Mississippi River-Twin Cities

Stressor Identification Update
April 2024

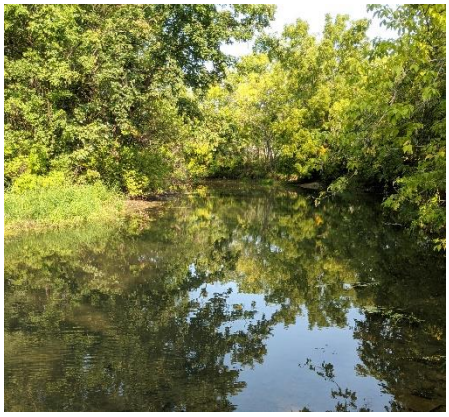


Figure 1: Bassett Creek at site S015-084.

Purpose

Water quality monitoring is essential to determining whether lakes and streams meet water quality standards. These standards are designed to ensure that lakes and streams are fishable and swimmable. Stressor identification (SID) is a process that looks specifically at why fish and bug communities are suffering. The purpose of Cycle 2 (C2) SID work is to perform SID in a way that supports follow-up watershed restoration and protections strategy (WRAPS) efforts and local water planning and implementation efforts, with an emphasis on meeting local partner needs, protection of biotic integrity, and identifying changes in biotic condition.

The Mississippi River-Twin Cities Watershed has many opportunities for recreation such as fishing, canoeing, and hiking. Water quality monitoring, identifying impairments, and completing SID work (Figure 1) helps guide where to implement restoration best management practices (BMPs) and where to protect healthy streams that will help to preserve them for future generations. This SID update focuses on streams, while the Minnesota Department Nature Resources (DNR) will produce a SID document focused on lake SID work for this watershed.

What have we learned about stream health and stressors in the Mississippi River-Twin Cities Watershed?

The Mississippi River-Twin Cities Watershed (Figure 2) faces issues related to altered hydrology and connectivity throughout. Much of this can be attributed to the various flow control structures and barriers that can stop fish migration and limit the consistent flow the stream needs to support aquatic life.

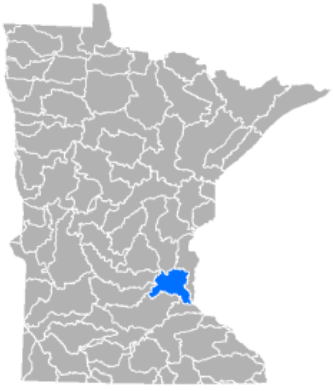


Figure 2: Mississippi River-Twin Cities Watershed

Dissolved oxygen (DO) and eutrophication were also common stressors in this watershed as six of the reaches had confirmed DO stressors, while seven reaches had eutrophication as a stressor. These can be attributed to various sources including land use, stream gradient, and other nonpoint sources.

Habitat (6), suspended solids (3) and chloride (2) were other stressors found in the Mississippi River-Twin Cities Watershed. Habitat restoration, bank stabilization, and improved chloride management activities are needed to enhance water quality conditions in the watershed.

Across the Mississippi River-Twin Cities Watershed, stream Index of Biotic Integrity (IBI) scores for fish improved by an average of nearly eight points. This improvement is encouraging as IBI scores in this watershed tend to be lower when compared to other sites in the same fish class. There was no significant change in macroinvertebrate community condition compared to 2010 monitoring results.

Results of these monitoring efforts indicate that restoration efforts and land management best practices have contributed to improved water quality in several water bodies throughout the watershed.

Nitrate levels in the watershed remained low; however, nutrients were elevated in some of the targeted streams for C2 SID monitoring. Stressors identified in Cycle 1 (C1) such as DO, eutrophication, suspended solids, habitat and altered hydrology/connectivity are still present.

For additional information on the updated conditions of the watershed, see the Mississippi River-Twin Cities-Upper Mississippi River Basin: Water Assessment and Trends Update (MPCA 2023).

Part 1: Mississippi River-Twin Cities Watershed SID Summary Results

C1 monitoring and SID reporting in the Mississippi River-Twin Cities Watershed focused on the biologically impaired reaches in Rush Creek, Minnehaha Creek, Long Lake Creek, Painter Creek, Plymouth Creek, Bassett Creek, Rice Creek, and Fish Creek. C1 monitoring was completed in 2010, with C1 SID monitoring completed by local partners. C2 biological monitoring occurred from 2020-2021 and C2 SID work happened from 2022-2023. See Table 1 for more information regarding these reaches.

Cycle 2 Biological Impairment Summary (MPCA 2023)

- Four new stream sections were found to have impaired macroinvertebrate communities in 2020, bringing the total number of macroinvertebrate impairments in the watershed to 26.
- There was one new stream section that was found to have an impaired fish community in 2021. This brings the total number of stream sections impaired for fish to 19.
- Aquatic life was determined to be fully supported on two new sections of stream in 2020, increasing the total for the watershed to 11.

Cycle 2 Stressor Identification: Areas of focus

The Mississippi River-Twin Cities Watershed is a mid-sized watershed. The SID process focused on several areas to gain additional information needed. The following list of streams were studied during the SID process in C2 and are further detailed in this report. These streams were selected based on impairment status, previous SID work, and local stakeholder input. Some streams needed additional information to understand stressor connections, while others needed information on source assessment for prioritization. The amount of information collected in each subwatershed was highly variable depending on the information needed.

- Minnehaha Creek (07010206-539)
- Painter Creek (07010206-700)
- Long Lake Creek (07010206-712)
- Rush Fish Creek (07010206-606)
- Creek (07010206-528)
- Rice Creek (07010206-583) and (07010206-584)
- Plymouth Creek (07010206-526)
- Bassett Creek (07010206-811)

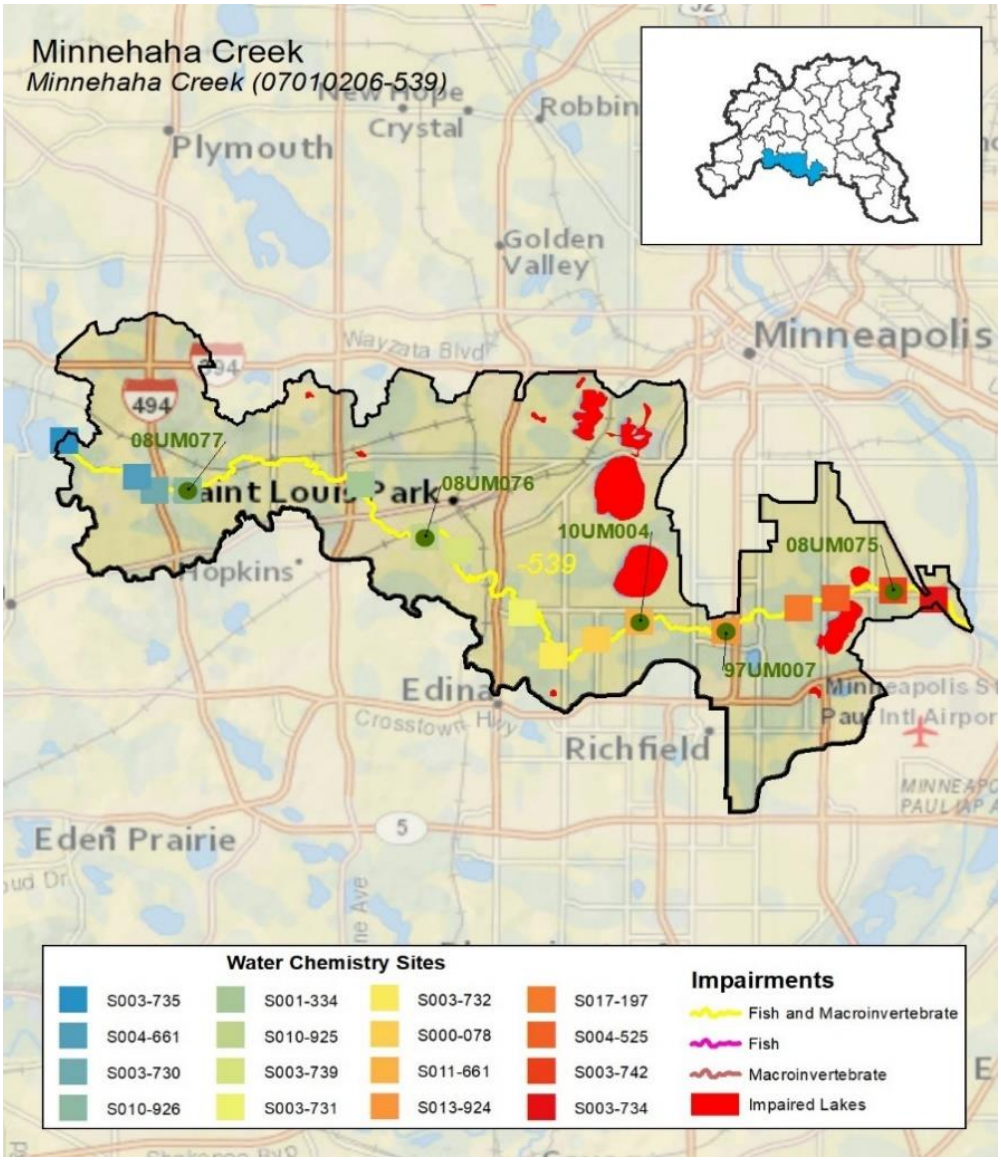
Part 2: Cycle 2 Stressor Identification Stream Reaches

Minnehaha Creek (07010206-539)

Biological Community Summary

Minnehaha Creek (-539), in the Minnehaha Creek Subwatershed (Figure 3), is designated as impaired for aquatic life use due to the poor fish and macroinvertebrate community conditions. The fish community was sampled eight times from 2010-2021 across five biological stations, 08UM075, 08UM076, 08UM077, 10UM004, and 97UM007. The Fish Index of Biological Integrity (FIBI) scores ranged from 13.8 to 46.5 and were all below the Fish Class 2 Southern Streams FIBI threshold of 50. The macroinvertebrate community was sampled frequently from 2010 through 2020 across the same five biological stations. The Macroinvertebrate Index of Biological Integrity (MIBI) scores ranged from 14 to 56. Only site 08UM076 scored above the MIBI threshold of 43 for the respective macroinvertebrate class. The many poor scoring samples led to the macroinvertebrate impairment.

