Black Dog Watershed Management Commission

AGENDA
Wednesday, March 17, 2021
5:00 P.M.

COMMISSIONERS:
Curt Enestvedt, Chairperson
Mike Hughes, Vice-Chairperson
Scott Thureen, Secretary/Treasurer
Tom Harmening
Rollie Greeno
Frank Boyce, Alternate
Greg Helms, Alternate
Natalie Walker, Alternate

I. Approval of Agenda

II. Approval of Minutes – February 17, 2021

III. Approval of Accounts Payable

IV. Review Budget Performance Reports

V. Review 2020 Orchard Lake Water Quality Monitoring Report

VI. Review 2020 Keller Lake Habitat Monitoring Report

VII. Review Draft 2020 Annual Watershed Report

VIII. Review Materials for the Initial Planning Meeting for the Plan Update

IX. Update on Survey Responses

X. Report on the Initial Technical Advisory Committee Meeting

XI. Miscellaneous

XII. Adjournment

Black Dog Watershed Management Commission

Agenda Background
March 17, 2021

I. Approval of Agenda

Agenda enclosed.

Action Requested: A motion be considered to approve the Agenda.

II. Approval of Minutes from the February 17, 2021 Meeting

Minutes enclosed.

Action Requested: A motion be considered to approve the Minutes from the February 17, 2021 meeting.

III. Approval of Accounts Payable

Accounts payable list enclosed.

Action Requested: A motion be considered to approve the accounts payable list as submitted by staff.

IV. Review of Budget Performance Reports

Current Budget Performance Reports enclosed.

Action Requested: No formal action required.

V. Review 2020 Orchard Lake Water Quality Monitoring Report

In 2020 Barr Engineering performed increased water quality monitoring on Orchard Lake. Staff from Barr will review the monitoring performed and the results of the monitoring at the meeting. Enclosed in your packet is a copy of the report. The technical memo provides information that most people will find beneficial. The technical reference document provides more detailed information and data.

Action Requested: Commissioners consider a motion accepting the report with any suggested edits at the meeting.

VI. Review 2020 Keller Lake Habitat Monitoring Report

Habitat Monitoring was performed on Keller Lake in 2020. Barr Engineering staff will review this report at the meeting. A copy of the report is enclosed in the packet. The technical memo provides information that most people will find beneficial. The technical reference document provides more detailed information and data.

Action requested: Commissioners consider a motion accepting the report with any suggested edits at the meeting.

VII. Review Draft 2020 Annual Watershed Report

A draft of the 2020 Watershed Annual Newsletter is enclosed with this background.

Action requested: Commissioners review the report and provide feedback to staff about changes that might be needed. Also, a motion be considered approving the annual newsletter for distribution contingent upon revisions noted at the meeting being made to the report.

VIII. Review Materials for the Initial Planning Meeting for the Plan Update

Barr Engineering will review materials and information related to the initial planning meeting for the plan update. The meeting is currently scheduled to coincide with the April Black Dog WMO Meeting.

Action Requested: Provide feedback to staff on the materials presented.

IX. Update on Survey Responses

Barr Engineering will provide an update on the current survey responses received.

Action Requested: This is an informational item.

X. Report on the Initial Technical Advisory Committee Meeting

The initial technical advisory committee meeting is scheduled for March 12, 2021. Staff will provide an update on that meeting.

Action Requested: This is an informational item.

XI. Miscellaneous

XII. Adjournment

Black Dog Watershed Management Commission

DRAFT
Meeting Minutes
February 17, 2021

MEMBERS PRESENT
Curt Enestvedt, Chair
Mike Hughes, Vice Chairperson
Scott Thureen, Secretary/Treasurer
Rollie Greeno
Tom Harmening
Frank Boyce, Alternate (not voting)
Natalie Walker, Alternate (not voting)

MEMBERS ABSENT
Greg Helms, Alternate

OTHERS PRESENT
Karen Chandler – Barr Engineering
Greg Williams – Barr Engineering
Samantha Berger – City of Apple Valley
Joel Jamnik, Campbell Knutson
Lindsey Albright – Dakota County Soil and Water Conservation District
Ann Messerschmidt – City of Lakeville
Daryl Jacobson – BDWMO Administrator
Tammi Carté – BDWMO Secretary

Curt Enestvedt, Chair, called the February 17, 2021, meeting to order at 5:00pm via WebEx.

I. Approval of Agenda

Motion by Hughes, second by Thureen, to approve the February 17, 2021 Agenda as presented.

Ayes – Enestvedt, Hughes, Thureen, Greeno, Harmening
Nays – None

Motion Carried Unanimously

II. Approval of Minutes from the January 20, 2021 Meeting

Motion by Greeno, second by Harmening, to approve the January 20, 2021 Minutes as presented.

Ayes – Enestvedt, Hughes, Thureen, Greeno, Harmening
Nays – None

Motion Carried Unanimously

III. Approval of Accounts Payable

Motion by Thureen, second by Harmening, to approve payments to Barr Engineering in the amount of $5,732.00 for services from December 26, 2020 through January 29, 2021; and, to Campbell Knutson in the amount of $340.00 for January 2021 general services; and, to the City of Burnsville in the amount of $19,101.21 for 2020 support services; and, to Dakota County Soil & Water Conservation District in the amount of $2,765.00 for October 2020 through December 2020 services.

Ayes – Enestvedt, Hughes, Thureen, Greeno, Harmening
Nays – None

Motion Carried Unanimously

IV. Review Budget Performance Reports

Daryl Jacobson, BDWMO Administrator – The last 2020 invoices were presented for payment at tonight's meeting. Finance will move forward with the end of year financial statement. The annual report for the alum treatment grant was received.

No Formal Action Required

V. Approval of 2021 Lakes for Met Council CAMP Monitoring Program

Staff proposes the Black Dog WMO sponsor monitoring at the five strategic water bodies identified in the Watershed Plan. This approach is consistent with what has occurred in past years. Staff recommends the Commission approve enrolling Crystal Lake, Keller Lake, Kingsley Lake, Orchard Lake, and Lac Lavon in the 2021 CAMP.

Motion by Harmening, second by Hughes, to approve enrollment of Crystal Lake, Keller Lake, Kingsley Lake, Orchard Lake, and Lac Lavon in 2021 CAMP.

Ayes – Enestvedt, Hughes, Thureen, Greeno, Harmening
Nays – None

Motion Carried Unanimously

VI. Review 10 Year Plan Update Items

An updated schedule for the 10 year plan update was provided to the Commission for review prior to this meeting. The new schedule includes the kickoff meeting along with other minor updates. Barr staff communicated the survey is live, but not advertised. Results will be provided at the March 2021 meeting.

No **Formal Action Required**

VII. Miscellaneous

1. The next Black Dog WMO meeting is scheduled for March 17, 2021.

2. Website Update – staff participated in a meeting to view the look and maneuverability of the proposed new web design.

3. Keller Lake Alum Treatment – The next alum treatment will be applied fall 2021 instead of the spring. The extension will provide additional data to evaluate the effectiveness of the first treatment prior to the second application.

VIII. Adjournment

Motion by Harmening, second by Hughes, to adjourn at 5:25pm.

Ayes – Enestvedt, Hughes, Thureen, Greeno, Harmening
Nays – None

Motion Carried Unanimously

BLACK DOG WATERSHED MANAGEMENT COMMISSION
100 Civic Center Parkway
Burnsville, MN 55337

Accounts Payable - March 17, 2021 Meeting

Barr Engineering - Services from January 29, 2020 through February 26, 2021

Engineering	$	1,912.00
Special Projects General Fund - Orchard Lake Water Quality Monitoring	$	2,000.00
Special Projects General Fund - Crystal Lake Mgmt Level Monitoring	$	84.00
Special Projects Capital Improvement Fund - Keller Lake Alum Treatment	$	525.00
Special Projects General Fund Reserve - Watershed Mgmt Plan Update	$	1,232.00
Water Quality Monitoring - Keller Lake	$	4,424.00
Water Quality Monitoring - Update Trend Analyses	$	1,312.50
Public Education - Watershed Annual Report	$	483.50
	$	**11,973.00**

Accounts Payable Total	**$**	**11,973.00**

resourceful. naturally.
engineering and environmental consultants

BARR

March 9, 2021

Black Dog Watershed Management Commission
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

Attn: Mr. Daryl Jacobson

RE: Engineering & Environmental Consulting Services

Invoice of Account with
BARR ENGINEERING COMPANY

For professional services during the period of January 29, 2021 through February 26, 2021

TOTAL PAYABLE THIS INVOICE:	**$ 11,973.00**
Allocation:	
Engineering	**$ 1,912.00**
Special Projects General Fund	
• **Orchard Lk Water Quality Monitoring**	**$ 2,000.00**
• **Crystal Lk Mgmt Level Monitoring**	**$ 84.00**
Special Projects Capital Improvement Fund	
• **Keller Lake Alum Treatment**	**$ 525.00**
Special Projects General Fund Reserve	
• **Watershed Mgmt Plan Update**	**$ 1,232.00**
Water Quality Monitoring	
• **Keller Lake**	**$ 4,424.00**
• **Update Trend Analyses**	**$ 1,312.50**
Public Education	
• **Watershed Annual Report**	**$ 483.50**

3-9-21
OK
Daryl

Barr declares under the penalties of law that this account, claim, or demand is just and that no part of it has been paid.

Karen L. Chandler

Karen L. Chandler
Vice President

BUDGET SUMMARY - 2021 FY
Black Dog Watershed Management Commission
through February 26, 2021

Work Description	Pre-2021 Costs	Barr Budget: Brought Forward	Barr Budget: Current Year	Barr Budget: Total Barr Budget	Current Invoice	Spent This Year	Balance
Engineering	-----	0.00	31,000.00	31,000.00	1,912.00	4,196.00	26,804.00
Special Projects: General Fund							
Reporting on Orchard Lk 2020 Water Quality Monitoring	-----	0.00	4,500.00	4,500.00	2,000.00	2,089.50	2,410.50 #
Crystal Lake 2021 Mgmt Level Monitoring			18,800.00	18,800.00	84.00	84.00	18,716.00 #
Subtotal -- Special Projects: General Fund	-----	0.00	23,300.00	23,300.00	2,084.00	2,173.50	21,126.50
Special Projects: Capital Improvement Fund							
Keller Lake Alum Treatment Feas Study & Impl Planning			10,000.00	10,000.00	525.00	1,680.00	8,320.00 #
Subtotal -- Special Projects: Capital Improvement Fund	-----	0.00	10,000.00	10,000.00	525.00	1,680.00	8,320.00
Special Projects: General Fund Reserve							
Watershed Management Plan Update [1]	10,905.00		70,000.00	70,000.00	1,232.00	2,418.00	67,582.00
Subtotal -- Special Projects: General Fund Reserve	-----	0.00	70,000.00	70,000.00	1,232.00	2,418.00	67,582.00
Water Quality Monitoring							
Reporting on 2020 Keller Lake Habitat Monitoring	-----	0.00	8,000.00	8,000.00	4,424.00	5,441.50	2,558.50
2021 Kingsley Lake Habitat Monitoring		0.00	3,300.00	3,300.00	0.00	0.00	3,300.00
Update Trend Analyses	-----	0.00	2,000.00	2,000.00	1,312.50	1,312.50	687.50
Subtotal -- W.Q. Monitoring	-----	0.00	13,300.00	13,300.00	5,736.50	6,754.00	6,546.00
Public Education							
Watershed Annual Report	-----	0.00	4,300.00	4,300.00	483.50	483.50	3,816.50
Annual Activity Report (BWSR)	-----	0.00	2,000.00	2,000.00	0.00	0.00	2,000.00
Subtotal -- Public Education	-----	0.00	6,300.00	6,300.00	483.50	483.50	5,816.50
Total Services	-----	0.00	153,900.00	153,900.00	11,973.00	17,705.00	136,195.00

Notes:

[1] Plan Update budget=$98,200 ($97,000 authorized at 11/18/2020 meeting, additional $1,200 authorized at 1/20/2021 meeting), including $10,000 budgeted in 2020

BARR

INVOICE

Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

March 9, 2021
Invoice No: 23190374.21 - 2

Total this Invoice $2,395.50

Regarding: BDWMO 2021 Engineering Services

Professional Services from January 30, 2021 to February 26, 2021

Job: 2021 Engineering Services

Task: 001 Attend BDWMO Meetings

Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	.60	185.00	111.00	
Engineer / Scientist / Specialist III				
Williams, Sterling	.70	150.00	105.00	
	1.30		216.00	
Subtotal Labor				**216.00**
			Task Subtotal	**$216.00**

Task: 002 Miscellaneous Consulting

Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	7.80	185.00	1,443.00	
Support Personnel II				
Burt, Deborah	.60	105.00	63.00	
Nypan, Nyssa	1.90	100.00	190.00	
	10.30		1,696.00	
Subtotal Labor				**1,696.00**
			Task Subtotal	**$1,696.00**

Task: 004 Newsletter/Watershed Report

Labor Charges

	Hours	Rate	Amount
Principal			
Chandler, Karen	2.10	185.00	388.50

Support Personnel I				
Kaul (Contracted), Karen	1.00	95.00	95.00	
	3.10		483.50	
Subtotal Labor				**483.50**
			Task Subtotal	**$483.50**
			Job Subtotal	**$2,395.50**
			Total this Invoice	**$2,395.50**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**2,395.50**	**2,284.00**	**4,679.50**	**2,284.00**	**2,395.50**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Karen Chandler, your Barr project manager, at (952) 832-2813 or email at kchandler@barr.com.

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Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

March 9, 2021
Invoice No: 23190375.21 - 2

Total this Invoice	**$2,084.00**

Regarding: Management Level Water Quality Monitoring

Professional Services from January 30, 2021 to February 26, 2021

Job: CRY Crystal Lk 2021 Water Quality Monitoring

Task: 100 Monitoring Data Mgmt & Proj Mgmt

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Olson, Terri	.20	150.00	30.00	
Technician I				
Melmer, David	.60	90.00	54.00	
	.80		84.00	
Subtotal Labor				**84.00**
		Task Subtotal		**$84.00**
		Job Subtotal		**$84.00**

Job: ORCH Orchard Lk 2020 Reporting

Task: 100 Letter Report

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Menken, Kevin	8.00	125.00	1,000.00	
Engineer / Scientist / Specialist II				
Phelps, Richard	6.50	115.00	747.50	
Technician I				
Hankard, Madeline	.20	85.00	17.00	
Melmer, David	.70	90.00	63.00	
Support Personnel II				
Treanor, Margaret	1.50	115.00	172.50	
	16.90		2,000.00	
Subtotal Labor				**2,000.00**
		Task Subtotal		**$2,000.00**
		Job Subtotal		**$2,000.00**
		Total this Invoice		**$2,084.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**2,084.00**	**89.50**	**2,173.50**	**89.50**	**2,084.00**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Kevin Menken, your Barr project manager, at (952) 832-2794 or email at kmenken@barr.com.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

INVOICE

BARR

Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

March 9, 2021
Invoice No: 23190375.98 - 10

Total this Invoice	**$525.00**

Regarding: Keller Lake Alum Treatment

Professional Services from January 30, 2021 to February 26, 2021

Job: 003 BWSR Contract Administration

Task: 001 BWSR Contract Administration

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist IV				
Wilson, Gregory	3.00	175.00	525.00	
	3.00		525.00	
Subtotal Labor				**525.00**
		Task Subtotal		**$525.00**
		Job Subtotal		**$525.00**
		Total this Invoice		**$525.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**525.00**	**38,838.47**	**39,363.47**	**38,838.47**	**525.00**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Greg Wilson, your Barr project manager, at (952) 832-2672 or email at gwilson@barr.com.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

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Barr Engineering Co.
4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

March 9, 2021
Invoice No: 23190375.99 - 4

Total this Invoice $1,312.50

Regarding: Trend Analysis

Professional Services from January 30, 2021 to February 26, 2021

Job: 2021 2020 Data

Task: 100 Trend Analysis 2020 Data

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Menken, Kevin	10.50	125.00	1,312.50	
	10.50		1,312.50	
Subtotal Labor				**1,312.50**
		Task Subtotal		**$1,312.50**
		Job Subtotal		**$1,312.50**
		Total this Invoice		**$1,312.50**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**1,312.50**	**1,620.00**	**2,932.50**	**1,620.00**	**1,312.50**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Greg Wilson, your Barr project manager, at (952) 832-2672 or email at gwilson@barr.com.

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Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

March 9, 2021
Invoice No: 23190457.21 - 2

Total this Invoice **$4,424.00**

Regarding: Habitat Monitoring

Professional Services from January 30, 2021 to February 26, 2021

Job: KELL Keller Lake 2020 Reporting

Task: 001 Analysis, Report & Presentation

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Wold, Karen	31.60	140.00	4,424.00	
	31.60		4,424.00	
Subtotal Labor				4,424.00
		Task Subtotal		**$4,424.00**
		Job Subtotal		**$4,424.00**
		Total this Invoice		**$4,424.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	4,424.00	1,017.50	5,441.50	1,017.50	4,424.00

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Karen Wold, your Barr project manager, at (952) 832-2707 or email at kwold@barr.com.

PLEASE REMIT TO ABOVE ADDRESS and INCLUDE INVOICE NUMBER ON CHECK.
Terms: Due upon receipt. 1 1/2% per month after 30 days. Please refer to the contract if other terms apply.

BARR

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4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
Phone: 952-832-2600; Fax: 952-832-2601
FEIN #: 41-0905995 Inc: 1966

Mr. Daryl Jacobson
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337-4720

March 9, 2021
Invoice No: 23191455.00 - 3

Total this Invoice $1,232.00

Regarding: BDWMO 2022 Watershed Management Plan

Professional Services from January 30, 2021 to February 26, 2021

Job: 100 Stakeholder Engagement

Task: 003 Online Survey

Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	.50	185.00	92.50	
Engineer / Scientist / Specialist III				
Williams, Sterling	1.50	150.00	225.00	
Support Personnel II				
Ungar, Lisa	.70	130.00	91.00	
	2.70		408.50	
Subtotal Labor				**408.50**
		Task Subtotal		**$408.50**

Task: 004 TAC meetings

Labor Charges

	Hours	Rate	Amount	
Principal				
Chandler, Karen	1.70	185.00	314.50	
Engineer / Scientist / Specialist III				
Williams, Sterling	1.50	150.00	225.00	
	3.20		539.50	
Subtotal Labor				**539.50**
		Task Subtotal		**$539.50**
		Job Subtotal		**$948.00**

Job: 200 Draft Plan Development

Task: 001 Physical Environment Inventory

Labor Charges

	Hours	Rate	Amount	
Engineer / Scientist / Specialist III				
Williams, Sterling	.50	150.00	75.00	
Engineer / Scientist / Specialist II				
Anderson, Edward	2.20	95.00	209.00	
	2.70		284.00	
Subtotal Labor				**284.00**
		Task Subtotal		**$284.00**
		Job Subtotal		**$284.00**
		Total this Invoice		**$1,232.00**

	Current	Prior	Total	Received	A/R Balance
Invoiced to Date	**1,232.00**	**2,120.00**	**3,352.00**	**2,120.00**	**1,232.00**

Thank you in advance for the prompt processing of this invoice. If you have any questions, please contact Greg Williams, your Barr project manager, at (952) 832-2945 or email at gwilliams@barr.com.

BLACK DOG WMO
CASH ACTIVITY REPORT 2021

Date	Description	Deposits	Check #	Check Amount	Monthly Cash Balance	Expenditures: General Engineering Support	Special Projects (General)	Special Projects (Capital)	Special Projects (Gen. Reserve)	Insurance	Legal & Audit	Admin Support	Public Education	Water Quality Monitoring	Conf Public	Contin-gency
	Balance as of 12/31/20				**572,983.92**											
20-Jan	Barr Engineering Co (2020)		1745	4,253.50		2,637.50	1,508.00	-	-					108.00		
20-Jan	Campbell Knutson (2020)		1746	85.00							85.00					
20-Jan	Met Council - Environ Services (2020)		1747	3,040.00										3,040.00		
31-Jan	Interest Income	9.67														
	01/31/20 Balance	9.67		7,378.50	**565,615.09**	2,637.50	1,508.00	-	-	-	85.00	-	-	3,148.00	-	-
17-Feb	Barr Engineering Co		1748	5,732.00		2,284.00	89.50	1,155.00	1,186.00				-	1,017.50		
17-Feb	Campbell Knutson		1749	340.00							340.00					
17-Feb	City of Burnsville (2020)		1750	19,101.21								19,101.21				
17-Feb	Dakota County Soil & Water (2020)		1751	2,765.00			2,250.00	-	-				515.00			
28-Feb	Interest Income	8.72														
	02/28/20 Balance	8.72		27,938.21	**537,685.60**	2,284.00	2,339.50	1,155.00	1,186.00	-	340.00	19,101.21	515.00	1,017.50	-	-
	Total Revenue	18.39	**Total Expense**	35,316.71		4,921.50	3,847.50	1,155.00	1,186.00	-	425.00	19,101.21	515.00	4,165.50	-	-
	Less: 2020 A/R	-	**Less: 2020 A/P**	(29,244.71)		(2,637.50)	(3,758.00)	-	-	-	(85.00)	(19,101.21)	(515.00)	(3,148.00)	-	-
	Total YTD 2020 Revenue	18.39	**Total YTD 2021 Exp**	6,072.00		2,284.00	89.50	1,155.00	1,186.00	-	340.00	-	-	1,017.50	-	-
			2021 Budget	214,500.00		31,000.00	36,800.00	10,000.00	70,000.00	3,000.00	5,000.00	18,000.00	18,100.00	17,100.00	500.00	5,000.00
			Budget Remaining	208,428.00		28,716.00	36,710.50	8,845.00	68,814.00	3,000.00	4,660.00	18,000.00	18,100.00	16,082.50	500.00	5,000.00

BLACK DOG WATER MANAGEMENT COMMISSION

Budget Performance Report
February 28, 2021

	CURRENT MONTH	YEAR TO DATE			
	ACTUAL	GENERAL FUND BUDGET	CAPITAL IMPROVEMENT FUND BUDGET	ACTUAL	VARIANCE FAVORABLE (UNFAVORABLE)
Opening Fund Balance		$ 421,605	$ 122,135	$ 543,739	
REVENUES :					
Member Contributions:					
City of Apple Valley	$ -	$ 10,489	$ 1,773	$ -	$ (12,262)
City of Burnsville	-	93,924	16,133	-	(110,057)
City of Eagan	-	580	-	-	(580)
City of Lakeville	-	26,007	4,094	-	(30,101)
Total Member Contributions	-	131,000	22,000	-	(153,000)
Other Revenues:					
Interest	$ 9	$ 40	$ -	$ 18	$ (22)
Grant (State of MN BWSR)	-	-	-	-	-
Total Other Revenue	9	40	-	18	(22)
Total Revenues	$ 9	$ 131,040	$ 22,000	$ 18	$ (153,022)
EXPENDITURES :					
General Engineering Support	$ 2,284	$ 31,000	$ -	$ 2,284	$ 28,716
Special Projects - General Fund	90	36,800	-	90	36,710
Special Projects - Capital Improvement Fund	1,155	-	10,000	1,155	8,845
Special Projects - General Fund Reserve	1,186	70,000	-	1,186	68,814
Insurance	-	3,000	-	-	3,000
Legal and Audit	340	5,000	-	340	4,660
Administrative Support	-	18,000	-	-	18,000
Public Education	-	18,100	-	-	18,100
Water Quality Monitoring	1,018	17,100	-	1,018	16,083
Conference/Publications	-	500	-	-	500
Contingency	-	5,000	-	-	5,000
Total Expenditures	6,072	204,500	10,000	6,072	208,428
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	(6,063)	(73,460)	12,000	(6,054)	
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES PLUS OPENING FUND BALANCE				537,685	

TOTAL CASH AVAILABLE 2/28/2021	537,685
Fund Balance 2/28/2021	$ 537,685

BLACK DOG WATER MANAGEMENT COMMISSION

Budget Performance Report
December 31, 2020
(as of February 28, 2021)

	CURRENT MONTH	YEAR TO DATE			
	ACTUAL	GENERAL FUND BUDGET	CAPITAL IMPROVEMENT FUND BUDGET	ACTUAL	VARIANCE FAVORABLE (UNFAVORABLE)
Opening Fund Balance		$ 415,753	$ 100,849	$ 514,787	
REVENUES :					
Member Contributions:					
City of Apple Valley	$ -	$ 10,376	$ 1,734	$ 12,110	$ -
City of Burnsville	-	94,293	16,256	110,549	-
City of Eagan	-	568	-	568	-
City of Lakeville	-	25,763	4,010	29,773	-
Total Member Contributions	-	131,000	22,000	153,000	-
Other Revenues:					
Interest	$ -	$ 40	$ -	$ 2,051	$ 2,011
Grant (State of MN BWSR)	-	-	-	-	-
Total Other Revenue	-	40	-	2,051	2,011
Total Revenues	$ -	$ 131,040	$ 22,000	$ 155,051	$ 2,011
EXPENDITURES :					
General Engineering Support	$ -	$ 31,000	$ -	$ 27,591	$ 3,409
Special Projects - General Fund	2,250	46,500	-	36,748	9,752
Special Projects - Capital Improvement Fund	-	-	-	714	(714)
Insurance	-	3,000	-	2,301	699
Legal and Audit	-	8,400	-	9,320	(920)
Administrative Support	19,101	18,000	-	19,101	(1,101)
Public Education	515	17,900	-	17,292	608
Water Quality Monitoring	-	15,400	-	12,891	2,509
Conference/Publications	-	500	-	26	475
Contingency	-	5,000	-	115	4,885
Total Expenditures	21,866	145,700	-	126,099	19,601
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES	(21,866)	(14,660)	22,000	28,952	
EXCESS OF REVENUES OVER (UNDER) EXPENDITURES PLUS OPENING FUND BALANCE				543,739	

TOTAL CASH AVAILABLE 12/31/2020	572,984
Fund Balance 12/31/2020	$ 543,739

Technical Memorandum

To: Black Dog Watershed Management Organization (BDWMO)
From: Kevin Menken, Barr Engineering
Subject: Orchard Lake 2020 Water Quality Monitoring Results
Date: March 10, 2021
Project: 23/19-0375

This memorandum presents the results of 2020 management-level water quality monitoring of Orchard Lake, conducted by Barr Engineering Co. (Barr) on behalf of the BDWMO. Results of monitoring performed by a citizen volunteer participating in the Metropolitan Council sponsored Citizen-Assisted Monitoring Program (CAMP) are included as well.

1.0 Introduction and Background

Orchard Lake is 243 acres in size, 75% of which is less than 15 feet deep. The maximum depth is 33 feet, and the average depth is 10 feet. Its tributary watershed is 2,260 acres, and is almost entirely within the City of Lakeville. A small portion of the Orchard Lake watershed is located within Credit River Township, which is outside of the BDWMO jurisdiction. There are three city parks located on Orchard Lake — a public boat access (Orchard Lake Park on south shore), a public beach (Orchard Lake Beach on west shore), and Wayside Park. Boating, fishing, swimming, and aesthetic and wildlife viewing are all popular recreational uses of the lake. Its 2,260-acre tributary watershed includes the Kingsley Lake watershed.

2.0 2020 Water Quality Monitoring Activities

The BDWMO Watershed Management Plan requires that Orchard Lake undergo "management-level" water quality monitoring once every three years. Management-level monitoring involves a more detailed collection of water quality data than the Metropolitan Council's Citizen-Assisted Monitoring Program (CAMP). This expanded effort was conducted by Barr in 2020 and included collection of the following data:

- Measurement of Secchi disc transparency (a measure of water clarity).
- Field probe measurements of dissolved oxygen concentration, water temperature, specific conductivity, and pH at 1-meter depth intervals.
- Composite water samples from the surface of Orchard Lake (0–2 meters); these samples were sent to a laboratory for analyses of total phosphorus and chlorophyll *a* (a measure of algal abundance) concentrations.
- Water samples from 3 meters to 8 meters, taken at 1-meter depth intervals; these samples were sent to a laboratory for analyses of total phosphorus concentrations.

Tabulated water quality data collected by Barr (Table 2) and the CAMP volunteer (Table 3) are attached at the end of this memorandum. The 2020 Barr and CAMP measurements of Secchi disc transparency, total phosphorus, and chlorophyll *a* are plotted in Figure 1. Measurements of SDT collected by Barr were very similar to the CAMP measurements throughout the season. Barr measurements of total phosphorus were higher compared to CAMP measurements for total phosphorus during early summer, while CAMP total phosphorus measurements were higher than Barr's measurements in late summer (Figure 1a). Barr and CAMP measurements of chlorophyll *a* were similar in early summer, but CAMP measurements were higher than Barr measurements in August-September (Figure 1b). The differences between Barr and CAMP measurements of total phosphorus and chlorophyll *a* are likely due to the different methods of water sample collection – Barr samples were collected as a composite of the top 2 meters (6.6 feet) of the lake, while CAMP samples are collected by dipping a sample bottle at the surface of the lake (i.e. elbow length below surface). Changes in lake temperature and predominant phytoplankton (i.e. algae) species during the growing season can result in changes in the depth at which nutrients and chlorophyll *a* are most concentrated near the lake surface. All parameters demonstrate better water quality in early-summer (June) compared to late-summer (August-September), which is typical for many Minnesota lakes.

3.0 Summer Averages of Water Quality Parameters and Associated Goals

The 2020 summer (June-September) averages of water quality parameters were calculated for Orchard Lake and plotted along with previous years' summer averages (Figure 2). The BDWMO classified Orchard Lake as a Category I water body (supporting swimming and other direct contact recreational activities). The water quality action level for summer average (June-September) Secchi disc transparency (SDT) for Orchard Lake was recalculated to be 2.3 meters (7.6 feet) for the most recent 10 years of monitoring (2011-2020). The summer average SDT in 2020 was 2.1 meters (6.9 feet), which is worse than the action level of 2.3 meters. There is also a statistically significant trend (95% confidence interval) of worsening water quality in summer average SDT for the most recent 10-year period. There were no statistically significant trends in summer averages of total phosphorus or chlorophyll *a*.

The MPCA's lake eutrophication standards include numeric criteria for summer averages (June-September) of Secchi disc transparency, total phosphorus, and chlorophyll *a*. Table 1 provides the eutrophication standards for a deep lake within the North Central Hardwood Forest ecoregion, along with the averages of the most recent 10 years (2011-2020) of monitoring for Orchard Lake. Summer averages of Orchard Lake water quality parameters are consistently much better than the MPCA's lake eutrophication standards. The BDWMO's *2012-2022 Watershed Management Plan* (Plan) lists recommended lake water quality management actions for strategic waterbodies under different scenarios of observed water quality. According to Table 4-1 of the BDWMO Plan, if Orchard Lake has summer average water quality worse than the Management Action Level, and a statistically significant 10-year trend of degrading water quality (i.e., SDT), the following actions are recommended: 1) comprehensive lake/watershed diagnostic-feasibility study; 2) intensive lake monitoring as part of diagnostic-feasibility study; and 3) detailed runoff water quality monitoring as part of diagnostic-feasibility study. Barr's recommendations for future activities on Orchard Lake are discussed at the end of this memorandum.

Table 1 Orchard Lake Water Quality and the MPCA's Lake Eutrophication Standards for Deep Lakes in North Central Hardwood Forest

Water Quality Parameter	MPCA Lake Eutrophication Standard	Orchard Lake 10-yr Average (2011-2020)
Total Phosphorus (µg/L)	≤ 40	22
Chlorophyll *a* (µg/L)	≤ 14	6.1
Secchi Disc Transparency (m)	≥ 1.4	2.5

4.0 Aquatic Macrophyte Surveys

The City of Lakeville continues its efforts to monitor and manage aquatic invasive species, including zebra mussels, and the invasive aquatic plant species curly-leaf pondweed and Eurasian watermilfoil. Zebra mussels have not been found in Orchard Lake, but Lakeville considers Orchard Lake at higher risk for infestation due to presence of zebra mussels in nearby Lake Marion. Curly-leaf pondweed and Eurasian watermilfoil are both present in Orchard Lake, and both plant species can form dense nuisance growth at the lake surface. Curly-leaf pondweed can also negatively impact water quality, as it grows and dies earlier in the season than native plants, releasing nutrients as it dies off in mid-summer.

The City of Lakeville's efforts to control curly-leaf pondweed in Orchard Lake include herbicide treatments and harvesting, starting in 2004. The reduction in the amount of curly-leaf pondweed may be one reason why water quality has been better in years 2008-2020 compared to years 2007 and earlier. The city's 2020 early season delineation of curly-leaf pondweed in Orchard Lake showed two areas totaling 9.5 acres that had potential for heavy growth – a 4.0-acre increase compared to 2019. The city treated these areas (9.5 acres) with an herbicide early in the 2020 growing season to reduce the curly-leaf pondweed where there was potential for heavy growth. The city's early season survey also showed 5 areas of heavy Eurasian watermilfoil growth; however, late season surveys showed these areas no longer had heavy growth, and treatment was not warranted. The City of Lakeville last conducted herbicide treatments for Eurasian watermilfoil in Orchard Lake in 2018.

5.0 Lake Levels

Lake elevation data have been collected on Orchard Lake regularly since 1992. The highest observed lake elevation was 977.75 feet above mean sea level on June 20, 2014, while the lowest observed was 975.84 feet on November 6, 2003, a difference of 1.9 feet. Lake elevations are plotted on Figure 3.

6.0 Fishery

The Minnesota Department of Natural Resources (DNR) reports fishery survey results on the DNR's Lake Finder web portal. The most recent fish survey conducted on Orchard Lake that is reported on the Lake Finder web portal was in 2016. Results of the most recent surveys are summarized below (note: this is the same information included in the report on the 2017 Orchard Lake monitoring):

- A nighttime electrofishing survey of Orchard Lake in 2016 that targeted largemouth bass found a relatively high abundance of largemouth bass compared to other lakes in the East Metro area.
- A 2012 DNR survey using trap nets and gill nets found a fishery dominated by small sunfish. Only 1 walleye was sampled in 2012, and northern pike abundance was reported as average. Crappie and yellow perch numbers were also reported as average.
- The lake is regularly stocked with walleye (most recently in 2015) and tiger muskellunge (most recently in 2016).

7.0 Orchard Lake Watershed Improvement Projects

The City of Lakeville conducted street reconstruction in the Orchard Lake watershed in 2020, and the project incorporated several water quality improvements, including rip rap shoreline stabilization along 175th Street West; replacement of degraded outfall structures; replacement of two equalizer culverts; and improvements in two stormwater ponds (source: 2020 Orchard Lake Update, City of Lakeville).

Other recent water quality improvements in the Orchard Lake watershed include an aeration device installed by the City of Lakeville in Orchard Pond, a wetland that contributes flow to Orchard Lake. The aeration system is designed to reduce phosphorus export from Orchard Pond and has operated for the past several open-water seasons.

8.0 Discussion of Orchard Lake Water Quality Results and Recommendations

Orchard Lake continues to experience good water quality. Summer averages of Secchi disc transparency, chlorophyll *a*, and total phosphorus have been consistently better than the MPCA's eutrophication standards for the period of 2008-2020. The 2020 summer-average Secchi disc transparency was worse than the BDWMO Plan "action level" (25th percentile of most recent 10-year summer averages). A statistical analysis shows a worsening trend (95% confidence) of summer averages of Secchi disc transparency for the recent 10-year period of 2011-2020. However, there were no statistically significant trends in either total phosphorus or chlorophyll *a*.

Secchi disc transparency measurements in lakes are affected by a number of factors, including suspended sediment, algae, and dissolved organic compounds (typically referred to as dissolved organic carbon) that originate from the decomposition of plants and algae. For most Minnesota lakes, turbidity from algae is the primary factor influencing water clarity. However, suspended sediments and dissolved organic carbon can also play a significant role in reducing water clarity in lakes. Dissolved organic carbon originates from decaying plant matter in the watershed (i.e. tree leaves, wetland plants), as well as algae and plants that grow in the lake, and at high enough concentrations can make the water look like tea, coffee, or root beer. Increased runoff from above average precipitation not only brings increased phosphorus and sediment loads, it can also increase the amount of dissolved organic carbon as more water is pushed out of wetlands in the watershed. The impact of dissolved organic carbon on Secchi disc transparency in Orchard Lake would be most pronounced during early summer (June), when algal turbidity is typically the lowest.

Secchi disc transparency was plotted separately for each calendar month (June, July, August, September) for the years 2011-2020 to see if trends in water clarity were more pronounced in any part of the growing season (Figure 4). All four months showed similar overall trends of decreasing water clarity for the 10-year period 2011-2020. Water clarity was typically highest in June and decreased each month until it reached the lowest water clarity in September. September 2020 had the worst Secchi disc transparency of any month in the period 2011-2020. There does not appear to be any part of the Orchard Lake summer growing season that has water clarity worsening more rapidly than other months. Although changes in dissolved organic carbon may account for some of the decline in Secchi disc transparency in Orchard Lake, there is not enough information available to make that assessment. In addition, if dissolved organic carbon were the primary reason for the worsening water clarity, we would expect to see a more substantial decrease in June water clarity readings compared to other months.

The BDWMO Plan includes recommended lake water quality management actions for strategic waterbodies under different scenarios of observed water quality. According to Table 4-1 of the Plan, if Orchard Lake has summer-average Secchi disc transparency worse than the updated "action level", and a statistically significant 10-yr trend of degrading water quality, the following actions are recommended: 1) comprehensive lake/watershed diagnostic-feasibility study; 2) intensive lake monitoring as part of diagnostic-feasibility study; and 3) detailed runoff water quality monitoring as part of diagnostic-feasibility study. The trend of degrading water quality is limited to Secchi disc transparency, as summer averages of total phosphorus and chlorophyll *a* do not show statistically significant trends of degrading water quality for the most recent 10-year period. Barr recommends continuation of the yearly CAMP level water quality monitoring of Orchard Lake, and continuation of the management-level water quality monitoring once every 3 years (year 2023). Barr does not recommend a comprehensive lake/watershed diagnostic-feasibility study, more intensive lake monitoring, or watershed monitoring at this time, as neither total phosphorus nor chlorophyll *a* show trends of degrading water quality for years 2011-2020.

Barr recommends the BDWMO consider additional monitoring parameters in 2023, including measurements of dissolved organic carbon, total suspended solids, and volatile suspended solids (the portion of total suspended solids that is organic). These additional parameters would help in understanding the reasons for the worsening Secchi disc transparency in Orchard Lake, considering total phosphorus and chlorophyll *a* do not show a trend of degrading water quality. Barr also recommends the BDWMO consider collecting samples from Orchard Lake in 2023 to analyze for phytoplankton species identification. The predominant phytoplankton types will shift over the summer season as lake temperature and other conditions change, often shifting from diatoms in spring and early-summer to cyanobacteria (i.e. blue-green algae) by late summer. Cyanobacteria have the ability to regulate their buoyancy and can concentrate at the lake surface; as a result, they may cause a larger decrease in water clarity than other phytoplankton types that are dispersed more evenly in the water column. Cyanobacteria can also produce toxins that can be harmful to people and animals. Cyanobacteria prefer warmer water temperatures, and there is a risk that cyanobacteria blooms will increase or occur earlier in the growing season as lake temperatures rise due to a warming climate.

Orchard Lake has a healthy community of native aquatic plants. The non-native plants curly-leaf pondweed and Eurasian watermilfoil are also present, but are kept in check by the City of Lakeville's continued management efforts – most recently targeted herbicide treatments of curly-leaf pondweed. Curly-leaf pondweed can negatively impact water quality when it releases phosphorus as it dies off in early to mid-summer. Barr recommends the City of Lakeville continue their efforts in monitoring aquatic vegetation, and targeted treatments of curly-leaf pondweed with herbicides, or other suitable methods for reducing curly-leaf pondweed. Although Eurasian watermilfoil does not die off early in summer and negatively affect water quality like curly-leaf pondweed, it can grow to nuisance levels, forming dense growth at the water surface that outcompetes native vegetation and impedes recreation activities. Barr recommends continued monitoring and targeted herbicide control of Eurasian watermilfoil to prevent it from becoming established and growing to nuisance levels in Orchard Lake.

Table 2
Orchard Lake 2020 Water Quality Measured by Barr Engineering
BDWMO

		Field Measurements						Laboratory Analyses	
Date	Sample Depth (m)	Dissolved oxygen [mg/l]	pH	Specific conductance @ 25 ºC [umhos/cm}	Water Temperature [℃]	Secchi disc [m]	Turbidity [NTU]	Chlorophyll a, pheophytin-adjusted [ug/l]	Phosphorus, total, as P [µg/l]
4/20/2020	0 - 2	--	--	--	--	**2.8**	**2.5**	**3.3**	**21**
4/20/2020	0	**12.0**	**7.9**	**787**	**7.8**	--	--	--	--
4/20/2020	1	**11.9**	**7.9**	**786**	**7.8**	--	--	--	--
4/20/2020	2	**11.9**	**8.0**	**786**	**7.8**	--	--	--	--
4/20/2020	3	**11.9**	**8.0**	**787**	**7.8**	--	--	--	**20**
4/20/2020	4	**11.9**	**8.0**	**786**	**7.7**	--	--	--	**18**
4/20/2020	5	**11.7**	**8.0**	**787**	**7.5**	--	--	--	**24**
4/20/2020	6	**11.7**	**8.0**	**786**	**7.4**	--	--	--	**23**
4/20/2020	7	**11.7**	**8.0**	**786**	**7.4**	--	--	--	**22**
4/20/2020	8	**11.6**	**8.0**	**785**	**7.4**	--	--	--	**25**
4/20/2020	8.5	**10.6**	**7.4**	**786**	**7.3**	--	--	--	**30**
5/18/2020	0 - 2	--	--	--	--	**2.1**	**2.8**	**< 1**	**15**
5/18/2020	0	**9.7**	**8.2**	**790**	**13.7**	--	--	--	--
5/18/2020	1	**9.6**	**8.2**	**789**	**13.7**	--	--	--	--
5/18/2020	2	**9.6**	**8.2**	**790**	**13.7**	--	--	--	--
5/18/2020	3	**9.6**	**8.2**	**789**	**13.7**	--	--	--	**20**
5/18/2020	4	**9.5**	**8.2**	**788**	**13.6**	--	--	--	**15**
5/18/2020	5	**9.6**	**8.2**	**786**	**13.6**	--	--	--	**17**
5/18/2020	6	**9.5**	**8.2**	**787**	**13.6**	--	--	--	**11**
5/18/2020	7	**9.5**	**8.2**	**788**	**13.6**	--	--	--	**19**
5/18/2020	8	**9.0**	**8.2**	**786**	**13.5**	--	--	--	**23**
6/02/2020	0 - 2	--	--	--	--	**2.4**	**2.5**	**3.6**	**22**
6/02/2020	0	**9.8**	**8.3**	**767**	**22.4**	--	--	--	--
6/02/2020	1	**9.8**	**8.3**	**767**	**22.3**	--	--	--	--
6/02/2020	2	**9.5**	**8.3**	**770**	**22.0**	--	--	--	--
6/02/2020	3	**9.4**	**8.3**	**770**	**21.5**	--	--	--	**24**
6/02/2020	4	**8.1**	**8.0**	**784**	**18.5**	--	--	--	**34**
6/02/2020	5	**6.0**	**7.7**	**789**	**15.3**	--	--	--	**24**
6/02/2020	6	**5.2**	**7.6**	**789**	**14.0**	--	--	--	**25**
6/02/2020	7	**3.8**	**7.5**	**790**	**13.7**	--	--	--	**19**
6/02/2020	8	**1.9**	**7.4**	**793**	**13.3**	--	--	--	**26**
6/02/2020	8.5	**0.9**	**7.3**	**795**	**13.2**	--	--	--	**20**
6/15/2020	0 - 2	--	--	--	--	**2.8**	**1.2**	**2.0**	**18**
6/15/2020	0	**8.8**	**8.3**	**760**	**20.8**	--	--	--	--
6/15/2020	1	**8.8**	**8.4**	**758**	**20.8**	--	--	--	--
6/15/2020	2	**8.7**	**8.5**	**758**	**20.8**	--	--	--	--
6/15/2020	3	**8.7**	**8.5**	**758**	**20.8**	--	--	--	**17**
6/15/2020	4	**8.7**	**8.5**	**756**	**20.8**	--	--	--	**15**
6/15/2020	5	**8.7**	**8.5**	**758**	**20.8**	--	--	--	**22**
6/15/2020	6	**2.3**	**7.8**	**790**	**15.4**	--	--	--	**45**
6/15/2020	7	**0.6**	**7.5**	**793**	**14.0**	--	--	--	**41**
6/15/2020	8	**0.4**	**7.5**	**802**	**13.3**	--	--	--	**30**
6/29/2020	0 - 2	--	--	--	--	**3.0**	**2.4**	**4.0**	**18**
6/29/2020	0	**8.5**	**8.5**	**704**	**24.5**	--	--	--	--
6/29/2020	1	**8.5**	**8.5**	**704**	**24.8**	--	--	--	--
6/29/2020	2	**8.6**	**8.6**	**705**	**24.8**	--	--	--	--
6/29/2020	3	**7.7**	**8.5**	**719**	**24.7**	--	--	--	**18**
6/29/2020	4	**2.2**	**7.7**	**756**	**21.6**	--	--	--	**15**
6/29/2020	5	**0.5**	**7.5**	**781**	**19.5**	--	--	--	**18**
6/29/2020	6	**0.4**	**7.5**	**805**	**14.2**	--	--	--	**41**
6/29/2020	7	**0.3**	**7.5**	**819**	**13.5**	--	--	--	**38**
6/29/2020	8	**0.3**	**7.3**	**820**	**13.4**	--	--	--	**72**
7/13/2020	0 - 2	--	--	--	--	**2.1**	**3.8**	**6.7**	**28**
7/13/2020	0	**9.0**	**8.7**	**668**	**27.4**	--	--	--	--
7/13/2020	1	**9.0**	**8.7**	**668**	**27.5**	--	--	--	--
7/13/2020	2	**9.0**	**8.8**	**667**	**27.5**	--	--	--	--
7/13/2020	3	**9.0**	**8.9**	**668**	**27.5**	--	--	--	**22**
7/13/2020	4	**2.9**	**7.9**	**640**	**25.3**	--	--	--	**32**
7/13/2020	5	**0.4**	**7.7**	**666**	**22.1**	--	--	--	**95**
7/13/2020	6	**0.3**	**7.7**	**784**	**18.6**	--	--	--	**44**
7/13/2020	7	**0.2**	**7.7**	**805**	**15.7**	--	--	--	**40**
7/13/2020	8	**0.2**	**7.7**	**833**	**13.4**	--	--	--	**130**

Table 2
Orchard Lake 2020 Water Quality Measured by Barr Engineering
BDWMO

Date	Sample Depth (m)	Field Measurements						Laboratory Analyses	
		Dissolved oxygen [mg/l]	pH	Specific conductance @ 25 ºC [umhos/cm}	Water Temperature [℃]	Secchi disc [m]	Turbidity [NTU]	Chlorophyll a, pheophytin-adjusted [ug/l]	Phosphorus, total, as P [µg/l]
7/27/2020	0 - 2	--	--	--	--	**1.8**	**3.3**	**3.1**	**24**
7/27/2020	0	**7.7**	**8.3**	**665**	**25.9**	--	--	--	--
7/27/2020	1	**7.6**	**8.3**	**666**	**25.9**	--	--	--	--
7/27/2020	2	**7.6**	**8.4**	**664**	**25.9**	--	--	--	--
7/27/2020	3	**7.6**	**8.4**	**664**	**25.9**	--	--	--	**22**
7/27/2020	4	**7.4**	**8.4**	**664**	**25.8**	--	--	--	**21**
7/27/2020	5	**0.3**	**7.4**	**686**	**23.4**	--	--	--	**58**
7/27/2020	6	**0.3**	**7.2**	**779**	**18.8**	--	--	--	**42**
7/27/2020	7	**0.3**	**7.3**	**818**	**15.7**	--	--	--	**45**
7/27/2020	8	**0.3**	**7.3**	**840**	**13.9**	--	--	--	**190**
7/27/2020	8.5	**0.2**	**7.2**	**860**	**13.0**	--	--	--	**310**
8/10/2020	0 - 2	--	--	--	--	**1.6**	**4.0**	**7.3**	**27**
8/10/2020	0	**7.5**	**8.2**	**668**	**24.5**	--	--	--	--
8/10/2020	1	**7.4**	**8.2**	**668**	**24.5**	--	--	--	--
8/10/2020	2	**7.4**	**8.3**	**667**	**24.5**	--	--	--	--
8/10/2020	3	**7.4**	**8.3**	**668**	**24.5**	--	--	--	**28**
8/10/2020	4	**7.4**	**8.3**	**667**	**24.4**	--	--	--	**28**
8/10/2020	5	**3.8**	**7.8**	**683**	**23.8**	--	--	--	**31**
8/10/2020	6	**0.3**	**7.3**	**768**	**20.1**	--	--	--	**54**
8/10/2020	7	**0.3**	**7.3**	**830**	**16.0**	--	--	--	**68**
8/10/2020	8	**0.3**	**7.3**	**841**	**14.8**	--	--	--	**190**
8/26/2020	0 - 2	--	--	--	--	**1.7**	**4.3**	**4.3**	**24**
8/26/2020	0	**8.4**	**8.4**	**668**	**26.4**	--	--	--	--
8/26/2020	1	**8.5**	**8.5**	**668**	**26.4**	--	--	--	--
8/26/2020	2	**8.5**	**8.5**	**667**	**26.4**	--	--	--	--
8/26/2020	3	**8.5**	**8.2**	**672**	**25.5**	--	--	--	**23**
8/26/2020	4	**2.7**	**7.6**	**673**	**24.4**	--	--	--	**26**
8/26/2020	5	**0.4**	**7.3**	**688**	**23.1**	--	--	--	**36**
8/26/2020	6	**0.3**	**7.2**	**756**	**20.2**	--	--	--	**41**
8/26/2020	7	**0.2**	**7.2**	**821**	**16.9**	--	--	--	**69**
8/26/2020	8	**0.2**	**7.1**	**862**	**14.6**	--	--	--	**96**
9/10/2020	0 - 2	--	--	--	--	**1.5**	**5.0**	**4.3**	**28**
9/10/2020	0	**6.2**	**7.3**	**678**	**17.6**	--	--	--	--
9/10/2020	1	**5.8**	**7.4**	**678**	**17.6**	--	--	--	--
9/10/2020	2	**5.8**	**7.5**	**678**	**17.6**	--	--	--	--
9/10/2020	3	**5.7**	**7.6**	**678**	**17.6**	--	--	--	**29**
9/10/2020	4	**5.7**	**7.7**	**678**	**17.6**	--	--	--	**26**
9/10/2020	5	**5.7**	**7.7**	**677**	**17.6**	--	--	--	**26**
9/10/2020	6	**5.6**	**7.7**	**677**	**17.5**	--	--	--	**26**
9/10/2020	7	**4.2**	**7.6**	**695**	**17.1**	--	--	--	**36**
9/10/2020	8	**0.5**	**7.3**	**846**	**15.8**	--	--	--	**140**
9/21/2020	0 - 2	--	--	--	--	**1.5**	**7.3**	**4.3**	**28**
9/21/2020	1	**8.4**	**7.7**	**691**	**16.8**	--	--	--	--
9/21/2020	2	**8.4**	**7.8**	**691**	**16.8**	--	--	--	--
9/21/2020	3	**8.3**	**7.8**	**691**	**16.8**	--	--	--	**29**
9/21/2020	4	**8.3**	**7.8**	**691**	**16.8**	--	--	--	**26**
9/21/2020	5	**8.2**	**7.9**	**692**	**16.8**	--	--	--	**26**
9/21/2020	6	**8.2**	**7.8**	**692**	**16.8**	--	--	--	**26**
9/21/2020	7	**8.3**	**7.8**	**692**	**16.8**	--	--	--	**36**
9/21/2020	8	**8.1**	**7.8**	**693**	**16.7**	--	--	--	**140**

Notes

-- Not analyzed

< 1 Less than method detection limit

Table 3: Orchard Lake 2020 Water Quality Measured by CAMP Volunteer

Sample Date	Sample Depth [m]	Secchi Disc Transparency [m]	Water Temperature [°C]	Chlorophyll-a, Pheophytin Corrected [µg/L]	Nitrogen, Total Kjeldahl [mg/L]	Total Phosphorus [ug/L]
5/30/2020	0	1.9	20.0	4.0	0.65	14
6/11/2020	0	2.8	--	2.2	0.58	12
6/26/2020	0	3.4	24.8	1.6	0.62	~9
7/8/2020	0	2.8	29.4	3.6	0.44	16
7/24/2020	0	1.8	25.7	6.9	0.72	29
8/7/2020	0	1.5	24.9	11	1.00	30
8/20/2020	0	1.9	24.7	9.8	0.94	33
9/4/2020	0	1.1	21.7	<1	0.68	34
9/20/2020	0	1.9	17.4	9.5	0.90	34
10/3/2020	0	2.0	14.9	8.9	0.84	22
10/17/2020	0	3.0	11.5	5.9	0.69	26

Notes

~9 - Value is less than the laboratory's method reporting limit, and is therefore an approximate value.

