City of Plymouth

SURFACE WATER MANAGEMENT PLAN

DECEMBER 2018

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Acknowledgements

CITY COUNCIL

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Regulatory and Compliance Program

Documents Included by Reference

The City of Plymouth includes, as may be amended, the following documents in the City of Plymouth Surface Water Plan:

- Storm Water Pollution Prevention Program
- Wellhead Protection Plan
- Capital Improvement Program
- Natural Resources Inventory and Minnesota Land Cover Classification System Mapping (2006)
- City of Plymouth Pond Maintenance Policy
- Plymouth City Code
- Plymouth Zoning Ordinance
- Water Conservation Plan
- Drainage Calculations
- Joint Powers Agreement – Bassett Creek Watershed
- Joint Powers Agreement – Elm Creek Watershed
- Joint Powers Agreement – Shingle Creek Watershed

EXECUTIVE SUMMARY

Federal and state law, including the federal Clean Water Act (1972) and its subsequent updates, as well as the Metropolitan Surface Water Management Act (1982) set the foundation for surface water and non-point source pollution management in the City of Plymouth.

As Plymouth continues to grow, develop, and redevelop, urbanization will continue to impact the quality of ponds, wetlands, streams and lakes. The City Council, with assistance from our Environmental Quality Committee (EQC) has revised the City's 2008 Surface Water Management Plan to comply with the rules and requirements of the 3rd Generation Plans (Minnesota Statute 103B.235) of each watershed management organization (WMO) within the City (Bassett, Elm, Minnehaha, Shingle) and the Board of Soil and Water Resources (Minnesota Rule 8410). The Metropolitan Council also has a role in water resources management at the local level. Current Metropolitan Council goals and policies pertaining to water management are addressed in its 2040 Water Resources Management Policy Plan. This plan includes a significant water quality goal – that the quality of water leaving the metropolitan area be as good as the quality of water entering the area, and be in compliance with state and federal regulations.

The City of Plymouth's strategy for improving water quality focuses on pollution prevention first and storm water treatment second. The plan goes beyond reacting to problems after they occur by implementing proactive programs and policies to protect surface water. In addition to improving water quality, the City also works with citizens and regulatory agencies to address water quantity and invasive species issues identified throughout the community. The City annually assesses the condition of water resources and develops strategies for achieving realistic, attainable, implementable and affordable goals. This plan utilizes environmental and water resource inventories, monitoring data, citizen input, ordinances and other available information to work towards achieving the goals. The plan is the framework for

implementation of best management practices (BMPs), programs and policies to manage surface water and to meet goals established for water resources in the future.

Over the next 10 years, the City anticipates a transition from a majority of development projects to a majority of redevelopment projects. The Plan focus will continue to be on problems associated with increased runoff volumes, sedimentation and storm water discharge into city lakes and wetlands.

CITY OF PLYMOUTH
SURFACE WATER MANAGEMENT PLAN

INTRODUCTION

The past 10 years has seen an enormous effort and investment by the City of Plymouth and its partners in improving water resources in Plymouth. These efforts were rewarded in 2016 when Schmidt Lake, previously placed on the State Impaired Waters List, was found to meet State standards and was removed from the Impaired Waters List.

The majority of funding for these efforts is Plymouth's Surface Water Fee which generated over 20 million dollars the past 10 years and was invested in over two dozen capital improvements and other projects to provide for improved flood protection, water quality, education, regulatory programming, and more. Partners with the City of Plymouth in improving water resources include the State of Minnesota, the Metropolitan Council, Hennepin County, Three Rivers Park District, the Bassett, Elm, Shingle Creek Watershed Management Organizations, the Minnehaha Creek Watershed District, the Association of Medicine Lake Area Citizens, the Schmidt Lake Association, the Gleason Lake Improvement Association, and the Bass Lake Improvement Association.

Over the next 10 years, two points of emphasis for the City will be to seek opportunities for water resource improvements within re-development projects and to seek cooperative and collaborative partnerships to address water quality, vegetation, and aquatic invasive species within our lakes.

WATER RESOURCE MANAGEMENT RELATED AGREEMENTS

The purpose of the Metropolitan Surface Water Management Act (1982) is to reduce, to the greatest practical extent, public expenditures related to quantity of storm water runoff. Responding to the state mandate, each watershed unit in the metropolitan area was charged with completing a watershed management plan. As a result, numerous watershed management organizations (WMOs) were formed, either as formal watershed districts or as Joint Powers Agreement WMOs. Each watershed in turn requires the preparation of local or community watershed plans to achieve consistency in water resources management.

Minnesota Rules Chapter 8410 apply to the general administration of watershed management activities within the metropolitan area. There are four WMO's with boundaries in Plymouth (Table 1). The City of Plymouth is party to a joint powers agreement with the Bassett, Elm, and Shingle Creek watersheds. Watershed boundaries are identified in Figure 1.

TABLE 1
WATERSHED PLAN STATUS

Watershed Management Organization	Original Plan Approval	Current Plan Approval
Bassett Creek	July 26, 1989	September 17, 2015
Elm Creek	May 25, 1990	October 14, 2015
Minnehaha Creek	May 26, 1993	January 11, 2018
Shingle Creek	April 25, 1990	April 11, 2013

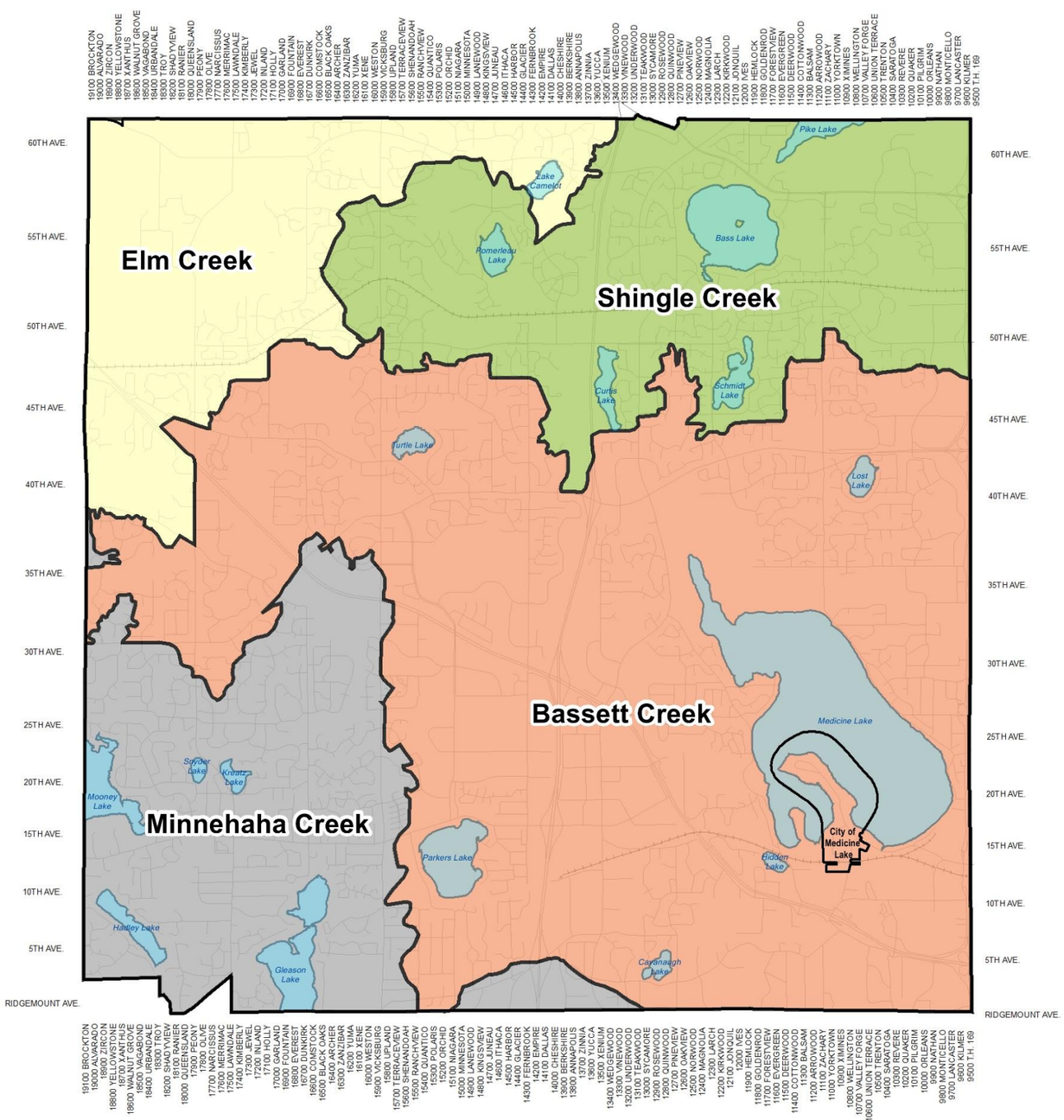

FIGURE 1

Watershed Boundries

Legend

- Bassett Creek Watershed Management Organization
- Elm Creek Watershed Management Organization
- Minnehaha Creek Watershed District
- Shingle Creek Watershed Management Organization
- Roads
- Railroad
- City Limits
- Lakes

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THIS REPRESENTS A COMPILATION OF INFORMATION AND DATA FROM CITY, COUNTY, STATE AND OTHER SOURCES THAT HAS NOT BEEN FIELD VERIFIED. INFORMATION SHOULD BE FIELD VERIFIED AND COMPARED WITH ORINGIAL SOURCE DOCUMENTS.

City of Plymouth
Adding Quality to Life

Information As of: February 26, 2016

EXISTING AND PROPOSED PHYSICAL ENVIRONMENT AND LAND USE

TOPOGRAPHY

The topography of Plymouth can be described as rolling, with wetlands, lakes and some bluffs. The topographic relief is approximately 200 feet with elevations varying from 1,070 feet above sea level in the southwestern part of the city to about 874 feet above sea level at Pike Lake in the northeastern part of the city.

Water drains naturally through most of the city, however, for a few isolated spots, natural overland drainage has been replaced by storm sewer pipe. The pipe can be large if the land has minimal relief. The high cost of large storm sewers has made it necessary to construct and maintain a large number of storm water holding ponds throughout the city in order to reduce the overall cost of the drainage system.

LAKES, WETLANDS, AND PONDS

Approximately 20 percent of the city's area is covered with water. There are 2,785 acres of wetlands, 77 acres of wetland mitigation, 123 acres of water quality ponding, and 1,542 acres covered by eight major lakes (Figure 21). Table 2 summarizes data from the major lakes within Plymouth.

TABLE 2
LAKE DATA SUMMARY

Lake	Watershed	Acreage	Figure
Bass	Shingle Creek	174 acres	Figure 2
Cavanaugh	Bassett Creek	14 acres	Figure 3
Curtis	Shingle Creek	32 acres	Figure 4
Gleason	Minnehaha Creek	142 acres	Figure 5
Hadley	Minnehaha Creek	38 acres	Figure 6
Hidden	Bassett Creek	9 acres	Figure 7

Kreatz	Minnehaha Creek	14 acres	Figure 8
Lake Camelot	Elm Creek	23 acres	Figure 9
Lost	Bassett Creek	23 acres	Figure 10
Medicine	Bassett Creek	898 acres	Figure 11
Mooney	Minnehaha Creek	118 acres	Figure 12
Parkers	Bassett Creek	97 acres	Figure 13
Pike	Shingle Creek	48 acres	Figure 14
Pomerleau	Shingle Creek	30 acres	Figure 15
Schmidt	Shingle Creek	37 acres	Figure 16
Snyder	Minnehaha Creek	9 acres	Figure 17
Turtle	Bassett Creek	24 acres	Figure 18

SOILS

The soil in Plymouth can be generally described as dense clay with occasional lenses of mixed sand and gravel (Figure 22). The three basic soil types are sandy clay till from the Des Moines ice lobe of the Wisconsin glaciation, natural silty sand and topsoil and organic silt deposits. The majority of the soils within the City have moderate to slow infiltration rates which leads to higher volumes of runoff when compared to sandy soil. Bedrock (Prairie du Chien formation and the St. Peter formation) is found between elevations 700 and 800 feet above sea level. The water table is very close to the ground surface in certain areas.

WATERSHEDS

Plymouth lies within the larger Mississippi River basin. The Mississippi River basin includes several smaller watershed units including Elm Creek, Shingle Creek, Bassett Creek and Minnehaha Creek (Table 3). The City identifies 17 lakes spread throughout these four watersheds (Table 2). These lakes are also Public Waters identified by the

Minnesota Department of Natural Resources. Additionally, each of these smaller watershed units is further broken down in the City of Plymouth into sub-watershed areas (Figure 23).

Figure 2 – Bass Lake Information and Access Map

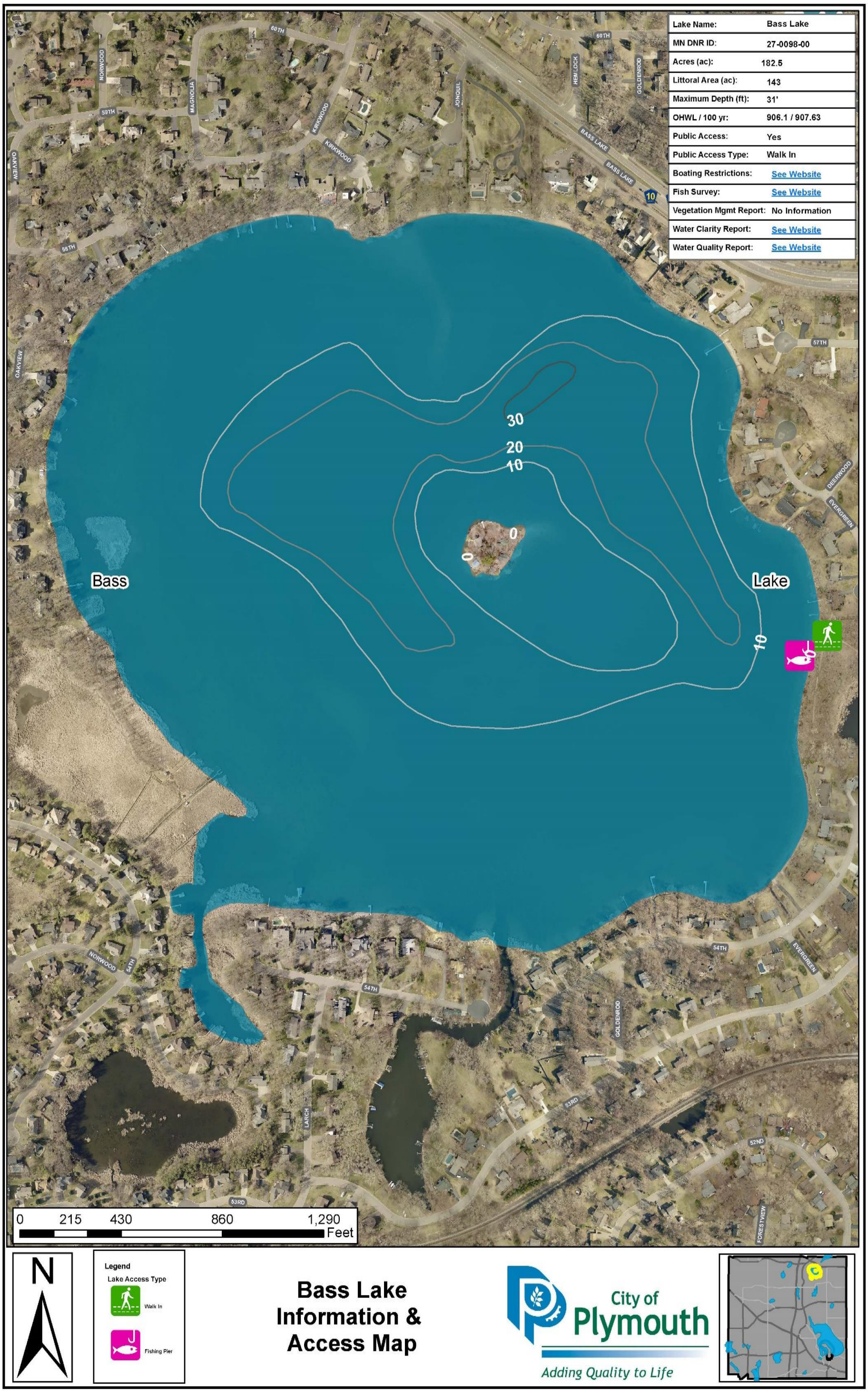


Figure 3 - Cavanaugh Lake Information and Access Map

Figure 4 – Curtis Lake Information and Access Map

Figure 5 – Gleason Lake Information and Access Map

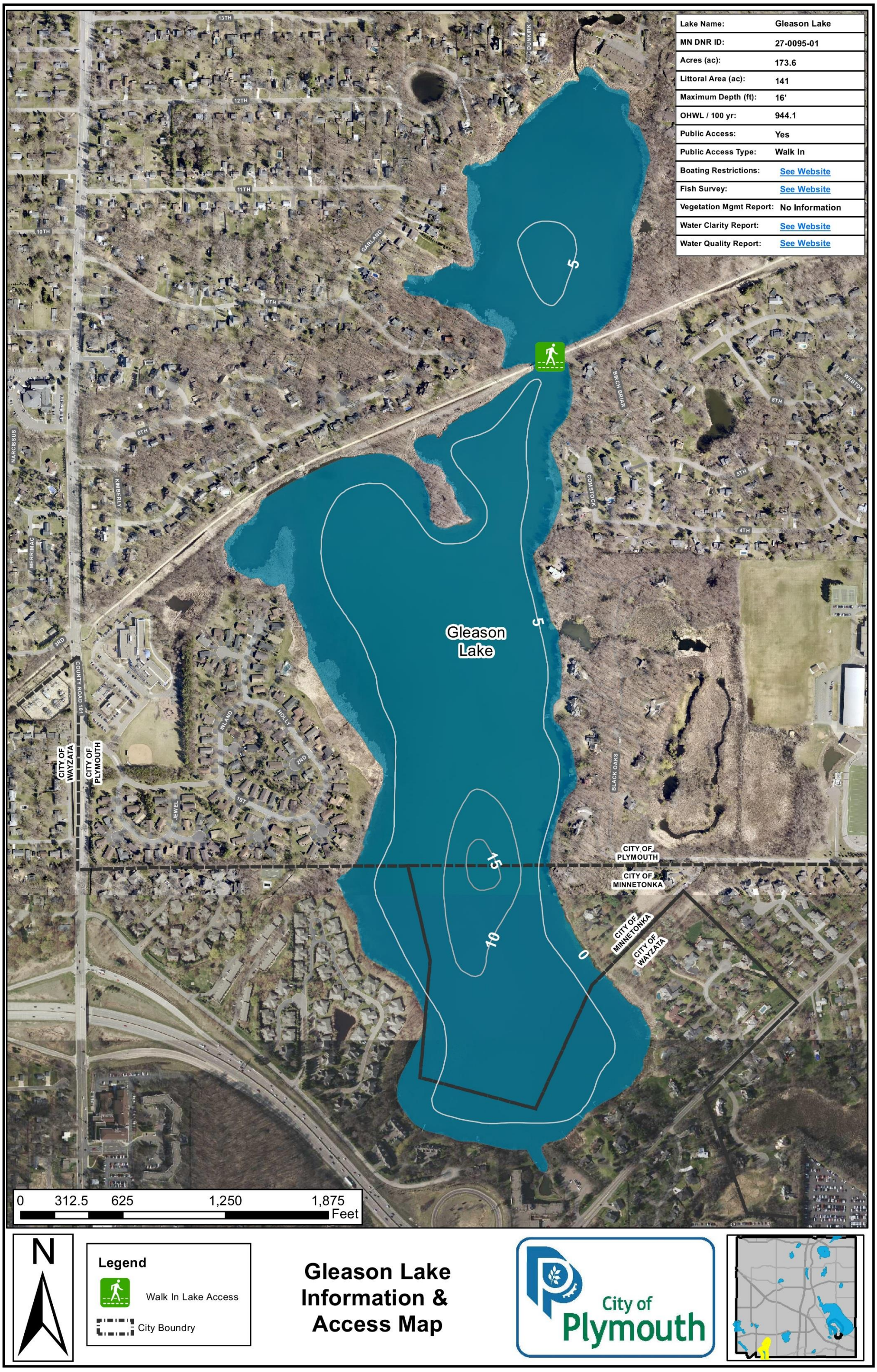


Figure 6 – Hadley Lake Information and Access Map

Figure 7 – Hidden Lake Information and Access Map

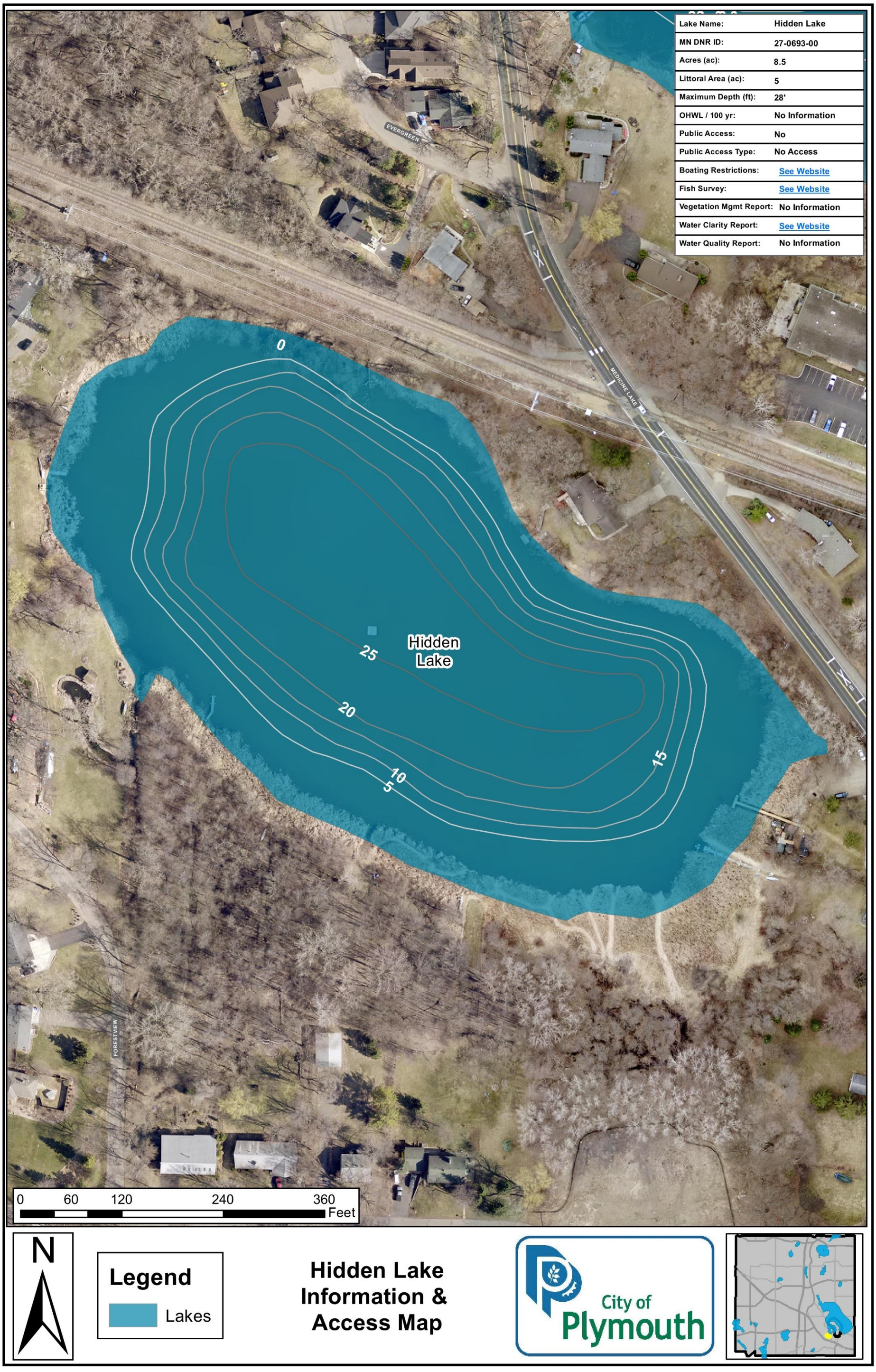


Figure 8 – Kreatz Lake Information and Access Map

Figure 9 – Lake Camelot Information and Access Map

Figure 10 – Lost Lake Information and Access Map

Figure 11 – Medicine Lake Information and Access Map

Figure 12 – Mooney Lake Information and Access Map

Figure 13 – Parkers Lake Information and Access Map

Figure 14 – Pike Lake Information and Access Map

Figure 15 – Pomerleau Lake Information and Access Map

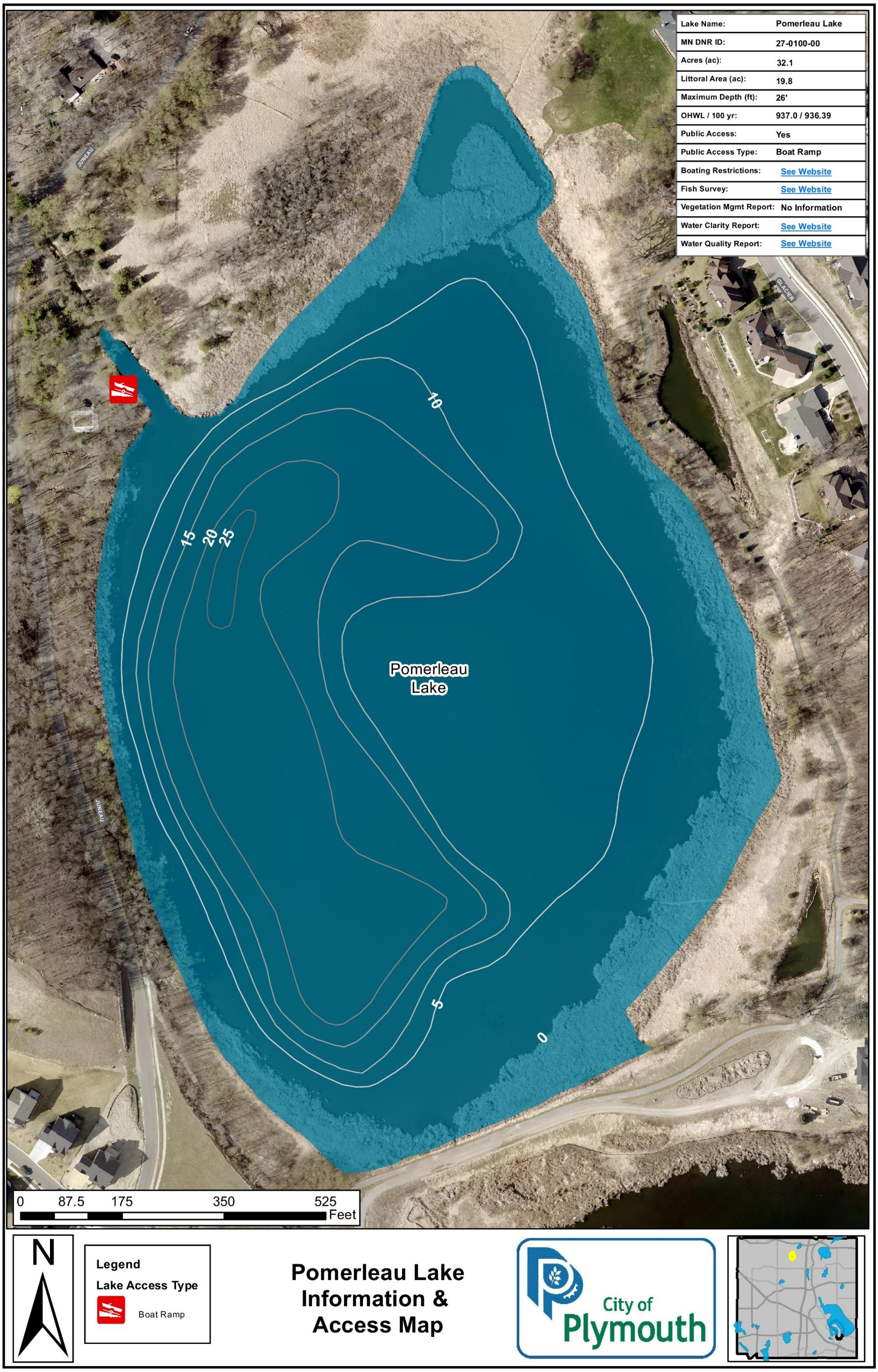
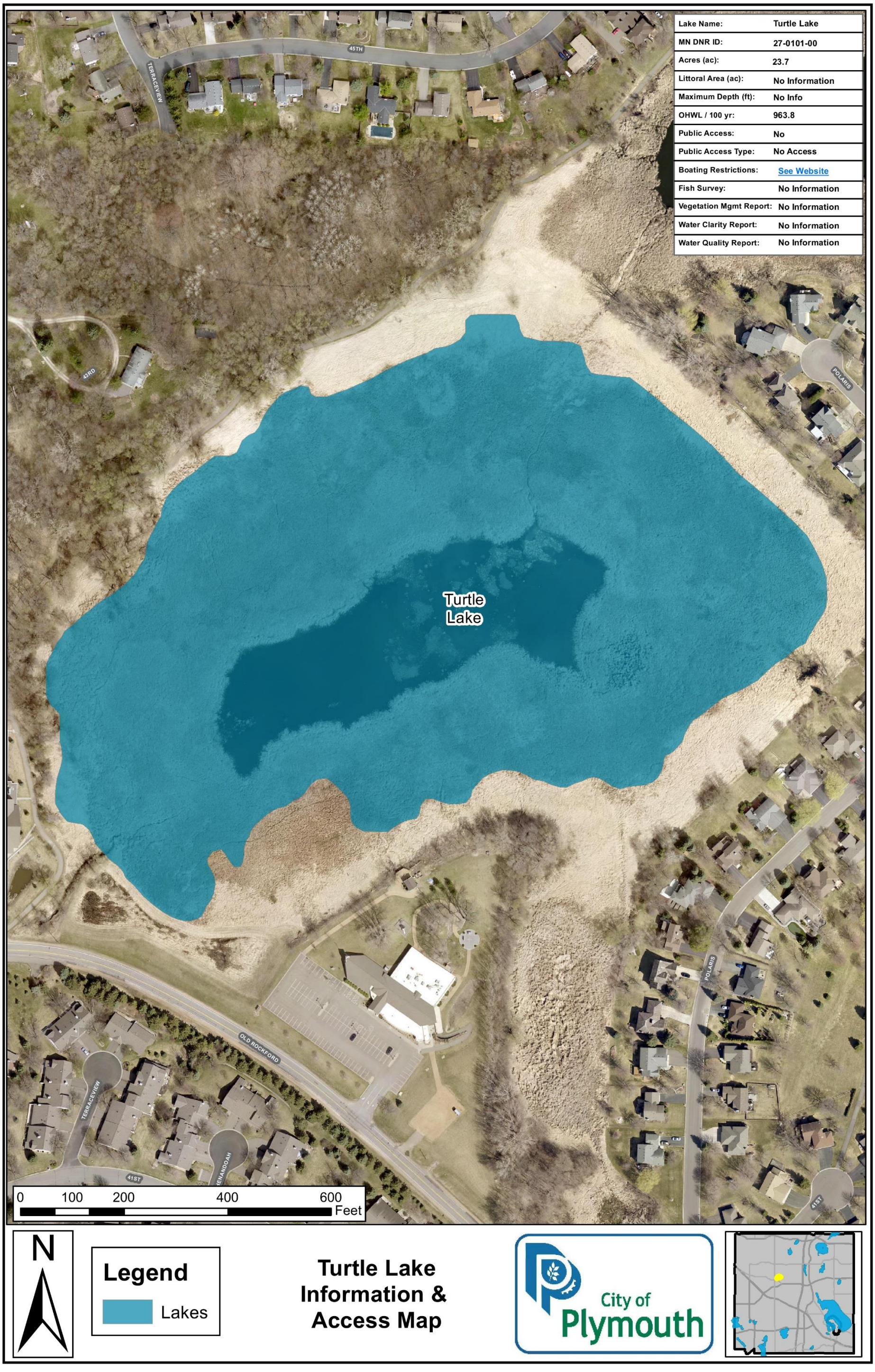


Figure 16 – Schmidt Lake Information and Access Map

Figure 17 – Snyder Lake Information and Access Map

Figure 18 – Turtle Lake Information and Access Map



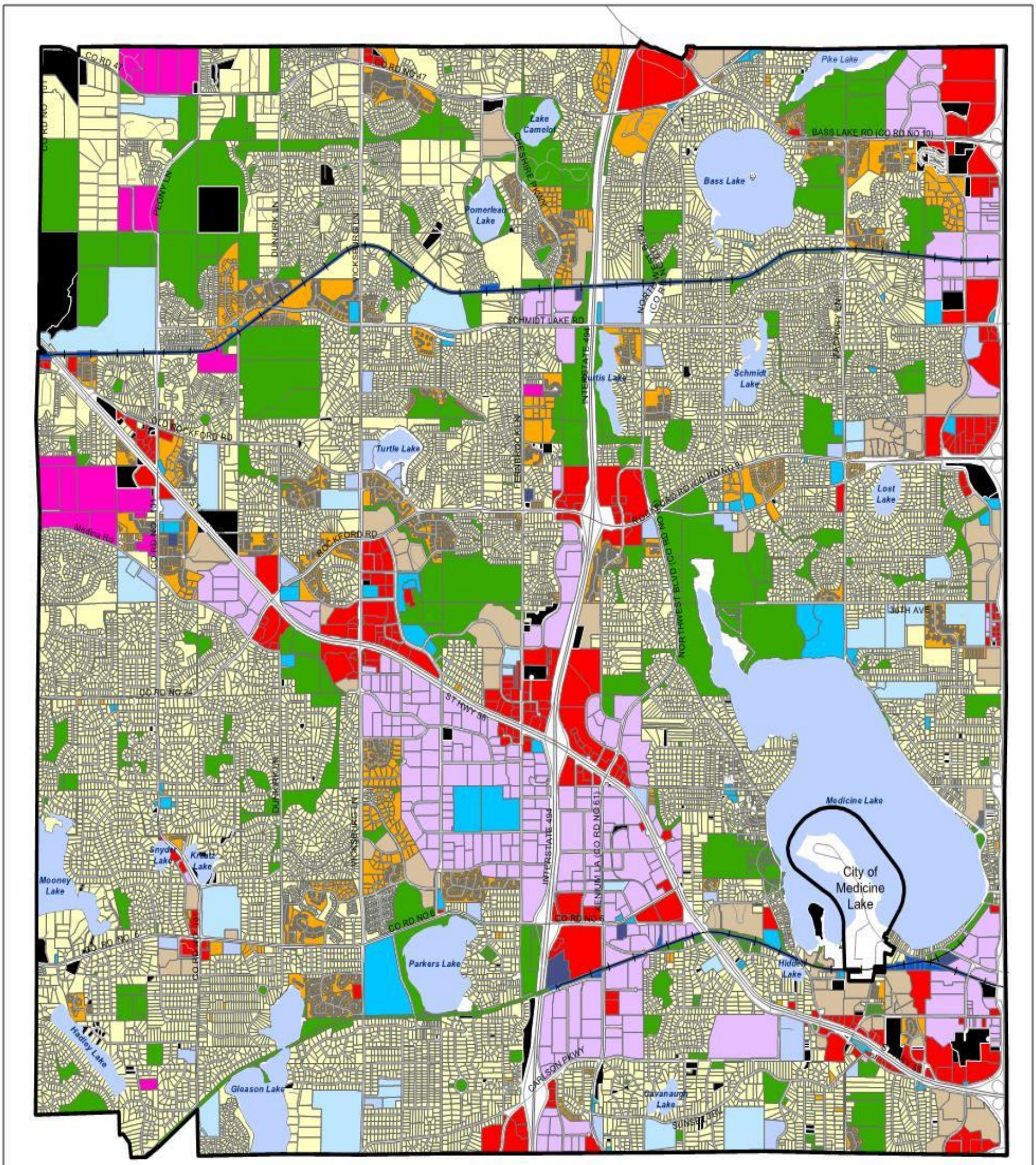


Figure 19

Existing Land Use

As of 3/1/2016

December, 2017

City of Plymouth

- Attached Non-Apartment
- Apartment
- Single Family Development
- Commercial/Office
- Industrial
- Public
- Church
- School
- Parks & Open Space
- Railroad
- Utilities
- Vacant
- Agriculture

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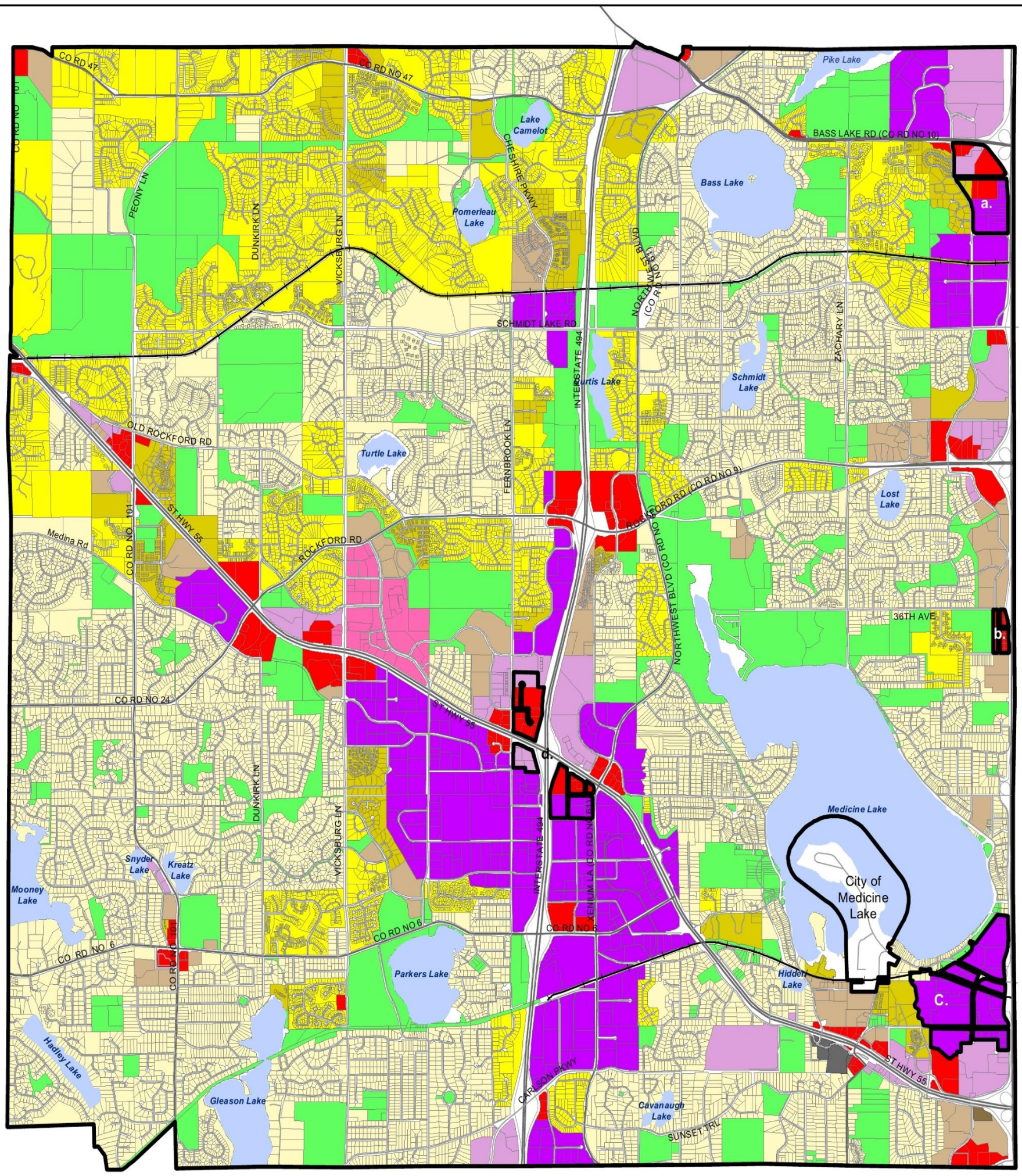

Figure 20

2040 Land Use Plan

As of 1/9/2018

July, 2018
City of Plymouth

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- Study Areas
- Living Area 1, LA-1 (2-3)
- Living Area 2, LA-2 (3-6)
- Living Area 3, LA-3 (6-12)
- Living Area 4, LA-4 (12-20)
- Living Area 5, LA-5 (20-60)
- Mixed Use, MXD
- Industrial, IND
- Commercial, C
- Commercial Office, CO
- City Center, CC
- Public/Semi-Public/Institutional, P-I

Areas with Potential Land Use Change

a. Potential Mixed Use Site
b. Potential Commercial Office / Light Industrial Site
c. Potential Commercial Office south of 10th Avenue and west of Nathan Lane; potential higher density residential north of 10th Avenue
d. Potential Mixed Use site

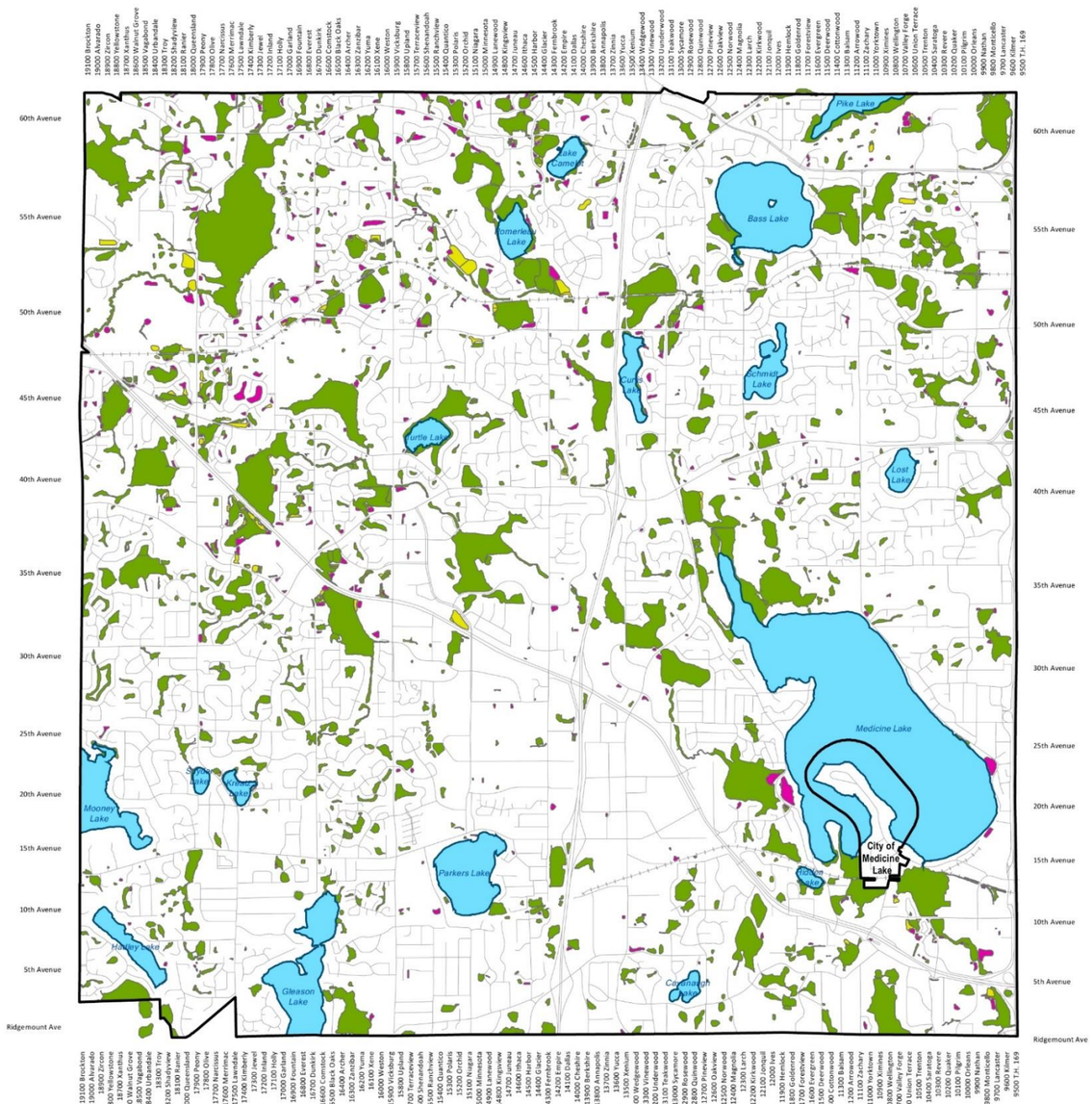

FIGURE 21

Wetlands & Water Quality Ponds

Legend

- Wetland
- Wetland Mitigation
- Water Quality Pond
- Roads
- Railroad
- City Limits
- Lakes

