Gem Lake

VLAWMO
Vadnais Lake Area
Water Management Organization

Macrophyte, Contour, Biovolume and Bottom Composition Survey 8/9/22

Gem Lake, located in the southeast corner of Vadnais Lake Area Water Management Organization, has a surface area of 40 acres and an average depth of 7 feet. Gem Lake is classified as a shallow lake. It is surrounded by a mix of residential, industrial, and commercial properties. Gem Lake is located to the northwest of Highway 61 and County Road E. Common fish found in Gem Lake include black crappie and predominant vegetation includes Clasping-leaf pondweed, Pickerel weed, White water lily, and Arrowhead. Gem Lake was delisted from the State Impaired List in 2018. Water quality has increased by a good margin since 2009, showing a decrease in phosphorus and chlorophyll A levels[1].

This document contains two reports of data collected on Gem Lake. The first report details the methods and findings of a point intercept survey of macrophyte vegetation. The second report details the methods and results of a contour, vegetation bio-volume and bottom hardness (composition) survey.

Data collected and prepared by **Ramsey County – Parks & Recreation, Soil and Water Conservation Division** for

Vadnais Lakes Watershed Management Organization
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[1] VLAWMO. (2020, October 3). *Gem Lake Fact Sheet 2020*. VLAWMO. Retrieved November 15, 2022, from https://www.vlawmo.org/waterbodies/gem-lake/

Aquatic Macrophyte Point-Intercept Survey

8/9/22

Methods:

The point-intercept method incorporating aerial photography and a Lowrance Elite-7 TI2 Global Positioning System (GPS) were used to assess the aquatic macrophyte community on Gem Lake on August 9, 2022. Samples were taken at 65 evenly spaced (50 m) geo-referenced points (Figure 2). Data on depth, plant species and abundance rank were recorded as displayed in Tables 2 and 3 and in the maps of this report. A Secchi disk measurement was also taken in the center of the lake on the shady side of the boat, as displayed in Table 3.

A double-tined metal rake attached to a 11-meter rope was used to collect specimens. At each point the device was thrown out approximately one meter and then dragged across the substrate for approximately one meter. Species were identified and given a ranking based on cover of rake tines (Table 1). Plant species that were floating in the water within one square meter of each collection point were also counted.

Table 1

Abundance rankings for percent cover of rake tines

Percent Cover of Tines	Abundance Ranking
41-100	3
21-40	2
1-20	1

Results:

Aquatic macrophytes were found at 25 of 65 points surveyed (Figure 2). Species found included: Coontail (*Ceratophyllum demersum),* Naiad *(Najas spp.),* Large leaf pondweed (*Potamogeton amplifolius),* Leafy pondweed *(Potamogeton foliosus),* Robbin's pondweed *(Potamogeton robbinsii),* Flatstem pondweed (*Potamogeton zosteriformis),* Bladderwort *(Utricularia macrorhiza),* Hornwort *(certatyphylum echinatum),* White waterlily *(Nymphaea odorata),* Wild Celery *(Vallisneria americana),* Duckweed *(Lemna major/minor),* Filamentous algae *(Spirogyra/Cladophora spp.)*. The three most common species found on Gem Lake were Large leaf pondweed (*Potamogeton amplifolius*), Hornwort (*certatyphylum*
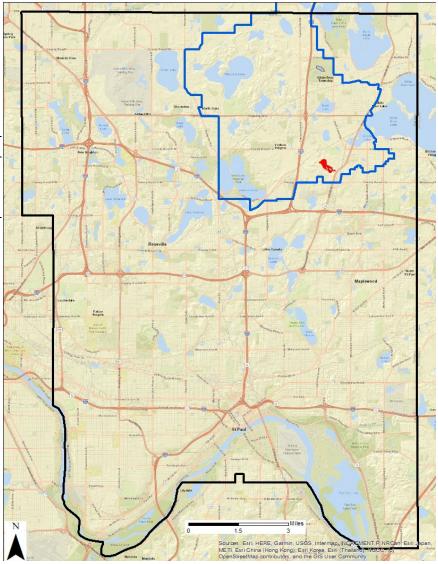
Figure 1. Location of Gem Lake shown in red within Vadnais Lakes Watershed Management Organization and Ramsey County Boundaries.

