SID Update

Medford Creek Watershed

January 2026

The purpose of Cycle 2 stressor identification (SID) work is to perform SID in a way that supports Cycle 2 watershed restoration and protection efforts, with an emphasis on meeting local partner needs, protection of biotic integrity, and identifying changes in biotic condition. Cycle 2 SID work is designed and executed to add value to local partner implementation planning efforts. SID staff will seek to strengthen local partnerships and provide scientific analyses and recommendations in a format and timeframe that is most useful to local partners.

Medford Creek Watershed was identified for Cycle 2 SID work via conversations with local partners and professional judgment from Minnesota Pollution Control Agency (MPCA) staff. Factors that led to selection included:

- Limited chemistry data in the upper part of the watershed.
- Medford Creek is a Tier 1 priority issue/area in the Cannon River Comprehensive Watershed Management Plan (CWMP).

Goals for Cycle 2 SID work in Medford Creek Watershed included:

- Summarize current chemical, biological, and physical conditions and identify changes between Cycle 1 (2011) and Cycle 2 (2022).
- Identify stressors and pollutant sources that are currently impacting biological communities and/or threaten future biological condition.
- Identify any “hot spots” or areas contributing a disproportionate amount of a pollutant.
- Identify and prioritize restoration areas.
- Provide value to local planning efforts.

Cycle 1 SID Summary:

- Cycle 1 SID was conducted on Medford Creek (AUID -547).
- Nitrate and habitat were identified as stressors in Cycle 1 and phosphorus, dissolved oxygen (DO), total suspended solids (TSS), and fish passage were inconclusive. Temperature was not a stressor.

Cycle 2 SID Summary:

- Cycle 2 SID was conducted on Medford Creek (AUID -547).

- Additional data collected after Cycle 1 confirmed the Cycle 1 habitat and nitrate stressors and also identified fish passage and flow alteration as stressors. Eutrophication, DO, and TSS were inconclusive in Cycle 2 and temperature was not a stressor.

This SID update document summarizes biological condition and provides monitoring highlights and stressor conclusions for Medford Creek Watershed. This document is designed to complement existing Cannon River Watershed reports (e.g. the Cannon River Watershed Restoration and Protection Strategy (WRAPS) and Cannon River CWMP), which should also be used to inform watershed work; these documents contain information such as priority issues, priority areas, and pollutant loading data, which are critical in prioritizing implementation work.

Biological Communities

Fish and macroinvertebrate communities in the Medford Creek Watershed are of varying quality; some are impaired and not meeting standards while others are healthy and meeting standards (Table 1, Figure 1). This variability is typical of many small warmwater streams in the region. The lower portion of Medford Creek (station 11LM065) was the only stream reach sampled in Cycle 1 and Cycle 2; fish index of biological integrity (FIBI) and macroinvertebrate index of biotic integrity (MIBI) scores were higher in Cycle 2 (and meeting standards). In general, macroinvertebrates belonging to the family Chironomidae (flies/non-biting midges) dominated the Cycle 2 sample and the fish community was primarily comprised of Cyprinidae (shiners, dace, minnows, stonerollers, chubs) and Percidae (darters).

The biological impairment (fish and macroinvertebrates) is located on Medford Creek (AUID -547); Unnamed Creek (AUID -726) is meeting biological standards. Stations located on the middle portion of Medford Creek (11LM063 and 13LM002) are responsible for the impairment; these stations were not sampled in Cycle 2 but should be considered for future biological sampling to determine if conditions have changed.

Table 1: Fish and macroinvertebrate IBI scores in Medford Creek Watershed.

Waterbody	AUID	Biological Stations	Biological Impairment	Class	FIBI	FIBI Threshol	FIBI Year	MIBI	MIBI Threshol	MIBI Year
Medford Creek	547	10EM075	Fish, Macroinvertebrates	2Bg	70.2	55	2010	44.7	37	2010
					73.3		2010	40.5		2015
					80.1		2015			
		11LM063			39.1	55	2011	30.8	43	2011
					57.7		2013	45.8		2013
		11LM065			69.2	55	2011	37.1	37	2011
					76.2		2022	38.6		2011
					79.7		2022	47.4		2022
		13LM002			40.8	55	2013	26.9	43	2013
Unnamed Creek	726	11LM064		2Bg	65.5	55	2011	48.4	43	2011
					36.8		2013	50.2		2013

Figure 1: Medford Creek Watershed monitoring stations and biological impairments.

