

Technical Memorandum

To: Commissioners, Black Dog Watershed Management Organization (BDWMO)
From: Barr Engineering Co.
Subject: 2019 Lac Lavon Habitat Monitoring
Date: March 10, 2020
Project: 23190457

This memorandum presents the results of the BDWMO's 2019 habitat monitoring of Lac Lavon.

1.0 Introduction and Background to the BDWMO Habitat Monitoring Program

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

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

This report provides the results of the Lac Lavon 2019 habitat monitoring.

Habitat quality was evaluated within the submergent, emergent, and upland buffer vegetation zones, and the lake was evaluated for sedimentation and shoreline erosion problems. Wildlife habitat characteristics were evaluated based on diversity of native plant communities present within each vegetation zone and an assessment of wetland functions and values. Additional detail describing the habitat assessment is provided in the technical reference section following this memorandum, which includes

- Lac Lavon aquatic plant survey results (**Appendix A**),
- floristic quality assessment data and methods (**Appendix B**),
- previous habitat assessment monitoring results from 2003 through 2018 (**Appendix C**),
- previous recommended and completed management actions from 2003 through 2018 (**Appendix D**),
- 2014 Lac Lavon Minnesota Routine Assessment Method (MNRAM 3.4) wetland functional assessment results (**Appendix E**),

- descriptions of the MNRAM wetland functions (**Appendix F**),
- examples of shoreline and buffer restoration projects (**Appendix G**), and
- buckthorn management guidelines (**Appendix H**).
- location of the prairie restoration area as provided by the City of Burnsville (**Appendix I**).

2.0 Lac Lavon Habitat Monitoring

Lac Lavon lies on the Burnsville/Apple Valley border and its 184-acre watershed encompasses portions of both Burnsville and Apple Valley. The only surface water outlet from Lac Lavon is a 12-inch diameter emergency overflow outlet to Keller Lake. A valve controls the flows in the overflow pipe; normally the valve is closed. Lac Lavon is unique in that it is an abandoned gravel pit and therefore not part of the Minnesota Department of Natural Resources (MNDNR) Public Waters Inventory. The lake's primary water source is groundwater. Lac Lavon's water surface area is approximately 60 acres, with 65 percent of the lake less than 15 feet (4.6 meters) deep and a maximum depth of 32 feet (9.8 meters).

Existing watershed land use is low density residential and park. Two city parks are located on Lac Lavon—a City of Burnsville park on the west shore, and a City of Apple Valley park with a path to a fishing pier on the northeast shore.

Lac Lavon is used for a variety of recreational purposes, including fishing, swimming, aesthetic viewing, and wildlife habitat. The City of Burnsville Park, with ballpark, tennis courts, paved trails, picnic shelter, play equipment and boat access, and the City of Apple Valley Park, with a fishing pier, canoe rack and access, picnic shelter, paved trails, and children's play equipment provide for most of the lake's recreational use.

Figure 2 shows the 2017 aerial imagery of Lac Lavon.

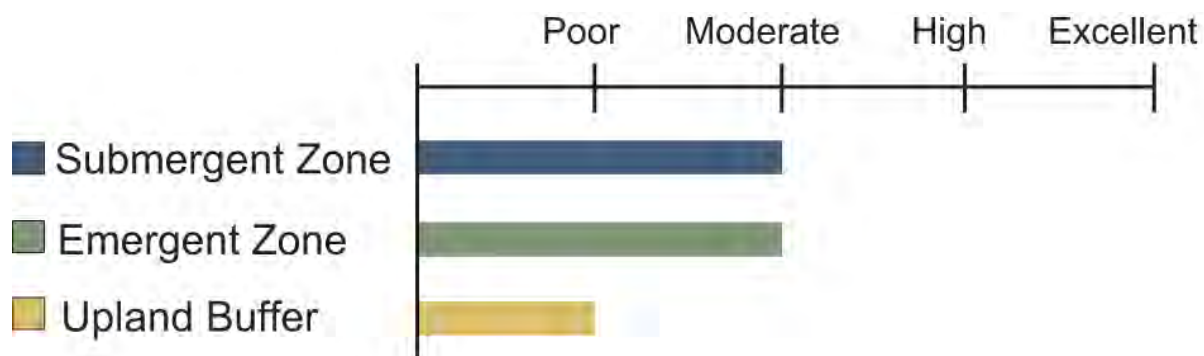
2.1 Lac Lavon 2019 Habitat Monitoring Results

