Scajaquada Creek
Stream Assessment: Post Project Monitoring

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1. Introduction

In October 2019, students in the Watershed Analysis class at SUNY Buffalo State used the Stream Visual Assessment Protocol (SVAP) (NRCS, 1998 and 2009) to conduct a qualitative assessment of stream corridor conditions in a section of Scajaquada Creek that flows through the Forest Lawn Cemetery in the City of Buffalo, NY. The objective of this work was to assess the physical, chemical, and biological conditions of Scajaquada Creek after a stream restoration project was completed. This assessment provides the post-restoration conditions that can be compared to pre-restoration baseline conditions observed in October 2016 (Frothingham et al., 2017). Monitoring pre- and post-restoration conditions is essential for evaluating the success of any stream restoration project (Federal Interagency Stream Restoration Working Group (FISRWG), 1998).

The following documents provide information on Scajaquada Creek:

- Background on Scajaquada Creek can be found in the Frothingham et al. (2017) pre-construction monitoring document. Several other studies on Scajaquada Creek are referenced in that document.
- Background on the stream restoration project, which was developed by the U.S. Army Corps of Engineers (USACE) in conjunction with Buffalo Niagara Waterkeeper (BNW), Forest Lawn Cemetery, and other partners, can be found in the USACE (2016) final report. The overall aim of the restoration project was to improve water quality, alleviate flooding, and make the creek more accessible and appealing to the public (USACE, 2016). Note that the assessed USACE (2016) restoration reaches were labelled Reach 2 and Reach 5 (Figure 1.1), which contained original BNW Reaches 5-8 (USACE Reach 2) and Reaches 20-22 (USACE Reach 5) (Figure 1.2) (Buffalo Niagara Riverkeeper (BNR) (now Waterkeeper), 2013). The BNW reach numbers are used in this report. Details of the stream restoration activities are summarized below.

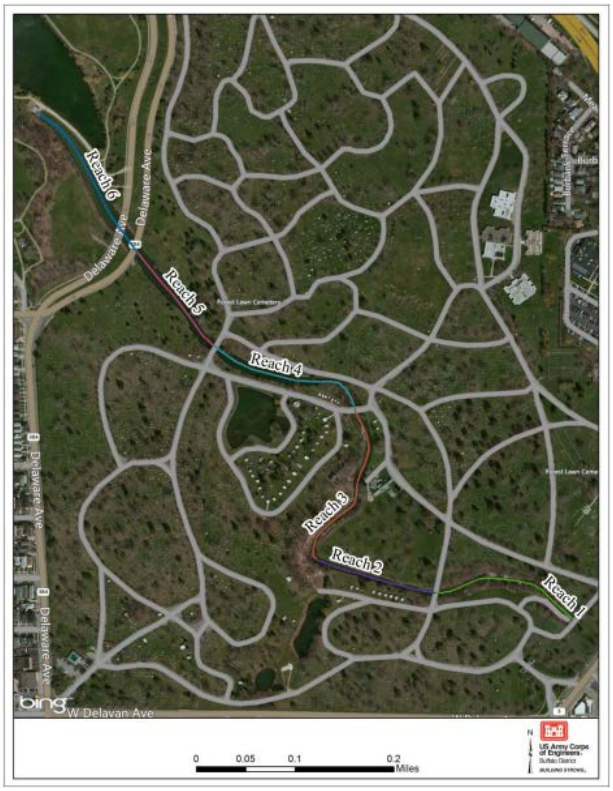


Figure 1.1 Map of stream restoration project area: USACE Reaches 2 and 5 (USACE, 2016).

