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:

- 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)		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)	(no survev)	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 (R²=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	Depth	Turi	ons per Sar	nple	Total	Total	Average	Viable Turions	
	2020	(π)	1	2	3		Turions	per Site	(number/m ⁻)	
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	10				
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 (R²=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.

Site	CLP	Depth	Turi	ons per San	nple	Total	Total	Average	Viable Turions
	2020	(π)	1	2	3		Viable Turions	per Site	(number/m ²)
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

Table 1. Keller Lake turion surve	v. October 14.	2020. Three	sediment sam	ples were collected	per site.
	\mathbf{y} , oolooci 1 \mathbf{x} ,	2020. 111100	Scament Sam		per site.

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 m² 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.



Keller Lake Curlyleaf Pondweed Growth And Turion Sample Sites

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/m² 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/m²) had no recorded CLP growth in 2020. There was a poor correlation for turion density related to CLP growth for specific sties (R²=0.06 where a good correlation would be R²=0.70 or greater).

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

Site	CLP	Depth	Turi	ons per Sar	mple	Total	Total	Average	Viable Turions
	2020	(ft)	1	2	3		Viable Turions	viable Turions per Site	(number/m²)
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/m²) 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.

	Average Turions (number per m²)	Curlyleaf Growth Status in the Lake
Keller Lake - 2020		<u>.</u>
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	250 (n=20)	Норми
Fast 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

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(from McComas, unpublished)				

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/m² 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/m² and a germination rate of 0.001% (from Rogers and Breen, 1980*). After turion production is reestablished, 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	0.87 stems/m ²	52 stems/m ²
	(assume 0.001% germination of seeds and a seed density of 1,445 seeds/m ²)	(assume 60% germination of 1.445 turions/m ² from Year 1)	(assume 60% germination of 87 turions/m ² from Year 2)
Late Season Stem Density (stems/m ²)	0.1445 stems/m ²	8.70 stems/m ²	520 stems/m ²
	(runners produce 10 stems)	(each sprouted turion produces runners and results in 10 stems/turion)	(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	87 turions/m ²	5,200 turions/m ²
````	(each of the 10 stems produces 10 turions)	(each of the 10 stems produces 10 turions)	(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-lakewater-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  $304\mu E/m^2/s$ , and low, approximately  $28\mu E/m^2/s$ , both on a 15-hour light and 9-hour dark photoperiod. Temperature and Relative humidity (RH) were set at approximately  $22^{\circ}C$  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.



#### Keller Lake Dakota County, Minneosta

#### 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  $304\mu E/m^2/s$ , yielded 71 sprouts compared to the 54 sprouts found in the low light, approximately  $28\mu E/m^2/s$  (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.

Week Number	Potamogeton crispus (Curlyleaf pondweed)	Ceratophyllum demersum (Coontail)	<i>Chara spp.</i> (Muskgrass)	Elodea canadensis (Canada waterweed)	Lemna minor (Lesser duckweed)	Najas flexilis (Slender naiad)	<i>Nitella spp.</i> (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 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.

Г										
	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
	To	otal:	71	<u>54 A</u>	verage:	0.31	0.81	Total:	65	60

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.

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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.

#### **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).



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

#### Outcomes

<u>CLP Delineation</u> (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/m²; total density ranged from 0-40 viable turions/m². 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

		Coefficient of
		Conservatism
		Value
Species	Common Name	(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 Submerg	ent/Floating-leaf Plants in the Lake)	4
Floristic Quality Index (FQI) = (Me	an 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

# 2015 Keller Emergent Vegetation Floristic Quality Index

		Coefficient of
Species	Common Name	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 Plan	nts in the Lake)	35
Floristic Quality Index (FQI) = (Mean C-	value)* (Square Root of S)	13.86



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

Keller 2015 Emergent Vegetation Survey

# 2020 Keller Emergent Vegetation Floristic Quality Index

		Coefficient of Conservatism
Species	Common Name	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	iewelweed	2
Iris versicolor	harleguin blueflag	4
Juncus effusus	soft rush	4
Juncus tenuis	path rush	1
Lactuca serriola	prickly lettuce	0
Leersia orvzoides	rice cut grass	3
Lemna minor	lesser duckweed	5
l vcopus 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 Plant	s in the Lake)	46
Floristic Quality Index (FQI) = (Mean C-v	alue)* (Square Root of S)	16.51



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

Keller 2020 Emergent Vegetation Survey

# 2015 Keller Upland Buffer Vegetation Floristic Quality Index

		Coefficient of
		Conservatism
		Value
Species	Common Name	(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) = (M	ean 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.



Relief 20	S Opianu Buner Vegetation Sulve	у	
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

Keller 2015 Upland Buffer Vegetation Survey

# 2020 Keller Upland Buffer Vegetation Floristic Quality Index

		Coefficient of
		Conservatism
		Value
Species	Common Name	(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	vellow 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 lonaistvlis	sweet cicely	4
Oxalis stricta	vellow wood sorrel	0
Parthenocissus vitacea	woodbine	2
Persicaria pensylvanicum	Pennsylvania smartweed	1
Phalaris arundinacea	reed canarvorass	0
Pinus strobus	white pine	5
Plantago maior	common plantain	0
Poa pratensis	Kentucky bluegrass	0
Polygonatum biflorum	Solomon's seal	4
Populus deltoides	cottonwood	1
Populus tremuloides		2
Potentilla simplex		2
Prunella vulgaris	heal-all	0
r runona vulgano		0

# 2020 Keller Upland Buffer Vegetation Floristic Quality Index

		Coefficient of Conservatism
Species	Common Name	(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 B	uffer Plants)	71
Floristic Quality Index (FQI) = (Me	an 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.



Number	Scientific Name	Common Name	C-value
1	Acer negundo	boxelder	1
2	Acer saccharinum	silver maple	3
3	Ageratina altissima	white snakeroot	2
5	Ambrosia artemisiifolia	common raqweed	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	Circaga lutotiana	broad-loaf enchanter's nightsha	0