-- Not measured.

< 1 Less than method detection limit.

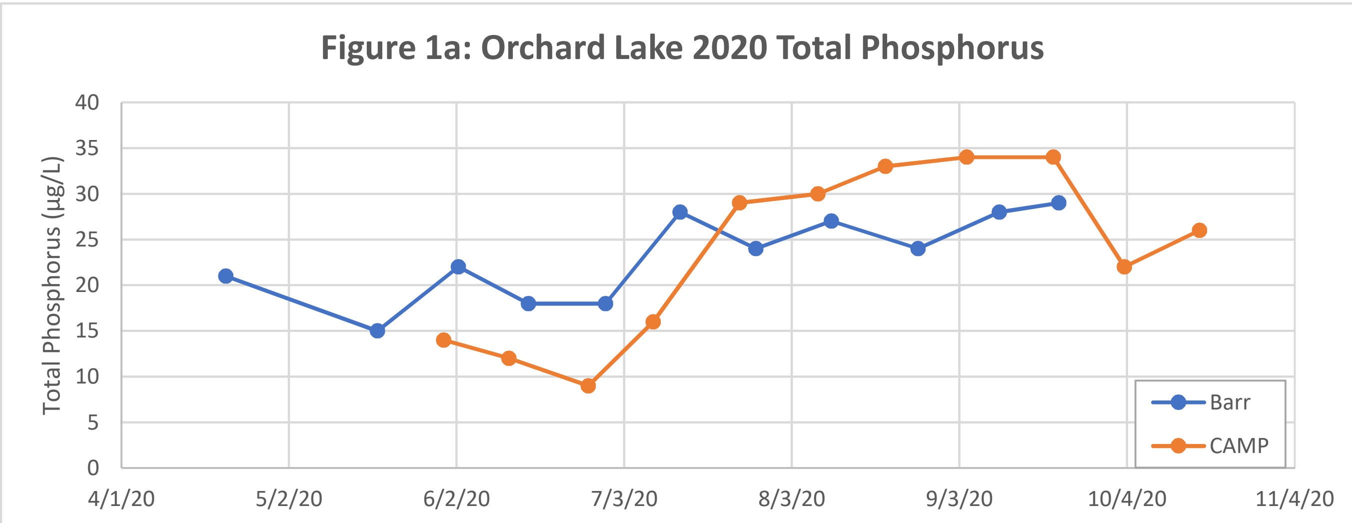


Figure 1a: Orchard Lake 2020 Total Phosphorus
Total Phosphorus (µg/L)
40
35
30
25
20
15
10
5
0
4/1/20
5/2/20
6/2/20
7/3/20
8/3/20
9/3/20
10/4/20
11/4/20
Barr
CAMP

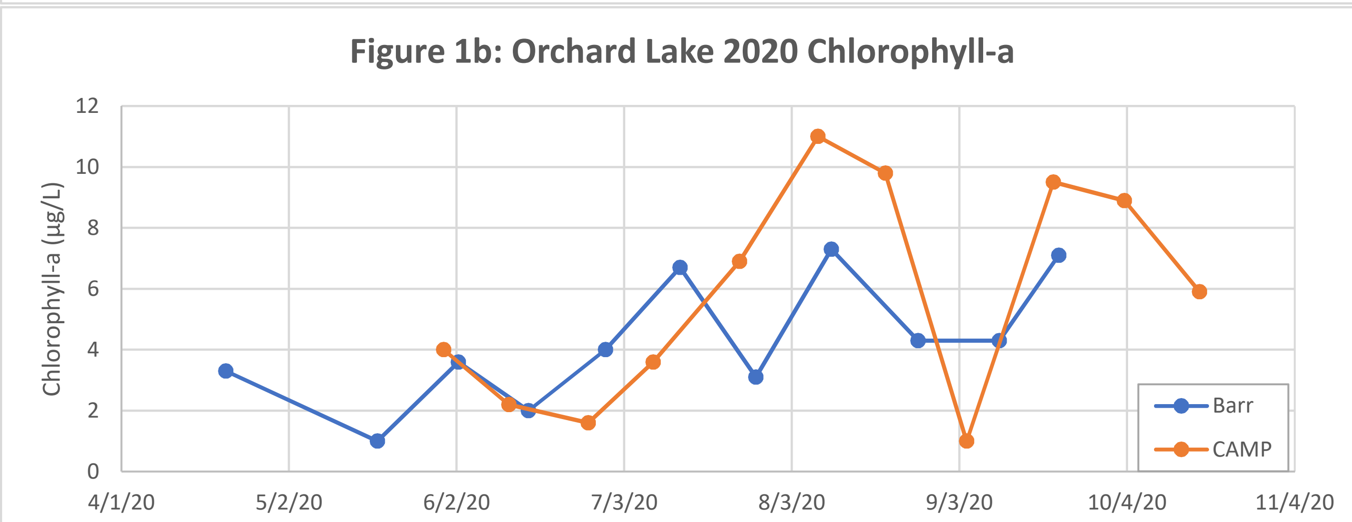


Figure 1b: Orchard Lake 2020 Chlorophyll-a
Chlorophyll-a (µg/L)
12
10
8
6
4
2
0
4/1/20
5/2/20
6/2/20
7/3/20
8/3/20
9/3/20
10/4/20
11/4/20
Barr
CAMP

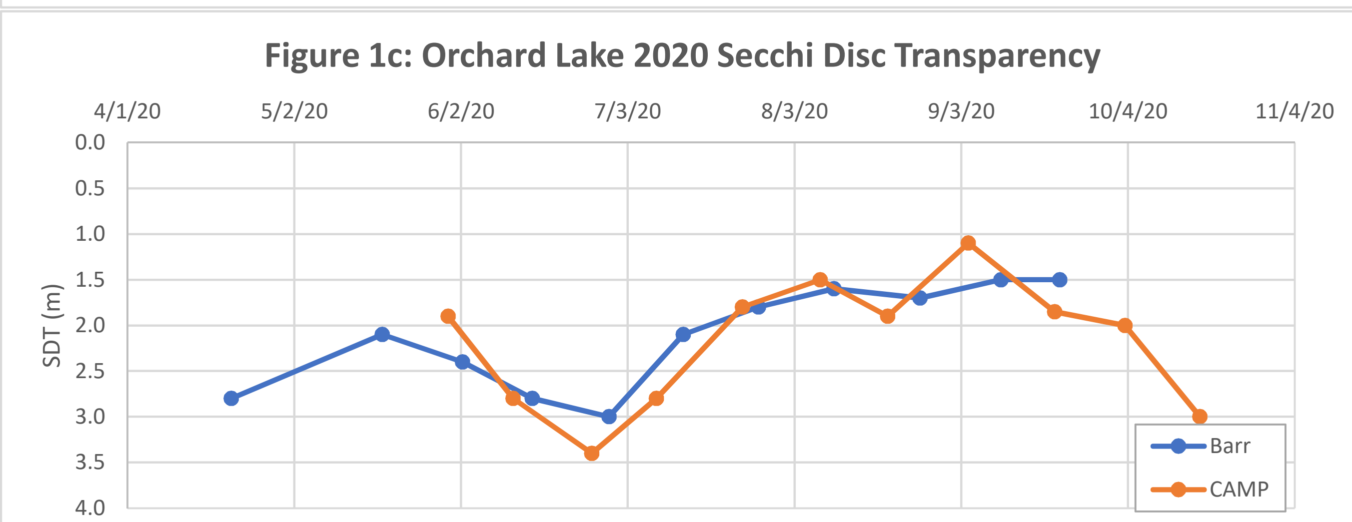


Figure 1c: Orchard Lake 2020 Secchi Disc Transparency
SDT (m)
4/1/20
5/2/20
6/2/20
7/3/20
8/3/20
9/3/20
10/4/20
11/4/20
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Barr
CAMP

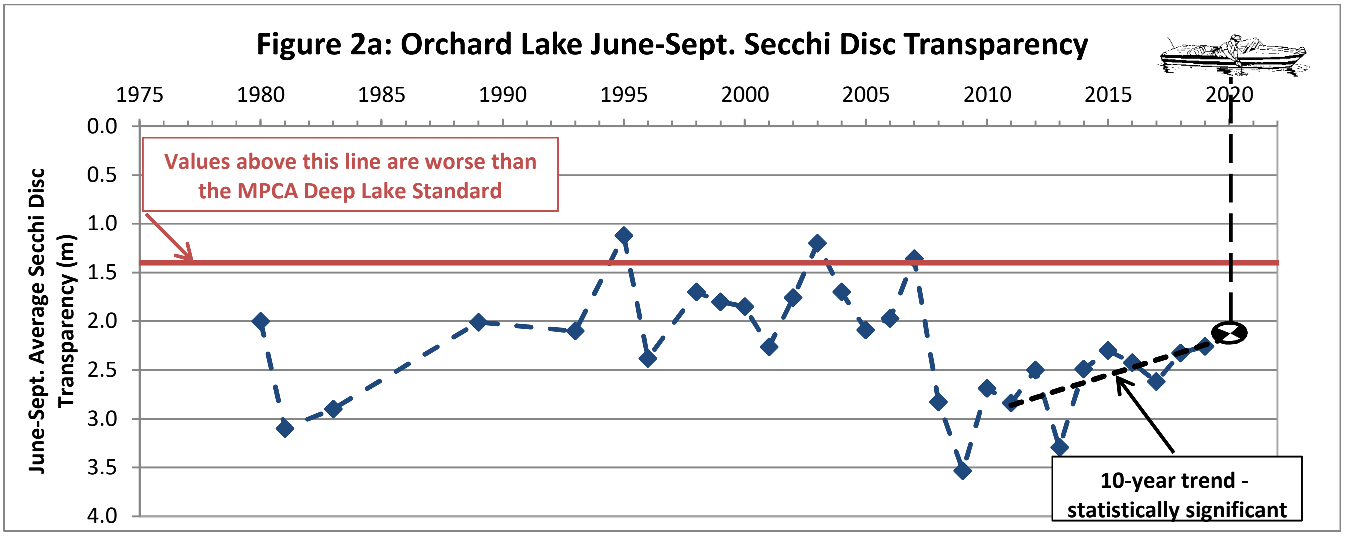


Figure 2a: Orchard Lake June-Sept. Secchi Disc Transparency
June-Sept. Average Secchi Disc Transparency (m)
Values above this line are worse than the MPCA Deep Lake Standard
10-year trend - statistically significant
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

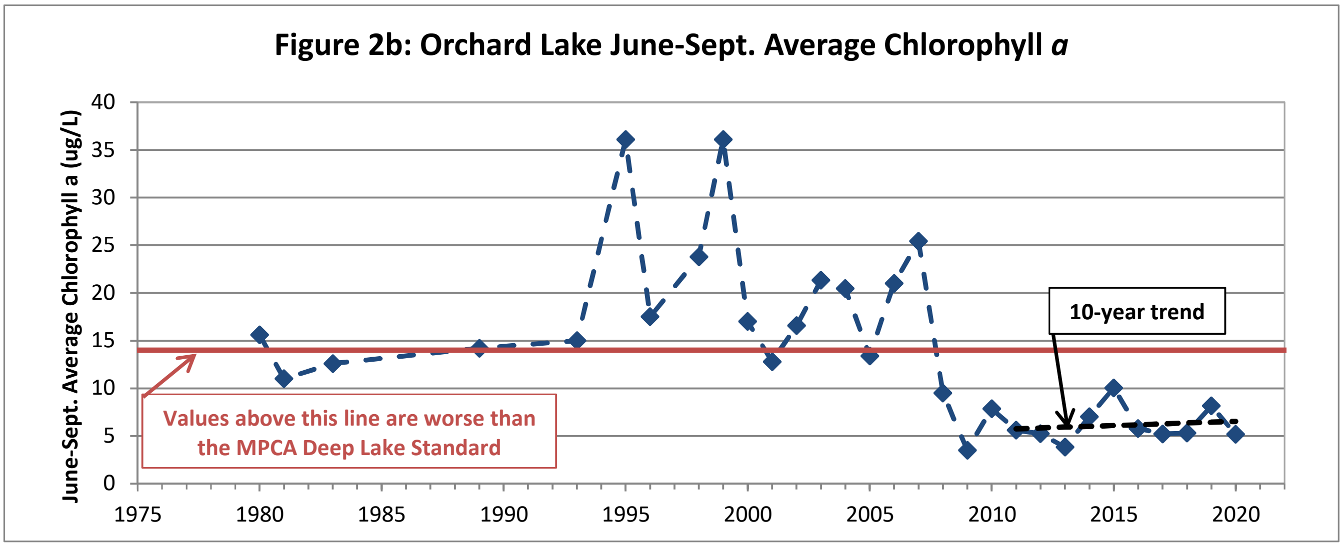


Figure 2b: Orchard Lake June-Sept. Average Chlorophyll *a*
June-Sept. Average Chlorophyll a (ug/L)
10-year trend
Values above this line are worse than the MPCA Deep Lake Standard
0
5
10
15
20
25
30
35
40
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

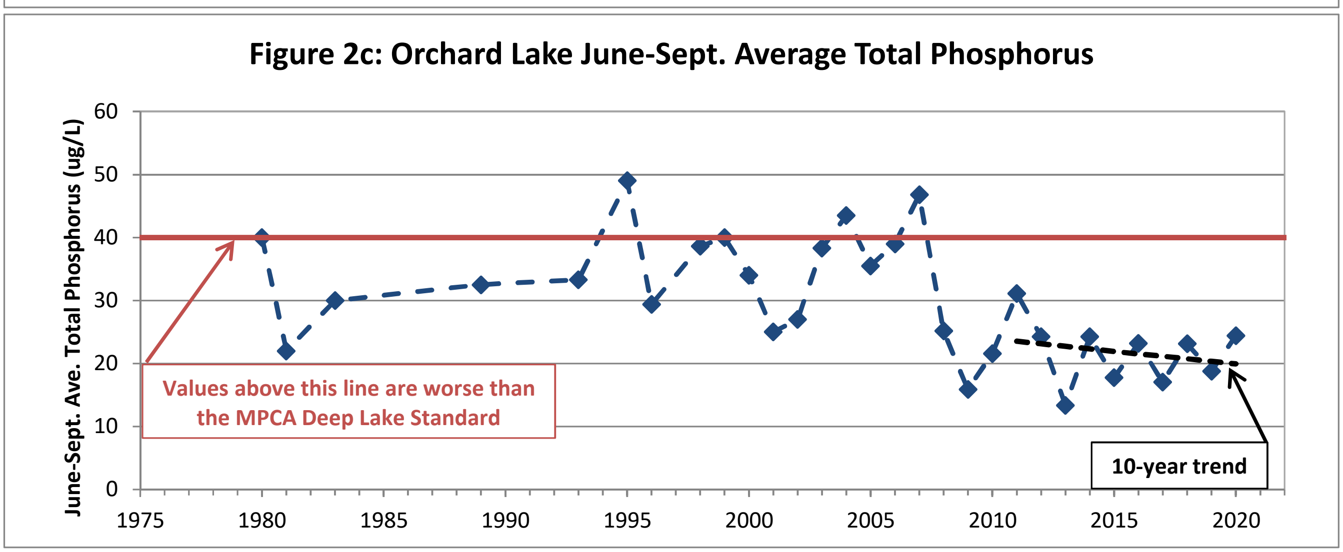
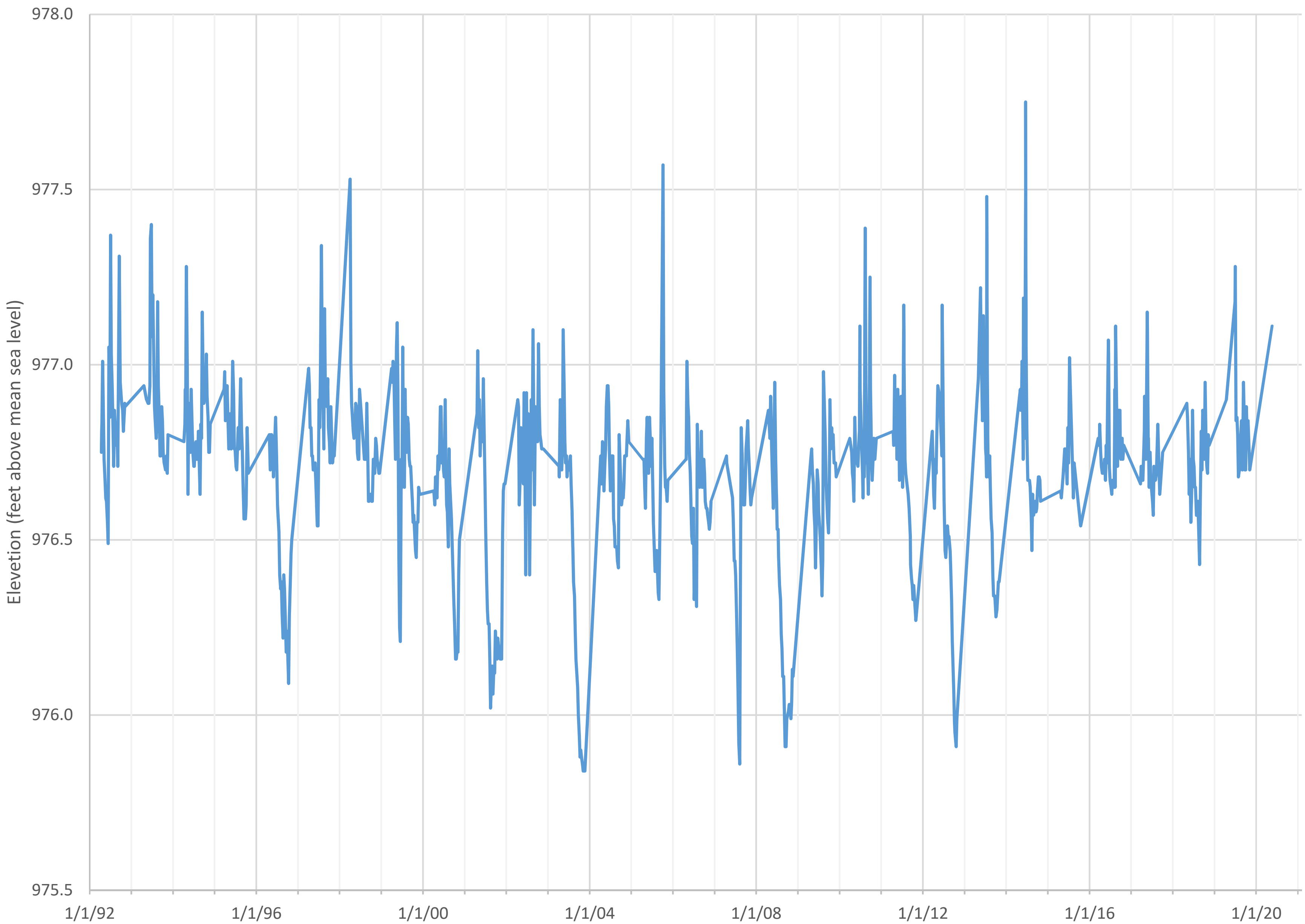


Figure 2c: Orchard Lake June-Sept. Average Total Phosphorus
June-Sept. Ave. Total Phosphorus (ug/L)
Values above this line are worse than the MPCA Deep Lake Standard
10-year trend
0
10
20
30
40
50
60
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

Figure 3: Orchard Lake Water Surface Elevation.



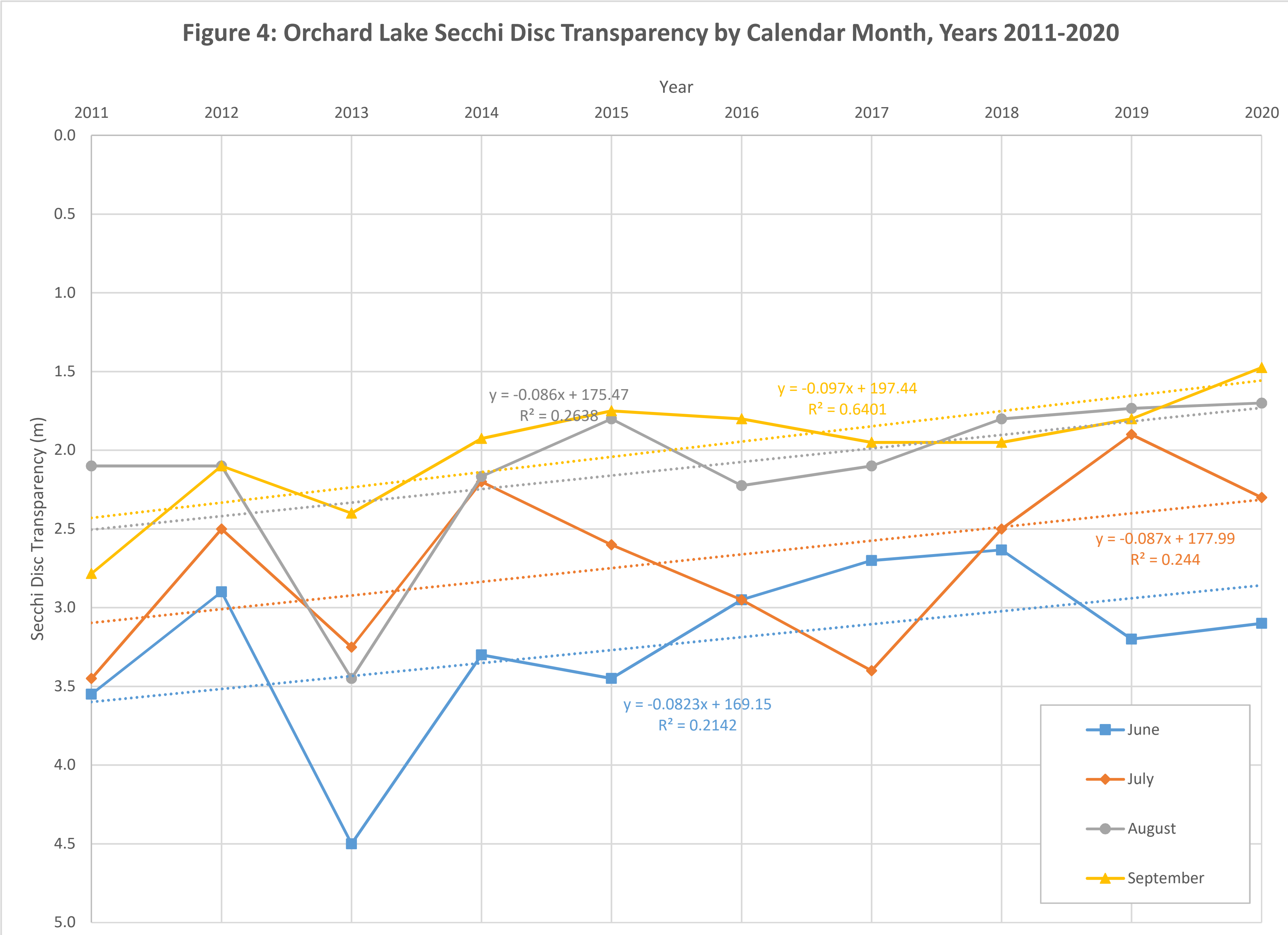


Figure 4: Orchard Lake Secchi Disc Transparency by Calendar Month, Years 2011-2020
Year
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Secchi Disc Transparency (m)
y = -0.086x + 175.47
R² = 0.2638
y = -0.097x + 197.44
R² = 0.6401
y = -0.087x + 177.99
R² = 0.244
y = -0.0823x + 169.15
R² = 0.2142
June
July
August
September

Technical Memorandum

To: Commissioners, Black Dog Watershed Management Organization (BDWMO)
From: Barr Engineering Co.
Subject: 2020 Keller Lake Habitat Monitoring
Date: March 10, 2021
Project: 23190457

This memorandum presents the results of the BDWMO's 2020 habitat monitoring of Keller Lake.

1.0 Introduction and Background to the BDWMO Habitat Monitoring Program

The BDWMO lies south of the Minnesota River in the northwest portion of Dakota County. **Figure 1** shows the subwatersheds to the BDWMO's strategic water bodies. From 2003-2009 Barr staff annually evaluated the habitat quality of all of the strategic water bodies. Beginning in 2011, the BDWMO revised the program to monitor the habitat quality at one strategic water body per year, such that the BDWMO monitors all five strategic water bodies over a five-year cycle. The 2011 through 2015 reports provided a new baseline for the strategic water bodies. The lakes and their monitoring dates are listed below:

1. Kingsley Lake: 2011 and 2016
2. Orchard Lake: 2012 and 2017
3. Crystal Lake: 2013 and 2018
4. Lac Lavon: 2014 and 2019
5. **Keller Lake: 2015 and 2020**

This report provides the results of the Keller Lake 2020 habitat monitoring.

Habitat quality was evaluated within three vegetation zones:

- Submergent zone refers to the areas of the water body where water depths are typically 2 to 20 feet and the vegetation is typically submerged or has floating leaves.
- Emergent zone typically refers to the areas of the water body where water depths are less than 2 feet and vegetation grows out of the water.
- Upland buffer is characterized as the upland area immediately surrounding the water body.

Wildlife habitat characteristics were evaluated based on diversity of native plant communities present within each vegetation zone and an assessment of wetland functions and values. The lake was also evaluated for sedimentation and shoreline erosion problems. **Table 1** shows the 2015 and 2020 habitat quality ratings for Keller Lake. **Table 2** provides a summary of identified problems, recommended management activities, and past actions. Section 3.2 of this memorandum describes nine recommendations which include:

1. Continuing efforts to control curly-leaf pondweed and Eurasian watermilfoil and increase native aquatic plant diversity.
2. Re-vegetate bare areas to prevent soil erosion into Keller Lake.
3. Organize a neighborhood clean-up project to pick up trash.
4. Continue to control and manage non-native invasive vegetation along the shoreline including buckthorn, spotted knapweed, and garlic mustard.
5. Improve the residential shorelines by creating a wider naturalized emergent zone and upland buffer.
6. Adjust mowing distance further away from the shoreline in Apple Valley's Keller Park.
7. Organize, initiate, and create a prairie restoration project in Lac Lavon Park south of Keller Lake.
8. Install a pre-treatment system such as a rain garden or sediment trap to collect sediment from the Lac Lavon Park parking lot.
9. Eradicate the Japanese hedge parsley located along the edge of the paved path near the storm pond north of Keller Lake.

Additional detail describing the habitat assessment is provided in the technical reference section following this memorandum, which includes

- Keller Lake aquatic plant survey results, assessments, and transplanting activities (**Appendix A**),
- floristic quality assessment data and methods (**Appendix B**),
- previous habitat assessment monitoring results from 2003 through 2019 (**Appendix C**),
- previous recommended and completed management actions from 2003 through 2019 (**Appendix D**),
- 2015 Keller Lake Minnesota Routine Assessment Method (MNRAM 3.4) wetland functional assessment results (**Appendix E**),
- descriptions of the MNRAM wetland functions (**Appendix F**),
- examples of shoreline and buffer restoration projects (**Appendix G**),
- buckthorn management guidelines (**Appendix H**), and
- example pollinator brochure (**Appendix I**).

2.0 Keller Lake Habitat Monitoring

Keller Lake is a 52-acre lake within the cities of Burnsville and Apple Valley in the southern portion of the BDWMO. Keller Lake has an average depth of 4.8 feet and a maximum depth of about 8 feet. Because the lake is so shallow, aquatic plants can grow over the entire lake bed and a summer thermocline is not usually present. Keller Lake discharges to the northeast side of Crystal Lake.

The Keller Lake watershed is 1,447 acres (including the lake surface area). The existing watershed is fully-developed. Land use is low density residential and park. The lake is used primarily for fishing, canoeing, and wildlife viewing by the local residents. There is no public beach or boat access. Only non-motorized watercraft and electric trolling motors are allowed on the lake. Three city parks are located on Keller Lake:

- Lac Lavon Park, in the city of Burnsville and located along Keller Lake's southern shoreline, has paved and non-paved trails used primarily for walking, running, and biking, which also provide shoreline fishing access. Farther from the shoreline, the paved trail leads to a horseshoe pit, volleyball net, children's playground, and picnic shelter.
- Keller Park, in the City of Apple Valley and located along the southeast shoreline includes a children's playground.
- Keller Lake Park, in the City of Burnsville and located at the north end of the lake includes a children's playground and a paved trail around a stormwater pond.

The City of Burnsville property on the northern shoreline is forested with no public access to the lake.

Figure 2 shows the 2020 aerial imagery of Keller Lake.

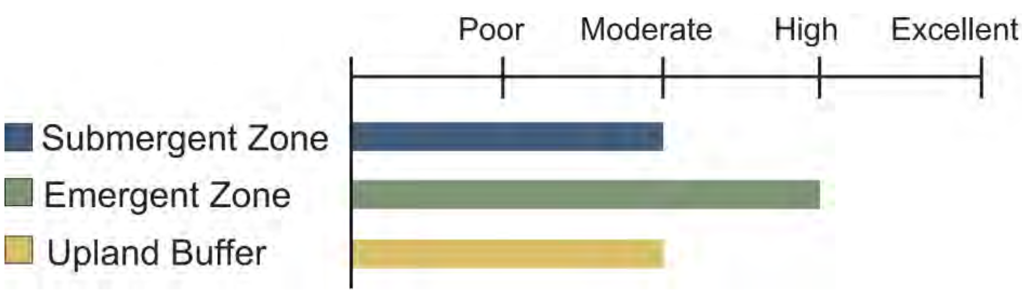
2.1 Keller Lake 2020 Habitat Monitoring Results

Habitat monitoring for Keller Lake was conducted from 2003 through 2009, in 2015, and in 2020. The 2020 field monitoring of Keller Lake was performed on April 16, July 29, and August 17, 2020. Vegetation data were collected in, within, and along the fringe of Keller Lake's three vegetation zones:
(1) submergent, (2) emergent, and (3) upland.

The 2020 Keller Lake monitoring included transect, plot, and meandering surveys. Plot locations were designated in 2003 based on representative characteristics for each vegetation zone. Returning to the same plot locations allows for consistent comparisons over time. In addition, the 2011 revised program provides evaluation and documentation of vegetation zones along the entire shoreline. Photographs were taken to document conditions and are included at the end of this memorandum. Analysis and reporting of the monitoring data includes a floristic quality assessment and a four-tiered rating system (poor, moderate, high, and excellent). The current rating system is detailed in footnotes on **Table 1**. Private versus public ownership was identified along the entire shoreline. The survey results, along with parcel data, were used to identify possible locations for restoration and preservation.

On April 16 and July 29, 2020, Blue Water Science staff conducted aquatic vegetation surveys within the submergent zone (**Appendix A**). On August 17, 2020, Barr staff conducted emergent vegetation and upland buffer zone surveys by walking along the shoreline. In addition, the discrete plots (shown in **Figure 2**) were monitored in the emergent zone and upland buffer, as done in 2003-2009 and 2015. **Figure 3** shows the shoreline parcels identifying private versus public ownership. An overall quality rating for each vegetation zone was computed using the field variables evaluated in each zone. **Table 1** shows the 2015 and 2020 habitat quality ratings for Keller Lake and **Table 2** shows the recommended management action items. (Note: previous monitoring reports provide the sampling methodology for monitoring conducted before 2011.)

The following schematic diagram shows the overall ratings in 2020 for each vegetation zone within and adjacent to Keller Lake:



2.1.1 Keller Lake Overall Vegetation Zone Ratings

Table 1 shows the 2015 and 2020 Keller Lake habitat monitoring results. Appendix C provides habitat ratings for the Keller Lake monitoring conducted prior to 2011.

Submergent Zone

The total number of native species in the submergent zone is **poor** (2), the average native plant density rating is **excellent** (1.2), the average exotic species density is rated **moderate** (1.8) and the Mean Coefficient of Conservatism Value (C-Value) Rating is **poor** (1.5). Averaging these four criteria results in a **moderate** rating overall for the submergent zone of Keller Lake. This is improved from the overall rating in 2015.

Curly-leaf pondweed (*Potamogeton crispus*) is a dominant species found every year within Keller Lake. In April, curly-leaf pondweed was present at 43 percent of sample points. In July, after treatment of curly-leaf pondweed, no plants were observed. This invasive plant often out-competes native vegetation early in the growing season and dies off in early to mid-summer, which creates a sudden loss of habitat and releases nutrients into the water that can produce algal blooms and create turbid water conditions. A curly-leaf pondweed turion survey was also conducted on October 14, 2020, which indicates the potential for continued growth of curly-leaf pondweed and the need for long term control of this species.

Eurasian watermilfoil (*Myriophyllum spicatum*) was also found in Keller Lake in 2020 and in previous years. In April 2020, Eurasian watermilfoil was present at 14 percent of the sites and at 19 percent of sample sites in July. Eurasian watermilfoil has fast growing stems and often branches out and covers the water surface, which impedes boating, makes water recreation difficult, and often shades out slower-growing native plants.

The two native species present in the submergent zone were coontail (*Ceratophyllum demersum*) and elodea (*Elodea canadensis*). These native plants typically are not shaded out by Eurasian watermilfoil.

The Mean C-Value Rating was added to the analysis in 2011 to provide an additional assessment of floristic quality. The C-value is a numerical rating of an individual species' conservatism and habitat fidelity in relation to disturbance. C-values range from 0 to 10. Species that are least conservative, or show the least fidelity to specific natural habitats are often opportunistic invaders of natural communities, or are native species typical of disturbed communities, and are assigned a low value. For example, coontail (*Ceratophyllum demersum*) has a C-value of 2 and curly-leaf pondweed has a C-value of 0. High values indicate the species is found in undisturbed communities and has a narrow range of ecological tolerances. For example, leafy pondweed (*Potamogeton pusillus*) and large-leaved pondweed (*Potamogeton amplifolius*) have C-values of 7. The mean C-value for vegetation found in the submergent zone of Keller Lake in 2020 was 1.5. For purposes of this habitat assessment, the mean C-value and the number of species are given separate ratings, and are averaged along with the density ratings to provide an overall rating for the submergent zone. The ratings used in this assessment are based on Minnesota Pollution Control Agency (MPCA) C-value guidelines (Floristic Quality Assessment for Minnesota Wetlands, MPCA, May 2007, https://www.pca.state.mn.us/water/floristic-quality-assessment-evaluating-wetland-vegetation).

In December of 2012, the MPCA published the Rapid Floristic Quality Assessment (Rapid FQA) Method, which is another method that can be used to evaluate and rate vegetation quality. The FQA method also uses the C-value, and the rating is weighted based on percent coverage and percent of each community type. However, the Rapid FQA method uses only select species in the rating. This means that many of the species found during a plant survey will not be included in the rating calculation. Because of this significant drawback, we do not recommend changing the BDWMO's assessment method to use the Rapid FQA. For information purposes only, we calculated the Rapid FQA for Keller Lake in 2020; the results are provided in **Appendix B.**

The mean C-value was rated as **poor**, and the Rapid Floristic Quality Assessment rating was **fair** for floristic quality in the submergent zone.

Another method for assessing vegetation quality is the Floristic Quality Index (FQI). The Minnesota Department of Natural Resources (MNDNR) uses the FQI, along with the number of plant species to calculate the plant eutrophication index of biological integrity (IBI). Currently, the MPCA uses this IBI as supporting information in assessing the lake fish IBI. However, it is expected that the MPCA will use this IBI in the future to evaluate whether a lake is impaired. The number of plant species must be at least 11 and the FQI must be at least 17.8 to meet the IBI standard. The FQI is calculated by multiplying the mean C-value by the square root of the number of species; the FQI for Keller Lake is 3.0 (see **Appendix B** for more details).

Also in 2020, the University of Minnesota conducted a seedbank assessment, which germinated nine aquatic plant species, eight of which are native species, from sediment cores within Keller Lake. In addition, a reintroduction program began in 2020, which included transplanting four species of native aquatic plants harvested from a nearby lake. The plants were transplanted into ten fenced plots and monitored from June-October 2020. **Appendix A** provides reports with more details of 2020 aquatic plant species monitoring, assessments, and transplanting activities.

Emergent Zone

The overall emergent vegetation zone quality is rated **high** for Keller Lake; this is the same as the overall 2015 rating. The emergent zone includes 36 native wetland plant species resulting in an **excellent** rating and percent cover of exotic species (26-50%), which is a **high** rating. The approximate percent cover of vegetation (51-75%) is a **high** rating. The emergent zone represents ten percent total areal coverage. The mean C-value rating is **poor** (2.4) and the Rapid Floristic Quality assessment calculations are rated as **poor** for the shallow marsh and floodplain forest communities resulting in an overall **fair** condition (**Appendix B**).

Non-native species, such as hybrid cattail (*Typha glauca*) and narrowleaf cattail (*Typha angustifolia*), dominate the vegetated emergent zone. The predominance of non-native species within the emergent zone limits the wildlife values in this zone of the water body. However, the presence of non-native cattail has a greater wildlife value when compared to an emergent zone void of vegetation. Also, the non-native cattail provides other functions similar to native emergent vegetation. Purple loosestrife (*Lythrum salicaria*), another non-native invasive plant species, is present along the shoreline (**Appendix B**). Purple loosestrife has been managed for years through the release of beetles, which eat the purple loosestrife plants. This management strategy has been relatively successful within the Twin Cities metropolitan area. The MNDNR's monitoring of the purple loosestrife beetles indicates that populations are sufficient within the Twin Cities metropolitan area to keep purple loosestrife from becoming a significant problem.

Native species present in the shallow marsh portions of the emergent zone including broom sedge (*Carex scoparia*), uptight sedge (*Carex stricta*), jewelweed (*Impatiens capensis*), water smartweed (*Persicaria amphibia*), woolgrass (*Scirpus cyperinus*), harlequin blueflag (*Iris versicolor*), and fowl bluegrass (*Poa palustris*) provide habitat and food sources for wildlife. Painted turtles were observed sunning on a log. A great blue heron, bald eagle, and monarch butterflies were also present in the area. The shallow marsh wetland areas within Keller Lake's emergent zone may provide habitat for the state threatened Blanding's turtle (*Emydoidea blandingii*). Native species such as silver maple (*Acer saccharinum*), elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), sandbar willow (*Salix interior*), rice cut grass (*Leersia oryzoides*), northern bugleweed (*Lycopus uniflorus*) and sensitive fern (*Onoclea sensibilis*) are present in the floodplain forest wetland areas along the southern shoreline of Keller Lake.

Upland Buffer

The overall upland buffer quality is rated **moderate** for Keller Lake. A total of 42 native species and 29 exotic plant species were observed in the upland buffer area in 2020. Exotic plants make up greater than 40 percent of the vegetative cover. The mean C-value rating (1.8) in the upland buffer is poor (**Appendix B**). The majority of residential properties have a narrow width of naturalized vegetation along the shoreline, which helps provide some water quality protection and erosion prevention but the buffer width is too narrow to provide significant wildlife habitat protection.

Dominant non-native invasive species within Keller Lake's upland buffer areas include common buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolata*), and spotted knapweed (*Centaurea stoebe*). Continued control of these species is recommended. Japanese hedge parsley (*Torilis japonica*) was found in 2020 along the edge of the path near the storm pond north of Keller Lake. This is a non-native invasive species that has recently been introduced in Minnesota. Early detection and control will prevent infestations.

Native trees within the forested upland buffer areas include white oak (*Quercus alba*), red oak (*Quercus rubra*), white cedar (*Thuja occidentalis*), basswood (*Tilia americana*), white pine (*Pinus strobus*), quaking aspen (*Populus tremuloides*), and cottonwood (*Populus deltoides*).

No significant erosion or sedimentation problems were noted within the lake or on the shoreline, but some areas with direct stormwater drainage from impervious surfaces into wetland and bare soil areas could be improved.

Buffer width recommendations vary according to the intended goal, such as bank stabilization, water quality protection (e.g., sediment and nutrient removal), and wildlife habitat. Even within these categories, an adequate buffer width can depend on shoreline slopes, species of wildlife to be protected, and publicized study results. For this report, the Keller Lake shoreline buffers were evaluated against the following buffer width criteria:

- 50-foot average buffer width to protect water quality and prevent erosion

- 25-foot average buffer width (i.e., 50% of the recommended buffer width) to identify areas providing some level of benefit
- 100-foot average buffer width to protect wildlife habitat

The shoreline property ownership around Keller Lake is about evenly split between residential and public (city) ownership.

For Keller Lake residential shoreline properties:

- The average buffer width is approximately 30 feet.
- Approximately 28% have an adequate buffer width to protect water quality and prevent erosion (≥50 feet).
- Approximately 55% have at least half of the recommended buffer width to protect water quality and prevent erosion (≥25 feet).
- One residential property along the shoreline of Keller Lake has a naturalized buffer width adequate for wildlife protection (≥100 feet).

The residential properties along the east shoreline of Keller Lake are significantly deep and have the potential to provide 100-foot wide naturalized buffer widths while still allowing for maintained lawn adjacent to the homes. Some of the residential shoreline properties on the northern shoreline of Keller Lake are not as deep, limiting the potential to provide wide naturalized buffers. However the narrowest buffers at this location are only 10 feet wide and even minor increases in naturalized buffer width will help provide additional benefits to the lake and habitat.

For Keller Lake city-owned public properties:

- The average buffer width is approximately 200 feet, providing both water quality and wildlife habitat protection.
- The city-owned property along the western shoreline of Keller Lake has limited buffer potential due to the location of Lac Lavon Road. Approximately 5-10 feet of width is mowed from the edge of the paved trail. Beyond that, the upland buffer is approximately 25-50 feet wide, with an additional emergent zone width of 10-50 feet.
- One area within Keller Park in Apple Valley has the potential to provide a wider naturalized buffer where it is currently mowed close to the shoreline.

Minnesota Routine Assessment Method (MNRAM) for Wetlands

In 2015, based on the MNRAM, Keller Lake rated **low** for overall vegetative diversity and integrity. The Keller Lake shoreline wetland community rated **high** for shoreline protection. Maintenance of characteristic wildlife habitat was rated **moderate**, amphibian habitat was rated **low**, and fish habitat was rated as **high**. Aesthetics/recreation/education rated **high**. The MNRAM assessment also indicates that many of the integral hydrologic and land use processes that affect the lake are intact and in relatively good condition with **high** ratings for maintenance of hydrologic regime, downstream water quality and **moderate** ratings for flood stormwater attenuation, maintenance of wetland water quality, and wetland sensitivity to stormwater and urban development. The 2015 Keller Lake MNRAM summary is provided in **Appendix E.** The MNRAM assessment was not repeated in 2020, as it would likely not result in significant changes from the 2015 assessment.

3.0 Keller Lake Management Recommendations

3.1 Past and Current Actions

Aquatic plant surveys have been conducted since 1998. Through the years, Keller Lake has been dominated by non-native invasive aquatic species with low native species richness. Efforts to improve water quality, control invasive species and increase the diversity of native aquatic plants in Keller Lake include:

- Iron dosing occurred during 1996 through 2008.
- Mechanical harvesting of curly-leaf pondweed was conducted from 2004 through 2015.
- Herbicide treatments for curly-leaf pondweed were conducted from 2017 through 2020.
- A curly-leaf pondweed turion survey was conducted in 2020.
- A seedbank assessment was conducted in 2020.
- Native aquatic plant re-introduction began in 2020.
- First of two phases of in-lake aluminum treatment conducted in 2019 to control sediment phosphorus release (second phase of treatment to be conducted in 2021).

Buckthorn within the upland buffer and forested wetland areas has been removed in city parks surrounding Keller Lake.

The cities of Burnsville and Apple Valley have provided lakeshore owners with shoreline restoration information since 2004 and continually promote and encourage lakeshore property owners each year to take advantage of the Dakota County SWCD Landscaping for Clean Water shoreline restoration program. The City of Apple Valley also encourages its residents to take advantage of the city's cost-share grant program (now called Rainwater Rewards) for private property shoreline, rain garden and native garden projects. Many residents receive funding from the city and Dakota SWCD programs. The cities of Burnsville and Apple Valley have invited residents to attend educational workshops and view demonstration projects to show how a native upland buffer can improve functions and values of the lake and improve aesthetics.

Shoreline restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city-owned property and residential property. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation.

3.2 Recommendations

The 2020 habitat assessment results suggest several recommended management activities that could help maintain and improve the overall wildlife habitat, vegetation diversity, aesthetics, and water quality of the lake. **Table 2** provides a summary of identified problems, recommended management activities, and past actions. The management recommendations are presented below:

1. Continue to monitor, control, and manage curly-leaf pondweed and Eurasian watermilfoil and increase native aquatic plant diversity. See **Appendix A** for the aquatic plant surveys, control measures, assessments, and native plant re-introduction activities.

2. Re-vegetate bare areas to prevent soil erosion into Keller Lake.

    - The inlet coming from the stormwater pond at the south end of Keller Lake is surrounded by bare soil or sparse vegetation. This bare soil should be seeded or planted with native vegetation to prevent soil erosion into Keller Lake (**Potential Restoration Area #1 and as shown in Figure 4 and photos**).

    - Bare soil in multiple areas along the southern shoreline caused by pedestrian observation and shoreline fishing could be replaced with stone walkways designated for observation and fishing access. The walkways could be placed strategically in locations where shoreline fishing and viewing is common. Directing foot traffic to these stone walkways will allow for vegetation to grow in other surrounding locations, decreasing exposed bare soil. Stone walkways have been successfully implemented by the City of Maplewood to minimize shoreline erosion along the Silver Lake shoreline. (**Potential Restoration Area #2 and as shown in Figure 4 and photos**).

3. Organize a neighborhood clean-up project to pick up trash and other dumped items along the south shoreline of the lake (**Potential Restoration Area #3 and as shown in Figure 4 and photos**).

4. Continue to control and manage non-native invasive vegetation along the shoreline including buckthorn, spotted knapweed, and garlic mustard. Buckthorn appears to have been previously removed in Lac Lavon Park along Keller Lake's southern shoreline, however follow up actions should continue in areas with new growth. Garlic mustard and spotted knapweed are dominant within Keller Lake Park at the north end of the lake. This work could be organized by volunteers involved in

programs such as the Minnesota Water Stewards, Minnesota Master Naturalists, or Master Gardeners and could recruit student assistance through schools, 4H, JROTC, National Honor Society, or scouting programs (**Potential Restoration Areas #4, as shown in Figure 4 and photos**).

5. Improve the residential shorelines by creating a wider naturalized emergent zone and upland buffer. Rather than manicured turf grass, the shoreline could be vegetated with native grasses and wildflowers. A wider buffer of native vegetation could help protect water quality, prevent erosion, and improve wildlife habitat, vegetative diversity, and aesthetics. Lakeshore residents and cities could receive assistance to create shoreline restoration projects through the Dakota County SWCD Landscaping for Clean Water program (see **Appendix G** for examples of shoreline restorations). As more lakeshore residents restore their shoreline to naturalized vegetation, the benefits of improved wildlife habitat, vegetation diversity, water quality, aesthetics, and recreation will be realized (**Potential Restoration Area #5, as shown in Figure 4 and photos)**.

6. Adjust mowing distance further away from the shoreline in Apple Valley's Keller Park. There doesn't appear to be a reason for mowing this portion of the park along the shoreline. Providing a wider naturalized buffer can increase wildlife habitat, improve water quality, and improve vegetative diversity (**Potential Restoration Area #6, as shown in Figure 4 and photos)**.

7. Organize, initiate, and create a prairie restoration project in Lac Lavon Park south of Keller Lake. There is a large area of mowed turf grass within this park which doesn't appear to be used for any activities. This could be an opportunity to restore prairie habitat, improve vegetative diversity and aesthetics, increase wildlife habitat, and provide critical pollinator habitat. Keller Lake is located within the U.S. Fish & Wildlife Service low potential zone identified for scientific recovery and additional conservation efforts for the federally endangered rusty patched bumble bee (*Bombus affinis*). With the implementation of additional conservation efforts, the species could be present in this low potential zone. The restoration project could include meandering trails and signage to educate users on the value of native habitats (See **Appendix I** for an example pollinator brochure). This work could be organized by volunteers involved in programs such as the Minnesota Water Stewards, Minnesota Master Naturalists, or Master Gardeners and could recruit student assistance through schools, 4H, JROTC, National Honor Society, or scouting programs. Guidance, assistance and potential funding may be available through the Xerces Society (Pollinator Conservation Program | Xerces Society) and the Minnesota Board of Water and Soil Resources Pollinator Initiative and Lawns to Legumes Program (Pollinator Habitat | MN Board of Water, Soil Resources (state.mn.us)). This project, along with the existing prairie restoration project on the shoreline of Lac Lavon, could be showcases to encourage residential landowners to provide additional pollinator habitat in their yards (**Potential Restoration Area #7, as shown in Figure 4 and photos**).