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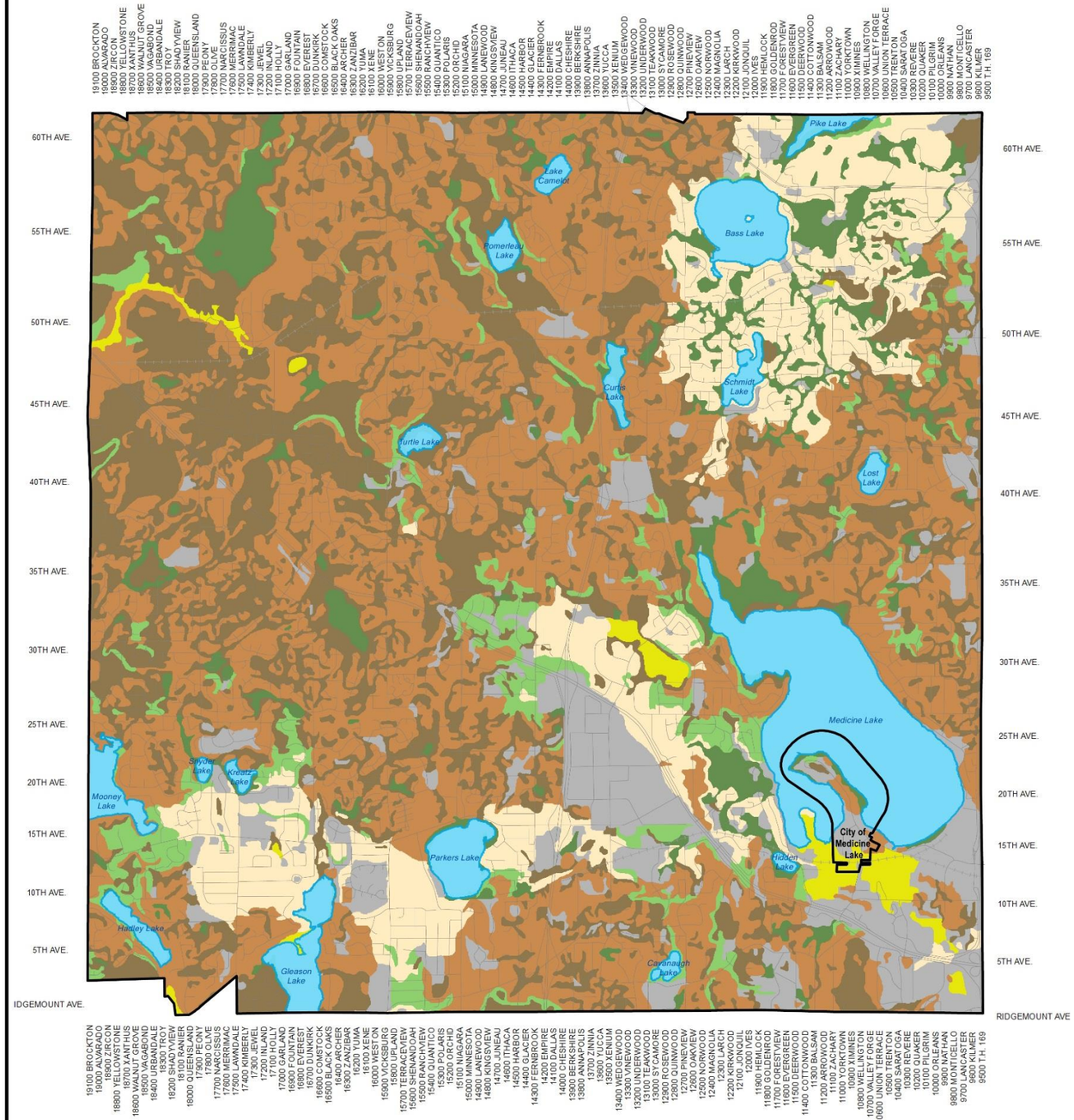
City of Plymouth
Adding Quality to Life

Information As of: August 8, 2018

FIGURE 22

Soil Hydrologic Group Information



Legend

- Roads
- Railroad

Soil Hydrologic Group

- A
- A/D
- B
- B/D
- C
- C/D
- Not Available
- City Limits
- Lakes

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Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

City of Plymouth
Adding Quality to Life

Information As of: February 29, 2016

TABLE 3
WATERSHEDS

Watershed	Area (acres)	Percent of City	Headwater Location
Shingle Creek	4,371	19.1	Plymouth
Bassett Creek	11,877	52.1	Plymouth
Minnehaha Creek	3,733	16.3	Minnetonka
Elm Creek	2,855	12.5	Medina
Total	**22,836**	**100.0**	

Elm Creek

Elm Creek drains the northwestern corner of Plymouth which includes the majority of the remaining undeveloped property in Plymouth. This area is also the most active area for new single family home developments and the associated infrastructure. Approximately 4,000 acres in Medina drain to Elm Creek before it enters Plymouth. The watershed will coordinate drainage plans for the two cities.

Shingle Creek

Shingle Creek drains the urbanized north central and northeastern part of Plymouth. Water from this watershed discharges to New Hope under Highway 169 and to Maple Grove through Pike and Eagle Lakes. The major lakes in the watershed include Bass, Pomerleau, Schmidt and Pike.

Bassett Creek

The predominant water feature in the urbanized Bassett Creek watershed is Medicine Lake, located in the southeastern portion of Plymouth. Medicine Lake's largest tributary is Plymouth Creek whose headwaters begin near the intersection of County Road 101 and State Highway 55 and travel 15,000 linier feet (2.8 miles) to discharge into Medicine Lake. Parkers Lake is also found in

this watershed and has a popular swimming beach and park area. Bassett Creek discharges southeasterly into Golden Valley then through Minneapolis to the Mississippi River.

Minnehaha Creek

The Minnehaha Creek basin is a 5.9 square mile area that is located in the southwestern portion of Plymouth. Generally, drainage in the Minnehaha Creek basin drains into either Mooney Lake, Hadley Lake or Gleason Lake before making its way into Lake Minnetonka in Wayzata.

CLIMATE

The climate of the area is moderate, characterized by large seasonal variations in temperature and rainfall and by moderate snowfall. The summers are warm and moderately humid and the winters are usually cold and moderately humid. The mean annual temperature is 44°F, and the mean monthly temperatures vary from 12°F in January to 73°F in July. The average annual precipitation is approximately 32 to 33 inches, with snowfall averaging approximately 44 inches annually and representing approximately 17 percent of the total precipitation.

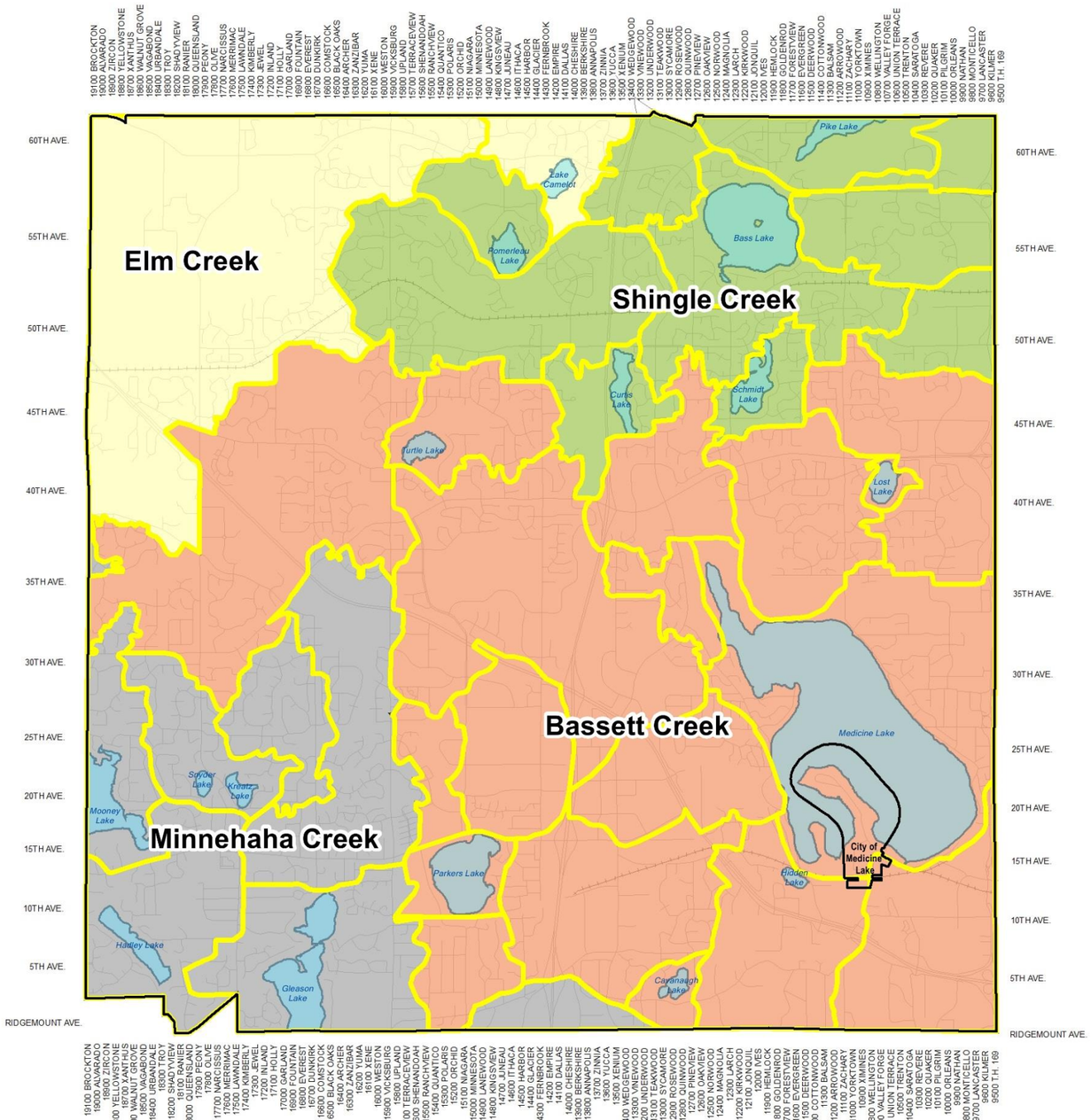

FIGURE 23

Subwatershed Boundries

Legend

- Subwatershed Boundries
- Bassett Creek Watershed Management Organization
- Elm Creek Watershed Management Organization
- Minnehaha Creek Watershed District
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City of Plymouth
Adding Quality to Life

Information As of: February 29, 2016

ASSESSMENT OF EXISTING OR POTENTIAL WATER RESOURCE RELATED PROBLEMS

The Federal Clean Water Act requires states to adopt water quality standards to protect lakes, streams, and wetlands from pollution. The City of Plymouth, among other agencies, monitors water resources such as lakes, streams, wetlands, ponds and other features on regular intervals. Other monitoring agencies include watersheds, the Three Rivers Park District, and citizens through the Metropolitan Council's Citizen Assisted Monitoring Program (CAMP).

The State of Minnesota sets standards to define how much of a pollutant (bacteria, nutrients, turbidity, mercury, etc.) can be in the water and still meet designated uses such as fishing, swimming or drinking. When the assessment indicates a water resource is not meeting the established State standard, it is considered impaired (Table 4). A water body is impaired if it fails to meet one or more of the State water quality standards. All of the water bodies that have been assessed as impaired in the State of Minnesota are listed on the 303(d) Impaired Waters List.

Once a water body is listed on the Impaired Waters List, a total maximum daily load (TMDL) study is required to be completed in order to assess and set pollutant reduction goals that are needed in order to restore the water body and meet water quality requirements.

The Municipal Separate Storm Sewer System (MS4) permit though the Minnesota Pollution Control Agency also establishes baseline intervals for which water resources and other assets are to be assessed for treatment effectiveness and maintenance needs. The goal of these assessments and inspections is to identify any pollution to water resources and eliminate it through procedures established by the city.

The City of Plymouth has identified the following issues that could potentially pose a problem to the water resources or environment within the City,

- Water Quantity (Flooding)
- Water Quality of Lakes, Streams & Wetlands
- Erosion and Sediment Control
- Wetland Protection
- Recreation, Fish and Wildlife Protection and Enhancement
- Groundwater Protection
- Invasive Species

This list is not comprehensive of all problems however shall serve as a baseline for implementation of this Surface Water Management Plan. These items are discussed in the implementation section of this plan.

TABLE 4

PLYMOUTH IMPAIRED WATERS

Water	Affected use	Impairment
Bass Creek	Aquatic Life	Chloride
Bass Creek	Aquatic Life	Fish IBI[1]
Bassett Creek	Aquatic Life	Chloride
Bassett Creek	Aquatic Life	Fish IBI[1]
Bassett Creek	Aquatic Recreation	Fecal Coliform
Elm Creek	Aquatic Life	Low Oxygen
Elm Creek	Aquatic Life	Chloride
Elm Creek	Aquatic Life	Invertebrate IBI[1]
Elm Creek	Aquatic Life	Fish IBI[1]
Elm Creek	Aquatic Recreation	E. Coli
Plymouth Creek	Aquatic Life	Chloride
Plymouth Creek	Aquatic Recreation	E. Coli
Shingle Creek	Aquatic Life	Chloride

Shingle Creek	Aquatic Life	Invertebrate IBI[1]
Shingle Creek	Aquatic Life	Low Oxygen
Shingle Creek	Aquatic Recreation	E. Coli
Bass Lake	Aquatic Recreation	Excess Nutrients
Gleason Lake	Aquatic Recreation	Excess Nutrients
Hadley Lake	Aquatic Recreation	Excess Nutrients
Medicine Lake	Aquatic Recreation	Excess Nutrients
Medicine Lake	Aquatic Consumption	Mercury FCA[2]
Mooney Lake	Aquatic Recreation	Excess Nutrients
Parkers Lake	Aquatic Life	Chloride
Parkers Lake	Aquatic Consumption	Mercury FCA
Pike Lake	Aquatic Recreation	Excess Nutrients
Pike Lake	Aquatic Consumption	Mercury FCA
Pomerleau Lake	Aquatic Recreation	Excess Nutrients
Snyder Lake	Aquatic Recreation	Excess Nutrients

Source: Minnesota Pollution Control Agency, 2018
[1]Index of biological integrity
[2]Fish consumption advisory

IMPLEMENTATION PLAN

To protect water resources and to address impaired waters, the City implements various projects, practices, and programs. Specifics on these projects, practices, and programs are found in Appendix C. In addition, the City has identified citywide goals, water body goals, and official controls for surface water planning and management functions. The goals and controls were established in accordance with the purposes of the water management programs required by State Statute Sections 103B.201 – 103B.251. Furthermore, they are in conformance with the goals of the watershed management organizations with some level of jurisdiction in Plymouth including the Bassett Creek, Elm Creek, and Shingle Creek WMOs and the Minnehaha Creek Watershed District.

CITYWIDE GOALS

Water Quantity (i.e., Flood Control)

Reduce the potential for flooding and minimize related public capital and maintenance expenditures necessary to control excessive volumes and rates of runoff.

Water Quality

Achieve water quality standards in lakes, streams, and wetlands consistent with indented use and classification.

Erosion and Sediment Control

The City will minimize the loss of soil into wetlands, lake, streams and creeks through plan review, education, enforcement and management.

Wetlands

The City shall administer the State Wetland Conservation Act, consistent with the rules of the Minnesota Board of Water and Soil Resources.

Public Participation, Information, and Education

The City will continue to promote public involvement and knowledge in management and protection of water resources through public participation and education.

Monitoring

The City will continue to support a comprehensive water resources monitoring program to help identify progress towards meeting water quality goals and allocations assigned by Total Maximum Daily Loads (TMDLs). Water quality parameters include, Total Suspended Solids (TSS), Total Phosphorus (TP), Nitrogen (N), and Chloride (Cl).

Maintenance and Inspection

The City will preserve the function, quantity, and quality of water resource facilities through routine inspections, regular maintenance activities, and administration of the Minnesota Wetland Conservation Act.

Recreation, Fish, and Wildlife

The City may support water recreation activities and improve fish and wildlife habitat by implementation of programs which will improve water quality.

Invasive Species Management

The City may support aquatic and upland invasive species management in conjunction with other organizations to minimize their impact on the environment.

Groundwater

The City shall strive to prevent contamination of the aquifers and promote groundwater recharge including water conservation practices to maintain base flows in streams.

Finance

The City may regularly evaluate and monitor funding sources used to finance water resources management activities.

WATER BODY GOALS (LAKES AND STREAMS)

Shallow Lakes

Shallow lakes are defined as lakes with a maximum depth of 15 feet or less and with 80% or more of the lake area shallow enough to support emergent or submergent rooted aquatic plants (littoral zone). The water quality standards are based on the June 1 to September 30 mean values of water quality

monitoring data obtained by MPCA, the City of Plymouth, the watershed management organization (WMO) or any combination of the three units of government.

The goal for all shallow lakes within the City is to have an average total phosphorus concentration of 60 µg/l or less, secchi depths greater than 1 meter and to have chlorophyll-a concentrations below 20 µg/l.

The WMO may have different goals for each lake, however in general, 303d listed lakes will need to work towards meeting the specific goals set forth in the US EPA approved TMDL Implementation Plan. The goal for lakes not listed as a 303d Impaired Water is protection of the resource as to prevent the water body from being listed as impaired in the future.

Shallow Lakes in Plymouth and their US EPA Approved TMDL (as applicable):

TABLE 5
SHALLOW LAKES WITH APPROVED TMDLS

Lake	Impairment	TMDL
Bass	Excess Nutrients	Yes
Cavanaugh	None	No
Camelot	None	No
Curtis	None	No
Gleason	Excess Nutrients	Yes
Hidden	None	No
Kreatz	None	No
Lost	None	No
Mooney	Excess Nutrients	Yes
Pike	Excess Nutrients, Mercury FCA	Yes

Schmidt	Delisted (2014)	Yes
Snyder	Excess Nutrients	Yes
Turtle	None	No

Deep Lakes

Deep lakes are defined as lakes with maximum depths over 15 feet and as having less than 80% of the lake area as shallow enough to support emergent or submergent rooted aquatic plants (littoral zone) The water quality standards are based on the June 1 to September 30 mean values of water quality monitoring data obtained by MPCA, The City of Plymouth, the WMO or any combination of the three units of government.

The goal for all deep lakes within the City is to have an average total phosphorus concentration of 40 µg/l or less, secchi depths greater than 1.4 meters and to have chlorophyll-a concentrations below 14 µg/l.

The WMO may have different goals for each lake, however in general, 303d listed lakes will need to work towards meeting the specific goals set forth in the US EPA approved TMDL plan. The goal for lakes not listed as a 303d Impaired Water is protection of the resource as to prevent the water body from being listed as impaired in the future.

Deep Lakes in Plymouth and their US EPA Approved TMDL (as applicable):

TABLE 6
DEEP LAKES WITH APPROVED TMDLS

Lake	Impairment	TMDL
Hadley	Excess Nutrients	Yes

Medicine	Excess Nutrients, Mercury FCA	Yes
Parkers	Chloride, Mercury FCA	Yes
Pomerleau	Excess Nutrients	Yes

Streams

Streams are important conduits in the water cycle and are instruments in groundwater recharge, and habitat for many aquatic species. Increased rates and volumes of stormwater runoff, resulting from urbanization and other activities, can degrade a stream's hydrology and physical condition. The City shall have water quality goals in streams for E. Coli, dissolved oxygen, chloride, and biotic integrity consistent with State standards.

The WMO may have different goals for each stream, however in general, 303d listed streams will need to work towards meeting the specific goals set forth in the US EPA approved TMDL Implementation Plan. The goal for streams not listed as a 303d Impaired Water is protection of the resource as to prevent the water body from becoming listed as impaired in the future. Streams in Plymouth and their US EPA Approved TMDL (as applicable):

TABLE 7
STREAMS WITH APPROVED TMDLS

Stream	Impairment	TMDL
Bass Creek	Fish and Macroinvertebrate IBI Chloride	Yes
Bassett Creek	Fish and Macroinvertebrate IBI Fecal Coliform[3] Chloride[2]	No
Elm Creek	Fish and Macroinvertebrate IBI E. Coli Dissolved Oxygen Chloride[2]	No
Plymouth Creek	Chloride[2] E. Coli[3]	No

1 Elm Creek TMDL is anticipated to be approved by US EPA in 2016.
2 Chloride impairment for Elm Creek and Bassett Creek will be covered as part of the Twin Cities Metro Area Chloride TMDL (MPCA 2015)
3 E. *Coli* and Fecal Coliform impairment are addressed by the *Upper Mississippi River Bacteria TMDL Study and Protection Plan* (MPCA 2014)

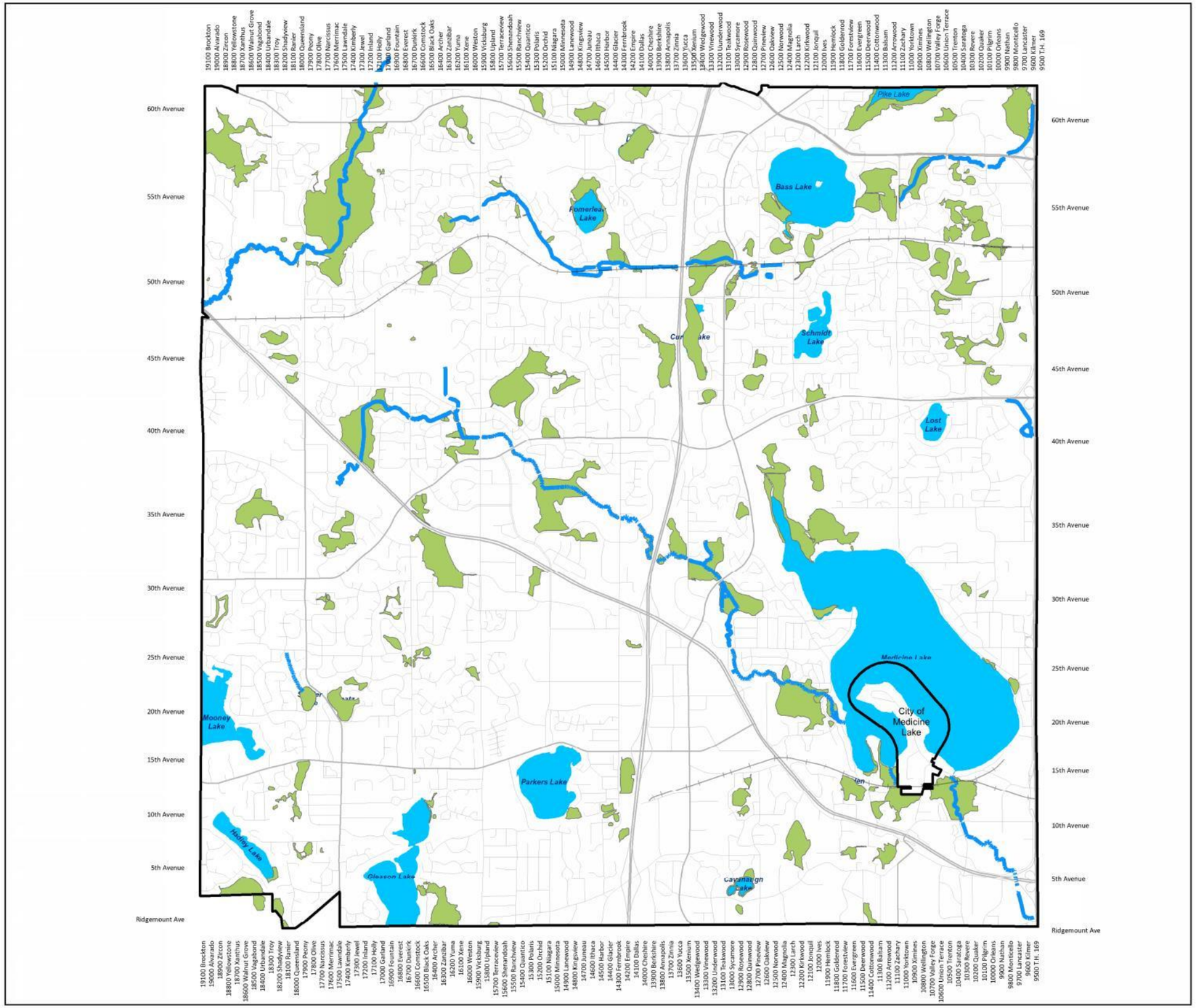


Figure 24

Minnesota DNR Public Water Wetlands and Creeks

As of 8/17/2018

Creek
MN D.N.R Public Water
Lakes

N
W
E
S

THIS REPRESENTS A COMPILATION OF INFORMATION AND DATA FROM CITY, COUNTY, STATE AND OTHER SOURCES THAT HAS NOT BEEN FIELD VERIFIED. INFORMATION SHOULD BE FIELD VERIFIED AND COMPARED WITH ORIGINAL SOURCE DOCUMENTS.

October 2018
City of Plymouth

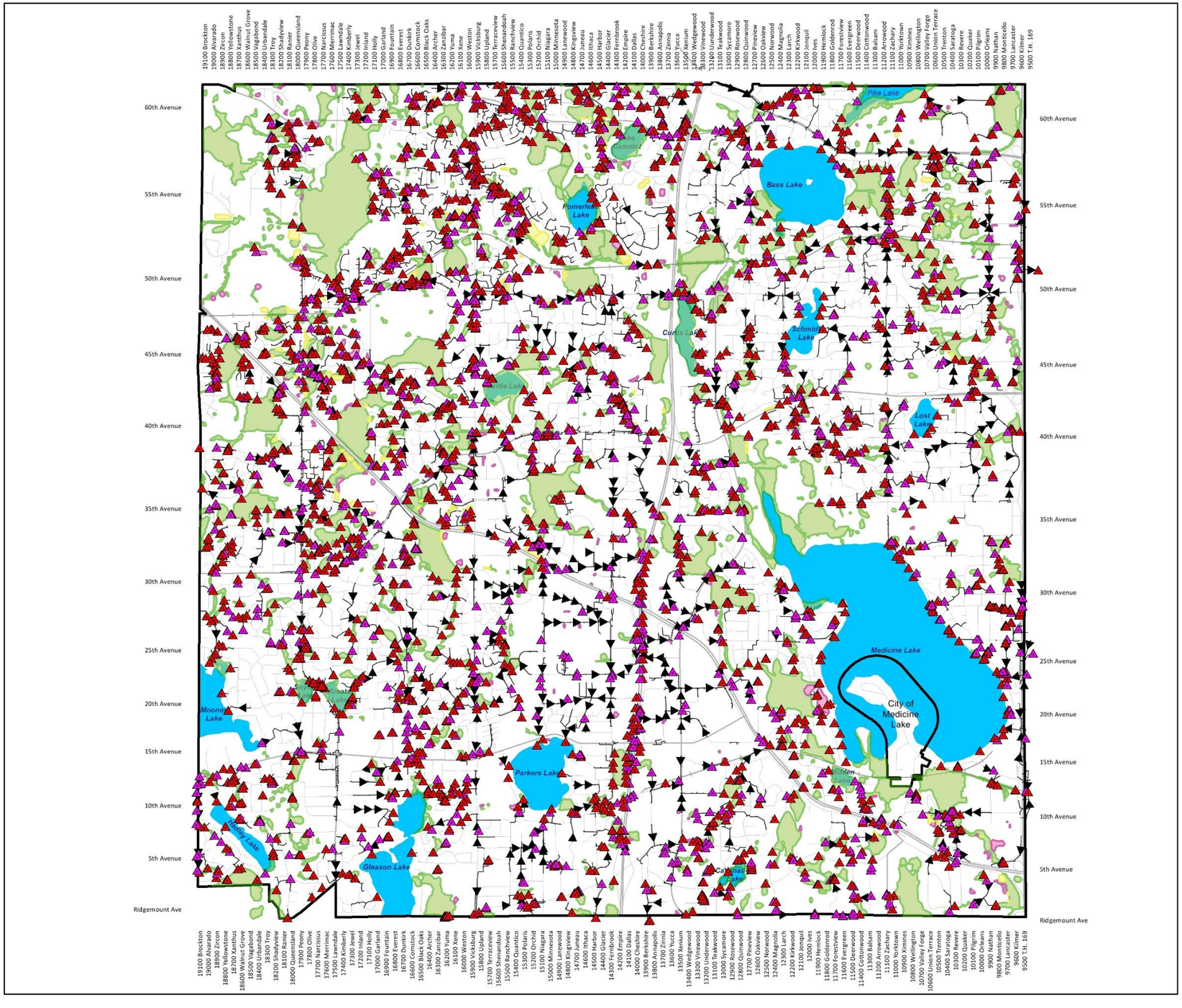


Figure 25

Storm Sewer System Map

As of 8/17/2018

- Outlet (Water enters system)
- Outfall (Water exits system)
- Storm_Lines
- Lakes
- Wetland
- Wetland Mitigation
- Water Quality Pond

N W E S

THIS REPRESENTS A COMPILATION OF INFORMATION AND DATA FROM CITY, COUNTY, STATE AND OTHER SOURCES THAT HAS NOT BEEN FIELD VERIFIED. INFORMATION SHOULD BE FIELD VERIFIED AND COMPARED WITH ORIGINAL SOURCE DOCUMENTS.

August, 2018

City of Plymouth

OFFICIAL CONTROLS

Entities currently having some level of administration responsibility within the City of Plymouth include the City of Plymouth, Bassett Creek WMO, Elm Creek WMO, Minnehaha Creek Watershed District, Shingle Creek WMO, Hennepin County, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, Minnesota Board of Water and Soil Resources, United States Army Corps of Engineers, and the Metropolitan Council. Projects that meet the thresholds set by the Bassett Creek, Elm Creek and Shingle Creek Watershed Management Organizations or the Minnehaha Creek Watershed District must also meet the water quality rules in place at the time of application. Additional permits or approvals from the Minnesota DNR, United States Army Corps of Engineers, the Board of Soil and Water Resources and as applicable, Minnehaha Creek Watershed District will be needed if wetland or other water body impacts are identified during the planning stages of the project.

The City's responsibilities include, but are not limited to:

- Comprehensive Plan updates;
- Surface Water Management Plan updates;
- Ordinance review and amendment;
- Local plat review and amendments;
- Permits;
- Administration of the State Wetland Conservation Act;
- Groundwater Management – Wells;
- Financing

Plymouth City Code and the Surface Water Management Plan contain the regulatory procedures and protections for surface water management. Several of the codes that relate to surface water management are incorporated by reference into this plan and are listed below (Table 8). Updates to City Code or changes to the Surface Water Management Plan may result in a plan amendment.

TABLE 8
OFFICIAL CONTROLS

Official Control	City Code
Floodplain Overlay District	Chapter 21 – Section 21660
Shoreland Management Overlay District	Chapter 21 – Section 21665
Wetland District	Chapter 21 – Section 21670
Erosion Control	Chapter 4 – Section 425 Chapter 5 – Section 526
Storm Drainage Systems	Chapter 7 – Section 725
Natural Preserves	Chapter 8 – Section 811
Preliminary Platting	Chapter 5 – Section 510
Final Platting	Chapter 5 – Section 512

The four watershed management organizations (Bassett, Elm, Minnehaha, Shingle) are responsible for:

- Water Quality, Lake, and Stream Monitoring;
- Local plan review and approval;
- Projects of regional significance;
- Education Activities

AMENDMENTS TO THE SURFACE WATER MANAGEMENT PLAN

Request for an amendment to any portion of the Surface Water Management Plan (text or maps) shall be made in writing to the City Engineer. Such request shall be accompanied by a fee as set forth in the City Code. Such request shall also be accompanied by detailed written and graphic materials, the number and size as prescribed by the City Engineer, fully explaining the proposed change to the plan, along with a list of property owners located within 750 feet of any subject property in a format prescribed by the City. The application shall be considered as being officially submitted and complete when the applicant has complied with all the specified information requirements.

Upon receipt of a complete application for any type of amendment and following staff analysis of the application and request, the City Engineer shall set a public hearing. The Environmental Quality Committee shall conduct the hearing and report its findings and make recommendations to the City Council. Notice of said hearing shall be published in the official newspaper at least ten days prior to the hearing and when the amendment affects a particular property.

The Environmental Quality Committee shall review the impact of the proposed amendment. Its judgment shall be based upon, but not limited to, the following factors:

- Evidence submitted by the applicant demonstrating the reason(s) that the plan should be changed, including, but not limited to, whether new information has become available since the Surface Water Management Plan was adopted that supports re-examination of the plan, or that new legislation offers new opportunities or constraints that were not previously considered by the plan.

- A demonstration by the applicant that the proposed amendment has merit beyond the interests of the proponent.

- The possible impacts of the amendment on all specific elements of the Surface Water Management Plan as may be applicable, including, but not limited to:

    - The 9 City Wide Goals
    - The 3 Water-body Goals
    - The Watershed Assessments; and
    - Capital Improvements Program (CIP).

- The impact of the amendment on City Code and the City Comprehensive Plan.

- Consideration of the impact of the proposed amendment upon current and future special assessments and utility area charges, future property tax assessments or other fiscal impacts upon the City of Plymouth.

The City may request additional information from the applicant concerning the requested amendment or retain expert testimony with the consent and at the expense of the applicant, said information to be declared necessary to establish the possible effects or benefits of the proposed Surface Water Plan amendment.

The applicant or a representative thereof may appear before the Environmental Quality Committee in order to present information and answer questions concerning the proposed request.

The Environmental Quality Committee shall make a recommendation on the request. Such recommendations shall be accompanied by the report and recommendation of

the City staff and discussion whether or not review by the Watershed Management Organizations, Watershed District, Metropolitan Council or other regulatory agencies as applicable.

The City Council shall not act upon an amendment until it has received a report and recommendation from the Environmental Quality Committee and City staff or until 60 days after the first regular Environmental Quality Committee meeting at which the request was considered.

Upon receiving the report and recommendation of the Environmental Quality Committee and City staff, the city manager shall schedule the application for consideration by the City Council. Such reports and recommendations shall be entered in and made part of the permanent written record of the City Council meeting.

Approval of a proposed amendment shall require passage by a two-thirds vote of the entire City Council.

The City Council may approve an amendment conditionally upon completion of any review by the Metropolitan Council pursuant to the Metropolitan Land Use Planning Act. Or, the City Council may direct staff to submit the amendment recommended by the Environmental Quality Committee to the Metropolitan Council for review prior to City Council consideration of the amendment and consider final passage of the amendment only after completion of the Metropolitan Council's review.

Whenever an application for an amendment has been considered and denied by the City Council, a similar application for an amendment shall not be considered again by the Environmental Quality Committee or City Council for at least six months from the date of its denial; and a subsequent application shall likewise not be considered again by the Environmental Quality Committee or City Council for an additional six months

from the date of the second denial unless a decision to reconsider such matter is made by a majority of the full City Council.

Amendment applications shall be approved or denied within 120 days from the date of official and complete submission unless extended by a mutual agreement between the applicant and the City Council.

Appendix A – Watershed Assessments

The Metropolitan Surface Water Management Act (1982) requires local units of government in the seven-county metropolitan area to prepare and implement watershed management plans through membership in a watershed management organization. A watershed management organization can be organized as either a watershed district, a function of county government, or a joint powers agreement organization. Watershed Districts are governed by Minnesota Statutes Chapter 103D while joint powers organizations are established per MN Statutes 471.59 and are governed by their respective joint powers agreement.

Minnesota Statute 103B.235 requires the City of Plymouth to update its Surface Water Management Plan in conformance with the watershed management plans of Bassett Creek, Elm Creek, Minnehaha Creek, and Shingle Creek watersheds. Per Statute, required contents of the plan include:

- a description of existing and proposed physical environment and land use;
- defined drainage areas and the volumes, rates, and paths of storm water runoff;
- identification of areas and elevations for storm water storage adequate to meet performance standards established in the watershed plan;
- defining water quantity and water quality protection methods adequate to meet performance standards established by the watershed plan;
- identification of regulated areas; and
- set forth an implementation program, including a description of official controls and, as appropriate, a capital improvement program.

The Watershed Assessments Section is intended to meet watershed plan requirements and facilitate decision making at the local level. The Watershed Assessments Section includes more detailed analysis of sub-watersheds including but not limited to wetlands and natural resources inventories, defined drainage areas, volumes, rates, storm water runoff directions, impaired waters, established total maximum daily

loads, and capital improvements. Unless noted, TMDL implementation, educational activities and associated costs for each sub watershed are represented as a city wide practice. Specific projects identified in the City of Plymouth or Watershed Organizations Capital Improvement Programs are listed separately for each sub watershed.

Over the course of this plan, the City of Plymouth is committed to provide the Bassett Creek Watershed Management Commission with any information that is required to update the watershed wide XP-SWMM Model. The City is also committed to update a sub watershed wide model for the Elm, Shingle and Minnehaha Creek Watersheds.

Bassett Creek Watershed

The Bassett Creek Watershed covers approximately 31 square miles in central Hennepin County. Predominant water features in Plymouth include Medicine Lake, Parkers Lake, Plymouth Creek, and Bassett Creek.

Generally, drainage in the Bassett Creek watershed comes to Plymouth Creek which begins about 1000 feet north of County Road 24, and becomes more of a defined stream at State Highway 55. Plymouth Creek parallels the highway as it flows southeasterly before discharging into Medicine Lake. Medicine Lake serves as the headwaters to Bassett Creek which begins on the south side of Medicine Lake and flows southeasterly into Golden Valley.

Bassett Creek Watershed Management Organization

Bassett Creek and its three branches extend across nine cities: Plymouth, Medicine Lake, Golden Valley, Robbinsdale, Crystal, New Hope, Minnetonka, St. Louis Park, and Minneapolis. In Minneapolis, Bassett Creek enters a tunnel under the City where it will eventually drain to the Mississippi River. Prior to the adoption of a formal joint powers agreement, the cities in the Bassett Creek Watershed acted together as a committee, which was formed to study flood control issues in the watershed. In 1968, the Bassett Creek Flood Control Commission was formed by adoption of a joint powers agreement between the nine communities in the watershed. In 1984, the Bassett Creek Flood Control Commission revised its joint powers agreement and created the Bassett Creek Watershed Management Commission (BCWMC). The joint powers agreement was most recently approved by the member cities in 2015 and provides for the authorizations and scope of authority of the BCWMC.

The BCWMC Board of Commissioners consists of nine commissioners and nine alternates appointed by the member cities. The term of each commissioner and alternate is three years. Regular meetings of the BCWMC are held on the third Thursday of each month. Funding for the administrative functions of the BCWMC is via an assessment, generally based on land area and tax capacity, to each member of the organization.

Per Minnesota Rules 8410.008, Subp. 2-8, watershed management organization goals generally fall into the following categories: water quantity, water quality, public drainage systems, groundwater, and wetlands. The BCWMC has established the following goals:

- Manage the surface water resources of the watershed to meet or exceed state standards and BCWMC water quality goals for wetlands, lakes, and streams.
    - BCWMC Management Classifications for Priority Waterbodies in Plymouth
        - Priority Stream — Main Stem Bassett Creek; Plymouth Creek
        - Priority 1 Deep Lakes — Medicine Lake; Parkers Lake
        - Priority 2 Shallow Lakes — Cavanaugh (Sunset Hill) Pond; Lost Lake
- Improve the quality of storm water runoff reaching the Mississippi River by reducing nonpoint source pollution.
- Protect and enhance fish and wildlife habitat in the BCWMC.
- Take into account aesthetics and recreational opportunities within the watershed when completing BCWMC projects.
- Reduce storm water runoff volume for the purposes of improving water quality.
- Protect against flood risks along the Bassett Creek trunk system.
- Protect human life, property, and surface water systems that could be damaged by flood events.

- Reduce storm water runoff rates and volumes to minimize flood problems, flood damages, and the future costs of storm water management systems.
- Provide leadership and assist member cities with coordination of intercommunity storm water runoff issues.
- Notwithstanding that which occurs from natural processes, minimize erosion and sedimentation to protect the BCWMC's water resources and health, safety, and welfare.
- Increase the quality and quantity of wetlands in the BCWMC.
- Protect the quantity and quality of groundwater resources.
- Manage public ditches in a manner that recognizes their current use as urban drainage systems and as altered natural waterways.
- Raise awareness of the BCWMC's existence and its role in protecting and improving water quality, minimizing flooding, and preserving the watershed's ecological functions and aesthetics.
- Strengthen public confidence in the BCWMC's expertise and enable meaningful public participation in the planning process and ongoing projects conducted by the BCWMC.
- Raise awareness of the impact that individuals, businesses, and organizations have upon water resources and motivate these audiences to change personal/corporate behavior that has a negative impact on the watershed.
- Minimize the spread and manage the adverse impacts of harmful aquatic invasive species.
- Develop a greater understanding of climate change and its impact on water resources, including storm water infrastructure capacity and flooding, and develop strategies to appropriately manage future impacts.