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
26	Laponea canadensis	Tatarian honevsuckle	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
36	Plinus strobus Plantago maior	common plantain	5
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 camanica Rhus tunhina *	stachorn 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
04 55	Sulidago canadensis	Canada goldenrod	1
56	Svindayo yiyaritea Svmphyotrichum lanceolatum	Fastern panicled aster	3 5
57	Taraxacum officianale	common dandelion	0
58	Thuja occidentalis	white cedar	ş 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 65	Ulmus americana	American elm	3
C0	Uruca diolca	stinging nettle	1
67	venuascum mapsus Vicia americana *	American vetch	0
68	Viola sp. **	violet	
69	Vitis riparia	wild grape	2
69 70	Vitis riparia Zanthoxylum americanum *	wild grape prickly ash	2

Keller 2020 Upland Buffer Vegetation Survey

# Community #1

Eggers & Reed Plant Community Type: Shallow Open Water Percent of AA Occupied by Type: 90

Spp.		Cover		Native	Rapid FQA						
# Scientific Name	Common Name	Class CC Range	Midpoint CC	Status	Stratum	NWI-GP	NWI-MW	NWI-NCNE C		a	DQ
1 Ceratophyllum demersum	Coon's-Tail	2 > 1 - 5%	3	Native	Aquatic	OBI	OBI	OBI	2	0.0239	0.0478
2 Elodea canadensis	Canadian Waterweed	4 > 25 - 50%	37.5	Nativo	Aquatic	OBL	OBL	OBL		0.2088	1 1052
2 Potamogoton crispus	Curly Pondwood	6 > 75 05%	95 1	Introducod	Aquatic	OBL				0.2300	2 0
	Curry Fondweed	0 > 73 - 95 /8	4N1/A	#NI/A	Aqualic #NI/A	4NI/A	UBL #NI/A	UDL #NI/A	4NI/A	#NI/A	, U
4	#N/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/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	#NI/A	#N/A	#NI/Δ	#N/Δ	#N/Δ	#N/Δ	#NI/A	#N/Δ	#NI/Δ	#N/Δ	#N/Δ
17	#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
18	#N/A	#IN/A	#IN/A	#IN/A	#N/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A	#N/A
19	#IN/A	#IN/A	#IN/A	#IN/A	#N/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/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/Δ	#N/A	#N/Δ	#N/A	#NI/A	#N/Δ	#N/Δ	#N/Δ	#N/A
32	#N/A	#N/A	#Ν/Δ	#N/Δ	#N/Δ	#N/Δ	#NI/A	#N/Δ	#NI/Δ	#N/Δ	#N/Δ
22	#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	#IN/PA	#N/A	#IN/A	#IN/P	#N//A	#N/A	#N//N
34	#N/A	#IN/A	#IN/A	#IN/A	#N/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A
30	#IN/A	#IN/A	#IN/A	#IN/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/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/Δ	#N/Δ	#N/Δ	#NI/Δ	#NI/Δ	#NI/Δ	#N/A	#N/A	#N/Δ	#N/Δ
51	#N/A	#N/A	#N/Δ	#N/Δ	#N/Δ	#NI/Δ	<u>#NI/Δ</u>	#N/A	#N/Δ	#NI/Δ	#NI/Δ
52	#N/A	π(N/A #N1/A	#N/A	#N//\	#N//A	#N//N	#NI/A	#NI/A	#NI/A	#NI/A	#N//N
52	#IN/A	#N/A	#IN/A	#IN/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A	#IN/A
50	#N/A	#N/A	#IN/A	#N/A	#N/A	#N/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A
54	#N/A	#N/A	#IN/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#IN/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 (	:	р	рС
1	Typha X glauca	C	3 > 5 - 25%	15 I	ntroduced	Herb	OBL	OBL	OBL	0	0.0935	0
2	Typha angustifolia	Narrow-Leaf Cat-Tail	6 > 75 - 95%	85 I	ntroduced	Herb	OBL	OBL	OBL	0	0.5296	0
3	Impatiens capensis	Spotted Touch-Me-Not	1 > 0 - 1%	0.5 N	Native	Herb	FACW	FACW	FACW	2	0.0031	0.0062
4	Persicaria amphibia	Water Smartweed	1 > 0 - 1%	0.5 1	Native	Aquatic, Herb	OBL	OBL	OBL	4	0.0031	0.0125
5	Scirpus cyperinus	Cottongrass Bulrush	1 > 0 - 1%	0.5 1	Native	Herb	OBL	OBL	OBL	3	0.0031	0.0093
6	Iris versicolor	Harlequin Blueflag	1 > 0 - 1%	0.5 1	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 1	Native	Herb	OBL	FACW	FACW	2	0.0935	0.1869
9	Solanum dulcamara	Climbing Nightshade	2 > 1 - 5%	3	ntroduced	Woody Vine	FACU	FAC	FAC	0	0.0187	0
10	Carex stricta	Uptight Sedge	2 > 1 - 5%	3 1	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	#IN/A #NI/A	#N/A #N/A	#IN/A #NI/A	#N/A #N/A	#IN/A #NI/A	#IN/A #NI/A	#N/A	#N/A #N/A	#IN/A #NI/A
1/		#Ν/Α #Ν/Δ	#IN/A #N/Δ	#IN/A #N/Δ	#IN/A #N/Δ	#N/A #N/Δ	#N/A #N/Δ	#N/A #N/Δ	#IN/A #N/Δ	#N/A #N/Δ	#N/A #N/Δ	#N/A #N/Δ
15		#N/A #N/A	#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/Δ	#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		#IN/A #N/A	#N/A	#N/A #N/A	#IN/A #NI/A	#IN/A #NI/A	#IN/A #NI/A	#IN/A #NI/A	#IN/A #NI/A	#IN/A	#N/A #N/A	#IN/A #NI/A
32		#N/A #N/A	#N/A #N/A	#N/A #N/A	#IN/A #NI/A	#N/A #N/A	#N/A #N/A	#N/A #N/A	#IN/A #NI/A	#N/A #NI/A	#N/A #N/A	#IN/A #NI/A
3/		#N/A	#Ν/Α #Ν/Δ	#Ν/Α #Ν/Δ	#Ν/Α #Ν/Δ	#N/A #N/Δ	#N/A #N/Δ	#N/A #N/Δ	#Ν/Α #Ν/Δ	#N/Δ	#N/Δ	#N/Δ
35		#N/A #N/A	#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
4/		#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	#IN/A	#N/A #N/A	#N/A	#N/A	#N/A
49 50		#N/A #N/A	#IN/A #N/A	#IN/A #NI/A	#IN/A #NI/A	#IN/A #NI/A	#N/A #N/A	#N/A #N/A	#IN/A #NI/A	#N/A #N/A	#N/A #N/A	#IN/A #NI/A
51		#N/A #N/A	#Ν/Α #Ν/Δ	#Ν/Α #Ν/Δ	#Ν/Α #Ν/Δ	#Ν/Α #Ν/Δ	#Ν/Α #Ν/Δ	#N/A #N/Δ	#Ν/Α #Ν/Δ	#N/Δ	#N/Δ	#N/Δ
52		#Ν/Δ	#N/A #N/Δ	#N/A	#N/A	#N/Δ	#N/A	#N/Δ	#N/Δ	#N/Δ	#N/Δ	#N/Δ
		#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.			Cover		Rapid FQA						
#	Scientific Name	Common Name	Class CC Range	Midpoint CC Native Status	Stratum	NWI-GP	NWI-MW	NWI-NCNE	C	D	рC
1	Illmus amoricana	Amorican Elm	3 5 - 25%	15 Nativo	Troo	EAC	EAC/M/	EACW/	3	0.0726	0.2170
	Des seluctris		1 0 10/		Llork	TAC	FACIN	FACW	5	0.0720	0.2179
2		Curly Deek	1 > 0 - 1%	0.5 Native	Heib	FACIN	FACIN	FACIN		0.0024	0.0121
3	Rumex crispus	Curly Dock	1 > 0 - 1%	0.5 Introduced	Herb	FAC	FAC	FAC	0	0.0024	0 0072
4			1 > 0 - 1%		Helb	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 Canany Grass	1 > 25 - 50%	37.5 Introduced	Herb	FACW	FACW	FACW	0	0.0024	0.0073
22	Corpus alba	Red Osior	1 > 0 - 1%		Shrub	FACW	EACW/	FACW	3	0.0024	0.0073
22	Loctuce corricle	Red Oslei	1 > 0 - 1%		Uarb	FAC	FACU	FACIL	0	0.0024	0.0073
2	Dereiserie neneulueniee	Diskused	1 > 0 - 1%		Heib	FAC	FACU	FACU	0	0.0024	0.0004
	Persicana pensylvanica	Pinkweed	1 > 0 - 1%		Tero	FACV	FACIV	FACIV	1	0.0024	0.0024
25	Acer rubrum	Red Maple	1 > 0 - 1%	0.5 Native	I ree	FAC	FAC	FAC	3	0.0024	0.0073
26	Equisetum arvense	Field Horsetall	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/Δ	#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/Δ	#N/A #N/A	#N/Δ	#N/A	#N/Δ	#N/A	#N/A	#N/Δ	#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
40		#N/A #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	#IN/A #NI/A	#N/Δ #N/Δ	#IN//A	#N/A #N/A	#N/A	#N/A	#N/A	#N/A	#IN//A
49		#N/A #N/A	#N/A #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	#N/A	#N/A
51 E0		#N/A	#IN/A	#N/A #N/A	#IN/A	#IN/A	#IN/A	#IN//A	#IN/A	#IN/A	#IN//A
52		#IN/A	#N/A	#IN/A #IN/A	#N/A	#N/A	#N/A	#IN/A	#IN/A	#IN/A	#IN/A
53		#N/A	#IN/A	#N/A #N/A	#IN/A	#N/A	#N/A	#IN/A	#IN/A	#N/A	#IN/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 Overall AA Condition Fair

3

Appendix C

2003-2019 Habitat Assessment Monitoring Results

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

1								Vege	tation Quality - We	at Areas		_	_					Veget	ation Quality - L	pland				
					Subr	mergent Zone Sa	mpling	vege	aation Quality - We	Areas	Ve	getated Emerger	nt Zone Sampling					Upla	and Buffer Samp	lina			Erosion/Sedir	mentation
		Approximate Proportion of		Anneningto	Cub							gotatoù Emorgoi												
	Monitoring	the Water Body Which	o "	Proportion of	Average Native			Exotic Species			Approximate	Approximate Total Percent	<b>T</b> ( 1)	Exotic	Species					5 " 0 " "	Exoti	c Species		