8. Install a pre-treatment system such as a rain garden or sediment trap to collect sediment from the Lac Lavon Park parking lot. Sediment from this parking lot is directed into the floodplain forest along the south shoreline of Keller Lake. A pre-treatment system combined with routine maintenance of sediment clean-out will protect the floodplain forest from further degradation and prevent sediment from reaching Keller Lake. This project could potentially receive funding assistance from the Dakota County SWCD's Community Conservation Partnership Incentives program (**Potential Restoration Area #8, as shown in Figure 4 and photos**).

9. Eradicate the Japanese hedge parsley located along the edge of the paved path near the storm pond north of Keller Lake. Early detection and control will prevent future infestations of this newly introduced non-native invasive species in Minnesota. Control can include pulling, cutting, or mowing in the spring before it flowers, followed by monitoring the area for new seedlings. Chemical control can include spraying rosettes or bolting plants in the spring with 1-2% glyphosate or 1-2% triclopyr, and on rosettes in the fall. A report of the presence of this species at this location was submitted through the Great Lakes Early Detection Network online application. Follow up with the Dakota County Cooperative Weed Management contact (Lindsey Albright lindsey.albright@co.dakota.mn.us) is recommended to verify action will be taken for eradication (**Potential Restoration Area #9, as shown in Figure 4 and photos**).

Tables

Table 1: Keller Lake 2015 and 2020 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone								
	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
				Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
2015	0%	**Poor**	90%	1.3 (Moderate)	2 (Poor)	1.5 (Poor)	2	1.8 (Moderate)	2.2 (Poor)
2020	0%	**Moderate**	90%	1.2 (Excellent)	2 (Poor)	1.5 (Poor)	2	1.8 (Moderate)	2.3 (Poor)

Monitoring Year	Vegetated Emergent Zone						
	Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
						Number of Species	Total Exotic Emergent Percent Coverage[9]
2015	**High**	10%	51-75% (High)	28 (Excellent)	2.3 (Poor)	8	26-50% (High)
2020	**High**	10%	51-75% (High)	36 (Excellent)	2.4 (Poor)	10	26-50% (High)

Monitoring Year	Upland Buffer								Erosion/Sedimentation	
	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Number of Species	Percent of Total Coverage[15]		
2015	**Moderate**	25-50 ft. (High)	>95% (High)	20 (Moderate)	1.6 (Poor)	76-100% (Excellent)	10	>40% (Poor)	0-10%	No
2020	**Moderate**	25-50 ft. (High)	>95% (High)	42 (Excellent)	1.8 (Poor)	51-75% (High)	29	>40% (Poor)	0-10%	No

P:\Mpls\23 MN\19\2319457\WorkFiles\hab\2020 Keller\working documents\BDWMO_hab_ind_tables_2020.xls\Table1 Keller 2015+2020

Table 1: Keller Lake 2020 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2020 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 and 2016, Orchard Lake in 2012 and 2017, Crystal Lake in 2013 and 2018, Lac Lavon in 2014 and 2019, Keller Lake in 2015 and 2020 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2020 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2011 through 2020 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3.
[3]Density data for Keller Lake were collected by Blue Water Science using a point intercept survey throughout the lake.
[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.
[5]The Total Number of Native Species within the submergent zone for Keller Lake was collected by Blue Water Science using a point intercept survey.
The additional category of "High" was added in 2011 through 2020 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.
[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Keller Lake 2020 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the two plot locations and a visual survey walking along the shoreline. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.
[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 2 plot locations and a visual survey walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.
[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on two plot locations, a visual survey walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)
[10]**Overall Upland Buffer Quality** is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.
[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.
[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the shoreline.
[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.
[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.
[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Table 2 2020 Recommended and Completed Management Actions for Keller Lake – Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curly-leaf pondweed dominates the lake in late spring-early summer.	Continue curly-leaf pondweed control measures.	Continue to control and manage. See Appendix A for details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys have been conducted by Blue Water Science since 1998. A curly-leaf pondweed turion survey was also conducted in 2020. Iron dosing occurred during 1996 - 2008. Mechanical harvesting was conducted from 2004 - 2015. Herbicide treatments were conducted from 2017 – 2020.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Continue to control and manage. See Appendix A for details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	Aquatic plant surveys have been conducted by Blue Water Science since 1998.
Low native aquatic vegetative diversity in the submergent zone.	Continue to increase native aquatic plant diversity.	Continue to monitor and assess. See Appendix A for details.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	A seedbank assessment was conducted in 2020. Native aquatic plant re-introduction began in 2020.
The inlet coming from the stormwater pond at the south end of Keller Lake is surrounded by bare soil or sparse vegetation.	Re-vegetate bare areas to prevent soil erosion into Keller Lake.	Seed or plant bare areas with native vegetation. **Potential Restoration Area #1**	Improve water quality and vegetative diversity.	Spring or Fall	
Shoreline pedestrian observation and fishing traffic is causing bare soil areas along the shoreline.	Re-vegetate bare areas to prevent soil erosion into Keller Lake.	Create designated stone walkways for observation and fishing access. **Potential Restoration Area #2**	Improve water quality, vegetative diversity, and aesthetics.	Spring-Fall	
The southern public park is littered with trash and other dumped items, especially near the shoreline.	Clean up the litter.	Organize a neighborhood clean-up project to pick up trash and other dumped items along the south shoreline of the lake. **Potential Restoration Area #3**	Improve aesthetics. Potentially prevent harm to wildlife. Prevent migration of trash into lake.	Spring - Fall	
Shoreline areas in city parks contain non-native invasive vegetation such as buckthorn, spotted knapweed, and garlic mustard.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation. Pull garlic mustard within the City of Burnsville property at the north end of the lake. Continue to remove and treat new growth of buckthorn in city parks. **Potential Restoration Area #4**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Buckthorn appears to have been previously removed in the park along the southern shoreline, however new seedlings are emerging. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation
Upland buffer areas lacking naturalized vegetation. Many of the residential properties have narrow buffers with lawns mowed to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. **Potential Restoration Area #5**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	The Dakota Soil and Water Conservation District program assists homeowners with establishment of shoreline restoration projects. Additional restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city owned property and residential property.
Shoreline areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	Adjust mowing distance away from shoreline in Apple Valley's Keller Park. **Potential Restoration Area #6**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
A portion of Lac Lavon Park in Burnsville south of Keller Lake includes a large area of mowed turf grass with no apparent use.	Consider using this area for a native prairie restoration with meandering trails and educational signs.	Recruit volunteers through neighborhood or organizations to transform the lawn into a prairie. **Potential Restoration Area #7**	Improve vegetative diversity and aesthetics. Increase wildlife habitat and provide pollinator habitat. Provide recreational and educational opportunities.	Spring - Fall	
Sediment from the Lac Lavon Park parking lot is directed into the floodplain forest along the south shoreline of Keller Lake.	Prevent sediment from entering the floodplain forest area.	Install a pre-treatment system such as a rain garden or sediment trap to collect sediment from the parking lot. Follow up with routine maintenance of sediment clean-out. **Potential Restoration Area #8**	Protect floodplain forest from further degradation and prevent sediment from reaching Keller Lake, thereby improving water quality.	Winter	
Japanese hedge parsley is located along the edge of the path near the storm pond north of Keller Lake. This is a new non-native invasive species in Minnesota. Early detection and control will prevent infestations.	Eradicate- Pull, cut or mow before flowering. Monitor area for new seedlings. Spray rosettes or bolting plants in spring with 1-2% glyphosate or 1-2% triclopyr. In fall, use herbicides on rosettes.	A report of this species at this location was submitted through the Great Lakes Early Detection Network online application. Follow up with the Dakota County Cooperative Weed Management contact to verify action will be taken for eradication. **Potential Restoration Area #9**	Prevent spread and infestation.	Spring - Fall	

Figures

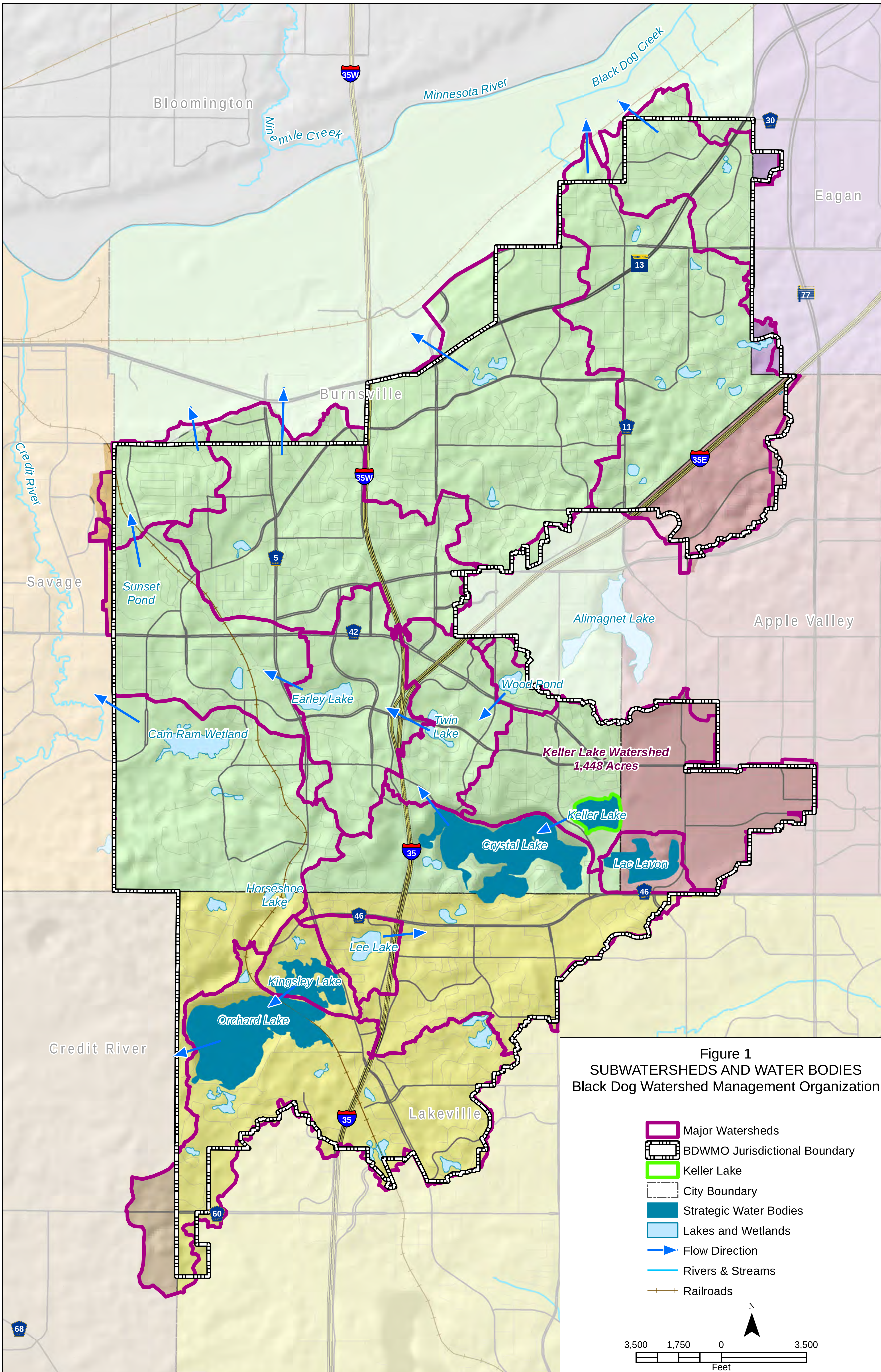


Figure 1
SUBWATERSHEDS AND WATER BODIES
Black Dog Watershed Management Organization

Plot Location

Municipal Boundary

Keller Lake

N

Feet

300 150 0 300

Figure 2

KELLER LAKE
Plot Locations
Black Dog WMO
Burnsville and Apple Valley, MN

Figure 3

KELLER LAKE
Shoreline Parcel Ownership
Black Dog WMO
Burnsville and Apple Valley, MN

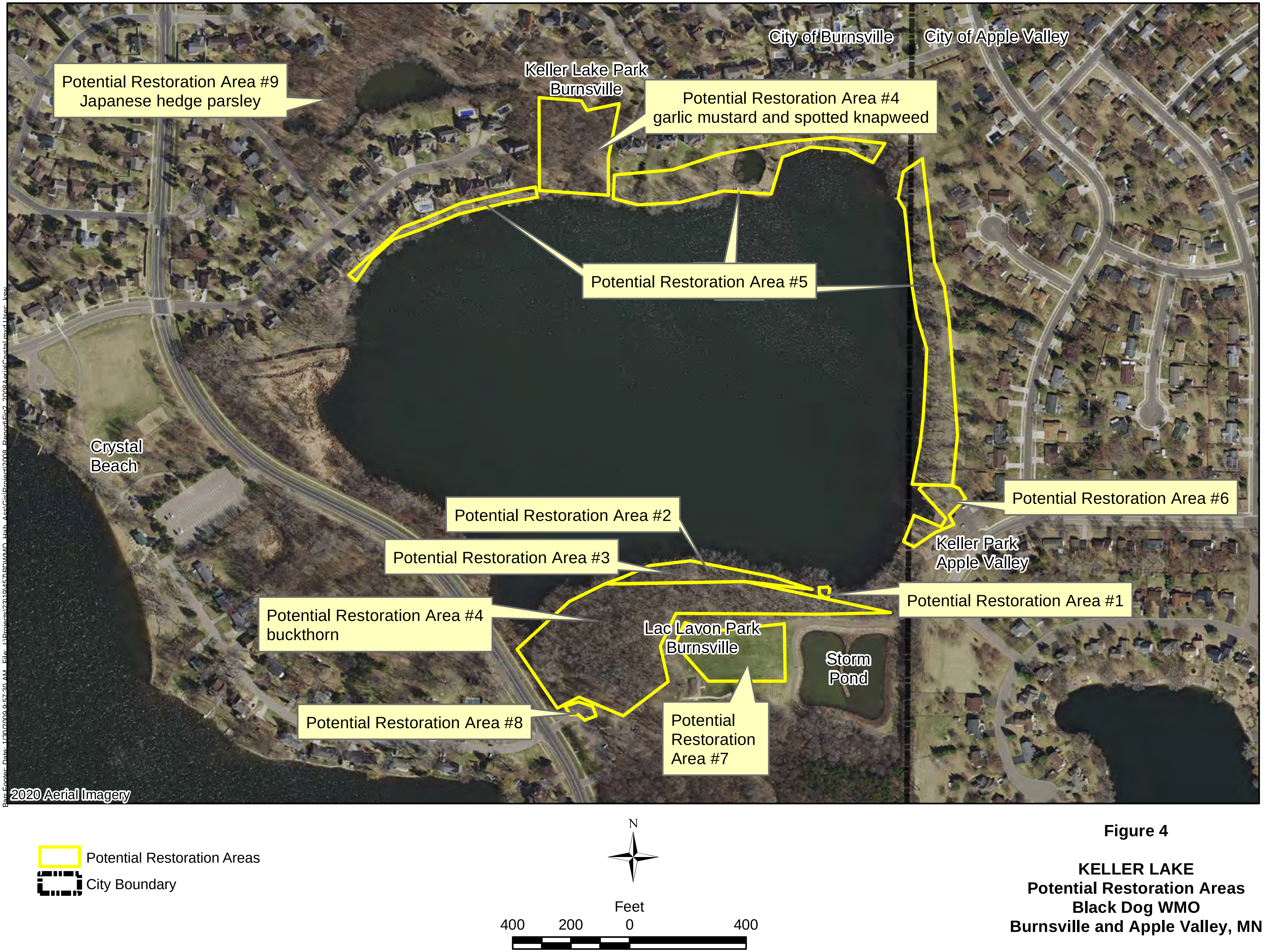


Figure 4

KELLER LAKE
Potential Restoration Areas
Black Dog WMO
Burnsville and Apple Valley, MN

Photos

Keller Lake and Shoreline August 17, 2020


Submergent Zone –east portion of Keller Lake


Plot 1B Emergent Zone

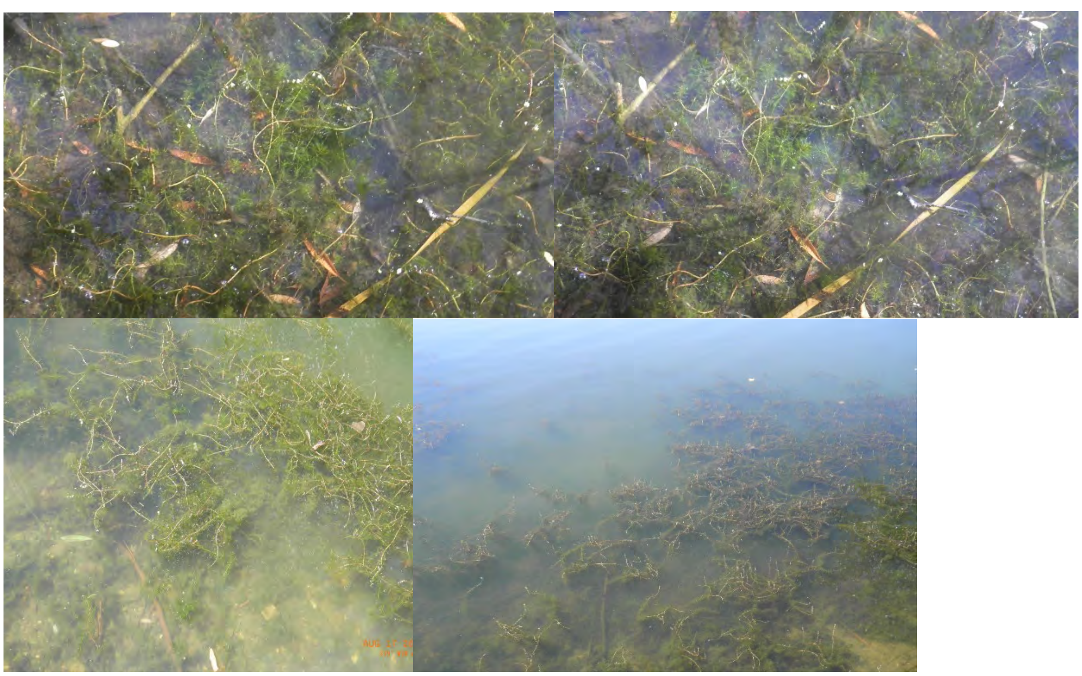

Plot 1C Upland Buffer

Submergent Zone – west portion of Keller Lake

Plot 2B Emergent Zone

Plot 2C Upland Buffer

Keller Lake


Aquatic submergent vegetation along Keller Lake shoreline on August 17, 2020.


One of ten fenced plots including transplanted native aquatic plants.

Lac Lavon Park along the southern shoreline of Keller Lake includes recreational trails.

Shoreline along City owned property with wide naturalized emergent zone and upland buffer, which helps prevent shoreline erosion and provide wildlife habitat.

Potential Restoration Area #1 – Seed or plant vegetation in area surrounding the inlet from storm pond

Potential restoration area #2 – Place designated stone walkways in popular shoreline fishing and observational locations to minimize bare soil exposure.

Potential restoration area #3 – Organize a neighborhood cleanup project to pick up trash.

Potential Restoration Area #4 – Continue to control non-native invasive vegetation with the naturalized upland buffer areas in the city parks, including control of buckthorn and garlic mustard.

Potential restoration area #5 – Residential properties are mowed to the lakeshore edge. A wider buffer of native vegetation in the emergent zone and upland buffer of residential properties could provide more shoreline stability and wildlife habitat.

Typical shoreline along City owned property with wide naturalized buffer helps prevent shoreline erosion and provide wildlife habitat.

Potential Restoration Area #6 – Adjust mowing distance away from shoreline in Apple Valley's Keller Park

Large area of mowed grass in Lac Lavon Park south of Keller Lake. Potential Restoration Area #7 – Consider using the area for a native prairie restoration with meandering trails and educational signs.

The public property at the south end of Keller Lake includes a valuable floodplain forest, which is disturbed by invasive buckthorn and sediment inputs.

Sediment from the Lac Lavon Park parking lot is directed into the floodplain forest. Potential Restoration Area #8 – Install a pre-treatment system such as a rain garden or sediment trap to collect sediment for protection of the floodplain forest along the southern shoreline of Keller Lake.

Japanese hedge parsley at path edge of storm pond north of Keller Lake. This is a new non-native invasive species in Minnesota. Early detection and control will prevent infestations. Potential Restoration Area #9 – Pull, cut, mow, or treat with herbicides to remove and prevent spread into other areas.

Technical Reference

(Provided in separate report)

Technical Reference

Black Dog Watershed Management Organization Habitat Monitoring Background Summary

In 2002, the Black Dog Watershed Management Organization (BDWMO) created a program for monitoring the habitat quality of strategic water resources in the watershed. The BDWMO lies south of the Minnesota River in the northwest portion of Dakota County. **Figure 1** shows the subwatersheds to the BDWMO's strategic water bodies. The BDWMO began implementing the habitat monitoring program in 2003 and continued the program through 2009. In 2004, based on feedback from the participating cities and to better define the vegetative quality, several improvements were made to the rating system. The BDWMO used this system for the annual habitat monitoring of each strategic water body through 2009. From 2003-2009 Barr staff annually evaluated the habitat quality of each of the following strategic water bodies:

- Crystal Lake (Burnsville)
- Keller Lake (Burnsville)
- Kingsley Lake (Lakeville)
- Lac Lavon (Apple Valley and Burnsville)
- Orchard Lake (Lakeville)
- Sunset Pond (Burnsville)

In 2010, the BDWMO suspended the habitat monitoring program and re-evaluated the program for its effectiveness. Based on feedback obtained from city staff, the BDWMO revised the habitat monitoring program to provide more effective monitoring, more useful and holistic results, and to reduce the monitoring costs. The BDWMO began implementing the revised habitat monitoring program in 2011. Also in 2011, the BDWMO removed Sunset Pond from its list of strategic water bodies.

The revised program includes monitoring habitat quality at one strategic water body per year, such that the BDWMO monitors all five strategic water bodies over a five-year cycle. The 2011 through 2015 reports provided a new baseline for the strategic water bodies—Kingsley Lake (2011), Orchard Lake (2012), Crystal Lake (2013), Lac Lavon (2014), and Keller Lake (2015). This report provides the results of the Keller Lake 2020 habitat monitoring.

The 2020 Keller Lake monitoring includes transect, plot, and meandering surveys. Supplemental photographs were taken to document conditions. Private versus public ownership was identified along the entire shoreline. The survey results, along with parcel data, were used to identify possible locations for restoration and preservation. Table 1 of the Technical Memo summarizes the 2020 Keller Lake monitoring results.

Habitat Quality

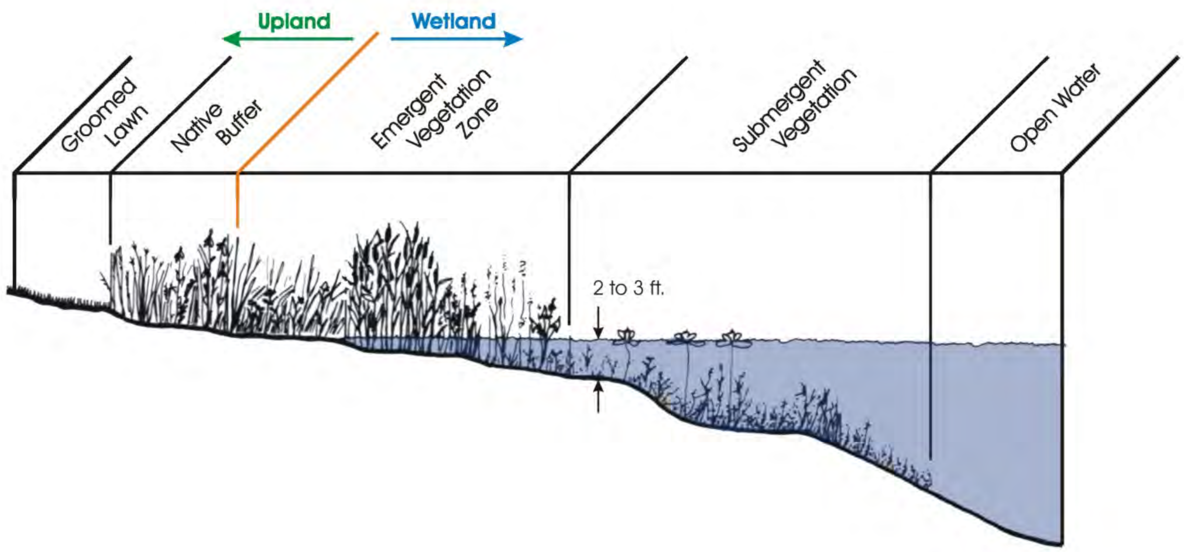
The BDWMO's assessment of the BDWMO strategic water bodies provides baseline and ongoing information regarding the habitat quality of the water bodies and a method for detecting change. Habitat quality was evaluated within the following four general zones:

1. **Submergent vegetation zone—**The submergent zone refers to the areas of the water body where water depths are typically 2 to 20 feet (normal maximum rooting depth) and the vegetation is typically submerged or has floating leaves. The vegetation quality within the submergent zone is normally rated as "excellent" when there are: (a) a diverse assemblage of native plant species (more than 14), (b) a moderate plant density or plant occurrence rating, and (c) no exotic species present.

2. **Emergent vegetation zone—**The emergent zone typically refers to the areas of the water body where water depths are less than 2 feet and vegetation grows out of the water. The vegetation quality within the emergent zone is typically rated as "excellent" when there are more than 15 species of native and non-invasive plants present, with few exotic plants present.

3. **Condition of the upland buffer area—**The upland buffer is characterized as the upland area immediately surrounding the water body. An excellent quality buffer should extend upslope at least 25 feet from the wetland edge, consist of native vegetation that is not routinely mowed, and be present continuously around the perimeter of the water body.

4. **Sedimentation and shoreline erosion problems—**The presence of sedimentation may come from erosion on slopes, from storm sewer outfalls, or from other sources. The presence of a regular sediment load to the water body can cause a significant reduction in water quality. Shoreline erosion can be caused by natural forces such as ice and wave action, but can also be human induced (e.g., vegetation removal, grading, runoff, structures, etc.). Identifying and correcting these problems early can prevent habitat degradation.



Vegetation Zones

Appendix C summarizes the overall ratings from 2003 through 2019. **Appendix D** includes the previous management recommendations for water bodies assessed from 2009 through 2019. **Table 2 of the Technical Memo** provides the 2020 management recommendations for Keller Lake.

Wildlife Habitat Characteristics

The strategic water bodies within the BDWMO range from shallow wetland systems to deeper lake systems. Some of them support sustainable fisheries, while others may only periodically support fish. All of the water bodies appear to have some potential for supporting waterfowl and shorebirds. To evaluate the wildlife value of these water bodies, it is important to understand the characteristics that will benefit wildlife.

In general, a more diverse assemblage of native plant species will provide a source of food and protective cover for a wider range of wildlife species. Typically, although not always, native plant species do not become established as monocultures to the detriment of other species, as is often the case with many exotic species. As vegetation diversity increases, so does the likelihood that the water body will support a more diverse assemblage of wildlife.

A diverse interspersion of various plant communities also leads to the potential for attracting a wider range of wildlife. For instance, some waterfowl prefer deeper, open water areas while others tend to inhabit the shallow emergent zones. Some furbearers rely heavily on the shallow, emergent zone and upland areas around the water body while others spend most of their time in the deep marsh areas. Amphibians will typically need a permanently inundated water body, but rely on diverse vegetative structure in the upland areas surrounding the water body for critical components of their life cycle. Fish also require permanent inundation to a depth that will not result in freeze-out and where oxygen will not become depleted. A diverse habitat structure is also important for fish.

The upland buffer surrounding these water bodies is important for a number of reasons. A high quality upland buffer will have a diverse vegetative structure dominated by self-sustaining native vegetation. A high quality upland buffer is used by wildlife for shelter, feeding, resting, nesting, and reproduction. In contrast, adjacent upland areas that are maintained in turf grass or paved trails provide little value to wildlife or water quality improvement. Turf grass and trails typically provide feeding and resting grounds only for geese and some species of ducks. Wide and contiguous natural buffers are important as they provide feeding, nesting and safe travel corridors. Upland buffers also help protect the water quality of the water body. Diverse native vegetation helps maintain an open soil structure that promotes infiltration, reduces surface runoff, and increases nutrient uptake.

Wetland Functions and Values Assessment—MNRAM

In addition to the specific habitat parameters described above, the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM) Version 3.0 was used to evaluate the hydrologic system and ecosystem making up each water resource, first in 2003 and then again in 2006. The results of the 2003 and 2006 MNRAM 3.0 assessments were provided in previous year's reports. Orchard Lake was re-assessed in 2012, Crystal Lake was re-assessed in 2013, Lac Lavon was re-assessed in 2014, Keller Lake was re-assessed in 2015, and Kinsley was re-assessed in 2016 with the more updated MNRAM version 3.4. The results of the 2015 Keller Lake MNRAM are provided in **Appendix E**. Evaluating each ecosystem with MNRAM is a way to get a detailed picture of the overall health of the watershed and the water resource itself. Instead of just looking at specific parameters that are direct indicators of habitat quality, the MNRAM evaluates many different parameters of the water body and its watershed that contribute to sustaining the wetland functions, which are described in **Appendix F**. In general, the MNRAM assessments compare favorably with the BDWMO habitat vegetation assessment results. This method identifies land use or ecological changes, which might affect the water body in the long term. In addition, the MNRAM assessment provides an independent evaluation of the overall wildlife habitat of the water body.

Appendices

Appendix A

Keller Lake Aquatic Plant Survey Results, Assessments, and Transplanting Activities

Keller Lake, June 29, 2020

Aquatic Plant Surveys and Water Quality for Keller Lake, Dakota County, 2020

Curlyleaf Delineation: April 16, 2020
Curlyleaf Treatment: May 1, 2020 (7.59 acres)
Curlyleaf Assessment: June 1, 2020
Late Season Survey and Eurasian Watermilfoil Check: July 29, 2020

Prepared for:
Cities of Burnsville and Apple Valley, Minnesota

Prepared by:
Steve McComas
Jo Stuckert
Blue Water Science
St. Paul, MN

December 4, 2020

Aquatic Plant Surveys and Water Quality for Keller Lake, Dakota County, 2020

Summary

Curlyleaf Management: Results of the curlyleaf pondweed (CLP) delineation (April 16, 2020) found that coontail, CLP, elodea, and northern watermilfoil were the only submerged aquatic plant species present in the lake on April 16, 2020. Results from the delineation using a point intercept plant survey found that plants grew throughout the lake bed with curlyleaf well distributed throughout the lake with high stem densities (5 or greater per rake sample) shown with red dots on the delineation map (Figure S1). A curlyleaf herbicide treatment of 7.59 acres was conducted on May 1, 2020.

Results of the curlyleaf pondweed assessment (June 1, 2020) found that all curlyleaf had been controlled and no viable CLP was observed.

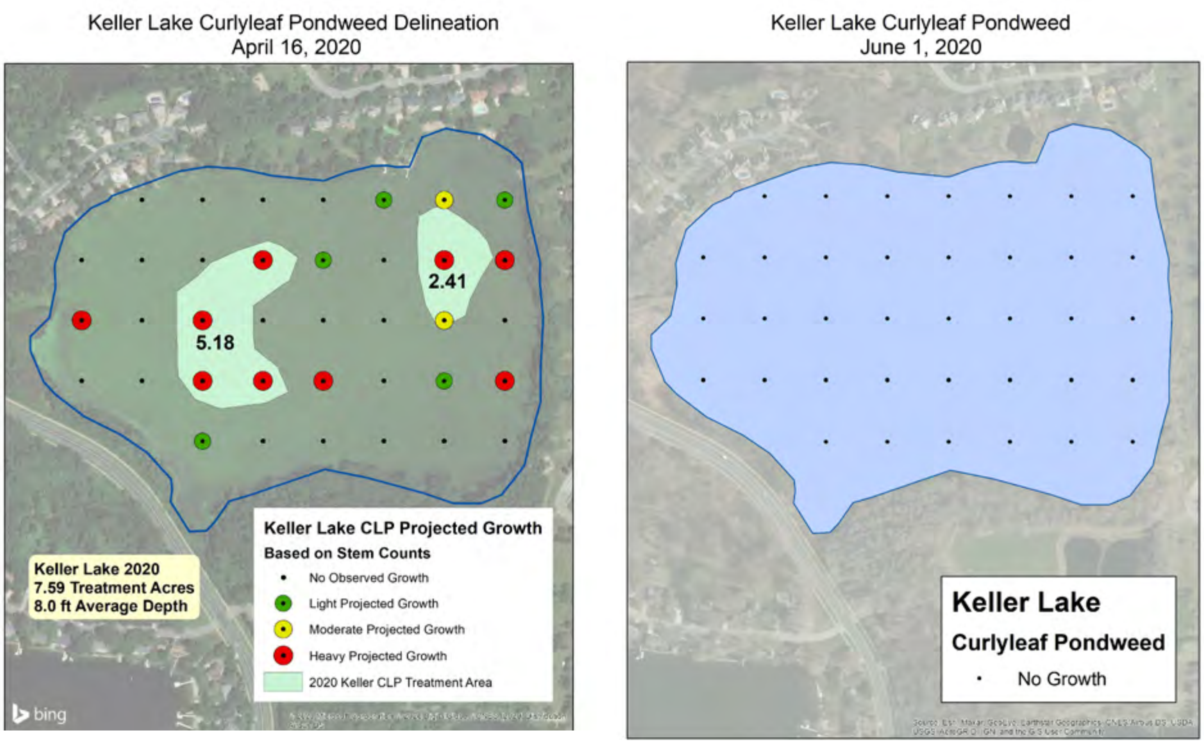


Figure S1. [left] Curlyleaf coverage for April 16, 2020 survey. [right] Curlyleaf coverage for June 1, 2020. Key: green dot = light growth, yellow dot = moderate growth, red dot = heavy growth, black dot = no growth. The light green shading indicates the area that could be controlled.

Eurasian Watermilfoil Management: The EWM check on June 1, 2020 used a meandering plant survey combined with a point intercept survey and found light growth of EWM at only 3 locations in the lake (Figure S2). No EWM treatment was conducted in 2020.

Results of the EWM check (July 29, 2020) using an aquatic plant point intercept survey found that EWM along with 2 other submerged aquatic plant species were present in the lake and coontail was the dominant plant. Several areas of scattered heavy growth of EWM were observed on the July 29, 2020 point intercept survey. However, coontail and elodea had light to moderate growth at several sites as well (Figure 5).

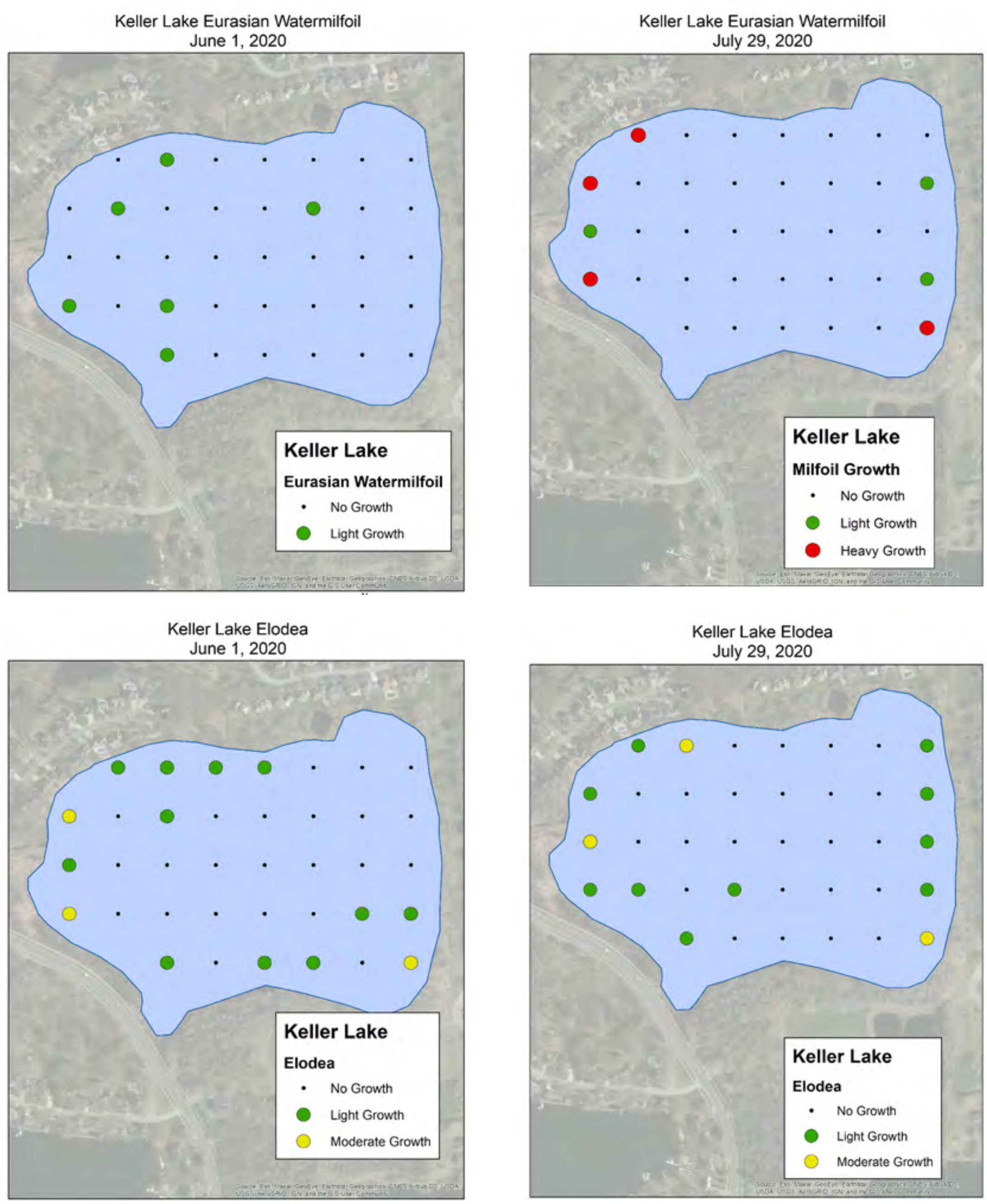
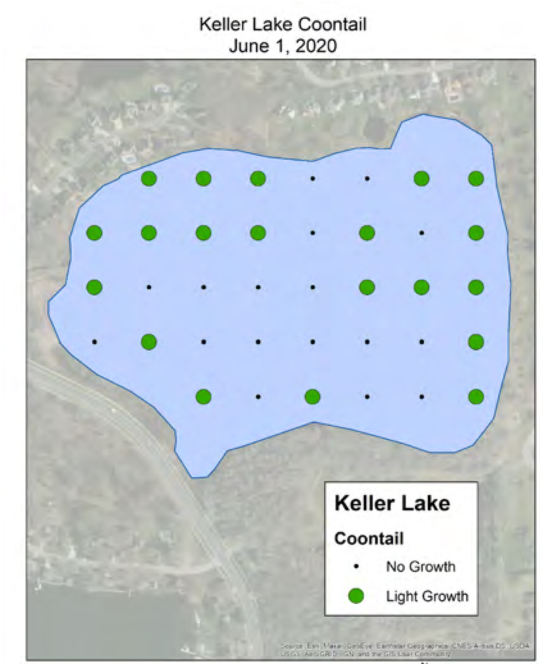


Figure S2. [top-left] EWM June 1, 2020. [top-right] EWM July 29, 2020. [bottom-left] Elodea June 1, 2020. [bottom-right] Elodea July 29, 2020.
Key: green dot = light growth, yellow dot = moderate growth, red dot = heavy growth, and black dot = no growth.

Native Plants in Point Intercept Surveys: Historically 6 different native aquatic plant species have been sampled. Coontail, elodea, and Eurasian watermilfoil (EWM) were the only submerged aquatic plant species present in the lake on June 1, 2020. Results from the June 1, 2020 point intercept plant survey found that plants grew throughout most of the lake with coontail found at 54% of the sample sites. Results of the late summer survey (July 29, 2020) found that coontail, elodea, and EWM were the only submerged aquatic plant species present in the lake. Results from the July 29 summer survey using a point intercept plant survey found that plants covered about 68% of the lake. EWM was present and was found at several scatterd locations. Coontail and elodea were the dominant plants.



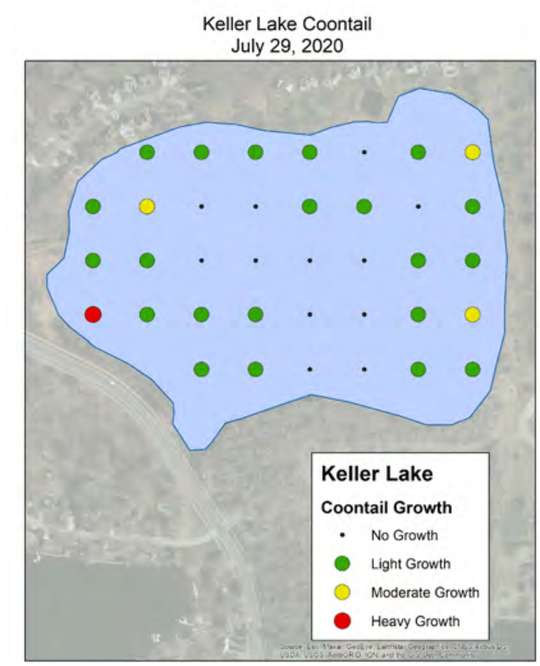


Figure S3. [left] Coontail distribution on June 1, 2020.
[right] Coontail distribution on July 29, 2020.
Key: green dot = light growth, yellow dot = moderate growth, red = heavy growth, and black dot = no growth.

Review of Early Season CLP and Late Season Aquatic Plant Surveys in Keller Lake

Table S1. Summary of Keller Lake aquatic plant surveys and water quality. Percent occurrence is shown and the average species density is shown in parentheses. Plant density ranges in a scale from 1 to 5 with 5 the most dense. In 2017, the density rating was changed to a scale from 1 to 4 with 4 the most dense. In 2018 through 2020, the density rating was changed to a scale from 1 to 3 with 3 the most dense.

	1998 May 27 (n=11) % occur (density)	1999 % occur (density)	2000 May 26 (n=12) % occur (density)	2003 May 22 (n=36) % occur (density)	2004 June 7 (n=37) % occur (density)	2005 May 20 (n=37) % occur (density)	2006 May 28 (n=37) % occur (density)	2007 May 28 (n=38) % occur (density)	2008 May 23 (n=37) % occur (density)	2009 May 25 (n=37) % occur (density)	2010 May 18 (n=36) % occur (density)
Coontail	36 (1.0)	(no survey)	17 (1.0)	28 (0.8)	41 (1.3)	46 (1.4)	57 (2.0)	53 (2.1)	84 (2.4)	78 (3.0)	75 (1.8)
Elodea	64 (2.1)		8 (1.0)	31 (1.8)	41 (1.1)	92 (2.2)	27 (1.4)	3 (1.0)	16 (1.0)	5 (3.5)	33 (1.2)
Eurasian watermilfoil	0		0	0	0	0	0	71 (1.9)	54 (1.6)	49 (2.5)	47 (1.3)
Curlyleaf	100 (1.2)		100 (2.0)	86 (3.2)	86 (1.8)	59 (1.1)	84 (2.5)	100 (3.8)	68 (2.1)	49 (2.2)	84 (2.3)
Stringy	100 (2.5)		8 (0.5)	0	9 (0.8)	0	0	0	0	0	0
Sago	0		0	6 (1.3)	0	0	0	0	0	0	0
% plant coverage	90%		90%	90%	90%	95%	100%	100%	100%	95%	100%
	Aug 26 (n=15)	**Sept 15 (n=16)**	**Aug 22 (n=10)**	**Sept 9 (n=37)**	**Aug 30 (n=38)**	**Sept 15 (n=37)**	**Aug 13 (n=37)**	**Aug 26 (n=38)**	**Sept 2 (n=37)**	**Aug 5 (n=38)**	**Aug. 10 (n=37)**
Coontail	40 (1.0)	56 (1.2)	60 (1.7)	54 (2.0)	79 (1.9)	76 (2.2)	97 (3.7)	100 (3.3)	97 (4.3)	87 (2.5)	62 (1.2)
Elodea	80 (2.3)	50 (1.3)	30 (1.0)	22 (1.0)	95 (1.8)	35 (1.2)	49 (1.2)	5 (1.3)	0	0	40 (1.4)
Duckweed	0	13 (0.5)	0	0	0	22 (1.9)	0	0	0	0	0
Eurasian watermilfoil	0	0	0	0	0	5 (0.5)	46 (1.0)	61 (1.6)	95 (2.9)	34 (3.3)	70 (2.4)
Curlyleaf	0	0	0	0	0	3 (0.5)	0	0	0	0	0
Stringy	5 (0.5)	0	0	3 (1.0)	39 (1.1)	0	3 (1.0)	0	0	0	0
Naiads	0	0	10 (2.0)	0	5 (2.5)	0	0	0	0	0	0
Sago	0	0	0	0	3 (1.0)	0	0	0	0	0	0
% plant coverage	60%	30%	30%	45%	95%	80%	97%	100%	100%	92%	89%
Iron dosing into Keller Lake	summer iron dosing (also in the summers of 1996 & 1997)	no iron	no iron	dosing for part of summer (3,400 kg of Fe) (June)	(10,600 kg of Fe) (April - Dec)	(3,020 kg of Fe) (April - Oct)	(2,405 kg of Fe)	(1,161 kg of Fe) (April - Nov)	(1,176 kg of Fe) (April - July)	no iron	no iron
Mechanical harvesting	yes 10-15 ac (stringy)				yes 25 ac	yes 20-25 ac	yes 20-25 ac	yes 20-25 ac	yes 20-25 ac	water levels too low	yes 15-22 ac
Herbicide treatment (acres)											
Total Phos (ug/l)	43	104	114	98	42	59	89	75	35	94	73
Chl a (ug/l)	4	36	34	36	15	14	63	17	5.2	110	61
Secchi Disc (m) (May-Sept)	2.0	1.0	0.7	0.8	1.5	1.5	1.2	1.7	2.0	0.9	0.7

Table S1 (concluded). Summary of Keller Lake aquatic plant surveys and water quality. Percent occurrence is shown and the average species density is shown in parentheses. Plant density ranges in a scale from 1 to 5 with 5 the most dense. In 2017, the density rating was changed to a scale from 1 to 4 with 4 the most dense. In 2018 through 2020, the density rating was changed to a scale from 1 to 3 with 3 the most dense.

	2011 June 1 (n=37) % occur (density)	2012 May 8 (n=37) % occur (density)	2013 May 30 (n=37) % occur (density)	2014 June 27 (n=37) % occur (density)	2015 June 16 (n=37) % occur (density)	2016 May 12 (n=37) % occur (density)	2017 April 6 (n=37) % occur (density)	2018 May 4 (n=37) % occur (density)	2019* April 19 (n=37) % occur (density)	2020 April 16 (n=37) % occur (density)
Coontail	22 (1.3)	19 (1.0)	5 (1.0)	5 (1.0)	3 (1.0)	0	3 (1.0)	30 (1.0)	35 (1.2)	51 (1.1)
Elodea	30 (1.5)	5 (1.0)	0	3 (1.0)	24 (1.2)	10 (1.5)	24 (1.6)	43 (1.7)	35 (1.2)	41 (1.1)
Eurasian watermilfoil	51 (1.3)	35 (1.6)	3 (1.0)	0	11 (1.0)	0	19 (1.0)	3 (1.0)	0	14 (1.0)
Curlyleaf	65 (2.0)	92 (2.7)	95 (2.8)	84 (2.4)	81 (1.3)	100 (3.6)	97 (3.8)	70	35	43
Stringy	0	0	0	0	0	0	0	0	0	0
Sago	0	0	0	0	0	0	0	0	0	0
% plant coverage	96%	100%	97%	84%	90%	100%	97%	92%	68%	84%
	Aug 3 (n=37)	Aug 2 (n=37)	Aug 2 (n=37)	July 23 (n=37)	July 31 (n=37)	July 13 (n=37)	July 24 (n=37)	Aug 2 (n=37)	Aug 2 (n=37)	July 29 (n=37)
Coontail	43 (1.5)	22 (1.4)	3 (1.0)	0	3 (1.0)	2 (1.5)	8 (1.0)	35 (1.2)	49 (1.2)	68 (1.2)
Elodea	27 (1.4)	0	0	6 (1.0)	32 (2.0)	23 (2.1)	62 (2.0)	38 (1.5)	38 (1.4)	35 (1.2)
Duckweed	0	0	0	0	0	0	0	0	0	0
Eurasian watermilfoil	76 (2.6)	54 (2.4)	3 (1.0)	0	41 (2.2)	23 (1.7)	19 (1.3)	11 (1.0)	5 (1.0)	19 (2.1)
Curlyleaf	0	0	0	81 (2.1)	2 (1.0)	0	3 (1.0)	0	0	0
Stringy	0	0	0	11 (1.0)	0	0	0	0	0	0
Naiads	0	0	0	6 (2.5)	0	0	0	0	0	0
Sago	0	0	0	0	0	0	0	0	0	0
% plant coverage	80%	54%	3%	81%	43%	86%	62%	44%	49%	68%
Iron dosing into Keller Lake	no iron	no iron	no iron	no iron	no iron	no iron	no iron	no iron	no iron	no iron
Mechanical harvesting	yes 17-22 ac	yes 20 ac	yes 22 ac	yes 18 ac	yes 20 ac					
Herbicide treatment (acres)							8.1	8.5	9.3	7.59
Total Phos (ug/l)	74	95	121	89	91	93	72	87	45	
Chl a (ug/l)	59	56	68	63	52	42	18	27	22	
Secchi Disc (m) (May-Sept)	0.8	0.6	0.6	0.8	0.7	1.0	0.8	0.7	1.3	

*Alum was applied to Keller Lake in June, 2019.

Other Keller Lake Aquatic Plant Activities in 2020

Reintroduction of Aquatic Plants into Keller Lake (Prepared by City of Burnsville): On June 24-25 2020 staff from the City of Burnsville, City of Apple Valley, and Blue Water Science conducted a native aquatic plant reintroduction project, as a method for enhancing the submerged native plant community under conditions where invasive species are being managed. About 300 native aquatic plants were harvested from Lake Hanrehan (within a Three Rivers Park District natural areas) and transplanted into Keller Lake the next day. The species included *Heteranthera dubia* (water stargrass), *Potamogeton amplifolius* (large leaf pondweed), *P. robinsii* (fern leaf pondweed), and *P. zosteriformis* (flatstem pondweed). The plants were transplanted into ten fenced plots, each secured by the roots in the sediment with a metal or biodegradable stake. The plants were monitored by City staff from June-October.