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echinatum), and Coontail (*Ceratophyllum demersum*). The Naiad species appeared to be Southern naiad (*Najas guadalupensis*), but further verification is needed. Spatterdock (*Nuphar variegatum*) was visible near point 33 but was not detected on the rake. The Secchi disk reading was 2.3m (7.55ft). Due to low water levels points 1-5, 37-38, 40-48, 51-53, and 66-75 were inaccessible and not able to be surveyed. They are included for calculation purposes however, points 66-75 have been removed from table 3 for brevity.

A previous macrophyte survey of Gem Lake was conducted on June 30, 2010, using a different methodology. There were six species present in the 2010 survey. There were eight species present in 2022 but not present in the August 2010 survey. They included: Large leaf pondweed (*Potamogeton amplifolius),* Leafy pondweed (*Potamogeton foliosus),* Robin's pondweed *(Potamogeton robbinsi),* Flat-stem pondweed (*Potamogeton zosteriformis),* Blatterwort (*Utricularia macrorhiza),* Hortwort *(Certatyphylum echinatum),* Greater duckweed (*Spirodela polyrhiza*), Lesser duckweed *(Lemna minor),* and Filamentous algae (*Spirogyra/Cladophora spp.).* One species, Clasping-leaf pondweed *(Potamogeton perfoliatus),* was present in 2010 and not present in 2022.

Due to the survey design differences between 2010 and 2022 direct comparisons of abundance would be difficult to make.

Table 2. Frequency of occurrence & average abundance of aquatic plant taxa present during Gem Lake point-intercept survey.

Species	Common Name	Scientific Name	Average Abundance 8/23/2022	Frequency of Occurrence 8/23/2022
1	Bladderwort	*Utricularia macrorhiza*	1.0	4%
2	Coontail	*Ceratophyllum demersum*	2.0	10%
3	Filamentous Algae	*Spirogyra/Cladophora spp.*	1.0	1%
4	Flat-stem Pondweed	*Potamogeton zosteriformis*	1.0	6%
5	Greater Duckweed	*Spirodela polyrhiza*	1.0	4%
6	Hornwort	*Ceratophyllum echinatum*	1.0	14%
7	Large Leaf Pondweed	*Potamogeton ampifolius*	1.0	22%
8	Leafy Pondweed	*Potamogeton foliosus*	1.0	5%
9	Lesser Duckweed	*Lemna minor*	1.0	4%
10	Naiad	*Najas spp.*	2.0	3%
11	Robbin's Pondweed	*Potamogeton robbinsi*	2.0	17%
12	Water Celery	*Vallisneria americana*	1.0	1%
13	White Waterlily	*Nymphae odorata*	1.0	1%

Table 3. Depth, Secchi disk, water temperature, and vegetation abundance point survey results on August 9, 2022

Sample Point	Depth (m)	Coontail *Ceratophyllum demersum*	Naiad *Najas spp.*	Large leaf pondweed *Potamogeton amplifolius*	Leafy pondweed *Potamogeton foliosus*	Robbin's pondweed *Potamogeton robbinsii*	Flat stem pondweed *Potamogeton zosteriformis*	Bladderwort *Utricularia macrorhiza*	Hornwort Certatyphylum echinatum	White waterlily *Nymphaea odorata*	Filamentous algae (*Spirogyra/ Cladophora spp.*)	Duckweed (*Lemna major/ minor*)
0	0.0											
1	0.0											
2	0.0											
3	0.0											
4	0.0											
5	0.0											
6	0.7								1			
7	3.1											
8	3.9											
9	3.8											
10	3.5											
11	1.3								1			
12	2.7											
13	4.0											
14	4.2											
15	3.6											
16	3.2					1						
17	3.6											
18	4.0											
19	3.6											
20	3.4											
21	2.0					1						

22	1.2							3			
23	3.4										
24	3.6										
25	3.4										
26	2.2				1			1			
27	2.7					1					
28	3.3										
29	3.2										
30	2.4			1	1	2		1			
31	0.9							1			
32	2.6			1	1	1	1				
33	2.4			1							
34	2.0			3				1			
35	0.7			1	1	2	1			1	
36	1.0			1		2					
37	0.0										
38	0.0										
39	0.7			1		3		1			
40	0.0										
41	0.0										
42	0.0										
43	0.0										
44	0.0										
45	0.0										
46	0.0										
47	0.0										
48	0.0										
49	0.1	1	1		1		1		1	1	
50	0.5			2		1					1
51	0.0										
52	0.0										
53	0.0										