Monitoring Highlights

Stream Temperature

- Several instantaneous (point) measurements were collected throughout the watershed in recent years (2013 through 2023), and all were below 30°C (daily average warmwater standard). Also, no recent sonde deployments have occurred, but one was deployed in August 2014 near station S007-482 and all values were below 30°C. The current data indicates suitable stream temperatures for warmwater biota.

Nitrate

- Nitrate samples were collected across the watershed at three stations as part of Cycle 2 SID in 2022 and 2023, with a goal to sample various flow conditions and establish a range of nitrate concentrations (Figure 2). Concentrations ranged from 0.05 to 14 mg/L (average of 7.0 mg/L), and 10 (25%) of the 40 samples were above 10 mg/L (nitrate drinking water standard); worth noting is that draft nitrate standards for aquatic life are in development and the draft proposed chronic standard for warmwater is 8 mg/L (https://www.pca.state.mn.us/sites/default/files/wq-s6-13.pdf). In general, concentrations were elevated across the watershed with each station having multiple samples above 10 mg/L; the highest concentrations were observed in spring/early summer and the lowest concentrations in late summer/early fall. Precipitation has significant influence on concentration dynamics from year to year (magnitude, variability, duration of elevated concentrations, etc.). Nitrate concentrations in the upper portion of Medford Creek (S007-482, average of 9.5 mg/L) were consistently higher than the other stations (S000-501 and S007-481, averages of 5.8 mg/L) and remained elevated throughout the year whereas the other stations dropped off late summer/early fall (Figure 2 and Figure 3). Based on this information, the upper portion of Medford Creek (S007-482) could be considered a priority area for nitrogen reduction. Elevated nitrate tolerant macroinvertebrates have also been documented across the watershed, ranging from 41% to 85% of the community with higher percentages in the upper portion of the watershed (13LM002, 11LM063, and 11LM064). The only Cycle 2 sample (11LM065) was 41%, which is lower than the Cycle 1 samples (58% and 74%).

  In addition, elevated nitrate concentrations were documented across the watershed in 2013 and 2014, ranging from 3.9 to 24 mg/L (average of 12.2 mg/L, 14 samples).

Habitat

- The MPCA Stream Habitat Assessment (MSHA) scores throughout the watershed range from 46.5 (“fair”) to 74.9 (“good”). The lower portion of Medford Creek (11LM065) was the only station sampled in Cycle 2; the Cycle 1 MSHA score was 61.8 and Cycle 2 MSHA scores ranged from 48.3 to 65.3. Bank erosion and embeddedness were documented in Cycle 2 and the amount of cover ranged from “sparse” to “moderate”; a habitat example from biological monitoring in 2022 can be seen in Figure 4. Slightly elevated burrowers and legless individuals were present in Cycle 2 (11LM065), which is often associated with lack of coarse substrate and/or woody debris, excess fine substrate, embeddedness, etc.; most Cycle 2 fish habitat metrics were better than average. In addition, minimal flow/no flow conditions have been documented, which can impact habitat quality and availability (Figure 5). Overall, habitat conditions vary across the watershed and degraded quality and limited availability have been documented.

Fish Passage

- As mentioned above in the habitat section, minimal flow/no flow conditions have been documented in the watershed along with a few perched culverts (Figure 5). These conditions are likely periodic based on climate, but fish passage does appear limited/impacted during low flow years; worth noting is that precipitation from 2021 to 2023 (27.3, 28.5, and 31.4 inches respectively) was below normal (35 inches, Minnesota State Climatology Office website for Medford, Minnesota). Migratory fish from Cycle 2 (2022) sampling at station 11LM065 comprised 9.3% and 9.6% of the community, well below the average (23%) for similar streams. In addition, migratory fish in samples with FIBI scores below the threshold were also below average (12.2% at station 11LM063 and 12.5% at station 13LM002).

