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TO: Mike Polkinghorn, Limit Calculator

FROM: Madeline Roberts, Stream Biologist; Jon Kleist, Stream Biologist; Kristi Minahan, Water Quality Standards; Diane Figiel, Limit Calculator Coordinator; Eric DeVenecia, Compliance Engineer

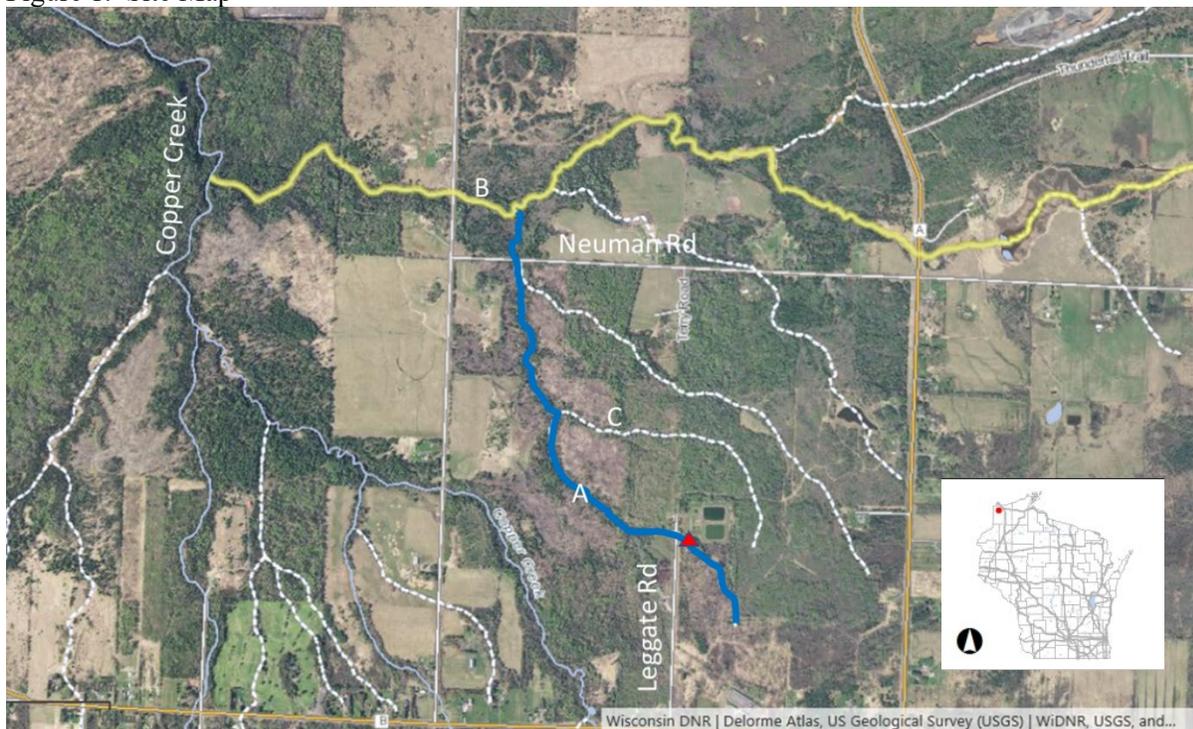
SUBJECT: School District of Superior (WPDES Permit 0035866) and Unnamed Tributary to Copper Creek (WBIC 3000143)

Overview of issue

The School District of Superior has a wastewater treatment plant (WWTP) at the end of Leggate Road. The WWTP discharges to an unnamed tributary shown here as Stream A (WBIC 300143) which in turn is a tributary to another unnamed tributary shown as Stream B (WBIC 2836600) to Copper Creek (WBIC 2836100). The wastewater program requested a site visit to assess the biological potential of Stream A that receives the discharge water from the WWTP to determine the appropriate stream classification (Figure 1).