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Point	Depth (m)											
54	1.0	1		3		2						1
55	1.0			1		2						1
56	0.0											
57	0.1	1	2	1						1		
58	1.0	1		1		3			1			
59	0.0											
60	1.2	1		3								
61	0.7	2		1			1	1	1			
62	1.0	3										
63	0.0											
64	1.3	2		1				1				
65	0.9	3		1				1	2			
Total Abundance		8	2	17	4	13	5	3	11	1	1	3
Count in Littoral zone (0-15ft)		8	8	17	4	13	5	3	11	1	1	3
Avg. Abundance		2	2	1	1	2	1	1	1	1	1	1
Frequency of Occurrence		10	3	22	5	17	6	4	14	1	1	4
Secchi Depth (m):	2.3											
Water Temperature (C):	24											

Note: Due to low water levels points 1-5, 37-38, 40-48, 51-53, and 66-75 were inaccessible and not able to be surveyed.

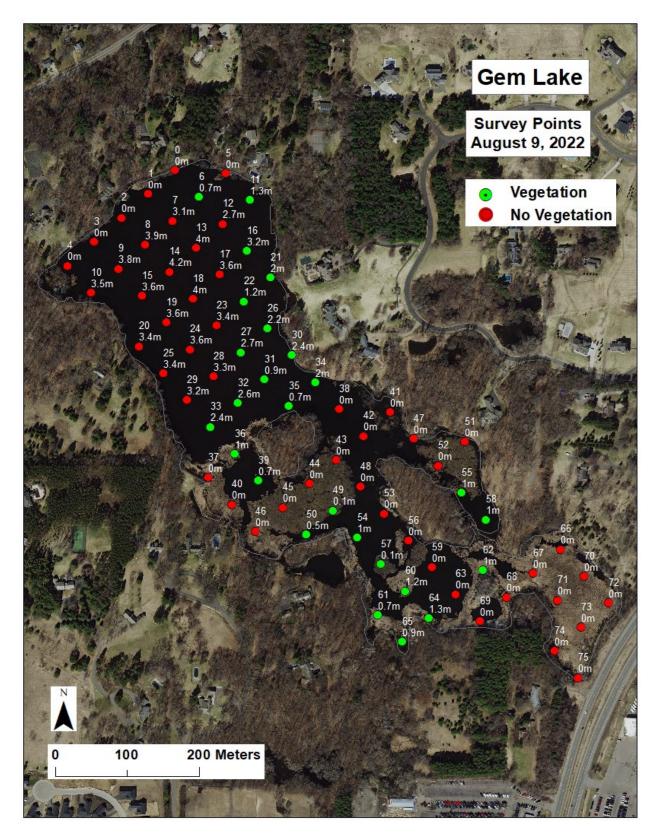Macrophyte, Contour, Biovolume and Bottom Composition Survey 5

Figure 2. Gem Lake vegetation point intercept survey locations. N=75.
Note: Due to low water levels points 1-5, 37-38, 40-48, 51-53, and 66-75 were inaccessible and not able to be surveyed.

Macrophyte, Contour, Biovolume and Bottom Composition Survey 3

Contour, Biovolume and Bottom Composition Survey

8/9/22

Methods:

A Lowrance Elite-7 Ti2 Global Positioning System (GPS)-enabled depth finder was used to collect submerged aquatic vegetation biovolume, lake depth (bathymetry), and bottom hardness (composition) data on Gem Lake on August 9, 2022. The lake was transected at a maximum distance of 40 meters between transects at a speed of no more than 5 miles per hour. Sonar log data were recorded using the Lowrance Elite-7 Ti2 Global Positioning System (GPS)-enabled depth finder. Transducer data were processed using Contour Innovations, LLC, BioBase software.

