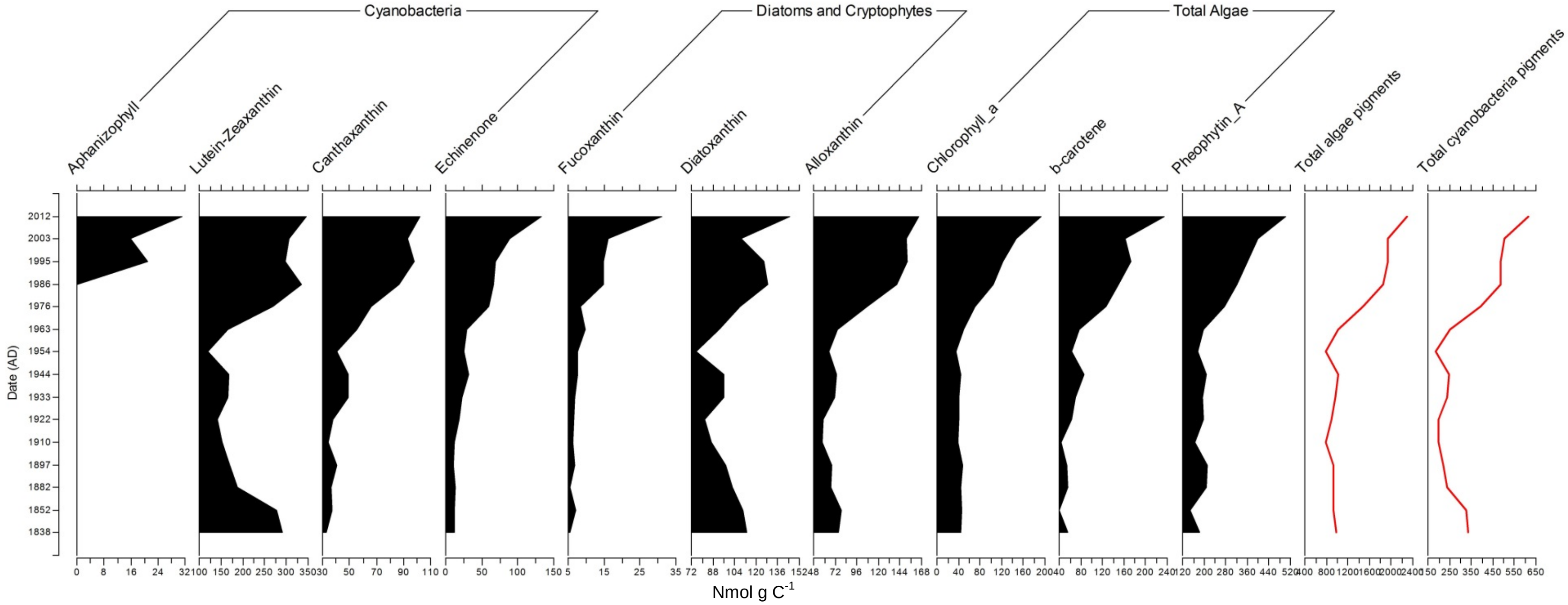


Fig. 13. The sediment algal pigments quantified in fifteen core sections from Big Blake Lake. The group of algae associated with each pigment is also shown along the x-axis.

Historical Zooplankton Communities

Cladoceran subfossils were quantified in fifteen core sections to determine the historical concentration or production of different zooplankton species (Figure 14). Total zooplankton, as measured by subfossil count, showed that overall abundance was high until the 1960s when sharp decreases in littoral species began. Other species followed this same pattern, with a small increase of production in the most recent two decades.

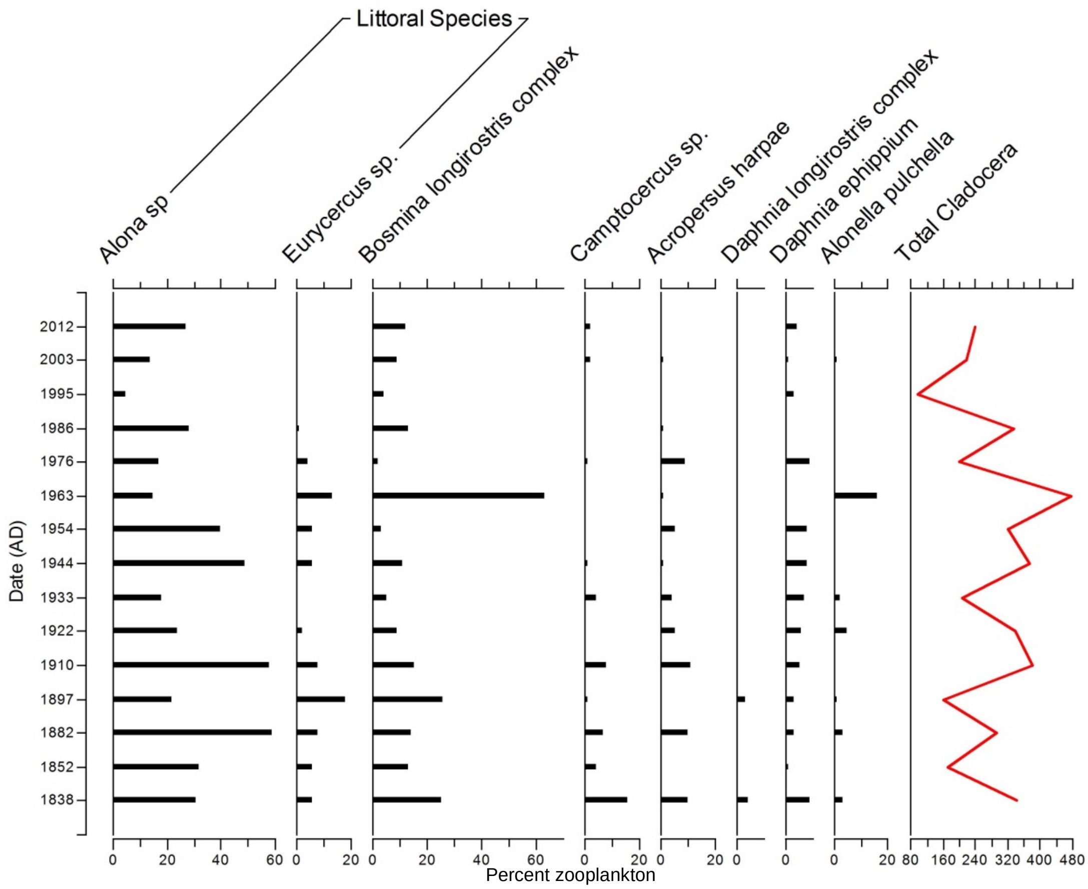


Fig. 14. The sediment cladoceran subfossils quantified in fifteen core sections from Big Blake Lake.

Zooplankton is often overlooked in paleolimnological studies, but their role in a lake is influential in structuring the algal and fish communities. Lake systems are valued primarily for water clarity, fishing, or other recreation, all of which are strongly linked to water quality and ecosystem health. Zooplankton is the primary link between the "bottom up" processes (through grazing) and "top down" processes (as a food source for fish) of the lake ecosystem.

Changes in the aquatic plant community and shoreland habitat can impact zooplankton populations. This occurs especially in shallow lakes where zooplankton are more likely to have the ability to migrate horizontally in and out of macrophyte (aquatic plant) beds to avoid predation from fish and other invertebrates, as is likely the case in Big Blake Lake. The loss of littoral taxa such as *Alona sp.* and *Eurycercus sp.* indicates changes in littoral habitat have occurred in Big Blake Lake, either from increased sedimentation, loss of the native aquatic plant diversity, or the introduction of invasive species such as *Potamogeton crispus*. The general decline in cladocera is likely due to multiple stressors such as sedimentation, aquatic invasive species, and the increasing prevalence of cyanobacteria in the system.

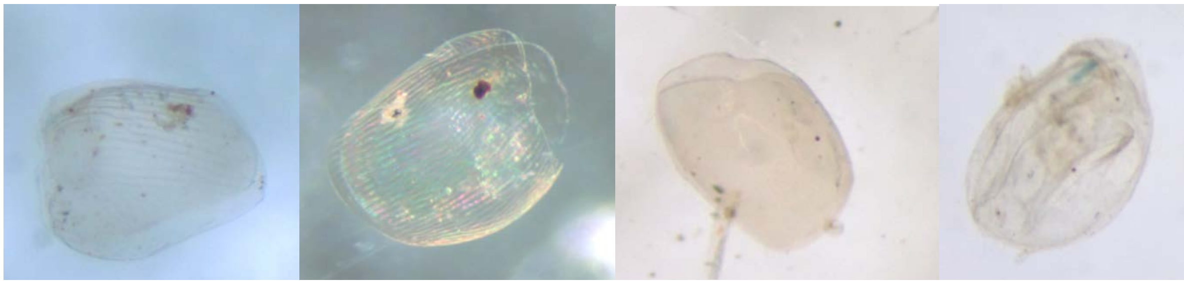


Fig. 15. Examples of subfossil cladocerans from Big Blake Lake recovered from various core depths.

Historical Chironomidae communities

Head capsules of larval chironomids, or the non-biting midges, have several attributes that make them useful as environmental indicators. They are stenotopic or able to tolerate only a restricted range of habitats or ecological conditions**,** but as a group are ubiquitous and abundant. In addition they are readily identifiable, species-rich, sensitive to change, and inferences drawn from chironomid assemblages can complement other paleoecological proxies (Brooks et al. 2007).

All head capsules from each sediment sample were identified to the lowest taxonomic level. Eleven taxa from five major groups were identified in the sediment samples (Figures 16 & 17). Some diagnostic characteristics that are used to separate taxonomic groups within the Chironomidae include: 1. the head capsule of the Tanypodinae looks very different than other chironomids as they do not have a distinctive row of teeth on the mentum, but have a hand-shaped ligula, 2. the Chironomini often have a large head capsule with fan-shaped striated ventromental plates and the mentum can have a variable number of teeth 3. Tanytarsini head capsules have sausage-shaped ventromental plates that are striated, and the mentum has one median tooth and five lateral teeth, and 4. the Orthocladiinae head capsule has a mentum that is very strongly arched (usually with 4-6 pairs of lateral teeth), with narrow, inconspicuous, unstriated ventromental plates, and sometimes has a beard. Another dipteran group that can be found in sediment is the phantom midges or Chaoboridae; for this group it is the mandibles rather than the head capsule that are preserved in lake sediment.

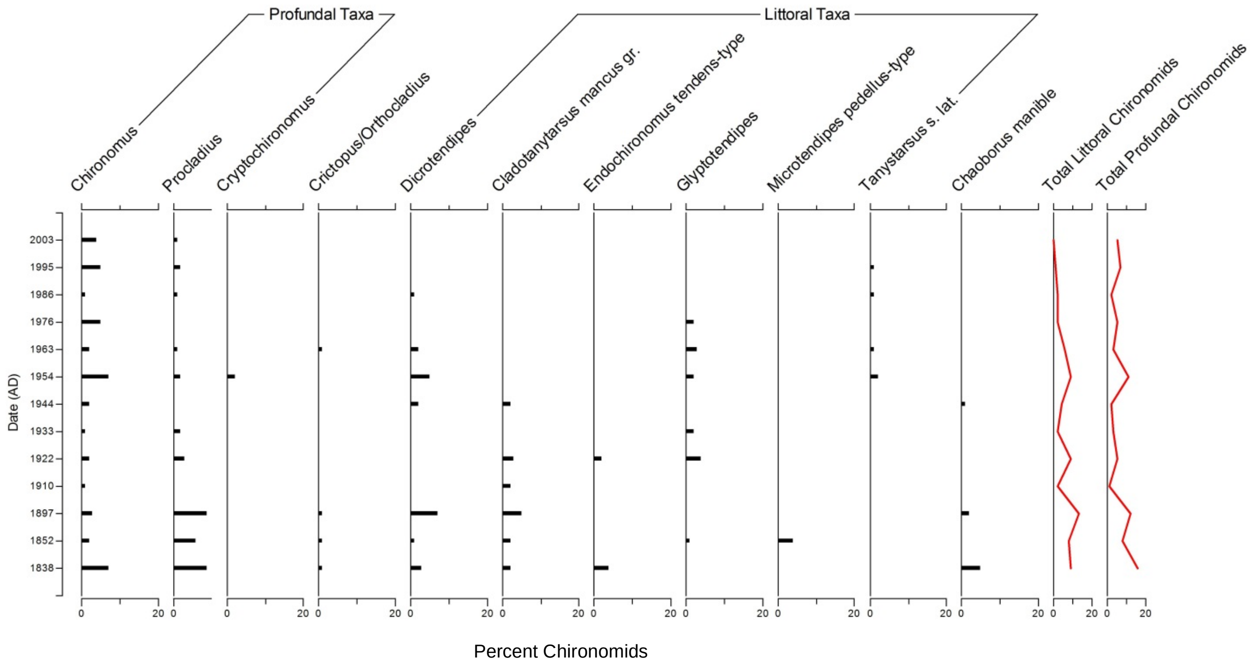


Fig. 16. The sediment chironomid head capsules and *Chaoborus* mandibles quantified in fifteen core sections from Big Blake Lake.

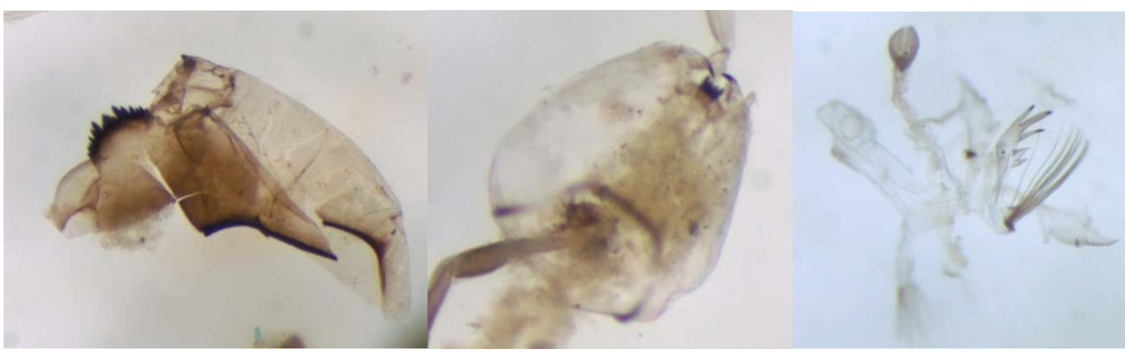


Fig. 17. Chironomid head capsules and a *Chaoborus* mandible from Big Blake Lake recovered from various core depths

Even with a low abundance of head capsules, differences in the chironomid community can be seen through time (Figure 16). There is a decline in *Procladius* starting in the early 1900s, while there is an increase in *Chironomus* in the 1950s. There is also a decline in *Chaoborus* in the early 1900s, and *Chaoborus* mandibles did not occur in the core after the 1940s. *Procladius* is carnivorous, and lives in fine sediments and may be eliminated during periods of anoxia; however, it can survive a long time in an anoxic environment. *Procladius* is most abundant in mesotrophic and eutrophic lakes. *Chironomus* is abundant in warm eutrophic lakes usually in the profundal zone. Due to the hemoglobin in their bodies, *Chironomus* is tolerant of low oxygen conditions and even anoxia for a few weeks. *Chironomus* is opportunistic and is often an early colonizer after environmental change. They are detritivores and filter feeders. *Chaoborus* are often referred to as phantom midges. A high abundance of remains can be indicative of anoxic conditions (Brooks et al., 2007). However, *Chaoborus* abundance is strongly influenced by fish predation, and remains can aid reconstructions of past fish population (Tolonen et al. 2012). There is also an increase of species of indicative of eutrophic conditions such as *Glyptotendipes*, *Dicrotendipes*, and *Chironomus* (Francis, 2001) beginning around the 1920s. *Glyptotendipes* and *Dicrotendipes* are large tube-building larvae that depend on a rain of plankton and detritus as food.

Chironomid head capsules have been used to model many facets of environmental change ranging from mean July air temperature and hypolimnetic oxygen to chlorophyll *a*. In this study chironomids where used to augment plant macrofossils and cladoceran subfossils to assess habitat alteration due to increased sedimentation and the introduction of *Potamogeton crispus* into Big Blake Lake. There is a sharp decrease in littoral species in the 1950s and there were none found in the most recently deposited sediment whereas profundal taxa generally did not decrease over time (Figure 16). This would suggest that habitat alteration due to increased sedimentation, aquatic plant management, and the introduction of *Potamogeton crispus* has had a profound effect on chironomid taxa in Big Blake Lake.

Historical Aquatic Macrophyte Communities

Rich aquatic plant communities in midwestern lakes are an invaluable part of the lake's ecosystem, particularly to invertebrates and fish. In lakes, plant growth is limited to certain depths based on availability of light. With greater water clarity, light can penetrate to greater depths and be used by plants for growth. In Big Blake Lake the maximum depth of plants is generally around 2.7 meters. In the spring and early summer, within vegetated areas, *Potamogeton crispus* (curly-leaf pondweed) is the most frequently encountered plant while *Ceratophyllum demersum* (coontail) is the most frequent plant in the late summer and early fall (Figure 18).

Fig. 18 *Ceratophyllum demersum* (coontail) macrofossil. Big Blake Lake core, 31 cm.

Potamogeton crispus can have a particularly negative impact on aquatic macrophyte communities because of its life cycle; germinating in the fall, lying dormant throughout the ice covered season, then actively growing in early spring before indigenous macrophytes have a chance to become established. Because of early germination, *Potamogeton crispus* also senescences early with the potential to release large pools of phosphorus from plant tissues and the sediment, and further reducing littoral coverage of indigenous species.

Because aquatic macrophytes play such an important role in lake ecosystems (especially shallow lakes) macrofossils were identified from 15 different core sections. All plant remains with diagnostic features where picked and identified to the lowest taxonomic resolution possible (Figure 19).

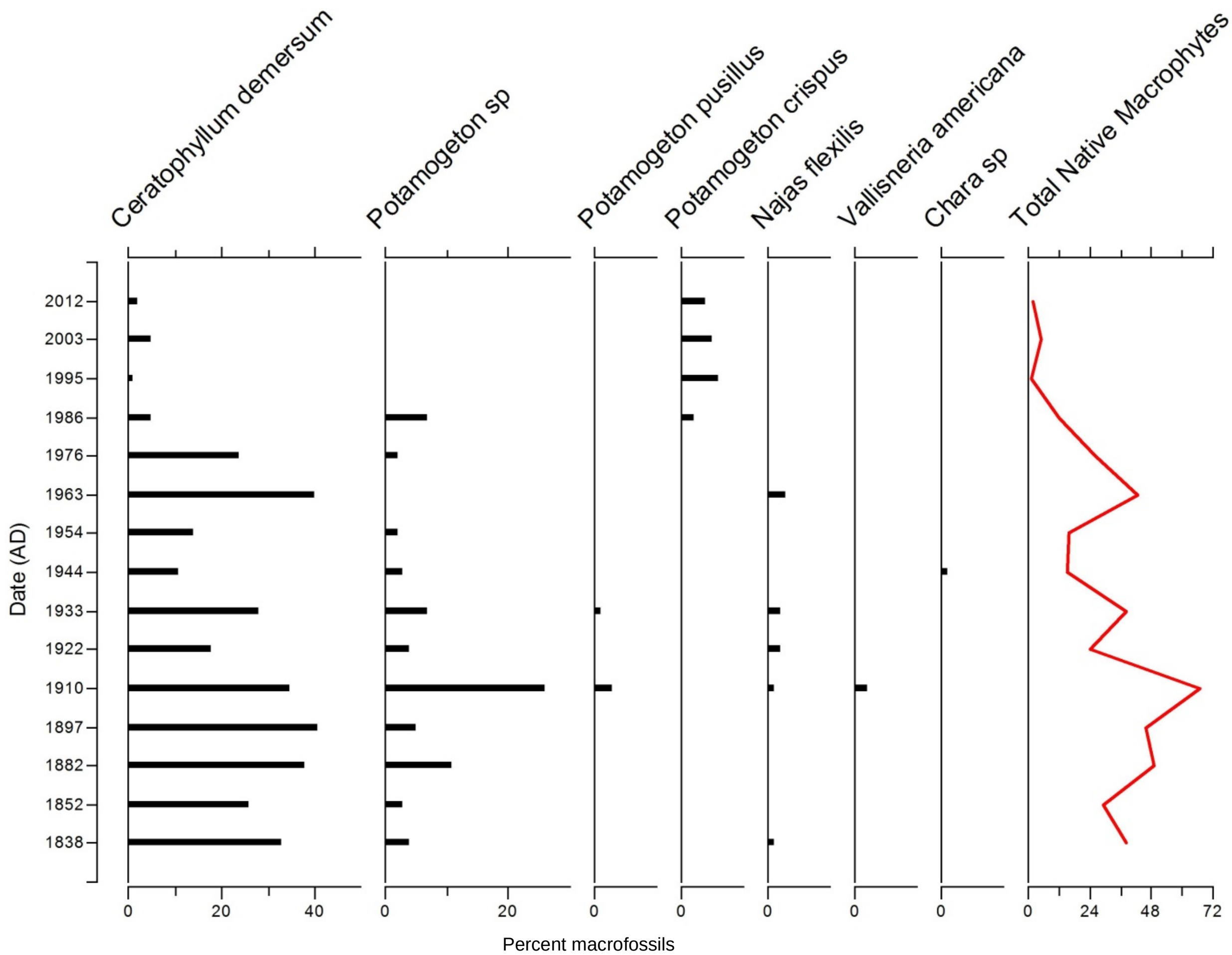


Fig. 19. The sediment aquatic plant remains quantified in fifteen core sections from Big Blake Lake.

Macrofossils of indigenous aquatic plants begin to decrease around 1910. This is likely to do land clearance on conversion in the watershed. There is a sharp decline in native macrophytes after the 1960s. This is likely due to additional watershed disturbances, the increase in nutrients, and the expansion of lake shore development, and eventually the introduction of *Potamogeton crispus* in the 1980s. The most recent decades have very few indigenous fossils but there is a higher occurrence of *Potamogeton cripus* beginning in the 1980s. Multiple stressors have severely altered littoral habitat in Big Blake Lake.

Conclusions

There have been dramatic changes in Big Blake Lake since pre-Euroamerican settlement. Sedimentation had a peak in 1910 and continued increasing in the 1940s to present day levels almost four times as high as historical sedimentation rates. The composition of the sediment has shifted from mostly organic to inorganic portions. Sediment phosphorus and biogenic silica also see significant increases over the period that this study examined.

Overall, the sediment record shows multiple lines of correlated biological evidence of a shift in Big Blake Lake to its current eutrophic condition (Figure 20). For example, there were major changes in the diatom community of Big Blake Lake. The diatom flora was dominated by benthic and mesotrophic taxa from pre-settlement until the 1930s. By the 1940s the lake became dominated by eutrophic, planktonic taxa likely due to phosphorus enrichment. Indeed, diatom inferred TP concentrations show an increase to phosphorus levels considered eutrophic by the 1940s. A sharp increase in *Fragilaria crotonensis* accompanied a period when small seasonal cottages were being replaced with year-round lake homes. The algal pigment analysis showed that cyanobacteria have significantly increased since the 1960s with nitrogen fixing, possibly toxic forms appearing by the 1980s.

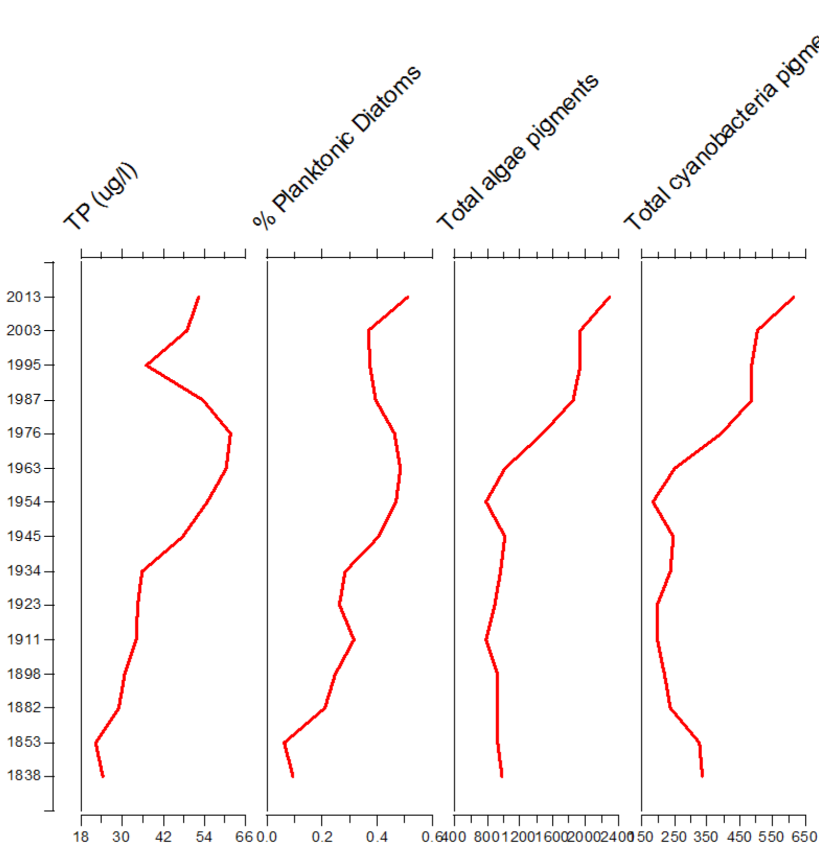


Fig. 20 Indicators for Big Blake Lake core showing a shift to a eutrophic state

Other biological indicators show how in-lake habitats have changed in Big Blake Lake (Figure 21). Cladoceran and littoral Chironomidae are greatly reduced after the 1960s indicating that there have been major habitat alterations in Big Blake Lake. This is like due to multiple factors such as sedimentation and changes in sediment composition, nutrient enrichment, loss of native plants, and the introduction of *Potamogeton crispus*. Aquatic plant remains of indigenous species decline sharply during this same time period as well. The absence of *Chaoborus* mandibles would indicate that habitat alterations also led to a change in the lake's fisheries.

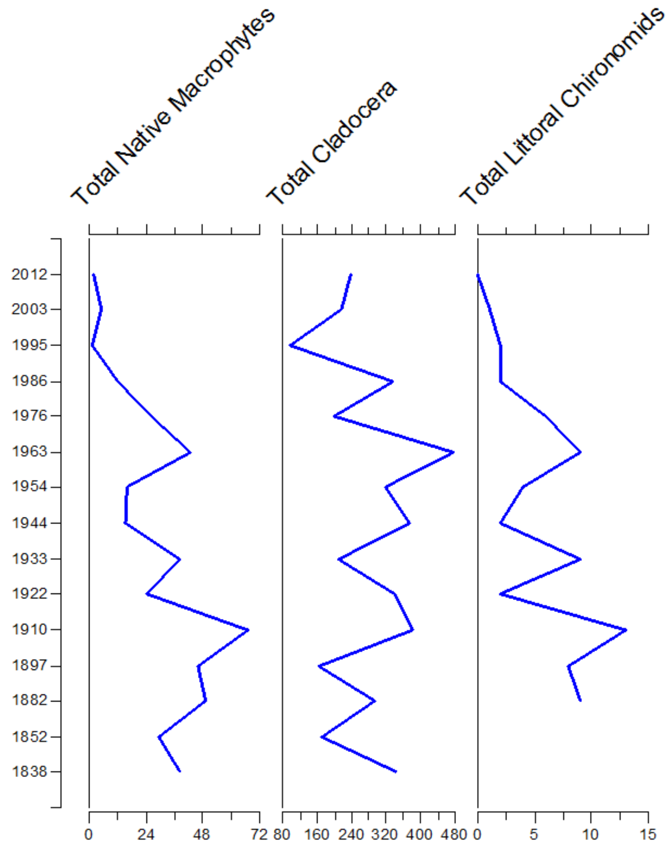


Fig. 21 Indicators of littoral and mesotrophic state showing decline from the Big Blake Lake core

Big Blake Lake has seen significant changes over the period of this study. The lake has shifted from a mesotrophic lake with a healthy aquatic plant community and associated fauna to a nutrient-rich eutrophic lake dominated by *Potamogeton crispus* in the spring and early summer (Figures 20 & 21). The Big Blake Lake Protection and Rehabilitation District should continue control efforts by harvesting and removing *Potamogeton crispus* biomass. Wider control efforts in the watershed should emphasize working collaboratively with other districts in the Straight River watershed. Efforts should be made on Big Blake Lake to install best management practices for nutrient control around the lake, including nearshore and littoral habitat protection along with other management strategies. The district should maintain monitoring efforts that are in place to detect further changes in lake condition.

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Appendix K

Newsletters, Presentations, and Handouts

BLAKE LAKE

BUGLE

Future District Meetings:

Spring Meeting 2015: May 16

Annual Meeting 2015: August 15

Current dam condition Sept. 1, 2014

UPDATE: Reconstruction of the Big Blake Lake Dam

What happened? Why did the dam break?

In late April three things happened to create "the perfect storm". Days of heavy, soaking rains saturated the soil and strong winds during "ice-out" pushed ice chunks into the old logging dam. Rip-rapped boulders and the old logs constituted the dam and it gave way to the elements.

New dam in 2015

The Lake District Board has been very busy figuring out all that needs to be done to replace the dam as quickly as possible.

The Sherrard family estate has owned the dam. They are working closely with the District to transfer ownership of the dam (and needed adjoining property) to the District. Also, there was some concern that the DNR may require us to completely remove what is left of the existing dam at some point this year. The folks from the DNR said that they did not feel it would need to be removed — as long as it poses no danger. The current plan is to remove the old dam 'after' the new dam is in place. The District received approval to place rip-rap where the dam breached this past Spring to prevent additional erosion. The work was professionally done by Marv Pass (see photo above). This is not intended to repair the existing dam structure nor is expected to help retain any additional water in the lake. *Continued on next page.*

On July 18th, members of the board and APM Coordinator Jim Maxwell, met at the dam site along with members of the Sherrard family, the DNR, a Polk County surveyor and our contracted engineer — Larry Gotham. All parties agreed on the placement of the reconstructed dam. This would be downstream of the existing structure which will allow us to complete construction of the new dam without lowering the current lake levels any further. The final survey is almost complete.

We have a preliminary project plan pulled together. We are looking to have all paperwork, engineering work and approvals completed by the Spring of 2015. The current estimate is May 1st, 2015 and we are seeing if we can move that date up any further. Once everything has been approved, contractors identified and construction begins, our engineering team is estimating 30 days to complete the construction of the dam.

New Dam: "Rip-Rap Rock Chute Dam"

Overview:

- This type of dam is simple, economical and can be built without dewatering
- Virtually Maintenance Free
- Rip-Rap Rock Chute Dam can be built in about thirty days after all the red tape
- Red tape takes about ten-twelve months (survey map, deed transfer, draft and final agreement, plans to WDNR, bidding/negotiations, build)
- Preliminary Estimate $100k - $150k

Above: This is a typical rip-rap rock chute dam for a high head. The steel sheet pile can be seen under the bridge. This dam will look very natural and in keeping with

Dam Costs Assessment: calculate what you own

How many parcels?
Do any parcels have lake access / lakeshore?
If so, how many feet of shoreline do you own?
For example:
1 parcel, shoreline, 100'
1 parcel, backlot
1 parcel, backlot w/access, 6' (easement is not considered access)

Riparian v non-Riparian 84% / 16% split	Unique: Flat Fee v Non: Flat Fee 91% / 9% split
193 parcels x $434=$83,762	**"Unique"** Owners own at least one property with lake access
75 parcels x $217 = $16,275	**"Non"** owners have no property with lake access
Riparian = $434 ea non-Riparian = $217ea	176 Unique Owners x $518 = $91,168 34 Non x $260 = $8,840
per Parcel based on $100,000 dam Riparian means you have deeded access to the lake or lakeshore property	**per Owner** based on $100,000 dam

Otter Sighting — Keep Your Distance

This family of river otters with a baby was spotted on a dock and boat lift on the west side of the lake in the narrows on September 7. Be careful around otters. Keep your distance. They are fun to watch, but are capable of aggressive behavior. Males can be 25 lbs., females 19 lbs.

Volunteers Active!

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, Clean Waters
That is a 20%
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Join Us! If you would like to volunteer for next year please contact Peggy Lauritsen at plauritsen@pldg.com or 612–940–2006.

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Some of the 52 CBCW volunteers, pictured left to right: Judy Hall, Katelin Holm/Water Quality Specialist, Polk County Land and Water Resources Department, Mike Rogge, Naomi Anderson, Tom Borden, Diane Borden, Sue

Call to Order at 9:05 by Sam Weber.

Welcome and Introductions

Board Members Present: Sam Weber, Tom Borden, Jim Filkins, Joan Maxwell, Polk Co Designee Cedric Solland.

Board Members Absent: Adam Elliott, Ron Ogren

Approval of meeting minutes (handout)

Motion to accept/approve minutes from 2013 Annual meeting by Stephanie Hinrichs; Second by Sue Ogren. Motion carries.

Approval of Treasurer's report (handout)

Motion to approve Treasurer's report by Char Dunst; Second by Stephanie Hinrichs. Motion carries

Introduction of Guests and Presentations

Jeremy Williamson, Polk Co LWRD

re: Core Sediment Sampling

Jeremy Williamson presented an update on the findings for the core sampling collected in September 2013. Jeremy has been doing studies on our lake since 2006. He is currently doing top and bottom water chemistry, algae and zooplankton sampling and reconstructing the history of Blake Lake through the core sampling.

