SID Update

Crane 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.

The upper portion of Crane Creek Watershed (Moonan Marsh drainage area) 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:

- Highlight water quality benefits of Moonan Marsh; this area has received recent local attention due to the failing dike system and desire to manage the marsh for flood control opposed to water quality and wildlife. There has been interest in acquiring conservation easements to fully restore the area.

Goals for Cycle 2 SID work in Crane 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:

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

Cycle 2 SID Summary:

- Cycle 2 SID was conducted on Crane Creek (AUID -743).
- Eutrophication, dissolved oxygen (DO), habitat, and flow alteration were identified as stressors; nitrate was inconclusive and temperature and total suspended solids (TSS) are not currently stressors.

This SID update document summarizes biological condition and provides monitoring highlights and stressor conclusions for the upper portion (Moonan Marsh drainage area) of Crane 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 Comprehensive Watershed Management Plan (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

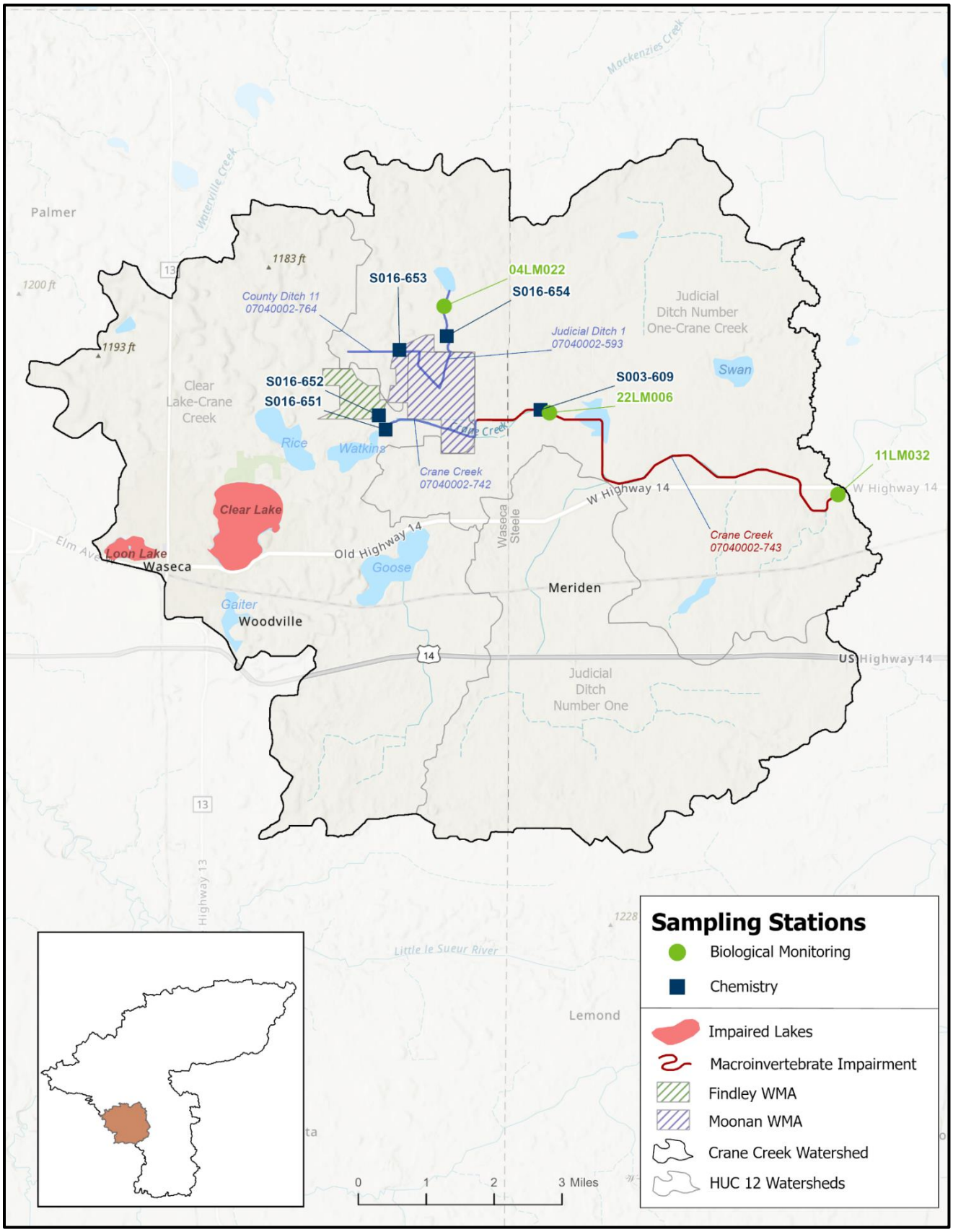
Fish and macroinvertebrate communities in the upper portion (Moonan Marsh drainage area) of Crane Creek Watershed are of varying quality; some are impaired and not meeting standards while others are healthy and meeting standards (Table 1, Figure 1). Station 11LM032 was the only station sampled in Cycle 1 and Cycle 2; fish index of biological integrity (FIBI) scores increased in Cycle 2, while macroinvertebrate index of biotic integrity (MIBI) scores were similar between Cycle 1 and Cycle 2. In general, macroinvertebrates belonging to the family Baetidae (mayflies), Hyalellidae (amphipods), Elmidae (riffle beetles), Coenagrionidae (damselflies), and Chironomidae (flies/non-biting midges) dominated the Cycle 2 sample at station 11LM032, while Hyalellidae dominated the Cycle 2 sample at station 22LM006. The two most abundant fish species in Cycle 2 were white sucker and rock bass at station 11LM032, and central mudminnow and black bullhead at station 22LM006.

The biological impairment (macroinvertebrates) is located on Crane Creek (AUID -743); station 22LM006 (just downstream of Moonan Marsh) is responsible for the impairment.

Table 1: Fish and macroinvertebrate IBI scores in the upper portion (Moonan Marsh drainage area) of Crane Creek Watershed.

Waterbody	AUID	Biological Stations	Biological Impairment	Class	FIBI	FIBI Threshol	FIBI Year	MIBI	MIBI Threshol	MIBI Year
Judicial Ditch 1	593	04LM022		2Bg	3.7	42	2004	-	-	-
Crane Creek	743	22LM006	Macroinvertebrates	2Bm	37.6	35	2022	16.2	30	2022
								28.1		2022
		11LM032			54.3	35	2011	35.0	30	2011
					71.9		2022	34.3		2022

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



Monitoring Highlights

Stream Temperature

- Several instantaneous (point) measurements have been collected throughout the upper portion of Crane Creek Watershed since 2004, with only two (1%) above 30°C (daily average warmwater standard). No continuous data has been collected, but the current data indicates suitable stream temperatures for warmwater biota.

Nitrate

- Nitrate samples were collected across the upper portion of the watershed at five 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 15 mg/L (average of 2.3 mg/L), and 4 (7%) of the 57 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 at times in the northern ditches (S016-653 and S016-654), extremely low coming out of Watkins Lake (S016-651) and Findley WMA (S016-652), and most concentrations were low at the mouth of Moonan Marsh (S003-609). Station S016-654 had three samples above 10 mg/L and station S016-653 had one. In general, the highest concentrations at the mouth of Moonan Marsh (S003-609) and the northern ditches (S016-653 and S016-654) were observed in spring/early summer and the lowest concentrations in late summer/fall; water coming out of Watkins Lake (S016-651) and Findley WMA (S016-652) had low concentrations year-round. Precipitation can have significant influence on concentration dynamics from year to year (magnitude, variability, duration of elevated concentrations, etc.), but the lakes and wetlands in the upper portion of Crane Creek Watershed mitigate some of the precipitation impacts (and nitrate concentrations) via residence time/denitrification/plant up-take/etc. Nitrate tolerant macroinvertebrates in Cycle 2 were better than the statewide median (45%), ranging from 3% to 36% of the community with very few just downstream of Moonan Marsh (station 22LM006, 3% and 8%). Station 11LM032 was sampled in Cycle 1 and Cycle 2, and nitrate tolerant macroinvertebrates were lower in Cycle 2 (2011- 59%, 2022-36%). Although elevated nitrate concentrations were documented, the lakes/wetlands/Moonan Marsh appear to serve as a form of "treatment" resulting in reduced concentrations downstream of Moonan Marsh.

Habitat

- The MPCA Stream Habitat Assessment (MSHA) scores throughout the upper portion of the watershed range from 27.3 ("poor") to 45 ("fair"), with most scores in the "poor" range. Station 11LM032 was the only station sampled in Cycle 1 and Cycle 2; the Cycle 1 score was 34 ("poor") and the Cycle 2 scores were 30 ("poor") and 45 ("fair"). Bank erosion and embeddedness were documented in Cycle 2 and the amount of cover ranged from "moderate" – "extensive"; a habitat example from biological monitoring in 2022 can be seen in Figure 3. Fine substrate is abundant and MPCA biologists noted that there wasn't suitable coarse substrate to support organisms. Very few clingers were sampled in Cycle 2, 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 at station 11LM032 and worse than average at station 22LM006. In addition, minimal flow/no flow conditions have been documented, which can impact habitat quality and availability (Figure 4). Overall, habitat conditions are poor in the upper portion of Crane Creek Watershed, and fine substrate dominates the channel bed.

Flow Alteration

- Most of the upper portion (Moonan Marsh drainage area) of Crane Creek Watershed is altered and drained via subsurface tile (Figure 5). In addition, low to no flow conditions have been documented (Figure 4); 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 (Minnesota Department of Natural Resources 2023). Increases in precipitation and streamflow can impact many variables including habitat and nutrient/sediment loading; the lakes/wetlands/Moonan Marsh in the upper portion of Crane Creek Watershed have the ability to mitigate these impacts via water storage/attenuation. 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 upper portion of the watershed at five 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 0.032 to 0.96 mg/L, and 29 (51%) of the 57 samples exceeded the river eutrophication standard for the South Region (0.15 mg/L). Each station had multiple exceedances, and exceedances occurred during various flow conditions and throughout the year. In general, concentrations downstream of Watkins Lake (S016-651) and Moonan Marsh (S003-609) were typically below the standard, whereas concentrations often exceeded the standard coming out of Findley WMA (S016-652) and the northern ditches (S016-653 and S016-654). Fifteen chlorophyll-a samples were collected near the mouth of Moonan Marsh (S003-609) during 2022 and 2023, with concentrations ranging from 2.1 to 43.6 µg/L, which includes two (13%) samples above the standard (35 µg/L). Also, there were no sonde deployments, but consistent low DO has been documented throughout the upper portion of the watershed. In addition, eutrophic conditions were observed in Cycle 2 (Figure 4), and phosphorus tolerant fish (25% of community) and macroinvertebrates (76% to 85% of community) were abundant just downstream of Moonan Marsh (station 22LM006) in Cycle 2. Current data suggests that eutrophication is an issue at times and likely limiting the biology in the upper portion of Crane Creek Watershed.

DO

- Several instantaneous (point) measurements were collected throughout the upper portion of the watershed in 2022 and 2023, ranging from 0.1 to 14.4 mg/L and 46 (63%) were below the DO standard of 5 mg/L; there were multiple exceedances at all sites. The fish and macroinvertebrates in Cycle 2 corroborate the chemistry values as they display signs of DO stress. The probability of meeting the DO standard based on the composition of the fish community was 14% (22LM006, just downstream of Moonan Marsh) and 79% (11LM032), both worse than the statewide median (82%). In addition, DO tolerant macroinvertebrates in Cycle 2 were abundant, ranging from 34% to 84% of the community (well above the statewide median of 10%). Overall, DO concentrations were frequently below the standard and likely having a negative impact on the biological communities. The lakes, wetlands, and ditches were all a source of low DO water at times, and low flows during Cycle 2 also negatively impacted DO concentrations.

TSS

- TSS samples were collected across the upper portion of the watershed at five 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 50 mg/L, and 0 of the 57 samples exceeded the warmwater TSS standard (65 mg/L). In general, TSS concentrations were low across this portion of the watershed, with the lakes and wetlands likely having positive influence (flow attenuation, sediment trapping, etc.). TSS tolerant macroinvertebrates in Cycle 2 comprised 15% to 30% of the community, and the probability of meeting the TSS standard based on the composition of the fish community ranged from 54% to 63%. In general, the fish and macroinvertebrates don't show signs of TSS stress and there were no elevated TSS concentrations documented in the upper portion of the watershed. However, 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), TP (purple), and nitrate (green) concentrations (mg/L) in the upper portion (Moonan Marsh drainage area) of Crane 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).

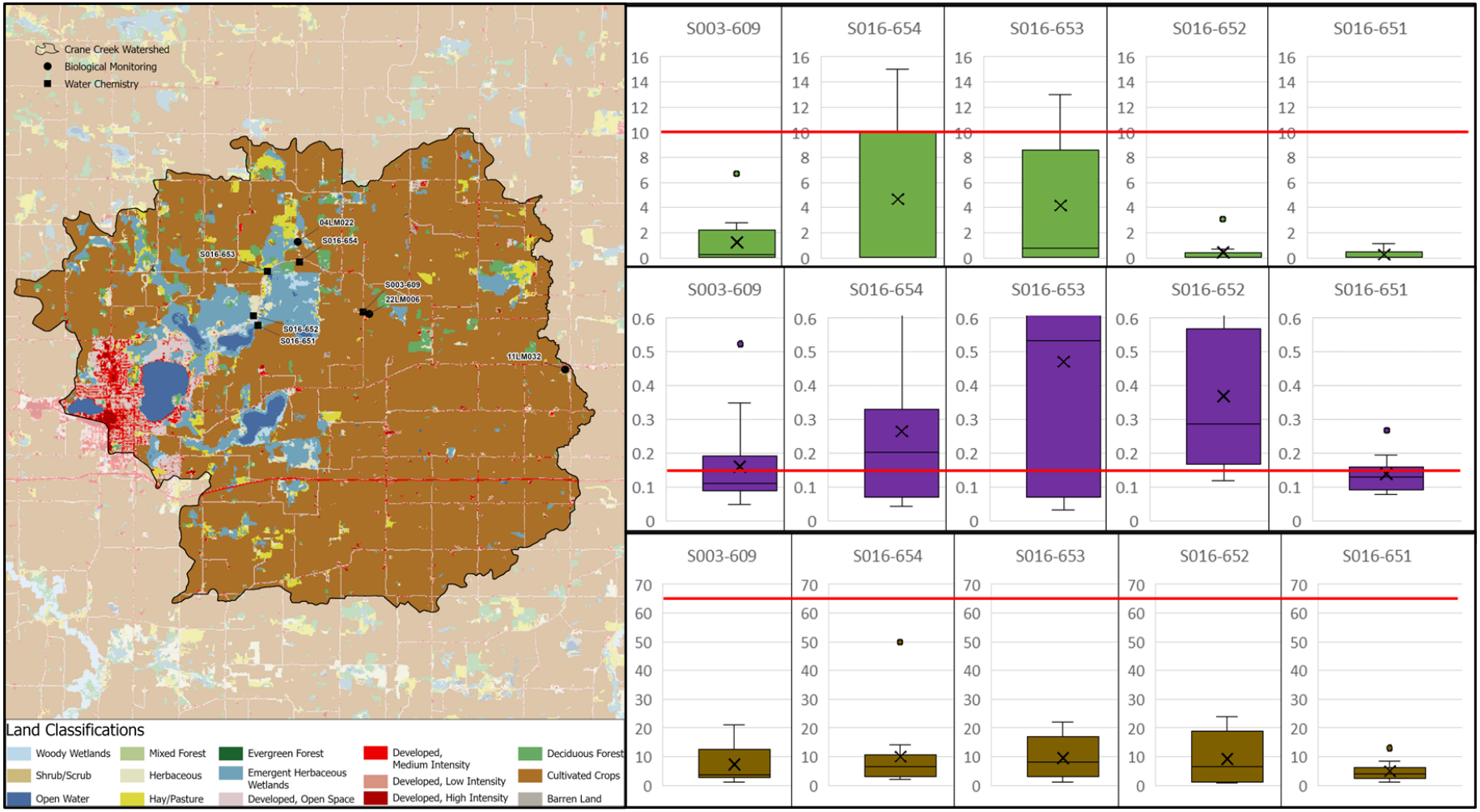
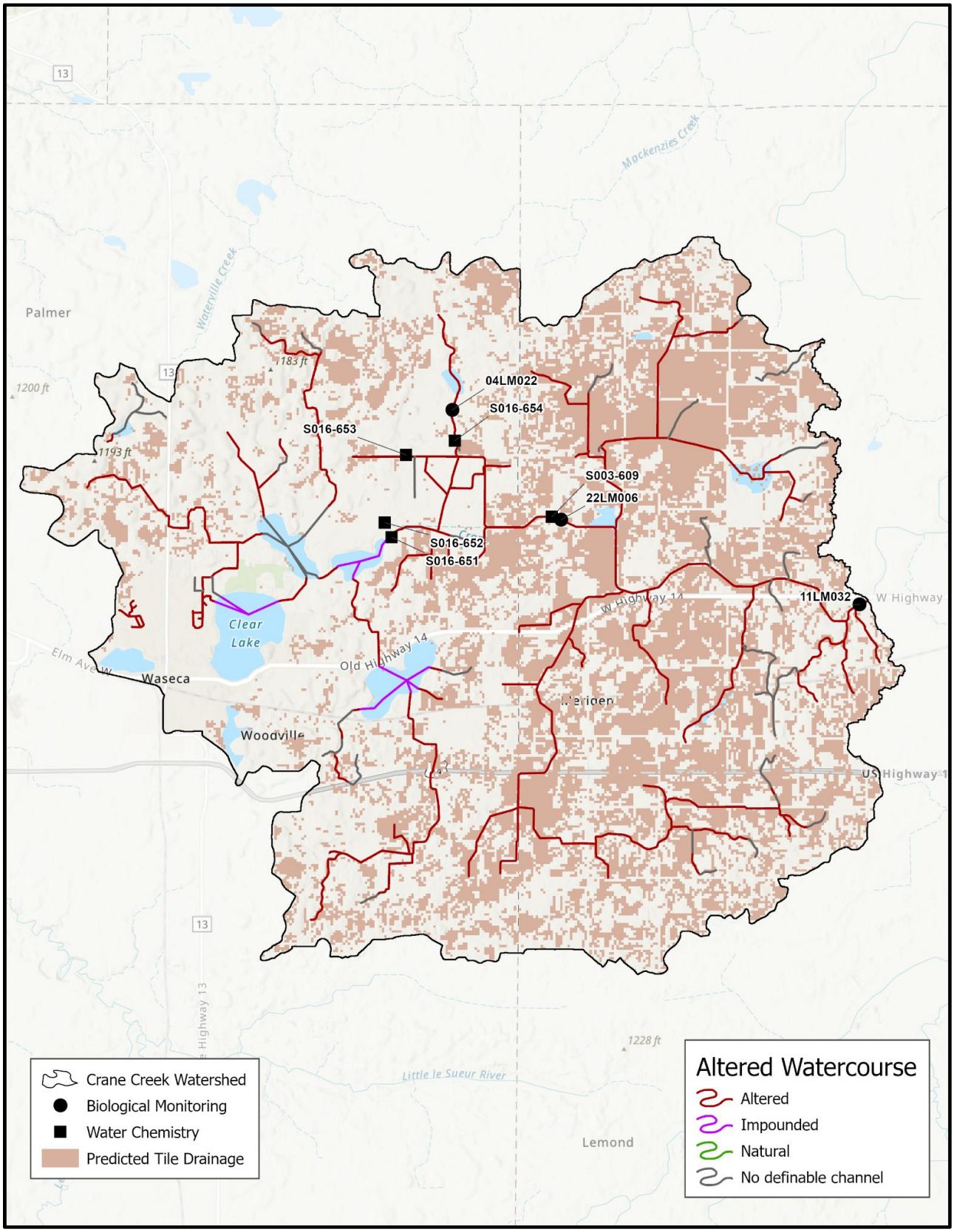


Figure 3: Habitat example from biological monitoring station 22LM006 in the upper portion of Crane Creek Watershed in 2022; the MSHA score from this site visit was 30.

Figure 4: Stream conditions during sampling in August 2023 across the upper portion of Crane Creek Watershed; low/no flow and eutrophic conditions were documented.

Figure 5: Natural, altered, impounded, and no definable channel watercourses and tile drainage estimates in the upper portion (Moonan Marsh drainage area) of Crane Creek Watershed.



Summary

- Eutrophication, DO, habitat, and flow alteration are stressing the macroinvertebrates in the upper portion (Moonan Marsh drainage area) of Crane Creek Watershed, while stream temperature and TSS are not currently stressors and nitrate is inconclusive (Table 2).
- In general, nitrate concentrations were elevated at times in the northern ditches (S016-653 and S016-654), extremely low coming out of Watkins Lake (S016-651) and Findley WMA (S016-652), and most concentrations were low at the mouth of Moonan Marsh (S003-609).
- In general, the highest nitrate concentrations at the mouth of Moonan Marsh (S003-609) and the northern ditches (S016-653 and S016-654) were observed in spring/early summer and the lowest concentrations in late summer/fall; water coming out of Watkins Lake (S016-651) and Findley WMA (S016-652) had low concentrations year-round.
- Moonan Marsh, lakes, and wetlands in the upper portion of Crane Creek Watershed mitigate some of the precipitation impacts and associated nutrient and sediment loading to Crane Creek; these features also reduce nitrate concentrations via residence time/denitrification/plant up-take/etc.
- 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.
- 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 2, Figure 5).
- Overall, habitat conditions are poor in the upper portion of Crane Creek Watershed, and fine substrate dominates the channel bed. Also, inadequate stream flows were documented during Cycle 2, which impact habitat quality and availability (in addition to variables such as fish passage and DO concentrations).
- Flow alteration is negatively impacting biology in the upper portion (Moonan Marsh drainage area) of Crane Creek Watershed; much of this area is altered and drained via subsurface tile (Figure 5). 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 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 are common in the upper portion of Crane Creek Watershed, and eutrophic conditions have been documented; these conditions/environment are likely having a negative impact on the biological communities.
- In general, TP concentrations downstream of Watkins Lake (S016-651) and Moonan Marsh (S003-609) were typically below the standard, whereas concentrations often exceeded the standard coming out of Findley WMA (S016-652) and the northern ditches (S016-653 and S016-654).
- DO concentrations were frequently below the standard; the lakes, wetlands, and ditches were all a source of low DO water at times, and low flows during Cycle 2 also negatively impacted DO concentrations.

- TSS concentrations were low (below the standard) in the upper portion of Crane Creek Watershed with the lakes and wetlands likely having positive influence through flow attenuation, sediment trapping, etc. However, sediment is still a concern via habitat loss and degradation from an abundance of fine substrate and embeddedness.
- Stream temperatures are adequate to support warmwater biota.
- The water quality and quantity in the upper portion of Crane Creek Watershed is largely defined/controlled by the lakes, wetlands, and Moonan Marsh. These features can provide benefits such as water storage/attenuation, sediment trapping, nutrient reduction, and flow dissipation; however, they can also be a source of low DO water, elevated TP, and excess productivity at times.

Table 2: Summary of stressors in the upper portion (Moonan Marsh drainage area) of Crane 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
Judicial Ditch 1	593	04LM022		2Bg	NE	NE	NE	NE	NE	NE	NE	NE
Crane Creek	743	22LM006, 11LM032	Macroinvertebrates	2Bm		○	•	•		•	NE	•

References

Minnesota Department of Natural Resources. 2023. Evaluation of Hydrologic Change (EHC) Technical Summary: Cannon River Watershed.

For more information

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

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