Appendix D

Water Quality Program

(Appendix D is divided into 4 parts)

Part 2
Bay Lake, Cloverdale Lake, Lake DeMontreville, Downs Lake, Eagle Point Lake, Echo Lake, Lake Edith
(Lake graphs and map of survey results)

Part 1
2012 VBWD Water Quality Data Collection Program
(Narration, Tables D-1 through D-6, Figure D-1 [Avg. water clarity depths], and Figures D-2 and D-3 [Biotic Index Values])

Part 2
Bay Lake, Cloverdale Lake, Lake DeMontreville, Downs Lake, Eagle Point Lake, Echo Lake, Lake Edith
(Lake graphs and map of survey results)

Part 3
Lake Elmo, Goose Lake (North), Goose Lake (South), Horseshoe Lake, Lake Jane, Klawitter Pond, Kramer Pond
(Lake graphs and map of survey results)

Part 4
Long Lake, McDonald Lake, Lake Olson, Rest Area Pond, Silver Lake, Sunfish Lake, Sunnybrook Lake
(Lake graphs and map of survey results)
Bay Lake
Average Summer Epilimnetic (0-2 meters) Total Phosphorus Concentrations

n=number of samples collected
June through August

TP (ug/L)

GOOD FAIR EXCELLENT

Year

Bay Lake
Average Summer Epilimnetic (0-2 meters) Chlorophyll a Concentrations

n=number of samples collected
June through August

Chl-a (mg/m²)

GOOD FAIR EXCELLENT

Year
Mann-Kendall/Sen’s Slope Trend Test
(Test Period – 2003 to 2012)

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<td>80%</td>
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Sen’s Slope -0.023 meters/year

Notes:
1. Points shown in the graph are the summer average (June-August) Secchi disc transparency depths. Only years with a calculated summer average based on at least 4 measured values are plotted. At least 5 data points were required to complete the trend test.
Water Quality Monitoring Location (1.3 m deep)

Scirpus fluviatilis (sporadic)

Scirpus fluviatilis

Glyceria borealis

Schoenoplectus acutus (sporadic)

Schoenoplectus fluviatilis

Nitella sp.

3.3' deep

FIELD NOTES:
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- No macrophytes found in water body
- Scirpus fluviatilis found around entire lake perimeter, denser areas are marked on map
- Reed canary grass (Phalaris arundinacea) present around entire lake perimeter
CLOVERDALE LAKE
SUMMER AVERAGE WATER CLARITY
Valley Branch Watershed District

Year

Secchi Disc Transparency Depth (feet)

POOR
FAIR
GOOD
EXCELLENT

Secchi Disc Transparency Depth (meters)

Cloverdale Lake
Carlson TSI Index Based on Summer Average Water Clarity

Cloverdale Lake
Minimum Summer Secchi Disc Transparency

CLOVERDALE LAKE
HISTORIC WATER QUALITY DATA
Valley Branch Watershed District
Mann-Kendall/Sen’s Slope Trend Test
(Test Period – 2003 to 2012)

<table>
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<th>Confidence Level</th>
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<td>-3 &gt; -17</td>
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<tr>
<td>80%</td>
<td>-3 &gt; -14</td>
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Sen’s Slope: -0.017 meters/year

Notes:
1. Points shown in the graph are the summer average (June-August) Secchi disc transparency depths. Only years with a calculated summer average based on at least 4 measured values are plotted. At least 5 data points were required to complete the trend test.

CLOVERDALE LAKE
MANN-KENDALL TREND ANALYSIS
OF SECCHI DISC TRANSPARENCY
Valley Branch Watershed District
Mann-Kendall/Sen’s Slope Trend Test
(Test Period – 2004 to 2012)

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<td>4 &lt; 17</td>
</tr>
<tr>
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<td>4 &lt; 15</td>
</tr>
<tr>
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No Significant

Sen’s Slope 0.06 meters/year

Notes:
1. Points shown in the graph are the summer average (June-August) Secchi disc transparency depths. Only years with a calculated summer average based on at least 4 measured values are plotted. At least 5 data points were required to complete the trend test.
Eurasian water milfoil
(Myriophyllum spicatum)
Aquatic Macrophyte Distribution
Lake Deforville
Valley Branch Watershed District
Washington County, MN
June 18, 2012
Aerial Imagery: 2010 MNAGeoWMS
Downs Lake
Carlson TSI Index Based on Summer Average Water Clarity