Flow Alteration

- Most of the lower to middle portion of Medford Creek is natural channel; however, much of the headwater areas in the watershed are altered and drained via subsurface tile (Figure 6). As previously mentioned, minimal flow/no flow conditions have been documented (Figure 5); these type of flow conditions are common during late summer/fall in altered and drained landscapes. Recent analysis conducted by the Minnesota Department of Natural Resources (DNR) for the Cannon River Watershed identified increasing trends in precipitation and streamflow (DNR 2023). Evaluation of Hydrologic Change (EHC) Technical Summary: Cannon River Watershed). Increases in precipitation and streamflow can impact many variables including habitat and nutrient/sediment loading. Flow alteration is complex and impacts biology in various ways throughout the year (e.g., both high/increased flows and low/no flow time periods can impact biology throughout the year).

TP/ Eutrophication

- Total phosphorus (TP) samples were collected across the watershed at three stations as part of Cycle 2 SID in 2022 and 2023, with a goal to sample various flow conditions and establish a range of TP concentrations (Figure 2). Concentrations ranged from 0.037 to 8.4 mg/L, and 8 (20%) of the 40 samples exceeded the river eutrophication standard for the South Region (0.15 mg/L). Each station had multiple exceedances, with most occurring during elevated flow conditions; extremely high exceedances (4.7 to 8.4 mg/L) were documented at all stations during an event sample in May 2022. In general, TP concentrations were low (below the standard) during low flow conditions. When comparing the similarly sized headwaters stations (S007-481 and S007-482), concentrations were similar during the first half of the year but Unnamed Creek (S007-481) was noticeably higher than upper Medford Creek (S007-482) during late summer/early fall (Figure 3). One chlorophyll-a (chl-*a*; 3.5 µg/L) and BOD (<6 mg/L) sample were collected in 2023 (August) at station S000-501 (near the mouth of Medford Creek); the chl-*a* sample was below the standard (35 µg/L) but it's unknown if the BOD sample was above or below the standard (3 mg/L) due to the lab's reporting limit (6 mg/L). There were no daily DO flux exceedances during the 2014 sonde deployment, but occasional low DO has been documented. Although elevated TP has been documented, it's unclear if excess TP is resulting in eutrophication issues.

DO

- Several instantaneous (point) measurements were collected throughout the watershed in recent years (2013 through 2023), and two (3%) were below the DO standard of 5 mg/L; both exceedances occurred on Unnamed Creek (S007-481) in 2023 (4.5 mg/L in July and 3.8 mg/L in August). In addition, low DO was documented near station S007-482 during a sonde deployment in August 2014; the minimum DO value during that deployment was 3.9 mg/L and concentrations were below 5 mg/L 18% of the deployment. The fish and macroinvertebrates

show minimal signs of DO stress, with generally few low DO tolerant individuals. The probability of meeting the DO standard based on the composition of the fish community ranged from 85% to 94% across the watershed. Overall, DO conditions appear suitable for warmwater biota most of the time, but occasional low DO has been documented.

TSS

- TSS samples were collected across the watershed at three stations as part of Cycle 2 SID in 2022 and 2023, with a goal to sample various flow conditions and establish a range of TSS concentrations (Figure 2). Concentrations ranged from 1.6 to 3,600 mg/L, and 4 (10%) of the 40 samples exceeded the warmwater TSS standard (65 mg/L). All stations had at least one exceedance, and they occurred during elevated flow conditions; extremely high exceedances (2,800 to 3,600 mg/L) were documented at all stations during an event sample in May 2022. In general, TSS concentrations were low (below the standard) during low flow conditions, and concentrations were similar among stations. TSS tolerant macroinvertebrates comprised 20% to 54% of the community; the Cycle 2 sample (11LM065) was 31% (just above the statewide median of 30%). The probability of meeting the TSS standard based on the composition of the fish community ranged from 53% to 64% with the Cycle 2 samples at 63% and 64% (better than the statewide median of 51%). Although elevated TSS concentrations have been documented and some biological indication of TSS stress exists, it's unclear if TSS is a stressor at this time. Regardless, sediment is a concern via habitat loss and degradation from an abundance of fine substrate and embeddedness.