The WWTP is on the East side of Leggate Road. The red triangle is the location of the outfall. The effluent is discharged through a pipe to Stream A (shown in dark blue). Stream A flows under Leggate Road through a concrete culvert down a natural channel toward Neuman Road. A concrete culvert allows the tributary to flow under Neuman Road to Stream B (shown in yellow) that then flows to Copper Creek.

Figure 1. Site Map



There are several questions regarding the previous permit limits and how they relate to stream classification. The facility has an intermittent discharge with flow limits of 0.1 MGD (0.15 cfs) in April-May and 0.015 MGD (0.023 cfs) in Sept.-Nov.

- The 2017 limit memo indicates that it treated the receiving water (from the outfall for ~ 1 mile to below Neuman Road) as being Limited Forage Fish (LFF) based on a 2003 recommendation of LFF. However, the BOD and TSS limits are more restrictive than those in ch. NR 104 for LFF, and their origins are unclear.
- For purposes of phosphorus limits, it was considered ephemeral so no phosphorus limits were given for the receiving water, and no downstream protection limits were applied for the unnamed perennial warmwater tributary (Stream B) below Neuman Road, due to dilution.
- This appears to be a mismatch because the LFF classification is defined as supporting a limited forage fish community, while ephemeral streams are dry except during precipitation or snowmelt, and do not support fish.

Because this site is not individually listed as LFF or Limited Aquatic Life (LAL) in ch. NR 104, the purpose of this site visit was to determine whether either “Limited” category may actually be appropriate or whether it should be a full warmwater community, and what the appropriate classifications are to characterize the receiving water and downstream waters.

Summary of recommendations for Stream A (WBIC 300143)

“Stream A”

- Segment 1 (most upstream): **Headwaters to ~140 m downstream of Leggate Road**
 - *Codified designated use:* This stretch is not specifically listed as LAL or LFF in ch. NR 104, but it fits the definition of “diffused surface water” under NR 104.02(1)(b) and can thereby be considered to have a codified use of LAL-Diffuse surface water. All “diffused surface waters” are classified as LAL under NR 104.02(3)(b)1, even if they are not individually listed in the tables in ch. NR 104 as LAL. It also fits the very similar definition of “ephemeral” in NR 102.06(2)(b), qualifying it for the phosphorus exclusion under NR 102.06(6)(a).
 - *Classification used for previous permit issuance:* LFF and ephemeral (no phosphorus limits)
 - *Previous stream class recommendations:* In 2003, Limited Forage Fish (LFF) was recommended from the facility outfall “to the confluence with another tributary in the SW1/4 NE1/4 T47N R14W S23”, which is a confluence with a small intermittent stream (shown as Stream C-WBIC 5001412, Fig. 1) about halfway between the outfall and Neuman Road.
 - *Modeled Natural Community:* Macroinvertebrate
 - *New recommended Natural Community and Designated Use:* NC-Macroinvertebrate; DU: LAL-Ephemeral/Diffuse surface water (due to naturally low flow)
- Segment 2: **Headwater Wetland Stream 140 m downstream of Leggate Road**
 - *Codified designated use:* This is not in NR 104 as LAL or LFF, so it is considered Warmwater (does not fit definition of ephemeral or diffused surface water, and there is channelized flow with fish through the wetland so it would be treated as a stream rather than a wetland)
 - *Classification used for previous permit issuance:* LFF and ephemeral (no phosphorus limits)
 - *Previous stream class recommendations:* In 2003, Limited Forage Fish (LFF) was recommended from the facility outfall “to the confluence with another tributary in the SW1/4 NE1/4 T47N R14W”, which is a confluence with a small intermittent stream (shown as Stream C-WBIC 5001412, Fig. 1) about halfway between the outfall and Neuman Road.
 - *Modeled Natural Community:* Macroinvertebrate