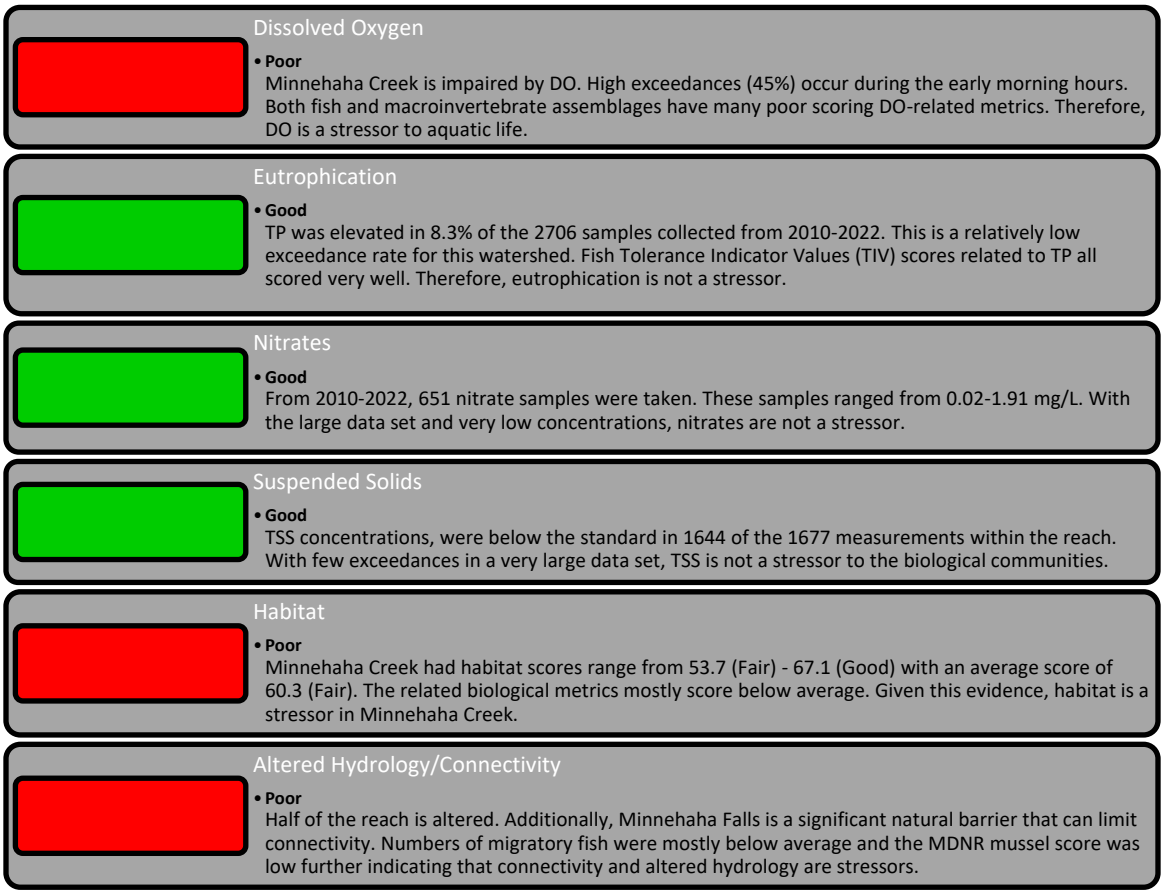
Figure 3: Minnehaha Creek Subwatershed with impairments.



What stressors are of concern?

SID monitoring in the Minnehaha Creek (-539) did not occur during C1. The goal of C2 SID work was to get additional information on DO, eutrophication, nitrates, connectivity, habitat, and stream transparency. C2 SID work focused on and identified DO, habitat, and flow connectivity/alteration as stressors (Figure 4).

Figure 4: Biological stressor determinations for Minnehaha Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.



Summary of stream health

Additional biological and water chemistry data has identified additional focus areas for DO, habitat, and altered hydrology/connectivity stress in Minnehaha Creek. Prioritization of future work should consider these stressor impacts at various locations in the Minnehaha Creek Subwatershed.

DO issues are present in Minnehaha Creek. DO concentrations tend to drop to harmful levels during the early morning hours, mostly in the upper half of the stream reach, which negatively impacts aquatic life.

Habitat scores were better in the upstream portion of the reach. Factors limiting the habitat were the developed land use, and channel morphology (fair channel development, sometimes limited depth variability). Habitat improvement projects could help further develop and provide more diversity to the biotic communities in this reach.

Altered hydrology and connectivity are also significant issues along Minnehaha Creek. The large natural barrier of Minnehaha Falls prevents fish migration from the Mississippi River. Also, the flow

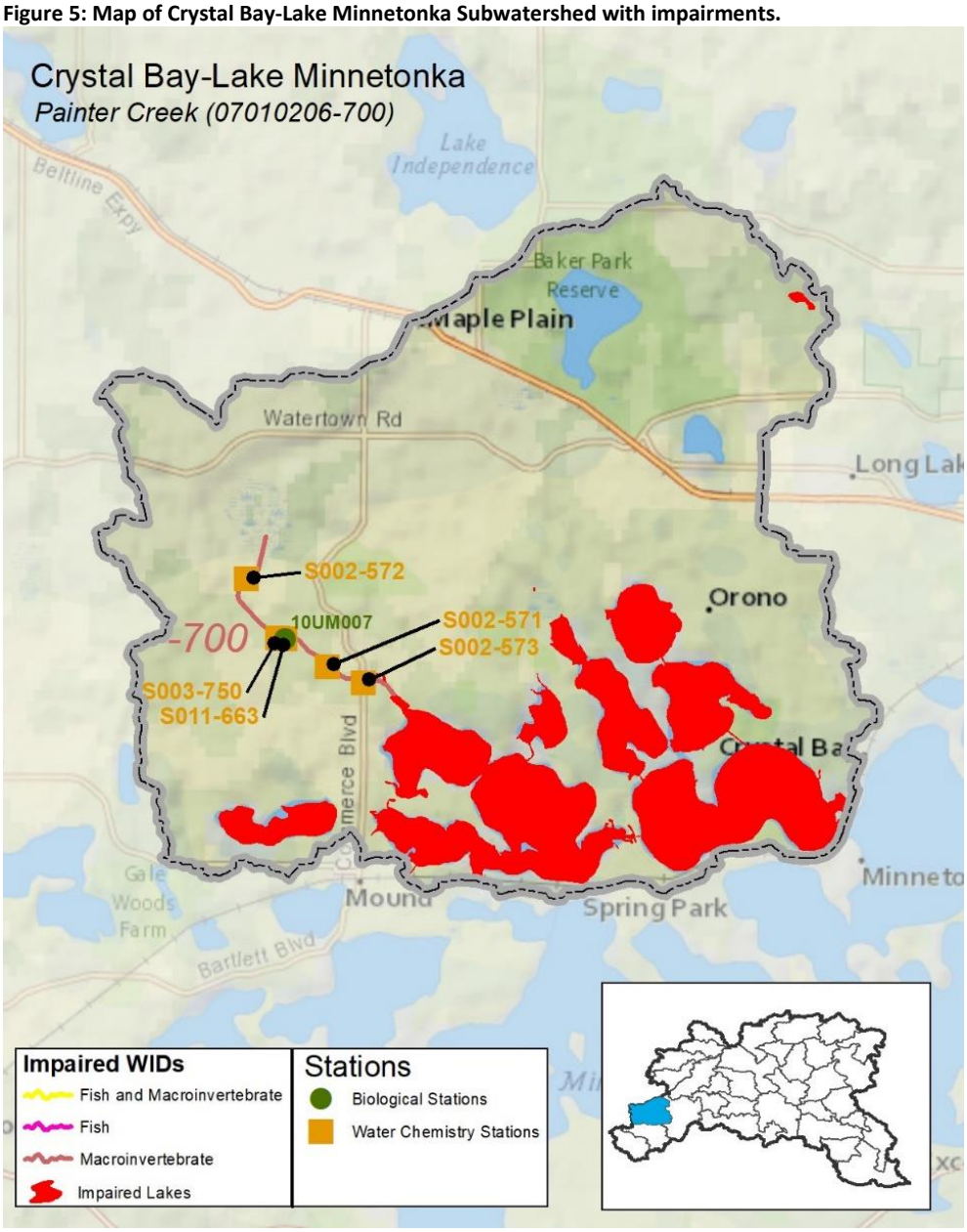
management along this reach can cause areas to dry up and prevent fish movement, especially during dry years or periods of low rainfall.

Painter Creek (07010206-700)

Biological Community Summary

Painter Creek (-700) in the Crystal Bay-Lake Minnetonka Subwatershed (Figure 5) is a 2.34-mile reach that is impaired for aquatic life use due to the degraded macroinvertebrate assemblage. The FIBI score was 67 in 2010 at site 10UM007. This score was above the fish class 3-Southern Headwaters modified use class threshold (33). This site could not be sampled due to low water level conditions in 2021. The MIB scores were 6.5 in 2010 and 26 in 2020, which were well below the macroinvertebrate Class 6-Southern Forest Streams GP MIBI modified use class threshold (30). The extremely low MIBI score in 2010 is likely due to the low flow conditions at the time of sample.

Figure 5: Map of Crystal Bay-Lake Minnetonka Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Painter Creek during C1 SID. The goal of C2 SID work was to get additional information. In this reach, DO, eutrophication, habitat, and altered hydrology were identified as stressors (Figure 6).

Figure 6: Biological stressor determinations for Painter Creek. Red boxes indicate poor conditions and therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.

Dissolved Oxygen

- **Poor**

From 2010-2022, 561 of 893 DO measurements fell below the 5 mg/L standard. Nearly all of the DO related biological metrics for the macroinvertebate community scored poorly. This reach is also impaired by low DO conditions. Therefore, DO is a stressor at this time.