Results:

The results below were produced by exporting the processed data from the BioBase system and interpolating spatial data using ArcGIS software. Results include maps as well as statistics of biovolume distribution represented as total percent of water column occupied by plant matter ranging from zero to one hundred. Additional results include contour depth maps at 0.3-meter intervals as well as bottom hardness (composition) maps. Bottom hardness is represented as soft, medium, or hard; with soft bottoms characterized as muck, loose silt or sand and medium to harder bottoms characterized as compacted sand, gravel, or rock. More robust interactive contour and vegetation map data, including sonar log trip replays, can be viewed on the BioBase website: www.biobasemaps.com.

BIO BASE

Gem Lake, Ramsey Minnesota

Survey Metadata

Data Collector:	Justin Townsend
Survey Time Stamp (UTC):	2022 August 09 - 13:25
Starting Location:	45.060057, -93.040937
Ending Location:	45.059760, -93.041808
Distance	2.591 km

Survey Statistics

Average Water Temperature:	24.5 °C
Survey Area:	9.753 ha
Survey Volume:	222804.529 cu. m
Percent of Waterbody Surveyed:	81.4%
Waterbody Area:	11.987 ha
Estimated Waterbody Volume	273843.181 cu. m

Survey Settings

Includes Edited Data:	Yes
Track Buffer:	30 m
BV Grid Cell Size:	5 m
BV Minimum Detection - Percent:	5.0%
BV Minimum Detection - Depth:	0.500 m
BV Maximum Detection - Depth:	6.100 m
BV Sonar Channel:	Primary

Survey Summary

Type	PAC	Avg BVp	SD BVp	Avg BVw	SD BVw	Depth Range	Depth Avg	No. Depth Records
Point	57.5%	28.9%	± 25.6%	16.6%	± 22.4%	0.12 - 3.69 m	0.800 m	1659
Grid	66.2%	31.4%	± 21.8%	20.8%	± 23.1%	0.03 - 4.49 m	2.284 m	7766

Bathymetric Contour Map

Vegetation Biovolume Heat Map

Biovolume Analysis by Quintiles

Type	0 - 20%	20 - 40%	40 - 60%	60 - 80%	80 - 100%
Point	66.2%	24.6%	4.3%	0.9%	4.0%
Grid	56.8%	25.9%	9.4%	4.3%	3.6%

Biovolume Analysis by Depth

Type	Depth	Count	PAC	Avg BVp	SD BVp	Avg BVw	SD BVw
Point	0 - 1 m	837	84.6%	30.4%	± 24.3%	25.7%	± 23.9%
	1 - 2 m	90	14.4%	15.3%	± 15.0%	2.2%	± 7.4%
	2 - 3 m	0	0%	0%	± 0%	0%	± 0%
	3 - 4 m	0	0%	0%	± 0%	0%	± 0%
	4 - 5 m	0	0%	0%	± 0%	0%	± 0%
	5 - 6 m	0	0%	0%	± 0%	0%	± 0%
	6 - 7 m	0	0%	0%	± 0%	0%	± 0%
	7 - 8 m	0	0%	0%	± 0%	0%	± 0%
	8 - 9 m	0	0%	0%	± 0%	0%	± 0%
	9 m +	0	0%	0%	± 0%	0%	± 0%
Grid	0 - 1 m	1951	99.8%	41.4%	± 21.4%	41.4%	± 21.5%
	1 - 2 m	1207	97.5%	34.7%	± 23.1%	33.8%	± 23.4%
	2 - 3 m	1521	88.1%	24.9%	± 15.4%	21.9%	± 16.6%
	3 - 4 m	2735	24.8%	9.5%	± 4.1%	2.4%	± 4.6%
	4 - 5 m	352	0%	0%	± 0%	0%	± 0%
	5 - 6 m	0	0%	0%	± 0%	0%	± 0%
	6 - 7 m	0	0%	0%	± 0%	0%	± 0%
	7 - 8 m	0	0%	0%	± 0%	0%	± 0%
	8 - 9 m	0	0%	0%	± 0%	0%	± 0%
	9 m +	0	0%	0%	± 0%	0%	± 0%

Gem Lake, Ramsey Minnesota

Survey Metadata

Data Collector:	Justin Townsend
Survey Time Stamp (UTC):	2022 August 09 - 14:51
Starting Location:	45.055912, –93.038568
Ending Location:	45.055519, –93.038855
Distance	0.484 km