- *New recommended NC & DU:* NC: Not determined, but one of the headwater categories. DU: Not determined, but not LAL due to the presence of a fish community. The current fish community reflects what would be expected for an LFF, but if the culvert at Neuman Road were replaced, the attainable designated use is likely to be a full fish and aquatic life use for a headwater stream. Further monitoring would be needed to determine thermal regime.
- **Segment 3: Upstream of Neuman Road**
 - *Codified designated use:* This is not in NR 104 as LAL or LFF, so it is considered Warmwater (does not fit definition of ephemeral or diffused surface water, and is below the wetland stream)
 - *Classification used for previous permit issuance:* LFF and ephemeral (no phosphorus limits)
 - *Previous stream class recommendations:* This stretch was NOT included in the LFF recommendation in 2003, indicating a determination of warmwater at that time.
 - *Modeled Natural Community:* Macroinvertebrate
 - *New recommended NC & DU:* NC: Not determined, but one of the headwater categories. DU: There is currently sufficient habitat in this stretch that it should support a full fish and aquatic life community, but the fish community in this stretch appears to be limited currently because of the perched culvert. It is expected to support a full fish community if the culvert were made passable. Further monitoring would be needed to determine thermal regime.

“Stream B”

- “Stream B” is below the confluence of Neuman Road. Stream B is modelled as a Coldwater Natural Community and was not assessed.

Copper Creek

- Copper Creek is the next stream below that, and is modeled as Cool-Cold Headwater.