They took two core samples and have 195cm of mud, essentially. From this core, they are extracting a lot of geo-chemical data looking at what phosphorus is bound to, finding out how much erosion has occurred in the entire watershed, etc. They date the core, calibrate it, then pull out the diatoms, zooplankton fossils, fish flies, pigments, and all sorts of things to measure and observe.

Blake Lake is really interesting because it has changed significantly over time. We have a low sedimentation rate. They took 2 meters of "mud" and they were able to go back to pre-settlement within 40cm... back to around the 1300s. Our geo-chemical analysis so far seems to indicate that our lake really began changing in the 1970s. In looking back to where we've been, to where our lake has been historically, we will be able to more accurately develop an aquatic plant management plan that is realistic and is based on evidence from where our lake has been in the past.

At the end of this core sampling data analysis, Blake Lake will develop a plan that will outline where we are going with respect to aquatic plant management. This will involve forming a committee to look at the data and present a plan to the District. This will also involve continued citizen lake monitoring participants. Clean Boats Clean Waters will also play a huge role in preventing the spread of aquatic invasive species and protecting our lake water and ecosystem.

Old Business

Slow-no-wake Zone (Tom Borden)

Commissioner Tom Borden updated the District

WDNR and we are n
for buoys to mark th
on Big Blake Lake. V
for the 2015 boating

Email List

The District would li
member in order to c
list sign-up sheet was
wishes to add their e
District info, CBCW
address to Peggy Lau

Standing Committe

Clean Boats Clean W
already completed 76
of CBCW monitoring
complete our goal.

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our Lake District me
serious issue on area
towels and ice packs
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Three CBCW volunte
PCALR for Citizen L
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training.

Polk Co LWRD expe
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Rogge, Naomi Ander
Marge Filkins, Jim Fi

APM Harvey Report
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e engineer is

reconstruct the Dam, to assess the District for the costs of this project, and to borrow funds to get things rolling on this with a cap of $175k. If Dam costs go above $175k, the District will hold a special meeting to discuss the project costs and seek approval for additional funding. We do not anticipate this happening, and feel comfortable with the $175k borrowing approval at this time.

VOTE: Funding for Dam Reconstruction: Approved

Motion approving the Dam Reconstruction project by Sue Ogren/ Ford Elliott. Motion carried unanimously.

VOTE: Borrowing Funds for Dam Reconstruction:
Approved unanimously. Three methods of assessment were presented to the District:

1) Riparian v Non-Riparian

2) Unique Flat Fee v non-Unique Flat Fee

3) Flat Fee for all plus Riparian cost per foot of shoreline

*Riparian means you have deeded access to the lake or you own lakeshore property. The Board will determine the method of assessment; thank you for your input.

Announcements - Save the Dates

1) Spring Meeting: May 16, 2015 (3rd Saturday in May)

2) 2015 Annual Meeting: August 15 (3rd Saturday in August)

3) 2015 Pontoon Parade: July 4, 4:00 p.m.

Adjourn: Sue Ogren/Gail Rustad, unanimous. Adjourned 11:10.

78 District Members attendees; 6 non-District attendees.

Minutes Submitted by: Sam Weber, Co-Chair

Common Acronyms:

APM:	Aquatic Plant Management
AIS:	Aquatic Invasive Species
BBLP&RD:	Big Blake Lake Protection & Rehabilitation District
CBCW:	Clean Boats Clean Waters
CLMN:	Citizen's Lake Monitoring Network
EPP:	Education, Prevention, & Planning
LWRD:	Polk Co. Land & Water Resources Department
PCALR:	Polk Co. Association of Lakes and Rivers
SWIMS:	Surface Water Integrated Monitoring System
WAL:	Wisconsin Area Lakes (now: WI Lakes Partnership)
WDNR:	Wisconsin Department of Natural Resources

Call to Order: Tom Borden, 9:00 AM

Motion to approve minutes: Jim Thorn/Sue Ogren. Unanimous.

Treasurer's Report: Jim Filkins presented the Treasurer's report and spoke about the need to approve a 50K Reserve account for Harvey as a Capital Expense Acct. Something that never was officially approved in the past. Sue Ogren motioned to approve capital exp acct and Peggy Lauritsen seconded, motion carried. Ogren/Lauritsen motion to approve Treasurer's report carries.

Presentation:

Jeremy Williamson: Core Sediment Sampling:

Jeremy and Katelin from Polk Co LWRD did point intercept surveys on the lake this summer and spoke about gathering extensive data and entering into the mapping program. Curly leaf way behind this year. Native plants are growing where curly leaf used to be abundant, and that's a good thing. Taking chemistry samples at inlet and outlet and using a flow meter to gain critical information. Also is interested in doing sediment core samples – working with science museum – doing Geo chemical analysis also and looking at historical land use, going back 150 years or so. Lessening curly leaf makes us eligible for more grants.

Old Business:

Slow – No-wake:

DNR needed comments and feedback from residents on the lake who have been impacted by the land erosion and lack of a slow wake zone.

Jack Belisle who doesn't live in the narrows commented on the boaters. Gerry Smith remarked about possibly having an on-line survey for our residents to give feedback regarding the need for a slow-no-wake zone. He thought it might be a danger to boaters to hit the buoy with their boat. He was told that it is the boaters responsibility if he does. This was a quote from Mark Little @ DNR. Gale Rustad lives in the narrows and has seen rip-rap totally washed away and seen people spin their watercraft in narrows. Peggy Lauritsen has seen a lot of traffic right by their dock. She commented that in her line of work they do surveys on-line often and if you get a 30% response on the survey is good. Ford Elliott says that 200 feet North of narrows gets hammered with wake. Says buoys are in the water at Balsam. On our lake we would be placing two buoys at each end. They are made of covered foam. Adam Elliott had a question regarding clarity on what kind of buoy. Sue Ogren says boaters are still coming too close to property. Suggested reminding boaters. Jerry Belisle has seen boaters going between his float and his shoreline. Vincent Tueber asked about the number of feet from shore and other boaters. Gail Rustad says people are asking "Where does the no wake zone start and end?" Says they need to see the signs.

Trash can vs. Signage at landings:

Tom Borden reported that trash cans rent for $55 a month and two would be required if we go that route. It was decided – no trash barrels. Signage is better to encourage people to take home their trash and dispose of it properly.

Standing Comm

CBCW: Peggy Laurit
signed up this year. S
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APM: Jim Maxwell s
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Core Sampling Gran
The total for District'
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Elliott seconded. Mo

New Business:

Annual budget: Jim
up significantly. The
Budget remains at $2
motion to approve ca

WAL Convention: S
strongly recommend
Borden and Peggy La

4th of July Parade: P

Spring Meeting 2014

Annual meeting: Au
Adam Elliott volunte
motion carried.

Adjourn: Ford Elli

Paleolimnology of Blake Lake Using Sediment

Paleolimnology is the study of ancient lakes from their sediments and fossils. Jeremy Williamson, Water Quality Specialist, Polk Co. LWRD collected core sediment samples in September, 2013. Since 2006, he has been studying water chemistry, algae and zooplankton to reconstruct the history of the lake. This core data analysis will be the foundation of an aquatic plant management plan for the future.

Read more on page 5. See August 16 District Meeting minutes.

Contacts

Waterfront Property, Polk Co., WI

Alterations to shoreline? Cutting Trees? Building, remodeling, boathouses, driveways, garages, fire numbers?

Polk County Zoning:
(715) 485-9111
http://www.co.polk.wi.us/

Burning permits and restrictions? WDNR or town, village or city:

1-888-947-2876
http://dnr.wi.gov/topic/forestfire/restrictions.html

More resources at:
Polk County Association of Lakes and Rivers (PCALR)
http://pcalr.org/our-lakes-and-rivers/

BLAKE LAKE BUGLE

1988 S. Baker Road
Balsam Lake, WI 54810

Photo by Sam Weber

SAVE THESE DATES

2015 Spring Meeting: May 16 (3rd Saturday in May)
2015 Annual Meeting: August 15 (3rd Saturday in August)
2015 Pontoon Parade: July 4, 4:00 p.m.

BLAKE LAKE BUGLE

Save the Dates!

May 16: Spring Meeting, 9am

June 6 and 13: CBCW season kickoff training

June 13: Pontoon Classroom

July 4: Pontoon Parade, 4pm

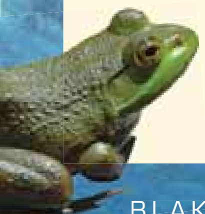
August 15: Annual Meeting, 9am


Current dam image

UPDATE: Blake Lake Dam Reconstruction

We are actively working on the dam reconstruction project and making progress. Working with the DNR and the Sherrard Family/estate, extra time has been needed to finalize legal agreements to get the project into reconstruction. We are moving as fast as we can while being mindful of the real estate issues inherent with the Sherrard family's recent loss. That being said, we are making progress.

We have been fielding questions in the past couple of weeks regarding the dam project. Yes - there are lots of discussions and rumors flying around, too. Our goal is to bring you up to date on our progress and answer some of the questions you may have. We will have more updates during the **Spring Meeting on Saturday, May 16, 9am.**



Questions & Answers

Q: How will the costs for the dam reconstruction at $100,000-$150,000 be assessed to members?
A: After careful consideration of the will of the District members who weighed in at the 2014 Annual Meeting, the value of the Sherrard Family deeded land to reconstruct the dam, and the loan terms offered by the BCPL State Trust Fund Loan Program, the Board has resolved that the dam may be assessed as follows:

$100,000 Dam reconstruction cost @ 3% interest rate*
Riparians: $111.50 per year x 5 yrs = $557.50
Non-Riparians: $57.10 per year x 5 yrs = 285.50

$150,000 Dam reconstruction cost @ 3% interest rate*
Riparians: $167.25 per year x 5 yrs = $836.25
Non-Riparians: $85.60 per year x 5 yrs = $428

Continued on page 3

BLPR District Leadership

Sam Rivers Weber Co-Chair
2cherokeerivers@gmail.com | (715) 554-1054

Adam Elliott Co-Chair
adam.elliott@idinsight.com | (651) 343-5380

Tom Borden Commissioner
trborden@msn.com | (651) 335-3895

Jim Filkins Treasurer
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Peggy Lauritsen
Communications Commissioner / Secretary
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The *Blake Lake Bugle* is a publication of the Big Blake Lake Protection and Rehabilitation District. The *Bugle* is published seasonally for friends and members of the district. To receive lake news, send your email address to Peggy at plauritsen@pldg.com or mail to the address below.

Lake Management Plan Update

By Sam Rivers Weber

Ice out on April 2nd, 2015, kicked-off our final year of significant data collection, which will inform our Aquatic Plant Management (APM) plan slated to be developed in late 2015 to early 2016 through the efforts of our district members forming an APM committee to look at all the results of the biological reports, core sample findings, the data collected by our Citizen Lake Monitors, our District-wide sociological survey results, and our CBCW data.

As you plan your seasonal activities, please consider becoming a part of these salient ventures designed to educate our members, protect our lake and what we value most about it, and prevent permanent and future damage from destroying this beauty, this goodness, this sanctuary of relaxation, recreation, and precious memories.

For more information, attend our Spring Meeting on May 16 and our Annual meeting on August 15 where some of the experts will present the findings of our grant-sponsored projects. Also, our first ever Pontoon Classroom will be held June 13; a wonderful opportunity to educate yourselves and your family members, and to become supportive stewards of Big Blake Lake.

Blake Lake: We Live It, We Love It, We Mean It!

Two District Board Positions Open, Fall 2015

Two current board members will be completing their term of office this year, Jim Filkens and Tom Borden. We will be electing new board members at our Annual Meeting on Saturday, August 15. Now is the time to think about serving on the board. For more information contact Sam Rivers Weber at 2cherokeerivers@gmail.com or (715) 554-1054.

Contacts

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http://dnr.wi.gov/topic/forestfire/restrictions.html

More resources at:
Polk County Association of Lakes and Rivers (PCALR)
http://pcalr.org/our-lakes-and-rivers/

Dam Reconstruction Update, cont.

Q: How are you managing the dam project?
A: After conferring with other lake districts and the DNR, we have hired a highly recommended engineer to oversee all aspects of the dam reconstruction project. He is working on all aspects of the project from surveying the property, helping secure all necessary agreements, creating the plan and submitting to the DNR as well as being responsible for the construction phase. It is our intent that this will allow us to complete the project in the most effective way possible.

Q: What is the current status of the dam project and what is the estimated timeline?
A: We have been working diligently on the dam reconstruction project and are currently working on all needed land transfer and easement agreements. Once complete, this will allow us to finalize our plans that will then be submitted to the DNR for final approval. We do not fully control these agreements or the DNR approval process so it is difficult right now to estimate the date when the dam reconstructed will be complete. While we are hopeful that everything will be completed in 2015, there are no assurances that this will be the case.

Q: How long will it take to reconstruct the dam once the plan is approved.
A: The actual construction of the dam is expected to take days and weeks, not months.

Q: What are the anticipated water levels this Summer before the reconstructed dam is complete?
A: Because Big Blake Lake is on a flowage, the water levels can fluctuate based on many factors, including Spring run-offs, overall precipitation and other factors. At the end of last Summer, the water levels were manageable with the existing dam. We are working closely with the DNR to do what we can to maintain the existing water levels until the dam project is complete.

Q: Should I be putting in our docks and boats this Spring, or wait until the dam project is complete?
A: As mentioned above, the water levels can fluctuate, especially with the current state of the dam. While we do not anticipate water levels dropping to levels that may impact your dock and boat placement, your decision is personal preference and may depend on the shoreline water depth near your property.

Q: If I am selling my property, what do I need to disclose to a potential buyer?
A: Please consult your realtor or real estate professional about what you need to disclose. The Board is doing our best to be transparent and update all members about the costs, the timelines, risks and process as we move forward.

Q: How long will it take to reconstruct the dam once the plan is approved.
A: The actual construction of the dam is expected to take days and weeks, not months.

Q: When the old dam is removed, will lake levels drop significantly?
A: The engineers have told us that this is not the expectation. The plan calls for placing the new dam West of the old dam and then to remove the old dam after placement of the new dam.

Q: Will there be a bridge over the new dam and will this be accessible by Big Blake Lake residents?
A: The current plan calls for a foot bridge to go over the dam that can be accessed by residents. The final bridge design is not yet complete.

Q: Will maintenance be required on the new dam?
A: Yes. Periodic inspections will be required and we will have secured the necessary easements and rights to inspect, maintain and repair (if necessary) the dam. We do not anticipate significant incremental costs to perform inspection, maintenance and repairs. We are anticipating any incremental costs to be covered in our annual budget.

Q: Is it possible that the new dam could also fail?
A: While this is certainly always a possibility, the new dam will have all of the latest technology and engineering that our 100 year old dam did not have. The DNR is requiring us to build a dam that is appropriate for a lake of our size and configuration. ❡

Respectfully,

Adam Elliott, Sam Weber, Tom Borden, Jim Filkins and Peggy Lauritsen | *Board Members, BBLPRD*

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* Our interest rate is not locked in yet, so assessments may vary slightly from these numbers. This answer is intended to give you the best information we have at this time from the BCPL Loan Program. Our rate will be locked in upon our loan approval, which is anticipated to take place by mid/end-of May 2015. All loan documents have been filed and are pending final approval. Dam costs have not been determined yet.

June is Invasive Species Awareness Month/WDNR!

Get Involved! Lake Monitoring

The Citizen Lake Monitoring Network is a 1000+ citizen volunteers statewide who gather and monitor lake data, supported by the Wisconsin Lakes Partnership. Volunteers provide their time, expertise, energy, and a willingness to share information with their fellow lake residents or other lake users. The information gathered by these monitoring programs is used by WDNR and university biologists and researchers, UW-Extension, and other interested individuals.

Clean Boats, Clean Waters, is a statewide program. Volunteers are trained to organize and conduct boater education in their community. Adults and youth teams educate boaters on how and where invasive species are most likely to hitch a ride into lakes. Volunteers perform boat and trailer checks for invasives, distribute brochures and collect and report any new lake infestations.

Join Us! To volunteer on Blake Lake, contact Peggy Lauritsen at plauritsen@pldg.com or 612–940–2006.

NEW Volunteers and Veteran Volunteers Welcome! Join us again this year!

There will be training on two Saturday mornings to refresh CBCW volunteers in June as part of the **WDNR "Drain Campaign" June 12-14**, a statewide initiative to make sure anglers know about Wisconsin's invasive species laws. Campaign posters, ice packs and flyers will be available for volunteers to give anglers at the landings again this year. Photos will be taken on all three dates for local media.

Clean Boats, Clean Waters - refresher basics and training at the landing
Saturday, June 6, 10am to noon
Blake Lake, east landing/north end of lake /Bystrom Lane
Come have a cup of coffee and kick off the boating season by volunteering with other CBCW volunteers. All new volunteers will be paired up with veteran volunteers this year. We will go over the basics of boat inspections and what is needed to educate the public about invasives. Supplies and t-shirts will be available for all volunteers Coffee, tea and treats provided.

Clean Boats, Clean Waters - refresher basics and training at the landing
Saturday, June 13, 10am to noon
Blake Lake, east landing/north end of lake /Bystrom Lane
Come have a cup of coffee and kick off the boating season by volunteering with other CBCW volunteers. All new volunteers will be paired up with veteran volunteers this year. Training will be done by Katelin Holmes, Water Quality Specialist, Polk County Land and Water Resources Department. We will go over the basics of boat inspections and what is needed to educate the public about invasives. Supplies and t-shirts will be available for all volunteers. Coffee, tea and treats provided.

New! Pontoon Classroom
Saturday, June 13, Noon to 2pm
Blake Lake, east landing/north end of lake /Bystrom Lane
Join the Polk County Land and Water Resources Department for an on the water experience to learn how water samples, algae samples, and sediment samples are collected and analyzed on Big Blake Lake. This is your opportunity to learn how to find wild rice, how water samples work, learn more about Big Blake Lake and ask any questions you have regarding the lake. There is no cost to attend the classroom, but please RSVP to Katelin Holm at katelin.holm@co.polk.wi.us or (715) 485-8637. Kids over 7 years are welcome, everyone bring a life jacket.

What's needed to be a CBCW volunteer?
Requires: 2 hours of reading orientation material, watch a 7 minute video about boat inspections, perform first boat inspection with a veteran volunteer, and do up to 4 hours per month alone or with others monthly (June, July, Aug., Sept.).

New CBCW Coordinator wanted for 2016
At the end of this season, Peggy Lauritsen will complete her fourth year and retire as CBCW Coordinator. We are looking for a new volunteer to step up and train this Summer to take her place next year. Could that be you? Let's talk. Contact Peggy at plauritsen@pldg.com or call 612-940-2006.

Contacts & Resources

Polk County Assoc. of Lakes and Rivers (PCALR)

Manage, promote, protect and preserve our lakes, rivers and streams

PCALR provides a forum for county lake and river groups to share information, ideas and resources for managing, protecting and restoring their lake, river or stream. The organization works in concert with Polk County Land and Water Resources Department to provide information and education to the public on rules, regulations and ways to help preserve the vitality of our waters.

Here are just a few reasons to visit their website resources: **http://pcalr.org/management-protection/frequently-asked-questions/**

- Lake protection plans, who benefits?
- Maintaining your lake lot, FAQs great questions!
- Shoreline ordinances you need to know

Library resources (just a sampling):

http://pcalr.org/library/

- Lake science basics
- Land use and watershed impact
- Blue-green algae effects on humans and pets
- Free tools for owners to self-assess habitat on your lakeshore
- Lakeshore property values and water quality

UW-Extension Lakes, College of Natural Resources

http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/default.aspx

A sampling of what you will find on their site:
- Wisconsin Lake Organizations
- Clean Boats Clean Waters
- Citizen Lake Monitoring Network
- Lake Leaders

Wisconsin Lakes Partnership

Since the early 1970s, the Wisconsin Lakes Partnership has been recognized as a national model of collaboration. Three groups form the core of this team:

1. UW- Extension Lakes (UWEX-Lakes), builds connections among stakeholders and provides supporting educational materials and programs;
2. The Wisconsin Department of Natural Resources (WDNR) supplies the technical expertise and regulatory authority;
3. Local lake people make up the third group, represented by Wisconsin Lakes. Citizen volunteers from around the state — lake organizations, property owners, and local governments — provide the political will and hard work to accomplish watershed restoration and lake protection goals.

We are all concerned with the future of our lakes and have joined together in active cooperation and conscientious planning for lake protection. Partnership activities include citizen volunteer monitoring, research, youth and adult training and education, aquatic plant protection, pollution prevention, invasive species education, water recreation planning, land and water regulation, and community assistance grants.

Source: UW-Extension Lakes http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/default.aspx

Subscribe to a FREE *Lake Tides* newsletter for people interested in Wisconsin lakes

http://www.uwsp.edu/cnrap/UWEXLakes/Pages/resources/newsletter/default.aspx

Amended Annual Meeting Minutes | August 16, 2014

Big Blake Lake Protection And Rehabilitation District

Note: to follow are amended minutes from the annual meeting on 8-16-14, that add detail to the minutes published previously. For a complete set of annual meeting minutes, see the September 2014 issue of the Bugle newsletter.

Annual Business

DAM Discussion

The preliminary figure we've been given by the engineer is between $100k-150k.

Therefore, the board is seeking approval from the District to reconstruct the Dam, to assess the District for the costs of this project, and to borrow funds to get things rolling on this with a cap of $175k. If Dam costs go above $175k, the District will hold a special meeting to discuss the project costs and seek approval for additional funding. We do not anticipate this happening, and feel comfortable with the $175k borrowing approval at this time.

VOTE: Funding for Dam Reconstruction: Approved

Motion approving the Dam Reconstruction project by Sue Ogren/Ford Elliott. Motion carried unanimously.

VOTE: Borrowing Funds for Dam Reconstruction:

Treasurer Filkins explained how BBLPRD can apply to the Board of Commissioners of Public Lands in order to borrow money and establish a line of credit for a District such as ours. General obligation moneys can be borrowed with interest, which will vary but today's rates are 1-2 yrs 2.5%; 3-5 yrs 3%; or 6-10 3.5%.

We would be looking at 60-90 days to get the public application approved. This will result in an assessment that will appear on our property tax statement, which will be financed over a number of years so people will have options to break up the payment plus interest over time. Also, the assessment will appear on your tax statement so that Polk Co Treasurer can track the transactions and payments from each property.

Common Acronyms:

APM:	Aquatic Plant Management
AIS:	Aquatic Invasive Species
BBLP&RD:	Big Blake Lake Protection & Rehabilitation District
CBCW:	Clean Boats Clean Waters
CLMN:	Citizen's Lake Monitoring Network
EPP:	Education, Prevention, & Planning
LWRD:	Polk Co. Land & Water Resources Department
PCALR:	Polk Co. Association of Lakes and Rivers
SWIMS:	Surface Water Integrated Monitoring System
WAL:	Wisconsin Area Lakes (now: WI Lakes Partnership)
WDNR:	Wisconsin Department of Natural Resources

Monitoring Opportunities: 2015 loon population survey

Northland College is looking for volunteers to assist with a one-day loon survey that has been conducted every five years since 1985 to estimate the state's loon population. 250 lakes across Wisconsin have been pre-selected, and many lakes still need a volunteer for this event. The survey takes place on **July 18 this year, from 5:00-10:00am**. Read more about this fun opportunity at **http://www.northland.edu/loon-population-survey.htm**

Spring Meeting Agenda | May 16, 2015

9:00am | Georgetown Town Hall, 1847 100th St. County Rd. H,
Balsam Lake, WI 54810

Approval of minutes

Treasurer's report

Guest Presentation

2014 Member Survey results and Pontoon Classroom; by Katelin Holm, Polk County Land & Water Resources Dept. and Adam Elliott

Old Business

1) Dam Update: (Tom Borden and Adam Elliott)
2) Slow-no-wake Zone (Tom Borden)

Committee Reports

1) Clean Boats Clean Waters (Peggy Lauritsen)
2) APM Harvey Report (Jim Maxwell)
3) EPP Grant Update (Sam Weber)
4) WAL Conference report (Peggy Lauritsen)

New Business

Announcements

August 15	Annual Meeting (3rd Saturday in August)
July 4	Boat Parade 4pm








Save — the — Dates!

Spring Meeting,
Saturday, May 16, 9am,
Georgetown Town Hall

July 4: Boat Parade (4:00 pm)

August 15: Annual Meeting

What can you do to improve water quality?

Restore your shore. Maintain a strip of native trees, shrubs, wildflowers, grasses and sedges 35 ft. wide back from the ordinary high water mark. Shoreland buffers help protect our lake from nutrients, pollutants and sediments in runoff from the land. Deep-rooted native plants can limit erosion while offering a place for wildlife.

Don't use products containing phosphorus. If you use fertilizer, the middle number in the formula on the package must be zero. Also, choose phosphorus-free soaps for laundry, dish washing and household cleaning.

Verify your septic system is working properly. Bacteria as well as nutrients can enter the water from improperly functioning septic systems.

Think about your role as shoreland owner. The way you manage your property affects the entire lake ecosystem.

Reprinted from: *Who's Who…Contacts for Your Waterfront Property*, published by PCALR.

BLAKE LAKE BUGLE

1988 S. Baker Road
Balsam Lake, WI 54810

SAVE THESE DATES

Spring Meeting: May 16 (3rd Saturday in May)
Annual Meeting: August 15 (3rd Saturday in August)
Pontoon Parade: July 4, 4:00 p.m.

BLAKE LAKE
BUGLE

AUGUST 2015

ANNUAL MEETING, SATURDAY, AUGUST 15, 2015

9am to 12pm at Georgetown Town Hall,
1847 100th Street,Balsam Lake, WI 54810

Board Members: Sam Rivers Weber/Co-Chair, Adam Elliott/Co-Chair, Tom Borden/ Commissioner, Jim Filkins/Treasurer, Peggy Lauritsen/Secretary, Ken Sample/Polk County Board, and Ron Ogren/Georgetown Chair.

AGENDA (AGENDA WITH FLEXIBILITY)

Call to order, welcome and introductions, approval of minutes

Treasurer's Report
Guest Presentation: Reconstructing the History of Blake Lake -Results of Core Sediment Sampling, presented by Jeremy Williamson, Polk County Land & Water Resources Dept.

Old Business
1. Dam Update: Adam Elliott
2. Slow-no-wake Zone (Tom Borden)

Committee Reports
1. Clean Boats Clean Waters (Peggy Lauritsen)
2. APM Harvey Report (Jim Maxwell)
3. EPP Grant Update (Sam Weber)

New Business
- Polk County Updates, Georgetown Updates WLP
- (WI Lakes Partnership) Convention Delegates for April 20-23, 2016

Annual Business
Approval of 2016 Annual Budget (Jim Filkins)
Vote: Election of 2 new commissioners – 3-year term currently held by Tom Borden and Jim Filkins

Announcements
- May 21, 2016 — Spring Meeting, 9am-noon (3rd Saturday in May)
- August 20, 2016 — Annual Meeting (3rd Saturday in August)
- July 4, 2016 — Boat Parade (July 4th is on Monday), 4pm

BLPRD 2016 ANNUAL BUDGET
August 1, 2015 to July 31, 2016

Category	Budget
EPP Grant	$2500
APM Coord	$2500
WAL Convention	$1500
Dues	$355
Harvey Pay/Exp	$7000
Insurance	$4500
Admin	$1645
TOTAL	$20,000

SPRING MEETING MINUTES

Meeting Date: 5-16-15

Meeting at Georgetown Town Hall called to order by Co-Chair Sam Rivers Weber at 9:01 am.

Board Members present: Sam Rivers Weber/Co-Chair, Adam Elliott/ Co-Chair, Tom Borden/ Commissioner, Jim Filkins/Treasurer, and Peggy Lauritsen/Secretary.

AGENDA

Welcome and Introductions
Co-Chair Rivers Weber proposed to approve the agenda with flexibility. Motion was made to approve agenda with flexibility by Jack Belisle, second by Mike Rogge. Unanimous. Motion carries.

Approval of Minutes
Co-Chair Rivers Weber explained the amended minutes from the 2014 Annual Meeting, published on page 6 in the Spring 2015 newsletter. Motion to approve minutes by Jim Seifert, second by Sheila Monson. Unanimous. Motion carries.

Treasurer's Report
Jim Filkins reported account balances as of 4-30-15 as follows: Checking $6363.99; Savings $5.00; and Money market $65,704.88. Anticipated taxes are $8000-$9000.

Introduction of Guest Presentation
Presenter: Katelin Holm, Information and Education Coordinator/Water Quality Specialist, Polk County Land & Water Resources Dept.

Grants ending
We have 2 grants that are ending in 2015, EPP Grant (Education/prevention/planning) and the Sediment Core Grant. Blake Lake is the only lake in Wisconsin that has a state harvesting grant to control invasive weeds, and not use a chemical treatment. Because of this we have a flagship program in the state.

2014 District Member Survey Results
The survey was mailed to 217 district members in May, 2014. There were 126 responses, or 58% response, which is excellent given that a 30% response is considered good or acceptable. The survey results will inform our lake management plan going forward.

- Top concerns by 75% of members: new invasives, more curly leaf, excessive plant growth, excess algae, water clarity, increased nutrient pollution and decrease on overall lake health.
- Low or no concern: 60% believe there is no concern about excessive noise or decreased wildlife.
- The average number of years owned property on the lake: 21 years. 50% living on the lake seasonally, which is common in Polk County; 56% are weekend residents and 33% are full-time residents. 148 days per year property is used. This data can helps with modeling and septic systems.

Continued on next page

- Shoreline buffer zone of 35 feet is ideal that includes plants, shrubs and trees. 91% of properties have mowed lawns; 38% unmowed section, 50% have shrubs in this area; and 15% have woods on shoreline.
- 49% of properties have piers/docks
- Amount of lawns: 50% of members said its just right; 25% said too much; and 25% were not sure.
- Interest in shoreline improvement: 75% interested
- Use phosphorous on property: 98% don't use or use phosphorous-free fertilizer.
- What activities members enjoy most: 93% value views and peaceful enjoyment.
- Watercraft used: 46% use canoes, kayaks and other non-motorized; 46% use watercraft with 21-50HP; 25% use boats on other lakes.
- Water Quality: 54% rated it fair; 26% rated it good. More people thought water quality had degraded rather than improved. What month algae a problem: 66% said July and 88% August.
- Impairments: 92% algae impairs swimming; 57% fishing; 52% boating/pets & animals. Boating not impaired by algae.
- Impairments by plants /Curly leaf identification: 50% could recognize it.
- Plant Harvesting/ how satisfied?: 44% somewhat; 19% very satisfied
- Key Actions and Priorities to Manage Big Blake Lake: 91% of members want the dam up to code; 89% believe AIS (invasives) is a top priority; 78% enhance fisheries, 71% upgrade non-conforming septic systems; 61% install shoreline buffers and rain gardens; 54% install farmland conservation practices; 44% want lake fairs and workshops and 44% want enforcement in slow-no-wake-zones; 90% want harvesting of lake weeds; 89% want monitoring of new AIS; 86% want Clean Boats, Clean Waters; 72% want educational programs; 54% want to use herbicides to control curly leaf; 37% want landing cameras; and 35% want washing stations at landings (not in Polk Co. now).

Katelin will email the full 10-page report summary to anyone who wants it. Contact her at katelin.holm@co.polk.wi.us.

APP Grant Expiration in 2015: Blake Lake has a 3-year AIS (aquatic invasive species) grant that ends in 2015. Every other week samples are collected from the lake including pH, temperature. Once a month nutrient samples are sent to the lab. Algae and zooplankton are measured once a year. The Spring and Fall plant survey is measured at 276 GPS points on the lake and three people rake samples of plants. Once-a-year dredge samples taken. In the Spring, curly leaf pondweed turions are sampled. Nutrient levels are sampled at inlets and outlets.

There is a county and state emphasis on AIS prevention via the June Drain Campaign (focused on anglers) and the July Landing Blitz (focused on all boaters). A key component of prevention is educating members, and all boaters. She handed out a list of AIS training and classes in June. Again this year she will be leading several of the trainings at the east landing including a new class "Pontoon Classroom" on June 13 from noon to 2pm. Details were published in the Spring newsletter.

Katelin advised us to think about the development of a lake management plan with a sightline of the next 20 years. How do we want the lake to be in the future? Everyone is invited to contribute to this coming effort.

Katelin reported on the Sediment Core Grant. Samples are taken from the deepest part of the lake to see how the lake is changing and has changed over the past 150-200 years. Samples identify what the state of the original lake was. Jeremy Williamson will be reporting updates at the Annual Meeting in August.

Old Business

Dam Update by Adam Elliott/Co-chair
We hired a good engineer Larry Gotham, early in the process to manage the project and keep things moving. The DNR advised that we had good timing for fast-tracking the project. We are approved for the loan of $150,000 as of May 5. We have 4 months, until September 5, to draw down the funds. We are expecting a 3% interest rate upon drawn down with a 5-year term. The funding source, BCPL (Board of Commissioners of Public Lands), funds schools and libraries in the state. We are in the process of getting the outlot transferred from the property owners/Sherrards. Once we get the ownership of the outlot the district takes over to start the reconstruction. There will be a permanent easement for maintenance and temporary easements for construction. Legal agreements are being processed, and with that we can get approval from the DNR. In all, the process is going well and going down the right path. Once all agreements are in place to the DNR, the reconstruction can start. Regarding the timeline, we do not know at this date if the project will be done in 2015. We are moving forward as much as we can and with respect to the Sherrard family dealing with estate issues. The new dam will be a rip-rap-rock-chute dam style. When the new construction goes in the old dam comes out. Members were encouraged to contact any district board member with questions. Board member contacts are listed on page 2 of the newsletter. A question and answer period followed the presentation.

Slow-no-wake zone update by Tom Borden/Commissioner
The 6 buoys are arriving within a week and will be installed by June. Signs will be posted at the landings. The buoys will identify the slow-no-wake zone through the narrows on Big Blake Lake.

Standing Committee Reports

Clean Boats, Clean Waters (CBCW) by Peggy Lauritsen/ AIS Coordinator
There are three seasonal goals: 1) volunteers perform 400 hours of CBCW monitoring (200 hours per each of two landings); 2) educate boaters and the public to avoid the accidental spreading of invasives; and 3) increase awareness with district members that our grant requires volunteer hours.

Peggy thanked all past CBCW volunteers who have helped to meet our goals year after year. Thanks to Vicky Dorner for representing our lake, attending the Annual CBCW training April 29 presented by Katelin Holm, Polk Co. Land and Water Resources Dept. Highlights are included in our display at the meeting.

CBCW Training Dates and Activities
There will be training on two June Saturday mornings to refresh CBCW volunteers in June as part of the WDNR "Drain Campaign" June 12-14, a statewide initiative to make sure anglers know about Wisconsin's invasive species laws. Dates are June 6 and 13. Posters, ice packs and flyers will be available for volunteers to give anglers at the landings again this year. Training on June 13 will be lead by Katelin Holmes.

New CBCW Coordinator Wanted
Peggy announced that she will complete her fourth year and retire as CBCW Coordinator. We are looking for a new coordinator for 2016. She suggested that a committee approach of several volunteers could be considered instead of having just one person coordinate all efforts.

APM Harvey Report by Jim Maxwell, APM Coordinator
There are lots of weeds already this year. This is the ninth year of studies done on our lake by the research team. This team needs to complete samples of the weed population before cutting can start. As soon as that happens cutting will be aggressive.

EPP Grant Update by Sam Rivers Weber
The EPP Grant (Education, Prevention, and Planning) is a 3 year grant that is ending in 2015. It is a $66,000 project designed to educate District members about the lake and about aquatic invasive species (AIS). Katelin Holm's report today is the detailed update on where we are at currently with the grant. District members are forming a committee to study the results of all the studies and surveys to inform our APM committee at the annual meeting in August.

WLP Convention by Peggy Lauritsen
The Wisconsin Lakes Partnership Convention (WLP) is an annual, statewide convention that she attended on April 23-25 in Stevens Point. Wisconsin Lakes Partnership consists of 3 core groups: 1) Wisconsin DNR (technical, financial, regulatory); 2) University of WI extension Lakes (educational materials) and 3) Wisconsin Lakes (advocates statewide for local lake people and lakes). The Wisconsin Lakes Partnership brings science, education, and citizens together to empower people to work together to care for our lakes. Six educational tracks included "Watersheds, Groundwater and Water Levels", AIS, Ecology, "People Policy and Politics", "Nutrients in our Lakes" and Public Health.

Conference highlights and value we can bring to our district include:
Networking with attendees: AIS leaders in our area attending from Balsam Lake, Deer Lake, Bone Lake, Amery Lakes, Round Lake and White Ash Lake.

Takeaways: literature in the display today is the latest and some "just published", many statewide contacts to experts in many areas.

Leadership training: all day workshop for "Beginner and Advanced Lake District Commissioner Training".

The latest information on key topics:
1. "Long term EW Milfoil research and long term effects of herbicide on native plants". Learnings: there are 100 plant species in Wisconsin lakes. After herbicide treatment some plant species NEVER COME BACK after treatment. As was the case in Sandbar Lake and Tomahawk Lake.
2. "Learning from our Neighbors: What's new in Minnesota AIS prevention and management". Tina Wolbers-AIS (Aquatic Invasive Species) Prevention Planner, Minnesota DNR.
    - MN has a 21- day dry time for docks/lifts
    - Citation: transport or possess prohibited species; and launch into non-infested waters with AIS attached MN=$500; WI=$295
    - Since 2013 MN using dogs to detect zebra mussels
    - MN increased the use of roadway checkpoints by 300% in last 3 years. Violation rate is 17%, down from 31% three years ago.
3. Greater awareness of impacts to the watershed that effects our lake district.
4. Invasive species are a very big threat: Increased education and strategies to fight Eurasian milfoil, zebra mussels, and purple loosestrife are top priorities.
5. County alliances forming for lakes and rivers: Eau Claire area watershed creating a coalition to qualify for federal grants. Polk County has 14 lake districts, with increased talk about collaborations to improve shorelines and buffer zones. Special sessions at the conference in 2016 to support new alliances.
6. 50% of Polk County revenue comes from waterfront property taxes. Important economically to protect our lakes and rivers.

New Business

Communications
Peggy Lauritsen reported that the results of the 2014 Member Survey will help to shape communications to members going forward. We are currently sending the newsletter to 226 members 2x per year; our email list is sent almost monthly to 92 members with an open rate of 65-70%; social media using Facebook has grown from 10 fans in 2013 to 77 fans in 2014 to 165 fans as of May 2015.

Announcements
- 2015 Annual Meeting will be held August 15th (3rd Saturday in August)
- 2015 Boat Parade July 4 at 4pm. (July 4th falls on a Saturday)
- A motion was made by Jim Sieffert to adjourn the meeting and second by Marge Kabis. Meeting adjourned 12:01 pm. A total of 68 district members attended the Spring Meeting.
- Minutes respectfully submitted by Peggy Lauritsen, Communications Commissioner/Secretary, plauritsen@pldg.com

PONTOON CLASSROOM ATTENDEES ON JULY 2

Instructor Katelin Holm/Information and Education Coordinator & Water Quality Specialist, Polk County Land and Water Resources Dept., Tommy Budd, Vicky Dorner, Lisa Denne, Joe Norby, Sue Budd, instructor Jeremy Williamson/ Polk County Land and Water Resources Dept. and not pictured, Peggy Lauritsen.

TWO DISTRICT BOARD POSITIONS OPEN FALL 2015

Two current board members will be completing their term of office this year, Jim Filkens and Tom Borden. We will be electing new board members at our Annual Meeting on Saturday, August 15. Now is the time to think about serving on the board. For more information contact Sam Rivers Weber at 2cherokeerivers@gmail.com or (715) 554-1054.

VOLUNTEERS DEFEND AGAINST INVASIVES

Thanks to the volunteers on our lake who contribute 400 hours each season to check boats at the landings and educate boaters about invasive species.

June 13 Clean Boats, Clean Waters Training and Volunteers on Blake Lake. Pictured (left to right) are AIS (Aquatic Invasive Species) experts Jeremy Williamson and Katelin Holm, water quality specialists, Polk County Land and Water Resources; Volunteer boat inspectors Mike Rogge, Judy Hall, Vince and Mary Teuber, Vicky Dorner, Sue Ogren, and Diane Borden. Not pictured: Peggy Lauritsen, Tom Borden, Jim and Marge Filkins and Joyce Booth.

June 6 Clean Boats, Clean Waters Volunteers on Blake Lake, (left to right): Mike Foley, Ann Foley and Shelley Rodriguez.

About Clean Boats, Clean Water Program

With the growing concern over the spread of aquatic invasive species to Wisconsin's inland lakes, many lake association members and other concerned citizens are looking for ways to get involved. The Clean Boats, Clean Waters volunteer watercraft inspection program is an opportunity to take a front line defense against the spread of aquatic invasive species. **If you want to get involved on Blake Lake contact Peggy at plauritsen@pldg.com or 612-940-2006.**

Save the Dates!

May 21, 2016 — Spring Meeting, 9am-noon (3rd Saturday in May)

August 20, 2016 — Annual Meeting (3rd Saturday in August)

July 4, 2016 — Boat Parade (July 4th is on Monday), 4pm

1988 S. Baker Road
Balsam Lake, WI 54810

BLAKE LAKE BUGLE

BLAKE LAKE
BUGLE

FALL 2015

Annual Meeting Minutes

Meeting Date: 8-15-15

Annual meeting at Georgetown Town Hall called to order by Co-Chair Adam Elliott at 9:00 am.

Board Members present: Sam Rivers Weber/Co-Chair, Adam Elliott/ Co-Chair, Tom Borden/ Commissioner, Jim Filkins/Treasurer, and Peggy Lauritsen/Secretary, Communications. Also present Ken Sample/Polk County Board.

AGENDA

WELCOME AND INTRODUCTIONS

After Board introductions, Co-Chair Elliott proposed to approve the agenda with flexibility. Motion was made to approve agenda with flexibility by Allen Moe, second by Jerry Smith. Unanimous. Motion carries.

APPROVAL OF MINUTES

Minutes of the Spring Meeting were printed in the Bugle newsletter and mailed to members, received on August 10. An email with the Spring Meeting minutes was sent on August 13. Copies of the minutes were also handed out at the meeting. A motion was made to approve the minutes by Steve Paul, second by Sue Ogren. Unanimous. Motion carries.

TREASURER'S REPORT

Jim Filkins reported account balances as of 7-31-15 as follows: Checking $633.25, Dam Project checking $1034.50; Savings $5.00; and Money Market $45,276.97.

GUEST PRESENTATION

Presenter: Jeremy Williamson, Water Quality Specialist and Aquatic Invasive Species Biologist, Polk County Land & Water Resources Department, presented "A History of Blake Lake – Results of Core Sediment Sampling". Since 2006 plant studies have been done on Blake Lake. Over the last 3 years a comprehensive water quality study has been done. A sediment core sampling was done to reconstruct the ecological history of the lake. Water quality has changed substantially over the past 50 years, and not in a healthy direction. Now with the data collected, a comprehensive lake management plan can be created. What do members want the lake water quality, plant life and fishing to be over the next 20 years? A Lake Management Committee (LMC) will be formed of 5-10 people/members. A sign-up sheet was passed around and approximately 15 people signed up to be a part of this committee. There will be 3-5 meetings over the Winter at a Balsam Lake location in the evening. At the 2016 Annual Meeting, the LMC committee will present the new lake management plan for approval to district members. If members want to sign up who were not at the meeting contact Sam Rivers Weber at 715-554-1054 or 2cherokeerivers@gmail.com.

Jeremy went on to explain the findings from the sediment core samples collected. Sediment reveals atmospheric nuclear testing done in the 50s. He used historic photos of Blake Lake for a geographic reference and overlaid the watershed area. From that he is able to see a timeline of historic loading, the amount of phosphorus in water. Jeremy talked about changes in property and housing development over time. From 1938 to 1974 there was very little buildings around the lake. Since 1974 there has been dramatically more development. Originally, the

Continued on next page

lake land around the lake was logged off, it reforested and row cropping dramatically reduced loading. "The good news is…we can get our house in order with very little effort".

Jeremy has analyzed loading rates for phosphorus in the mud of other Polk County lakes near the size of Blake Lake at 250 acres. Mud can have a lot of nutrients collect and it's an easy fix to get phosphorus to move. This corrolates with when curly leaf pondweed really took off. Since the 60s and 70s pigments increased and drastically changed. Much greener due to algae. Blue-green algae pigment increased possibly due to internal load or curly leaf.

Jeremy went on to say that he is reconstructing the fish history from the 1800s. The lake was 10 feet deeper at one time before logging and the dam. Jeremy is one of four in North America working on plant microphossils. Part of his mission is to find ways to restore good native plants. From 1800s to 1990s the lake plant community completely changed, sediment and water quality also changed. Changes in sediment changes the plants.

In Blake Lake the curly leaf has been reduced, but the challenge is to get back to native plants that provide clear water quality and good fish habitat. He sited Deer Lake has done many best practices to achieve significantly clearer water. Deer Lake and Bone Lake used grants to help pay for 75% of the costs.

A question and answer period followed the presentation.

OLD BUSINESS

Dam Update by Adam Elliott/Co-chair

We have spent $15,000 to date on the Dam Project. While there are still aspects of the project still out of our control, here are the latest projections after conferring with our Engineer.

1. **Land Transfer:** DNR approval of Transfer is expected to occur in early September. Upon DNR approval, the Deed can be signed and recorded. The property will then be transferred to the District at that point in time.
2. **Planning:** Our engineers will be working on the overall dam design this Fall and early Winter.
3. **DNR Approval:** We are expecting approval of dam plans in the Spring of 2016.
4. **Contractor:** Upon DNR approval, our engineer will help us select a contractor as soon as possible — expected in early Summer of 2016.
5. **Construction:** Our engineering team is expecting to commence work in late Summer or early Fall of 2016. Late Summer or early Fall is generally a time of lower stream flows.
6. **Completion:** Project completion and certification to the DNR is expected in the Fall of 2016.

The BLPRD Board applied for and was granted a $150,000 loan. Here is a summary of the financing terms:

- On August 26th, 2015 a check for the entire loan amount ($150,000) will be sent to BLPRD.
- The term of the loan is 5 years.
- The interest rate on the loan is 3%.
- The total finance charge is approximately $12,000.
- We have the ability to pay the loan off early.

Jim Filkins, Treasurer, confirmed we are receiving the loan on 8-26-15 and reminded members that we have locked in an interest rate of 3% for a 5-year term. The style of the dam will be a rip-rap-rock-chute-style dam. The WDNR controls the water level in the lake when the new dam is complete. The WDNR and engineer recorded the "normal" water level prior to the dam failing and when the new dam is complete the water level will be returned to this standard.

Slow-no-wake Zone Update by Tom Borden/Commissioner

Tom opened a discussion to get feedback from members about the 6 new buoys installed in late June. He reviewed that the purpose of the buoys is to protect the safety of people on the water and in the water, and to avoid shoreline erosion. The slow-no-wake zone follows state law and is 100 feet before buoys and 100 feet after buoys. Discussion ensued. The Board plans to take this under advisement and come up with solutions. They will look at buoy placement, quantity, education, enforceability and DNR support.

The Board plans to take slow-no-wake zone feedback under advisement and come up with solutions. They will look at buoy placement, quantity, education, enforceability and DNR support.

A motion was made as follows by Anne Yourchuck, second by Vince Teuber: The motion was to wait until next season to vote in a special session if necessary (immediately following the Spring Meeting) to make changes regarding the buoys. Unanimous. Motion carries.

Comment by Ken Sample/Polk County Board

Ken encouraged our district to work in unison with other districts and organizations in the county to have the most impact. He offered assistance to help "carry our message" wherever needed to achieve our lake management plan.

STANDING COMMITTEE REPORTS

Clean Boats, Clean Waters (CBCW) by Peggy Lauritsen/AIS Coordinator

There are three seasonal goals:

1. Volunteers perform 400 hours of CBCW monitoring (200 hours per each of two landings);
2. Educate boaters and the public to avoid the accidental spreading of invasives; and
3. Increase awareness with district members that our grant requires volunteer hours. Peggy thanked all past CBCW volunteers who have helped to meet our goals year after year.

<u>From the 2014 Member Survey we learned that:</u>

- 89% of us/members believe AIS (invasives) are a top priority
- 89% want monitoring of new AIS (invasives)
- 86% want to keep our CBCW program
- 50% believe we can identify curly leaf pondweed, the invasive weed we have now

CBCW Results – YTD: Education & boat inspections: goal is 400 hours per season.

Completed hours YTD: 295 hours, 73% complete. We are right on target.

In the 45 days until September 30 we have 105 hours remaining to finish our goal. We will meet our goal same as last year. Most of our boat inspection data is entered online and is up-to-date.

<u>AIS Training done this year:</u>
Seventeen volunteers attended two trainings June 6 and 13 as part of the DNR "Drain Campaign" a statewide initiative started last year to make sure anglers know about Wisconsin's invasive species laws, and the Annual 4th of July DNR 7th annual statewide Landing Blitz, focused on boaters with heightened awareness about invasives. We were one of 290 lakes in 53 counties in WI participating again this year.

Pontoon Classroom – 8 people attended on July 2, rescheduled due to rain from June 13. Instructors were Katelin and Jeremy, Polk County Land and Water Resources Department. We learned about how to extract water samples, algae samples, sediment and identification of invasives.

<u>Public Awareness Efforts to achieve our CBCW goals:</u>

- CBCW information published in BL Bugle sent 2-3x per year to district members.
- Literature and displays at May and August member meetings: includes the latest AIS information from state and county sources.
- Email communications to 40 volunteers 2x month, June to October.
- Distribute brochures and posters to local bait shops throughout the Summer.
- Placed 1 newspaper article in Inter-County Leader, published 2nd week of July about the Landing Blitz and featured pictures of our volunteers. We received excellent Outdoor Section page placement. This newspaper has a circulation of 13,000 readers.

Peggy is completing her fourth year as CBCW Coordinator. She asked for a new CBCW coordinator. No volunteer came forward. She suggested that a committee approach of several volunteers could be considered instead of having just one person coordinate all efforts.

APM Harvey Report by Jim Maxwell/ APM Coordinator

The first weed cutting this year started May 1. By May 31 we cut 131 loads of curly leaf pondweed. Since then we cut 32 more loads for a total of 163 loads YTD. In all of 2014 we cut 28 total loads. There have been a few minor repairs to the Harvester. Max Bay has been helping to drive the Harvester. We have cut 30 loads of coontail YTD. We need more places to dump weeds on the east side of the lake.

EPP Grant Update by Sam Rivers Weber

See guest presentation for reference to new lake management committee forming and potential for new grant too.

NEW BUSINESS

July 4th Boat Parade

A motion was made by Ford Elliott, second by Steve Wistrcill to move the July 4 Boat Parade to Sunday, July 3, at 4:00 pm. Unanimous. Motion carries.

It was also suggested that boaters in the parade leave their own dock at 4pm and start the parade from their dock and not meet at the north end. This will allow more people at the south end and east side to see the parade. Ford Elliott volunteers to fire up his shot gun at 4pm to officially start the parade.

There was discussion about the water balloon fights between parade boaters. People reported having to clean up after the parade and are picking balloons out of the water, consider them pollution and a hazard to wildlife. Water guns, on the other hand are fine in the parade. A motion was made by Sue Ogren for no water balloons in the July 4th parade, second by Vince Teuber. Unanimous. Motion carries.

ANNUAL BUSINESS

Annual Budget

A motion was made to approve the budget by Ken Knutson, second by Roxanne Smith. Unanimous. Motion carries.

Election of 2 New Commissioners: Vote

Two candidates were on the ballot. Peggy Lauritsen nominated Shelley Rodriguez and Ford Elliott nominated Jen Wistrcill. Roxanne Smith was nominated by Francis O'Connor. A motion was made to approve the nominees by Allen Moe, second by Vince Teuber. Unanimous. Motion carries. The voting resulted in the election of Shelley Rodriguez and Jen Wistrcill.

ANNOUNCEMENTS

2016 Spring Meeting will be May 21, 9am to noon (3rd Saturday in May)

2016 Annual Meeting will be August 20, 9am to noon (3rd Saturday in August)

2016 Boat Parade July 3 at 4pm. (July 4th falls on a Monday)

Meeting adjourned at 11:15am. A total of 83 district members attended the Annual Meeting.

Minutes respectfully submitted by Peggy Lauritsen, Communications Commissioner/Secretary, plauritsen@pldg.com

The Blake Lake Bugle is a publication of the Big Blake Lake Protection and Rehabilitation District. The Bugle is published seasonally for friends and members of the district. To receive lake news, send your email address to Peggy at plauritsen@pldg.com or mail to the address below.

CONGRATS TO CLEAN BOATS, CLEAN WATERS VOLUNTEERS

Annual Goal Completed – 400 hours!

Thanks to the volunteers on our lake who contribute 400 hours each season to check boats at the landings and educate boaters about invasive species.

Pictured L to R: Peggy Lauritsen, Vicky Dorner, Gabe Benjamin, Adriel Benjamin, Ford Elliott, Vince Teuber and Mike Rogge.
Seated in front: Joanne Elliott, Diane Borden, Marge Filkins, Jim Filkins, Jim Maxwell, Joan Maxwell, and Naomi Anderson.
Back row: Mary Teuber, Sue Ogren and Sam Rivers Weber. 2015 volunteers not pictured: Joyce Booth, Gail Rustad, Max and Loretta Bay, Tom Borden, Dale Butler, Larry Knutson, Shelley Rodriguez, Ann Foley, and Kathy Maradon.

Save the Dates!

2016 Spring Meeting, May 21, 9am to noon. (3rd Saturday in May)

2016 Annual Meeting, August 20, 9am to noon. (3rd Saturday in August)

2016 Boat Parade, July 3 at 4pm. (July 4th falls on a Monday)

BLAKE LAKE BUGLE
1988 S. Baker Road
Balsam Lake, WI 54810

CLIP AND SAVE — SHARE WITH VISITORS, GUESTS AND RENTERS

KNOW SAFETY TIPS BEFORE FUN ON THE LAKE

Slow-no-wake zone: Is defined as the minimum speed required to maintain steerage. Includes all boaters and jet skis. Boaters watch your distance, 100 FEET: WI law prohibits boaters within 100 feet of shoreline, docks, rafts, piers, swimmers and buoyed restricted areas. Jet skis watch your distance, 200 FEET: Cannot operate at a speed greater than slow-no-wake within 200 feet of the shoreline of any lake. They also are required to cut back to slow-no-wake speed when passing within 100 feet of other boats, including other jet skis.

Life jackets: required for kids under 13. A life jacket is required for every person on your boat.

Jet ski safety: A USCG approved life jacket is required. Do not operate between sunset and sunrise. Be mindful of wildlife (geese and loons). Must be at least 12 years old to operate, see below.

Paddle boards: Life jacket is recommended. Fastest growing water sport in the world!

Age to operate? Anyone born on or after January 1, 1989 is required to complete a boating safety course to legally operate a motorized boat or jet ski. Must be at least 10 years old to operate a motorboat; 10 to 11-year-olds must be accompanied by parent or someone at least 18 years old. Must be at least 12 years old to operate a jet ski. Persons at least 12 but less than 16 years of age may operate a personal watercraft if they have successfully completed a DNR prescribed Boating Safety Course and possess a safety certificate issued by the Department or state of their residency. Parental accompaniment may not be substituted for possession of a valid DNR safety certificate.

Sunset to sunrise: WI law… no skiing, no towing, no jet skis

Other checklist items: Is there a fire extinguisher on the boat? Is there a throwable floatation device on the boat? Test all of the lights work for sunset cruising? Is there a lifejacket on board for everyone? Leave alcohol on shore and never use alcohol before or during operating a craft on the water.

Wildlife caution: Watch out for loons! They are hard to see and cherished on our lake. Stay clear of geese families by 100 feet.

Emergency Contacts: DNR Warden: 715-822-8107
Polk County Sheriff: 715-485-8300

More than 90% of boat fatalities related to drowning involve victims not wearing life jackets, you need one for your safety.

Intoxicants are related to 50% of all boating accidents.

More boating safety tips:
http://dnr.wi.gov/topic/boat/boatSafetyTips.html

WI fishing license: http://dnr.wi.gov/topic/Fishing

Wisconsin Laws:
http://dnr.wi.gov/files/PDF/pubs/LE/LE0301.pdf

Polk County Laws:
http://www.obnet.com/polkcounty/tourism/boat.html

10 MOST COMMON BOATING VIOLATIONS

1. Failure to provide life jackets for all on board.
2. Operating boat without valid certificate of number.
3. Operating boat in prohibited area, in excess of speed limit on lakes 50 acres or less, or in excess of fixed limits.
4. Personal Watercraft (jet ski) violations.
5. Operating motorboat while under the influence of an intoxicant, or operating motorboat with BAC of 0.1% or greater.
6. Operating within 100 feet of dock, raft, swimmer, pier, etc.
7. Operating boat at night without required lights.
8. Failure to display registration number or decal on boat.
9. Failure to secure or cover storage battery.
10. Failure to have certificate of number on board.

BOAT PARADE — SUNDAY, JULY 3
4:00PM START AT YOUR DOCK

The Independence Day holiday is almost here! We are expecting a lot of enthusiasm for the Blake Lake Boat Parade. Last year, over 30 boats participated! Everyone is welcome to join in the parade, decorated or undecorated boats. We are trying something new this year. Boats will wait at their dock until a 4pm "shotgun start" and travel counter clockwise around the lake. Ford Elliott has offered to perform the shotgun task from their property on the northeast side of the lake.

Please note that water balloons are discouraged during the parade. Water guns, on the other hand are fine. Please be mindful of all boaters, those who do not want to get wet or who have small children.

WEED CUTTING — RECORD YEAR

ANOTHER BUMPER CROP OF CURLY-LEAF IN POLK COUNTY LAKES

Just like 2015, we have a "bumper crop" of curly leaf pondweed in the lake again this year. So far this year we have harvested a record 159 loads of weeds compared to 171 loads in all of 2015 and only 30 loads in 2014! Weather permitting (wind or rain), weed cutting continues at a heavy pace until mid July. Max Bay and Bruce Peterson operate the harvester. Weeds are not cut on the weekend. "We expect to cut weeds at this pace until the weeds drop or die down starting now in late June. After mid-July we will cut as needed until August 30", says BLPRD Aquatic Plant Manager Jim Maxwell. He can be reached at 715-857-5316 if you have questions.

The majority of weeds you are seeing on the lake are curly-leaf pondweed, an invasive species, unfortunately, common to 542 lakes in Wisconsin. According to Jeremy Williamson, Water Quality Specialist, Polk County Land and Water Resources Department, "weed growth in lakes varies year to year. Light snow cover over the ice allowed more light to penetrate. More than any other factor, this is likely the reason we are seeing more weed growth in lakes across Polk County". Another factor that added to the bumper crop of curly-leaf is the lower water level of the lake at the start of Spring.

WHY IS THE LAKE WATER SO CLEAR? IT'S THE WEEDS

With a bumper crop of curly-leaf pondweed growing this year, more weeds means more clarity. Up until now that is. Once the curly-leaf dies back in July, nutrients will be available to other plant forms, and by August, you will see the change. Water clarity, or seechi depth, changes over the Summer. Seechi depth is a measure of the cloudiness or turbidity of surface water. In May, seechi depth can be 11 feet, in June it can be 8.5 feet and August, 4 feet.

SLOW-NO-WAKE ZONE — BUOYS MARK THE ZONE

BLPRD established, and is enforcing, a slow-no-wake zone in the narrows, marked by 6 buoys. Slow-no-wake is defined as the minimum speed required to maintain steerage and the law applies to all boaters, pontoons, jet skis, fishing boats, speed boats, etc. Wisconsin law prohibits boaters within 100 feet of shoreline, docks, rafts, piers, swimmers and buoyed restricted areas.

Jet skis cannot operate at a speed greater than slow-no-wake within 200 feet of the shoreline. They also are required to cut back to slow-no-wake speed when passing within 100 feet of other boats, including other jet skis.

BLAKE LAKE
BUGLE

1988 S. Baker Road
Balsam Lake, WI 54810

BLAKE LAKE BUGLE

BLAKELAKE.ORG AUGUST 2016

Annual Meeting

Saturday, August 20, 2016

New location! Georgetown Lutheran Church,
877 190th Ave./County Road G, Balsam Lake, WI 54810
(.8 mile west of Baker Road)

8:00 - 9:00am	Breakfast* / Door Prizes / Mini Lake Fair
9:00 - 11:00am	Annual Meeting

*a $5 donation is kindly requested for the meal. All proceeds will go to the Georgetown Lutheran Church".

Board Members:
Sam Rivers Weber: Co-Chair, Adam Elliott: Co-Chair, Shelley Rodriguez: Commissioner, Jen Wistrcill: Treasurer, Peggy Lauritsen: Secretary, Representative, Polk County Board, and Ron Ogren: Georgetown Chair.

AGENDA (with flexibility)

Welcome and introductions, approval of minutes

Treasurer's Report

Presentation: New Lake Management Plan

(Commissioner Rodriguez) with Q&A by a representative from Polk County Land & Water Resources Dept. 20 min

Old Business

1. Dam Update: (Co-Chair Elliott and Larry Gotham, P.E.) 20 min.
2. Buoy placements, slow-no-wake zone: (Co-Chairs Weber and Elliott). Vote: on options for buoys placement. 10 min

Committee Reports

1. AIS / Clean Boats Clean Waters: (Commissioner Lauritsen). 5 min
2. APM Harvey Report: (APM Coordinator Jim Maxwell). 5 min
3. EPP/AIS/HL Grants Update: (Co-Chair Weber). 10 min

New Business

1. Healthy Lakes Program/managing runoff & phosphorus: (Commissioner Lauritsen). 5 min
2. WI Lakes Partnership Convention delegates for April 5-7, 2017. 2 min
3. Polk County Updates. 5 min
4. Georgetown Updates. 5 min

Annual Business

1. Approval of 2017 Annual Budget and review of audit results: (Treasurer Wistrcill). 5 min
2. Vote: Election of 1 new commissioner — 3-year term currently held by Adam Elliott. 15 min
3. Communications: (Commissioner Lauritsen). 5 min
4. Recognition of volunteers. 10 min

Announcements

August 20, 2016 — BLPRD Board Meeting to follow Annual Meeting at Georgetown Lutheran Church.

May 20, 2017 — Spring Meeting,
8:30 am-11:00 am (3rd Saturday in May)

August 19, 2017 — Annual Meeting,
8:00am to 11:00 am (3rd Saturday in August)

July 4, 2017 — Boat Parade
(July 4th is on Tuesday), 4pm

BLPRD 2017 Annual Budget: Vote to approve

Category	Budget
EPP	$0
APM	$2,500
WLP	$1,500
Dues	$475
Harvey	$8,500
Ins.	$4,500
Admin	$4,525
TOTAL	$22,000

Spring Meeting Minutes

Meeting Date: May 21, 2016

The Spring Meeting at Georgetown Lutheran Church was called to order by Co-Chair Sam Rivers Weber at 9:07am.

Board Members present: Sam Rivers Weber/Co-Chair, Adam Elliott/ Co-Chair, Shelley Rodriguez/ Commissioner, Jen Wistrcill/Treasurer, and Peggy Lauritsen/ Secretary, Communications. Also present Sedric Solland/Polk County Board.

AGENDA

Welcome and Introductions

Co-Chair Elliott expressed thanks to the Georgetown Lutheran Church for offering the use of the site at no charge. We are confirmed for our annual meeting on August 20 at this site. Donations to the church welcomed. Members were encouraged to fill out feedback comment cards on the tables and sign up for committees at the volunteer table in the back.

After board introductions, Co-Chair Elliott proposed to approve agenda with flexibility. Motion was made to approve agenda with flexibility by Marge Kabis, second by Gerry Smith. Unanimous motion carries.

Approval of Minutes

Minutes of the Annual Meeting were printed in the Fall Bugle newsletter, mailed to members and are also located on our new website. Copies of the minutes were also available for view at the meeting. A motion was made to approve minutes by Gail Rustad second by Ford Elliott. Unanimous. Motion carries.

TREASURER'S REPORT

Jen Wistrcill reported account balances as of 30-APR-2016 as follows: Big Blake Lake (BBL) checking $15,216.67, Dam checking $106,958.41, BBL Money Market $52,474.84, Savings $5.00. Brief discussion on loan granted for dam and that first payment was made in March 2016.

GUEST PRESENTATION

Laws and Enforcement for Slow-No-Wake Zones (WDNR Conservation Warden Jesse Ashton)
Introduction. What is enforceable by DNR? Operating at greater than a no wake speed, DNR citation around $200 if someone were to go too fast through the zone. DNR Warden and local sheriff can issue citations. DNR is probably on our lake 5-7 times over the summer.

Reviewed slow-no-wake zone, which is "The lowest possible speed that you can keep maintaining steering control". If you are on a PWC you have to be 200 feet away from shore or dock. For boats it is 100 feet. Jumping wakes or spraying each other on PWC with wake are common citations. Question from member: "What would we do if someone issued a complaint?" "Depends how bad it was, is there video? " DNR can issue citations. DNR does not do written warnings only verbal, however Sheriff can give written warnings. The most common problem is visitors of property owners who do not know the laws or the rules. Suggestion to the board of putting the basic laws up on the website to inform. One member reported problems taking off full tilt within the buoys. Seeing people skiing through the center. If the buoys are not installed, then the zone is not enforceable. Once buoys are placed, it is considered posted and enforceable. No one has been fined on BBL since the buoys have been placed according to Warden Ashton.

Has the decision been made to put the buoys out? Yes, until we revise ordinances we have to. Can you ski through the no wake zone? No, identified by the buoys, this is a restricted zone. Jesse reinforced that we, the district, decide on the buoys. Is there a restriction on where you stop before the buoys? No, it is like a speed zone. In order to change the buoys placement we have to resubmit to Spooner. The 100ft and 200ft from shoreline distance also applies to docks. Mentioned that with the docks extend the limit of 100 and 200 ft. Buoys do not need a light on them. Ordinances around the buoys are determined by the district.

What are the restrictions for floating devices? Beyond 200 feet of shore it has to have a light on it. There is a size restriction? Must be 144 sq. ft. or less, and larger requires a permit.

OLD BUSINESS:

Buoy placements, slow-no-wake zone (Co-Chairs Sam Weber and Adam Elliott)

Reviewed what was discussed last year. Reviewed why we brought Warden Ashton in to discuss rules and laws. Reviewed slides of what was approved several years ago by the district. Option presented: buoys will go in and we can vote to remove buoys, change buoys or leave as is at the August 20 Annual Meeting. Motion made by Trent Walden for the following options for vote at August annual meeting:

1. Remove
2. Keep six buoys but compress area and revise plan
3. Leave buoys as-is

Second by Sheila Munson. With discussion. Amendment to the motion purposed by Jack Belisle to add three options of placement if a revise option 2 is picked. Amendment accepted by Trent Walden. Second the amendment to the motion Sheila Munson.

Dam Update (Co-Chair Elliott)

Going as planned. Our engineer, Larry, for the last two months has been getting project/engineering plan to the DNR for approval. Larry believes the plan will be approved by June/July timeframe. One minor complication was that Round Lake has to have a hydrology study which also would apply to our lake. We hope to have approval by end of July from WDNR. Late summer or early fall the construction can take place. The WDNR/Larry don't anticipate any issues. Once the plan is approved it has to go for bid for at least three sources. Estimate for the dam project is $100,000.00 - $150,000.00.

COMMITTEE REPORTS

Lake Plan Update (Commissioner Rodriguez)

A committee of 8-12 people was formed and will meet 5 times to establish a new lake plan prior to the Annual Meeting. Slides noted committee members. Slide covered survey results and goals. As of 2016, BBL is on the impaired waters list, due to high levels of phosphorus – with goal to get us off the list. There is more to come at the August meeting as the plan is finalized. There will be many opportunities to volunteer to be part of our new lake plan.

WI Lakes Partnership Convention (Commissioner Lauritsen)

Peggy attended the 3-day lakes convention. As a district we benefit by attending: Networking with leaders in our county and state; Get the latest info and best practices; and at our Spring and Annual Meetings we share free literature and resources. Four key takaways from the convention: 1) Updates on legislation/ shoreland zoning and more (handout to all); 2) Deer Lake Conservancy wins national recognition for successful watershed efforts – literature in packets given to all ("Lake Tides" cover story); 3) AIS and CBCW – latest information in displays (Wisconsin know as "best in nation" addressing AIS, last 14 yrs); and 4) Improving water quality – Healthy Lakes Program supports our emerging new lake plan. She reviewed the Healthy Lakes 3-year program started last year by WDNR and WI Lakes Partnership which includes simple and inexpensive projects – up to $1000 per project, 75% covered by grants typically.

Healthy Lakes Program goals:

- Filter runoff water, through buffers, plants, shrubs
- Stop phosphorus and other nutrients from entering the lake
- Slow down and divert runoff – hard surfaces, roofs, driveways, slopes; help water soak into ground
- Improve shoreline wildlife habitat - frogs, birds, turtles, fish
- Cleaner swimming, reduce algae, beautify view, keep geese out
- Preserving water quality for generations to come

Peggy will be organizing with the lake plan committee to get more training and to apply for the grants involved.

AIS/Clean Boats Clean Waters (AIS Coordinator Lauritsen)

We are looking for more volunteers and a team approach. Help is needed. Thank you to the people who have volunteered. Our district goals are to 1) perform free boat checks; 2) talk to boaters at landings; 3) prevent the spread of invasives entering or exiting our lake and 4) inform and educate. We are participating in the WDNR "Drain Campaign" on June 10-12, a statewide initiative to make sure anglers know about Wisconsin's invasive species laws. We are also participating in the WDNR 8th annual statewide Landing Blitz, July 1-4, with heightened awareness and inspections at both landings. This is our 5th year participating. We are one of 90 lakes in Wisconsin participating again this year. Peggy reviewed current top threats such as Eurasian milfoil and zebra mussels and the nearby lakes that have these invasives. There was a special thank you from board members for Peggy's current role with AIS.

APM Harvesting (APM Coordinator Maxwell)

Repairs were made to the harvestor such as changing the oil (it's been five years) and replacing a chain. Weeds are bad again this year, and we started havesting last week and took 33 loads out. Max Bay is driving the harvestor. Question on how close to shorelines we can harvest… 100 feet from shore, stay out of 3 feet water, 10 feet away from the dock. We were able to cut paths on south and west ends. Comment from member goal of the harvestor was to hopefully eliminate weeds from the lake, last few years have been higher. Possibly due to the lower lake levels, and less snow cover in last two winters.

Jeremy Williamson, Water Quality Specialist and Aquatic Invasive Species Biologist, Polk County Land & Water Resources Department, reviewed BBL nutrient budget and internal loading (handouts supplied). Since we have harvesting since 2006 we have reduced the phosphorus 158.7 pounds to 98.5 pounds. We have reduced the amount of phosphorus by 38% by removing the curly leaf from the lake. This is a significant success, and proof that our harvesting strategy is working.

EPP Grant (Co-Chair Weber)

Sam reviewed the status of the grant (slides presented). We will have a report at the annual meeting.

NEW BUSINESS

Communications, new website reveal (Commissioner Lauritsen)

Our new website is blakelake.org. It launched in March at the WLP convention. We were offered a special opportunity in December to be part of a pilot program that allowed us to create a website in 60 days with 150 volunteer hours, at a cost of $450, saving the district $9500. We had 374 visitors to the site in the first week. Peggy reviewed the content strategy, features and functions of the site and how it will meet the needs of our members. Peggy also recruited a new volunteer, Dave Rogge, to help us maintain fresh content on the site. He has volunteered to donate $4800 of his time over the next year. Peggy also recommended that we consider increasing the annual budget to meet the demands of members who want multi-channel communications about district news.

ANNOUNCEMENTS

20-August-2016 Annual Meeting (3rd Sat. in August)
03-July-2016 Boat Parade 4PM

Motion to adjourn the meeting by Vince Teuber, 2nd by Marge Kabis.

Meeting adjourned at 11:29pm. A total of 75 district members attended the Annual Meeting.

Meeting minutes respectfully submitted by Jen Westrcill, Treasurer and Peggy Lauritsen, Secretary.

BOARD ELECTIONS: LAKE DISTRICT BOARD COMMITMENT

- The Board shall nominate one or more members for any vacant positions. Additional nominations present at the annual meeting and willing to serve may be taken from the floor.
- The Board consists of a Chairman, a Treasurer, a Secretary and commissioners.
- Beyond the Spring meeting and the Annual meeting, the Board is also required to meet within 60 days of the Annual meeting. Other meetings are held as lake district business demands. Over the past couple of years, the board has gotten together 3-5 times each year to follow up on business related to the dam, the new lake management plan and new channels of communication.
- Board meetings are held in person if possible or via teleconference.
- Board members are asked to serve three year terms.
- Board members are not compensated for their board service.

Healthy Lakes Workshop

Stop phosphorous from entering the lake — manage runoff on your property

Sponsored by Polk County Association of Lakes and Rivers (PCALR)

Date: Wednesday, August 17
Time: 6-9:00 pm
Place: Justice Center in Balsam Lake, WI
Cost: FREE*
RSVP: **president@pcalr.org or call 651-395-0969**
*A $10 membership to PCALR is encouraged. Apply online at pcalr.org.

One District Board Position Open Fall 2016

One current board member will be completing their term of office this year, Adam Elliot. He may run again, be re-elected, or, we will elect a new member at our Annual Meeting on Saturday, August 20. Now is the time to think about serving on the board. For more information contact Sam Rivers Weber at 2cherokeerivers@gmail.com or (715) 554-1054, or see page 3 for a description.

Workshop presenters: Pamela Toshner and Alex Smith, Water Resources Management Specialists, Wisconsin DNR. Many Polk County lake districts have expressed interest in the Healthy Lakes Initiative grants so Pamela and Alex are bringing the workshop to us! This is your chance to learn how to reduce runoff on your property, with plenty of time to submit our grant application (in February 2017) for funding. The lake district submits a collective grant application for all members. This learning opportunity with state experts doesn't come any closer!!

What you will learn: The 5 Healthy Lakes practices, the grants process, and tools for designing and constructing the practices at your property. The Healthy Lakes practices are: 10'x35' native plantings (shoreline buffers), rain gardens, fish sticks, diversion (driveway, slopes), rock infiltration (trenches, boxes).

Healthy Lakes goals:

- **Filter** runoff water, through buffers, plants, shrubs
- **Stop** phosphorus and other nutrients from entering the lake
- **Slow** down and divert runoff — hard surfaces, roofs, driveways, slopes; help water soak into ground
- **Improve** shoreline wildlife habitat — frogs, birds, turtles, fish
- **Cleaner swimming**, reduce algae, beautify view, keep geese out
- **Preserve water quality** for generations to come

Need more details? Visit healthylakeswi.com where practices are explained and downloads are available.

If you are unable to attend this workshop, but want your property involved in the Healthy Lakes Program on Blake Lake, more information will be available at the Annual Meeting on August 20. You can also contact Peggy Lauritsen at plauritsen@pldg.com.

BLAKE LAKE BUGLE

1988 S. Baker Road
Balsam Lake, WI 54810

SAVE THE DATE

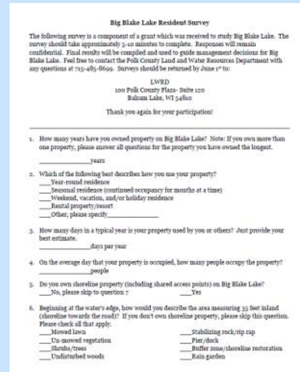
Annual Meeting: Saturday, August 20, 8am – 11:00am

District Members: This newsletter has the annual meeting agenda on the cover. You will not be receiving a POST CARD announcing the annual meeting.

Big Blake Lake Resident Survey Spring 2015

Katelin Holm

Polk County Land and Water Resources Department



Big Blake Lake Resident Survey

The following survey is a component of a grant which was received to study Big Blake Lake. The survey should take approximately 5-10 minutes to complete. Responses will remain confidential. Final results will be compiled and used to guide management decisions for Big Blake Lake. Feel free to contact the Polk County Land and Water Resources Department with any questions at 715-485-8699. Surveys should be returned by June 1st to:

LWRD
100 Polk County Plaza- Suite 120
Balsam Lake, WI 54810

Thank you again for your participation!

1. How many years have you owned property on Big Blake Lake? Note: If you own more than one property, please answer all questions for the property you have owned the longest.
   ____________years
2. Which of the following best describes how you use your property?
   ___Year-round residence
   ___Seasonal residence (continued occupancy for months at a time)
   ___Weekend, vacation, and/or holiday residence
   ___Rental property/resort
   ___Other, please specify____________
3. How many days in a typical year is your property used by you or others? Just provide your best estimate.
   ____________days per year
4. On the average day that your property is occupied, how many people occupy the property?
   ____________people
5. Do you own shoreline property (including shared access points) on Big Blake Lake?
   ___No, please skip to question 7 ___Yes
6. Beginning at the water's edge, how would you describe the area measuring 35 feet inland (shoreline towards the road)? If you don't own shoreline property, please skip this question. Please check all that apply.
   ___Mowed lawn ___Stabilizing rock/rip rap
   ___Un-mowed vegetation ___Pier/dock
   ___Shrubs/trees ___Buffer zone/shoreline restoration
   ___Undisturbed woods ___Rain garden

Mailed 217 surveys in May 2014

126 respondents, 58%

Thank you!

Big Blake Lake Property Owners

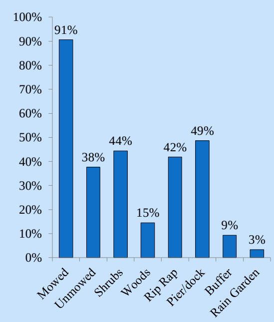
Property ownership: 21 years

People occupying property: 3.6

Half of property owners are weekend, vacation, or holiday residents (56%) and one third are full time residents (33%)

Number of days property used: 148 days

Characterizing the Shoreline



Half of property owners think the amount of lawn on Big Blake Lake is just right,

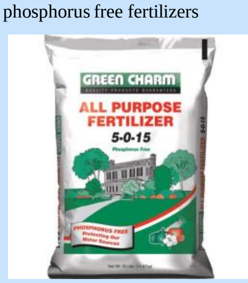
one quarter think there is too much lawn,

and **one quarter** are unsure.

Nearly **three quarters** believe that buffers, rain gardens, and natives plants are somewhat or very important to the water quality of Big Blake Lake.

A Very Positive Side Note

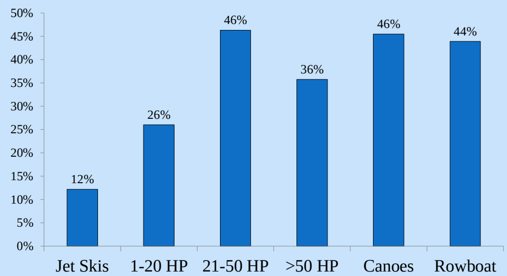
98% of survey respondents either don't use fertilizer or use phosphorus free fertilizers



Activities Enjoyed on Big Blake Lake

- Peace and tranquility (93%)
- Scenic view (89%)
- Open water fishing (83%)
- Motorized boating (80%)
- Observing birds/wildlife (79%)
- Swimming (70%)
- Non-motorized boating (47%)
- Ice fishing (45%)

Watercraft and Use

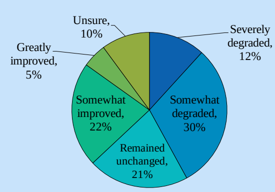


A quarter of respondents use their watercraft on other waterbodies

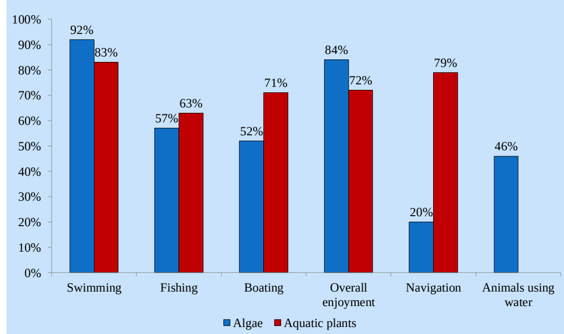
Concern	Total Points
Expansion of current invasive species (curly leaf pondweed)	411
Excessive algae blooms	406
Excessive aquatic plant growth	401
Lack of water clarity or quality	394
Decrease in overall lake health	388
New invasive species entering the lake	373
Increased nutrient pollution	350
Decreased property values	336
Decreased fisheries	304
Unsafe use of motorized water craft	303
Disregard for slow-no-wake zones	288
Loss of natural scenery/beauty	275
Increased development	259
Excessive noise level on the lake	249
Decreased wildlife populations	248

Current Conditions on Big Blake Lake

Water level:
too low (81%)
Water quality:
fair (54%) or good (26%)
Change in water quality:
graph
Months algae is a problem:
July (66%) and August (88%)
Aquatic plants:
too many (69%) and healthy amount (29%)
Months aquatic plants are a problem:
June (46%), July (74%), and August (67%)

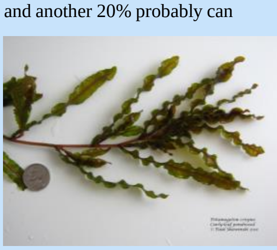


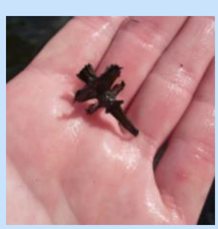
Uses Impaired by Algae and Aquatic Plants



Curly Leaf Pondweed (CLP)

Half of respondents can definitely recognize curly leaf pondweed and another 20% probably can

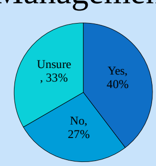




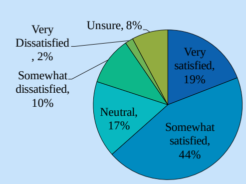
Paul Skawinski, UW-Extension Lakes

Aquatic Plant Management Program

Is the current program effectively controlling nuisance aquatic plant growth?



How satisfied are property owners with the aquatic plant harvesting program?



Actions to Manage Big Blake Lake

Ranked by priority

Bring the dam up to code: 91%

Programs to prevent and monitor AIS: 89%

Enhance fisheries: 78%

Upgrade non-conforming septic systems: 71%

Install shoreline buffers/rain gardens: 61%

Install farmland conservation practices: 54%

Lake fairs and workshops: 44%

Enforce slow no wake zones: 44%

Actions to Manage Aquatic Invasive Species (AIS)

Ranked by priority

Harvesting CLP: 90%

Monitoring to detect new AIS: 89%

Clean Boats, Clean Waters: 86%

Educational programs: 72%

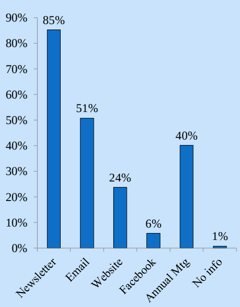
Trainings to identify and manage AIS: 69%

Herbicide control of CLP: 54%

Boat landing cameras: 37%

Boat wash stations: 35%

Communication




BLAKE LAKE BUGLE

UPDATE: Blake Lake Dam Reconstruction

Half of property owners were unaware of the Facebook page and another third have never visited the page.

2015 is the last year of a three year grant!

Projects completed include:

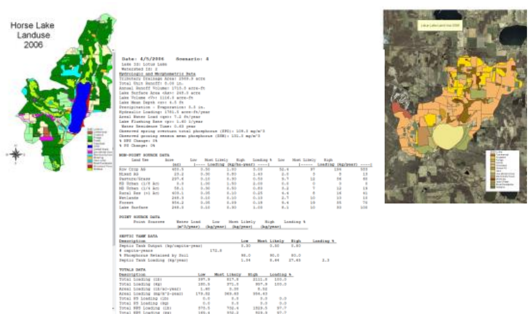
- In-lake monitoring for chemistry, algae, zooplankton, plants, and CLP turions
- Tributary monitoring
- Lake resident survey
- Education efforts: The Landing Blitz, Citizen Lake Monitoring Network, Drain Campaign, and Clean Boats, Clean Waters

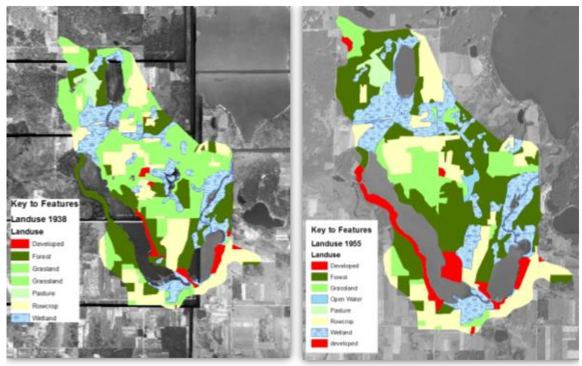
Projects yet to be completed include:

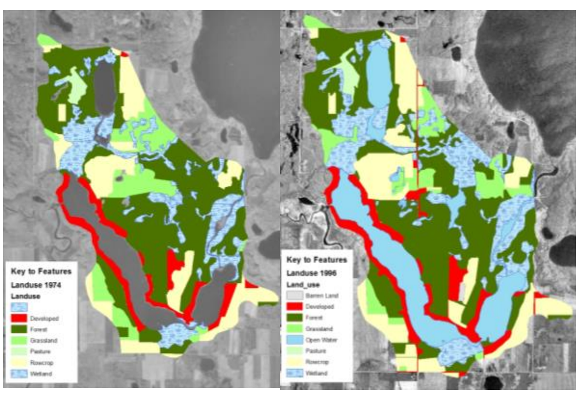
- Pontoon Classroom: **Saturday, June 13th from 12-2 pm at the North Boat Landing**
- Development of a Lake Management Plan

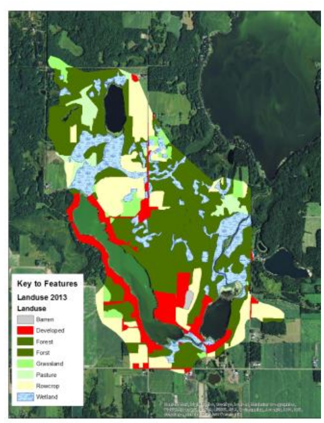
Historical Land Use

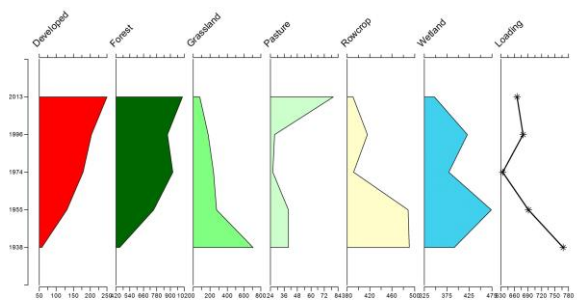
Watershed Modeling

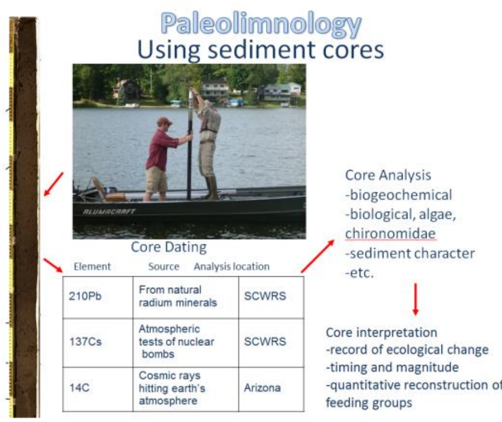


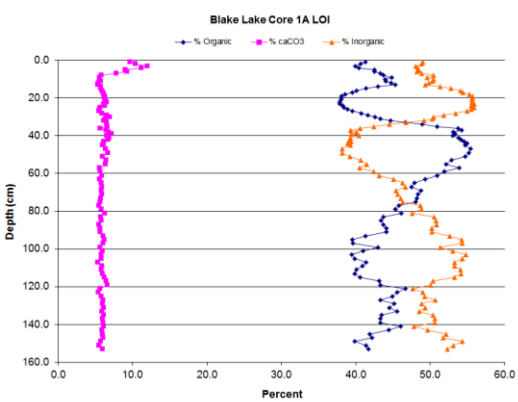


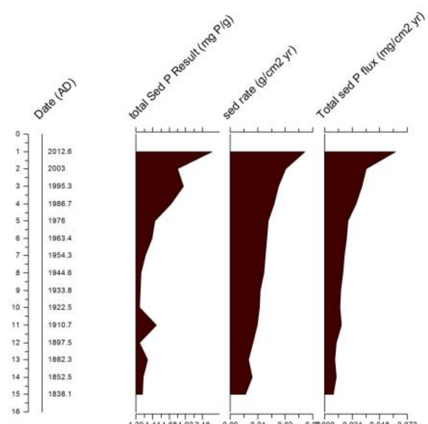





Developed
Forest
Grassland
Pasture
Rowcrop
Wetland
Loading
2013
1996
1974
1955
1938

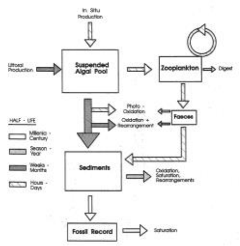

Paleolimnology
Using sediment cores
ALUMACRAFT
Core Dating
Element
Source
Analysis location
210Pb
From natural radium minerals
SCWRS
137Cs
Atmospheric tests of nuclear bombs
SCWRS
14C
Cosmic rays hitting earth's atmosphere
Arizona
Core Analysis
-biogeochemical
-biological, algae, chironomidae
-sediment character
-etc.
Core interpretation
-record of ecological change
-timing and magnitude
-quantitative reconstruction of feeding groups


Blake Lake Core 1A LOI
% Organic
% caCO3
% Inorganic
Depth (cm)
Percent
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
10.0
30.0
50.0

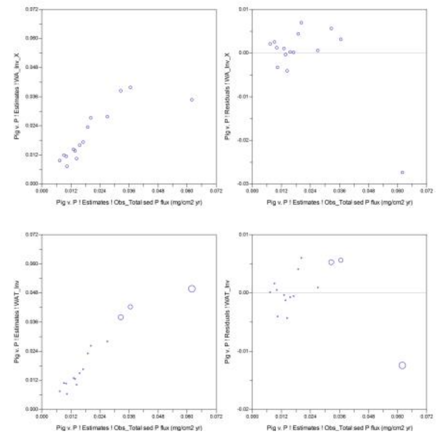

Date (AD)
total Sed P Result (mg P/g)
sed rate (g/cm2 yr)
Total sed P flux (mg/cm2 yr)
2012.6
2003
1995.3
1986.7
1976
1963.4
1954.3
1944.6
1933.8
1922.5
1910.7
1897.5
1882.3
1852.5
1838.1

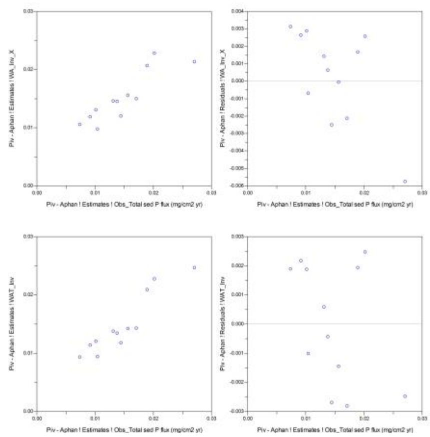
Pigment sedimentation

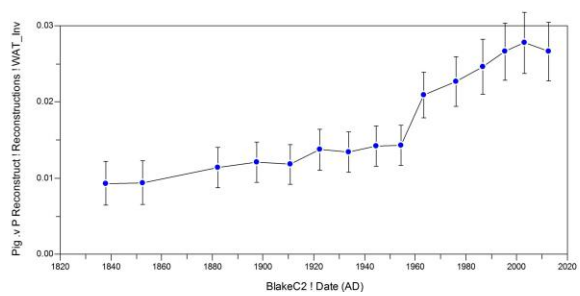
- Pigments are an important record of non-siliceous algae
- Pigment losses are well studied
- Zooplankton can increase transfer rate

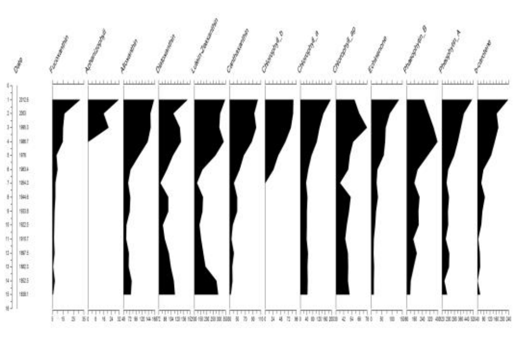


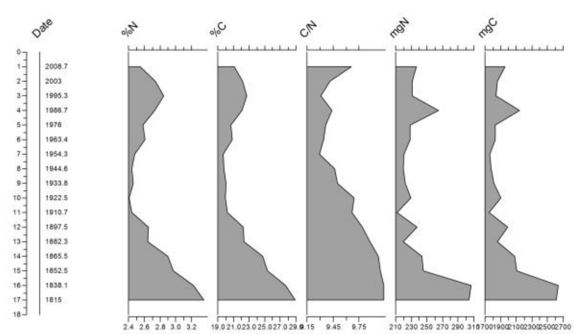
Slide courtesy of N. John Anderson











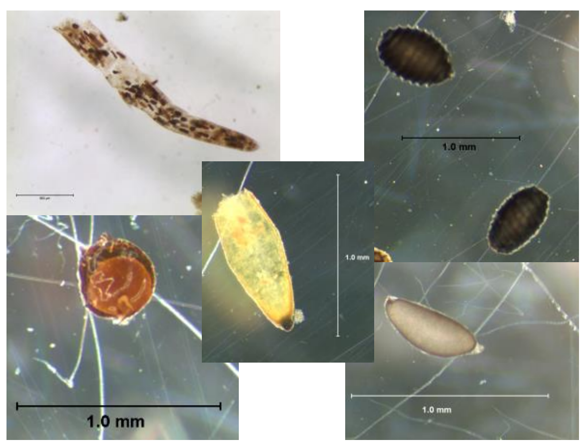
Blake Lake 1852

Blake Lake 2012

Altered biological structure and the reconstruction of fish

- How do we get to fish from the sediment record?
  - **directly: fish scales**
  - **indirectly - through zooplankton assemblage structure**
  - **Pigments – grazing indicators**

Slide courtesy of N. John Anderson



Questions?

Jeremy A. Williamson
Water Quality Specialist
Aquatic Invasive Species Biologist
Polk County Land & Water Resources Department
100 Polk County Plaza, Suite 120
Balsam Lake, WI 54810
jeremyw@co.polk.wi.us
http://www.co.polk.wi.us/index/landwater
715-485-8639

Big Blake Lake: 2016 Lake Management Plan Overview

Prepared and presented by:

Shelley Rodriguez, Commissioner
Big Blake Lake Protection and Rehabilitation District

August 20, 2016

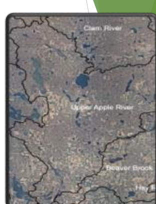
Lake Management Plan Committee

A special thank you to the following Blake Lake Management Committee volunteers for their contributions to this project.

Big Blake Lake - Lake Management Plan Committee	
John Belisle	Sue Budd
Don Craft	Peggy Lauritsen
Jim Maxwell	Jim Mitchell
Sam Rivers	Mike Rogge
Gerry Smith	Roxanne Smith

Big Blake Lake at at Glance

- Big Blake Lake is a 208 acre lake located in the Town of Georgetown in Polk County, Wisconsin, approximately 80 miles northeast of the Twin Cities metropolitan area.
- The main inlet for Big Blake Lake is a channel flowing directly from Little Blake Lake. Big Blake Lake also receives water from an inlet located on the north side of the lake. This tributary flows from Lost Lake and is called Lost Creek. The lake's outlet is located on the northwest side of Big Blake Lake and flows to the Apple River via Fox Creek.
- Big Blake Lake is defined as a **drainage lake**, or a lake with an inlet and an outlet.
- The **residence time** for Big Blake Lake is 0.10 year, meaning that water is replaced approximately every 36 days.
- The Big Blake Lake Protection and Rehabilitation District was formed in 1976 in response to concerns about algae blooms and aquatic plant problems.
- The District includes two hundred twenty-two residences.



Big Blake Lake Characteristics

Area: 208 Acres

Maximum depth: 14 feet

Mean depth: 9 feet

Bottom: 55% sand, 0% gravel, 0% rock, and 45% muck

Total shoreline: 6.65 miles

Invasive species: Curly-leaf pondweed, Chinese mystery snail, and banded mystery snail

Fish: Musky, panfish, largemouth bass, northern pike, and walleye

Boat landings: 2

Impaired Waters

Big Blake Lake was assessed during the 2016 listing cycle and proposed for listing for the pollutant total phosphorus and the impairment of excess algal growth. The general condition is suspected poor.

- **Total phosphorus** sample data exceeded the 2016 Wisconsin's Consolidated Assessment and Listing Methodology (WisCALM) listing thresholds for recreational use (40 μg/L) **but not** for fish and aquatic life use (100 μg/L).
- **Chlorophyll** sample data exceeded the 2016 WisCALM listing thresholds for recreational use (30% of days in the sampling season have nuisance algal blooms with chlorophyll values greater than 20 μg/L) **and** fish and aquatic life use (60 μg/L).

Listing thresholds can be found in: Wisconsin 2014 Consolidated Assessment and Listing Methodology (WisCALM) Clean Water Act Section 305(b), 314, and 303(d) Integrated Reporting, Wisconsin Department of Natural Resources, September 2013

- http://dnr.wi.gov/water/waterDetail.aspx?key=16558

What is Phosphorus?
Where does it come from?

- Phosphorus is **necessary for plant and algae growth.**
- **Excessive amounts** can lead to an overabundance of growth which can **decrease water clarity** and lead to **nutrient pollution** in lakes.
- When lakes lose oxygen in the winter or when the hypolimnion becomes anoxic in the summer, these particles dissolve and phosphorus is redistributed throughout the water column with **strong wind action or turnover events.**

How does Phosphorus get into the lake?	
• Naturally in soil and rocks	• Release from lake bottom sediments
• Atmosphere in form of dust	• Fertilizer runoff both urban and agricultural
• Groundwater	• **Watershed drainage**
• Soil erosion	

Big Blake Lake Management Plan:

Vision

- *Big Blake Lake is a sustainable, healthy environment for people, recreation, wildlife, and native plants. Engaged and informed stakeholders protect the lake and its watershed.*

Big Blake Lake Management Plan

Guiding Principles

- *Lake management decisions are data driven and evidence-based to incorporate analysis of past, present, and future data and are implemented in a manner that will limit unintended negative environmental impacts.*
- *Member education, engagement, and neighbor-to-neighbor communications for all generations are important to meet the vision of and manage the future of Big Blake Lake.*
- *Clear and concise multi-channel communications to members express the ever evolving nature of lake management and the complexity of issues.*

7 Plan Goals

Goal 1: Reduce nuisance algae and plant growth by reducing watershed and internal sources of phosphorus

Goal 2: Reduce curly-leaf pondweed coverage and density to restore reasonable uses of the lake while promoting the recovery of the beneficial native plant community and protecting sensitive areas from disturbances

Goal 3: Provide information and education with the intent of changing stakeholder behaviors to protect Big Blake Lake

Goal 4: Prevent the introduction of new invasive species and eradicate newly introduced invasive species

Goal 5: Evaluate the progress of lake management efforts and needs through monitoring

Goal 6: Protect, maintain, and enhance fish and wildlife habitat

Goal 7: Sustain the implementation of the plan

Goal 1: Reduce nuisance algae and plant growth by reducing watershed and internal sources of phosphorus

- **Objective 1.** Support harvesting of curly leaf pondweed to remove nutrients from Big Blake Lake
- **Objective 2.** Install at least 10 shoreline native plantings/restorations, diversion practices, rock infiltration practices or rain gardens per year
- **Objective 3.** Evaluate the purchase of highly erodible/ecologically sensitive land if option arises
- **Objective 4.** Engage the agricultural community as a partner in reducing watershed runoff
- **Objective 5.** Ensure that stakeholders understand the relationship between boat traffic and phosphorus release from the sediment
- **Objective 6.** Upgrade non-compliant septic systems by engaging and educating 100% of shoreline property owners

Goal 2: Reduce curly-leaf pondweed coverage and density to restore reasonable uses of the lake while promoting the recovery of the beneficial native plant community and protecting sensitive areas from disturbances

- **Objective 1.** Ensure that the timing and location of harvesting is appropriate
- **Objective 2.** Allow individual riparian owners to manually remove vegetation if adequate navigational opportunities are not provided with the harvester
- **Objective 3.** Monitor the success of the harvesting program
- **Objective 4.** Plant control will prevent harm to important fish spawning and nursery habitat and prevent direct removal or indirect harm to wild rice

Goal 3: Provide information and education with the intent of changing stakeholder behaviors to protect Big Blake Lake

- **Objective 1.** Use existing channels to deliver at least one focused educational message per year to meet the goals of this plan
- **Objective 2.** Explore new and innovative methods to provide information and education

Goal 4: Prevent the introduction of new invasive species and eradicate newly introduced invasive species

- **Objective 1.** Ensure that lake residents and users understand the steps necessary to prevent invasive species
- **Objective 2.** Implement an annual monitoring program to quickly identify the introduction of new invasive species

Goal 5: Evaluate the progress of lake management efforts and needs through monitoring

- **Objective 1.** Continue current data collection efforts to evaluate progress
- **Objective 2.** Expand data collection efforts depending on needs

Goal 6: Protect, maintain, and enhance fish and wildlife habitat

- **Objective 1.** Maintain and enhance desirable populations of game fish in Big Blake Lake by installing 5 habitat improvements such as fish sticks
- **Objective 2.** Restore 10 developed shorelines to more native habitats per year

Goal 7: Sustain the implementation of the plan

Objective 1. Form teams to ensure that the goals of the plan are met

- *Water quality (land acquisition and healthy lakes sub teams), fish and wildlife, information and education, aquatic invasive species and aquatic plans teams*

Objective 2. Continue to seek funding to implement the Big Blake Lake Management Plan

- *Apply for WDNR Lake Planning, Lake Protection, and Aquatic Invasive Species Grants*
- *Leverage current partner efforts to strengthen grant applications*
- *Identify additional funding sources and partners to expand opportunities for action*

Team and sub-team volunteers

Our Plan cannot become a reality without **YOU!**
Volunteers for the following teams/committees are needed!

- **Water quality team**
  - Land acquisition sub team
  - Healthy Lakes sub team
- **Fish and wildlife team**
- **Information and education team**
- **Aquatic invasive species team**
- **Aquatic plans team**

? Questions ?

Big Blake Lake Protection and Rehabilitation District

Annual Meeting, August 16, 2014

Agenda

Board Members: Tom Borden, Co-Chair Sam Weber, Co-Chair;
Jim Filkins, Treasurer; Joan Maxwell, Secretary; Adam Elliott Commissioner
Ken Sample, Polk County Board; Ron Ogren, Georgetown Chair

Call to Order at 9:05 by Sam Weber.

Welcome and Introductions

Board Members Present: Sam Weber, Tom Borden, Jim Filkins, Joan Maxwell, Polk Co Designee Cedric Solland.

Board Members Absent: Adam Elliott, Ron Ogren

Approval of meeting minutes (handout) Motion to accept/approve minutes from 2013 Annual meeting by Stephanie Hinrichs; Second by Sue Ogren. Motion carries.

Approval of Treasurer's report (handout) Motion to approve Treasurer's report by Char Dunst; Second by Stephanie Hinrichs. Motion carries

Introduction of Guests and Presentations:

Jeremy Williamson, Polk Co LWRD - re: Core Sediment Sampling

Jeremy Williamson presented an update on the findings for the core sampling collected in September 2013. Jeremy has been doing studies on our lake since 2006. He is currently doing top and bottom water chemistry, algae and zooplankton sampling and reconstructing the history of Blake Lake through the core sampling.

They took two core samples and have 195cm of mud, essentially. From this core, they are extracting a lot of geo-chemical data looking at what phosphorus is bound to, finding out how much erosion has occurred in the entire watershed, etc. They date the core, calibrate it, then pull out the diatoms, zooplankton fossils, fish flies, pigments, and all sorts of things to measure and observe.

Blake Lake is really interesting because it has changed significantly over time. We have a low sedimentation rate. They took 2 meters of "mud" and they were able to go back to pre-settlement within 40cm... back to around the 1300s. Our geo-chemical analysis so far seems to indicate that our lake really began changing in the 1970s. In looking back to where we've been, to where our lake has been historically, we will be able to more accurately develop an aquatic plant management plan that is realistic and is based on evidence from where our lake has been in the past.

At the end of this core sampling data analysis, Blake Lake will develop a plan that will outline where we are going with respect to aquatic plant management. This will involve forming a committee to look at the data and present a plan to the District. This will also involve continued citizen lake monitoring participants. Clean Boats Clean Waters will also play a huge role in preventing the spread of aquatic invasive species and protecting our lake water and ecosystem.

Old Business

Slow-no-wake Zone (Tom Borden) Commissioner Tom Borden updated the District that most of the paperwork has been approved by WDNR and we are making progress toward gaining final approval for buoys to mark the slow-no-wake zone through the Narrows on Big Blake Lake. We expect to have full approval by next Spring for the 2015 boating season.

Email list The District would like to have an email address for every District member in order to communicate in a timely fashion. An email list sign-up sheet was circulated during this meeting; anyone who wishes to add their email address to our District list-serve for District info, CBCW info, and dam updates please give your email address to Peggy Lauritsen: plauritsen@pldg.com

Standing Committee/Report

Clean Boats Clean Waters (Peggy Lauritsen) 52 Volunteers have already completed 76 percent of our seasonal goal of 400 hours of CBCW monitoring per landing. We still have 45 days left to complete our goal.

Through the Drain Campaign, the Landing Blitz, and AIS flyers and brochures, our CBCW team is increasing awareness among our Lake District members and visiting boaters that AIS is a serious issue on area lakes. This year we handed out free AIS towels and ice packs to educate boaters on WDNR's statewide initiative to teach anglers to "Drain and Ice" - drain all lake water from your boat, your live-well, your bait buckets; ice your catch - this will help stop the spread of aquatic invasive species.

Three CBCW vounteers attended a 9-hour training through PCALR for Citizen Lake Monitoring Network; thank you Gail Rustad, Marge Filkins, and Vicky Dorner for attending this training.

Polk Co LWRD expert Katelin Holm/ Water Quality Specialist held a training here at Big Blake Lake to help us identify invasive species and go over the new inspection forms for CBCW. Big thanks to attendees for this training session: Judy Hall, Mike Rogge, Naomi Anderson, Tom Borden, Diane Borden, Sue Ogren, Marge Filkins, Jim Filkins, Peggy Lauritsen, and Kathy Maraden.

APM Harvey Report (Jim Maxwell) Our APM Coordinator Jim Maxwell informed us that 30 loads of CLP and 1 load of Coontail have been harvested this season (so far). Due to the decreasing density of CLP, it takes more hours of active harvesting to get an entire load of weeds. This is great news for our harvesting efforts as it is active proof that we are making a difference in our invasive weed population. Jim explained that as we continue to harvest CLP before it drops its seeds (turions), we have better odds of long-term reduction because new seeds are harvested while they are still attached to the CLP plant, then loaded onto a trailer and tilled into someone's farmland or garden thereby ending their cycle of growth in our lakebed.

EPP Grant Update (Sam Weber) The EPP Grant (Education, Prevention, and Planning) is a 3 yr, $49k grant designed to educate District members about the lake and about aquatic invasive species (AIS), to prevent the spread of AIS through programs like

CBCW and CLMN along with Bait Dealer Initiatives and the distribution of flyers at the boat landings, and to plan for the future of our lake by developing a comprehensive Aquatic Plant Management (APM) Plan.

Each Spring and Fall Polk Co LWRD conducts a full point intercept survey at 276 gps coordinates on our lake plus every-other week they collect water samples, plant samples, and related water quality data such as water temperature, etc. at those same sites. Samples are sent to the State Lab of Hygiene (SLOH) where further analysis is conducted and transmitted back to Polk Co LWRD.

An executive summary will be available to all District members at the end of this grant cycle in 2016. Please consider becoming part of the APM Committee to help develop our comprehensive APM Plan beginning next year.

New Business

Polk County updates - Ken Sample or designee C.Solland

No Polk Co updates other than our opportunity to greet Cedric Solland as our Big Blake Lake designee. Cedric will serve as a liaison between our lake district and the county. Welcome Cedric.

Georgetown updates - Ron Ogren There were no Georgetown updates.

WAL Convention Delegates (April 23-25, 2015; Stevens Point)

Annual Business

VOTE: Annual Budget (Treasurer: Jim Filkins) Jim Maxwell/Vince Teuber motion to approve the annual budget of $20,000. Motion carries unanimously.

VOTE: Commissioner Election: 3-year terms currently held by Sam Rivers Weber and Joan Maxwell.

Voting held by private ballot with Joan Maxwell, Sam Weber, and Peggy Lauritsen as nominees. Sam Weber and Peggy Lauritsen were elected to these positions for the next 3 yrs.

DAM Discussion The BBL P&R District Board presented a powerpoint explaining the procedures for reconstruction of the Dam. Through a series of meetings with the Sherrard family, the BBL P&R District, WDNR, and our Engineer, we've developed a scope and sequence of events; a timeline, as it were, to reconstruct the Dam that went out on or around April 28th, 2014.

A Rip-Rap Rock Chute Dam is our best choice because it is economical, simple, and virtually maintenance free. The Board also looked at Concrete Dams, and Concrete Drop Box Dams, both of which require de-watering prior to construction, which would cost at least $100,000 more than a Rip-Rap Rock Chute Dam.

The "red tape" will take about 10-12 months to complete with property surveys, transferring deeds, approval of project, drafts, and final approval by the DNR then bidding from Dam builders. Once construction starts, it'll take about 30 days to complete the Dam. We are hoping to have this fully completed by next summer.

The preliminary figure we've been given by the engineer is between $100k-150k.

Therefore, the board is seeking approval from the District to reconstruct the Dam, to assess the District for the costs of this project, and to borrow funds to get things rolling on this with a cap of $175k. If Dam costs go above $175k, the District will hold a special meeting to discuss the project costs and seek approval for additional funding. We do not anticipate this happening, and feel comfortable with the $175k borrowing approval at this time.

VOTE: Funding for Dam Reconstruction: Approved

Motion approving the Dam Reconstruction project by Sue Ogren/Ford Elliott. Motion carried unanimously.

VOTE: Consideration of Borrowing Funds for Dam Reconstruction: Approved unanimously.

Three methods of assessment were presented to the District:

1) Riparian v Non-Riparian

2) Unique Flat Fee v non-Unique Flat Fee

3) Flat Fee for All plus Riparian cost per foot of shoreline

*Riparian means you have deeded access to the lake or you own lakeshore property.

The Board will determine the method of assessment; thank you for your input.

<u>**Announcements**</u>

Spring Meeting will be held May 16, 2015 (3rd Saturday in May)

2015 Annual Meeting will be held August 15th (3rd Saturday in August)

2015 Parade Date (July 4th falls on a Saturday) PARADE HELD ON THE 4th at 4pm.

Sue Ogren/Gail Rustad motion to adjourn at 11:10 carries unanimously.

78 District Members attended the annual meeting; 6 non-District attendees.

Common Acronyms you may hear or read today:

APM:	Aquatic Plant Management
AIS:	Aquatic Invasive Species
BBLP&RD:	Big Blake Lake Protection & Rehabilitation District
CBCW:	Clean Boats Clean Waters
CLMN:	Citizen's Lake Monitoring Network
EPP:	Education, Prevention, & Planning
LWRD:	Polk Co. Land & Water Resources Department
PCALR:	Polk Co Association of Lakes and Rivers
SWIMS:	Surface Water Integrated Monitoring System [Database]
WAL:	Wisconsin Area Lakes [now: WI Lakes Partnership]
WDNR:	Wisconsin Department of Natural Resources

Minutes: BIG BLAKE LAKE P&R DISTRICT ANNUAL MEETING
AUG. 17 2013

Tom Borden called the meeting to order at 9:00 AM

Jim Thorn/Sue Ogren motion to approve minutes as printed in June Bugle, unanimous.

Jim Filkins presented the Treasurer's report and spoke about the need to approve a 50K Reserve account for Harvey as a Capital Expense Acct. Something that never was officially approved in the past. Sue Ogren motioned to approve capital exp acct and Peggy Lauritsen seconded, motion carried. Ogren/Lauritsen motion to approve Treasurer's report carries.

Jeremy Williamson - Core Sediment Sampling: Jeremy and Katelin from Polk Co LWRD did point intercept surveys on the lake this summer and spoke about gathering extensive data and entering into the mapping program. Curly leaf way behind this year. Native plants are growing where curly leaf used to be abundant, and that's a good thing. Taking chemistry samples at inlet and outlet and using a flow meter to gain critical information. Also is interested in doing sediment core samples – working with science museum – doing Geo chemical analysis also and looking at historical land use, going back 150 years or so.
Lessening curly leaf makes us eligible for more grants.

Old Business:
Slow – No-wake. DNR needed comments and feedback from residents on the lake who have been impacted by the land erosion and lack of a slow wake zone.
* Jack Belisle who doesn't live in the narrows commented on the boaters
* Gerry Smith remarked about possibly having an on-line survey for our residents to give feedback regarding the need for a slow-no-wake zone. He thought it might be a danger to boaters to hit the buoy with their boat. He was told that it is the boaters responsibility if he does. This was a quote from Mark Little @ DNR.
* Gale Rustad lives in the narrows and has seen rip-rap totally washed away and seen people spin their watercraft in narrows.
* Peggy Lauritsen has seen a lot of traffic right by their dock. She commented that in her line of work they do surveys on-line often and if you get a 30% response on the survey is good.
* Ford Elliott says that 200 feet North of narrows gets hammered with wake. Says buoys are in the water at Balsam. On our lake we would be placing two buoys at each end. They are made of covered foam.
* Adam Elliott had a question regarding clarity on what kind of buoy.
* Sue Ogren says boaters are still coming too close to property. Suggested reminding boaters.
* Jerry Belisle has seen boaters going between his float and his shoreline.
* Vincent Tueber asked about the number of feet from shore and other boaters.
* Gail Rustad says people are asking "Where does the no wake zone start and end?" Says they need to see the signs.

Trash can vs. Signage at landings: Tom Borden reported that trash cans rent for $55 a month and two would be required if we go that route. It was decided – no trash barrels. Signage is better to encourage people to take home their trash and dispose of it properly.

Vicky Dorner - is continuing to work on the email spreadsheet for District contacts.

Standing Committee report:
CBCW: Peggy Lauritsen – 42 people signed up this year. Some volunteers put literature at Bait Shops. We should be at landings 400 hours a season. We are not hiring kids to do 'voluntary' hours but we might have to. Our Landing Blitz was mentioned in the Amery Free Press which has a 5000 circulation.

APM: Jim Maxwell says Harvey is running good this year. Took out 6 loads of coontail compared to 85 last year.
On 6/30/2013 Jim Maxwell and Jim Filkins met with two fellows from the DNR and GLIFWC and received permission to expand cutting at the Belisle and Foley properties and near Lyle Sunde's property. Areas that were not permitted in the past.
Large mouth bass limits were discussed and DNR Fisheries agent Aaron Cole encouraged us to keep everything the same. Vicky Dorner would like Aaron as a guest at a future meeting.
The $3010 GPS system that was purchased last fall allows the Harvey driver to punch in the coordinates and not cover the same ground he just went over. Fixed head on Harvey by rearranging small motors; runs quieter now.

EPP Grant (AIS) Sam Weber reports that as we go to the next level of study we may qualify for a new grant. The Education, Prevention, and Planning Grant will involve more lake citizens for monitoring and CBCW activities and next summer there will be a Pontoon Classroom.

Core Sampling Grant Approval: The total for District's commitment to the core grant is $8,000 over two years. Motioned to approve made by Jim Thorn, Ford Elliott seconded. Motion carried.

New Business:
No update from Polk Cty or from Georgetown.

Annual budget - Jim Filkins reports that insurance has gone up significantly. The board is actively looking for alternatives. Budget remains at $20,000 per year. Vince Tueber/Ford Elliott motion to approve carries unanimously.

Wal Convention: Stevens Point hosts it this year. Ford Elliott strongly recommended that a board member attend. Tom Borden and Peggy Lauritsen volunteered to go this Spring (2014).

The 4th of July falls on a Friday in 2014 – the boat parade will be on that Friday at 4pm.

It was announced that the spring meeting in 2014 will be on May 17th (third Sat in May)
and the Annual meeting will be on August 16, 2014 (third Sat in August).

Adam Elliott volunteered to be a commissioner; Elliott/Filkins motion carried.

Motion to adjourn made by Ford Elliott / Seconded by Vicky Dorner. Adjourned 10:15 a.m.

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SPRING MEETING MINUTES

Meeting Date: 5-16-15 FINAL

Meeting at Georgetown Town Hall called to order by Co-Chair Sam Rivers Weber at 9:01 am.
Board Members present: Sam Rivers Weber/Co-Chair, Adam Elliott/ Co-Chair, Tom Borden/ Commissioner, Jim Filkins/Treasurer, and Peggy Lauritsen/Secretary.

Agenda

Welcome and Introductions

Co-Chair Rivers Weber proposed to approve the agenda with flexibility. Motion was made to approve agenda with flexibility by Jack Belisle, second by Mike Rogge. Unanimous. Motion carries.

Approval of Minutes

Co-Chair Rivers Weber explained the amended minutes from the 2014 Annual Meeting, published on page 6 in the Spring 2015 newsletter. Motion to approve minutes by Jim Seifert, second by Sheila Monson. Unanimous. Motion carries.

Treasurer's Report

Jim Filkins reported account balances as of 4-30-15 as follows: Checking $6363.99; Savings $5.00; and Money market $65,704.88. Anticipated taxes are $8000-$9000.

Introduction of Guest Presentation

Presenter: Katelin Holm, Information and Education Coordinator/Water Quality Specialist, Polk County Land & Water Resources Dept.
Grants ending: We have 2 grants that are ending in 2015, EPP Grant (Education/prevention/planning) and the Sediment Core Grant. Blake Lake is the only lake in Wisconsin that has a state harvesting grant to control invasive weeds, and not use a chemical treatment. Because of this we have a flagship program in the state.

2014 District Member Survey Results. The survey was mailed to 217 district members in May, 2014. There were 126 responses, or 58% response, which is excellent given that a 30% response is considered good or acceptable. The survey results will inform our lake management plan going forward.

Top concerns by 75% of members: new invasives, more curly leaf, excessive plant growth, excess algae, water clarity, increased nutrient pollution and decrease on overall lake health.
Low or no concern: 60% believe there is no concern about excessive noise or decreased wildlife.

The average number of years owned property on the lake: 21 years. 50% living on the lake seasonally, which is common in Polk County; 56% are weekend residents and 33% are full-time residents. 148 days per year property is used. This data can helps with modeling and septic systems.
Shoreline buffer zone of 35 feet is ideal that includes plants, shrubs and trees. 91% of properties have mowed lawns; 38% unmowed section, 50% have shrubs in this area; and 15% have woods on shoreline.
49% of properties have piers/docks
Amount of lawns: 50% of members said its just right; 25% said too much; and 25% were not sure.
Interest in shoreline improvement: 75% interested
Use phosphorous on property: 98% don't use or use phosphorous-free fertilizer.

What activities members enjoy most: 93% value views and peaceful enjoyment.
Watercraft used: 46% use canoes, kayaks and other non-motorized; 46% use watercraft with 21-50HP; 25% use boats on other lakes.
Water Quality: 54% rated it fair; 26% rated it good. More people thought water quality had degraded rather than improved. What month algae a problem: 66% said July and 88% August.
Plants: 2/3 thought there were too many plants; 1/3 thought there is a healthy amount of plants. Members thought plants are a problem 46% in June, 74% in July and 67% in August.
Impairments: 92% algae impairs swimming; 57% fishing; 52% boating/pets & animals. Boating not impaired by algae.
Impairments by plants /Curly leaf identification: 50% could recognize it.
Plant Harvesting/ how satisfied?: 44% somewhat; 19% very satisfied
Key Actions and Priorities to Manage Big Blake Lake: 91% of members want the dam up to code; 89% believe AIS (invasives) is a top priority; 78% enhance fisheries, 71% upgrade non-conforming septic systems; 61% install shoreline buffers and rain gardens; 54% install farmland conservation practices; 44% want lake fairs and workshops and 44% want enforcement in slow-no-wake-zones; 90% want harvesting of lake weeds; 89% want monitoring of new AIS; 86% want Clean Boats, Clean Waters; 72% want educational programs; 54% want to use herbicides to control curly leaf; 37% want landing cameras; and 35% want washing stations at landings (not in Polk Co. now).
Communications members want: 85% want the newsletter; 51% email; 24% website; 6% Facebook; and 40% annual meeting.

Katelin will email the full 10-page report summary to anyone who wants it. Contact her at katelin.holm@co.polk.wi.us.

Katelin reported on the APP Grant expiration in 2015: Blake Lake has a 3-year AIS (aquatic invasive species) grant that ends in 2015. Every other week samples are collected from the lake including pH, temperature. Once a month nutrient samples are sent to the lab. Algae and zooplankton are measured once a year. The Spring and Fall plant survey is measured at 276 GPS points on the lake and three people rake samples of plants. Once-a-year dredge samples taken. In the Spring, curly leaf pondweed turions are sampled. Nutrient levels are sampled at inlets and outlets.

Katelin reported there is a county and state emphasis on AIS prevention via the June Drain Campaign (focused on anglers) and the July Landing Blitz (focused on all boaters). A key component of prevention is educating members, and all boaters. She handed out a list of AIS training and classes in June. Again this year she will be leading several of the trainings at the east landing including a new class "Pontoon Classroom" on June 13 from noon to 2pm. Details were published in the Spring newsletter.

Katelin advised us to think about the development of a lake management plan with a sightline of the next 20 years. How do we want the lake to be in the future? Everyone is invited to contribute to this coming effort.

Katelin reported on the Sediment Core Grant. Samples are taken from the deepest part of the lake to see how the lake is changing and has changed over the past 150-200 years. Samples identify what the state of the original lake was. Jeremy Williamson will be reporting updates at the Annual Meeting in August.

Old Business

Dam update by Adam Elliott/Co-chair. We hired a good engineer Larry Gotham, early in the process to manage the project and keep things moving. The DNR advised that we had good timing for fast-tracking the project. We are approved for the loan of $150,000 as of May 5. We have 4 months, until September 5, to draw down the funds. We are expecting a 3% interest rate upon drawn down with a 5-year term. The funding source, BCPL (Board of Commissioners of Public Lands), funds schools and libraries in the state. We are in the process of getting the outlot transferred from the property owners/Sherrards. Once we get the ownership of the outlot the district takes over to start the reconstruction. There will be a permanent easement for maintenance and temporary easements for construction. Legal agreements are being processed, and with that we can get approval from the DNR. In all, the process is going well and going down the right path. Once all agreements are in place to the DNR, the reconstruction can start. Regarding the timeline, we do not know at this date if the project will be done in 2015. We are moving forward as much as we can and with respect to the Sherrard family dealing with estate issues. The new dam will be a rip-rap-rock-chute dam style. When the new construction goes in the old dam comes out. Members were encouraged to contact any district board member with questions. Board member contacts are listed on page 2 of the newsletter. A question and answer period followed the presentation.

Slow-no-wake zone update by Tom Borden/Commissioner. The 6 buoys are arriving within a week and will be installed by June. Signs will be posted at the landings. The buoys will identify the slow-no-wake zone through the narrows on Big Blake Lake.

Standing Committee Reports

Clean Boats, Clean Waters (CBCW) by Peggy Lauritsen/AIS Coordinator.
There are three seasonal goals: 1) volunteers perform 400 hours of CBCW monitoring (200 hours per each of two landings); 2) educate boaters and the public to avoid the accidental spreading of invasives; and 3) increase awareness with district members that our grant requires volunteer hours.

Peggy thanked all past CBCW volunteers who have helped to meet our goals year after year. Thanks to Vicky Dorner for representing our lake, attending the Annual CBCW training April 29 presented by Katelin Holm, Polk Co. Land and Water Resources Dept. Highlights are included in our display at the meeting.

CBCW training dates and activities: There will be training on two June Saturday mornings to refresh CBCW volunteers in June as part of the WDNR "Drain Campaign" June 12-14, a statewide initiative to make sure anglers know about Wisconsin's invasive species laws. Dates are June 6 and 13. Posters, ice packs and flyers will be available for volunteers to give anglers at the landings again this year. Training on June 13 will be lead by Katelin Holmes, Water Quality Specialist, Polk County Land and Water Resources Department. She and Jeremy Williamson will lead the new Pontoon Classroom on June 13 from noon to 2pm, an on the water experience to learn how water samples, algae samples, and sediment samples are collected and analyzed on Big Blake Lake. This is your opportunity to learn how to find wild rice, how water samples work, learn more about Big Blake Lake and ask any questions you have regarding the lake. There is no cost to attend. Blake Lake will also participate in the WDNR 7th annual statewide Landing Blitz, July 3 -6. We are one of 90 lakes in Wisconsin participating again this year.

Peggy described the goals for the CBCW public relations efforts and named 4 ways for volunteers to get involved.

New CBCW coordinator wanted. Peggy announced that she will complete her fourth year and retire as CBCW Coordinator. We are looking for a new coordinator for 2016. She suggested that a committee approach of several volunteers could be considered instead of having just one person coordinate all efforts.

APM Harvey Report by Jim Maxwell, APM Coordinator. There are lots of weeds already this year. This is the ninth year of studies done on our lake by the research team. This team needs to complete samples of the weed population before cutting can start. As soon as that happens cutting will be aggressive.

EPP Grant Update by Sam Rivers Weber. The EPP Grant (Education, Prevention, and Planning) is a 3 year grant that is ending in 2015. It is a $66,000 project designed to educate District members about the lake and about aquatic invasive species (AIS). Katelin Holm's report today is the detailed update on where we are at currently with the grant. District members are forming a committee to study the results of all the studies and surveys to inform our APM committee at the annual meeting in August.

WLP Convention by Peggy Lauritsen. The Wisconsin Lakes Partnership Convention (WLP) is an annual, statewide convention that she attended on April 23-25 in Stevens Point. Wisconsin Lakes Partnership consists of 3 core groups: 1) Wisconsin DNR (technical, financial, regulatory); 2) University of WI extension Lakes (educational materials) and 3) Wisconsin Lakes (advocates statewide for local lake people and lakes). The Wisconsin Lakes Partnership brings science, education, and citizens together to empower people to work together to care for our lakes. Six educational tracks included "Watersheds, Groundwater and Water Levels", AIS, Ecology, "People Policy and Politics", "Nutrients in our Lakes" and Public Health.

Approximately 600 people attend from all over the state. Sessions and workshops were excellent. Speakers were very knowledgeable and attendees very willing to share best practices, resources and advice.

Conference highlights and value we can bring to our district include:
Networking with attendees: AIS leaders in our area attending from Balsam Lake, Deer Lake, Bone Lake, Amery Lakes, Round Lake and White Ash Lake.
Takeaways: literature in the display today is the latest and some "just published", many statewide contacts to experts in many areas.
Leadership training: all day workshop for "Beginner and Advanced Lake District Commissioner Training**".**

The latest information on key topics:
a) "Long term EW Milfoil research and long term effects of herbicide on native plants". Learnings: there are 100 plant species in Wisconsin lakes. After herbicide treatment some plant species NEVER COME BACK after treat. As was the case in Sandbar Lake and Tomahawk Lake.

b) "Learning from our Neighbors: What's new in Minnesota AIS prevention and management". Tina Wolbers-AIS (Aquatic Invasive Species) Prevention Planner, Minnesota DNR. Learnings: AIS laws
• MN has a 21- day dry time for docks/lifts
• Citation: transport or possess prohibited species; and launch into non-infested waters with AIS attached MN=$500; WI=$295
• Since 2013 MN using dogs to detect zebra mussels
• MN increased the use of roadway checkpoints by 300% in last 3 years. Violation rate is 17%, down from 31% three years ago.
• Top invasives include curly-leaf pondweed, Eurasian milfoil and flowering rush.
• New rules for Lake Service Providers (marina, boat club, yacht club; rent o leases water related equipment that will be placed into or removed from waters) owners or managers must:
- register online for a service provider training
- pay $50 application and testing fee
- attend AIS training, pass AIS 20 minute online test and recertify every 3 years
- the business owner must have all staff trained and certified

c) Greater awareness of impacts to the watershed that effects our district and lake.

d) Fighting invasive species is a very big threat: Increased education and strategies to fight Eurasian milfoil, zebra mussels, and purple loosestrife are top priorities.

e) County alliances forming for lakes and rivers: Eau Claire area watershed creating a coalition to qualify for federal grants. Polk County has 14 lake districts, with increased talk about collaborations to improve shorelines and buffer zones. Special sessions at the conference in 2016 to support new alliances.

f) 50% of Polk County revenue comes from waterfront property taxes. Important economically to protect our lakes and rivers.

Recommendations: Attending future WLP annual convention is highly recommended. It serves to make us stronger as a district. Attendance will engage and inspire members with the latest information to be able to protect the lake we all value.
• representation at the state convention annually (2-4 people) so we can better cover more educational tracks related to our top priorities
•Regular participation at county level such as PCALR

Communications
Peggy Lauritsen reported that the results of the 2014 Member Survey will help to shape communications to members going forward. We are currently sending the newsletter to 226 members 2x per year; our email list is sent almost monthly to 92 members with an open rate of 65-70%; social media using Facebook has grown from 10 fans in 2013 to 77 fans in 2014 to 165 fans as of May 2015.

Announcements
2015 Annual Meeting will be held August 15th (3rd Saturday in August)
2015 Boat Parade July 4 at 4pm. (July 4th falls on a Saturday)

A motion was made by Jim Sieffert to adjourn the meeting and second by Marge Kabis. Meeting adjourned 12:01 pm. A total of 68 district members attended the Spring Meeting.

Minutes respectfully submitted by Peggy Lauritsen, Communications Commissioner/Secretary, plauritsen@pldg.com

Big Blake Lake Protection and Rehabilitation District

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ANNUAL MEETING MINUTES

Meeting Date: 8-15-15 FINAL

Annual meeting at Georgetown Town Hall called to order by Co-Chair Adam Elliott at 9:00 am.
Board Members present: Sam Rivers Weber/Co-Chair, Adam Elliott/ Co-Chair, Tom Borden/ Commissioner, Jim Filkins/Treasurer, and Peggy Lauritsen/Secretary, Communications. Also present Ken Sample/Polk County Board.

Agenda

Welcome and Introductions

After Board introductions, Co-Chair Elliott proposed to approve the agenda with flexibility. Motion was made to approve agenda with flexibility by Allen Moe, second by Jerry Smith. Unanimous. Motion carries.

Approval of Minutes

Minutes of the Spring Meeting were printed in the Bugle newsletter and mailed to members, received on August 10. An email with the Spring Meeting minutes was sent on August 13. Copies of the minutes were also handed out at the meeting. A motion was made to approve the minutes by Steve Paul, second by Sue Ogren. Unanimous. Motion carries.

Treasurer's Report

Jim Filkins reported account balances as of 7-31-15 as follows: Checking $633.25, Dam Project checking $1034.50; Savings $5.00; and Money Market $45,276.97.

Guest Presentation

Presenter: Jeremy Williamson, Water Quality Specialist and Aquatic Invasive Species Biologist, Polk County Land & Water Resources Department, presented "A History of Blake Lake – Results of Core Sediment Sampling". Since 2006 plant studies have been done on Blake Lake. Over the last 3 years a comprehensive water quality study has been done. A sediment core sampling was done to reconstruction the ecological history of the lake. Water quality has changed substantially over the past 50 years, and not in a healthy direction. Now with the data collected, a comprehensive lake management plan can be created. What do members want the lake water quality, plant life and fishing to be over the next 20 years? A Lake Management Committee (LMC) will be formed of 5-10 people/members. A sign-up sheet was passed around and approximately 15 people signed up to be a part of this committee. There will be 3-5 meetings over the Winter at a Balsam Lake location in the evening. At the 2016 Annual Meeting, the LMC committee will present the new lake management plan for approval to district members. If members want to sign up who were not at the meeting contact Sam Rivers Weber at 715-554-1054 or 2cherokeerivers@gmail.com.

Jeremy went on to explain the findings from the sediment core samples collected. Sediment reveals atmospheric nuclear testing done in the 50s. He used historic photos of Blake Lake for a geographic reference and overlaid the watershed area. From that he is able to see a timeline of historic loading, the amount of phosphorus in water. Jeremy talked about changes in property and housing development over time. From 1938 to 1974 there was very little buildings around the lake. Since 1974 there has been dramatically more development. Originally, the lake land around the lake was logged off, it reforested and row crop (sp) dramatically reduced loading. "The good news is…we can get our house in order with very little effort".

Jeremy has analyzed loading rates for phosphorus in the mud of other Polk County lakes near the size of Blake Lake at 250 acres. Mud can have a lot of nutrients collect and it's an easy fix to get phosphorus to move. This corrolates with when curly leaf pondweed rally took off. Since the 60s and 70s pigments increases and drastically changed. Much greener due to algae. Blue-green algae pigment increased possibly due to internal load or curly leaf.

Jeremy went on to say that he is reconstructing the fish history from the 1800s. The lake was 10 feet deeper at one time before logging and the dam. Jeremy is one of four in North America working on plant microphossils. Part of his mission is to find ways to restore good native plants. From 1800s to 1990s the lake plant community completely changed, sediment and water quality also changed. Changes in sediment changes the plants.

In Blake Lake the curly leaf has been reduced, but the challenge is to get back to native plants that provide clear water quality and good fish habitat. He sited Deer Lake has done many best practices to achieve significantly clearer water. Deer Lake and Bone Lake used grants to help pay for 75% of the costs.

A question and answer period followed the presentation.

Old Business

Dam update by Adam Elliott/Co-chair. We have spent $15,000 to date on the Dam Project. While there are still aspects of the project still out of our control, here are the latest projections after conferring with our Engineer.

1. **Land Transfer**: DNR approval of Transfer is expected to occur in early September. Upon DNR approval, the Deed can be signed and recorded. The property will then be transferred to the District at that point in time.
2. **Planning**: Our engineers will be working on the overall dam design this Fall and early Winter.
3. **DNR Approval**: We are expecting approval of dam plans in the Spring of 2016.
4. **Contractor**: Upon DNR approval, our engineer will help us select a contractor as soon as possible — expected in early Summer of 2016.
5. **Construction**: Our engineering team is expecting to commence work in late Summer or early Fall of 2016. Late Summer or early Fall is generally a time of lower stream flows.
6. **Completion**: Project completion and certification to the DNR is expected in the Fall of 2016.

The BLPRD Board applied for and was granted a $150,000 loan. Here is a summary of the financing terms:

- On August 26th, 2015 a check for the entire loan amount ($150,000) will be sent to BLPRD.
- The term of the loan is 5 years.
- The interest rate on the loan is 3%.
- The total finance charge is approximately $12,000.
- We have the ability to pay the loan off early.

Jim Filkins, Treasurer, confirmed we are receiving the loan on 8-26-15 and reminded members that we have locked in an interest rate of 3% for a 5-year term. The style of the dam will be a rip-rap-rock-chute-style dam. The WDNR controls the water level in the lake when the new dam is complete. The WDNR and engineer recorded the "normal" water level prior to the dam failing and when the new dam is complete the water level will be returned to this standard.

Slow-no-wake zone update by Tom Borden/Commissioner. Tom opened a discussion to get feedback from members about the 6 new buoys installed in late June. He reviewed that the purpose of the buoys is to protect the safety of people on the water and in the water, and to avoid shoreline erosion. The slow-no-wake zone follows state law and is 100 feet before buoys and 100 feet after buoys. Discussion ensued. The Board plans to take this under advisement and come up with solutions. They will look at buoy placement, quantity, education, enforceability and DNR support.

A motion was made as follows by Anne Yourchuck, second by Vince Teuber: The motion was to wait until next season to vote in a special session if necessary (immediately following the Spring Meeting) to make changes regarding the buoys. Unanimous. Motion carries.

Comment by Ken Sample/Polk County Board. Ken encouraged our district to work in unison with other districts and organizations in the county to have the most impact. He offered assistance to help "carry our message" wherever needed to achieve our lake management plan.

Standing Committee Reports

Clean Boats, Clean Waters (CBCW) by Peggy Lauritsen/AIS Coordinator.
There are three seasonal goals: 1) volunteers perform 400 hours of CBCW monitoring (200 hours per each of two landings); 2) educate boaters and the public to avoid the accidental spreading of invasives; and 3) increase awareness with district members that our grant requires volunteer hours. Peggy thanked all past CBCW volunteers who have helped to meet our goals year after year.

From the 2014 Member Survey we learned that:
89% of us/members believe AIS (invasives) are a top priority
89% want monitoring of new AIS (invasives)
86% want to keep our CBCW program
50% believe we can identify curly leaf pondweed, the invasive weed we have now

CBCW Results – YTD: Education & boat inspections: goal is 400 hours per season.
Completed hours YTD: 295 hours, 73% complete. *We are right on target.*

In the 45 days until September 30 we have 105 hours remaining to finish our goal. We will meet our goal same as last year. Most of our boat inspection data is entered online and is up-to-date.

AIS Training done this year

Seventeen volunteers attended two trainings June 6 and 13 as part of the **DNR "Drain Campaign"** a statewide initiative started last year to make sure anglers know about Wisconsin's invasive species laws, and the Annual **4th of July DNR 7th annual statewide Landing Blitz**, focused on boaters with heightened awareness about invasives. We were one of 290 lakes in 53 counties in WI participating again this year.

Pontoon Classroom – 8 people attended on July 2, rescheduled due to rain from June 13.
Instructors were Katelin and Jeremy, Polk County Land and Water Resources Department. We learned about how to extract water samples, algae samples, sediment and identification of invasives.

Public Awareness Efforts to achieve our CBCW goals:

- CBCW information published in BL Bugle sent 2-3x per year to district members.
- Literature and displays at May and August member meetings: includes the latest AIS information from state and county sources.
- Email communications to 40 volunteers 2x month, June to October.
- Distribute brochures and posters to local bait shops throughout the Summer.
- Placed 1 newspaper article in Inter-County Leader, published 2nd week of July about the Landing Blitz and featured pictures of our volunteers. We received excellent Outdoor Section page placement. This newspaper has a circulation of 13,000 readers.

Peggy is completing her fourth year as CBCW Coordinator. She asked for a new CBCW coordinator. No volunteer came forward. She suggested that a committee approach of several volunteers could be considered instead of having just one person coordinate all efforts.

APM Harvey Report by Jim Maxwell/APM Coordinator.
The first weed cutting this year started May 1. By May 31 we cut 131 loads of curly leaf pondweed. Since then we cut 32 more loads for a total of 163 loads YTD. In all of 2014 we cut 28 total loads. There have been a few minor repairs to the Harvester. Max Bay has been helping to drive the Harvester. We have cut 30 loads of coontail YTD. We need more places to dump weeds on the east side of the lake.

EPP Grant Update by Sam Rivers Weber. See guest presentation for reference to new lake management committee forming and potential for new grant too.

New Business

July 4th boat parade: A motion was made by Ford Elliott, second by Steve Wistrcill to move the July 4 Boat Parade to Sunday, July 3, at 4:00 pm. Unanimous. Motion carries.

It was also suggested that boaters in the parade leave their own dock at 4pm and start the parade from their dock and not meet at the north end. This will allow more people at the south end and east side to see the parade. Ford Elliott volunteers to fire up his shot gun at 4pm to officially start the parade.

There was discussion about the water balloon fights between parade boaters. People reported having to clean up after the parade and are picking balloons out of the water, consider them pollution and a hazard to wildlife. Water guns, on the other hand are fine in the parade. A motion was made by Sue Ogren for no water balloons in the July 4th parade, second by Vince Teuber. Unanimous. Motion carries.

Annual Business

Annual Budget
A motion was made to approve the budget by Ken Knutson, second by Roxanne Smith. Unanimous. Motion carries.

Election of 2 New Commissioners: Vote
Two candidates were on the ballot. Peggy Lauritsen nominated Shelley Rodriguez and Ford Elliott nominated Jen Wistrcill. Roxanne Smith was nominated by Francis________________. A motion was made to approve the nominees by Allen Moe, second by Vince Teuber. Unanimous. Motion carries. The voting resulted in the election of Shelley Rodriguez and Jen Wistrcill.

Announcements

2016 Spring Meeting will be May 21, 9am to noon (3rd Saturday in May)
2016 Annual Meeting will be August 20, 9am to noon (3rd Saturday in August)
2016 Boat Parade July 3 at 4pm. (July 4th falls on a Monday)

Meeting adjourned at 11:15am. A total of 83 district members attended the Annual Meeting.

Minutes respectfully submitted by Peggy Lauritsen, Communications Commissioner/Secretary, plauritsen@pldg.com

Big Blake Lake Protection and Rehabilitation District

District Leadership

Sam Rivers Weber *Co-Chair*
2cherokeerivers@gmail.com
(715) 554-1054

Adam Elliott *Co-Chair*
adam.elliott@idinsight.com
(651) 343-5380

Shelley Rodriguez *Commissioner*
shelleyrodriguez2010@gmail.com
(651) 253-3093

Jen Wistrcill *Treasurer*
wistrcill@yahoo.com
Home: (651) 429-1501
Cell: (651) 280-7196

Peggy Lauritsen
Communications Commissioner/ Secretary
plauritsen@pldg.com
(612) 940-2006

SPRING MEETING MINUTES

Meeting Date: May 21, 2016 FINAL: July 15, 2016

The Spring Meeting at Georgetown Lutheran Church was called to order by Co-Chair Sam Rivers Weber at 9:07am.
Board Members present: Sam Rivers Weber/Co-Chair, Adam Elliott/ Co-Chair, Shelley Rodriguez/ Commissioner, Jen Wistrcill/Treasurer, and Peggy Lauritsen/Secretary, Communications. Also present Sedric Solland/Polk County Board.

Agenda

Welcome and Introductions

Co-Chair Elliott expressed thanks to the Georgetown Lutheran Church for offering the use of the site at no charge. We are confirmed for our annual meeting on August 20 at this site. Donations to the church welcomed. Members were encouraged to fill out feedback comment cards on the tables and sign up for committees at the volunteer table in the back.

After board introductions, Co-Chair Elliott proposed to approve agenda with flexibility. Motion was made to approve agenda with flexibility by Marge Kabis, second by Gerry Smith. Unanimous motion carries.

Approval of Minutes

Minutes of the Annual Meeting were printed in the Fall Bugle newsletter, mailed to members and are also located on our new website. Copies of the minutes were also available for view at the meeting. A motion was made to approve minutes by Gail Rustad second by Ford Elliott. Unanimous. Motion carries.

Treasurer's Report

Jen Wistrcill reported account balances as of 30-APR-2016 as follows: Big Blake Lake (BBL) checking $15,216.67, Dam checking $106,958.41, BBL Money Market $52,474.84, Savings $5.00. Brief discussion on loan granted for dam and that first payment was made in March 2016.

Guest Presentation: Laws and Enforcement for Slow-No-Wake Zones (WDNR Conservation Warden Jesse Ashton)

Introduction. What is enforceable by DNR? Operating at greater than a no wake speed, DNR citation around $200 if someone were to go too fast through the zone. DNR Warden and local sheriff can issue citations. DNR is probably on our lake 5-7 times over the summer.

Reviewed slow-no-wake zone, which is "The lowest possible speed that you can keep maintaining steering control". If you are on a PWC you have to be 200 feet away from shore or dock. For boats it is 100 feet. Jumping wakes or spraying each other on PWC with wake are common citations. Question from member: "What would we do if someone issued a complaint?" "Depends how bad it was, is there video? " DNR can issue citations. DNR does not do written warnings only verbal, however Sheriff can give written warnings. <u>The most common problem is visitors of property owners who do not know the laws or the rules.</u> Suggestion to the board of putting the basic laws up on the website to inform. One member reported problems taking off full tilt within the buoys. Seeing people skiing through the center. If the buoys are not installed, then the zone is not enforceable. Once buoys are placed, it is considered posted and enforceable. No one has been fined on BBL since the buoys have been placed according to Warden Ashton.

Has the decision been made to put the buoys out? Yes, until we revise ordinances we have to. Can you ski through the no wake zone? No, identified by the buoys, this is a restricted zone. Jesse reinforced that we, the district, decide on the buoys. Is there a restriction on where you stop before the buoys? No, it is like a speed zone. In order to change the buoys placement we have to resubmit to Spooner. The 100ft and 200ft from shoreline distance also applies to docks. Mentioned that with the docks extend the limit of 100 and 200 ft. Buoys do not need a light on them. Ordinances around the buoys are determined by the district.

What are the restrictions for floating devices? Beyond 200 feet of shore it has to have a light on it. There is a size restriction? Must be 144 sq. ft. or less, and larger requires a permit.

Old Business:

1. Buoy placements, slow-no-wake zone (Co-Chairs Sam Weber and Adam Elliott)

Reviewed what was discussed last year. Reviewed why we brought Warden Ashton in to discuss rules and laws. Reviewed slides of what was approved several years ago by the district. Option presented: buoys will go in and we can vote to remove buoys, change buoys or leave as is at the August 20 Annual Meeting. Motion made by Trent Walden for the following options for vote at August annual meeting:

1. Remove
2. Keep six buoys but compress area and revise plan
3. Leave buoys as-is

Second by Sheila Munson. With discussion. Amendment to the motion purposed by Jack Belisle to add three options of placement if a revise option 2 is picked. Amendment accepted by Trent Walden. Second the amendment to the motion Sheila Munson.

4. Dam Update (Co-Chair Elliott)

Going as planned. Our engineer, Larry, for the last two months has been getting project/engineering plan to the DNR for approval. Larry believes the plan will be approved by June/July timeframe. One minor complication was that Round Lake has to have a hydrology study which also would apply to our lake. We hope to have approval by end of July from WDNR. Late summer or early fall the construction can take place. The WDNR/Larry don't anticipate any issues. Once the plan is approved it has to go for bid for at least three sources. Estimate for the dam project is $100,000.00 - $150,000.00.

Committee Reports

1. **Lake Plan Update (Commissioner Rodriguez)**

A committee of 8-12 people was formed and will meet 5 times to establish a new lake plan prior to the Annual Meeting. Slides noted committee members. Slide covered survey results and goals. As of 2016, BBL is on the impaired waters list, due to high levels of phosphorus – with goal to get us off the list. There is more to come at the August meeting as the plan is finalized. There will be many opportunities to volunteer to be part of our new lake plan.

2. **WI Lakes Partnership Convention (Commissioner Lauritsen)**

Peggy attended the 3-day lakes convention. As a district we benefit by attending: Networking with leaders in our county and state; Get the latest info and best practices; and at our Spring and Annual Meetings we share free literature and resources. Four key takaways from the convention: 1) Updates on legislation/ shoreland zoning and more (handout to all); 2) Deer Lake Conservancy wins national recognition for successful watershed efforts – literature in packets given to all ("Lake Tides" cover story); 3) AIS and CBCW – latest information in displays (Wisconsin know as "best in nation" addressing AIS, last 14 yrs); and 4) Improving water quality – Healthy Lakes program supports our emerging new lake plan. She reviewed the Healthy Lakes 3-year program started last year by WDNR and WI Lakes Partnership which includes simple and inexpensive projects – up to $1000 per project, 75% covered by grants typically.

Healthy Lakes Program goals:

- **Filter** runoff water, through buffers, plants, shrubs
- **Stop** phosphorus and other nutrients from entering the lake
- **Slow** down and divert runoff – hard surfaces, roofs, driveways, slopes; help water soak into ground
- **Improve** shoreline wildlife habitat - frogs, birds, turtles, fish
- **Cleaner swimming**, reduce algae, beautify view, keep geese out
- **Preserving water quality** for generations to come

Peggy will be organizing with the lake plan committee to get more training and to apply for the grants involved.

3. **AIS/Clean Boats Clean Waters (AIS Coordinator Lauritsen)**

We are looking for more volunteers and a team approach. Help is needed. Thank you to the people who have volunteered. Our district goals are to 1) perform free boat checks; 2) talk to boaters at landings; 3) prevent the spread of invasives entering or exiting our lake and 4) inform and educate. We are participating in the WDNR "Drain Campaign" on June 10-12, a statewide initiative to make sure anglers know about Wisconsin's invasive species laws. We are also participating in the WDNR 8th annual statewide Landing Blitz, July 1-4, with heightened awareness and inspections at both landings. This is our 5th year participating. We are one of 90 lakes in Wisconsin participating again this year. Peggy reviewed current top threats such as Eurasian milfoil and zebra mussels and the nearby lakes that have these invasives. There was a special thank you from board members for Peggy's current role with AIS.

4. **APM Harvesting (APM Coordinator Maxwell)**
   Repairs were made to the harvestor such as changing the oil (it's been five years) and replacing a chain. Weeds are bad again this year, and we started havesting last week and took 33 loads out. Max Bay is driving the harvestor. Question on how close to shorelines we can harvest… 100 feet from shore, stay out of 3 feet water, 10 feet away from the dock. We were able to cut paths on south and west ends. Comment from member goal of the harvestor was to hopefully eliminate weeds from the lake, last few years have been higher. Possibly due to the lower lake levels, and less snow cover in last two winters.

   Jeremy Williamson, Water Quality Specialist and Aquatic Invasive Species Biologist, Polk County Land & Water Resources Department, reviewed BBL nutrient budget and internal loading (handouts supplied). Since we have harvesting since 2006 we have reduced the phosphorus 158.7 pounds to 98.5 pounds. We have reduced the amount of phosphorus by 38% by removing the curly leaf from the lake. This is a significant success, and proof that our harvesting strategy is working.

5. **EPP Grant (Co-Chair Weber)**
   Sam reviewed the status of the grant (slides presented). We will have a report at the annual meeting.

New Business
Communications, new website reveal (Commissioner Lauritsen)
Our new website is blakelake.org. It launched in March at the WLP convention. We were offered a special opportunity in December to be part of a pilot program that allowed us to create a website in 60 days with 150 volunteer hours, at a cost of $450, saving the district $9500. We had 374 visitors to the site in the first week. Peggy reviewed the content strategy, features and functions of the site and how it will meet the needs of our members. Peggy also recruited a new volunteer, Dave Rogge, to help us maintain fresh content on the site. He has volunteered to donate $4800 of his time over the next year. Peggy also recommended that we consider increasing the annual budget to meet the demands of members who want multi-channel communications about district news.

Announcements
20-August-2016 Annual Meeting (3rd Sat. in August)
03-July-2016 Boat Parade 4PM

Motion to adjourn the meeting by Vince Teuber, 2nd by Marge Kabis.

Meeting adjourned at 11:29pm. A total of 75 district members attended the Annual Meeting.

Meeting minutes respectfully submitted by Jen Westrcill, Treasurer and Peggy Lauritsen, Secretary.

2015 Upcoming Events

Polk County Aquatic Invasive Species Strategic Plan

Wednesday, May 20th, 7-9 pm, Polk County Justice Center, Balsam Lake
Wednesday, June 17th, 7-9 pm, Polk County Justice Center, Balsam Lake

Everyone with a stake in the prevention of aquatic invasive species is encouraged to attend this strategic planning session to help prioritize which actions should take place in Polk County in response to aquatic invasive species.

Big Blake Lake Clean Boats, Clean Waters Refresher Basics and Training

Saturday, June 6th, 10am-noon, East Landing/North End of the Lake/Bystrom Lane
Saturday, June 13th, 10am-noon, East Landing/North End of the Lake/Bystrom Lane

Learn the basics of boat inspections and what is needed to educate the public about invasives! These trainings are part of the WDNR Drain Campaign, a statewide initiative to increase awareness of Wisconsin's invasive species laws.

Big Blake Lake Pontoon Classroom

Saturday, June 13th, noon-2 pm, East Landing/North End of the Lake/Bystrom Lane

Join the Polk County Land and Water Resources Department for an on-the-water experience to learn how water samples, algae samples, and sediment samples are collected and analyzed on Big Blake Lake. This is your opportunity to learn how to find wild rice, how water samples work, learn more about Big Blake Lake and ask any questions you have regarding the lake.

Project RED Training

Classroom Training: Thursday, June 11th, 6-8pm OR Tuesday, June 16th, 6-8 pm, St. Croix River Association, St. Croix Falls
River Detection Field Day: Tuesday, June 23rd , time to be determined, St. Croix River

Become a Riverine Early Detector and monitor rivers and streams for 16 invasive species.

Aquatic Invasive Species Citizen Lake Monitoring Network

Wednesday, July 15th, 1-4pm , Polk County Government Center , Balsam Lake

Join a network of volunteers to monitor Big Blake Lake for aquatic invasive species.

Aquatic Invasive Species Bridge Snapshot Day

Saturday, August 29th, 9am-1pm , St. Croix River Association, St. Croix Falls

Join 200 other volunteers at one of more than 20 rendezvous sites statewide to help search for invasive species on rivers.

All events are free. Please RSVP to Katelin Holm, katelin.holm@co.polk.wi.us , 715-485-8637.

Big Blake Lake Protection & Rehabilitation District

VOLUNTEERS NEEDED

Protect our lake, prevent invasives

Join us. We have great volunteers, but always need more. Let's talk. It's easy and fun.

Clean Boats, Clean Waters Program

WHEN: **June through September**

TIME: 4 hours per month
Best times: Fridays: 3-9pm; Saturdays, Sundays, holidays, fishing tournaments

WHO: You and a buddy, friend or spouse (homeowners on the lake, or in area)
Veteran volunteers will assist and train new volunteers.

WHAT: **you can volunteer to help in many ways, such as:**

a) inspect boats at the landings, hand out literature to visitors and neighbors launching a watercraft;
b) put brochures at bait shops in the area; help with displays at the annual meeting
c) enter data online into SWIMS database as other volunteers complete inspection forms;
d) write copy for the newsletter, social media or for mailings.

TRAINING: Watch one of several 7-minute videos, read a few pages of orientation and do your first inspection with an experienced volunteeer. That's it ….easy and fun.

DNR grant to district requires 400 hours

The Big Blake Lake P& R District receives a grant to remove coontail weeds and control the spread of AIS. Currently, curly-leaf pondweed is an invasive weed in Big Blake Lake. The DNR requires a contribution of <u>400 hours per season inspecting boats at 2 landings, 200 hours per landing.</u> Without this grant, homeowners would have to pay these costs. Volunteers are critical to keep costs down.

About Clean Boats, Clean Waters Program

With the growing concern over the spread of aquatic invasive species to Wisconsin's inland lakes, many lake district members and other concerned citizens are looking for ways to get involved. The *Clean Boats, Clean Waters* volunteer watercraft inspection program is an opportunity to take a front line defense against the spread of aquatic invasive species.

Contact:
Peggy Lauritsen / **Clean Boats, Clean Waters** – AIS *Volunteer Coordinator*
Big Blake Lake Protection & Rehabilitation District plauritsen@pldg.com 612-940-2006

Resources for CBCW Volunteers

1) Learn more about Clean Boats, Clean Waters?
Learn about aquatic invasive species laws?
Learn about data entry?
Instructions or tips for completing inspection forms?
Get more inspection forms forms?
Find more training?

This site has it all for you:
http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/cbcw/default.aspx

2) Enter data from completed inspection forms? *(if you don't want to enter data online, submit forms to Peggy L. and she will handle data entry for you).*
http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/cbcw/data.aspx

Enter data here: Wisconsin DNR: Surface Water Integrated Monitoring System (SWIMS)
https://dnrx.wisconsin.gov/swims/login.jsp?site=ais

3) CBCW Inspection Video Scenarios, June 4, 2015
New Clean Boats, Clean Waters Watercraft Inspection Video Scenarios are now available to view on the CBCW website! Seven scenarios were created to help volunteer inspectors learn how to have a conversation with boaters and anglers at the boat landing while conducting an inspection. An introductory video explains the purposes of the scenarios, and the first scenario provides an example of a complete watercraft inspection from start to finish. The following six videos focus on specific scenarios, such as how to talk to an angler leaving the landing with live bait, and begin after the inspector has introduced themselves to the boater and asked some of the initial questions from the inspection report form. The last video discusses how to thoroughly take the prevention steps and walks through the process of cleaning off a boat. These videos are meant to enhance the CBCW trainings, not replace them, and serve as a post-training resource for our inspectors.
CBCW Inspection Video Scenarios: http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/cbcw/resources.aspx

This older video is a good one for new volunteers: Watch this7-minute video about boat and trailer inspections: http://www.youtube.com/watch?v=OdFmFaC7ldE&noredirect=1

Big Blake Lake Protection & Rehabilitation District

CBCW VOLUNTEERS

AIS - Facts to use at the landing

Invasives Blake Lake has now: Curly-leaf pondweed, banded mystery snail, Chinese mystery snail. 38 Polk County lakes have curly-leaf pondweed.

TOP THREATS: Eurasian milfoil and zebra mussels

Why? Because these invasives are very difficult and expensive to get rid of

Eurasian Milfoil

Quick to spread: It only takes ¼ inch of the plant to start a new population.

Small fragments can blow from one side of the lake to the other.

Costly: In another lake district in the area, members pay $600+ per year to treat milfoil with herbicide.

Extra caution: 4 nearby waters have milfoil; Horseshoe, Pike, Long Trade (and St. Croix River).

Nearby in Twin Cities lakes: 150 TC lakes have milfoil. 275 lakes in Minnesota have milfoil.

Many visitors to Blake Lake are from the TC metro, only 77 miles away.

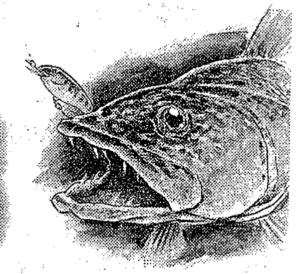
Zebra Mussels

Nearby in St. Croix County: Bass Lake and Lake St. Croix.

Nearby in Minnesota: 141 waterbodies in MN have zebra mussels!

INTER-COUNTY LEADER

OUTDOORS



ATVS · BIRDING · BOATING · CAMPING · FISHING · HIKING · HUNTING · RECREATIONAL VEHICLES

Clean boats, clean waters on Blake Lake

Boat checks part of DNR Landing Blitz over holiday weekend

BALSAM LAKE – Volunteers from the Big Blake Lake Protection and Rehabilitation District educated boaters and conducted free boat checks over the Fourth of July weekend as part of the seventh-annual statewide DNR Landing Blitz. Over 200 lakes were part of the blitz this year. Statewide last year, over 12,000 boats were inspected and 28,573 people were contacted during the holiday. Inspectors work to assure that boaters do not accidentally spread Eurasian water milfoil, zebra mussels and other aquatic invasive species.

The volunteer inspectors help boaters understand Wisconsin's invasive species laws and what they must do to clean equipment entering or exiting the water.

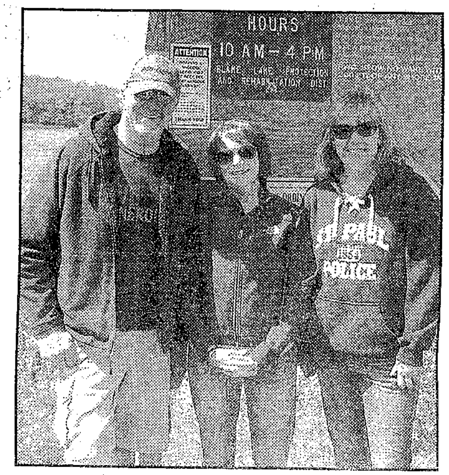
"Invasives are a serious threat to water quality and property value. By following simple steps, boaters can preserve the quality of our lakes for our grandkids to enjoy," says Peggy Lauritsen, Clean Boats, Clean Waters, AIS coordinator. "We have 40 dedicated volunteers who give 400 hours per season to help protect water quality on Blake Lake."

Invasive species crowd out native species, disrupt lake ecosystems and interfere with boating, fishing and other recreation.

Clean Boats, Clean Waters training and volunteers on Blake Lake over the Fourth of July weekend shown (L to R) are: Aquatic invasive species experts Jeremy Williamson and Katelin Holm, water quality specialists of Polk County Land and Water Resources; volunteer boat inspectors Mike Rogge, Judy Hall, Vince and Mary Teuber, Vicky Dorner, Sue Ogren and Diane Borden. Not pictured: Peggy Lauritsen, Tom Borden, Jim and Marge Filkins and Joyce Booth.

The main ways invasive species and fish diseases spread to new waters is aboard boating and fishing equipment, live fish or water moved from one water body to another.

The volunteers, who have been trained through Wisconsin's Clean Boats, Clean Waters program, demonstrated the required prevention steps boaters must take, provided stickers for boaters to place on their trailer posts to remind them of these steps and talked about Wisconsin invasive species and VHS laws.



Some of the Clean Boats, Clean Waters volunteers on Blake Lake over the Fourth of July weekend shown (L to R) are: Mike Foley, Ann Foley and Shelley Rodriguez.

Boaters, anglers and others enjoying Wisconsin waters are required to inspect boats, trailers and equipment; remove all attached aquatic plants and animals; drain all water from boats, vehicles and equipment; and never move plants or live fish away from a water body. Limited exceptions apply. Visit dnr.wi.gov and search for bait laws. – *from CBCW*

Appendix L

Management Options for Aquatic Plants

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
No management	N	Do not actively manage plants	Minimizing disturbance can protect native species that provide habitat for aquatic fauna, reduce shoreline erosion, may improve water clarity, and may limit spread of invasive species	May allow small population of invasive plants to become larger, more difficult to control later
			No financial cost	Excessive plant growth can hamper navigation and recreational lake use
			No system disturbance	May require modification of lake users' behavior and perception
			No unintended effects of chemicals	
			Permit not required	
Mechanical Control	May be required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase turbidity and nutrient release
a. Handpulling/Manual raking	Y/N	SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics	Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
b. Harvesting	Y	Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore	Immediate results	Not selective in species removed
		Harvest invasives only if invasive is already present throughout the lake	EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting	Fragments of vegetation can re-root
			Usually minimal impact to lake ecology	Can remove some small fish and reptiles from lake
			Harvested lanes through dense weed beds can increase growth and survival of some fish	Initial cost of harvester expensive
			Can remove some nutrients from lake	
Biological Control	Y	Living organisms (e.g. insects or fungi) eat or infect plants	Self-sustaining; organism will over-winter, resume eating its host the next year	Effectiveness will vary as control agent's population fluctuates
			Lowers density of problem plant to allow growth of natives	Provides moderate control - complete control unlikely
				Control response may be slow
				Must have enough control agent to be effective
a. Weevils on EWM	Y	Native weevil prefers EWM to other native water-milfoil	Native to Wisconsin: weevil cannot "escape" and become a problem	Need to stock large numbers, even if some already present
			Selective control of target species	Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines
			Longer-term control with limited management	Bluegill populations decrease densities through predation

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
b.	Pathogens	Y	Fungal, bacterial, or viral pathogen introduced to target species to induce mortalitiy	May be species specific	Largely experimental; effectiveness and longevity unknown
				May provide long-term control	Possible side effects not understood
				Few dangers to humans or animals	
c.	Allelopathy	Y	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long-term, maintenance-free control	Initial transplanting slow and labor-intensive
				Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermilfoil growth	Spikerushes native to WI, and have not effectively limited EWM growth
					Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water
d.	Native plantings	Y	Diverse native plant community established to compete with invasive species	Native plants provide food and habitat for aquatic fauna	Initial transplanting slow and labor-intensive
				Diverse native community more repellant to invasive species	Nuisance invasive plants may outcompete plantings
					Transplants from another lake or nursery may unintentionally introduce invasive species
					Largely experimental; few well-documented cases

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Physical Control	Required under Ch. 30 / NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a. Fabrics/ Bottom Barriers	Y	Prevents light from getting to lake bottom	Reduces turbidity in soft-substrate areas Useful for small areas	Eliminates all plants, including native plants important for a healthy lake ecosystem May inhibit spawning by some fish Need maintenance or will become covered in sediment and ineffective Gas accumulation under blankets can cause them to dislodge from the bottom Affects benthic invertebrates Anaerobic environment forms that can release excessive nutrients from sediment
b. Drawdown	Y, May require Environmental Assessment	Lake water lowered with siphon or water level control device; plants killed when sediment dries, compacts or freezes Season or duration of drawdown can change effects	Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLP) Restores natural water fluctuation important for all aquatic ecosystems	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling May impact attached wetlands and shallow wells near shore Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning Winter drawdawn must start in early fall or will kill hibernating reptiles and amphibians Navigation and use of lake is limited during drawdown

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
c.	Dredging	Y	Plants are removed along with sediment	Increases water depth	Severe impact on lake ecosystem
			Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
			For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
			Extensive planning required		Sediment testing may be necessary
					Removes benthic organisms
					Dredged materials must be disposed of
d.	Dyes	Y	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity	Appropriate for very small water bodies
				Usually non-toxic, degrades naturally over a few weeks.	Should not be used in pond or lake with outflow
					Impairs aesthetics
					Effects to microscopic organisms unknown
e.	Non-point source nutrient control	N	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use) thereby providing fewer nutrients available for plant growth	Attempts to correct source of problem, not treat symptoms	Results can take years to be evident due to internal recycling of already-present lake nutrients
				Could improve water clarity and reduce occurrences of algal blooms	Requires landowner cooperation and regulation
				Native plants may be able to better compete with invasive species in low-nutrient conditions	Improved water clarity may increase plant growth

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Chemical Control	Required under NR 107	Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae	Some flexibility for different situations	Possible toxicity to aquatic animals or humans, especially applicators
		Results usually within 10 days of treatment, but repeat treatments usually needed	Some can be selective if applied correctly	Often affect desirable plant species that are important to lake ecology and compete with invasive species
		Chemicals must be used in accordance with label guidelines and restrictions	Can be used for restoration activities	Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration
				May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape
				Often controversial
a. 2,4-D (e.g. Weedar, Navigate)	Y	Systemic[1] herbicide selective to broadleaf[2] plants that inhibits cell division in new tissue	Moderately to highly effective, especially on EWM	May cause oxygen depletion after plants die and decompose
		Applied as liquid or granules during early growth phase	Monocots, such as pondweeds (e.g. CLP) and many other native species not affected.	May affect native dicots such as water lilies and coontail
			Can be used in synergy with endotholl for early season CLP and EWM treatments	Cannot be used in combination with copper herbicides (used for algae)
			Can be selective depending on concentration and seasonal timing	Toxic to fish
			Widely used aquatic herbicide	

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
b.	Endothall (e.g. Aquathol)	Y	Broad-spectrum[3], contact[4] herbicide that inhibits protein synthesis	Especially effective on CLP and also effective on EWM	Affects many native pondweeds
			Applied as liquid or granules	May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring	Not as effective in dense plant beds; heavy vegetation requires multiple treatments
				Can be selective depending on concentration and seasonal timing	Not to be used in water supplies; post-treatment restriction on irrigation
				Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds	Toxic to aquatic fauna (to varying degrees)
				Limited off-site drift	
c.	Diquat (e.g. Reward)	Y	Broad-spectrum, contact herbicide that disrupts cellular functioning	Mostly used for water-milfoil and duckweed	May affect non-target plants, especially native pondweeds, coontail, elodea, naiads
			Applied as liquid, can be combined with copper treatment	Rapid action	Toxic to aquatic invertebrates
				Limited direct toxicity on fish and other animals	Must be reapplied several years in a row
					Ineffective in muddy or cold water (<50°F)

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
d.	Fluridone (e.g. Sonar or Avast)	Y; special permit and Environmental Assessment may be required	Broad-spectrum, systemic herbicide that inhibits photosynthesis	Effective on EWM for 1 to 4 years with aggressive follow-up treatments	Affects native milfoils, coontails, elodea, and naiads, even at low concentrations
			Must be applied during early growth stage	Some reduction in non-target effects can be achieved by lowering dosage	Requires long contact time: 60-90 days
			Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107	Slow decomposition of plants may limit decreases in dissolved oxygen	Often decreases water clarity, particularly in shallow eutrophic systems
			Applied at very low concentration at whole lake scale	Low toxicity to aquatic animals	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments
					Unknown effect of repeat whole-lake treatments on lake ecology
e.	Glyphosate (e.g. Rodeo)	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants	RoundUp is often illegally substituted for Rodeo; surfactants in RoundUp believed to be toxic to reptiles and amphibians
			Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Cannot be used near potable water intakes
			Applied as liquid spray or painted on loosestrife stems	Non-toxic to most aquatic animals at recommended dosages	Ineffective in muddy water
				Effective control for 1-5 years	No control of submerged plants

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
f.	Triclopyr (e.g. Renovate)	Y	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher doses (e.g. coontail)
			Applied as liquid spray or liquid	Most effective on dicots, such as purple loosestrife; may be more effective than glyphosate	May be toxic to sensitive invertebrates at higher concentrations
				Control of target plants occurs in 3-5 weeks	Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm)
				Low toxicity to aquatic animals	Sensitive to UV light; sunlight can break herbicide down prematurely
				No recreational use restrictions following treatment	Relatively new management option for aquatic plants (since 2003)
g.	Copper compounds (e.g. Cutrine Plus)	Y	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
			Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment	Short-term results
			Wisconsin allows small-scale control only	Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Long-term effects of repeat treatments to benthic organisms unknown
					Toxic to invertebrates, trout and other fish, depending on the hardness of the water
					Clear water may increase plant growth

[1]Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.
[2]Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.
[3]Broad-spectrum herbicide - Affects both monocots and dicots.
[4]Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.

This document is intended to be a guide to available aquatic plant control techniques, and is not necessarily an exhaustive list.
References to registered products are for your convenience and not intended as an endorsement or criticism of that product versus other similar products.
Specific effects of herbicide treatment contingent on usage within label guidelines and in accordance with all applicable laws.
Please contact your local Aquatic Plant Management Specialist when considering a permit.

Aquatic Plant Control Techniques Not Allowed in Wisconsin

Updated Oct 2006

	Option	How it Works	PROS	CONS
Biological Control				
a.	Carp	Plants eaten by stocked carp	Effective at removing aquatic plants	Illegal to transport or stock carp in Wisconsin
			Involves species already present in Madison lakes	Carp cause resuspension of sediments, increased water temperature, lower dissolved oxygen levels, and reduction of light penetration
				Widespread plant removal deteriorates habitat for other fish and aquatic organisms
				Complete alteration of fish assemblage possible
				Dislodging of plants such as EWM or CLP turions can lead to accelerated spreading of plants
b.	Crayfish	Plants eaten by stocked crayfish	Reduces macrophyte biomass	Illegal to transport or stock crayfish in Wisconsin
				Control not selective and may decimate plant community
				Not successful in productive, soft-bottom lakes with many fish predators
				Complete alteration of fish assemblage possible
Mechanical Control				
a.	Cutting (no removal)	Plants are "mowed" with underwater cutter	Creates open water areas rapidly	Root system remains for regrowth
			Works in water up to 25 ft	Fragments of vegetation can re-root and spread infestation throughout the lake
				Nutrient release can cause increased algae and bacteria and be a nuisance to riparian property owners
				Not selective in species removed
				Small-scale control only
b.	Rototilling	Sediment is tilled to uproot plant roots and stems	Decreases stem density, can affect entire plant	Creates turbidity
		Works in deep water (17 ft)	Small-scale control	Not selective in species removed
			May provide long-term control	Fragments of vegetation can re-root
				Complete elimination of fish habitat
				Releases nutrients
				Increased likelihood of invasive species recolonization
c.	Hydroraking	Mechanical rake removes plants from lake	Creates open water areas rapidly	Fragments of vegetation can re-root
		Works in deep water (14 ft)		May impact lake fauna
				Creates turbidity
				Plants regrow quickly
				Requires plant disposal

Appendix M

Meeting Agendas and Materials

Big Blake Lake Management Plan Development
Committee Meeting 1

Saturday, February 20th
9-11 am
Polk County Justice Center

9:00 Introductions, roles, and responsibilities (all)

9:15 Schedule future meetings—bring your calendar (all)
- March
- April
- May

9:20 Presentation (Polk County Land and Water Resources Department)
- Purpose of the meeting
- Big Blake Lake chemistry results
- Big Blake Lake resident survey results
- Time for questions

10:00 Brainstorming session (Management Plan Committee)
- What do you value about Big Blake Lake?
- What concerns/issues do you have for Big Blake Lake?

11:00 Adjourn

Katelin Holm
(715) 485-8637
katelin.holm@co.polk.wi.us

Jeremy Williamson
(715) 485-8639
jeremyw@co.polk.wi.us

Big Blake Lake Management Plan Development Rules and Responsibilities

Overall Objective
Develop a Lake and Aquatic Plant Management Plan for Big Blake Lake

A management plan outlines goals and actions that everyone can live with

Ground Rules
Listen to what others are saying
Don't interrupt when others are speaking
Input is heard from everyone
Stay on topic and stick to the agenda

Management Plan Committee Responsibilities
Attend all meetings
Share your knowledge and concerns about Big Blake Lake
Review background information and draft documents
Develop lake and aquatic plant management strategies
Decide when draft document is ready to forward to board for approval

Land and Water Resources Department Responsibilities
Send out agendas and materials prior to meetings
Keep discussion on track, may need to interrupt to keep discussion focused
Summarize key study findings
Write goals, objectives, and action items for the plan using committee input
Write draft and final plan documents
Submit plan for public comment and WDNR review

District Responsibilities
Participate as part of the committee
Review draft Management Plan
Approve draft Management Plan to forward to the WI DNR <u>or</u> disapprove draft Management Plan and return to committee

Big Blake Lake Management Plan Development Committee Meeting 1 Notes
Saturday, February 20th
9:00-11:15 am
Polk County Justice Center

Introductions, roles, and responsibilities
Mike Rogge, Peggy Lauritsen, Jim Mitchell, Don Craft, Shelley Rodriguez, Sam Rivers, Sue Budd, John Belisle, Roxanne Smith, Gerry Smith, Katelin Holm, and Jeremy Williamson

Schedule March meeting—Saturday, March 12th 9-11am

Discussed the purpose of the meetings and the activities covered under both grants
Reviewed Big Blake Lake chemistry results from 2013-2015
Reviewed Big Blake Lake resident survey results

Discussion points resulting from presentation
Discussed the use of buffers and rain gardens as a strategy for lake improvement and how native plants provide benefits to water quality
Discussed aquatic plant management techniques
- Allow individual permits for herbicide
- Allow for harvesting of individual navigation channels for access
- Mechanical harvesting (with a rake) does not require a permit

Discussed the impact of raising and lowering the dam on water quality
Discussed offering individual property owner consultations for making improvements
Discussed sources of phosphorus (watershed, internal loading)
Discussed the relationship between curly-leaf pondweed and internal loading
Discussed the life cycle of curly leaf pondweed
Discussed the impacts that harvesting has had on curly-leaf pondweed

Brainstormed concerns for Big Blake Lake
- ✓ Algae
- ✓ Curly-leaf pondweed
- ✓ New AIS, such as Eurasian water milfoil
- ✓ Dangerous jet skis, specifically in regards to loons
- ✓ Phosphorus
- ✓ Failing/outdated septic systems
- ✓ Septic waste being spread on neighboring fields
- ✓ Farm field runoff
- ✓ Loss of wildlife

- ✓ Lake gets stirred up during the weekend
  - o Can we limit speeds by enforcing slow no wake? Would we want to?
  - o Can we limit tournaments?
  - o Can we limit power-loading or the speed when boats take off?
- ✓ Enforcement
  - o Septic, boating, etc
- ✓ Aging population
  - o How can we engage the younger generation?

Education needs and messaging

- ✓ Shoreline restoration/buffers
- ✓ The impact of boating speed and size of motor on phosphorus loading from the sediments
  - o There are reports on this topic which could be posted on the website
- ✓ Everyone has an impact
- ✓ Provide Clean Boats, Clean Waters education (clean when leave and launch) for people who don't live on the lake

Over-riding factors to consider

- ✓ Communication
  - o One-on-one conversations
  - o Stress the important issues
  - o Repeat the same message
  - o Highlight a simple take away message
- ✓ Member engagement (being neighborly)
  - o Connect with people, know the person
  - o How can we let everyone know who we are?

Adjourn

Big Blake Lake Planning Meeting

Meeting 1

Saturday, February 20, 2016

Purpose of the Meeting

Review the data collected

Develop Aquatic Plant Management Plan

Develop Lake Management Plan

Grant Deliverables-Data Collected

- Lake resident survey
- In-lake physical and chemical monitoring
- Tributary monitoring
- Phytoplankton
- Zooplankton
- Aquatic plant point intercept surveys
- Curly leaf pondweed biomass and turion monitoring
- Watershed delineation, land use determination, and modeling
- Participation in AIS statewide programs: Citizen Lake Monitoring Network for AIS and Water Quality, Bait Dealer Initiative, and Clean Boats, Clean Waters
- Communication of information: the Blake Lake Bugle Newsletter, pontoon classrooms, and distribution of AIS flyers

- Sediment core collection and analysis
- Historical land use and conditions

- Development of an Aquatic Plant and Lake Management Plan

2004 Goals

- Public education and shoreline restoration
- Create a committee to improve the Straight River Watershed
- Work with County and Towns as they create land use and zoning regulations
- Collect in-lake data
- Reduce CLP

- Harvest CLP and native plants in navigation channels
- Implement watershed best management practices
- Promote the growth of native plants in sensitive areas

2016 Goals Format

Goal 1: Reduce algae and phosphorus in the three lake system by reducing watershed runoff

Action	Timeline	Cost Estimate	Volunteer Hours	Responsible Parties	Funding Sources
Identify shoreline landowners willing to install shoreline buffers, rain gardens, and water diversions on their property	2013, ongoing	$1,000	80	Board Water quality committee	District
Provide technical assistance and cost sharing for implementation of projects	2014, ongoing	$250,000		Board Consultant	District WDNR Lake Protection Grant*
Recognize landowners that have taken steps to reduce watershed runoff	Ongoing	$50 annual		Board	District
Partner with landowners to install rain gardens, water diversions, and erosion control practices at or near the Church Pine Lake boat landing	2014, ongoing	TBD		Board Consultant	District WDNR Lake Protection Grant*
Support the work of the Horse Creek Watershed Farmer Led Council	2015, ongoing	TBD		Board LWRD	District
Work with Polk County LWRD/consultant to identify agricultural best management practices to reduce the phosphorus load from North Creek	2014, ongoing	TBD		Board LWRD Consultant	District WDNR Lake Planning Grant
Examine the economic feasibility and effectiveness of a sediment pond on North Creek	2015	$2,500		Board Consultant	District WDNR Lake Planning Grant
Partner with landowners to install rain gardens, water diversions, and erosion control practices at or near the Big Lake boat landing	2014, ongoing	TBD		Board Consultant	District WDNR Lake Protection Grant*

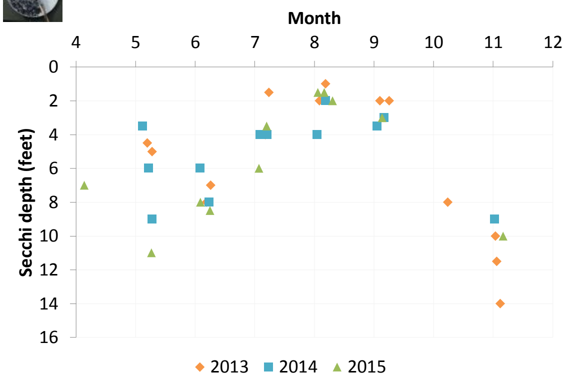
Big Blake Lake Chemistry

Secchi Depth

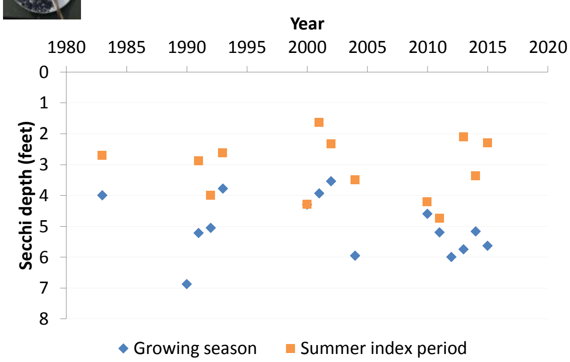
Measure of water clarity

Bigger numbers = greater clarity

Big Blake Lake secchi depth profile, 2013-2015



Big Blake Lake average secchi depth profile, 1983-2015



Phosphorus (P)

Excess amounts can cause excessive plant and algae growth

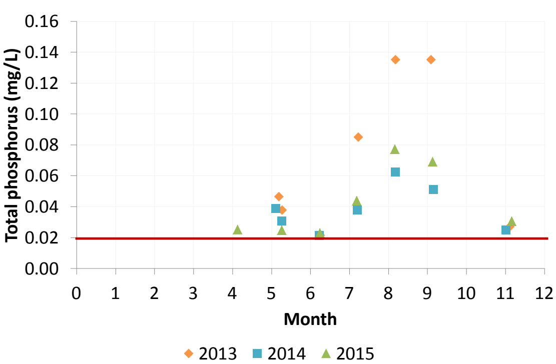
Occurs naturally in soil

Component of fertilizer

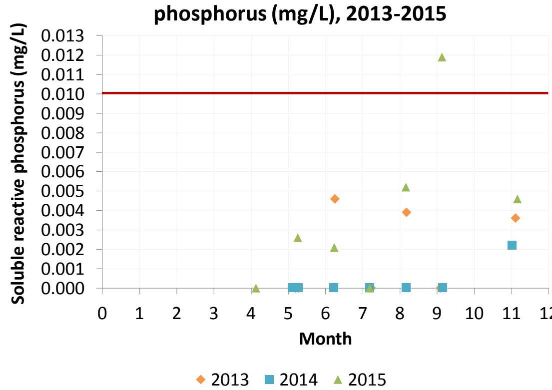
Total P= all P in a water sample

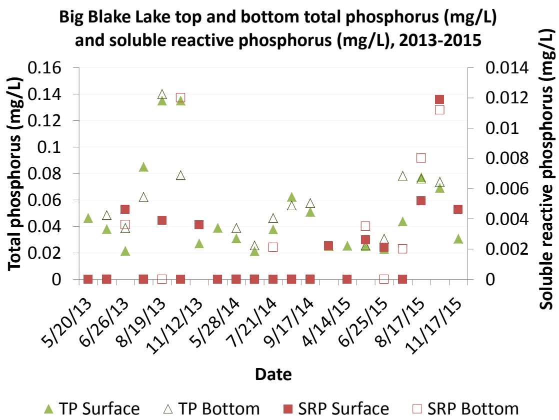
Soluble reactive P = P dissolved in water, ready for uptake by plants and algae

Big Blake Lake surface total phosphorus (mg/L), 2013-2015



Big Blake Lake surface soluble reactive phosphorus (mg/L), 2013-2015



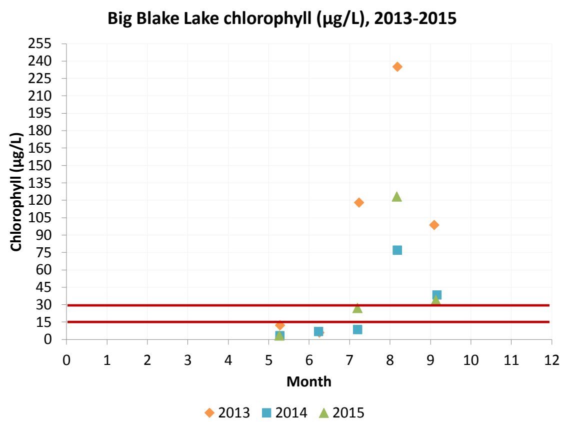


Chlorophyll

Pigment in plants and algae

Provides a general indication of the amount of algae in a lake

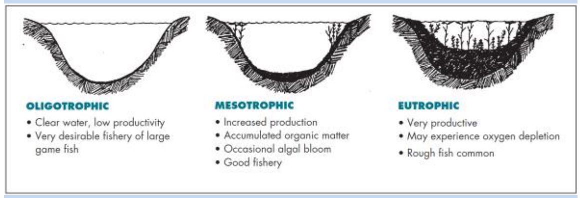
Higher values = more algae



Trophic State Index

Serves as an indicator of water quality

– Reflects nutrient and clarity levels

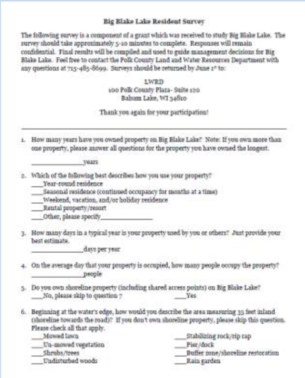


Trophic State Index

2013 = 73 2014 = 62 2015 = 67

TSI	General Description
<30	Oligotrophic; clear water, high dissolved oxygen throughout the year/lake
30-40	Oligotrophic; clear water, possible periods of oxygen depletion in the lower depths of the lake
40-50	Mesotrophic; moderately clear water, increasing chance of anoxia near the bottom of the lake in summer, fully acceptable for all recreation/aesthetic uses
50-60	Mildly eutrophic; decreased water clarity, anoxic near the bottom, may have macrophyte problem; warm-water fisheries only
60-70	Eutrophic; blue-green algae dominance, scums possible, prolific aquatic plant growth. Full body recreation may be decreased
70-80	Hypereutrophic; heavy algal blooms possible throughout the summer, dense algae and macrophytes
>80	Algal scums, summer fish kills, few aquatic plants due to algal shading, rough fish dominate

Big Blake Lake Resident Survey


Big Blake Lake Resident Survey

The following survey is a component of a grant which was received to study Big Blake Lake. The survey should take approximately 5-10 minutes to complete. Responses will remain confidential. Final results will be compiled and used to guide management decisions for Big Blake Lake. Feel free to contact the Polk County Land and Water Resources Department with any questions at 715-485-8699. Surveys should be returned by June 1st to:

LWRD
100 Polk County Plaza- Suite 120
Balsam Lake, WI 54810

Thank you again for your participation!

1. How many years have you owned property on Big Blake Lake? Note: If you own more than one property, please answer all questions for the property you have owned the longest.
   ______________years
2. Which of the following best describes how you use your property?
   ___Year-round residence
   ___Seasonal residence (continued occupancy for months at a time)
   ___Weekend, vacation, and/or holiday residence
   ___Rental property/resort
   ___Other, please specify______________
3. How many days in a typical year is your property used by you or others? Just provide your best estimate.
   ______________days per year
4. On the average day that your property is occupied, how many people occupy the property?
   ______________people
5. Do you own shoreline property (including shared access points) on Big Blake Lake?
   ___No, please skip to question 7 ___Yes
6. Beginning at the water's edge, how would you describe the area measuring 35 feet inland (shoreline towards the road)? If you don't own shoreline property, please skip this question. Please check all that apply.
   ___Mowed lawn ___Stabilizing rock/rip rap
   ___Un-mowed vegetation ___Pier/dock
   ___Shrubs/trees ___Buffer zone/shoreline restoration
   ___Undisturbed woods ___Rain garden

Mailed 217 surveys in May 2014

126 respondents, 58%

Thank you!

Big Blake Lake Owners

Property ownership: 21 years

People occupying property: 3.6

Number of days property used: 148 days

Most people are weekend residents (56%)
One third are full time residents (33%)

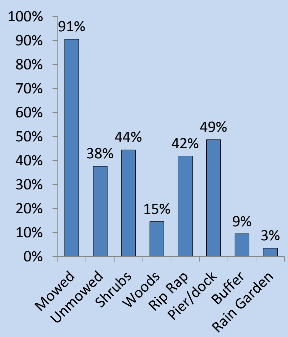
Characterizing the Shoreline

Half of property owners think the amount of lawn on Big Blake Lake is just right,

one quarter think there is too much lawn,

and one quarter are unsure.

Most believe that buffers, rain gardens, and natives plants are somewhat (34%) or very important (37%) to the water quality of Big Blake Lake.



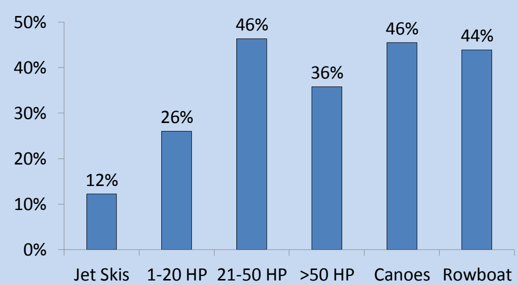
A Very Positive Note

98% of survey respondents either don't use fertilizer or use phosphorus free fertilizers

Activities Enjoyed on Big Blake Lake?

- Peace and tranquility (93%)
- Scenic view (89%)
- Fishing (83%)
- Motorized boating (80%)
- Observing birds/wildlife (79%)
- Swimming (70%)
- Non-motorized boating (47%)
- Ice fishing (45%)

Watercraft and Use



A quarter of respondents use their watercraft on other waterbodies

Concerns for Big Blake Lake

High or Medium Concern
By 75% of respondents

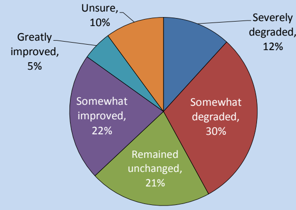
- Excessive aquatic plant growth
- Expansion of curly leaf pondweed
- Excessive algae blooms
- Decrease in overall lake health
- Lack of water clarity or quality
- New invasive species entering the lake
- Increased nutrient pollution

Low or No Concern
By 60% of respondents

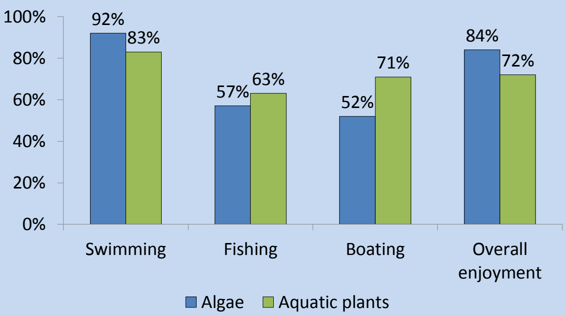
- Excessive noise level on the lake
- Decreased wildlife populations

Current Conditions on Big Blake Lake

Water level:
too low (81%)
Water quality:
fair (54%) or good (26%)
Change in water quality:
graph
Months algae is a problem:
July (66%) and August (88%)
Aquatic plants:
too many (69%) and healthy amount (29%)
Months aquatic plants are a problem:
June (46%), July (74%), and August (67%)



Uses Impaired by Algae and Aquatic Plants



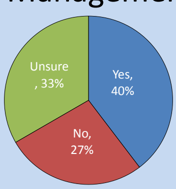
Curly Leaf Pondweed (CLP)

50% of respondents can definitely recognize curly leaf pondweed and another 20% probably can

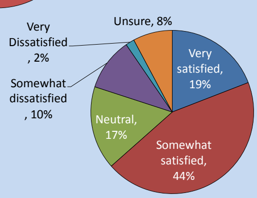
Paul Skawinski, UW-Extension Lakes

Aquatic Plant Management Program

Is the current program effectively controlling nuisance aquatic plant growth?



How satisfied are property owners with the aquatic plant harvesting program?



Actions to Manage Big Blake Lake

Ranked by priority

- Bring the dam up to code: 91%
- Programs to prevent and monitor AIS: 89%
- Enhance fisheries: 78%
- Upgrade non-conforming septic systems: 71%
- Install shoreline buffers/rain gardens: 61%
- Install farmland conservation practices: 54%
- Lake fairs and workshops: 44%
- Enforce slow no wake zones: 44%

Actions to Manage Aquatic Invasive Species (AIS)

Ranked by priority

Harvesting CLP: 90%

Monitoring to detect new AIS: 89%

Clean Boats, Clean Waters: 86%

Educational programs: 72%

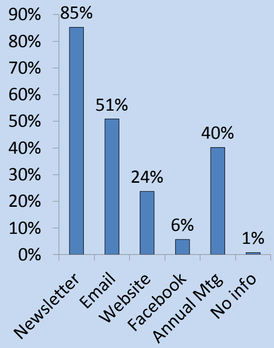
Trainings to identify and manage AIS: 69%

Herbicide control of CLP: 54%

Boat landing cameras: 37%

Boat wash stations: 35%

Communication



Half of property owners were unaware of the Facebook page and another third have never visited the page.

Questions?

Thank you!

Big Blake Lake Management Plan Development
Committee Meeting 2

Saturday, March 12th, 2016
9-11 am
Polk County Government Center, County Board Room (note location change)
100 Polk County Plaza, Balsam Lake (kiddie corner across street from Justice Center)

9:00 Introductions

9:05 Consider possible vision statements and guiding principles

A vision statement is an overall statement for what you want the waterbody to look like
Guiding principles provide guidance on how the lake management plan will be implemented

9:30 Review and make changes to draft goals
Begin to brainstorm objectives and actions (as time allows)

10:15 Presentation (Polk County Land and Water Resources Department)

Harvesting background information (page 62 in management plan)
CLP biomass and turion sampling (pages 63-65 in management plan)
Point intercept aquatic macrophyte surveys (pages 66-79 in management plan)

11:00 Adjourn

Next meeting will be scheduled through a doodle poll

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(715) 485-8637
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Jeremy Williamson
(715) 485-8639
jeremyw@co.polk.wi.us

History of Harvesting

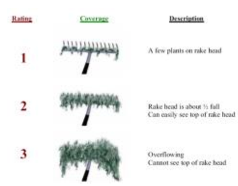
1976	District formed
1980/1990	Contracted harvesting, herbicide
1998	First plant survey
1999	Plant management plan
2004	Plant survey and plan
2007	District begins harvesting

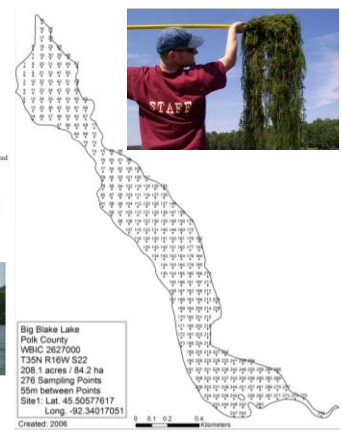
Curly-leaf pondweed harvesting information

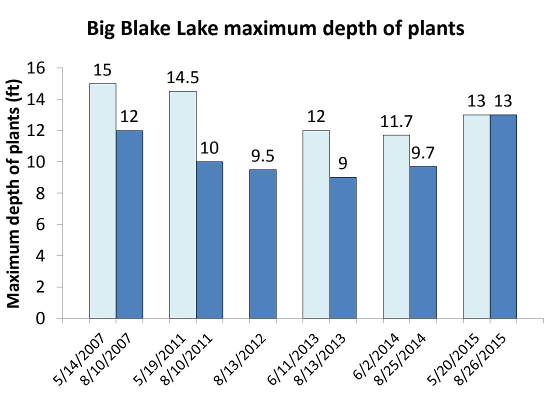
	Harvesting start date	Harvesting end date	Loads of curly-leaf pondweed removed
2013	June 16	July 3	8
2014	June 8	July 14	30
2015	May 19	July 1	143

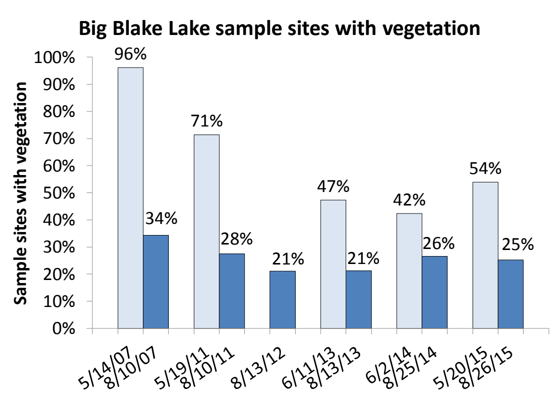
Coontail harvesting information

	Harvesting start date	Harvesting end date	Loads of coontail removed
2013	July 18	Sept 17	14
2014	Aug 14	Sept 18	6
2015	July 22	Sept 3	28









What are the dominant species?

??

Relative frequency

?

Frequency of occurrence at sites shallower than maximum depth of plants

??

FREQUENCY OF OCCURRENCE IN VEGETATED AREAS

??

??

CLP Frequency of Occurrence

SPRING	5/14/07	5/19/11	6/11/13	6/2/14	5/20/15
Vegetated areas	100%	93%	73%	59%	93%
Maximum depth of plants	97%	67%	53%	32%	51%

FALL	8/10/07	8/10/11	8/13/12	8/13/13	8/25/14	8/26/15
Vegetated areas	1.1%	1.4%	1.8%	1.8%	1.4%	1.5%
Maximum depth of plants	0.4%	0.8%	0.9%	1.1%	0.8%	0.4%

Coontail Frequency of Occurrence

SPRING	5/14/07	5/19/11	6/11/13	6/2/14	5/20/15
Vegetated areas	20%	26%	34%	32%	19%
Maximum depth of plants	19%	18%	25%	17%	11%

FALL	8/10/07	8/10/11	8/13/12	8/13/13	8/25/14	8/26/15
Vegetated areas	86%	92%	86%	82%	73%	85%
Maximum depth of plants	31%	52%	44%	51%	42%	22%

Relative Frequency

- How common a species is compared to all the species found
- Adds up to 100%

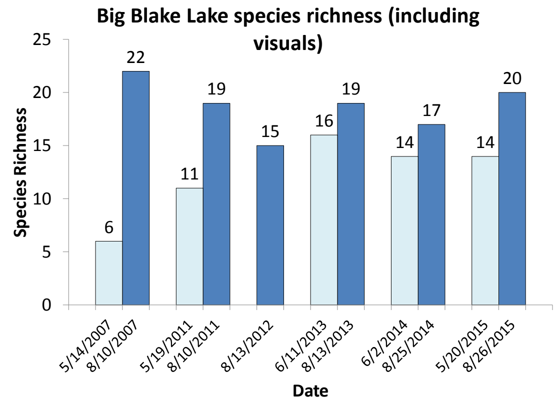
	5/14/07	5/19/11	6/11/13	6/2/14	5/20/15
CLP	75%	61%	38%	32%	60%
Coontail	15%	17%	18%	17%	13%

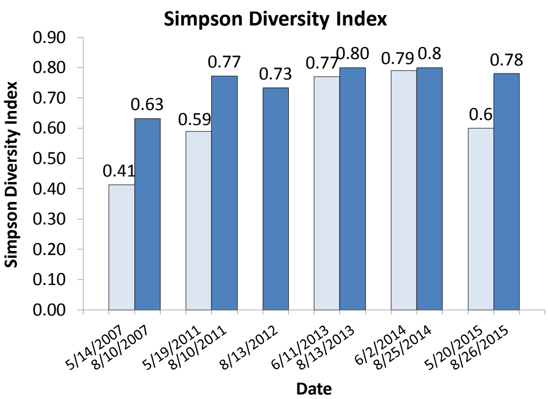
	8/10/07	8/10/11	8/13/12	8/13/13	8/25/14	8/26/15
CLP	0.7%	0.6%	1%	0.8%	0.7%	0.7%
Coontail	59%	41%	46%	36%	36%	38%

Spring relative frequency, 2007, 2011, and 2013-2015

	5/14/07	5/19/11	6/11/13	6/2/14	5/20/15
Ceratophyllum demersum, coontail	14.6	16.7	17.8	17.1	12.6
Filamentous algae	6.3				
Heteranthera dubia, water star-grass			0.8		0.5
Lemna minor, small duckweed			1.2		
Lemna trisulca, forked duckweed	1.5	8.0	8.1	16.1	3.6
Myriophyllum sibiricum, northern water milfoil		1.3	0.4	1.4	2.7
Nitella sp., nitella					0.5
Nuphar variegata, spatterdock		0.7	0.4	1.9	0.9
Nymphaea odorata, white water lily		0.3	1.2	0.9	0.5
Potamogeton crispus, curly-leaf pondweed	74.9	60.7	38.1	32.2	60.4
Potamogeton praelongis, white-stem pondweed		0.3	1.6	0.9	0.9
Potamogeton pulcher, spotted pondweed		0.3			
Potamogeton pusillus, small pondweed	0.9	9.0	18.6	21.3	12.2
Potamogeton zosteriformis, flat-stem pondweed	1.8	2.7	8.5	7.1	3.6
Ranunculus aquatilis, white water crowfoot			1.6		0.9
Vallisneria americana, wild celery			0.4		
Wolffia columbiana, common watermeal			0.8		
Zizania palustris, northern wild rice			0.4	0.9	0.9

Fall relative frequency, 2007, 2011, and 2013-2015						
	8/10/07	8/10/11	8/13/12	8/13/13	8/25/14	8/26/15
Ceratophyllum demersum, coontail	58.5	40.7	45.7	36.2	36.4	38.4
Chara sp., Muskgrasses						0.7
Elodea canadensis, common waterweed	0.7					2.0
Filamentous algae	5.9		2.9			
Heteranthera dubia, water star-grass	0.7	1.2		1.6	3.5	1.3
Lemna minor, small duckweed	2.2	3.0		0.8	2.8	2.0
Lemna trisulca, forked duckweed	9.6	19.2	16.2	12.6	18.9	19.9
Myriophyllum sibiricum, northern water milfoil	2.2	3.6	7.6	3.9	6.3	5.3
Najas flexilis, bushy pondweed	0.7	1.8		0.8	4.2	
Nitella sp., nitella	0.7					
Nuphar variegata, spatterdock		3.0	1.0		2.1	0.7
Nymphaea odorata, white water lily	1.5	1.8	3.8	3.9	2.8	3.3
Potamogeton amplifolius, large-leaf pondweed					0.7	
Potamogeton crispus, curly-leaf pondweed	0.7	0.6	1.0	0.8	0.7	0.7
Potamogeton illinoensis, Illinois pondweed	2.2					
Potamogeton praelongis, white-stem pondweed		1.2		1.6		2.0
Potamogeton pusillus, small pondweed	0.7	3.6		7.9	5.6	1.3
Potamogeton richardsonii, clasping-leaf pondweed	1.5	1.2	1.0	3.9	0.7	2.0
Potamogeton zosteriformis, flat-stem pondweed	10.4	13.8	14.3	21.3	14.0	15.9
Ranunculus aquatilis, white water crowfoot		0.6		0.8	0.7	1.3
Sparganium angustifolium, narrow-leaved burreed			4.8			
Spirodela polyrhiza, large duckweed	0.7	3.0		0.8		
Stuckenia pectinata, sago pondweed	0.7					
Vallisneria americana, wild celery		0.6	1.9	2.4		1.3
Wolffia columbiana, common watermeal		0.6		0.8	0.7	2.0
Zizania palustris, northern wild rice		0.6				





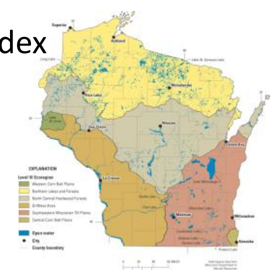
Floristic Quality Index

Closeness of flora to an undisturbed condition

Mean species richness = 14

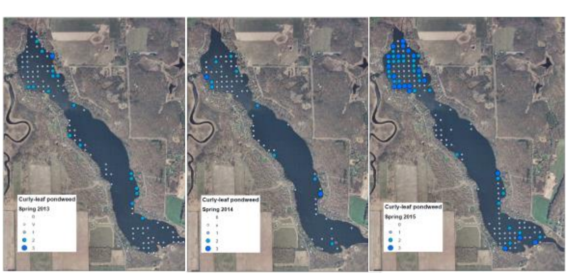
Mean average conservatism = 5.6

Mean Floristic Quality = 20.9



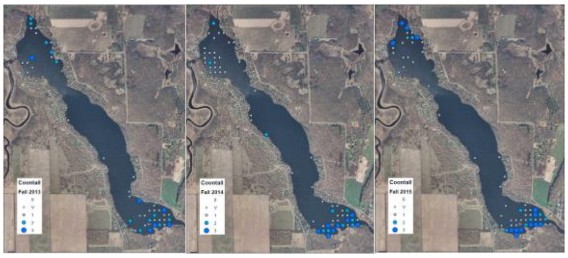
	5/14/07	8/9/07	5/19/11	8/10/11	8/13/12	6/11/13	8/13/13	6/2/14	8/25/14	5/20/15	8/26/15
Species Richness	4	15	9	17	9	14	15	9	14	12	16
Conservatism	5.5	5.3	6.4	5.9	6.0	6.1	5.9	6.2	5.8	6.4	5.8
FQI	11.0	20.4	19.3	24.5	18.0	22.7	22.7	18.7	21.6	22.2	23.0

Spring Curly-leaf Pondweed



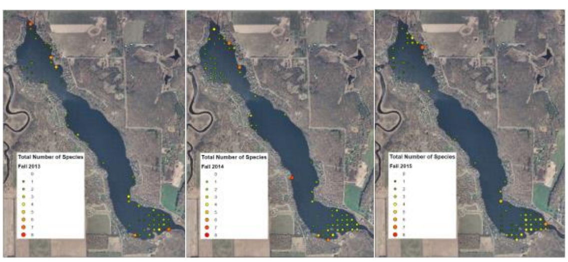
Spring Coontail

Fall Coontail



Spring All Species (Excluding AIS)

Fall All Species

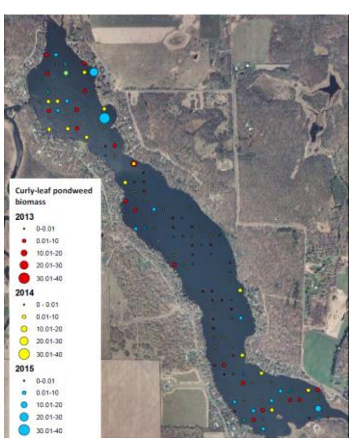


CLP Biomass and Turion Sampling

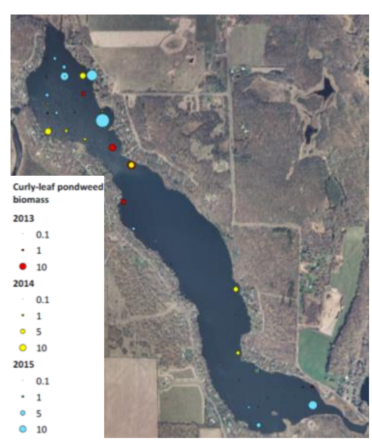
Year	Turions per dredge sample	Turions per square meter	Curly-leaf pondweed biomass (grams)
2013	2.7	117	0.656
2014	1.9	83	0.768
2015	1.3	56	2.272

Big Blake Lake dry weight curly-leaf pondweed biomass (grams), 2013-2015

Shows a biomass of zero

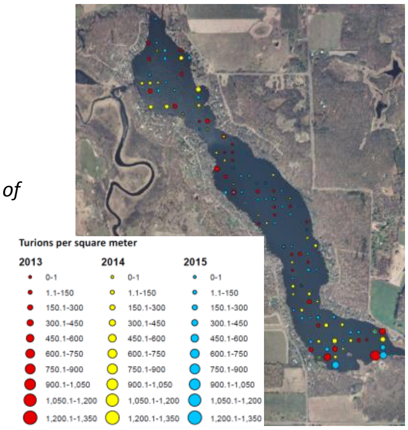


Big Blake Lake dry weight curly-leaf pondweed biomass (grams), 2013-2015

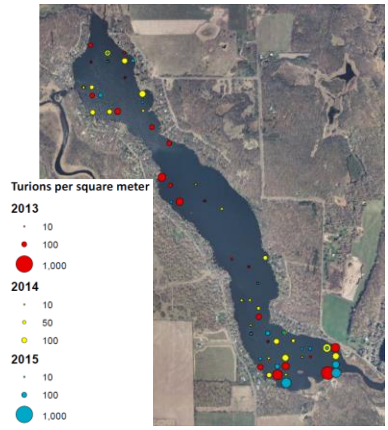


Big Blake Lake turions per square meter, 2013-2015

Shows a turion of zero



Big Blake Lake turions per square meter, 2013-2015



Big Blake Lake Management Plan Development
Committee Meeting 3

Tuesday, April 5, 2016
6-8 PM
Polk County Government Center, County Board Room
100 Polk County Plaza, Balsam Lake

6:00 Introductions

6:05 Review vision statement, guiding principles, and goals
Brainstorm and review objectives and actions

7:15 Presentation (Polk County Land and Water Resources Department)
- Tributary and Outlet Chemistry (pages 41-43, 46-47, and 50 in management plan)
- Land Use (pages 82-87 in management plan)
- Modeling

8:00 Adjourn

Next meeting will be scheduled through a doodle poll

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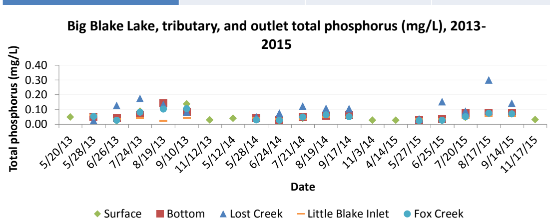
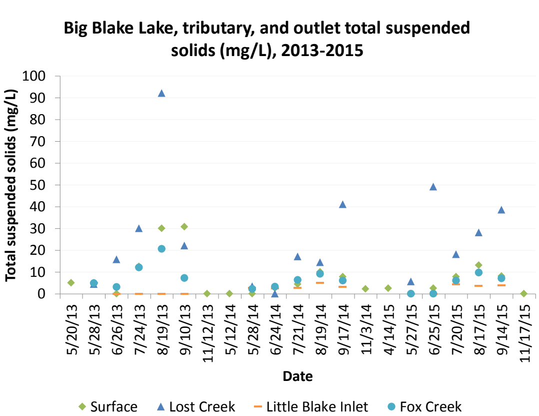
katelin.holm@co.polk.wi.us

Jeremy Williamson
(715) 485-8639
jeremyw@co.polk.wi.us

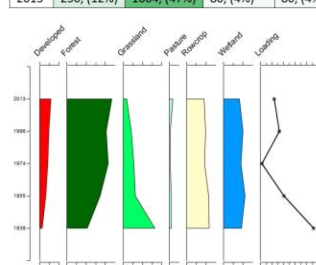
Average total phosphorus (mg/L)			
	2013	2014	2015
Surface of Big Blake Lake	0.08	0.04	0.05
Bottom of Big Blake Lake	0.07	0.04	0.06
Lost Creek	0.11	0.09	0.14
Little Blake Lake Inlet	0.04	0.04	0.04
Fox Creek	0.07	0.04	0.05

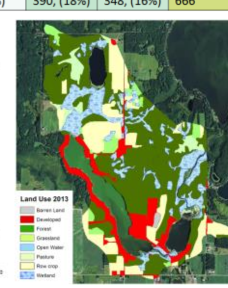


Site	TP (mg/L)	Area (m^2)	Discharge (l/s)	Phosphorus (lb/yr)
2013 Fox Creek	0.0720	4.11	4,942	24,755
2014 Fox Creek	0.0422	5.72	10,696	31,402
2015 Fox Creek	0.0477	4.08	7,075	23,479
2013 Lost Creek	0.1065	5.90	360	2,667
2014 Lost Creek	0.0899	7.22	1,227	7,674
2015 Lost Creek	0.1423	8.26	760	7,524
2013 Little Blake Inlet	0.0424	10.37	4,571	13,484
2014 Little Blake Inlet	0.0415	8.17	7,487	21,616
2015 Little Blake Inlet	0.0445	8.21	5,460	16,904

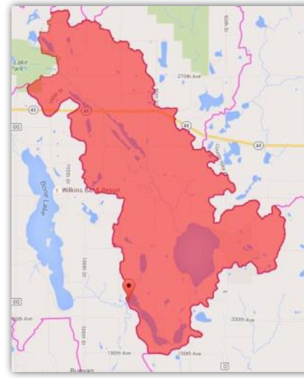


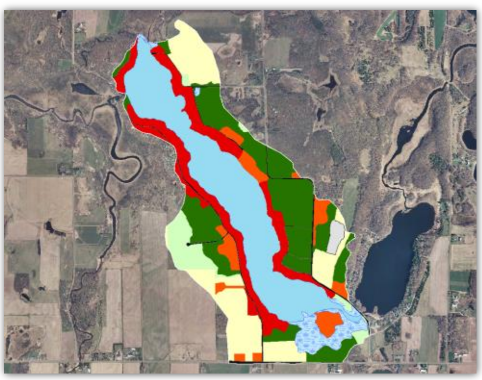
Date	Developed (acres)	Forest (acres)	Grassland (acres)	Pasture (acres)	Row crop (acres)	Wetland (acres)	Phosphorus loading (lbs/yr)
1938	57, (3%)	451, (21%)	705, (33%)	40, (2%)	490, (23%)	391, (18%)	769
1955	132, (6%)	753, (35%)	279, (13%)	40, (2%)	489, (23%)	474, (22%)	691
1974	179, (8%)	922, (43%)	244, (11%)	26, (1%)	392, (18%)	379, (18%)	634
1996	204, (10%)	873, (41%)	177, (8%)	28, (1%)	417, (20%)	421, (20%)	679
2013	250, (12%)	1004, (47%)	80, (4%)	80, (4%)	390, (18%)	348, (16%)	666

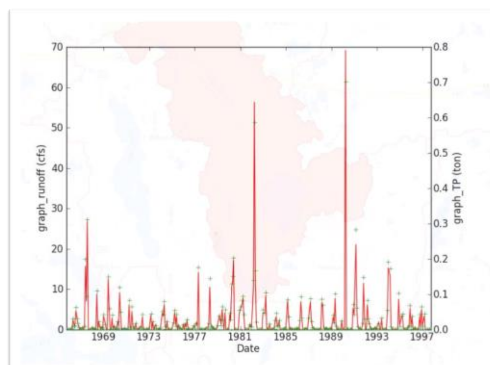


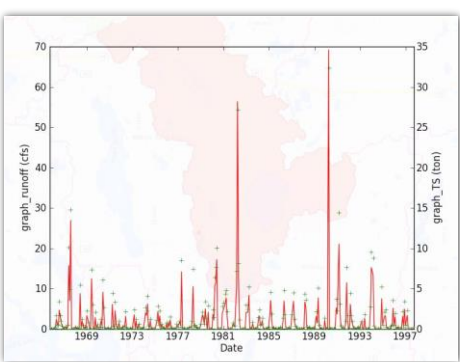


Watershed Modeling

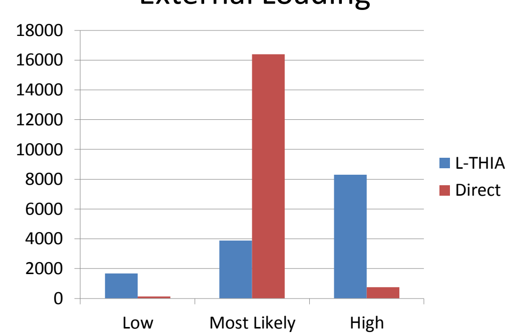




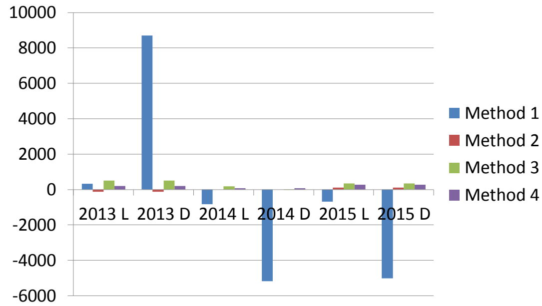




External Loading



Internal Loading

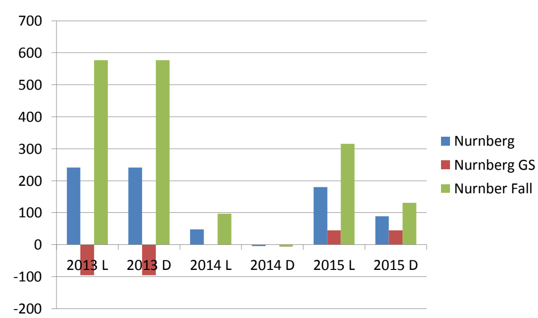


Nurnberg Model

$$P = \frac{L_{Ext}}{q_s}(1 - R) + \frac{L_{int}}{q_s}$$

Where $R = \frac{15}{18 + q_s}$

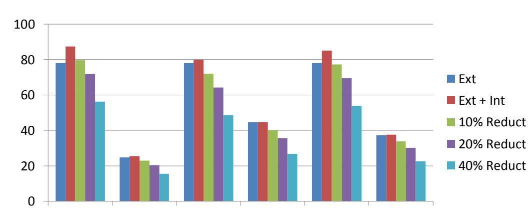
Nurnberg Model



Reckhow Model

$$P = \frac{L}{0.17z + 1.13\,{}^{z}/_{T_w}}$$

Reckhow Model



	2013 L	2013 D	2014 L	2014 D	2015 L	2015 D
Ext	77.91	24.76	77.91	44.57	77.91	37.3
Ext + Int	87.37	25.43	79.78	44.57	84.98	37.55
10% Reduct	79.58	22.96	71.98	40.12	77.19	33.82
20% Reduct	71.79	20.48	64.19	35.66	69.4	30.09
40% Reduct	56.21	15.53	48.61	26.74	53.81	22.63

Big Blake Lake Management Plan Development
Committee Meeting 4

Thursday, June 30, 2016
6-8 PM
Polk County Government Center, County Board Room
100 Polk County Plaza, Balsam Lake

6:00 Introductions

6:05 Nutrient Budget and Sediment Core Presentation (Jeremy Williamson)

6:30 Complete goals spreadsheet (all)

8:00 Adjourn

Katelin Anderson
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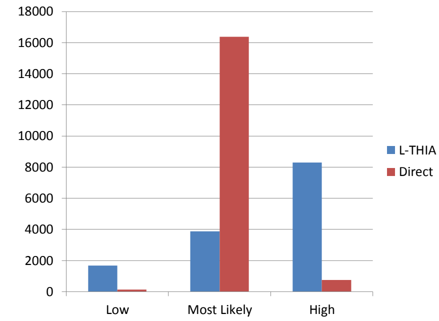
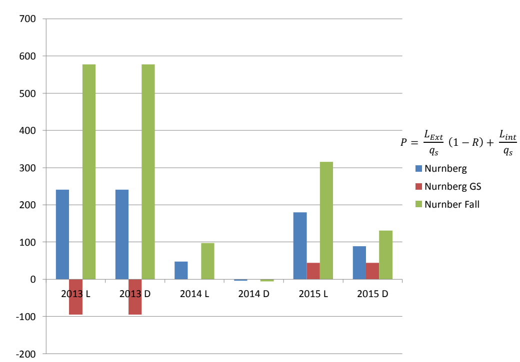
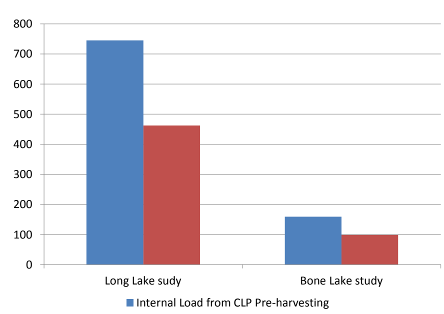
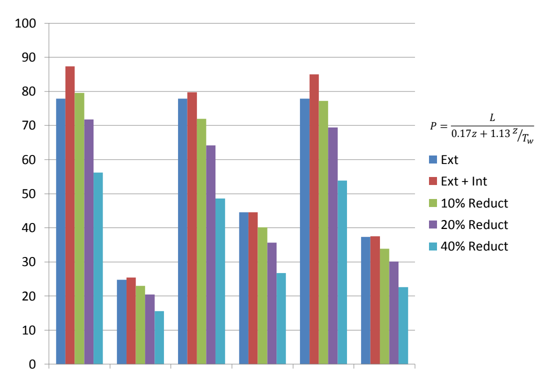
Jeremy Williamson
(715) 485-8639
jeremyw@co.polk.wi.us

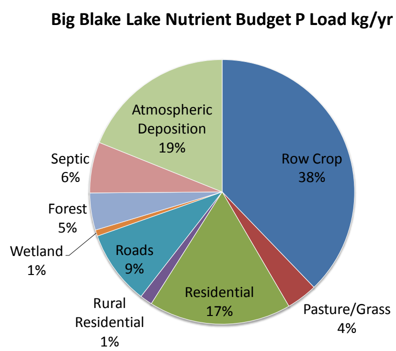

Blake Lake Nutrient Budget and Reconstruction
Jeremy Williamson
Water Quality Specialist
Polk County Land & Water Resources Dept.

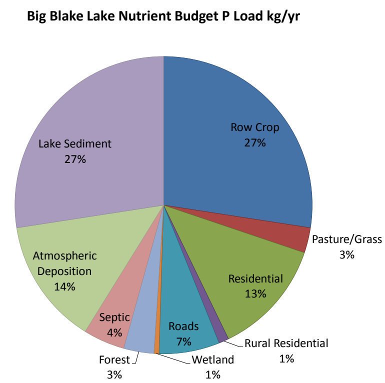

18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Low
Most Likely
High
L-THIA
Direct


700
600
500
400
300
200
100
0
-100
-200
2013 L
2013 D
2014 L
2014 D
2015 L
2015 D
$P = \frac{L_{Ext}}{q_s}(1 - R) + \frac{L_{int}}{q_s}$
Nurnberg
Nurnberg GS
Nurnber Fall

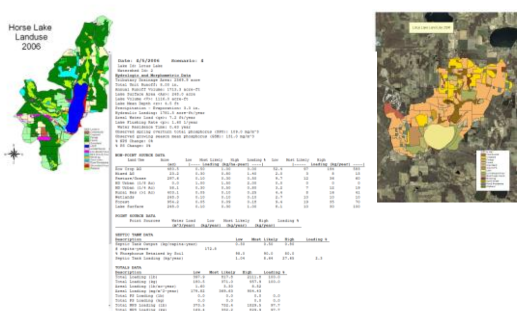

800
700
600
500
400
300
200
100
0
Long Lake sudy
Bone Lake study
Internal Load from CLP Pre-harvesting
Internal Load from CLP Post-Harvesting

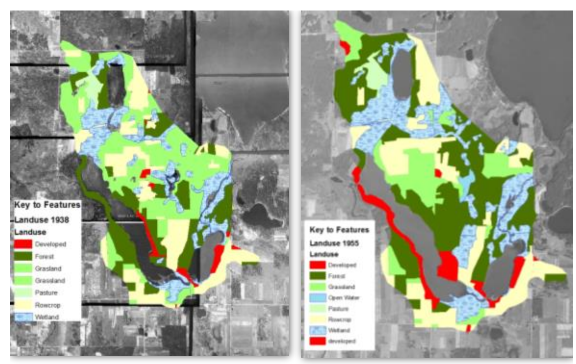

100
90
80
70
60
50
40
30
20
10
0
2013 L
2013 D
2014 L
2014 D
2015 L
2015 D
$P = \frac{L}{0.17z + 1.13\, ^{z}/_{T_w}}$
Ext
Ext + Int
10% Reduct
20% Reduct
40% Reduct

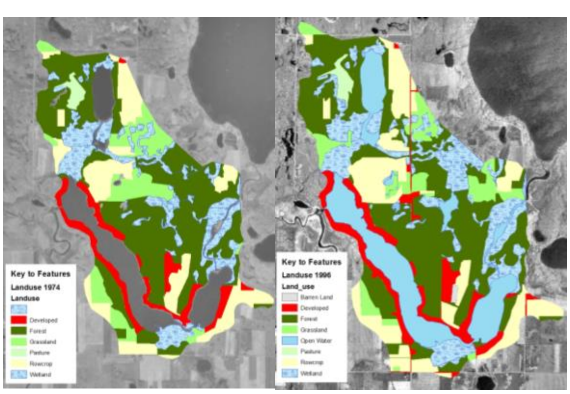


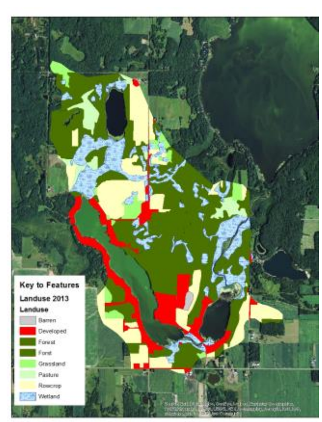


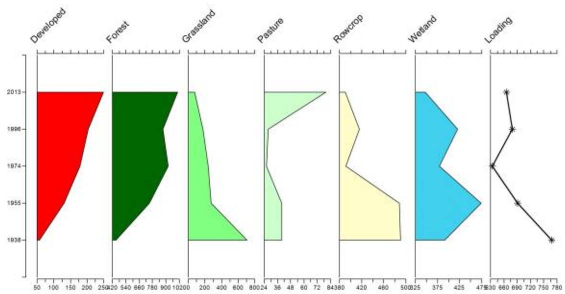
Watershed Modeling

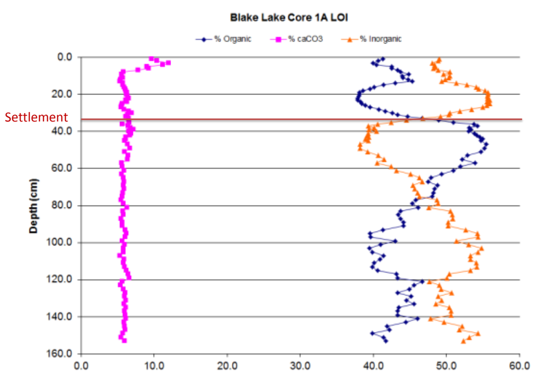


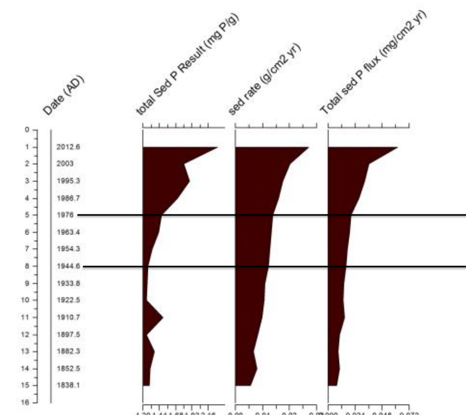


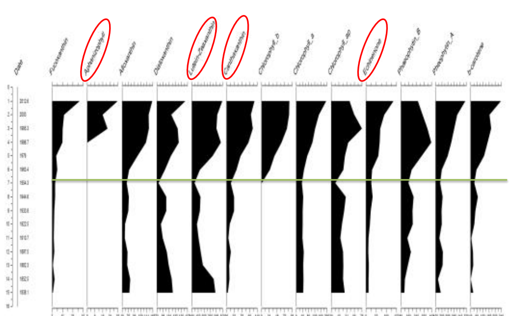


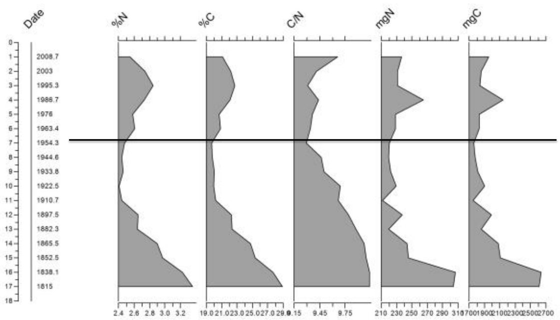



Developed
Forest
Grassland
Pasture
Rowcrop
Wetland
Loading
2013
1996
1974
1955
1938

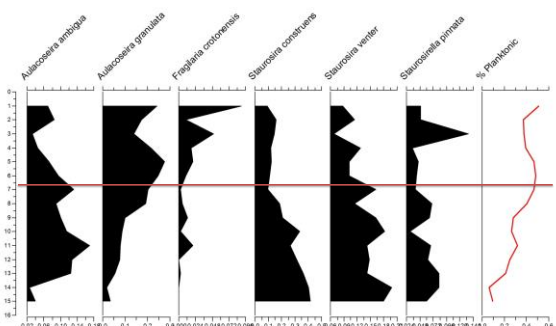

Blake Lake Core 1A LOI
% Organic
% caCO3
% Inorganic
Settlement
Depth (cm)
Percent
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
10.0
30.0
40.0
50.0
60.0

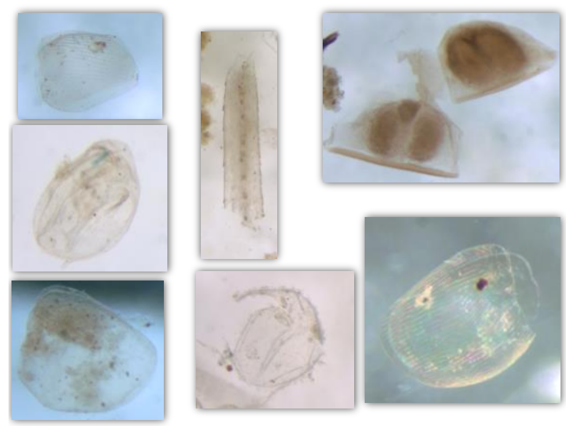

Date (AD)
total Sed P Result (mg P/g)
sed rate (g/cm2 yr)
Total sed P flux (mg/cm2 yr)
2012.6
2003
1995.3
1986.7
1976
1963.4
1954.3
1944.6
1933.8
1922.5
1910.7
1897.5
1882.3
1852.5
1838.1

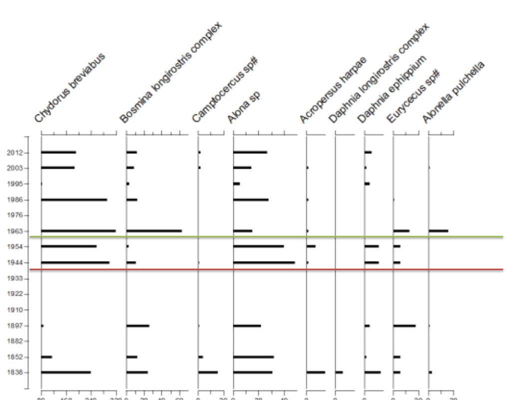


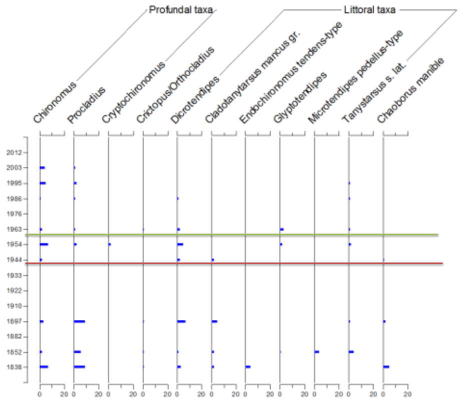

Date
%N
%C
C/N
mgN
mgC
2008.7
2003
1995.3
1986.7
1976
1963.4
1954.3
1944.6
1933.8
1922.5
1910.7
1897.5
1882.3
1865.5
1852.5
1838.1
1815

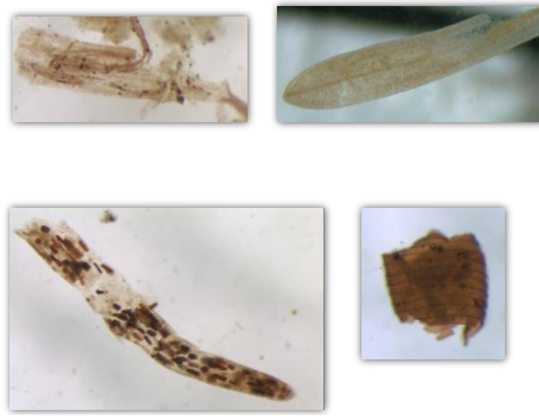

Blake Lake 1852
Blake Lake 2012

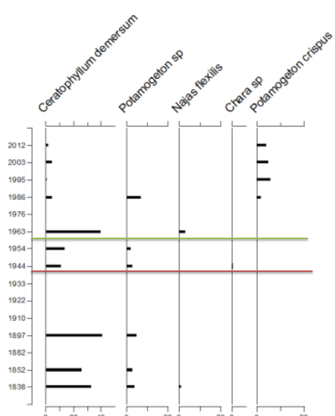

Aulacoseira ambigua
Aulacoseira granulata
Fragilaria crotonensis
Staurosira construens
Staurosira venter
Staurosirella pinnata
% Planktonic

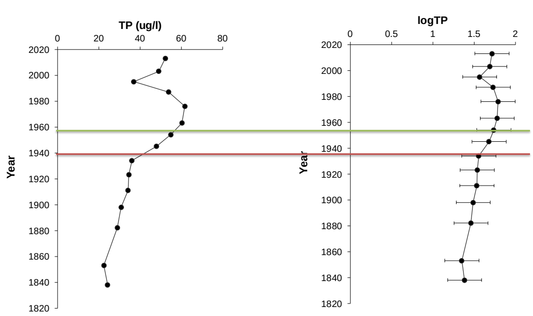



Chydorus breviabus
Bosmina longirostris complex
Camptocercus sp#
Alona sp
Acropersus harpae
Daphnia longirostris complex
Daphnia ephippium
Eurycecus sp#
Alonella pulchella
2012
2003
1995
1986
1976
1963
1954
1944
1933
1922
1910
1897
1882
1852
1836


Profundal taxa
Littoral taxa
Chironomus
Procladius
Cryptochironomus
Cricotopus/Orthocladius
Dicrotendipes
Cladotanytarsus mancus gr.
Endochironomus tendens-type
Glyptotendipes
Microtendipes pedellus-type
Tanytarsus s. lat.
Chaoborus manible




Ceratophyllum demersum
Potamogeton sp
Najas flexilis
Chara sp
Potamogeton crispus


TP (ug/l)
Year
logTP

Questions?