Water Body	Year	is Deep	Submergent	Water Body Typically	Plant Occurrence or	Total Number		Average Exotic	Maximum Exotic	Emergent Zone	Proportion of Emergent Zone	Vegetative	of Native			Overall Upland	Unmanicured	Estimated Total	Total Number	(Percent			Erosion	Sediment
		Habitat (~ >	Vegetative Quality ¹	Dominated By Submergent	Density	Species ⁵	Total Number	Plant Occurrence	Plant Occurrence	Quality ⁶	(0 - 2 ft. depth) Within The Water	The Entire	Wetland Plant Species ⁸	Number of	Total Exotic Emergent	Quality ¹⁰	Buffer Width ¹¹	(Percent Range) ¹²	Species ¹³	Surrounding Water Body) ¹⁴	Number of	Percent of Total	(Percent of Shoreline) ¹⁶	(Yes/No)
		20 ft. depth)	Quanty	Vegetation (~ 2 -	Rating ^{2,3}		of Species	Rating or Average Density	Rating or Maximum		Body	Emergent Zone ⁷	opeoles	Species	Percent					Dody)	Species	Coverage ¹⁵	Ghorenne)	
				20 II. deptri)				Rating ^{2, 3}	Density Rating ⁴						Coverage									
	2003		Moderate		15	15	2	1 1	1 1	Moderate		26-50%	18	4	26-50%	Moderate	<10 ft	>95%	16	26-50%	2	15-40%	0-10%	No
	2003		Moderate		1.5	15	2	1.1	1.1	Woderate		20=30 %	10	4	20-30 %	Woderate	<1011.	>55%	10	20-30 %	2	13-40 %	0-10%	
	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
Crystal	2006	15%	Excellent	80%	1.0	17	2	1.5	3.2	Excellent	5%	26-50%	18	8	26-50%	Moderate	<10 ft.	>95%	17	26-50%	3	15-40%	0-10%	No
	2007		Excellent		15	16	2	16	34	Excellent		26-50%	22	10	26-50%	Moderate	<10 ft	>95%	15	26-50%	5	15-40%	0-10%	No
					1.0	10		1.0	0.1			20 500/0		10	20 00 //		40.0			20 50%		45.400/	0.400/	
	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
	2003		Moderate		1.9	4	1	3.2	3.2	Poor		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
Keller	2006	0%	Madarata	90%	2.0	E	2	1.0	2.5	Madarata	10%	E1 7E0/		2	26 50%	Madarata	-10.4	. 05%	0	76 100%		- 409/	0.10%	No
	2006		Moderate		2.0	5	2	1.8	2.5	Moderate		51-75%	8	2	26-50%		<10 π.	>95%	8	76-100%	8	>40%	0-10%	INO
	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
	2003		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
	0004		Madanta		0.7			0.0	0.0	E		54 750/			0.05%	E	05 50 4	05%	45	54 759/		45 400/	0.40%	
	2004		Moderate		2.7	1	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
Kingsley	2006	0%	Excellent	95%	1.8 ¹⁷	13 ¹⁸	1	1.0	1.0	Excellent	5%	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		29	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
	2000				2.0			0.0	0.0	Execution in		54 750/	10	-	0.25%	Exterior in	20 00 11.	20070	20	70 100%	-	15 40%	0 10%	
	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
	2003		Poor		2.0	7	1	1.0	1.0	Poor		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
Lac Lavon	2006	25%	Moderate	70%	16	10 ¹⁹	2	2.5	4.0	Excellent	5%	0-25%	16	13	0-25%	Poor	<10 ft	<75%	11	0-25%	19	>40%	0-10%	No
	2000		moderate		1.0	20	2	2.0	4.0	Execution		0 20 %	10	10	0 20 /0		CTO IL.	(10/0		0 20 /0	10	24070	0 10/0	110
	2007		Excellent		1.8	10-*	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
	2003		Poor		1.2	13	1	2.3	3.4	Moderate		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		Madarata		10	14		1.0	2.6	Madarata		26 50%	14	6	26 50%	Madarata	.10.4	. 05%	E	26 50%	F	. 409/	0.10%	No
Orchard	2005	20%	woderate	75%	1.3	14	1	1.8	2.6	Moderate	5%	26-50%	14	6	26-50%	Moderate	<10 π.	>95%	5	26-50%	5	>40%	0-10%	INO
oronard	2006	2070	Moderate	10%	1.2	13	1	1.7	3.4	Excellent	070	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
	2002		Moderate		2.0		4	4.0	4.0			76 4000/	F	E	76 4000/	Madaut	10.05.4	75.050/	10	E4 750/	45	15 400/	0.40%	Ve-
	2003		woderate		3.0		1	1.0	1.0	Poor		10-100%	5	5	10-100%	woderate	10-20 II.	10-90%	10	31-75%	61	13-40%	0-10%	TES
	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
Sunset Pond	2006	0%	Moderate	75%	2.6	11	1	1.0	1.0	Poor	25%	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
	2000	1	Excellent		1 8	10	1	20	3.0	Poor		76-100%	10	5	76-100%	Moderate	10-25 #	75-05%	5	76-100%	15	~10%	0-10%	No
	2000		Excenent		1.0	10		2.0	3.0	Puol		70-100%	10	5	10-100%	moderate	10=20 IL.	10-90%		10-100%	10	24070	0-10%	
L	2009		Moderate		2.2	11	1	3.0	3.0	Poor	<u> </u>	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.

¹Overall 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	.2575	0.33 - 0.66
Excellent	0	1.0	1.5 to 2.5	1.0	>14	1.0	> 0.66

²Plant 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).

³Density 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. ⁴Maximum 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.

⁵The 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.

⁶Emergent 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<="" td=""><td>0.1</td><td>76-100%</td><td>0.1</td><td>&lt; 0.33</td></or=>	0.1	76-100%	0.1	< 0.33
Moderate	76-100% or 26-50%	0.5	>5 - 15	0.66 - 0.33	26-75%	.3366	0.33 - 0.66
Excellent	51-75%	1.0	> 15	1.0	0-25%	1.0	> 0.66

⁷Approximate 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. ⁸The 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.

⁹Total 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) ¹⁰Overall 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.

					Buffer Width		Buffer Continuity Percent		
Overall Upland Buffer Quality	Percent Cover	Percent Cover Rating Score	Exotics Percent Cover Range	Exotics Percent Cover Rating Score	Range	Buffer Width Rating Score	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%	.47	0.33 - 0.66
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	> 0.66

¹¹Unmanicured (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.

¹²Estimated 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%. ¹³The 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%.

¹⁵Upland 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%.

¹⁶The 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%.

¹⁷The 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. ¹⁸The 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.

¹⁹The 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.

²⁰Native 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

		Submergent Zone													
Monitoring	Approximate Proportion of the	Quart	Approximate Proportion of Water Body	Native	Species			Exotic Species							
Year	Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality ¹	Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Density Rating ^{2,3}	Total Number of Native Species ⁵	Mean Coefficient of Conservatism Value	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)						

				Emergent Zor	ne		
Monitoring Year	Overall Emergent	Approximate Proportion of Emergent Zone	Approximate Total Percent Vegetative	Total Number of Native	Mean Coefficient of	Exotic S	pecies
	Zone Quality ⁶	(0 - 2 ft. depth) Within The Water Body	Cover Within The Entire Emergent Zone ⁷	Wetland Plant Species ⁸	Conservatism Value	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)

				Up	land Buffer				Erosion/Se	dimentation	
Monitoring Year	Overall Upland	Unmanicured	Estimated Total Vegetative Cover	Total Number of Native Plant	Mean Coefficient of	Buffer Continuity (Percent Surrounding	Exotic	Species	Shoreline Erosion (Percent	Sediment Deltas	
, our	Buffer Quality ¹⁰	Buffer Width ¹¹	(Percent Range) ¹²	Species ¹³	Conservatism Value	Water Body) ¹⁴	Number of Species Percent of Total Coverage ¹⁵		of Shoreline) ¹⁶	(183/100)	
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	

P:\Mpls\23 MN\19\2319457\WorkFiles\hab\2017 Orchard\working documents\BDWMO_hab_ind_tables_2017.xls\Table1 Orchard 2012+2017

### 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:

¹Overall 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.

