VLAWMO

VADNAIS LAKE AREA WATER MANAGEMENT ORGANIZATION

West Vadnais Lake Review, Ramsey County, MN

Loon family
West Vadnais Lake, June 2019
Photo credit: WC and MC

2024

Vadnais Lake Area Water Management Organization
800 County Road E East
Vadnais Heights, MN 55127
651-204-6070
www.vlawmo.org

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1 INTRODUCTION

1.1 INTRODUCTION

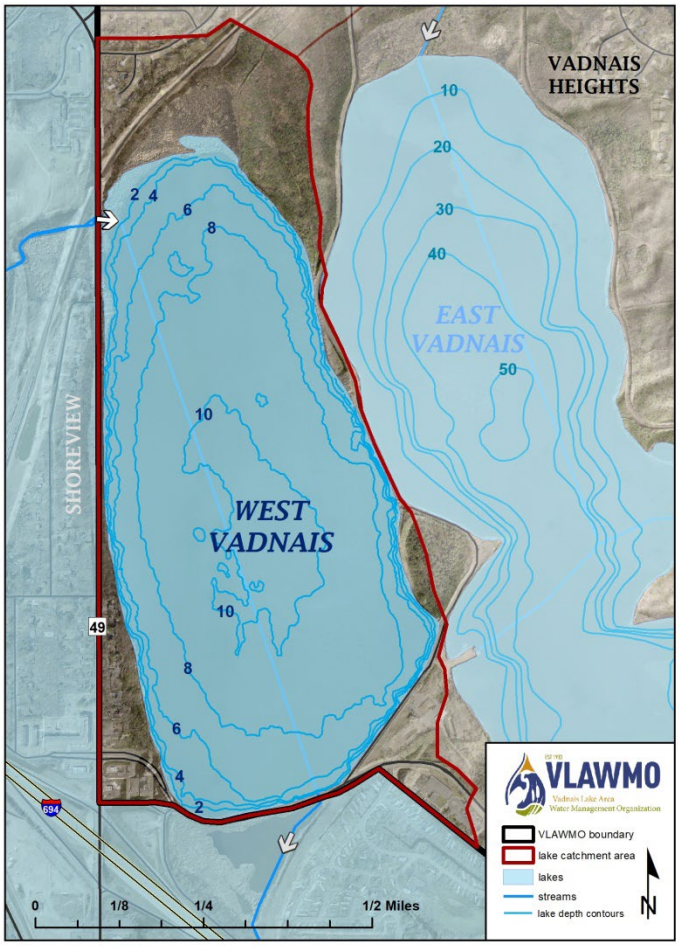
This SLMR includes monitoring, surveys, projects, and partnership with Ramsey Washington Metro Watershed District (RWMWD). Surveys for vegetation and lake contours were prioritized for West Vadnais Lake by VLAWMO during 2019 in partnership with Ramsey County Soil and Water Conservation Division (RCSWCD). Following a request from RWMWD to take over management of West Vadnais Lake, VLAWMO has continued to budget for a small amount of possible partnership costs that might be conducted with RWMWD.

Figure 1: West Vadnais Lake Image from NearMap (April 1, 2021). Even early in the growing season, West Vadnais shows a darker green appearance compared to East Vadnais (to the east and separated by a created land bridge; the 2 lakes are not hydrologically connected). The green color in West Vadnais Lake comes from abundant algae and is an indicator of poor water quality. Major roads that bound the area are County Road F to the north, Rice Street to the west, and West Vadnais Blvd to the south. 694 is the larger freeway on the southern edge of the image.

1 INTRODUCTION

West Vadnais Lake is located in the Vadnais Heights, Ramsey County, and is in the Vadnais Lake Area Watershed. West Vadnais Lake is a shallow lake with a maximum depth of 11.3 feet. The 213-acre lake receives input from the surrounding 394-acre subwatershed. West Vadnais Lake has poor water quality and is classified as hypereutrophic according to the TSI (Trophic State Index, MPCA). West Vadnais Lake receives chloride from nearby roads and neighborhoods and nutrients from developed areas. The lake receives inflow from its surrounding subwatershed and upstream from the Ramsey Washington Metro Watershed (RWMWD) through Grass Lake. It outflows on the south end of the lake through a small wetland area and a recently modified culvert back into the Ramsey Washington Metro Watershed. Although West Vadnais is one of the namesake lakes for the Vadnais Lake Area Watershed, opportunities for BMPs to improve the lake are primarily outside of the watershed. This is one reason why partnership with RWMWD is important to make improvements to the lake. Toward that goal, VLAWMO and RWMWD partnered on carp management (2019-2022).

Figure 2: West Vadnais Lake and Subwatershed



West Vadnais Lake was targeted for a culvert modification by RWMWD in 2019/2020. For the culvert modification, RWMWD lowered the existing outlet of West Vadnais Lake from 881.8 ft to 881.0 ft to help alleviate flooding in the surrounding area and provide additional in-lake water storage volume. An Environmental Assessment Worksheet (EAW) was prepared for the project in 2019. Information from the EAW is included in this document. The outlet modification was completed in 2020. The culvert elevation was lowered to allow a buffer for flooding. This effort was completed by RWMWD and Barr Engineering following a couple of years of high snowmelt/rainfall, and increased flooding risk in especially in Shoreview and for residents around Twin Lake to the immediate south. Ramsey County also completed a project to elevate Rice Street and the Ramsey-Washington Metro Watershed District added rip rap shoreline armoring along Vadnais Blvd in 2019 after closures over consecutive years caused considerable nuisance for residents. A county-wide forum on flooding was hosted by Commissioner Frethem in March, 2020, to help facilitate discussion about flooding, related issues, and expected continued changes due to climate change. VLAWMO was in attendance at this meeting along with: Ramsey County Parks and Recreation, Ramsey County Public Works, Rice Creek Watershed District, Ramsey-Washington Watershed District, the City of Shoreview, and the City of Vadnais Heights.

A carp management project was begun in partnership with RWMWD and Carp Solutions in 2019, with financial contribution from VLAWMO 2020-2022. RWMWD completed an initial carp survey in 2017/2018 and shared results of that survey with VLAWMO. Because of the connections from West Vadnais to RWMWD, VLAWMO worked to partner on the existing carp management project to include West Vadnais. This work is

especially important in protecting RWMWD's investment toward maintaining a reduction in carp biomass in the Phalen Chain of Lakes to the south. The VLAWMO/RWMWD partnership has included a financial contribution by VLAWMO to help support population monitoring, survey, baited box netting, and the addition of carp barriers to prevent movement out of West Vadnais Lake.

2 WATERSHED FEATURES

2.1 AERIAL PHOTO HISTORY

An excellent book is available with historical information about the City of Vadnais Heights including East and West Vadnais Lakes. *Reflections from the Lake: A 160-Year History of the Vadnais Heights Community* is available from the City of Vadnais Heights at City Hall. A summary of information relevant to West Vadnais Lake is included here.

Pre-European Settlement and Characterization of the Area from *Reflections from the Lake*

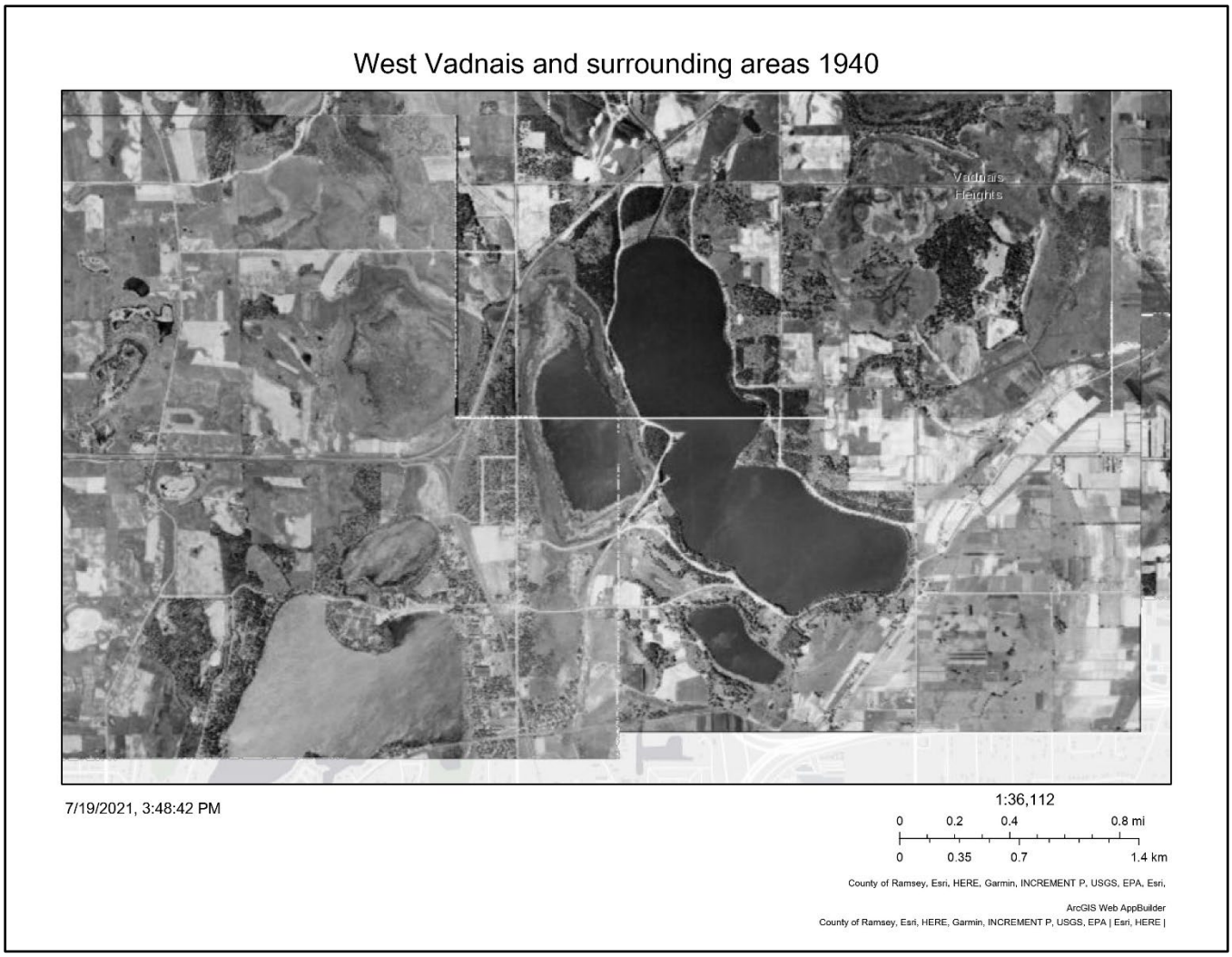
An early map, that includes a sketch of East and West Vadnais Lakes from 1848, shows that the Dakota were present in what is now Vadnais Heights and includes East and West Vadnais Lakes prior to fur trading by European settlers. The Kaposia Band of the Mdewakanton Dakota used hunting areas that stretched from St Paul to north of Lake Vadnais. Trails and roads that were part of Dakota land and travel routes became roads that are still in use today.

A federal government survey in 1847 showed that land around the lakes was composed of: open meadows; marsh; large stands of oak and basswood trees; and patches of maple, nuts trees, and elm. Marshes were edged with willow and tamaracks. Streams connected the lake with a chain of marshes to the north.

