

## 2. LAND AND WATER RESOURCES

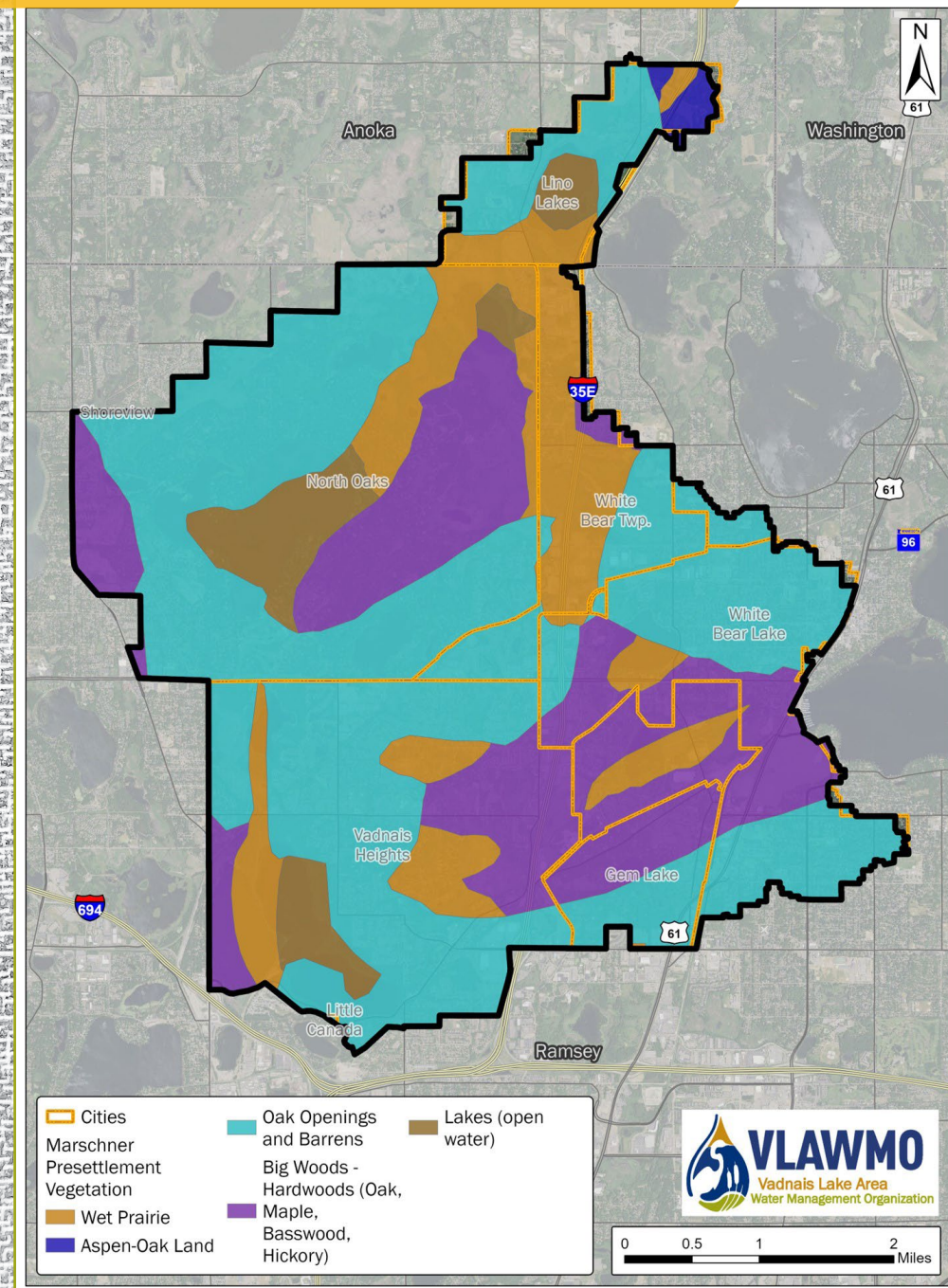
The Vadnais Lake Water Management Organization (VLAWMO) watershed covers 24.2 square miles of northern Ramsey County and a small portion of Anoka County in the Twin Cities metropolitan area. It encompasses the City of North Oaks and part of Gem Lake, Lino Lakes, Vadnais Heights, White Bear Lake, and White Bear Township. The watershed is a subsection of the larger Mississippi River – Twin Cities Watershed which covers the entire Twin Cities metropolitan area. This larger watershed is further split into smaller watershed units for management purposes. There are 15 watershed districts and management organizations with jurisdiction in the Mississippi River – Twin Cities Watershed, including VLAWMO.

VLAWMO is an urban watershed with abundant lakes, streams, parks, and natural spaces, providing ecological, recreational, and cultural benefits to its residents and visitors. This section of the Plan aims to summarize these valuable resources and their current conditions, so that upcoming efforts can be focused on effectively managing the watershed's resources into the future. More detailed information than what is included here is used in watershed planning and project development. This summary is intended to provide background, guidance, and reference information.

### 2.1 Past and Present

VLAWMO's landscape today looks much different than it did prior to European settlement. Historically, the land was predominately covered by maple-basswood forests that were interspersed with wetlands. Marschner's pre-settlement vegetation map (Figure 2-1) shows big woods, oak openings, wet prairie, and open water covering what is now VLAWMO (DNR, 2022). About 16% of the watershed area was wet prairie. The first inhabitants of the region were Native Americans that lived near the Mississippi River. Early settlers established Fort Snelling

Figure 2-1. Marschner's pre-settlement vegetation map.



in the early 1800s to support the fur trade, and the development of St. Paul and surrounding areas followed. The location along the river allowed settlers to arrive to the new territory via steamboat, and later railroad. Many people settled outside of the city to farm the land in what is now the suburbs and VLAWMO. Over time, and with the development of infrastructure, the area became increasingly developed with homes and businesses replacing farmland. This residential, suburban, and industrial development continues today. In the late 1800s, wetlands were drained to accommodate farming and suburbanization, which eventually grew into a blend of residential, commercial, and industrial development.

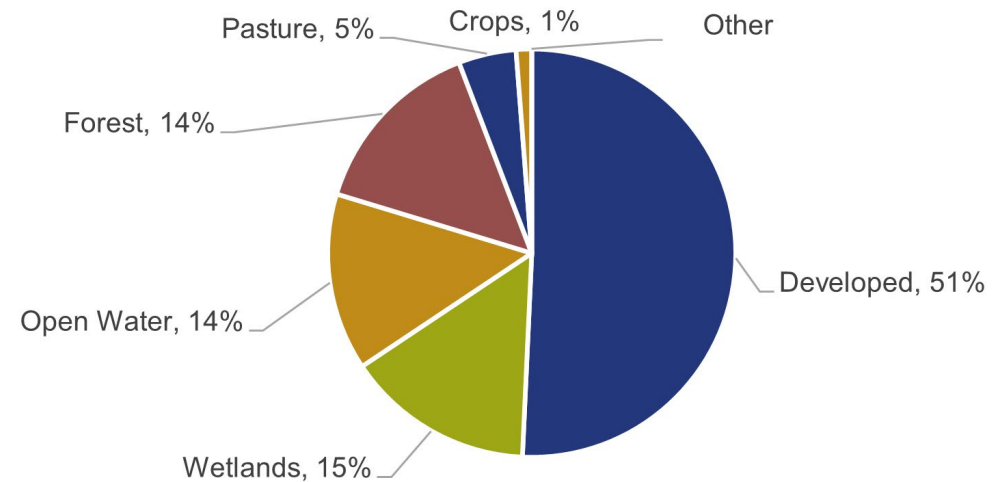


Now, in present-day, VLAWMO is estimated to be home to close to 30,000 people (US Census, 2021; see Section 2.8). Over half of the watershed is developed; however, nearly 30% of the watershed remains as forested land or wetlands. This is a fairly large

percentage for its location in the Twin Cities metropolitan area, compared to neighboring watersheds. A breakdown of watershed land uses and land cover is shown in Figure 2-2, Figure 2-3, and Table 2-1. Figure 2-2 shows the land cover in the National Land Cover Database based on satellite imagery. Table 2-1 and Figure 2-3 shows the land use in the metropolitan area which the Metropolitan Council developed based on aerial imagery. Each dataset is useful in its own way but should be interpreted separately from each other.