Habitat monitoring for Lac Lavon was conducted from 2003 through 2009, in 2014, and in 2019. The 2019 field monitoring of Lac Lavon was conducted on June 30 and August 23, 2019. Vegetation data were collected in, within, and along the fringe of Lac Lavon's three vegetation zones: (1) submergent, (2) emergent, and (3) upland.

The 2019 Lac Lavon monitoring included transect, plot, and meandering surveys. Photographs were taken to document conditions and are included at the end of this memorandum. Analysis and reporting of the monitoring data includes a floristic quality assessment and a four-tiered rating system (poor, moderate, high, and excellent). The current rating system is detailed in footnotes on **Table 1**. Private versus public ownership was identified along the entire shoreline. The survey results, along with parcel data, were used to identify possible locations for restoration and preservation.

On June 30 and August 23, 2019, Endangered Resource Services, LLC staff conducted aquatic vegetation surveys within the submergent zone (**Appendix A**). On August 23, 2019, Barr staff conducted emergent vegetation and upland buffer zone surveys by walking along the shoreline. In addition, the discrete plots were monitored in the emergent zone and upland buffer, as done in 2003-2009 and 2014. **Figure 3** shows the plot locations and the shoreline parcels identifying private versus public ownership. Previous monitoring reports provide the sampling methodology for monitoring conducted before 2011. An overall quality rating for each vegetation zone was computed using the field variables evaluated in each zone. **Table 1** shows the 2014 and 2019 habitat quality ratings for Lac Lavon and **Table 2** shows the recommended management action items.

The following schematic diagram shows the overall ratings in 2019 for each vegetation zone within and adjacent to Lac Lavon:



2.1.1 Lac Lavon Overall Vegetation Zone Ratings

Table 1 shows the 2014 and 2019 Lac Lavon habitat monitoring results. Appendix C provides habitat ratings for the Lac Lavon monitoring conducted prior to 2011.

Submergent Zone

The total number of native species in the submergent zone is **high** (12), the average native plant density rating is **moderate** (1.5), the average exotic species density is rated **moderate** (1.7) and the Mean Coefficient of Conservatism Value (C-Value) Rating is **moderate** (4.5). Averaging these four criteria results in a **moderate** rating overall for the submergent zone of Lac Lavon. This is consistent with the overall rating in 2014.

Curly-leaf pondweed (*Potamogeton crispus*) is a dominant species found every year within Lac Lavon. In June, curly-leaf pondweed was present at 29 percent of sample points shallower than the maximum depth of plant growth. In August, which was after the seasonal die-off of curly-leaf pondweed, only a handful of curly-leaf pondweed plants were observed near the west landing. This invasive plant often

out-competes native vegetation early in the growing season and dies off in early to mid-summer, which creates a sudden loss of habitat and releases nutrients into the water that can produce algal blooms and create turbid water conditions.

Eurasian watermilfoil (*Myriophyllum spicatum*) was also found in Lac Lavon in 2019 and in previous years. In both June and August of 2019, Eurasian watermilfoil was present at more than half of sites shallower than the maximum depth of plant growth – at 54 percent of sample sites in June and 56 percent of sites in August. The densest growth of Eurasian watermilfoil was in the west bay. Eurasian watermilfoil has fast growing stems and often branches out and covers the water surface, which impedes boating, makes water recreation difficult, and often shades out slower-growing native plants. During August, the Eurasian watermilfoil in the west bay was so dense that it was not possible to motor through it with an electric motor. The MNDNR has identified low-dose fluridone (2-4 ppb maintained for at least 60 days) herbicide as an effective Eurasian watermilfoil control.