> *Creeks flowed to shallow Lambert's Lake on the eastside of the Lake Vadnais area and to Lakes Gervais and Savage to the south. Lake Vadnais lay in a transition zone between the pine forests of the north and the vast hardwood forests east of the Mississippi River. Glaciers had left ponds dammed by mounds of gravel and silt as they melted, so their water drained poorly and swamps dotted the land.* (*Reflections*, p. 21)

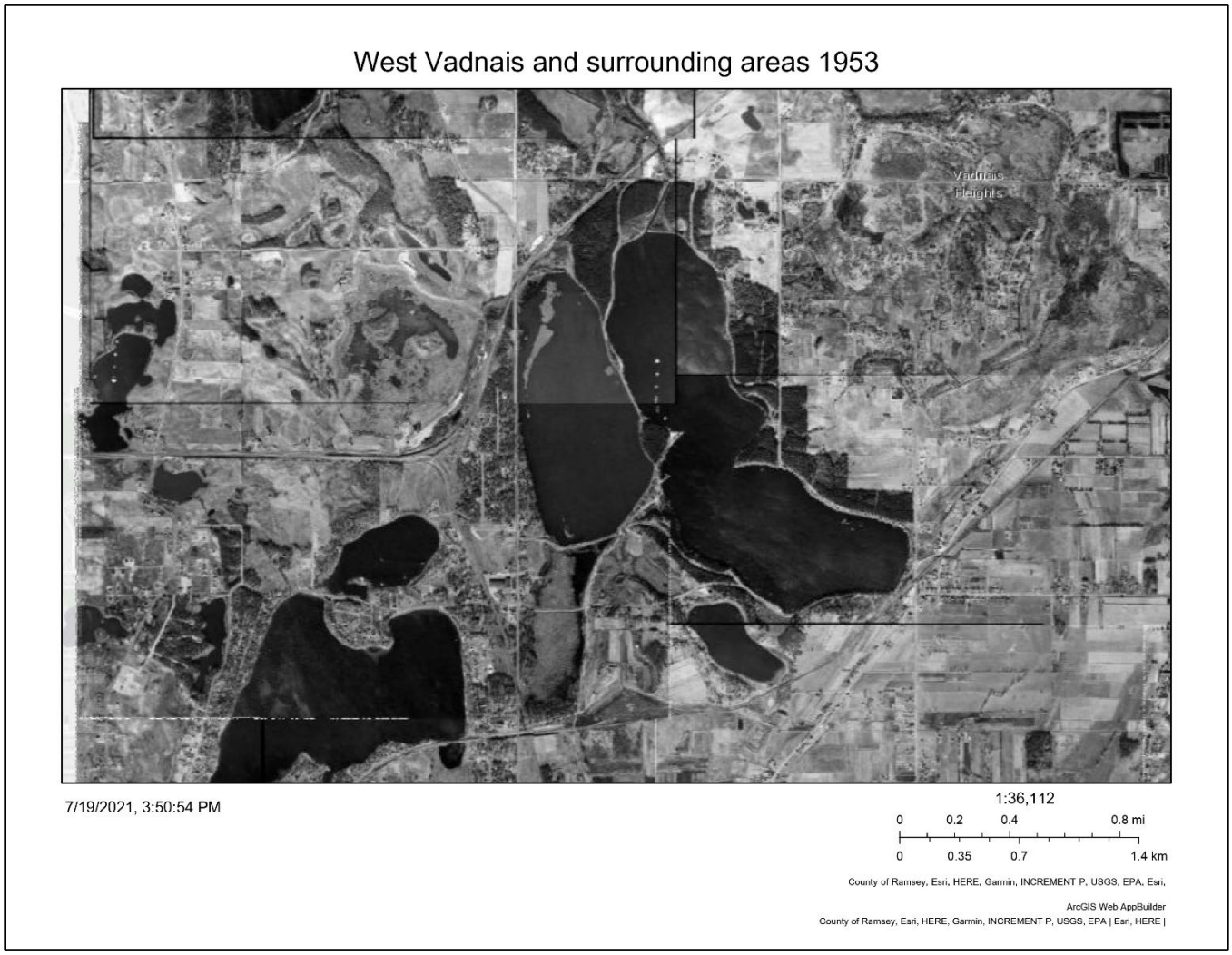
Two French Canadian families (Jean Vadnais, Jean Garceau, and their families) settled the area around the lakes. Jean Vadnais was the namesake of the lakes and city to come. A map of the area including settlers' home locations in 1854 can be found on p. 35 of *Reflections*.

Figure 3: 1940 aerial photo of West Vadnais Lake



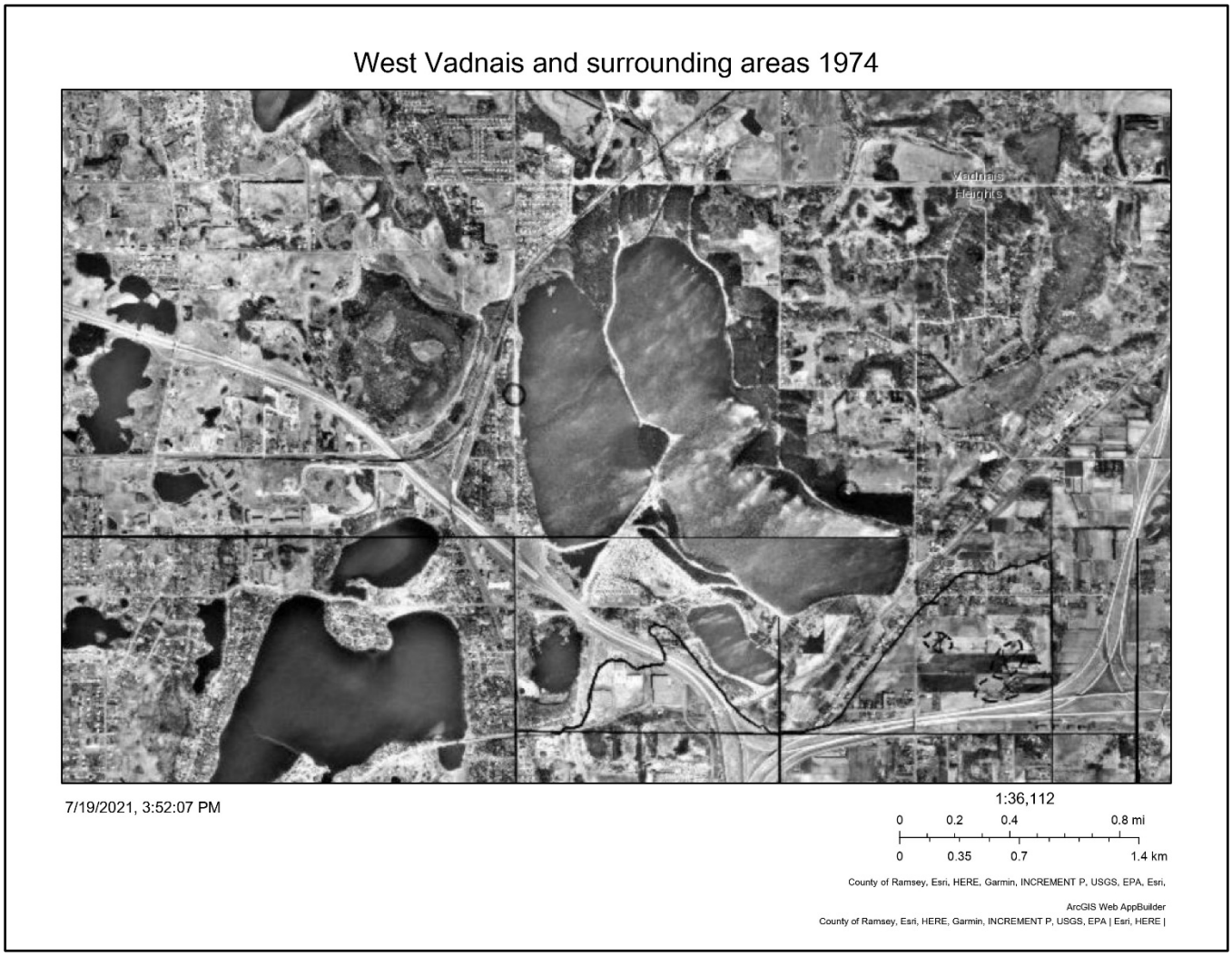
In 1940, aerial photos from Ramsey County show that the land surrounding West Vadnais Lake was largely agricultural, and the road that is now County Road F was in place to the north of West Vadnais Lake. The Lake Vadnais area was part of White Bear Township. County roads were paved, while smaller roads were still laid out and graded by hand (*Reflections*, p. 108). The township area primarily consisted of farms and small proprietors. Vadnais-Sucker Lake Regional Park was present by 1937 (*Reflections,* p. 195).

Figure 4: 1953 aerial photo of West Vadnais Lake



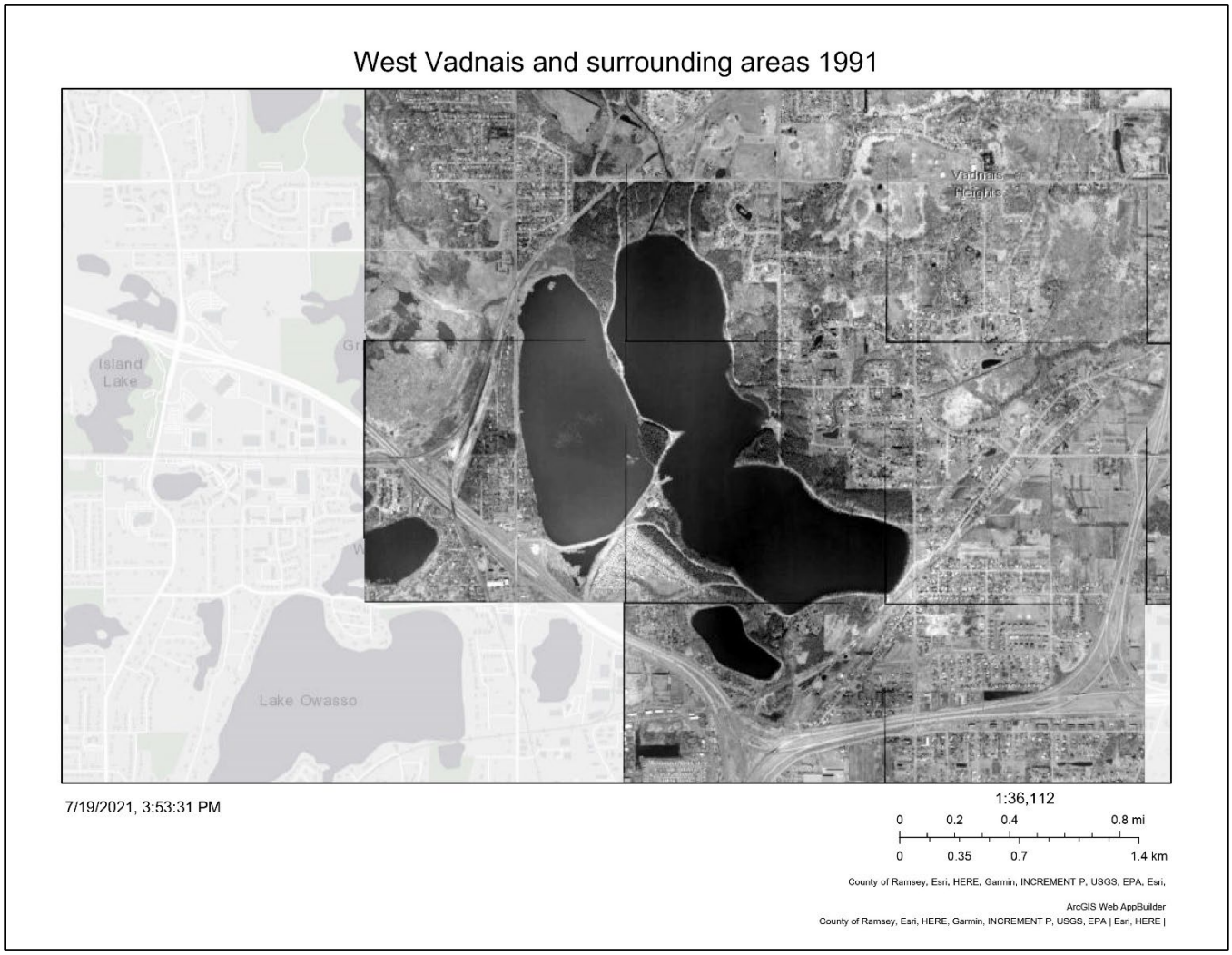
In 1953, the area is still mostly agricultural with some residential development. World War II ended in 1945. In the 10 years after, the area around the Vadnais Lake Area changed rapidly. More homes were built. By 1957, the population had increased from 750 prior to the war to 1,977 (*Reflections,* p. 115). Wetlands were being drained and filled for housing development. The Village of Vadnais Heights was incorporated in 1957.