Site overview maps

Unnamed Tributary and School District of Superior WWTP Outfall

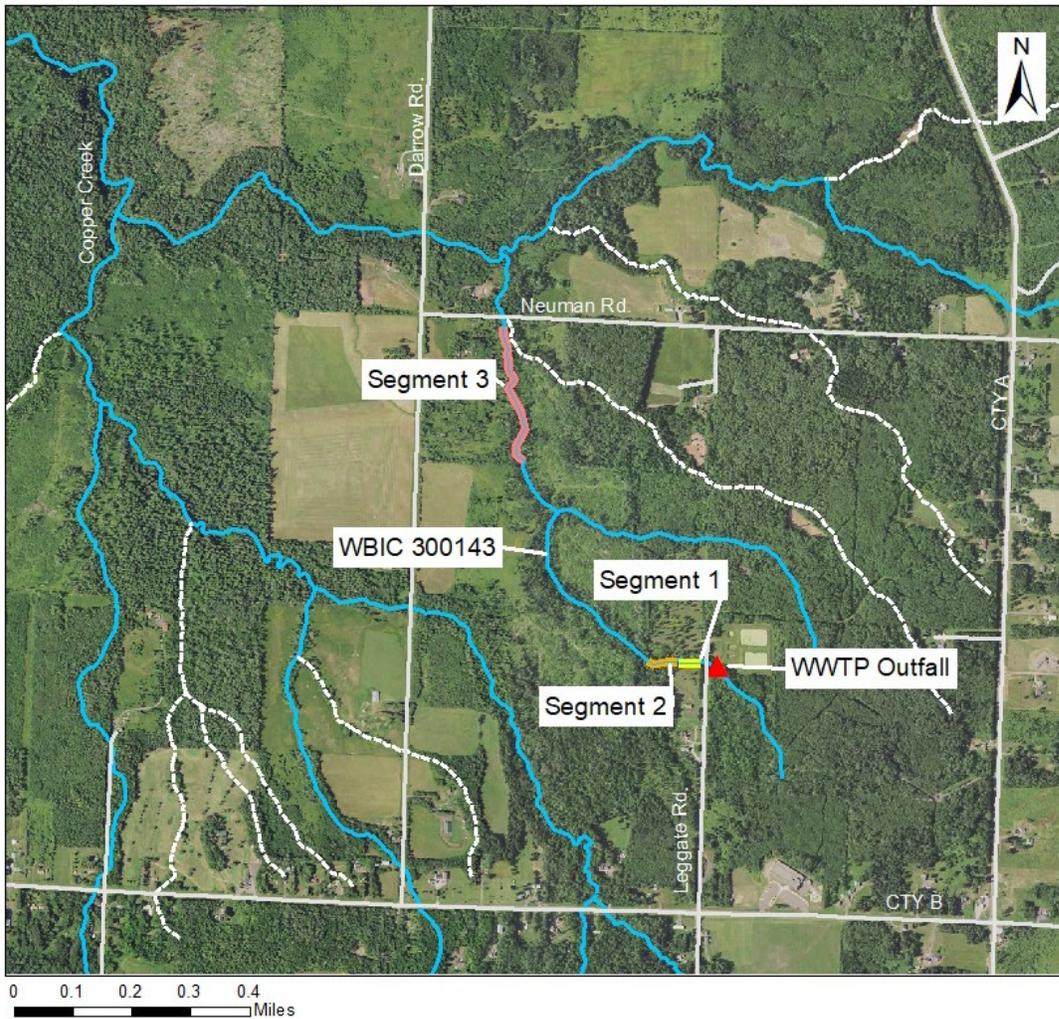


Figure 2. Stream A Survey sites. Stream A (WBIC 3000143) was assessed at 2 access points and broken into 3 stream segments based on changes in flow. The yellow stream section is the location of segment 1. The first fish survey was downstream of Leggate road in segment 2 (orange stream section). The second fish survey was upstream of Neuman Road in segment 3 (pink stream section).

Segment 1 & 2 of Unnamed Tributary 3000143



Figure 3. Segment 1 & 2 of Stream A. Segment 1 is shown in yellow. Segment 2 is in orange. The red triangle east of Leggate Rd is the WWTP outfall.

Segment 3 of Unnamed Tributary 3000143

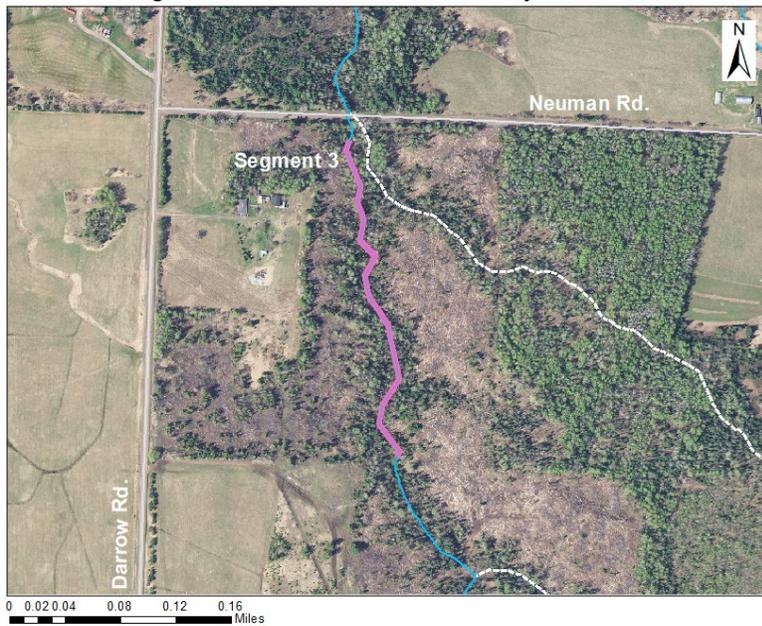


Figure 4. Segment 3 of Stream A. Segment 3 is shown in pink.

The purpose of this site visit was to determine whether the direct receiving water is appropriately considered an ephemeral/diffuse surface water and to characterize the downstream waters. Two sites were evaluated on Stream A to achieve this goal: downstream of Leggate Road (segments 1 and 2) and upstream of Neuman Road (segment 3). Downstream of Leggate Road, Stream A changes flow characteristics so the stream was evaluated as two different segments (Figure 2-3). Details of each segment are listed below.