VLAWMO partners are required to develop local ordinances that are in compliance with VLAWMO's Water Management Policy (Appendix X). The land in VLAWMO is nearly fully developed or used as parks and open space. Most of the undeveloped land is either protected or not suitable for development. Current and future land use changes are primarily through redevelopment or retrofit projects. Land use regulations and upcoming planning is described in each of the member community comprehensive plans, which are linked below:

- ✦ Vadnais Heights [2040 Comprehensive Plan](#)
- ✦ North Oaks [2040 Comprehensive Plan](#)
- ✦ Gem Lake [Comprehensive Plan](#)
- ✦ Lino Lakes [2040 Comprehensive Plan](#)
- ✦ White Bear Lake [2040 Comprehensive Plan](#)
- ✦ White Bear Township [2040 Comprehensive Plan](#)



**Figure 2-2:** Land cover breakdown in VLAWMO (USGS, 2021).



Description	Watershed Area
Single Family Detached	37%
Park, Recreational, or Preserve	16%
Open Water	14%
Undeveloped	14%
Single Family Attached	3%
Industrial or Utility	3%
Agricultural	2%
Retail and Other Commercial	2%
Major Highway	2%
Institutional	2%
Golf Course	2%
Multifamily	1%
Other (office, mixed industrial, farmstead)	1%

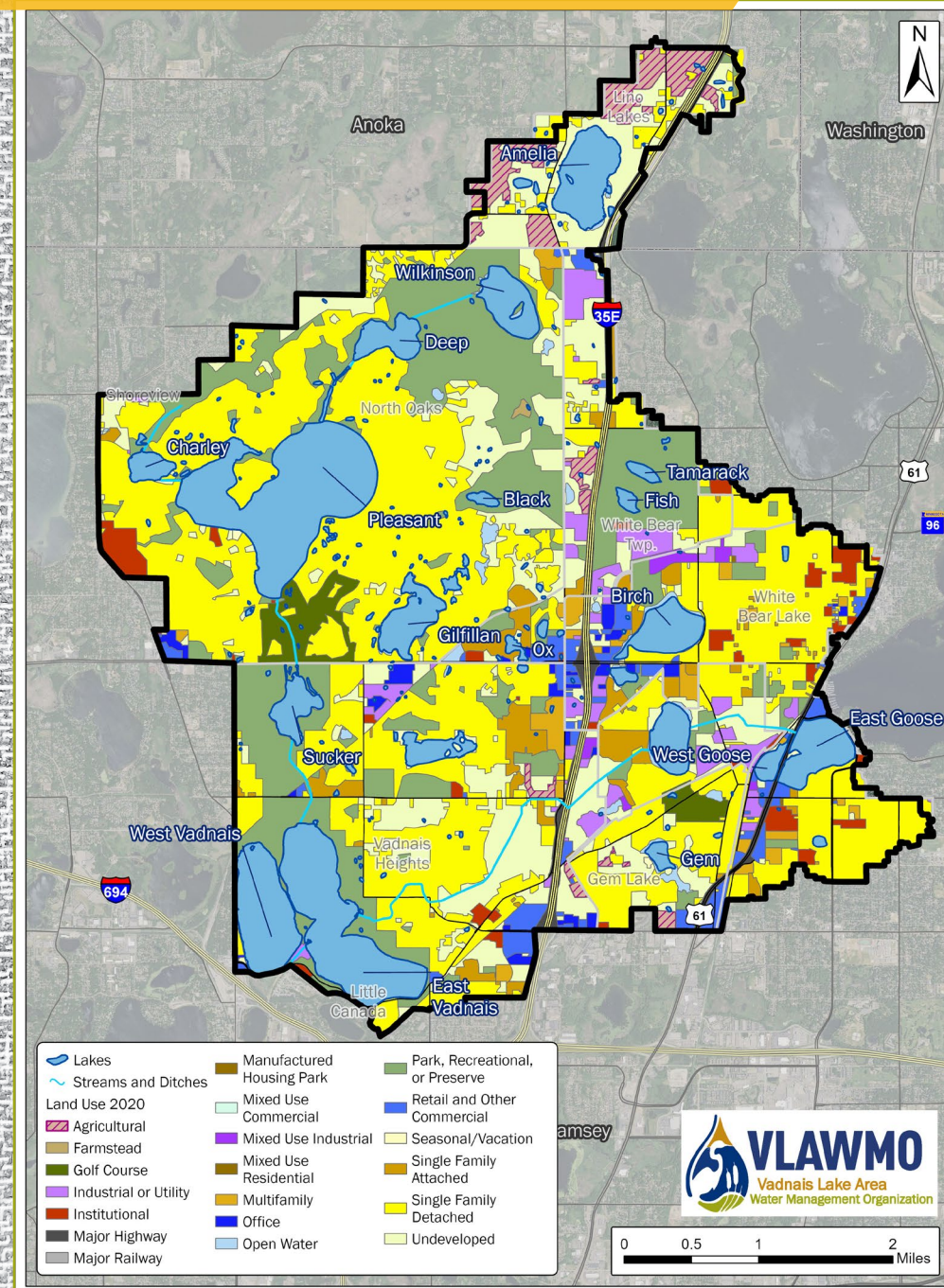
**Table 2-1:** Land use in VLAWMO (Metropolitan Council, 2020).

## 2.2 Geology and Soils

The geology and topography of the watershed is a result of thousands of years of glacial advance and retreat. The most recent glacial deposits that now form the sand, gravel, till, and lake sediment are from the movement of the Grantsburg and Superior glacial sublobes between 12,000 and 20,000 years ago. The glaciers left behind the relatively level or gently rolling topography that is present today. The highest elevation is 1,014 feet near Gem Lake and the lowest is 880 feet near the watershed outlet (DNR, 2011).

The Department of Natural Resources (DNR) developed an Ecological Classification System for categorizing regions across the state on various scales according to ecology, geology, and hydrology. Subsections in the system are defined by glacial depositions, surface bedrock, climate, topography, and plants. Most of VLAWMO is in the St. Paul-Baldwin Plains ecological subsection, with the southwestern edge in the Anoka Sand

**Figure 2-3.** Land use in VLAWMO (Metropolitan Council, 2020).





Plain subsection (a flat, sandy lake plain). The St. Paul-Baldwin subsection is composed of moraine material (debris, glacial till) deposited by the Superior lobe of a glacier and is bordered by flat outwash plains created by glacial streams (DNR, n.d.).

There are many types of soil found in the watershed, but sandy loam and sandy till are widespread. Detailed soil units can be seen on the Web Soil Survey. Soils are classified into hydrologic groups based on soil permeability. The soil survey shows a mix of all four hydrologic soil groups (A, B, C, & D) scattered around the watershed, which indicates that the infiltration capacity varies. Group A is the most prevalent, which are characterized as having high infiltration rates and are typically sand and gravel. In group C or D areas, the soil is less permeable, and heavy precipitation is more likely to result in overland runoff. Knowledge of native soil types and characteristics is useful for understanding how development can impact infiltration. Development can compact soils and increase impervious surface area, leading to more runoff.