Figure 5: 1974 aerial photo of West Vadnais Lake



By 1974, Interstate 694 is in place, and development increased. In 1971, there were 28 businesses in Vadnais Heights. A few farms remained in the 1970s, especially along County Road E. A rapid conversation from remaining farmland to residential and commercial development occurred during this time. Vadnais Heights officially became a city in 1975.

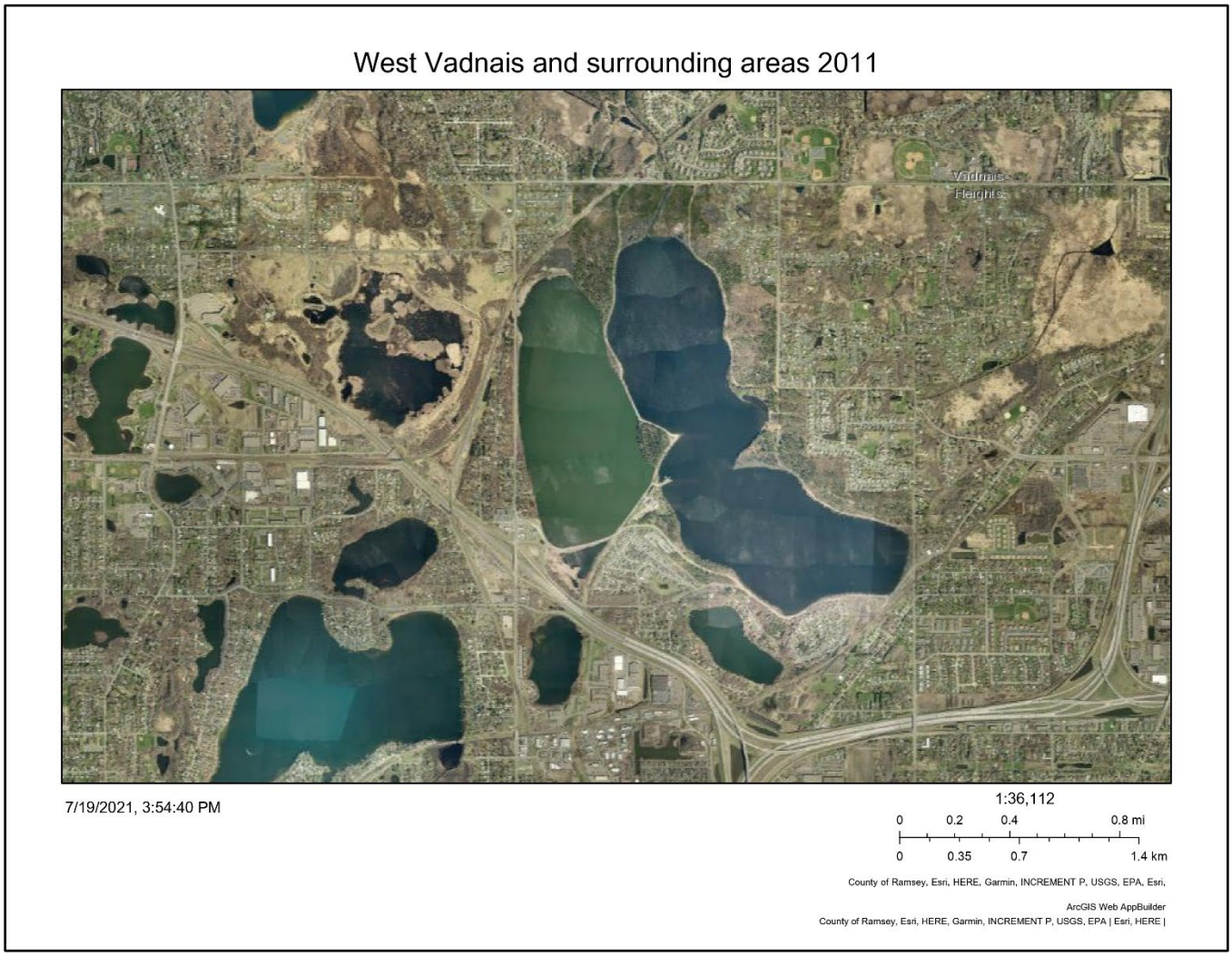
Figure 6: 1991 aerial photo of West Vadnais Lake



By 1991, some commercial development is visible, residential areas have expanded, and the park area around the lakes is clearly defined by road boundaries. Roadways were being expanded during this time.

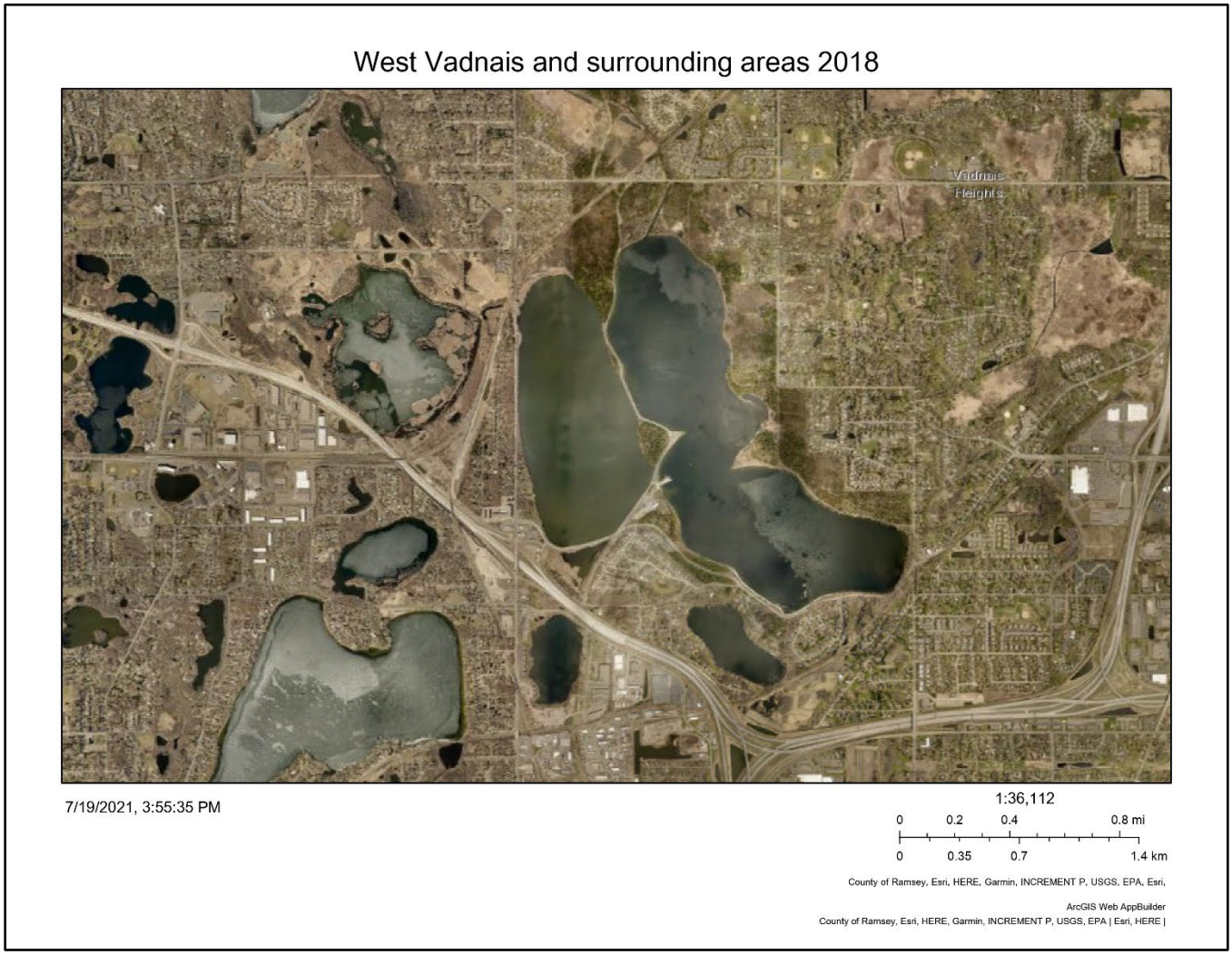
> *To accommodate the higher volume of traffic that Wal-Mart and Target generate, the County Road E bridge over I-35E was widened in 1992. Highway 96 renovation rerouted traffic into the city during the mid-90s, and the reconstruction of the Edgerton Street bridge over I-694 took a year beginning in July, 2004… A new Fire Station went up in 1994, and a new City Hall rose at City Center in 2001* (*Reflections*, p. 172).

Figure 7: 2011 aerial photo of West Vadnais Lake



In 2011, the green hue of algae is clearly visible indicating poor water quality. Lambert stormwater pond (built in 2004) is present on this map, as is the ditch system discharging from the pond and flowing into East Vadnais Lake.

Figure 8: 2018 aerial photo of West Vadnais Lake



In 2018, an early season photo shows ice still present on East Vadnais Lake. Note that additional years of aerials are available on the VLAWMO GIS Map, linked on the website under Resources.

2 WATERSHED FEATURES

2.2 WEST VADNAIS LAKE DRAINAGE AREA

The subwatershed area (shaded area in Figure 9) of West Vadnais Lake is approximately 301 acres, and the surface area of West Vadnais Lake is 221 acres. West Vadnais Lake's basin footprint comprises nearly 75% of the subwatershed area, leaving only 80 areas of terrestrial land area that drains to the lake, and is a relatively small drainage area to a lake. Though lakes with a small drainage area (less than 10:1 ratio) tend to have better water quality, West Vadnais Lake is impaired and was added to the Minnesota Impaired Waters List for nutrients affecting aquatic vegetation in 2014.