Figure 2: The 2022 and 2023 TSS (brown box plots), TP (purple box plots), and nitrate (green box plots) concentrations (mg/L) in Medford Creek Watershed. The red lines represent the TSS standard (65 mg/L), river eutrophication standard for the South Region (0.15 mg/L), and nitrate drinking water standard (10 mg/L).

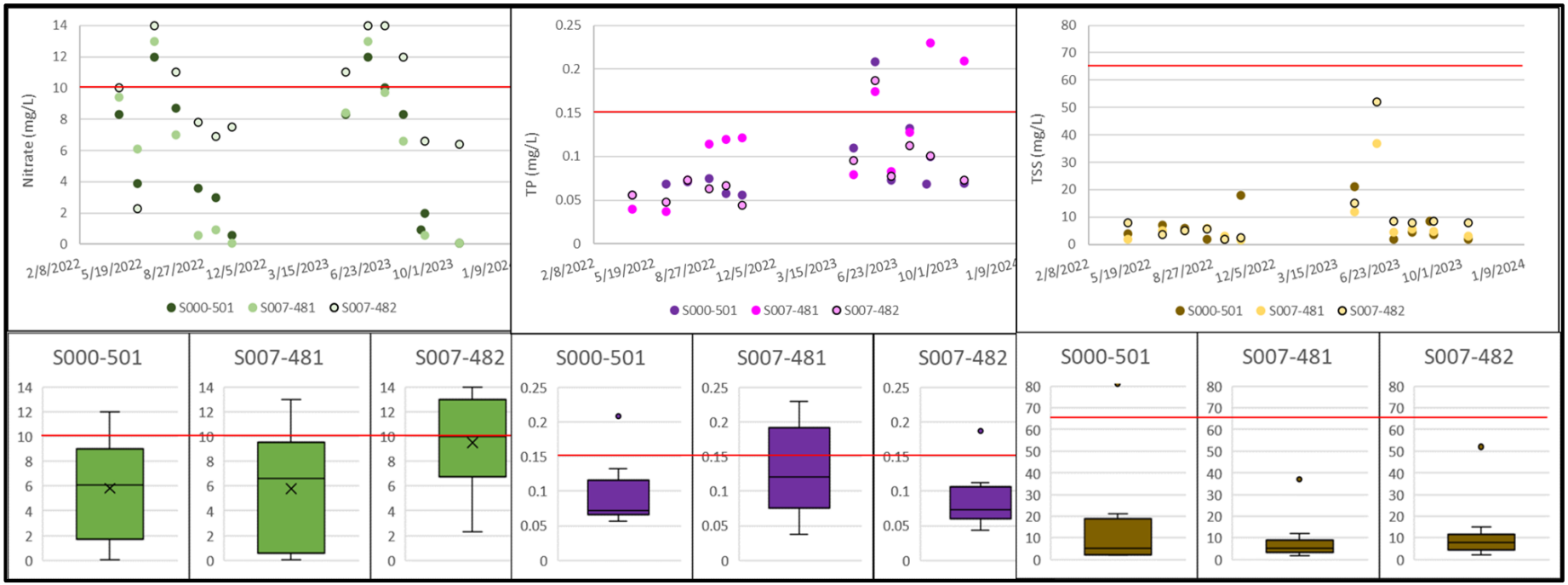


Figure 3: The 2022 and 2023 nitrate, TSS, and TP concentrations in the headwaters area of Medford Creek Watershed (stations S007-481 and S007-482). Nitrate concentrations in the upper portion of Medford Creek (S007-482, average of 9.5 mg/L) were consistently higher than Unnamed Creek (S007-481, average of 5.8 mg/L) and remained elevated throughout the year whereas Unnamed Creek dropped off late summer/early fall. When comparing TP concentrations among the similarly sized headwaters stations, concentrations were similar during the first half of the year but Unnamed Creek (S007-481) was noticeably higher than upper Medford Creek (S007-482) during late summer/early fall. TSS concentrations were similar, but often a little higher in upper Medford Creek (S007-482).