Eutrophication

- **Poor**

Phosphorus levels were elevated in the stream reach with 842 of 896 samples from 2010-2022 above 0.10 mg/L. Given this really high exceedance rate, along with the poor DO conditions, eutrophication is a stressor to aquatic life in Painter Creek.

Nitrates

- **Good**

From 2010-2022, 137 nitrate samples were taken. These samples ranged from 0.02-2.64 mg/L. With the large data set and very low concentrations, nitrates are not a stressor.

Suspended Solids

- **Good**

TSS concentrations were predominantly below the standard in a large data set. Additionally, the majority of the biological metrics related to TSS scored above average. Therefore, suspended solids are not a stressor to aquatic life at this time.

Habitat

- **Poor**

MSHA Scores in Painter Creek were 48.3 (Fair 2010), 39.5 (Poor 2020), and 54.5 (Fair 2021). The majority of the habitat related biological metrics scored poorly in both communites. Therefore, habitat is a stressor to aquatic life.

Altered Hydrology/Connectivity

- **Poor**

Painter Creek has been completely altered. The altered conditions likely contributed to the poor habitat conditions. There are no known connectivity issues

Summary of stream health

Additional water chemistry information taken in 2022 in Painter Creek identified additional focus areas for DO and eutrophication, while habitat and altered hydrology issues were also found to be stressors to aquatic life. Prioritization of future work should consider these stressor impacts at various locations in the Crystal Bay-Lake Minnetonka Subwatershed.

Painter Creek has issues related to eutrophication and DO. Elevated levels of phosphorus can lead to eutrophic conditions (Figure 7) and oxygen depletion. DO levels frequently fell below the standard, while also reaching high levels, which is common in eutrophic streams. Phosphorus levels were often elevated throughout this reach. The amount of wetland areas may be a contributing factor.

Figure 7: Eutrophic conditions at S002-573 on Painter Creek.

Habitat conditions were considered fair in 2009 and then poor in 2019. Limiting the habitat at this site was the predominant fine substrates (sand and silt), no coarse substrates, moderate channel stability, very little depth variability, poor sinuosity, and poor channel development

(no riffles or pools present). Habitat improvement projects could help further develop and provide more diversity to the biotic communities in this reach.

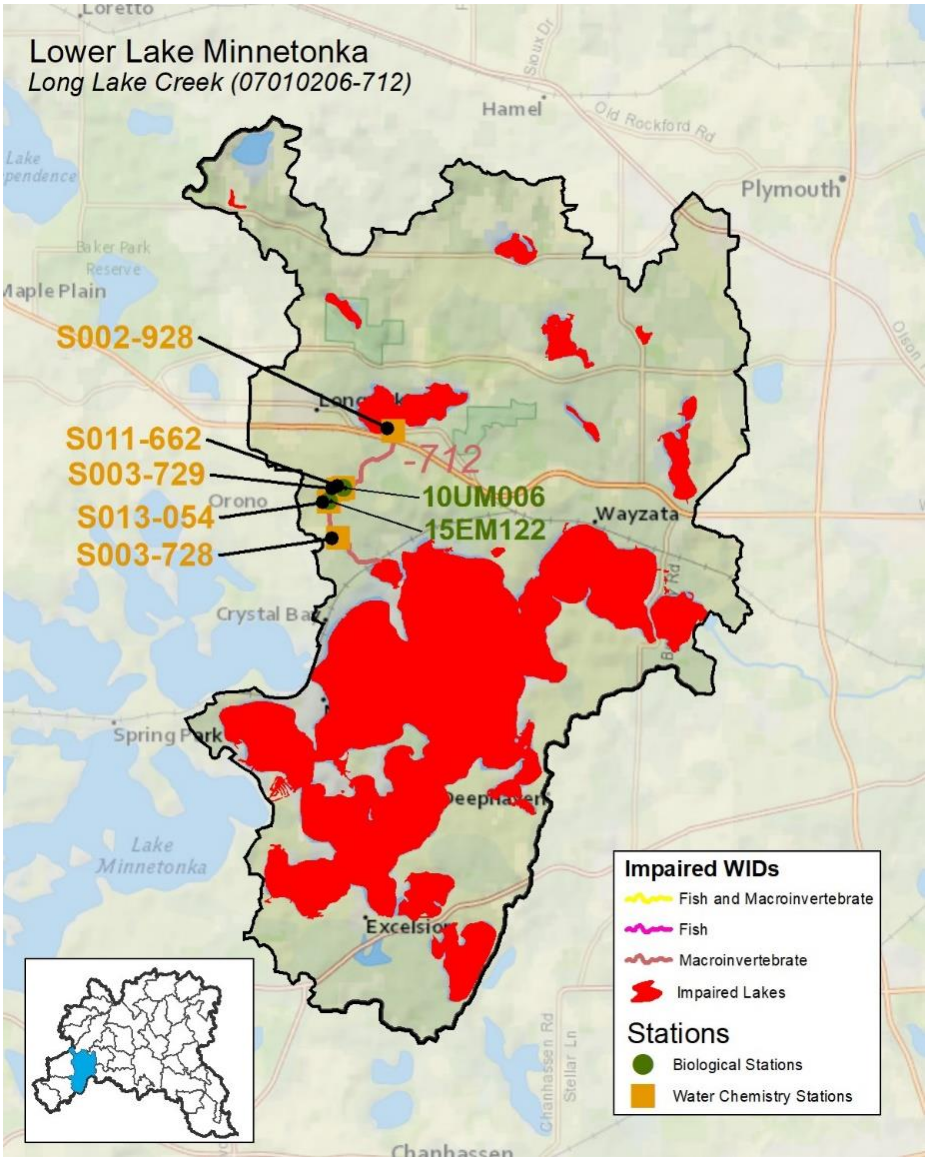
Wetlands in the upper portions of this reach and further upstream can both be a source for excess phosphorus and low DO conditions. Furthermore, these low-lying areas reduce flow and the ability to push silt through a stream system resulting in siltation and degraded habitat conditions.

Long Lake Creek (07010206-712)

Biological Community Summary

Long Lake Creek (-712) is a 2.54-mile reach in the Lower Lake Minnetonka Subwatershed (Figure 8) that is impaired for aquatic life use due to the low macroinvertebrate assemblage scores. The MIBI scores ranged from 18 to 40 during sampling visits in 2010, 2015, and 2020 across two biological stations (10UM006, 15EM122). All scores were below the class thresholds. The macroinvertebrate community was dominated by tolerant organisms such as Hyalella (amphipod), Physella (snail), and Polypedilum (midge).

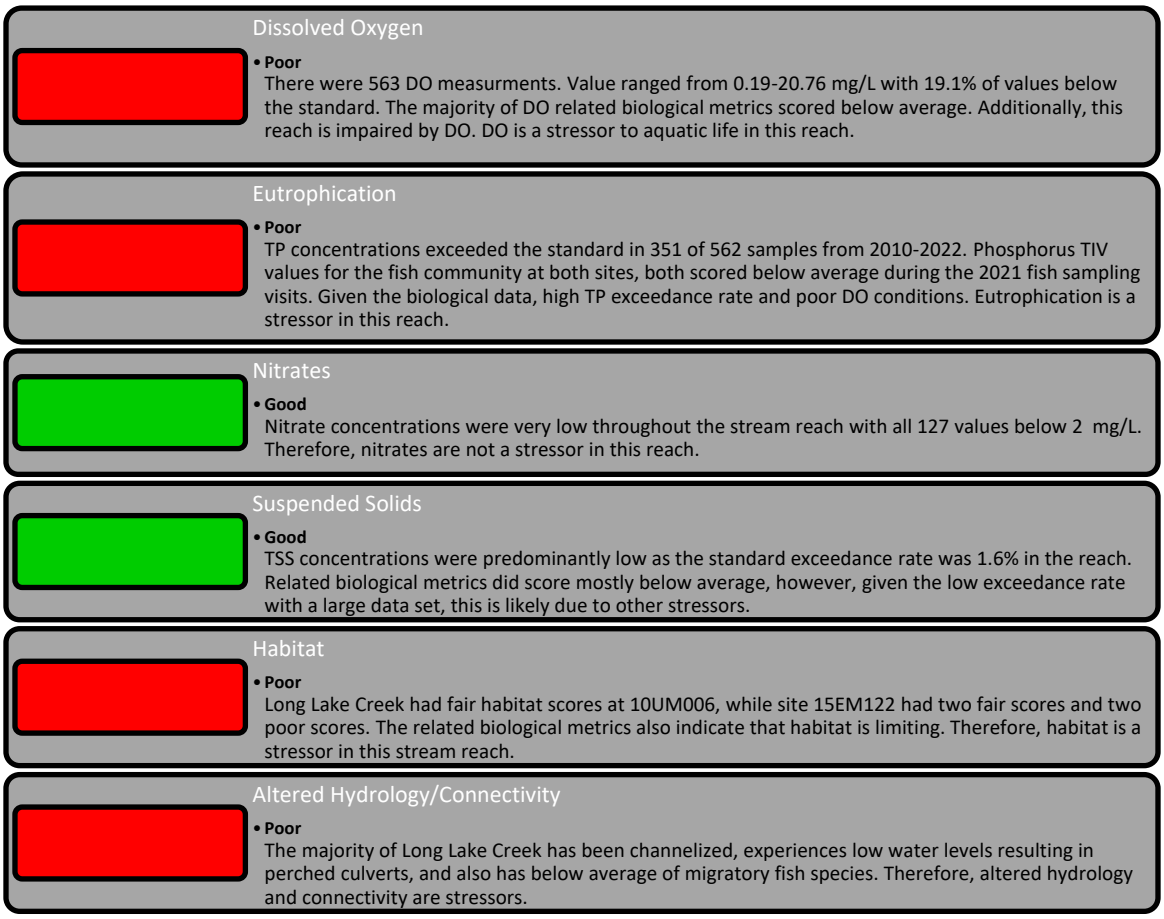
Figure 8: Map of Lower Lake Minnetonka Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Long Lake Creek (-712) during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired macroinvertebrate community. Based on the information collected and analyzed, it was determined that DO, eutrophication, habitat, as well as altered hydrology and connectivity, are the stressors to biology in Long Lake Creek (Figure 9).