Figure 9: West Vadnais Lake Drainage Area and Flow Patterns

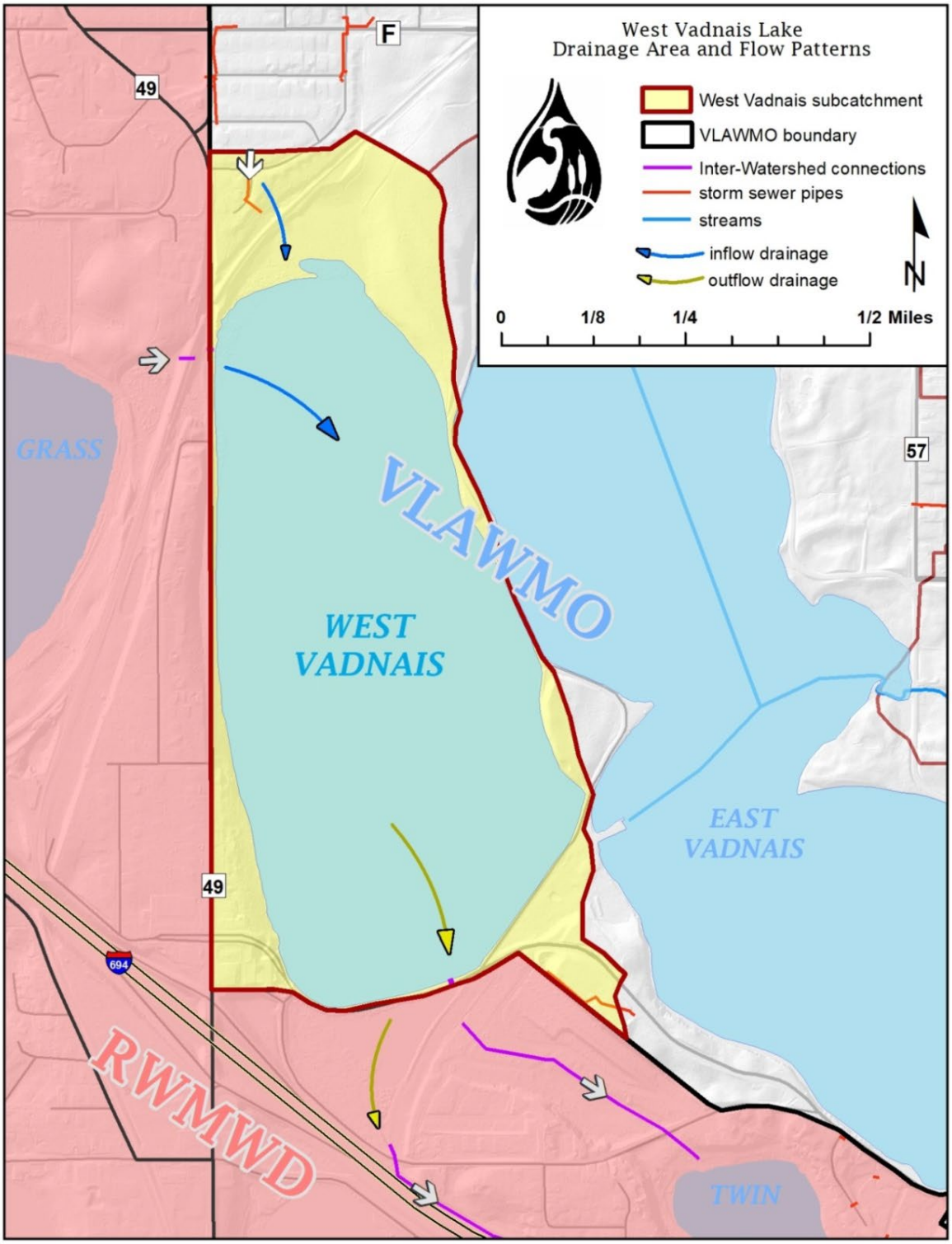
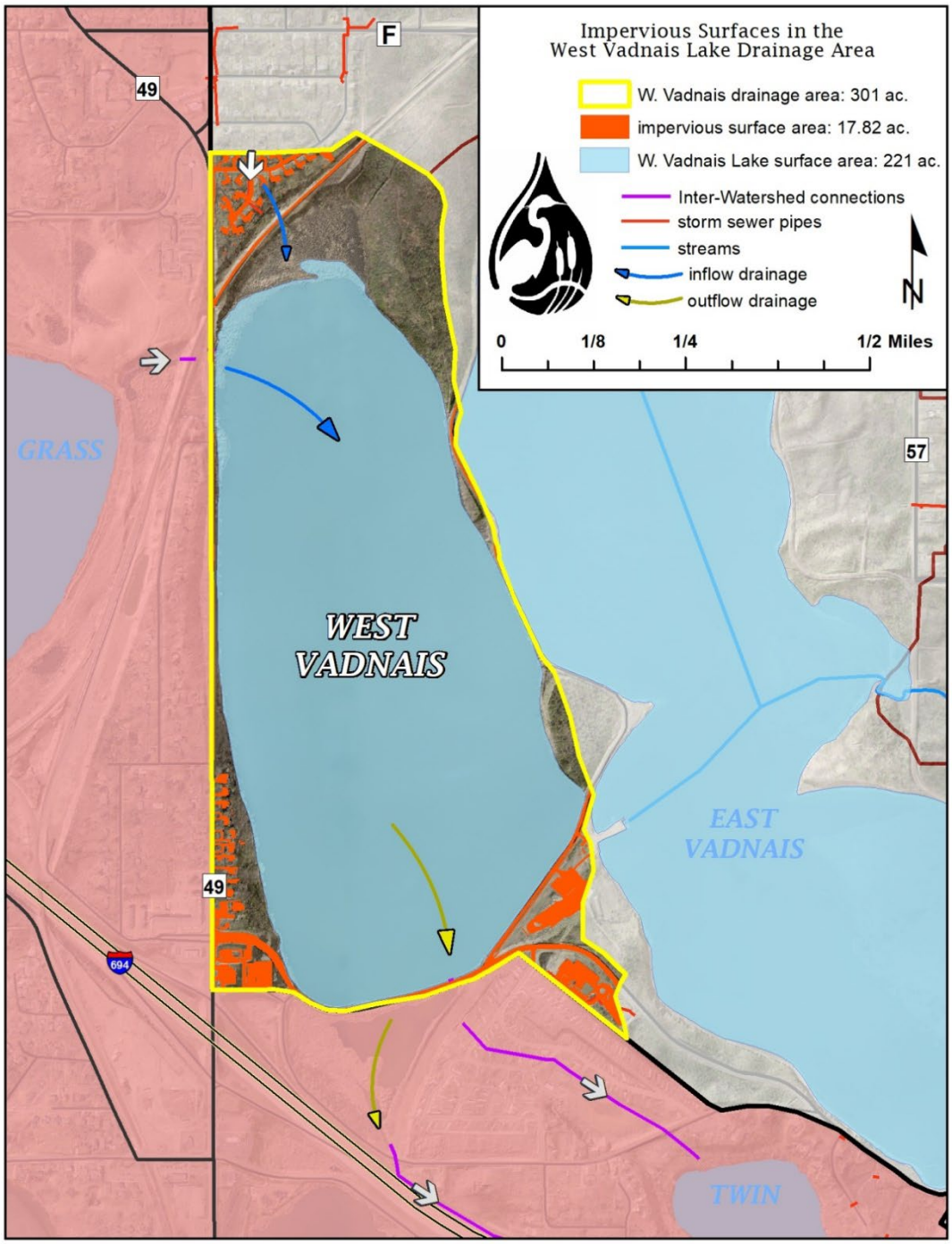


Figure 10: Impervious Surfaces in the West Vadnais Lake Drainage



2 WATERSHED FEATURES

Figure 10 shows that a modest amount of land cover in the West Vadnais Lake area is developed. Impervious surfaces make up 17.8 acres or of total land area or 5.9% within the subwatershed area, including water surface area and terrestrial surface area. Not including West Vadnais Lake's surface water area, impervious surface area comprises of 21% of the 80 acres of terrestrial land cover. The majority of precipitation that falls on those surfaces moves rapidly into downstream lakes, wetlands, and streams.

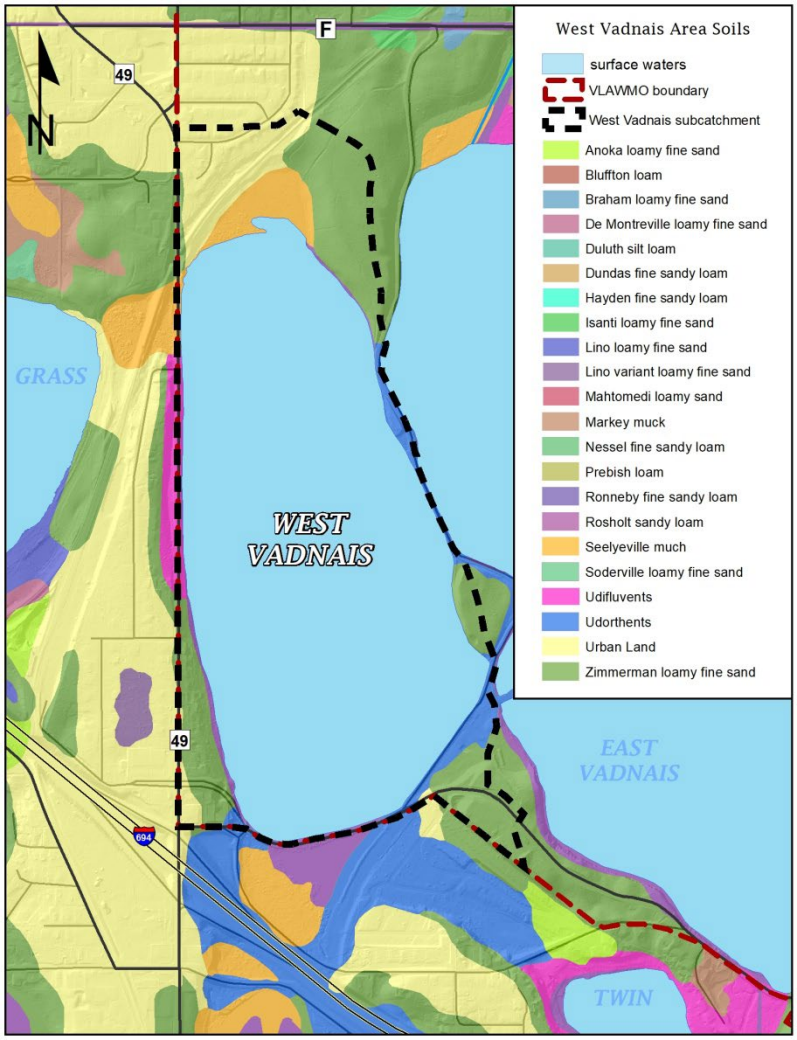
2.3 WEST VADNAIS LAKE SOILS

Soils in the West Vadnais Lake subwatershed drainage area are mainly comprised of Zimmerman loamy fine sand, Seelyeville muck, urban land, udifluvents and udorthents. Zimmerman loamy fine sand is moderately well drained, allowing water to infiltrate. With urban soils associated land development, much of the soils have been compacted, moved, and paved over, and are often heterogeneous. Retrofit Best Management Practices (BMPs), such as rain gardens, infiltration basins, and filtration basins, are designed with these differing soil types in-mind.

From the RWMWD 2019 Environmental Assessment Worksheet (EAW): *"Bedrock in the area is the Prairie Du Chien formation. The Prairie Du Chien formation consists of dolostone that varies greatly in thickness because its top is highly erodible. The Prairie Du Chien is karsted and may be rubbly where remnants less than 50 feet thick are covered by the St. Peter Sandstone. Depth to bedrock is up to 350 feet below ground surface. Surficial geology consists of sandy lake sediment, which is primarily fine to medium sand, silt and clay, and scattered dropstones.*

No karst features or other geologically sensitive features are known to occur in the vicinity of the proposed Project area."