Bedrock, the solid rock beneath soils and glacial deposits, that is closest to the surface in the watershed is from marine sedimentary rocks from the Paleozoic Era. Aquifers can be found within glacial deposits and bedrock. The aquifers commonly used for water supply in the watershed include buried sand and gravel (glacial) aquifers, the St. Peter Sandstone, and the Prairie du Chien Group. More information on the geology of the region can be found in the Ramsey County Geologic Atlas, accessible [here](#).

## 2.3 Surface Water

The VLAWMO watershed area is known for its surface water features. VLAWMO's lakes cover 14% of the watershed. VLAWMO waters consist of 15 public water basins (lakes), 47 public water wetlands, Lambert Creek with its associated tributaries, and a series of minor streams, ditches, and

channels. There are no dams in VLAWMO, however there is a network of weirs on Lambert Creek. This section highlights the prominence and condition of these surface water features.

### 2.3.1 Lakes

VLAWMO has a unique chain of lakes downstream from the Mississippi River that drains into a drinking water reservoir for multiple communities. Because VLAWMO includes East Vadnais Lake, which is the drinking water source for St. Paul and surrounding communities, more than 450,000 people (in 2024) receive their drinking water from this watershed. The 15 public water lakes in the watershed along with Lambert Creek are summarized in Table 2-2. The table includes a summary of each lake's size, impairment status (MPCA, 2024a), trophic status index (which rates waterbodies based on biological productivity and provides insight into water quality), if it is a shallow lake (DNR, 2019b), trend in total



Gilfillan Lake (above) and East Goose Lake (right).  
 Photos: <https://www.vlawmo.org/waterbodies/>

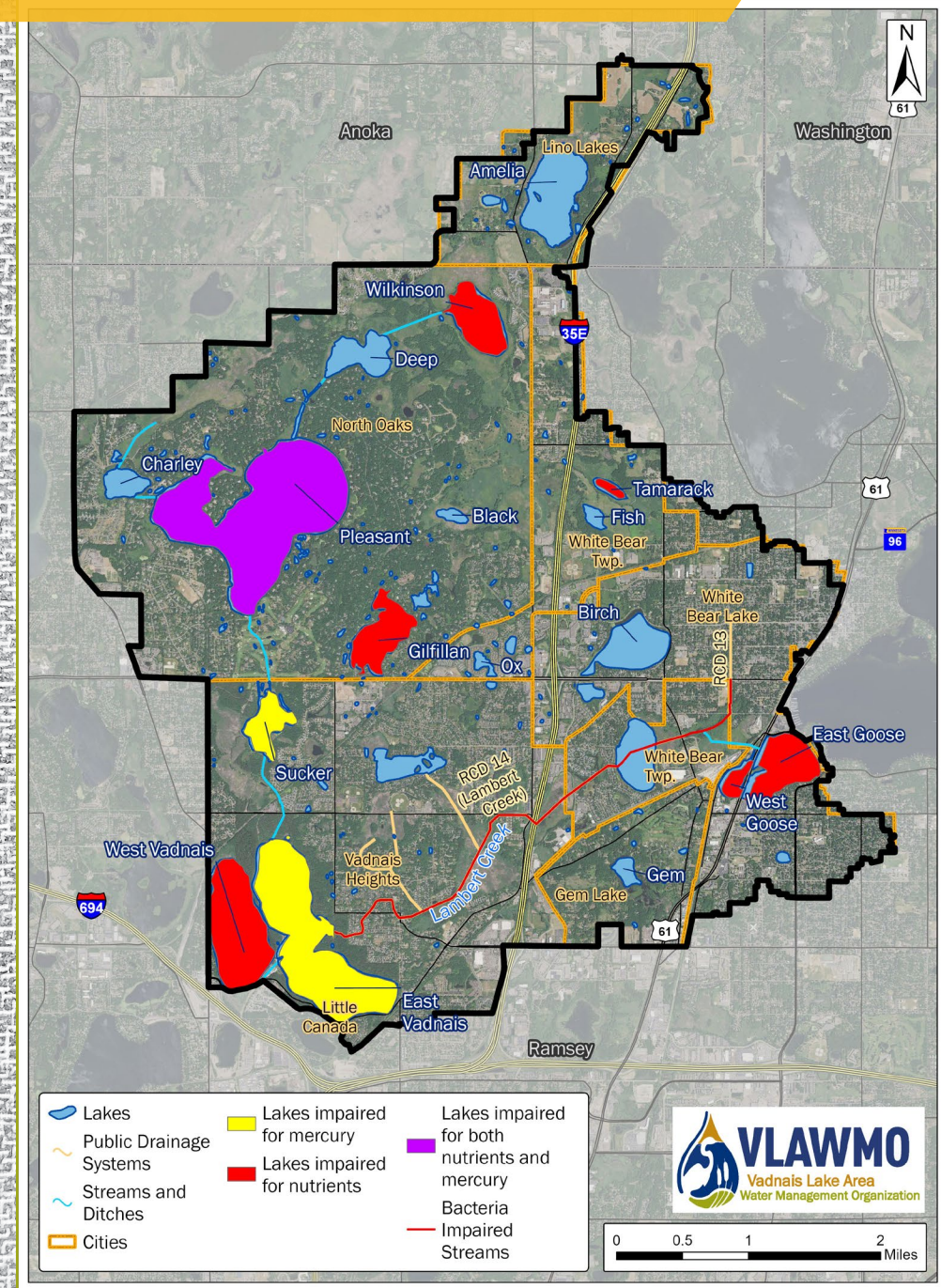


phosphorus (TP) and chlorophyll-a (Chl-a), and any invasive species detected and reported. The shallow lake status is included as shallow lakes (under 15 feet deep) are important for wildlife. These lakes are thus are managed with increased attention to water and habitat quality. VLAWMO monitors waterbodies and releases an annual monitoring report, which was used to inform trend data in Table 2-2. VLAWMO also monitors once annually for chloride after ice-off. Birch and East Goose Lake have the highest chloride concentrations, which is expected given their proximity to roads with salt application.

The Federal Clean Water Act requires states to adopt water quality standards to protect surface waters. These standards define how much of a pollutant can be in a waterbody while still allowing it to meet its designated uses, such as drinking water, fishing, and swimming. The Clean Water Act requires states to publish an updated list of streams and lakes that are not meeting their designated uses because of excess pollutants. The list, known as the 303(d) list or the Impaired Waters list, is based on those water quality standards. Given that the surface water in VLAWMO is a critical drinking water source, the Safe Drinking Water Act regulates public water suppliers in the watershed.

The Minnesota Pollution Control Agency (MPCA) monitors waterbodies statewide and classifies a resource as impaired if it does not support the designated use set for the resource. There are 10 aquatic life or recreation impairments on 9 VLAWMO lakes due to nutrients or mercury in fish tissue (Figure 2-4). While there are no public water (boating) access points in VLAWMO, there is a public park and fishing pier along Sucker and East and West Vadnais Lakes, and VLAWMO's many lakes are enjoyed by residents and visitors for recreation. Visitors and residents value boating, swimming, fishing, and wildlife watching in the watershed's lakes.

Figure 2-4. Impaired waters (MPCA, 2024) in VLAWMO.





## 2.3.2 Streams, Ditches, and Channels

Lambert Creek and its associated tributaries are defining features of VLAWMO. Lambert Creek, in addition to being a public watercourse, is also designated as a portion of Ramsey County Ditch 14 (RCD 14).