Figure 9: Biological stressor determinations for Long Lake Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.



Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Long Lake Creek identified additional focus areas for DO, eutrophication, habitat and altered hydrology/connectivity issues. Prioritization of future work should consider these stressor impacts at various locations in the Lower Lake Minnetonka Subwatershed.

Altered Hydrology is a significant stressor to aquatic life in Long Lake Creek. The prior channelization of this reach has changed the overall flow conditions, often resulting in low flow conditions. These low flow conditions result in perched culverts (Figure 10) further limiting the proper movement of fish communities.

This stream section is impaired by DO. Given this impairment and the poor biological response, DO is a stressor to Long Lake Creek.

Figure 10: Perched culvert on Long Lake Creek.

This reach experiences large swings in DO with very low values (0.19 mg/L) and elevated values (20.76 mg/L). This may be due to the high concentrations of phosphorus in Long Lake Creek. Potential sources of phosphorus in Long Lake Creek are wetlands and stormwater runoff.

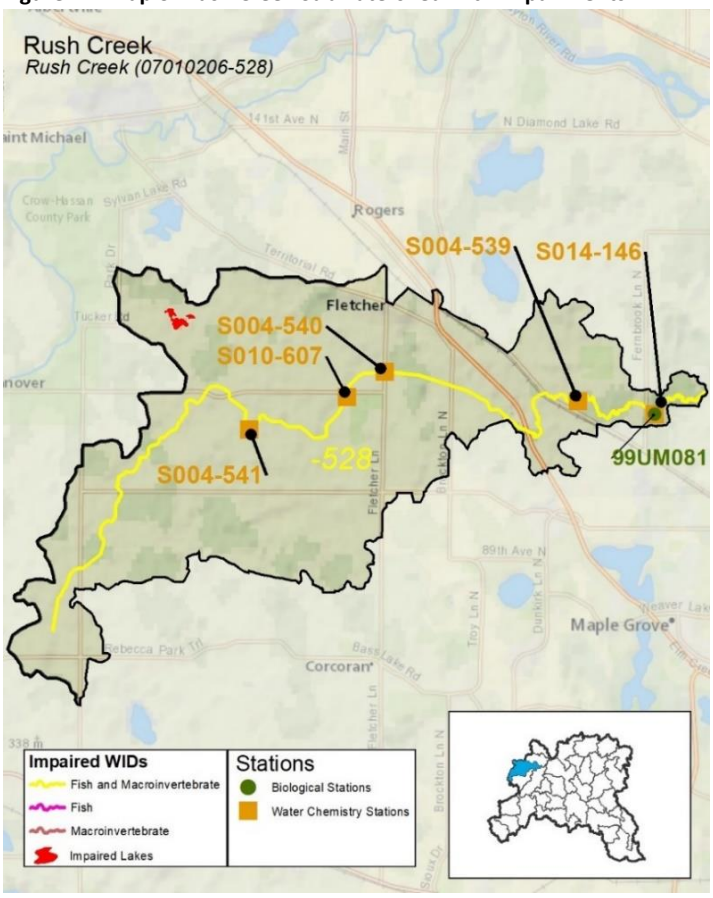
The habitat conditions in Long Lake Creek were poor to fair at both biological stations. This was primarily due to the surrounding developed land use, moderate bank erosion, high amounts of sand and silt substrates, moderate embeddedness, the lack of riffles, fair channel development, and poor channel stability. Poor habitat leads to tolerant and unhealthy fish and macroinvertebrate communities.

Rush Creek (07010206-528)

Biological Community Summary

Rush Creek (-528) in the Rush Creek Subwatershed (Figure 11) is a 16.92-mile stream reach that is impaired for aquatic life use due to the low scoring fish and macroinvertebrate assemblages at its biological monitoring site, 99UM081. The FIBI scores at 99UM081 were 25.0 in 2010 and 44 in 2021. The 2010 score was below and the 2020 score was slightly above the Fish Class 6 Northern Headwaters general use threshold of 42. The MIBI scores at this site were 42.6 in 2010 and 49.1 in 2020. The 2010 score was below and the 2020 score was above the Macroinvertebrate Class 6 Southern Forest Streams GP general use threshold of 43. With both assemblages very close to their respective class thresholds, the decision was made to keep this aquatic life impairment due to the documented DO and nutrient issues as well as the Biological Condition Gradient (BCG) score of 4, which suggests an impacted stream either impaired or on the cusp of impairment.

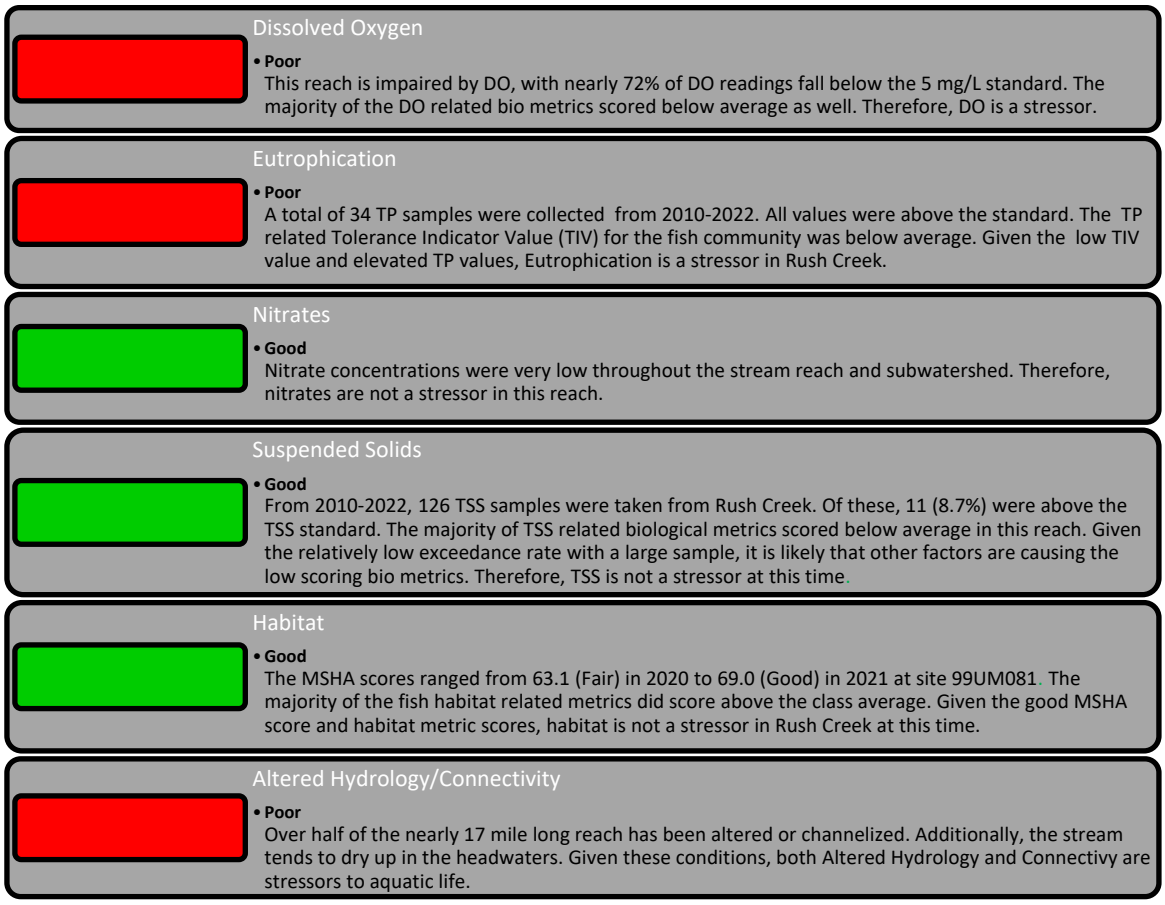
Figure 11: Map of Rush Creek Subwatershed with impairments.



What stressors are of concern?

SID work was completed in Rush Creek during C1 SID. This effort determined that DO, eutrophication, and suspended solids were stressors to aquatic life. The goal of C2 SID work was to gather and analyze the biological and chemical data to confirm these stressors as well as evaluate other potential stressors to the impaired fish and macroinvertebrate communities. The latest SID work found DO and eutrophication to still be stressors as well as altered hydrology and connectivity. Suspended solids are not a stressor at this time. For further details of the stressors, see Figure 12.

Figure 12: Biological stressor determinations for Rush Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.



Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Rush Creek has determined that Rush Creek is still negatively impacted by the excess amount of nutrients in the stream system. These eutrophic conditions also negatively impact DO concentrations. Altered hydrology and connectivity were also found to be stressors to aquatic life. Habitat conditions in this reach were good and not limiting the biotic communities.

All phosphorus samples were above the standard, while chlorophyll-a samples exceeded the standard 17.1% of the time. These high concentrations are leading to eutrophic conditions (Figure 13) in this reach. The presence of wetlands along this reach may also be contributing to these conditions. Increasing stream riparian areas could be a potential solution to limiting nutrients entering the stream system.

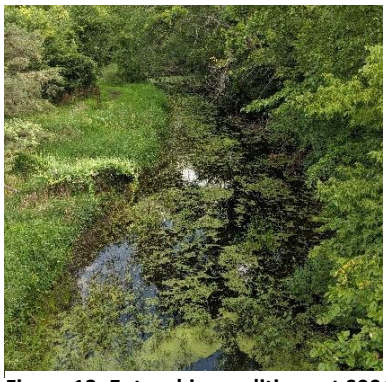


Figure 13: Eutrophic conditions at S004-539, downstream of Territorial Road.