Figure 11: West Vadnais Lake Area Soils



2.4 West Vadnais Lake Wetlands

There are two main wetland areas in the West Vadnais Lake area, on the north end and south end of the Lake. The wetland to the south is across the VLAWMO border and is within the Ramsey-Washington Metro Watershed District. The north wetland totals just over 12 acres, while the north totals just under 30 acres. Not including lake open water area, wetlands comprise 15% of the land area of the West Vadnais Lake subwatershed area. For new development or redevelopment, the creation or addition of storm water management or possible wetland disturbance must be reviewed, the Wetland Conservation Act (WCA) rules and/or the VLAWMO Water Management Policy, as adopted by VLAWMO's 6 JPA member communities.

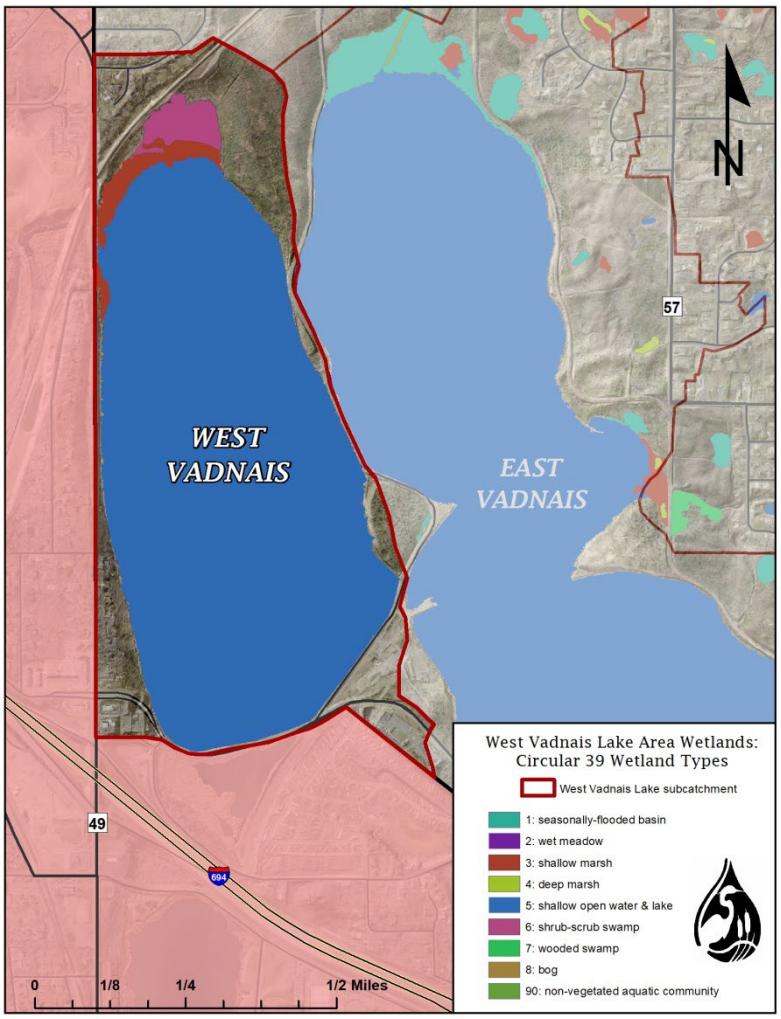
From the RWMWD 2019 EAW: *A field wetland delineation was conducted on June 17, 2019 and July 3, 2019. Two wetlands collectively totaling 28.9 acres were delineated as part of the culvert modification project. Wetland one, encompassing approximately 12.1 acres, was delineated on the north end of the proposed Project area (Figure 5). This wetland consists of two primary vegetation types, a scrub-shrub area dominated by glossy buckthorn (Frangula alnus; PSS1C) and shallow marsh area dominated by cattails (Typha spp.; PEMC).*

Wetland two is located on the southern end of the proposed Project area and spans approximately 16.8 acres. This wetland also had two dominant plant communities: shallow marsh (PEMH) dominated by cattails and a wet meadow (PEMC) dominated by reed canary grass (Phalaris arundinacaea).

Based on the Minnesota Routine Assessment Method (MnRAM), both wetlands were classified as preserve wetlands. Shallow-water bathymetric data was also collected in June 2019 in where the littoral zone and wetland area on the north side of the Lake intersect (Figure 3). Surface water depths are primarily less than 0.5 feet, but do get as deep as 3 feet within the delineated wetland area. Bathymetric data collection across the entire delineated wetland area was impeded by accessibility; however, it does indicate the presence of standing water across the entire area.

Figure 12: Wetland areas delineated for the RWMWD EAW

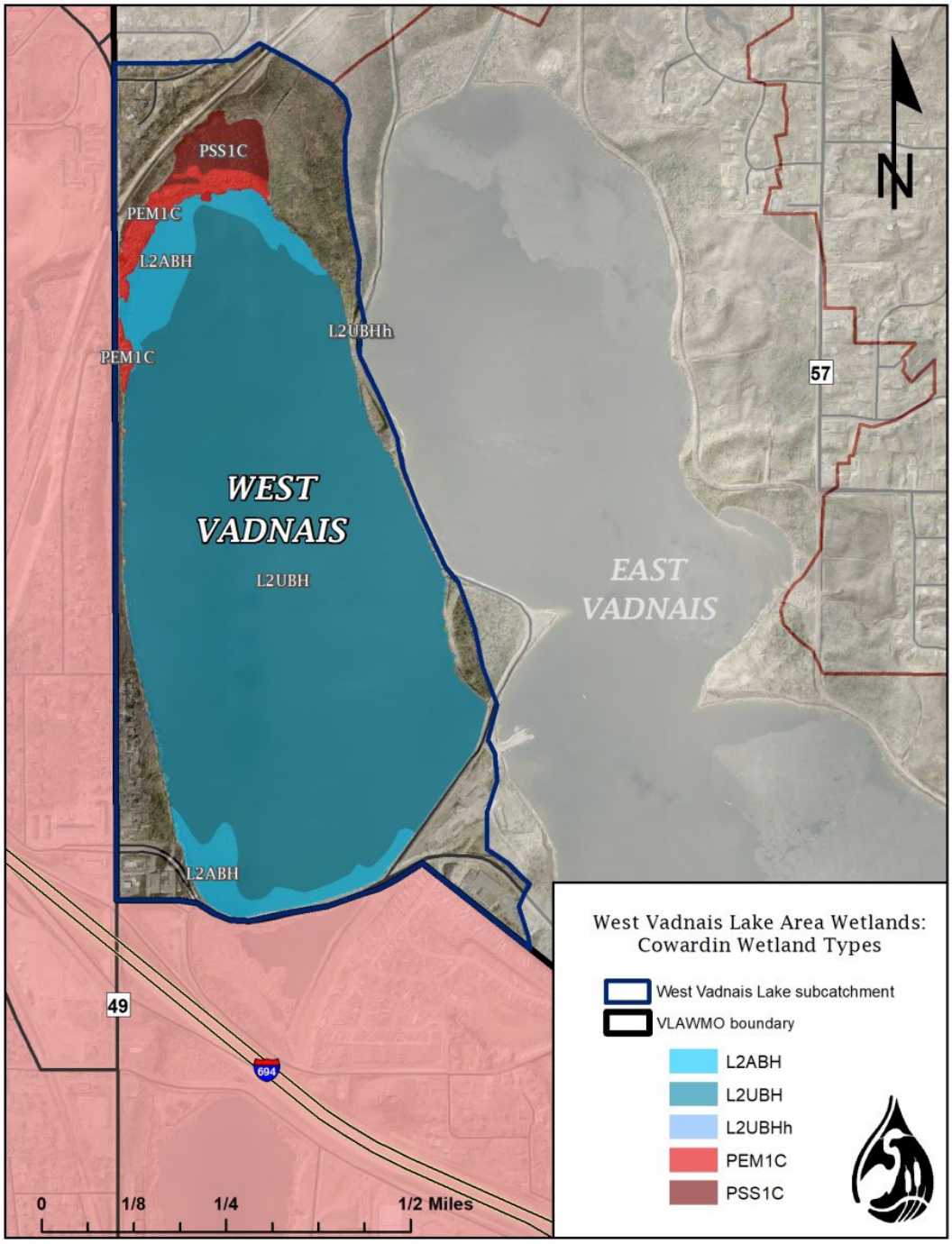
Figure 13: West Vadnais Lake Circular 39 Wetland



As Classified by the Circular 39 wetland classification system, the north end of West Vadnais Lake is classified as forested shrub/scrub further away from the shore, and adjacent to the shore is listed as freshwater emergent wetland, in the shallows. While the greater area of West Vadnais Lake is classified as shallow open water or lake, as the majority of the lake's perimeter is surrounded by emergent wetland vegetation. The north of the Lake exhibits the most shallow wetland characteristics with predominantly emergent vegetation, and the south and southwestern shore has the most developed or altered shoreline habitat, though it is light.

Within the US Fish & Wildlife Service's National Wetland Inventory (Cowardin Classification System), there are four predominant classifications around and within West Vadnais Lake: PSS1C, PEM1C, L2ABH, and L2UBH which correspond to shrub, shallow marsh, and freshwater lake descriptions (Figure 14). PEM1C refers to palustrine, emergent, persistent marshes that are seasonally flooded (1C), whereas PSS1C is identified as a palustrine, scrub-shrub, and seasonally flooded. PEM1C and PSS1C both occur in the north shore area of the lake, with PSS1C occupying periodically-flooded areas. L2ABH is identified as a shallow open water lake community, and covers the north and south shores, while L2UBH is identified as a non-vegetated lake community and covers the deeper areas and majority of West Vadnais Lake.

Figure 14: West Vadnais Lake Cowardin Wetland



2.5 West Vadnais Lake Shoreline Vegetation

A shoreline survey has not been conducted for West Vadnais Lake at this time. The decision was made not to conduct a shoreline survey in 2019 because the space between the road and lake is very narrow, steep, presents a built/modified environment, and consists primarily of road and trail right of way. Vegetation has low diversity in general in this area and an abundance of common invasive species.

From the RWMWD 2019 EAW: Topography along the West Vadnais Lake shoreline is generally steeply sloping due to the lake being surrounded by man-made infrastructure (roads, railroad, and berm). West Vadnais Lake is separated from East Vadnais Lake by a constructed berm/causeway, and the lakes are hydrologically independent. An assessment of land cover types was estimated using geographic information systems (GIS); the results are summarized in the following Table 1.

Table 1 Summary of Cover Types (in acres) Cover Type	**Before culvert modification**	**After culvert modification (completed in 2020)**
Wetlands	19.8	19.8
Deep water/streams	216.1	216.1
Wooded/forest	2.0	2.0
Brush/grassland	0.4	0.4
Cropland	0	0
Lawn/landscaping	0	0
Impervious Surface	0	0
Stormwater Pond	0	0
Other – Vacant lot/sparse vegetation	0	0
Total Area	**238.3**	**238.3**
Source: U.S Geological Survey National Land Cover Dataset.		

2.6 West Vadnais Lake Levels

Water levels began being recorded in West Vadnais Lake in the 2000s, though regular monitoring began in 2008 by the Ramsey-Washington Metro Watershed District. Water levels were within a consistent range, until continued, extreme precipitation events occurred between 2015–2019 throughout the region. This brought the highest lake level recordings that had been seen on West Vadnais Lake and presented localized flooding issues. As these issues persisted, the RWMWD pursued a project to lower the southern outlet of the lake by 0.8 feet to reduce peak lake levels and flooding during extended high-precipitation periods. This project was completed in 2020.