Survey Statistics

Average Water Temperature:	24.0 °C
Survey Area:	1.526 ha
Survey Volume:	10208.349 cu. m
Percent of Waterbody Surveyed:	12.7%
Waterbody Area:	11.987 ha

Survey Settings

Includes Edited Data:	Yes
Track Buffer:	28 m
BV Grid Cell Size:	5 m
BV Minimum Detection – Percent:	5.0%
BV Minimum Detection – Depth:	0.701 m
BV Maximum Detection – Depth:	6.096 m
BV Sonar Channel:	Primary

Survey Summary

Type	PAC	Avg BVp	SD BVp	Avg BVw	SD BVw	Depth Range	Depth Avg	No. Depth Records
Point	88.5%	81.8%	± 40.5%	72.5%	± 39.4%	0.14 – 1.01 m	0.357 m	135
Grid	100%	71.7%	± 18.5%	71.7%	± 18.5%	0.05 – 1.80 m	0.669 m	1215

Bathymetric Contour Map   **Vegetation Biovolume Heat Map**

Biovolume Analysis by Quintiles

Type	0 – 20%	20 – 40%	40 – 60%	60 – 80%	80 – 100%
Point	18.3%	8.4%	5.3%	4.6%	63.4%
Grid	0.5%	7.5%	14.8%	39.9%	37.3%

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Biovolume Analysis by Depth

Type	Depth	Count	PAC	Avg BVp	SD BVp	Avg BVw	SD BVw
Point	0 – 1 m	116	88.5%	81.8%	± 40.5%	72.5%	± 39.4%
	1 – 2 m	0	0%	0%	± 0%	0%	± 0%
	2 – 3 m	0	0%	0%	± 0%	0%	± 0%
	3 – 4 m	0	0%	0%	± 0%	0%	± 0%
	4 – 5 m	0	0%	0%	± 0%	0%	± 0%
	5 – 6 m	0	0%	0%	± 0%	0%	± 0%
	6 – 7 m	0	0%	0%	± 0%	0%	± 0%
	7 – 8 m	0	0%	0%	± 0%	0%	± 0%
	8 – 9 m	0	0%	0%	± 0%	0%	± 0%
	9 m +	0	0%	0%	± 0%	0%	± 0%
Grid	0 – 1 m	978	100%	77.4%	± 12.7%	77.4%	± 12.7%
	1 – 2 m	236	100%	48,0%	± 19,7%	48,0%	± 19,7%
	2 – 3 m	0	0%	0%	± 0%	0%	± 0%
	3 – 4 m	0	0%	0%	± 0%	0%	± 0%
	4 – 5 m	0	0%	0%	± 0%	0%	± 0%
	5 – 6 m	0	0%	0%	± 0%	0%	± 0%
	6 – 7 m	0	0%	0%	± 0%	0%	± 0%
	7 – 8 m	0	0%	0%	± 0%	0%	± 0%
	8 – 9 m	0	0%	0%	± 0%	0%	± 0%
	9 m +	0	0%	0%	± 0%	0%	± 0%

Glossary

AOI

Area of Interest: Defines the individual transects or contiguous data samples as depicted by the color coding of each trip line. Seperate areas of interest can be generated through merging of multiple trips, appending data to a single sonar log or lapses in time (greater than five minutes) within a sonar log.

BVp

Biovolume (Plant): Refers to the percentage of the water column taken up by vegetation when vegetation exists. Areas that do not have any vegetation are not taken into consideration for this calculation.

BVw

Biovolume (All water): Refers to the average percentage of the water column taken up by vegetation regardless of whether vegetation exists. In areas where no vegetation exists, a zero value is entered into the calculation, thus reducing the overall biovolume of the entire area covered by the survey.

PAC

Percent Area Covered: Refers to the overall surface area that has vegetation growing.

Grid

Geostatistical Interpolated Grid: Interpolated and evenly spaced values representing kriged (smoothed) output of aggregated data points. The gridded data is most accurate summary of individual survey areas.