Ramsey County transferred two public drainage systems, RCD 13 and RCD 14, to VLAWMO in 1986. RCD 13 consists entirely of a storm sewer system beginning at 5th Street and flowing south to Whitaker Pond in White Bear Lake. RCD 14 consists of primarily open channel (with some storm sewer). It includes a Main Trunk (i.e. Lambert Creek) and five branches that span from White Bear Lake to Vadnais Heights, flowing east to west or southwest. RCD 13 and 14 are the only public ditches in the watershed. RCD 14 is also called Lambert Creek.

Lambert Creek is assessed as a creek for water quality standards and is listed as impaired for aquatic recreation due to bacteria. While it is not officially impaired due to nutrients, the creek does have high nutrient concentrations and may be at elevated risk of becoming impaired in the future.

## 2.3.3 Wetlands

Wetlands make up 15% of the land area of the VLAWMO watershed (USGS, 2021). There are 47 public water wetlands in the watershed (DNR, 2024b) and over 1,000 wetlands in the watershed, with the majority being a freshwater emergent wetland type with a Simplified Plan Community Classification of shallow marsh or non-vegetative aquatic community (DNR, 2019b2019a). The land was more heavily forested and covered in wetlands prior to settlement, and many wetlands were drained to accommodate agriculture and land development.

VLAWMO is the Wetland Conservation Act (WCA) local government unit for the watershed (excluding Minnesota Department of Transportation (MnDOT) projects) and is involved whenever there is development or other activities which occur near or in a wetland. VLAWMO's formal role and responsibility in regulatory review is limited to only the administration of the Wetland Conservation Act (WCA).

VLAWMO partners with the Technical Evaluation Panel (TEP) and encourages early communication to ensure WCA is adhered to. Information on WCA and VLAWMO's role is available on the VLAWMO website.



*Wilkinson Lake Wetland, Ramsey County, MN.*



**Table 2-2.** Summary of VLAWMO waters.

Name (AUID)	Acres	Impairment(s)	Trophic State Index (TSI)	DNR Shallow Lake	Fish Identified in Fish Survey	Infested with AIS	5-year TP and Chl-a Average*	Other
<b>Amelia (02-0014-00)</b>	217		59	X	No survey	Eurasian water-milfoil, **Flowering rush	TP: 40 µg/L Chl-a: 12 µg/L	DNR lake of outstanding biological significance. Classified by DNR as the highest priority class for Lakes of Phosphorus Sensitivity (LPSS).
<b>Birch (62-0024-00)</b>	127		51	X	Black Bullheads, Bluegills, Black Crappies, Largemouth Bass, Northern Pike, Pumpkinseeds	Curly-leaf pondweed, Eurasian watermilfoil	TP: 21 µg/L Chl-a: 28 µg/L	
<b>Black (62-0019-00)</b>	10		51	X	No survey		TP: 33 µg/L Chl-a: 5 µg/L	Only VLAWMO lake with wild rice.
<b>Charley (62-0062-00)</b>	37		59		Common carp, Sunfish, Northern Pike, Walleye***	Curly-leaf pondweed, Eurasian watermilfoil, Zebra mussels	TP: 53 µg/L Chl-a: 10 µg/L	High LPSS priority class.
<b>Deep (62-0018-00)</b>	80		60	X	Common carp, Walleye, Bass, Sunfish, Northern pike***	Curly-leaf pondweed, Eurasian watermilfoil	TP: 73 µg/L Chl-a: 11 µg/L	High LPSS priority class.
<b>East Goose (62-0034-00)</b>	115	Nutrients	80	X	Black bullhead, Black crappies, Bluegills, Fathead minnows, Golden shiner, Green sunfish, Hybrid sunfish, Pumpkinseed, Yellow perch****	Curly-leaf pondweed	TP: 170 µg/L Chl-a: 138 µg/L	
<b>East Vadnais (62-00038-01)</b>	393	Mercury in fish tissue	45		Black bullhead, Black Crappie, Bluegill, Brown bullhead, Channel catfish, Green sunfish, Hybrid sunfish, Largemouth bass, Northern pike, Pumpkinseed, Rock bass, Smallmouth bass, Walleye, White bass, White crappie, Yellow bullhead, Yellow perch, Bowfin, Common carp, White sucker, Golden shiner	Curly-leaf pondweed, Eurasian watermilfoil	TP: 23 µg/L Chl-a: 4.5 µg/L	Higher LPSS priority class.
<b>Gem (62-0037-00)</b>	48		49		Black Crappie, minnow		TP: 35 µg/L Chl-a: 10 µg/L	Classified as public water wetland. Delisted for nutrient impairment in 2018.
<b>Gilfillan (62-0027-00)</b>	110	Nutrients	62	X	Walleye, Sunfish***	Curly-leaf pondweed	TP: 54 µg/L Chl-a: 38 µg/L	Water has been pumped from Pleasant to Gilfillan to increase water levels.

**Table 2-2. Summary of VLAWMO waters.**

Name (AUID)	Acres	Impairment(s)	Trophic State Index (TSI)	DNR Shallow Lake	Fish Identified in Fish Survey	Infested with AIS	5-year TP and Chl-a Average*	Other
<b>Fish (62-0021-00)</b>	12		N/A		No survey		N/A	Classified as public water wetland
<b>Lambert Creek (07010206 -656)</b>	N/A	Bacteria	N/A		N/A		TP: 212 µg/L Chl-a: 24 µg/L	Partially RCD 14
<b>Pleasant (62-0046-00)</b>	607	Nutrients, Mercury in fish tissue	53		No survey, common carp present	Curly-leaf pondweed, Eurasian watermilfoil, Rusty crayfish, Zebra mussels	TP: 46 µg/L Chl-a: 13 µg/L	
<b>Sucker (62-0028-00)</b>	63	Mercury in fish tissue	50		Black crappie, Bluegill, Bowfin, Brown Bullhead, Common carp, Green sunfish, Hybrid sunfish, Largemouth bass, Northern pike, Pumpkinseed, Walleye, Yellow bullhead, Yellow Perch	Curly-leaf pondweed, Eurasian watermilfoil, Rusty crayfish, Zebra mussels	TP: 38 µg/L Chl-a: 10 µg/L	
<b>Tamarack (62-0022-00)</b>	86	Nutrients	75		No survey		TP: 162 µg/L Chl-a: 175 µg/L	Classified as public water wetland.
<b>West Goose (62-0126-00)</b>	24	Nutrients	81		Black bullhead, Black crappies, Bluegills, Fathead minnows, Golden shiner, Green sunfish, Hybrid sunfish, Pumpkinseed, Yellow perch****	Curly-leaf pondweed	TP: 174 µg/L Chl-a: 153 µg/L	Classified by DNR as an unnamed public water wetland.
<b>West Vadnais (62-0038-02)</b>	212	Nutrients	68		Bullhead, Common carp, Pan fish***	Curly-leaf pondweed, Eurasian watermilfoil, Zebra mussels	TP: 98 µg/L Chl-a: 85 µg/L	
<b>Wilkinson (62-0043-00)</b>	93	Nutrients	66	X	Black bullhead, Black crappies, Bluegills, Golden shiner, Green sunfish, Hybrid sunfish, Largemouth bass, Pumpkinseed, Yellow perch	Curly-leaf pondweed	TP: 100 µg/L Chl-a: 16 µg/L	

*\*For more information, see the 2023 Monitoring Report on the VLAWMO web site. This data is only for the years identified in the 2023 Monitoring Report and will change over the life of the plan. Lambert Creek averaged between 6 sampling sites.*

*\*\*Flowering rush is being treated in a nearby wetland, but it has not been detected in the lake in recent years.*

*\*\*\*No fish survey done – common species only.*

*\*\*\*\*Fish survey combines East and West Goose.*



## 2.4 Groundwater and Drinking Water

Within VLAWMO, protection of both groundwater and surface water features are critical for protecting public drinking water and therefore public health. This section summarizes sources of drinking water and potential risks to be managed, both for groundwater and surface water.

