



VLAWMO

**VADNAIS LAKE AREA WATER MANAGEMENT ORGANIZATION
Sustainable Lake Management Report
Amelia Lake, Ramsey County, MN**



**Prepared by Dawn Tanner and Lauren Sampedro
2023**

VLAWMO SUSTAINABLE LAKE MANAGEMENT REPORT (SLMR): AMELIA LAKE

This SLMR includes monitoring, surveys, planning, and partnerships for Amelia Lake in Lino Lakes. Information is compiled here to provide a synthesis of knowledge to date as we work to protect this lake, designated as a lake of Biological Significance by the MN DNR, and to improve water quality. In recent years, we have learned more about invasive Flowering rush (*Butomus umbellatus*) in the Amelia subwatershed. We also seek to protect Swamp loosestrife (also called Water willow, *Decodon verticillatus*), which is a species of conservation concern in Minnesota that is abundant on Amelia Lake. A recent partnership has been underway (2021-present) with Lino Lakes and VLAWMO to identify possible projects to form a greenway as development continues into the future. The resulting plan and possible projects will provide guidance to the watershed for planning in years to come.

Our mission at VLAWMO is to protect and enhance water resources in the watershed through water quality monitoring, wetland protection, and water quality improvement projects. The cornerstone of our success is our partnerships. We appreciate all of our partners' work and assistance to help us fulfill our mission.

Figure 1: Amelia Lake has abundant Swamp loosestrife. It is a native species that seems to require low development along the shoreline and ice heave during the winter. Swamp loosestrife is abundant on Amelia Lake. Protecting the integrity of the lake and this species of conservation concern is a priority for VLAWMO.



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FULL REPORTS (BELOW) INDICATED IN APPENDIX AVAILABLE ON VLAWMO WEBSITE -> AMELIA LAKE
AND UNDER RESOURCES -> REPORTS

AMELIA LAKE AQUATIC VEGETATION AND LAKE CONTOUR SURVEY REPORT (2021 BY RCSWCD)
FROG AND TOAD CALL SURVEY REPORT (2019-2020)
REMOTE CAMERA SURVEY REPORT (2018-2020)
GILFILLAN-WILKINSON-TAMARACK-AMELIA RETROFIT REPORT (2012 BY RCSWCD)

1.1 INTRODUCTION

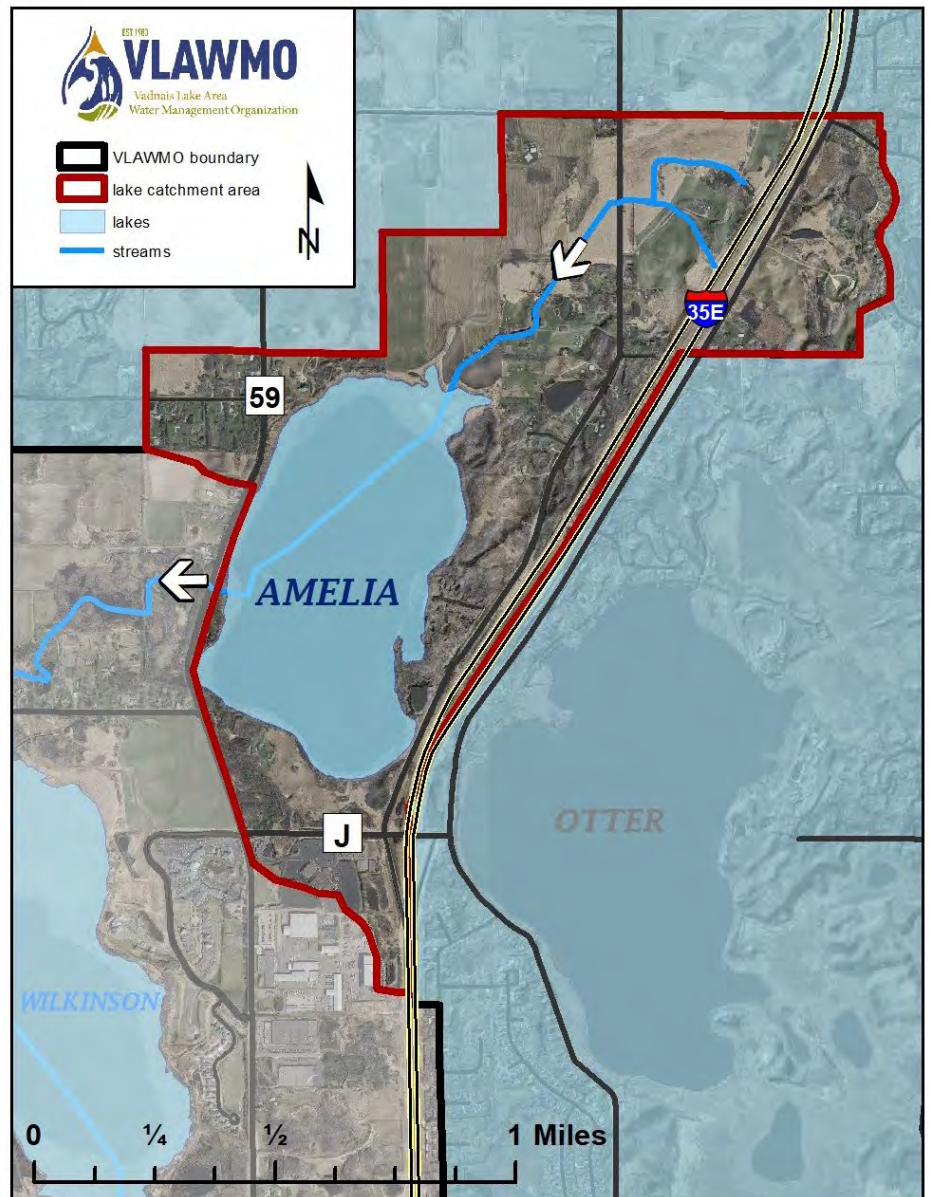
Amelia Lake is located in Lino Lakes, Anoka County, and in the Vadnais Lake Area Watershed. Amelia is the northernmost lake in the watershed and flows into Wilkinson Lake from the north. This connection occurs intermittently, during high-water years, when there is sufficient flow to reach Wilkinson Lake from Amelia.

Amelia Lake has fair water quality, low development along the shoreline area, few residents living on the lake, and no public access.

Amelia Lake is especially interesting because it has less common aquatic plant species with dense coverage throughout the lake. It is an important stopover location for migrating birds. Resident breeding birds in recent years have included Trumpeter swans. Amelia Lake also has uncommon shoreline plant species. The water level in Amelia fluctuates from year to year; it is overall quite shallow and not considered suitable for motorized boating recreation. Amelia Lake was recognized with the designation by the Minnesota Department of Natural Resources as a Lake of Biological Significance in 1993.

Amelia Lake has a water quality score of 59 (2022), up from 58 in 2021. That is equivalent to “green/eutrophic” according to the TSI (Trophic State Index, Carlson Scale, MPCA). Amelia Lake is protected by riparian buffers but still has only fair water quality.

Figure 2: Amelia subwatershed area



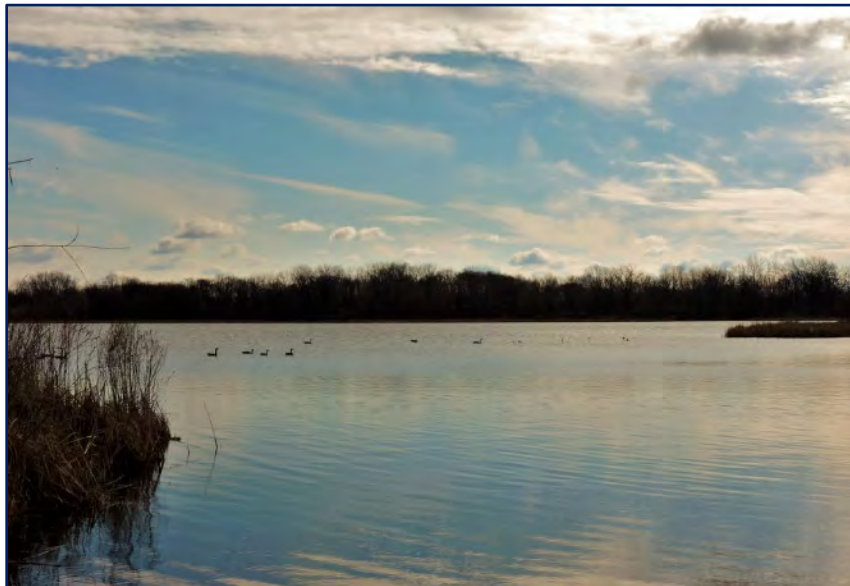
2 WATERSHED FEATURES

2.1 AERIAL PHOTO HISTORY

To better understand changes in the Amelia Lake subwatershed over time and prepare this SLMR, VLAWMO staff met with Lino Lakes' city staff and residents living on and near the lake during summer 2022. Residents expressed concern regarding possible upcoming development and road reconstruction changes in the area. They also discussed a long-term conservation ethic for the area especially focused on a ~40-acre conservation easement with the Minnesota Land Trust (MLT), established in 1994, on the southern shore of the lake. The easement area involves multiple landowners. The move toward eventual protection of this area was begun by Art and Betty Hawkins who purchased land on the lake in 1954. They worked to improve habitat quality through restoration activities and advocated for protection of the lake and surrounding areas. Art worked for the U.S. Fish and Wildlife Service and was a student of Aldo Leopold's. Art brought his own land ethic to endeavors at Amelia Lake, where he recorded data and documented observations, providing a record that continues to shape our understanding of the local area today.

People living on the lake help managers to understand changes through time and current conditions. A note from Amy Donlin, Art and Betty Hawkins' daughter and a current landowner in the MLT easement area, provides a glimpse into a summer morning on the lake:

Figure 3: Photo of Amelia Lake, from the VLAWMO website



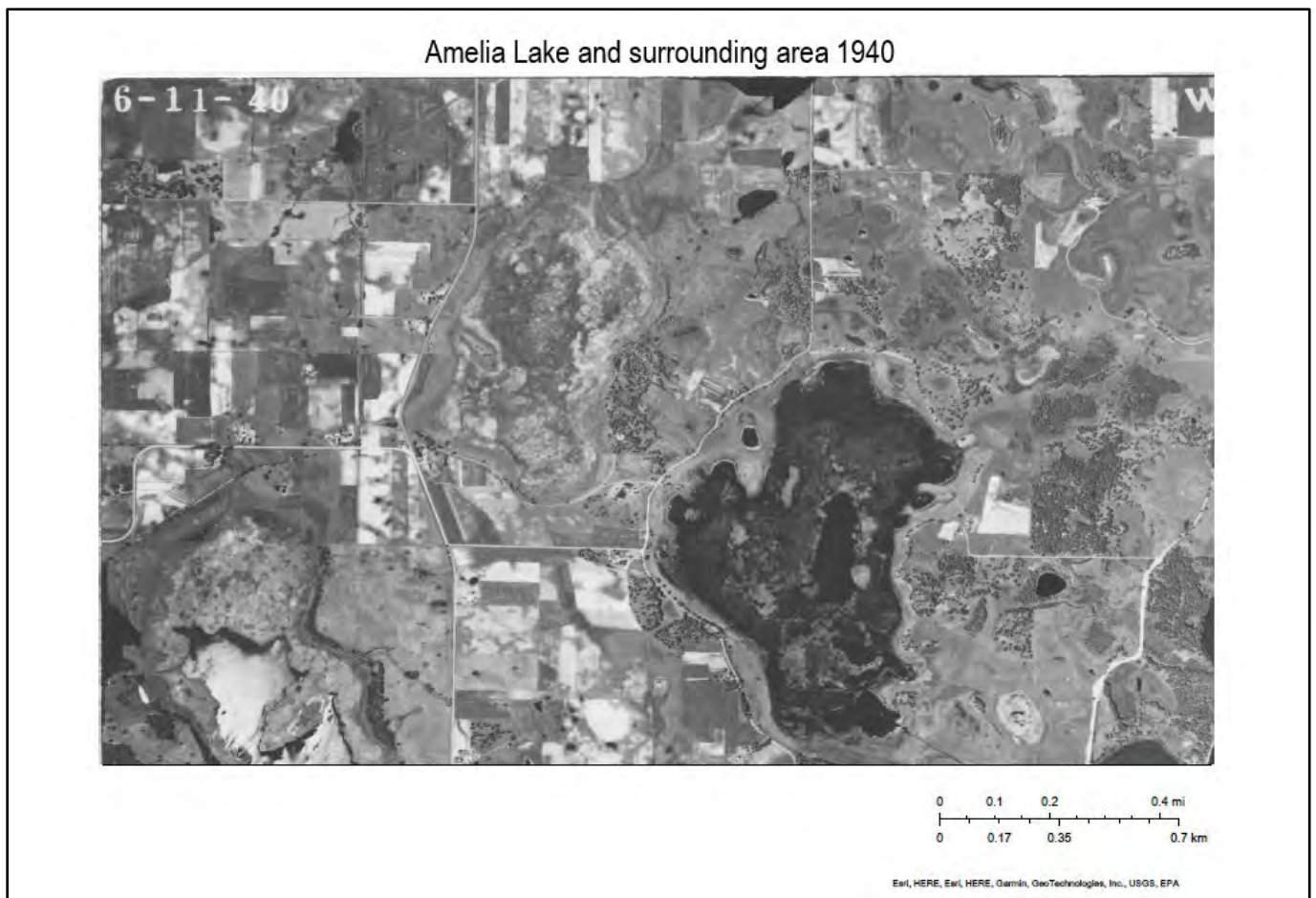
Good morning from the farm!