Figure S4. [top-right] Transplant locations in Keller Lake. [middle and bottom] Plot 9 plant status on October 14, 2020.

Curlyleaf Pondweed Turion Survey in Keller Lake, Dakota County, 2020 (Conducted by Blue Water Science): Curlyleaf pondweed (*Potamogeton crispus*) is a non-native perennial pondweed which acts as a winter annual in lakes in Minnesota. Nearly all new curlyleaf pondweed (CLP) regrowth comes from turions (a turion is a type of vegetative bud that is produced by a CLP plant and can sprout and grow a new plant). There is very little CLP growth from its seeds, roots, or plant fragments. A CLP sediment turion survey was conducted in Keller Lake on October 14, 2020 to examine the correlation of turion density to CLP vegetation density. Results indicated an overall low to moderate sediment turion density and a poor correlation of turion density to CLP stem density (R^2=0.06)(Table S2 and Figure S5). However, the overall low turion density indicates in general CLP growth in Keller Lake will be mostly light to moderate with some areas of heavy growth. Because of regrowth potential of CLP, long term CLP control will be a challenge and annual spot treatments still remain the best option for nuisance CLP control.

Table S2. Keller Lake turion survey, October 14, 2020. Three sediment samples were collected per site.

Site	CLP Growth 2020	Depth (ft)	Turions per Sample			Total	Total Viable Turions	Average Viable Turions per Site	Viable Turions (number/m^2)
			1	2	3				
8	none	6.8	2a	1c	1a	3	3	1.0	40
10	heavy	7.5	0	1b	1c	2	0	0	0
12	none	7.7	1c	0	0	1	0	0	0
13	light	7.0	0	0	1a	1	1	0.33	13
14	heavy	6.0	0	0	0	0	0	0.00	0
23	none	4.7	1c	1c	1a	3	1	0.33	13
25	heavy	6.9	0	0	0	0	0	0	0
27	none	7.3	1c	0	2b	3	0	0	0
28	heavy	6.5	1a	0	1a	2	2	0.67	27
29	heavy	4.2	0	0	1a, 1b	2	1	0.33	13

a=viable
b=non-viable
c=partial-turion leaf

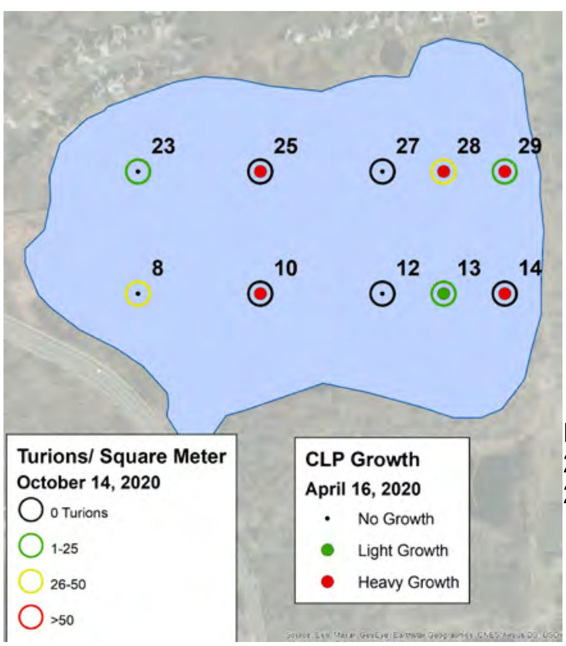
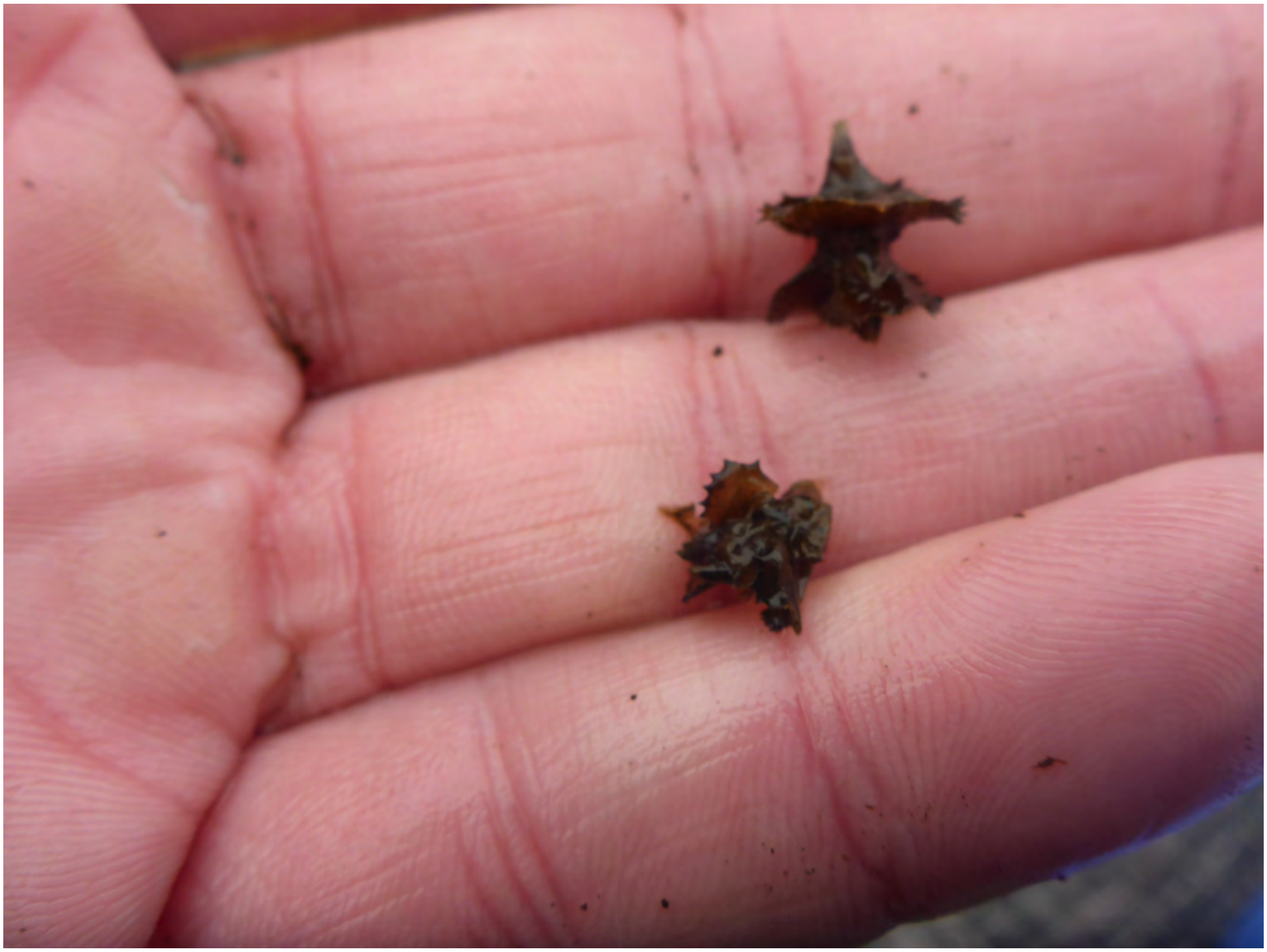


Figure S5. Predicted curlyleaf pondweed growth in 2020 and sediment turion densities on October 14, 2020.

Keller Lake Aquatic Macrophyte Seedback Assessment (Conducted by Berg and Newman, Univ. of Minnesota): Keller Lake sediment cores (22) were collected on July 16, 2020 and sediments were placed into 44 trays. Nine species of aquatic plants germinated over an 8-week period.

Table 1. Sprouts per week by taxa from Keller Lake from forty-four trays over the eight-week seed bank assessment experiment, including total sprouts by taxa.

Week Number	*Potamogeton crispus* (Curlyleaf pondweed)	*Ceratophyllum demersum* (Coontail)	*Chara spp.* (Muskgrass)	*Elodea canadensis* (Canada waterweed)	*Lemna minor* (Lesser duckweed)	*Najas flexilis* (Slender naiad)	*Nitella spp.* (Nitella)	*Potamogeton berchtoldii* (Small pondweed)	*Zosterella dubia* (Water stargrass)
1	1	3		7					
2	2	1		2		1		24	
3	3			2	2	3		40	
4					1	1		8	
5								2	
6						1	4	9	1
7						1			
8	1		5					2	
Total:	7	4	5	11	3	7	4	85	1



Turions Collected from Keller Lake Sediments on October 14, 2020

Curlyleaf Pondweed Turion Survey in Keller Lake, Dakota County, 2020

Field Collection: October 14, 2020

Submitted to:
Cities of Apple Valley and Burnsville

Prepared by:
Steve McComas
Jo Stuckert
Connor McComas
Blue Water Science
St. Paul, MN 55116

December 2, 2020

Curlyleaf Pondweed Turion Survey in Keller Lake, Dakota County, 2020

Summary

Curlyleaf pondweed (*Potamogeton crispus*) is a non-native perennial pondweed which acts as a winter annual in lakes in Minnesota. Nearly all new curlyleaf pondweed (CLP) regrowth comes from turions (a turion is a type of vegetative bud that is produced by a CLP plant and can sprout and grow a new plant). There is very little CLP growth from its seeds, roots, or plant fragments. A CLP sediment turion survey was conducted in Keller Lake on October 14, 2020 to examine the correlation of turion density to CLP vegetation density. Results indicated an overall low to moderate sediment turion density and a poor correlation of turion density to CLP stem density (R^2=0.06)(Table 1 and Figure 1). However, the overall low turion density indicates in general CLP growth in Keller Lake will be mostly light to moderate with some areas of heavy growth. Because of regrowth potential of CLP, long term CLP control will be a challenge and annual spot treatments still remain the best option for nuisance CLP control.

Table 1. Keller Lake turion survey, October 14, 2020. Three sediment samples were collected per site.

Site	CLP Growth 2020	Depth (ft)	Turions per Sample			Total	Total Viable Turions	Average Viable Turions per Site	Viable Turions (number/m²)
			1	2	3				
8	none	6.8	2a	1c	1a	3	3	1.0	40
10	heavy	7.5	0	1b	1c	2	0	0	0
12	none	7.7	1c	0	0	1	0	0	0
13	light	7.0	0	0	1a	1	1	0.33	13
14	heavy	6.0	0	0	0	0	0	0.00	0
23	none	4.7	1c	1c	1a	3	1	0.33	13
25	heavy	6.9	0	0	0	0	0	0	0
27	none	7.3	1c	0	2b	3	0	0	0
28	heavy	6.5	1a	0	1a	2	2	0.67	27
29	heavy	4.2	0	0	1a, 1b	2	1	0.33	13

a=viable
b=non-viable
c=partial-turion leaf

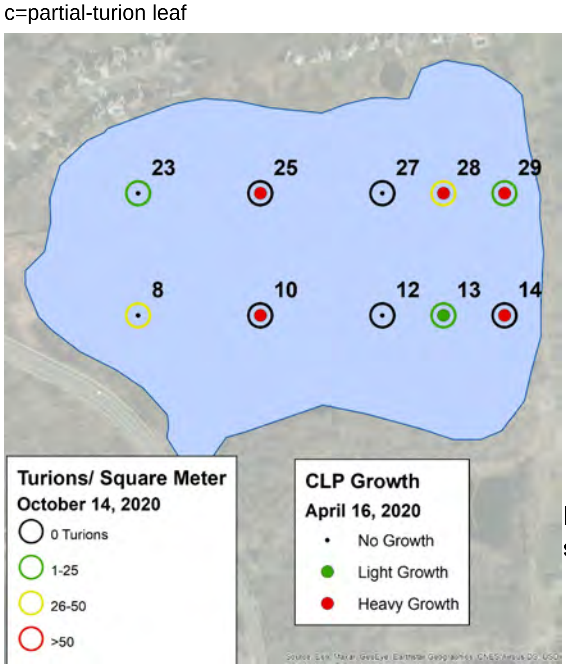


Figure 1. Predicted curlyleaf pondweed growth in 2020 and sediment turion densities on October 14, 2020.

Curlyleaf Pondweed Turion Survey in Keller Lake, Dakota County, 2020

Keller Lake, Dakota County (ID: 19-002500)
Size: 51 acres (MnDNR)
Maximum depth: 9.0 ft (at normal water levels)

Introduction

Keller Lake is located in the boundaries of the Cities of Apple Valley and Burnsville which is within Dakota County. Curlyleaf pondweed (CLP) has been in Keller Lake since at least 1998 and is the dominant submerged aquatic plant in early spring.

This turion survey was conducted to determine the abundance of turions in the sediments of Keller Lake.

Methods

On October 14, 2020, 3 members of Blue Water Science collected triplicate sediment samples from Keller Lake at 10 locations around the lake. Sites were selected around the lake based on the amount of CLP that was determined in the April 16, 2020 submerged aquatic plant survey of Keller Lake. Four sites had no CLP growth, 1 site had light projected CLP growth, and 5 sites had heavy projected CLP growth (Figure 2).

Sample sites were accessed by boat using a sonar and GPS to get to the pre-determined sample locations. Once at the sample location, sediments were collected using a ponar dredge (0.025 m^2 in sampling area). The sample was then transferred to a 5-gallon bucket that had a 5 mm mesh bottom. Washing of the sample occurred by swishing the bucket in the lake to get rid of the fine sediment particles. After the washing occurred, particles were examined to determine the number of turions (Figure 3). If a turion, or part of a turion, was collected it was determined if the turion was viable or non-viable based on its firmness if it was a partial turion. Three sediment samples were collected at each sample location all within about 5 meters of the GPS point.

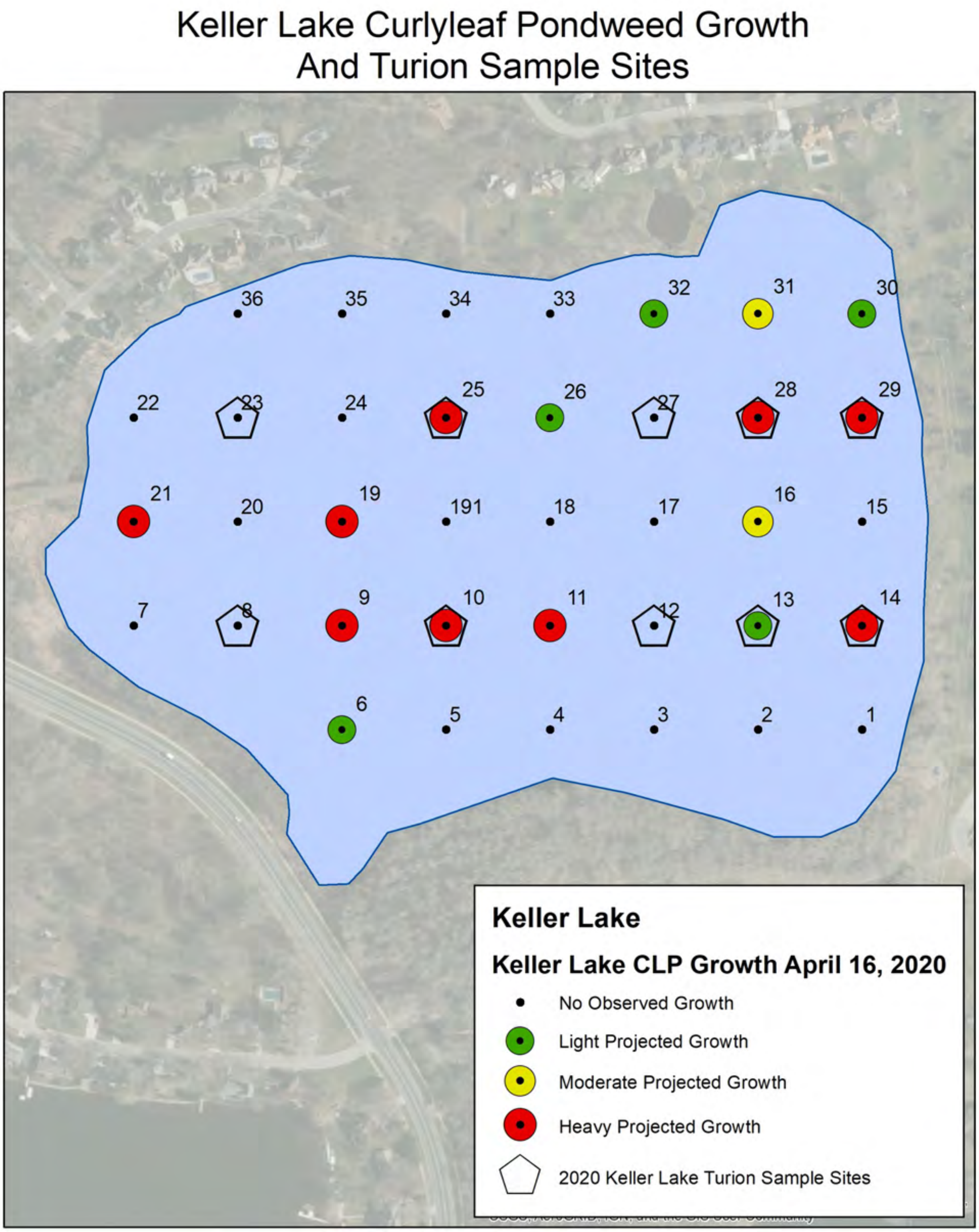


Figure 2. Sample site locations around Keller Lake.

Methods - turion collection in Keller Lake

Figure 3. Turion collection methods for Keller Lake using a ponar dredge and filtering the sediments through a bucket with a wire mesh bottom.

Results

Curlyleaf pondweed turions recovered in the Keller Lake sediments were relatively low in density (Table 2). The overall average density of 11 turions/m^2 for all 30 sites indicates turion distribution is scattered in Keller Lake. Turions were found at 7 out of 30 samples. Triplicate samples were collected at each of the 10 locations and turions were found at 5 out of 10 locations (Table 2) The site with the highest turion density (Site 8 with 40 turions/m^2) had no recorded CLP growth in 2020. There was a poor correlation for turion density related to CLP growth for specific sties (R^2=0.06 where a good correlation would be R^2=0.70 or greater).

Table 2. Keller Lake turion survey, October 14, 2020. Three sediment samples were collected per site.

Site	CLP Growth 2020	Depth (ft)	Turions per Sample			Total	Total Viable Turions	Average Viable Turions per Site	Viable Turions (number/m^2)
			1	2	3				
8	none	6.8	2a	1c	1a	3	3	1.0	40
10	heavy	7.5	0	1b	1c	2	0	0	0
12	none	7.7	1c	0	0	1	0	0	0
13	light	7.0	0	0	1a	1	1	0.33	13
14	heavy	6.0	0	0	0	0	0	0.00	0
23	none	4.7	1c	1c	1a	3	1	0.33	13
25	heavy	6.9	0	0	0	0	0	0	0
27	none	7.3	1c	0	2b	3	0	0	0
28	heavy	6.5	1a	0	1a	2	2	0.67	27
29	heavy	4.2	0	0	1a, 1b	2	1	0.33	13

a=viable
b=non-viable
c=partial-turion leaf

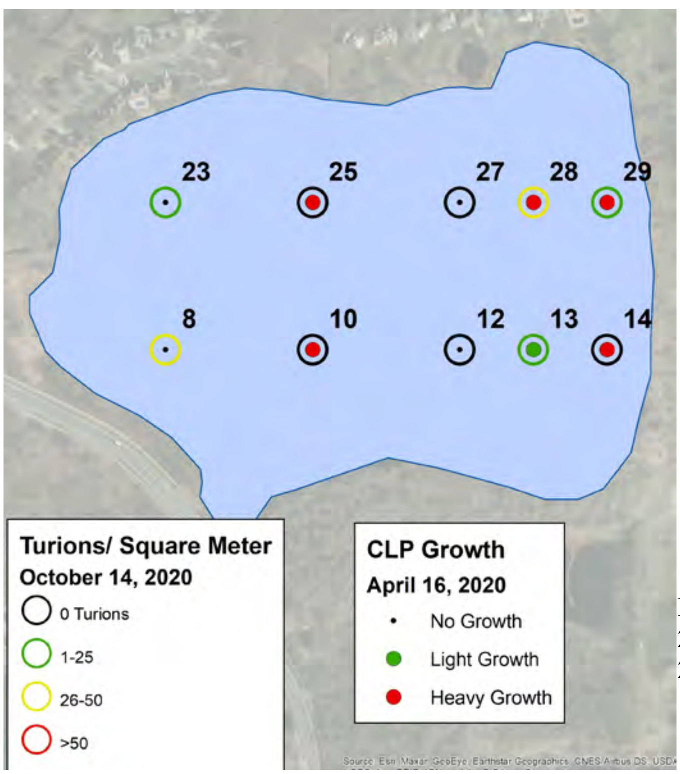


Figure 4. Predicted curlyleaf pondweed growth in 2020 and sediment turion densities on October 14, 2020.

Discussion

Keller Lake Setting: One of the questions addressed in this study was can we use turion density to predict CLP density? Results indicated turion density does not appear to be correlated with CLP stem density for specific spots in a lake, but the overall turion density may give some indication of the potential for light or heavy CLP growth in a lake in general. For example, Keller Lake turion density is relatively low and both light or heavy CLP can occur in areas in some years (Table 3).

Other lakes previously sampled for sediment turion densities show a similar pattern. High turion densities (over 100 turions/m^2) would indicate the potential for moderate to heavy growth and lower turion densities would indicate the potential for light to heavy CLP growth in a lake (Table 3). For example, when Alimagnet Lake was sampled in 1998, overall turion densities were high and CLP growth was moderate to heavy in these areas as well. In 2020, CLP is lighter. It is likely turion density would be lower as well in these areas in 2020. Sediment Turion density may indicate an overall growth potential for CLP in a lake but does not do a very good job of predicting exactly where heavy CLP growth will occur in a lake.

Table 3. Keller Lake sediment turion densities compared to other lake sediment turion densities (from McComas, unpublished).

	Average Turions (number per m^2)	Curlyleaf Growth Status in the Lake
Keller Lake - 2020		
10 sites	11 (n=30)	Light to heavy
Alimagnet Lake - 1998		
West arm (east shore)	131 (n=10)	Moderate to heavy
West arm (channel)	316 (n=40)	Heavy
East arm (south shore)	293 (n=30)	Moderate to heavy
French Lake (Rice Co) - 1998		
North side (Knipples)	259 (n=30)	Heavy
East side (Hoy's)	564 (n=30)	Heavy
West side (Schomakers)	697 (n=30)	Heavy
Long Lake (Isanti Co) - 1998	465 (n=40)	Heavy
Diamond Lake (Kandiyohi Co) - 1998	67 (n=45)	Light to heavy
Lake Ripley (Meeker Co) - 1998	31 (n=30)	Light to heavy

Long-term Curlyleaf Control Is a Challenge: In Keller Lake it appears it will be difficult to achieve long term control of curlyleaf pondweed. Even if it was possible to destroy all curlyleaf turions in Keller Lake there would still be a potential for curlyleaf reestablishment. Curlyleaf could come back from seed germination. Although the seed germination rate is low (estimated at a germination rate of 0.001%; Rogers and Breen 1980*) even a low germination rate is enough to replenish the CLP community. Seed germination has the potential to repopulate a lake in 3 to 4 years at an estimated stem density of over 500 CLP stems/m^2 which would result in a heavy growth condition)(Table 4). Therefore, because curlyleaf can come back from seeds it is probable that long term control of curlyleaf is unlikely.

Data on Keller Lake as well as from other lakes indicates if sediment conditions are conducive to growth, curlyleaf will grow. Therefore, annual spot treatments remain a good control option.

Table 4. Theoretical curlyleaf regrowth from seeds. Assume a CLP density of 1,445 seeds/m^2 and a germination rate of 0.001% (from Rogers and Breen, 1980*). After turion production is re-established, assume 60% germination rate of turions (from Rogers and Breen 1980). The rate of 10 stems produced from a single turion and 10 turions per stem is from McComas (unpublished).

	Year 1	Year 2	Year 3
Early Season Stem Density (stems/m^2)	**0.01445 stems/m^2** (assume 0.001% germination of seeds and a seed density of 1,445 seeds/m^2)	**0.87 stems/m^2** (assume 60% germination of 1.445 turions/m^2 from Year 1)	**52 stems/m^2** (assume 60% germination of 87 turions/m^2 from Year 2)
Late Season Stem Density (stems/m^2)	**0.1445 stems/m^2** (runners produce 10 stems)	**8.70 stems/m^2** (each sprouted turion produces runners and results in 10 stems/turion)	**520 stems/m^2** (each sprouted turion produces 10 stems. 520 stems/m^2 in year 3 represents heavy growth of curlyleaf)
Turions Produced (turions/m^2)	**1.445 turions/m^2** (each of the 10 stems produces 10 turions)	**87 turions/m^2** (each of the 10 stems produces 10 turions)	**5,200 turions/m^2** (each of the 10 stems produces 10 turions. There is a potential for nuisance growth conditions from here on.)

** Rogers, K.H. and C.M. Breen. 1980. Growth and reproduction of* Potamogeton crispus *in a South African lake. Journal of Ecology 68:561-571.*

Keller Lake Aquatic Macrophyte Seedbank Assessment:

2020 Report to Burnsville and Apple Valley

Noah M. Berg
and
Raymond M. Newman

University of Minnesota

16 October 2020

Background

Aquatic macrophytes provide critical habitat for fish and invertebrate (Valley et al. 2004), stabilize sediments (Madsen et al. 2001), and help maintain water clarity in the littoral zone (Hanson and Butler 1994, Scheffer 1998). Therefore, healthy native aquatic vegetation is important to maintaining lake quality, and restoration and maintenance of native vegetation is a common management goal (Scheffer 1998, Valley et al. 2004, Cooke et al. 2005). However, high densities of invasive species such as common carp, Eurasian watermilfoil, and Curly-leaf pondweed may suppress native plant communities (Madsen et al. 1991, Bajer and Sorensen 2015, Jones et al. 2012, Knopik and Newman 2018). Restoring and enhancing submersed native plants is often a goal of lake managers, particularly in conjunction with efforts to enhance water quality and clarity to meet water quality goals (Baker and Newman 2014, Bakker et al. 2013, Hilt et al. 2018).

A variety of approaches are used to improve water clarity including reducing external loading, carp removal, and controls on internal loading (e.g., Huser et al. 2011, Bajer and Sorensen 2015) but invasive species often capitalize on the improved clarity and must be controlled. Rapid recovery of native plant communities after fish removal or control of invasive species is not ensured and integration of strategies to promote revegetation by native plants is often needed (Cooke et al. 2005). Transplanting can be used to speed the process, but the success of transplants may be limited to shallow water if water clarity is not fully restored (Knopik and Newman 2018).

Sustaining good summer-long water clarity, for example with alum treatment, is thus critical to restoring native plant communities (Knopik and Newman 2018, Dunne and Newman 2019). However, before attempting intensive and costly transplanting after water clarity improvements, it is useful to first assess the seed bank present (Lu et al. 2012, Dunne and Newman 2019). If a diverse and viable seed bank is present, there may not be a need to transplant taxa (Dunne and Newman 2019) and it would be advisable to transplant only taxa not present in the seed bank to make the most effective use of resources and also to assess the success of the transplant efforts.

Keller Lake, Dakota County (DOW 19-0025) is a small (21 ha), shallow (max depth 2.1m) lake within the Black Dog Watershed Management area. The lake has been listed as impaired for recreational use due to excess nutrients (phosphorus) since 2002 (https://www.pca.state.mn.us/water/tmdl/crystal-keller-and-lee-lakes-tmdl-and-earley-lake-water-quality-assessment-excess). A variety of management actions have been taken to reduce phosphorus and improve water quality including iron sediment dosing and macrophyte harvesting to reduce internal loading, watershed management, and stormwater treatment to reduce external loading and an alum treatment in June 2019 (Anon 2019). The alum treatment did reduce phosphorus and improve clarity during 2019 based on Secchi depth observations and efforts are now focused on improving the native plant community. Curlyleaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*) are present (McComas and Stuckert 2017). Curlyleaf pondweed has been controlled with early-season endothall applications since 2017 (Anon 2019). This project aimed to assess the seed bank of Keller Lake and to determine the native taxa present based on the samples collected across the lake.

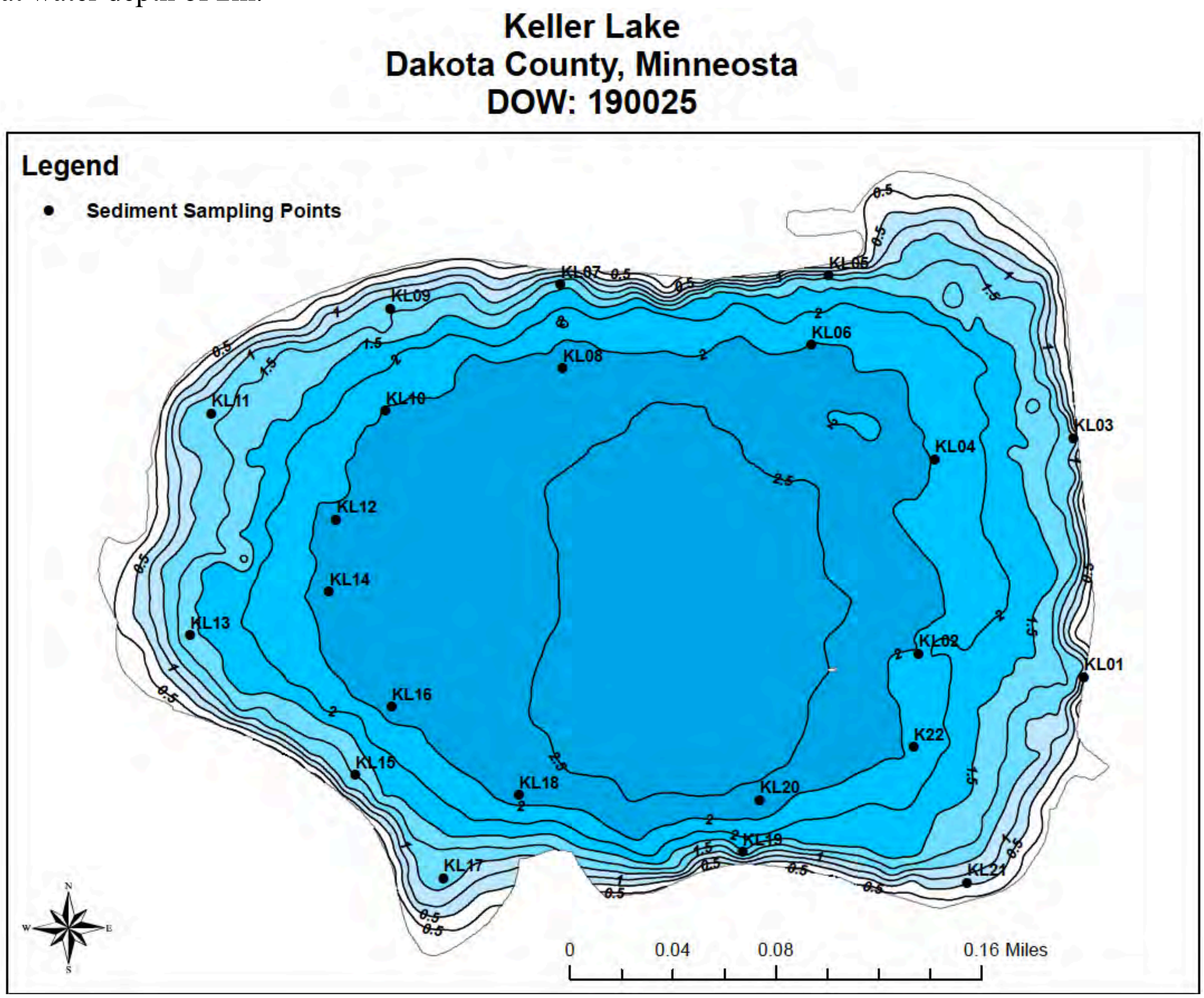
Methods

Twenty-two sediment cores were collected on 16 July 2020 from randomly selected locations evenly spaced around the littoral zone with half the cores coming from a water depth of one meter and the other half being collected at a water depth of two meters (Figure 1). The sediment cores were collected using a 10-centimeter diameter PVC coring device. At each sampling location, except for samples 21 and 22, the top 5 cm of sediment from each core was collected and placed into labeled bags. For the final two samples, the top 10 cm of sediment was collected to include viable seeds lower in the sediment. The cores were then placed in a cooler for temporary storage and were held in a refrigerator at the Newman lab until the germination/viability experiment was initiated.

The collected sediment was then placed into a growth chamber to allow for sprouting to occur in a controlled stable environment. Each core was divided in half and placed in two 19cm x 19cm x 6cm trays and covered with 3cm of water. Then each half was placed under one of two light levels: high, approximately 304µE/m^2/s, and low, approximately 28µE/m^2/s, both on a 15-hour light and 9-hour dark photoperiod. Temperature and Relative humidity (RH) were set at approximately 22°C and 90% respectively. At the onset of the experiment, gibberellic acid was applied at a concentration of 0.3mM to all trays to produce optimal sprouting conditions (Tuckett 2010, Baskin and Baskin 2014, Dunne and Newman 2019).

The trays were monitored for eight weeks, with total sprouts being enumerated weekly by taxa. Taxa were identified under a microscope based on seed and shoot traits using Skawinski's Aquatic Plants of the Upper Midwest (2018). Identified sprouts were removed each week to prevent double counting. Some sprouts were grown for two weeks to aid in identification.

Figure 1. Keller seed bank assessment sediment core sample points collected 16 July 2020; odd numbered points were collected at a water depth of 1m and even numbered points were collected at water depth of 2m.



Results

During the eight-week-long seed bank assessment, nine taxa sprouted, with eight being native species (Table 1). Slender naiad (*Najas flexilis*), curly-leaf pondweed, Canada waterweed (*Elodea canadensis*), and small pondweed (*P. berchtodii*; often considered *P. pusillus* by others) occurred the most frequently with a frequency of 7, 7, 11, and 85 sprouts respectively out of the 44 trays examined (Table 1). Trays that were in the high light, approximately 304μE/m^2/s, yielded 71 sprouts compared to the 54 sprouts found in the low light, approximately 28μE/m^2/s (Table 2). For the 5cm core samples, each tray yielded an average of 0.31 sprouts per week, whereas the 10cm core samples yielded an average of 0.81 sprouts per week (Table 2). The 11 samples collected at a depth of 1m produced 65 sprouts and those at 2m 60 sprouts (Table 2), which indicates that the number of viable seeds is nearly equal at each of the two water depths.

The number of taxa found in Keller Lake (9 taxa) was much lower than the number of species found in Lakes Riley (17), Ann (16) (Dunne and Newman 2019), or Hyland Lake (16; Olson and Newman) indicating a depleted seed bank in Keller Lake. McComas and Stuckert (2017) reported 8 species from recent surveys of Keller Lake. They found Eurasian watermilfoil (*Myriophyllum spicatum*) and sago pondweed (*Stuckenia pectinata*) that we did not; we found *Chara, Nitella,* and water stargrass (*Zosterella dubia*) that they did not find in the lake. Their surveys and our study both found curlyleaf pondweed, coontail, duckweed, slender naiad, and small pondweed (we identified it as *Potamogeton berchtoldii;* McComas and Stuckert called it *P. pusillus*, which many consider as the same taxa). Nonetheless, the diversity is low in Keller Lake and stocking additional taxa is probably warranted. We advise against stocking taxa already present in lake surveys or our seed bank assessment so that stocking efforts can be properly assessed and to maximize diversity potential in the lake.

Soil that was exposed to light levels of greater intensity yielded a higher number of native sprouts which demonstrates the need to lower nutrient input and maximize water clarity. Sediment samples that had 10cm cores grew more sprouts on average than those of 5cm cores with the same quantity of soil, which indicates that Keller lake has more viable seeds lower in the sediment that can sprout when exposed to optimal growing conditions.

It would be best to transplant native taxa from local water bodies that were not found during the seed bank experiment to help support a diverse native community and lower phosphorus levels in the system (Scheffer 1998, Valley et al. 2004, Cooke et al. 2005). These plants should be introduced into shallow waters to maximize light availability for newly introduced plants. This process should be monitored through point intercept or delineation surveys of Keller lake in order to assess the long-term effects of a variety of treatments conducted on the system.

Table 1. Sprouts per week by taxa from Keller Lake from forty-four trays over the eight-week seed bank assessment experiment, including total sprouts by taxa.

Week Number	*Potamogeton crispus* (Curlyleaf pondweed)	*Ceratophyllum demersum* (Coontail)	*Chara spp.* (Muskgrass)	*Elodea canadensis* (Canada waterweed)	*Lemna minor* (Lesser duckweed)	*Najas flexilis* (Slender naiad)	*Nitella spp.* (Nitella)	*Potamogeton berchtoldii* (Small pondweed)	*Zosterella dubia* (Water stargrass)
1	1	3		7					
2	2	1		2		1		24	
3	3			2	2	3		40	
4					1	1		8	
5								2	
6						1	4	9	1
7						1			
8	1		5					2	
Total:	7	4	5	11	3	7	4	85	1

Table 2. Sprouts per week based on light level, the average number of spouts per tray based on the depth of sediment collected, and the number of sprouts produced at each collection depth.

Week Number	**Light Level Control**	Higher Light Level Trays	Lower Light Level Trays	**Sediment Depth Control**	5 cm Core Sample Average per Tray (1-20)	10 cm Core Sample Average per Tray (21-22)	**Sample Collection Depth**	Samples Collected at 1m Water Depth	Samples Collected at 2m Water Depth
1		5	6		0.125	1.5		9	2
2		15	15		0.6	1.5		19	11
3		33	17		1.025	2.25		20	30
4		3	7		0.175	0.75		4	6
5		2	0		0.05	0		1	1
6		6	7		0.3	0.25		7	6
7		0	1		0.025	0		1	0
8		7	1		0.175	0.25		4	4
	Total:	71	54	Average:	0.31	0.81	Total:	65	60

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Keller Lake Curlyleaf Pondweed Control & Native Plant Reintroduction

Cost

Total project costs: $12,615.10

Grant funding covered $6,307.55 and the City provided $6,307.55 in matching funds, including $2,550.50 of in-kind match.

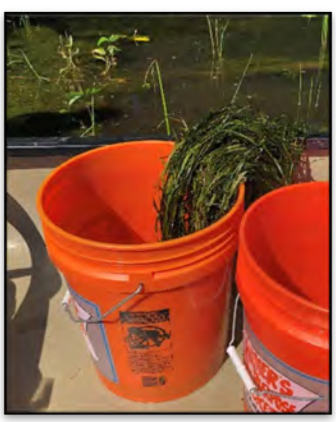
Left-Sediment samples are sifted, leaving behind CLP turion to be assessed and recorded (Steve McComas).

Project Description

Curlyleaf pondweed (CLP) has been an issue on Keller Lake for many years. Until 2017 management primarily consisted of harvesting, which improved recreation and aesthetic concerns but did not impact long-term coverage and abundance. Three years of herbicide treatment (2017-2019) have successfully managed CLP, however continued treatment is needed.

In 2020, plant surveys were conducted to delineate the CLP treatment area and to record other plant growth (including native plants). A turion survey was conducted to gather information on potential future CLP growth. This was the first turion survey of Keller Lake. Finally, to address the lack of native vegetation in Keller Lake, a native plant reintroduction was conducted to test whether transplanted aquatic plants would establish, spread, and eventually compete with the dominant vegetation.

The Cities of Apple Valley and Burnsville work together to address AIS and lake condition issues, including the projects listed here.



Left-Native aquatic plants were harvested by hand and transplanted into protective plots the next day. Right-Large leaf pondweed transplants on 10/6/20. Transplant percent cover was recorded during the growing season (Linnea Wier).

Outcomes

CLP Delineation (4/16/20) – 37 sites were sampled. Results include 43% occurrence of CLP at light, moderate, and heavy projected growth. A 7.59-acre treatment area was delineated based on locations of heavy growth areas. The only other plants observed were coontail, elodea and Eurasian water milfoil.

Post-Treatment Survey (6/1/20) – No viable CLP was observed, showing success of the 5/1/20 treatment.

Late-Season Survey (7/29/20) – The following plants were observed at these percent occurrences: coontail (68%), elodea (35%) and Eurasian water milfoil (19%). For reference, the observed native plant diversity since 2014 is one species (coontail).

Turion Survey (10/14/20) – Three sediment samples were collected at each of 10 sites representative of a range of CLP growth estimates, including "none observed," as recorded in the 4/16/20 survey. Low-moderate density was reported - average density per site was 11 viable turions/m^2; total density ranged from 0-40 viable turions/m^2. The turion survey & CLP delineation results together show a poor correlation between turion density and CLP growth for specific sites. However average turion density may predict a lake-wide growth estimate for CLP in the future.

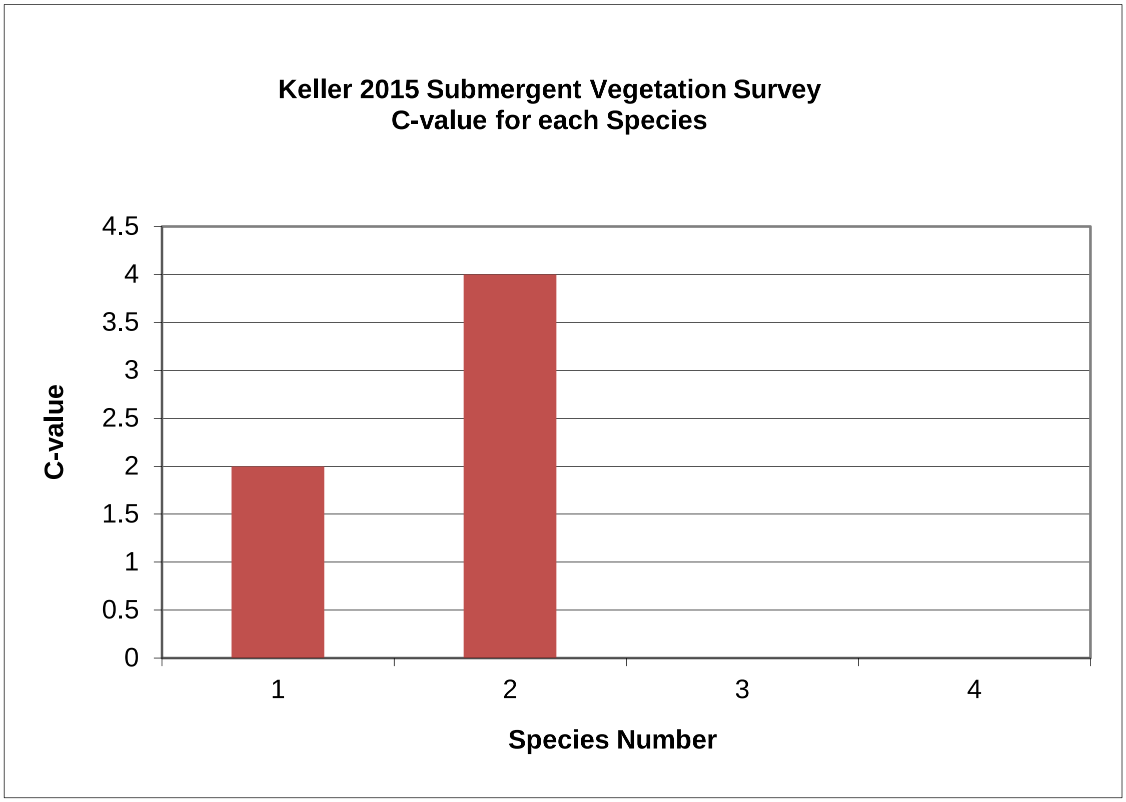
Native Plant Reintroduction (6/24-10/6/20) - ~300 plants (fern leaf pondweed, flatstem pondweed, large leaf pondweed, and water stargrass) were harvested by hand from Lake Hanrehan (Three Rivers Park District) and transplanted the next day into 10 fenced plots. Plots were monitored during the growing season to record percent cover, clarity, and density of plants surrounding the plots. One encouraging result is the overall survival of all species - as of final monitoring date all species were present in all plots where transplanted. Future monitoring is needed to record long term establishment and spread.