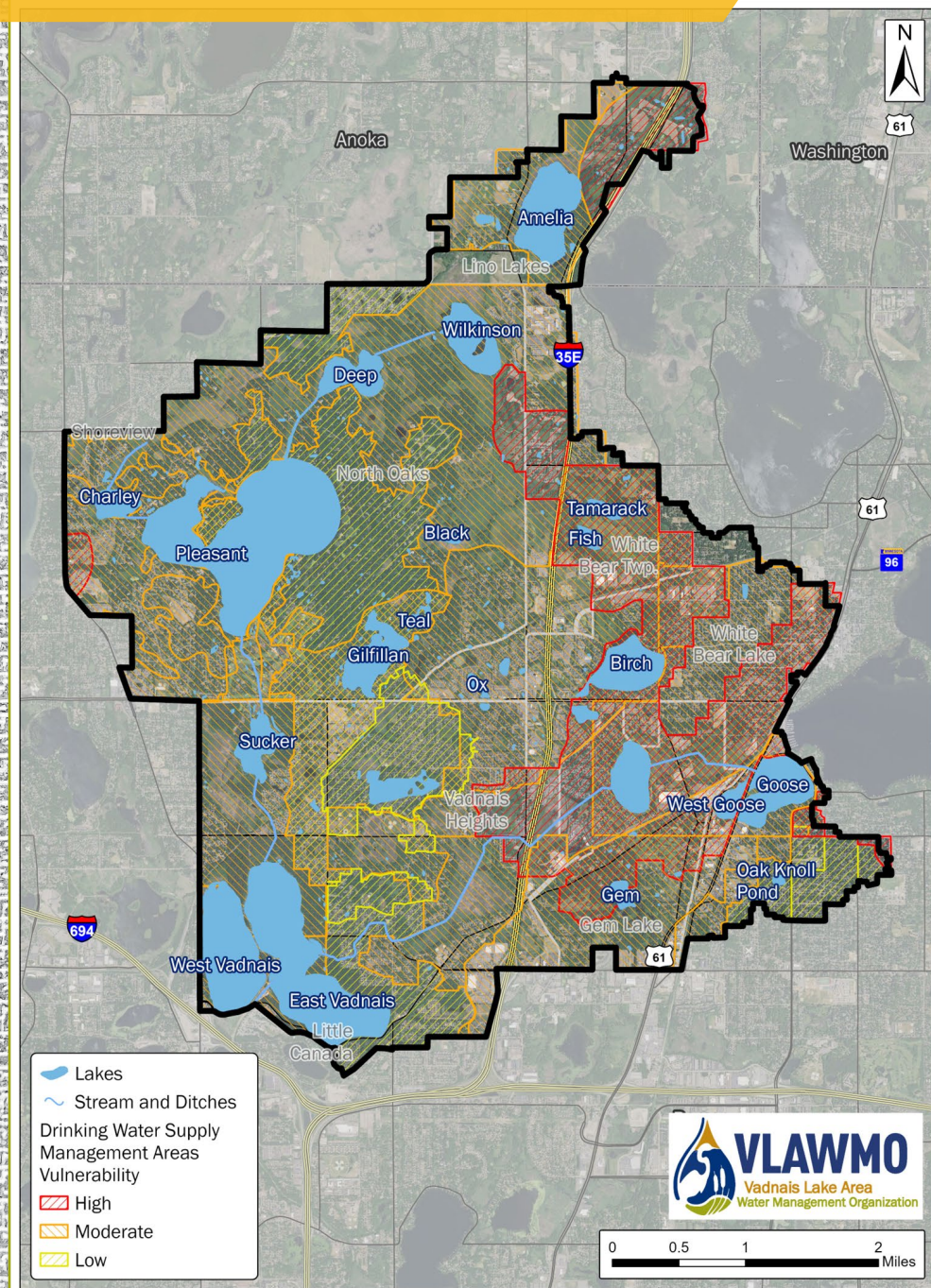
### 2.4.1 Groundwater Resources

The Minnesota Department of Health (MDH) works with public water systems to identify and manage potential threats around public drinking water sources. Part of this effort includes defining a protection area for drinking water sources, known as a Drinking Water Supply Management Area (DWSMA). Within DWSMAs, contamination on the land surface or in water can affect the drinking water supply, making the areas important to consider for managing threats to drinking water and public health.

Nearly the entire VLAWMO watershed overlaps with one or more groundwater DWSMAs, ranging from low to high vulnerability, with the majority (by area) being of moderate vulnerability (MDH, 2022) (Figure 2-5). Most of the watershed is covered by the Saint Paul Regional Water Services DWSMA, Vadnais Heights North DWSMA, Vadnais Heights South DWSMA, and White Bear Township DWSMA. Other DWSMAs in the watershed include the Lino Lakes, White Bear Lake, and Five Star Mobile Home Park DWSMAs. Additionally, there are many private drinking water wells in the watershed, especially in the community of North Oaks.

DWSMAs are given a vulnerability rating based on the susceptibility of the aquifer(s) used by the public water supply system to contamination from or near the surface. Most of the watershed has a moderate vulnerability to contamination, but there are areas of low vulnerability from north to south along the center of the watershed and high vulnerability in the

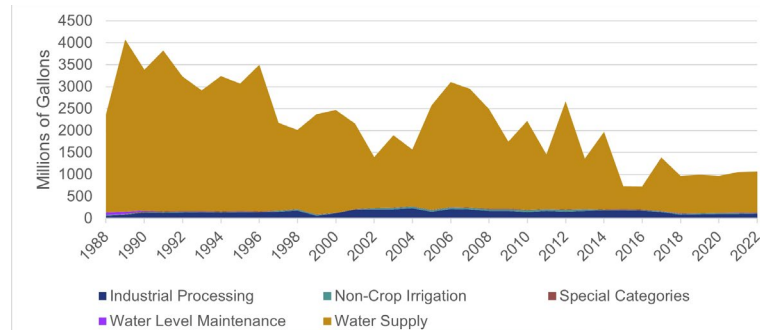
Figure 2-5. Drinking Water Supply Management Areas in VLAWMO.