Carlson TSI Index

Year


POOR
FAIR
GOOD
EXCELLENT
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
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<tbody>
<tr>
<td>Slender waterweed</td>
<td>Elodea nuttallii</td>
</tr>
<tr>
<td>Water smartweed</td>
<td>Polygonum amphibium</td>
</tr>
<tr>
<td>Arrowhead</td>
<td>Sagittaria sp.</td>
</tr>
<tr>
<td>Cattail</td>
<td>Typha sp.</td>
</tr>
<tr>
<td>Northern Mannagrass</td>
<td>Glyceria borealis</td>
</tr>
<tr>
<td>Reed canary grass</td>
<td>Phalaris arundinacea</td>
</tr>
<tr>
<td>River bulrush</td>
<td>Schoenoplectus fluviatilis</td>
</tr>
<tr>
<td>Softstem bulrush</td>
<td>Schoenoplectus tabernaemontani</td>
</tr>
<tr>
<td>Spikerush</td>
<td>Eleocharis sp.</td>
</tr>
<tr>
<td>Water smartweed</td>
<td>Polygonum amphibium</td>
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</table>

FIELD NOTES:
- Macrophyte densities estimated as follows:
  1 = light; 2 = moderate; 3 = heavy
- No macrophytes found in water >2 ft
EAGLE POINT LAKE
SUMMER AVERAGE WATER CLARITY
Valley Branch Watershed District
Eagle Point Lake
Carlson TSI Index Based on Summer Average Water Clarity

EAGLE POINT LAKE
HISTORIC WATER QUALITY DATA
Valley Branch Watershed District
Mann-Kendall/Sen’s Slope Trend Test  
(Test Period – 2003 to 2012)

<table>
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<td>95%</td>
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<td>Not Significant</td>
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<tr>
<td>80%</td>
<td>-2 &gt; -7</td>
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Sen’s Slope: -0.019 meters/year

Notes:
1. Points shown in the graph are the summer average (June-August) Secchi disc transparency depths. Only years with a calculated summer average based on at least 4 measured values are plotted. At least 5 data points were required to complete the trend test.
ECHO LAKE
HISTORIC WATER QUALITY DATA
Valley Branch Watershed District
### Emergent Plants

- **Common Name**: Bulrush
  - **Scientific Name**: Scirpus sp.

- **Common Name**: Cattail
  - **Scientific Name**: Typha sp.

- **Common Name**: Common rush
  - **Scientific Name**: Juncus sp.

- **Common Name**: Northern blue flag
  - **Scientific Name**: Iris versicolor

- **Common Name**: Pickerelweed
  - **Scientific Name**: Pontederia cordata

- **Common Name**: Purple loosestrife
  - **Scientific Name**: Lythrum salicaria

- **Common Name**: Sedge
  - **Scientific Name**: Carex sp.

- **Common Name**: Water shortweed
  - **Scientific Name**: Polygonum amphibium

*Note: Bold red name indicates extremely aggressive/invasive introduced species.*

### Scirpus sp.

**- Common Name**: Bulrush

**- Scientific Name**: Scirpus sp.

*Note: Bold red name indicates extremely aggressive/invasive introduced species.*

### Floating Leaf Plants

- **Common Name**: White waterlily
  - **Scientific Name**: Nymphaea odorata

- **Common Name**: Yellow waterlily
  - **Scientific Name**: Nuphar lutea

### Submerged Aquatic Plants

- **Common Name**: Bladderwort
  - **Scientific Name**: Utricularia sp.

- **Common Name**: Canada waterweed
  - **Scientific Name**: Elodea canadensis

- **Common Name**: Coontail
  - **Scientific Name**: Ceratophyllum demersum

- **Common Name**: Curly leaf pondweed
  - **Scientific Name**: Potamogeton crispus

- **Common Name**: Floating leaf pondweed
  - **Scientific Name**: Potamogeton natans

- **Common Name**: Largeleaf pondweed
  - **Scientific Name**: Potamogeton amplifolius

- **Common Name**: Muskgrass
  - **Scientific Name**: Chara sp.

- **Common Name**: Northern waternettle
  - **Scientific Name**: Myriophyllum sibiricum

- **Common Name**: Pondweed
  - **Scientific Name**: Potamogeton pusillus

- **Common Name**: Sago pondweed
  - **Scientific Name**: Stuckenia pectinatus

- **Common Name**: Smartweed
  - **Scientific Name**: Polygonum sp.