It's 72 and sunny, soft breeze, azure sky and a flush of green after last week's gift of rain. Loon tremolos and yodels lulled me to sleep last night, and this morning our 6 trumpeter signets (there were 7 to start with) are bookended by their elegant parents while the ospreys peacefully feed 3 young on the south tower. Mama turkey strolls through with 3 half-grown chicks, and I can hear cranes somewhere northwest of here. Dad and mum would be so pleased by it all; the ecological successes brought on by restoration and clean water—and tickled to see little families of ducks and geese in flight, trying out their new skills, and the evening pilgrimage of hundreds of gulls heading NW directly over the Marsh... a sunset ritual, presumably to the Centerville chain of lakes... We can set our watches by them!

-Amy Donlin, July 30, 2022

2 WATERSHED FEATURES

Figure 4: 1940 aerial photo of Amelia Lake

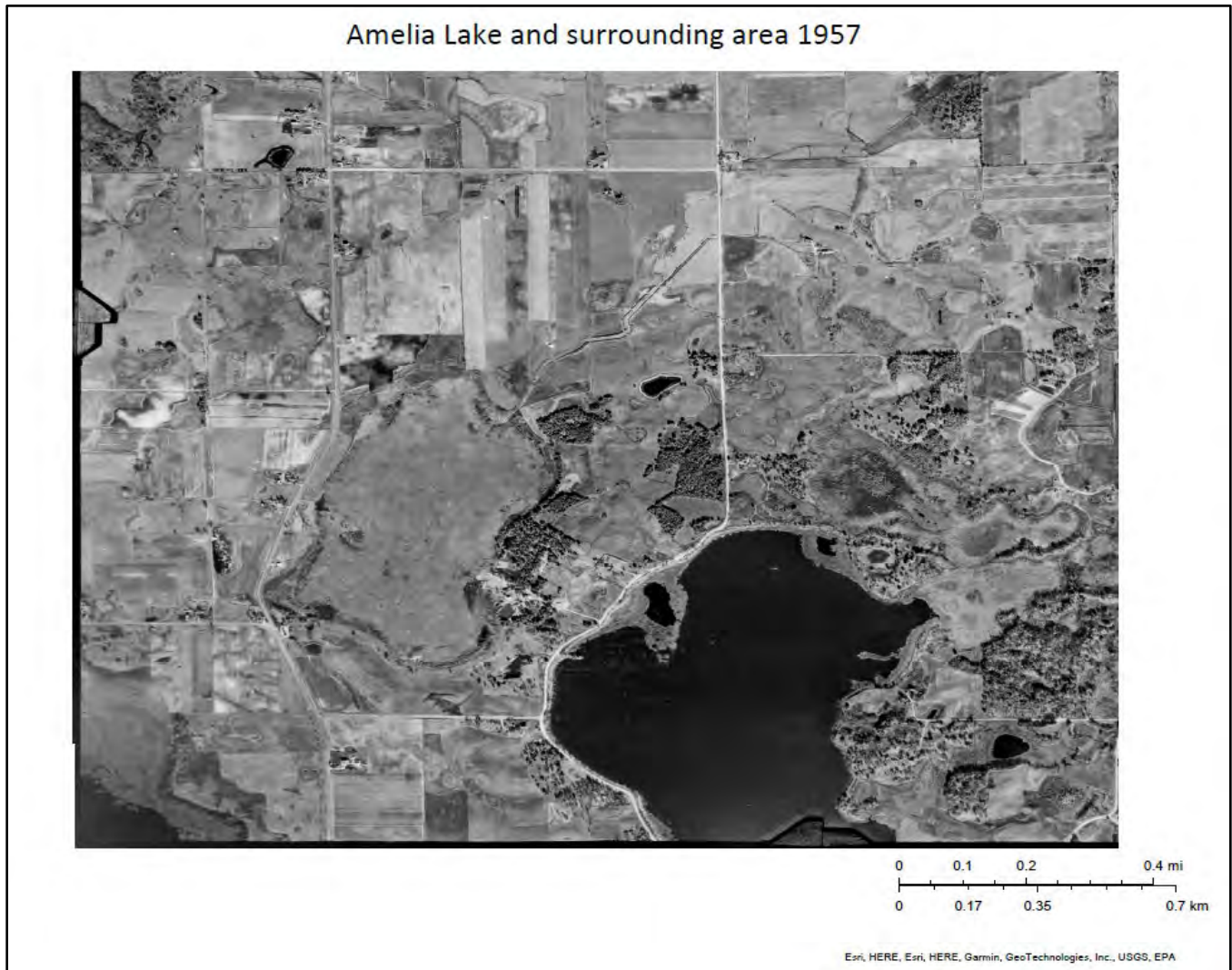


In 1940, the Amelia Lake basin contained thick wetland vegetation and dryer areas, due to draining that occurred decades earlier. It was used for hay harvest by local farmers. This use was possible because, in the early 1900s, an illegal ditch was put in to the west to drain the lake and make it suitable for agriculture.

Prior to early development, Amelia supported wild rice stands and was surrounded by a broader landscape composed of oak savanna, mixed woodland, and prairie.

2 WATERSHED FEATURES

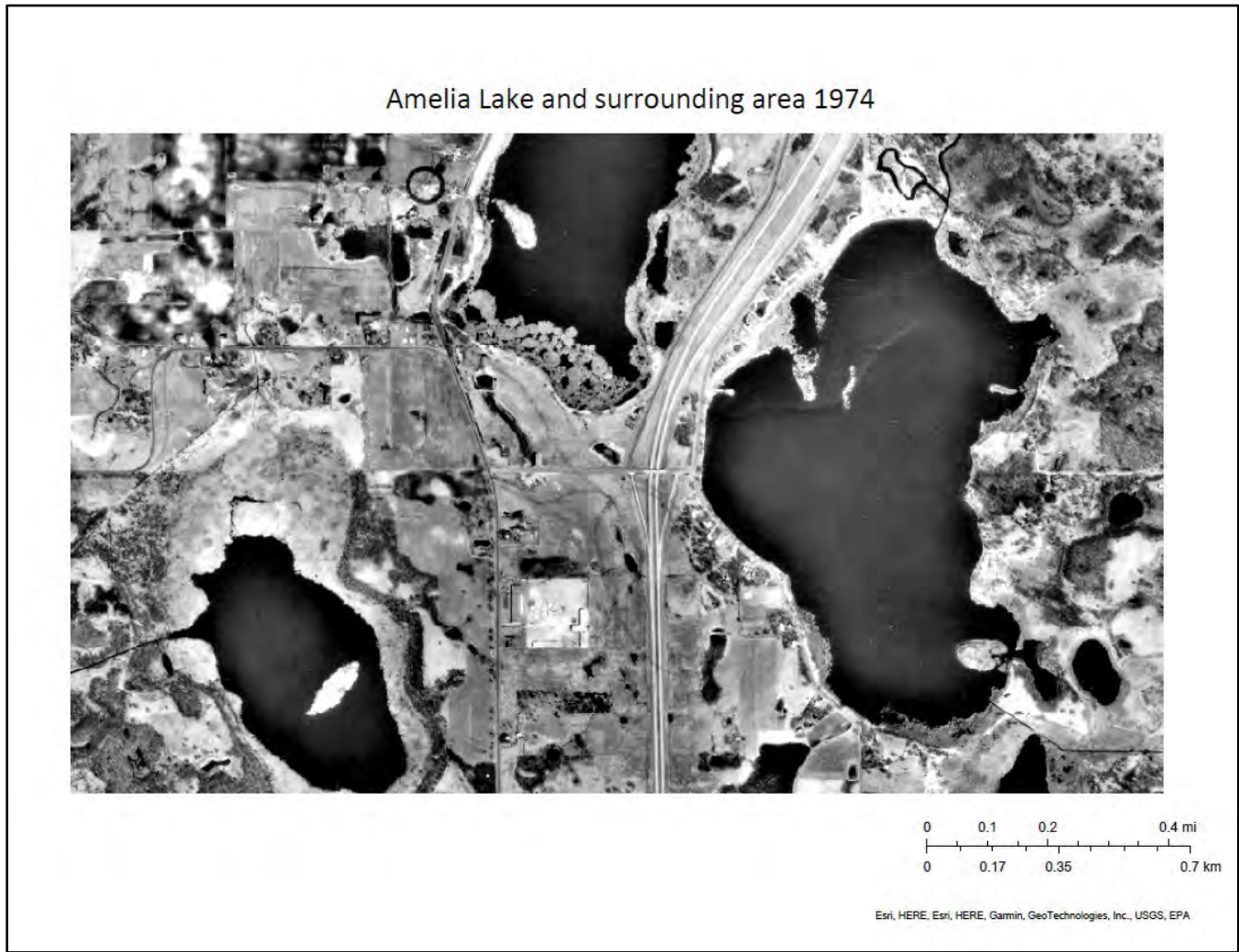
Figure 5: 1957 aerial photo of Amelia Lake



In 1957, the ditched area had not yet been addressed. A mix of wetland vegetation and agricultural haying was still present. In the 1940s and 1950s, a gravel mining operation was active on the east side of the lake. This mining operation has had lasting effects. In the area where mining was conducted, the deepest water levels are still found today. This pool was excavated as part of the mining operation. In the 1950s and beyond, the gravel-pit area was a known party spot for locals. It is rumored that large trash, even possibly vehicles, might have been deposited into the pool. The extent of this lore is not known by VLAWMO staff.

2 WATERSHED FEATURES

Figure 6: 1974 aerial photo of Amelia Lake



By 1974, the lake water levels were being restored. In the gap between the previous image from 1953 and this one, two efforts occurred. In 1954, the Hawkins family requested that the Minnesota Conservation Department (now MN DNR) plug the ditch. A plan to address the ditch and restore the lake was approved. However, in 1956, before approved plans could be completed, St. Paul Regional Water Services' water supply redirection was begun. During that time, the aqueduct running from Centerville Lake was closed, and the water supply was rerouted from the Mississippi River (through the chain of lakes in North Oaks to East Vadnais Lake), as is currently the case today. That change allowed the Amelia basin to refill without reworking the ditch. The road network was also substantially increased since the previous image, including the addition of Highway 35E. The addition of 35E increased the rate of development of the local area and broader surrounding areas.