From the RWMWD 2019 EAW: *West Vadnais Lake has a surface area of 213 acres. Based on bathymetric data collected in early summer 2019 as part of the culvert modification Project, the Lake has an average depth of about 8 feet and a maximum depth of 11 feet. Water levels within the Lake have steadily increased over the years and have led to the flooding of the surrounding areas including Grass Lake located on the west side of Rice Street, as well as overtopping Rice Street itself.*

Figure 15: 10-year Hydrograph of West Vadnais Lake from the RWMWD EAW

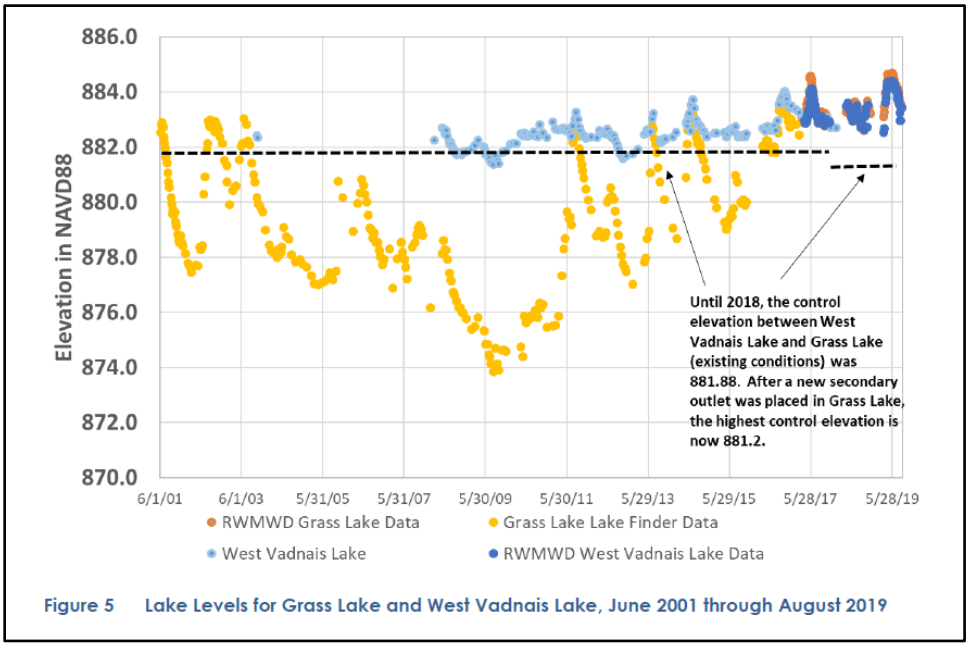
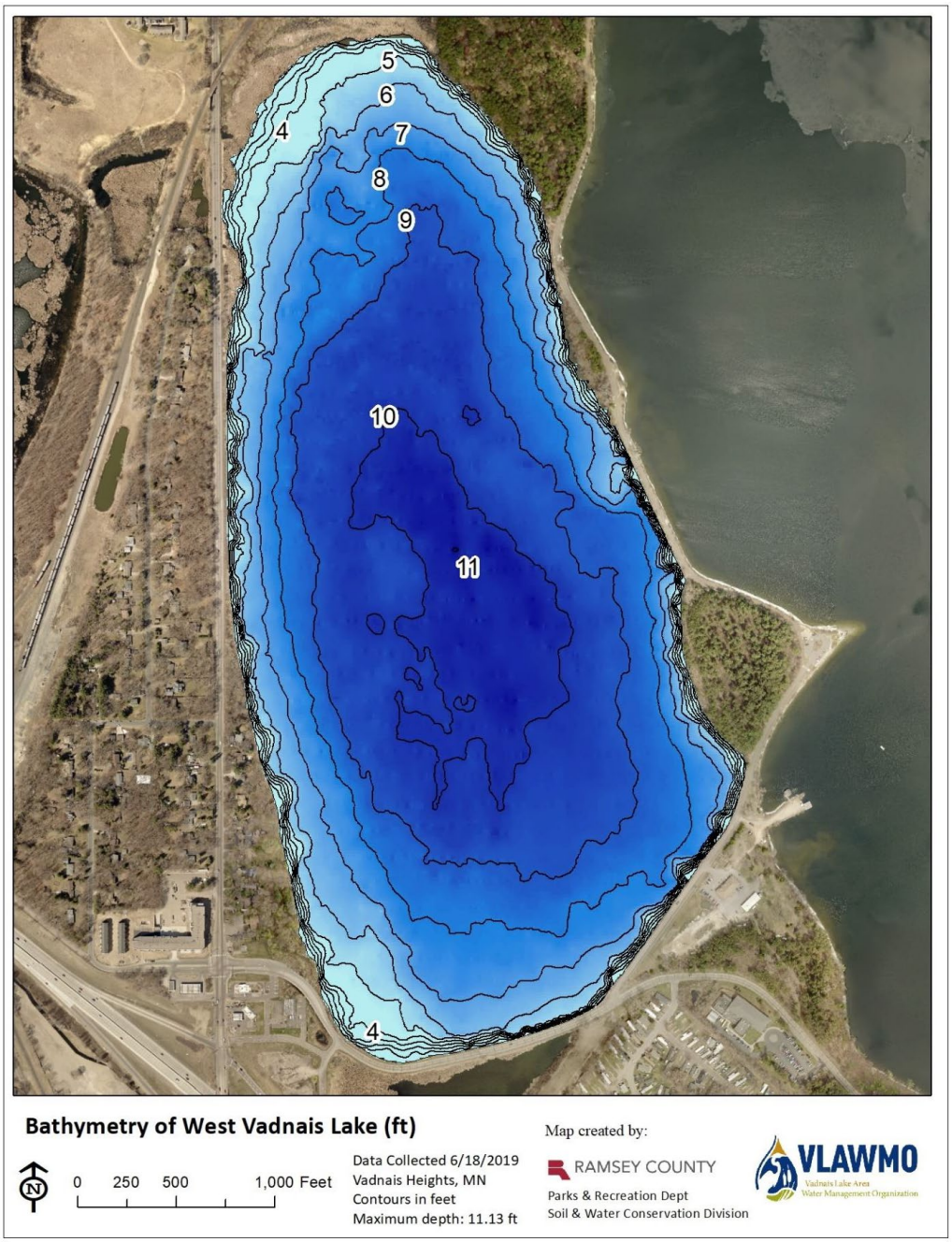


Figure 5 Lake Levels for Grass Lake and West Vadnais Lake, June 2001 through August 2019

3.1 WEST VADNAIS LAKE DEPTH

A bathymetry survey was completed by Ramsey County Soil and Water Conservation Division (RCSWCD) on June 18, 2019, to develop a map of the bottom of West Vadnais Lake and determine depths. The deepest point measured with a rod was 10.05 ft (not at the deepest location in the lake). The deepest location detected by sonar was 11.13 ft. The average lake depth is between 7-8 ft.

Figure 16: West Vadnais Lake Depth with 1-foot Contours



3.2 West Vadnais Lake Biovolume and Aquatic Vegetation

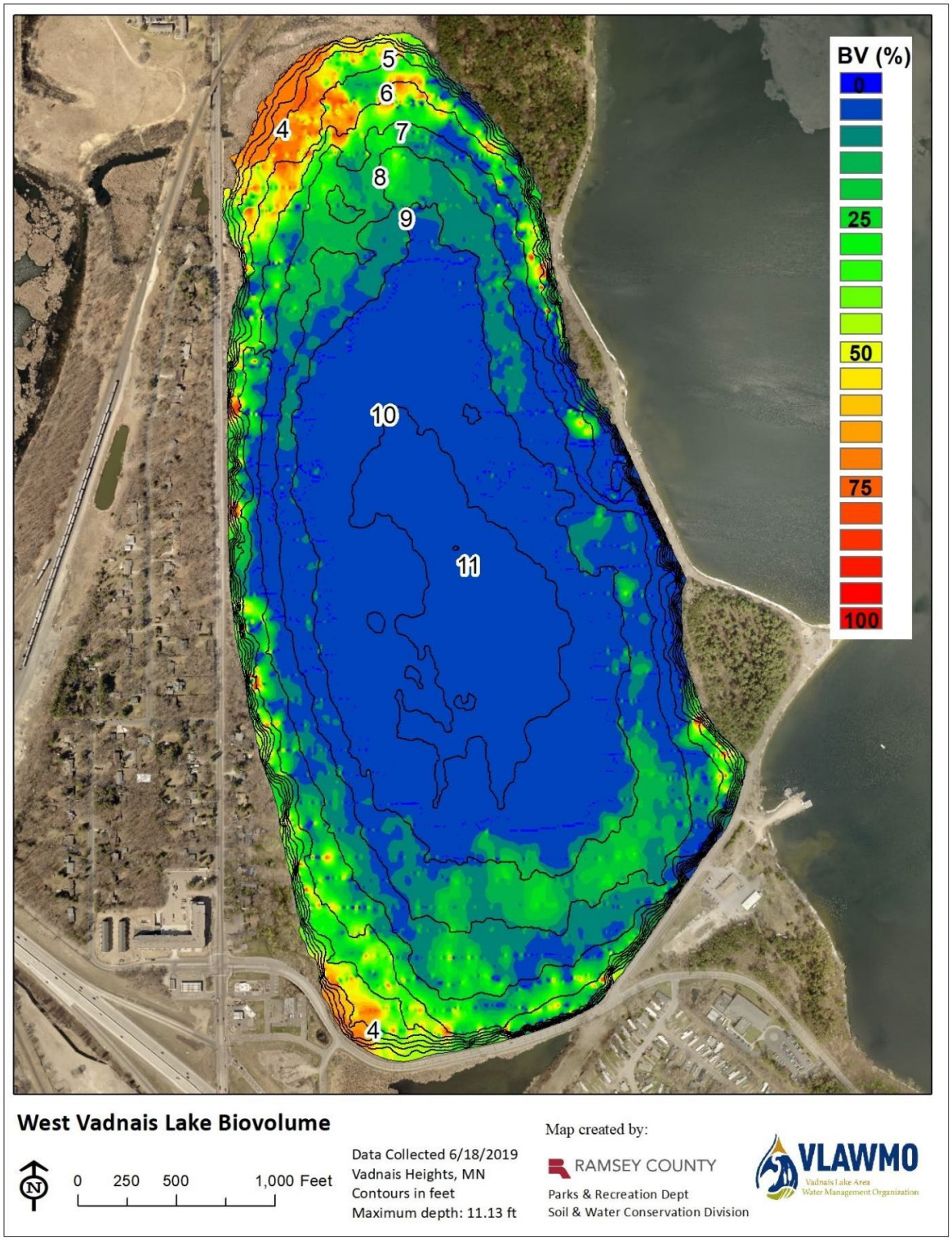
Biovolume and aquatic vegetation

Ramsey Soil and Water Conservation Division (RCSWCD) conducted a biovolume and aquatic vegetation survey on June 18, 2019. 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. West Vadnais Lake has abundant plant life in the littoral areas and no vegetation in the deeper portions of the lake. (Figure 17).

For the aquatic macrophyte survey, 137 points were surveyed using the metal portion of a rake/tines tied to a rope. Aquatic macrophytes were found at 37 of 137 points surveyed. The vegetation in West Vadnais Lake was dominated by submerged plant species such as Muskgrass (*Chara* spp.), Filamentous algae (*Spirogyra/Caldophora* spp.), Curly-leaf pondweed (*Potamogeton crispus*), and Leafy pondweed (*Potamogeton foliosus*). Sago pondweed (*Stuckenia pectinata*), Coontail (*Ceratophyllum demersum*), Flat-stem pondweed (*Potamogeton zosteriformis*), and Northern watermilfoil (*Myriophyllum exalbescens*) were also detected. Floating-leaf plants such as White water lily (*Nymphaea odorata*) and Yellow water lily (*Nuphar lutea*) were found the shallower portions of the Lake.