- **Common Name**: Water moss
  - **Scientific Name**: Drepanocladus (observed in sw corner of lake)

- **Common Name**: Water stargrass
  - **Scientific Name**: Zosterella dubia

*Note: Bold red name indicates extremely aggressive/invasive introduced species.*

### FIELD NOTES:
- Macrophyte densities estimated as follows:
  - 1 = light; 2 = moderate; 3 = heavy
- No macrophytes found in water >4.0' - 5.0'
- Low water levels
- Potamogeton amplifolius - 2-3 along entire perimeter
- Lythrum salicaria - sporadic along entire perimeter
- High water level

### WATER QUALITY MONITORING LOCATION

- **6' - 7' Depth**

- **Potamogeton amplifolius** - 1
- **Lythrum salicaria**
- **Iris versicolor**
- **Juncus sp.**
- **Lythrum salicaria**
- **Polygonum amphibium**
- **Ceratophyllum demersum** - 3+
- **Elodea canadensis** - 1-2
- **Myriophyllum sibiricum** - 1
- **Potamogeton amplifolius** - 1-3
- **Potamogeton pusillus** - 1-3
- **Utricularia sp.** - 2-3
- **Ceratophyllum demersum** - 1-3
- **Elodea canadensis** - 1-2
- **Myriophyllum sibiricum** - 1
- **Potamogeton amplifolius** - 1
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3+
- **Chara sp.** - 2-3
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**
- **Potamogeton amplifolius** - 2-3
- **Potamogeton pusillus** - 1-3
- **Potamogeton zosteriformis** - 1
- **Utricularia sp.** - 2-3
- **Chara sp.** - 1-2
- **Potamogeton pusillus** - 2-3
- **Drepanocladus (water moss)**

### Summary

**ECHO LAKE MACROPHYTE SURVEY RESULTS**

**June 5, 2012**

Valley Branch Watershed District

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**Imagery Source:** 2009 AE

**User:** kac2

**Barr Footer:** ArcGIS 10.0, 2012-09-28 16:34 File: I:\Client\VBWD\District\Maps\MacrophyteMaps\2012\EchoLk_Macrophytes_060512.mxd
LAKE EDITH
SUMMER AVERAGE WATER CLARITY
Valley Branch Watershed District
Lake Edith
Average Summer Epilimnetic (0-2 meters) Total Phosphorus Concentrations

POOR

n=number of samples collected June through August

FAIR

Year

EXCELLENT

Lake Edith
Average Summer Epilimnetic (0-2 meters) Chlorophyll a Concentrations

POOR

n=number of samples collected June through August

FAIR

GOOD

EXCELLENT

LAKE EDITH
HISTORIC WATER QUALITY DATA
Valley Branch Watershed District
Mann-Kendall/Sen’s Slope Trend Test  
(Test Period – 2005 to 2012)

<table>
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<tr>
<td>95%</td>
<td>-5 &gt; -17</td>
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<td>-5 &gt; -15</td>
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<tr>
<td>80%</td>
<td>-5 &gt; -12</td>
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<tr>
<td>Sen’s Slope</td>
<td></td>
<td></td>
<td>-0.033 meters/year</td>
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Notes:
1. Points shown in the graph are the summer average (June-August) Secchi disc transparency depths. Only years with a calculated summer average based on at least 4 measured values are plotted. At least 5 data points were required to complete the trend test.

LAKE EDITH
MANN-KENDALL TREND ANALYSIS
OF SECCHI DISC TRANSPARENCY
Valley Branch Watershed District
**Barr Footer:** ArcGIS 10.0, 2012-09-24 13:56  
File: I:\Client\VBWD\District\Maps\MacrophyteMaps\2012\LkEdith_Macrophytes_06042012.mxd  
User: kac2  
Imagery Source: 2009 AE

**Lake Edith Macrophyte Survey Results**  
June 4, 2012  
Valley Branch Watershed District

**FIELD NOTES:**  
- Macrophyte densities estimated as follows:  
  1-light; 2-moderate; 3-heavy  
- Densities generally not noted for emergent and floating leaf plants  
- No macrophytes found in water >10-12'  
- Carex sp. sporadic along perimeter of lake  
- Numerous carp present  
- No Stuckenia dubia  
- No Nostoc present  
- Algal mats on west side

**Emergent Plants**

**Floating Leaf Plants**

**Submerged Aquatic Plants**

**No Aquatic Vegetation**

**Common Name** | **Scientific Name**  
--- | ---  
Narrowleaf pondweed | Potamogeton sp.  
Illinois pondweed | Potamogeton illinoensis  
Slender naiad | Najas sp.  
Coontail | Ceratophyllum demersum  
Curlyleaf pondweed | Potamogeton crispus  
Flatstem pondweed | Potamogeton zosteriformis  
Muskgrass | Chara sp.  
Northern watermilfoil | Myriophyllum sibiricum  
Sago pondweed | Stuckenia pectinat

**Emergent Plants**

**Floating Leaf Plants**

**Submerged Aquatic Plants**

**No Aquatic Vegetation**

**Common Name** | **Scientific Name**  
--- | ---  
Yellow pondlily | Nuphar lutea  
Blue flag iris | Iris versicolor  
Cattail | Typha sp.  
Sedge | Carex sp.  
Softstem bulrush | Schoenoplectus tabernaemontani  

*Note: Bold red name indicates extremely aggressive/invasive introduced species.*