2 WATERSHED FEATURES

Figure 7: 2006 aerial photo of Amelia Lake



By 2006, increased development in the area is visible, along with continued upgrades and additions to the road network. Residential development around the lake consists primarily of low-density, larger lot residential properties. Prior to this image, two major proposals were unsuccessful that could have dramatically changed the conditions of the lake. One of those was a proposal by the Metro Sanitation Department to use the old gravel-pit land to the east of the lake as a landfill. Neighbors and SPRWS provided evidence of potential threats of this activity to the drinking water resource, and the proposal was not pursued further. In the late 1980s, a proposal for high-density development was also put forward for this same area. That was also not successful. High-quality wetlands and a small prairie remnant are still present in this area today.

2 WATERSHED FEATURES

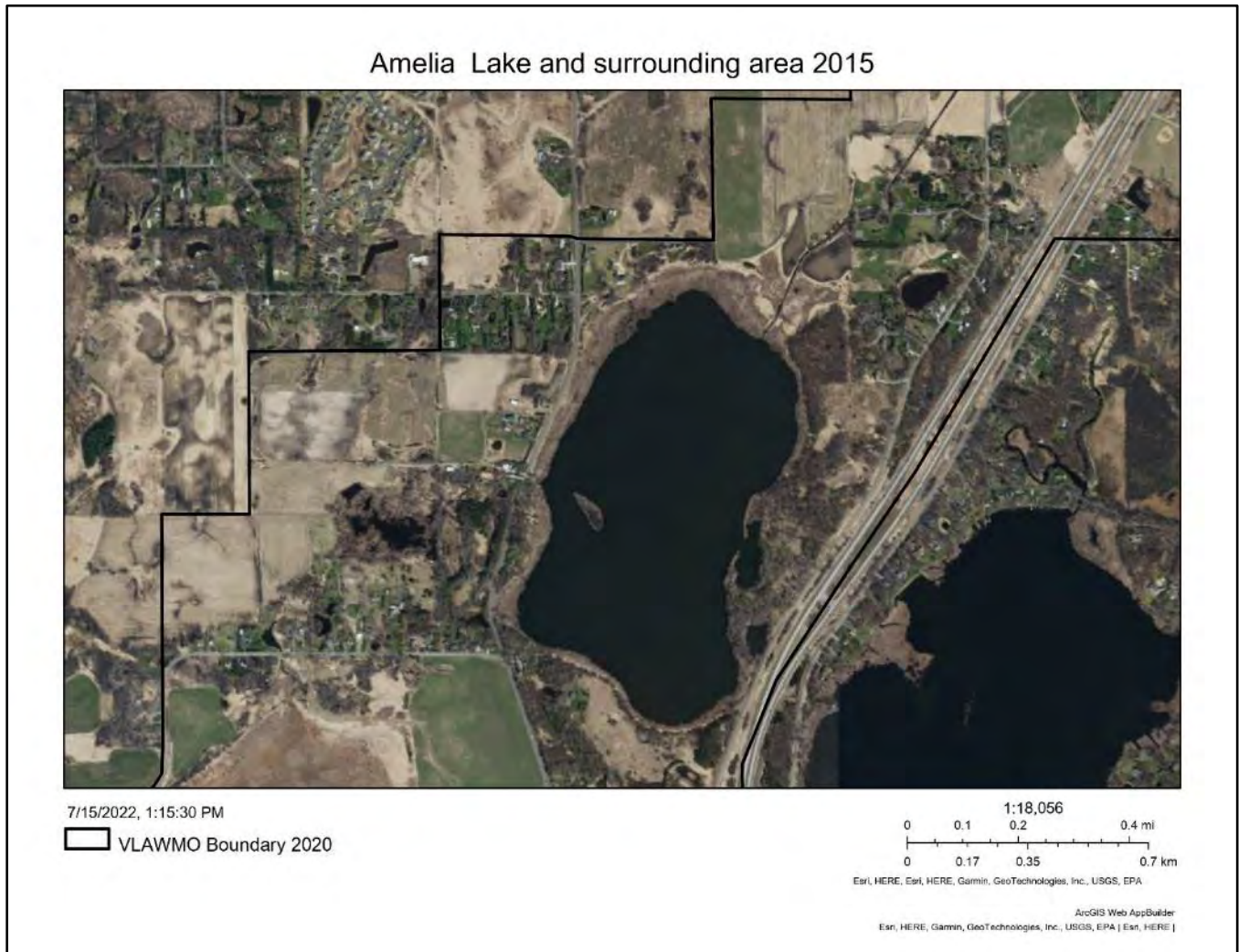
Figure 8. 2008 aerial photo of Amelia Lake



In 2008, agricultural fields and low-density residential development are dominant land cover types.

2 WATERSHED FEATURES

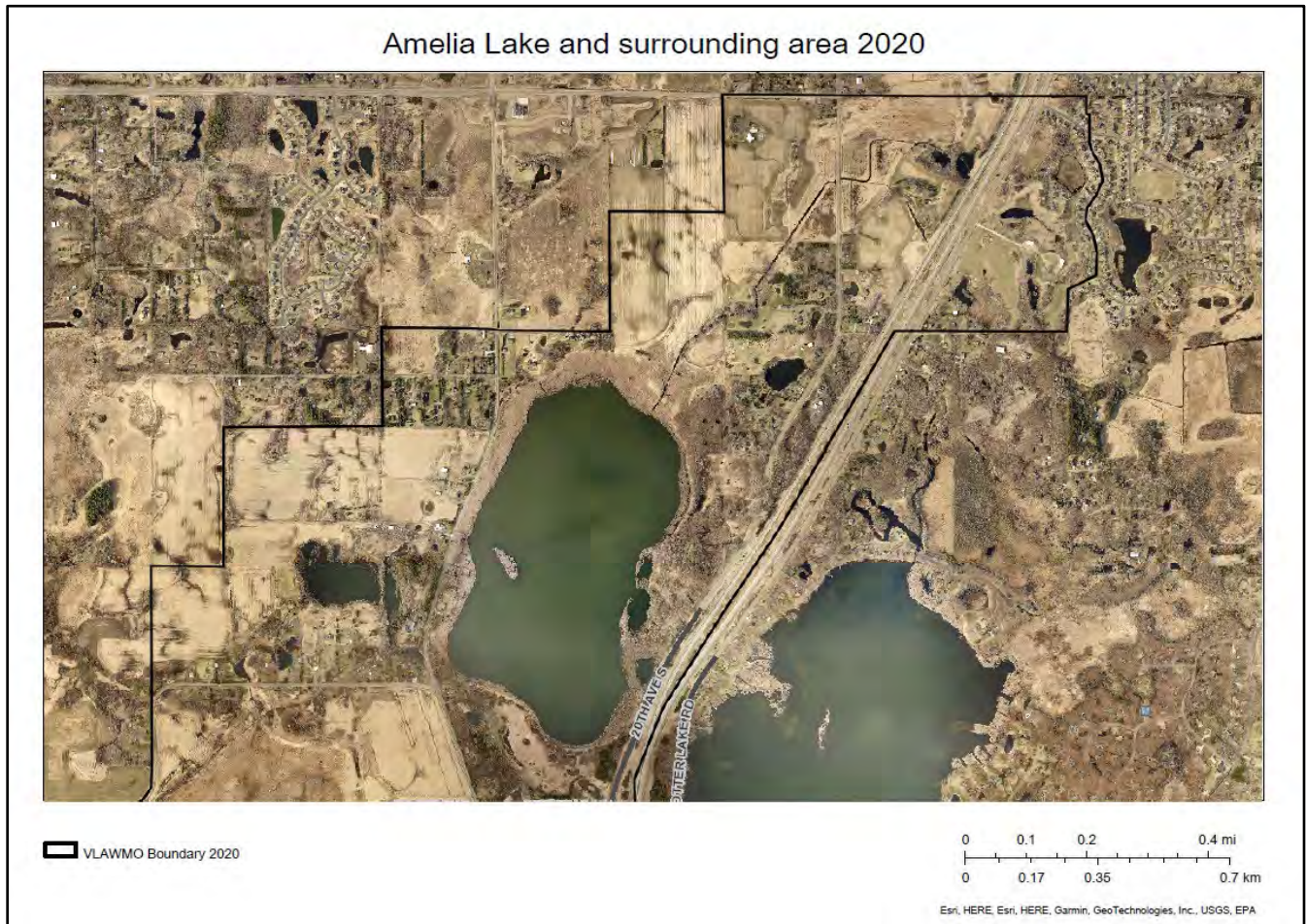
Figure 9: 2015 aerial photo of Amelia Lake



By 2015, more homes had been added, especially to the northeast side of the lake. The eastern area was not developed. Multiple proposals were considered for the area over time. Possible wetland impacts remained an important consideration for these projects.

2 WATERSHED FEATURES

Figure 10. 2020 aerial photo of Amelia Lake



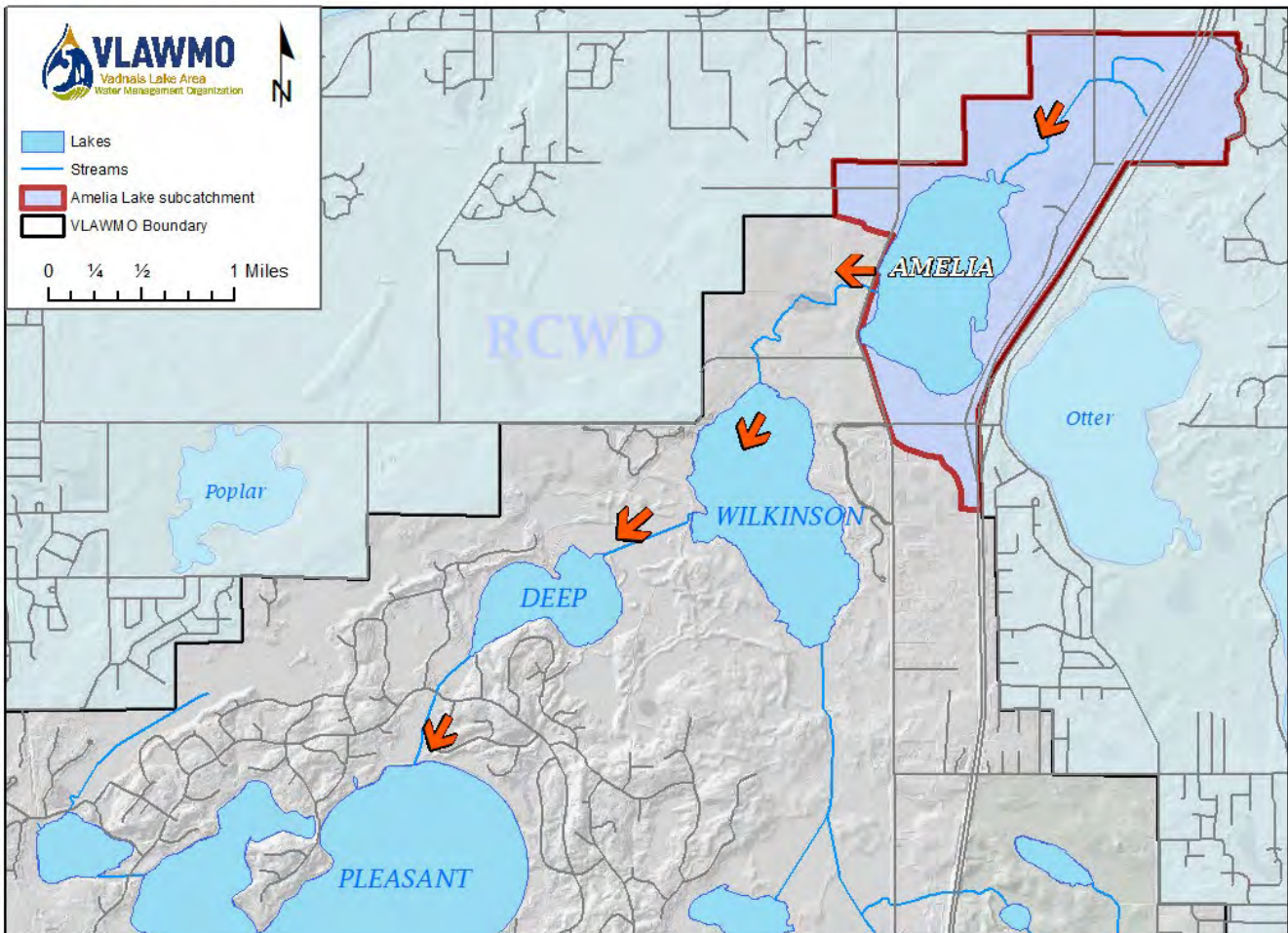
In 2020, road traffic continued to increase. In 2022/2023, County J was scheduled for reconstruction. Low-density residential development was going forward in the area to the east of the lake. Wetland delineations and inventories were completed to identify wetland boundaries, potentially fragile plant-community areas, and a remnant prairie ridge that should be protected during construction.