Point

Individual Coordinate Point: A single point represents a summary of sonar pings and the derived bottom and canopy depths. Individual point data create an irregularly spaced dataset that may have overlaps and/or gaps in the data resulting in a increased potential for error.
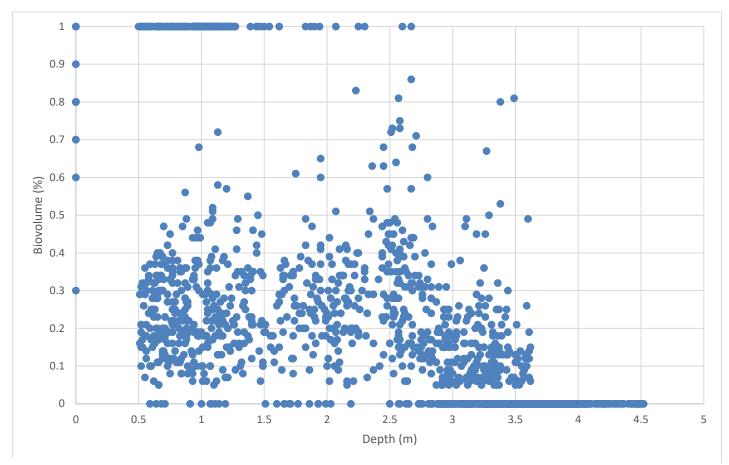
Figure 3. Gem Lake BioBase survey summary statistics.

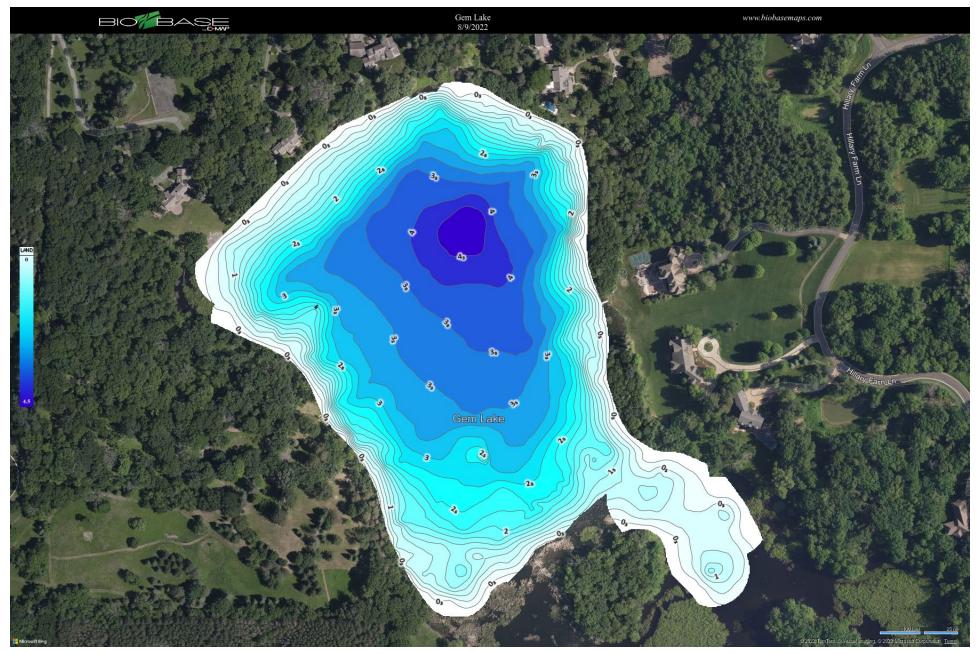Figure 4. Gem Lake biovolume distribution scatter chart.