In addition, moderate densities of brittle naiad, a non-native, invasive plant species have been found in Lac Lavon during previous monitoring years

The Mean C-Value Rating was added to the analysis in 2011 to provide an additional assessment of floristic quality. The C-value is a numerical rating of an individual species' conservatism and habitat fidelity in relation to disturbance. C-values range from 0 to 10. Species that are least conservative, or show the least fidelity to specific natural habitats are often opportunistic invaders of natural communities, or are native species typical of disturbed communities, and are assigned a low value. For example, coontail (*Ceratophyllum demersum*) has a C-value of 2 and curlyleaf pondweed has a C-value of 0. High values indicate the species is found in undisturbed communities and has a narrow range of ecological tolerances. For example, leafy pondweed (*Potamogeton pusillus*) and white water crowfoot (*Ranunculus longirostris*) have C-values of 7. The mean C-value for vegetation found in the submergent zone of Lac Lavon in 2019 was 4.5. For purposes of this habitat assessment, the mean C-value and the number of species are given separate ratings, and are averaged along with the density ratings to provide an overall rating for the submergent zone. The ratings used in this assessment are based on Minnesota Pollution Control Agency (MPCA) C-value guidelines (Floristic Quality Assessment for Minnesota Wetlands, MPCA, May 2007, <https://www.pca.state.mn.us/water/floristic-quality-assessment-evaluating-wetland-vegetation>).

In December of 2012, the MPCA published the Rapid Floristic Quality Assessment (Rapid FQA) Method, which is another method that can be used to evaluate and rate vegetation quality. The FQA method also uses the C-value, and the rating is weighted based on percent coverage and percent of each community type. However, the Rapid FQA method uses only select species in the rating. This means that many of the species found during a plant survey will not be included in the rating

calculation. Because of this significant drawback, we do not recommend changing the BDWMO's assessment method to use the Rapid FQA. For information purposes only, we calculated the Rapid FQA for Lac Lavon in 2019; the results are provided in **Appendix B**.

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

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

Emergent Zone

The overall emergent vegetation zone quality is rated **moderate** for Lac Lavon; this is the same as the overall 2014 rating. The emergent zone includes 38 native wetland plant species resulting in an **excellent** rating and percent cover of exotic species (26-50%), which is a **high** rating. The approximate percent cover of vegetation (0-25%) is a **poor** rating. The emergent zone represents less than five percent total areal coverage, due primarily to owner-maintained sand beaches and riprap walls. The mean C-value rating is **poor** (2.4) and the Rapid Floristic Quality assessment calculations are rated as **fair** for the shrub-carr and fresh meadow communities resulting in an overall **good** condition (**Appendix B**).

Narrowleaf cattail (*Typha angustifolia*) is a dominant non-native invasive species within the vegetated emergent zone. Purple loosestrife (*Lythrum salicaria*), another non-native invasive plant species, is present in shallow open water and along the shoreline (**Appendix B**). Purple loosestrife has been managed for years through the release of beetles, which eat the purple loosestrife plants. This management strategy has been relatively successful within the Twin Cities metropolitan area. The MNDNR's monitoring of the purple loosestrife beetles indicates that populations are sufficient within the Twin Cities metropolitan area to keep purple loosestrife from becoming a significant problem. The cities of Apple Valley and Burnsville also removed purple loosestrife on shallow island areas in 2011.

At the southwest portion of the lake, the emergent shoreline adjacent to the City of Burnsville prairie restoration project was seeded with native emergent vegetation and includes native sedge species (*Carex comosa*, *Carex stricta*, *Carex vulpinoidea*), rushes (*Eleocharis erythropoda*, *Schoenoplectus tabernaemontani*, *Juncus effuses*, *Juncus tenuis*, and *Juncus torreyi*), rice cut grass (*Leersia oryzoides*),

switchgrass (*Panicum virgatum*), and fowl bluegrass (*Poa palustris*), providing desirable diverse habitat. Several forb species present in the emergent zone, including swamp milkweed (*Asclepias incarnata*), boneset (*Eupatorium perfoliatum*), blueflag iris (*Iris versicolor*), golden alexanders (*Zizia aurea*), and blue vervain (*Verbena hastata*) also provide important pollinator habitat. Due to flooded conditions in 2019, several areas within the lakeshore emergent zone were flooded with drowned out vegetation.