Photo: Yellow water lilies on the northern shoreline area of West Vadnais Lake.

Figure 17: West Vadnais Lake



3.3 RARE SPECIES, WILDLIFE MONITORING, FISH SURVEY

Rare Species

Rare species were documented in the area within 1 mile of West Vadnais Lake as part of the RWMWD EAW. Results of rare species documented are included in Table 2 below.

Table 2: Rare Species Documented within One Mile of Proposed Project Area According to MDNR NHIS

Common Name	Scientific Name	Federal Status	State Status	Habitat[1]
Blanding's turtle	*Emydoidea blandingii*	None	Threatened	Wetland complexes adjacent to sandy uplands; calm shallow waters, including wetlands associated with rivers and streams.
Black huckleberry	*Gaylussacia baccata*	None	Threatened	Well drained sandy soil or dry sandstone outcrops in fire-dependent forest.
Swamp blackberry	*Rubus semisetosus*	None	Threatened	Savanna remnants and tamarack swamps.
Autumn fimbry	*Fimbristylis autumnalis*	None	Special Concern	Sedge meadows, where water table is at or very near the surface.
Red-shouldered hawk	*Buteo lineatus*	None	Special Concern	Large tracts of mature deciduous forest with scattered wetland openings.
Rusty patched bumble bee	*Bombus affinis*	Endangered	Watchlist	Open areas with abundant flowering plants and undisturbed soils for overwintering.
Western foxsnake	*Pantherophis ramspotti*	None	Watchlist	Agricultural fields, farms, grasslands, and riparian woodlands.

1: Habitat information obtained from MDNR Rare Species Guide: https://www.dnr.state.mn.us/rsg/index.html

Wildlife Monitoring

During 2019-2020, VLAWMO conducted frog and toad call surveys in representative locations throughout the watershed. Six species were detected in the wetland areas on the north and west sides of Vadnais Lake. Species included: Spring peepers, Boreal chorus frogs, Gray tree frogs, Cope's gray tree frogs, American toads, and Green frogs. A full report from these surveys is available on the VLAWMO website and as a StoryMap.

Residents often share photos of wildlife that they take on and near West Vadnais Lake. A few photos are included at the end of this section. Highlights have included residents observing River otter families swimming and playing, Common loons raising their chicks, and more.

Fish Surveys

A fish survey is planned for 2022 to help inform the ongoing carp project partnership with RWMWD. Previous fish surveys have not been conducted on West Vadnais Lake by VLAWMO. The Minnesota Department of Natural Resources (MN DNR) conducted fish surveys on the lake in 1986 and 2001.

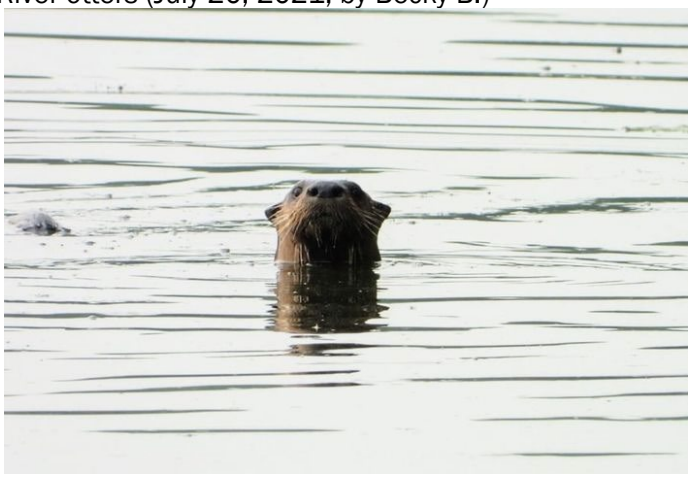
The MN DNR conducted a fish survey on West Vadnais Lake on July 9, 2001 using gill nets and trap nets. Full details are available on the MN DNR Lake Finder website. Species sampled included: Black bullhead, Black crappie, Bluegill, Brown bullhead, Green sunfish, Hybrid sunfish, Northern pike, Pumpkinseed, White crappie, Yellow bullhead, Yellow perch, Common carp, White sucker, and Golden shiner. Black bullhead numbers were more than double the normal high for a lake in Minnesota. Carp were reported but not abundant in this survey. According to the MN DNR:

> **Status of the Fishery**
>
> *West Vadnais Lake has been dominated by black bullheads since the survey of 1986. Prior to that brown bullheads were the most commonly caught specie. The fish population of West Vadnais apparently suffers complete or partial winterkill on nearly an annual basis. Game fish sampled were one 19" northern pike, several bluegill averaging 5-6" in length, and three 7" black crappies. Other species represented were; black bullhead, brown bullhead, hybrid sunfish, pumpkinseed sunfish, green sunfish, golden shiner, and carp.*

Figure 18: Submitted photos of wildlife from residents

River otters (July 20, 2021, by Becky B.)

River otters (July 20, 2021, by Becky B.)



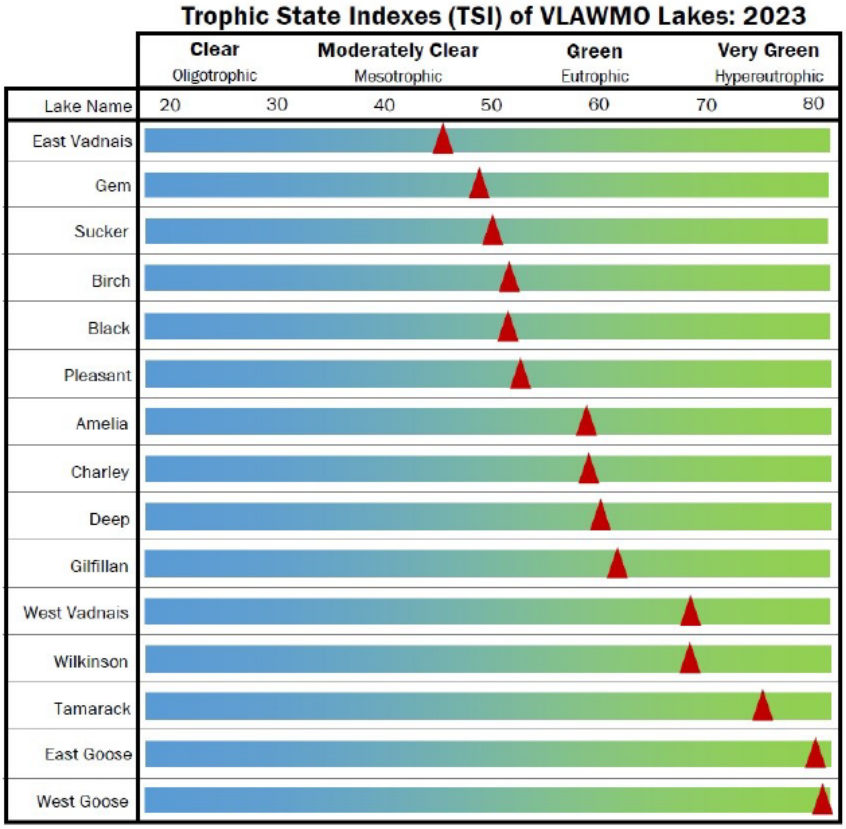
Wood ducks (July 2019 by WC and MC)

Common loons (June 2019 by WC and MC)

3.4 WATER QUALITY SUMMARY

West Vadnais Lake is impaired for nutrients. It has poor water quality as shown by its score of 71 in 2022 and 68 in 2023 on the Trophic State Index (TSI). The lake is characterized as “very green” or hypereutrophic.

Figure 19: TSI Scores for VLAWMO Lakes



VLAWMO has collected water quality (WQ) data on West Vadnais Lake since 2009. Regular, long-term uniform sampling was implemented in 2013 (Table 3). VLAWMO staff collects WQ data and water samples biweekly, May-September, for water clarity (secchi disk), nutrients (TP, Chl-a, SRP, nitrogens), 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.

- 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 3: West Vadnais Lake Monitoring Data 2009, 2013-2023

West Vadnais Historical Avg TP/Chl A/SDT			
Year	**TP (µg/L)**	**Chl A (mg/m³)**	**Secchi (m)**
2009	185	103	0.4
2013	79	59	0.4
2014	70	56	0.5
2015	88	108	0.3
2016	110	71	0.3
2017	130	54	0.4
2018	102	94	0.4
2019	79	64	0.5
2020	127	80	0.5
2021	104	106	0.5
2022	102	112	0.7
2023	78	61	0.7

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Figure 20: Historical Water Quality Averages in West Vadnais Lake 2013-2023

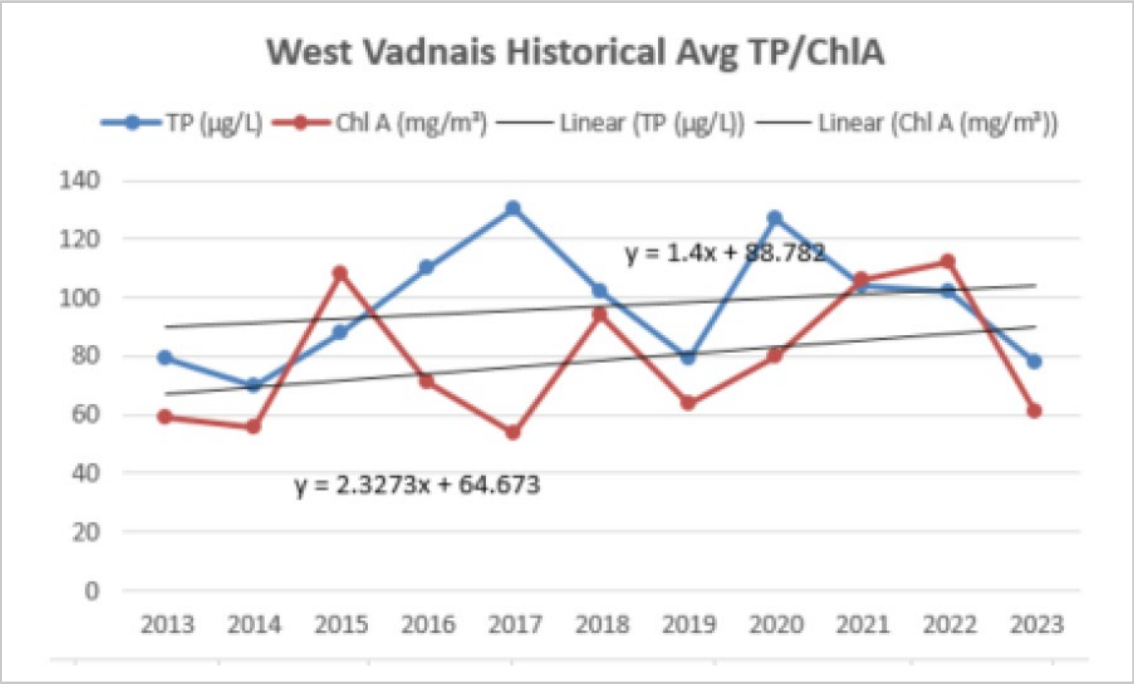


Figure 20: The graph shows results of TP/Chl-a with a linear trend through time. Both TP and Chl-a consistently exceed the State standards.

4 MANAGEMENT EFFORTS

4.1 MANAGEMENT PLAN FOR WEST VADNAIS LAKE: RETROFIT, BMPS, PROJECT PARTNERSHIPS

Retrofit Report (2013)

In 2013, the Ramsey Conservation District (RCD), now Ramsey County Soil and Water Conservation Division (RCSWCD), completed a Retrofit Report for the Sucker, East Vadnais, and West Vadnais Lake subwatershed area. This was part of a larger effort to assess the full watershed and subwatershed scales and identify optimal locations for BMPs. For these retrofit reports, 3 types of bioretention were considered for implementation. The full report is available on the VLAWMO website -> Vadnais Lake.