To assist in meeting the goals of the BCWMC, the BCWMC has established a 5-year Capital Improvement Program. Capital improvements are currently funded under an ad-velorum tax through Hennepin County. The current BCWMC Capital Improvement program includes four projects in the City of Plymouth (Table 9)

TABLE 9
BCWMC CAPITAL IMPROVEMENTS IN PLYMOUTH 2018-2022

ID	Name	Plymouth Sub-watershed	Funding Amount	Funding Year
2017CR-P	Plymouth Creek Stream Restoration – Annapolis Lane upstream for 2,500 linier feet	Middle Plymouth Creek	$860,000	2017-2018
ML-20	Mt. Olivet Stream Restoration	NE Medicine Lake	$400,000	2021
ML-22	Ponderosa Woods Stream Restoration	Lower Plymouth Creek	$475,000	2024
PL-7	Parkers Lake Drainage Improvement	North Parkers Lake	$400,000	2021-2022

Bassett Creek Sub-watersheds

The City of Plymouth has divided the portion of the Bassett Creek watershed within the City bounds into 18 sub-watersheds for administrative and management purposes. The 18 sub-watersheds (Figure 23) are:

- Upper Plymouth Creek
- Turtle Lake
- Middle Plymouth Creek
- Fernbrook Lane
- North Parkers Lake
- South Parkers Lake
- Parkers Lake
- Sunset Hills Pond/Cavanaugh Lake
- Plymouth Creek Southwest
- Lower Plymouth Creek
- West Medicine Lake
- North Medicine Lake
- Northeast Medicine Lake
- South Medicine Lake
- Medicine Lake
- Bassett Creek
- Lost Lake
- North Branch of Bassett Creek

Upper Plymouth Creek Sub-watershed

Physical Land Use Characteristics

The Upper Plymouth Creek sub-watershed is located in west central Plymouth. The sub-watershed is split by State Highway 55 and follows County Road 24 on the south side, extending into and including part of the City of Medina. The sub-watershed extends northeasterly where it is generally bounded by Vicksburg Lane and by 49th Avenue North. The existing land use is primarily a mix of single family residential and commercial/industrial development.

Significant landmarks within this sub-watershed include the headwaters of Plymouth Creek, which is classified as a priority stream by the Bassett Creek Watershed Management Commission and the 129-acre Hollydale Golf Course. The sub-watershed is mostly developed, however, there are a few remaining properties including the golf course which could develop in the next 10 years. This sub-watershed has 284.6 acres of wetland, 12.0 acres of wetland mitigation, and 17.7 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities, however, within the Upper Plymouth Creek sub-watershed there is one 2.7 acre moderate quality Maple-Basswood forest.

TABLE 10
UPPER PLYMOUTH CREEK SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Headwater	Figure 26
Downstream-most water body:	BC-12 (17411-NB01)	Figure 26
Discharges to:	Middle Plymouth Creek	Figure 26
Wetlands	284.6 Acres	Figure 26
Wetland Mitigation	12.0 Acres	Figure 26
Water Quality Ponding	17.7 Acres	Figure 26
Lakes	N/A	Figure 26
General Hydrologic Soil Group	Variable	
Drainage Area	1,710.9 acres	

Assessment of Water Resource Related Problems

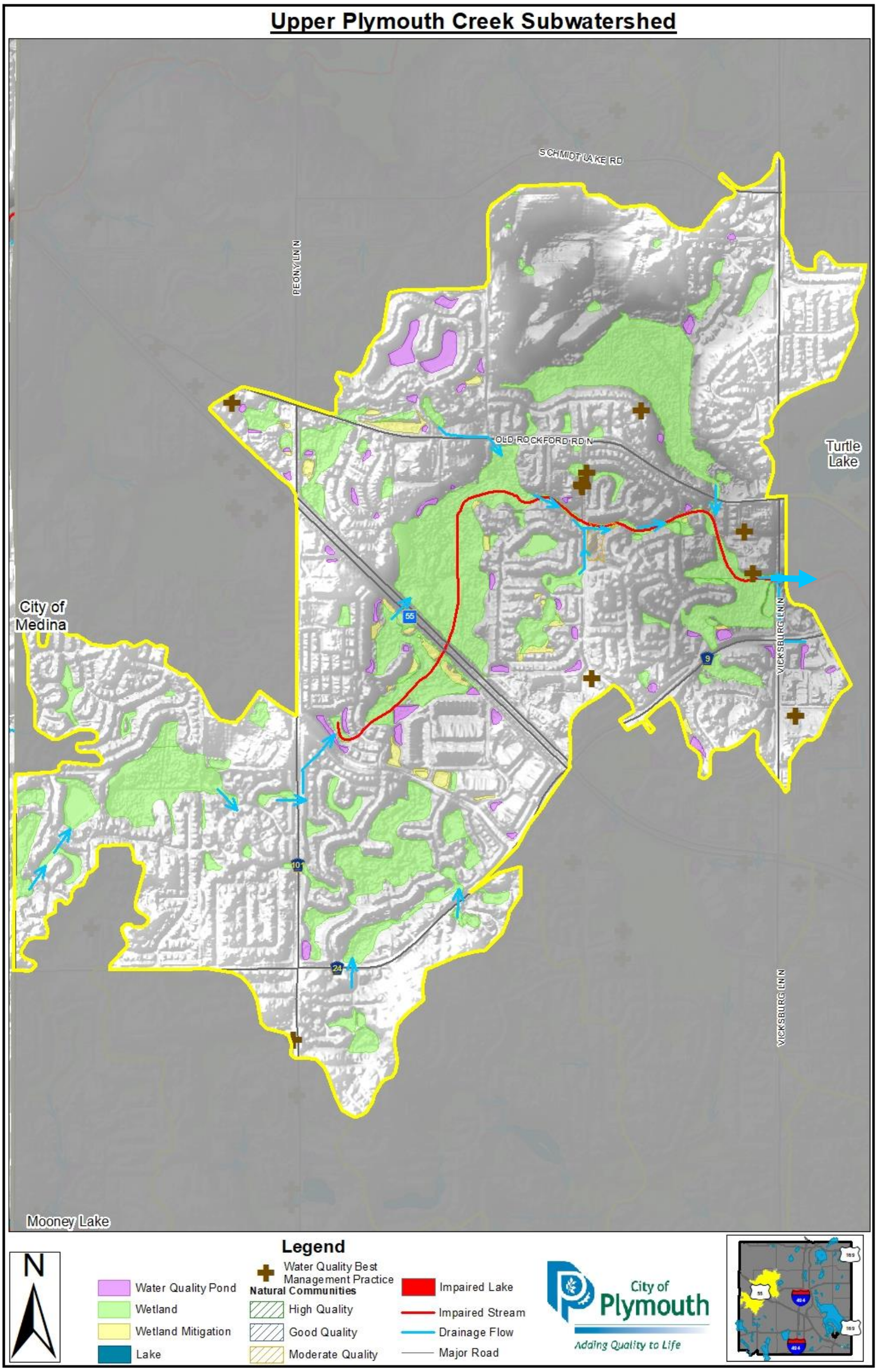
The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 11) and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 11
UPPER PLYMOUTH CREEK SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Plymouth Creek[1]	Chloride & E Coli	2014

1 The E. coli impairment of Plymouth Creek is addressed by the *Upper Mississippi River Bacteria TMDL Study and Protection Plan*

Figure 26. Upper Plymouth Creek Sub-watershed



Implementation Program

Recent projects pre-dating this plan include water flow and ponding improvements, completed in 2005, south of Old Rockford Road and east of Yuma Lane as well as a drainage and water quality improvement project south of the intersection of Old Rockford Road and Holly Lane. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 12.

TABLE 12
UPPER PLYMOUTH CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Upper Plymouth Creek Sub-Watershed has two known impairments through the 2018 impaired water list produced by the State of Minnesota. The Twin Cities Metro Area Chloride TMDL Implementation Plan was approved by the Minnesota Pollution Control Agency in March, 2016. Additionally, the Upper Mississippi River Bacteria TMDL Study and Protection Plan was approved in 2014 and will be implemented during the course of this 10-year Surface Water Management Plan. The Implementation Program for the Upper Plymouth Creek Sub-watershed includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Plymouth Creek and other water bodies within this sub-watershed.

Turtle Lake Sub-watershed

Physical Land Use Characteristics

The Turtle Lake sub-watershed is located in central Plymouth and is generally bounded by Vicksburg Lane to the west and County Road 9 (Rockford Road) to the south, 46th Avenue to the north and Fernbrook Lane to the east. The existing land use is primarily single family residential.

The most significant landmark within this sub-watershed is Turtle Lake itself (Figure 27). The sub-watershed is mostly developed and contains 73.0 acres of wetland, 0.0 acres of wetland mitigation, and 0.6 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high quality natural upland communities but does indicate a small portion of good quality oak forest.

TABLE 13
TURTLE LAKE SUB-WATERSHED CHARACTERISTICS

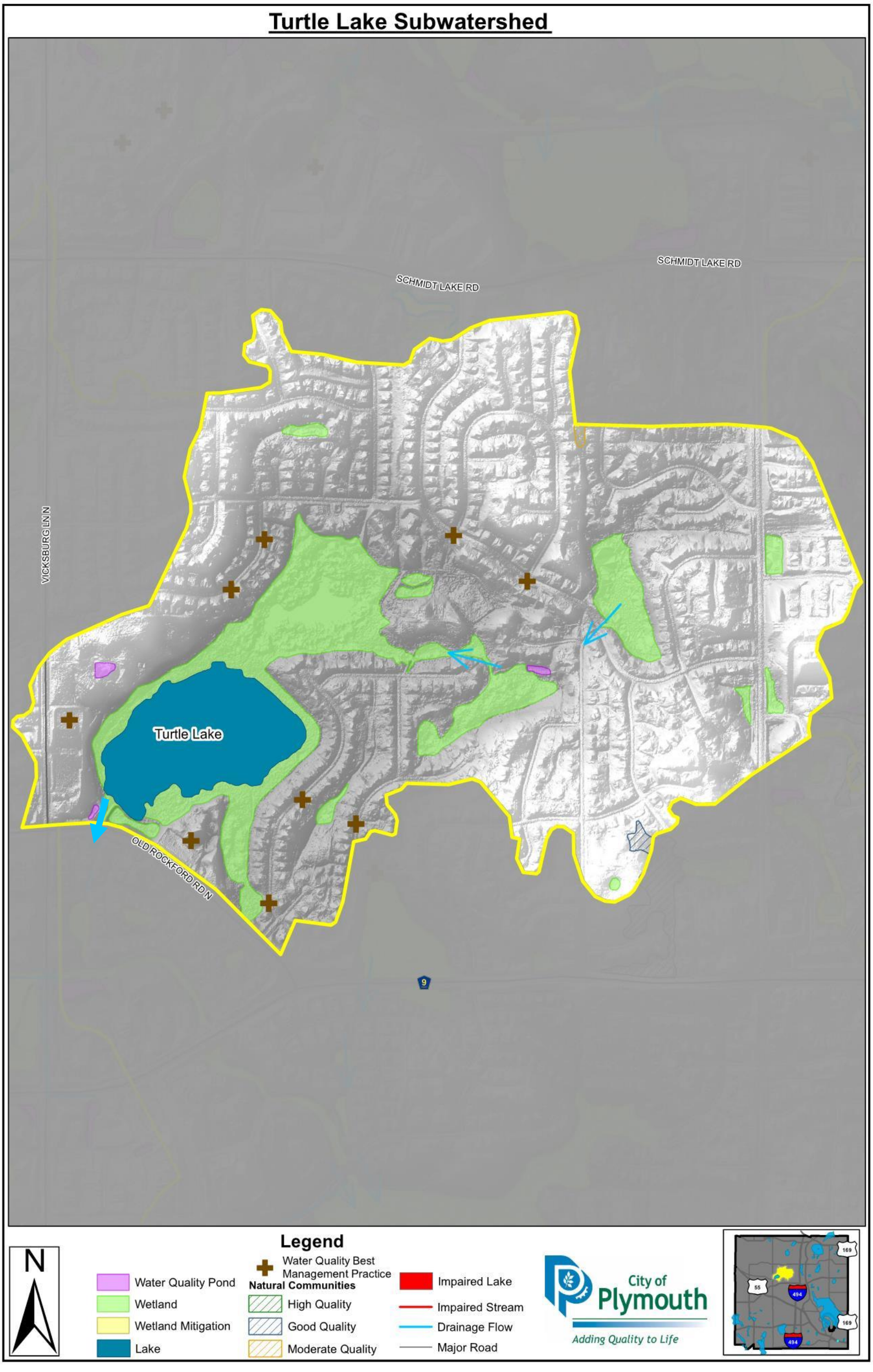
	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Plymouth Creek	
Receives runoff from:	Headwater	Figure 27
Downstream-most water body:	Turtle Lake	Figure 27
Discharges to:	Middle Plymouth Creek	Figure 27
Wetlands	73.0 Acres	Figure 27
Wetland Mitigation	0.0 Acres	Figure 27
Water Quality Ponding	0.6 Acres	Figure 27
Lakes	Turtle – 23.7	Figure 18 Figure 27
General Hydrologic Soil Group	B, B/D, C/D	
Drainage Area	409.4 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby

support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality. No impaired waters are identified within the Turtle Lake sub-watershed.

Figure 27. Turtle Lake Sub-watershed



Implementation Program

Recent projects pre-dating this plan include drainage improvements east of Turtle Lake and north of 44th Avenue North in the Quail Ridge development. In addition, a feasibility study was completed to review opportunities to manage water levels in Turtle Lake, however, based on low-floor elevations of adjacent properties, no changes to the Turtle Lake outlet and no management of water levels was recommended. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents.

Non-structural, programmatic, and structural solutions to improve water quality within this sub-watershed are shown in Table 14.

TABLE 14
TURTLE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$25,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$25,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Quail Ridge 3rd Addition Drainage Imp	2017	NA	$350,000	Plymouth

Conclusions

The Turtle Lake sub-watershed does not have a known water quality impairment through the 2018 impaired waters list produced by the State of Minnesota. The Implementation Program for the Turtle Lake Sub-watershed includes a number of nonstructural, programmatic, and structural solutions to improve water quality and provide flood protection.

Middle Plymouth Creek Sub-watershed

Physical Land Use Characteristics

The Middle Plymouth Creek Sub-watershed is located in the center of Plymouth, bisected east/west by I-494 and north/south by Highway 55. The sub-watershed receives water from the Upper Plymouth Creek and Turtle Lake Sub-watersheds, before discharging to the Lower Plymouth Creek sub-watershed. The sub-watershed is generally bounded to the north by County Road 9, to the west by Vicksburg Lane and to the south by Campus Drive.

Significant landmarks within this sub-watershed include Plymouth Creek, which is classified as a priority stream by the Bassett Creek Watershed Management Commission and four exceptionally large wetland areas. The sub-watershed is mostly developed and includes a mix of industrial, commercial, and residential areas. This sub-watershed has 284.6 acres of wetland, 12.0 acres of wetland mitigation, and 17.7 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) indicates several high or good quality natural upland communities including Maple/Basswood forests and a 10.9 acre Willow Swamp.

TABLE 15
MIDDLE PLYMOUTH CREEK SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Upper Plymouth Creek and Turtle Lake Sub-watersheds	Figure 28
Downstream-most water body:	BC-39 (22442-NB01)	Figure 28
Discharges to:	Lower Plymouth Creek	Figure 28
Wetlands	247.7 Acres	Figure 28
Wetland Mitigation	6.3 Acres	Figure 28
Water Quality Ponding	5.1 Acres	Figure 28
Lakes	None	
General Hydrologic Soil Group	B & C/D	
Drainage Area	1583.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 16) and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

A drainage improvement project was completed in 2007 between 38th and 39th Avenues and west of Harbor Lane. A stream restoration project on Plymouth Creek was completed in 2018 from Plymouth Creek playfields to Annapolis Lane and another section of Plymouth Creek was restored just north of 26th Avenue North in 2010.

TABLE 16
MIDDLE PLYMOUTH CREEK SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Plymouth Creek[1]	Chloride & E Coli	2014

1 The E. coli impairment of Plymouth Creek is addressed by the *Upper Mississippi River Bacteria TMDL Study and Protection Plan*

Figure 28. Middle Plymouth Creek Sub-watershed

Implementation Program

Recent projects pre-dating this plan include drainage improvements and stream restorations on Plymouth Creek as well as a drainage improvement near the intersection of Ranchview Lane and Medina Road. Non-structural, programmatic, and structural solutions to address impairments within this sub-watershed are shown in Table 17.

TABLE 17
MIDDLE PLYMOUTH CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Plymouth Creek Stream Restoration Plym Crk. Park to Annapolis Lane	2017-2018	$86,000	$860,000	Plymouth BCWMC
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Middle Plymouth Creek Sub-Watershed has one known impairment through the 2018 impaired water list produced by the State of Minnesota. The Twin Cities Metro Area Chloride TMDL Implementation Plan was approved by the Minnesota Pollution Control Agency in March, 2016. Additionally, the Upper Mississippi River Bacteria TMDL Study and Protection Plan was approved in 2014 and will be implemented during the course of this 10-year Surface Water Management Plan. The Implementation Program for the Middle Plymouth Creek Sub-watershed includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Plymouth Creek and other water bodies within this sub-watershed.

Fernbrook Lane Sub-watershed

Physical Land Use Characteristics

The Fernbrook Lane Sub-watershed is located in south central Plymouth. The sub-watershed is generally bounded by I-494 to the east, Highway 55 to the north, County Road 6 to the south, and Niagara Lane to the west. The existing land use is primarily commercial/industrial with small pockets of multi-family and single family residential.

The sub-watershed is mostly developed, however, there are a few remaining properties which could develop in the next 10 years. This sub-watershed has 3.8 acres of wetland, 0.1 acres of wetland mitigation, and 1.5 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities.

TABLE 18
FERNBROOK LANE SUB-WATERSHED CHARACTERISTICS

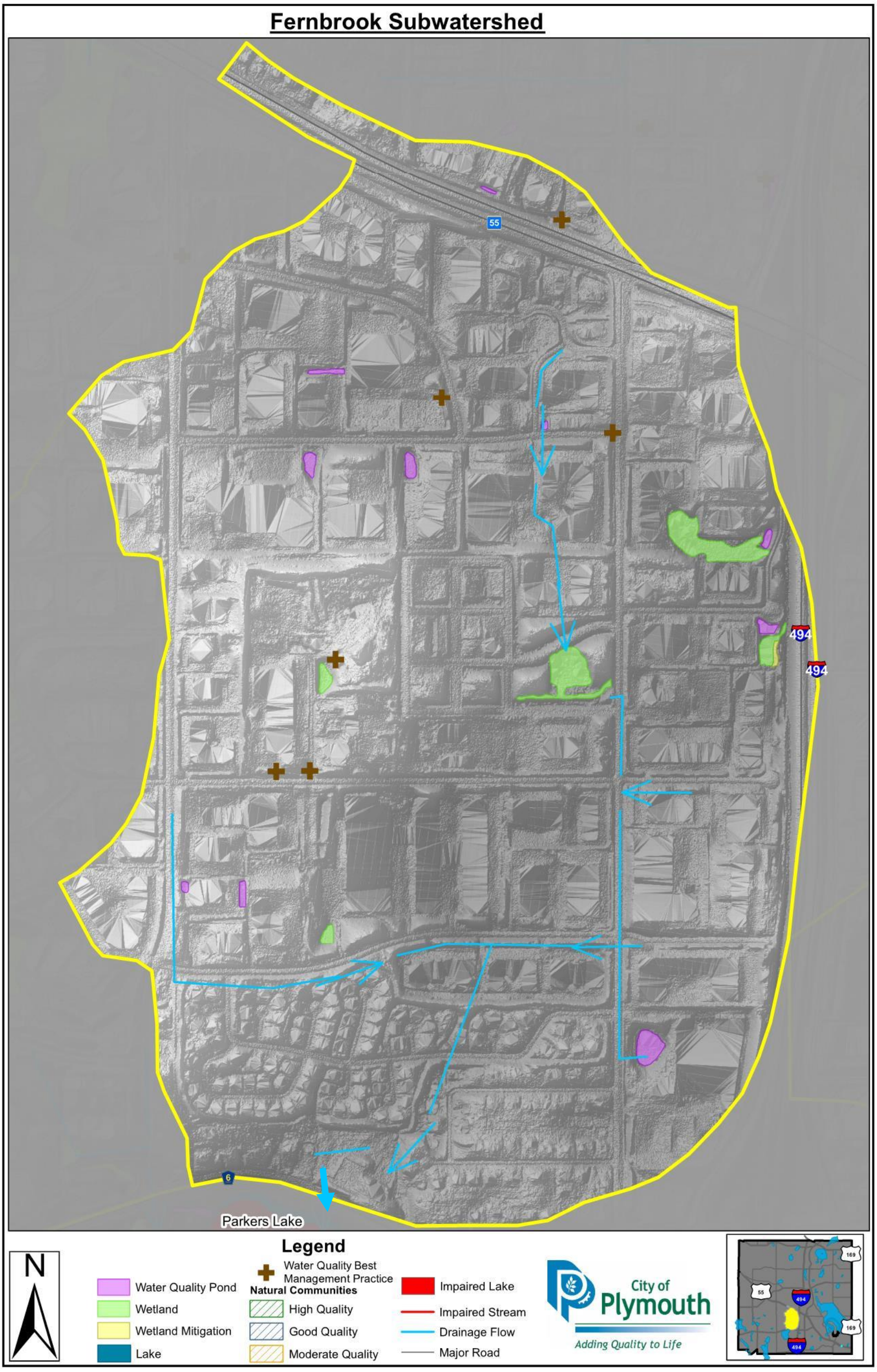
	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Parkers Lake	
Receives runoff from:	Headwater	Figure 29
Downstream-most water body:	Parkers Lake	Figure 29
Discharges to:	Parkers Lake	Figure 29
Wetlands	3.8 Acres	Figure 29
Wetland Mitigation	0.1 Acres	Figure 29
Water Quality Ponding	1.5 Acres	Figure 29
Lakes	None	
General Hydrologic Soil Group	B; B/D; C/D	
Drainage Area	491.2 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water

quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are no impaired waters currently in the Fernbrook Lane Sub-watershed.

Figure 29. Fernbrook Lane Sub-watershed



Implementation Program

There are no recent projects in this sub-watershed predating this plan. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 19.

TABLE 19
FERNBROOK LANE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Fernbrook Lane Sub-Watershed drains to Parkers Lake, a public access water in the City of Plymouth. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Parkers Lake and other water bodies within this sub-watershed.

North Parkers Lake Sub-watershed

Physical Land Use Characteristics

The North Parkers Lake Sub-watershed lies west of and adjacent to Fernbrook Lane, between 26th Avenue North and County Road 6. This sub-watershed is generally bounded to the west by Vicksburg Lane. The existing land use is a combination of multi-family residential, commercial, and park space.

A significant landmark within this sub-watershed is the Parkers Lake Regional Park and Playfields. The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 8.5 acres of wetland, 0.0 acres of wetland mitigation, and 0.0 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities.

TABLE 20
NORTH PARKERS LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Parkers Lake	
Receives runoff from:	Headwater	Figure 30
Downstream-most water body:	Parkers Lake	Figure 30
Discharges to:	Parkers Lake	Figure 30
Wetlands	8.5 acres	Figure 30
Wetland Mitigation	0.0 acres	Figure 30
Water Quality Ponding	0.0 acres	Figure 30
Lakes	None	
General Hydrologic Soil Group	B; B/D; C/D	
Drainage Area	188.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby

support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently no impairments within the North Parkers Lake Sub-watershed.

Figure 30. North Parkers Lake Sub-watershed

Implementation Program

There are no recent projects pre-dating this plan within this sub-watershed. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 21.

TABLE 21
NORTH PARKERS LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$25,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$25,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Parkers Lake Park Drainage Improvement	2019-2020	-	$400,000	Plymouth/ BCWMC

Conclusions

The North Parkers Lake Sub-Watershed does not contain any known impairments through the 2018 impaired water list produced by the State of Minnesota, however, this watershed does eventually drain to three waterbodies with impairments (Parkers Lake, Medicine Lake & Bassett Creek). A TMDL Implementation Plan has been developed for Medicine Lake and a future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Parkers Lake and other water bodies within this sub-watershed and downstream.

South Parkers Lake Sub-watershed

Physical Land Use Characteristics

The South Parkers lake sub-watershed lies directly south of Parkers Lake, generally between Vicksburg Lane and I-494. A small portion of this sub-watershed extends south into neighboring Minnetonka. The existing land use is primarily single family residential.

The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 3.9 acres of wetland, 0.0 acres of wetland mitigation, and 0.3 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities, however, within the South Parkers Lake sub-watershed there is 10.0 acres of poor quality Oak-mesic forest.

TABLE 22
SOUTH PARKERS LAKE SUB-WATERSHED CHARACTERISTICS

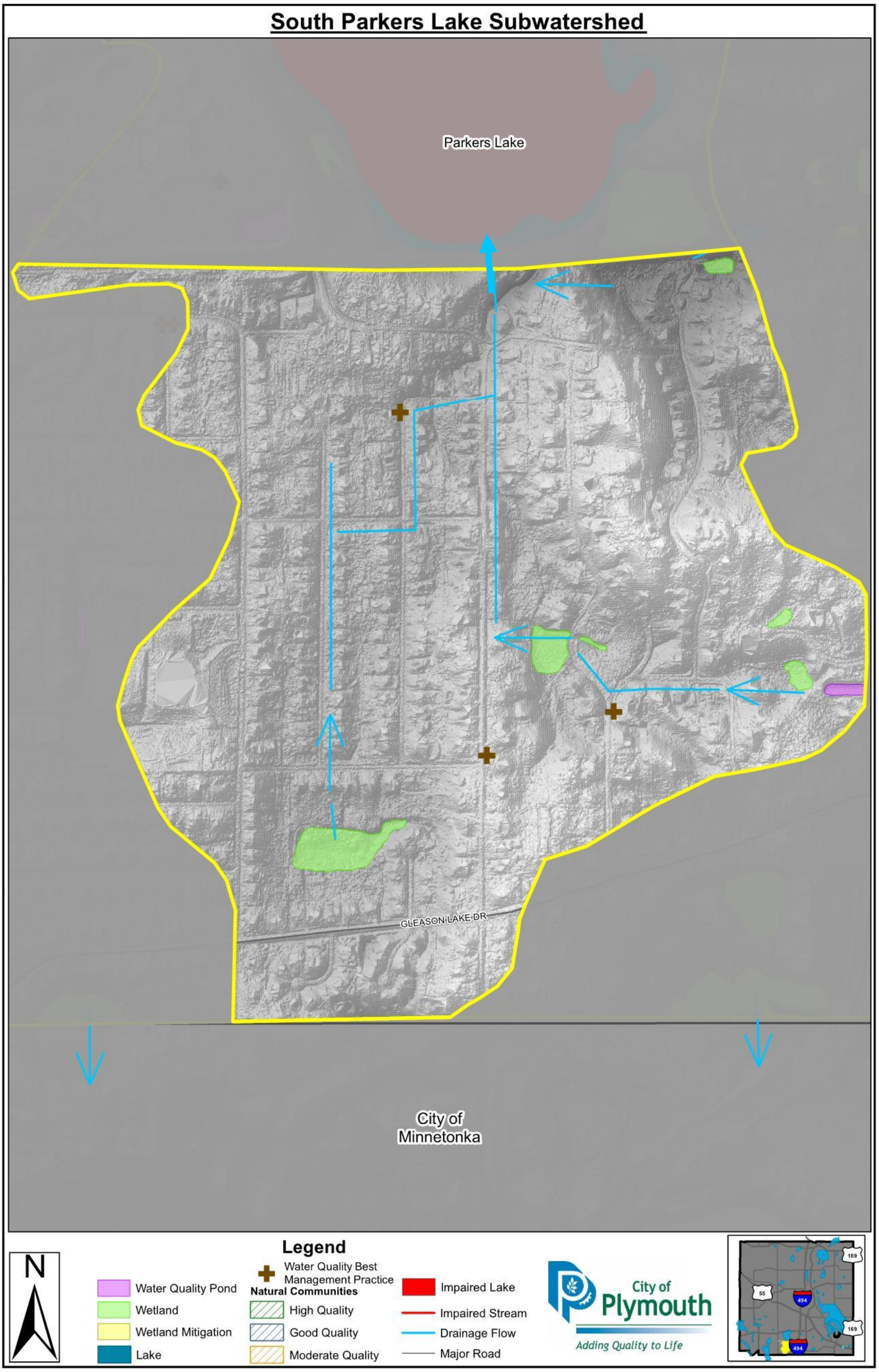
	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Parkers Lake	
Receives runoff from:	Headwater	Figure 31
Downstream-most water body:	Parkers Lake	Figure 31
Discharges to:	Parkers Lake	Figure 31
Wetlands	3.9 acres	Figure 31
Wetland Mitigation	0.0 acres	Figure 31
Water Quality Ponding	0.3 acres	Figure 31
Lakes	None	
General Hydrologic Soil Group	B; B/D; A	
Drainage Area	258.2 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be

established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no documented water quality impairments within the Parkers Lake South Sub-watershed.

Figure 31. South Parkers Lake Sub-watershed



Implementation Program

Recent projects pre-dating this plan include a water quality pond improvement adjacent to Circle Park (2010), a drainage improvement southwest of Parkers Lake and south of the Luce Line trail (2016) and a storm sewer/stream restoration (2005) at the inflow to Parkers Lake. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 23.

TABLE 23
SOUTH PARKERS LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The South Parkers Lake Sub-Watershed has no known impairments through the 2018 impaired water list produced by the State of Minnesota, however, this sub-watershed eventually drains to three impaired waters (Parkers Lake, Medicine Lake & Bassett Creek). A TMDL Implementation Plan has been developed for Medicine Lake and a future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Parkers Lake and other water bodies within this sub-watershed and downstream.

Parkers Lake Sub-watershed

Physical Land Use Characteristics

The Parkers Lake Sub-watershed lies in south central Plymouth, directly east of Shenandoah Lane and south of County Road 6. The existing land use is primarily Parkers Lake itself, with open space on the west and single family residential on the east.

The significant landmark within this sub-watershed is Parkers Lake, which is classified as a Priority 1 Deep Lake by the Bassett Creek Watershed Management Commission. The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 5.4 acres of wetland, 0.0 acres of wetland mitigation, and 1.2 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities.

TABLE 24
PARKERS LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Parkers Lake	
Receives runoff from:	North Parkers Lake Fernbrook Lane South Parkers Lake	Figure 32
Downstream-most water body:	Parkers Lake	Figure 32
Discharges to:	Plymouth Creek SW	Figure 32
Wetlands	5.4 Acres	Figure 32
Wetland Mitigation	0.0 Acres	Figure 32
Water Quality Ponding	1.2 Acres	Figure 32
Lakes	Parkers – 102 acres	Figure 13 Figure 32
General Hydrologic Soil Group	B	
Drainage Area	213 acres	

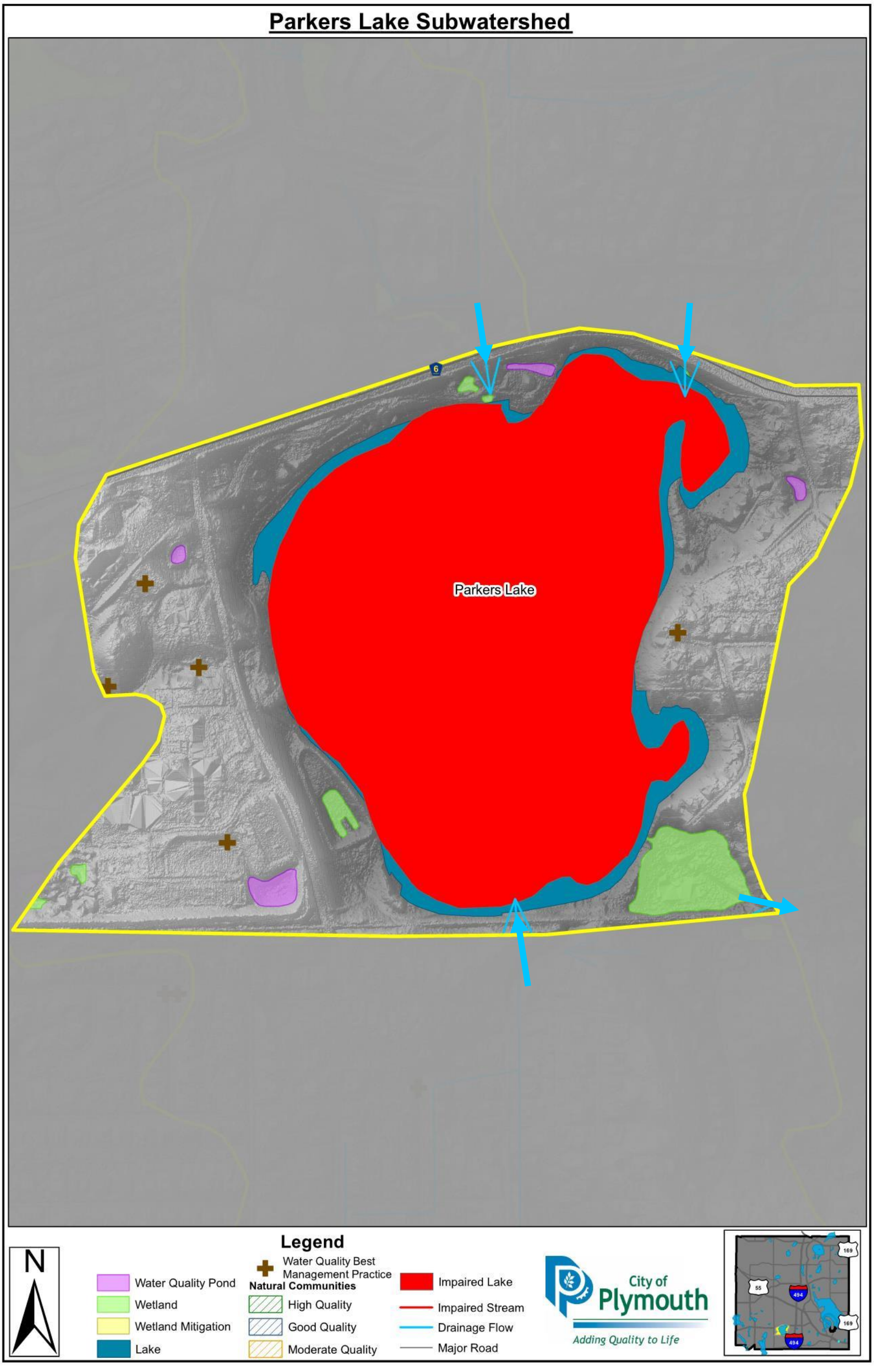
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 25) and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 25
PARKERS LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Parkers Lake	Chloride & Aquatic Consumption	2014

Figure 32. Parkers Lake Sub-watershed



Implementation Program

Recent projects in the Parkers Lake Sub-Watershed pre-dating this plan include the Parkers Lake Rock Weir and the South Parkers Lake tributary stream restoration and erosion repair project. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 26. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents.

TABLE 26
PARKERS LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$10,000	$100,000	Plymouth
Lake Management	2019-20128	$1,000	$10,000	Plymouth and Partners

Conclusions

The Parkers Lake Sub-Watershed has two known impairments (chloride & mercury) through the 2018 impaired water list produced by the State of Minnesota. Implementation of best management practices consistent with the TMDL Implementation Plan for chloride will be implemented during the course of this plan. This 10-year Surface Water Management Plan also includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Parkers Lake and other water bodies within this sub-watershed.

Cavanaugh Lake Sub-watershed

Physical Land Use Characteristics

The Cavanaugh Lake Sub-watershed is located in southeastern Plymouth. The sub-watershed extends south into Minnetonka. The existing land use is primarily single family residential but also includes Sunset Hill Elementary School.

The significant landmark within this sub-watershed is Cavanaugh Lake, which is classified as a Priority 2 Shallow Lake by the Bassett Creek Watershed Management Commission. The sub-watershed is developed and redevelopment will be the primary driver of change within this sub-watershed. This sub-watershed has 9.4 acres of wetland, 0.0 acres of wetland mitigation, and 0.1 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities, however, within the Sunset Hills Pond/Cavanaugh Lake sub-watershed there is one 6.2 acre moderate quality Oak forest.

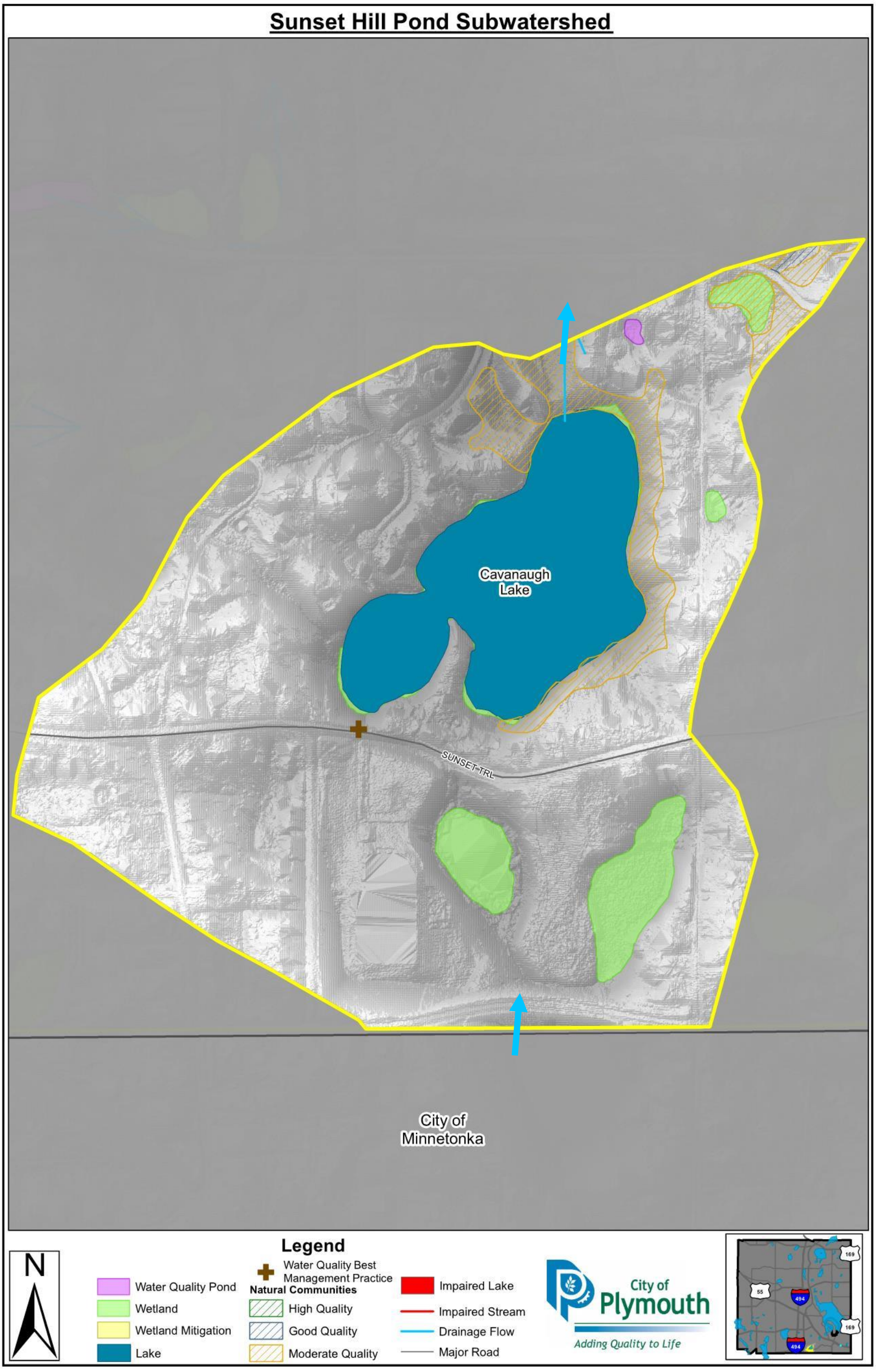
TABLE 27
CAVANAUGH LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Minnetonka	Figure 33
Downstream-most water body:	Medicine Lake	Figure 33
Discharges to:	Plymouth Creek SW	Figure 33
Wetlands	9.4 Acres	Figure 33
Wetland Mitigation	0.0 Acres	Figure 33
Water Quality Ponding	0.1 Acres	Figure 33
Lakes	Cavanaugh-14.2 acres	Figure 3 Figure 33
General Hydrologic Soil Group	B; C/D	
Drainage Area	107.4 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently, no know water quality impairments within the Sunset Hills Pond/Cavanaugh Lake Sub-watershed.

Figure 33. Sunset Hills Pond/Cavanaugh Lake Sub-Watershed



Implementation Program

There are no recent projects pre-dating this plan, however, non-structural, programmatic, and structural solutions to prevent water quality degradation within or downstream of this sub-watershed are shown in Table 28. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents.

TABLE 28
CAVANAUGH LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth and Partners

Conclusions

The Cavanaugh Lake Sub-Watershed drains to three known impairments through the 2018 impaired water list produced by the State of Minnesota, however, there are no know impairments within the Sunset Hills Pond/Cavanaugh Lake Sub-watershed. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving and protecting water quality in Cavanaugh Lake and other water bodies within this sub-watershed.

Plymouth Creek Southwest Sub-watershed

Physical Land Use Characteristics

The Plymouth Creek Southwest Sub-watershed is located in south-central Plymouth. Bounded generally to the west by I-494 and centered along the Luce Line trail, the Plymouth Creek Southwest sub-watershed receives runoff from the Parkers Lake and the Sunset Hill Pond/Cavanaugh Lake sub-watersheds. The existing land use is primarily commercial/industrial but does have significant pockets of single family residential.

Significant landmarks within this sub-watershed include I-494, County Road 61, and the Luce Line trail. The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 54.0 acres of wetland, 0.0 acres of wetland mitigation, and 2.3 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities, however, within the Plymouth Creek Southwest sub-watershed there are three low quality Oak Forests totaling 10.0 acres and one 2.9 acre moderate quality Maple-Basswood Forest.