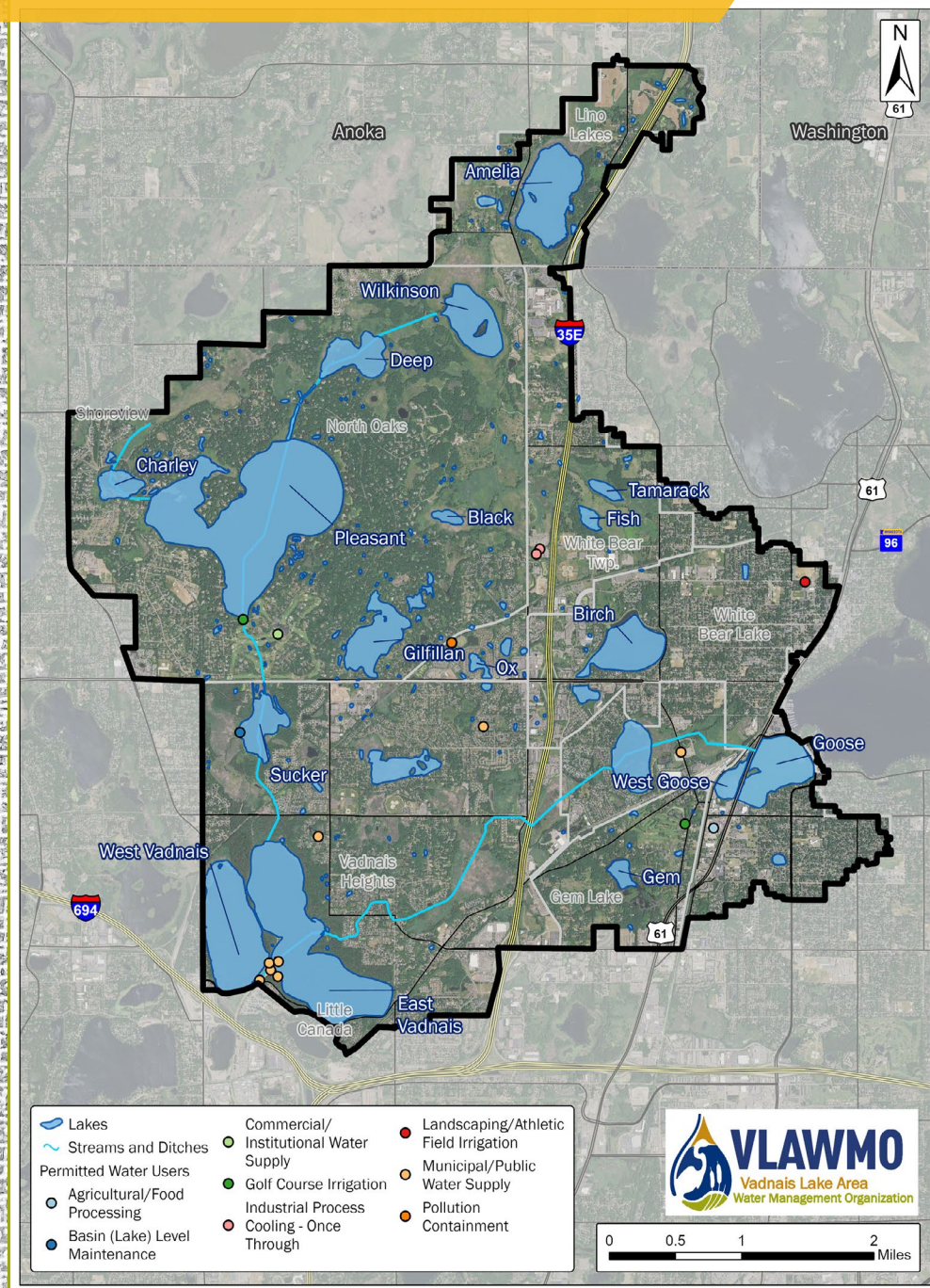
eastern half of the watershed (Figure 2-5). The pollution sensitivity of near-surface materials, which evaluates the time it takes for water to infiltrate 10 feet, varies from low to high throughout the watershed. The pollution sensitivity of near surface materials can be viewed on the [Watershed Health Assessment Framework tool](#). Groundwater is sourced from both buried sand and gravel (glacial) and bedrock aquifers. The most commonly used aquifers in the watershed for water supply are buried sand and gravel aquifers, the St. Peter Sandstone, and the Prairie du Chien Group.

As of 2022, there are 22 surface water and groundwater use permits in the watershed (Figure 2-6). Further information on DNR water use permits is available on the DNR [Water Permitting and Reporting System webpage](#). In order of volume used, the permits are for public water supply, agricultural or food processing, golf course irrigation, private water supply, pollution containment, industrial water supply, lake level maintenance, and landscaping irrigation. Figure 2-7 shows groundwater uses. Surface water uses are largely for water supply and far outweigh groundwater use in the watershed. Groundwater withdrawals have been generally decreasing in the watershed since the late 1980s (as far as the DNR records go) and in 2022, 1,073,000 million gallons of groundwater was withdrawn. The decrease may be due to water conservation efforts made by partner communities. The vast majority of groundwater is used for the public water supply (DNR, 2023b).



**Figure 2-7.** VLAWMO groundwater use categories.

**Figure 2-6.** Permitted groundwater in VLAWMO (DNR, 2023b).





## 2.4.2 Surface Drinking Water

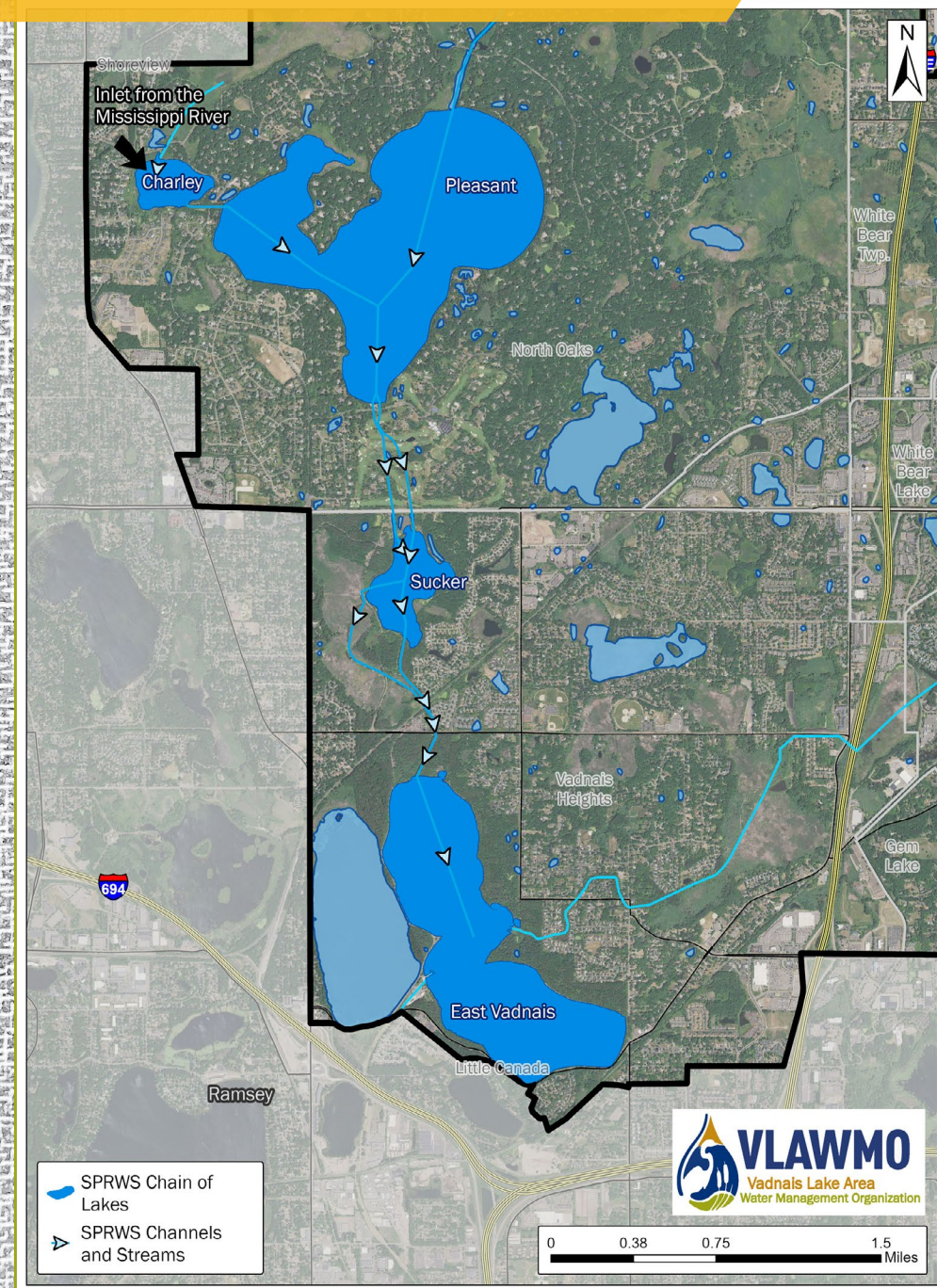
Almost the entirety of the VLAWMO watershed is within Priority Area A of the surface water DWSMA for the Saint Paul-Chain of Lakes public water supply system. MDH is in the process of updating Priority A and B delineations as Emergency Response Areas and Spill Management Areas. The Surface Water Protection Web Map Viewer can be accessed [here](#) for the most up-to-date management areas.