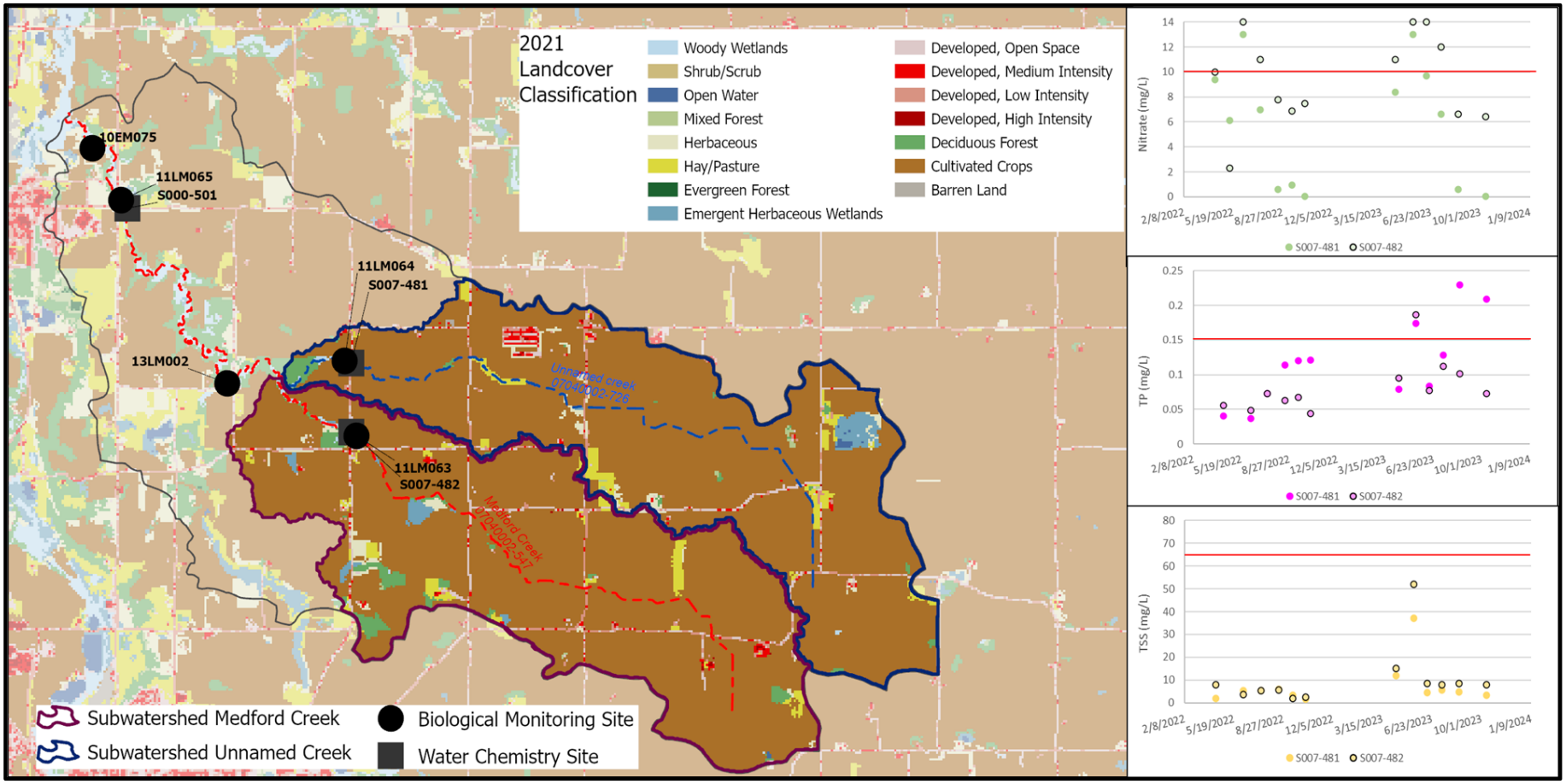
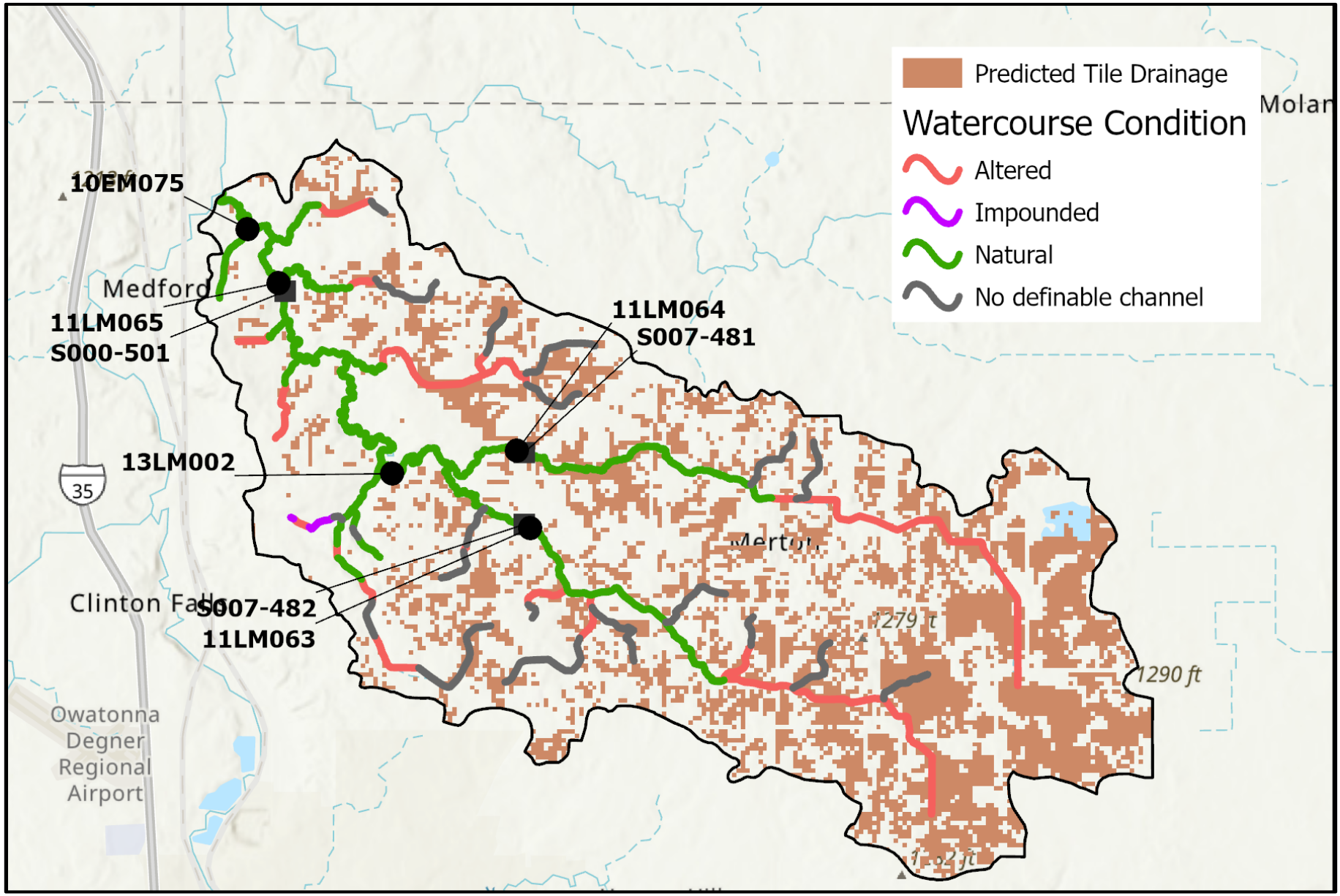