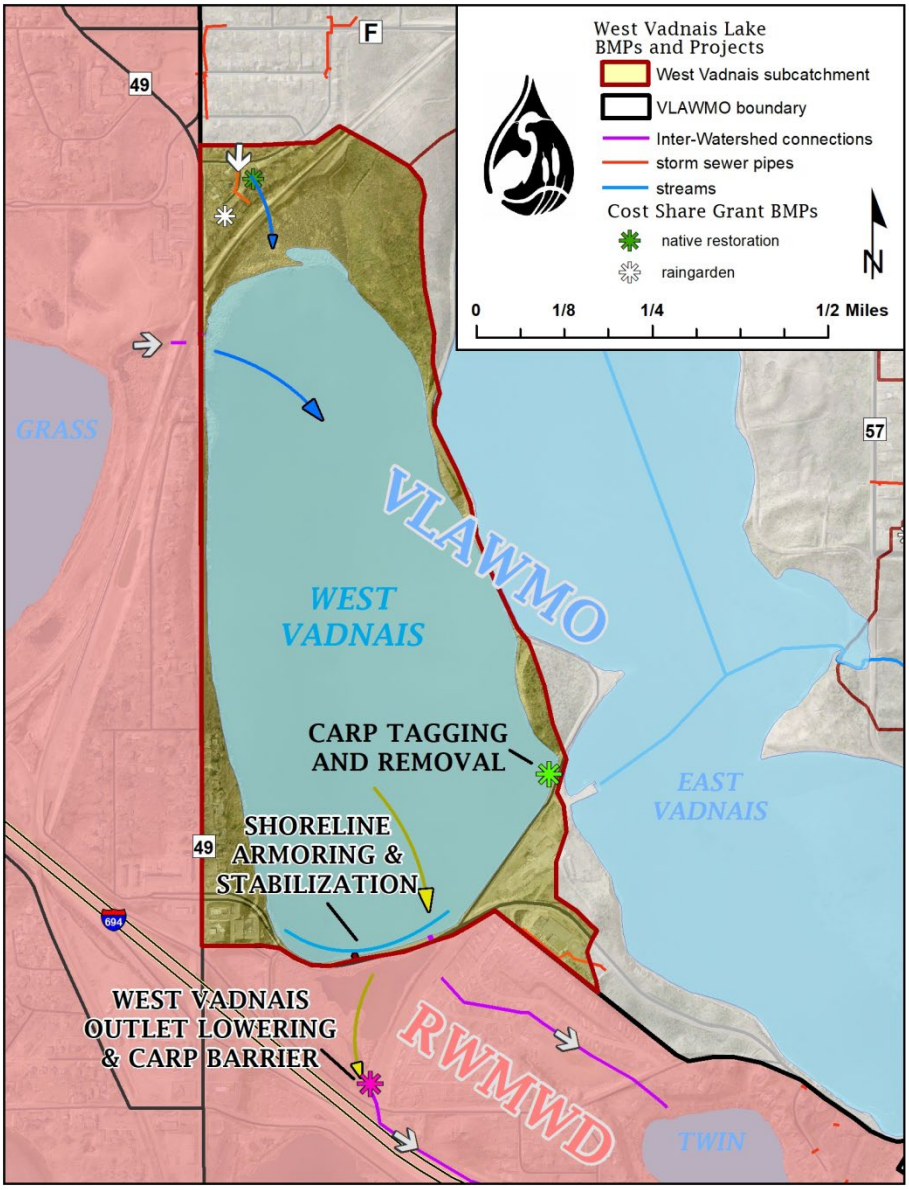
In the report, a conclusions was made that:

> *East Vadnais Lake currently receives in lake treatment by the Saint Paul Water Authority as a measure to protect the drinking water supply. VLAWMO is responsible for the external loading from the surrounding subwatershed into East Vadnais Lake. West Vadnais does not receive any treatment, and it is unlikely that any treatment can be performed. The land use around West Vadnais Lake does not allow for the addition of BMPs, and the lake is mainly surrounded by open space. It is likely that East and West Vadnais Lakes will have different water quality in comparison to each other regardless of the installation of BMPs. To improve the water quality of West Vadnais Lake, alternative in lake activities such as aeration, chemical treatment, rough fish harvest, etc. could be completed in lieu of stormwater BMPs.*

4.1 COMPLETED BPMS AND PROJECT PARTNERSHIPS IN THE SUBWATERSHED

Best Management Practices (BMPs) are implemented to improve and protect water quality. Common small-scale examples of BMPs include rain gardens, infiltration basins, shoreline restorations, rain barrels, and native restorations and plantings. Larger BMPs include stormwater retention basins, iron-enhanced sand filters, weirs and stormwater conveyance retrofits, and in-lake treatments such an alum treatment, rough fish management, or aquatic vegetation management. Only a few smaller-scale BMPs have been implemented in the West Vadnais Lake subwatershed area, as the total land area within the subwatershed area is small, in comparison to the open water area of the Lake. This presents fewer options for terrestrial BMPs, but targets location implementation, and presents an opportunity for in-lake water quality projects and management efforts. West Vadnais Lake has been the focus of joint project efforts and parting by both VLAWMO and the Ramsey-Washington Metro Watershed District (RWMWD), presenting opportunities for concerted project and management efforts.

Figure 21: West Vadnais Lake Subwatershed Implemented projects and BMPs



Summary of projects and BMPs implemented:

- South shoreline armoring for lake shore stabilization, completed in 2019 by the RWMWD.
- 2020 West Vadnais Lake outlet lowering, completed by the RWMWD.
- 2 VLAWMO Cost Share grant BMPs: 1 native restoration and 1 residential rain garden within the Suzanne neighborhood, tributary to West Vadnais Lake storm sewer drainage.
- Carp management efforts were conducted in partnership with RWMWD 2019-2022.

4 MANAGEMENT EFFORTS

Project Partnerships

Ramsey-Washington Metro Watershed District (RWMWD), working with Barr Engineering, lowered the existing outlet of West Vadnais Lake from 881.8 feet to 881.0 feet in 2020 to help alleviate flooding in the surrounding area and provide additional in-lake water storage volume. An EAW was completed in 2019 to inform the process. VLAWMO was the responsible government unit and issued the final opinion that an Environmental Impact Statement (EIS) was not required. Information gathered for the EAW in included in many sections of this report. The EAW has helped to improve current understanding of the lake and wetlands in the surrounding area.

In addition to the culvert modification, VLAWMO has been working with RWMWD to include West Vadnais Lake in their larger carp management program. In-lake strategies, such as rough fish removal, were recommended as part of the RCSWCD retrofit report because of the highly developed and modified condition of the subwatershed and also because much of the contributing runoff is in the RWM Watershed.

Carp Project

In June 2017, RWMWD worked with Carp Solutions to conduct a carp survey in RWMWD including: Owasso, Wabasso, Grass, and Bennett Lakes. West Vadnais was included in this work because of its connection to Grass Lake upstream and flow via culvert into the Phalen Chain to the south. The Phalen Chain has been a focus of carp control efforts for many years, and RWMWD has successfully been able to maintain carp biomass below the management threshold of 100 kg/ha. West Vadnais could contribute carp to reestablish them in the Phalen Chain. West Vadnais was surveyed on August 23, 2018. The results of the carp survey via mark-recapture estimation showed that carp biomass in West Vadnais was quite high compared to other lakes surveyed (248.2 kg/ha) and was nearly 2.5 times the management threshold. The population consisted primarily of young fish from few age classes (2- and 3-year-olds from a small number of fish that were aged using extracted otoliths). West Vadnais was identified as a potential nursery lake for carp and thought to likely winterkill every few years. The report that resulted from this work was published in 2018 and is included in the Appendix of this report.

Table 4: Biomass estimates from carp surveys conducted by Carp Solutions, Inc., in 2017.

Lake Name	Owasso	Wabasso	Grass	Bennett	W. Vadnais	Owasso Basin
Lake Area (ha)	152	17	56	12	86	3.2
Length (mm)	475	470	419	511	482	456
CPUE (carp/h)	74.0	27.0	11.3	7.8	38.0	9.5
Mass (kg)	1.5	1.4	1.1	1.8	1.6	1.3
Density (carp/ha)	302	115	50	35	160	43
N	16,777*	1,959	2,807	422	13,739	136
Biomass (kg/ha)	218.3*	167.0	52.9	64.2	248.2	56.6

VLAWMO began working closely with RWMWD in 2019, with financial contributions to the carp control effort beginning in 2020 and continuing in 2021. That work so far has involved: a revised biomass survey using Passive Integrated Transponder (PIT) tags, baited box net carp removal, a physical barrier that was in place at the culvert location in 2020 (a modification when the electrified barrier could not be deployed due to

COVID complications), installation of electricity by RWMWD, and an electrified barrier that was operational in 2021. A summary of results of work to date are included in reports, the most recent of which was completed in 2022.

Brief summary of carp work

Before the start of the 2020 season, the carp management plan for West Vadnais was to install an electric barrier in the outlet channel of the lake, mark 100 carp with Passive Integrated Transponder (PIT) tags in the lake, place a PIT antenna near the barrier, and conduct carp removals at the barrier in the spring. The combination of marking carp with PIT tags and removing carp at the barrier while checking for PIT tags would allow for a mark-recapture population estimate to be calculated. Additionally, the PIT antenna at the outlet and potentially at other locations on connected water bodies would show carp seasonal migration patterns, potentially leading to the construction of other barriers and spring removal at those barriers. Unfortunately, the COVID-19 pandemic forced a change in those plans. The electric barrier system became unavailable, so a simple ABS pipe physical barrier was installed instead. The installation of PIT antennas was postponed, with the possibility of continuing the effort in 2021. As the lake warmed up and the carp became active in the shallows of the lake, 3 electrofishing surveys were conducted in late April to mark carp. A total of 120 carp were caught in these surveys. Because one of them in a later survey was a recapture from a previous survey, only 119 carp were marked with a PIT tag and released. No significant aggregation of carp was seen at the barrier throughout the spring, so no migration removal was attempted. Instead, it was decided to use 2 box nets to examine the feasibility of removing carp using the box net method while also fulfilling the objective of obtaining a robust carp population and biomass density estimate. Over the course of 7 removal attempts between 7/30/20 and 10/8/20, 356 carp were removed. A total of 21 marked carp were recaptured during these removals. Based on these recaptures, 18% of the carp population in West Vadnais was removed. The population is estimated to be around 1,950 carp, with a corresponding biomass density of 26 kg/ha.

A winterkill likely occurred between the survey in 2017 and the survey in 2020. Such winterkills were suspected during the initial survey because of primarily young fish from only a 2 age classes. The current biomass estimate is lower than the carp management threshold of 100 kg/ha. Because bullhead populations have also historically been high when the MN DNR has conducted fish surveys in the lake, bullhead may also be contributing to poor water quality in the lake. Consequently, a fish survey is planned for 2022 to better understand next steps for fish management with a goal of water-quality improvement.

Figure 22: West Vadnais Carp Project Photos

Carp electroshocking to implant passive transmitter tags and estimate biomass (2019)

Temporary barrier in place for 2019 when COVID complications negated a plan for an electrified barrier

Baited netting effort. Nets were baited with corn and remotely triggered to capture carp feeding at the site during the nighttime (2019)

Boat for and early carp captures (2019)

Power run for electrified barrier (2020)

Electrified barrier on southern wetland at modified culvert (2020)