2 WATERSHED FEATURES

2.2 AMELIA LAKE DRAINAGE AREA

Amelia Lake has a surface area of 127 acres and a contributing subwatershed area of 691 acres. The subwatershed area is shown below, shaded in purple and outlined in red. The north and east sides of the subwatershed are outside of VLAWMO in the Rice Creek Watershed District (RCWD) boundary. Drainage in Amelia Lake flows south into Wilkinson Lake in North Oaks and continues south to ultimately reach East Vadnais Lake.

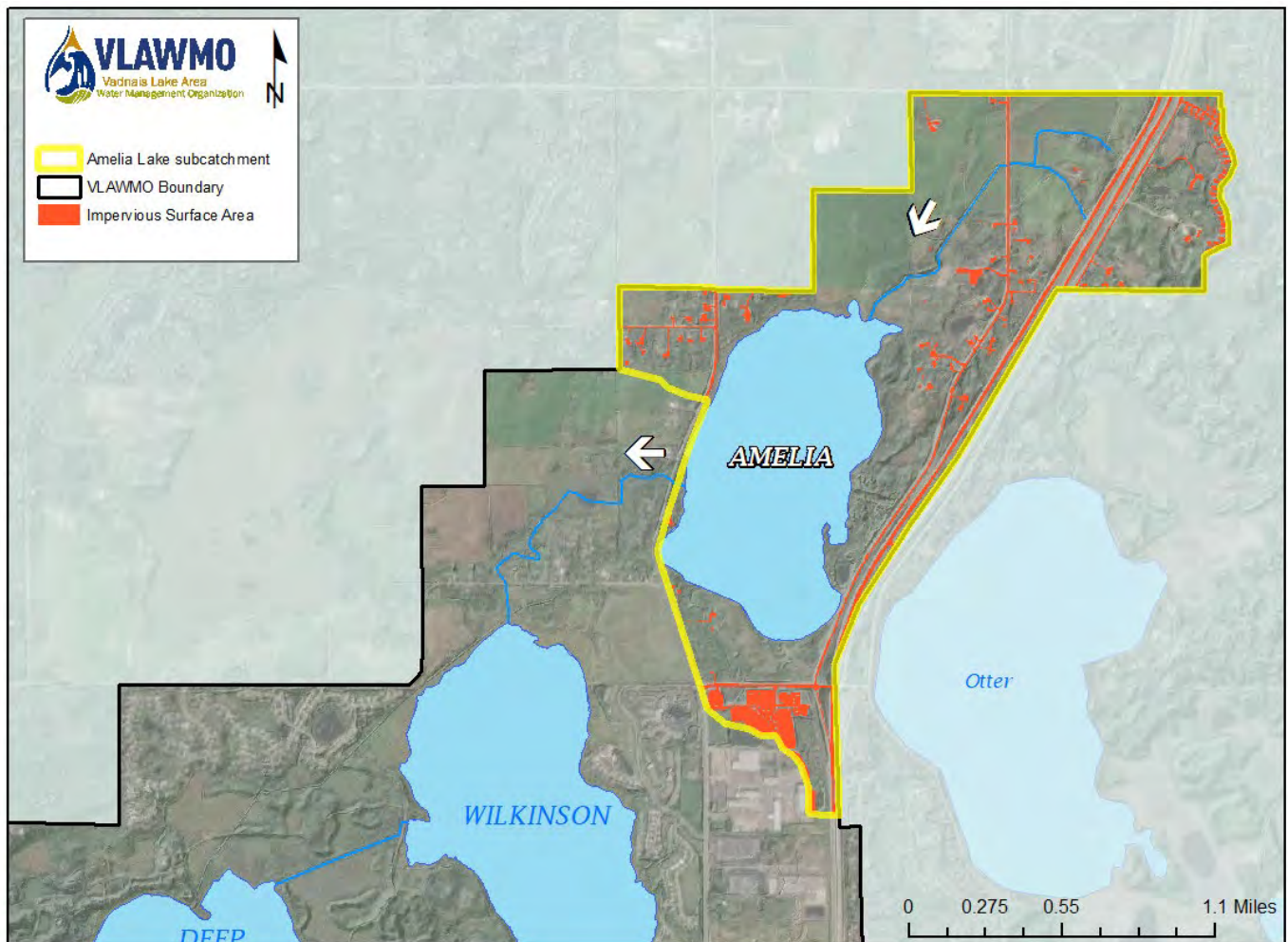
Figure 11: Amelia Lake drainage area and flow patterns



2 WATERSHED FEATURES

A low amount of land cover in the Amelia Lake subwatershed is developed. A majority of land cover is undeveloped space and agricultural land. Impervious surfaces make up about 54 acres of total land area (8%) within the Amelia Lake subwatershed, including water surface area and terrestrial surface area. Not including Amelia Lake's surface water area, impervious surface area comprises 9.5% of the 564 acres of terrestrial land cover. The majority of precipitation that falls on these impervious surfaces moves rapidly into the downstream wetlands and Amelia Lake instead of soaking into the ground.

Figure 12: Impervious surfaces in Amelia Lake drainage area

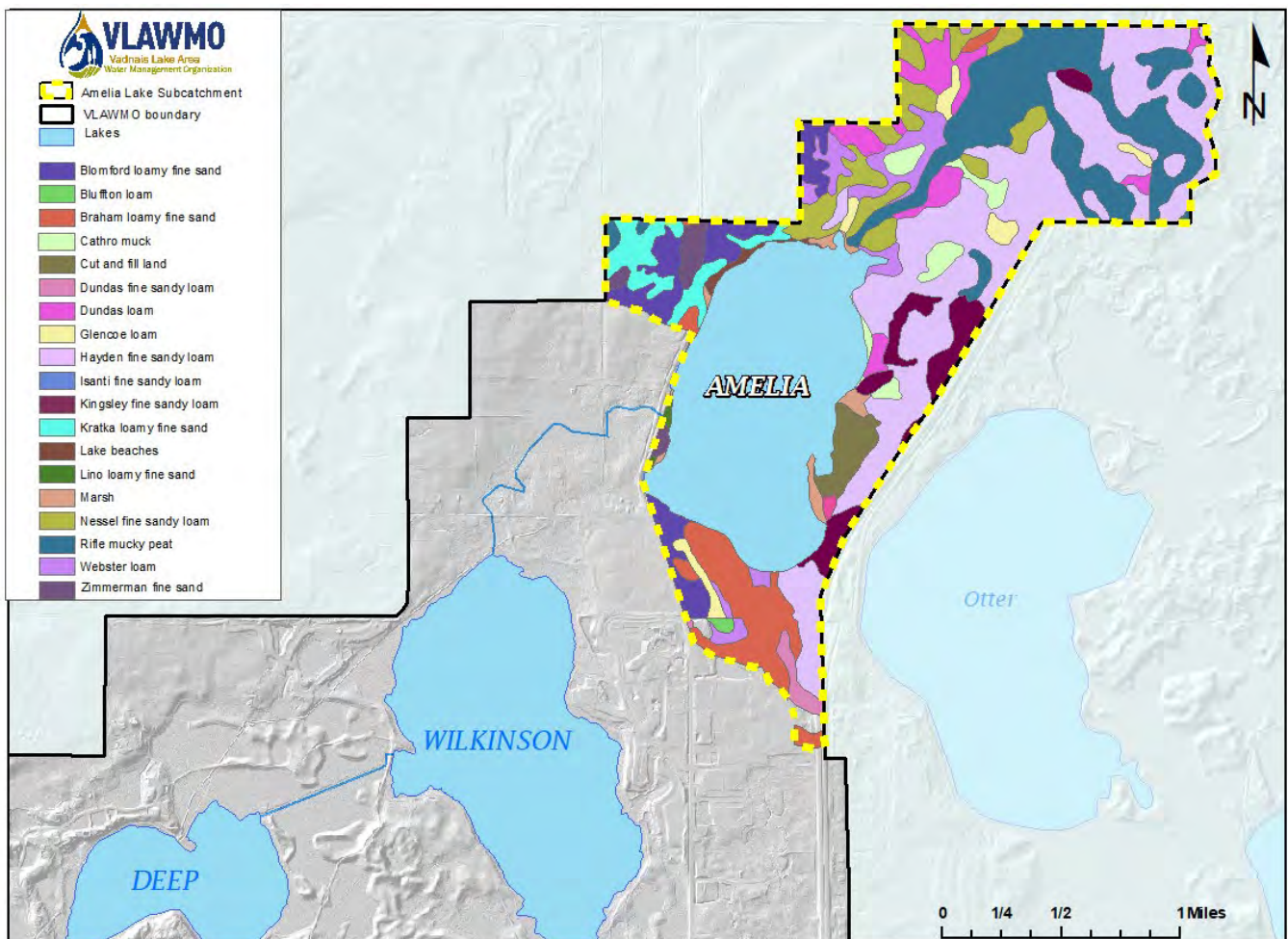


2 WATERSHED FEATURES

2.3 AMELIA LAKE SOILS

Soils in the Amelia Lake subwatershed drainage area are comprised of loams, loamy fine sands, fine sandy loams, and muck/marshland soils. Over half of the area on the northeast side are fine sandy loam soils. Fine sandy loam soils are deep and well-drained. These soils allow precipitation and water runoff to soak into the ground relatively quickly. They were formed from moraines and till left from receding glaciers. They are classified as moderate-to-average permeable soils. Unlike urban soils and muck/marshland soils with limited permeability, fine sandy loam soils allow precipitation to enter the ground more readily, to reach the water table and recharge shallow groundwater. A medium amount of runoff still occurs, especially with significant precipitation events, which is diverted into nearby waterbodies.

Figure 13: Amelia Lake area soils



2 WATERSHED FEATURES

2.4 AMELIA LAKE WETLANDS, RARE PLANTS, AND INVASIVE SPECIES

Amelia Lake is very shallow and has historically been, at times, fully covered by cattails and other vegetation. As of the lake survey that was conducted in 2021, the average depth in the main basin of the lake, excluding the deep hole that remains from the gravel mining operation, was only 2.3 feet. The lake itself has large, floating mats of vegetation that often break off and relocate themselves in new areas around the lake (Figure 14).

A rare plant that is widely present along the shoreline of the lake is Swamp loosestrife/Water willow (*Decodon verticillatus*) (Figure 15). This plant should be protected where possible.

Invasive species found in the area include Purple loosestrife (*Lythrum salicaria*), Flowering rush (*Butomus umbellatus*), and Narrowleaf (*Typha angustifolia*) and Hybrid (*Typha x glauca*) cattail. Purple loosestrife plants frequently show evidence of beetle damage. Likely, beetles introduced widely in the state of Minnesota for Purple loosestrife control are reducing the extent of this invasive species on the lakeshore. Flowering rush was identified in the 1960s and 1990s in the basin of Amelia Lake. Follow-up checks by VLAWMO staff and Ramsey County Soil and Water Conservation Division (RCSWCD) have not detected it on the lake in recent years. However, a fairly large (0.2-0.3-acre) infestation of Flowering rush was located and reported to EDDMapS in 2022 (Figure 16). Treatment of that infestation is currently being planned by RCSWCD, in coordination with Anoka Conservation District, VLAWMO, and the local landowners.

Figure 14: Example of a floating mat of vegetation in Amelia Lake from 2021. The photo was taken when large wild fires were burning in other parts of the country, which resulted in the visible haze.