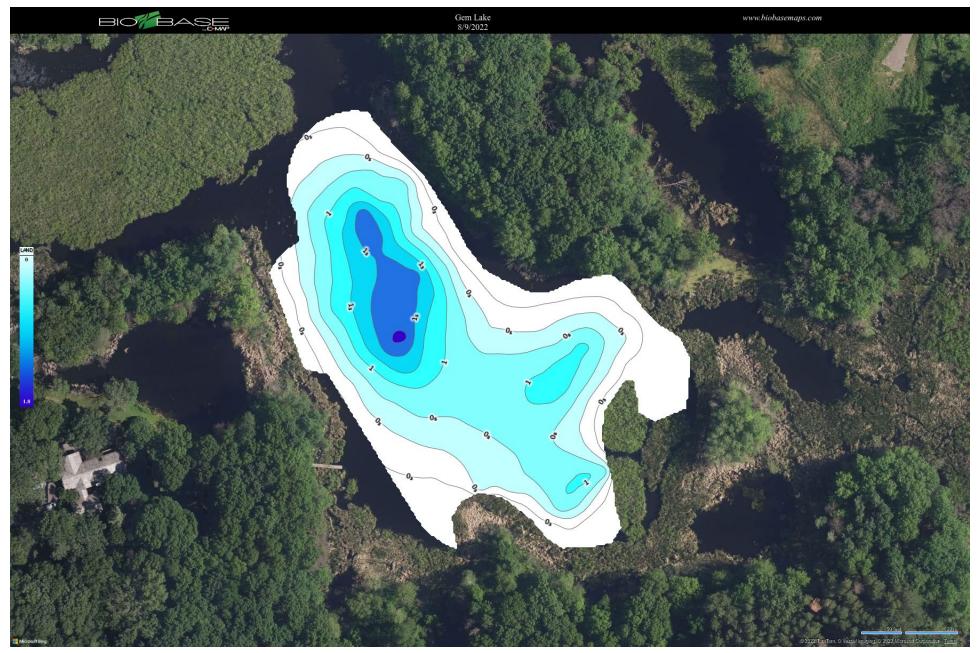Figure 5. North Gem Lake 0.3-m contours with depth in meters taken on August 9, 2022.