Site observations of Stream A

- **Segment 1 (most upstream): Headwaters to ~140 m downstream of Leggate Road**
 - This segment flows through a horse pasture (Figure 3). At the road crossing, the streambed was dry and there was no discharge when the site was visited. The tributary continued as a dry stream channel for approximately 140 m downstream of Leggate Rd (Photo 1). There was a defined channel that could be easily followed. While not measured during the survey, the channel width ranged from approximately 0.5 to 1 m. The channel depth to top of bank was around 0.3 m and up to around 0.5 m. The stream through this segment likely flows only during rain events, snow melt, or during discharge from the WWTP.

- **Segment 2: Headwater Wetland Stream 140 m downstream of Leggate Road**
 - After an estimated 140 m, the tributary entered a headwater wetland area in the horse pasture (Photo 2). At this point water was observed in the stream channel and the wetland soils were saturated to the surface. The channel braided a bit and had some flow from groundwater discharge (Photo 3). Iron floc bacteria, which are indicative of groundwater discharge, were also observed in the stream channel. The channel widths were slightly wider through this area when compared to the upstream segment and the gradient slightly less. Water Resources staff did not have permission to enter the next property downstream, however the channel was easily visible in the open woods. Downstream of the property line, the stream quickly changed into a more clearly defined, wider and deeper channel. The channel widths were probably a meter or more and water was visible in the channel. The stream began to meander. This change in channel dimensions matches a change in elevation on the 7.5 minute USGS topo maps in this area.

- **Segment 3: Upstream of Neuman Road**
 - The stream channel was well defined through this reach and flowed through a mix of forest and agricultural lands (Figure 4). We did not measure the stream width, but a reasonable estimate is 1 to 1.5 m in width and a depth of 0.5 m or maybe a little more in the pools (Photos 4, 5). There was observable flow throughout the reach. There were well defined riffles, runs, and pools and several bends or meanders. The segment had good water depth and habitat to support fish. Spring activity entering the stream was observed near the end of the fish survey.
 - A perched concrete culvert on Neuman Road was observed. This culvert was in very poor condition and held together with a couple rusty clamps and cables (Photos 6-8). It was cracked and twisted with water flowing outside the culvert through the cracks with none of the flow reaching the end of the pipe. It is a complete barrier to fish movement upstream.

Fish survey results

Fish surveys were conducted on October 21, 2022 using a single backpack shocker (Table 1). This date is outside of the standard sampling period, but the goal of the survey was primarily to determine whether a fish community was present to inform whether an LAL classification was appropriate. Leaves in the tributary obscured visibility in the water and made detecting fish difficult for both surveys, so more fish may have been present than were captured. Because the goal of the survey was to determine if fish were present and it was outside the standard sampling dates, a Natural Community Verification was not completed.

- **Segment 1: Headwaters to ~140 m downstream of Leggate Road**
 - No fish survey was conducted due to lack of water.

- **Segment 2: Headwater Wetland Stream 140 m downstream of Leggate Road**
 - Segment 2 had water in the stream channel, and Water Resources staff conducted a fish survey starting approximately 11 m upstream from the fence (property) line to the upstream end of water in the channel. The survey was shorter than 100 m because of the limits of instream water and staff didn't have access to the adjoining property downstream and the stream. Nine brook sticklebacks were captured (Table 1).

- **Segment 3: Upstream of Neuman Road**
 - In segment 3, an 80 m segment was surveyed starting 15 m upstream of the road crossing. Twenty-one brook sticklebacks were captured (Table 1). The survey was ended before 100 m at a series of logs and other obstructions in the stream channel. By this point, several riffles, runs, and pools were surveyed it seemed unlikely any other fish species would be captured in the survey.
 - **Downstream of perched culvert:** Water Resources staff thought surveying downstream of the perched culvert would be more useful to assess the influence of the culvert on the fish community in segment 3. Downstream of Neuman road the stream channel was again well defined, but heavy alder growth would have required brushing to survey any length of stream. Water Resources staff surveyed the plunge pool downstream of Neuman Road culvert to look for other fish species. In the pool several creek chubs of various sizes and/or year classes and a mud minnow were captured. No brook stickleback were captured.

Habitat survey results

Habitat was surveyed using the qualitative fish habitat form on October 21, 2022 in conjunction with the fish surveys (Table 2).