								C-Value	
					Total Number		Mean	Rating	
					of Native	Species	Coefficient of	(using	Total Overall
Overall	Avg. Exotic	Exotic Plant	Avg. Native	Avg. Native	Species In	Richness	Conservatism	MPCA	Submergent
Submergent	Plant	Density Rating	Plant	Plant Density	Submergent	Rating	Value (C-	values,	Zone Quality
Zone Quality	Density	Score	Density	Rating Score	Zone	Score	Value)	2007)	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

²Plant 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.

³Density data for Orchard Lake were collected by Blue Water Science using a stratified line transect survey throughout the lake.

⁴Maximum 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.

⁵The 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. ⁶Overall 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.

						Percent	Mean		
Overall		Percent	Total Number	Number of		Cover of	Coefficient of	C-Value	Overall
Emergent		Cover	of Native	Native Wetland	Percent	Exotics	Conservatism	Rating (using	Emergent
Zone	Percent	Rating	Wetland Plant	Plant Species	Cover of	Rating	Value (C-	MPCA	Zone Quality
Quality	Cover	Score	Species	Rating Score	Exotics	Score	Value)	values, 2007)	Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
	76-100% or								
Moderate	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

⁷Approximate 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.

⁸The 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.

⁹Total 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)

¹⁰Overall 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.

										C-Value		Number	
				Exotics					Mean	Rating		of	Overall
Overall		Percent	Exotics	Percent		Buffer	Buffer	Buffer	Coefficient of	(using	Number	Native	Upland
Upland		Cover	Percent	Cover	Buffer	Width	Continuity	Continuity	Conservatism	MPCA	of	Species	Buffer
Buffer	Percent	Rating	Cover	Rating	Width	Rating	Percent	Rating	Value (C-	values,	Native	Rating	Quality
Quality	Cover	Score	Range	Score	Range	Score	Range	Score	Value)	2007)	Species	Score	Score
Deer	.750/	0.1	. 400/	0.4	.40.4	0.4	0.050/	0.1	00	0.10		0.1	. 0. 00
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
													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	0.66
													0.67 -
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

¹¹Unmanicured (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. ¹²Estimated 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%. ¹³The Total Number of Native Plant Species within the upmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the

¹³The 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%.

¹⁵Upland 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%.

¹⁶The 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

		Submergent Zone Sampling												
Monitoring Year	Approximate Proportion of the	Overall	Approximate Proportion of Water	Native	Native Species		Exotic Species							
Year	Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Submergent Zone Quality ¹	Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Density Rating ^{2,3}	Total Number of Native Species ⁵	Mean Coefficient of Conservatism Value	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% <b>High</b> 80%			1.2 (Excellent)	15 (Excellent)	5.0 (Moderate)	2	1.2 (Moderate)	1.4 (Moderate)					

		Vegetated Emergent Zone Sampling											
Monitoring Year	Overall Emergent	Approximate Proportion of Emergent	Approximate Total Percent Vegetative	Total Number of Native	Mean Coefficient of	Exotic Sp	ecies						
	Zone Quality ⁶	Zone (0 - 2 ft. depth) Within The Water Body	Cover Within The Entire Emergent Zone ⁷	Wetland Plant Species ⁸	Conservatism Value	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)						

				Upland Bu	Iffer Sampling				Erosion/Sedimentation	
Monitoring Year	Overall Upland Buffer Quality ¹⁰	Unmanicured Buffer	Estimated Total Vegetative Cover	Total Number of Native Plant	Mean Coefficient of	Buffer Continuity (Percent	Exotic	c Species	Shoreline Erosion	Sediment Deltas
		Width ¹¹	(Percent Range) ¹²	Species ¹³	Conservatism Value	Surrounding Water Body) ¹⁴	Number of Species	Percent of Total Coverage ¹⁵	(Percent of Shoreline) ¹⁶	(Yes/No)
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.

								C-Value	
					Total Number		Mean	Rating	
					of Native	Species	Coefficient of	(using	Total Overall
Overall	Avg. Exotic	Exotic Plant	Avg. Native	Avg. Native	Species In	Richness	Conservatism	MPCĂ	Submergent
Submergent	Plant	Density Rating	Plant	Plant Density	Submergent	Rating	Value (C-	values,	Zone Quality
Zone Quality	Density	Score	Density	Rating Score	Zone	Score	Value)	2007)	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

²Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3.

³Density data for Orchard Lake were collected by Blue Water Science using a stratified line transect survey throughout the lake.

⁴Maximum 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.

⁵The 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. ⁶Overall 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.

						Percent	Mean		
Overall		Percent	Total Number	Number of		Cover of	Coefficient of	C-Value	Overall
Emergent		Cover	of Native	Native Wetland	Percent	Exotics	Conservatism	Rating (using	Emergent
Zone	Percent	Rating	Wetland Plant	Plant Species	Cover of	Rating	Value (C-	MPCA	Zone Quality
Quality	Cover	Score	Species	Rating Score	Exotics	Score	Value)	values, 2007)	Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
	76-100% or								
Moderate	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

⁷Approximate 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.

⁸The 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.

⁹Total 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)

¹⁰Overall 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.

										C-Value		Number	
				Exotics					Mean	Rating		of	Overall
Overall		Percent	Exotics	Percent		Buffer	Buffer	Buffer	Coefficient of	(using	Number	Native	Upland
Upland		Cover	Percent	Cover	Buffer	Width	Continuity	Continuity	Conservatism	MPCA	of	Species	Buffer
Buffer	Percent	Rating	Cover	Rating	Width	Rating	Percent	Rating	Value (C-	values,	Native	Rating	Quality
Quality	Cover	Score	Range	Score	Range	Score	Range	Score	Value)	2007)	Species	Score	Score
Deer	.750/	0.1	. 400/	0.4	.40.4	0.4	0.050/	0.1	00	0.10		0.1	. 0. 00
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
													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	0.66
													0.67 -
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

¹¹Unmanicured (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. ¹²Estimated 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%. ¹³The Total Number of Native Plant Species within the upmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the

¹³The 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%.

¹⁵Upland 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%.

¹⁶The 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 Z	one			
Approximate Proportion of the		Approximate Proportion of Water Body	Native	Species			Exotic Species	
Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Overall Submergent Zone Quality ¹	Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Density Rating ^{2,3}	Total Number of Native Species ⁵	Mean Coefficient of Conservatism Value	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	Approximate Proportion of Emergent Zone	Approximate Total Percent Vegetative	Total Number of Native	Mean Coefficient of	Exotic Spe	ecies							
Zone Quality ⁶	(0 - 2 ft. depth) Within The Water Body	Cover Within The Entire Emergent Zone ⁷	Wetland Plant Species ⁸	Conservatism Value	Number of Species	Total Exotic Emergent Percent Coverage ⁹							
High	10%	51-75% (High)	28 (Excellent)	2.3 (Poor)	8	26-50% (High)							

			Upla	and Buffer				Erosion/Sedimentation	
Overall Upland	Unmanicured	Estimated Total Vegetative	Total Number of Native Plant	Mean Coefficient of	Buffer Continuity (Percent Surrounding	Exotic	Species	Shoreline Erosion (Percent	Sediment Deltas
Buffer Quality ¹⁰	Buffer Width''	Cover (Percent Range) ¹²	Species ¹³	Conservatism Value	Water Body) ¹⁴	Number of Species	Percent of Total Coverage ¹⁵	of Shoreline) ¹⁶	(Yes/No)
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.

								C-Value	
					Total Number		Mean	Rating	
					of Native	Species	Coefficient of	(using	Total Overall
Overall	Avg. Exotic	Exotic Plant	Avg. Native	Avg. Native	Species In	Richness	Conservatism	MPCA	Submergent
Submergent	Plant	Density Rating	Plant	Plant Density	Submergent	Rating	Value (C-	values,	Zone Quality
Zone Quality	Density	Score	Density	Rating Score	Zone	Score	Value)	2007)	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

²Plant 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 6tined 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).