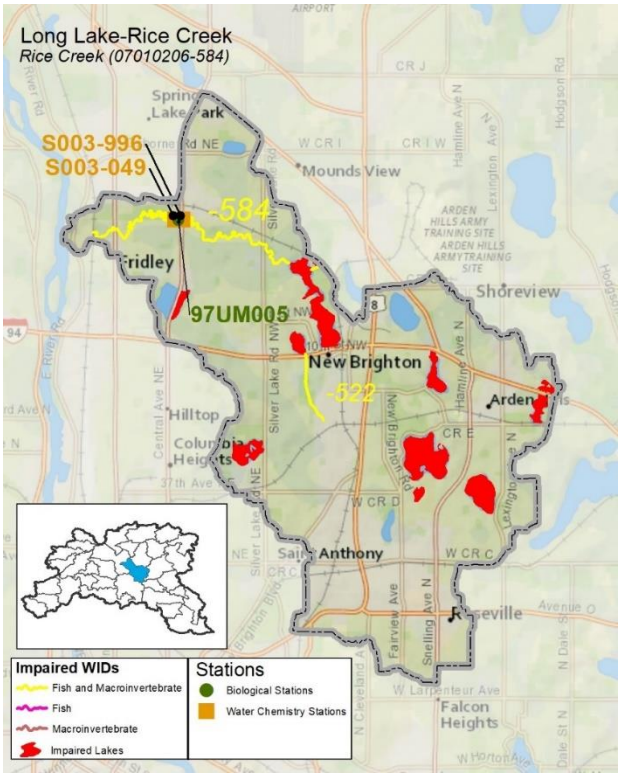
Most of Rush Creek has been altered at some point. These changes often have an impact on the consistent flow of the stream system. The headwaters of this reach consistently goes dry during the summer months impacting connectivity. Incorporating BMPs focused on maintaining consistent flow throughout the reach would help reduce dry or stagnant conditions that are conducive to algal growth.

Rice Creek (07010206-584)

Biological Community Summary

Rice Creek (-584), in the Long Lake-Rice Creek Subwatershed, is a 5.75-mile stream reach that is impaired for aquatic life use due to the low scoring fish and macroinvertebrate assemblages at biological monitoring site, 97UM005. The FIBI scores at 97UM005 were 25.2 in 2010 and 28.44 in 2021. These scores were both below the Fish Class 5 Northern Streams general use threshold of 47. The MIBI score at this site was 7.5 in 2010 and increased to 21.8 in 2020, which are well below the Macroinvertebrate Class 5 Southern Streams general use threshold of 37. See Figure 14 for a map of Long Lake-Rice Creek Subwatershed.

Figure 14: Map of Long Lake-Rice Creek Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Rice Creek during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired fish and macroinvertebrate communities. Eutrophication and connectivity were the identified as stressors in this reach. DO levels were at acceptable levels, nitrate concentrations were very low, and the habitat in this reach was deemed suitable for aquatic life. See Figure 15 for more details regarding the stressor decisions in this reach.

Figure 15: Biological stressor determinations for Rice Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.

Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Rice Creek has pointed to the importance of connectivity. Barriers that limit fish migration can change fish community dynamics upstream of the barrier. Eutrophication and connectivity stressors were present along this reach.

Total phosphorus values exceeded the standard at a very high rate in Rice Creek. This high exceedance rate is likely having a negative impact on the biotic assemblages. Immediately upstream of this reach, Long Lake is impaired by nutrients and is a likely source for the elevated phosphorus concentrations in this reach. Additionally, connections to eutrophic stormwater ponds are a potential source of stress. Reducing phosphorus inputs to Locke Lake, Rice Creek, and further upstream in this subwatershed is a priority.

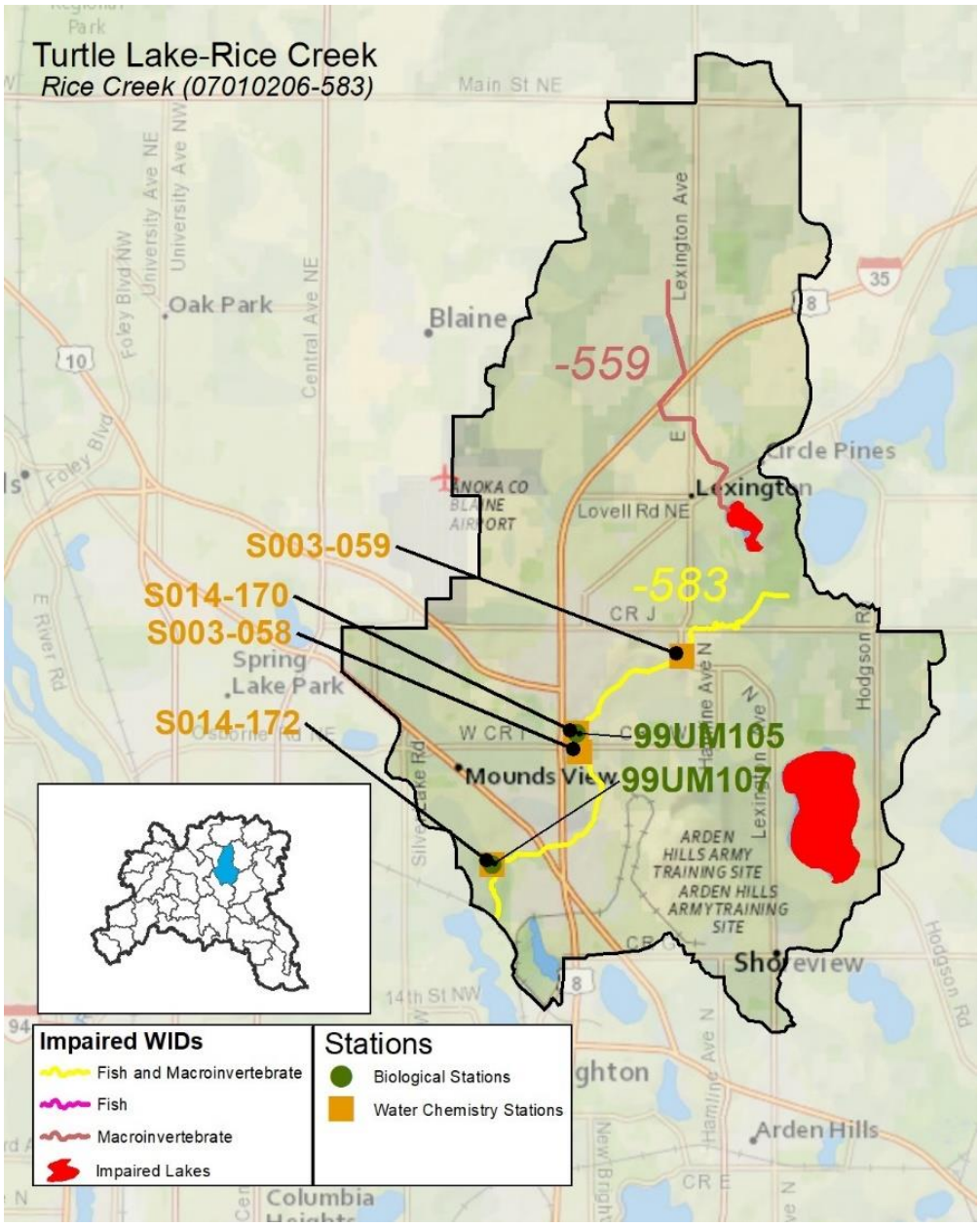
Connectivity is a stressor in Rice Creek. The dam located at the outlet of Locke Lake acts as a barrier and prevents fish migration from the Mississippi River and Rice Creek.

Rice Creek (07010206-583)

Biological Community Summary

Rice Creek (-583) in the Turtle Lake-Rice Creek Subwatershed (Figure 16) is a 5.99-mile stream reach that is impaired for aquatic life use due to the low scoring fish and macroinvertebrate assemblages at its two biological monitoring sites, 99UM105 and 99UM107. The FIBI score at 99UM105 was 27 in 2012 and decreased to 10 in 2021. Site 99UM107 had a FIBI score of 25 in 2021. All scores were below the FIBI threshold of 47. The MIBI score was 33 at both stations, 99UM105 and 99UM107, when sampled in 2020. Both scores were below the MIBI threshold of 43 for these sites.

Figure 16: Map of Rice Creek in the Turtle Lake-Rice Creek Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Rice Creek (-583) during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired fish and macroinvertebrate communities. DO, eutrophication, suspended solids, and habitat were the identified stressors. Nitrate concentrations are very low in this stream reach and there are no nearby connectivity issues. See Figure 17 for more details regarding stressors in Rice Creek (-583).

Figure 17: Biological stressor determinations for Rice Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.

Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Rice Creek showed that eutrophication and DO were significant issues in this reach. Suspended solids and habitat were also determined to be stressors.

The habitat conditions in Rice Creek were best at site 99UM107, downstream of CSAH 77. Habitat seemed to degrade at site 99UM105 dropping 15 points from 2012 to 2021. This drop in habitat is due to the higher abundance of sand and silt substrates found in the reach. Reducing siltation and improving channel morphology will be needed to improve conditions at this site.

Total phosphorus values exceeded the standard at a very high rate in Rice Creek. High phosphorus concentrations can lead to depleted oxygen. DO levels were both very low and very high, which is also a signal for issues related to DO flux, which is common in streams negatively impacted by eutrophic conditions. The high phosphorus concentrations and the extreme DO levels are having a negative impact

on the biotic assemblages. The presence of wetlands and shallow lakes upstream may be potential sources. Additionally, Rice Lake is impaired by nutrients and is located upstream of this reach.