- **Segment 1: Headwaters to ~140 m downstream of Leggate Road**

Segment 1 likely only flows during rain events, snow melt, and WWTP discharge events. No qualitative fish habitat form was completed for this reach because a fish survey was not done due to lack of water.

- **Segment 2: Headwater Wetland Stream 140 m downstream of Leggate Road**

Segment 2 is shallow and likely has water present at least in pools or runs for most of the year because of groundwater inputs. There were limited pools, riffles, and bends. Fine sediments were common. The stream banks were stable and had no significant erosion. The overall habitat for fish is limited due to the lack of depth and small size of the stream in these headwater wetlands (Table 2).

The number and species of fish captured in the fish survey matched the available habitat within this system.

- **Segment 3: Upstream of Neuman Road**

Segment 3 had a well-defined stream channel, a good width to depth ratio and much better cover for fish. The stream also had a good riparian buffer, with over 10 m in forest with minimal disturbance. A good number of pools and bends were observed (Table 2). Fish cover was common and was mainly large woody cover.

Discussion:

Note: Recommendations from this site visit are shown at the top of this memo.

- Overall, Stream A changes from having limited potential for aquatic life at the WWTP discharge point to maintaining a fish community where water is in the channel. The stream is in the clay plain, and these tight soils are known to have flashy watersheds during periods of runoff which would tend to move fish and other organisms downstream. This small watershed of 1.56 sq km area has almost certainly gone through drought cycles that have reduced flows to the stream. However, there has at least been enough water to maintain a limited, tolerant fish population of brook stickleback which are currently living upstream of Neuman Road and all the way to the limits of water in the channel at segment 2. Each segment will be discussed in detail below.

- **Segment 1: Headwaters to ~140 m downstream of Leggate Road**

The unnamed tributary has limited potential for aquatic life at the effluent discharge point downstream to the end of segment 1 (~ 140 m downstream from Leggate Rd.) due to gradient and limited water flows. Since there is no water at the effluent discharge point, there is likely not enough flow upstream to support a fish community. Therefore the headwaters of Stream A (above the WWTP) through to the end of segment 1 are likely all a macroinvertebrate (or ephemeral) natural community due to low flows.

- This stretch fits the definition of ephemeral in ch. NR 102.06(2)(b): ““Ephemeral stream” means a channel or stream that only carries water for a few days during and after a rainfall or snowmelt event and does not exhibit a flow during other periods, and includes, but is not limited to, grassed waterways, grassed swales, and areas of channelized flow as defined in s. NR 243.03 (7).” Therefore the phosphorus exclusion for ephemeral waters under NR 102.06(6)(a) is appropriate for this stretch.
- It also fits the very similar definition of “diffused surface water” under NR 104.02(1)(b): “*Diffused surface water*. This classification includes any water from rains, intermittent springs or melting snow which flows on the land surface, through ravines, etc., which are usually dry except in times of runoff. This category does not include waters at the land surface in the vicinity of agricultural or wastewater irrigation disposal systems.” All “diffused surface waters” are classified as LAL under NR 104.02(3)(b)1, even if they are not individually listed in the tables in ch. NR 104 as LAL (in this case it is not individually listed).
- (Note: The Water Quality Standards program is considering combining the definitions of ephemeral and diffused surface water in a future code update since they are essentially describing the same conditions.)