Appendix B

Keller Lake Floristic Quality Assessment Data

2015 Keller Submergent Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Elodea canadensis	elodea	4
Myriophyllum spicatum	Eurasian watermilfoil	0
Potamogeton crispus	curlyleaf pondweed	0
Mean C-value		1.5
S (Number of Species of Submergent/Floating-leaf Plants in the Lake)		4
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		3.00



Species Number	Scientific Name	Common Name	C-value
1	*Ceratophyllum demersum*	coontail	2
2	*Elodea canadensis*	elodea	4
3	*Myriophyllum spicatum*	Eurasian watermilfoil	0
4	*Potamogeton crispus*	curlyleaf pondweed	0

2020 Keller Submergent Vegetation
Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Ceratophyllum demersum	coontail	2
Elodea canadensis	elodea	4
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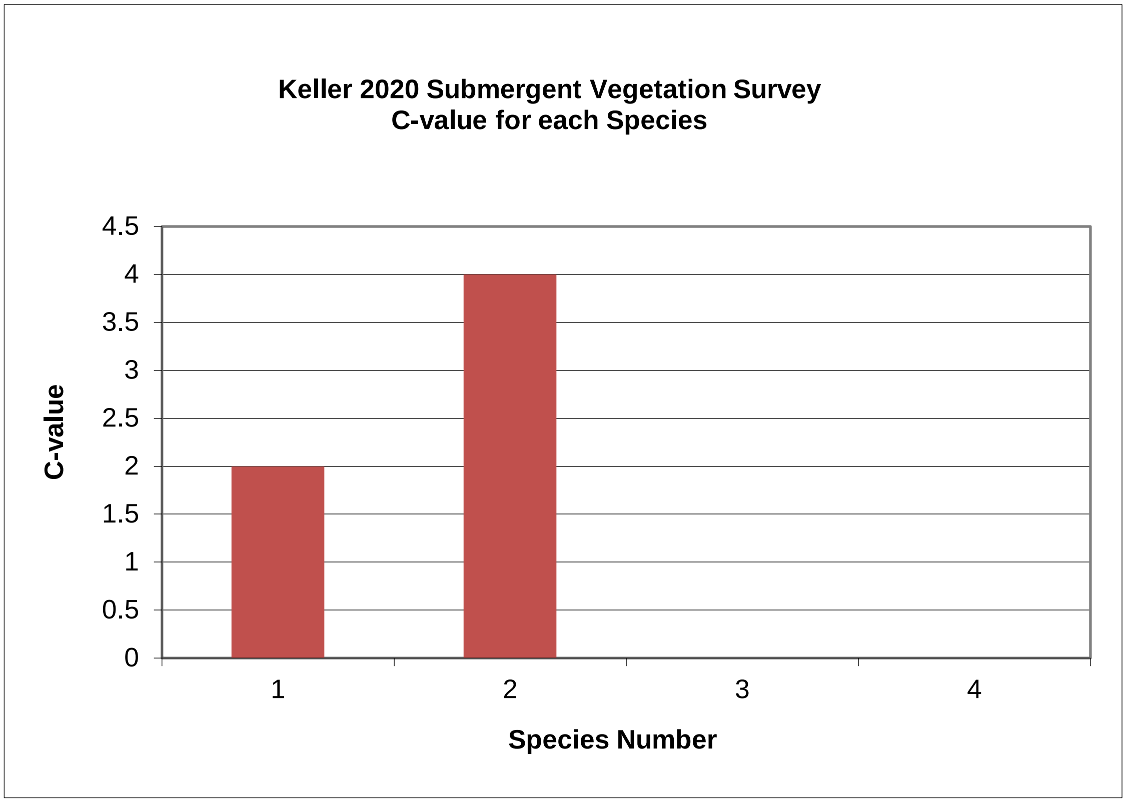

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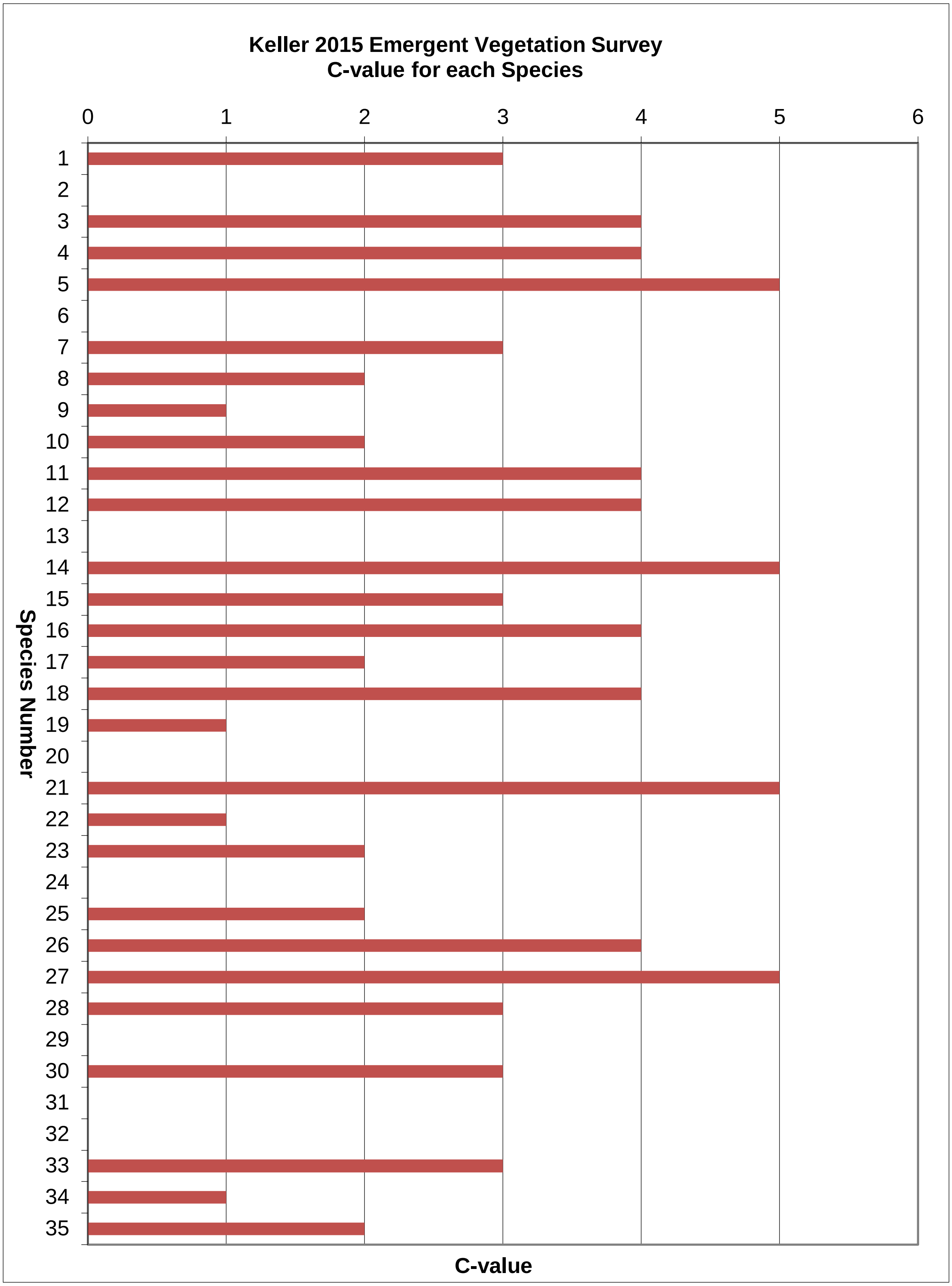
2	*Elodea canadensis*	elodea	4
3	*Myriophyllum spicatum*	Eurasian watermilfoil	0
4	*Potamogeton crispus*	curlyleaf pondweed	0

2015 Keller Emergent Vegetation
Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Acer saccharinum	silver maple	3
Alliaria petiolata	garlic mustard	0
Asclepias incarnata	swamp milkweed	4
Carex scoparia	broom sedge	4
Carex stricta	Uptight Sedge	5
Cirsium vulgare	bull thistle	0
Cornus alba	red osier dogwood	3
Fraxinus pennsylvanica	green ash	2
Galium aparine	cleavers	1
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Juncus effusus	soft rush	4
Lactuca serriola	prickly lettuce	0
Lycopus uniflorus	northern bugleweed	5
Mentha arvensis	wild mint	3
Onoclea sensibilis	sensitive fern	4
Parthenocissus vitacea	woodbine	2
Persicaria amphibia	water smartweed	4
Persicaria pensylvanicum	Pennsylvania smartweed	1
Phalaris arundinacea	reed canarygrass	0
Poa palustris	fowl bluegrass	5
Potentilla norvegica	rough cinquefoil	1
*Rubus occidentalis **	black raspberry	2
Rumex crispus	curly dock	0
Salix interior	sandbar willow	2
Salix nigra	black willow	4
Sambucus racemosa	red elderberry	5
Scirpus cyperinus	woolgrass	3
Solanum dulcamara	climbing nightshade	0
Solidago gigantea	Late Goldenrod	3
Typha angustifolia	narrowleaf cattail	0
Typha X glauca	hybrid cattail	0
Ulmus americana	American elm	3
Urtica dioica	Stinging Nettle	1
Vitis riparia	wild grape	2
Mean C-value		2.3
S (Number of Species of Emergent Plants in the Lake)		35
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		13.86


Keller 2015 Emergent Vegetation Survey
C-value for each Species
0
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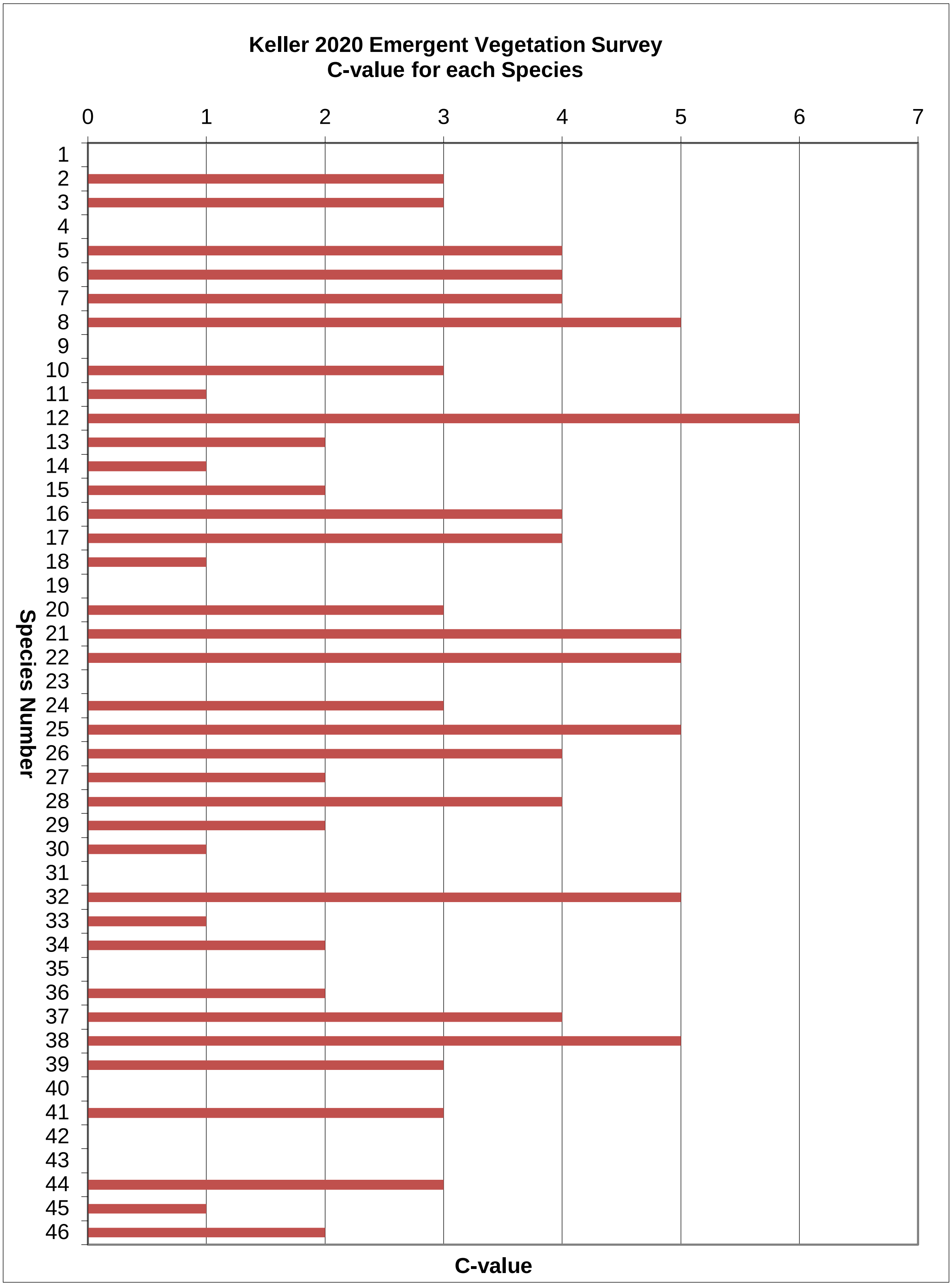
Species Number
C-value

Keller 2015 Emergent Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer saccharinum*	silver maple	3
2	*Alliaria petiolata*	garlic mustard	0
3	*Asclepias incarnata*	swamp milkweed	4
4	*Carex scoparia*	broom sedge	4
5	*Carex stricta*	Uptight Sedge	5
6	*Cirsium vulgare*	bull thistle	0
7	*Cornus alba*	red osier dogwood	3
8	*Fraxinus pennsylvanica*	green ash	2
9	*Galium aparine*	cleavers	1
10	*Impatiens capensis*	jewelweed	2
11	*Iris versicolor*	harlequin blueflag	4
12	*Juncus effusus*	soft rush	4
13	*Lactuca serriola*	prickly lettuce	0
14	*Lycopus uniflorus*	northern bugleweed	5
15	*Mentha arvensis*	wild mint	3
16	*Onoclea sensibilis*	sensitive fern	4
17	*Parthenocissus vitacea*	woodbine	2
18	*Persicaria amphibia*	water smartweed	4
19	*Persicaria pensylvanicum*	Pennsylvania smartweed	1
20	*Phalaris arundinacea*	reed canarygrass	0
21	*Poa palustris*	fowl bluegrass	5
22	*Potentilla norvegica*	rough cinquefoil	1
23	*Rubus occidentalis* *	black raspberry	2
24	*Rumex crispus*	curly dock	0
25	*Salix interior*	sandbar willow	2
26	*Salix nigra*	black willow	4
27	*Sambucus racemosa*	red elderberry	5
28	*Scirpus cyperinus*	woolgrass	3
29	*Solanum dulcamara*	climbing nightshade	0
30	*Solidago gigantea*	Late Goldenrod	3
31	*Typha angustifolia*	narrowleaf cattail	0
32	*Typha X glauca*	hybrid cattail	0
33	*Ulmus americana*	American elm	3
34	*Urtica dioica*	Stinging Nettle	1
35	*Vitis riparia*	wild grape	2

2020 Keller Emergent Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value
Acer ginnala	amur maple	0
Acer rubrum	red maple	3
Acer saccharinum	silver maple	3
Alliaria petiolata	garlic mustard	0
Asclepias incarnata	swamp milkweed	4
Bidens tripartita	beggarticks	4
Carex scoparia	broom sedge	4
Carex stricta	Uptight Sedge	5
Cirsium vulgare	bull thistle	0
Cornus alba	red osier dogwood	3
Equisetum arvense	field horsetail	1
Equisetum pratense	meadow horsetail	6
Fraxinus pennsylvanica	green ash	2
Galium aparine	cleavers	1
Impatiens capensis	jewelweed	2
Iris versicolor	harlequin blueflag	4
Juncus effusus	soft rush	4
Juncus tenuis	path rush	1
Lactuca serriola	prickly lettuce	0
Leersia oryzoides	rice cut grass	3
Lemna minor	lesser duckweed	5
Lycopus uniflorus	northern bugleweed	5
Lythrum salicaria	purple loosestrife	0
Mentha arvensis	wild mint	3
Mimulus ringens	blue monkey flower	5
Onoclea sensibilis	sensitive fern	4
Parthenocissus vitacea	woodbine	2
Persicaria amphibia	water smartweed	4
Persicaria lapathifolium	nodding smartweed	2
Persicaria pensylvanicum	Pennsylvania smartweed	1
Phalaris arundinacea	reed canarygrass	0
Poa palustris	fowl bluegrass	5
Potentilla norvegica	rough cinquefoil	1
Rubus occidentalis *	black raspberry	2
Rumex crispus	curly dock	0
Salix interior	sandbar willow	2
Salix nigra	black willow	4
Sambucus nigra	black elderberry	5
Scirpus cyperinus	woolgrass	3
Solanum dulcamara	climbing nightshade	0
Solidago gigantea	Late Goldenrod	3
Typha angustifolia	narrowleaf cattail	0
Typha X glauca	hybrid cattail	0
Ulmus americana	American elm	3
Urtica dioica	Stinging Nettle	1
Vitis riparia	wild grape	2
Mean C-value		2.4
S (Number of Species of Emergent Plants in the Lake)		46
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		16.51


Keller 2020 Emergent Vegetation Survey
C-value for each Species
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Species Number
C-value
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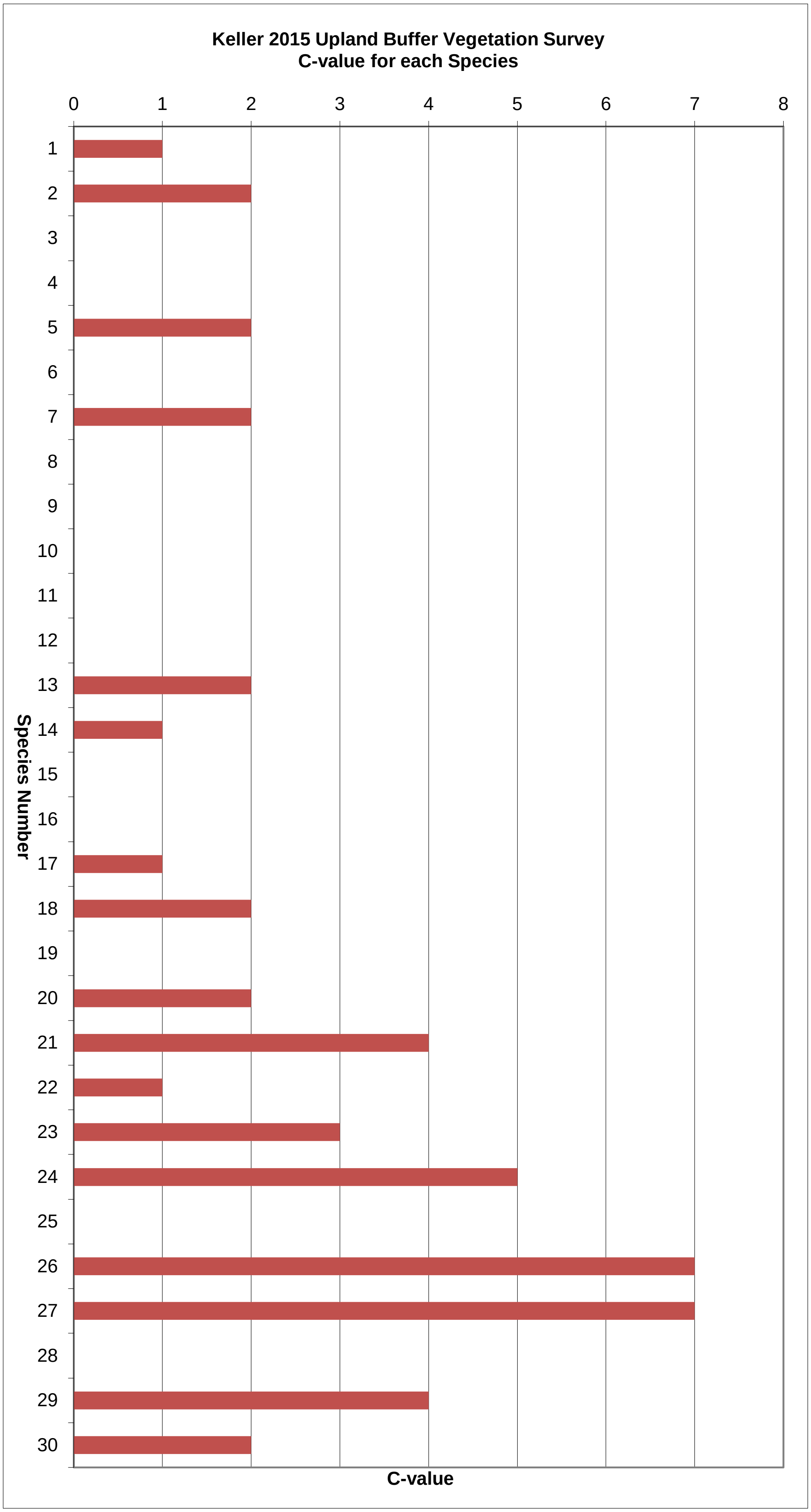
Keller 2020 Emergent Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer ginnala*	amur maple	0
2	*Acer rubrum*	red maple	3
3	*Acer saccharinum*	silver maple	3
4	*Alliaria petiolata*	garlic mustard	0
5	*Asclepias incarnata*	swamp milkweed	4
6	*Bidens tripartita*	beggarticks	4
7	*Carex scoparia*	broom sedge	4
8	*Carex stricta*	Uptight Sedge	5
9	*Cirsium vulgare*	bull thistle	0
10	*Cornus alba*	red osier dogwood	3
11	*Equisetum arvense*	field horsetail	1
12	*Equisetum pratense*	meadow horsetail	6
13	*Fraxinus pennsylvanica*	green ash	2
14	*Galium aparine*	cleavers	1
15	*Impatiens capensis*	jewelweed	2
16	*Iris versicolor*	harlequin blueflag	4
17	*Juncus effusus*	soft rush	4
18	*Juncus tenuis*	path rush	1
19	*Lactuca serriola*	prickly lettuce	0
20	*Leersia oryzoides*	rice cut grass	3
21	*Lemna minor*	lesser duckweed	5
22	*Lycopus uniflorus*	northern bugleweed	5
23	*Lythrum salicaria*	purple loosestrife	0
24	*Mentha arvensis*	wild mint	3
25	*Mimulus ringens*	blue monkey flower	5
26	*Onoclea sensibilis*	sensitive fern	4
27	*Parthenocissus vitacea*	woodbine	2
28	*Persicaria amphibia*	water smartweed	4
29	*Persicaria lapathifolium*	nodding smartweed	2
30	*Persicaria pensylvanicum*	Pennsylvania smartweed	1
31	*Phalaris arundinacea*	reed canarygrass	0
32	*Poa palustris*	fowl bluegrass	5
33	*Potentilla norvegica*	rough cinquefoil	1
34	*Rubus occidentalis **	black raspberry	2
35	*Rumex crispus*	curly dock	0
36	*Salix interior*	sandbar willow	2
37	*Salix nigra*	black willow	4
38	*Sambucus racemosa*	red elderberry	5
39	*Scirpus cyperinus*	woolgrass	3
40	*Solanum dulcamara*	climbing nightshade	0
41	*Solidago gigantea*	Late Goldenrod	3
42	*Typha angustifolia*	narrowleaf cattail	0
43	*Typha X glauca*	hybrid cattail	0
44	*Ulmus americana*	American elm	3
45	*Urtica dioica*	Stinging Nettle	1
46	*Vitis riparia*	wild grape	2

2015 Keller Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer negundo	boxelder	1
Amphicarpaea bracteata	hog peanut	2
Arctium minus	burrdock	0
Asclepias syriaca	common milkweed	0
Circaea canadensis	common enchanter's nightshade	2
Cirsium arvense	Canada thistle	0
Fraxinus pennsylvanica	green ash	2
Lonicera tatarica	Tatarian honeysuckle	0
Melilotus officinalis	sweetclover	0
Morus rubra	red mulberry	0
Nepeta cataria	catnip	0
Oxalis stricta	yellow wood sorrel	0
Parthenocissus vitacea	woodbine	2
Persicaria pensylvanicum	Pennsylvania smartweed	1
Phalaris arundinacea	reed canarygrass	0
Poa pratensis	Kentucky bluegrass	0
Populus deltoides	cottonwood	1
Potentilla simplex	cinquefoil	2
Rhamnus cathartica	common buckthorn	0
Rhus typhina *	staghorn sumac	2
Ribes americanum	wild black current	4
Solidago altissima	late goldenrod	1
Solidago gigantea	giant goldenrod	3
Symphyotrichum lanceolatum	Eastern panicled aster	5
Taraxacum officinale	common dandelion	0
Thuja occidentalis	white cedar	7
Toxocodendron radicans	poison ivy	7
Trifolium repens	white clover	0
Vicia americana *	American vetch	4
Vitis riparia	wild grape	2
Mean C-value		1.6
S (Number of Species of Upland Buffer Plants)		30
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		8.76

* A C-value for this species has not been determined in Minnesota.
The C-value used is from the Wisconsin Floristic Quality Assessment.


Keller 2015 Upland Buffer Vegetation Survey
C-value for each Species
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Species Number
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C-value

Keller 2015 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Amphicarpaea bracteata*	hog peanut	2
3	*Arctium minus*	burrdock	0
4	*Asclepias syriaca*	common milkweed	0
5	*Circaea canadensis*	common enchanter's nightshade	2
6	*Cirsium arvense*	Canada thistle	0
7	*Fraxinus pennsylvanica*	green ash	2
8	*Lonicera tatarica*	Tatarian honeysuckle	0
9	*Melilotus officinalis*	sweetclover	0
10	*Morus rubra*	red mulberry	0
11	*Nepeta cataria*	catnip	0
12	*Oxalis stricta*	yellow wood sorrel	0
13	*Parthenocissus vitacea*	woodbine	2
14	*Persicaria pensylvanicum*	Pennsylvania smartweed	1
15	*Phalaris arundinacea*	reed canarygrass	0
16	*Poa pratensis*	Kentucky bluegrass	0
17	*Populus deltoides*	cottonwood	1
18	*Potentilla simplex*	cinquefoil	2
19	*Rhamnus cathartica*	common buckthorn	0
20	*Rhus typhina* *	staghorn sumac	2
21	*Ribes americanum*	wild black current	4
22	*Solidago altissima*	late goldenrod	1
23	*Solidago gigantea*	giant goldenrod	3
24	*Symphyotrichum lanceolatum*	Eastern panicled aster	5
25	*Taraxacum officinale*	common dandelion	0
26	*Thuja occidentalis*	white cedar	7
27	*Toxocodendron radicans*	poison ivy	7
28	*Trifolium repens*	white clover	0
29	*Vicia americana* *	American vetch	4
30	*Vitis riparia*	wild grape	2

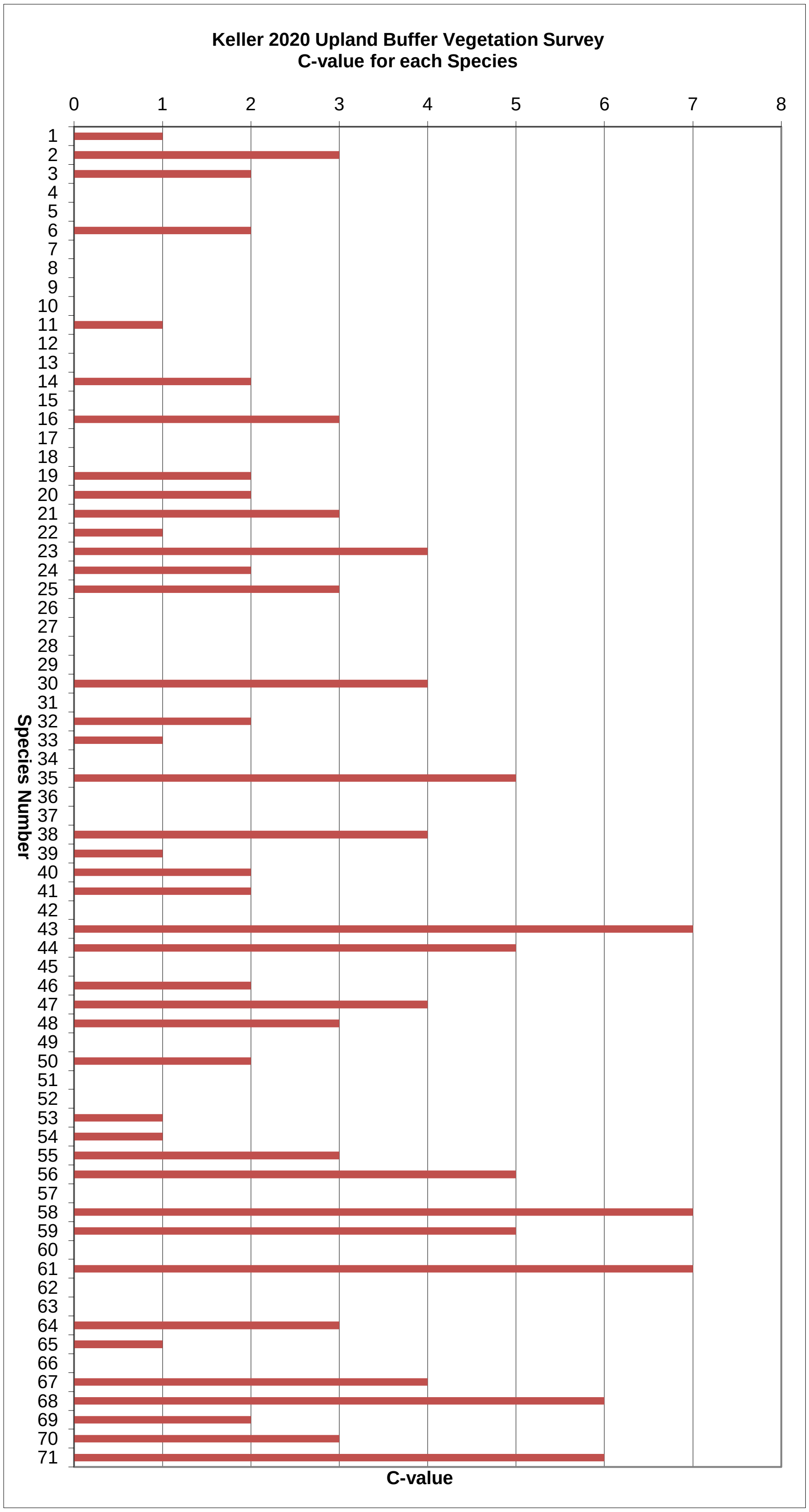
2020 Keller Upland Buffer Vegetation Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Acer negundo	boxelder	1
Acer saccharinum	silver maple	3
Ageratina altissima	white snakeroot	2
Alliaria petiolata	garlic mustard	0
Ambrosia artemisiifolia	common ragweed	0
Amphicarpaea bracteata	hog peanut	2
Arctium minus	burrdock	0
Artemisia sp.	wormwood	0
Asclepias syriaca	common milkweed	0
Bromus inermis	smooth brome	0
Calystegia sepium	bindweed	1
Campanula rapunculoides	bellflower	0
Centaurea stoebe	spotted knapweed	0
Circaea lutetiana	broad-leaf enchanter's nightshade	2
Cirsium arvense	Canada thistle	0
Cornus alba	red-osier dogwood	3
Dactylis glomerata	orchard grass	0
Digitaria sanguinalis	crabgrass	0
Erigeron strigosus	daisy fleabane	2
Fraxinus pennsylvanica	green ash	2
Geum aleppicum	yellow avens	3
Hackelia virginiana	sticktight	1
Juglans nigra	black walnut	4
Juniperus virginiana	eastern red cedar	2
Laportea canadensis	wood nettle	3
Lonicera tatarica	Tatarian honeysuckle	0
Melilotus officinalis	sweetclover	0
Morus rubra	red mulberry	0
Nepeta cataria	catnip	0
Osmorhiza longistylis	sweet cicely	4
Oxalis stricta	yellow wood sorrel	0
Parthenocissus vitacea	woodbine	2
Persicaria pensylvanicum	Pennsylvania smartweed	1
Phalaris arundinacea	reed canarygrass	0
Pinus strobus	white pine	5
Plantago major	common plantain	0
Poa pratensis	Kentucky bluegrass	0
Polygonatum biflorum	Solomon's seal	4
Populus deltoides	cottonwood	1
Populus tremuloides	quaking aspen	2
Potentilla simplex	cinquefoil	2
Prunella vulgaris	heal-all	0

2020 Keller Upland Buffer Vegetation
Floristic Quality Index

Species	Common Name	Coefficient of Conservatism Value (C-value)
Quercus alba	white oak	7
Quercus rubra	red oak	5
Rhamnus cathartica	common buckthorn	0
Rhus typhina *	staghorn sumac	2
Ribes americanum	wild black current	4
Rudbeckia hirta	black-eyed Susan	3
Rumex crispus	curly dock	0
Salix interior	sandbar willow	2
Securigera varia	crown vetch	0
Solanum dulcamera	climbing nightshade	0
Solidago altissima	late goldenrod	1
Solidago canadensis	Canada goldenrod	1
Solidago gigantea	giant goldenrod	3
Symphyotrichum lanceolatum	Eastern panicled aster	5
Taraxacum officianale	common dandelion	0
Thuja occidentalis	white cedar	7
Tilia americana	basswood	5
Torilis japonica	Japanese hedge parsley	0
Toxocodendron radicans	poison ivy	7
Trifolium hybridum	alsike clover	0
Trifolium repens	white clover	0
Ulmus americana	American elm	3
Urtica dioica	stinging nettle	1
Verbascum thapsus	common mullein	0
Vicia americana *	American vetch	4
Viola sp. **	violet	6
Vitis riparia	wild grape	2
Zanthoxylum americanum *	prickly ash	3
Zizia aurea	golden alexanders	6
Mean C-value		1.8
S (Number of Species of Upland Buffer Plants)		71
Floristic Quality Index (FQI) = (Mean C-value)* (Square Root of S)		15.31

* A C-value for this species has not been determined in Minnesota.
The C-value used is from the Wisconsin Floristic Quality Assessment.



Keller 2020 Upland Buffer Vegetation Survey
C-value for each Species
Species Number
C-value

Keller 2020 Upland Buffer Vegetation Survey

Species Number	Scientific Name	Common Name	C-value
1	*Acer negundo*	boxelder	1
2	*Acer saccharinum*	silver maple	3
3	*Ageratina altissima*	white snakeroot	2
4	*Alliaria petiolata*	garlic mustard	0
5	*Ambrosia artemisiifolia*	common ragweed	0
6	*Amphicarpaea bracteata*	hog peanut	2
7	*Arctium minus*	burrdock	0
8	*Artemisia sp.*	wormwood	0
9	*Asclepias syriaca*	common milkweed	0
10	*Bromus inermis*	smooth brome	0
11	*Calystegia sepium*	bindweed	1
12	*Campanula rapunculoides*	bellflower	0
13	*Centaurea stoebe*	spotted knapweed	0
14	*Circaea lutetiana*	broad-leaf enchanter's nightsha	2
15	*Cirsium arvense*	Canada thistle	0
16	*Cornus alba*	red-osier dogwood	3
17	*Dactylis glomerata*	orchard grass	0
18	*Digitaria sanguinalis*	crabgrass	0
19	*Erigeron strigosus*	daisy fleabane	2
20	*Fraxinus pennsylvanica*	green ash	2
21	*Geum aleppicum*	yellow avens	3
22	*Hackelia virginiana*	sticktight	1
23	*Juglans nigra*	black walnut	4
24	*Juniperus virginiana*	eastern red cedar	2
25	*Laportea canadensis*	wood nettle	3
26	*Lonicera tatarica*	Tatarian honeysuckle	0
27	*Melilotus officinalis*	sweetclover	0
28	*Morus rubra*	red mulberry	0
29	*Nepeta cataria*	catnip	0
30	*Osmorhiza longistylis*	sweet cicely	4
31	*Oxalis stricta*	yellow wood sorrel	0
32	*Parthenocissus vitacea*	woodbine	2
33	*Persicaria pensylvanicum*	Pennsylvania smartweed	1
34	*Phalaris arundinacea*	reed canarygrass	0
35	*Pinus strobus*	white pine	5
36	*Plantago major*	common plantain	0
37	*Poa pratensis*	Kentucky bluegrass	0
38	*Polygonatum biflorum*	Solomon's seal	4
39	*Populus deltoides*	cottonwood	1
40	*Populus tremuloides*	quaking aspen	2
41	*Potentilla simplex*	cinquefoil	2
42	*Prunella vulgaris*	heal-all	0
43	*Quercus alba*	white oak	7
44	*Quercus rubra*	red oak	5
45	*Rhamnus cathartica*	common buckthorn	0
46	*Rhus typhina* *	staghorn sumac	2
47	*Ribes americanum*	wild black current	4
48	*Rudbeckia hirta*	black-eyed Susan	3
49	*Rumex crispus*	curly dock	0
50	*Salix interior*	sandbar willow	2
51	*Securigera varia*	crown vetch	0
52	*Solanum dulcamera*	climbing nightshade	0
53	*Solidago altissima*	late goldenrod	1
54	*Solidago canadensis*	Canada goldenrod	1
55	*Solidago gigantea*	giant goldenrod	3
56	*Symphyotrichum lanceolatum*	Eastern panicled aster	5
57	*Taraxacum officianale*	common dandelion	0
58	*Thuja occidentalis*	white cedar	7
59	*Tilia americana*	basswood	5
60	*Torilis japonica*	Japanese hedge parsley	0
61	*Toxocodendron radicans*	poison ivy	7
62	*Trifolium hybridum*	alsike clover	0
63	*Trifolium repens*	white clover	0
64	*Ulmus americana*	American elm	3
65	*Urtica dioica*	stinging nettle	1
66	*Verbascum thapsus*	common mullein	0
67	*Vicia americana* *	American vetch	4
68	*Viola sp.* **	violet	6
69	*Vitis riparia*	wild grape	2
70	*Zanthoxylum americanum* *	prickly ash	3
71	*Zizia aurea*	golden alexanders	6

Community #1

Eggers & Reed Plant Community Type: Shallow Open Water

Percent of AA Occupied by Type: 90

Spp. #	Scientific Name	Common Name	Cover Class	CC Range	Midpoint CC	Native Status	Rapid FQA Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	p	pC
1	Ceratophyllum demersum	Coon's-Tail	2	> 1 - 5%	3	Native	Aquatic	OBL	OBL	OBL	2	0.0239	0.0478
2	Elodea canadensis	Canadian Waterweed	4	> 25 - 50%	37.5	Native	Aquatic	OBL	OBL	OBL	4	0.2988	1.1952
3	Potamogeton crispus	Curly Pondweed	6	> 75 - 95%	85	Introduced	Aquatic	OBL	OBL	OBL	0	0.6773	0
4		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
5		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
6		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
7		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
8		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
9		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
10		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
11		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
13		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
14		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
15		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
16		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
17		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
18		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
19		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
20		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
21		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
22		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
23		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
24		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
26		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
27		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
28		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
29		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
30		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
31		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
32		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
33		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
34		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
37		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
38		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
39		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
40		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
41		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
42		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
43		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
44		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
45		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
46		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
47		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
48		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
49		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
50		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
51		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
52		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
53		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
54		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
56		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
57		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
58		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
59		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
60		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Community #2

Eggers & Reed Plant Community Type: Shallow Marsh

Percent of AA Occupied by Type: 5

Spp. #	Scientific Name	Common Name	Cover Class	CC Range	Midpoint CC	Native Status	Rapid FQA Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	p	pC
1	Typha X glauca	0	3	> 5 - 25%	15	Introduced	Herb	OBL	OBL	OBL	0	0.0935	0
2	Typha angustifolia	Narrow-Leaf Cat-Tail	6	> 75 - 95%	85	Introduced	Herb	OBL	OBL	OBL	0	0.5296	0
3	Impatiens capensis	Spotted Touch-Me-Not	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	2	0.0031	0.0062
4	Persicaria amphibia	Water Smartweed	1	> 0 - 1%	0.5	Native	Aquatic, Herb	OBL	OBL	OBL	4	0.0031	0.0125
5	Scirpus cyperinus	Cottongrass Bulrush	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	3	0.0031	0.0093
6	Iris versicolor	Harlequin Blueflag	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	4	0.0031	0.0125
7	Lemna minor	Common Duckweed	4	> 25 - 50%	37.5	Native	Aquatic	OBL	OBL	OBL	5	0.2336	1.1682
8	Persicaria lapathifolia	Dock-Leaf Smartweed	3	> 5 - 25%	15	Native	Herb	OBL	FACW	FACW	2	0.0935	0.1869
9	Solanum dulcamara	Climbing Nightshade	2	> 1 - 5%	3	Introduced	Woody Vine	FACU	FAC	FAC	0	0.0187	0
10	Carex stricta	Uptight Sedge	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	5	0.0187	0.0935
11		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
13		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
14		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
15		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
16		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
17		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
18		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
19		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
20		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
21		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
22		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
23		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
24		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
26		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
27		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
28		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
29		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
30		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
31		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
32		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
33		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
34		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
35		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
37		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
38		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
39		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
40		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
41		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
42		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
43		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
44		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
45		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
46		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
47		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
48		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
49		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
50		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
51		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
52		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
53		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
54		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
56		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
57		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
58		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
59		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
60		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Community #3

Eggers & Reed Plant Community Type: Floodplain Forest

Percent of AA Occupied by Type: 5

Spp. #	Scientific Name	Common Name	Cover Class	CC Range	Midpoint CC	Native Status	Rapid FQA Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	p	pC
1	Ulmus americana	American Elm	3	> 5 - 25%	15	Native	Tree	FAC	FACW	FACW	3	0.0726	0.2179
2	Poa palustris	Fowl Blue Grass	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	5	0.0024	0.0121
3	Rumex crispus	Curly Dock	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FAC	FAC	0	0.0024	0
4	Mentha arvensis	American Wild Mint	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	3	0.0024	0.0073
5	Sambucus nigra	Black Elder	1	> 0 - 1%	0.5	Native	Shrub	FAC	FACW	FACW	3	0.0024	0.0073
6	Galium aparine	Sticky-Willy	1	> 0 - 1%	0.5	Native	Herb	FACU	FACU	FACU	1	0.0024	0.0024
7	Salix nigra	Black Willow	2	> 1 - 5%	3	Native	Tree	FACW	OBL	OBL	4	0.0145	0.0581
8	Solanum dulcamara	Climbing Nightshade	1	> 0 - 1%	0.5	Introduced	Woody Vine	FACU	FAC	FAC	0	0.0024	0
9	Fraxinus pennsylvanica	Green Ash	3	> 5 - 25%	15	Native	Tree	FAC	FACW	FACW	2	0.0726	0.1453
10	Potentilla norvegica	Norwegian Cinquefoil	1	> 0 - 1%	0.5	Native	Herb	FAC	FAC	FAC	1	0.0024	0.0024
11	Vitis riparia	River-Bank Grape	1	> 0 - 1%	0.5	Native	Woody Vine	FAC	FACW	FAC	2	0.0024	0.0048
12	Carex stricta	Uptight Sedge	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0024	0.0121
13	Asclepias incarnata	Swamp Milkweed	1	> 0 - 1%	0.5	Native	Herb	FACW	OBL	OBL	4	0.0024	0.0097
14	Parthenocissus inserta	Thicket-Creeper	1	> 0 - 1%	0.5	Native	Woody Vine	FAC	FACU	FACU	2	0.0024	0.0048
15	Urtica dioica	Stinging Nettle	1	> 0 - 1%	0.5	Native	Herb	FAC	FACW	FAC	1	0.0024	0.0024
16	Impatiens capensis	Spotted Touch-Me-Not	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	2	0.0024	0.0048
17	Acer saccharinum	Silver Maple	2	> 1 - 5%	3	Native	Tree	FAC	FACW	FACW	3	0.0145	0.0436
18	Alliaria petiolata	Garlic-Mustard	3	> 5 - 25%	15	Introduced	Herb	FACU	FAC	FACU	0	0.0726	0
19	Salix interior	Sandbar Willow	6	> 75 - 95%	85	Native	Shrub	FACW	FACW	FACW	2	0.4116	0.8232
20	Solidago gigantea	Late Goldenrod	1	> 0 - 1%	0.5	Native	Herb	FAC	FACW	FACW	3	0.0024	0.0073
21	Phalaris arundinacea	Reed Canary Grass	4	> 25 - 50%	37.5	Introduced	Herb	FACW	FACW	FACW	0	0.1816	0
22	Cornus alba	Red Osier	1	> 0 - 1%	0.5	Native	Shrub	FACW	FACW	FACW	3	0.0024	0.0073
23	Lactuca serriola	Prickly Lettuce	1	> 0 - 1%	0.5	Introduced	Herb	FAC	FACU	FACU	0	0.0024	0
24	Persicaria pensylvanica	Pinkweed	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	1	0.0024	0.0024
25	Acer rubrum	Red Maple	1	> 0 - 1%	0.5	Native	Tree	FAC	FAC	FAC	3	0.0024	0.0073
26	Equisetum arvense	Field Horsetail	1	> 0 - 1%	0.5	Native	Herb	FAC	FAC	FAC	1	0.0024	0.0024
27	Leersia oryzoides	Rice Cut Grass	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	3	0.0024	0.0073
28	Lycopus uniflorus	Northern Water-Horehound	2	> 1 - 5%	3	Native	Herb	OBL	OBL	OBL	5	0.0145	0.0726
29	Lythrum salicaria	Purple Loosestrife	3	> 5 - 25%	15	Introduced	Herb	OBL	OBL	OBL	0	0.0726	0
30	Mimulus ringens	Allegheny Monkey-Flower	1	> 0 - 1%	0.5	Native	Herb	OBL	OBL	OBL	5	0.0024	0.0121
31	Onoclea sensibilis	Sensitive Fern	1	> 0 - 1%	0.5	Native	Herb	FACW	FACW	FACW	4	0.0024	0.0097
32	Persicaria amphibia	Water Smartweed	1	> 0 - 1%	0.5	Native	Aquatic, Herb	OBL	OBL	OBL	4	0.0024	0.0097
33	Typha angustifolia	Narrow-Leaf Cat-Tail	2	> 1 - 5%	3	Introduced	Herb	OBL	OBL	OBL	0	0.0145	0
34	Urtica dioica	Stinging Nettle	1	> 0 - 1%	0.5	Native	Herb	FAC	FACW	FAC	1	0.0024	0.0024
35		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
36		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
37		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
38		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
39		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
40		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
41		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
42		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
43		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
44		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
45		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
46		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
47		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
48		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
49		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
50		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
51		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
52		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
53		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
54		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
55		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
56		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
57		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
58		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
59		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
60		#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Metric Summary & Community Assessments

	Community #1	Community #2	Community #3
Community Type	Shallow Open Water	Shallow Marsh	Floodplain Forest
wC	1.2	1.5	1.5
Numerical Condition Category	3	4	4
Condition Category	Fair	Poor	Poor

Additional Metrics			
Native Species Richness	2	7	27
Introduced Species Richness	1	3	7
Mean C	2.0	2.5	2.2
FQI	2.8	6.6	11.6
Total Midpoint % Cover	125.5	160.5	206.5
Total Introduced Spp. Cover	85	103	72
Proportion of Introduced Cover	0.68	0.64	0.35

Overall Assessment

Community #	Community Type	*wC*	Condition Category	Numerical Category	Proportion of AA	Proportion x Numerical Category
1	Shallow Open Water	1.2	Fair	3	0.9	2.7
2	Shallow Marsh	1.5	Poor	4	0.05	0.2
3	Floodplain Forest	1.5	Poor	4	0.05	0.2

Weighted Average Numerical Category for AA **3**

Overall AA Condition **Fair**

Appendix C

2003-2019 Habitat Assessment Monitoring Results

Appendix C: 2003-2009 Habitat Assessment Monitoring Results
Black Dog Watershed Management Organization

Water Body	Monitoring Year	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Vegetation Quality - Wet Areas: Submergent Zone Sampling							Vegetated Emergent Zone Sampling						Vegetation Quality - Upland: Upland Buffer Sampling							Erosion/Sedimentation	
			Overall Submergent Vegetative Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Occurrence or Density Rating[2,3]	Total Number of Native Species[5]	Exotic Species: Total Number of Species	Exotic Species: Average Exotic Plant Occurrence Rating or Average Density Rating[2, 3]	Exotic Species: Maximum Exotic Plant Occurrence Rating or Maximum Density Rating[4]	Emergent Zone Vegetative Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Exotic Species: Number of Species	Exotic Species: Total Exotic Emergent Percent Coverage[9]	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species: Number of Species	Exotic Species: Percent of Total Coverage[15]	Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
Crystal	2003	15%	**Moderate**	80%	1.5	15	2	1.1	1.1	**Moderate**	5%	26-50%	18	4	26-50%	**Moderate**	<10 ft.	>95%	16	26-50%	2	15-40%	0-10%	No
	2004		**Excellent**		1.2	14	2	1.1	2.9	**Excellent**		26-50%	16	6	26-50%	**Moderate**	<10 ft.	>95%	16	26-50%	4	15-40%	0-10%	No
	2005		**Moderate**		1.2	13	2	1.1	2.7	**Excellent**		26-50%	16	6	26-50%	**Moderate**	<10 ft.	>95%	17	26-50%	3	15-40%	0-10%	No
	2006		**Excellent**		1.0	17	2	1.5	3.2	**Excellent**		26-50%	18	8	26-50%	**Moderate**	<10 ft.	>95%	17	26-50%	3	15-40%	0-10%	No
	2007		**Excellent**		1.5	16	2	1.6	3.4	**Excellent**		26-50%	22	10	26-50%	**Moderate**	<10 ft.	>95%	15	26-50%	5	15-40%	0-10%	No
	2008		**Moderate**		1.3	15	2	1.6	2.5	**Excellent**		26-50%	21	12	26-50%	**Moderate**	<10 ft.	>95%	15	26-50%	5	15-40%	0-10%	No
	2009		**Moderate**		1.3	14	2	1.6	2.8	**Excellent**		26-50%	20	11	26-50%	**Moderate**	<10 ft.	>95%	15	26-50%	7	15-40%	0-10%	No
Keller	2003	0%	**Moderate**	90%	1.9	4	1	3.2	3.2	**Poor**	10%	51-75%	5	2	51-75%	**Moderate**	<10 ft.	>95%	7	76-100%	6	>40%	0-10%	No
	2004		**Moderate**		1.7	5	1	1.8	2.5	**Moderate**		51-75%	6	2	51-75%	**Moderate**	<10 ft.	>95%	7	76-100%	6	>40%	0-10%	No
	2005		**Moderate**		1.3	5	2	1.0	1.1	**Moderate**		51-75%	7	2	26-50%	**Moderate**	<10 ft.	>95%	8	76-100%	7	>40%	0-10%	No
	2006		**Moderate**		2.0	5	2	1.8	2.5	**Moderate**		51-75%	8	2	26-50%	**Moderate**	<10 ft.	>95%	8	76-100%	8	>40%	0-10%	No
	2007		**Moderate**		2.1	3	2	2.4	3.8	**Moderate**		51-75%	9	3	26-50%	**Moderate**	<10 ft.	>95%	5	76-100%	9	>40%	0-10%	No
	2008		**Moderate**		2.2	3	2	2.2	2.9	**Moderate**		51-75%	9	3	26-50%	**Moderate**	<10 ft.	>95%	6	76-100%	12	>40%	0-10%	No
	2009		**Poor**		3.0	2	2	2.7	3.3	**Moderate**		51-75%	9	4	26-50%	**Moderate**	<10 ft.	>95%	4	76-100%	11	>40%	0-10%	No
Kingsley	2003	0%	**Moderate**	95%	2.7	7	0	0.0	0.0	**Excellent**	5%	51-75%	11	2	0-25%	**Excellent**	25-50 ft.	>95%	15	51-75%	4	15-40%	0-10%	No
	2004		**Moderate**		2.7	7	0	0.0	0.0	**Excellent**		51-75%	11	2	0-25%	**Excellent**	25-50 ft.	>95%	15	51-75%	4	15-40%	0-10%	No
	2005		**Moderate**		2.6	7	1	1.0	1.0	**Excellent**		51-75%	15	6	0-25%	**Excellent**	25-50 ft.	>95%	19	76-100%	2	15-40%	0-10%	No
	2006		**Excellent**		1.8[17]	13[18]	1	1.0	1.0	**Excellent**		51-75%	15	6	0-25%	**Excellent**	25-50 ft.	>95%	19	76-100%	3	15-40%	0-10%	No
	2007		**Excellent**		1.6	13	1	1.0	1.0	**Excellent**		51-75%	19	6	0-25%	**Excellent**	25-50 ft.	>95%	21	76-100%	4	15-40%	0-10%	No
	2008		**Moderate**		2.9	5	0	0.0	0.0	**Excellent**		51-75%	18	5	0-25%	**Excellent**	25-50 ft.	>95%	25	76-100%	4	15-40%	0-10%	No
	2009		**Excellent**		2.0	11	1	1.0	1.0	**Excellent**		51-75%	16	5	0-25%	**Excellent**	25-50 ft.	>95%	23	76-100%	5	15-40%	0-10%	No
Lac Lavon	2003	25%	**Poor**	70%	2.0	7	1	1.0	1.0	**Poor**	5%	0-25%	14	5	0-25%	**Poor**	<10 ft.	<75%	12	0-25%	17	>40%	0-10%	No
	2004		**Moderate**		0.9	9	2	1.6	1.9	**Moderate**		0-25%	15	5	0-25%	**Poor**	<10 ft.	<75%	12	0-25%	17	>40%	0-10%	No
	2005		**Moderate**		2.3	5	1	2.0	2.0	**Excellent**		0-25%	20	10	0-25%	**Poor**	<10 ft.	<75%	12	0-25%	16	>40%	0-10%	No
	2006		**Moderate**		1.6	10[19]	2	2.5	4.0	**Excellent**		0-25%	16	13	0-25%	**Poor**	<10 ft.	<75%	11	0-25%	19	>40%	0-10%	No
	2007		**Excellent**		1.8	10[20]	3	1.8	4.0	**Excellent**		0-25%	16	12	0-25%	**Poor**	<10 ft.	<75%	12	0-25%	18	>40%	0-10%	No
	2008		**Poor**		1.0	5	2	1.0	1.0	**Moderate**		0-25%	14	9	0-25%	**Poor**	<10 ft.	<75%	9	0-25%	13	>40%	0-10%	No
	2009		**Moderate**		1.6	10	2	2.5	4.0	**Moderate**		0-25%	13	8	0-25%	**Poor**	<10 ft.	<75%	9	0-25%	11	>40%	0-10%	No
Orchard	2003	20%	**Poor**	75%	1.2	13	1	2.3	3.4	**Moderate**	5%	26-50%	16	5	26-50%	**Moderate**	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2004		**Moderate**		1.2	13	1	2.3	2.3	**Excellent**		26-50%	17	5	26-50%	**Moderate**	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2005		**Moderate**		1.3	14	1	1.8	2.6	**Moderate**		26-50%	14	6	26-50%	**Moderate**	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2006		**Moderate**		1.2	13	1	1.7	3.4	**Excellent**		26-50%	18	9	26-50%	**Moderate**	<10 ft.	>95%	5	26-50%	5	>40%	0-10%	No
	2007		**Moderate**		1.3	11	1	1.9	3.3	**Excellent**		26-50%	18	9	26-50%	**Moderate**	<10 ft.	>95%	3	26-50%	5	>40%	0-10%	No
	2008		**Moderate**		1.3	14	1	1.6	2.8	**Excellent**		26-50%	16	8	26-50%	**Moderate**	<10 ft.	>95%	3	26-50%	7	>40%	0-10%	No
	2009		**Moderate**		1.6	11	1	1.7	2.5	**Excellent**		26-50%	16	8	26-50%	**Moderate**	<10 ft.	>95%	3	26-50%	6	>40%	0-10%	No
Sunset Pond	2003	0%	**Moderate**	75%	3.0	11	1	1.0	1.0	**Poor**	25%	76 - 100%	5	5	76-100%	**Moderate**	10-25 ft.	75-95%	10	51-75%	15	15-40%	0-10%	Yes
	2004		**Excellent**		2.2	11	0	0.0	0.0	**Poor**		76 - 100%	4	3	76-100%	**Moderate**	10-25 ft.	75-95%	10	51-75%	18	15-40%	0-10%	Yes
	2005		**Excellent**		2.1	10	1	1.0	1.0	**Poor**		76 - 100%	6	4	76-100%	**Moderate**	10-25 ft.	75-95%	9	76-100%	20	>40%	0-10%	Yes
	2006		**Moderate**		2.6	11	1	1.0	1.0	**Poor**		76 - 100%	7	4	76-100%	**Moderate**	10-25 ft.	75-95%	9	76-100%	19	>40%	0-10%	No
	2007		**Excellent**		1.9	12	1	1.0	1.0	**Moderate**		76-100%	11	6	76-100%	**Moderate**	10-25 ft.	75-95%	8	76-100%	19	>40%	0-10%	No
	2008		**Excellent**		1.8	10	1	2.0	3.0	**Poor**		76-100%	10	5	76-100%	**Moderate**	10-25 ft.	75-95%	5	76-100%	15	>40%	0-10%	No
	2009		**Moderate**		2.2	11	1	3.0	3.0	**Poor**		76-100%	10	5	76-100%	**Moderate**	10-25 ft.	75-95%	6	76-100%	17	>40%	0-10%	Yes

Appendix C: 2003-2009 Habitat Assessment Monitoring Results
Black Dog Watershed Management Organization

The following footnotes pertain to 2003-2009 data.