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

⁴Maximum 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.

⁵The 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. ⁶Overall 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.

						Percent	Mean		
Overall		Percent	Total Number	Number of		Cover of	Coefficient of	C-Value	Overall
Emergent		Cover	of Native	Native Wetland	Percent	Exotics	Conservatism	Rating (using	Emergent
Zone	Percent	Rating	Wetland Plant	Plant Species	Cover of	Rating	Value (C-	MPCA	Zone Quality
Quality	Cover	Score	Species	Rating Score	Exotics	Score	Value)	values, 2007)	Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
	76-100% or								
Moderate	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

⁷Approximate 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.

⁸The 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.

⁹Total 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)

¹⁰Overall 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.

										C-Value		Number	
				Exotics					Mean	Rating		of	Overall
Overall		Percent	Exotics	Percent		Buffer	Buffer	Buffer	Coefficient of	(using	Number	Native	Upland
Upland		Cover	Percent	Cover	Buffer	Width	Continuity	Continuity	Conservatism	MPCA	of	Species	Buffer
Buffer	Percent	Rating	Cover	Rating	Width	Rating	Percent	Rating	Value (C-	values,	Native	Rating	Quality
Quality	Cover	Score	Range	Score	Range	Score	Range	Score	Value)	2007)	Species	Score	Score
Deer	.750/	0.1	. 400/	0.4	.40.4	0.1	0.050/	0.1	0	0.10		0.1	. 0. 00
Poor	5%</th <th>0.1</th> <th>&gt;40%</th> <th>0.1</th> <th>&lt;10 It.</th> <th>0.1</th> <th>0-25%</th> <th>0.1</th> <th>0 - &lt;3</th> <th>0.10</th> <th>&lt;5</th> <th>0.1</th> <th>&lt; 0.33</th>	0.1	>40%	0.1	<10 It.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
													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	0.66
													0.67 -
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

¹¹Unmanicured (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. ¹²Estimated 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%.

¹³The 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%.

¹⁵Upland 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%.

¹⁶The 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		Submergent Zone												
	Approximate Proportion of the	0	Approximate Proportion of Water Body	Native	Species		Exotic Species							
Year	Water Body Which is Deep Water Habitat (~ > 20 ft. depth)	Submergent Zone Quality ¹	Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Density Rating ^{2,3}	Total Number of Native Species ⁵	Mean Coefficient of Conservatism Value	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	Approximate Proportion of Emergent Zone	Approximate Total Percent Vegetative Cover	Total Number of Native	Mean Coefficient of	Exotic Species						
	Zone Quality ⁶	(0 - 2 ft. depth) Within The Water Body	Within The Entire Emergent Zone ⁷	Wetland Plant Species ⁸	Conservatism Value	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												
	Overall Upland	Unmanicured	Estimated Total Vegetative	Total Number of Native Plant	Mean Coefficient of	Buffer Continuity (Percent Surrounding	Exot	ic Species	Shoreline Erosion (Percent	Sediment Deltas				
	Buffer Quality ¹⁰	Buffer Width	Cover (Percent Range) ¹²	Species ¹³	Conservatism Value	Water Body) ¹⁴	Number of Species	Percent of Total Coverage ¹⁵	of Shoreline) ¹⁶	(Yes/No)				
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				

P:\Mpls\23 MN\19\2319457\WorkFiles\hab\2016 Kingsley\working documents\BDWMO_hab_ind_tables_2016.xls\Table1 Kingsley 2016

### 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.

								C-Value	
					Total Number		Mean	Rating	
					of Native	Species	Coefficient of	(using	Total Overall
Overall	Avg. Exotic	Exotic Plant	Avg. Native	Avg. Native	Species In	Richness	Conservatism	MPCA	Submergent
Submergent	Plant	Density Rating	Plant	Plant Density	Submergent	Rating	Value (C-	values,	Zone Quality
Zone Quality	Density	Score	Density	Rating Score	Zone	Score	Value)	2007)	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

²Plant 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 6tined 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).

³Density data for Kingsley Lake were collected by Barr using a meander survey throughout the lake.

⁴Maximum 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.

⁵The 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. ⁶Overall 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.

						Percent	Mean		
Overall		Percent	Total Number	Number of		Cover of	Coefficient of	C-Value	Overall
Emergent		Cover	of Native	Native Wetland	Percent	Exotics	Conservatism	Rating (using	Emergent
Zone	Percent	Rating	Wetland Plant	Plant Species	Cover of	Rating	Value (C-	MPCA	Zone Quality
Quality	Cover	Score	Species	Rating Score	Exotics	Score	Value)	values, 2007)	Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
	76-100% or								
Moderate	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

⁷Approximate 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.

⁸The 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.

⁹Total 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)

¹⁰Overall 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.

										C-Value		Number	
				Exotics					Mean	Rating		of	Overall
Overall		Percent	Exotics	Percent		Buffer	Buffer	Buffer	Coefficient of	(using	Number	Native	Upland
Upland		Cover	Percent	Cover	Buffer	Width	Continuity	Continuity	Conservatism	MPCA	of	Species	Buffer
Buffer	Percent	Rating	Cover	Rating	Width	Rating	Percent	Rating	Value (C-	values,	Native	Rating	Quality
Quality	Cover	Score	Range	Score	Range	Score	Range	Score	Value)	2007)	Species	Score	Score
Deer	.750/	0.4	. 400/	0.4	.40.4	0.1	0.050/	0.1	0	0.10		0.1	. 0. 00
Poor	<75%	0.1	>40%	0.1	<10 ft.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
													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	0.66
													0.67 -
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.80
Excollent	>05%	1.0	~15%	1.0	> 50 ft	1.0	76 100%	1.0	>0.10	1.00	> 20	10	× 0.90
Excellent	>90%	1.0	<1070	1.0	>00 IL.	1.0	10-100%	1.0	29 - IU	1.00	>30	1.0	> 0.00

¹¹Unmanicured (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. ¹²Estimated 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%. ¹³The Total Number of Native Plant Species within the upmanicured upland buffer zone is based on two plot locations and a meandering visual survey along the

¹³The 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%.

¹⁵Upland 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%.

¹⁶The 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

		Submergent Zone Sampling										
	Monitoring Year	Approximate Proportion of the	0 "	Approximate Proportion of Water	Native Species			Exotic Species				
		Water Body Which is Deep Water Habitat (~ > 20 ft. depth)		Body Typically Dominated By Submergent Vegetation (~ 2 - 20 ft. depth)	Average Native Plant Density Rating ^{2,3}	Total Number of Native Species ⁵	Mean Coefficient of Conservatism Value	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 (Hlgh)	4.6 (Moderate)	2	2.0 (Moderate)	3.0 (Poor)		
	2019	25%	Moderate	70%	1.5 (Moderate)	12 (Hlgh)	4.5 (Moderate)	2	1.7 (Moderate)	3.0 (Poor)		

	Vegetated Emergent Zone Sampling									
Monitoring Year	Overall Emergent	Approximate Proportion of Emergent	Approximate Total Percent Vegetative	Total Number of	Mean Coefficient	Exotic Species				
	Zone Quality ⁶	ft. depth) Within The Water Body	The Entire Emergent Zone ⁷	Plant Species ⁸	of Conservatism Value	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)			

		Upland Buffer Sampling								
Monitoring Year	Overall Upland	Unmanicured Buffer	Estimated Total Vegetative Cover	Estimated Total Total Number of		Buffer Continuity (Percent	Exotic	c Species	Shoreline Erosion (Percent	Sediment Deltas
	Buffer Quality ¹⁰	Width ¹¹	(Percent Range) ¹²	² Species ¹³	Value	Body) ¹⁴	Number of Species	Percent of Total Coverage ¹⁵	of Shoreline) ¹⁶	(Yes/No)
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

# 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.

								C-Value	
					Total Number		Mean	Rating	
					of Native	Species	Coefficient of	(using	Total Overall
Overall	Avg. Exotic	Exotic Plant	Avg. Native	Avg. Native	Species In	Richness	Conservatism	MPCA	Submergent
Submergent	Plant	Density Rating	Plant	Plant Density	Submergent	Rating	Value (C-	values,	Zone Quality
Zone Quality	Density	Score	Density	Rating Score	Zone	Score	Value)	2007)	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

²Plant density ratings are a relative measure of the total amount of submergent vegetation covering the submergent zone, with a scale from 1 to 3.