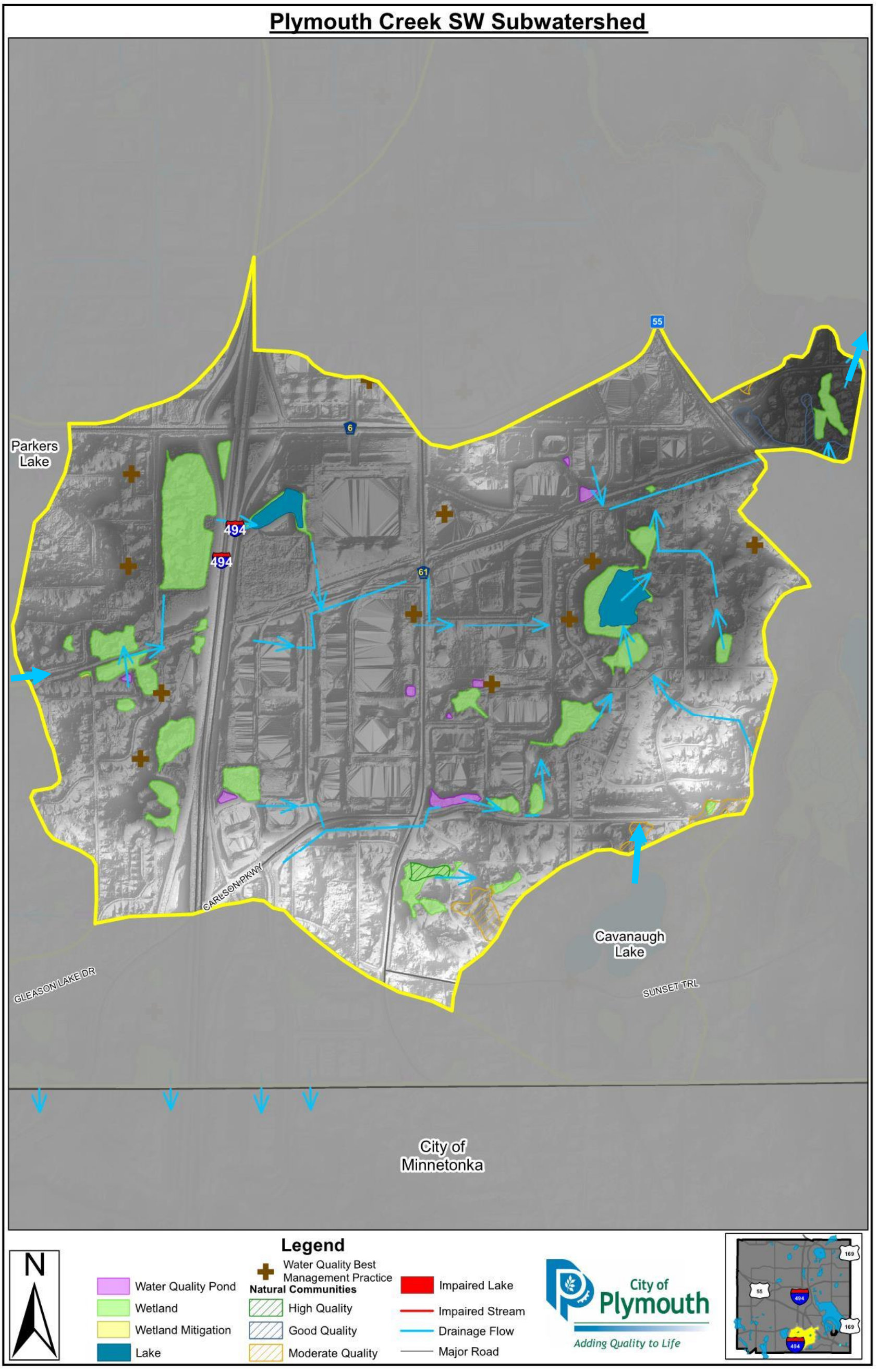
TABLE 29
PLYMOUTH CREEK SOUTHWEST SUB-WATERSHED

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Parkers Lake Sunset Hills Pond/Cavanaugh Lake	Figure 34
Downstream-most water body:	(26313-NB01)	Figure 34
Discharges to:	Lower Plymouth Creek	Figure 34
Wetlands	54.0 Acres	Figure 34
Wetland Mitigation	0.0 Acres	Figure 34
Water Quality Ponding	2.3 Acres	Figure 34
Lakes	None	
General Hydrologic Soil Group	B	
Drainage Area	873.7 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently, no know water quality impairments within the Plymouth Creek Southwest Sub-watershed.

Figure 34. Plymouth Creek Southwest Sub-watershed



Implementation Program

There are no recent water quality projects pre-dating this plan, however, the City of Plymouth has recently performed rehabilitation work on the Parkers Lake lift station to provide for flood protection. Non-structural, programmatic, and structural solutions to protect and improve water quality within or downstream of this sub-watershed are shown in Table 30.

TABLE 30
PLYMOUTH CREEK SOUTHWEST SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Harbor Place Erosion Repair	2020	$200,000	$200,000	Plymouth

Conclusions

The Plymouth Creek Southwest Sub-Watershed drains to three known impairments through the 2018 impaired water list produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving and protecting water quality within this sub-watershed and other downstream water bodies.

Lower Plymouth Creek Sub-watershed

Physical Land Use Characteristics

The Lower Plymouth Creek Sub-watershed lies between Medicine Lake and I-494 in southeastern Plymouth. The sub-watershed is bisected northwest to southeast by Highway 55 and is on the receiving end of discharge from about two-thirds of the total contributing area to Medicine Lake. The existing land use is primarily commercial/industrial southwest of Highway 55 and single family residential northeast of Highway 55 with smaller pockets of multi-family residential.

Significant landmarks within this sub-watershed include Highway 55, Plymouth Creek, which is classified by the Bassett Creek Watershed Management Commission as a Priority Stream and two regional water quality ponds in the easternmost portion of the sub-watershed and within West Medicine Lake Park. The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 65.2 acres of wetland, 0.0 acres of wetland mitigation, and 9.3 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities.

TABLE 31
LOWER PLYMOUTH CREEK SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Middle Plymouth Creek Plymouth Creek SW	Figure 35
Downstream-most water body:	(26422-NU02)	Figure 35
Discharges to:	Medicine Lake	Figure 35
Wetlands	65.2 Acres	Figure 35
Wetland Mitigation	0.0 Acres	Figure 35
Water Quality Ponding	9.3 Acres	Figure 35
Lakes	None	
General Hydrologic Soil Group	A; B	
Drainage Area	518.2 acres	

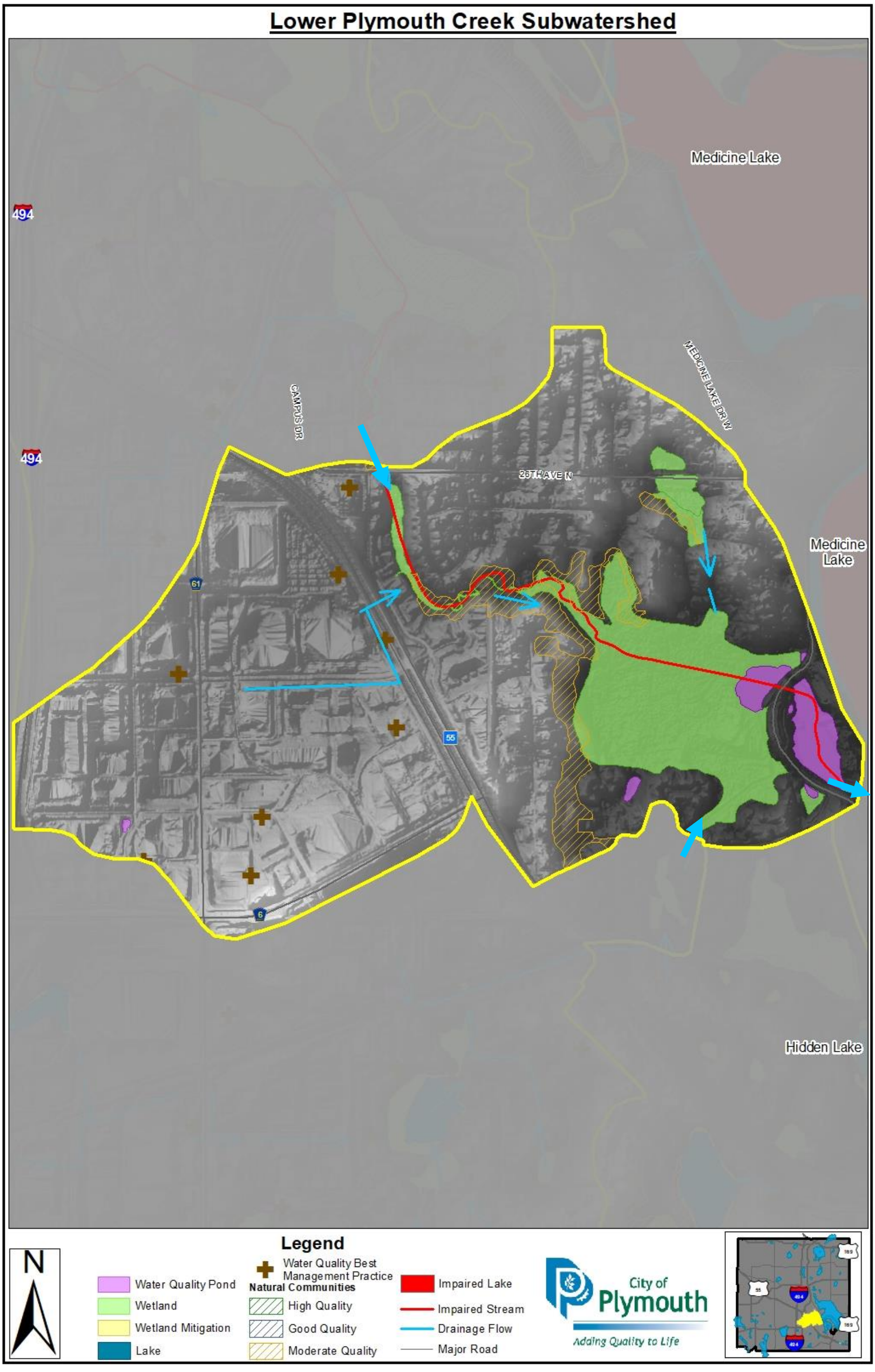
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 32) and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 32
LOWER PLYMOUTH CREEK SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Plymouth Creek	Chloride and E. Coli	2014

Figure 35. Lower Plymouth Creek Sub-watershed



Implementation Program

To assist in meeting the required load reductions of the Medicine Lake TMDL several improvements have been constructed to date within the Lower Plymouth Creek Sub-watershed. The Plymouth Creek Regional Water Quality Ponds, constructed in 2008, and the Plymouth Creek Stream Restoration (26th Avenue to the Plymouth Creek Regional Water Quality Ponds), constructed in 2010, have reduced phosphorus loading to Medicine Lake by an estimated 1,000 lbs annually. Storm sewer pipes under West Medicine Lake Drive at West Medicine Lake Park were removed and drainage was routed for treatment to the first (west) cell of the Plymouth Creek Regional Water Quality Ponds. In addition, erosion was repaired on the downstream end of the Plymouth Creek Fish Barrier. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 33.

TABLE 33
LOWER PLYMOUTH CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$10,000	$100,000	Plymouth

Conclusions

The Lower Plymouth Creek Sub-Watershed drains to three known impairments through the 2018 impaired water list produced by the State of Minnesota. A TMDL plan has been approved for Medicine Lake and the Upper Mississippi River Bacteria TMDL Study and Protection Plan are approved to address the E. Coli and fecal coliform impairments on Plymouth and Bassett Creeks. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

West Medicine Lake Sub-watershed

Physical Land Use Characteristics

The West Medicine Lake Sub-watershed lies southeast of the I-494/County Road 9 interchange, directly adjacent to the north end of Medicine Lake. The existing land use is primarily single family residential with an expanse of open space on the east side of Northwest Boulevard that is a part of French Regional Park.

Significant landmarks in this sub-watershed include the western portion of French Regional Park which is operated by the Three Rivers Park District. The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 24.8 acres of wetland, 0.0 acres of wetland mitigation, and 0.0 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities, however, it does indicate a 13.6 acre moderate quality Maple-Basswood Forest and a 1.9 acre low quality Oak Forest.

TABLE 34
WEST MEDICINE LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	NA	NA
Downstream-most water body:	Medicine Lake	Figure 36
Discharges to:	Medicine Lake	Figure 36
Wetlands	24.8 Acres	Figure 36
Wetland Mitigation	0.0 Acres	Figure 36
Water Quality Ponding	0.0 Acres	Figure 36
Lakes	None	
General Hydrologic Soil Group	B; C/D	
Drainage Area	193.8 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 35) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The TMDL plan for Medicine Lake was approved in 2008. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 35
WEST MEDICINE LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Medicine Lake	Excess Nutrients	2004

Figure 36. West Medicine Lake Sub-watershed

Implementation Program

There are no recent projects pre-dating this plan, however, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 36.

TABLE 36
WEST MEDICINE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The West Medicine Lake Sub-Watershed drains to two known impairments through the 2018 impaired water list produced by the State of Minnesota. A TMDL plan has been approved for Medicine Lake and future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

North Medicine Lake Sub-watershed

Physical Land Use Characteristics

The North Medicine Lake Sub-watershed is located between 48th Avenue North and 39th Avenue, directly north of Medicine Lake. The existing land use is a mix of commercial area located near the interchange of I-494 and County Road 9 and single family residential located primarily north and west of the intersection of County Road 9 and Northwest Boulevard.

Significant landmarks in this sub-watershed include the commercial properties located at the interchange of I-494 and County Road 9. The sub-watershed assessment is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 55.7 acres of wetland, 1.4 acres of wetland mitigation, and 3.1 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities.

TABLE 37
NORTH MEDICINE LAKE SUB-WATERSHED CHARACTERISTICS

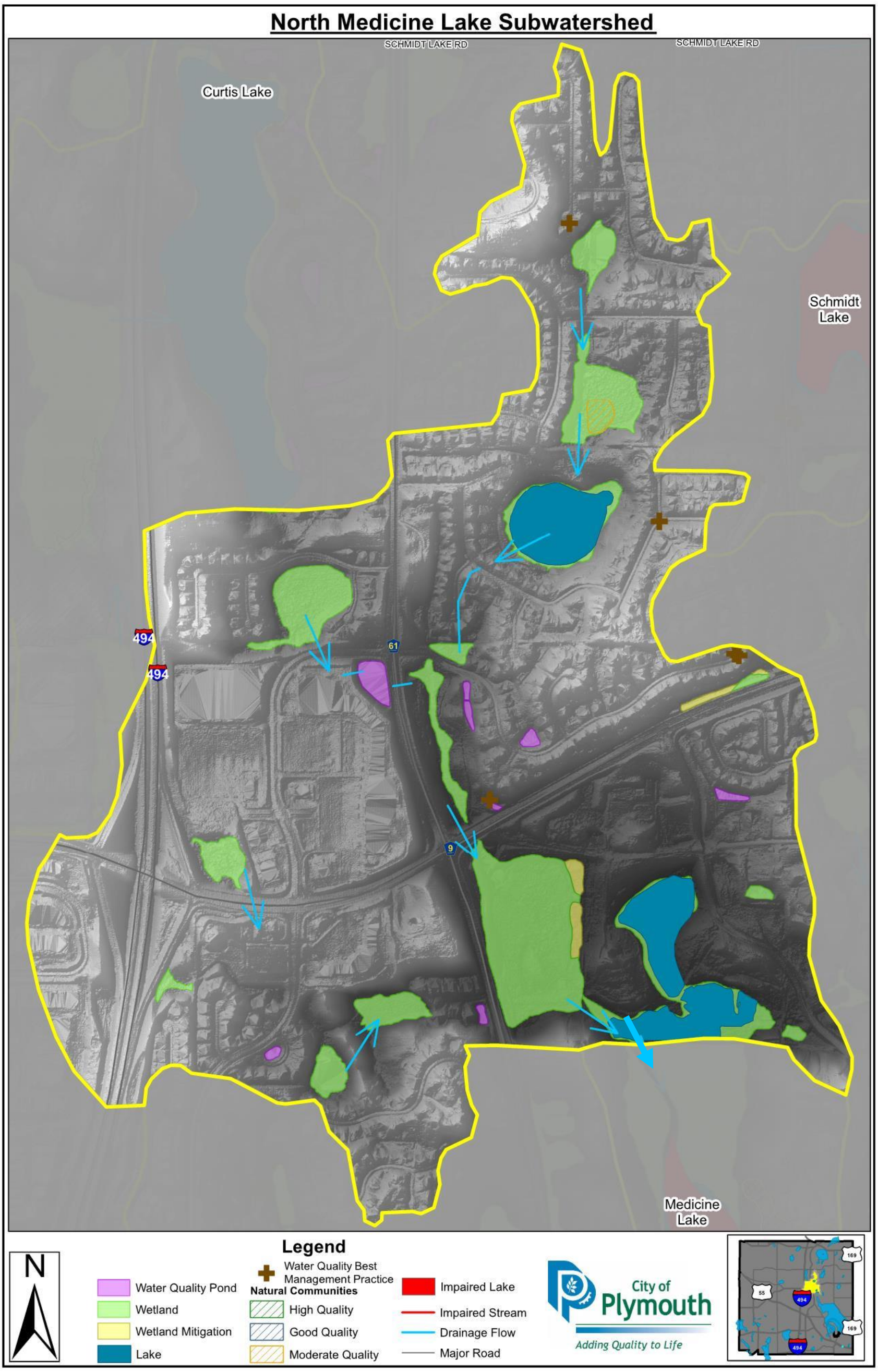
	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	NA	NA
Downstream-most water body:	(14322-NB01)	Figure 37
Discharges to:	Medicine Lake	Figure 37
Wetlands	55.7 Acres	Figure 37
Wetland Mitigation	1.4 Acres	Figure 37
Water Quality Ponding	3.1 Acres	Figure 37
Lakes	None	
General Hydrologic Soil Group	B	
Drainage Area	486.8 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses

they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently no known impairments within the North Medicine Lake Sub-watershed.

Figure 37. North Medicine Lake Sub-watershed



Implementation Program

Recent projects pre-dating this plan include the County Road 9/61 Erosion Repair Project (2008) which was cooperatively funded by the City of Plymouth, Three Rivers Park District, and the Board of Water and Soil Resources. Additional non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 38.

TABLE 38
NORTH MEDICINE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The North Medicine Lake Sub-Watershed drains to two known impairments through the 2018 impaired water list produced by the State of Minnesota. A TMDL plan has been approved for Medicine Lake and future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

Northeast Medicine Lake Sub-watershed

Physical Land Use Characteristics

The Northeast Medicine Lake Sub-watershed extends from 45th Avenue, south of Schmidt Lake to just south of 36th Avenue where it discharges to Medicine Lake. The sub-watershed is generally bounded to the west by Larch Lane and extends about one-quarter mile east of Zachary Lane. The existing land use is primarily single family residential, however, there is significant open space on the southern portion which is a part of French Regional Park and Zachary Playfields occupy part of the northern portion.

Significant landmarks in this sub-watershed include French Regional Park operated by the Three Rivers Park District. The sub-watershed assessment is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 85.6 acres of wetland, 0.0 acres of wetland mitigation, and 1.5 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural upland communities however it does note 14.9 acres of moderate Maple-Basswood Forest and a 14.9 acre low quality Lowland Hardwood Forest.

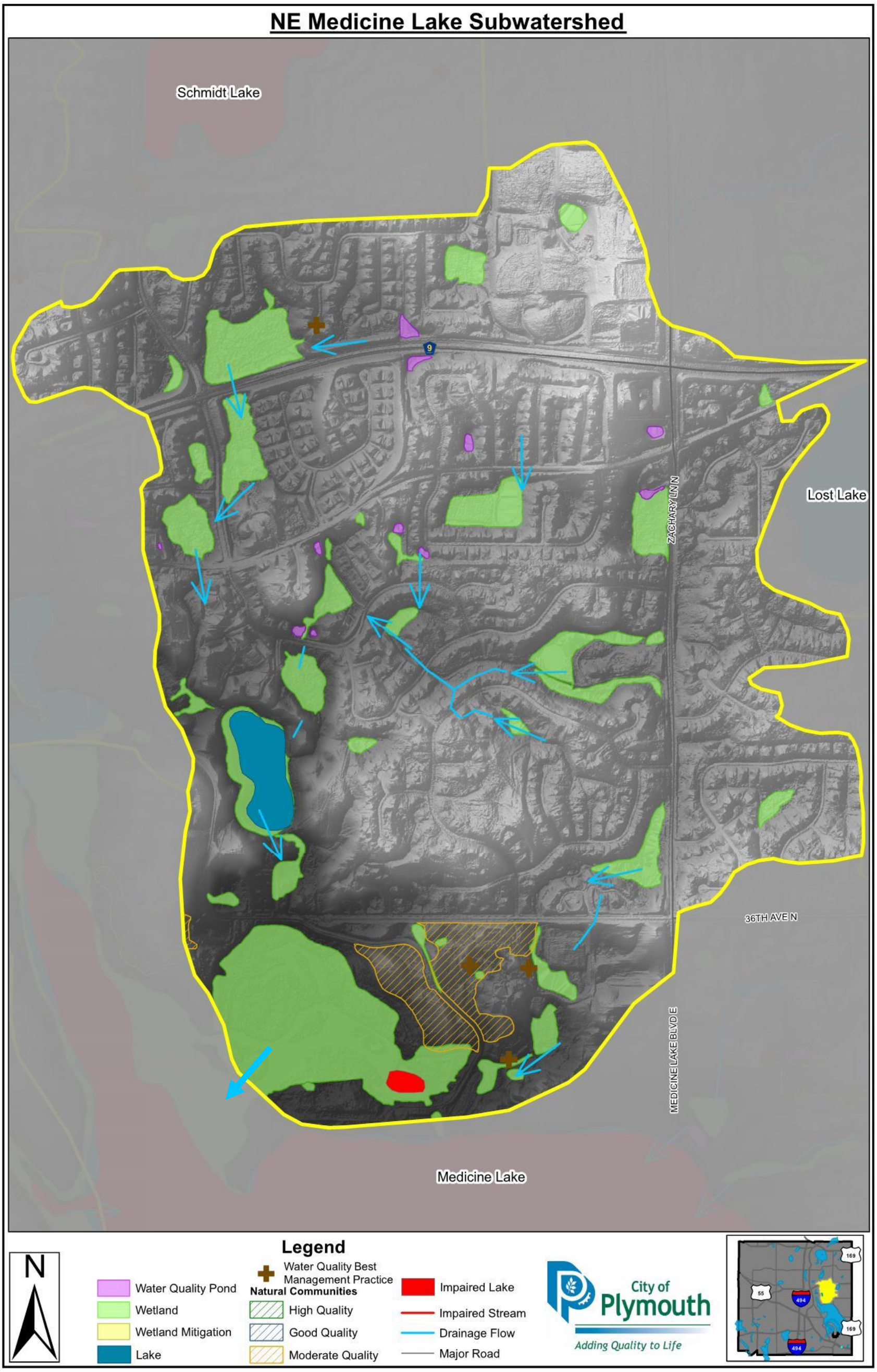
TABLE 39
NORTHEAST MEDICINE LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	NA	NA
Downstream-most water body:	(23242-NB01)	Figure 38
Discharges to:	Medicine Lake	Figure 38
Wetlands	85.6 Acres	Figure 38
Wetland Mitigation	0.0 Acres	Figure 38
Water Quality Ponding	1.5 Acres	Figure 38
Lakes	None	
General Hydrologic Soil Group	B	
Drainage Area	662.9 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no known impairments within the Northeast Medicine Lake Sub-watershed.

Figure 38. Northeast Medicine Lake Sub-watershed



Implementation Program

Drainage improvements were previously completed in the wetland in the northwest corner of the intersection of Old Rockford Road and Larch Lane as well as water quality ponds near the intersection of 41st and Goldenrod. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 40.

TABLE 40
NORTHEAST MEDICINE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Mouth Olivet Stream Restoration	2019-2020	$40,000	$400,000	Plymouth/ BCWMC

Conclusions

The Northeast Medicine Lake Sub-Watershed drains to two known impairments through the 2018 proposed impaired water list produced by the State of Minnesota. A TMDL plan has been approved for Medicine Lake and future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

South Medicine Lake Sub-watershed

Physical Land Use Characteristics

The South Medicine Lake Sub-watershed is located between Balsam Lane and South Shore Drive on the east and Pineview Lane to the west. The South Medicine Lake Sub-watershed receives runoff from the City of Minnetonka (Ridgedale area) and discharges through an open channel/culvert system under Highway 55 and into Medicine Lake. The existing land use is a diverse mix of single family residential and commercial/industrial along the Highway 55 corridor.

Significant landmarks in this sub-watershed include the Crossroads Commons redevelopment at Highway 55 and West Medicine Lake Drive and Wayzata East Middle School. The sub-watershed assessment is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 122.8 acres of wetland, 0.5 acres of wetland mitigation, and 0.9 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) indicates 14.6 acres of good quality Lowland Hardwood Forest. In addition, there are 1.8 acres of poor quality Lowland Hardwood Forest, 7.3 acres of poor quality Maple-Basswood Forest, and 16.6 acres of Oak Forest.

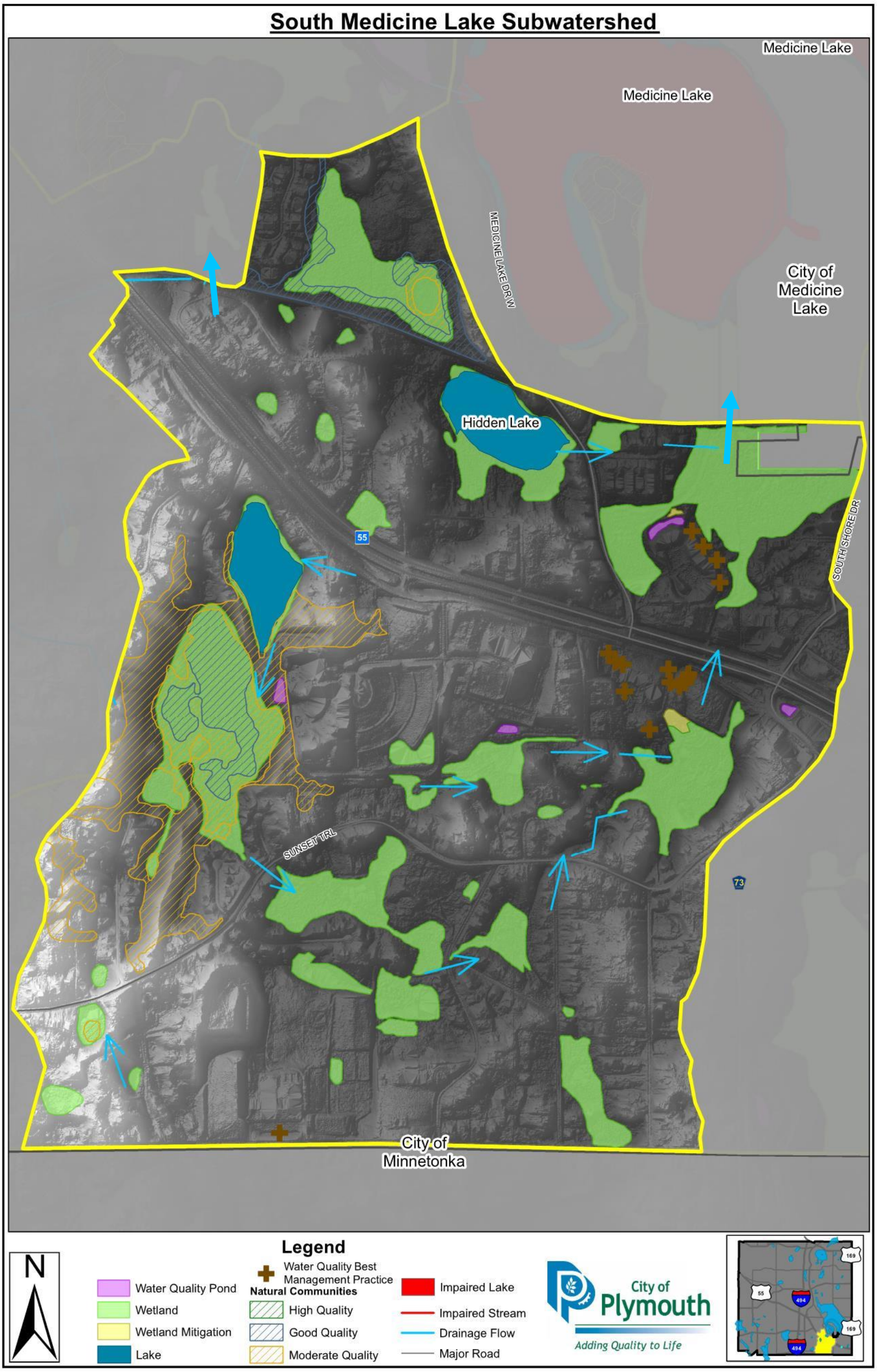
TABLE 41
SOUTH MEDICINE LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	City of Minnetonka	NA
Downstream-most water body:	(35111-NB01)	Figure 39
Discharges to:	Medicine Lake	Figure 39
Wetlands	122.8 Acres	Figure 39
Wetland Mitigation	0.5 Acres	Figure 39
Water Quality Ponding	0.9 Acres	Figure 39
Lakes	Hidden (8.5 Acres)	Figure 7 Figure 39
General Hydrologic Soil Group	B; C/D	
Drainage Area	694.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no known impairments within the South Medicine Lake Sub-watershed.

Figure 39. South Medicine Lake Sub-watershed



Implementation Program

In 2008, the City of Plymouth coordinated with the Minnesota Department of Transportation to relieve a flooding issue under Highway 55 just east of West Medicine Lake Drive and in 2013 the City completed the St. Mary's Drainage Improvement Project. A second drainage improvement in the St. Mary's neighborhood is programmed for the winter of 2018-2019. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents.

Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 42.

TABLE 42
SOUTH MEDICINE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
St. Mary's Drainage Improvement Phase II	2018-2019	$135,000	$135,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth

Conclusions

The South Medicine Lake Sub-Watershed drains to two known impairments through the 2018 proposed impaired water list produced by the State of Minnesota. A TMDL plan has been approved for Medicine Lake and future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

Medicine Lake Sub-watershed

Physical Land Use Characteristics

The Medicine Lake Sub-watershed is located in southeast Plymouth. Medicine Lake is the largest lake in the City and the second largest in Hennepin County behind Lake Minnetonka. Plymouth Creek is the main discharge into Medicine Lake, however several other intermittent/first order streams discharge to Medicine Lake and are referred to locally as Wood Creek, Timber Creek, and Ridgedale Creek. Medicine Lake also serves as the headwaters of Bassett Creek.

Medicine Lake (Figure 11) is the most significant resource in this sub-watershed and is a heavily used recreational water body, with residents, neighbors and visitors using the trails, parks, and beaches located along the shores of the lake. Medicine Lake is classified by the Bassett Creek Watershed Management Commission as a Priority 1 Deep Lake. The sub-watershed is developed with redevelopment being the primary driver of change within this sub-watershed. This sub-watershed has 128.7 acres of wetland, 0.0 acres of wetland mitigation, and 5.4 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) indicates 6.6 acres of good quality Oak Forest. In addition, there are 31.8 acres of moderate quality Maple-Basswood Forest, 3.6 acres of moderate quality mix emergent, and 0.7 acres of moderate quality wet meadow. Last, there are 18.1 acres of low quality Lowland Hardwood Forest.

TABLE 43
MEDICINE LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Lower Plymouth Creek West Medicine Lake North Medicine Lake NE Medicine Lake South Medicine Lake	Figure 40
Downstream-most water body:	Medicine Lake	Figure 40
Discharges to:	Bassett Creek	Figure 40

Wetlands	128.7 Acres	Figure 40
Wetland Mitigation	0.0 Acres	Figure 40
Water Quality Ponding	5.4 Acres	Figure 40
Lakes	Medicine (898 Acres)	Figure 11 Figure 40
General Hydrologic Soil Group	A, C, C/D	
Drainage Area	1920.4 acres	

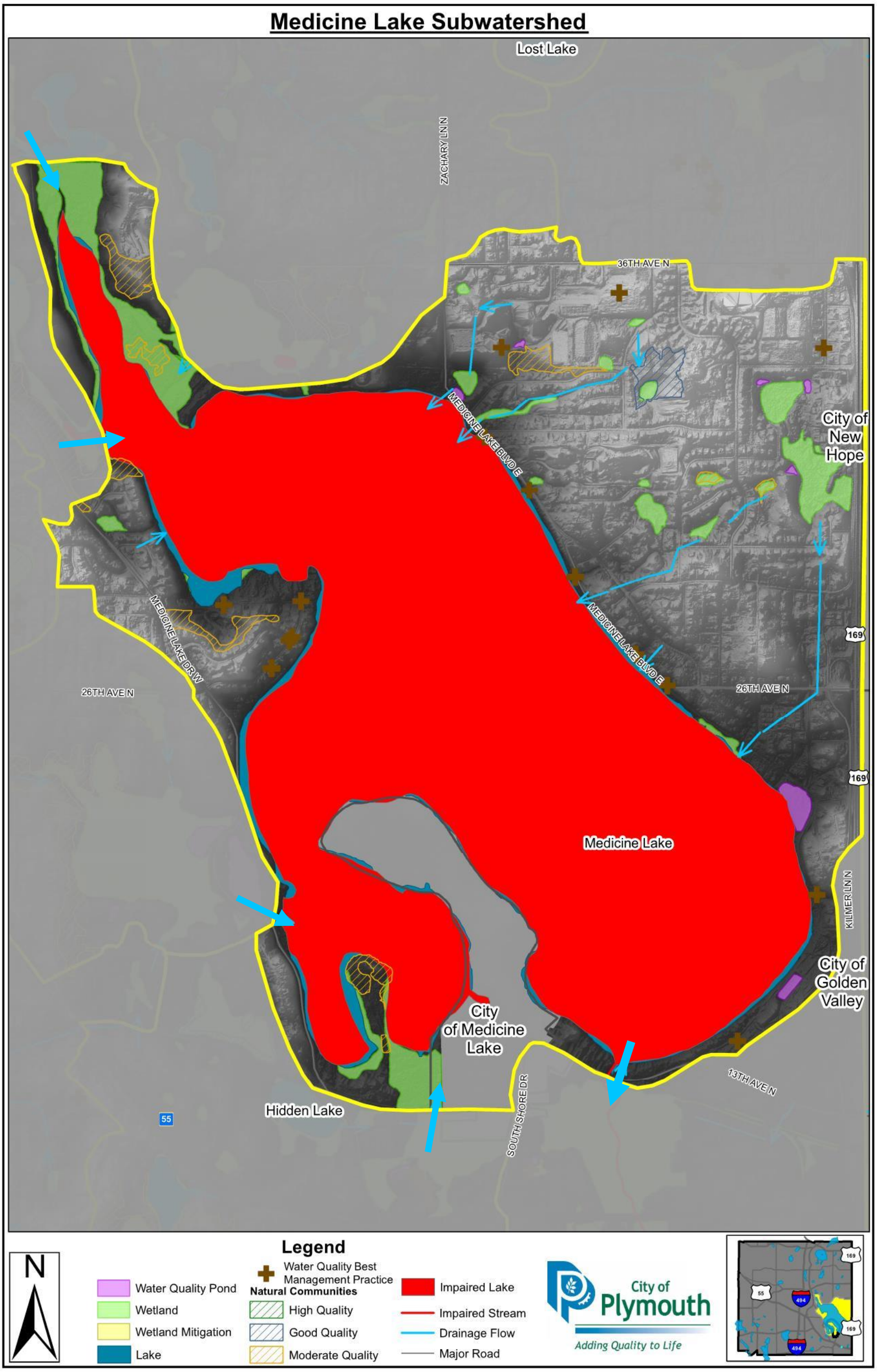
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 44) and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 44
MEDICINE LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Medicine Lake	Excess Nutrients	2004
Bassett Creek	Fish Bio assessment	2004

Figure 40. Medicine Lake Sub-watershed



Implementation Program

In 2003, the City of Plymouth and the Bassett Creek Watershed partnered to construct two regional ponds on the east side of Medicine Lake. The first at the intersection of 23rd Avenue and East Medicine Lake Drive and second within East Medicine Lake Park. In 2006, the City of Plymouth completed the Wood Creek Erosion Repair and Drainage Improvement project east of Medicine Lake and between 32nd and 34th Avenues. In 2007, the City of Plymouth completed the Timber Creek Erosion Repair and Drainage improvement project east of Medicine Lake and between 28th and 29th Avenues. The Timber Creek Erosion Repair and Drainage Improvement project also included a stormceptor hydrodynamic separator underneath East Medicine Lake Drive. In 2009, the City of Plymouth completed water quality pond maintenance within the Sunrise Marsh development. City of Plymouth also provided grants to residents for shoreline restoration projects and treated curlyleaf pondweed in Medicine Lake for over a decade before that program was turned over to the Bassett Creek Watershed.

During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents. Future non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 45.

TABLE 45
MEDICINE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$10,000	$100,000	Plymouth
Kilmer Area Water Quality, Drainage, and Erosion Control Improvements	2018-2019	$1,300,000	$1,300,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth

Conclusions

The Medicine Lake Sub-Watershed drains to two known impairments through the 2018 impaired water list produced by the State of Minnesota. A TMDL plan has been approved for Medicine Lake and future TMDL plan will be developed for Bassett Creek. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

Bassett Creek Sub-watershed

Physical Land Use Characteristics

The Bassett Creek Sub-Watershed is located in the southeastern corner of Plymouth. Medicine Lake is the headwater for Bassett Creek which will flow southeasterly through Golden Valley and Minneapolis to the Mississippi River.

Significant landmarks in this sub-watershed include Bassett Creek itself, which is classified by the Bassett Creek Watershed Management Commission as a Priority Stream, as well as portions of the commercial/industrial corridors of State Highway 55 and Highway 169. The sub-watershed is developed and has greater impervious surfaces than the average sub-watershed in Plymouth. Redevelopment will be the primary driver of change within this sub-watershed. This sub-watershed has 115.7 acres of wetland, 3.9 acres of wetland mitigation, and 7.5 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any natural resources of significant value.

TABLE 46
BASSETT CREEK SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	Medicine Lake	
Receives runoff from:	Medicine Lake	Figure 41
Downstream-most water body:	BC105	Figure 41
Discharges to:	Golden Valley	Figure 41
Wetlands	115.7 Acres	Figure 41
Wetland Mitigation	3.9 Acres	Figure 41
Water Quality Ponding	7.5 Acres	Figure 41
Lakes	None	
General Hydrologic Soil Group	A, C, C/D	
Drainage Area	703.4 Acres	

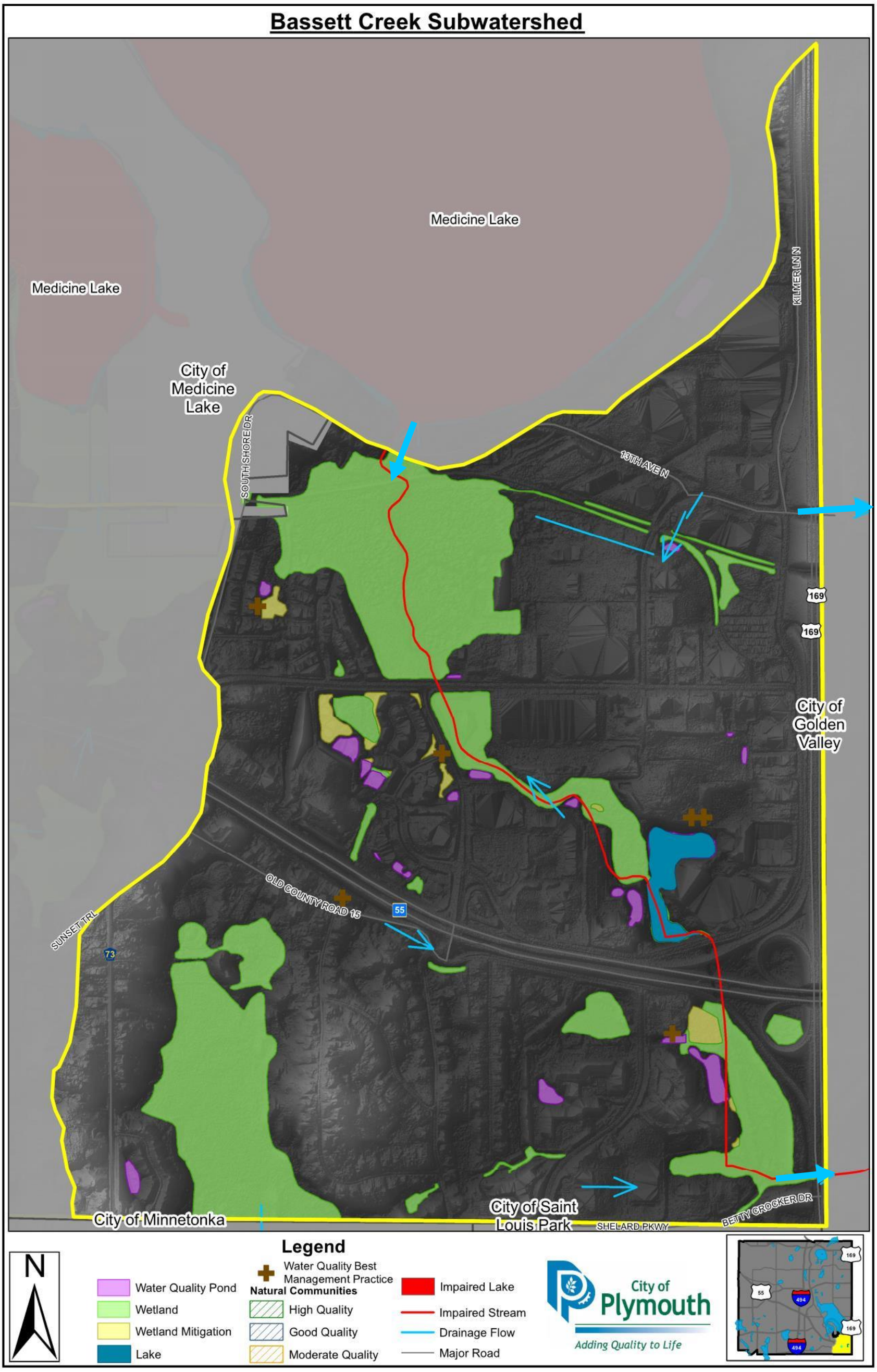
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 47) and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 47
BASSETT CREEK SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Bassett Creek	Fish Bio assessments Chloride Fecal coliform	2004, 2014

Figure 41. Bassett Creek Sub-watershed



Implementation Program

There are no recent projects pre-dating this plan. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 48.

TABLE 48
BASSETT CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2025-2028	$1,000	$3,000	Plymouth

Conclusions

The Bassett Creek Sub-Watershed drains to three known impairment through the 2018 impaired water list produced by the State of Minnesota. The Upper Mississippi River Bacteria TMDL Study and Protection Plan will address the impairments. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

Lost Lake Sub-watershed

Physical Land Use Characteristics

The Lost Lake Sub-watershed is located directly southeast of the Zachary Lane/County Road 9 intersection in east central Plymouth.

The significant landmark in this sub-watershed include Lost Lake, which is surrounded by residential development and is classified by the Bassett Creek Watershed Management Commission as a Priority 2 Shallow Lake. The outlet to Lost Lake, along the south side of County Road 9 is a combination of pipe and open channel. The Bassett Creek Watershed Management Commission prepared the Lost Lake Watershed and Lake Management Plan in 1996, however, at that time it was concluded that structural BMP's to improve lake quality are not practical or cost effective. Lost Lake has a maximum depth of 6.5 feet and a mean depth of 3.5 feet, limiting recreational opportunities. This sub-watershed has 0.0 acres of wetland, 0.0 acres of wetland mitigation, and 0.0 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) does not indicate any natural resources of significant value.

TABLE 49
LOST LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	NA	
Receives runoff from:	NA	
Downstream-most water body:	Lost Lake	Figure 42
Discharges to:	North Branch	Figure 42
Wetlands	0.0 acres	Figure 42
Wetland Mitigation	0.0 acres	Figure 42
Water Quality Ponding	0.0 acres	Figure 42
Lakes	Lost Lake	Figure 10 Figure 42
General Hydrologic Soil Group	C	
Drainage Area	51.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no known impairments within the Lost Lake sub-watershed.