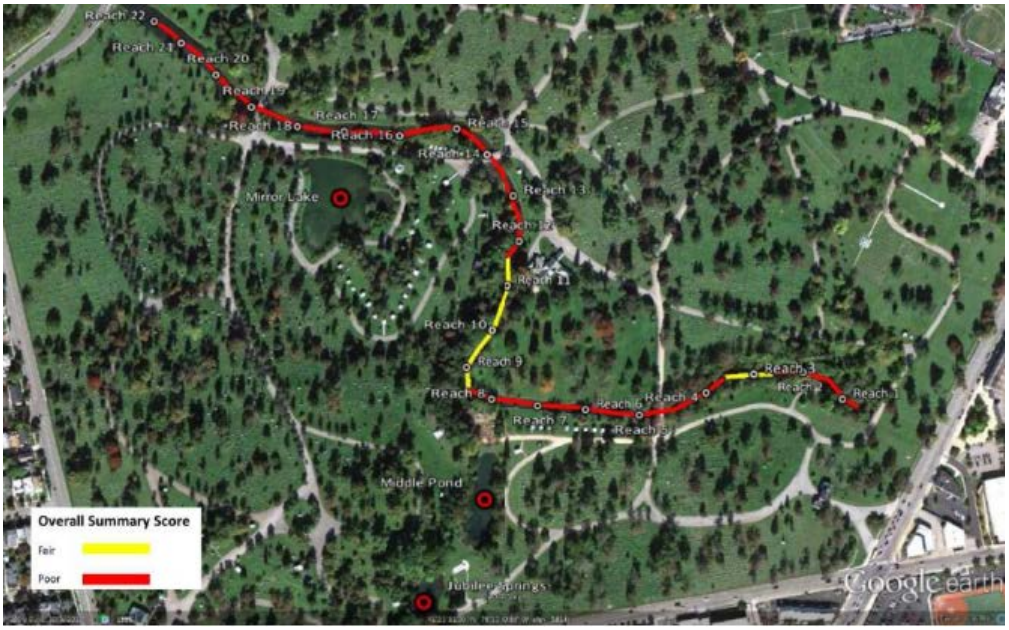


Figure 1.2 Map of stream restoration project area: BNW Reaches 5-8 and 20-22 (BNR, 2013).

The restoration plan for the upstream reach (BNW Reaches 5-8) can be seen in Figure 1.3 (USACE, 2016). The plan for this area included streambank grading with stone "steps" and the creation of a more natural floodplain along the right (left and right determined by orienting downstream) streambank. The area in white on Figure 1.3 was designed to be submerged during high flow events. During low flow events, this area was designed to provide added green space as an improved riparian zone with shrubs and emergent vegetation which the public can access via steps that were constructed using the existing stone wall material. In the channel itself, the plan included adding bendway weirs to create an artificial meander with vegetation planted behind the weirs. The weirs were designed to create habitat and dissipate high velocities, which should decrease erosion around the bend at the end of this section. Native trees and shrubs were planted along the banks to add canopy cover to provide more habitat and cooler water temperatures.

Figure 1.3 Restoration plan for the upstream restoration area (BNW Reaches 5-8) (USACE, 2016).

The downstream reach (BNW Reaches 20-22) restoration involved dredging, plus planting native vegetation along both banks and creating a wetland along the right streambank (Figure 1.4) (USACE, 2016). To restore connection between the stream channel to the floodplain in this area, all but a short segment of the stone wall on the right streambank was removed. The remaining stone wall was shortened to become part of a tiered multi-level riparian zone. In addition, the ground was graded to achieve a more natural bank slope outside of the tiered area. To address the issue of an existing sediment bar, the area was dredged. The material that was dredged was replaced with new, coarse-grained stone to redirect flows and create flow diversity and complexity, which was designed to increase instream habitat and benefit benthic aquatic species. A series of bendway weirs with vegetation plantings also contributed to instream habitat. Upland and wetland plantings and seed mixes were added along both streambanks to enhance the riparian zone and increase canopy cover. A large wetland area was created at the downstream end of this section along the right streambank. The wetland was designed to increase habitat, biodiversity, and flood capacity. A pedestrian bridge connects an island in the wetland to the riparian zone.

Figure 1.4 Restoration plan for the upstream area (BNW Reaches 20-22) (USACE, 2016).

2. Methods

The Stream Assessment Visual Protocol (SVAP) (NRCS, 1998 and 2009) was used to assess Scajaquada Creek stream corridor conditions pre- (Frothingham et al., 2017) and post-construction (this study). The SVAP is a qualitative method used to assess of the overall health of a stream reach. The application of the SVAP requires the user to visually assess stream elements related to stream health. Each element has a scoring description associated with a numerical scale from zero to ten. The scores from each element are averaged together to yield an overall score for each reach. The higher the score, the healthier the reach. The SVAP scores are associated with ratings as follows: 1.0 - 2.9 = Severely Degraded, 3.0 - 4.9 = Poor, 5.0- 6.9 = Fair, 7.0 - 8.9 = Good, and 9.0 – 10.0 = Excellent (NRCS, 2009). The elements assessed during this project were as follows: channel condition, riparian zone, bank condition, water appearance, nutrient enrichment, instream fish cover, pools, and canopy cover (Table 2.1 and Appendix 1 SVAP field sheet). The right and left streambanks (determined by orienting downstream) are assessed separately for the riparian zone and bank condition elements and the average score for each element is used to calculate the overall score.