Upland Buffer

The overall upland buffer quality is rated **poor** for Lac Lavon. A total of 56 native species and 41 exotic plant species were observed in the upland buffer area in 2019. Exotic plants make up greater than 40 percent of the vegetative cover. The mean C-value rating (2.0) in the upland buffer is poor (**Appendix B**). The naturalized upland buffer within the city-owned property along the western and northeastern portions of the shoreline is wide, providing wildlife habitat and shoreline protection. However, the majority of residential properties are dominated by maintained lawn grasses and sand beaches with little to no naturalized vegetation.

The City of Burnsville has actively managed non-native invasive Canada thistle and spotted knapweed within publicly owned upland buffer areas. The City of Apple Valley released spotted knapweed seedhead boring weevils in Lac Lavon Park in 2010. In 2013, the City of Burnsville installed a native prairie planting, converting a sand beach and turf grass to prairie and wetland vegetation. This planting project has been well managed to control non-native invasive species and is dominated by diverse native plant species. One well-designed residential shoreline restoration project installed on Highview Drive provides an aesthetically pleasing atmosphere to enjoy the lake shoreline, practical erosion protection on a steep slope, and excellent habitat for pollinators and other species.

These restoration projects allow for the growth of desirable native species present in the upland buffer areas, including big bluestem (*Andropogon gerardii*), side-oats grama (*Bouteloua curtipendula*), Pennsylvania sedge (*Carex pensylvanica*), globular coneflower (*Ratbida pinnata*), black eyed Susan (*Rudbeckia hirta*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), common milkweed (*Asclepias syriaca*), butterfly weed (*Asclepias tuberosa*), white wild indigo (*Baptisia alba*), partridge pea (*Chamecrista fasciculata*), purple coneflower (*Echinacea purpurea*), joe pye weed (*Eutrochium maculatum*), prairie smoke (*Geum triflorum*), sawtooth sunflower (*Helianthus grosseserratus*), wild bergamot (*Monarda fistulosa*), stiff goldenrod (*Oligoneuron rigidum*), cup plant (*Silphium perfoliatum*), zigzag goldenrod (*Solidago flexicaulis*), and showy goldenrod (*Solidago speciosa*).

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

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

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

The shoreline property ownership around Lac Lavon is about 80% residential and 20% city ownership.

For Lac Lavon residential shoreline properties:

- The average buffer width is less than 10 feet.
- Approximately 2% have an adequate buffer width to protect water quality and prevent erosion (≥ 50 feet).
- Approximately 10% have at least half of the recommended buffer width to protect water quality and prevent erosion (≥ 25 feet).
- One residential property along the shoreline of Lac Lavon has a naturalized buffer width adequate for wildlife protection (≥ 100 feet).

The majority of the residential shoreline properties on Lac Lavon have the potential to provide a 50-foot naturalized buffer without altering any structures. Of the 105 residential properties, only ten do not have the potential to provide at least a 25-foot naturalized buffer.

For Lac Lavon city-owned public properties:

- The average buffer width is approximately 230 feet.
- The buffers on the portion of the city-owned property on the west side of the lake owned by the City of Burnsville average 300 feet wide.
- The buffers on the portion of the city-owned property on the northeast side of the lake owned by the City of Apple Valley average 120 feet wide.