³Density data for Lac Lavon were collected by Matt Berg using a point intercept survey throughout the lake.

⁴Maximum 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.

⁵The 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.⁶Overall 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.

						Percent	Mean		
Overall		Percent	Total Number	Number of		Cover of	Coefficient of	C-Value	Overall
Emergent		Cover	of Native	Native Wetland	Percent	Exotics	Conservatism	Rating (using	Emergent
Zone	Percent	Rating	Wetland Plant	Plant Species	Cover of	Rating	Value (C-	MPCA	Zone Quality
Quality	Cover	Score	Species	Rating Score	Exotics	Score	Value)	values, 2007)	Score
Poor	0-25%	0.1	< or= 5	0.1	76-100%	0.1	0 - <3	0.10	< 0.33
	76-100% or								
Moderate	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

⁷Approximate 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.

⁸The 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.

⁹Total 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)

¹⁰Overall 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.

										C-Value		Number	
				Exotics					Mean	Rating		of	Overall
Overall		Percent	Exotics	Percent		Buffer	Buffer	Buffer	Coefficient of	(using	Number	Native	Upland
Upland		Cover	Percent	Cover	Buffer	Width	Continuity	Continuity	Conservatism	MPCA	of	Species	Buffer
Buffer	Percent	Rating	Cover	Rating	Width	Rating	Percent	Rating	Value (C-	values,	Native	Rating	Quality
Quality	Cover	Score	Range	Score	Range	Score	Range	Score	Value)	2007)	Species	Score	Score
Deer	.750/	0.1	× 400/	0.1	-10.#	0.1	0.059/	0.1	0 .2	0.10	Æ	0.1	. 0. 22
Poor	5%</th <th>0.1</th> <th>&gt;40%</th> <th>0.1</th> <th>&lt;10 II.</th> <th>0.1</th> <th>0-25%</th> <th>0.1</th> <th>0 - &lt;3</th> <th>0.10</th> <th>&lt;5</th> <th>0.1</th> <th>&lt; 0.33</th>	0.1	>40%	0.1	<10 II.	0.1	0-25%	0.1	0 - <3	0.10	<5	0.1	< 0.33
													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	0.66
													0.67 -
High	>95%	1.0	<15%	1.0	25-50 ft.	0.7	51-75%	0.7	>6 - <9	0.75	20-30	0.66	0.80
Excellent	>95%	1.0	<15%	1.0	>50 ft.	1.0	76-100%	1.0	>9 - 10	1.00	>30	1.0	> 0.80

¹¹Unmanicured (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. ¹²Estimated 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%. ¹³The 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%.

¹⁵Upland 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%.

¹⁶The 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
	Unmanicured, native vegetation in adjacent upland and emergent zone is narrow and not continuous limiting wildlife benefits	<ol> <li>Increase width and continuity of native upland buffer and emergent zone.</li> </ol>	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
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	Park. In 2009 and 2008, garlic mustard within the upland buffer was
Crystal	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	periodic development, 2004-2005, rile periodic development and continued and and the statement ponds (including West Buck Hill Park), which reduced the phosphorus loading into the lake, and 2) conducted annual harvestim of Eurasian watermilfoil and curlyleaf
	Curlyleaf pondweed is present.	3. Control curlyleaf pondweed	Control by harvesting or chemical treatment.	Maintain wildlife habitat.	Late Spring	pondweed. The City of Lakeville excavated/enhanced the Bluebill stormwater
	Eurasian watermilfoil is present.	4. Control Eurasian watermilfoil.	Control by chemical treatment.	Maintain wildlife habitat.	Summer	ueaunent pond.
	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting wildlife hearofite	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
	widne benefits.		Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	operation of the ferric chloride treatment system halted and no harvesting of
Keller Lake	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 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:
	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	The Cities of Apple Valley and Burnsville partnered to conduct annual harvesting of curtyleaf pondweed. 2005: The City of Apple Valley excavated and enhanced Redwood Pond, which will decrease phosphorus loading into the curter of the content of the curter of the cu
	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	Keller Lake. Also, in 2010 the City of Apple Valley may construct Whitney Pond for stormwater treatment within the Keller Lake watershed.
	Curlyleaf pondweed is present.	<ol> <li>Conduct a detailed late spring macrophyte survey to ascertain densities and extent of coverage.</li> </ol>	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
	Common buckthorn dominates portions of the 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	surrounding the lake. On March 6, 2008, soil sediment samples were collected on Kingsley Lake by Blue Water Science (BWS) and the City of the surround of the same set of the Surround s
Kingsley Lake	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	Lakewile. Based on the results of the soit analysis, the BWS report stated that "curlylead 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 next density and percent total coverance of curlyleaf.
	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 TM can be used to effectively control both invasive emergent species.	Increase/maintain wildlife habitat.	Spring-Summer	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 Biue Thumb program, commenced shoreline stabilization utilizing native plants.
	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
Lac Lavon	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	The treatment is expected to provide control of Eurasian watermilfoil for three years, while allowing native plant species to rebound. The titles have continued to inform the MnDNR of the ongoing treatments and the MnDNR
	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting	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	proposes to continue aquatic plant surveys to study the effects of whole-lake fluridone treatments. However, no MnDNR macrophyte survey was conducted in 2008.
			Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	
	Curlyleaf pondweed dominates the lake in late spring-early summer.	<ol> <li>Continue curlyleaf pondweed control measures.</li> </ol>	Control and manage	Increase/maintain wildlife habitat and water quality.	Late Spring - Early summer	2009: The City of Lakeville conducted herbicide treatment for curlyleaf
Orchard Lake	Unmanicured, native vegetation in adjacent upland is narrow and not continuous, limiting	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	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
	widne benefits.		Restore sustainable native communities	Increase wildlife habitat.	Spring - Fall	restoration projects. Annually, the City of Lakeville harvested approximately
	Purple loosestrife is present.	<ol> <li>Conduct a detailed evaluation of purple loosestrife, followed by removal/control.</li> </ol>	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	boat launch, was restored using native plants.
	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	
	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	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.
Sunset Pond	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	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 loosestriffe. A prescription burn, inter-
	Presence of curlyleaf pondweed observed in 2003 and 2005 through 2008.	<ol> <li>Conduct a late spring macrophyte survey to ascertain densities and extent of coverage.</li> </ol>	consider control measures dependent on the results of an early growing season survey.	Maintain wildlife habitat. Reduce down-stream phosphorus loading.	Late Spring	second or prame species, and bucknorn removal were conducted in 2006 to increase the plant diversity in the upland area.
	The southern portion of the pond is shallow (1 to 2 foot doop)	5. Create a "navigation channel".	Excavate and remove sediment.	Improve wildlife habitat, fishery habitat, and	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	
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	2005 - 2008: Annually, the City of Lakeville and members of the Kingsley Lake Homeowner's
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	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
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	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
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	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
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	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
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	Takeshore resident, inspired by the Blue Thumb program, commenced shoreline stabilization utilizing native plants.
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	
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	<ul> <li>1999 through 2012: The City of Lakeville conducts aquatic vegetation monitoring twice/year.</li> <li>2009 through 2012: The City of Lakeville conducted annual herbicide treatment for curlyleaf pondweed.</li> <li>2004 through 2008: Annually, the City of Lakeville harvested approximately 70 acres of curlyleaf pondweed.</li> <li>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.</li> <li>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.</li> </ul>
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	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 population that the MNDNR feels is appropriate for biological control of purple loosestrife plants.
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 LakeBlack Dog Watershed Management Organization Habitat Monitoring

Problem Identified	Recommendation	Proposed Action	Benefits	Implementa Period
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 - Easummer
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

tion	Completed Actions Which May Improve Wildlife
arly	
	<ul> <li>1999 through 2013: The City of Burnsville conducts aquatic vegetation monitoring twice/year.</li> <li>2003 through 2013: The City of Burnsville conducted annual harvesting of curlyleaf pondweed.</li> <li>2004-2008:</li> </ul>
	-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 <b>2009 and 2008</b> , garlic mustard within the upland buffer was removed/pulled. In late <b>2009</b> , the City of Burnsville treated 14 acres of buckthorn within Crystal West Park.