Table 2.1 Description of SVAP Elements (after NRCS, 1998 and 2009)

SVAP Element	Criteria
Channel Condition	Evidence of channelization or alteration of the stream and channel incision or aggradation
Riparian Zone	Width of the vegetation zone from the edge of the bankfull channel out onto the floodplain
Bank Condition	Evidence of streambank instability and presence/absence of hardened streambanks
Water Appearance	Compares turbidity and other visual characteristics with a healthy or reference stream
Nutrient Enrichment	Reflected by the types and amounts of aquatic vegetation in the water
Instream Fish Cover	Measures availability of physical habitat for fish
Canopy Cover	Percentage of the water surface shaded within the length of the reach

Physical reach characteristics (e.g., low flow and bankfull channel width and depth) also were recorded and a photo was taken at the upstream end of each reach.

3. Results

Post-construction assessment was completed in seven reaches of Scajaquada Creek in Forest Lawn Cemetery on October 5, 2019. Most of the project construction (e.g., installation of bendway weirs and riparian zone work) was completed during 2017 and 2018, with the wetland project and some adaptive management completed in 2019 prior to this assessment (E. Root, 2019 pers.comm.). The reaches that were assessed were as follows: Reaches 5-8 and Reaches 20-22 (see Figure 1.2 above). As stated above, these reach numbers correspond to the reaches assessed by BNW in 2013 (BNR, 2013) and the reaches are contained in Reaches 2 and 5 of the USACE (2016) stream restoration document (see Figure 1.1 above). Each reach was approximately 160 feet long. The SVAP results were recorded on field sheets (Appendix 1) and field crews estimated bankfull and lowflow width and depth measurements and recorded dominate bed substrate (Table 3.1). A photo also was taken at the upstream end of each reach. The weather conditions on October 5th were cool, clear, and sunny.

Table 3.1 Physical Channel Conditions in Each Reach

Reach	**Bankfull**		**Lowflow**		
	Depth (ft)	**Width (ft)**	**Depth (ft)**	**Width (ft)**	**Dominant Bed Material**
5	5	40	0.5	20	bedrock/concrete
6	5	25	1	20	bedrock/concrete
7	4	18	0.5	10	bedrock/concrete
8	5	20	1.5	20	bedrock/concrete
20	4.5	40	3.5	35	silt/clay
21	5	40	4	35	silt/clay
22	5	30	2	25	silt/clay

Summaries of SVAP element scores for each reach can be found in Tables 3.2 to 3.8. These tables provide post-construction conditions for Reaches 5-8 and 20-22.

Table 3.2 Reach 5 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	4.0	Poor	Altered channel, straightened, hard structures; bankfull channel disconnected from floodplain along both streambanks
Bank Condition (average)	2.5	Severely Degraded	Limestone blocks dominate banks; streambanks are stable
Riparian Zone (average)	1.5	Severely Degraded	Little to no vegetation along left streambank; some emergent aquatic vegetation along right bank; mowed lawn dominates riparian zone
Water Appearance	10.0	Excellent	Water clear and submerged objects are visible
Nutrient Enrichment	8.0	Good	Fairly clear water; moderate algal growth on stream substrates
Instream Fish Cover	5.0	Poor	Overhanging vegetation, dense macrophyte beds, riffle, bendway weir
Canopy Cover	2.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	4.7	Poor	

Table 3.3 Reach 6 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	5.0	Poor	Altered channel, straightened, hard structures; bankfull channel disconnected from floodplain along left streambank
Bank Condition (average)	2.0	Severely Degraded	Limestone blocks dominate banks (especially left streambank); streambanks are moderately stable
Riparian Zone (average)	5.5	Fair	Little to no vegetation along left streambank (some evergreen trees); small areas of emergent aquatic vegetation along both streambanks; mowed lawn dominates left bank, but taller grasses growing in area of new mowing pattern in right bank riparian zone
Water Appearance	4.0	Excellent	Generally, clear water and submerged objects are visible, but low score due to small pockets of iron sheen
Nutrient Enrichment	7.0	Good	Fairly clear water; moderate algal growth on stream substrates
Instream Fish Cover	4.0	Poor	Overhanging vegetation, boulders/cobbles, dense macrophyte beds, bendway weir
Canopy Cover	2.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	4.2	Poor	