Minnesota Routine Assessment Method (MNRAM) for Wetlands

In 2014, based on the MNRAM, Lac Lavon rated **moderate** for overall vegetative diversity and wildlife habitat. The Lac Lavon shoreline wetland community rated **moderate** for shoreline protection. Maintenance of characteristic amphibian habitat was rated **low**. Maintenance of fish habitat was rated as **high**. Shoreline restoration projects would have the potential to protect the shoreline from erosion and provide spawning and nursery habitat for fish and wildlife. Aesthetics/recreation/education rated **high**. The MNRAM assessment also indicates that many of the integral hydrologic and land use processes that affect the lake are intact and in relatively good condition with **moderate** ratings for flood stormwater attenuation, downstream water quality, maintenance of hydrologic regime, and wetland sensitivity to stormwater and urban development. The 2014 Lac Lavon MNRAM summary is provided in **Appendix E**. The MNRAM assessment was not repeated in 2019, as it would likely not result in significant changes from the 2014 assessment.

3.0 Lac Lavon Management Recommendations

3.1 Past and Current Actions

In 2006, the cities of Burnsville and Apple Valley and lakeshore homeowners partnered to fund a fluridone treatment for control of Eurasian watermilfoil. The one-time treatment was expected to provide control of Eurasian watermilfoil for three years, while allowing native plant species to grow. Although Eurasian watermilfoil was not documented within the lake during the May 30, 2007 habitat assessment, City of Apple Valley staff noted the presence of Eurasian watermilfoil later in the 2007 growing season. In 2008, it was documented primarily in the west portion of the lake. Eurasian watermilfoil has since rebounded in the lake. The MNDNR studied the effects of whole-lake fluridone treatments. The MNDNR's current recommendation is to treat Eurasian watermilfoil with low-dose fluridone herbicide (2-4 ppb maintained for 60 days).

Aquatic plant surveys were conducted in 2013, 2014, and 2019.

In 2010, the city of Apple Valley released about 150 spotted knapweed seedhead boring weevils in Lac Lavon Park in Apple Valley. Purple loosestrife removal on shallow island areas was completed by the cities of Apple Valley and Burnsville in 2011.

In 2013, the city of Burnsville installed a native prairie planting, converting a sand beach and turf grass to prairie and wetland vegetation. The layout of the planting is shown in **Appendix I**. The prairie restoration area is approximately 0.4 acre. Some invasive species control for Canada thistle and knapweed was conducted on this new native planting area in 2014.

The cities of Burnsville and Apple Valley have provided lakeshore owners with shoreline restoration information since 2004 and continually promote and encourage lakeshore property owners each year to

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

One shoreline restoration project was installed in the backyard of a shoreline property owner on Highview Drive in Apple Valley received technical assistance from the Dakota County Soil and Water Conservation District (SWCD). Additional/more numerous shoreline restoration projects (especially contiguous) on residential properties in the future will help balance out the differences in upland buffer habitat between city-owned property and residential property. Property owners have also created rain gardens on their properties through the Dakota County SWCD Landscaping for Clean Water program. Continued management of the vegetation communities and shoreline restoration activities will help to maintain and improve wildlife habitat, vegetation diversity, aesthetics, and recreation.

3.2 Recommendations

The 2019 habitat assessment results suggest several recommended management activities that could help maintain and improve the overall wildlife habitat, vegetation diversity, aesthetics, and water quality of the lake. **Table 2** provides a summary of identified problems, recommended management activities, and past actions. The management recommendations are presented below:

1. Continue to monitor, control, and manage curly-leaf pondweed and Eurasian watermilfoil. See **Appendix A** for the 2019 aquatic plant survey charts; more detailed information is available upon request.
2. Continue to control and manage non-native invasive vegetation including purple loosestrife, buckthorn, Siberian elm, leafy spurge, and spotted knapweed. The prairie restoration area in the southwest portion of the lakeshore could be extended to the east along a hillside in an area that does not appear to be used for any activities. This area is currently dominated by non-native knapweed. This project could potentially receive funding assistance from the Dakota SWCD Landscaping for Clean Water program. (**Potential Restoration Areas #1, 2, and 4, as shown in Figure 4 and photos**)
3. 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 in the Apple Valley Park near the fishing pier. This project could potentially receive funding assistance from the Dakota SWCD

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Landscaping for Clean Water program. (**Potential Restoration Area #3, as shown in Figure 4 and photos**)

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

Tables

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

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

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

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

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
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The following footnotes pertain to 2011 through 2019 data:

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

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

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.