Figure 42. Lost Lake Sub-watershed

Implementation Program

There are no recent projects pre-dating this plan. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents.

Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 50.

Table 50
LOST LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth

Conclusions

The Lost Lake Sub-watershed is not currently listed as an impaired water by the State of Minnesota, however, it may be listed in the future and a TMDL plan may be developed. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

North Branch Sub-watershed

Physical Land Use Characteristics

The North Branch Sub-watershed is located in east-central Plymouth, between Zachary Lane and Highway 169, north of 35th Avenue and centered about County Road 9.

Significant landmarks in this sub-watershed include the commercial area at the intersection of County Road 9 and Highway 169 and Zachary Lane Elementary school on the western side of the sub-watershed. Redevelopment will be the primary driver of change within this sub-watershed. This sub-watershed has 61.9 acres of wetland, 0.8 acres of wetland mitigation, and 1.2 acres of water quality ponding. The Natural Resources Inventory for Plymouth (2006) indicates 10.2 acres of moderate quality oak forest.

TABLE 51
NORTH BRANCH SUB-WATERSHED CHARACTERISTICS

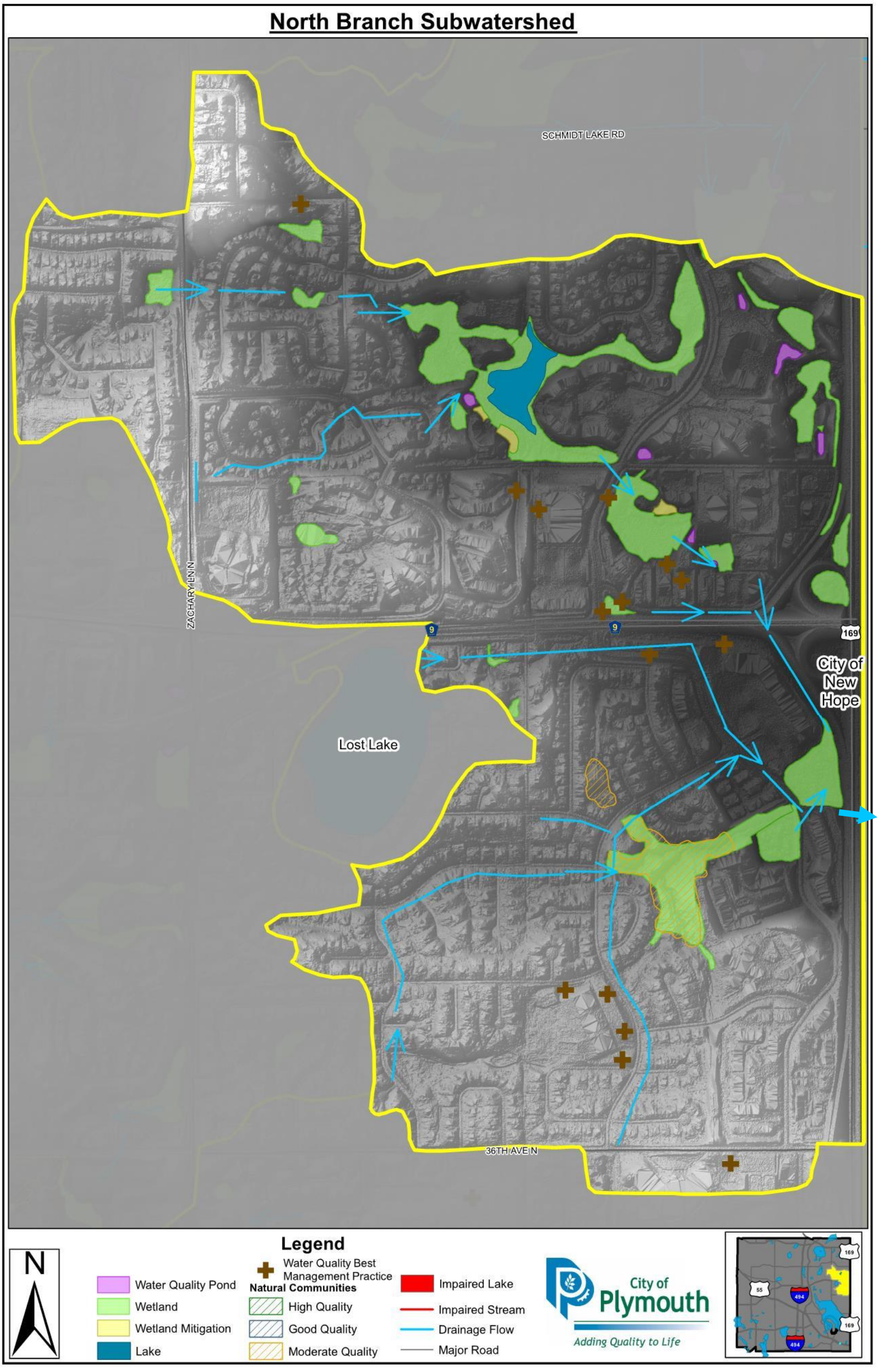
	Characteristic	Plan Reference
Watershed	Bassett Creek	
Receiving Water	NA	
Receives runoff from:	Lost Lake	NA
Downstream-most water body:	NB7	Figure 43
Discharges to:	New Hope	Figure 43
Wetlands	61.9 acres	Figure 43
Wetland Mitigation	0.8 acres	Figure 43
Water Quality Ponding	1.2 acres	Figure 43
Lakes	None	
General Hydrologic Soil Group	A, B/D, C, C/D	
Drainage Area	784.4	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be

established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no known impairments within the North Branch Sub-watershed.

Figure 43. North Branch Sub-watershed



Implementation Program

In 2011, the City of Plymouth completed a drainage improvement project at the SE corner of 45th Avenue North and Nathan Lane to improve upstream flooding issues. Also in 2011, the City of Plymouth and Bassett Creek Watershed partnered on a water quality improvement project for Northwood Lake which is just downstream of this sub-watershed in the city of New Hope. The project, originally a stream restoration west of Lancaster Lane and south of Pilgrim Lane, was not well received by some area residents due to the number of trees to be removed. The project was repurposed as a cooperative project between the City of Plymouth, Bassett Creek Watershed, and a possible developer of the now defunct Four Seasons Mall. The developer, however, did not move forward with the development project and the project was not completed.

Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 52.

Table 52
NORTH BRANCH SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Northwood Lake Improvement Project	TBD	$80,000	$800,000	BCWMC

Conclusions

The North Branch Sub-Watershed has no known impairments through the 2018 proposed impaired water list produced by the State of Minnesota, however Northwood Lake, which is directly downstream of this sub watershed in New Hope is on the impaired waters list. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other downstream water bodies.

Elm Creek Watershed

The Elm Creek Watershed covers approximately 130 square miles in northwestern Hennepin County. Predominant water features in Plymouth include Lake Camelot and Elm Creek.

Elm Creek drains to the northeast from its headwaters in Medina to its confluence with the Mississippi River in Champlin. Within Plymouth, Elm Creek becomes more of a defined stream near the intersection of State Highway 55 and Hennepin County Road 101 where it travels underneath State Highway 55. From there, Elm Creek flows east behind Wayzata High School, underneath Peony Lane North and then flows north underneath Hennepin County Road 47 to the east of Lawndale Lane and into Maple Grove.

Elm Creek Watershed Management Organization

Elm Creek and its tributaries extend across seven cities: Plymouth, Medina, Corcoran, Rogers, Dayton, Maple Grove, Champlin and the Hennepin Conservation District. In Champlin, Elm Creek enters the Mississippi River just downstream of the Champlin Mill Pond. In 1973, the Elm Creek Watershed Management Commission was formed by adoption of a joint powers agreement between the cities of Champlin, Corcoran, Dayton, Maple Grove, Medina, Plymouth and Hennepin Conservation District, under the authority conferred to the member parties through Minnesota Statutes. On July 18, 1980 the Elm Creek Watershed Management Commission added the Town of Hassan to the Joint Powers Agreement with Rogers following in 1983. Greenfield was in the Commission, but left in 2001. In 2012, the Town of Hassen was annexed by Rogers and is no longer a separate party to the joint powers agreement. The joint powers agreement was most recently approved by the seven member cities in 2004.

The ECWMC Board of Commissioners currently consists of seven commissioners and seven alternates appointed by the member cities. The term of each commissioner and alternate is three years. Regular meetings of the ECWMC are held on the second

Wednesday of each month. Funding for the administrative functions of the EMWMC is via an assessment, generally based on land area and tax capacity, to each member of the organization.

Per Minnesota Rules 8410.008, Subp. 2-8, watershed management organization goals generally fall into the following categories: water quantity, water quality, public drainage systems, groundwater, and wetlands. The ECWMC has established the following goals:

- Maintain the post-development 2-year, 10-year, and 100-year peak rate of runoff at pre-development level for the critical duration precipitation event.
- Maintain the post-development annual runoff volume at pre-development volume.
- Prevent the loss of floodplain storage below the established 100-year elevation.
- Reduce peak flow rates in Elm, Diamond, and Rush Creeks and tributary streams to the Crow and Mississippi and preserve conveyance capacity.
- Improve Total Phosphorus concentration in the impaired lakes by 10% over the 2004-2013 average by 2024.
- Maintain or improve water quality in the lake and streams with no identified impairments.
- Conduct a TMDL/WRAPS progress review every five years following approval of the TMDLs and WRAPS study.
- Identify high priority areas where the Commission will partner with cities and other agencies to provide technical and financial assistance.
- Promote groundwater recharge by requiring abstraction/infiltration of runoff from new development and redevelopment.
- Protect groundwater quality by incorporating wellhead protection study results into development and redevelopment Rules and Standards.
- Preserve the existing functions and values of wetlands within the watershed.
- Promote wetland enhancement or restoration of wetlands in the watershed.

- Continue current Hennepin County jurisdiction over the county ditches in the watershed.
- Identity and operate within a sustainable funding level that is reasonable to member cities.
- Foster implementation of priority TMDL and other implementation project by sharing in their cost and proactively seeking grant funds.
- Operate a public education and outreach program to supplement the NPDES Phase II education requirements for the member cities.
- Operate a monitoring program sufficient to characterize water quantity, water quality, and biotic integrity in the watershed and to evaluate progress toward meeting goals.
- Maintain rules and standards for development and redevelopment that are consistent with local and regional TMDLs, federal guidelines, source water and wellhead protection requirements, non-degradation, and ecosystem management goals.
- Serve as a technical resource for member cities.

To assist in meeting the goals of the ECWMC, the ECWMC has established a 7-year Capital Improvement Program. Capital improvements are currently funded under an ad-velorum tax through Hennepin County. The current ECWMC Capital Improvement program includes a stream restoration project of Elm Creek between State Highway 55 and Wayzata High School. (Table 54)

TABLE 53
ECWMC CAPITAL IMPROVEMENTS IN PLYMOUTH 2018-2024

ID	Name	Plymouth Sub-watershed	Funding Amount	Funding Year
CIP-2017-PL-01	Elm Creek Stream Restoration – State Highway 55 to Wayzata High School	Elm Creek	$212,500	2018

Elm Creek Sub-watersheds

The City of Plymouth has divided the portion of the Elm Creek watershed within the City limits into 2 sub-watersheds for administrative and management purposes. The 2 sub-watersheds (Figure 34) are:

- Elm Creek
- Lake Camelot

Elm Creek Sub-Watershed

Physical Land Use Characteristics

The Elm Creek sub-watershed is located in northwest Plymouth. The sub-watershed in Plymouth generally follows Hamel Road along its southern border, to the city limits. Along the western and northern boundary, the sub-watershed follows the City limits, however, the watershed extends well into Medina, Corcoran and Maple Grove. The sub-watershed is bound along the eastern border by the jurisdictional border of the Elm Creek Watershed Management Commission and the Lake Camelot sub-watershed, which is discussed later in this plan.

Significant landmarks within this sub-watershed include Wayzata High School, the Plymouth Dog Park and the former Elm Creek Golf Course. This sub-watershed has seen a dramatic transition in land use from large lot residential and agriculture to single family residential in the last 5 years and could be fully developed within the next 10 years. This sub-watershed has 498.5 acres of wetland, 16.6 acres of wetland mitigation, 41.2 acres of water quality ponding, and 34 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) indicates 1 high quality 0.78 acre wet meadow and 7 good quality natural communities that includes 32.3 acres of mesic oak forest, 20.2 acres of maple-basswood forests and 0.4 acres of wet meadow.

TABLE 54
ELM CREEK SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Elm Creek	
Receiving Water	Maple Grove	
Receives runoff from:	Headwaters in Medina	Figure 44
Downstream-most water body:	(05221-NB01)	Figure 44
Discharges to:	Maple Grove	Figure 44
Wetlands	498.5 Acres	Figure 44

Wetland Mitigation	16.6 Acres	Figure 44
Water Quality Ponding	41.2 Acres	Figure 44
Water Quality Best Management Practices	34 BMPs	Figure 44
Lakes	NA	
General Hydrologic Soil Group	C & D	
Drainage Area	2567.6 acres	

Assessment of Water Resource Related Problems

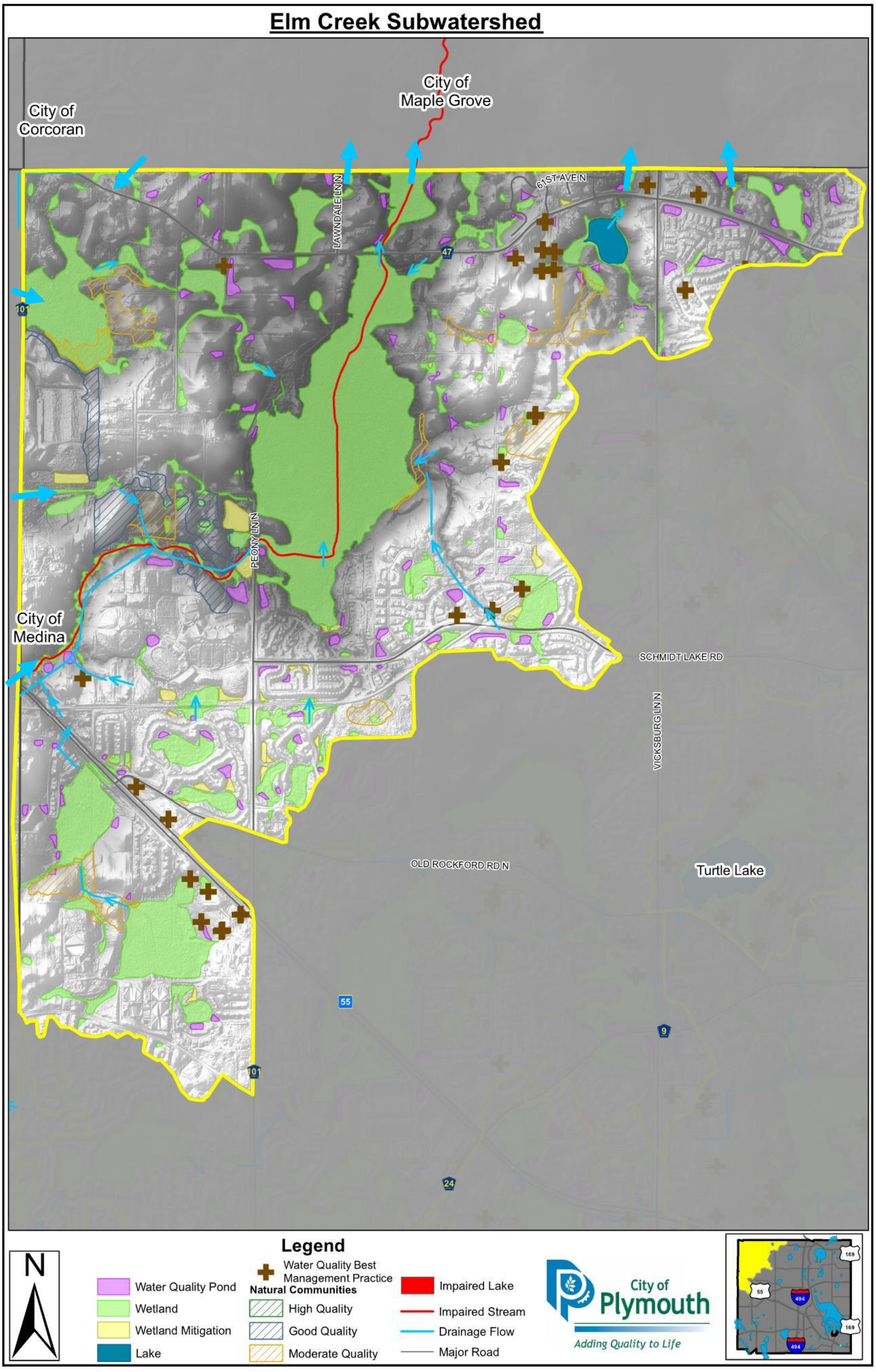
The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 55) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 55
ELM CREEK SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Elm Creek	Escherichia Coli (E. Coli)	2010
	Low Dissolved Oxygen	2004
	Fish Bio assessment	2014
	Macroinvertebrate bio assessment	2014
	Chloride[1]	2014

1. The Chloride impairment for Elm Creek will be addressed in the Twin Cities Metropolitan Area (TCMA) Chloride TMDL and not the Elm Creek Watershed Management Commission TMDL.

Figure 44. Elm Creek Sub-watershed



Implementation Program

This sub-watershed has been involved in a land use transition over the last 5 years from primarily large lot single family residential and agriculture to smaller lot single family residential developments. Each of the new subdivisions have been subject to water quality requirements, which includes water quality and quantity best management practices as outlined in the City of Plymouth Regulatory Program and Elm Creek Watershed Management Commissions Rules and Standards. The land use transition has also removed 17 of the 53 total septic systems from the watershed. This will help further improve water quality by removing the additional sources of excess nutrients and bacteria to surface and groundwater.

Recent projects pre-dating this plan include the Conor Meadows Erosion Repair Project and a stream restoration project, completed in 2016, that stabilized, restored and enhanced 4,500 feet of Elm Creek located just north of Wayzata High School. The stream restoration project also installed two iron-enhanced sand filter systems on the two NURP ponds on the school site to reduce phosphorus loads. Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 56.

TABLE 56
ELM CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Elm Creek Stream Restoration	2019-2020	$700,000	$700,000	Plymouth /ECWMC
Plum Tree 3rd Addition Drainage Improvement	2019-2020	$270,000	$270,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Elm Creek Sub-Watershed has five known impairments through the 2018 impaired water list produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Elm Creek and other water bodies within this sub-watershed. The City will continue to implement best management practices during land use transition and will work to improve the remaining segment of Elm Creek stretching from Wayzata High School to State Highway 55 in 2018/2019.

Camelot Lake Sub-watershed

Physical Land Use Characteristics

The Lake Camelot sub-watershed is located in north central Plymouth and is generally bounded by Interstate I-494 to the east, 56th Ave to the south, the Plymouth – Maple Grove border to the north and Cheshire Parkway / Lanewood Lane N to the west. The existing land use is primarily single family residential.

The most significant landmark within this sub-watershed is Lake Camelot itself (Figure 9). The sub-watershed is mostly developed and contains 68.9 acres of wetland, 3.7 acres of wetland mitigation, 3.9 acres of water quality ponding, and 1 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any high or good quality natural communities.

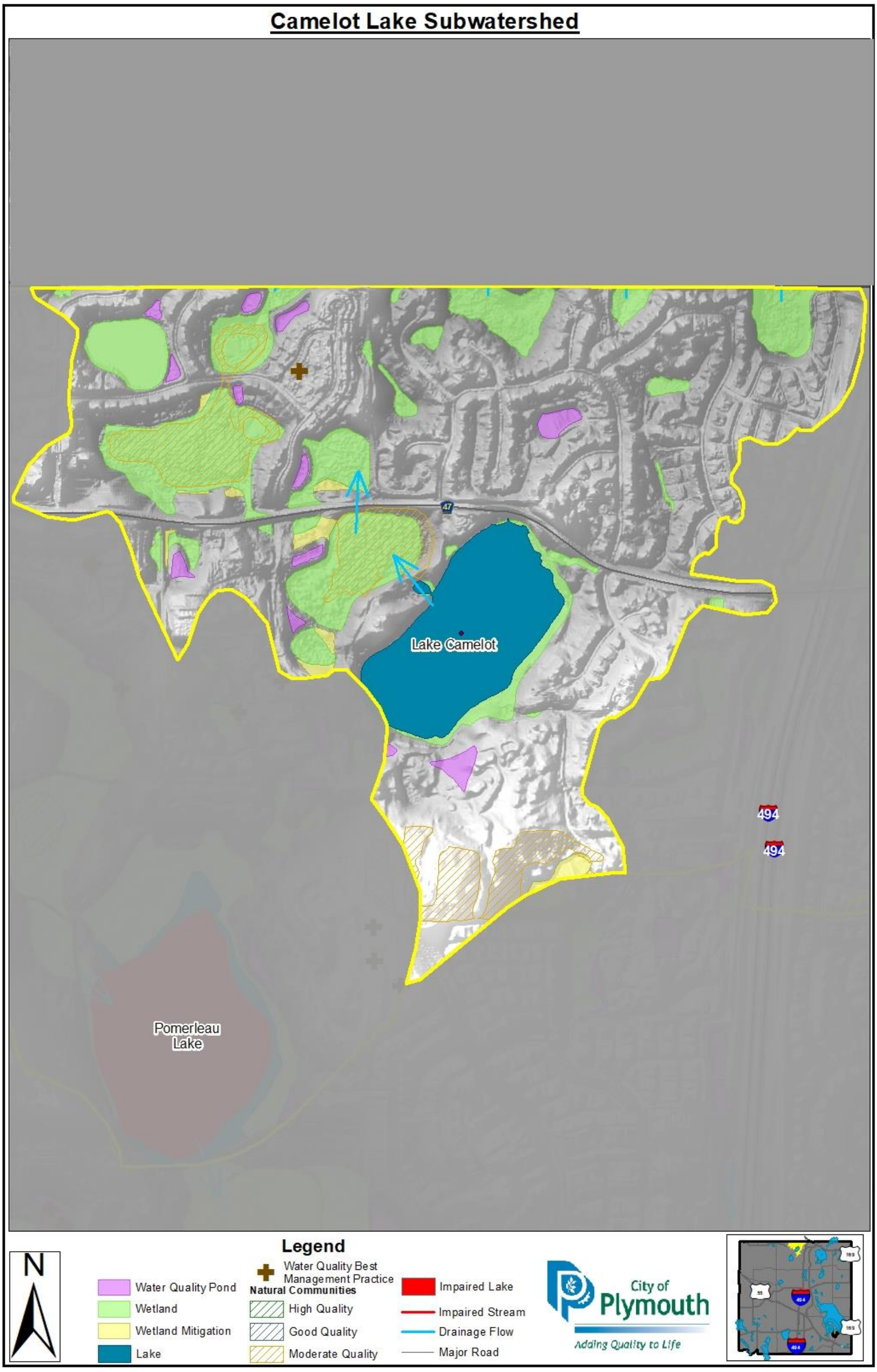
TABLE 57
CAMELOT LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Elm Creek	
Receiving Water	N/A	
Receives runoff from:	N/A	Figure 45
Downstream-most water body:	Elm Creek	Figure 45
Discharges to:	Maple Grove	Figure 45
Wetlands	68.9 Acres	Figure 45
Wetland Mitigation	3.7 Acres	Figure 45
Water Quality Ponding	3.9 Acres	Figure 45
Water Quality Best Management Practices	1 BMP	Figure 45
Lakes	Camelot – 22.5	Figure 9 Figure 45
General Hydrologic Soil Group	B/D, C, C/D	
Drainage Area	287.5 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. No impaired waters are identified within the Lake Camelot sub-watershed, however, this sub-watershed drains to Elm Creek and Fish Lake in Maple Grove, which are both impaired.

Figure 45. Camelot Lake Sub-watershed



Implementation Program

One project pre-dates this plan, which is the replacement of the outlet to Lake Camelot to provide for better flood protection and reduced erosion.

As this sub-watershed has developed, water quality best management practices have been installed as required by the city and watershed management organization. The northeast portion of this sub-watershed, which was developed in the late 1980's and early 1990's, was built around the existing wetlands, but does not have any water quality ponding. The northwest and southern portions of this sub-watershed, which were developed after 2008, have water quality ponding and best management practices installed to improve water quality.

During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Bassett Creek Watershed, and residents.

Non-structural, programmatic, and structural solutions to address impairments within this sub-watershed are shown in Table 58.

TABLE 58
CAMELOT LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth

Conclusions

The Lake Camelot sub-watershed does not have a known water quality impairment through the 2018 impaired water list produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and downstream.

Minnehaha Creek Watershed

The Minnehaha Creek Watershed District's legal boundary encompasses approximately 178 square miles within the western Twin Cities metropolitan area. Of this area, approximately 148 square miles lies within Hennepin County and approximately 30 square miles lie within Carver County.

The Minnehaha Creek Watershed is comprised of two distinct hydrologic basins. The "Upper Watershed" drains through 104 square miles of rural and suburban land into lake Minnetonka, a 22 square-mile lake that is the tenth largest, and one of the most heavily recreated waterbodies in Minnesota. Lake Minnetonka outlets through a dam controlled by the Minnehaha Creek Watershed District (MCWD) into Minnehaha Creek, which flows for roughly 23 miles and discharges into the Mississippi River in Minneapolis. About 52 square miles, constituting the "Lower Watershed" drains into Minnehaha Creek through the Minneapolis Chain of Lakes, or directly into the creek by means of stormwater conveyances or overland flow. Predominant water features in Plymouth include Mooney Lake, Snyder Lake, Kreatz Lake, Hadley Lake, Gleason Lake and Gleason Creek.

The City of Plymouth has 5.8 square miles or 3.3% of MCWD's total area within the city. Generally, drainage in the portion of the Minnehaha Creek Watershed District that is within Plymouth drains into either Mooney Lake, Hadley Lake or Gleason Lake before making its way into Lake Minnetonka in Wayzata.

Minnehaha Creek Watershed District

The Minnehaha Creek Watershed District's boundaries encompasses twenty-seven cities and two townships as listed in table 1 below. Additionally, two regional park authorities exist within the District's boundaries: the Minneapolis Park and Recreation Board, and the Three Rivers Park District.

Table 59: Municipalities within the MCWD

Hennepin County	
Deephaven	Minnetrista
Edina	Mound
Excelsior	Orono
Golden Valley	Plymouth
Greenwood	Richfield
Hopkins	St. Bonifacius
Independence	St. Louis Park
Long Lake	Shorewood
Maple Plain	Spring Park
Medina	Tonka Bay
Minneapolis	Wayzata
Minnetonka	Woodland
Minnetonka Beach	
Carver County	
Chanhassen	Victoria
Laketown Township	Watertown Township

On April 12, 1966, the Hennepin County Board of Commissioners petitioned the Minnesota Water Resources Board under authority of Minnesota Statues Chapter 112 (now 103D) to establish the MCWD. The cited purposes for the MCWD were to conserve the watershed's waters and natural resources; improve lakes, marshes, and channels for water storage, drainage, recreation, and other public purposes; reduce

flooding, keep silt from streams; control land erosion; reclaim wetlands; control stormwater; and preserve water quality in lakes and streams. The MCWD was established on March 9, 1967.

Since that time, the MCWD has implemented numerous policies, programs, and projects to advance its goals. It first adopted rules to regulate development in 1967 and began exercising oversight of development to limit water resource impacts from erosion, stormwater flows, floodplain alteration, wetland disturbance, shoreline and stream bank alterations, dredging, and other causes. In 1972, the MCWD accepted authority over eight county and judicial drainage systems located within the watershed.

The MCWD Board of Managers consists of a seven-members that are appointed by the Hennepin and Carver County Board of Commissioners. Regular meetings of the MCWD Board of Managers are held twice each month on the 2nd and 4th Thursdays. Funding for the MCWD is collected through local property taxes.

Per Minnesota Statute 103D.201 watershed districts general purpose is to conserve the natural resources of the state by land use planning, flood control and other conservation projects by using sound scientific principles for the protection of the public health and welfare and the provident use of the natural resources. The MCWD developed watershed management plans in 1969, 1997, 2007 and most recently on January 11, 2018.

MCWD has established the four strategic goals for their 2018 Watershed Management Plan:

- Water Quality – To preserve and improve the quality of surface and groundwater.
- Water Quantity – To manage the volume and flow of stormwater runoff to minimize the impacts of land use change on surface and groundwater.

- Ecological Integrity – To restore, maintain, and improve the health of ecological systems.
- Thriving Communities – To promote and enhance the value of water resources in creating successful, sustainable communities.

While MCWD's plan is organized around these four simple strategic goals, the MCWD recognizes that watershed management requires a holistic approach of ecosystem management. Accordingly, it approaches planning and implementation in a manner that integrates hydrologic, chemical, physical biological and built components of the sub-watershed system.

To assist in meeting the goals of the MCWD, the MCWD has established a 10-year Capital Improvement Plan. This plan describes the District's principle strategy of integrating water resource and land use planning, recognizing the potential for greater public benefit and efficient use of public funds when plans and investments are coordinated and aligned. The current proposed MCWD Capital Improvement program includes 1 project in the City of Plymouth for the Gleason Lake sub-watershed. (Table 60)

TABLE 60
MCWD CAPITAL IMPROVEMENTS IN PLYMOUTH 2018-2027

ID	Name	Plymouth Sub-watershed	Funding Amount	Funding Year
TBD	Stormwater volume and Pollutant Load Reduction	Gleason Lake	$600,000	Opportunity-Based

Minnehaha Creek Sub-watersheds

The City of Plymouth has divided the portion of the Minnehaha Creek Watershed District within the City limits into 8 sub-watersheds for administrative and management purposes. The 8 sub-watersheds (Figure 23) are:

- 19th Avenue
- Dunkirk Lane
- Gleason Lake
- Hadley Lake
- Kreatz / Snyder Lakes
- Medina
- Minnetonka Outlet
- Mooney Lake

19th Avenue Sub-Watershed

Physical Land Use Characteristics

The 19th Avenue sub-watershed is located in south west Plymouth. The sub-watershed in Plymouth generally follows Dunkirk Lane on its eastern border and shares a larger portion of the border with the Dunkirk Lane sub-watershed that is discussed later in this plan. Along northwestern boarder, the sub-watershed shares the jurisdictional border of the Bassett Creek Watershed Management Commission. The sub-watershed is bound on the southern border by Holly Lane North and 19th Avenue North and the Kreatz / Snyder Lakes sub-watershed that is discussed later in this plan.

Significant landmarks within this sub-watershed include the Shiloh, Ponderosa and Fazendin Neighborhood Parks which are operated by the City of Plymouth. This sub-watershed is fully built out and was developed from the early 1960's to the late 1990's with the majority of the development occurring during the 1970's. This sub-watershed has 25.0 acres of wetland, 0.0 acres of wetland mitigation, 0.0 acres of water quality ponding, and 2 water quality best management practices. The two Water Quality Best Management Practices in this sub-watershed are iron enhanced rain gardens that were installed with the Ponderosa Street Reconstruction Project in 2016. The City of Plymouth received a grant from MCWD to install the BMPs and the city will be monitoring their effectiveness annually until at least 2020. Additional Water Quality Best Management Practices that could be installed include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any high or good quality natural communities within this sub-watershed.

TABLE 61
19th AVENUE SUB-WATERSHED CHARACTERISTICS

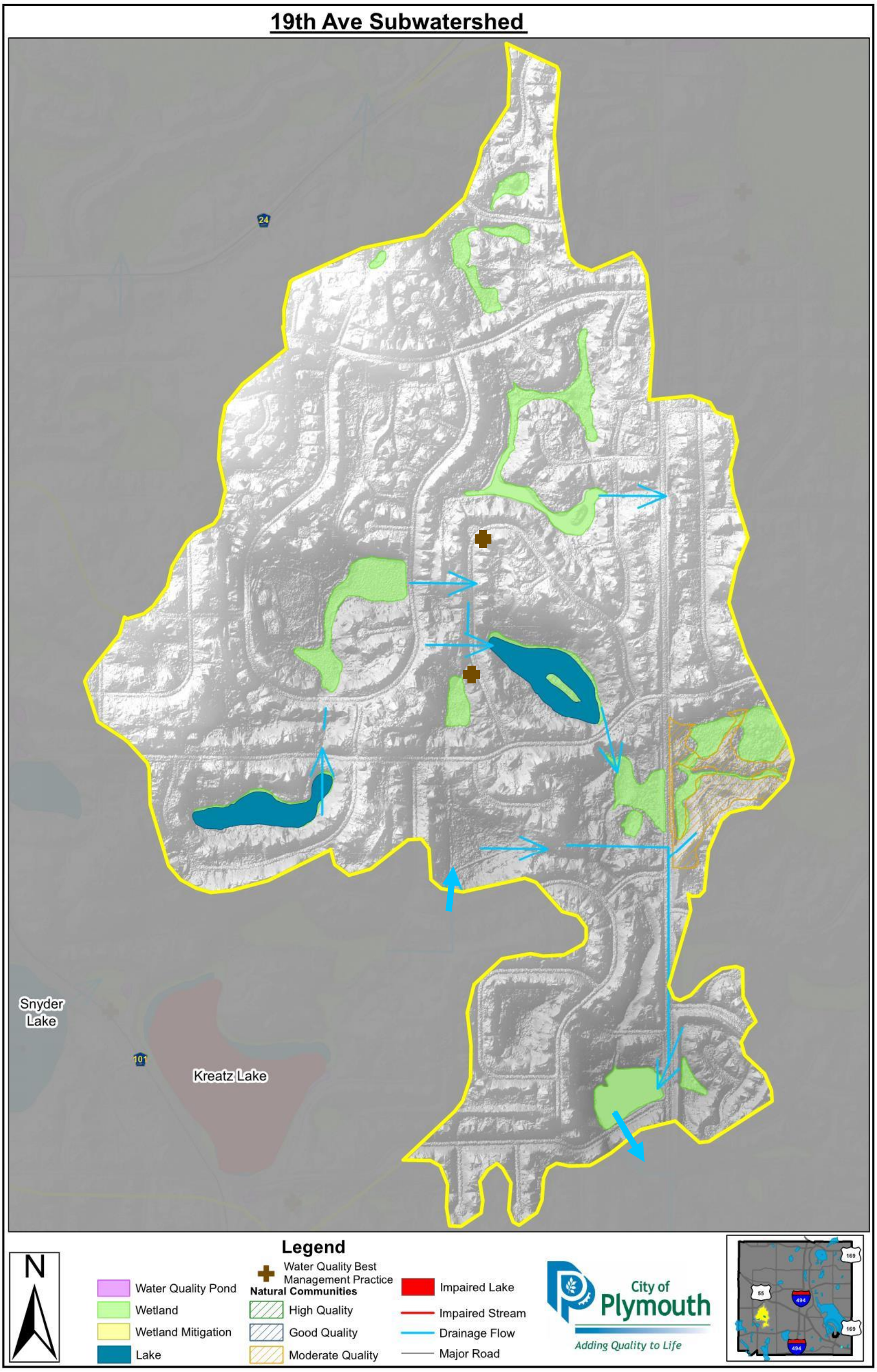
	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	Gleason Creek & Gleason Lake	

Receives runoff from:	Kreatz/Snyder & Dunkirk Lane	Figure 46
Downstream-most water body:	Gleason Lake	Figure 46
Discharges to:	Gleason Creek	Figure 46
Wetlands	25.0 Acres	Figure 46
Wetland Mitigation	0 Acres	Figure 46
Water Quality Ponding	0 Acres	Figure 46
Water Quality Best Management Practices	2 BMPs	Figure 46
Lakes	N/A	
General Hydrologic Soil Group	C	
Drainage Area	341.9 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no known impairments within the 19th Avenue Sub-watershed. While the 19th Avenue sub-watershed does not have any impaired waters within its boundaries, it receives water from Kreatz Lake which is impaired for excess nutrients and drains into Gleason Lake which is also impaired for excess nutrients on the State of Minnesota's 2018 Impaired Waters List.

Figure 46. 19th Avenue Sub-watershed



Implementation Program

This sub-watershed has been developed since the 1990's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

Recent projects pre-dating this plan include two iron enhanced rain gardens that were installed with a street reconstruction project and were partially funded by a grant from the Minnehaha Creek Watershed District. The City of Plymouth also replaced a failing culvert at the intersection of 29th Avenue North and Everest Lane to provide for flood protection. One city capital improvement project (19th Avenue / Dunkirk Lane Pond Improvement Project) is scheduled for 2019-2020. This project would remove accumulated sediment in the pond to increase phosphorus removal and improve water quality for Gleason Lake. Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 62.

TABLE 62
19th AVENUE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
19th Avenue/Dunkirk Lane Pond Improvement	2019-2020	-	$550,000	Plymouth & MCWD

Conclusions

This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Gleason Lake and other water bodies within this sub-watershed. The City will continue to implement best management practices during street reconstruction projects and will work to improve the other waterbodies within this sub-watershed

Dunkirk Lane Sub-watershed

Physical Land Use Characteristics

The Dunkirk Lane sub-watershed is located in south west Plymouth. The sub-watershed in Plymouth generally follows Vicksburg Lane on its eastern border and shares a larger portion of the border with the 19th Avenue sub-watershed that is discussed earlier in this plan. Along the northern and eastern border, the sub-watershed shares the jurisdictional border of the Bassett Creek Watershed Management Commission. The sub-watershed is bound on the southern border by 12th Avenue North and the Gleason Lakes sub-watershed that is discussed later in this plan.

Significant landmarks within this sub-watershed include Maple Creek South, Gleason Creek and Oakwood Elementary School. This sub-watershed is fully built out and was developed steadily from the early 1950's to the early 2000's with the majority of the development occurring during the 1970's & 1980's. This sub-watershed has 112.8 acres of wetland, 9.2 acres of wetland mitigation, 5.5 acres of water quality ponding, and 8 water quality best management practices. While large scale redevelopment in this watershed will be unlikely, additional Water Quality Best Management Practices that would be installed could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any high or good quality natural communities within this sub-watershed.

TABLE 63
DUNKIRK LANE SUB-WATERSHED CHARACTERISTICS

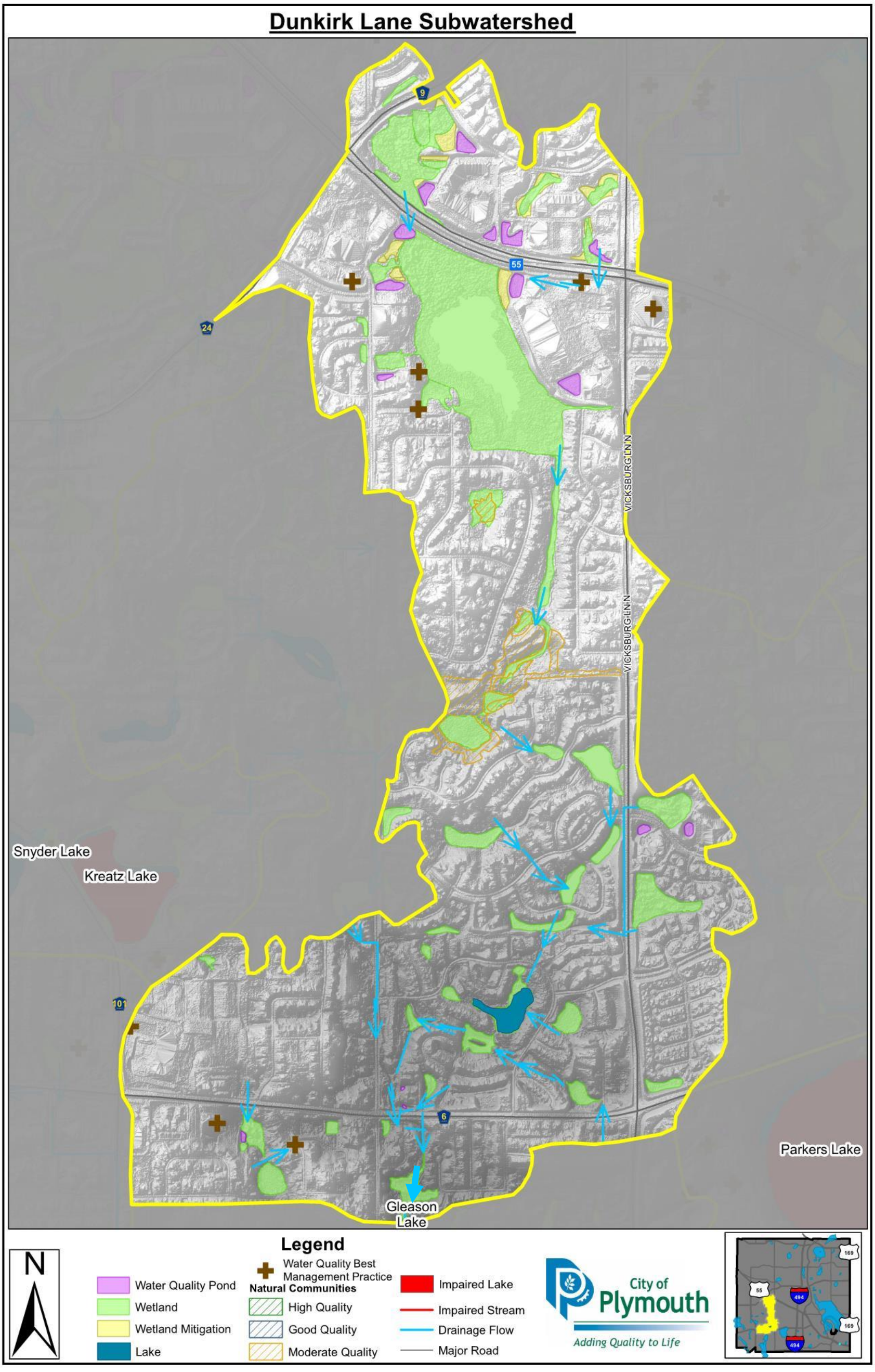
	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	Gleason Lake	
Receives runoff from:	Kreatz/Snyder & 19th Avenue	Figure 47
Downstream-most water body:	Gleason Lake	Figure 47

Discharges to:	Gleason Lake	Figure 47
Wetlands	112.8 Acres	Figure 47
Wetland Mitigation	9.2 Acres	Figure 47
Water Quality Ponding	5.5 Acres	Figure 47
Water Quality Best Management Practices	8 BMP	Figure 47
Lakes	N/A	
General Hydrologic Soil Group	C & C/D	
Drainage Area	924.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. Currently, there are no know water quality impairments within the Dunkirk Lane Sub-watershed. While the Dunkirk Lane sub-watershed does not have any impaired waters within its boundaries, it receives water from Kreatz Lake which is impaired for excess nutrients and drains into Gleason Lake which is also impaired for excess nutrients on the State of Minnesota's 2018 Impaired Waters List.

Figure 47. Dunkirk Lane Sub-watershed



Implementation Program

As this sub-watershed has developed, water quality best management practices have been installed as required by the city and watershed management organization. The majority of this watershed was built before the 1990's and were built around existing wetlands, but do not include any water quality ponding. The portions of this sub-watershed, which were developed after 2000, have water quality ponding and best management practices installed to improve water quality. Projects pre-dating this plan include the Chelsea Woods Stream Restoration project (2007) and the construction/maintenance of the Gleason Lake Water Quality Ponds by the MCWD.

The City has also identified non-structural, programmatic, and structural solutions to address impairments within this sub-watershed are shown in Table 64.

TABLE 64
DUNKIRK LANE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Chelsea Woods Drainage Improvement Project – Weston Lane to County Road 6	2020	-	$300,000	Plymouth
Weston Lane Storm Sewer Lift Station Rehabilitation	2018-2021	-	$550,000	Plymouth
Maple Creek Stream Restoration	2020-2021	-	$850,000	Plymouth & MCWD

Conclusions

The Dunkirk Lane sub-watershed does not have a known water quality impairment through the 2018 proposed impaired water list produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-

watershed and downstream in Gleason Lake. The City will continue to implement best management practices during street reconstruction projects and will work to improve the other waterbodies within this sub-watershed.

Gleason Lake Sub-Watershed

Physical Land Use Characteristics

The Gleason Lake Sub-watershed is located in south west Plymouth. The sub-watershed in Plymouth generally follows Ranchview Lane on its eastern border, 13th Avenue North on the northern border, County Road 101 / Queensland Lane North on the western border and the City Limits on the southern border.

Significant landmarks within this sub-watershed include Gleason Lake, Gleason Lake Elementary School and Wayzata Central Middle School. Gleason Lake is a 164 acre basin that receives stormwater runoff from the cities of Plymouth, Wayzata, Orono, Medina and Minnetonka. The lake has a maximum depth of 16 feet in the center and has an ordinary high water level of 944.1' above sea level. This sub-watershed is fully built out and was developed from the 1940's to the late 1990's with the majority of the development occurring during the 1960's & 1970's. There are 10 single family lots that range from 1.3 acres to 8.0 acres on the southeast side of Gleason Lake that could potentially redevelop in the future, if this is the case, the redevelopment would be subject to the city's Water Quality Rules and Standards at that time. This sub-watershed has 45.3 acres of wetland, 0.0 acres of wetland mitigation, 1.2 acres of water quality ponding, and 10 water quality best management practices. Additional Water Quality Best Management Practices that would be installed could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any high quality natural communities but does indicate one good quality floating mat wet meadow on the east side of Gleason Lake.

TABLE 65
GLEASON LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	Gleason Lake	

Receives runoff from:	Kreatz/Snyder, 19th Avenue & Dunkirk Lane	Figure 48
Downstream-most water body:	Gleason Lake	Figure 48
Discharges to:	City of Wayzata	Figure 48
Wetlands	45.3 Acres	Figure 48
Wetland Mitigation	0 Acres	Figure 48
Water Quality Ponding	1.2 Acres	Figure 48
Water Quality Best Management Practices	11 BMPs	Figure 48
Lakes	Gleason Lake	Figure 5 Figure 48
General Hydrologic Soil Group	A, C, C/D	
Drainage Area	798.7 acres	

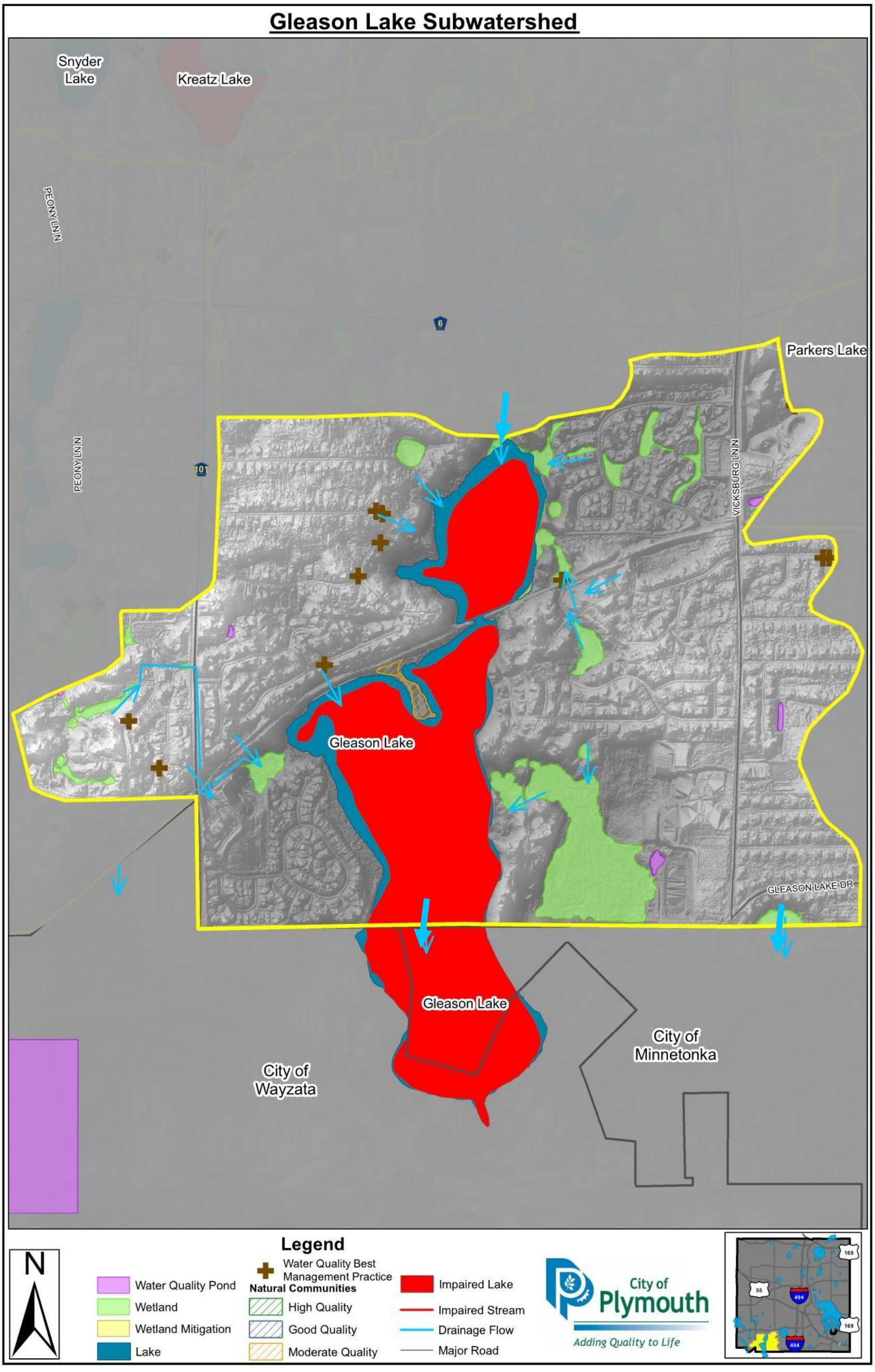
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 66) and a Total Maximum Daily Load (TMDL) was approved in 2014. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality. Gleason Lake which is also impaired for excess nutrients on the State of Minnesota's 2018 Impaired Waters List.

TABLE 66
GLEASON LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Gleason Lake	Excess Nutrients	2014

Figure 48. Gleason Lake Sub-watershed.



Implementation Program

This sub-watershed has been developed since the 1990's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

Recent projects pre-dating this plan include five rain gardens and 5 sump manholes that were installed with street reconstruction projects in 2005 and 2007 in this area. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Minnehaha Creek Watershed, and residents.

Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 67.

TABLE 67
GLEASON LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Gleason Lake Sub-Watershed has one known impairment through the 2018 impaired water list produced by the State of Minnesota. While the TMDL plan has

been developed, this 10-year Surface Water Management Plan also includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Gleason Lake and other water bodies within this sub-watershed. The City will continue to implement best management practices during street reconstruction projects and will work to improve the other waterbodies within this sub-watershed.

Hadley Lake Sub-Watershed

Physical Land Use Characteristics

The Hadley Lake sub-watershed is located in the far south west corner of Plymouth. The sub-watershed in Plymouth generally follows County Road 101 / Queensland Lane North on its eastern border, County Road 6 and 19th Avenue North on the northern border and the Plymouth City limits with Orono and Wayzata on the western and southern borders respectively.

The most significant landmark within this sub-watershed is Hadley Lake. Hadley Lake is a 38 acre basin that receives stormwater runoff from Mooney Lake and the cities of Plymouth, Orono and Medina. The maximum depth of this lake has not been measured and it has an ordinary high water level of 961.4' above sea level and a 100 year water elevation of 964.0' above sea level. This sub-watershed is fully built out and was developed from the 1950's to the late 1990's with the majority of the development occurring during the 1960's & 1970's. While unlikely, redevelopment could occur in portions of this sub-watershed over the life of this plan. If this were to happen, the redevelopment would be subject to the city's Water Quality Rules and Standards at that time. This sub-watershed has 61.5 acres of wetland, 0.0 acres of wetland mitigation, 1.1 acres of water quality ponding, and 19 water quality best management practices. Additional Water Quality Best Management Practices that would be installed could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) indicates a 1.28 acre, high quality wet meadow floating mat natural community on the east side of Hadley Lake.

TABLE 68
HADLEY LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	Hadley Lake	
Receives runoff from:	Mooney Lake	Figure 49

Downstream-most water body:	Hadley Lake	Figure 49
Discharges to:	City of Wayzata	Figure 49
Wetlands	61.5 Acres	Figure 49
Wetland Mitigation	0 Acres	Figure 49
Water Quality Ponding	1.1 Acres	Figure 49
Water Quality Best Management Practices	19 BMPs	Figure 49
Lakes	Gleason Lake	Figure 6 Figure 49
General Hydrologic Soil Group	B, C	
Drainage Area	689.1 acres	

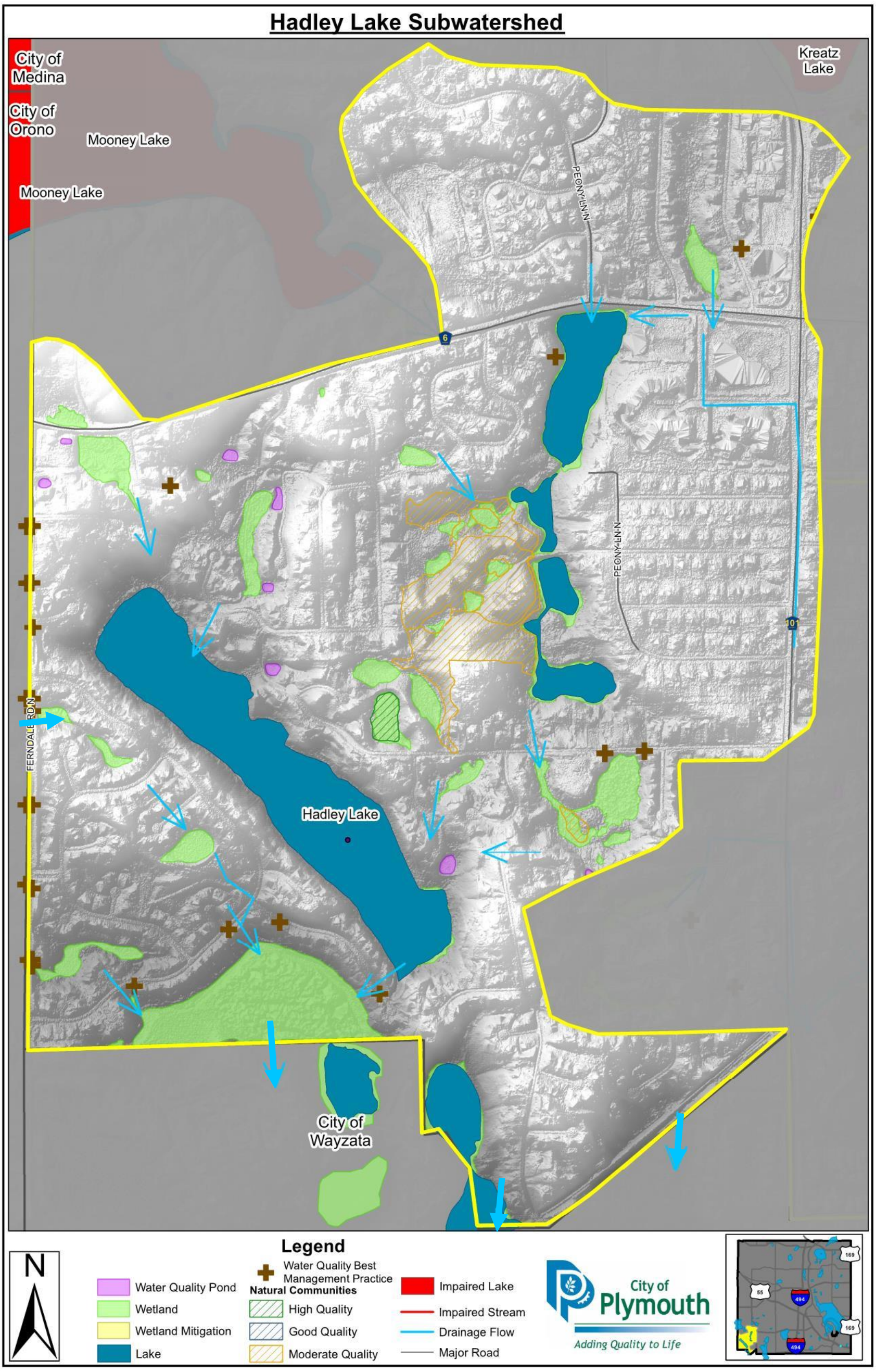
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 69) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality. Hadley Lake is impaired for excess nutrients in the State of Minnesota's 2018 Impaired Waters List.

TABLE 69
HADLEY LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Hadley Lake	Excess Nutrients	2014

Figure 49. Hadley Lake Sub-watershed



Implementation Program

This sub-watershed has been mostly developed since the 1990's, however, recent development since 2006 has been occurring on select parcels of land. Once the development activities are completed, this sub-watershed unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

Recent projects pre-dating this plan include 2 sump manholes and a rain garden that were installed as part of street reconstruction and drainage projects in 2010 & 2011. The Villages Stream Restoration Project was also completed in 2013. This project consisted of installing 20 linear feet of storm sewer adjacent to Hadley Lake in order to prevent erosion and property damage and to restore an additional 60 feet of streambank. In addition, during the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Minnehaha Creek Watershed, and residents. Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 70.

TABLE 70
HADLEY LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

4th Avenue North & Zircon Lane North Drainage Improvement	2018-2019		$130,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Hadley Lake Sub-Watershed has one known impairment through the 2018 Impaired Waters List produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Hadley Lake and other water bodies within this sub-watershed. The City will continue to implement best management practices during street reconstruction projects and will work to improve the other waterbodies within this sub-watershed.

Kreatz & Snyder Lakes Sub-Watershed

Physical Land Use Characteristics

The Kreatz & Snyder Lakes Sub-watershed is located in southwest Plymouth between Hennepin County Road 24 and Hennepin County Road 6. The sub-watershed in Plymouth spit in half by Hennepin County Road 101 and generally follows Urbandale Lane North & Vagabond Lane North on its western border, Hennepin County Road 24 on the northern border, 19th Avenue North on the southern border and Garland Lane North & Merrimac Lane North on the eastern border.

The most significant landmarks within this sub-watershed are Kreatz and Snyder Lakes, which are on the east and west sides of Hennepin County Road 101 respectively. Snyder Lake is a 9 acre lake that receives stormwater runoff from the watershed to the north. The lake has a maximum depth of 12 feet in the center and has an estimated ordinary high water level of 977.0' above sea level. Kreatz Lake is a 16 acre lake that receives stormwater runoff from Snyder Lake. The lake has a maximum depth of 7 feet in the center and has an ordinary high water level of 972.3' above sea level. This sub-watershed is fully built out and was steadily developed from the late 1950's to the late 1980's with the majority of the development occurring during the 1960's & 1970's. While unlikely, redevelopment could occur in the portions of this sub-watershed along Hennepin County Road 101 directly adjacent to Kreatz and Snyder Lakes. If this were to happen, the redevelopment would be subject to the city's Water Quality Rules and Standards at that time.

This sub-watershed has 47.9 acres of wetland, 0.2 acres of wetland mitigation, 0.6 acres of water quality ponding, and 5 water quality best management practices. Additional Water Quality Best Management Practices that could be installed include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any good or high natural communities within this sub-watershed.

TABLE 71
KREATZ & SNYDER LAKES SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	Kreatz Lake	
Receives runoff from:	N/A	Figure 50
Downstream-most water body:	Kreatz Lake	Figure 50
Discharges to:	19th Avenue	Figure 50
Wetlands	47.9 Acres	Figure 50
Wetland Mitigation	0.2 Acres	Figure 50
Water Quality Ponding	0.6 Acres	Figure 50
Water Quality Best Management Practices	5 BMPs	Figure 50
Lakes	Kreatz & Snyder Lakes	Figure 8 Figure 17 Figure 50
General Hydrologic Soil Group	B, C	
Drainage Area	385.2 acres	

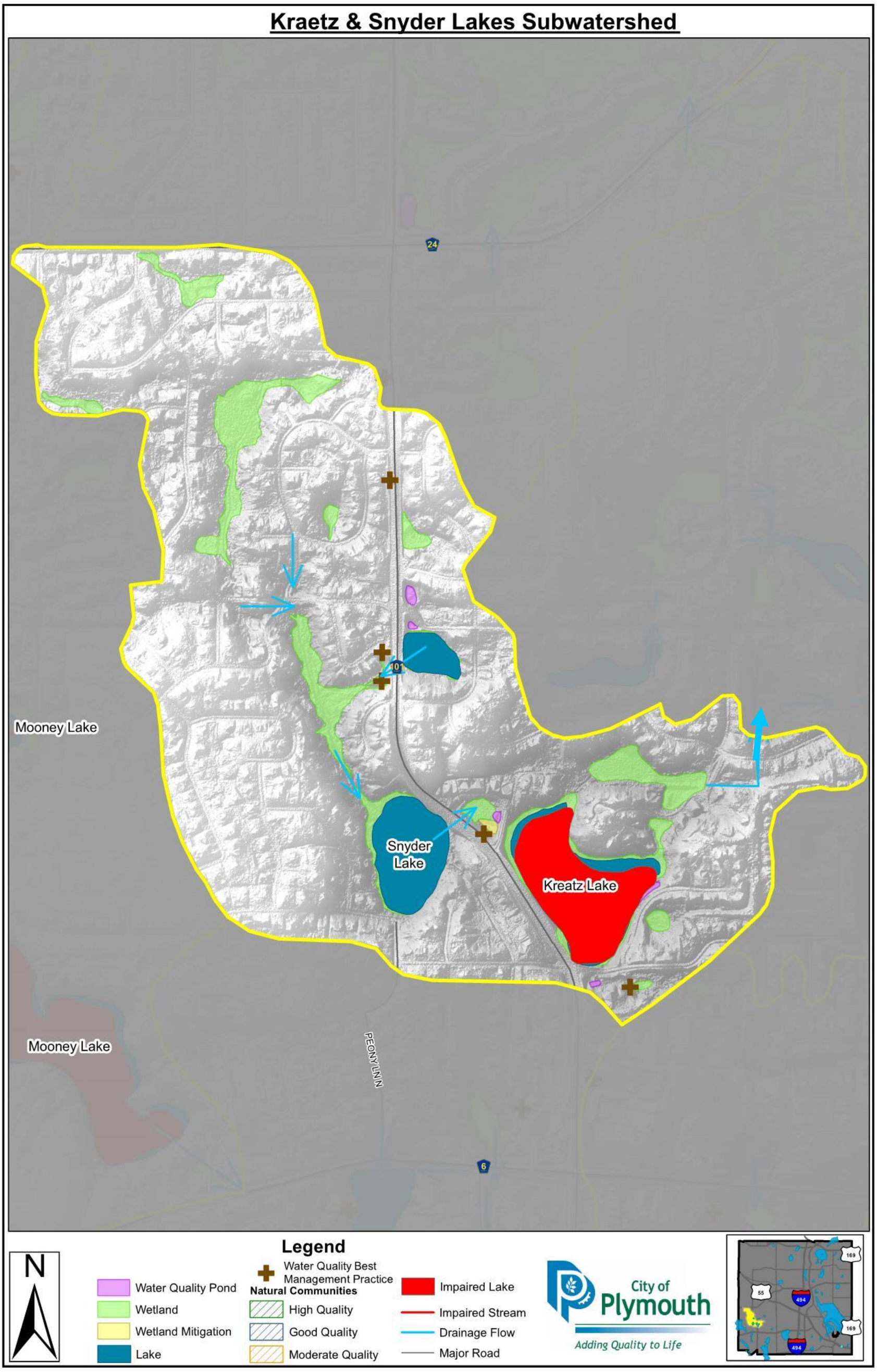
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 72) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality. Kreatz (*MPCA - Snyder*) Lake is impaired for excess nutrients in the State of Minnesota's 2018 Impaired Waters List.

TABLE 72
KREATZ & SNYDER LAKES SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Kreatz Lake (*MPCA - Snyder Lake*)	Excess Nutrients	2010

Figure 50. Kreatz & Snyder Lakes Sub-watershed



Implementation Program

This sub-watershed has been developed since the 1990's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

Recent projects pre-dating this plan include the installation of three underground storage chambers and a sand filter as part of the County State Aid Highway (C.S.A.H) 101 Reconstruction Project in 2009 and drainage improvements to reduce erosion at the intersection of 26th Avenue North and Shadyview Lane. During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Minnehaha Creek Watershed, and residents.

Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 73.

TABLE 73
KREATZ & SNYDER LAKES SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Meadow Wood Drainage Improvement Project	2018 - 2019	-	$295,000	Plymouth / MCWD
Lake Management	2019-2028	$1,000	$10,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Kreatz & Snyder Lakes sub-watershed has one known impairment through the 2018 Impaired Waters List produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan also includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Kreatz (Snyder) Lake and other water bodies within this sub-watershed. The City will continue to implement best management practices during street reconstruction projects and will work to improve the other waterbodies within this sub-watershed.

Medina Sub-Watershed

Physical Land Use Characteristics

The Medina sub-watershed is located in the south west Plymouth. The sub-watershed in Plymouth is within the Bridlewood Farm subdivision and generally follows Medina Road on its northern border, the Plymouth City Limits on the western border, 37th Avenue North on the southern border and Alvarado Lane North on the eastern border.

The most significant landmark within this sub-watershed is the large wetland located in the west central portion of the sub-watershed. This sub-watershed is fully built out and was developed in the early 1990's. This sub-watershed will not undergo redevelopment within the next 10 years. Any future redevelopment would be subject to the city's Water Quality Rules and Standards at that time. This sub-watershed has 1.3 acres of wetland, 0.0 acres of wetland mitigation, 0.0 acres of water quality ponding, and 0 water quality best management practices. Additional Water Quality Best Management Practices that could be installed include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any good or high natural communities within this sub-watershed.

TABLE 74
MEDINA SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	City of Medina	
Receives runoff from:	N/A	Figure 51
Downstream-most water body:	City of Medina	Figure 51
Discharges to:	City of Medina	Figure 51
Wetlands	1.3 Acres	Figure 51
Wetland Mitigation	0.0 Acres	Figure 51
Water Quality Ponding	0.0 Acres	Figure 51
Water Quality Best Management Practices	0 BMPs	Figure 51
Lakes	N/A	

General Hydrologic Soil Group	C, C/D	
Drainage Area	18.4 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently no known water quality impairments within the Medina Sub-watershed.

Figure 51. Medina Sub-watershed

Implementation Program

This sub-watershed was developed in the early 1990's will not undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

There have been no water resource improvement projects within this sub-watershed over the last 10 years and there are no projects scheduled in the Plymouth 2018-2022 Capital Improvement Program. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 75.

TABLE 75
MEDINA SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Medina sub-watershed has no known impairments through the 2018 Impaired Waters List produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in water bodies within this sub-watershed and downstream. The City will continue to implement best management practices during street reconstruction projects and will work to improve the waterbody within this sub-watershed.

Minnetonka Outlet Sub-Watershed

Physical Land Use Characteristics

The Minnetonka Outlet sub-watershed is located in south central Plymouth. The sub-watershed generally follows Gleason Lake Road / Carlson Parkway on its northern border, Niagara Lane North on the western border, Plymouth's City Limits on the southern border and Vinewood Lane North on its eastern border.

The most significant landmarks within this sub-watershed are the large commercial office buildings on the east and west sides of Interstate 494, which divides the sub-watershed in half. This sub-watershed is fully built out and was developed in the mid 1980's until the late 1990's. This sub-watershed is unlikely to undergo redevelopment within the next 10 years. Any future redevelopment would be subject to the city's water quality rules and standards at that time.

This sub-watershed has 11.4 acres of wetland, 0.0 acres of wetland mitigation, 0.2 acres of water quality ponding, and 1 water quality best management practice. Additional Water Quality Best Management Practices that could be installed include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any good or high natural communities within this sub-watershed.

TABLE 76
MINNETONKA OUTLET SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Minnehaha Creek	
Receiving Water	City of Minnetonka	
Receives runoff from:	N/A	Figure 52
Downstream-most water body:	City of Minnetonka	Figure 52
Discharges to:	City of Minnetonka	Figure 52
Wetlands	11.4 Acres	Figure 52
Wetland Mitigation	0.0 Acres	Figure 52

Water Quality Ponding	0.2 Acres	Figure 52
Water Quality Best Management Practices	1 BMP	Figure 52
Lakes	N/A	
General Hydrologic Soil Group	C, C/D	
Drainage Area	179.9 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are no known impairments within the Minnetonka Outlet Sub-watershed.

Figure 52. Minnetonka Outlet Sub-watershed

Implementation Program

This sub-watershed was developed in the middle 1980's to the late 1990's is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

There have been no water resource improvement projects within this sub-watershed over the last 10 years and there are no projects scheduled in the Plymouth 2018-2022 Capital Improvement Program. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 77.

TABLE 77
MINNETONKA OUTLET SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Minnetonka Outlet sub-watershed has no known impairments through the 2018 Impaired Waters List produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in water bodies within this sub-watershed and downstream. The City will continue to implement best management practices during street reconstruction projects and will work to improve the waterbody within this sub-watershed.

Mooney Lake Sub-Watershed

Physical Land Use Characteristics

The Mooney Lake sub-watershed is located in southwest Plymouth. The sub-watershed in Plymouth generally follows 33rd Avenue North on its northern border, Plymouth's City Limits with the City of Orono and Medina on the western border, Hennepin County Road 6 on the southern border and Urbandale Lane North on its eastern border. Mooney Lake is the most significant landmark within this sub-watershed, which is a 115 acre land-locked basin that receives stormwater runoff from the cities of Orono, Medina and Plymouth. This lake has a maximum depth of 12 feet in the center and has an ordinary high water level of 988.0' above sea level and the 100-year high water level is 990.0' above sea level. This lake has history of high water concerns that date back to 1976 and a plan for emergency pumping from the lake is discussed later in this plan.

This sub-watershed is fully built out with the majority of development occurring in the 1960's and the early 1990's. This sub-watershed is unlikely to undergo redevelopment within the next 10 years. Any future redevelopment would be subject to the watershed and city water quality rules and standards at that time. This sub-watershed has 19.0 acres of wetland, 0.0 acres of wetland mitigation, 1.2 acres of water quality ponding, and 2 water quality best management practices. Additional Water Quality Best Management Practices that could be installed include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory of Plymouth (2006) does not indicate any good or high natural communities within this sub-watershed.

TABLE 78
MOONEY LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Minnehaha Creek	

Receiving Water	Mooney Lake	
Receives runoff from:	N/A	Figure 53
Downstream-most water body:	Mooney Lake	Figure 53
Discharges to:	Hadley Lake	Figure 53
Wetlands	19.0 Acres	Figure 53
Wetland Mitigation	0.0 Acres	Figure 53
Water Quality Ponding	1.2 Acres	Figure 53
Water Quality Best Management Practices	2 BMPs	Figure 53
Lakes	Mooney	Figure 12 Figure 53
General Hydrologic Soil Group	C, C/D	
Drainage Area	179.9 acres	

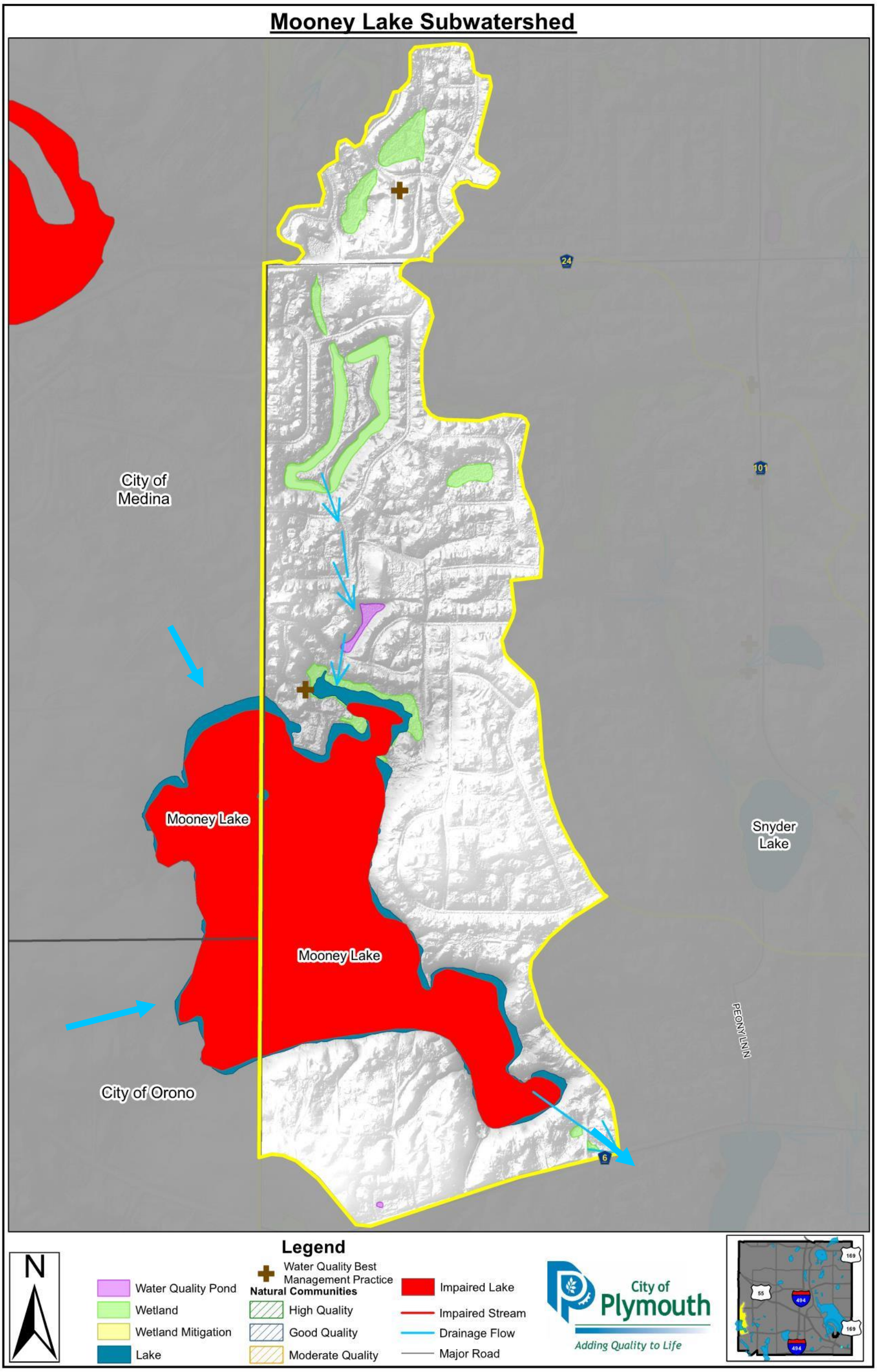
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 79) and ultimately a Total Maximum Daily Load (TMDL) is established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 79
MOONEY LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Mooney Lake	Excess Nutrients	2010

Figure 53. Mooney Lake Sub-watershed



Implementation Program

This sub-watershed was developed in the 1960's and the early 1990's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and the Minnehaha Creek Watershed Districts Stormwater Management Rules would apply.

There have been several projects in this sub-watershed pre-dating this plan. Maintenance projects were completed to help provide flood control and water quality improvements and were located in the Bay Pointe on Mooney Lake (Pond #30222-NU01) and the Greentree West (19332-NB01) neighborhoods. Additionally, capital improvement projects were also completed in this sub-watershed over the last 10 years. The Xanthus Lane Pipe Replacement Project (WRS 13024) consisted of replacing an existing, failed storm sewer pipe that drained directly into Mooney Lake with a new one. The Mooney Lake Permanent Emergency Outlet Project consisted of the installation of 1,100 linear feet of underground pipe and installation of a left station to connect Mooney Lake to the City storm sewer system. This project was a cooperative project between the City of Plymouth and the Minnehaha Creek Watershed District. The operations for the pumping of Mooney Lake are outlined in the "Mooney Lake Operating Plan for Emergency Pumping – August 2017".

During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Minnehaha Creek Watershed, and residents.

Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 80.

TABLE 80
MOONEY LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	%50,000	Plymouth

Conclusions

The Mooney Lake sub-watershed has an excess nutrient impairment noted in the 2018 Impaired Waters List produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in water bodies within this sub-watershed and downstream. The City will continue to implement best management practices during street reconstruction projects and will work to improve the waterbody within this sub-watershed.

Shingle Creek Watershed

The Shingle Creek Watershed covers approximately 44 square miles in northeastern Hennepin County. Predominant water features in Plymouth include Pomerleau Lake, Curtis Lake, Bass Lake, Schmidt Lake, Pike Lake and Bass Creek.

Generally, drainage in the Shingle Creek watershed comes to Bass Creek, which starts in the wetland located to the east of 54th Avenue North and Vicksburg Lane North. The water runs eastbound though a series of wetlands and storm sewer pipes before entering Bass Lake near 54th Avenue North and Norwood Lane North. The water exits Bass Lake on the east side and travels through a series of wetlands before becoming more of a defined stream to the north of the intersection of Zachary Lane North and 56th Avenue North. The water then travels northeast into the wetland located in the northwest corner of the intersection of into the US 169 Right of Way and Bass Lake Road and then east into New Hope.

Shingle Creek Watershed Management Commission

Shingle Creek and its tributaries extend across nine cities: Plymouth, Brooklyn Center, Brooklyn Park, Crystal, Maple Grove, Minneapolis, New Hope, Osseo and Robbinsdale.

Shingle Creek enters the Mississippi River in North Mississippi Park, which is located to the north of 42nd Avenue North and east of Interstate 94 in Minneapolis. In 1984, the Shingle Creek Watershed Management Commission (SCWMC) was formed using a joint powers agreement between the cities of Brooklyn Center, Brooklyn Park, Crystal, Maple Grove, Minneapolis, New Hope, Osseo, Robbinsdale and Plymouth, under the authority conferred to the member parties through Minnesota Statutes. The joint powers agreement was most recently approved by the nine member cities in 2015.

The SCWMC Board of Commissioners currently consists of nine commissioners and nine alternates appointed by the member cities. The term of each commissioner and

alternate is three years. Regular meetings of the SCWMC are held on the second Thursday of each month. Funding for the administrative functions of the SCWMC is via an assessment, generally based on land area and tax capacity, to each member of the organization.

Per Minnesota Rules 8410.008, Subp. 2-8, watershed management organization goals generally fall into the following categories: water quantity, water quality, public drainage systems, groundwater, wetlands, drainage systems and commission operations and programming. The SCWMC has established the following goals:

- Maintain the existing 100-year flood profile throughout the watersheds.
- Determine ecological low flows for Shingle and Bass Creeks.
- As lake water quality improves and lakes are removed from the State's Impaired Waters list, implement management strategies to protect lake water quality. Schmidt, Lower Twin, and Ryan Lakes were delisted in 2014.
- Implement phosphorus and sediment load reduction actions sufficient to achieve de-listing from the Impaired Waters list for Bass, Eagle, Crystal, and Middle Twin Lakes.
- Improve water clarity in the balance of the lakes by 10% over the average of the previous ten years.
- Improve at least 30% of the length of Shingle Creek to meet Corridor Study and TMDL design standards.
- Maintain nondegradation of all waterbodies compared to 1985 conditions.
- Infiltrate stormwater runoff from new impervious surface.
- Identify opportunities for and implement projects to infiltrate runoff from existing impervious surface.
- Work with the appropriate state agencies to incorporate groundwater assessment into the sustainable water budget analysis for each watershed.
- Maintain the existing functions and values of wetlands identified in the Commissions' Water Quality Plan as high-priority.

- Informed by the sustainable water budget study, improve functions and values of wetlands.
- Continue current Hennepin County jurisdiction over County Ditch #13.
- Identify and operate within a sustainable funding level that is affordable to member cities.
- Foster implementation of TMDL and other implementation projects by sharing in their cost and proactively seeking grant funds.
- Operate a public education and outreach program that meets the NPDES Phase II education requirements for the member cities.
- Operate a monitoring program sufficient to characterize water quantity, water quality, and biotic integrity in the watersheds and to evaluate progress towards meeting TMDL goals.
- Maintain rules and standards for development and redevelopment that are consistent with local and region TMDLs, federal guidelines, source water and wellhead protection requirements, sustainable water yields, nondegradation, and ecosystem management goals.
- Serve as a technical resource for member cities.

To assist in meeting the goals of the SCWMC, the SCWMC has established a 10-year Capital Improvement Program. Capital improvements are currently funded under an ad-velorum tax through Hennepin County. The current SCWMC Capital Improvement program includes two projects in the City of Plymouth (Table 81).

TABLE 81
SCWMC CAPITAL IMPROVEMENTS IN PLYMOUTH 2018-2024

ID	Name	Plymouth Sub-watershed	Funding Amount	Funding Year
N/A	Palmer Creek Estates Bass Creek Stream Restoration	Bass Lake South	25%	2021
N/A	Bass and Pomerleau Lakes Alum Treatment	Bass Lake & Pomerleau	100%	2018

Shingle Creek Sub-watersheds

The City of Plymouth has divided the portion of the Shingle Creek watershed within the City limits into 11 sub-watersheds for administrative and management purposes. The 11 sub-watersheds (Figure 23) are:

- Pomerleau Lake
- Upper Shingle Creek
- Curtis Lake
- Bass Lake South
- Schmidt Lake
- Bass Lake
- Bass Lake Northwest
- Pike Lake
- Lower Shingle Creek
- Shingle Creek Outlet
- New Hope

Pomerleau Lake Sub-Watershed

Physical Land Use Characteristics

The Pomerleau Lake Sub-watershed is located in north central Plymouth. The sub-watershed generally follows County Road 47 along its northern boundary at 60th Avenue North and Niagara Lane. Along the western boundary, the sub-watershed runs through many large lot residential properties. The sub-watershed is bound along the eastern border by the jurisdictional border of the Elm Creek Watershed Management Commission and the Lake Camelot sub-watershed, which is discussed later in this plan and the southern border is the south end of Pomerleau Lake.

The most significant landmark within this sub-watershed is Pomerleau Lake. (Figure 15). The sub-watershed consists of mostly large lot residential and undeveloped land uses, however, single family, townhomes and condominium residential developments have been completed in the past 10 years. This sub-watershed contains 57.8 acres of wetland, 3.7 acres of wetland mitigation, 3.2 acres of water quality ponding, and 9 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) indicates a high quality willow swamp natural community and two good quality natural communities, a mixed hardwood swamp and a willow swamp.

TABLE 82
POMERLEAU LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Pomerleau Lake	
Receives runoff from:	N/A	Figure 54
Downstream-most water body:	Pomerleau Lake	Figure 54
Discharges to:	Upper Shingle Creek	Figure 54
Wetlands	57.8 Acres	Figure 54

Wetland Mitigation	0.4 Acres	Figure 54
Water Quality Ponding	3.1 Acres	Figure 54
Water Quality Best Management Practices	9 BMPs	Figure 54
Lakes	Pomerleau – 32.1	Figure 15 Figure 54
General Hydrologic Soil Group	C, C/D	
Drainage Area	270.4 acres	

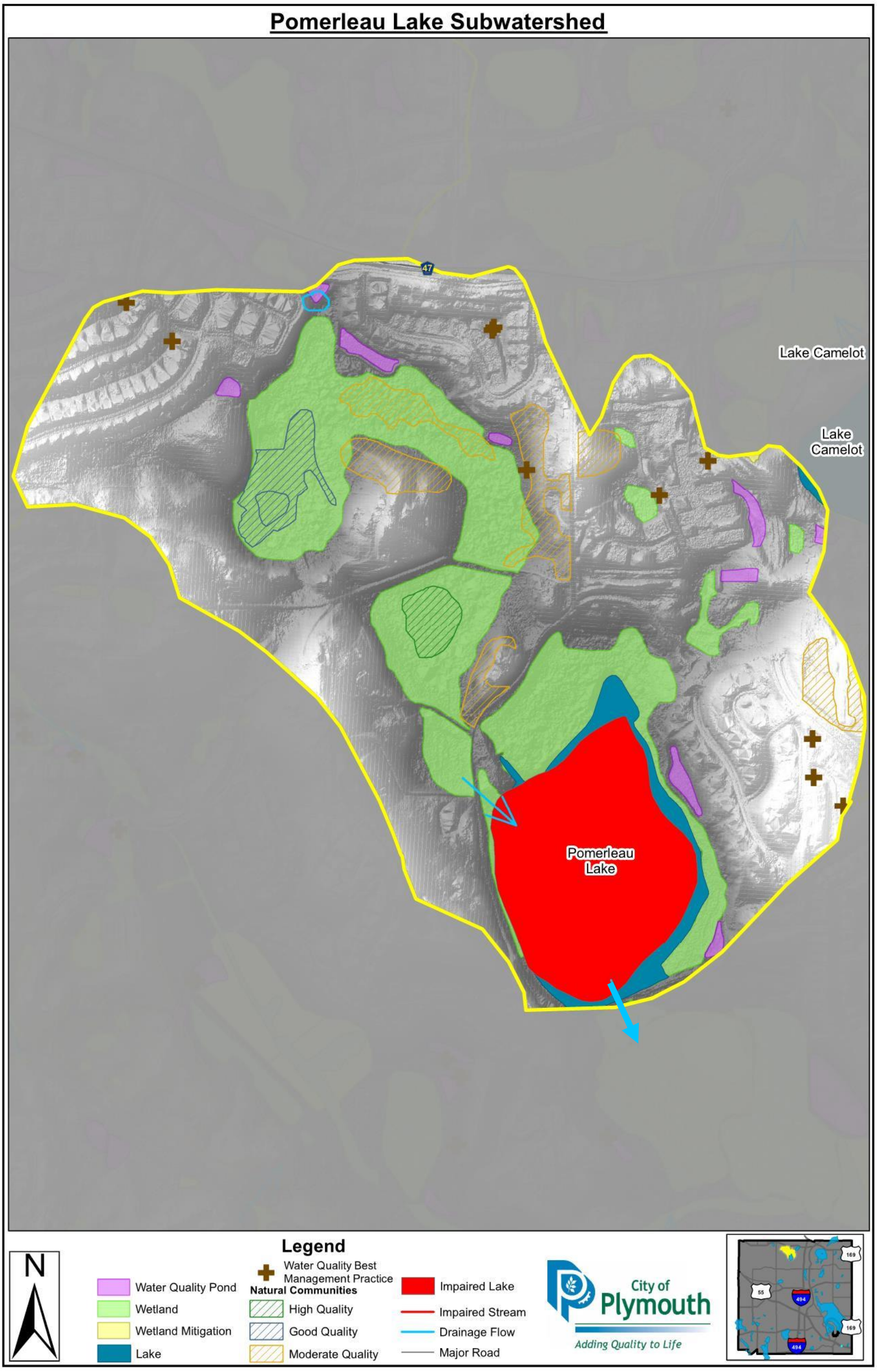
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 83) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 83
POMERLEAU LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Pomerleau Lake	Excess nutrients	2002

Figure 54. Pomerleau Lake Sub-watershed



Implementation Program

This sub-watershed has been involved in a land use transition over the last 10 years from primarily large lot single family residential and agriculture to smaller lot, single family and multi-family residential developments. Each of the new subdivisions have been subject to water quality requirements, which includes water quality and quantity best management practices as outlined in the City of Plymouth Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards.

In addition to improving water quality through stormwater management, the removal of septic systems discharging to surface waters will help to removing additional sources of excess nutrients and bacteria to the surface and groundwater. Some of the original septic systems have been removed during the land use transition previously mentioned and it is anticipated the remaining 17 septic systems in the sub-watershed will be removed when the large lot residential and undeveloped area is developed.

During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Shingle Creek Watershed, and residents.

There have been no city capital improvement projects in this sub-watershed that pre-date this plan, however, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 84.

TABLE 84
POMERLEAU LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Lake Management	2019-2028	$1,000	$10,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth
Alum Treatment – Pomerleau	2019	$100,000	$100,000	SCWMC

Conclusions

The Pomerleau Lake Sub-Watershed has one known impairment identified in the 2018 impaired water list produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Pomerleau Lake and other water bodies within this sub-watershed. The City will continue to implement best management practices during future land use transition.

Upper Shingle Creek Sub-Watershed

Physical Land Use Characteristics

The Upper Shingle Creek sub-watershed is located in north central Plymouth. The sub-watershed generally bound by 57th Avenue on the north, Northwest Boulevard on the east, 47th Avenue and the jurisdictional border of Bassett Creek Watershed Management Commission on the south and Black Oaks Lane North and the jurisdictional border of the Elm Creek Watershed Management Commission on the west.

The most significant landmark within this sub-watershed is Bass Creek. (Figure 55). The sub-watershed consists primarily of single family residential and multi-family residential, however, there are some land uses on the west side of Interstate 494 that are institutional, commercial and industrial. The majority of the development in this area has taken place in the past 10 years. This sub-watershed contains 178.7 acres of wetland, 22.1 acres of wetland mitigation, 21.6 acres of water quality ponding, and 19 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any high quality or good quality natural communities in this sub-watershed.

TABLE 85
UPPER SHINGLE CREEK SUB-WATERSHED CHARACTERISTICS

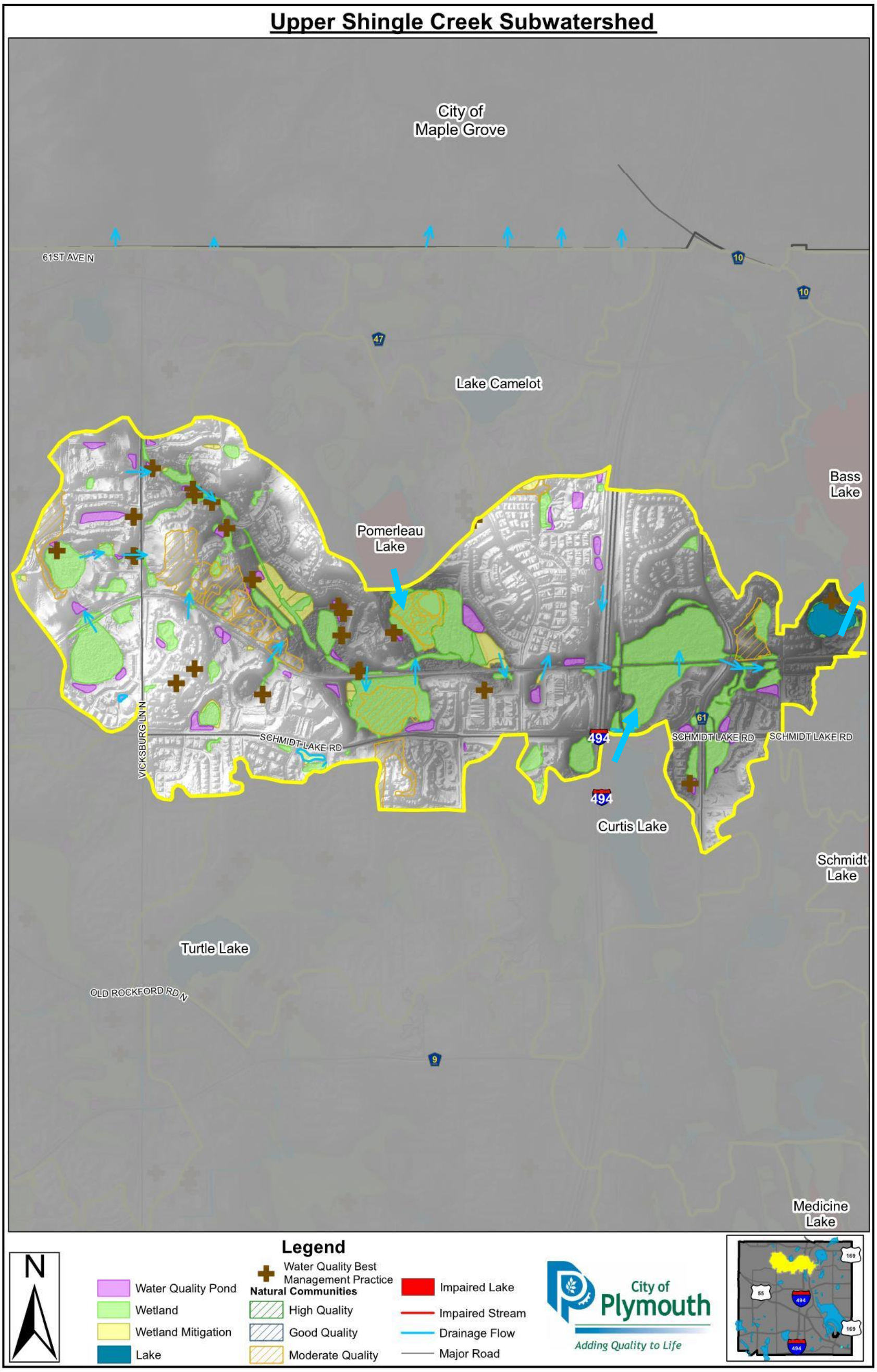
	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Creek	
Receives runoff from:	Pomerleau Lake Curtis Lake	Figure 55
Downstream-most water body:	Bass Lake	Figure 55
Discharges to:	Bass Lake	Figure 55
Wetlands	178.7 Acres	Figure 55
Wetland Mitigation	22.1 Acres	Figure 55

Water Quality Ponding	21.6 Acres	Figure 55
Water Quality Best Management Practices	19 BMPs	Figure 55
Lakes	N/A	
General Hydrologic Soil Group	C, C/D	
Drainage Area	1135.4 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently no known impairments within the Upper Shingle Creek Sub-watershed.

Figure 55. Upper Shingle Creek Sub-watershed



Implementation Program

This sub-watershed has been going through a land use transition over the last 10 years from primarily large lot single family residential, open space, golf course and agriculture to smaller lot, single family and multi-family residential developments. Each of the new subdivisions have been subject to water quality requirements, which includes water quality and quantity best management practices as outlined in the City of Plymouth Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards.

In addition to improving water quality through stormwater management, the removal of septic systems discharging to surface waters will help to removing additional sources of excess nutrients and bacteria to the surface and groundwater. Some of the original septic systems have been removed during the land use transition previously mentioned and it is anticipated the remaining 17 septic systems in the sub-watershed will be removed when the large lot residential and undeveloped area is developed.

There have been no city capital improvement projects in this sub-watershed that pre-date this plan, however, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 86.

TABLE 86
UPPER SHINGLE CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Upper Shingle Creek Sub-watershed has no known impairments identified in the 2018 impaired water list produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality within this sub-watershed and other waterbodies downstream. The City will continue to implement best management practices during future land use transition.

Curtis Lake Sub-Watershed

Physical Land Use Characteristics

The Curtis Lake sub-watershed is located in north central Plymouth. The sub-watershed generally bound by Schmidt Lake Road on the north, Northwest Boulevard on the east, Rockford Road (County Road 9) on the south and Fernbrook Lane on the west.

The most significant landmark within this sub-watershed is Curtis Lake. (Figure 4). The land use in this sub-watershed consists of single family residential, multi-family residential, commercial / industrial and open space. The watershed has a significant amount of undeveloped area on both the east and west sides of the Interstate 494 corridor. The majority of the development in this area took place from the late 1980's to the early 2000's and appropriate water quality treatment practices have been installed. This sub-watershed contains 66.9 acres of wetland, 0.4 acres of wetland mitigation, 4.1 acres of water quality ponding, and 2 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) indicates a high quality oak forest mesic subtype natural community in this sub-watershed.

TABLE 87
CURTIS LAKE SUB-WATERSHED CHARACTERISTICS

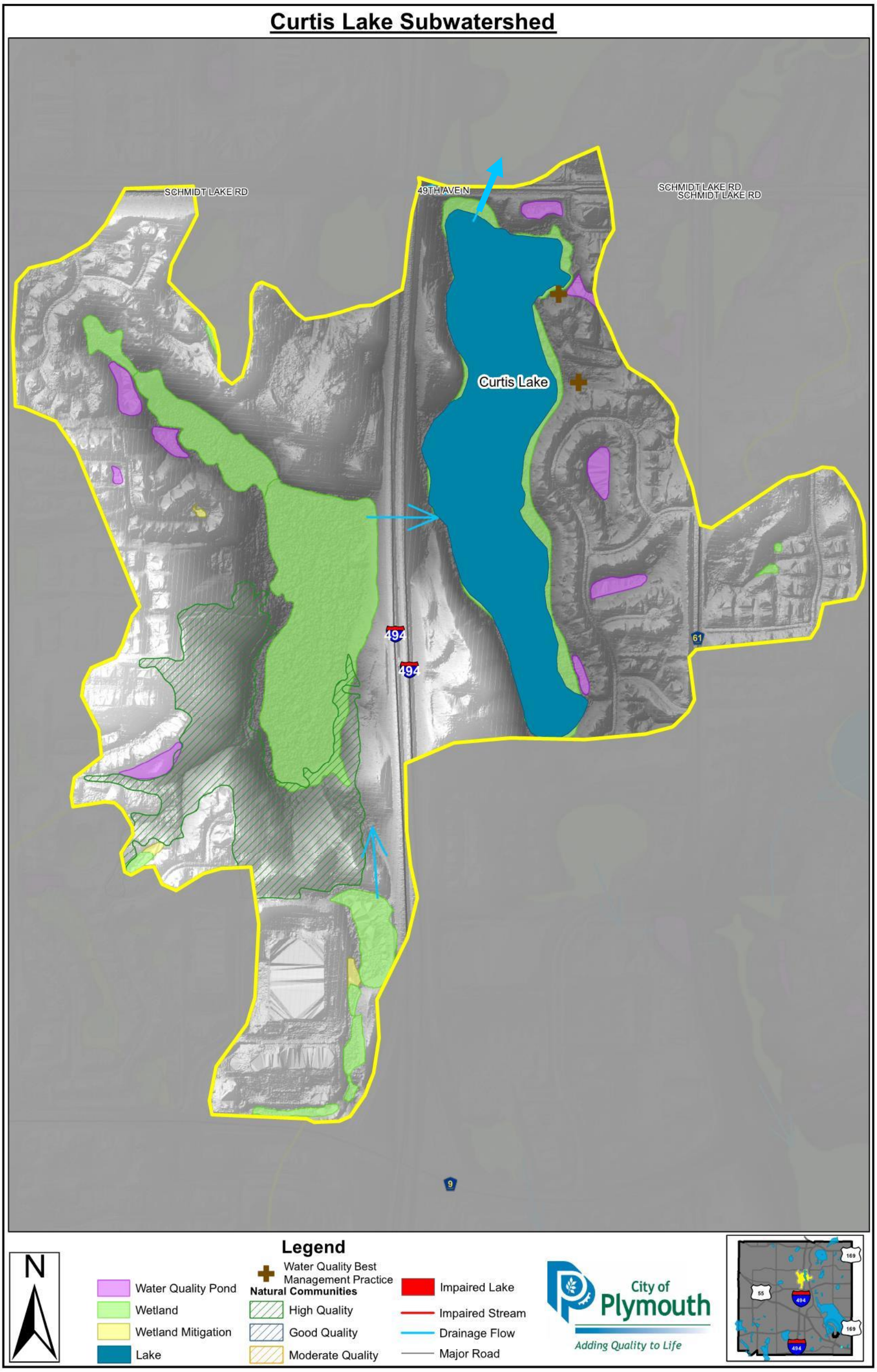
	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Creek	
Receives runoff from:	N/A	Figure 56
Downstream-most water body:	Bass Lake	Figure 56
Discharges to:	Bass Lake South	Figure 56
Wetlands	66.9 Acres	Figure 56
Wetland Mitigation	0.4 Acres	Figure 56
Water Quality Ponding	4.1 Acres	Figure 56

Water Quality Best Management Practices	2 BMPs	Figure 56
Lakes	Curtis – 31.9 acres	Figure 4 Figure 56
General Hydrologic Soil Group	C, C/D	
Drainage Area	294.0 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are currently no know water quality impairments within the Curtis Lake Sub-watershed.

Figure 56. Curtis Lake Sub-watershed



Implementation Program

This sub-watershed has been developed since the early 2000's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply.

There was one city capital improvement project in this sub-watershed that pre-dated this plan. The Nature Canyon Erosion Repair Project installed storm sewer pipe and drainage swales with rock check dams to reduce erosion and project a high quality oak forest from stormwater runoff before it entered the downstream wetland to the west of Interstate 494.

During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Shingle Creek Watershed, and residents.

Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 88.

TABLE 88
CURTIS LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Curtis Lake Sub-Watershed does not currently have any impaired waters. Water from this sub-watershed drains into Bass Lake and Bass Creek, which are both listed as impaired on the 2018 impaired waters list produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan also includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Lake, Bass Creek and other water bodies within this sub-watershed.

Schmidt Lake Sub-Watershed

Physical Land Use Characteristics

The Schmidt Lake sub-watershed is located in north east Plymouth. The sub-watershed is generally bound by Larch Lane on the west, 50th Avenue on the north, Deerwood Lane on the east and 44th Avenue on the south.

The most significant landmark within this sub-watershed is Schmidt Lake (Figure 16). The land use in this sub-watershed consists primarily of single family residential, with a small amount of park / open space on the north east corner of Schmidt Lake. The sub-watershed was primarily developed in the late 1970's through the 1980's and little to no water quality treatment was installed as part of this development. This sub-watershed contains 1.3 acres of wetland, 0 acres of wetland mitigation, 0.08 acres of water quality ponding and 8 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any natural communities in this sub-watershed.

TABLE 89
SCHMIDT LAKE SUB-WATERSHED CHARACTERISTICS

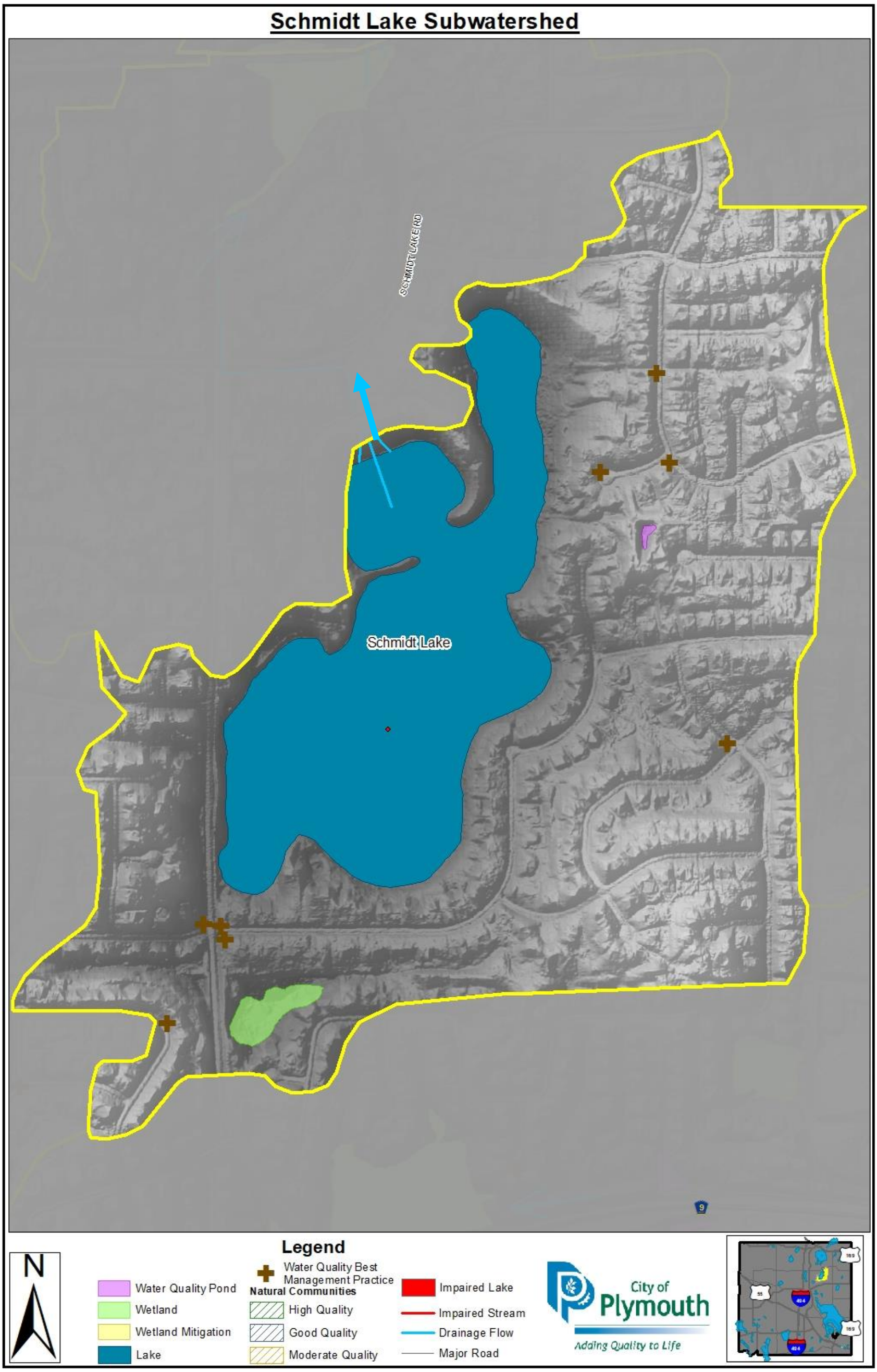
	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Creek	
Receives runoff from:	N/A	Figure 57
Downstream-most water body:	Bass Lake	Figure 57
Discharges to:	Bass Creek	Figure 57
Wetlands	1.3 Acres	Figure 57
Wetland Mitigation	0 Acres	Figure 57
Water Quality Ponding	0.1 Acres	Figure 57
Water Quality Best Management Practices	8 BMPs	Figure 57
Lakes	Schmidt – 43.8	Figure 16 Figure 57

General Hydrologic Soil Group	A, B/D, C, C/D	
Drainage Area	203.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 108) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are no know water quality impairments within the Schmidt Lake Sub-watershed.

Figure 57. Schmidt Lake Sub-watershed



Implementation Program

This sub-watershed has been developed since the late 1980's and subsequently does not have much for water quality treatment, additionally, the sub-watershed is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply.

The city has not had any capital improvement projects in this sub-watershed that pre-date this plan. However, sump catch basins have been installed in this sub-watershed as part of street reconstruction projects since 2002 and several rain gardens were installed in cooperation with grant funding from the Metropolitan Council in 2004.

During the course of this plan, the City of Plymouth endeavors to generate partnerships for lake management where there are interested parties to address in-lake issues such as internal nutrient loading, aquatic invasive species management, fish management or other in-lake issues. Partners may include but is not limited to the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, Hennepin County, the Shingle Creek Watershed, and residents.

Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 90.

TABLE 90
SCHMIDT LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Schmidt Lake Sub-Watershed was listed as an impaired lake in 2002, however improvements in the watershed completed by both the City and the active lake association, have led to the lake being delisted in 2014. Water from this sub-watershed drains into Bass Lake and Bass Creek, which are both listed as impaired on the 2016 impaired waters list produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Lake, Bass Creek and other water bodies within this sub-watershed

Bass Lake South Sub-Watershed

Physical Land Use Characteristics

The Bass Lake South sub-watershed is located in north east Plymouth. The sub-watershed is generally bound by Pineview Lane North on the west, the Soo Line Railroad on the north, Forestview Lane North on the east and 48th Avenue North on the south.

The land use in this sub-watershed consists primarily of single family residential, with a small amount of railroad property along the northern border of the sub-watershed. The sub-watershed was primarily developed in the late 1970's through the 1980's and little to no water quality treatment was installed as part of this development. This sub-watershed contains 3.6 acres of wetland, 0 acres of wetland mitigation, 0 acres of water quality ponding and 0 water quality best management practices. The Natural Resources Inventory for Plymouth (2006) does not indicate any natural communities in this sub-watershed.

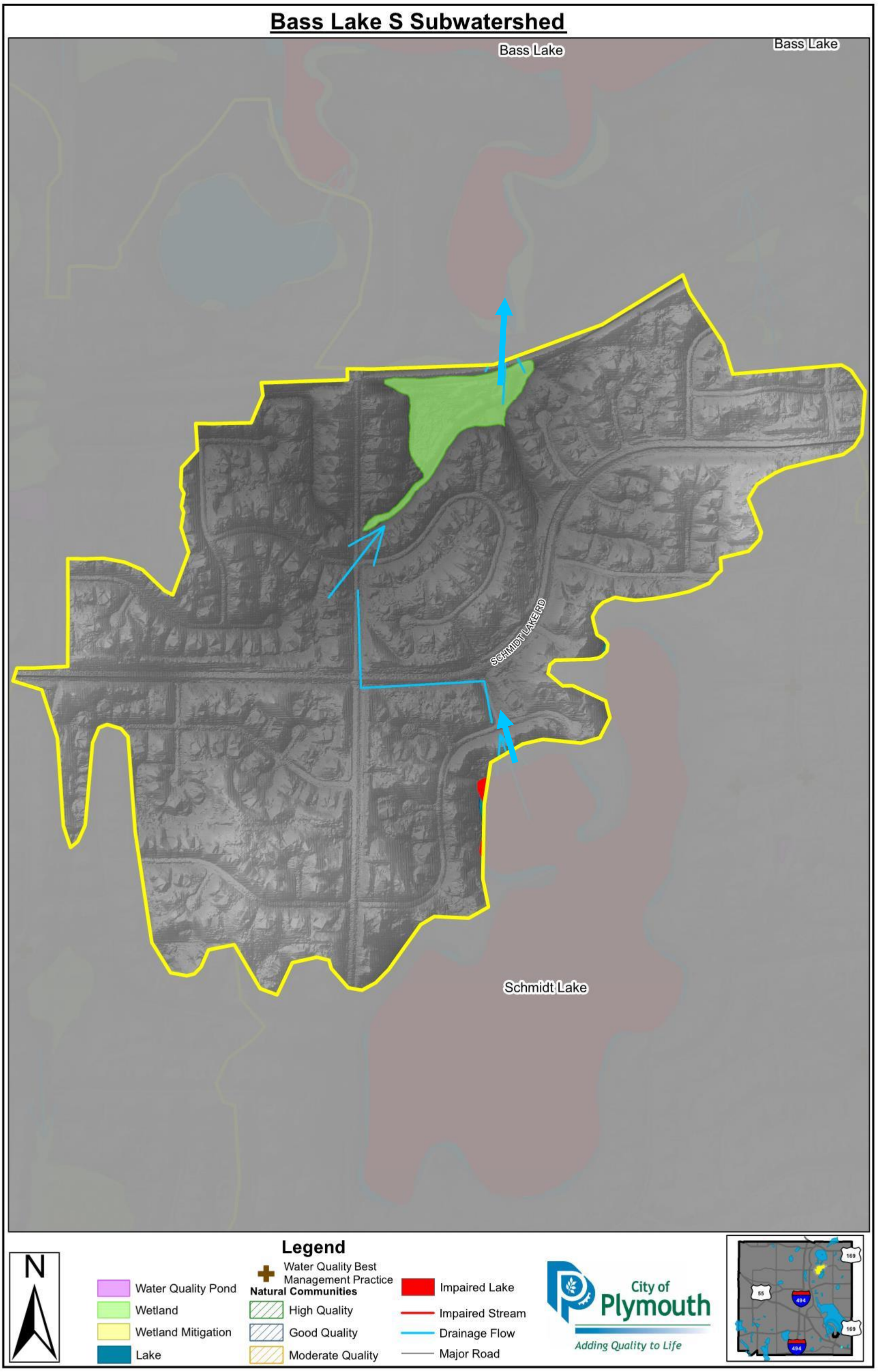
TABLE 91
BASS LAKE SOUTH SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Lake	
Receives runoff from:	Schmidt Lake	Figure 58
Downstream-most water body:	Bass Lake	Figure 58
Discharges to:	Bass Lake	Figure 58
Wetlands	3.6 Acres	Figure 58
Wetland Mitigation	0 Acres	Figure 58
Water Quality Ponding	0 Acres	Figure 58
Water Quality Best Management Practices	0 BMPs	Figure 58
Lakes	N/A	
General Hydrologic Soil Group	A	
Drainage Area	245.9 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are no known impairments within the Bass Lake South Sub-watershed.

Figure 58. Bass Lake South Sub-watershed



Implementation Program

This sub-watershed has been developed since the late 1980's and subsequently does not have much for water quality treatment, additionally, the sub-watershed is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply.

The city has not had any capital improvement projects in this sub-watershed that pre-date this plan. However, one capital improvement project (Palmer Creek Estates Stream Restoration) is scheduled for 2021-2022. The stream restoration is proposed to restore 1250 linear feet of streambank and will reduce pollutant loading to Bass Lake. Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 92.

TABLE 92
BASS LAKE SOUTH SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Palmer Creek Estates Stream Restoration	2021-2022	$450,000	$450,000	Plymouth SCWMC

Conclusions

The Bass Lake South Sub-Watershed does not have any impaired waters directly in the sub-watershed. Water from this sub-watershed drains into Bass Lake and Bass Creek, which are both listed as impaired on the 2016 impaired waters list produced by the State of Minnesota. This 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Lake, Bass Creek and other water bodies downstream.

Bass Lake Northwest Sub-Watershed

Physical Land Use Characteristics

The Bass Lake Northwest sub-watershed is located in north central Plymouth. The sub-watershed is generally bound by the Maple Grove Border and Bass Lake Road (County Road 10) on the north, Pineview Lane North on the east, 56th Avenue North on the south and Annapolis Lane North on the west.

The most significant landmarks within this sub-watershed are Interstate 494, County Road 47, Northwest Boulevard (County Road 61) and Bass Lake Road (County Road 10). (Figure 59). The land use in this sub-watershed consists of single family residential, multi-family residential and a business campus. The sub-watershed has a significant amount of open space on the east side of the Interstate 494 corridor north of County Road 47 on the Prudential Business Campus. The majority of the development in this area took place from the late 1980's to the mid 1990's and water quality treatment practices have been installed. This sub-watershed contains 17.2 acres of wetland, 0.0 acres of wetland mitigation, 1.2 acres of water quality ponding, and 0 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) indicates no natural communities in this sub-watershed.

TABLE 93
BASS LAKE NORTHWEST SUB-WATERSHED CHARACTERISTICS

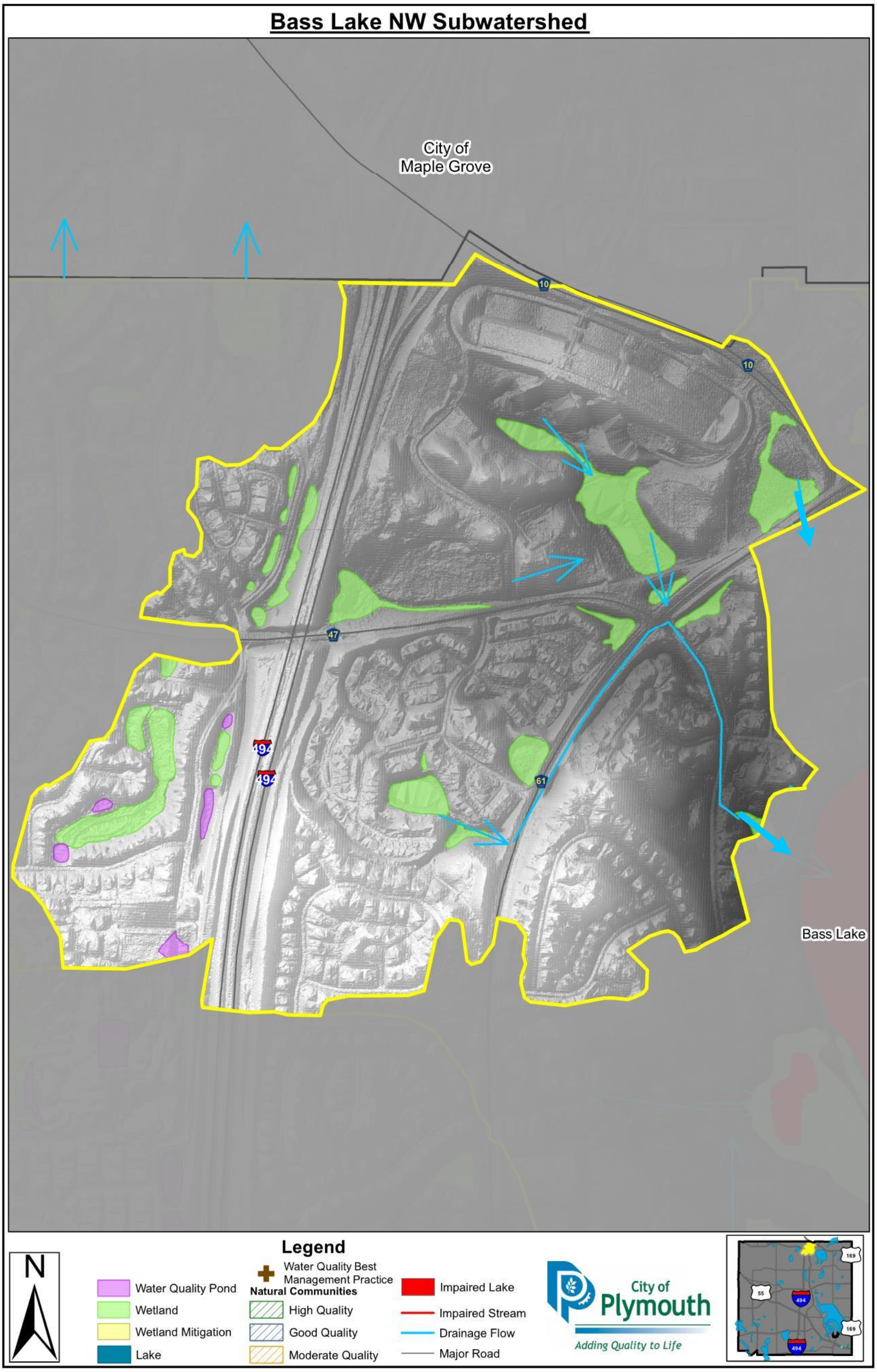
	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Lake	
Receives runoff from:	N/A	Figure 59
Downstream-most water body:	Bass Lake	Figure 59
Discharges to:	Bass Lake	Figure 59
Wetlands	17.2 Acres	Figure 59

Wetland Mitigation	0.0 Acres	Figure 59
Water Quality Ponding	1.2 Acres	Figure 59
Water Quality Best Management Practices	0 BMPs	Figure 59
Lakes	N/A	
General Hydrologic Soil Group	C	
Drainage Area	279.9 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are no known water quality impairments within the Bass Lake Northwest Sub-watershed.

Figure 59. Bass Lake Northwest Sub-watershed



Implementation Program

This sub-watershed has been developed since the mid 1990's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply.

There have been no city capital improvement projects in this sub-watershed that pre-dated this plan, however, Interstate 494 was reconstructed and expanded from 2 lanes to 3 lanes in each direction in 2015-2016. Water quality treatment practices were installed, however no BMPs were installed within this sub-watershed. Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 94.

TABLE 94
BASS LAKE NORTHWEST SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The Bass Lake Northwest Sub-Watershed does not have any impaired waters directly in the sub-watershed. Water from this sub-watershed drains into Bass Lake and Bass Creek, which are both listed as impaired on the 2016 impaired waters list produced by the State of Minnesota. While the TMDL plans have been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Lake, Bass Creek and other water bodies within this sub-watershed.

Bass Lake Sub-Watershed

Physical Land Use Characteristics

The Bass Lake sub-watershed is located in north east Plymouth. The sub-watershed is generally bound by Northwest Boulevard on the west, Bass Lake Road (County Road 10) on the north, Trenton Lane on the east and 48th Avenue North on the south.

The most significant landmark within this sub-watershed is Bass Lake (Figure 2, Figure 60). The land use in this sub-watershed consists primarily of single family residential, however there are two areas of multi-family and public/open space. The sub-watershed was developed between the late 1950's through the early 2000's and minimal water quality treatment practices were incorporated as part of the development process. This sub-watershed contains 54.1 acres of wetland, 0 acres of wetland mitigation, 2.2 acres of water quality ponding and 4 water quality best management practices. The Natural Resources Inventory for Plymouth (2006) indicated a good quality oak forest mesic subtype in this sub-watershed.

TABLE 95
BASS LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Lake	
Receives runoff from:	Bass Lake Northwest Upper Shingle Creek Bass Lake South	Figure 60
Downstream-most water body:	Bass Creek	Figure 60
Discharges to:	Lower Shingle Creek	Figure 60
Wetlands	54.1 Acres	Figure 60
Wetland Mitigation	0.0 Acres	Figure 60
Water Quality Ponding	2.2 Acres	Figure 60
Water Quality Best Management Practices	4 BMPs	Figure 60
Lakes	Bass Lake – 182.47	Figure 2 Figure 60

General Hydrologic Soil Group	A	
Drainage Area	679.1 acres	

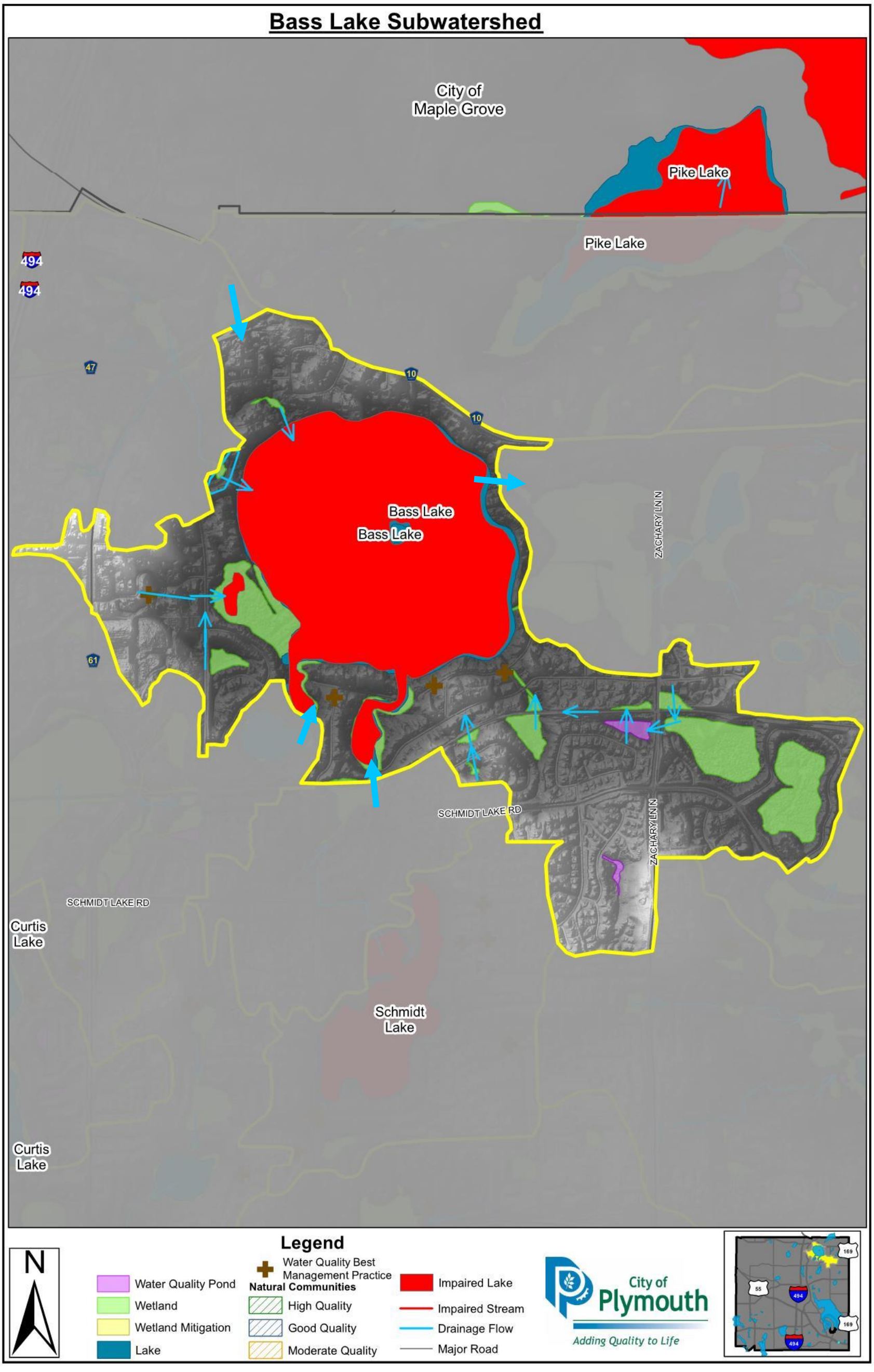
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 96) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 96
BASS LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed	Year Delisted
Bass Lake	Excess nutrients	2002	N/A

Figure 60. Bass Lake Sub-watershed



Implementation Program

This sub-watershed has been developed since the early 2000's and subsequently does not have much for water quality treatment, additionally, the sub-watershed is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply.

The city has had one capital improvement project in this sub-watershed that pre-dates this plan. The Wild Wings Flood Improvement Project (City Project No. 7135) was completed in the winter of 2010-2011 and improved the flood protection of the wetlands by removing sediments and vegetation that was blocking the natural flow of the water through this wetland system. One city capital improvement project (Wild Wings Western Wetland Improvements) is scheduled for 2020-2021. This project would provide improvement of flow and flood protection near the northeast corner of Zachary Lane and Schmidt Lake Road. One Shingle Creek Watershed Management Organization capital improvement project is also being developed to reduce the internal loading of nutrients in Bass Lake. This project would consist of an alum treatment of the lake sediment and is estimated to reduce the internal loading significantly.

In addition to the projects mentioned above, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 97.

TABLE 97
BASS LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Wild Wings Western Wetland Improvements	2018-2019	$225,000	$225,000	Plymouth
Bass Lake Internal Loading	2019	$200,000	$200,000	Plymouth SCWMC
TMDL Implementation Plan	2018-2019	5,000	$50,000	Plymouth

Conclusions

The Bass Lake Sub-Watershed includes Bass Lake, which is an impaired water directly in the sub-watershed. Water from this sub-watershed drains into Bass Creek, which is listed as impaired on the 2016 impaired waters list produced by the State of Minnesota. While the TMDL plans have been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Lake, Bass Creek and other water bodies downstream.

Pike Lake Sub-Watershed

Physical Land Use Characteristics

The Pike Lake sub-watershed is located in northeast Plymouth. The sub-watershed is generally bound by the Maple Grove border on the north, Nathan Lane North on the east, Bass Lake Road (County Road 10) on the south and Quinwood Lane North on the west.

The most significant landmark within this sub-watershed is Pike Lake. (Figure 14, Figure 61). The land use in this sub-watershed consists of single family residential, multi-family residential, commercial and public/institutional. The watershed has a significant amount of undeveloped land directly adjacent to Pike Lake. The majority of the development in this area took place from the mid 1960's to the early 2000's and appropriate water quality treatment practices have been installed as required. This sub-watershed contains 50.8 acres of wetland, 1.9 acres of wetland mitigation, 3.9 acres of water quality ponding, and 2 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any high quality or good quality natural communities in this sub-watershed.

TABLE 98
PIKE LAKE SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Pike Lake	
Receives runoff from:	N/A	Figure 61
Downstream-most water body:	Bass Lake	Figure 61
Discharges to:	Bass Lake South	Figure 61
Wetlands	50.8 Acres	Figure 61
Wetland Mitigation	1.9 Acres	Figure 61
Water Quality Ponding	3.9 Acres	Figure 61

Water Quality Best Management Practices	2 BMPs	Figure 61
Lakes	Pike Lake – 34.6	Figure 14 Figure 61
General Hydrologic Soil Group	A, C	
Drainage Area	368.2 acres	

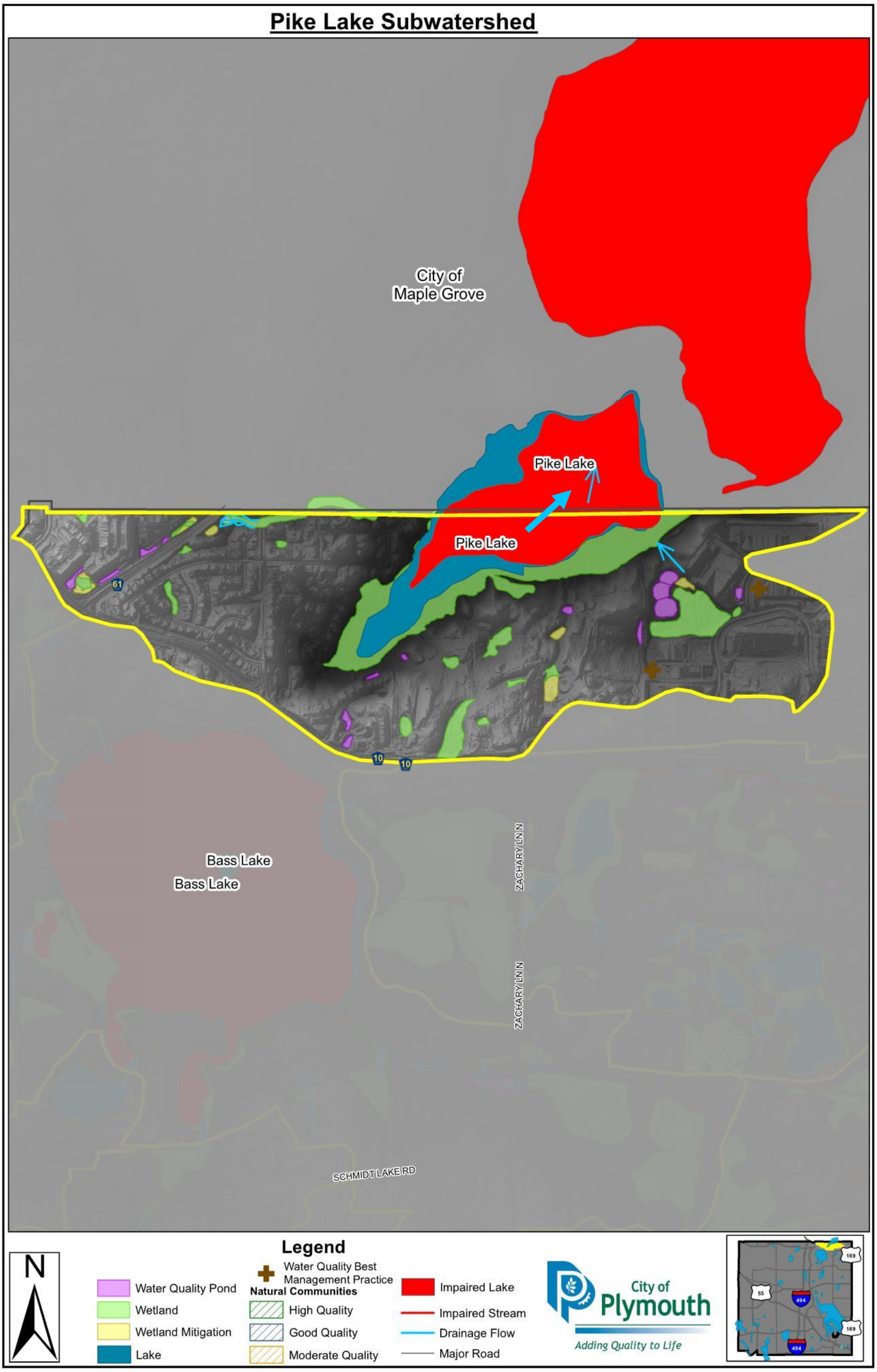
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 99) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 99
PIKE LAKE SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Pike Lake	Excess nutrients	2010

Figure 61. Pike Lake Sub-watershed



Implementation Program

This sub-watershed has been developed since the early 2000's and is unlikely to undergo redevelopment in the next 10 years. If this area were to redevelop, water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply. The Shingle Creek Watershed Management Organization also completed a sub-watershed assessment of area in 2017. Best management practices identified in this report would be considered as redevelopment or street reconstruction projects occur.

There has been one city capital improvement project in this sub-watershed that pre-dates this plan. The Pike Lake Channel Stabilization Project (City Project 1043) was a cooperative project with the City of Maple Grove between Hemlock Lane and Pike Lake. The project included the installation of a sediment basin in Pike Creek, bank reshaping and gabion structures to help reduce streambank erosion. Maintenance dredging occurred in 2017

In addition to the above mentioned project, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 100.

TABLE 100
PIKE LAKE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
Bass Lake Estates Stream Restoration	2022-2023	$500,000	$500,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Pike Lake Sub-Watershed has Pike Lake, which is an impaired water directly in the sub-watershed. Water from this sub-watershed drains into Pike Lake and Eagle Lake, which are both listed as impaired on the 2016 impaired waters list produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Pike Lake and other water bodies within this sub-watershed.

Lower Shingle Creek Sub-Watershed

Physical Land Use Characteristics

The Lower Shingle Creek sub-watershed is located in northeast Plymouth. The sub-watershed is generally bound by Bass Lake Road (County Road 10) on the north, US Highway 169 on the east, 52nd Avenue North on the south and Evergreen Lane North on the west.

The most significant landmark within this sub-watershed is Bass Creek. (Figure 62). The land use in this sub-watershed consists of single family residential, multi-family residential, commercial, industrial and public/institutional. The watershed has a significant amount of undeveloped and wetland area on the east and west sides of Zachary Lane and to the east of Union Terrace Lane which will remain undeveloped. This area has undergone steady development since the late 1960's and appropriate water quality treatment practices have been installed as required. This sub-watershed contains 119.7 acres of wetland, 2.4 acres of wetland mitigation, 1.8 acres of water quality ponding, and 6 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any high quality or good quality natural communities in this sub-watershed.

TABLE 101
LOWER SHINGLE CREEK SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Creek	
Receives runoff from:	N/A	Figure 62
Downstream-most water body:	Bass Creek	Figure 62
Discharges to:	Shingle Creek Outlet	Figure 62
Wetlands	119.7 Acres	Figure 62
Wetland Mitigation	2.4 Acres	Figure 62

Water Quality Ponding	1.8 Acres	Figure 62
Water Quality Best Management Practices	6 BMPs	Figure 62
Lakes	N/A	
General Hydrologic Soil Group	A	
Drainage Area	458.9 acres	

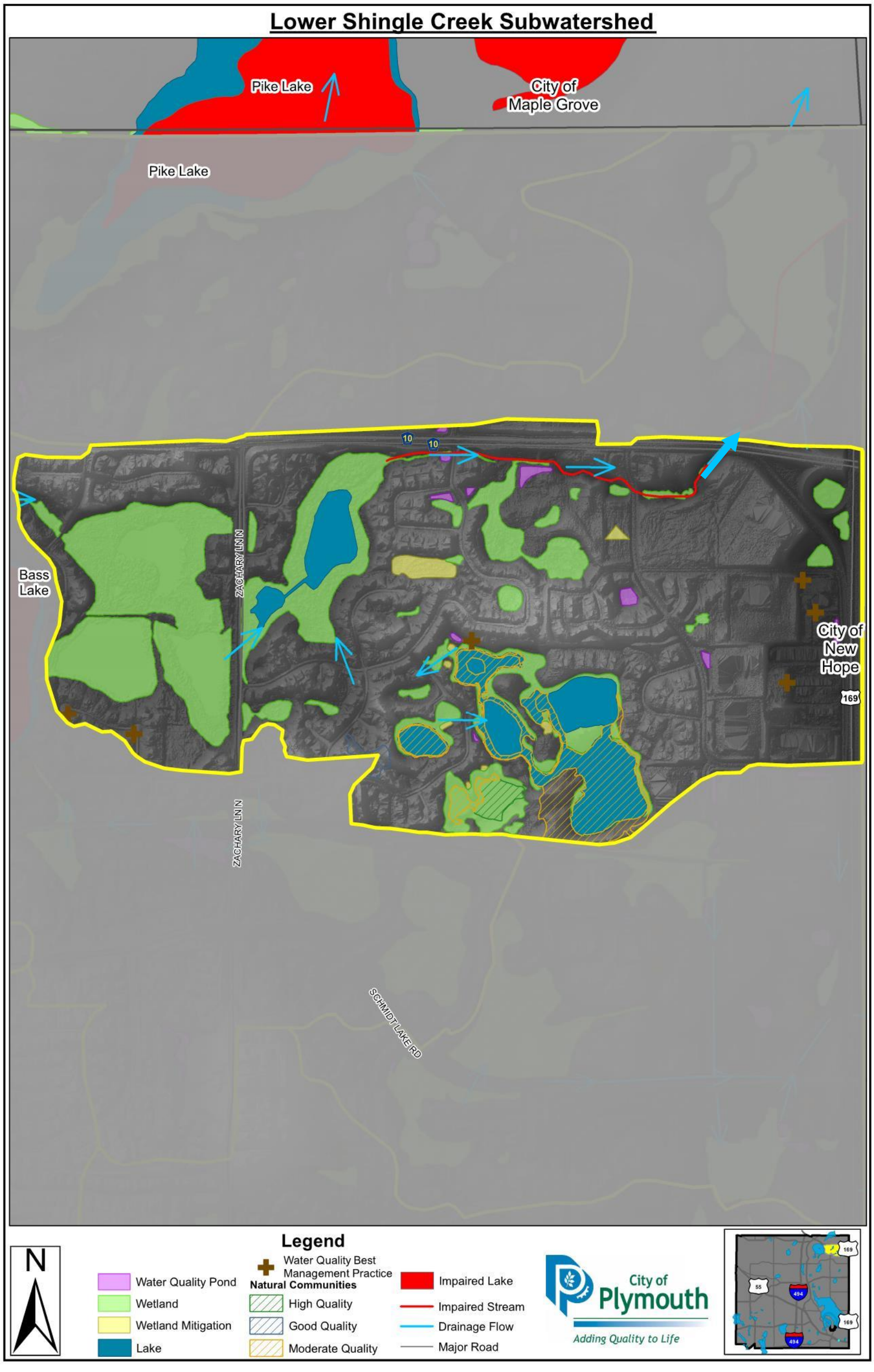
Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 102) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 102
LOWER SHINGLE CREEK SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Bass Creek	Chloride	2010
	Fish bioassessments	2002

Figure 62. Lower Shingle Creek Sub-watershed



Implementation Program

This sub-watershed has undergone steady development since the late 1960's and appropriate water quality treatment practices have been installed as required. Future redevelopment of the area east of Nathan Lane North, North of 56th Avenue North, west of US Highway 169 and south of Bass Lake Road (County Road 10) is expected within the next 10 years. Water quantity and quality best management practices as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards would apply as development and redevelopment occurs.

The city has had one capital improvement project within this sub-watershed pre-dating this plan. A drainage improvement project southwest of the intersection of 57th Avenue North and Zachary Lane was completed in 2014. In addition, rain gardens have been installed in this sub-watershed as part of street reconstruction projects since 2006.

Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 103.

TABLE 103
LOWER SHINGLE CREEK SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Lower Shingle Creek Sub-Watershed has Bass Creek, which is an impaired water directly in the sub-watershed. Water from this sub-watershed drains into Bass Creek,

which is listed as impaired on the 2016 impaired waters list produced by the State of Minnesota. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Creek and other water bodies within this sub-watershed.

Shingle Creek Outlet Sub-Watershed

Physical Land Use Characteristics

The Shingle Creek Outlet sub-watershed is located in the northeast corner of Plymouth. The sub-watershed is generally bound by the Maple Grove border on the north, US Highway 169 on the east, Bass Lake Road (County Road 10) on the south and Trenton Lane North on the west.

The most significant landmark within this sub-watershed is Bass Creek. (Figure 63). The land use in this sub-watershed consists of commercial, business campus and public/institutional. The watershed has a significant amount of undeveloped and wetland area directly west of US Highway 169 which will remain undeveloped. This area underwent development in the 1990's and appropriate water quality treatment practices have been installed as required. This sub-watershed contains 40.3 acres of wetland, 0.0 acres of wetland mitigation, 0.4 acres of water quality ponding, and 1 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any high quality or good quality natural communities in this sub-watershed.

TABLE 104
SHINGLE CREEK OUTLET SUB-WATERSHED CHARACTERISTICS

	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Creek	
Receives runoff from:	Lower Shingle Creek	Figure 63
Downstream-most water body:	Bass Creek	Figure 63
Discharges to:	New Hope	Figure 63
Wetlands	40.3 Acres	Figure 63
Wetland Mitigation	0.0 Acres	Figure 63
Water Quality Ponding	0.4 Acres	Figure 63

Water Quality Best Management Practices	1 BMPs	Figure 63
Lakes	N/A	
General Hydrologic Soil Group	A, B/D	
Drainage Area	159.6 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired (Table 105) and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. The City of Plymouth uses these assessments to develop nonstructural, programmatic, and structural solutions to improving the water quality.

TABLE 105
SHINGLE CREEK OUTLET SUB-WATERSHED IMPAIRED WATERS

Impaired Waterbody	Impairment(s)	Year Listed
Bass Creek	Chloride	2010
	Fish bioassessments	2002

Figure 63. Shingle Creek Outlet Sub-watershed

Implementation Program

This sub-watershed underwent development in the 1990's and appropriate water quality treatment practices have been installed as required. Water quantity and quality best management practices would be required as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards if redevelopment occurs.

The city has not had any capital improvement projects in this sub-watershed that pre-date this plan. Additionally, non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 106.

TABLE 106
SHINGLE CREEK OUTLET SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth
TMDL Implementation Plan	2019-2028	$5,000	$50,000	Plymouth

Conclusions

The Shingle Creek Outlet Sub-Watershed has Bass Creek, which is an impaired water, directly in the sub-watershed. While the TMDL plan has been developed, this 10-year Surface Water Management Plan includes a number of nonstructural, programmatic, and structural solutions to improving water quality in Bass Creek and other water bodies within this sub-watershed.

New Hope Sub-Watershed

Physical Land Use Characteristics

The New Hope sub-watershed is located in the northeast corner of Plymouth. The sub-watershed is generally bound by 54th Avenue on the north, US Highway 169 on the east, 48th Avenue on the south and Ximines Lane on the west.

The most significant landmark within this sub-watershed is the intersection of Schmidt Lake Road and US Highway 169. (Figure 64). The land use in this sub-watershed consists of commercial, industrial, single family residential and open space. The watershed has a significant amount of undeveloped and wetland area located throughout the sub-watershed. This sub-watershed area underwent significant development in the 1980's through the 1990's and appropriate water quality treatment practices have been installed as required. More recently, a few remaining vacant parcels in this area has also been developing and newer water quality treatment practices have been installed.

This sub-watershed contains 42.4 acres of wetland, 0.0 acres of wetland mitigation, 2.6 acres of water quality ponding, and 5 water quality best management practices. Examples of Water Quality Best Management Practices could include but is not limited to; rain gardens, infiltration/filtration basins, iron enhanced sand filters, underground storage and pervious pavement. The Natural Resources Inventory for Plymouth (2006) does not indicate any high quality or good quality natural communities in this sub-watershed.

TABLE 107
NEW HOPE SUB-WATERSHED CHARACTERISTICS

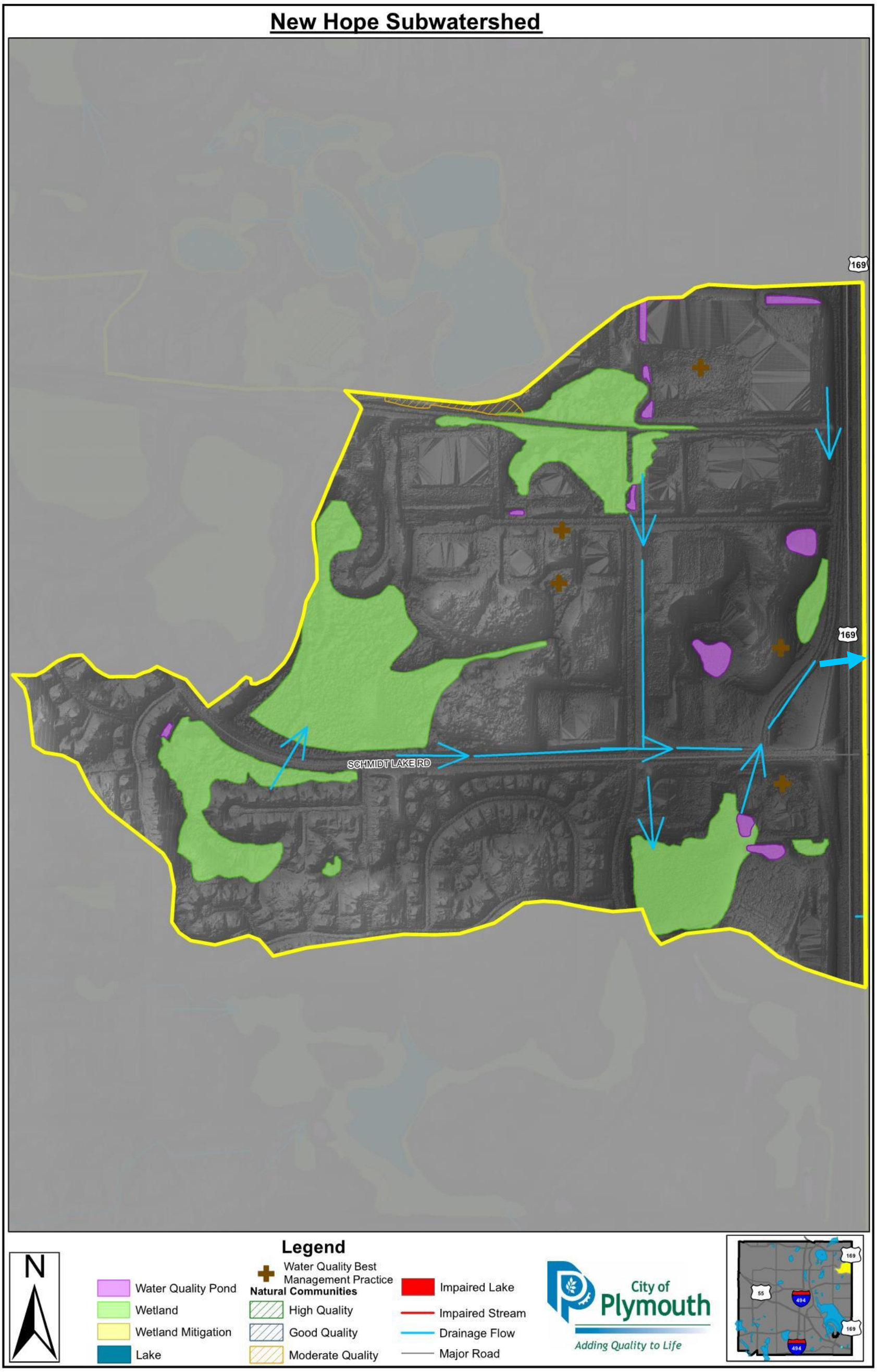
	Characteristic	Plan Reference
Watershed	Shingle Creek	
Receiving Water	Bass Creek	
Receives runoff from:	Lower Shingle Creek	Figure 64

Downstream-most water body:	Bass Creek	Figure 64
Discharges to:	New Hope	Figure 64
Wetlands	42.4 Acres	Figure 64
Wetland Mitigation	0.0 Acres	Figure 64
Water Quality Ponding	2.6 Acres	Figure 64
Water Quality Best Management Practices	5 BMPs	Figure 64
Lakes	N/A	
General Hydrologic Soil Group	A, B/D	
Drainage Area	276.4 acres	

Assessment of Water Resource Related Problems

The State of Minnesota is required through the federal Clean Water Act to monitor and assess waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired and ultimately a Total Maximum Daily Load (TMDL) will be established at the maximum amount of a pollutant the water body can assimilate before becoming impaired. There are no known water quality impairments within the New Hope Sub-watershed.

Figure 64. New Hope Sub-watershed



Implementation Program

This sub-watershed underwent development in the 1980's to the 1990's and appropriate water quality treatment practices have been installed as required. Water quantity and quality best management practices would be required as outlined in the City of Plymouth's Regulatory Program and Shingle Creek Watershed Management Commissions Rules and Standards if development and redevelopment continues to occur as it has in the past 5 years.

The city has no capital improvement projects in this sub-watershed that pre-date this plan. Non-structural, programmatic, and structural solutions to address impairments within or downstream of this sub-watershed are shown in Table 108.

TABLE 108
NEW HOPE SUB-WATERSHED IMPLEMENTATION PROGRAM

Implementation Item	Implementation Year(s)	Annual Cost	Total Cost	Funding Source
Education	2019-2028	$20,000	$200,000	Plymouth
Regulatory Program	2019-2028	$25,000	$250,000	Plymouth
Street Sweeping	2019-2028	$150,000	$1,500,000	Plymouth
Drainage System Inspections	2019-2028	$25,000	$250,000	Plymouth
Pond Maintenance	2019-2028	$150,000	$1,500,000	Plymouth

Conclusions

The New Hope Sub-Watershed does not have an impaired water directly in the sub-watershed. The city will continue to implement a number of nonstructural, programmatic, and structural solutions to improving water quality in the water bodies within this sub-watershed.

APPENDIX B – REGULATORY AND COMPLIANCE PROGRAM

To protect water resources and to address impaired waters, the City has established a regulatory and compliance program consisting of 12 controls including water quantity, water quality, erosion control, wetland, public participation, monitoring, recreation, maintenance, groundwater, and finance. Additionally, the City has goals for shallow lakes, deep lakes, and streams. Stakeholders may be subject to some or all of these controls. These controls were established in accordance with the purposes of the water management programs required by State Statute Sections 103B.201 – 103B.251. Furthermore, they are in conformance with the regulatory programs of the watershed management organizations with some level of jurisdiction in Plymouth including the Bassett Creek, Elm Creek, and Shingle Creek WMOs and the Minnehaha Creek Watershed District.

City policies are indicated for each control of the regulatory and compliance program, followed by requirements to maintain compliance with each policy.

WATER QUANTITY (FLOOD CONTROL)

Reduce the potential for flooding and minimize related public capital and maintenance expenditures necessary to control excessive volumes and rates of runoff.

- For projects which create over one acre of new or fully reconstructed impervious surface, pre-project flow rates shall be maintained or reduced for the 2, 10, and 100-year storm events.
- NOAA Atlas 14, Volume 8, subsequent updates, or approved equal, be used to calculate precipitation amounts and stormwater runoff rates.
- The City encourages regional detention areas, whenever practical.
- Emergency overflows, outlets to drainage systems or other provisions shall be provided pursuant to the City Engineering Guidelines.
- Encroachment into the flood plain and flood way (volume) below 100-year flood levels shall be prohibited without mitigating action that will preserve

the storage capacity, prevent a surcharge in the flood profile, and minimize excessive velocities.

- The minimum building elevation (lowest floor elevation) for all structures must be two feet above the established 100-year water level in accordance with Plymouth Engineering Guidelines.
- Increased volumes of runoff due to development or redevelopment should be minimized by limiting impervious cover and encouraging infiltration of storm water where soil conditions are appropriate or modifiable.
- The City shall acquire easements covering ponds, wetlands, flood plains, streams, and ditches as part of land development proposals.
- The City shall maintain the drainage system for flood prevention and water flow including excavation, facility management, stream and channel restoration, and removal of debris obstructing water conveyance facilities.
- The City shall promote disconnection of on-site impervious surfaces to the City's drainage system.

WATER QUALITY

The City accepts the Minnesota Pollution Control Agency's Minimal Impact Design Standards (MIDS), or an approved equal as the approved water quality design standard for new, redevelopment and linear projects within the City. MIDS will help to achieve water quality standards and meet Total Maximum Daily Load (TMDL) allocations for shallow and deep lakes, streams and creeks. The City supports the emphasis of MIDS on keeping the raindrop where it falls in order to minimize stormwater runoff, pollution and preserving our natural resources. All best management practices and site design specifications shall conform to the current version of the Minnesota Stormwater Manual.

- Best management practices shall be designed based on the current version of the Minnesota Stormwater Manual.

- The City shall maintain a response plan to minimize the impact of hazardous spills in accordance with the current version of the Minnesota Pollution Control Agency's MS4 Permit.
- The City shall supplement its regulatory approach with an education-based approach to achieve proper yard care measures that will reduce nutrient loadings to lakes, creeks and wetlands and to reduce the impacts of animal waste.
- The City shall promote the reduction or minimization of impervious areas.
- The City will balance protection of wetlands, use of wetlands to protect the water quality of other water resources (i.e. other wetlands, lakes, streams), and use of wetlands to provide flood control.
- The City will manage its properties in accordance with appropriate and innovative BMPs as an example for its citizens.
- The City requires that NOAA Atlas 14, Volume 8 be used to calculate precipitation amounts and stormwater runoff rates.
- The City will provide plans for best management practices constructed within the City to the BCWMC annually, and upon request.
- The City will collaborate with the BCWMC to determine responsibilities for major rehabilitation and replacement of the Flood Control Project features.
- The City will continue to work towards the goals listed in the Shingle Creek and Twin Cities Metropolitan Area Chloride Total Maximum Daily Loads.

EROSION CONTROL

The City will minimize the loss of soil into wetlands, lakes, streams and creeks through plan review, education, enforcement and management.

- All erosion and sediment control requirements shall conform to the current requirements of the Minnesota Pollution Control Agency's General Permit for Small Municipal Separate Storm Sewer Systems (Permit No. MNR040000), the Minnesota Pollution Control Agency's General Permit for Construction Activity under the National Pollutant Discharge Elimination System / State

Disposal System Program (Permit No. MNR10001) and the Minnesota Stormwater Manual.

- Erosion control plans shall be required for grading activities in excess of 50 cubic yards or 10 cubic yards in a shoreland district.
- The City shall continue implementing an erosion control enforcement program for all properties in Plymouth. New, redevelopment and linear projects will receive a higher priority than single family homes.
- The City shall use regulatory measures to control erosion and sediment to extend the effective life of water resource facilities and to reduce pollutant loadings.
- The City will annually report compliance with erosion and sediment control requirements as required by the Minnesota Pollution Control Agency's General Permit for Small Municipal Separate Storm Sewer Systems (Permit No. MNR040000) and the Minnesota Pollution Control Agency's General Permit for Construction Activity under the National Pollutant Discharge Elimination System / State Disposal System Program (Permit No. MNR10001) to the BCWMC annually, and upon request.

WETLANDS

The City will provide for wetland protections consistent with State and Federal law and improve the wetland functions and values within the city, where feasible.

- The City shall administer wetland protection and mitigation in accordance with the Minnesota Wetland Conservation Act, as amended, and the City's wetland regulations as described in the City of Plymouth Zoning Ordinance – Wetlands District.
- Wetland Buffers classifications as described in the City Zoning Ordinance – Wetlands District translate according to the following:
    - Exceptional ⟷ Preserve
    - High ⟷ Manage 1

  - Medium ⟷ Manage 2
  - Low ⟷ Manage 3

- Wetlands classified as Preserve are to be inspected annual for invasive vegetation and should be controlled or treated, where feasible.
- Wetland Bounce, Inundation and Runout Control will be regulated as described in the City of Plymouth Zoning Ordinance – Wetlands District
- For development which creates more than 1.0 acres of impervious surface, water quality treatment must be provided prior to discharge to wetlands.
- The City will encourage the use of wetland banking as the primary means to satisfying wetland mitigation requirements.

PUBLIC PARTICIPATION, INFORMATION, AND EDUCATION

The City will continue to increase public involvement and knowledge in management and protection of water resources through public participation and education.

- The City will use a public involvement process in resource management decision-making (ex. the Environmental Quality Committee).
- The City will use a variety of media, including newsletters, brochures, local cable television, social media and the City's web site, to inform the community about surface water issues.
- The City will work with existing government and non-government organizations to increase public participation and education in surface water management.
- The City will establish model interpretive sites for public education.
- The City will continue to manage public education grant and rebate programs, including but not limited to, programs for alternative landscapes and water efficiency.
- The City will highlight water quality issues at City sponsored and community events.

- The City will provide speakers and workshops for property owners on shoreline, landscaping and yard care BMPs to protect water quality.

MONITORING

The City will continue to support a comprehensive water resources monitoring program to help identify progress towards meeting water quality goals and allocations assigned by Total Maximum Daily Loads (TMDLs). Water Quality parameters include, Total Suspended Solids (TSS), Total Phosphorus (TP), Nitrogen (N), Chloride (Cl) and may include additional parameters.

- The City will conduct in-lake and stormwater flow monitoring programs to develop baseline and long-term water quality records for all city lakes, as well as Bassett, Elm, Plymouth, and Shingle Creeks.
- The City will cooperate with all public agencies to conduct monitoring projects.
- The City will assist with citizen monitoring programs as opportunities arise.

MAINTENANCE AND INSPECTION

The City will preserve the function, quantity, and quality of water resource facilities through routine inspections, regular maintenance activities, compliance with MS4 permitting, and administration of the Minnesota Wetland Conservation Act.

- The City will inspect its drainage system to be in compliance with the most recent version of the Minnesota Pollution Control Agency's General Permit for Small Municipal Separate Storm Sewer Systems (Permit No. MNR040000), the City's Pond Maintenance Policy and BCWMC Flood Control Projects.
- The City shall require maintenance of privately owned and operated water quality treatment ponds and water quality best management practices as outlined in any applicable maintenance agreement(s).
- The City shall require adequate access to public and private surface water facilities (ponds, rain gardens, underground storage areas etc.) for inspection and maintenance purposes.

RECREATION, FISH, AND WILDLIFE

Support water recreation activities and improve fish and wildlife habitat by implementation of programs which will improve water quality.

- Use appropriate BMPs during construction to protect natural areas and wildlife habitat intended for preservation.
- Preserve vegetative buffers around wetlands and riparian areas to provide habitat for wildlife.
- Support programs for controlling exotic and invasive species of plants and animals.
- Design and construct lake outlets to provide a barrier to upstream migration of rough fish whenever practical.
- Balance water recreational activity with water quality and habitat issues.
- Explore new opportunities to integrate surface water-based recreation activities and wildlife interests within wildlife corridors.

GROUNDWATER

Prevent contamination of the aquifers and promote groundwater recharge including water conservation practices to maintain base flows in streams.

- The City shall develop and implement controls to protect identified wellhead areas.
- Infiltration practices shall be implemented in accordance with the NPDES General Construction Stormwater Permit, as amended; MIDS, as amended; and the Minnesota Department of Health (MDH) requirements.
- The City shall promote proper well abandonment.
- The City will consider alternatives to conventional storm water detention to enhance groundwater recharge through infiltration.
- Design and installation of on-site wastewater systems shall be in accordance with the standards set forth in Minnesota Rules, Chapter 7080 and the Individual Sewage Treatment System (ISTS) Act.

- The City will implement and enforce the current Water Emergency and Conservation Plan.
- The City shall promote and demonstrate the use of alternative landscape techniques and materials to reduce dependency on groundwater supplies.
- The City will continue to work towards the goals listed in the Shingle Creek and Twin Cities Metropolitan Area Chloride Total Maximum Daily Loads.

Finance

Regularly evaluate and monitor funding sources used to finance water resources management activities.

- The City shall continue to help fund surface water management through the surface water utility fee.
- The City will actively pursue grants, donations, in-kind contributions, and watershed resources to help fund surface water management.
- The City shall assist citizens and businesses in their efforts to improve water quality, decrease water quantity and/or improve the functions and values of surface water resources.

WATER BODY GOALS (LAKES AND STREAMS)

Shallow Lakes

Shallow lakes are defined as lakes with a maximum depth of 15 feet or less and with 80% or more of the lake area shallow enough to support emergent or submergent rooted aquatic plants (littoral zone). The water quality standards are based on the June 1 to September 30 mean values of water quality monitoring data obtained by MPCA, the City of Plymouth, the watershed management organization (WMO) or any combination of the three units of government.

The goal for all shallow lakes within the City is to have an average total phosphorus concentration of 60 µg/l or less, secchi depths greater than 1 meter and to have chlorophyll-a concentrations below 20 µg/l.

The WMO may have different goals for each lake, however in general, 303d listed lakes will need to work towards meeting the specific goals set forth in the US EPA approved TMDL Implementation Plan. The goal for lakes not listed as a 303d Impaired Water is protection of the resource as to prevent the water body from being listed as impaired in the future.

Shallow Lakes in Plymouth and their US EPA Approved TMDL (as applicable):

TABLE 109
SHALLOW LAKES WITH APPROVED TMDLS

Lake	Impairment	TMDL
Bass	Excess Nutrients	Yes
Cavanaugh	None	No
Camelot	None	No
Curtis	None	No
Gleason	Excess Nutrients	Yes
Hidden	None	No
Kreatz	None	No
Lost	None	No
Mooney	Excess Nutrients	Yes
Pike	Excess Nutrients, Mercury FCA	Yes
Schmidt	Delisted (2014)	Yes
Snyder	Excess Nutrients	Yes
Turtle	None	No

Deep Lakes

Deep lakes are defined as lakes with maximum depths over 15 feet and as having less than 80% of the lake area as shallow enough to support emergent or submergent rooted aquatic plants (littoral zone) The water quality standards are based on the June 1 to September 30 mean values of water quality monitoring data obtained by MPCA, The City of Plymouth, the WMO or any combination of the three units of government.

The goal for all deep lakes within the City is to have an average total phosphorus concentration of 40 µg/l or less, secchi depths greater than 1.4 meters and to have chlorophyll-a concentrations below 14 µg/l.

The WMO may have different goals for each lake, however in general, 303d listed lakes will need to work towards meeting the specific goals set forth in the US EPA approved TMDL plan. The goal for lakes not listed as a 303d Impaired Water is protection of the resource as to prevent the water body from being listed as impaired in the future.

Deep Lakes in Plymouth and their US EPA Approved TMDL (as applicable):

TABLE 110
DEEP LAKES WITH APPROVED TMDLS

Lake	Impairment	TMDL
Hadley	Excess Nutrients	Yes
Medicine	Excess Nutrients, Mercury FCA	Yes
Parkers	Chloride, Mercury FCA	Yes
Pomerleau	Excess Nutrients	Yes

Streams

Streams are important conduits in the water cycle and are instruments in groundwater recharge, and habitat for many aquatic species. Increased rates and volumes of stormwater runoff, resulting from urbanization and other activities, can degrade a stream's hydrology and physical condition. The City shall have water quality goals in streams for E. Coli, dissolved oxygen, chloride, and biotic integrity consistent with State standards.

The WMO may have different goals for each stream, however in general, 303d listed streams will need to work towards meeting the specific goals set forth in the US EPA approved TMDL Implementation Plan. The goal for streams not listed as a 303d Impaired Water is protection of the resource as to prevent the water body from becoming listed as impaired in the future. Streams in Plymouth and their US EPA Approved TMDL (as applicable):

TABLE 111
STREAMS WITH APPROVED TMDLS

Stream	Impairment	TMDL
Bass Creek	Fish and Macroinvertebrate IBI Chloride	Yes
Bassett Creek	Fish and Macroinvertebrate IBI Fecal Coliform[3] Chloride[2]	No
Elm Creek	Fish and Macroinvertebrate IBI E. Coli Dissolved Oxygen Chloride[2]	No
Plymouth Creek	Chloride[2] E. Coli[3]	No

1 Elm Creek TMDL is anticipated to be approved by US EPA in 2016.
2 Chloride impairment for Elm Creek and Bassett Creek will be covered as part of the Twin Cities Metro Area Chloride TMDL (MPCA 2015)
3 E. *Coli* and Fecal Coliform impairment are addressed by the *Upper Mississippi River Bacteria TMDL Study and Protection Plan* (MPCA 2014)

OFFICIAL CONTROLS

Entities currently having some level of administration responsibility within the City of Plymouth include the City of Plymouth, Bassett Creek WMO, Elm Creek WMO, Minnehaha Creek Watershed District, Shingle Creek WMO, Hennepin County, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, Minnesota Board of Water and Soil Resources, United States Army Corps of Engineers, and the Metropolitan Council. Projects that meet the thresholds set by the Bassett Creek, Elm Creek and Shingle Creek Watershed Management Organizations or the Minnehaha Creek Watershed District must also meet the water quality rules in place at the time of application. Additional permits or approvals from the Minnesota DNR, United States Army Corps of Engineers, the Board of Soil and Water Resources and as applicable, Minnehaha Creek Watershed District will be needed if wetland or other water body impacts are identified during the planning stages of the project.

The City's responsibilities include, but are not limited to:

- Comprehensive Plan updates;
- Surface Water Management Plan updates;
- Ordinance review and amendment;
- Local plat review and amendments;
- Permits;
- Administration of the State Wetland Conservation Act;
- Groundwater – Wells;
- Financing Alternatives

Plymouth City Code contains the regulatory procedures and protections for surface water management. Several of the codes that relate to surface water management are incorporated by reference into this plan and are listed below (Table 134).

Updates to City Code or changes to the Surface Water Management Plan may result in a plan amendment.

TABLE 112
OFFICIAL CONTROLS

Official Control	City Code
Floodplain Overlay District	Chapter 21 – Section 21660
Shoreland Management Overlay District	Chapter 21 – Section 21665
Wetland District	Chapter 21 – Section 21670
Erosion Control	Chapter 4 – Section 425 Chapter 5 – Section 526
Storm Drainage Systems	Chapter 7 – Section 725
Natural Preserves	Chapter 8 – Section 811
Preliminary Platting	Chapter 5 – Section 510
Final Platting	Chapter 5 – Section 512

The four watershed management organizations (Bassett, Elm, Minnehaha, Shingle) are responsible for:

- Water Quality, Lake, and Stream Monitoring;
- Local plan review and approval;
- Projects of regional significance;
- Education Activities

APPENDIX C – IMPLEMENTATION PROGRAM

Project or Program	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Chelsea Woods Drainage Improvement (Weston to CR 6)			300,000							
Weston Lane Lift Station Rehabilitation	75,000		475,000							
Wild Wings Drainage Improvement		100,000	100,000							
Harbor Place Erosion Repair		200,000								
St. Mary's Addition Drainage Improvement	125,000									
Mengelkochs First Addition Drainage Improvement	20,000	50,000								
Plum Tree East Drainage Improvement	20,000	250,000								
Schiebers Addition Erosion Repair	20,000	150,000								
Elm Creek Stream Restoration (Hwy 55 to Wayzata H.S.)	663,000									
Ivanhoe/Pheasant Hills Drainage Improvement	100,000									
Meadow Wood Drainage Improvement	250,000									
4th & Zircon Drainage Improvement	110,000									
19th Avenue and Dunkirk Lane Pond Improvement	75,000	250,000								
Maple Creek Stream Restoration		50,000	400,000							
Plymouth Marketplace Drainage Improvement		20,000	80,000							
County Road 9 / Larch Lane Drainage Improvement		75,000	100,000							
Courts/Fields of Nantarre Drainage Improvement		20,000	75,000							
Street Sweeper		350,000								
Palmer Creek Estates Stream Restoration			75,000	350,000						
Ponderosa Woods Stream Restoration					75,000					
Kingsview Heights Drainage Improvement			25,000	125,000						
Schmidt Lake Woods Drainage Improvement			50,000	200,000						
Bass Lake Estates 2nd Addition Stream Restoration				100,000	400,000					
Water Quality Pond Maintenance	75,000	100,000	100,000	100,000	150,000	200,000	200,000	200,000	200,000	200,000
Street Sweeping	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000	175,000
Future Water Resource Improvements			75,000	75,000	200,000	800,000	800,000	800,000	800,000	800,000
Education Programing	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Total	**1,728,000**	**2,110,000**	**1,750,000**	**1,145,000**	**1,020,000**	**1,195,000**	**1,195,000**	**1,195,000**	**1,195,000**	**1,195,000**

Appendix D - ACRONYMS, ABBREVIATIONS & DEFINITIONS

AIS	Aquatic Invasive Species
AMLAC	Association of Medicine Lake Area Citizens
AUAR	Alternative Urban Area-wide Review
BCWMC	Bassett Creek Watershed Management Commission
BMPs	Best Management Practices
BWSR	Minnesota Board of Water and Soil Resources
CAMP	Citizen Assisted Monitoring Program
CLMP	Citizen Lake Monitoring Program
CFS	Cubic Feet per Second
CIP	Capital Improvement Program
CLP	Clean Lakes Partnership
CWA	Clean Water Act
CWF	Clean Water Fund
CWP	Clean Water Partnership
DEED	Department of Employment and Economic Development
DO	Dissolved Oxygen
DS	Downstream
DUP	Duplicate (sample analyzed for water quality parameters)
DWSMA	Drinking Water Supply Management Area
EAW	Environmental Assessment Worksheets
ECWMC	Elm Creek Watershed Management Commission
EIS	Environmental Impact Statement
EPT	Ephemeroptera, Plecoptera, and Trichoptera (invertebrate families)
EQB	Environmental Quality Board
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Studies
FTO	Flexible Treatment Options
GIS	Geographic Information Systems
GPS	Geographic Positioning System
GWMA	Groundwater Management Areas
HBI	Hilsenhoff Biotic Index
ICI	Invertebrate Community Index
JD	Judicial Ditch
JPA	Joint Powers Agreement

LA	Load Allocation
LCA	Local Cooperation Agreement
LCCMR	Legislative-Citizen Commission on Minnesota Resources
LGU	Local Government Unit
LOMA	Letter of Map Amendment
MCES	Metropolitan Council Environmental Services
MCWD	Minnehaha Creek Watershed District
MDH	Minnesota Department of Health
MDL	Minimum Detection Limit
MDNR	Minnesota Department of Natural Resources
MIBI	Macroinvertebrate Index of Biological Integrity
MIDS	Minimal Impact Design Standards
MLCCS	Minnesota Land Cover Classification System
MnRAM	Minnesota Rapid Assessment Method
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPRB	Minneapolis Parks and Recreation Board
MRL	Minimum Reporting Limit
MS4	Municipal Separate Storm Sewer System
MSP	Minneapolis/St. Paul
MSW	Mean Stream Width
MUSA	Metropolitan Urban Service Area
NAPP	National Aerial Photography Program
NCDC	National Climatic Data Set
NFIP	National Flood Insurance Program
NHIS	National Heritage Information System
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NURP	Nationwide Urban Runoff Program
NWI	National Wetland Inventory
OHWL	Ordinary High Water Level
ORP	Oxidation-Reduction Potential
ORVW	Outstanding Resource Value Water
P8	Program for Predicting Polluting Particle Passage through Pits, Puddles and Ponds
PAH	Polycyclic Aromatic Hydrocarbon
PCA	Project Cooperation Agreement
PWI	Public Waters Inventory
RCP	Reinforced Concrete Pipe
RPD	Relative Percent Difference
RUSS	Remote Underwater Sampling Station
SCWMC	Shingle Creek Watershed Management Commission

SDS	State Disposal System
SHPO	State Historic Preservation Office
SRV	Soil Reference Value
SSTS	Individual Sewage Treatment Systems
SSURGO	Soil Survey Geographic Dataset maintained by the NRCS
SWCS	Soil and Water Conservation Society
SWPPP	Storm Water Pollution Prevention Plan
TAC	Technical Advisory Committee
TEP	Technical Evaluation Panel
TIF	Tax Increment Financing
TIV	Tolerance Indicator Value
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TP-40	Technical Paper Number 40 (Rainfall frequency atlas for the US pre-dating Atlas 14)
TRPD	Three Rivers Park District
TSI	Trophic State Index
TSS	Total Suspended Solids
US	Upstream
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VIC	Voluntary Investigation and Cleanup
WAVE	Watershed Assessment and Visioning Exercise
WCA	Wetland Conservation Act
WHEP	Wetland Health Evaluation Program
WHPP	Wellhead Protection Plan
WLA	Waste Load Allocation
WMC	Watershed Management Commission
WMO	Watershed Management Organization
WMWA	West Metro Watershed Alliance
WOMP	Watershed Outlet Monitoring Program
WRAPS	Watershed Restoration and Protection Strategy
XPSWMM	Storm Water Management Model (interface by XP Solutions)