Table 3.4 Reach 7 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	5.0	Poor	Altered channel, straightened, hard structures; bankfull channel disconnected from floodplain along left streambank
Bank Condition (average)	3.0	Poor	Limestone blocks dominate banks (especially left streambank); streambanks are moderately stable
Riparian Zone (average)	5.0	Fair	Moderate amount of vegetation along left streambank (evergreen trees); small areas of emergent aquatic vegetation along both banks; mowed lawn dominates left bank, but taller grasses growing in area of new mowing pattern along right bank riparian zone
Water Appearance	4.0	Poor	Generally, clear water and submerged objects are visible, but low score due to an oil/bacterial sheen present behind a bendway weir
Nutrient Enrichment	7.0	Good	Fairly clear water; moderate algal growth on stream substrates
Instream Fish Cover	6.0	Fair	Overhanging vegetation, logs, riffles, dense macrophyte beds, bendway weir
Canopy Cover	2.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	4.6	Poor	

Table 3.5 Reach 8 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	4.0	Poor	Altered channel, straightened, hard structures; bankfull channel connected to floodplain along this reach, especially at the downstream end
Bank Condition (average)	5.0	Fair	Limestone blocks dominate banks; streambanks are moderately stable
Riparian Zone (average)	8.0	Good	Vegetation (primarily tall grasses and sedges) extends one bankfull channel width from the top of the bankfull channel on both streambanks along the majority of the length of the reach
Water Appearance	8.0	Fair	Water clear and submerged objects are visible
Nutrient Enrichment	8.0	Good	Fairly clear water; moderate algal growth on stream substrates
Instream Fish Cover	8.0	Good	Overhanging vegetation, logs, riffles, dense macrophyte beds, cobble/boulders, deep pool, bendway weir
Canopy Cover	2.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	6.1	Fair	

Table 3.6 Reach 20 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	2.0	Severely Degraded	Altered channel, straightened, hard structures; bankfull channel disconnected from floodplain along both streambanks
Bank Condition (average)	1.0	Severely Degraded	Limestone blocks dominate both streambanks; banks are stable
Riparian Zone (average)	1.0	Severely Degraded	Little to no vegetation in riparian zone along both streambanks; mowed lawn dominates riparian zone
Water Appearance	2.0	Severely Degraded	Water was turbid
Nutrient Enrichment	6.0	Fair	Fairly clear or slightly greenish water; moderate algal growth on stream substrates
Instream Fish Cover	4.0	Poor	Overhanging vegetation, log, undercut bank
Canopy Cover	1.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	2.4	Severely Degraded	

Table 3.7 Reach 21 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	2.0	Severely Degraded	Altered channel, straightened, hard structures; bankfull channel disconnected from floodplain along both streambanks (except in wetland area at the downstream end of this reach)
Bank Condition (average)	2.0	Severely Degraded	Limestone blocks dominate streambanks; banks are stable
Riparian Zone (average)	1.5	Severely Degraded	Little to no vegetation in riparian zone along both streambanks; mowed lawn dominates riparian zone (excluding wetland project area)
Water Appearance	4.0	Poor	Water was turbid
Nutrient Enrichment	5.0	Fair	Greenish water; abundant algal growth on hard surfaces
Instream Fish Cover	5.0	Fair	Log, boulder/cobble, bendway weir, wetland adjacent to the bank
Canopy Cover	1.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	2.9	Severely Degraded	

Table 3.8 Reach 22 SVAP Element Summaries and Overall Score

SVAP Element	Score	Rating	Notes
Channel Condition	5.0	Fair	Altered channel; limited hard structures at upstream end of reach; channel connected to floodplain/wetland project area along right bank
Bank Condition (average)	9.0	Excellent	Limited hard structures; streambanks moderately stable
Riparian Zone (average)	4.5	Poor	Mowed lawn dominates riparian zone along both streambanks in upstream end of reach (total length of riparian zone along left bank); natural vegetation in wetland project area along right bank
Water Appearance	7.0	Good	Water was slightly turbid
Nutrient Enrichment	8.0	Good	Fairly clear or slightly greenish water; moderate algal growth on stream substrates
Instream Fish Cover	4.0	Poor	Overhanging vegetation, undercut banks, wetland adjacent to the right streambank
Canopy Cover	2.0	Severely Degraded	Less than 20% of water surface shaded within the length of the reach
Overall Score	5.6	Fair	