VLAWMO works closely with the St. Paul Regional Water Service (SPRWS) to monitor surface water quality of East Vadnais Lake as well as the lakes that feed into it, as East Vadnais Lake is the drinking water source for over 450,000 people in the 14 cities, including the City of St. Paul. Water from the Mississippi River is pumped into Charley Lake, where it enters Pleasant Lake, Sucker Lake, then East Vadnais Lake (Figure 2-8). Monitoring and protecting surface water quality is essential for these lakes due to the use for drinking water. Algae blooms are a particular concern in the drinking water chain of lakes (e.g. Pleasant and Vadnais) because they can produce toxins and alter the taste of the water. SPRWS monitors for algae blooms, especially in the late summer and early fall.



*Sucker Lake Channel Restoration.  
Photo Credit: vlawmo.org*

**Figure 2-8.** Surface water for drinking water in VLAWMO.





## 2.5 Stormwater and Wastewater



Residents learning about raingardens at White Bear Montessori.  
Photo Credit: @vlawmo

Stormwater is runoff in urban areas. In a natural landscape, water infiltrates into the soil during a rain event and runs overland when infiltration capacity is reached. Construction of impervious land such as roads and buildings reduces the ability of the land to store water. Urban contaminants

such as road salt, sediment, yard runoff, pet waste, and more are picked up by stormwater as it moves over urban areas. Stormwater is typically directed along gutters and curbs into the city's storm sewer system, which discharge into streams or ditches without filtration.

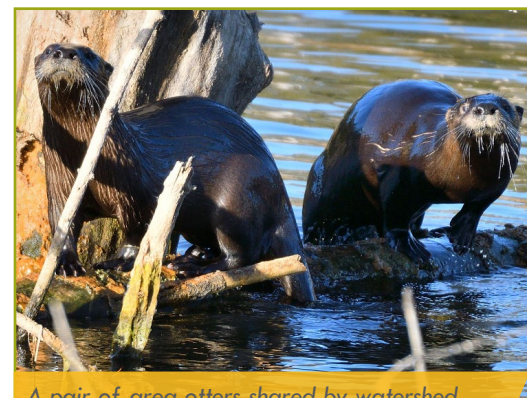
A Municipal Separate Storm Sewer System (or MS4) is a network of catch basins, gutters, roads, and storm drains that drain stormwater and are publicly owned. VLAWMO's six member communities, Anoka County, Ramsey County, and MnDOT are covered by the MPCA MS4 general permit (MPCA, 2024b). MS4s are required to reduce the amount of sediment and pollutants in stormwater where possible and each has a stormwater pollution prevention program. VLAWMO actively supports MS4s in the watershed by providing education and outreach materials.

Member community MS4s are required to meet the standards of the VLAWMO Water Management Policy, last updated in 2022 (Appendix X). The Water Management Policy details WMO-specific regulations on erosion and sediment control, floodplain and drainage alteration, groundwater and stormwater management, shoreline and streambank alteration, stream and lake crossing, and wetlands and buffers.

There are two active wastewater treatment facilities in the watershed, one privately owned for industry and the other owned by White Bear Township. Subsurface sewage treatment systems (SSTS) are present in North Oaks, Vadnais Heights, Lino Lakes, and White Bear Township. MPCA's What's in My Neighborhood map shows sites of interest for potential contamination, permits, licenses, registrations, inspections, and other enforcement activities. In VLAWMO, there are 187 sites in MPCA's hazardous waste program, 122 stormwater sites, 94 in the investigation and cleanup sites, and 6 SSTS sites (MPCA, 2024c).

## 2.6 Habitat, Endangered, and Invasive Species

The DNR identifies lakes of biological significance due to the presence of unique plants or animals. There is one lake of biological significance in the watershed (Amelia) and multiple lakes and wetlands that the Minnesota Biological Survey (MBS) identifies as sites of biodiversity significance. Outstanding biodiversity sites include the North Oaks Natural Area (which covers Deep Lake, Black Lake, and Wilkinson Lake) and Sucker Lake Natural Area west of Sucker Lake. There is one site with high significance (Long Lake wetlands on the western edge of VLAWMO) and nine sites of moderate significance (DNR, 2024a).



A pair of beaver in a stream shared by watershed residents. Photo Credit: vlawmo.org

VLAWMO conducts aquatic plant surveys with partners (i.e., Ramsey County Soil and Water Conservation Division) to assess aquatic communities and manages invasive species.



Aquatic plant surveys are available for all of VLAWMO's lakes. Eurasian watermilfoil, curly-leaf pondweed, rusty crayfish, and zebra mussels are invasive species found in the watershed. One infestation of flowering rush was detected in a wetland adjacent to Amelia Lake. That infestation is currently being treated (2024).

VLAWMO conducted frog and toad call surveys, remote-camera surveys, and otter monitoring including a citizen-science Otter Spotter online tool that all contribute to understanding about wildlife and habitat quality watershed-wide. VLAWMO considers fish and wildlife habitat in projects and does work with habitat protection and restoration in mind.

There are 55 native plant communities identified by the DNR in 12 different community categories (DNR, 2014). Most are congregated around Deep, Wilkinson, Sucker, and Black Lakes. Table 2-3 includes a list of the state and federal endangered species found within the VLAWMO boundary.



Tubercled Rein Orchids.  
Photo Credit: minnesotawildflowers.info



A napping Rusty Patched Bumble Bee.  
Photo Credit: @vlawmo

**Table 2-3.** Species that are threatened, special concern, watchlist, proposed endangered, or endangered in VLAWMO.

Scientific Name	Common Name	Category	Status
<b>State: Threatened, Special Concern Species, Watchlist, or Endangered (NHIS)</b>			
<i>Emydoidea blandingii</i>	Blanding's Turtle	Vertebrate Animal	Threatened
<i>Buteo lineatus</i>	Red-shouldered Hawk	Vertebrate Animal	Special Concern
<i>Platanthera flava</i> var. <i>herbiola</i>	Tubercled Rein Orchid	Vascular Plant	Threatened
<i>Bombus affinis</i>	Rusty Patched Bumble Bee	Invertebrate Animal	Watchlist
<i>Anguilla rostrata</i>	American Eel	Vertebrate Animal	Special Concern
<i>Decodon verticillatus</i>	Water-willow	Vascular Plant	Special Concern
<i>Platanthera clavellata</i>	Small Green Wood Orchid	Vascular Plant	Special Concern
<i>Sterna forsteri</i>	Forster's Tern	Vertebrate Animal	Special Concern
<i>Perimyotis subflavus</i>	Tricolored Bat	Vertebrate Animal	Special Concern
<i>Cygnus buccinator</i>	Trumpeter Swan	Vertebrate Animal	Special Concern
<i>Rubus multiflorus</i>	Kinnickinnick Dewberry	Vascular Plant	Special Concern
<i>Empidonax virens</i>	Acadian Flycatcher	Vertebrate Animal	Special Concern
<i>Juncus articulatus</i>	Jointed Rush	Vascular Plant	Endangered
<b>Federal: Endangered, Proposed Endangered, or Proposed Threatened (IPAC)</b>			
<i>Myotis septentrionalis</i>	Northern Long-eared Bat	Mammals	Endangered
<i>Perimyotis subflavus</i>	Tricolored Bat	Mammals	Proposed Endangered
<i>Simpsonia ambigua</i>	Salamander Mussel	Clams	Proposed Endangered
<i>Danaus plexippus</i>	Monarch Butterfly	Insects	Proposed Threatened
<i>Bombus affinis</i>	Rusty Patched Bumble Bee	Insects	Endangered
<i>Argynnis idalia occidentalis</i>	Western Regal Fritillary	Insects	Proposed Threatened