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Figure 6. South Gem Lake 0.3-m contours with depth in meters taken on August 9, 2022.
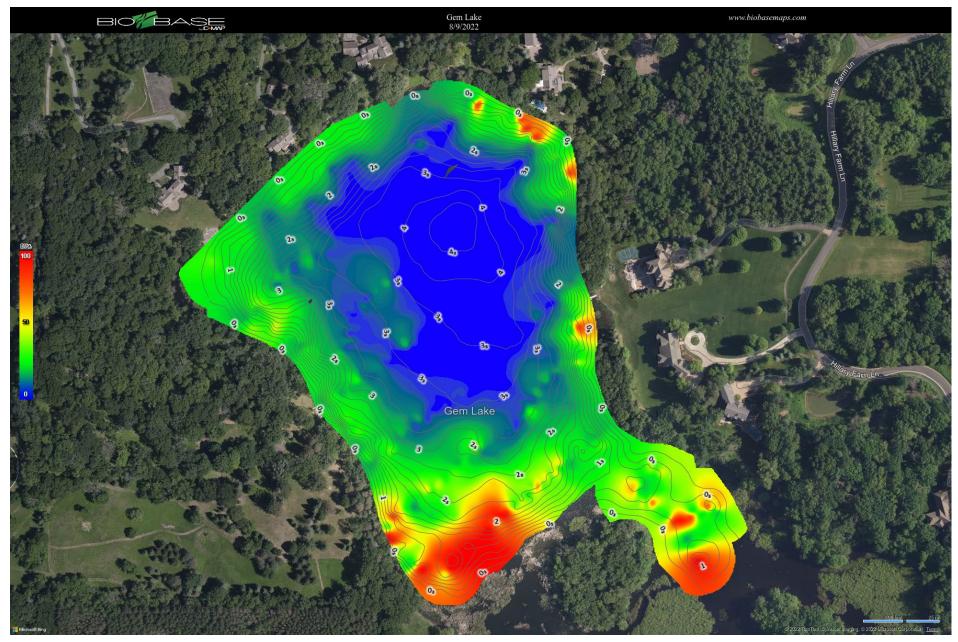
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Figure 7. North Gem Lake vegetation biovolume with 1m contours taken on August 9, 2022. Percent values range from zero to one hundred; Blue = 0%, Yellow = 50% and Red = 100%.
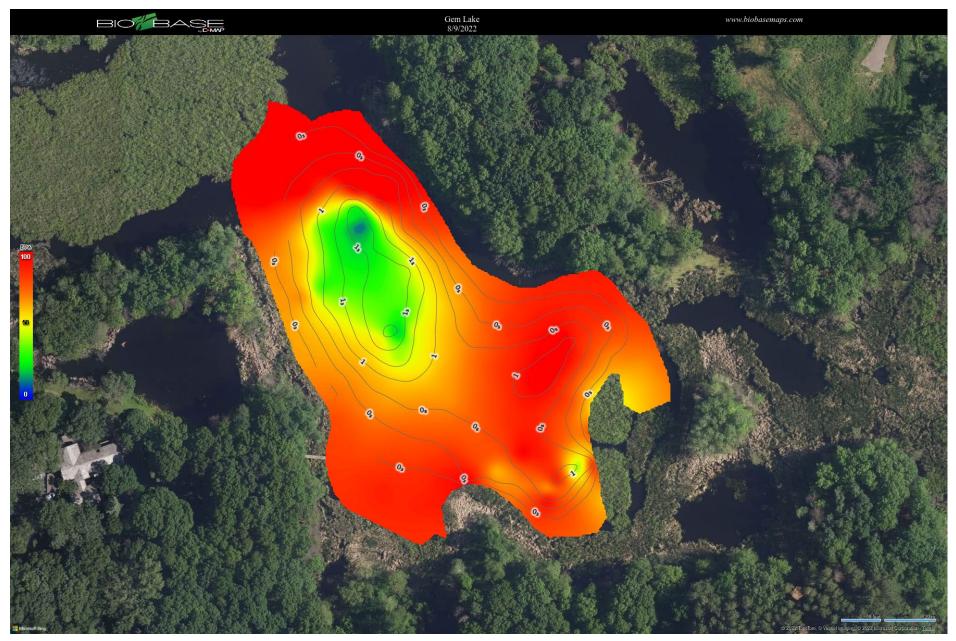
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Figure 8. South Gem Lake vegetation biovolume with 1m contours taken on August 9, 2022. Percent values range from zero to one hundred; Blue = 0%, Yellow = 50% and Red = 100%.
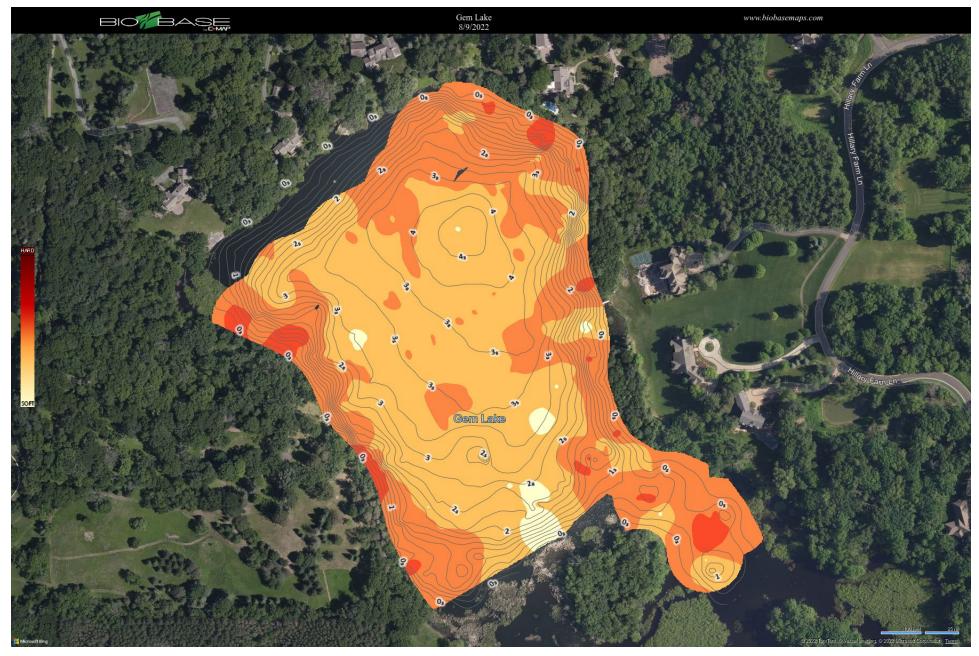
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Figure 9. North Gem Lake bottom composition values with 0.3-m contours taken on August 9, 2022.

Macrophyte, Contour, Biovolume and Bottom Composition Survey 9

Figure 10. South Gem Lake bottom composition values with 0.3-m contours taken on August 9, 2022.

Macrophyte, Contour, Biovolume and Bottom Composition Survey 10