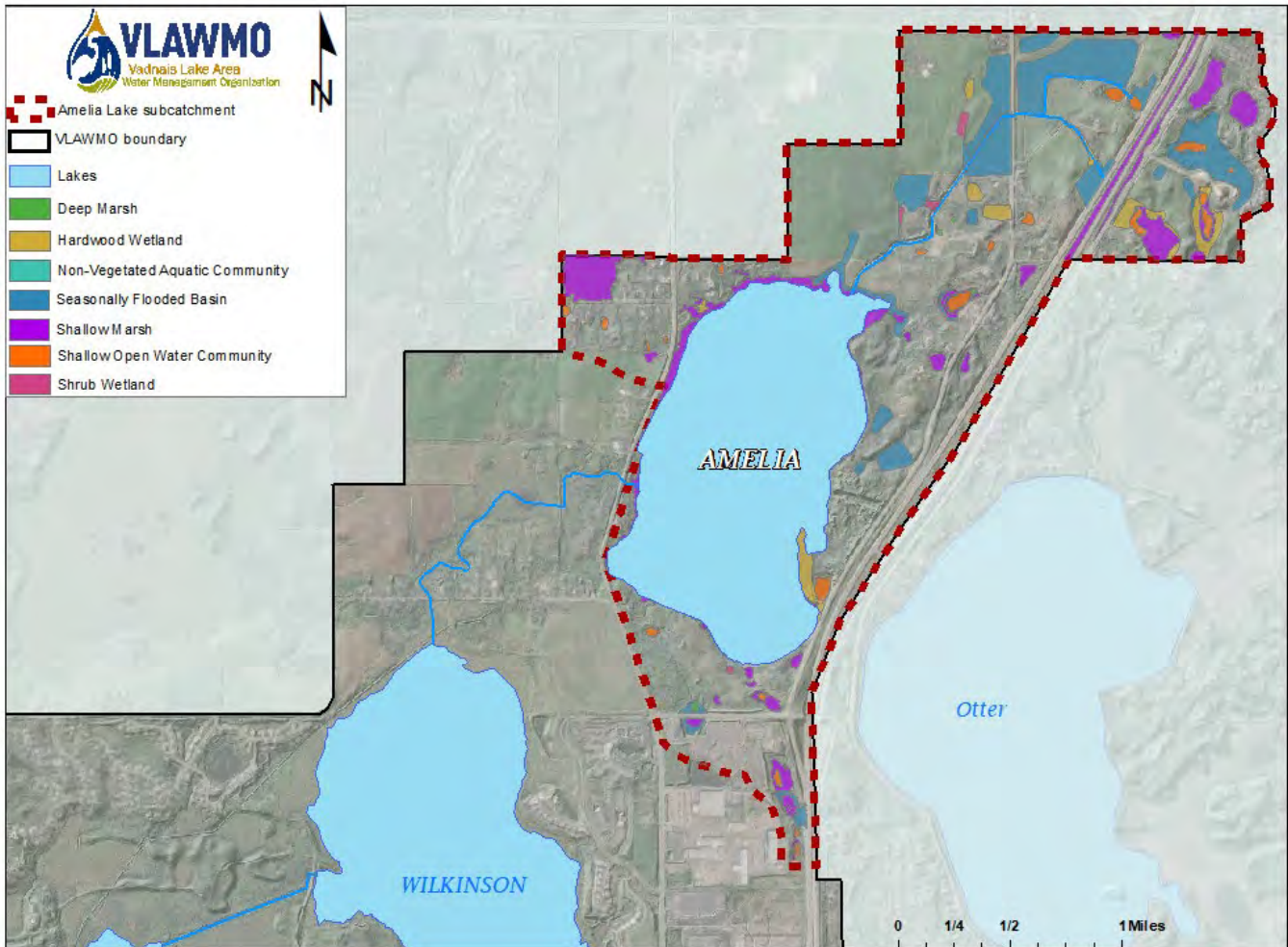


2 WATERSHED FEATURES

Wetlands

Wetland areas are abundant in and around Amelia Lake. The National Wetland Inventory (2015) shows delineated areas (Figure 15). More detail is also available as part of the wetland delineation that was done for a current construction project on the east side of the lake.

Figure 15: National Wetland Inventory (2015) Wetland areas in and around Amelia Lake, Circular 39 Classification System.



2 WATERSHED FEATURES

Rare plants

Figure 16: Swamp loosestrife (*Decodon verticillatus*) on Amelia Lake

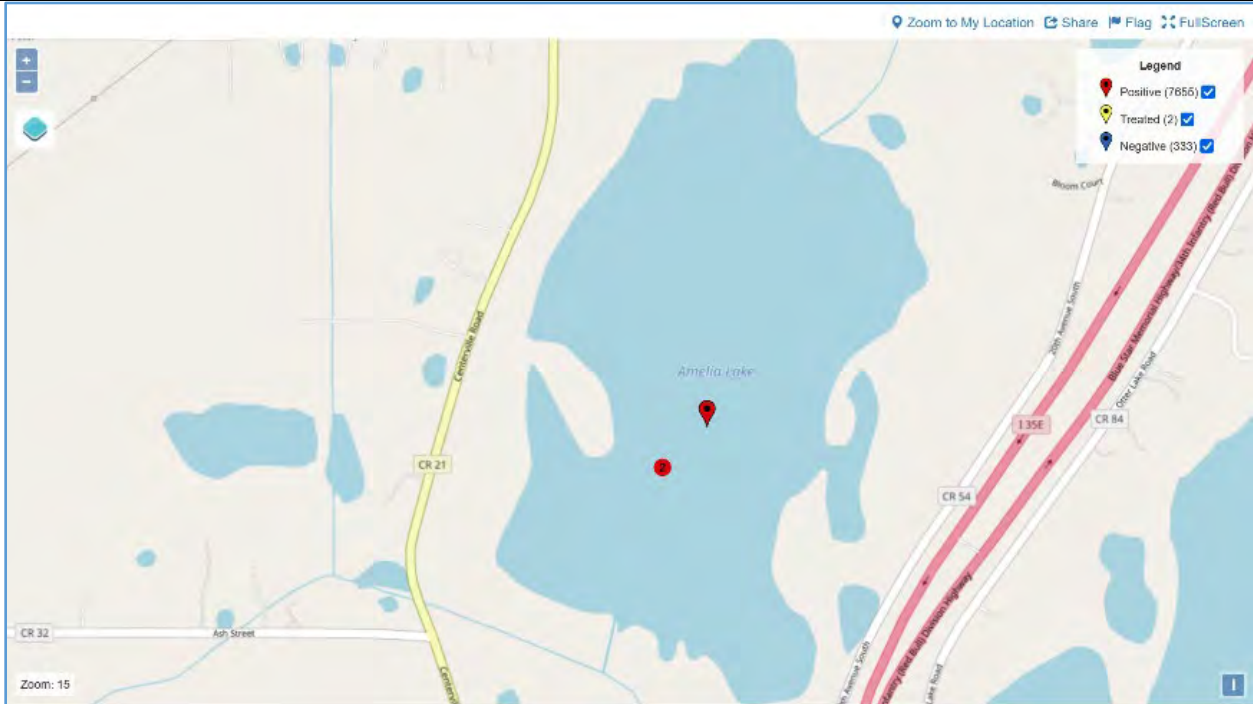


2 WATERSHED FEATURES

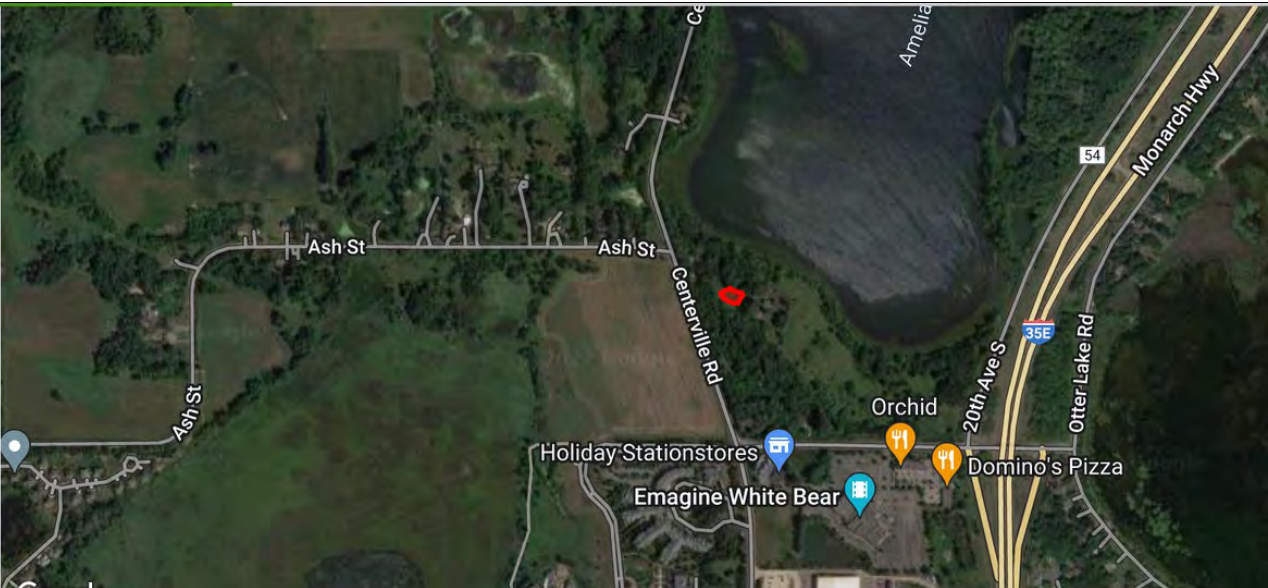
Invasive species

Figure 17: Flowering rush on Amelia from EddMapS

Downloaded on July 15, 2022: Lake points were recorded by USGS (1968), MN DNR (1968), and MN DNR (1995). These points have been checked by VLAWMO and RCSWCD staff in 2021 and 2022. A current infestation in the lake has not been detected.



Downloaded on August 29, 2022: A wetland area with a Flowering rush infestation was identified by VLAWMO staff in 2022. The polygon is shown below. This was reported to EDDMapS by VLAWMO staff. The infestation covers 0.2-0.3 acres.



2 WATERSHED FEATURES

Flowering rush close-up for ID



Extent of infestation



3.1 AMELIA LAKE DEPTH

MN DNR has baseline depth information available from historical monitoring. Amelia's Lake ID number is 02001400. This information was obtained from the MN DNR Lake Finder website.

Water Level Data was checked 5 times between 11/08/1940 to 1/28/2013:

Highest recorded: 909 ft (5/22/1986)

Highest known: 911.9 ft (1965)

Lowest recorded: 900.98 ft (11/08/1940)