## 2.7 Climate

The watershed experiences a wide range of temperatures, from hot humid summers to cold snowy winters. The average annual temperature is 45 degrees Fahrenheit, with an average of 18 degrees in the winter and 70 degrees in the summer. The temperature has been increasing; specifically, it is getting less cold at night and in the winter. Since 1895, the watershed has been warming by an average of 0.22 degrees per decade (Figure 2-9, DNR, 2024c).

As the climate shifts, so too does the water cycle. Ice-out dates are occurring earlier, plant hardiness zones have changed (UMN, 2023), and heavier rainstorms are occurring. While annual precipitation is expected to continue increasing, periods of drought in between heavy rain events is projected to be more common (UMN, n.d.). Seasonal climate impacts have implications for local watershed management- a shorter winter can result in increased algae blooms and invasive aquatic plant densities. VLAWMO considers the current and projected future climate when

planning, especially potential impacts on water quality, peak flows, and terrestrial and aquatic habitat. Tangible climate impacts to recreation including ice fishing, gardening, and summer recreation on lakes. VLAWMO intends to continue its efforts to educate residents on and gain support for VLAWMO programs and projects that build climate resiliency.

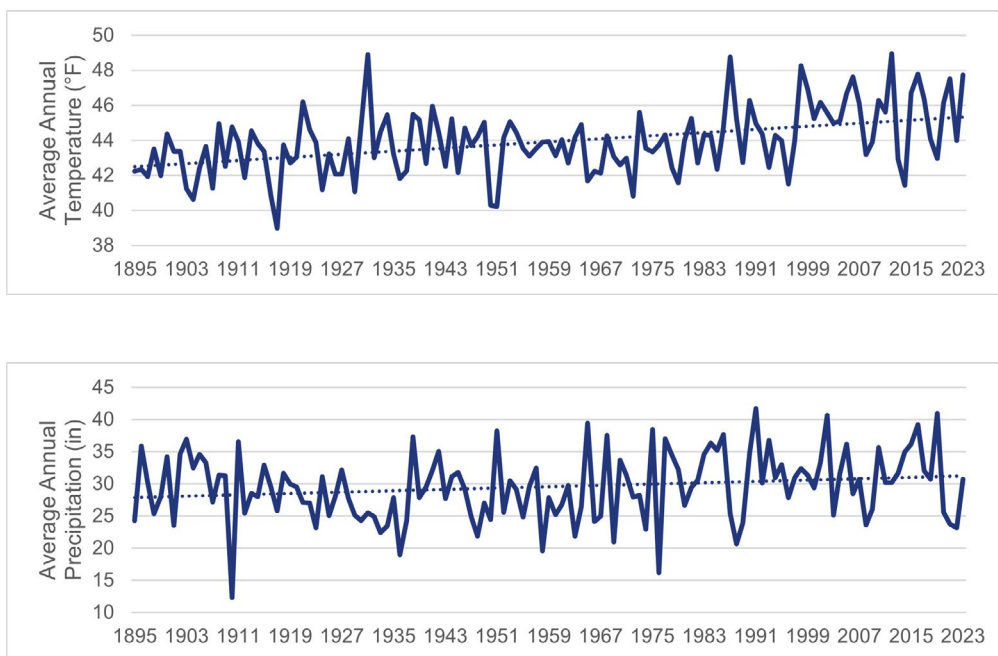
An increase in extreme rain events can be a burden on infrastructure. Stormwater infrastructure was designed for 10-100 year rain events, which are occurring more often. NOAA Atlas 14 rainfall depth for a 100-year, 24-hour storm in the watershed is 7.25 inches of rain. The watershed receives an average of 31 inches of rain a year, which is more than it historically received (DNR, 2024c). NOAA is revising national rainfall frequency data in Atlas 15 to account for climate change. Atlas 15 is expected to be available in 2026 and will be useful in designing infrastructure.



Ring-necked ducks. Photo Credit: vlawmo.org



The MN DNR reviewed climate and hydrology data in the Mississippi River – Twin Cities Watershed and published the Evaluation of Hydrologic Change (EHC) report, summarizing how precipitation and flow have changed in the watershed. The impacts of more precipitation and heavier rain events are compounded by changes in land use that reduce the natural capacity of the land to store water. Hydrologic change can impact stream volume, flooding, erosion, and in-stream habitat. The EHC found that the mid-1970s could be identified as marking a shift in hydrology in the watershed, with statistically different streamflow and precipitation prior to and after the point of change. The report found the watershed receives an additional 4 inches of annual precipitation after the mid-1970s when compared to the decades before (DNR, 2023a).



**Figure 2-9.** Annual temperature and precipitation in the Mississippi River-Twin Cities Watershed 1895-present.

## 2.7.1 Flooding, Peak Discharge, and Climate Resiliency

Changing precipitation trends can have profound impacts on water resources management, including flooding. Flood-prone areas within VLAWMO are centered primarily on roadway intersections where storm sewers are inadequately sized to accommodate modern runoff events. The Metropolitan Council developed the Localized Flood Map Screening Tool, with a [web viewer](#) for members of the public to see potential flooding locations in a high intensity rain event. With increasing precipitation and heavier rain events, there is a pressing need for increasing climate resiliency to combat changing climate patterns. Section 4, Implementation, describes how VLAWMO will incorporate resiliency into the watershed, including analyzing locations in the watershed for increased water storage and infiltration, and partnering with communities when infrastructure is replaced.



County Road F Flume Going West. Photo Credit: vlawmo.org



## 2.8 Demographics

Using census data, an estimate of watershed demographics can be made by weighing each city's data by the proportion that is in the watershed. The estimated population in the watershed is 28,600, with an average age of 44. 86% of the population identified as White, 5% Asian, 5% Hispanic, and 2% Black. Approximately 60% of residents have a household income of over \$100,000 per year, while 18% have a household income under \$50,000 a year. An estimated 40% of residents over age 25 have an associate or bachelor's degree, 24% have a graduate degree, and 33% have a high school diploma, 16% of which have some college education without a degree (US Census, 2021). The population of Ramsey County is expected to shrink in the upcoming decade (DEED, 2024).

The MPCA designated areas of concern for environmental justice, which includes land where over 35% of people are below 200% of the federal poverty line, over 40% of people have limited English proficiency or are people of color, and in census tribal areas. In VLAWMO, a part of Vadnais Heights is an area of concern with over 40% of the population being people of color (Figure 2-10). For more information or an up-to-date map, please visit <https://www.pca.state.mn.us/about-mpca/environmental-justice> (MPCA, 2024d).



Birch Lake Elementary Field Day at the Birch Lake Rotary Nature Preserve.  
Photo Credit: Instagram @vlawmo

Figure 2-10. Environmental justice areas of concern in VLAWMO.