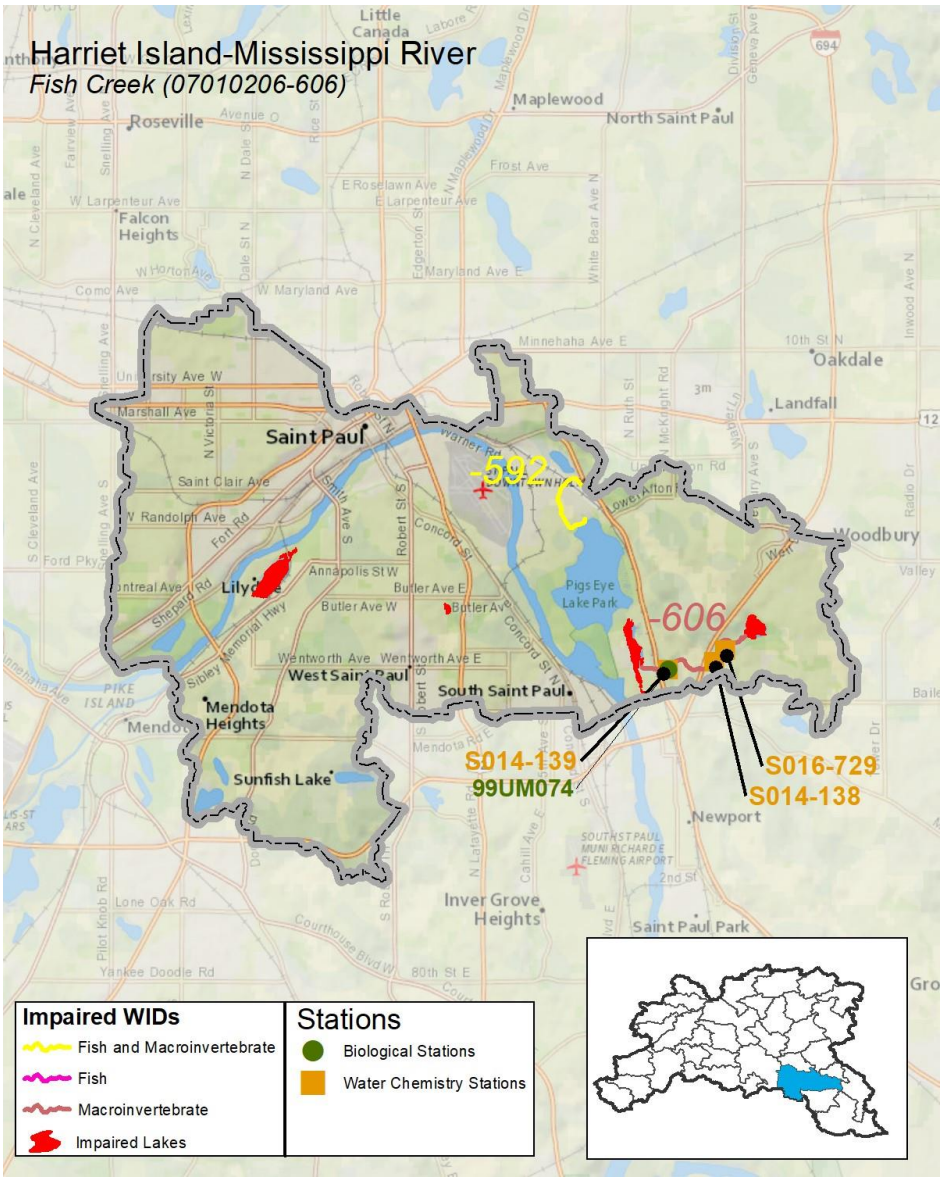
This portion of Rice Creek is also impaired by total suspended solids (TSS). This is a new impairment and will be listed on the 2024 impaired waters list. As a result, further work will be done to help reduce TSS concentrations in this reach.

Fish Creek (07010206-606)

Biological Community Summary

Fish Creek (-606) in the Harriet Island-Mississippi River Subwatershed (Figure 18) is a 2.1-mile stream reach that is impaired for aquatic life use due to the low scoring macroinvertebrate assemblage at its one biological monitoring site, 99UM074. The MIBI scores at this site ranged from 8 to 25, while being sampled annually from 2011 through 2019. These scores are below the Macroinvertebrate Class 5 Southern Rivers RR general use stream threshold of 37.

Figure 18: Map of Harriet Island-Mississippi River Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Fish Creek during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired macroinvertebrate community. Suspended solids, habitat and altered hydrology/connectivity were the identified stressors. See Figure 19 for more information regarding stressors in Fish Creek.

Figure 19: Biological stressor determinations for Fish Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.

Dissolved Oxygen

- **Good**

All 8 of the DO measurements were above the 5 mg/L minimum standard. Many macroinvertebrate taxa intolerant to low DO conditions were present, while limited DO tolerant species were present. Therefore, DO is not a stressor in Fish Creek.

Eutrophication

- **Good**

Out of 8 TP samples collected along this reach, one was above the standard. Very few phosphorus tolerant macroinvertebrate species were present, while one species very intolerant to high TP concentrations was sampled. Therefore, eutrophphication is not a stressor in Fish Creek.

Nitrates

- **Good**

Nitrate concentrations were very low throughout the stream reach with a large data set. Also, there are no obvious sources of potential nitrate pollution. Therefore, nitrates are not a stressor in this reach.

Suspended Solids

- **Poor**

Fish Creek is impaired by TSS due to a high standard exceedance rate. Both Fish and Macroinvertebrate communities reflect a reach stressed by TSS

Habitat

- **Poor**

The MSHA scores were 55.1 (Fair) at 22UM025 and 67.6 (Good) at 99UM073. Biological metrics largely reflected the MSHA scores as the most upstream site, 22UM025 had more poorly scoring metrics. Limitiing habitat at 22UM025 was mainly the predominant sand and silt substrates, fair channel development and fair channel sinuosity. Habitat is a stressor to Fish Creek, especially the upstream portion of this reach.

Altered Hydrology/Connectivity

- **Poor**

Fish Creek is almost entriely a natural stream channel, However, multiple perched culverts were observed along Fish Creek prior to the low conditions observed in 2022.

Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Fish Creek has pointed to the importance of connectivity. Barriers that limit fish migration can change fish community dynamics upstream of the barrier. Additionally, habitat and suspend solids were also determined to be stressors to aquatic life in this reach.

Connectivity is a stressor in Fish Creek. Multiple perched culverts were observed along Fish Creek preventing the upstream migration of fish species (Figure 20). Correcting culvert elevations would improve conditions.

Figure 20: Perched culvert along Fish Creek.

The habitat conditions in Fish Creek seemed to improve with an increase in stream gradient as site 22UM025, upstream of Carver Ave, has a lower gradient resulting in increased deposition with minimal channel development. Tolerant species prefer these degraded conditions. Further

downstream at 99UM073, habitat conditions were improved, and the gradient was higher. Habitat improvement practices aimed at reducing siltation in the upstream portion of this reach are recommended to reduce stress to the biotic communities.

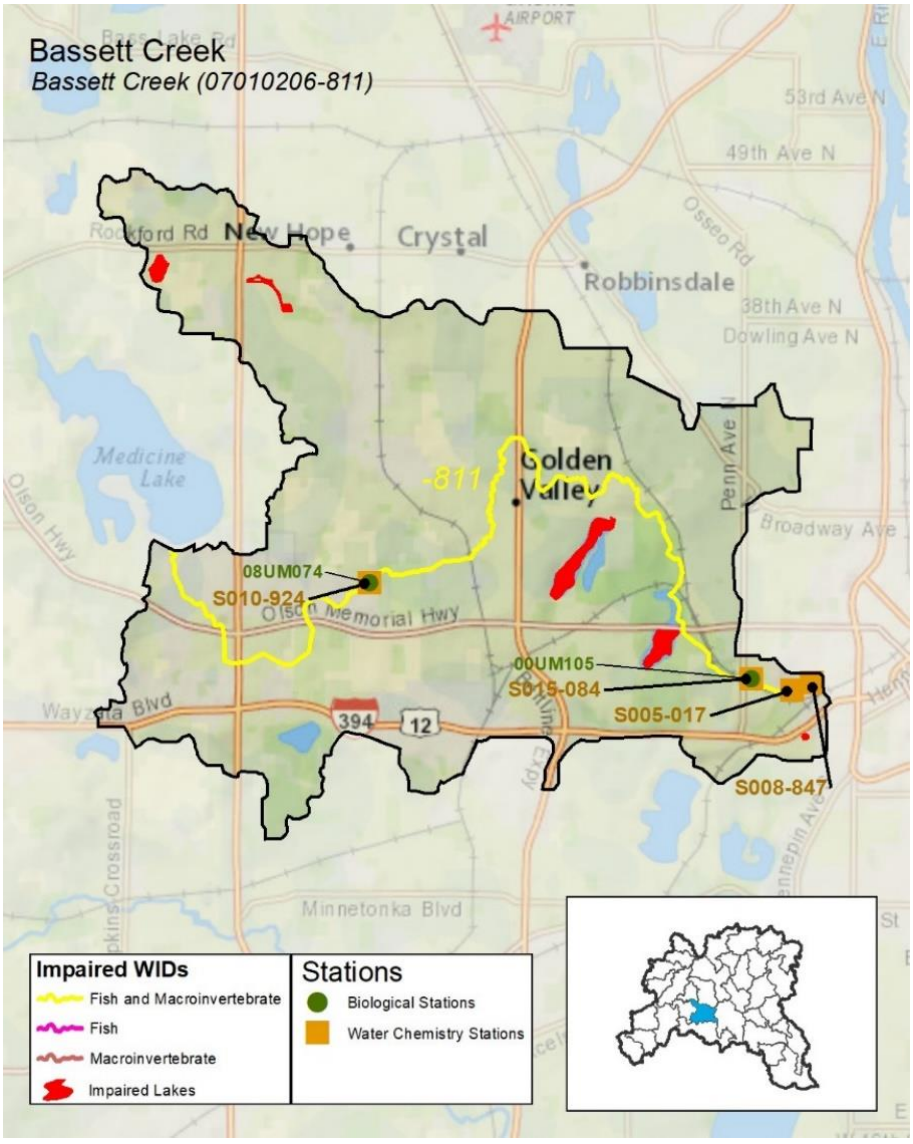
TSSs are also significant problem in Fish Creek as this reach is impaired by TSS.