Recorded range: 8.02 ft

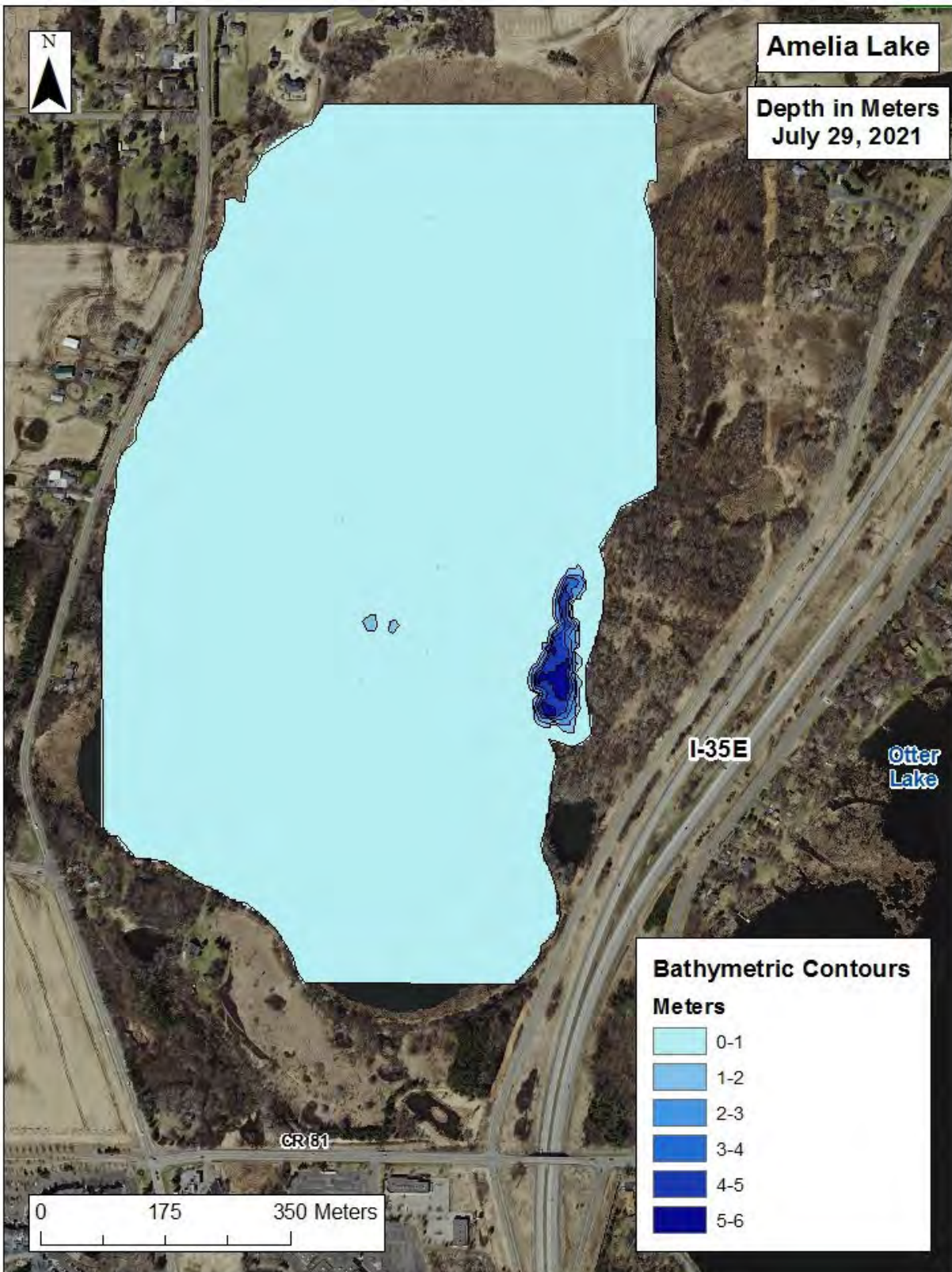
Last reading: 906.5 ft (1/28/2013)

Ordinary High Water Level (OHW) elevation: 908.1 ft

A bathymetry survey was completed by RCSWCD on July 29, 2021, to develop a map of the bottom and determine lake depths. The deepest location detected by sonar was 6.3 m (20.7 ft) in a hole on the eastern side of the lake, and the average was 0.7m (2.3 ft). The lake overall was quite uniform in depth and very shallow, with the exception of the hole on the eastern side of the lake. 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. Amelia has a primarily medium lake bottom.

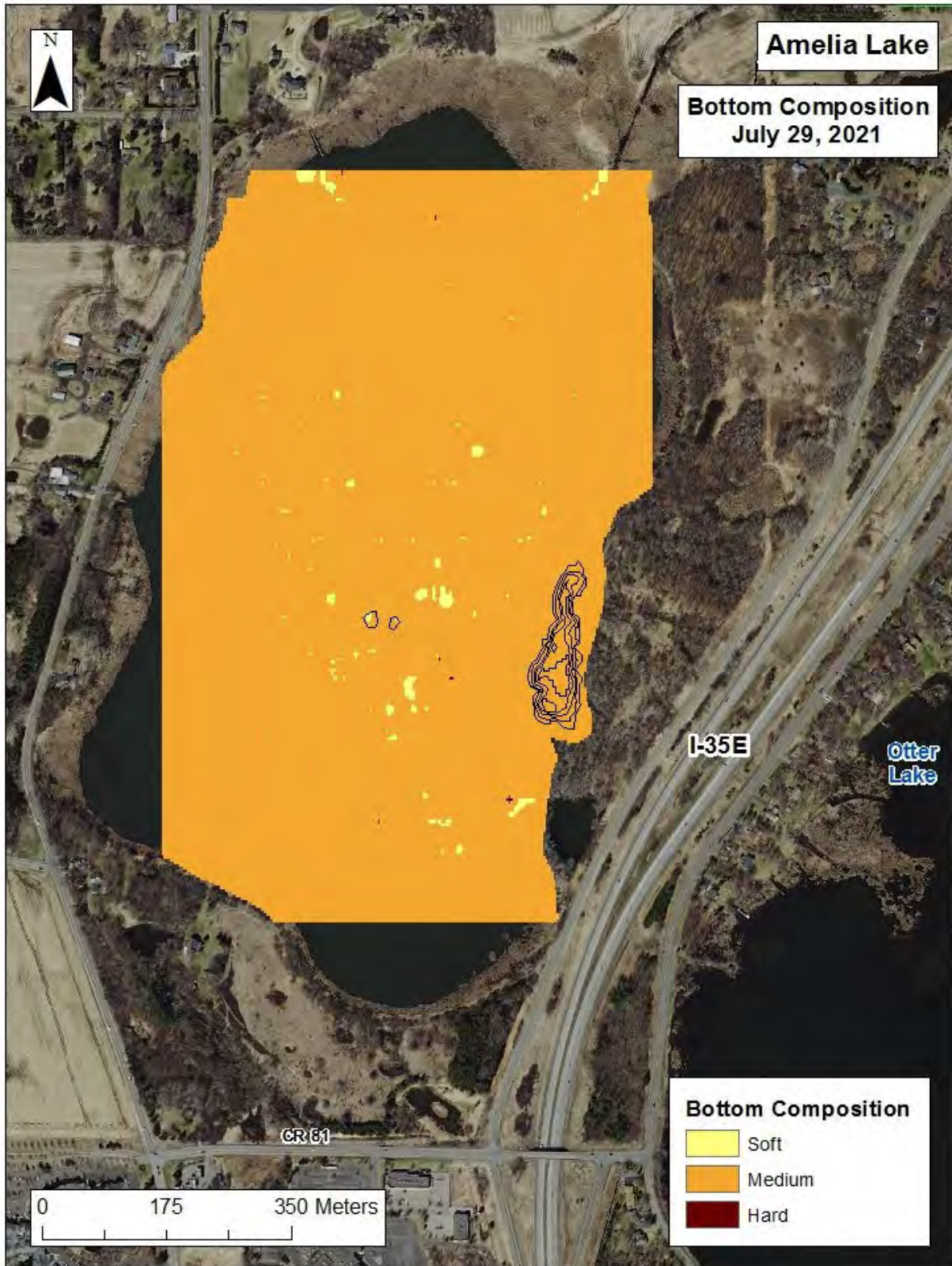
3 LAKE FEATURES

Figure 18: Amelia Lake depths with 1-meter contours



3 LAKE FEATURES

Figure 19: Amelia Lake bottom hardness



3.2 AMELIA LAKE BIOVOLUME AND AQUATIC VEGETATION

Biovolume and Aquatic Vegetation

RCSWCD conducted a biovolume and aquatic vegetation survey on July 29, 2021, in Amelia Lake. Biovolume measures the density of plant life within the lake. Blue signifies 0% plant life, and red signifies 100% plant life. At depths greater than 4-6 feet, there is commonly no plant life in Minnesota lakes. Plant growth is limited because the sun does not penetrate the water column below those depths enough to allow photosynthesis to occur.

For the aquatic macrophyte survey, 90 evenly spaced (40 m) georeferenced points were surveyed using the metal portion of a rake/tines tied to a rope. Aquatic macrophytes were found at 88 of 90 points surveyed. The two most common species observed were Flat-stem pondweed (*Potamogeton zosteriformis*) and N. mucronata (*Nitella mucronata*). Other species observed included Canada waterweed (*Elodea canadensis*), Coontail (*Ceratophyllum demersum*), Eurasian watermilfoil (*Myriophyllum spicatum*), Filamentous algae (*Spirogyra/Cladophora spp.*), Muskgrass (*Chara spp.*), Sago pondweed (*Stuckenia pectinata*), and Slender naiad (*Najas flexilis*). Although not collected on the rake, field staff observed Northern watermilfoil in the northern and southern areas of the lake.

Figure 20: Macrophyte sampling with RCSWCD and VLAWMO staff. Note the hazy sky is because major fires were burning in other parts of the country at the time

<p>Boat, supplies, and shoreline vegetation</p>	<p>The sampling rake with a high amount of <i>Chara</i>, which is dominant in some parts of the lake</p>	<p>The survey was conducted at a time of low water. The shoreline is visible with arrowhead and Swamp loosestrife in the foreground and invasive Purple loosestrife in the background</p>
		

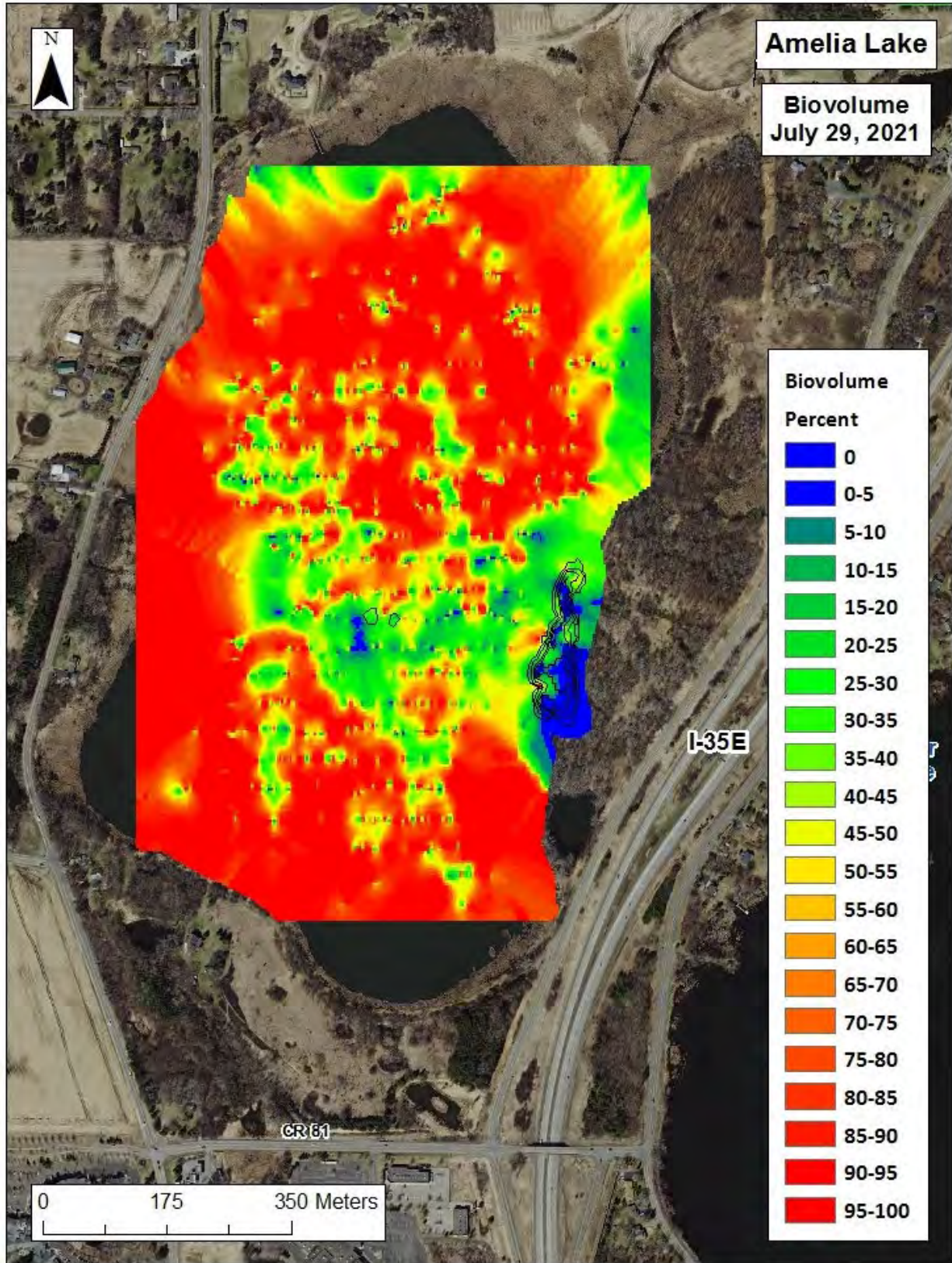
3 LAKE FEATURES

Figure 21: Amelia Lake survey points with depth



3 LAKE FEATURES

Figure 22: Amelia Lake biovolume



3.3 WILDLIFE MONITORING AND BIOLOGICAL SIGNIFICANCE DESIGNATION

Wildlife Monitoring

Wildlife monitoring has been conducted in the shoreline area next to Amelia Lake through:

1. Frog and toad call surveys
2. Remote-camera monitoring
3. Biological Significance designation by the MN DNR

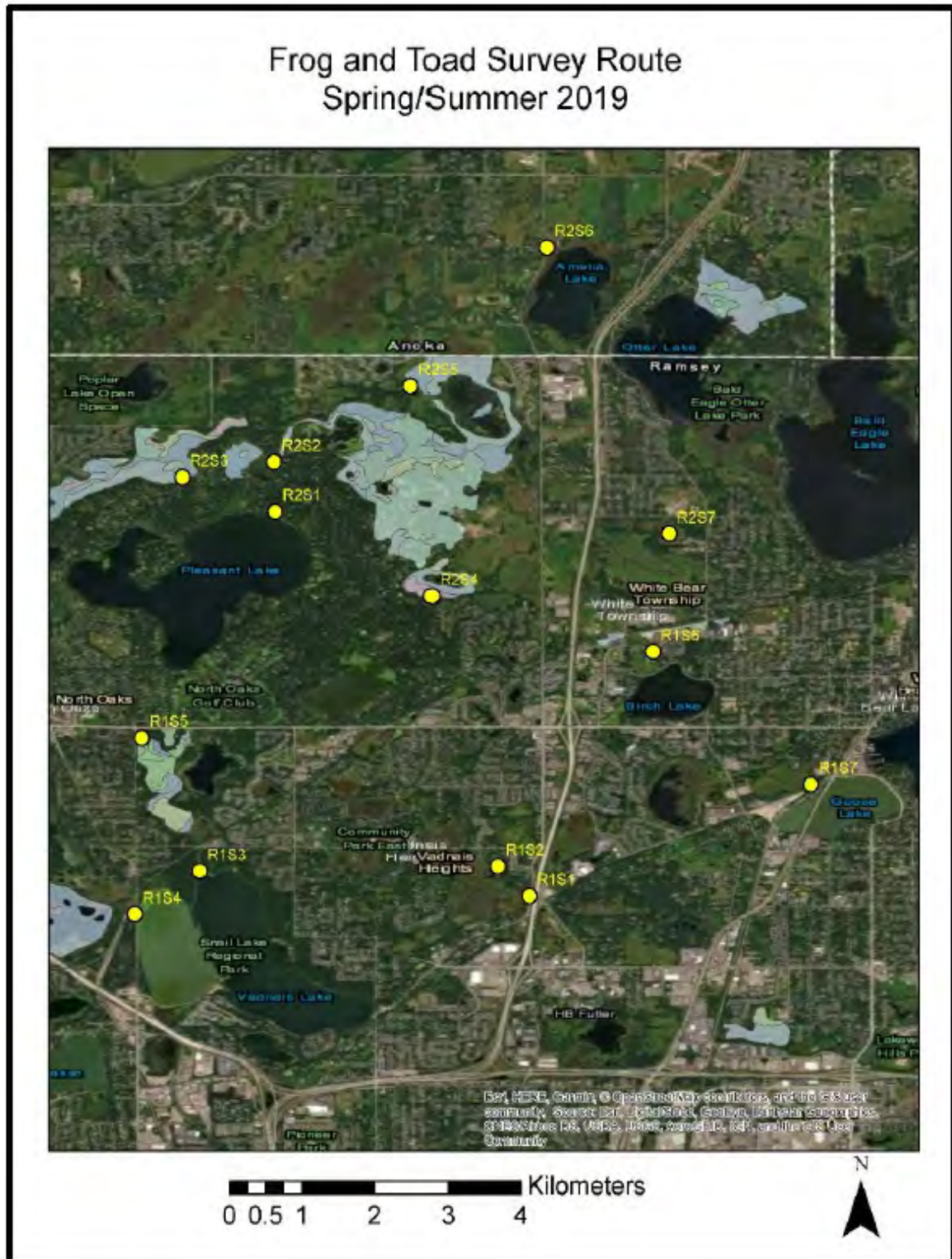
Each of these techniques and relevant results within the park are described in this section. Full information and reports are available that include more detailed information on the VLAWMO website and through the MN DNR LakeFinder and GIS data online tools.

1. Frog and Toad Call Surveys

During 2019-2020, VLAWMO conducted frog and toad call surveys in representative locations throughout the watershed. Amelia Lake had a medium diversity of frogs and toads compared to other sampled locations in the watershed. Eight species were detected in the watershed with 5 species detected at Amelia Lake. Species included Wood frogs, Boreal chorus frogs, American toads, Gray tree frogs, and Cope's gray tree frogs. A full report from these surveys is available on the VLAWMO [website](#) and as a [StoryMap](#).

3 LAKE FEATURES

Figure 23: Frog and toad call sampling locations watershed-wide



3 LAKE FEATURES

2. Remote-camera Monitoring

During 2018-2020, VLAWMO conducted remote-camera monitoring in representative locations throughout the watershed. The Amelia Lake remote cameras had avian visitors to the cameras that included Great blue herons and Sandhill cranes. Mammals included Beaver, Mink, Muskrat, and Raccoon. The full [remote-camera monitoring report](#) and the [remote camera StoryMap](#) are available on the website.

Table 1: An excerpt from a summary table in the remote-camera monitoring report that shows monitoring at Amelia Lake

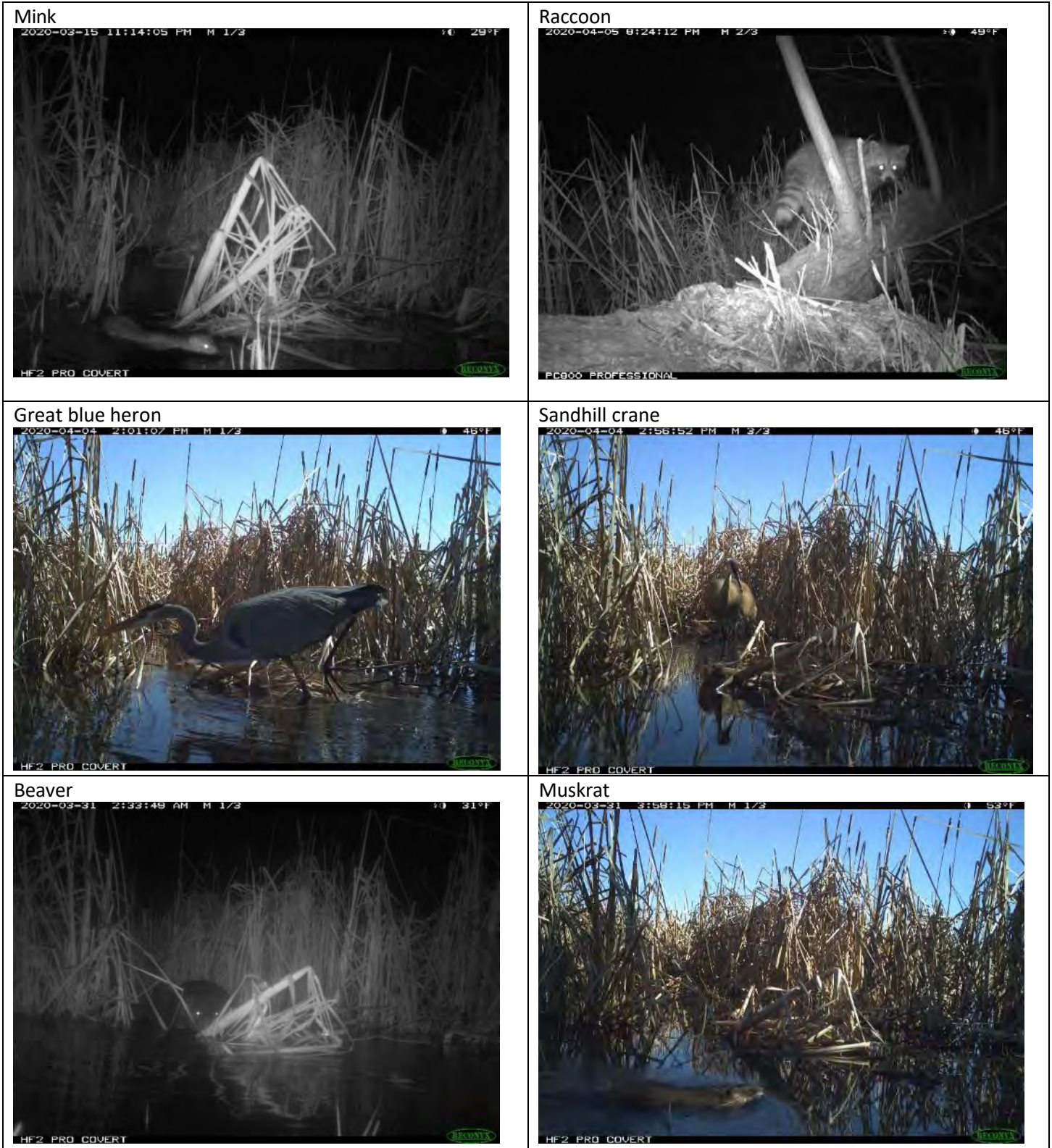
Site	Locations	Total cameras	Dates	Weeks	Trapnights
Amelia Lake	3	3	March 13-April 7, 2020	~4	75

Figure 24: Remote-camera monitoring locations watershed-wide



3 LAKE FEATURES

Figure 25: Photos from remote cameras at Amelia Lake



3. Biological Significance Designation

The designation for Lakes of Biological Significance means that these lakes have been selected by the Minnesota Department of Natural Resources (MN DNR) based on the presence of unique plant or animal communities (including aquatic plants, fish, birds, and amphibians). They are divided into 3 classes (outstanding, high, or moderate) based on biological significance. This list of high quality lakes based on dedicated biological sampling can be used to focus protection efforts.

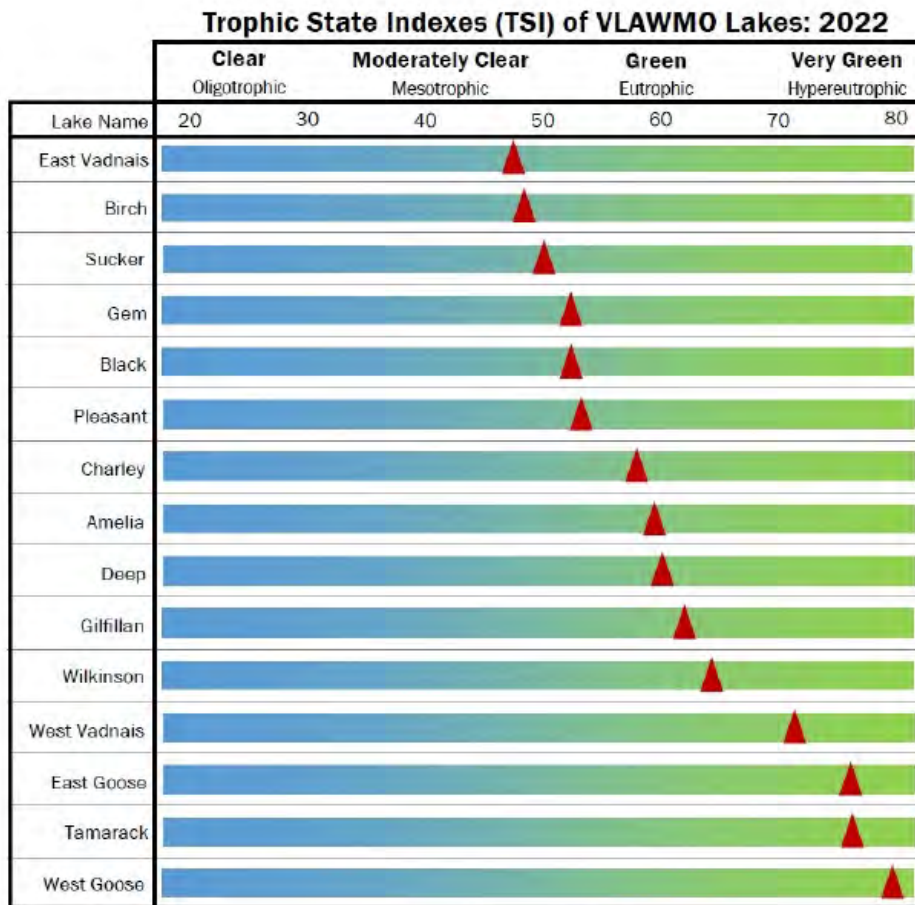
The list and data layer, available from the MN DNR, is updated every 5 years. The last update occurred in 2020. Amelia is listed as “high” for its biological significance value.