Figure 4: Habitat example from biological monitoring station 11LM065 in Medford Creek Watershed in 2022.

Figure 5: Very low flow (left, 11LM065) and no flow/ponded water (center, 11LM064) conditions in September 2023, and a perched culvert (right, just upstream of 11LM064 on 34th Avenue) in March 2024; worth noting is that station 11LM064 is not located on the biologically impaired reach. Fish passage has the potential to be a stressor during years with limited precipitation and low flows.

Figure 6: Natural, altered, impounded, and no definable channel watercourses and tile drainage estimates in Medford Creek Watershed.



Summary

- Nitrate, habitat, fish passage, and flow alteration are stressing the biology in Medford Creek Watershed, while stream temperature is not currently a stressor and eutrophication, DO, and TSS are inconclusive (Table 2).
- Below average precipitation and low stream flows occurred during Cycle 2 SID fieldwork, which can impact many variables such as habitat, fish passage, and nutrient/sediment/DO concentrations.
- Nitrate concentrations were elevated across the watershed. Cultivated crops dominate the watershed and are the primary source of nitrogen to surface waters; tile drainage is abundant and a primary transport path to surface waters (Figure 6).
- Nitrate concentrations in the upper portion of Medford Creek (S007-482, average of 9.5 mg/L) were consistently higher than the other stations (S000-501 and S007-481, averages of 5.8 mg/L) and remained elevated throughout the year whereas the other stations dropped off late summer/early fall (Figure 2 and Figure 3). Based on this information, the upper portion of Medford Creek (S007-482) could be considered a priority area for nitrogen reduction.
- Overall, habitat conditions vary across the watershed. Excess fine substrate, embeddedness, and inadequate stream flow (at times) are impacting habitat quality and availability in Medford Creek Watershed. No flow/minimal flow time periods can also impact variables such as fish passage and DO concentrations.
- Flow alteration is negatively impacting biology in Medford Creek Watershed; headwater areas are altered and drained via subsurface tile (Figure 6). Altered watercourses are often associated with poor habitat, an abundance of fine substrate, excess nutrients and productivity, altered DO regimes (low DO and high DO flux), and minimal flow time periods. Increasing trends for precipitation and streamflow are also a concern and highlight the need for water storage/infiltration on the landscape; increases in precipitation and streamflow have the potential to alter multiple variables such as nutrient/sediment loading, bank erosion, and habitat.
- Elevated TP concentrations and low DO have been documented, but it's uncertain if they are stressing the fish and/or macroinvertebrate communities. Currently there is no clear link indicating that elevated TP concentrations are creating eutrophic conditions resulting in low DO environments. Most TP exceedances occurred during elevated flow conditions (when phosphorus is attached to sediment particles), and low flows during certain years/times of year may result in periodic low DO in Medford Creek Watershed.
- When comparing TP concentrations among the similarly sized headwaters stations (S007-481 and S007-482), concentrations were similar during the first half of the year but Unnamed Creek (S007-481) was noticeably higher than upper Medford Creek (S007-482) during late summer/early fall (Figure 3).
- TSS concentrations were low (below the standard) during low flow conditions. Although elevated TSS concentrations have been documented and some biological indication of TSS stress

exists, it's unclear if TSS is a stressor at this time. Regardless, sediment is a concern via habitat loss and degradation from an abundance of fine substrate and embeddedness. Since cultivated crops are the dominant land use in the watershed, likely sediment sources include runoff from agricultural fields and stream bank erosion.

- Stream temperatures are adequate to support warmwater biota.
- Overall, reducing nutrient and sediment loading, improving in-stream habitat, and addressing flow alteration related issues (e.g., poor habitat, fine substrate, nitrogen rich tile water, etc.) are critical to improve fish and macroinvertebrate health in Medford Creek Watershed.

Table 2: Summary of stressors in the Medford Creek Watershed (• = stressor, ○ = inconclusive stressor, blank = not a stressor, NE = not evaluated).

Waterbody	AUID	Biological Stations	Biological Impairment	Class	Stressors							
					Temperature	Nitrate	Eutrophication	DO	TSS	Habitat	Fish Passage	Flow Alteration
Medford Creek	547	10EM075, 11LM063, 11LM065, 13LM002	Fish, Macroinvertebrates	2Bg		•	○	○	○	•	•	•
Unnamed Creek	726	11LM064		2Bg	NE	NE	NE	NE	NE	NE	NE	NE

For more information

For more information, go to https://www.pca.state.mn.us/watershed-information/cannon-river.

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MINNESOTA POLLUTION CONTROL AGENCY

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