- **Segment 2: Headwater Wetland Stream 140 m downstream of Leggate Road**
At segment 2 the stream enters a small wetland complex and receives groundwater input. At this point the channel likely has a more continuous presence of water. Segment 2 demonstrated it can support a limited forage fish community through the fish survey, despite its small size and limited habitat. While fish may not be present at all times in segment 2, shortly past the wetland the stream becomes more defined and channel dimensions increase. The upper edge of the wetland forms the upstream boundary of what would likely support a fish community, with a more consistent fish population downstream from the wetland as the stream channel becomes more defined. With the presence of groundwater inputs, further monitoring would be needed to determine the thermal regime of Segment 2.
- **Segment 3: Upstream of Neuman Road**
Upstream of Neuman Road the unnamed Tributary has sufficient groundwater input, depth and habitat to support at least a limited forage fish community. The culvert on Neuman Road is a barrier to fish movement upstream and is likely restricting the observed fish community to brook stickleback. The culvert at Neuman road has been blocking fish movement for years. Since the stream is in the clay plain, it likely experiences fast changes in flow with runoff events which would tend to move fish and other organisms downstream. Despite this characteristic and the culvert barrier to fish movement, a brook stickleback population is maintained in this segment.
- While more fish species were not observed in Stream A upstream of Neuman Road, the stream could support a more diverse fish community if the culvert on Neuman road was not a barrier to fish moving upstream. The capture of other fish species downstream of Neuman road demonstrates that other species are present in the system and do survive in the stream. In its current state it supports a limited forage fish community, but if the culvert were appropriately replaced with one that allows fish passage, it would be expected to support a more well-balanced community upstream to a point where there is continuous water in the stream channel (segments 2 and 3). Further monitoring would be needed to determine the thermal regime given the presence of groundwater inputs in these segments.
- Code updates:
 - Segment 1 is already covered under NR 104 as an LAL because it fits the definition of a diffuse surface water.
 - Segments 2 and 3 likely have the potential to support a full aquatic life community if the culvert is properly replaced. Therefore, it is unlikely that a use attainability analysis would be appropriate on these segments to establish a “limited” use, since a designated use is based on the highest attainable use of a waterbody. Under current conditions, the fish community reflects what would be expected of an LFF community. If there is desire to further consider whether an LFF classification could be appropriate, it would require further monitoring, a use attainability analysis (UAA), and a code revision. This may be a low priority because the facility’s phosphorus limits would be calculated the same way under either warmwater or LFF for segments 2 and 3 (i.e., designating it as LFF would not provide additional relief to the facility).

Attachments

Fish Survey Data for Unnamed Tributary 3000143

Site	Station length (m)	Fish species	Abundance
~200m downstream of Leggate Rd.	58	Brook Stickleback	9
~15m upstream of Neuman Rd.	80	Brook Stickleback	21

Table 1. Fish survey data for unnamed Tributary to Copper Creek (shown in this document as Stream A, WBIC 300143). Fish surveys were conducted on October 21, 2022.

Habitat Survey Results for Unnamed Tributary to Copper Creek 300143

Site	Mean Stream Width (m)	Riparian buffer width	Bank erosion	Pool area	Width:depth ratio	Riffle:riffle or bend:bend ratio	Fine sediments	Cover for fish	Overall score
~200m downstream of Leggate Rd.	1	Fair (5)	Excellent (15)	Fair (3)	Fair (5)	Fair (5)	Fair (5)	Poor (0)	38
~15m upstream of Neuman Rd.	1.5	Excellent (15)	Fair (5)	Good (7)	Good (10)	Good (10)	Fair (5)	Good (10)	62

Table 2. Qualitative Habitat Surveys for unnamed Tributary to Copper Creek (Stream A, WBIC 300143) conducted on October 21, 2022. Surveys were done on the same segments as the fish surveys.

Photo 1. Downstream view of dry stream bed of segment 1.



Photo 2. End of segment 2 fish survey looking upstream.



Photo 3. Upstream of the start of segment 2 fish survey looking downstream.



Photo 4. Near the end of the segment 3 fish survey looking downstream. Spring activity was noted in this area.



Photo 5. Start of segment 3 fish survey looking upstream.



Photo 6. (Left) Upstream end of Neuman Road culvert. Large debris barrier was present.



Photo 7. (Center) Inside of Neuman Road culvert viewed from the upstream end. There is a rise and bend in the culvert.



Photo 8. (Right) Downstream end of Neuman Road culvert. Rock pile at the mouth of the culvert is about 1m high.