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

				Implementation	
Problem Identified	Recommendation	Proposed Action	Benefits	Period	Completed Actions W
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 wer
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 Burn to fund a fluridone treatme Aquatic plant surveys wer
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 remova Apple Valley and Burnsvil
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 Burnsv beach and turf grass to pr
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 co the new native planting ar In 2010, the city of Apple boring weevils in Lac Lav Continued management of activities will help to main 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 insta Highview Drive in Apple V The establishment of sho residential properties in th buffer habitat between cit

hich May Improve Wildlife Habitat and/or Water Quality
e conducted by Barr in 2013 and 2014.
sville and Apple Valley and the lake homeowners partnered ent for control of Eurasian watermilfoil.
e conducted by Barrin 2013 and 2014.
I on shallow island areas was completed by the cities of le in 2011.
ville installed a native prairie planting converting a sand rairie and wetland vegetation.
-
ntrol for Canada thistle and knapweed was conducted on rea in 2014.
Valley released about 150 spotted knapweed seedhead on Park in Apple Valley.
of the vegetation communities and shoreline restoration tain and improve wildlife habitat, vegetation diversity,
lled in the backyard of a shoreline property owner on /alley through the Blue Thumb program.
reline restoration projects (especially contiguous) on le future will help balance out the differences in upland y owned property and residential property.

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

					Completed Actions Which May Improve Wildlife Habitat and/or
Problem Identified	Recommendation	Proposed Action	Benefits	Period	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. <b>Potential Restoration Area #3</b>	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. <b>Potential Restoration Area #4</b>	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 Act
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 Kingsley Lake by Lakeville. Based report stated that produce heavy gro solid canopy) in K
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, Kingsley Lake Ass portions of the lak 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. <b>See Figure 4 for purple loosestrife locations.</b>	Increase/maintain wildlife habitat.	Spring - Fall	From 2005-2008, Kingsley Lake Ass from portions of th lake. Purple loose prior to 2002. Follo that beetles are pr is appropriate for l
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. <b>See Figure 4, Potential</b> <b>Restoration Area #3</b>	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. <b>See</b> <b>Figure 4, Potential Restoration Areas #4 through 7</b> . See <b>Appendix G</b> for examples of improvements. See also island shoreline areas becoming bare from YMCA camper overuse ( <b>Figure 4, Potential Restoration</b> <b>Areas 10 and 11</b> ).	Improve water quality, increase wildlife habitat. Improve vegetative diversity and aesthetics.	Spring - Fall	In 2008, a Kingsle Blue Thumb progr utilizing native pla
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	

# tions Which May Improve Wildlife Habitat and/or Water Quality

B, soil sediment samples were collected on Blue Water Science (BWS) and the City of on the results of the soil analysis, the BWS "curlyleaf pondweed is not expected to rowth conditions (where plants top out in a Kingsley Lake."

the City of Lakeville and members of the sociation removed common buckthorn from ke and the upland buffer surrounding the

the City of Lakeville and members of the sociation removed purple loosestrife plants he lake and the upland buffer surrounding the estrife beetles were released by the MnDNR low up monitoring by the MnDNR indicates present at a population that the MnDNR feels biological control.

ey Lake lakeshore resident, inspired by the ram, commenced shoreline stabilization ants.

# Table 2: 2017 Recommended and Completed Management Actions for Orchard LakeBlack 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. <b>See</b> <b>Figure 4 and Site Photos, Potential Restoration</b> <b>Areas #1-3, 7 and 8</b> . See <b>Appendix G</b> 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	Comple
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 throug vegetation 2003 throug harvesting
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 Crystal Lak
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 within the u
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 loos 2002. Follo are present for biologica
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 a location of l significantly
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 residen restortion p and Water

eted Actions Which May Improve Wildlife Habitat	
and/or Water Quality	

ugh 2018: The City of Burnsville conducts aquatic n monitoring twice/year. ugh 2018: The City of Burnsville conducted annual g of curlyleaf pondweed.

he City of Burnsville treated 14 acres of buckthorn within ake West Park (Appendix I).

nd 2009, the City of Burnsville removed garlic mustard upland buffer (Appendix I)

osestrife beetles were released by the MnDNR prior to low up monitoring by the MnDNR indicates that beetles nt at a population that the MnDNR feels is appropriate ical control.

and density of naturalized shoreline buffer at the f Emergent Plot #1B near the beach area has improved the since 2009.

ntial property owners have completed shoreline projects using either City of Burnsville or Dakota Soil r 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	Complet
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 pla
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 homeowner control of E Aquatic plan
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 loose cities of App Purple loose Follow up n a populatio
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 a sand beac
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 invasi conducted of In 2010, the seedhead b Continued r restoration vegetation of
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 shoreline pr Dakota Soil The establis contiguous) the differen residential p

#### ted Actions Which May Improve Wildlife Habitat and/or Water Quality

nt surveys were conducted in 2013, 2014, and 2019.

e cities of Burnsville and Apple Valley and the lake ers partnered to fund a one-time fluridone treatment for Eurasian watermilfoil.

ant surveys were conducted in 2013, 2014, and 2019.

estrife removal on shallow island areas was completed by the ple Valley and Burnsville in 2011.

estrife beetles were released by the MnDNR prior to 2002. nonitoring by the MnDNR indicates that beetles are present at n that the MnDNR feels is appropriate for biological control.

e city of Burnsville installed a native prairie planting converting ch and turf grass to prairie and wetland vegetation.

ive species control for Canada thistle and knapweed was on the new native planting area in 2014.

city of Apple Valley released about 150 spotted knapweed oring weevils in Lac Lavon Park in Apple Valley.

nanagement of the vegetation communities and shoreline activities will help to maintain and improve wildlife habitat, diversity, aesthetics, and recreation

prairie restoration project was installed in the backyard of a operty owner on Highview Drive in Apple Valley through the and Water Conservation District program.

hment of shoreline restoration projects (especially on residential properties in the future will help balance out ces in upland buffer habitat between city owned property and property.

# Appendix E

2015 Keller Lake MNRAM 3.4 Wetland Functional Assessment Results

<b>Wetland Functional Assessment Summary</b>					Maintenan of	ce Flood/	Downstream Water	Maintenance of Wetland		
Wetland Name	Hydrogeomor	phology				Hydrologi Regime	Attenuation	Quality	Quality	Shoreline Protection
Keller Lake	Depressional/Fl inlet and outlet), waterbody bank	ow-through (apparent in . Lacustrine Fringe (edg s)	nlet and outlet), Depress ge of deepwater areas)/S	sional/Flow-through ( Shoreland, Floodplai	(apparent in (outside	0.75	0.63	0.71	0.44	0.72
						High	Moderate	High	Moderate	High
								A	dditional Inform	ation
Wetland Name	Maintenance of Characteristic Wildlife Habitat Structure	Maintenance of Characteristic Fish Habitat	Maintenance of Characteristic Amphibian Habitat	Aesthetics/ Recreation/ Education/ Cultural	Commer	cial Uses	Ground- Water Interaction	Wetland Restoration Potential	Wetland Sensitivity to Stormwater and Urban Development	y Additional Stormwater Treatment Needs
Keller Lake	0.39	0.77	0.05	0.76	0.0	00	Discharge	0.00	0.50	0.44
	Moderate	High	Low	High	Not App	olicable		Not Applicable	Moderate	Moderate

# Wetland Community Summary

	<i>. .</i>		Vegetative Diversity/Integrity					
Wetland Name	Location	Cowardin Classification 39	ommunity r 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

**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 weth based on MnRAM data	land Functional Category ^S	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 Diversi	ity 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**

# 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/Att enuation	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 deeprooted, 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.

# Appendix A: Dominant Species By Plant Community

	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	Туре 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	Туре 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, C Cowardin Classification: L2UBGh	<b>Open Water C</b> Circular 39: Type 5
Plant Community: Shallow M Cowardin Classification: PEM1C	<b>larsh</b> Circular 39: Type 3
Plant Community: Floodplain Cowardin Classification: PFO1A	<b>Forest</b> Circular 39: Type 1
<ol> <li>Listed, rare, special species?</li> <li>Rare community or habitat?</li> <li>Pre-European-settlement conditional settlement settlement conditional settlement settlement settlement conditional settlement sett</li></ol>	No No ion? No
Hydrogeomorphology / topogra7Depressional/FlowThree	p <b>hy:</b> u, Lacustrine, Floodplain
<ul><li>8-1 Maximum water depth</li><li>8-2 % inundated</li></ul>	120 inch 100%
<ul><li><i>9 Immediate drainagelocal WS</i></li><li><i>10 Esimated size/existing site:</i></li></ul>	1448 acre (see #66)
11-Upland SoilMayer silt loam11-Wetland SoilQuam silt loam	
<ol> <li>Outlet for flood control</li> <li>Outlet for hydro regime</li> <li>Dominant upland land use</li> <li>Wetland soil condition</li> <li>Vegetation (% cover)</li> <li>Emerg. veg flood resistance</li> </ol>	B A B A 90% B

18	Sediment delivery		Α
19	Upland soils (soil group)		В
20	Stormwater runoff		В
21	Subwatershed wetland densi	ity	С
22	Channels/sheet flow		А
• •		40	fact
23	Adjacent buffer width	40	ieei

23	Adjacent buffer width
----	-----------------------

#### Adjacent area management

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

Adjacent area diversity/structure

25-A	Native
25-B	Mixed
25-C	Sparse

0%

90%

10%

Yes

А

В

С

No

No

С

С В

В

В

50 feet

## Adjacent area slope

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

27 Downstream sens./WQ protect. А 28 Nutrient loading С

29 Shoreline wetland?

#### Shoreline Wetland

- 30 Rooted veg., % cover 80% 31 Wetland in-water width 32 Emerg. veg. erosion resistance
- 33 Erosion potential of site 34 Upslope veg./bank protection
- 35 Rare wildlife?
- Scare/Rare/S1/S2 community 36 Vegetative cover 37
- 38 Veg. community interspersion
- 39 Wetland detritus
- Interspersion on landscape 40
- 41 Wildlife barriers

#### Amphibian-breeding potential

42	Hydroperiod adequacy	Adequate
43	Fish presence	С
44	Overwintering habitat	А
45	Wildlife species (list) greating tu	at blue heron, rtles, ducks, egret
46	Fish habitat quality	A
47	Fish species (list)	
48	Unique/rare opportunity	No
49	Wetland visibility	Α
50	Proximity to population	Yes
51	Public ownership	В
52	Public access	Α
53	Human influence on wetland	В

54	Human influence on viewsh	ed	(
55	Spatial buffer	ĺ	/
56	Recreational activity potent	tial	/
57	Commercial crophydro in	ıpact	N
Gro	undwater-specific question	ons	
58	Wetland soils	Dischar	ge
59	Subwatershed land use	Dischar	ge
60	Wetland size/soil group	Rechar	ge
61	Wetland hydroperiod	Dischar	ge
62	Inlet/Outlet configuration	Dischar	ge
63	Upland topo relief	Dischar	ge

#### Additional information

64	Restoration potential	No
65	I O affected by restoration	

LO affected by restoration

66	Existing size	63
	Restorable size	0
	Potential new wetland	0
67 68	Average width of pot. buffer Ease of potential restoration	0 feet
<u>69</u>	Hydrologic alterations	0
70	Potential wetland type	0
71	Stormwater sensitivity	
72	Additional treatment needs	
Wate	ershed Minnesota (Shakope	ee)

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

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 nonnative 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	3B	<b>3</b> C	3D	<b>3</b> E
	Proportion	Individual	Highest	Non-Weighted	Weighted
	of Wetland	Community	Quality	Average	Average
		Scores			
Community #1	Т	Α		Α	Α
Community #2	U	В		В	В
Community #3	V	С		C	С
Community #4	W	D		D	D
Community #5	X	Ε		E	Ε
Community #6	Y	F		F	F
Community #7	Z	G		G	G
Wetland	1.0		Highest	(A+B+C+D+E	(A*T)+(B*U
<b>Rating Value</b>			Value	+ <b>F</b> + <b>G</b> )/7 =	)+(C*V)+(D
				Ave.	*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 Divers	sity/ Integrity					
	3a. Proportion of Wetland	3b. Individual Community Scores	3c. Highest Rated Community Quality	3d. Non- Weighted Average	3e. W Av	Veighted verage
Community #1	Т	Α				
Community #2	U	В	If Sman Eastern	aab dania		d then wete
Community #3	V	С	II Spec. Featur	Exceptional	(2)	ed then rate
Community #4	$\mathbf{W}$	D	if oithor quas	Exceptional	(4); oro Vos	than rate
Community #5	X	Ε	F	vcentional (?	). else.	then rate
Community #6	Y	F		Acceptional (2	), eise.	
Community #7	Z	G				
Overall	1.0		: Highest	: (A+B+C+	- :(4	A*T)+(B*
Wetland Value			Value of A-G	D+E+F+G	) <b>/7</b> U)	)+(C*V)+
Rating				= Ave.	(D	<b>)*W)+(E*</b>
					X	)+(F*Y)+(
					G	*Z) = Wt.
					A	ve.

# 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 wetland²³. 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 equation²⁴. 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,

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.

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

Flood and Stormwater Storage/Attenuation Variables

# 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 guidebook⁵⁴ with the downstream sensitivity concept from *The Minnesota Wetland Evaluation Methodology*. Three major processes make up equal portions of the Downstream Water Quality Protection function²⁵ 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 ¹/₄ of the total downstream water quality functional index).

# Downstream Water Quality Functional Index Computations:

If 12=0, then: (14+20_{reversed}+18+(23+24+26)/3+(16+17)/2+27)/6
 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 Quanty variables					
MpDAM #	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	Controllingoptional		

## Downstream Water Quality Variables

# 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:**

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

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

Wetland Water Quality Variables

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 equally²⁶: 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.

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**+2**4**+2**5**)/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**+2**4**+2**5**)/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 component²⁷ 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 habitat⁵⁶. 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 frogs²⁸. Extreme water level fluctuations during winter may also cause mortality in overwintering reptiles and amphibians²⁹. 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 quality³⁰.

# 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  $(23)_{Wildlife}$  + Dominant Upland Land Use {14} + Barriers {41} + Stormwater Input {20_{reverse}}]/6}

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

Amphibian Habitat Variables

# 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.

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

All questions contribute equally to the overall index.

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

If Special Features c, h, or u is checked³¹, 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 nonwetland-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.

4/10/2006

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 criteria³⁴.

- 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)
- $B = 0.33 < Maintenance of Wetland Water Quality Index \le < 0.66 \text{ (sediment removal needed)}$

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**





**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. **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.







**Location:** Burnsville Minnesota

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

## **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.





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Location:	Aller
Burnsville	
Minnesota	

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



## **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

#### **PROJECT FACTSHEET**

# COADY SHORELINE PLANTING



- **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



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**

<u>Goal</u>: 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

#### <u>Chemical</u>

- 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: <a href="http://mipncontroldatabase.wisc.edu/search?name=common_buckthorn&habitat=7&season=7">http://mipncontroldatabase.wisc.edu/search?name=common_buckthorn&habitat=7&season=7</a>

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

U.S. Department of Agriculture Natural Resources Conservation Service: <u>https://efotg.sc.egov.usda.gov/references/public/MN/797Buckthorn.pdf</u> 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.

- A
- 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

## **PROTECTING**

# Minnesota's Pollinators

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,

MINNESOTA BOARD OF WATER & SOIL RESOURCES

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 **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.

## 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.

## **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.





Columbine Aquilegia spp.



Joe Pye Weed *Eupatorium* spp.

Goldenrod Solidago spp.

Milkweed Asclepias spp. Black-eyed Susan Rudbeckia spp.

**Prairie Blazing Star** *Liatris* spp.