Bassett Creek (07010206-811)

Biological Community Summary

Bassett Creek (-811) in the Bassett Creek Subwatershed (Figure 21) is a 10.91-mile stream reach that is impaired for aquatic life use due to the low scoring fish and macroinvertebrate assemblages at its two biological monitoring sites, 08UM074 and 00UM105. The FIBI scores at 08UM074 were 21.0 in 2010 and 26.0 in 2021. Site 00UM105 had FIBI scores of 19.0 in 2010 and 16 in 2021. All FIBI scores were below the Fish Class 6 Northern Headwaters threshold of 42. The MIBI scores at these sites were 23.5 (2010) and 10.8 (2020) at site 00UM105, while 23.0 (2010) and 19.9 (2020) at site 08UM074. All visits were below the macroinvertebrate class thresholds for the sites.

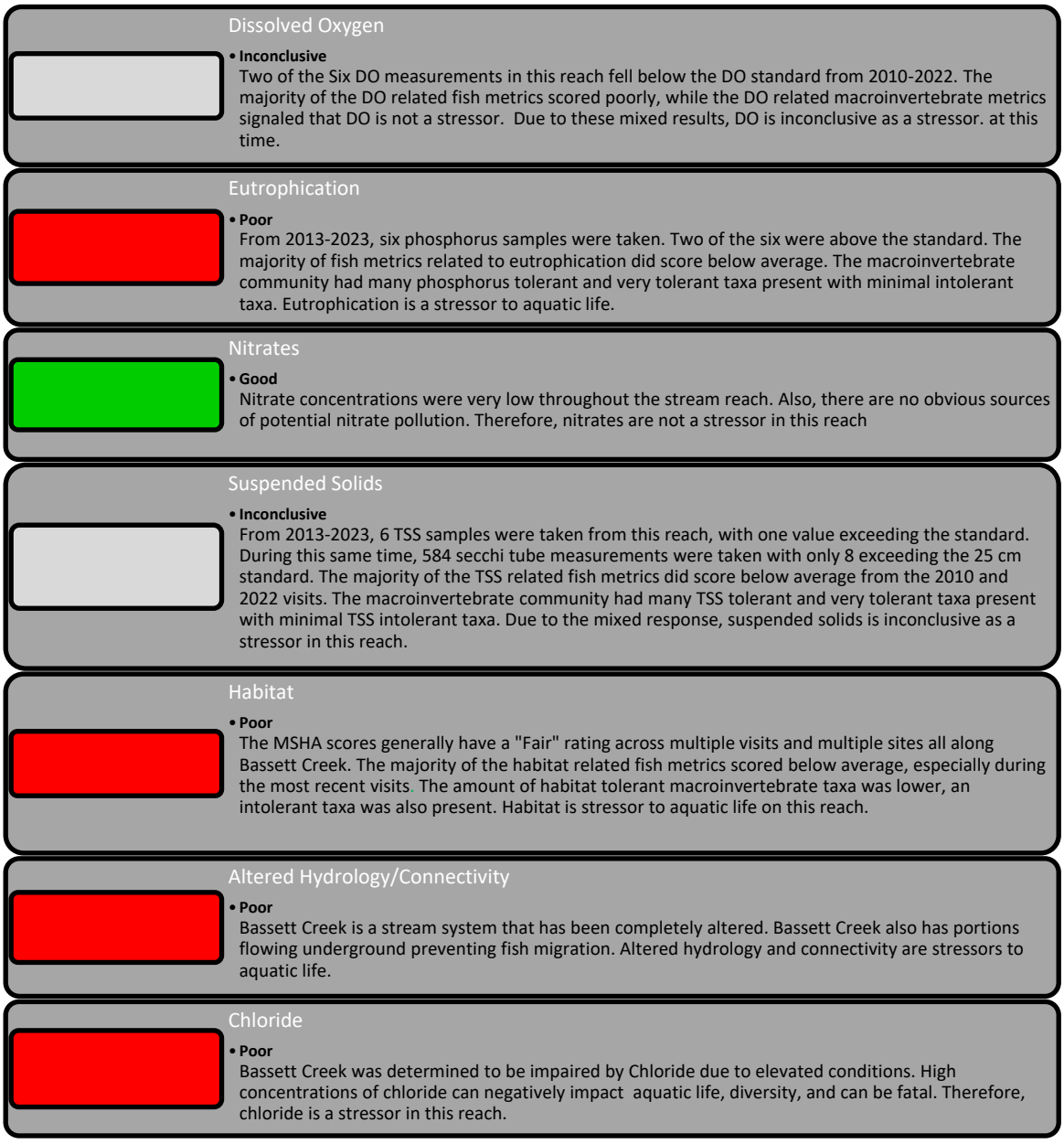
Figure 21: Map of Bassett Creek Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Bassett Creek during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired fish and macroinvertebrate communities. Eutrophication, habitat, altered hydrology/connectivity and chloride were the identified stressors, while suspended solids and DO were inconclusive. More DO and suspended solids data is needed to determine if it is having a negative impact on aquatic life (Figure 22).

Figure 22: Biological stressor determinations for Bassett Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life. Grey boxes indicate that the parameter is inconclusive as a stressor.



Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Bassett Creek has pointed to the importance of connectivity. Barriers that limit fish migration can change fish community dynamics upstream of the barrier. Eutrophication, habitat, and chloride issues were also present along this reach. Additional transparency and DO data are needed to more accurately determine if these candidate causes are stressors in Bassett Creek.

Altered hydrology and connectivity are significant stressors in Bassett Creek. Flow control structures are present along the Bassett Creek system, in addition to the reach flowing underground via the Old Bassett Creek Tunnel. Due to the significant presence and purpose of these structures, which are common in an urban environment, solutions may be difficult to realistically obtain.

Generally, the habitat conditions in Bassett Creek had minimal riparian areas, sparse fish cover, poor to fair channel development, and fair sinuosity. The most downstream site, 00UM105, had an increase in sand and silt substrates, causing moderate siltation and covering coarse substrates suitable for reproduction of healthy and desirable fish species.

Total phosphorus values exceeded the standard at a rate suggesting potential stress in Bassett Creek. Further samples would likely show high exceedance rates, which can have a negative impact on aquatic life. Improving riparian buffers and limiting phosphorus access to the stream will likely lead to much improved conditions regarding eutrophication.

Additionally, Bassett Creek is impaired for aquatic life due to the elevated chloride levels in the stream system. High concentrations of chlorides can be fatal for many fish species. Continued reductions of chloride entering Bassett Creek is needed to improve aquatic life.

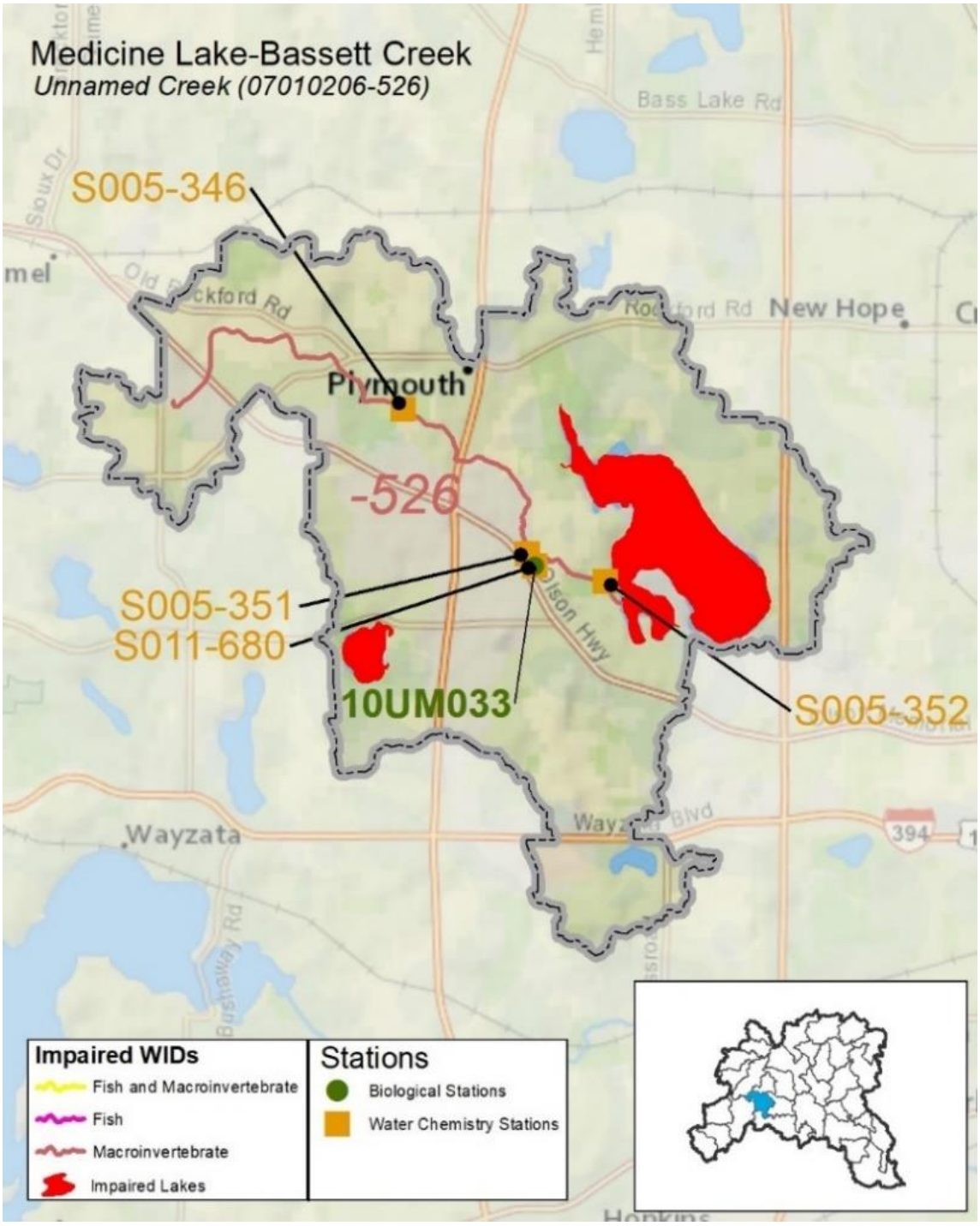
Plymouth Creek (07010206-526)

Biological Community Summary

Plymouth Creek (-526) in the Medicine Lake Subwatershed (Figure 23) is a 5.88-mile stream reach that is impaired for aquatic life use due to the low scoring fish and macroinvertebrate assemblages at biological monitoring site, 10UM033. The FIBI score at 10UM033 was 26.0 in 2010, which is below the Fish Class 6 Northern Headwaters FIBI threshold of 42, resulting in impairment. The MIBI score at this site was 24.9 in 2010 and decreased to 7.7 in 2020. Both scores are well below the Macroinvertebrate Class 5, Southern Streams RR, threshold of 37.0. Further macroinvertebrate sampling done by MPCA partners have also shown repeated MIBI scores below the class threshold.