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

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

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

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)

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

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

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

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

Figures

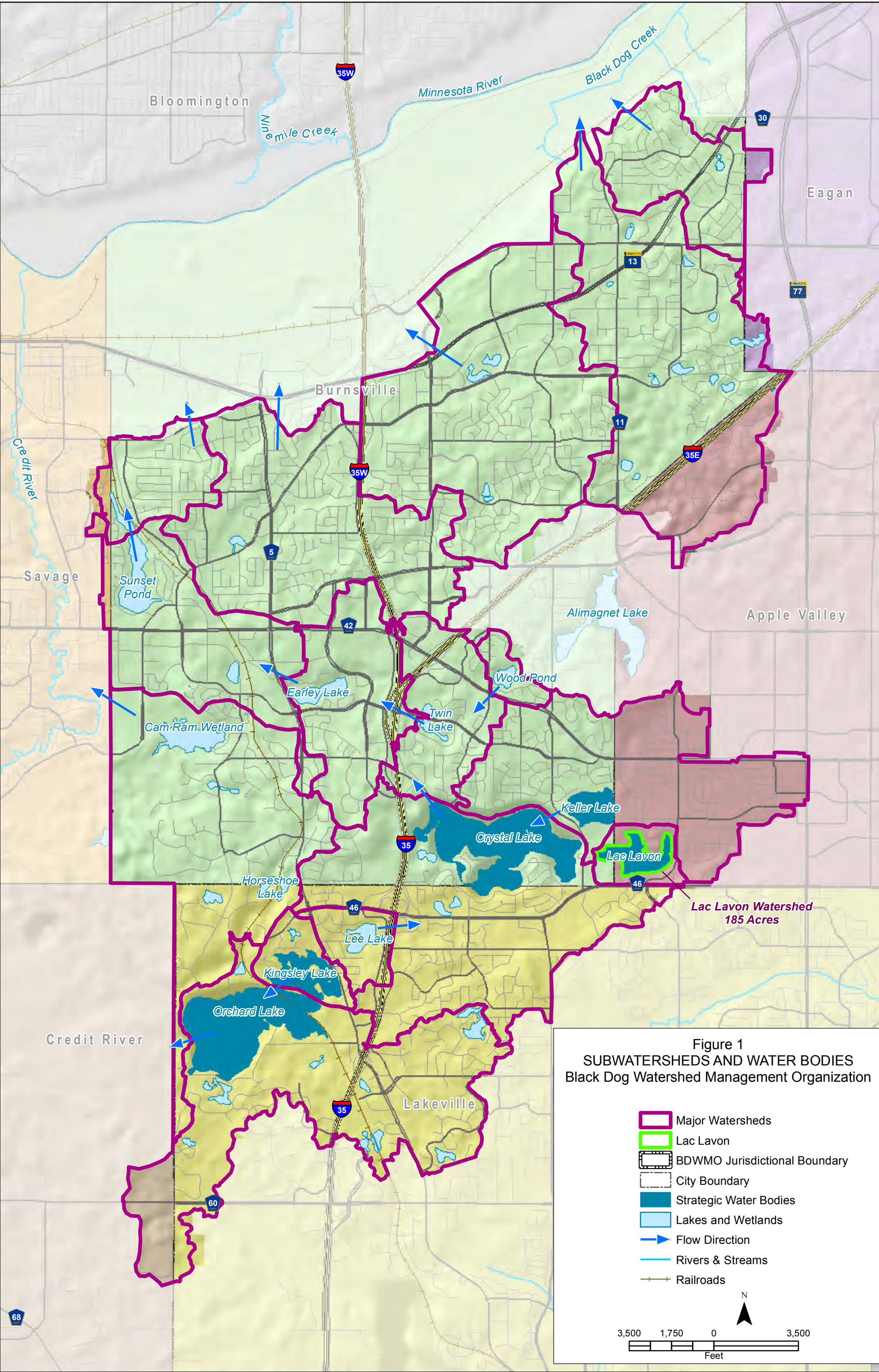
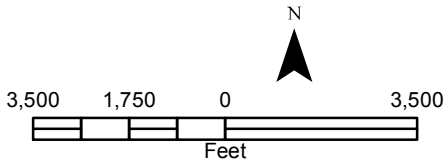


Figure 1
SUBWATERSHEDS AND WATER BODIES
Black Dog Watershed Management Organization

- Major Watersheds
- Lac Lavon
- BDWMO Jurisdictional Boundary
- City Boundary
- Strategic Water Bodies
- Lakes and Wetlands
- Flow Direction
- Rivers & Streams
- Railroads



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2017 Aerial Imagery

Figure 2

**LAC LAVON
SAMPLE PLOT LOCATIONS
Black Dog WMO
Burnsville and Apple Valley, MN**

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2017 Aerial Imagery

- | | |
|-------------------------|----------------------------|
| ● Sample Plot Locations | Shoreline Parcel Ownership |
| --- Municipal Boundary | Public |
| ■ Lac Lavon | Residential |

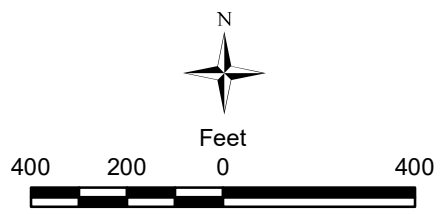


Figure 3
LAC LAVON
SHORELINE PARCEL OWNERSHIP
Black Dog WMO
Burnsville and Apple Valley, MN



2017 Aerial Imagery

Potential Restoration Areas

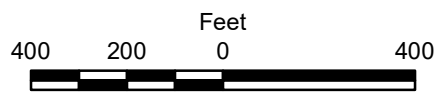


Figure 4
LAC LAVON
Potential Restoration Areas
Black Dog WMO
Burnsville and Apple Valley, MN

Photos

Lac Lavon and Shoreline August 23, 2019



Submergent Zone –west portion of Lac Lavon



Plot 1B Emergent Zone



Plot 1C Upland Buffer



Submergent Zone – north portion of Lac Lavon



Plot 2B Emergent Zone



Plot 2C Upland Buffer



Submergent Zone – northeast portion of Lac Lavon



Plot 3B – Emergent Zone



Plot 3C – Upland Buffer



City of Burnsville prairie restoration area



The City of Burnsville prairie restoration area provides habitat for pollinators



Emergent shoreline adjacent to City prairie restoration was also seeded with native vegetation.



Potential restoration area #1 - The City of Burnsville prairie restoration area could be extended to include this area currently dominated by knapweed. Remove knapweed and restore with tall grass prairie.



Flooded conditions in 2019 prevented access to fishing dock in City of Apple Valley Park



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

Potential Restoration Areas #2 and #4 – Continue to control non-native invasive vegetation with the naturalized upland buffer areas in the city parks, including control of buckthorn, Siberian elm, leafy spurge, and spotted knapweed.



Potential Restoration Area #3 – Stormwater flows directly to the lake along impervious surfaces and turf grass where it can collect pollutants and decrease water quality. Create buffer strips of naturalized vegetation adjacent to the bituminous lake access pathway to slow down and pretreat stormwater prior to entering the lake.



Typical residential shoreline – mowed turf grass or sand beach to edge of water, lacking protective vegetation.

Potential Restoration Area #5 - Sturdy native vegetation in the emergent zone and upland buffer of residential properties could provide more shoreline stability.



A successful existing residential shoreline restoration



Lac Lavon provides natural habitat for recreational activities including biking and kayaking.

Technical Reference
(Provided in separate report)