3 LAKE FEATURES

3.4 WATER QUALITY SUMMARY

Amelia Lake is shallow and falls in the area of green/eutrophic on the Carlson Scale Trophic State Index (TSI) (shown below). Amelia Lake had a score of 59 in 2022, up from 58 in 2021. Note: A higher number corresponds to poorer water quality, but trends are not detectable from a small sample of only a couple to a few years. Trends should be based on a larger, continuous dataset of approximately 10 years, as recommended by the MPCA. More information can be found in the annual VLAWMO Monitoring Report.

Figure 26: TSI scores for VLAWMO lakes



VLAWMO has collected water quality (WQ) data on Amelia Lake since 1997. VLAWMO staff collects WQ data and water samples biweekly, May-September, for water clarity (secchi disk), nutrients (TP, Chl-a, SRP, nitrogen), and chemistry (temperature, conductivity, dissolved oxygen, and potential hydrogen [pH]). Total Phosphorus (TP) and Chlorophyll A (Chl-a) analyses are conducted by a contracted lab.

- TP is the primary cause of excessive plant and algae growth in lake systems. Phosphorus originates from a variety of sources, many of which are human related. Major sources include human and animal waste, soil erosion, detergents, septic systems, and stormwater runoff. Internal loading can also be present in a lake. Internal loading can result from P becoming re-suspended into the water column from the sediment. High amounts of P in sediments may occur as a result of historical land uses including, but not limited to, waste disposal into the lake.

3 LAKE FEATURES

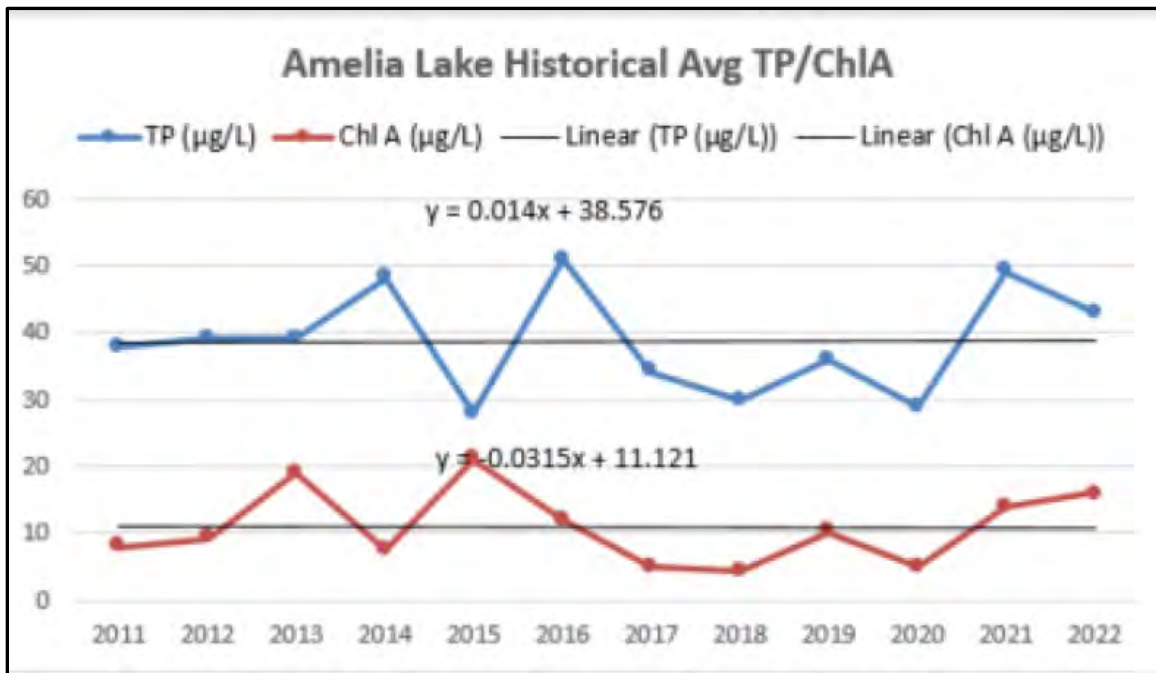
- Chl-a is a green pigment in algae. Measuring Chl-a concentration gives an indication of algae abundance.
- The MN Pollution Control Agency (MPCA) has impairment standards for the levels of TP and Chl-a. For shallow lakes in Minnesota, the impaired water quality standard levels are: <60µg/L for TP, <20µg/L for Chl-a, and <230 mg/L for Chloride.
- Red numbers indicate values that exceed MN State Standards.

Table 2: Amelia Lake monitoring data 1997-2022

Amelia Lake Historical Avg TP/Chl A/ SDT			
Year	TP (µg/L)	Chl A (µg/L)	Secchi (m)
1997	28	0	1.5
1998	36	14	1.1
1999	38	9	1.2
2000	40	12	0.9
2001	33	8	1.1
2002	34	13	1.4
2003	29	7	1.5
2004	28	0	0
2005	24	7	0
2006	36	12	0
2007	82	32	0.4
2008	26	5	1.1
2009	55	24	0.9
2010	32	12	1.1
2011	38	8	1.1
2012	39	9	1.1
2013	39	19	1.1
2014	48	7.5	1.3
2015	28	21	1.1
2016	51	12	1.1
2017	34	5	1.3
2018	30	4.5	1.4
2019	36	10	1.3
2020	29	5	1.3
2021	49	14	1.3
2022	43	16	1

3 LAKE FEATURES

Figure 27: Water quality trends in Amelia Lake



4 MANAGEMENT EFFORTS

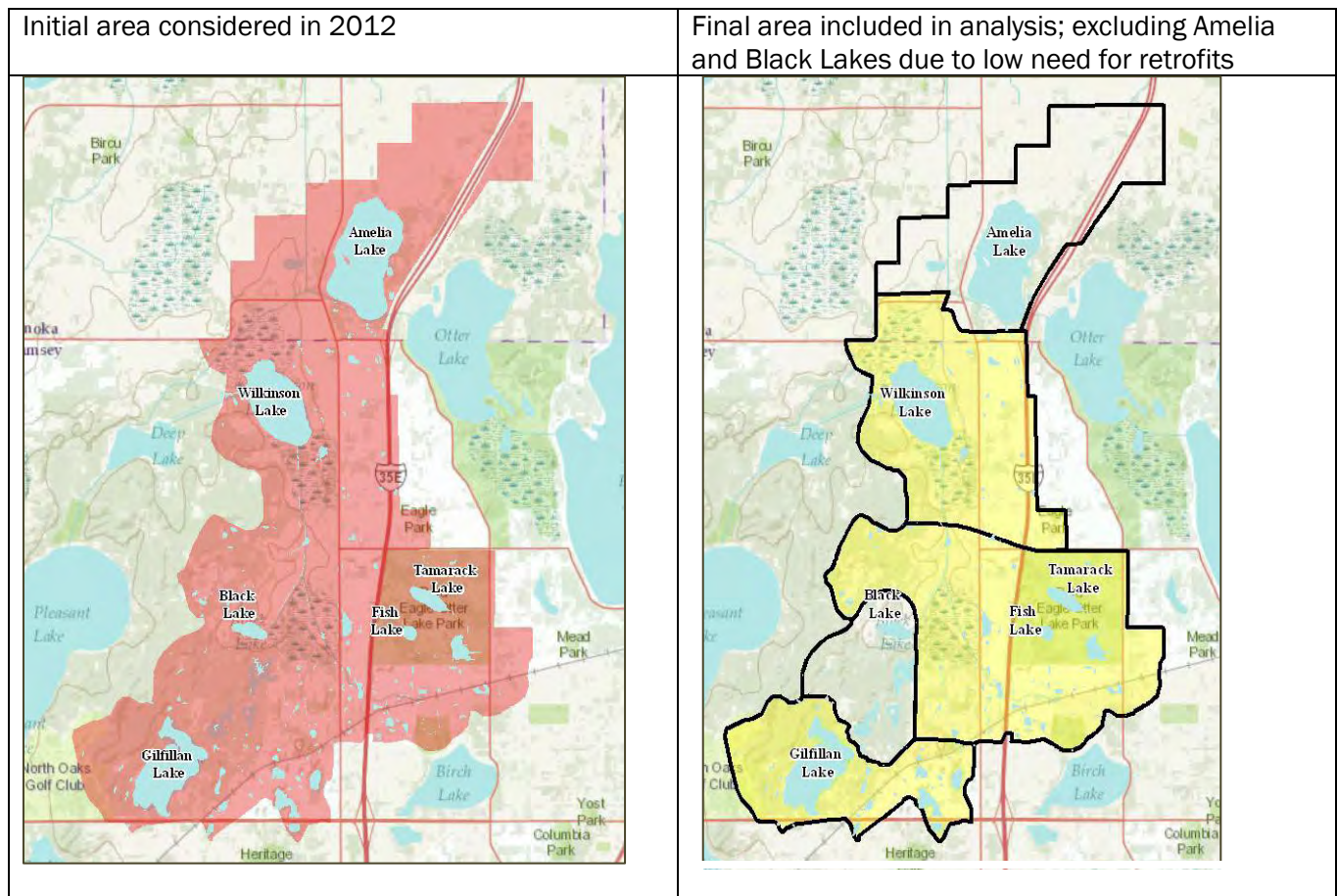
4.1 MANAGEMENT EFFORTS: RETROFIT, BMPS, PROJECT PARTNERSHIPS

Retrofit Report (2012)

In 2012, the Ramsey Conservation District, now Ramsey County Soil and Water Conservation Division (RCSWCD), completed a Retrofit Report for the Gilfillan, Black, Wilkinson, Amelia, Fish and Tamarack Lake chain of waterbodies. This was part of a larger effort to assess the full watershed and subwatershed scales and identify optimal locations for BMPs. Although Amelia was considered in early development for the project, this lake was not included in the final analysis. As stated in the report at that time:

The Amelia and Black Lake catchments were analyzed through the field reconnaissance process, but were excluded from further analysis within the study due to their current land use consisting of mainly open space and thus eliminating the need to implement retrofit water quality improvement practices.

Figure 28: Initial and final areas considered for retrofit analysis



Since the time that the retrofit report was completed, development has continued in the Amelia Lake subwatershed. A current analysis is underway with the City of Lino Lakes and VLAWMO to identify possible projects for a greenway that may be pursued in the future. This report will look forward to identify opportunities as development occurs (instead of retrofits as has been needed in other parts of the

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watershed due to prior, completed development). A report for that analysis and projects identified will be included when it is available.

At the time of this report, BMPs have not been completed in the Amelia Lake subwatershed and will be a future focus through VLAWMO's grant programs and partnerships.

AMELIA LAKE AQUATIC VEGETATION AND LAKE CONTOUR SURVEY REPORT (2021 BY RCSWCD)
FROG AND TOAD CALL SURVEY REPORT (2019-2020)
REMOTE CAMERA SURVEY REPORT (2018-2020)
GILFILLAN-WILKINSON-TAMARACK-AMELIA RETROFIT REPORT (2012 BY RCSWCD)