Additionally, Plymouth Creek (-526) was assessed and is impaired for aquatic life due to the excessive amounts of chloride present in the reach.

Figure 23: Map of Medicine Lake Subwatershed with impairments.



What stressors are of concern?

SID work was not completed in Plymouth Creek during C1 SID. The goal of C2 SID work was to gather and analyze the biological and chemical data to determine the likely cause of stress to the impaired fish and macroinvertebrate communities. DO, eutrophication, suspended solids, altered hydrology/connectivity, and chloride were the identified stressors. Nitrate levels were low on this reach and in the watershed, and the habitat scores were generally good at the biological site on this reach. See Figure 24 for more details related to the stressors of this reach.

Figure 24: Biological stressor determinations for Plymouth Creek. Red boxes indicate poor conditions; therefore, a stressor to aquatic life. Green boxes indicate good conditions and not a stressor to aquatic life.

Dissolved Oxygen

- **Poor**

A total of 57 DO measurements were taken in Plymouth Creek from 2010-2022. Eight of these measurements were below the 5 mg/L minimum standard. The majority of the DO related bio metrics scored below average. Therefore, DO is a stressor.

Eutrophication

- **Poor**

A total of 361 of 568 TP samples collected were above the standard. This is a very high exceedance rate. The biological communities both signalled that eutrophication was an issue as well. Therefore, eutrophication is a stressor.

Nitrates

- **Good**

Nitrate concentrations were very low throughout the stream reach. Also, there are no obvious sources of potential nitrate pollution. Therefore, nitrates are not a stressor in this reach.

Suspended Solids

- **Poor**

Out of 401 TSS samples, 85 samples exceeded that 30 mg/L TSS standard. However, no transparency exceedances were measured in a minimal data set. TSS related fish metrics scored below average, while the macroinvertebrate community had elevated numbers of TSS tolerant taxa, without any TSS intolerant taxa. Suspended solids is a stressor to aquatic life.

Habitat

- **Good**

MSHA scores at site 10UM033 were 67.5 (Good) and 69.2 (Good) in 2010 and 2020. However, habitat related metrics did score below average. Given the good MSHA scores over a 10 year period, the low metric scores are likely driven by other stressors, therefore, habitat is not a stressor in Plymouth Creek.

Altered Hydrology/Connectivity

- **Poor**

The majority of the upper portion of Plymouth Creek is altered. Additionally, flow control structures and barriers are present along the reach that can prevent fish migration.

Chloride

- **Poor**

Plymouth Creek was determined to be impaired by Chloride due to elevated conditions. High concentrations of chloride can negatively impact aquatic life, diversity, and can be fatal. Therefore, chloride is a stressor in this reach.

Summary of stream health

Additional analysis of the biological, water chemistry, and general stream conditions in Plymouth Creek has pointed to the importance of connectivity and altered hydrology. This stressor can also contribute to other stressors as well. Additionally, eutrophication, DO, suspended solids, and chloride issues were also present in this reach.

Barriers that limit fish migration can change fish community dynamics upstream of the barrier. Numerous barriers and flow control structures are present, for various reasons, however, fish migration and flow conditions are still heavily impacted. (Figure 25)

Figure 25: Flow Control Structure on Plymouth Creek.

Suspended solids in Plymouth Creek was determined to be a stressor to aquatic life. The maximum recorded value of TSS was 158 mg/L, which is more than five times the TSS standard.

Total phosphorus values exceeded the standard at a very high rate in Plymouth Creek. This high exceedance rate is likely having a negative impact on the biotic assemblages. These elevated values can

also negatively impact the DO conditions as well. Improving the riparian buffer and limiting phosphorus transport to the stream will likely lead to improved conditions regarding eutrophication.

Additionally, Plymouth Creek is impaired for aquatic life due to the elevated chloride levels in the stream system. High concentrations of chlorides can be fatal for many fish species. Continued reductions of chloride entering Plymouth Creek is needed to improve aquatic life.

Part 3: Conclusion and Recommendations

Summary of Stressors

The stressors for the biological impairments in the Mississippi River-Twin Cities Watershed are listed in Table 1. The most common stressor in the watershed was altered hydrology/connectivity (8), followed by eutrophication (7), DO (6), habitat (6), suspend solids (3), and chloride (3). Nitrates were not found to be a stressor in any of the studied reaches.

Part 3: Conclusion and Recommendations

Table 1: Stressor determinations for the Mississippi River-Twin Cities Watershed.

		Stressors	Dissolved Oxygen	Eutrophication	Nitrate	Suspended Solids	Habitat	Altered Hydrology /Connectivity	Chloride
Stream Name	**AUID**	**Aquatic Life Impairment**							
Cycle 2 SID (2022-2023)									
Minnehaha Creek	07010206-539	Fish, Macroinvertebrates	●	---	---	---	●	●	n/a
Painter Creek	07010206-700	Macroinvertebrates	●	●	---	---	●	●	n/a
Long Lake Creek	07010206-712	Macroinvertebrates	●	●	---	---	●	●	n/a
Rice Creek	07010206-583	Fish, Macroinvertebrates	●	●	---	●	●	---	n/a
Rice Creek	07010206-584	Fish, Macroinvertebrates	---	●	---	---	---	●	n/a
Fish Creek	07010206-606	Macroinvertebrates	---	---	---	●	●	●	n/a
Rush Creek	07010206-528	Fish, Macroinvertebrates	●	●	---	---	---	●	n/a
Plymouth Creek	07010206-526	Fish, Macroinvertebrates	●	●	---	●	---	●	●
Bassett Creek	07010206-811	Fish, Macroinvertebrates	o	●	---	o	●	●	●
Previous SID (2009-2015)									
Coon Creek	07010206-530	Fish, Macroinvertebrates	●	●	---	●	●	●	n/a
County Ditch 17	07010206-557	Macroinvertebrates	---	●	---	o	●	●	n/a
Sand Creek	07010206-558	Fish, Macroinvertebrates	---	●	---	●	●	●	n/a
Unnamed ditch	07010206-594	Macroinvertebrates	---	●	---	●	●	---	n/a
Elm Creek	07010206-508	Fish, Macroinvertebrates	●	●	o	●	o	o	o
Diamond Creek	07010206-525	Fish, Macroinvertebrates	●	●	o	●	o	o	o
Rush Creek, South Fork	07010206-732	Fish, Macroinvertebrates	●	●	o	●	o	o	o
Rush Creek, South Fork	07010206-760	Fish, Macroinvertebrates	●	●	o	●	o	o	o
Hardwood Creek	07010206-596	Fish	●	●	●	●	●	●	o
Shingle Creek	07010206-506	Fish, Macroinvertebrates	●	---	---	---	●	●	o
Bass Creek	07010206-784	Fish, Macroinvertebrates	●	---	---	---	●	●	o
Battle Creek	07010206	Fish, Macroinvertebrates	●	●	---	●	●	o	●

● = stressor; o = inconclusive stressor; --- = not an identified stressor; n/a = not evaluated

Recommendations and Additional Monitoring

In the Mississippi River-Twin Cities Watershed, the most common stressors identified were altered hydrology/connectivity, eutrophication, DO, and habitat. These stressors are largely tied to land use activities in the watershed, as well as human-caused alterations to the stream channel and flow regime. Table 2 contains recommendations of possible solutions to these stressors.

Table 2: Recommended prioritization of restoration activities relative to the stressors contributing to the biological impairment in the Mississippi River-Twin Cities Watershed.

Stressor	Priority	Comment
Habitat	**High**	Habitat improvement projects focused on increasing stream stability, protecting streambanks, reducing erosion, providing more fish cover, as well as increasing riparian buffers and potentially re-meandering channelized stream sections would reduce biological stress.
DO and Eutrophication	**High**	Identify and work on areas needing more flow to increase DO concentrations, while preventing stagnant areas that often result in eutrophication. Limiting hyper-eutrophic stormwater ponds from entering the stream system would help prevent DO and eutrophication stressors. Recognize and work to preserve/expand wetland areas. While wetland areas can contribute low DO downstream, there are other benefits to maintaining these areas, especially in the headwater regions throughout the watersheds.
Flow Alteration/Connectivity	**High**	Altered Hydrology and Connectivity are challenging stressors in a developed urban watershed. Finding stream sections that could be re-meandered can be difficult due to local infrastructure that is in place. Creating streams that are re-meandered would reduce flashy flow regimes, create more channel stability, and improve habitat conditions. Responsible removal of barriers from lakes and streams would encourage more fish movement.
Suspended Solids	**Medium**	Focus on reducing sediment input from riparian corridor and immediate stream channel (stream banks).
Chloride	**Medium**	Focus on reducing chlorides entering the lake and stream systems. Incorporate smart salting techniques and using alternative methods for winter road maintenance will help reduce chlorides from entering water ways.

For more information

WRAPS Updates, including necessary TMDLs, follow the completion of the SID process. For more information, go to https://www.pca.state.mn.us/watershed-information/mississippi-river-twin-cities or search for “Mississippi River-Twin Cities Watershed” on the MPCA website.

Details and specific monitoring information related to the SID analysis of this report is available from the contact person below.

Contact person

Michael Koschak
Minnesota Pollution Control Agency
michael.koschak@state.mn.us
651-757-2504

Document number: wq-ws5-07010206

MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT