SID Update

Rush Creek Watershed

August 2025

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.

Rush 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.
- Rush Creek is a Tier 1 priority issue/area in the Cannon River Comprehensive Watershed Management Plan (CWMP).

Goals for Cycle 2 SID work in Rush 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 protection areas.
- Provide value to local planning efforts.

Cycle 1 SID Summary:

- There were no biological impairments identified in the Rush Creek Watershed in Cycle 1; therefore, no Cycle 1 SID was conducted.

Cycle 2 SID Summary:

- Cycle 2 SID was conducted on Rush Creek (AUID -505).
- Currently there are no biological impairments on Rush Creek (thus no stressors per se), but reducing nutrient and sediment loading, maintaining/improving in-stream habitat, and addressing flow alteration related issues (e.g., poor habitat, fine substrate, nitrogen rich tile water, etc.) are critical to maintain the currently healthy fish and macroinvertebrate communities in Rush Creek Watershed.

This SID update document summarizes biological condition and provides monitoring highlights and stressor conclusions for Rush 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 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.

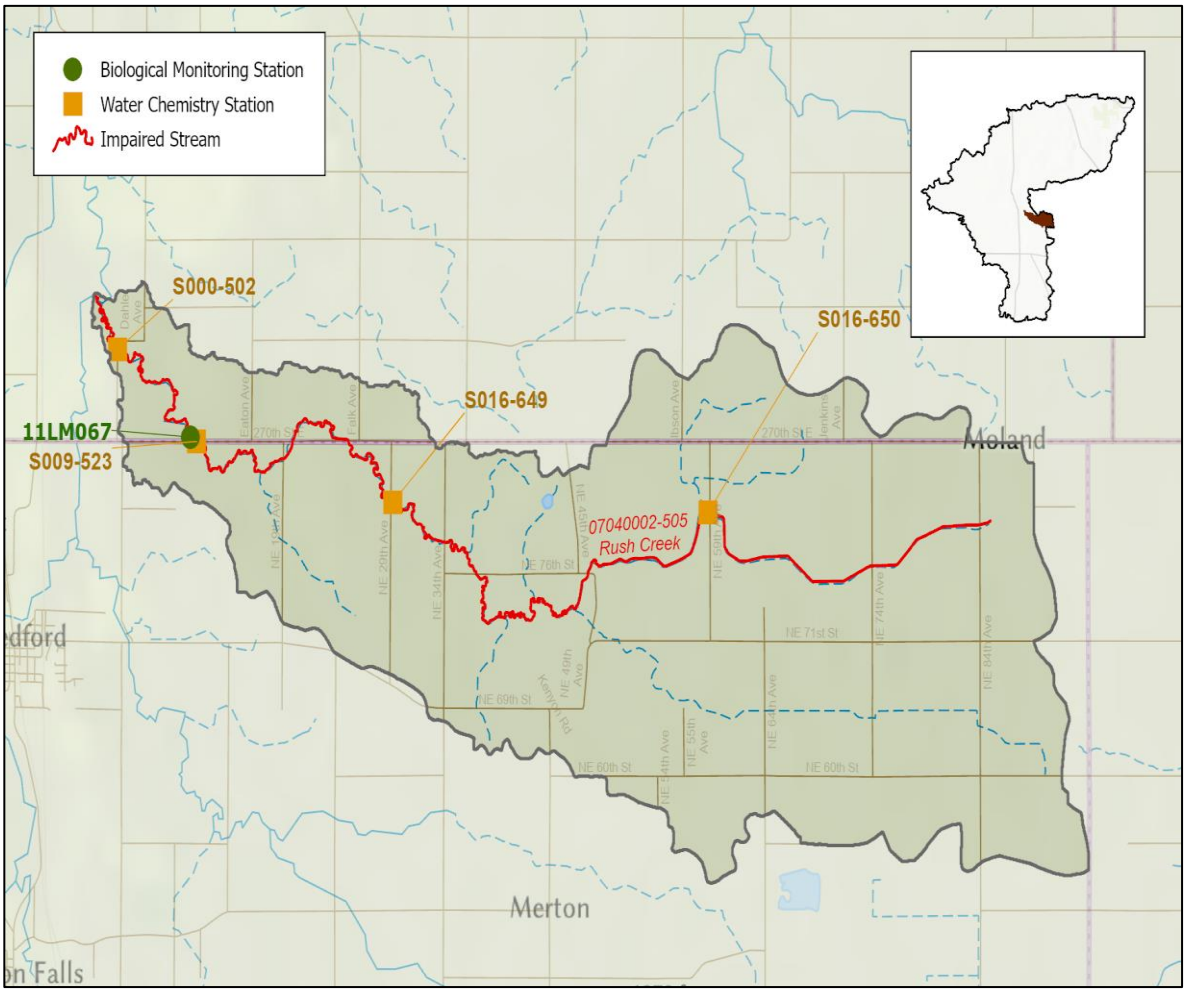
Biological Communities

Fish and macroinvertebrate communities in Rush Creek Watershed are healthy and meeting standards (Table 1, Figure 1). Station 11LM067 is located in the lower portion of Rush Creek and is the only biological station on Rush Creek. This station was sampled in Cycle 1 and Cycle 2, and fish index of biological integrity (FIBI) and macroinvertebrate index of biotic integrity (MIBI) scores were similar between samples. In general, macroinvertebrates belonging to the family Chironomidae (flies/non-biting midges) and Hydropsychidae (net-spinning caddisflies) dominated both samples and the fish community was primarily comprised of Cyprinidae (shiners, dace, minnows, stonerollers, chubs), Percidae (darters), and Catostomidae (white suckers).

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

Waterbody	AUID	Biological Stations	Biological Impairment	Class	FIBI	FIBI Threshold	FIBI Year	MIBI	MIBI Threshold	MIBI Year
Rush Creek	505	11LM067		2Bg	74.5	55	2011	40.5	37	2011
					75.3		2022	42.9		2022

Figure 1: Rush Creek Watershed monitoring stations.



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). No sonde deployments have occurred; existing 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 17 mg/L (average of 6.4 mg/L), and 8 (21%) of the 38 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 at least one sample 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.). Average nitrate concentrations decreased slightly from upstream to downstream (Figure 2); average concentrations from upstream to downstream were 7.2 mg/L (S016-650), 6.5 mg/L (S016-649), and 5.7 mg/L (S000-502). Elevated nitrate tolerant macroinvertebrates have also been documented, representing 71% (2011) and 51% (2022) of the community at station 11LM067; nitrate tolerant macroinvertebrates decreased between the Cycle 1 and Cycle 2 samples.

  In addition, elevated nitrate concentrations were documented near the mouth of Rush Creek (S000-502) in 2008 and 2009; concentrations were generally lower than the recent samples collected for Cycle 2 SID, ranging from 0.3 to 12.7 mg/L (average of 3.6 mg/L, 18 samples).

Habitat

- The MPCA Stream Habitat Assessment (MSHA) scores at station 11LM067 were 63.2 (2011), 65.3 (2022), and 63.8 (2022); habitat scores were similar between Cycle 1 and Cycle 2 and are on the high end of the "fair" range. Bank erosion and embeddedness were documented in Cycle 2 and the amount of cover was "moderate"; a habitat example from biological monitoring in 2022 can be seen in Figure 3. During fieldwork in September 2023, no flow/dry streambed conditions were observed near the mouth of Rush Creek (S000-502); these conditions can impact many variables including habitat quality and availability (Figure 4). In general, fish and macroinvertebrate metrics related to habitat showed minimal signs of habitat stress in Cycle 2 as most were better than average. Overall, habitat conditions appear suitable to support healthy warmwater biota.

Fish Passage

- As mentioned above in the habitat section, no flow/dry streambed conditions were documented in September 2023 (Figure 4); these conditions are likely periodic based on climate, but fish passage does appear limited during certain years. Migratory fish at station 11LM067 comprised 26% (2011) and 9% (2022) of the community; the Cycle 2 sample was well below the average (23%) for similar streams. A survey to check for perched culverts was not completed during Cycle 2 SID but could be done in the future to gain a better understanding of longitudinal connectivity in the watershed.

Flow Alteration

- Most of the lower to middle portion of Rush Creek is natural channel; however, much of the headwater areas in the watershed are altered and drained via subsurface tile (Figure 6). In addition, low to no flow/dry streambed conditions have been documented (Figure 4 and Figure 5); these type of flow conditions are common during late summer/fall in altered and drained

landscapes. 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 0.008 to 0.885 mg/L, and 8 (21%) of the 38 samples exceeded the river eutrophication standard for the South Region (0.15 mg/L). The lower two stations (S000-502 and S016-649) each had four exceedances, and there were no exceedances at the farthest upstream station (S016-650); the exceedances occurred during various flow conditions. In general, TP concentrations were low (below the standard) during low flow conditions, and concentrations increased moving downstream. One chlorophyll-*a* (2.7 µg/L) and BOD (<6 mg/L) sample were collected in 2023 (August) at station S000-502 (near the mouth of Rush Creek); the chlorophyll-*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). Occasional low DO and elevated TP have been documented, but it's unclear if excess TP is resulting in eutrophication issues.

  In addition, elevated TP concentrations were documented near the mouth of Rush Creek (S000-502) in 2008 and 2009; concentrations were generally similar to the recent samples collected for Cycle 2 SID, ranging from 0.01 to 0.69 mg/L (average of 0.133 mg/L, 27 samples).

DO

- Several instantaneous (point) measurements were collected throughout the watershed in recent years (2009 through 2023), and six (8%) were below the DO standard of 5 mg/L; most exceedances occurred in the upper portion of Rush Creek (S016-650) during Cycle 2 SID monitoring (very low flows and excess productivity were also present, Figure 5). No continuous DO data has been collected. Overall, DO conditions appear suitable for warmwater biota most of the time, but occasional low DO has been documented during low flows. 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 was 91% (2011) and 92% (2022) at station 11LM067.

TSS

- Total suspended solids (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 to 490 mg/L, and 3 (8%) of the 37 samples exceeded the warmwater TSS standard (65 mg/L). In general, exceedances occurred during elevated flow conditions and concentrations were low (below the standard) during low flow conditions. Similar to TP, concentrations generally increased moving downstream. TSS tolerant macroinvertebrates comprised 48% (2011) and 55% (2022) of the community at station 11LM067, and the probability of meeting the TSS standard based on the composition of the fish community was 62% (2011) and 65% (2022). Although elevated TSS concentrations have been documented and Rush Creek has a turbidity impairment, minimal biological indication of TSS stress exists. Regardless, sediment is a concern as excess fine substrate and associated embeddedness can reduce habitat quality and availability.

  In addition, elevated TSS concentrations were documented near the mouth of Rush Creek (S000-502) in 2008; concentrations in Cycle 1 were generally similar to the recent samples collected for Cycle 2 SID, ranging from 0.4 to 398 mg/L (2 exceedances, 26 samples).

Figure 2: The 2022 and 2023 TSS (brown box plots), TP (purple box plots), and nitrate (green box plots) concentrations (mg/L) in Rush 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).

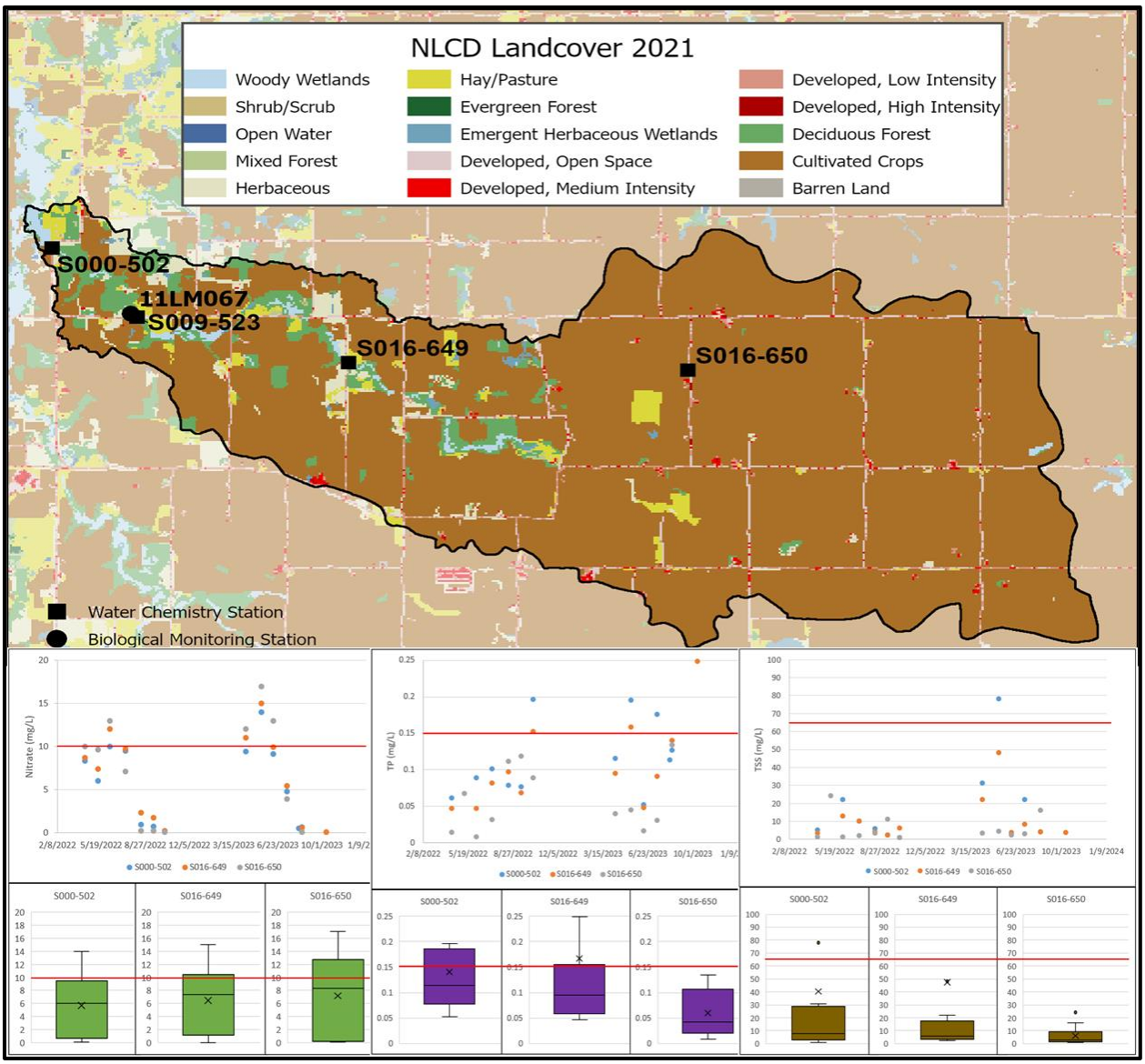
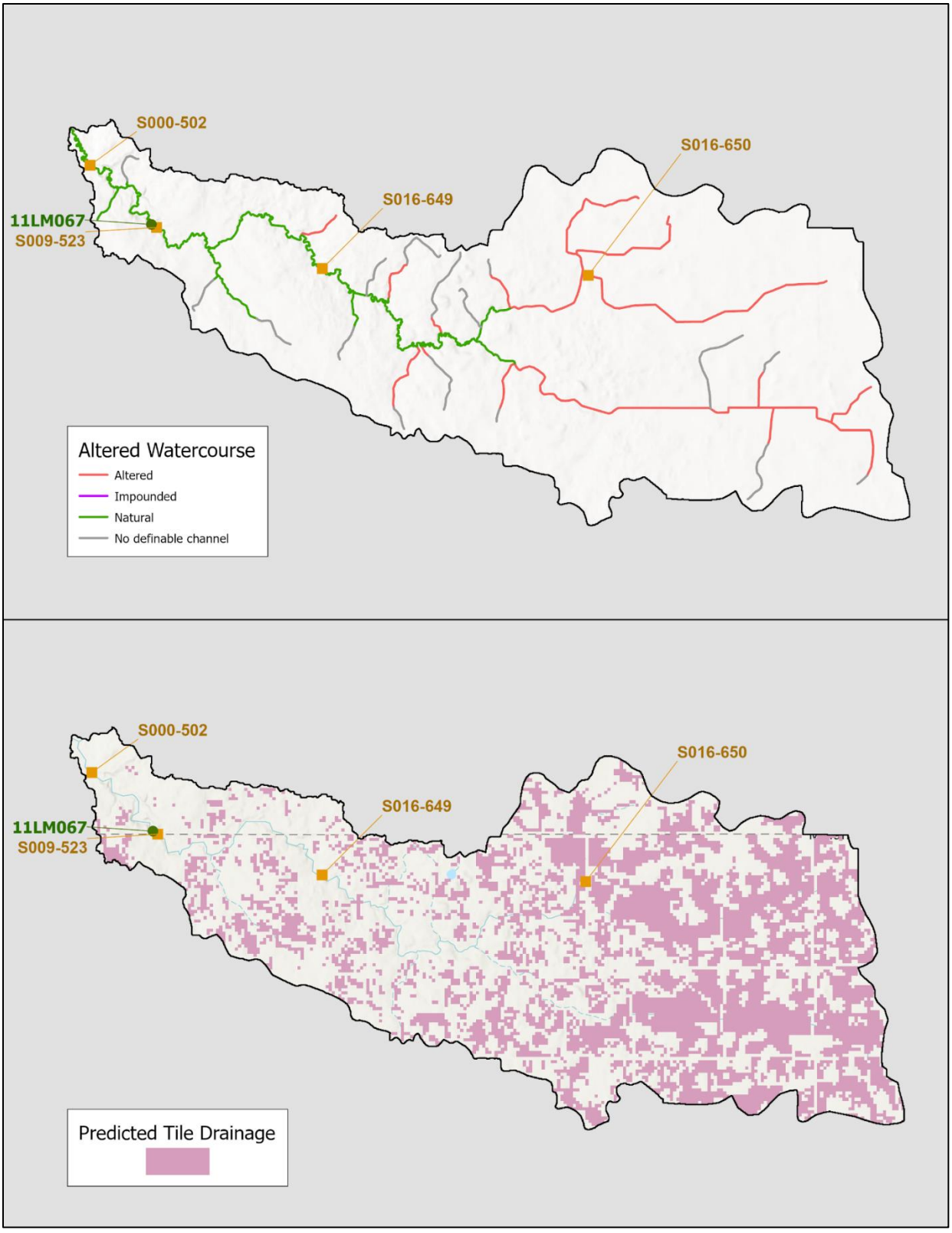


Figure 3: Habitat example from biological monitoring station 11LM067 in Rush Creek Watershed in 2022; the MSHA score during this visit was 63.8.

Figure 4: No flow/dry streambed conditions in September 2023 near the mouth of Rush Creek (S000-502); these conditions can impact many variables including habitat and fish passage.

Figure 5: Headwaters of Rush Creek (S016-650) in 2023 where very low flows, low DO, and excess productivity were observed.

Figure 6: Natural, altered, impounded, and no definable channel watercourses in Rush Creek Watershed (top), and tile drainage estimates in Rush Creek Watershed (bottom).



Summary

- Fish and macroinvertebrate communities in Rush Creek Watershed are healthy and meeting standards, and IBI scores were similar between Cycle 1 (2011) and Cycle 2 (2022) biological monitoring.
- Below average precipitation and low stream flows occurred during Cycle 2 SID fieldwork (2022 and 2023), which can impact many variables such as habitat, fish passage, and nutrient/sediment/DO concentrations. If drought conditions and/or low stream flows become more common it could potentially result in degraded biological communities.
- Elevated sediment and nutrient (nitrate and TP) concentrations and occasional low DO has been documented, and fish passage can be limited during low flow time periods.
- In general, TSS and TP concentrations increased moving downstream, while nitrate concentrations decreased moving downstream (Figure 2).
- Elevated TP concentrations and low DO have been documented; currently there is no clear link indicating that elevated TP concentrations are creating eutrophic conditions resulting in low DO environments. However, very low flows in 2023 did result in low DO and excess productivity in the headwaters of Rush Creek (S016-650, Figure 5).
- TSS concentrations were low (below the standard) during low flow conditions, but elevated concentrations have been documented and Rush Creek is impaired for turbidity. The biological communities are currently healthy, but sediment loading is still a concern as it can degrade habitat quality and availability (e.g. excess 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.
- Flow alteration has influence in Rush Creek Watershed; channelization and tile drainage are present and often negatively impact variables such as habitat, nutrients, DO, and flow. Tile drainage is a primary transport path of nitrogen to surface waters.
- Stream temperature and habitat are currently adequate to support warmwater biota. Low flow/no flow/dry streambed conditions were observed during Cycle 2 SID work, which negatively impact habitat (in addition to other variables). Excess fine substrate, embeddedness, and low flows are potential threats to habitat conditions and biological health.
- Currently there are no biological impairments in Rush Creek Watershed, and therefore no stressors per se. However, the macroinvertebrate IBI scores are near the threshold and threats to biological health do exist in the watershed. Taking measures to reduce nutrient loading and addressing flow alteration related issues (e.g., poor habitat, fine substrate, nitrogen rich tile water, low flows, etc.) in Rush Creek Watershed would help ensure healthy biological communities in the future.

For more information

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

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