[1]Overall Submergent Vegetative Quality rating is the average of the exotic species density, macrophyte density, and total number of native: >0.66 = Excellent, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Vegetative Quality	Avg. Exotic Species Density	Exotic Species Density/ Occurrence Rating Score	Avg. Macrophyte Density	Avg. Macrophyte Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating	Total Overall Diversity Score
Poor	>2.0	0.1	0.0 - 1.0 and >3.0	0.1	<9	0.1	< 0.33
Moderate	>0 - 2.0	0.5	1.0 - 1.5 and > 2.5 to 3.0	0.5	9-14	.25-.75	0.33 - 0.66
Excellent	0	1.0	1.5 to 2.5	1.0	>14	1.0	> 0.66

[2]Plant occurrence ratings are a relative measure of the amount of native submergent vegetation with a scale from 1 to 5; 1 = lowest density (present on only 1 of 4 casts), 5 = highest density (hook full of vegetation on 4 of 4 casts).

[3]Density data for Crystal, Keller, and Orchard Lakes were collected by Blue Water Science. Numerous sample plots were conducted over the entire water body. A density scale of 1 to 4 was utilized (max = 4) by estimating the amount of vegetation obtained by rake casts and also transforming visual observations.

[4]Maximum exotic plant occurrence ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.

[5]The Total Number of Native Species within the submergent zone for Crystal, Keller and Orchard Lakes is based on a detailed survey conducted by Blue Water Science; and for Kingsley Lake, Lac Lavon, and Sunset Pond, based on a survey by Barr Engineering and volunteers. The survey of the 3 water bodies conducted by Blue Water Science involved the sampling of numerous sample plots or stations. The survey for Lac Lavon, Kingsley, and Sunset Pond is based on 3 sampling locations and a visual survey during travels on the water body: <7 = Poor, 7-14 = Moderate, >14 = Excellent.

[6]Emergent Zone Vegetative Quality is the average of the following parameters within the emergent zone: the approximate total percent coverage, the total number of native wetland species, and the percent coverage of exotic species: >0.66 = Excellent, 0.33-0.66 = Moderate, <0.33 = Poor.

Emergent Zone Vegetative Quality	Percent Cover	Percent Cover Rating Score		Total Number of Native Wetland Plants	Number of Native Wetland Plants Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Overall Emergent Zone Quality Score
Poor	0-25%	0.1		<or= 5	0.1	76-100%	0.1	< 0.33
Moderate	76-100% or 26-50%	0.5		>5 - 15	0.66 - 0.33	26-75%	.33-.66	0.33 - 0.66
Excellent	51-75%	1.0		> 15	1.0	0-25%	1.0	> 0.66

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into four categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=Excellent, 76-100%=Moderate.

[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations and a visual survey during travels on the water body: 0-5 = Poor, 6-15 = Moderate, >15 = Excellent.

[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into four categories: 0-25%=Excellen(1.0), 26-50%=Moderate(0.5), 51-75%=Poor(0.0), 76-100%=Poor(0.1)

[10]Overall Upland Buffer Quality is determined based on the average of the four upland buffer quality parameters, with the exception of the number of exotic species present and the number of native plant species: >0.66 = Excellent, 0.33-0.66 = Moderate, <0.66 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Overall Upland Buffer QualityScore
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-50 ft.	0.4 - 0.7	25-75%	.4-.7	0.33 - 0.66
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	> 0.66

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent(1.0) = >50 ft, High(0.7) = 25-50 ft, Moderate(0.4) = 10-25 ft, and Low(0.1) = <10 ft.

[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: Excellent(1.0) = >95%, Moderate(0.5) = 75 - 95%, and Poor(0.1) = <75%.

[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on 3 sampling locations and a visual survey.

[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent(1.0) = 76 - 100%, High(0.7) = 51 - 75%, Medium(0.4) = 26 - 50%, and Low(0.1) = 0 - 25%.

[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: Excellent(1.0) = <15%, Moderate(0.5) = 15 - 40%, and Poor(0.1) = >40%.

[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

[17]The 2006 plant occurrence rating is lower (has improved), when compared to past assessment years primarily due to the low occurrence of additional plants found during a more detailed survey of the lake. The more detailed plant survey was conducted to better understand the extent of curlyleaf pondweed.

[18]The number of plant species documented in 2006, when compared to past assessment years, increased primarily due to additional plants found during a more detailed survey of the lake. The more detailed plant survey was conducted to better understand the extent of curlyleaf pondweed.

[19]The number of native submergent plant species documented in 2006, was incorrectly represented as 11 in the 2006 annual report. The actual number of native submergent plant species documented in 2006 was 10.

[20]Native plant species were noted by the Minnesota Department of Natural Resouces during an October 25, 2007 macropyte survey and used in the 2007 annual report.

Rating Code:			
	Poor	**Moderate**	**Excellent**

Table 1: Orchard Lake 2012 and 2017 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone								
	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
				Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
2012	20%	**Moderate**	75%	2.0 (Moderate)	13 (High)	5.4 (Moderate)	1	1.7 (Moderate)	3.0 (Poor)
2017	20%	**High**	75%	1.2 (Excellent)	16 (Excellent)	5.2 (Moderate)	2	1.1 (Moderate)	1.5 (Moderate)

Monitoring Year	Emergent Zone						
	Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
						Number of Species	Total Exotic Emergent Percent Coverage[9]
2012	**Moderate**	5%	26-50% (Moderate)	43 (Excellent)	3.1 (Moderate)	12	51-75% (Moderate)
2017	**Moderate**	15%	51-75% (High)	50 (Excellent)	2.7 (Poor)	13	51-75% (Moderate)

Monitoring Year	Upland Buffer								Erosion/Sedimentation	
	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Number of Species	Percent of Total Coverage[15]		
2012	**Poor**	<10 ft. (Poor)	>95% (High)	19 (Moderate)	1.6 (Poor)	0-25% (Poor)	20	>40% (Poor)	0-10%	No
2017	**Moderate**	<10 ft. (Poor)	>95% (High)	25 (High)	1.9 (Poor)	0-25% (Poor)	21	>40% (Poor)	0-10%	No

Table 1: Orchard Lake 2017 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2017 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 - Conduct a meandering survey of submergent, emergent, and upland buffer zones rather than monitoring of plot locations. Orchard Lake in 2012, Crystal Lake in 2013, Lac Lavon in 2014, Keller Lake in 2015, Kingsley Lake in 2016, Orchard Lake in 2017 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2017 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2011 through 2017 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 4 according to MN DNR methodology. The rating system is based on a 1 to 3 scale. Therefore the density results were converted to match the rating system.
[3]Density data for Orchard Lake were collected by Blue Water Science using a stratified line transect survey throughout the lake.
[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.
[5]The Total Number of Native Species within the submergent zone for Orchard Lake was collected by Blue Water Science using a stratified line transect survey. The additional category of "High" was added in 2011 through 2017 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.
[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Orchard Lake 2017 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.
[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations, a meandering visual survey during travels on the water body, and walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.
[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on two plot locations, a meandering visual survey during travels on the water body, and walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)
[10]**Overall Upland Buffer Quality** is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.
[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.
[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the shoreline.
[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.
[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.
[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Table 1: Crystal Lake 2013 and 2018 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone Sampling								
	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
				Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
2013	15%	**High**	80%	1.2 (Excellent)	18 (Excellent)	4.9 (Moderate)	2	1.8 (Moderate)	2.2 (Poor)
2018	15%	**High**	80%	1.2 (Excellent)	15 (Excellent)	5.0 (Moderate)	2	1.2 (Moderate)	1.4 (Moderate)

Monitoring Year	Vegetated Emergent Zone Sampling						
	Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
						Number of Species	Total Exotic Emergent Percent Coverage[9]
2013	**High**	5%	26-50% (Moderate)	36 (Excellent)	3.0 (Moderate)	10	26-50% (High)
2018	**High**	5%	26-50% (Moderate)	50 (Excellent)	3.3 (Moderate)	9	26-50% (High)

Monitoring Year	Upland Buffer Sampling								Erosion/Sedimentation	
	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Number of Species	Percent of Total Coverage[15]		
2013	**Moderate**	<10 ft. (Poor)	>95% (High)	39 (Excellent)	2.6 (Poor)	26-50% (Moderate)	16	15-40% (Moderate)	0-10%	No
2018	**Moderate**	<10 ft. (Poor)	>95% (High)	54 (Excellent)	2.7 (Poor)	26-50% (Moderate)	20	15-40% (Moderate)	0-10%	No

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Table 1: Crystal Lake 2018 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2018 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 and 2016, Orchard Lake in 2012 and 2017, Crystal Lake in 2013 and 2018, Lac Lavon in 2014, Keller Lake in 2015 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2018 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2011 through 2018 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3.
[3]Density data for Orchard Lake were collected by Blue Water Science using a stratified line transect survey throughout the lake.
[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.
[5]The Total Number of Native Species within the submergent zone for Orchard Lake was collected by Blue Water Science using a stratified line transect survey. The additional category of "High" was added in 2011 through 2018 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.
[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Crystal Lake 2018 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.
[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations, a meandering visual survey during travels on the water body, and walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.
[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on two plot locations, a meandering visual survey during travels on the water body, and walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)
[10]**Overall Upland Buffer Quality** is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.
[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.
[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the shoreline.
[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.
[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.
[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Table 1: Keller Lake 2015 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Submergent Zone								
Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
			Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
0%	**Poor**	90%	1.3 (Moderate)	2 (Poor)	1.5 (Poor)	2	1.8 (Moderate)	2.2

Emergent Zone						
Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
					Number of Species	Total Exotic Emergent Percent Coverage[9]
High	10%	51-75% (High)	28 (Excellent)	2.3 (Poor)	8	26-50% (High)

Upland Buffer								Erosion/Sedimentation	
Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
						Number of Species	Percent of Total Coverage[15]		
Moderate	25-50 ft. (High)	>95% (High)	20 (Moderate)	1.6 (Poor)	76-100% (Excellent)	10	>40% (Poor)	0-10%	No

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Table 1: Keller Lake 2015 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2015 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake only in 2011 - Conduct a meandering survey of submergent, emergent, and upland buffer zones rather than monitoring of plot locations. Orchard Lake only in 2012, Crystal Lake only in 2013, Lac Lavon only in 2014, Keller Lake only in 2015 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2015 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2015 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3 utilizing a 6-tined hook; 1 = light density (plant species found on only 1 tine), 2 = moderate density (plant species found on 2 to 4 tines), 3 = heavy density (plant species found on 5 or 6 tines).

[3]Density data for Keller Lake were collected by Blue Water Science using a point intercept survey throughout the lake.

[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.

[5]The Total Number of Native Species within the submergent zone for Keller Lake was collected by Blue Water Science using a point intercept survey.
The additional category of "High" was added in 2011 through 2015 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.

[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Keller Lake 2015 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.

[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations, a meandering visual survey during travels on the water body, and walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.

[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on two plot locations, a meandering visual survey during travels on the water body, and walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)

[10]**Overall Upland Buffer Quality** is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.

[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.

[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the shoreline.

[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.

[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.

[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Table 1: Kingsley Lake 2011 and 2016 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone								
	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
				Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
2011	0%	**High**	70%	1.4 (Moderate)	18 (Excellent)	5.8 (Moderate)	0	0.0 (Excellent)	0.0 (Excellent)
2016	0%	**High**	70%	1.4 (Moderate)	20 (Excellent)	5.7 (Moderate)	1	<1.0 (High)	<1.0 (High)

Monitoring Year	Emergent Zone						
	Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
						Number of Species	Total Exotic Emergent Percent Coverage[9]
2011	**High**	30%	51-75% (High)	22 (Excellent)	3.3 (Moderate)	4	26-50% (High)
2016	**High**	30%	51-75% (High)	31 (Excellent)	3.8 (Moderate)	4	26-50% (High)

Monitoring Year	Upland Buffer								Erosion/Sedimentation	
	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Number of Species	Percent of Total Coverage[15]		
2011	**High**	25-50 ft. (High)	>95% (High)	45 (Excellent)	2.2 (Poor)	76-100% (Excellent)	25	15-40% (Moderate)	0-10%	No
2016	**High**	25-50 ft. (High)	>95% (High)	59 (Excellent)	2.2 (Poor)	76-100% (Excellent)	26	15-40% (Moderate)	0-10%	No

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Table 1: Kingsley Lake 2016 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2016 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 - Conduct a meandering survey of submergent, emergent, and upland buffer zones rather than monitoring of plot locations. Orchard Lake in 2012, Crystal Lake in 2013, Lac Lavon in 2014, Keller Lake in 2015, Kingsley Lake in 2016 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2016 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2011 through 2016 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3 utilizing a 6-tined hook; 1 = light density (plant species found on only 1 tine), 2 = moderate density (plant species found on 2 to 4 tines), 3 = heavy density (plant species found on 5 or 6 tines).
[3]Density data for Kingsley Lake were collected by Barr using a meander survey throughout the lake.
[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.
[5]The Total Number of Native Species within the submergent zone for Kingsley Lake was collected by Barr using a meander survey.
The additional category of "High" was added in 2011 through 2016 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.
[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Kingsley Lake 2016 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.

[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations, a meandering visual survey during travels on the water body, and walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.

[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on two plot locations, a meandering visual survey during travels on the water body, and walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)

[10]**Overall Upland Buffer Quality** is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.

[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.

[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the shoreline.

[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.

[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.

[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Table 1: Lac Lavon 2014 and 2019 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

Monitoring Year	Submergent Zone Sampling								
	Approximate Proportion of the Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality[1]	Approximate Proportion of Water Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Native Species		Mean Coefficient of Conservatism Value	Exotic Species		
				Average Native Plant Density Rating[2,3]	Total Number of Native Species[5]		Total Number of Species	Average Exotic Plant Density Rating[2, 3]	Maximum Exotic Plant Density Rating[4]
2014	25%	**Moderate**	70%	1.4 (Moderate)	12 (HIgh)	4.6 (Moderate)	2	2.0 (Moderate)	3.0 (Poor)
2019	25%	**Moderate**	70%	1.5 (Moderate)	12 (HIgh)	4.5 (Moderate)	2	1.7 (Moderate)	3.0 (Poor)

Monitoring Year	Vegetated Emergent Zone Sampling						
	Overall Emergent Zone Quality[6]	Approximate Proportion of Emergent Zone (0 - 2 ft. depth) Within The Water Body	Approximate Total Percent Vegetative Cover Within The Entire Emergent Zone[7]	Total Number of Native Wetland Plant Species[8]	Mean Coefficient of Conservatism Value	Exotic Species	
						Number of Species	Total Exotic Emergent Percent Coverage[9]
2014	**Moderate**	5%	0-25% (Poor)	32 (Excellent)	2.3 (Poor)	15	26-50% (High)
2019	**Moderate**	5%	0-25% (Poor)	38 (Excellent)	2.4 (Poor)	17	26-50% (High)

Monitoring Year	Upland Buffer Sampling								Erosion/Sedimentation	
	Overall Upland Buffer Quality[10]	Unmanicured Buffer Width[11]	Estimated Total Vegetative Cover (Percent Range)[12]	Total Number of Native Plant Species[13]	Mean Coefficient of Conservatism Value	Buffer Continuity (Percent Surrounding Water Body)[14]	Exotic Species		Shoreline Erosion (Percent of Shoreline)[16]	Sediment Deltas (Yes/No)
							Number of Species	Percent of Total Coverage[15]		
2014	**Poor**	<10 ft. (Poor)	>95% (High)	32 (Excellent)	1.3 (Poor)	0-25% (Poor)	31	>40% (Poor)	0-10%	No
2019	**Poor**	<10 ft. (Poor)	75-95% (Moderate)	56 (Excellent)	2.0 (Poor)	0-25% (Poor)	41	>40% (Poor)	0-10%	No

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Table 1: Lac Lavon 2019 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

The following changes were made to the 2011 - 2019 monitoring and analysis:

- Monitor one or two water bodies per year. Kingsley Lake in 2011 and 2016, Orchard Lake in 2012 and 2017, Crystal Lake in 2013 and 2018, Lac Lavon in 2014 and 2019, Keller Lake in 2015 - Conduct a meandering survey of submergent, emergent, and upland buffer zones. In addition, the emergent and upland buffer plot locations were evaluated.
- Changes were made in 2011 through 2019 to the calculations to include floristic quality as part of the assessment. These changes include adding a rating of "High" to the categories to accommodate MPCA ratings for floristic quality. These changes included adding a Rating Code:

Poor	Moderate	High or Excellent

The following footnotes pertain to 2011 through 2019 data:

[1]**Overall Submergent Zone Quality** rating is the average of the rating scores for the following parameters: average exotic plant density, average native plant density, total number of native species, and C-value rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Submergent Zone Quality	Avg. Exotic Plant Density	Exotic Plant Density Rating Score	Avg. Native Plant Density	Avg. Native Plant Density Rating Score	Total Number of Native Species In Submergent Zone	Species Richness Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Total Overall Submergent Zone Quality Score
Poor	>2.0	0.1	> 1.75	0.1	<7	0.1	0 - <3	0.10	< 0.33
Moderate	>1.0 - 2.0	0.5	1.25 - 1.75	0.5	>7 - <9	0.5	>3 - <6	0.50	0.33 - 0.66
High	>0 - 1.0	0.75			>9 - <14	0.75	>6 - <9	0.75	0.67 - 0.80
Excellent	0	1.0	1.0 to 1.25	1.0	>14	1.0	>9 - 10	1.00	> 0.80

[2]Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3.
[3]Density data for Lac Lavon were collected by Matt Berg using a point intercept survey throughout the lake.
[4]Maximum exotic plant density ratings represent the worst case scenario of curlyleaf pondweed density early in the growing season and/or Eurasian watermilfoil when it is most prolific later in the growing season.
[5]The Total Number of Native Species within the submergent zone for Lac Lavon was collected by Matt Berg using a point intercept survey.
The additional category of "High" was added in 2011 through 2019 and values were adjusted to: <7 = Poor, 7-9 = Moderate, 9-14 = High, >14 = Excellent.
[6]**Overall Emergent Zone Quality** is the average of the rating scores for the following parameters within the emergent zone: the total percent coverage, the total number of native wetland plant species, the percent coverage of exotic species, and the C-Value Rating: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Emergent Zone Quality	Percent Cover	Percent Cover Rating Score	Total Number of Native Wetland Plant Species	Number of Native Wetland Plant Species Rating Score	Percent Cover of Exotics	Percent Cover of Exotics Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Overall Emergent Zone Quality Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
Moderate	76-100% or 26-50%	0.5	6 - 10	0.33	51-75%	0.33	>3 - <6	0.50	0.33 - 0.66
High	51-75%	1.0	11 - 15	0.66	26-50%	0.66	>6 - <9	0.75	0.67 - 0.80
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	>9 - 10	1.00	> 0.80

Table 1: Lac Lavon 2019 Habitat Assessment Monitoring Results Black Dog Watershed Management Organization

[7]Approximate Total Percent Vegetative Cover Within the Entire Emergent Zone (0-2 ft. depth) is estimated based on the three sampling locations and a visual survey during travels around the water body. Estimates are broken into the following categories: 0-25%=Poor, 26-50%=Moderate, 51-75%=High and Excellent, 76-100%=Moderate.
[8]The Total Number of Native Wetland Plant Species within the emergent zone is based on 3 sampling locations, a meandering visual survey during travels on the water body, and walking along the shoreline: 0-5 = Poor, 6-10 = Moderate, 11-15 = High, and >15 = Excellent.
[9]Total Exotic Emergent Percent Coverage, out of the entire emergent zone area, is estimated based on two plot locations, a meandering visual survey during travels on the water body, and walking along the shoreline. Estimates are broken into four categories: 0-25%=Excellent (1.0), 26-50%=High (0.66), 51-75%=Moderate (0.33), 76-100%=Poor (0.1)
[10]Overall Upland Buffer Quality is determined based on the average of the six upland buffer quality parameter rating scores: >0.80 = Excellent, 0.67-0.80 = High, 0.33-0.66 = Moderate, <0.33 = Poor.

Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Buffer Width Range	Buffer Width Rating Score	Buffer Continuity Percent Range	Buffer Continuity Rating Score	Mean Coefficient of Conservatism Value (C-Value)	C-Value Rating (using MPCA values, 2007)	Number of Native Species	Number of Native Species Rating Score	Overall Upland Buffer Quality Score
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
Moderate	75-95%	0.5	15-40%	0.5	10-25 ft.	0.4	25-50%	0.4	>3 - <6	0.50	5-20	0.33	0.33 - 0.66
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.67 - 0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

[11]Unmanicured (upland) Buffer Width is divided into four categories: Excellent (1.0) = >50 ft, High (0.7) = 25-50 ft, Moderate (0.4) = 10-25 ft, and Low (0.1) = <10 ft.
[12]Estimated Total Vegetative Cover (Percent Range) for upland buffer is the proportion of the ground covered by vegetation within 50 feet of the wetland/upland transition zone. The percent cover is divided into three categories: High and Excellent (1.0) = >95%, Moderate (0.5) = 75 - 95%, and Poor (0.1) = <75%.
[13]The Total Number of Native Plant Species within the unmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the shoreline.
[14](Upland) Buffer Continuity is a measure of the proportion of the water body surrounded by the unmanicured, native upland buffer. This measure is divided into four categories: Excellent (1.0) = 76 - 100%, High (0.7) = 51 - 75%, Medium (0.4) = 26 - 50%, and Low (0.1) = 0 - 25%.
[15]Upland buffer exotic species "Percent of Total Coverage" is the percent cover of exotic species within the unmanicured upland buffer, which is divided into three categories: High and Excellent (1.0) = <15%, Moderate (0.5) = 15 - 40%, and Poor (0.1) = >40%.
[16]The presence of shoreline erosion is determined by the approximate percentage of the shoreline affected and is divided into the following three categories: 0 - 10%, 11 - 25%, 26 - 100%.

Appendix D

2003–2019 Recommended and Completed Management Actions

Table D-1: 2009 Recommended and Completed Management Actions
Black Dog Watershed Management Organization Habitat Monitoring

Strategic Water Body	Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed 2004-2009 Actions Which May Improve Wildlife Habitat and/or Water Quality
Crystal	Unmanicured, native vegetation in adjacent upland and emergent zone is narrow and not continuous, limiting wildlife benefits.	1. Increase width and continuity of native upland buffer and emergent zone.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding and obtaining any needed MnDNR permits for potential upland buffer and emergent zone enhancements.	Inform/show lakeshore property owners how a native upland buffer and native emergent zone can improve functions and values of the lake and improve aesthetics.	Spring - Fall	2009: Operation of the ferric chloride treatment system halted due to low water levels. The City of Burnsville harvested curlyleaf pondweed. In late 2009, the City of Burnsville treated 14 acres of buckthorn within Crystal West Park. In 2009 and 2008, garlic mustard within the upland buffer was removed/pulled. 2004-2008: The BDWMO resumed and continued operation of the ferric chloride treatment system. The City of Burnsville: 1) excavated/enhanced four stormwater treatment ponds (including West Buck Hill Park), which reduced the phosphorus loading into the lake, and 2) conducted annual harvesting of Eurasian watermilfoil and curlyleaf pondweed. The City of Lakeville excavated/enhanced the Bluebill stormwater treatment pond.
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Purple loosestrife is present.	2. Continue to control and manage purple loosestrife.	Control and manage. For large stands of purple loosestrife, contact the MnDNR to request a release of purple loosestrife-controlling beetles. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase/maintain wildlife habitat.	Spring - Fall	
	Curlyleaf pondweed is present.	3. Control curlyleaf pondweed	Control by harvesting or chemical treatment.	Maintain wildlife habitat.	Late Spring	
	Eurasian watermilfoil is present.	4. Control Eurasian watermilfoil.	Control by chemical treatment.	Maintain wildlife habitat.	Summer	
Keller Lake	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife benefits.	1. Increase width and continuity of native upland buffer.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding of potential upland buffer enhancements.	Inform/show lakeshore property owners how a native upland buffer can improve functions and values of the lake and improve aesthetics.	Spring - Fall	In 2010 the City of Apple Valley may construct Whitney Pond for stormwater treatment within the Keller Lake watershed. 2009: Due to low water levels, operation of the ferric chloride treatment system halted and no harvesting of curlyleaf pondweed was conducted. The City of Burnsville stabilized approximately one hundred feet of shoreline on the southeast edge of the lake. Logs were interlaced and secured along the shoreline and red-osier dogwood live stakes were installed along the eroding banks. 2004 - 2008: The Cities of Apple Valley and Burnsville partnered to conduct annual harvesting of curlyleaf pondweed. 2005: The City of Apple Valley excavated and enhanced Redwood Pond, which will decrease phosphorus loading into Keller Lake. Also, In 2010 the City of Apple Valley may construct Whitney Pond for stormwater treatment within the Keller Lake watershed.
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Purple loosestrife is present.	2. Continue to control and manage purple loosestrife.	Control and manage. For large stands of purple loosestrife, contact the MnDNR to request a release of purple loosestrife-controlling beetles. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase/maintain wildlife habitat.	Spring - Fall	
	Curlyleaf pondweed dominates the lake in late spring-early summer.	3. Continue control of curlyleaf pondweed.	Control as recommended by the MnDNR. Since the MnDNR designates Keller Lake as a "Natural Environment", a special permit is needed to chemically treat the lake.	Maintain wildlife habitat.	Summer	
	Eurasian watermilfoil is present.	4. Control Eurasian watermilfoil.	Control as recommended by the MnDNR. Since the MnDNR designates Keller Lake as a "Natural Environment", a special permit is needed to chemically treat the lake.	Maintain wildlife habitat.	Summer	
Kingsley Lake	Curlyleaf pondweed is present.	1. Conduct a detailed late spring macrophyte survey to ascertain densities and extent of coverage.	Consider control measures, dependent on results of an detailed early growing season survey.	Maintain wildlife habitat.	Late Spring	2005 - 2008: Annually, the City of Lakeville and members of the Kingsley Lake Homeowner's Association removed purple loosestrife plants and common buckthorn from portions of the lake and the upland buffer surrounding the lake. On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curlyleaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake." However, since curlyleaf pondweed may typically die-off prior to the early-June habitat assessment, the peak density and percent total coverage of curlyleaf pondweed is uncertain. To date, it is unclear if curlyleaf pondweed densities and percent coverage have been relatively consistent or increasing within the lake over the last few years. In 2008, a Kingsley lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
	Common buckthorn dominates portions of the upland buffer.	2. Conduct an evaluation of common buckthorn, followed by removal.	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide.	Increase wildlife habitat.	Open	
	Purple loosestrife is present.	3. Continue to control and manage purple loosestrife.	Control and manage. For large stands of purple loosestrife, contact the MnDNR to request a release of purple loosestrife-controlling beetles. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase/maintain wildlife habitat.	Spring - Fall	
	Hybrid cattail and reed canary grass are present.	4. Control hybrid cattail and reed canary grass.	Control hybrid cattail and reed canary grass now before colonies become more abundant. The herbicide Rodeo ™ can be used to effectively control both invasive emergent species.	Increase/maintain wildlife habitat.	Spring-Summer	
Lac Lavon	Eurasian watermilfoil dominates portions of the lake.	1. Continue to manage Eurasian watermilfoil.	Control by chemical treatment as recommended by MnDNR.	Increase/maintain wildlife habitat and water quality	Spring-Summer	2006: The Cities of Burnsville and Apple Valley and the lake homeowners partnered to fund a fluridone treatment for control of Eurasian watermilfoil. The treatment is expected to provide control of Eurasian watermilfoil for three years, while allowing native plant species to rebound. The cities have continued to inform the MnDNR of the ongoing treatments and the MnDNR proposes to continue aquatic plant surveys to study the effects of whole-lake fluridone treatments. However, no MnDNR macrophyte survey was conducted in 2008.
	Curlyleaf pondweed is present.	2. Monitor presence of curlyleaf pondweed.	Control if increased occurrence and subsequent midsummer die off threatens water quality)	Identify the problem before it becomes difficult to treat.	Spring	
	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife benefits.	3. Increase width/creation of native upland buffer.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding of potential upland buffer enhancements.	Inform/show lakeshore property owners of how a native upland buffer can improve functions and values of the lake and improve aesthetics.	Spring - Fall	
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
Orchard Lake	Curlyleaf pondweed dominates the lake in late spring-early summer.	1. Continue curlyleaf pondweed control measures.	Control and manage	Increase/maintain wildlife habitat and water quality.	Late Spring - Early summer	2009: The City of Lakeville conducted herbicide treatment for curlyleaf pondweed within the northeast bay (~20 acres). The herbicide treatment resulted in lake-wide control of curlyleaf pondweed. 2004-2008: The City of Lakeville provided lakeshore owners with shoreline restoration information. However, to date, no plans have been made for potential future shoreline restoration projects. Annually, the City of Lakeville harvested approximately 70 acres of curlyleaf pondweed. 2007: A small area of lakeshore, near the boat launch, was restored using native plants.
	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife benefits.	2. Increase width and continuity of native upland buffer.	Conduct an educational workshop and lakescaping demonstration project. Assist lakeshore owners with funding of potential upland buffer enhancements.	Inform/show lakeshore property owners how a native upland buffer can improve functions and values of the lake and improve aesthetics.	Spring - Fall	
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Purple loosestrife is present.	3. Conduct a detailed evaluation of purple loosestrife, followed by removal/control.	Control and manage by hand-pulling if only a few plants are present or introduce beetles if numerous plants are present.	Increase/maintain wildlife habitat.	Spring - Summer	
Sunset Pond	Extensive algal bloom	1. Reduce phosphorus loading into the pond.	Construct/install: catch basin sumps, prefabricated treatment devices (e.g. Stormceptor), infiltration facilities within the watershed, or other more conventional methods. Conduct more frequent street sweepings.	Improve wildlife habitat, fishery habitat, and aesthetics/recreation.	Open	In 2009, as in past years, the City of Burnsville actively managed the restored native buffer adjacent to the pond, the surrounding prairie restoration area, and portions of the emergent zone. Specifically, in 2007 through 2009 the City of Burnsville conducted spot spraying of invasive vegetation, such as reed canary grass, thistle, and purple loosestrife. A prescription burn, inter-seeding of prairie species, and buckthorn removal were conducted in 2008 to increase the plant diversity in the upland area.
	Maintained turf grass remains within portions of the upland buffer.	2. Enhance/maintain upland buffer.	Continue restoring sustainable native communities	Improve wildlife habitat and water quality.	Spring - Fall	
	Exotic species are dominant in emergent zone, and include narrow-leaf cattail, hybrid cattail, and reed canary grass.	3. Manage exotic species within emergent zone.	Selective herbicide treatments to reduce presence of exotic species	Allow for the establishment of more diverse native species that provide better wildlife values.	Spring - Fall	
	Presence of curlyleaf pondweed observed in 2003 and 2005 through 2008.	4. Conduct a late spring macrophyte survey to ascertain densities and extent of coverage.	consider control measures dependent on the results of an early growing season survey.	Maintain wildlife habitat. Reduce down-stream phosphorus loading.	Late Spring	
	The southern portion of the pond is shallow (1 to 3 feet deep).	5. Create a "navigation channel".	Excavate and remove sediment.	Improve wildlife habitat, fishery habitat, and aesthetics/recreation.	Winter	

Table 2: 2011 Recommended and Completed Management Actions for Kingsley Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed 2004-2009 Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed is present in some years.	Conduct a detailed late spring macrophyte survey to ascertain densities and extent of coverage.	Consider control measures, dependent on results of a detailed early growing season survey.	Maintain wildlife habitat.	Late Spring	2005 - 2008: Annually, the City of Lakeville and members of the Kingsley Lake Homeowner's Association removed purple loosestrife plants and common buckthorn from portions of the lake and the upland buffer surrounding the lake. Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control. On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curlyleaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake." However, since curlyleaf pondweed may typically die-off prior to the early-June habitat assessment, the peak density and percent total coverage of curlyleaf pondweed is uncertain. To date, it is unclear if curlyleaf pondweed densities and percent coverage have been relatively consistent or increasing within the lake over the last few years. In 2008, a Kingsley Lake lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
Common buckthorn dominates portions of the upland buffer.	Conduct an evaluation of common buckthorn, followed by removal.	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide.	Increase wildlife habitat.	Open	
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. Continue to request monitoring from the MnDNR to assure beetles are present and at appropriate populations for biological control.	Increase/maintain wildlife habitat.	Spring - Fall	
Hybrid cattail and reed canary grass are present.	Control hybrid cattail and reed canary grass.	Control hybrid cattail and reed canary grass now before colonies become more abundant. The herbicide Rodeo ™ can be used to effectively control both invasive emergent species.	Increase/maintain wildlife habitat.	Spring-Summer	
Stormwater drainage from impervious surfaces is directed into the lake.	Redirect stormwater for infiltration prior to discharge.	Install a rainwater garden or other suitable method for infiltration.	Improve water quality	Open	
Bare soil on steep slope could cause erosion and sedimentation into lake.	Vegetate hillslope.	Plant vegetation suited for steep slopes along hillside to prevent erosion.	Improve water quality	Open	
Upland buffer areas lacking naturalized vegetation.	Improve the shoreline with a naturalized upland buffer.	Rather than manicured turf grass, gravel, and managed plantings with bare soil, the shoreline could be vegetated with native grasses and wildflowers. A landscape architect could create inviting spaces and views for restaurant customers to enjoy.	Increase wildlife habitat and Improve water quality	Open	
Emergent and upland buffer areas contain non-native invasive vegetation.	Replace non-native invasive vegetation with native vegetation.	Treat non-native invasive vegeation and then seed with an appropriate BWSR seed mix.	Increase/maintain wildlife habitat.	Spring-Summer	

Table 2: 2012 Recommended and Completed Management Actions for Orchard Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed 2004-2012 Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. See Figure 3 for locations of curlyleaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	**1999 through 2012:** The City of Lakeville conducts aquatic vegetation monitoring twice/year. **2009 through 2012**: The City of Lakeville conducted annual herbicide treatment for curlyleaf pondweed. **2004 through 2008:** Annually, the City of Lakeville harvested approximately 70 acres of curlyleaf pondweed. **2010**: Adjacent to the southwest end of the lake, an aeration system was installed in Orchard Pond to precipitate out phosphorus and improve water quality flowing into Orchard Lake. **2004 through 2012**: The City of Lakeville annually provides lakeshore owners with shoreline restoration information and encourages homeowners to take advantage of the Blue Thumb restoration program. One shoreline resident started a restoration project in **2012**. **2007**: A small area of lakeshore, near the boat launch, was restored using native plants. **2002**: Purple loosestrife beetles were released by the MNDNR. Follow up monitoring indicates that beetles are present at a popoulation that the MNDNR feels is appropriate for biological control of purple loosestrife plants.
Upland buffer areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	To expand on the shoreline restoration that was done near the boat launch in 2007, the adjacent upland buffer could also be restored to naturalized native vegetation and not mowed (Potential Restoration Area #1 as shown in Appendix A and Figure 5). In the Wayside Park Area, non-native invasive vegetation including common buckthorn, vetch, spotted knapweed, and cattails could be removed and replaced with native vegetation. The naturalized upland buffer could be widened (Potential Restoration Area #2 as shown in Appendix A and Figure 5). At the beach area, there is a timber wall which is currently being used for fishing. A shoreline restoration could be done in this area (Potential Resotration Area #3 as shown in Appendix A and Figure 5). On the northwest side of the lake, one property owned by the City of Lakeville (adjacent to residential shoreline properties) could be restored to naturalized vegetation and provide an example for adjacent residential landowners for shoreline and upland buffer restoration (Potential Restoration Area #4 as shown in Appendix A and Figure 5).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass up the the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics (Potential Restoration Area #5 as shown in Appendix A and Figure 5).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. Continue to request monitoring from the MNDNR to assure beetles are present and at appropriate populations for biological control (See Figures 3 and 5 for location of purple loosestrife).	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	

Table 2: 2013 Recommended and Completed Management Actions for Crystal Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. See Blue Water Science report for locations of curlyleaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	**1999 through 2013:** The City of Burnsville conducts aquatic vegetation monitoring twice/year. **2003 through 2013**: The City of Burnsville conducted annual harvesting of curlyleaf pondweed. **2004-2008**: -The BDWMO operated the ferric chloride treatment system. -The City of Burnsville: 1) excavated/enhanced four stormwater treatment ponds (including West Buck Hill Park), which reduced the phosphorus loading into the lake, and 2) conducted annual harvesting of Eurasian watermilfoil and curlyleaf pondweed. -The City of Lakeville excavated/enhanced the Bluebill stormwater treatment pond. In **2009 and 2008**, garlic mustard within the upland buffer was removed/pulled. In late **2009**, the City of Burnsville treated 14 acres of buckthorn within Crystal West Park.
Upland buffer areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	The width and density of naturalized shoreline buffer at the location of Emergent Plot #1 near the swimming area has improved significantly since 2009. The adjacent upland buffer could also be restored to naturalized native vegetation and not mowed (Potential Restoration Areas #1 through 4 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass up the the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics (Potential Restoration Area #5 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Continue to control. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment.	Maintain wildlife habitat.	Summer	

Table 2: 2014 Recommended and Completed Management Actions for Lac Lavon
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. **See Macrophyte Survey Results for locations of curlyleaf pondweed**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys were conducted by Barr in 2013 and 2014.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment. **See Macrophyte Survey Results for locations of Eurasian watermilfoil**	Maintain wildlife habitat.	Summer	In 2006, the cities of Burnsville and Apple Valley and the lake homeowners partnered to fund a fluridone treatment for control of Eurasian watermilfoil. Aquatic plant surveys were conducted by Barr in 2013 and 2014.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Continue to control. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. **See Macrophyte Survey Results for locations of purple loosestrife**	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	Purple loosestrife removal on shallow island areas was completed by the cities of Apple Valley and Burnsville in 2011.
Upland buffer areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	Expand native prairie planting to include area to the east, which is dominated by knapweed. This could become a tall grass prairie. **Potential Restoration Area #1**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2013, the city of Burnsville installed a native prairie planting converting a sand beach and turf grass to prairie and wetland vegetation.
Upland buffer areas in city parks contain non-native invasive vegetation such as buckthorn, Siberian elm, leafy spurge, and spotted kanpweed.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation **Potential Restoration Area #2**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Some invasive species control for Canada thistle and knapweed was conducted on the new native planting area in 2014. In 2010, the city of Apple Valley released about 150 spotted knapweed seedhead boring weevils in Lac Lavon Park in Apple Valley. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation
Impervious surfaces and turf grass in the Apple Valley park near the fishing pier can collect pollutants in stormwater and flow directly into the lake, decreasing water quality.	Increase areas of naturalized vegetation to slow down and pretreat stormwater prior to entering the lake.	Strategically create buffer strips with naturalized vegetation adjacent to impervious surfaces to slow down and pretreat stormwater prior to entering the lake. **Potential Restoration Area #3**	Improve water quality	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass or sand up to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. **Potential Restoration Area #4**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	One raingarden was installed in the backyard of a shoreline property owner on Highview Drive in Apple Valley through the Blue Thumb program. The establishment of shoreline restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city owned property and residential property.

Table 2: 2015 Recommended and Completed Management Actions for Keller Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. **See Appendix A Aquatic Plant Survey for locations of curlyleaf pondweed**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys have been conducted by Blue Water Science 1998-2015. Iron dosing occurred from 1999 through 2008. Mechanical harvesting is conducted each year since 2004.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Continue to monitor. Control as recommended by the MnDNR. Since the MnDNR designates Keller Lake as a "Natural Environment Lake", chemical treatment is not allowed.	Maintain wildlife habitat.	Summer	Aquatic plant surveys have been conducted by Blue Water Science 1998-2015.
The inlet coming from the stormwater pond at the south end of Keller Lake is surrounded by bare soil or sparse vegetation.	Re-vegetated bare areas to prevent soil erosion into Keller Lake.	Seed or plant bare areas with native vegetation. **Potential Restoration Area #1**	Improve water quality and vegetative diversity.	Spring or Fall	
Shoreline fishing traffic is causing bare soil areas along the shoreline.	Re-vegetated bare areas to prevent soil erosion into Keller Lake.	Create designated stone walkways for fishing access. **Potential Restoration Area #2**	Improve water quality, vegetative diversity, and aesthetics.	Spring - Fall	
The southern public park is littered with trash and other dumped items especially near the shoreline.	Clean up the litter.	Organize a neighborhood clean-up project to pick up trash and other dumped items along the south shoreline of the lake. **Potential Restoration Area #3**	Improve aesthetics. Potentially prevent harm to wildlife. Prevent migration of trash into lake.	Spring - Fall	
Upland buffer areas in city parks contain non-native invasive vegetation such as buckthorn and garlic mustard.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation. Pull garlic mustard within the City of Burnsville property at the north end of the lake. Continue to remove and treat new growth of buckthorn in city parks. **Potential Restoration Area #4**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Buckthorn appears to have been previously removed in the park along the southern shoreline.
Upland buffer areas lacking naturalized vegetation. Some of the residential properties have narrow buffers with turf grass close to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Manicured turf grass near the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. **Potential Restoration Area #5**	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	Most residential properties allow a narrow width of naturalized vegetation to prevent soil erosion, however a wider buffer of native vegetation could help improve wildlife habitat, vegetative diversity, and aesthetics.

Table 2: 2016 Recommended and Completed Management Actions for Kingsley Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed is present in some years.	Continue to monitor	Consider control measures, if densities and locations increase to an extent of concern.**See Appendix A Aquatic Plant Survey for locations of curlyleaf pondweed**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of Lakeville. Based on the results of the soil analysis, the BWS report stated that "curlyleaf pondweed is not expected to produce heavy growth conditions (where plants top out in a solid canopy) in Kingsley Lake."
Common buckthorn dominates portions of the upland buffer.	Conduct an evaluation of common buckthorn, followed by removal.	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide. **See Figure 4, Potential Restoration Area #1**	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	From 2005-2008, the City of Lakeville and members of the Kingsley Lake Association removed common buckthorn from portions of the lake and the upland buffer surrounding the lake.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. **See Figure 4 for purple loosestrife locations.**	Increase/maintain wildlife habitat.	Spring - Fall	From 2005-2008, the City of Lakeville and members of the Kingsley Lake Association removed purple loosestrife plants from portions of the lake and the upland buffer surrounding the lake. Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Stormwater drainage from impervious surfaces is directed into the lake.	Redirect stormwater for infiltration prior to discharge.	Install a rainwater garden, pervious pavement, or other suitable method for infiltration. **See Figure 4, Potential Restoration Area #2.**	Improve water quality	Open	
Bare soil on steep slope could cause erosion and sedimentation into lake.	Re-vegetate bare areas to prevent soil erosion into Kingsley Lake.	Plant vegetation suited for steep slopes along hillside to prevent erosion. **See Figure 4, Potential Restoration Area #3**	Improve water quality	Spring - Fall	
Upland buffer areas lacking naturalized vegetation.	Increase width and continuity of native upland buffer.	Rather than manicured turf grass, gravel, and managed plantings with bare soil, the shoreline could be vegetated with native grasses and wildflowers. **See Figure 4, Potential Restoration Areas #4 through 7**. See **Appendix G** for examples of improvements. See also island shoreline areas becoming bare from YMCA camper overuse (**Figure 4, Potential Restoration Areas 10 and 11)**.	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2008, a Kingsley Lake lakeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
Emergent zone and upland buffer areas contain non-native invasive vegetation.	Continue to control and manage non-native invasive vegetation, including, but not limited to reed canary grass, hybrid cattail, and yellow iris.	Treat non-native invasive vegeation and then seed with an appropriate BWSR seed mix. **See Figure 4, Potential Restoration Areas #8 and 9.** Remove yellow iris **(See Appendix A for locations of yellow iris).** The MN DNR may require a permit for cattail treatment and yellow iris removal if below the OHW. Dense reed canary grass is located at **Plot 2b as shown of Figure 3**. Dense hybrid cattail is located at **Plot 1b as shown on Figure 3**.	Increase/maintain wildlife habitat.	Spring-Summer	

Table 2: 2017 Recommended and Completed Management Actions for Orchard Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed is common in early spring	Continue to monitor, control, and manage.	Continue to treat curlyleaf pondweed where growth is predicted to be heavy. **See Appendix A Aquatic Plant Survey for more details**.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	From 1999-2017, the City of Lakeville contracts Blue Water Science to conduct aquatic plant surveys twice per year. Curlyleaf pondweed was harvested annually from 2004-2009. Herbicide treatments were conducted annually from 2009-2012 and 2015-2017.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. **See Figure 4 for purple loosestrife locations.**	Increase/maintain wildlife habitat.	Spring - Fall	Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Stormwater drainage from impervious surfaces is directed into the lake.	Redirect stormwater for infiltration prior to discharge.	Install a rainwater garden, pervious pavement, or other suitable method for infiltration and establish a naturalized upland buffer. **See Figure 4 and Site Photos, Potential Restoration Area #6.**	Improve water quality	Open	Two raingardens were completed on 175th St W. In 2010, adjacent to the southwest end of the lake, an aeration system was installed in Orchard Pond to precipitate out phosphorus and improve water quality flowing into Orchard Lake.
Bare soil along shoreline could cause erosion and sedimentation into lake.	Re-vegetate bare areas to prevent soil erosion into Orchard Lake.	Improve soil and plant vegetation along shoreline to prevent erosion. Establish a canoe and kayak access at Wayside Park. **See Figure 4 and Site Photos, Potential Restoration Area #4 and #5.**	Improve water quality	Spring - Fall	The City of Lakeville removed a dilapidated timber wall and attempted a shoreline restoration south of the beach, however, the soil was too poor for the plantings to become established. North of the beach, a concrete wall was built to prevent shoreline erosion.
Upland buffer areas lacking naturalized vegetation.	Increase width and continuity of native upland buffer.	Rather than manicured turf grass the shoreline could be vegetated with native grasses and wildflowers. **See Figure 4 and Site Photos, Potential Restoration Areas #1-3, 7 and 8**. See **Appendix G** for examples of improvements.	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring - Fall	2004 through 2012: The City of Lakeville annually provides lakeshore owners with shoreline restoration information and encourages homeowners to take advantage of the Blue Thumb restoration program. Two residential shoreline restoration projects have been completed. One is located north of the beach area and one is on 175th St. W. 2007: A small area of lakeshore, near the boat launch, was restored using native plants.

Table 2: 2018 Recommended and Completed Management Actions for Crystal Lake
Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curlyleaf pondweed dominates the lake in late spring-early summer.	Continue curlyleaf pondweed control measures.	Continue to control and manage. See Appendix A Blue Water Science report for locations of curlyleaf pondweed.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	1999 through 2018: The City of Burnsville conducts aquatic vegetation monitoring twice/year. 2003 through 2018: The City of Burnsville conducted annual harvesting of curlyleaf pondweed.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment. See Appdendix A Blue Water Science report for locations of Eurasian watermilfoil.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	
Common and glossy buckthorn are present	Control common and glossy buckthorn	Remove buckthorn. Volunteer groups and contractors can effectively remove buckthorn by pulling, cutting, and treating stumps with herbicide. See Appendix H for buckthorn management guidelines. See Appendix I for locations of buckthorn.	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Fall	In 2009, the City of Burnsville treated 14 acres of buckthorn within Crystal Lake West Park (Appendix I).
Garlic mustard is present	Control garlic mustard	Organize a volunteer neighborhood group to pull garlic mustard. See Appendix I for locations of garlic mustard.	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring	In 2008 and 2009, the City of Burnsville removed garlic mustard within the upland buffer (Appendix I)
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Control and manage. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed. See Appendix I for locations of purple loosestrife.	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Bare soil areas are present along shoreline in Crystal Lake West Park area.	Re-vegetate bare soil areas to prevent soil erosion into Crystal Lake and create designated stone walkways for fishing access.	Exposed soil along the shoreline of Crystal Lake West Park Area could be re-vegetated to prevent shoreline erosion. Strategically located stones could provide fishing access to prevent disturbance of vegetation after it is established. (Potential Restoration Area #1 as shown in Figure 4 and photos)	Improve water quality and prevent erosion.	Spring - Fall	
Timber retaining wall in Tyecke Park area is in poor condition.	Repair timber retaining wall to prevent soil erosion into Crystal Lake.	Steep slopes in the Tyecke Park area are well protected with mature naturalized vegetation, however a timber retaining wall along the shoreline may need to be repaired or replaced to prevent slope destabilization and erosion. (Potential Restoration Area #2 as shown in Figure 4 and photos)	Prevent erosion	Winter	
Shoreline areas lacking naturalized vegetation within publicly owned beach area. Some areas have mowed turf grass close to the lakeshore edge.	Increase width and continuity of native upland buffer.	The upland buffer near the location of Plot #1C and shoreline to the south, and north of the beach area could be restored to naturalized native vegetation and not mowed (Potential Restoration Areas #3 and 4 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	The width and density of naturalized shoreline buffer at the location of Emergent Plot #1B near the beach area has improved significantly since 2009.
Shoreline areas lacking naturalized vegetation within residential properties. Most of the residential properties have turf grass up the the lakeshore edge.	Increase width and continuity of native upland buffer.	Rather than manicured turf grass, the shoreline could be vegetated with native grasses and wildflowers. (Potential Restoration Area #5 as shown in Figure 4 and photos).	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	Six residential property owners have completed shoreline restortion projects using either City of Burnsville or Dakota Soil and Water Conservation District grants.

Table 2 2019 Recommended and Completed Management Actions for Lac Lavon – Black Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementation Period	Completed Actions Which May Improve Wildlife Habitat and/or Water Quality
Curly-leaf pondweed dominates the lake in late spring-early summer.	Continue curly-leaf pondweed control measures.	Continue to control and manage. Detailed results are available upon request.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Late Spring - Early summer	Aquatic plant surveys were conducted in 2013, 2014, and 2019.
Eurasian watermilfoil is present.	Control Eurasian watermilfoil.	Control by chemical treatment. Detailed results are available upon request.	Increase wildlife habitat, improve water quality, vegetative diversity, aesthetics, and recreation.	Summer	In 2006, the cities of Burnsville and Apple Valley and the lake homeowners partnered to fund a one-time fluridone treatment for control of Eurasian watermilfoil. Aquatic plant surveys were conducted in 2013, 2014, and 2019.
Purple loosestrife is present.	Continue to control and manage purple loosestrife.	Continue to control. For a few small colonies of purple loosestrife, hand pull or dig the plants out before they go to seed.	Increase wildlife habitat. Improve vegetative diversity.	Spring - Fall	Purple loosestrife removal on shallow island areas was completed by the cities of Apple Valley and Burnsville in 2011. Purple loosestrife beetles were released by the MnDNR prior to 2002. Follow up monitoring by the MnDNR indicates that beetles are present at a population that the MnDNR feels is appropriate for biological control.
Shoreline areas lacking naturalized vegetation within publicly owned properties.	Increase width and continuity of native upland buffer.	Expand native prairie planting to include area to the east, which is dominated by knapweed. This could become a tall grass prairie. Potential Restoration Area #1	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2013, the city of Burnsville installed a native prairie planting converting a sand beach and turf grass to prairie and wetland vegetation.
Shoreline areas in city parks contain non-native invasive vegetation such as buckthorn, Siberian elm, leafy spurge, and spotted knapweed.	Continue to control and manage non-native invasive vegetation	Continue to control and manage non-native invasive vegetation Potential Restoration Area #2	Increase wildlife habitat. Improve vegetative diversity and aesthetics	Spring - Fall	Some invasive species control for Canada thistle and knapweed was conducted on the new native planting area in 2014. In 2010, the city of Apple Valley released about 150 spotted knapweed seedhead boring weevils in Lac Lavon Park in Apple Valley. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation
Impervious surfaces and turf grass in the Apple Valley park near the fishing pier can collect pollutants in stormwater and flow directly into the lake, decreasing water quality.	Increase areas of naturalized vegetation adjacent to impervious surfaces to slow down and pretreat stormwater prior to entering the lake.	Strategically create buffer strips of naturalized vegetation adjacent to the bituminous lake access pathway to slow down and pretreat stormwater prior to entering the lake. Potential Restoration Area #3	Improve water quality	Spring - Fall	
Upland buffer areas lacking naturalized vegetation. Most of the residential properties have turf grass or sand up to the lakeshore edge.	Increase width and continuity of native upland buffer.	Restore sustainable native communities. Rather than manicured turf grass, sand, and bare soil, the shoreline could be vegetated with native grasses and wildflowers. A native upland buffer can improve functions and values of the lake and improve aesthetics. Potential Restoration Area #4	Increase wildlife habitat. Improve water quality. Improve vegetative diversity and aesthetics.	Spring - Fall	One native prairie restoration project was installed in the backyard of a shoreline property owner on Highview Drive in Apple Valley through the Dakota Soil and Water Conservation District program. The establishment of shoreline restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city owned property and residential property.

Appendix E

2015 Keller Lake MNRAM 3.4 Wetland Functional Assessment Results

Wetland Functional Assessment Summary

Wetland Name	Hydrogeomorphology	Maintenance of Hydrologic Regime	Flood/ Stormwater/ Attenuation	Downstream Water Quality	Maintenance of Wetland Water Quality	Shoreline Protection
Keller Lake	Depressional/Flow-through (apparent inlet and outlet), Depressional/Flow-through (apparent inlet and outlet), Lacustrine Fringe (edge of deepwater areas)/Shoreland, Floodplain (outside waterbody banks)	0.75	0.63	0.71	0.44	0.72
		High	Moderate	High	Moderate	High

Wetland Name	Maintenance of Characteristic Wildlife Habitat Structure	Maintenance of Characteristic Fish Habitat	Maintenance of Characteristic Amphibian Habitat	Aesthetics/ Recreation/ Education/ Cultural	Commercial Uses	Ground-Water Interaction	Additional Information: Wetland Restoration Potential	Additional Information: Wetland Sensitivity to Stormwater and Urban Development	Additional Information: Additional Stormwater Treatment Needs
Keller Lake	0.39	0.77	0.05	0.76	0.00	Discharge	0.00	0.50	0.44
	Moderate	High	Low	High	Not Applicable		Not Applicable	Moderate	Moderate

Wetland Community Summary

Wetland Name	Location	Community: Cowardin Classification	Community: Circular 39	Community: Plant Community	Wetland Proportion	Individual Community Rating	Highest Wetland Rating	Average Wetland Rating	Weighted Average Wetland Rating
Keller Lake	19-114-21-11-001	L2UBGh	Type 5	Shallow, Open Water Communities	90	0.1	0.50	0.23	0.12
							Moderate	Low	Low
		PEM1C	Type 3	Shallow Marsh	5	0.1	0.50	0.23	0.12
							Moderate	Low	Low
		PFO1A	Type 1	Floodplain Forest	5	0.5	0.50	0.23	0.12
							Moderate	Low	Low
					100		0.50	0.23	0.12

(Vegetative Diversity/Integrity)

☑ *Denotes incomplete calculation data.*

Management Classification Report for Keller Lake **;DWMO Strategic Waterbodies**

ID: 5

DAKOTA County
Minnesota (Shakopee) Watershed, #33
Corps Bank Service Area 9

Based on the MnRAM data input from field and office review and using the classification settings as shown below, this wetland is classified as Preserve

Functional rank of this wetland based on MnRAM data	Functional Category	Self-defined classification value settings for this management level
Low	Vegetative Diversity/Integrity	Exceptional
Moderate	Habitat Structure (wildlife)	Exceptional
Low	Amphibian Habitat	High
High	Fish Habitat	Exceptional
High	Shoreline Protection	High
High	Aesthetic/Cultural/Rec/Ed and Habitat	Exceptional / High
Moderate	Stormwater/Urban Sensitivity and Vegetative Diversity	Exceptional / Moderate
Moderate	Wetland Water Quality and Vegetative Diversity	High / High
High	Characteristic Hydrology and Vegetative Diversity	High / High
Moderate	Flood/Stormwater Attenuation*	-
Not Applicable	Commericial use*	-
High	Downstream Water Quality*	-

The critical function that caused this wetland to rank as **Preserve** was
Shoreline Protection

Details of the formula for this action are shown below:

Shoreline Protection **(Q30+Q31+Q32+Q33+Q34)/5**

Question	*Value*	*Description*
30	1	Shoreline rooted vegetation (%cover)
31	1	Shoreline wetland in-water width
32	1	Shoreline emergent veg/erosion resistance
33	0.5	Shoreline erosion potential
34	0.1	Shoreline upslope veg/bank protection

This report was printed on: Monday, December 28, 2015

* The classification value settings for these functions are not adjustable

MnRAM Site Assessment Report

Monday, December 28, 2015

Wetland: Keller Lake **Project: BDWMO Strategic Waterbodies**

Wetland ID: 5, Township 114, Section 11, Range 21, , ,

DAKOTA County, Minnesota (Shakopee) Watershed, Corps Bank Service Area #9

Assessment Purpose: Inventory

A site visit was made to this wetland on 7/10/2015 by KSW. Site conditions were Normal. This wetland is estimated to cover 63 acres.

This report reflects conditions on the ground at the date of the assessment and, unless noted or implicit in the standard questions, does not reflect speculation on the future or past conditions.

This wetland is located in or near the city of Burnsville

General Features

Hydrogeomorphology

The maximum water depth at this site is 120 inches, with 100 percent inundated. With an immedidate drainage area of 1448 acres, it is doubtful that this wetland is sustainable given its small catchment area.

As a Depressional/Flow-through wetland, this site has an apparent inlet and outlet. As such, Placeholder for Depressional/Flow-through discussion

As a Lacustrine Fringe wetland, this site located at the edge of deepwater areas and may be considered shoreland. As such, it protects from possible erosive wave effects and may be used as a spawning area for fish.

As a Floodplain wetland, this site is outside waterbody banks. As such, it likely receives water on an irregular basis.

This wetland has been drained or altered 0% from its original size of 63 acres.

Soils

The soils in the immediate wetland area are primarily Quam silt loam. The adjacent upland, to about 500 feet, is Mayer silt loam.

Vegetation and Upland Buffer

The extent of vegetation in this wetland is about 90 percent and the naturalized buffer width averages 40 feet. Vegetated buffers around wetlands provide multiple benefits including wildlife habitat, erosion protection, and a reduction in surface water runoff.

This buffer provides some protection for the wetland water quality but little habitat for wildlife.

As a shoreline wetland, this site has the potential to protect from erosion and provide spawning and nursery habitat for fish and wildlife. The potential for erosion and/or slope failure of shoreline or streambank areas is also dependent on the land use and condition on the slope above the water level and on top of the bank. Deep-rooted grasses allowed to grow naturally provide the most protection, as will species with stronger stems; this includes submerged macrophytes. The greater the vegetation density, the greater the shoreline protection.

Special Features

F Public park, forest, trail or recreation area.

K Local Shoreland Management Plan area.

M Shoreland area identified in a zoning ordinance.

Vegetative Communities

The following plant communities were observed:

(See Appendix A for details on the Dominant Species per plant community)

Shallow, Ow Communities Type 5, L2UBGh. This community had a vegetative index of low and comprised 90 percent of the entire area.

Shallow Marsh Type 3, PEM1C. This community had a vegetative index of low and comprised 5 percent of the entire area.

Floodplain Forest Type 1, PFO1A. This community had a vegetative index of moderate and comprised 5 percent of the entire area.

The highest rated community was the Shallow Marsh community rated at 0.5. Averaging all the communities together, the Vegetative Diversity and Integrity of this wetland is Low. A more accurate look uses a weighted average; using this method, this site shows a Low Vegetative Diversity and Integrity.

The majority of vegetation at this site, such as it is, does not contribute to wetland function beyond water retention and flow resistance. However, because the weighted average can "hide" smaller communities, always check for even small patches of high-quality species.

Functional Ratings

Function	*Rating*	*Comment*
Vegetative Diversity	Moderate	Moderate-functioning vegetative communities indicate a presence of native wetland species with substantial non-native or invasive species.
Additional stormwater treatment needs	Moderate	Sediment removal would improve the ability of this site to maintain water quality.
Maintenance of Hydrologic Regime	High	Due either to careful human management or lack of alteration of the outlet or watershed conditions, the wetland maintains a hydrologic regime similar to the original wetland type. This stability supports characteristic vegetative communities and is closely associated with flood attenuation, water quality, and groundwater interaction.
Flood/Stormwater/Attenuation	Moderate	The wetland provides some flood storage and/or flood wave attenuation. It may have either an altered or unrestricted outlet, disturbed wetland soils, thin or little emergent vegetation (with channels) or it may be situated high in a watershed with a low proportion of impervious surfaces, moderate runoff volumes, loamy upland soils, and one or more other wetlands present within the subwatershed.

Downstream Water Quality	High	This wetland has the ability and opportunity to protect valuable downstream resources, including recreational waters. A wetland with significant emergent vegetation and overland flow characteristics removes sediment from stormwater. A high nutrient removal rating indicates dense vegetation (to maximize nutrient uptake) and sheet flow. The wetland may protect a valuable water resource within 0.5 miles downstream. More (and less-treated) runoff also increase a wetland's opportunity to rate high for this function. Maintaining wide, natural buffers and keeping out surges of untreated stormwater will help maintain this wetland's role as a protector of important resources lower in the watershed.
Maintenance of Wetland Water Quality	Moderate	Wetland water quality is average. Sediment removal from incoming water would benefit the site. Also consider reducing the amount of stormwater directed at the site. Sustaining a diverse wetland may require additional control over upland land use and the buffer.
Shoreline Protection	High	The site has a resource in need of protection (with wave action, sandy erodible soils) and is capable of providing that protection with deep-rooted, sturdy vegetation in a wide buffer.
Maintenance of Characteristic Wildlife Habitat Structure	Moderate	The site provides good habitat and is relatively accessible to wildlife, although it may be somewhat isolated on the landscape and lack the rich vegetative community and complex structure that would support a wider range of wildlife.
Maintenance of Characteristic Fish Habitat	High	The site has a direct connection to spawning or nursery habitat, or may provide refuge or shade for native species of fish. Low amounts of sediment mean that eggs are not smothered; good water quality supports fish health.
Maintenance of Characteristic Amphibian Habitat	Low	Predatory fish are always present and winter habitat unsuitable as site often freezes to the bottom. High inputs of untreated stormwater or unfiltered runoff contribute to poor water quality and reproductive conditions.
Aesthetics/Recreation /Education/Cultural	High	Regardless of actual integrity, the site is accessible and valued by significant populations of people. Its value is enhanced by not being visibly altered by human influences such as trash or roads. There is a high evidence it is used for mulitple recreational activities.
Wetland restoration potential	Not Applicable	Because restoration would affect permanent structures or infrastructure (houses, roads, septic systems), this site is not suitable for restoration.
Wetland Sensitivity to Stormwater and Urban Development	Moderate	This wetland is moderately sensitive to stormwater; Floodplain forests, fresh wet meadows dominated by reed canary grass, shallow and deep marshes dominated by cattail, reed canary grass, giant reed or purple loosestrife, and shallow, open water communities with low to moderate vegetative diversity.

<u>Appendix A: Dominant Species By Plant Community</u>

	Wetland Type	Plant Community	Dominant Species	Percent Cover
L2UB	**Type 5**	**Shallow, Ow Communities**		
			Common coontail	>10-25%
			Curly pondweed	>10-25%
			Eurasian water milfoil	>3-<10%
			Canadian elodea	>3-<10%
PEM1	**Type 3**	**Shallow Marsh**		
			Hybrid cattail	>10-25%
			Narrow-leaved cattail	>75-100%
			Spotted touch-me-not	0-3%
			Water smartweed	0-3%
			Woolgrass	0-3%
PFO1	**Type 1**	**Floodplain Forest**		
			American elm	>3-<10%
			Fowl bluegrass	0-3%
			Curly dock	0-3%
			Common mint	0-3%
			Common elder	0-3%
			Cleavers	0-3%
			Bull thistle	0-3%
			Black willow	0-3%
			Bittersweet nightshade	0-3%
			Green ash	>10-25%
			Black raspberry	0-3%
			Rough cinquefoil	0-3%
			Wild grape	0-3%
			Virginia creeper	0-3%
			Tussock sedge	0-3%
			Swamp milkweed	0-3%
			Stinging nettle	0-3%
			Spotted touch-me-not	0-3%
			Soft rush	0-3%
			Silver maple	0-3%
			Garlic mustard	>10-25%
			Sandbar willow	>25-50%
			Giant goldenrod	0-3%
			Reed canary grass	>3-<10%
			Red-osier dogwood	0-3%
			Prickly lettuce	0-3%
			Pointed broom sedge	0-3%
			Pennsylvania smartweed	0-3%

Northern bugleweed	0-3%
Northern blue flag	0-3%
Woolgrass	0-3%
Sensitive fern	0-3%

MnRAM: Site Response Record

For Wetland Keller Lake

Location: 19-114-21-11-001

BDWMO Strategic Waterbodies

Plant Community: Shallow, Open Water C

Cowardin Classification: L2UBGh — Circular 39: Type 5

Plant Community: Shallow Marsh

Cowardin Classification: PEM1C — Circular 39: Type 3

Plant Community: Floodplain Forest

Cowardin Classification: PFO1A — Circular 39: Type 1

4	*Listed, rare, special species?*	No
5	*Rare community or habitat?*	No
6	*Pre-European-settlement condition?*	No

Hydrogeomorphology / topography:

7		Depressional/FlowThru, Lacustrine, Floodplain
8-1	*Maximum water depth*	120 inch
8-2	*% inundated*	100%
9	*Immediate drainage--local WS*	1448 acre
10	*Esimated size/existing site:*	*(see #66)*
11-Upland Soil		Mayer silt loam
11-Wetland Soil		Quam silt loam

12	*Outlet for flood control*	B
13	*Outlet for hydro regime*	A
14	*Dominant upland land use*	B
15	*Wetland soil condition*	A
16	*Vegetation (% cover)*	90%
17	*Emerg. veg flood resistance*	B
18	*Sediment delivery*	A
19	*Upland soils (soil group)*	B
20	*Stormwater runoff*	B
21	*Subwatershed wetland density*	C
22	*Channels/sheet flow*	A
23	*Adjacent buffer width*	40 feet

Adjacent area management

24-A	*Full*	70%
24-B	*Manicured*	20%
24-C	*Bare*	10%

Adjacent area diversity/structure

25-A	*Native*	0%
25-B	*Mixed*	90%
25-C	*Sparse*	10%

Adjacent area slope

26-A	*Gentle*	70%
26-B	*Moderate*	20%
26-C	*Steep*	10%

27	*Downstream sens./WQ protect.*	A
28	*Nutrient loading*	C
29	*Shoreline wetland?*	Yes

Shoreline Wetland

30	*Rooted veg., % cover*	80%
31	*Wetland in-water width*	50 feet
32	*Emerg. veg. erosion resistance*	A
33	*Erosion potential of site*	B
34	*Upslope veg./bank protection*	C
35	*Rare wildlife?*	No
36	*Scare/Rare/S1/S2 community*	No
37	*Vegetative cover*	C
38	*Veg. community interspersion*	C
39	*Wetland detritus*	B
40	*Interspersion on landscape*	B
41	*Wildlife barriers*	B

Amphibian-breeding potential

42	*Hydroperiod adequacy*	Adequate
43	*Fish presence*	C
44	*Overwintering habitat*	A
45	*Wildlife species (list)*	great blue heron, turtles, ducks, egret
46	*Fish habitat quality*	A
47	*Fish species (list)*	
48	*Unique/rare opportunity*	No
49	*Wetland visibility*	A
50	*Proximity to population*	Yes
51	*Public ownership*	B
52	*Public access*	A
53	*Human influence on wetland*	B
54	*Human influence on viewshed*	C
55	*Spatial buffer*	A
56	*Recreational activity potential*	A
57	*Commercial crop--hydro impact*	NA

Groundwater-specific questions

58	*Wetland soils*	Discharge
59	*Subwatershed land use*	Discharge
60	*Wetland size/soil group*	Recharge
61	*Wetland hydroperiod*	Discharge
62	*Inlet/Outlet configuration*	Discharge
63	*Upland topo relief*	Discharge

Additional information

64	*Restoration potential*	No
65	*LO affected by restoration*	
66	*Existing size*	63
	Restorable size	0
	Potential new wetland	0
67	*Average width of pot. buffer*	0 feet
68	*Ease of potential restoration*	
69	*Hydrologic alterations*	0
70	*Potential wetland type*	0
71	*Stormwater sensitivity*	
72	*Additional treatment needs*	

Watershed Minnesota (Shakopee)

WS# 33 Service Area: 9

For functional ratings, please run the Summary tab report.

This report printed on: 12/28/2015

Appendix F

Descriptions of MNRAM Wetland Functions

6.0 Functional Rating Formulas

GENERAL NOTE: Some questions are not applicable to particular wetlands and will be scored N/A. In these cases, rather than count N/A as zero, an alternate equation is provided that eliminates the question from the formula altogether. Because not every question has N/A as an option, formulas that do not include N/A-option questions have only one configuration.

Formulas with a "reverse rating" (marked as "R") take the actual response and "flip" its value for the calculation, so that a question response of "A" high (value of 1.0) will be calculated as low (value of 0.1). In such a formula, medium ratings stay medium.

6.1 VEGETATIVE DIVERSITY/INTEGRITY

Table 3: Vegetative Diversity/Integrity Summary

The functional rating is based primarily on the diversity of vegetation within the wetland in comparison to an undisturbed condition for that wetland type. An exceptional rating results from one of the following conditions: 1) highly diverse wetlands with virtually no non-native species, 2) rare or critically impaired wetland communities in the watershed, or 3) the presence or previous siting of rare, threatened, or endangered plant species. A high rating indicates the presence of diverse, native wetland species and a lack of non-native or invasive species. Wetlands that rate low are primarily dominated by non-native and/or invasive species.

This table may be used when calculating Vegetative Diversity/Integrity Functional Index manually. It shows four options for calculating and presenting floristic data. If you are entering data directly into the MnRAM 3.0 database, this table does not apply.

	3A Proportion of Wetland	3B Individual Community Scores	3C Highest Quality	3D Non-Weighted Average	3E Weighted Average
Community #1	**T**	**A**		**A**	**A**
Community #2	**U**	**B**		**B**	**B**
Community #3	**V**	**C**		**C**	**C**
Community #4	**W**	**D**		**D**	**D**
Community #5	**X**	**E**		**E**	**E**
Community #6	**Y**	**F**		**F**	**F**
Community #7	**Z**	**G**		**G**	**G**
Wetland Rating Value	**1.0**		**Highest Value**	**(A+B+C+D+E +F+G)/7 = Ave.**	**(A*T)+(B*U)+(C*V)+(D *W)+(E*X)+ (F*Y)+(G*Z) = Wt. Ave.**

If any questions #4-6 are answered yes and/or if any of the Special Features b, d, or i have been selected, enter Exceptional for the functional index. If not, compute the contribution to vegetative diversity and integrity by each plant community by doing the following: multiply the ranking for each community (Question #3b) by its total proportion in Question 3a (percent of total). Then, the functional index for the entire wetland can be calculated four ways (as follows) and should be utilized according to the scope of the project:

3b) Individual Community Scores: maintain raw data as recorded.

3c) Highest Quality Community: report the highest-functioning community.

3d) Non-Weighted Average Quality of all Communities: straight average

3e) Weighted Average Quality Based on Percentage of Each Community: multiply each community rating by its percentage, then add all together.

Vegetative Diversity/ Integrity					
	3a. Proportion of Wetland	**3b. Individual Community Scores**	**3c. Highest Rated Community Quality**	**3d. Non-Weighted Average**	**3e. Weighted Average**
Community #1	**T**	**A**	**If Spec. Features b, d or i are checked then rate Exceptional (2); if either question 4, 5, or 6 are Yes, then rate Exceptional (2); else:**		
Community #2	**U**	**B**			
Community #3	**V**	**C**			
Community #4	**W**	**D**			
Community #5	**X**	**E**			
Community #6	**Y**	**F**			
Community #7	**Z**	**G**			
Overall Wetland Value Rating	**1.0**		**: Highest Value of A-G**	**: (A+B+C+ D+E+F+G)/7 = Ave.**	**:(A*T)+(B* U)+(C*V)+ (D*W)+(E* X)+(F*Y)+(G*Z) = Wt. Ave.**

6.2 MAINTENANCE OF CHARACTERISTIC HYDROLOGIC REGIME

A wetland's hydrologic regime or hydroperiod is the seasonal pattern of the wetland water level that is like a hydrologic signature of each wetland type. It defines the rise and fall of a wetland's surface and subsurface water. The constancy of the seasonal patterns from year to year ensures a reasonable stability for the wetland[23]. The ability of the wetland to maintain a hydrologic regime characteristic of the wetland type is evaluated based upon wetland soil and vegetation characteristics, land use within the wetland, land use within the upland watershed contributing to the wetland, and wetland outlet configuration. Maintenance of the hydrologic regime is important for maintaining a characteristic vegetative community, and is closely associated with other functions including flood attenuation, water quality and groundwater interaction.

Measures the degree of human alteration of the wetland hydrology, either by outlet control or by altering immediate watershed conditions. Each parameter is weighted equally.

MnRAM #	Excel #	Variable Description	Type of Interaction
13	E17	Outlet—natural hydrologic regime	Controlling
14	E18	Dominant upland land use	Compensatory
15	E19	Soil condition/wetland	Compensatory
20	F24	Stormwater runoff/pretreatment-Reverse	Compensatory

Hydrologic Regime Index = (13+14+15+20)/4

6.3 FLOOD AND STORMWATER STORAGE/ATTENUATION

A wetland's ability to provide flood storage and/or flood wave attenuation is dependent on many characteristics of the wetland and contributing watershed. Characteristics of the subwatershed that affect the wetlands ability to provide flood storage and attenuation include: soil types, land use and resulting stormwater runoff volume, sediment delivery from the subwatershed, and the abundance of wetlands and waterbodies in the subwatershed. Wetland characteristics which affect the wetland's ability to store and or attenuate stormwater include: condition of wetland soils; presence, extent, and type of wetland vegetation; presence and connectivity of channels; and most importantly outlet configuration. Higher rated wetlands will have an unaltered or restricted outlet, undisturbed wetland soils, dense emergent vegetation without channels, a high proportion of impervious surfaces in the subwatershed, large runoff volumes, clayey upland soils, and few wetlands present within the subwatershed.

This formula is based on the Surface Water Storage Functional Capacity Index scoring concept and equation[24]. The formula was altered with the addition of three surface flow characteristics and two stormwater runoff parameters (Stormwater Runoff Quality/Quantity and Subwatershed Wetland Density) along with the removal of two parameters (Soil Porosity and Subsurface Outlet,

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[23] Mitsch and Gosselink, 2000
[24] Lee et al., 1997

which is already characterized in another parameter). This index is comprised of 5 primary processes, which are weighted equally; included in each major process are one to three characteristics that equally contribute to that process.

1. **Outlet Characteristics**: Outlet characteristics
2. **Upland Watershed**: Upland land use, Upland soils,
3. **Wetland Condition/Land Use**: Wetland land use, sediment delivery
4. **Runoff Characteristics:** Stormwater runoff quality/quantity, subwatershed wetland density
5. **Surface Flow Characteristics**: Flow-through emergent vegetation density, surface flow characteristics

Flood and Stormwater Storage Index Computation:

Entire Formula: Outlet for flood retention{12} + (Dominant upland use-RR{14}+ Upland soils{19})/2 + (Soil condition{15} + Sediment delivery{18})/2 + Stormwater runoff pretreat&det{20} + Subwatershed wetland density{21})/2 + (Percent emergent vegetative cover{16} + Flow-through emergent vegetative roughness{17} + Channels/sheet flow{22})/3)/5.

1. If 12=0, then: ((14+19)/2+(15+18)/2+(20+21)/2+(16+17+22)/3)/4

2. If 12>0, then: (12+(14+19)/2+(15+18)/2+(20+21)/2+(16+17+22)/3)/5

No changes to the formula are necessary if 16=0.

Flood and Stormwater Storage/Attenuation Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
12	E16	Outlet—flood attenuation	Controlling—optional
14	F18	Dominant upland land use-RR	Compensatory
19	E23	Upland soils	Compensatory
15	E19	Soil condition	Compensatory
18	E22	Sediment delivery	Compensatory
20	E24	Stormwater pretreatment &detention	Compensatory
21	E25	Subwatershed wetland density	Compensatory
16	F20	Emergent vegetation % cover	Comp.—optional
17	E21	Emergent vegetation flood resistance	Comp.—optional
22	E26	Channels/sheet flow	Compensatory

6.4 DOWNSTREAM WATER QUALITY PROTECTION

This rates the wetland's ability and opportunity to protect valuable downstream resources. Valuable downstream resources include recreational waters (i.e. lakes, streams, rivers, creeks, etc) and potable water supplies. The level of functioning is determined based on runoff characteristics, sedimentation processes, nutrient cycling, and the presence and location of significant downstream water resources. Runoff characteristics that are evaluated include: land use and soils in the upstream watershed, the stormwater delivery system to the wetland, and sediment delivery characteristics. The ability of the wetland to remove sediment from stormwater is determined by emergent vegetation and overland flow characteristics. A high nutrient removal rating indicates dense vegetation and sheet flow to maximize nutrient uptake and residence time within the wetland. The opportunity for a wetland to protect a valuable water resource diminishes with distance from the wetland so wetlands with valuable waters within 0.5 miles downstream have the greatest opportunity to provide protection.

Compute Functional Index for Downstream Water Quality Protection
This functional index computation was derived from a combination of Nutrient Cycling and Retention of Particulates functions in the HGM Prairie Pothole draft guidebook[54] with the downstream sensitivity concept from *The Minnesota Wetland Evaluation Methodology*. Three major processes make up equal portions of the Downstream Water Quality Protection function[25] with a measure of opportunity to protect downstream resources; each process is comprised of two to four observable parameters.

1. **Rate, Quantity, and Quality of Runoff to the Wetland**: this is characterized by the conditions in the upstream watershed; both land use and soils, that affect the sediment and nutrient loads to the wetland, and by the existing storm water delivery system to the wetland (Upland watershed conditions, storm water runoff, evidence of sediment delivery, and upland buffer each comprise 1/16 of the entire downstream water quality functional index based on their contribution to sediment removal).
2. **Sedimentation**: this is characterized by the presence of flow-through emergent vegetation density and by the overland flow characteristics within the wetland. A wetland with primarily sheet flow through the wetland and dense emergent vegetation density will allow sediment to drop out more effectively than a wetland with channel flow and no vegetation (When all parameters are applicable; emergent vegetative density and overland flow characteristics each make up 1/8 of the total downstream water quality functional index based on their contribution to sediment removal).
3. **Nutrient Uptake**: this is characterized by the outlet configuration and vegetative characteristics. A wetland with long water retention times has more capacity to remove nutrients from the water column via physical and biological processes. Vegetation slows floodwaters by creating frictional drag in proportion to stem density which allows sediment particles to settle out, thereby improving the water quality for downstream uses (Outlet characteristics and vegetative density each make up 1/8 of the total downstream water quality functional index based on their contribution to nutrient uptake).

[25] Derived from a combination of Nutrient Cycling and Retention of Particulates functions in the HGM Prairie Pothole draft guidebook (Lee et al., 1997) with the downstream sensitivity concept from *The Minnesota Wetland Evaluation Methodology.*

4. **Downstream Sensitivity**: if the wetland contributes to the maintenance of water quality within one-half mile of a recreational water body or potable water supply source downstream, it operates at a higher functioning level than a similar wetland farther from or without significant downstream water resources (This factor accounts for ¼ of the total downstream water quality functional index).

Downstream Water Quality Functional Index Computations:

1. If 12=0, then: (14+$20_{reversed}$ +18+(**23+24+26**)/3+(**16**+17)/2+27)/6

2. If 12>0, then: (14+$20_{reversed}$ +18+(**23+24+26**)/3+(**16**+17)/2+27+12)/7

No changes to the formula are necessary if 16=0.

Entire Formula:
(Dominant upland land use{14} + Stormwater runoff pretreatment & detention{$20_{reversed}$ } + Sediment delivery {18} + (Upland buffer width{23}WQ + Upland buffer vegetative cover{24} + Upland buffer slope {26})/3 + (Flow-through %emergent vegetative cover{16} + Flow-through emergent vegetative roughness{17})/2 + Downstream sensitivity{27}+ Outlet for flood{12})/7

Downstream Water Quality Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
14	E18	Dominant upland land use	Controlling
20	E24	Stormwater runoff pretreatment &detention	Controlling
18	E22	Sediment delivery	Controlling
23	G27	Upland buffer width	Comp.
24	G28	Upland area management	Comp.
26	G34	Upland area slope	Comp.
16	F20	Emergent vegetation (% cover)	Comp.—optional
17	E21	Emergent vegetation (roughness coefficient)	Comp.—optional
27	E39	Downstream sensitivity	Comp.
12	E16	Outlet for flood	Controlling--optional

6.5 MAINTENANCE OF WETLAND WATER QUALITY

The sustainability of a wetland is partially driven by the quality and quantity of stormwater runoff entering the wetland. The ability of the wetland to sustain its characteristics is evaluated based on characteristics of the contributing subwatershed and indicators within the wetland. Subwatershed conditions which affect the wetland's sustainability in relation to water quality impacts include: upland land use; sediment delivery characteristics to the wetland; stormwater runoff volumes and rates; and the extent, condition, and width of upland buffer. Indicators of nutrient loading to the wetland indicate that a diverse wetland may not be sustainable. Indicators that a wetland has been affected by nutrient loading include the presence of monotypic vegetation and/or algal blooms.

This functional index was derived from a combination of sources including MNRAM, HGM, WEM, WET, and experiences of the project team. The sustainability of a wetland is partially driven by the quality and quantity of stormwater runoff entering the wetland. The ability of the wetland to sustain its characteristics is evaluated based on characteristics of the contributing subwatershed and indicators within the wetland. Subwatershed conditions which affect the wetland's sustainability in relation to water quality impacts include: upland land use; sediment delivery characteristics to the wetland; stormwater runoff volumes and rates; and the extent, condition, and width of upland buffer. Indicators of nutrient loading to the wetland indicate that a diverse wetland may not be sustainable. Indicators that a wetland has been affected by nutrient loading include the presence of monotypic vegetation and/or algal blooms.

Wetland Water Quality Functional Index Computation:

(3e*2+14+$20_{reversed}$ +(**23**+**24**+**26)**/3+18+28)/7

Entire Formula:
(Vegetative Diversity/Integrity{3e*2} + Dominant upland land use{14} + Stormwater runoff pretreatment & detention{$20_{reversed}$ } + (Upland buffer width{23}WQ + Upland buffer vegetative cover {24} + Upland buffer slope {26})/3 + Sediment delivery {18})/2 + Nutrient loading {28})/7

Wetland Water Quality Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
3e	D6*2	Vegetative Diversity/Integrity	Contributing
14	E18	Dominant upland land use	Contributing
20	F24	Stormwater runoff pretreatment and detention—RR	Contributing
23	G27	Upland buffer width	Contributing
24	G28	Upland area management	Contributing
26	G34	Upland area slope	Contributing
18	E22	Sediment delivery	Contributing
28	E40	Nutrient loading	Contributing

This functional index was derived from a combination of sources including MNRAM, HGM, WEM, WET, and experiences of the project team. The sustainability of a wetland is partially driven by the quality and quantity of stormwater runoff entering the wetland. The ability of the wetland to sustain its characteristics is evaluated based on characteristics of the contributing subwatershed and indicators within the wetland. Subwatershed conditions which affect the wetland's sustainability in relation to water quality impacts include: upland land use; sediment delivery characteristics to the wetland; stormwater runoff volumes and rates; and the extent, condition, and width of upland buffer. Indicators of nutrient loading to the wetland indicate that a diverse wetland may not be sustainable. Indicators that a wetland has been affected by nutrient loading include the presence of monotypic vegetation and/or algal blooms.

6.6 SHORELINE PROTECTION

Shoreline protection is evaluated only for those wetlands adjacent to lakes, streams, or deepwater habitats. The function is rated based on the wetlands opportunity to protect the shoreline; i.e. wetlands located in areas frequently experiencing large waves and high currents have the best opportunity to protect the shore. In addition, shore areas composed of sands and loams with little vegetation or shallow-rooted vegetation will benefit the most from shoreline wetlands. The wetland width, vegetative cover, and resistance of the vegetation to erosive forces determine the wetland's ability to protect the shoreline.

Each of the five parameters contributes equally[26]: based primarily on the characteristics presented in WEM with a simple, straightforward computation of the index assuming all characteristics contribute equally.

MnRAM #	Excel #	Variable Description	Type of Interaction
29	E41	Shoreline?	Controlling
30	E42	Rooted shoreline vegetation (% cover)	Contributing
31	E43	Wetland width (average)	Contributing
32	E44	Emergent vegetation erosion resistance	Contributing
33	E45	Shoreline erosion potential	Contributing
34	E46	Bank protection ability	Contributing

Shoreline Protection Functional Index Computation:

If 29=1, then:
Shoreline Protection Index = (30+31+32+33+34)/5

Entire Formula:
(Rooted shoreline vegetation {30} + Average shoreline wetland width {31} + Emergent vegetation erosion resistance {32} + (Shoreline erosion potential {33} + Bank protection ability {34})/5

6.7 MAINTENANCE OF CHARACTERISTIC WILDLIFE HABITAT STRUCTURE

The ability of a wetland to support various wildlife species is difficult to determine due to the specific requirements of the many wildlife species that utilize wetlands. This function determines the value of a wetland for wildlife in a more general sense, and not based on any specific species. The characteristics evaluated to determine the wildlife habitat function include: vegetative quality, outlet characteristics (which control hydrologic regime), upland land use, wetland soil type and conditions, water quality of storm water runoff entering the wetland, upland buffer extent, condition, and diversity; the interspersion of wetlands in the area; barriers to wildlife movement; wetland size; vegetative and community interspersion within the wetland; and amphibian breeding potential and overwintering habitat.

Thirteen parameters are weighed equally as described below; vegetative quality weighted double the other factors. The questions are borrowed or modified from MNRAM, WET, WEM, and HGM methodologies, combined to provide a measure of wildlife habitat in general, not focusing on any particular species.

If Rare Wildlife (35) or Rare Natural Community (36) are true, then this Index is Exceptional.

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[26] Based primarily on the characteristics presented in WEM.

If Special Features d, g, or j are checked, then this Index is Exceptional, otherwise, follow conditions below:

If 37=0 and 38=0 and 39=0, then:
(3e*2+40+41+(**23**+**24**+**25)**/3+13+ 20)/7

If 38=0 and 39=0, then:
(3e*2+37+40+41+(**23**+**24**+**25)**/3+ 13+20)/8

If 37=0 and 39=0, then:
(3e*2+38+40+41+(**23**+**24**+**25)**/3+ 13+20)/8

If 37=0 and 38=0, then:
(3e*2+39+40+41+(**23**+**24**+**25)**/3+ 13+20)/8

If 39=0, then:
(3e*2+37+38+40+41+(**23**+**24**+**25)**/3+13+20)/9

If 38=0, then:
(3e*2+39+37+40+41+(**23**+**24**+**25)**/3+13+20)/9

If 37=0, then:
(3e*2+39+38+40+41+(**23**+**24**+**25)**/3+13+20)/9

If 37>0 and 38>0 and 39>0, then:
(3e*2+39+37+38+40+41+(**23+24+25**)/3+13+20)/10

Entire Equation:

(Vegetative Diversity/Integrity{3e*2} + Wetland Detritus {39} + Vegetation Interspersion {37} + Community Interspersion {38} + Wetland Interspersion {40} + Wildlife Barriers {41} + (Upland buffer width {23}WQ + Upland Area Management{24} + Upland area diversity {25})/3 + Outlet natural hydrologic regime {13}+ Stormwater runoff pretreatment and detention 20)/11

MnRAM #	Excel #	Variable Description	Type of Interaction
41	E53	Wildlife barriers	Controlling
3e	D6	Vegetative Ranking (communities' weighted average)	Compensatory
39	E51	Wetland detritus (n/a)	
23	I27	Upland buffer average width	
24	G28	Upland area management	
25	G31	Upland area diversity	
13	E17	Outlet natural hydrologic regime	
20	F24	Stormwater runoff pretreatment & detention—RR	
37	F49	Vegetation interspersion (n/a)	
38	F50	Community interspersion (n/a)	
40	E52	Wetland interspersion	

6.8 MAINTENANCE OF CHARACTERISTIC FISH HABITAT

The ability of the wetland to support native fish populations is determined by structural factors within the wetland as well as water quality contributions from upland factors. Wetlands rated High are lacustrine or riverine and provide spawning/nursery habitat, or refuge for native species (included but not limited to game fish). Wetlands rated Low for fish habitat do not have a direct hydrologic connection to a waterbody with a native fishery or have poor water quality.

MnRAM #	Excel #	Variable Description	Type of Interaction
46	E58*2	Fish habitat quality	Controlling
29	D41	Fringe wetland?	Contributing
24	G28	Adjacent area management	Compensatory
18	E22	Sediment delivery	Compensatory
20 (R)	F24	Storm water runoff	Compensatory
28	E40	Nutrient load	Compensatory
30	E42	Percent cover	Compensatory
31	E43	Wetland shoreline width	Compensatory
33 (R)	F45	Shoreline erosion potential	Compensatory

Fish Habitat Functional Index Computation:

If Special Features a or g are checked, then Fishery Habitat Index = Exceptional.

If 46=0, then Fishery Habitat = N/A

If 29=0, Fishery Habitat Index = [(46*2)+24+18+20(R) +28]/6

If 29>0, Fishery Habitat Index = [(46*2)+24+18+20(R) +28+**30**+**31**+**33(R)**]/9

6.9 MAINTENANCE OF CHARACT. AMPHIBIAN HABITAT FOR BREEDING/OVERWINTERING

The ability of a wetland to support various amphibian species is difficult to determine due to the specific requirements of the many amphibian species that depend on wetlands. This function determines the value of a wetland for amphibians in general, not based on specific species. An adequate wetland hydroperiod and the presence or absence of predatory fish are considered to be limiting variables for this function. In general, wetlands must remain inundated until early to mid-June to allow the larval stages to metamorphose into adults. Because many amphibians are partly terrestrial, the characteristics evaluated to determine the amphibian habitat function include numerous hydrology and terrestrial measures. The characteristics evaluated include: upland land use, upland buffer width, water quality of storm water runoff entering the wetland, barriers to wildlife movement, and amphibian breeding potential and overwintering habitat.

An adequate wetland hydroperiod (Question 42) is considered to be the primary limiting variable for this functional index. If the hydroperiod is insufficient for breeding, the wetland rating for amphibian use will be Not Sufficient. The status of predatory fish in the wetland (Q.43) is a secondary limiting factor to the final rating; the lowest rating for this variable, however, is 0.1 (Low), rather than zero (Not Sufficient).

Amphibians' ability to use a particular wetland for over wintering is a contributing factor in rating the wetland's functional index (Q.44). Because most amphibians are partly terrestrial, the extent of upland buffer habitat surrounding the wetland (Q.23) is an important habitat component[27] and is weighted by a factor of two. Question 14 (Upland Land Use) is also included as an indicator of the quality of the surrounding upland habitat[56]. Unnatural fluctuations in water depth in wetlands from conducted storm water runoff can impair reproductive success in amphibians, which often attach their eggs to stems of wetland vegetation, e.g., salamanders, tree frogs, green frogs, and wood frogs[28]. Extreme water level fluctuations during winter may also cause mortality in overwintering reptiles and amphibians[29]. Thus, Question 20 is included in the formula, with a reverse rating. Question 41 (Barriers) is included because access to and from the wetland by amphibians is an important factor in habitat quality[30].

Amphibian Habitat Functional Index Computation:

If 42=0, then N/A

Otherwise: Amphibian Habitat Index = (43) * [(44 + 2*23_{wildlife} + 14 + 41 + 20_{reversed})/6]

Entire Formula:

If Amphibian Breeding Potential-Hydroperiod {42} is applicable, then: (Amphibian Breeding Potential-Predator Fish {43}) * {[(Amphibian Overwintering Habitat {44}+ 2*Upland Buffer Width $(23)_{\text{Wildlife}}$ + Dominant Upland Land Use {14} + Barriers {41} + Stormwater Input {20_{reverse}}]/6}

Amphibian Habitat Variables

MnRAM #	Excel #	Variable Description	Type of Interaction
42	D54	Amphibian breeding potential—hydroperiod	Controlling
43	D55	Amphibian breeding potential—fish presence	Controlling
44	E56	Amphibian overwintering habitat	Compensatory
23	I27	Upland buffer width	Compensatory
41	E53	Wildlife barriers	Compensatory
14	E18	Dominant upland land use	Compensatory
20	F24	Stormwater runoff pretreatment & detention—RR	Compensatory

6.10 AESTHETICS/RECREATION/EDUCATION/CULTURAL/SCIENCE

The aesthetics/recreation/education/cultural and science function and value of each wetland is evaluated based on the wetland's visibility, accessibility, evidence of recreational uses, evidence of human influences (e.g. noise and air pollution) and any known educational or cultural purposes. Accessibility of the wetland is key to its aesthetic or educational appreciation. While dependent on accessibility, a wetland's functional level could be evaluated by the view it provides observers. Distinct contrast

27 Knutson et al., 2000
28 Richter and Azous, 1995
29 Hall and Cuthbert, 2000
30 Knutson, et al., 1999; Findlay and Bourdages, 2000; Semlitsch, 2000.

between the wetland and surrounding upland may increase its perceived importance. Also, diversity of wetland types or vegetation communities may increase its functional level as compared to monotypic open water or vegetation. Excess negative human influence on the wetland is counted double in the formula.

All questions contribute equally to the overall index.

MnRAM #	Excel #	Variable Description	Type of Interaction
48	E60	Rare educational opportunity	Controlling
49	E61	Wetland visibility	Compensatory
50	E62	Proximity to population	Compensatory
51	E63	Public ownership	Compensatory
52	E64	Public access	Compensatory
53	E65	Human influence—wetland	Compensatory
54	E66	Human influence—viewshed	Compensatory
55	E67	Spatial buffer	Compensatory
56	E68	Recreational activities in wetland	Compensatory

Aesthetics/Recreation/Education/Cultural/Science Functional Index Computations:

If Special Features c, h, or u is checked[31], or

If 48=1, then Index = Exceptional;

If 53=0.1 (Low), then = (50+51+52+2*53+54+55+56)/8

If 53>0.1, then = (49+50+51+52+53+54+55+56)/8

Entire Formula

(Wetland Visibility {49} + Proximity to Population {50} + Public Ownership {51} + Public Access {52} + Human Influence - Wetland {53} + Human Influence - Viewshed {54} + Spatial Buffer {55} + Recreational Activities in Wetland {56})/8

6.11 COMMERCIAL USES

This question considers the nature of any commercially-valuable use of the wetland and requires the assessor to consider how such use may be a detriment to the sustainability of the wetland. Some row crops can be planted in Type 1 wetlands after spring flooding has ceased and still have adequate time to grow to maturity. This non-wetland-dependent agricultural use of wetlands may include hay, pasture/grazing, or row crops such as soybeans or corn. Wetland-dependent crops include wild rice and cranberries, which rely on the wetland hydrology for part of their life cycle.

[31] c = Designated scientific and natural area; h = Archeologic or historic site designated by the State Historic Preservation Office; u = State or Federal designated wilderness area.

Sustainable uses of the wetland would not require modifying a natural wetland. Products in this category would include collection of botanical products, wet native grass seed, floral decorations, wild rice, black spruce, white cedar, and tamarack. Sustainable uses may require modification of the natural hydrology, such as for wetland-dependent crops (rice, cranberries). Haying and grazing can be less intrusive agricultural activities utilized more or less casually when hydrologic conditions permit; light pasture and occasional haying would be considered more or less sustainable. Like peat-mining, cropping is an unsustainable use of the wetland as it is results in severe alterations of wetland characteristics (soil, vegetation, hydrology).

MnRAM #	Excel #	Variable Description	Type of Interaction
57	E69	Commercial crop—hydrologic impact	Controlling

Commercial Uses Functional Index = 57

6.12 GROUND-WATER INTERACTION

The ground water interaction function is the most difficult to assess. Here the most likely type of ground water interaction is determined, i.e. recharge or discharge, or a combination. In many cases, a wetland will exhibit both recharge and discharge characteristics, however one is usually more dominant. Several wetland and watershed characteristics are evaluated to determine the likely interaction including: wetland soil type, upland land use, upland soil types and wetland size, wetland hydroperiod, wetland outlet characteristics, and topographic relief.

The purpose of this function is strictly to determine the likelihood of the appropriate ground-water interaction based on observable characteristics of the wetland and watershed. The significance of ground water as a component of the wetland water budget is the most difficult functional characteristic to determine without large quantities of detailed hydrologic and geologic information. The following methodology takes the most easily observable and distinct measures of recharge/discharge relationships from the *Wetland Evaluation Technique*[32] and the *Hydrogeomorphic Assessment Methodology*[33]. In many wetlands, surface water and ground water both make significant contributions to the water budget, but occasionally recharge or discharge is dominant. The goal here is to identify the dominant ground-water interaction (if there is one) to help guide future management and provide an indication when additional information may be warranted.

[32] Adamus, et al., 1987
[33] Magee and Hollands, 1998

- If 5 or 6 of questions 58-63 are answered the same, this indicates a strong likelihood that the most frequently stated interaction exerts the primary influence on the wetland.
- If 3-4 questions are answered the same, then the wetland is likely influenced by a combination of both recharge and discharge interactions (i.e. both types of ground water interaction are likely to be present at some point during most years).

58. Wetland Soils – from HGM system functional assessments and Novitzki
59. Subwatershed Land Use/Imperviousness – taken from WET Volume I
60. Wetland Size and Upland Soils – taken from WET Volume I and HGM
61. Wetland Hydrologic Regime– taken from WET Volume I and HGM
62. Inlet/Outlet Configuration – taken from WET Volume I and HGM
63. Upland Topographic Relief – taken from WET Volume I

Special Concerns for Recharge Wetlands

Wherever ground water recharge is indicated as the **primary** interaction and the wetland lies within a sensitive ground water area (**Special Feature Question q**), a contribution area to a public water supply, or a wellhead protection area (**Special Feature Question r**), it should be recorded as Exceptional for the ground water/wetland function.

6.13 WETLAND RESTORATION POTENTIAL

The potential for wetland restoration is determined based on the ease with which the wetland could be restored, the number of landowners within the historic wetland basin, the size of the potential restoration area, the potential for establishing buffer areas or water quality ponding, and the extent and type of hydrologic alteration. Each variable uses the High, Medium, Low rating rather than raw numbers—see MnRAM for individual ranges.

MnRAM #	Excel #	Variable Description	Type of Interaction
64	D79	Wetland Restoration Potential	Controlling
65	F80	Number of Landowners Affected	Contributing
21	E25	Subwatershed Wetland Density	Contributing
66b	F82	Total Wetland Restored Size (Potential)	Contributing
66c	F83	Calculated potential new wetland area	Contributing
67	F84	Potential Buffer Width	Contributing
68	F85	Likelihood of Restoration Success	Contributing

If 64="Yes", then Wetland Restoration Potential = (65+21+66b+66c+67+68)/6,

Otherwise, if 64="No" then "N/A"

Entire Formula

(Landowners Affected by Restoration (65)+Subwatershed Wetland Density (21)+ Wetland Restoration Size (66b)+Proportion of Wetland Drained (66c)+Potential Buffer Width (67)+Likelihood of Restoration Success (68))/6

6.14 WETLAND SENSITIVITY TO STORMWATER INPUT AND URBAN DEVELOPMENT

The sensitivity of the wetland to stormwater and urban development is determined based on guidance within the *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snow-Melt Runoff on Wetlands*, State of Minnesota Storm-Water Advisory Group, June, 1997.

Use habitat proportions from Vegetative Integrity section and enter into a formula to compute answer according to the following criteria[34].

Exceptional = Sedge meadows, open and coniferous bogs, calcareous fens, low prairies, wet to wet-mesic prairies, coniferous swamps, lowland hardwood swamps, or seasonally flooded basins.

A = Shrub-carrs, alder thickets, diverse fresh wet meadows dominated by native species, diverse shallow and deep marshes, and diverse shallow, open water communities.

B = Floodplain forests, fresh wet meadows dominated by reed canary grass, shallow and deep marshes dominated by cattail, reed canary grass, giant reed or purple loosestrife, and shallow, open water communities with low to moderate vegetative diversity.

C = Gravel pits, cultivated hydric soils, or dredge/fill disposal sites.

6.15 ADDITIONAL STORMWATER TREATMENT NEEDS

This rates the sustainability of the wetland with regard to stormwater discharges to the wetland. The need for additional stormwater treatment prior to discharge to the wetland is rated based on the overall rating for Maintenance of Wetland Water Quality. If a wetland is severely degraded by stormwater inputs, the rating will be low, since a diverse, high quality wetland will not be sustainable.

Use functional rating for Maintenance of Wetland Water Quality (MWWQ) as follows (this index is rated strictly from the measure of the water quality in the wetland and the sustainability, i.e. if the water quality in the wetland is low, additional stormwater treatment is needed to protect the wetland and the rating is low):

Use Value for Maintenance of Wetland Water Quality Index (D76, Excel spreadsheet) and apply to criteria below.

A = Maintenance of Wetland Water Quality Index >0.66 (no additional treatment needed)

B = 0.33 < Maintenance of Wetland Water Quality Index ≤ < 0.66 (sediment removal needed)

[34] Taken directly from State of Minnesota Storm-Water Advisory Group, 1997.

C = Maintenance of Wetland Water Quality Index < 0.33 (sediment and nutrient removal needed)

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Appendix G

Vegetation Shoreline Buffer Brochure Examples

Sullivan Shoreline Planting

Project: A 375 square foot shoreline planting along Crystal Lake, covering approximately 50 linear feet of shoreline. Erosion control blanket, native shrubs, and deep-rooted native plant plugs were used to stabilize the existing slope.

Costs: Project material costs were estimated at $935.

Funding: Dakota County SWCD provided technical assistance and Blue Thumb Grant in the amount of $100. The City of Burnsville provided Neighborhood Water Resources Enhancement Grant.

Blue Thumb
PLANTING FOR CLEAN WATER™

Location:

Burnsville

Minnesota

Practice:

Shoreline Planting

Shoreline Benefits:

Reduced erosion and sediment into the receiving waterbody

Improved aesthetics

Improved water quality

Slope stabilization

Partners:

Black Dog Watershed Management Organization

City of Burnsville

Watershed:

Minnesota River

Construction:

July

2009

Dakota County Soil and Water Conservation District
4100 220th St. W., Suite 102, Farmington, MN 55024 651-480-7777 www.dakotaswcd.org

Fay Shoreline

Project: A 600 square foot shoreline planting.

Costs: Project material costs were estimated at $1,847.

Funding: Dakota County SWCD provided technical assistance and Blue Thumb Grant in the amount of $250.

Location:

Burnsville

Minnesota

Practice:

Shoreline planting and Native garden

Benefits:

Runoff volume reduction

Improved aesthetics

Improved water quality

Opportunity for public education and outreach

Wildlife habitat

Slope stabilization

Partner:

Black Dog Watershed Management Organization

Watershed:

Minnesota River

Construction:

2013

Dakota County Soil and Water Conservation District
4100 220th St. W., Suite 102, Farmington, MN 55024 651-480-7777 www.dakotaswcd.org

PROJECT FACTSHEET

COADY

SHORELINE PLANTING

DAKOTA COUNTY SOIL & WATER CONSERVATION DISTRICT

Shoreline planting is the use of native vegetation to protect a shoreline from existing or potential erosion

PROJECT: Installation of a 1000 square foot shoreline planting

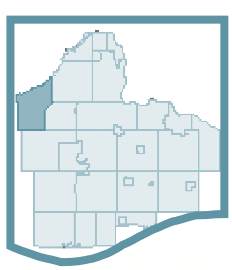
COST: Project materials cost estimated at $3,192

FUNDING: Landowners receive a $250 Blue Thumb grant as well as technical assistance provided by the Dakota County SWCD

Blue Thumb PLANTING FOR CLEAN WATER®

LOCATION:

Burnsville MN
Bluebill Bay Road



PRACTICE:

- Shoreline Planting

BENEFITS:

- Shoreline stabilization and erosion reduction
- Improved water quality
- Improved wildlife habitat
- Opportunity for public education and outreach
- Improved aesthetics

PARTNERS:

- Black Dog Watershed Management Organization

WATERBODY:

- Crystal Lake

WATERSHED:

- Minnesota River

INSTALLATION:

- Summer 2014

Appendix H

Buckthorn Management Guidelines

Buckthorn Management Guidelines

Goal: Restore native plant communities in designated natural areas and other park locations by controlling and removing non-native invasive species.

Buckthorn belongs to the *Rhamnaceae* family. It is native to Europe and Asia, first appearing in the U.S. in the late 1700s. Buckthorn quickly naturalized in the woodlands of the northeastern states. Today buckthorn flourishes in the understory of Minnesota woodlands and in brushy thickets along roadsides and fields. It has become a major plant pest in natural woodlands and wetlands.

Buckthorn can grow to 15-20 feet and has dark green elliptical or oval leaves. In the fall its leaves hang on late into the season and without much color change. It starts easily from seed and will tolerate almost any soil condition or location. In partial shade it will outstretch its neighbors toward the light.

Buckthorn removal is recommended for those areas where the native plant community has been displaced by buckthorn species and where there is a high likelihood that the native plant community can be enhanced and restored.

Restoration of the native communities is the overall intent of non-native eradication efforts.

Volunteer Considerations

Volunteers must be trained in species identification, removal techniques and other aspects related to the eradication/restoration efforts.

Identification of buckthorn by volunteers is best performed during the month of October.

Process

Buckthorn removal is a long-term process requiring several steps over a three- to four-year period. Pulling seedlings, cutting and removing mature plants, chemically treating stumps and replanting the site with native species are critical to the long-term success of restoration efforts.

Staff are responsible for cutting mature plants and chemically treating the stumps in areas designated for restoration. A 20%-25% solution of glyphosate (Roundup) with a dye is used to paint, chemically treat, and mark the stumps.

Volunteer procedures

1. Hand pulling allowed by volunteers with training or under the supervision of a “trained” volunteer supervisor.
2. Use of loppers allowed by volunteers.
3. No use of power tools or chemicals by volunteers; chemicals and power tool use only by staff or contractor.
4. Volunteers must sign waiver form.

Recommended chronology of restoration activities with volunteers

Year one

- Seedlings cut or pulled (September-November)
- Mature trees cut by staff and/or volunteers in late fall (October-December)
- Stumps or stems chemically treated by staff immediately after cutting
- Removal of brush to a chipping location (or pile on site for burning)

Year two

- Remove seedlings by hand pulling or cutting and treating (June-November)
- Follow-up cutting by staff and/or volunteers in late fall (October-December) and chemically treat stump and stems.

Year three

- Seedling removal by hand pulling or cutting and treating as necessary
- Plant native understory shrubs, trees, ferns, wildflowers and grasses to approximate prior native plant community.

Year four

- Continued monitoring and buckthorn seedling removal

Other removal techniques

Mechanical

- Prescribed fire for seedlings; prescribed burns in early spring and fall annually or biannually to control buckthorn may have to be continued for several years

Chemical

- Cut-stump and stem treatment with glyphosate; 20%-25% active ingredient cut-stump; or basal bark spray treatment around the stem with 25-50% a.i. triclopyr (Garlon) – consideration of worker safety issues will dictate chemical selection. Glyphosate products registered for wetland/aquatic use should be used on water bodies and wetlands. Sponge applicators can help prevent chemical spill or spread to workers.
- Fosamine, a non-selective bud inhibitor for woody species, can be applied as a basal bark treatment in the fall at 3% a.i. concentration in winter

Another technique is goat rental.

The method of buckthorn control should be selected based on the site, safety concerns, and opportunities for continued vegetation management.

Other Sources for Guidance

University of Minnesota:
http://www.extension.umn.edu/environment/agroforestry/woody-vegetation-control.html

University of Wisconsin:
http://mipncontroldatabase.wisc.edu/search?name=common_buckthorn&habitat=7&season=7

Minnesota Department of Natural Resources:
http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/buckthorn/control.html

U.S. Department of Agriculture Natural Resources Conservation Service:
https://efotg.sc.egov.usda.gov/references/public/MN/797Buckthorn.pdf
See Buckthorn Control Quick Guide for a summary of control techniques.

Appendix I

Pollinators Brochure

How can YOU help pollinators?

A decline in pollinators affects us all. Reversing this trend is important to our ecosystem as well as to human health and well-being. Pollinators have evolved with plants over thousands of years, developing unique and interdependent relationships. We can all do our part to help pollinators rebound from the challenges they face.

1. Plant a variety of native flowering plants in your home garden, agricultural or natural landscapes (with bloom times from April to October).

2. Provide a variety of natural habitats for nesting sites and clean water sources.

3. Avoid pesticide use and purchase pollinator plants (and seeds) that have not been treated with systemic pesticides.

4. Help increase awareness about the need to protect pollinators

More resources about pollinators can be found at http://www.bwsr.state.mn.us/practices/pollinator/index.html

Minnesota Board of Water & Soil Resources
www.bwsr.state.mn.us

Minnesota Board of Water & Soil Resources

MINNESOTA BOARD OF WATER & SOIL RESOURCES

PROTECTING Minnesota's Pollinators

Minnesota Board of Water & Soil Resources

There is increasing evidence that insect pollinators are disappearing at alarming rates. Major factors include loss of forage plants and nesting habitat, disease, pesticide use, and pests.

Pollination causes plants to produce the seeds and fruits that sustain wildlife and humans, and provides important ecosystem services. More than 1/3rd of all plants or plant products consumed by humans are dependent on pollinators.

Many Minnesota-grown crop plants cannot produce seed without the help of insect pollinators. These include:

- Apples
- Berries
- Sunflowers
- Clovers
- Beans
- Squash
- Cucumbers

Minnesota's Pollinators & Pollinator Plants

When these critters visit a flower to consume nectar and/or pollen, some of the pollen grains stick to their bodies. Pollination occurs when this pollen is transferred from one plant to another.

Bees

With over 4000 species, bees are considered the most important pollinators in North America, around 500 of which are native to Minnesota and Wisconsin. Bee families include honey bees, bumble bees, mason bees, carpenter bees, and sweat bees.

Butterflies & Moths

Butterflies and moths are also important pollinators and many are in trouble. Milkweed is the host plant for monarch butterfly caterpillars, and the loss of this plant is drastically reducing monarch butterfly populations. The Poweshiek skipperling, Dakota skipper, and Karner Blue butterflies are threatened or endangered in Minnesota.

Beetles, Flies, Wasps & Midges

Beetles are considered to be important pollinators because of their large numbers. Beetles play an important role in controlling agricultural pests. Though less effective as pollinators, many flies, wasps, midges, and even mosquitos visit flowers and consume nectar as part of their diet.

Hummingbirds

Of the 20 hummingbirds in North America, only the Ruby-throated is regularly found in Minnesota. This charismatic pollinator is attracted to brightly colored tubular flowers like the columbine.

Goldenrod
Solidago spp.

Joe Pye Weed
Eupatorium spp.

Milkweed
Asclepias spp.

Black-eyed Susan
Rudbeckia spp.

Prairie Blazing Star
Liatris spp.

Columbine
Aquilegia spp.

Minnesota Board of Water & Soil Resources

DRAFT

Black Dog Watershed Management Organization

2020 WATERSHED ANNUAL REPORT

Published April 2021

Our mission is . . .

To provide leadership in the management and stewardship of the water resources in northwestern Dakota County, Minnesota, through the cooperation of four cities and the involvement of local stakeholders.

Evaluating our Success

The BDWMO watershed management plan calls for the organization and its member cities to identify outcome-based goals for specific water bodies found within the watershed, and to meet annually to discuss progress toward these goals. The BDWMO uses the following tools to track progress toward goals:

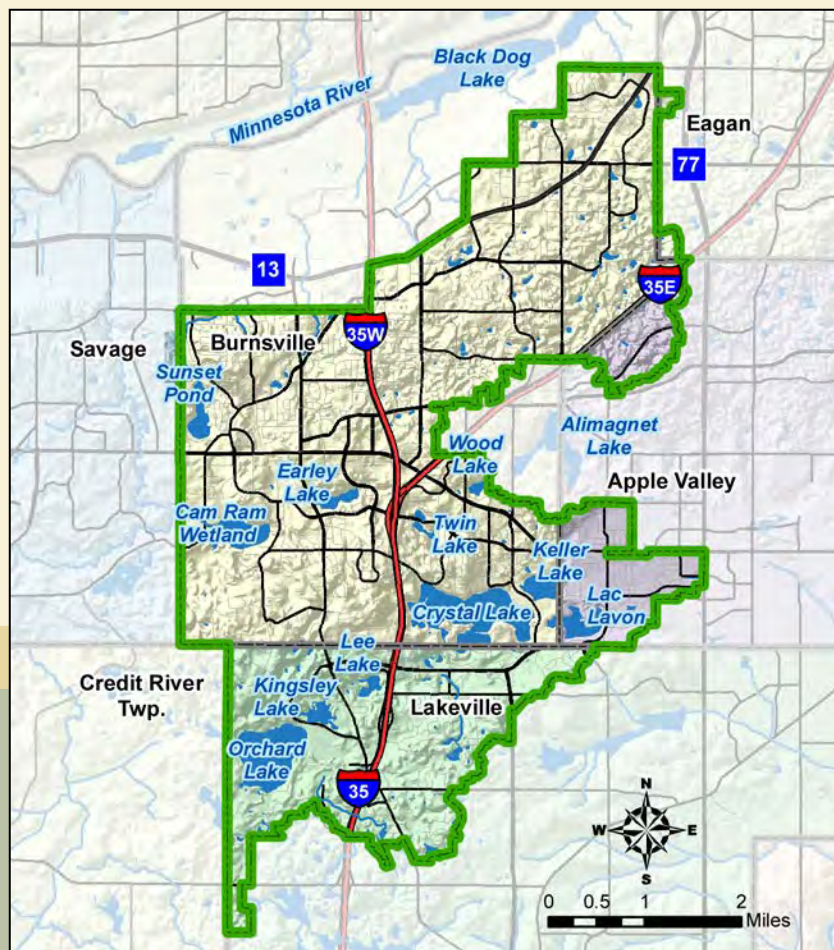
- **Trend Analysis**—The BDWMO collects water quality information to track water quality trends.
- **Performance Analysis**—The BDWMO will evaluate the member cities' implementation of maintenance plans, captial improvement projects, programs, and other items.
- **Habitat Quality Analysis**—The BDWMO collects habitat quality data to detect conditions that would trigger a need for management actions.

This annual report outlines the BDWMO's goals, progress toward those goals in 2020, and plans for 2021 and beyond.

What is the Black Dog Watershed Management Organization?

The Black Dog Watershed Management Organization (BDWMO) actively manages surface water, such as that found in lakes, streams, and wetlands, located in the Black Dog and Credit River watersheds within Dakota County. To effectively manage surface water, the BDWMO develops and implements plans that address water quality, responds to drainage issues that cross multiple municipal boundaries, and assists cities within the watershed to manage surface water runoff. The BDWMO is represented by commissioners who are appointed by the cities within the watershed, which include Burnsville, Lakeville, Apple Valley, and Eagan.

The total area of the Black Dog watershed is 17,500 acres; 70 percent of the watershed lies within the city of Burnsville, 21 percent of the area is within the city of Lakeville, 8 percent is within the city of Apple Valley, and 1 percent is within the city of Eagan.



In this Issue

Watershed Management Plan Update

The BDWMO is in the process of updating its Watershed Management Plan. The Plan will establish the goals, policies, and activities for managing and protecting the lakes, ponds, creeks, streams, wetlands, drainages, and groundwater in the BDWMO from 2022 through 2032.

State law and rules govern the watershed planning process and require that watershed management plans be updated every 10 years. The BDWMO adopted its current Plan in 2012 and anticipates completing the updated Plan in 2022. To promote a transparent and inclusive plan development process, the BDWMO is collecting input from cities and other local stakeholders in developing the 2022 Plan. Representatives from the member cities and state, regional, and county agencies have been asked to participate in a technical advisory committee (TAC). The TAC will meet periodically during the project to discuss issues, priorities, and implementation activities.

In 2020, the BDWMO began the preliminary planning process and will continue with the numerous tasks required throughout 2021 and into 2022. The planning process is divided into three phases and includes the following tasks:

Phase I — Stakeholder Engagement

- Notifying Plan review authorities and summarizing responses
- Interviewing BDWMO city and partner staff
- Developing a stakeholder engagement plan for BWSR review and approval
- Providing updates for the BDWMO website
- Hosting an online survey
- Establishing and meeting with a Technical Advisory Committee
- Initial planning (public kickoff) meeting
- Hosting a Commissioner issue identification workshop
- Attending partner and community events (as public health guidance permits)

Phase II — Plan Development

- Updating the Land and Water Resources Inventory
- Defining issues and measurable goals
- Revising BDWMO policies
- Creating a targeted implementation program
- Compiling the complete draft Plan

Phase III — Plan Review, Approval and Adoption

- Completing formal 60-day review and responding to comments
- Distributing responses to comments and hosting public hearing
- Obtaining Plan approval by BWSR
- Adopting and distributing the final Plan

The BDWMO's current plan was approved by the Minnesota Board of Water and Soil Resources (BWSR) on September 26, 2012 and adopted by the BDWMO Board of Commissioners on October 17, 2012.

The 2012 Plan includes a summary of the BDWMO's history, inventory of water and other natural resources, discussion of issues facing the BDWMO, goals and policies defining the organization's and member cities' responsibilities, and an implementation plan outlining the BDWMO's activities over the next 10 years. An important aspect of the project was the incorporation of total maximum daily load (TMDL) studies into the implementation plan.

The 2012 Plan strengthened existing policies, but also addressed emerging and evolving topics, including cost allocation for internal load reduction projects. Based on new policies included in the 2012 Plan, the BDWMO began annual contributions to a Project Reserve Fund. This fund has served as a savings account for internal load reduction projects stemming from TMDLs. The establishment of this fund has allowed for a significant head start in financing internal load reduction projects.

The 2012 Plan is publicly available from the BDWMO's website at: www.blackdogwmo.org/pdfs/2012_Watershed_Mgmt_Plan.pdf

Landscaping for Clean Water—Clean Water Starts at Home

Since most land is privately owned, it is up to each individual landowner to do the right thing on their property to help keep water clean. The Landscaping for Clean Water program makes it easy for residents to turn their yards into a lush and lovely force for clean water rather than a contributor to water pollution.

Are you doing everything possible on your patch of lawn? Attend a Landscaping for Clean Water workshop to find out. Participants in the program attend design workshops to develop landscape plans for their own yards. These plans include creating native gardens, raingardens, or native shorelines that stabilize soil. These planting practices provide habitat for pollinators and birds, reduce watering and require no chemical inputs. On top of that, these practices help water soak into the ground rather than running off and delivering polluted stormwater into lakes, rivers and wetlands.

Who can get a grant?

Participants in the workshops can submit an application, project plan, and cost estimates to the Dakota County SWCD for grant funds of up to $250.

The Landscaping for Clean Water program moved online in the spring of 2020 in response to the Covid-19 pandemic. All three programs—Introduction to Clean Water Class, Design Course, and Maintenance Workshop —became available to participants beginning in mid-April. Over 600 people participated in the Introduction to Clean Water class, either in-person or online.

Three Introduction Classes were held in-person before the shutdown; one hosted by the BDWMO. 31 people attended the class hosted by the BDWMO, 26 of whom reside in Burnsville. 6 Burnsville residents attended the other two presentations.

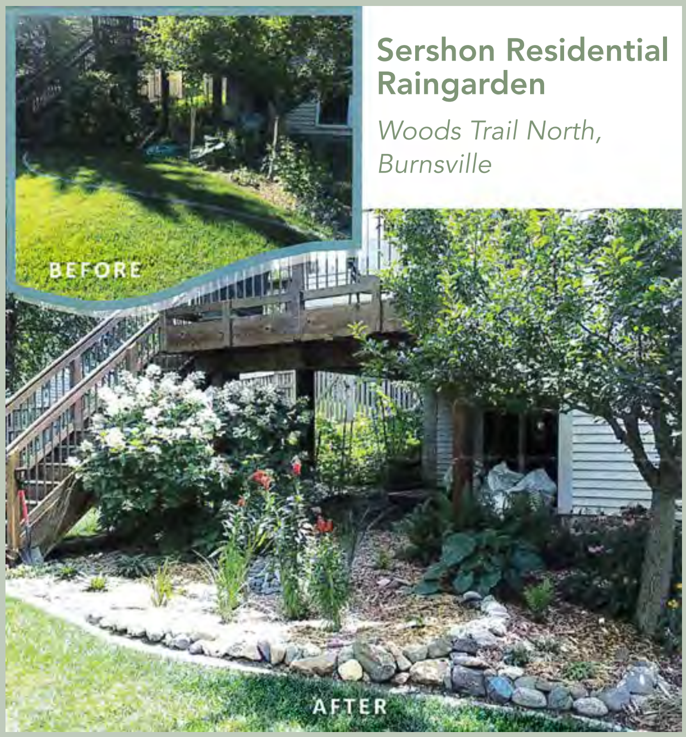
In 2020, the BDWMO provided funding for 9 construction funding grants (2 native gardens, 1 shoreline restoration, and 6 raingardens) through the Landscaping for Clean Water program. In 2021, the BDWMO will provide 18 grants to residents interested in refreshing their landscaping with plants that support both pollinators and local water quality. Homeowners must attend workshops to apply for grants.

2020 Project Examples

Benefits include: runoff volume reduction, improved water quality, improved wildlife habitat, opportunity for public education and outreach, and improved aesthetics.

Sershon Residential Raingarden

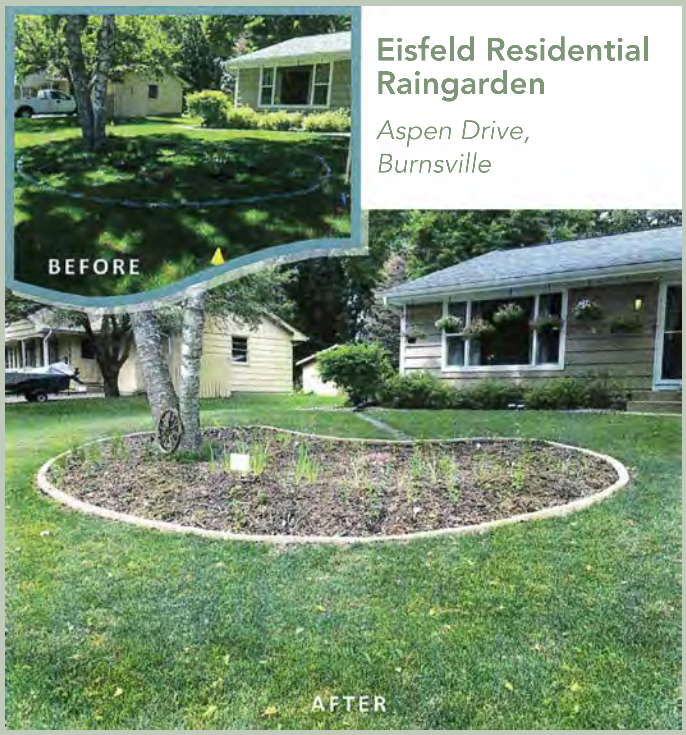
Woods Trail North, Burnsville



PROJECT: Installation of a 104 square foot raingarden. Project materials cost estimated at $497. Landowners received a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County SWCD.

Eisfeld Residential Raingarden

Aspen Drive, Burnsville



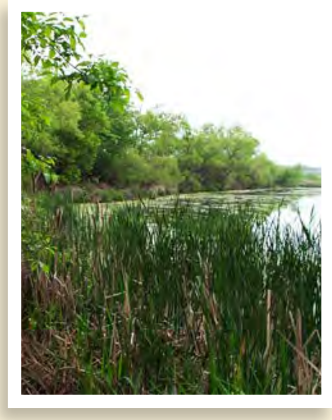
PROJECT: Installation of a 210 square foot raingarden. Project materials cost estimated at $996. Landowners received a $250 Landscaping for Clean Water grant as well as technical assistance provided by the Dakota County SWCD.

Landscaping for Clean Water is one type of cost-sharing program offered by the Dakota County SWCD. For more information, call 651-480-7777 or go to www.dakotaswcd.org/costshare.html.

Observing Orchard Lake

The BDWMO is pleased to report that Orchard Lake continues to have good water quality. The summer-average Secchi disc transparency (a measure of water clarity) in 2020 was 2.1 meters (6.9 feet), which is better than the MPCA deep-lake water quality standard of 1.4 meters. Concentrations of chlorophyll-*a* (a measure of algal abundance) and total phosphorus (the nutrient that drives algal growth) were also monitored in Orchard Lake. The summer-average concentrations of chlorophyll-*a* (5.2 μg/L) and total phosphorus (24 μg/L) were both better than the MPCA deep-lake water quality standards of 14 μg/L and 40 μg/L, respectively. There was a statistically significant trend of degrading water quality for the most recent 10-year period (2011-2020), as indicated by summer averages of Secchi disc transparency. However, summer averages of total phosphorus and chlorophyll-*a* do not show a statistically significant trend for the same period. The lake's water clarity is primarily influenced by changes in the amount of algae in the lake, but suspended sediments, and dissolved organic compounds from the decomposition of plants in the watershed may also contribute to reduced water clarity. Changes in the amount of annual precipitation can result in changes in the concentrations of sediments and dissolved organic compounds in the lake, as well as concentrations of phosphorus that spur algae growth.

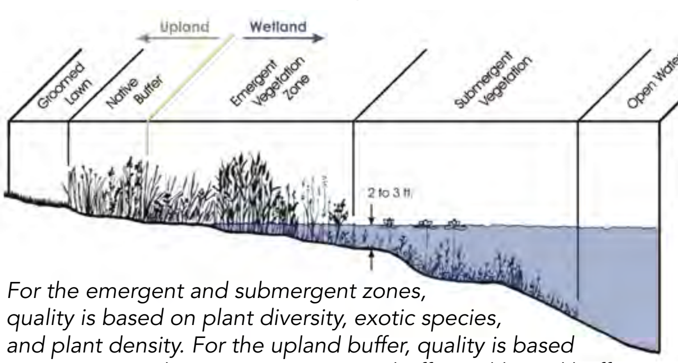
Aquatic plant surveys were conducted in Orchard Lake in 2020, and two invasive, non-native aquatic plant species were identified—curly-leaf pondweed and Eurasian watermilfoil. Both plants can form dense nuisance growth in Minnesota lakes. Curly-leaf pondweed dies off in mid-summer, earlier than native plants, releasing nutrients that can contribute to summer algae blooms. An herbicide treatment was conducted in select areas of the lake in spring 2020 to reduce the growth of curly-leaf pondweed where spring surveys showed potential for heavy growth. Orchard Lake is also monitored for the non-native zebra mussel. No zebra mussels have been found in Orchard Lake to date, but zebra mussels continue to spread to Minnesota lakes, and zebra mussels have been identified in nearby Lake Marion. Invasive, non-native aquatic plants and animals can be spread to other lakes by transport of seeds and/or plant fragments. Zebra mussels can also be attached to plant fragments, and their microscopic larvae can be transported in live wells, wakeboard boat ballast tanks, or other watercraft areas that retain lake water. In order to prevent the spread of invasive plants and animals, lake users should take care in removing all plant fragments from boats and trailers; and remove boat plugs and thoroughly drain all water from live wells when leaving the lake.



The BDWMO will continue to monitor the water quality of Orchard Lake in 2021. Habitat monitoring is scheduled again for Orchard Lake in 2022.

Habitat Monitoring Program

Since 2003, the BDWMO has implemented a program for monitoring the wildlife and fish habitat quality of strategic water resources in the watershed, including biological and physical indicators, such as upland and aquatic vegetation, buffer zones, erosion, sedimentation, and the presence of non-native exotic species. The program also recommends management actions based upon monitoring results.



For the emergent and submergent zones, quality is based on plant diversity, exotic species, and plant density. For the upland buffer, quality is based on vegetation density, exotic species, buffer width, and buffer continuity.

Modified from: Lakescaping for Wildlife and Water Quality

In 2020, the BDWMO monitored the habitat quality of Keller Lake. Monitoring included transect, plot, and meandering surveys. Photographs were taken to document conditions. Analysis and reporting of the monitoring data includes a floristic quality assessment and a four-tiered rating system (poor, moderate, high, and excellent). Private versus public ownership was identified along the entire shoreline. The survey results, along with parcel data, were used to identify possible locations for restoration and preservation.

Also in 2020, the University of Minnesota conducted a seedbank assessment, which germinated nine aquatic plant species, eight of which are native species, from sediment cores within Keller Lake. In addition, a reintroduction program began in 2020, which included transplanting four species of native aquatic plants harvested from a nearby lake. The plants were transplanted into ten fenced plots and monitored from June-October 2020.

See page 7 for additional Keller Lake habitat monitoring results. See www.blackdogwmo.org for the full report.

The member cities have provided lakeshore owners with shoreline restoration information since 2004 and continually promote and encourage lakeshore property owners each year to take advantage of the Dakota County SWCD Landscaping for Clean Water shoreline restoration program. (See page 3 for more about this program.)

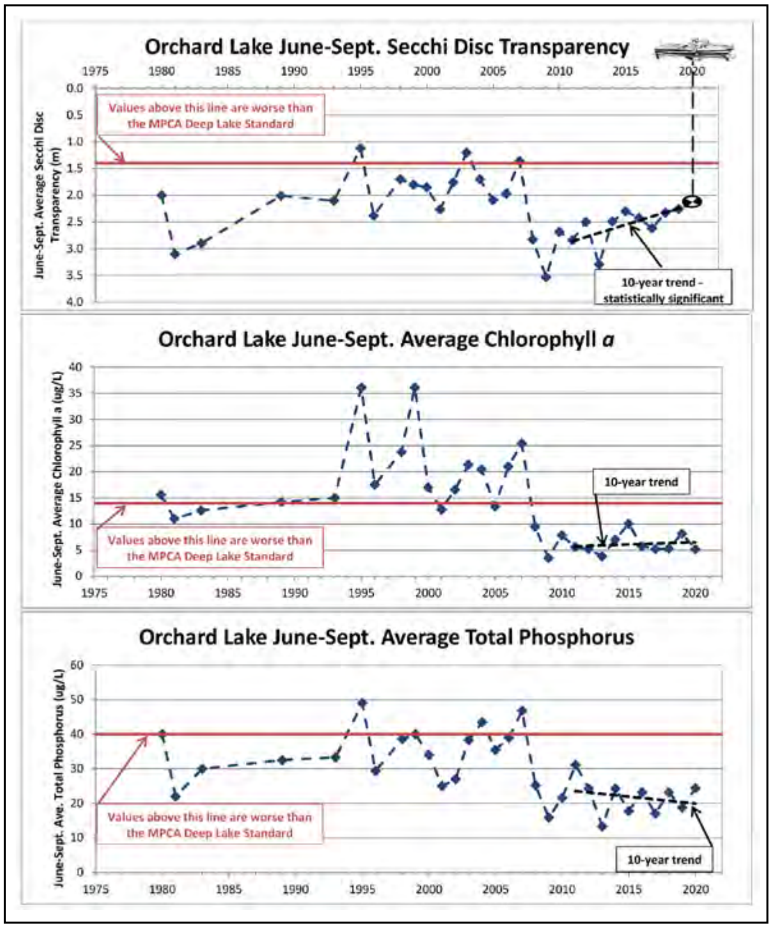
Water Quality Monitoring Program

The BDWMO and member cities continued to monitor several of its lakes during 2020 through the Metropolitan Council's Citizen-Assisted Monitoring Program (CAMP) to detect any water quality changes that would require management action by the WMO. In addition, the BDWMO conducted more detailed monitoring on Orchard Lake (see page 4). The monitoring focused on three water quality indicators—total phosphorus and chlorophyll-*a* concentrations, plus Secchi disc transparency. All three variables correlate strongly to the open-water nuisance conditions of lakes (i.e., algal blooms).

Long-term monitoring is important because lakes can change from year to year. Only when several years of data are compiled do trends become apparent. Because the MPCA periodically evaluates water quality data from the most recent ten-year period to determine if a lake violates applicable water quality standards, the WMO has adopted the same time convention for conducting its annual trend analyses. Graphs on this page and subsequent pages show historic trends in water quality.

Orchard Lake (Lakeville)

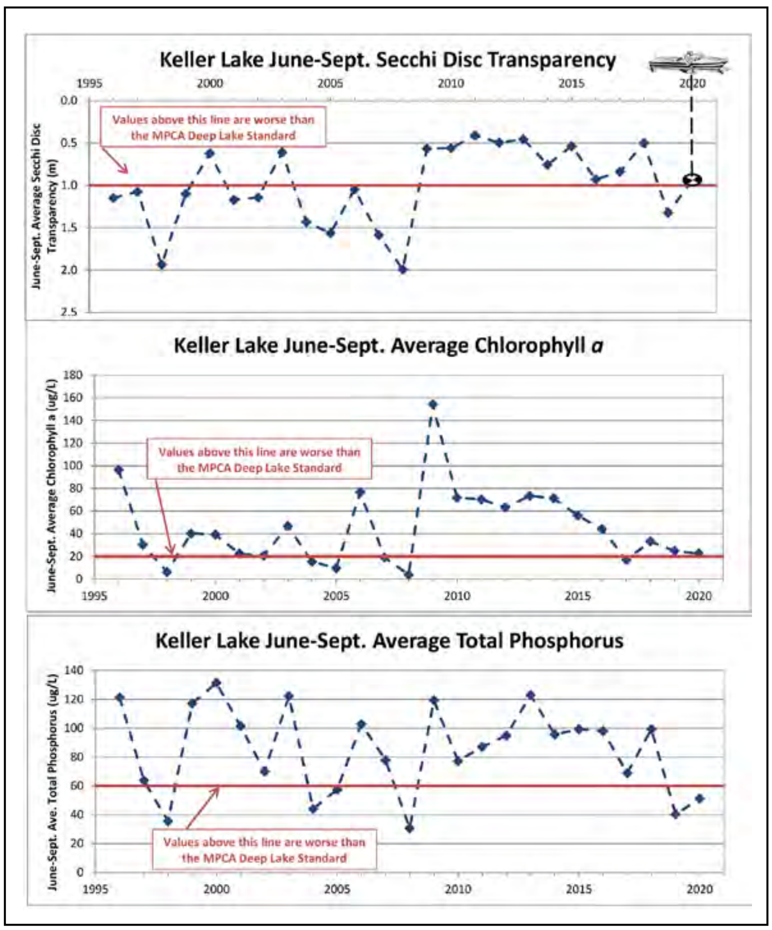
Water Quality Monitoring—In 2020, the BDWMO performed more detailed management level monitoring on the lake (see story on page 4). Habitat monitoring is scheduled for the lake in 2022.

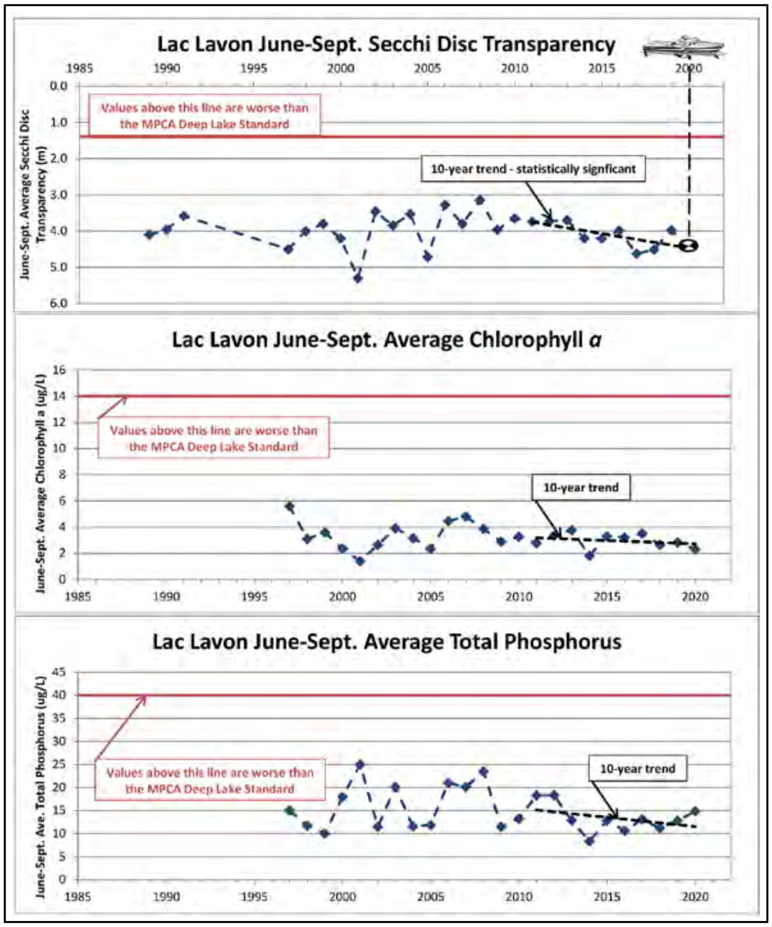


Keller Lake (Burnsville & Apple Valley)

Water Quality Monitoring—An alum and sodium aluminate treatment was conducted on Keller Lake in Spring 2019, resulting in improved water quality in 2019 and 2020 compared to the previous decade. A phase II alum treatment is planned for the fall of 2021. The 2020 Secchi disc transparency summer average was 0.9 meters (3.0 feet), which is worse than it was in 2019, and is slightly worse than the MPCA's shallow lake standard of 1.0 meter (3.3 feet). The summer-average total phosphorus (51 µg/L) was worse than it was in 2019, but was better than the MPCA's shallow lake standard of 60 µg/L. Summer averages of total phosphorus had been consistently worse than the MPCA standard every year for the period 2009-2018. The 2020 summer-average of chlorophyll-*a* (23 µg/L) was slightly better than it was in 2019, but is worse than the MPCA's shallow lake standard of 20 µg/L.

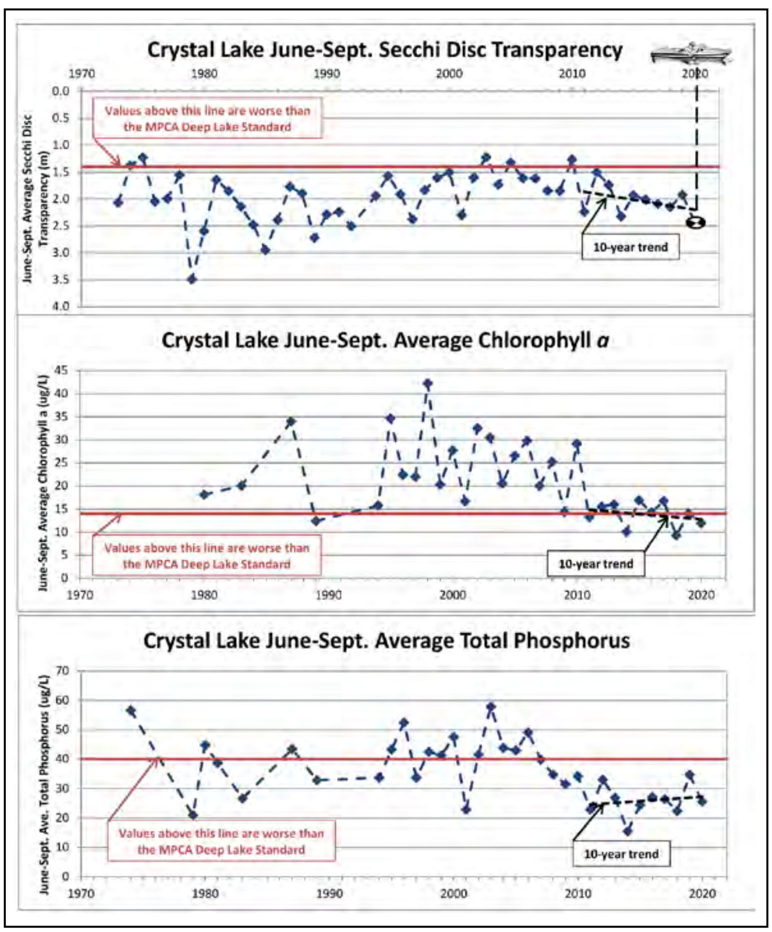
Trend analyses were not completed for Keller Lake because of the alum treatment that was conducted in Spring 2019. The three-lake TMDL study and implementation plan identifies the water quality improvement measures needed to achieve the BDWMO and MPCA goals for the lake. The BDWMO will continue to monitor the water quality of Keller Lake in 2021. Habitat monitoring was performed in 2020 (see page 7 for results).





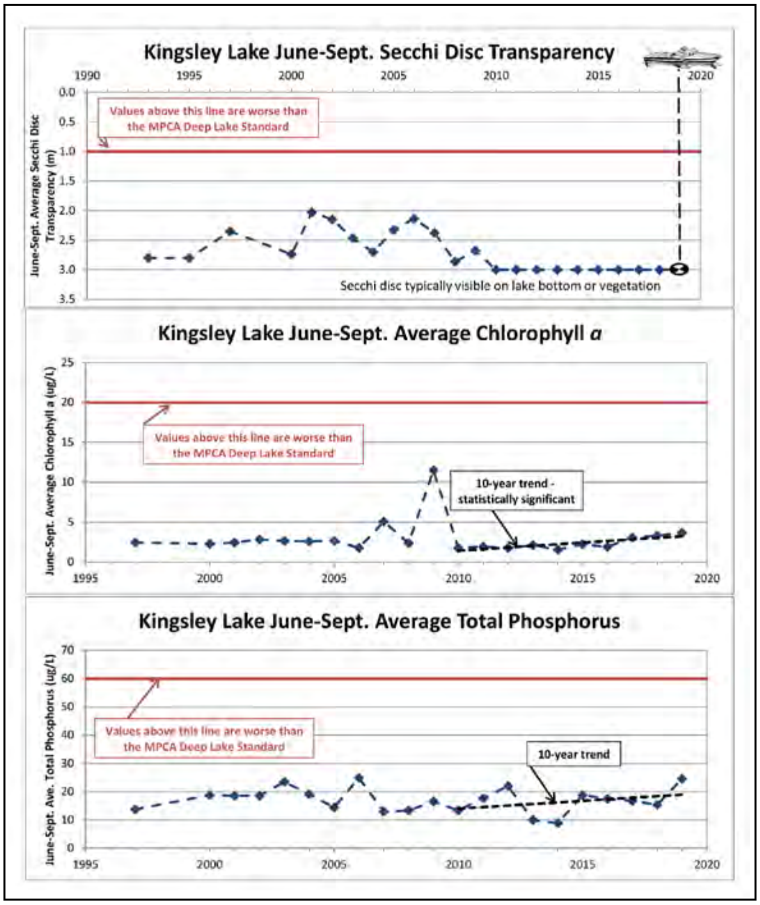
Lac Lavon (Apple Valley & Burnsville)

Water Quality Monitoring—Lac Lavon continued to experience excellent water quality in 2020. The 2020 summer-average Secchi disc transparency was 4.4 meters (14 feet), and is much better than the MPCA deep-lake water quality standard of 1.4 meters. The 2020 summer averages of total phosphorus (15 µg/L) and chlorophyll-*a* (2.3 µg/L) further indicate excellent water quality for Lac Lavon. Summer averages of Secchi disc transparency show a statistically significant improving trend for the most recent 10-year period of 2011-2020. There was no significant trend in summer averages of total phosphorus or chlorophyll-*a* for the same period. The BDWMO will continue to monitor the water quality of Lac Lavon in 2021. Habitat monitoring was performed in 2019 and is scheduled again in 2024.



Crystal Lake (Burnsville & Lakeville)

Water Quality Monitoring—The 2020 summer-average Secchi disc transparency was 2.4 meters (7.9 feet), which is better than other recent summer averages, and better than the MPCA deep-lake water quality standard of 1.4 meters. The last time the Secchi measurement was 2.4 meters or better was 1997. The 2020 summer average of total phosphorus (26 µg/L) was better than the 2019 summer average, and is better than the MPCA's deep lake standard (40 µg/L). The summer-average chlorophyll-*a* (12 µg/L) was better than the 2019 summer average, and is better than the MPCA's deep lake standard (14 µg/L). The BDWMO will continue to monitor the water quality of Crystal Lake in 2021, including management level monitoring that is conducted every 3 years. The next Crystal Lake habitat monitoring is scheduled for 2023.



2019 water quality monitoring data

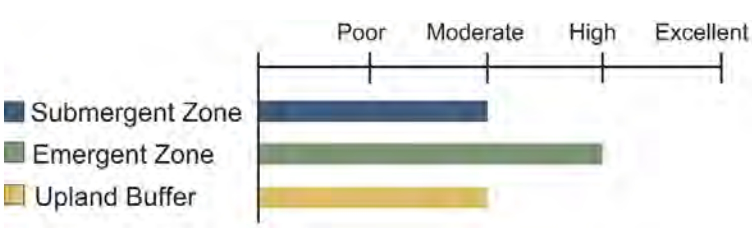
Kingsley Lake (Lakeville)

Water Quality Monitoring—Kingsley Lake was not monitored in 2020, but water quality monitoring data from 2019 (see above) show continued excellent water quality in Kingsley Lake. The lake is often clear enough that the Secchi disc used to measure transparency can still be seen when resting on the bottom of the lake.* The 2019 summer averages of total phosphorus (25 µg/L) was the highest it's been since 2006, but still considerably better than the MPCA shallow lake standard (60 µg/L). The 2019 summer average chlorophyll-*a* (3.7 µg/L) was similar to years 2015-2018, and is considerably better than the MPCA's shallow lake standard (20 µg/L). The BDWMO will continue to monitor the water quality of Kingsley Lake in 2021. Habitat monitoring is also scheduled for the lake in 2021.

** Secchi disc readings in Kingsley Lake are difficult because lake vegetation obscures the Secchi disc, giving false measurements; therefore, there is no trend line in the graph above.*

Keller Lake Habitat Monitoring Results for 2020

As mentioned in the article on page 4, Keller Lake habitat monitoring was conducted in 2020. The BDWMO made the following quality ratings, based on the monitoring results:



Submergent zone quality rating = Moderate

Rating based on averaging four criteria:

1. low total number of native species (2)
2. excellent average native plant density (1.2)
3. moderate rating for average exotic species density (1.8)
4. poor coefficient of conservatism value (mean C-value) (1.5)

Curly-leaf pondweed, a dominant species found every year in Keller Lake, was present at 43 percent of sample points in April. In July, (after treatment) no plants were observed. This die-off creates a sudden loss of habitat and releases nutrients into the water that can produce algal blooms and create turbid water conditions. A curly-leaf pondweed turion survey was conducted in mid-October, indicating the potential for continued growth of this species and the need for its long term control. Eurasian watermilfoil was also found in Keller Lake in 2020 and in previous years. It has fast growing stems that will branch out and cover the water surface—impeding boating, complicating water recreation, and shading out slower-growing native plants.

The BDWMO recommends continued monitoring, control, and management of invasive species and continued efforts to increase native aquatic plant diversity.

Emergent vegetation zone quality rating = High

Rating based on averaging four criteria:

1. excellent number of native wetland plant species (36)
2. high rating for % coverage of exotic species (26-50%)
3. a poor mean C-value rating (2.4)
4. high rating for total vegetative cover (51-75%)

Narrowleaf and hybrid cattail are dominant non-native invasive species found in the vegetated emergent zone. Purple loosestrife, another non-native invasive plant species, is present in shallow open water and along the shoreline and has been managed for years through the release of beetles, which eat the plants. A floodplain forest wetland community is present along the southern shoreline of Keller Lake.

The BDWMO recommends continued control and management of purple loosestrife.

Upland buffer zone quality rating = Moderate

- 42 native species and 29 exotic species observed
- Exotic plant species > 40% of upland vegetative cover. The mean C-value rating is 1.8 (poor).
- Upland buffer within portions of the publicly owned shoreline is wide, providing wildlife habitat and shoreline protection.
- The majority of residential properties have a narrow width of naturalized vegetation along the shoreline, which helps provide some water quality protection and erosion prevention, but the buffer width is too narrow to provide significant wildlife habitat protection. The majority of the residential shoreline properties on Keller Lake have the potential to provide a 50-foot naturalized buffer without altering any structures. One residential property has a naturalized buffer width adequate for wildlife protection (≥100 feet).
- Lakeshore property owners are encouraged to apply for funds (see page 3) to assist with implementation of the BDWMO recommendations.

Black Dog Watershed Management Organization

Board of Commissioners

Representing Burnsville:

Curtis Enestvedt, Chair
(serving since 2014)
Mike Hughes, Vice Chair
(serving since 2008)
Tom Harmening, Commissioner
(serving since 2002)
Frank Boyce, Alternate
(serving since 2021)

Representing Apple Valley and Eagan:

Rollie Greeno, Commissioner
(serving since 2018)
Greg Helms, Alternate
(serving since 2011)

Representing Lakeville:

Scott Thureen, Secretary/Treasurer
(serving since 2008)
Natalie Walker, Alternate
(serving since 2020)

Engineering Consultant:

Karen Chandler, P.E., Barr Engineering Co.

Legal Consultant:

Joel Jamnik, Campbell Knutson, P.A.

Regular board meetings...

are held at 5:00 p.m. on the third Wednesday of the month at the Burnsville Maintenance Facility at 13713 Frontier Court.

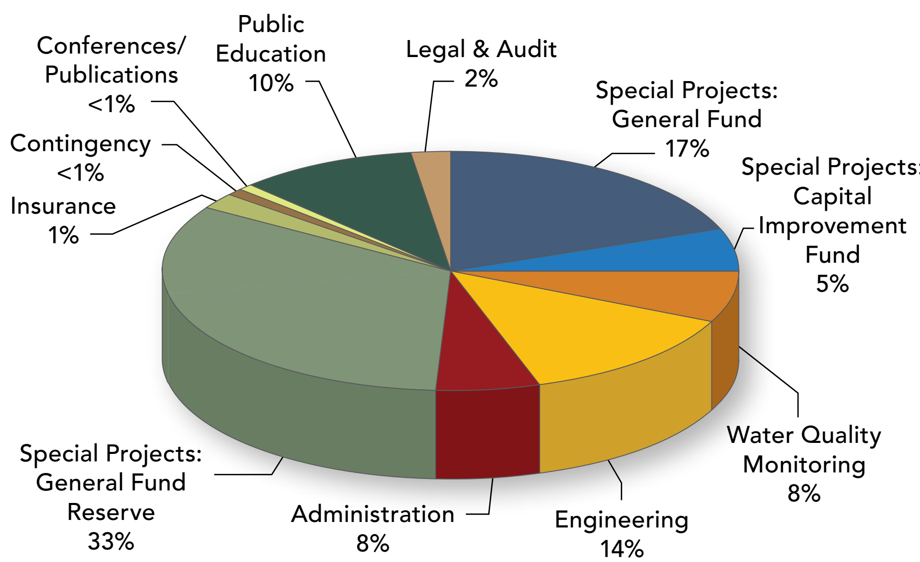
For more information, please contact:

Daryl Jacobson, Administrator
Black Dog WMO
City of Burnsville
13713 Frontier Court
Burnsville, MN 55337
Telephone: 952-895-4574
Fax: 952-895-4531

Website: www.blackdogwmo.org

2021 Budget

Engineering	$31,000
Legal and Audit	$5,000
Administrative Services	$18,000
Public Education	$22,100
Insurance	$3,000
Special Projects – General Fund	$36,800
Special Projects – Capital Improvement Fund	$10,000
Special Projects – General Fund Reserve	$70,000
Conference/Publications	$500
Water Quality Monitoring	$17,100
Contingency	$1,000
Total Expenditures	**$214,500**



2021 Income

Member Contributions	$153,000
Interest	$40
Total Income	**$153,040**