3.1 2016 versus 2019 SVAP Comparisons

The following tables (Tables 3.9-3.15) summarize the pre- and post-construction monitoring results from 2016 (from Frothingham et al., 2017) and 2019. In addition, SVAP graphs and reach photos from 2016 and 2019 are contained in Figures 3.1-3.7. The SVAP score changes were not very large, but they appear to be trending in the correct direction—towards improvements, particularly in areas that the restoration project design was intended to improve (i.e., instream habitat, riparian zone improvements, and, to a lesser extent, improvements in channel condition to re-connect the channel to the floodplain). In the USACE (2016) report, projections were made that SVAP scores would, in time, increase from Poor to Fair in Reach 2 (BNW Reaches 5-8) and from Poor to Good in Reach 5 (BNW Reaches 20-22). Note that these projections were based on a slightly different SVAP assessment method used when BNW assessed the creek in 2013 (BNR, 2013). The 2013 assessment used the original 1998 SVAP (NRCS, 1998), which employed comparable but somewhat different qualitative measures and they assessed additional stream elements (see Frothingham et al., 2017 for a discussion on this topic). These projection endpoints have not yet been met; however, it is recommended that post-construction monitoring be completed in the future (e.g., 1-3 years from now) because the projected improvements may be observed after more time has passed. Because, while a large percentage of the project was completed during 2017 and 2018, the wetland project and some

adaptive management was just completed in 2019, so the project needs time to mature before all anticipated benefits can be noted.

Table 3.9 Reach 5 2016 versus 2019 SVAP Comparisons

	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	1.0	Severely Degraded	4.0	Poor
Bank Condition (average)	5.5	Fair	2.5	Severely Degraded
Riparian Zone (average)	1.5	Severely Degraded	1.5	Severely Degraded
Water Appearance	6.0	Fair	10.0	Excellent
Nutrient Enrichment	7.0	Good	8.0	Good
Instream Fish Cover	3.0	Poor	5.0	Poor
Canopy Cover	1.0	Severely Degraded	2.0	Severely Degraded
Overall Score	3.6	Poor	4.7	Poor

Table 3.10 Reach 6 2016 versus 2019 SVAP Comparisons

	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	3.0	Poor	5.0	Poor
Bank Condition (average)	2.0	Severely Degraded	2.0	Severely Degraded
Riparian Zone (average)	1.0	Severely Degraded	5.5	Fair
Water Appearance	6.0	Fair	4.0	Excellent
Nutrient Enrichment	7.0	Good	7.0	Good
Instream Fish Cover	1.0	Severely Degraded	4.0	Poor
Canopy Cover	0.0	Severely Degraded	2.0	Severely Degraded
Overall Score	2.9	Severely Degraded	4.2	Poor

Table 3.11 Reach 7 2016 versus 2019 SVAP Comparisons

	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	1.0	Severely Degraded	5.0	Poor
Bank Condition (average)	3.0	Poor	3.0	Poor
Riparian Zone (average)	1.0	Severely Degraded	5.0	Fair
Water Appearance	3.0	Poor	4.0	Poor
Nutrient Enrichment	7.0	Fair	7.0	Good
Instream Fish Cover	1.0	Severely Degraded	6.0	Fair
Canopy Cover	0.0	Severely Degraded	2.0	Severely Degraded
Overall Score	2.3	Severely Degraded	4.6	Poor

Table 3.12 Reach 8 2016 versus 2019 SVAP Comparisons

	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	1.0	Severely Degraded	4.0	Poor
Bank Condition (average)	1.5	Severely Degraded	5.0	Fair
Riparian Zone (average)	0.5	Severely Degraded	8.0	Good
Water Appearance	5.0	Fair	8.0	Fair
Nutrient Enrichment	6.0	Fair	8.0	Good
Instream Fish Cover	3.0	Poor	8.0	Good
Canopy Cover	3.0	Poor	2.0	Severely Degraded
Overall Score	2.9	Severely Degraded	6.1	Fair

Table 3.13 Reach 20 2016 versus 2019 SVAP Comparisons

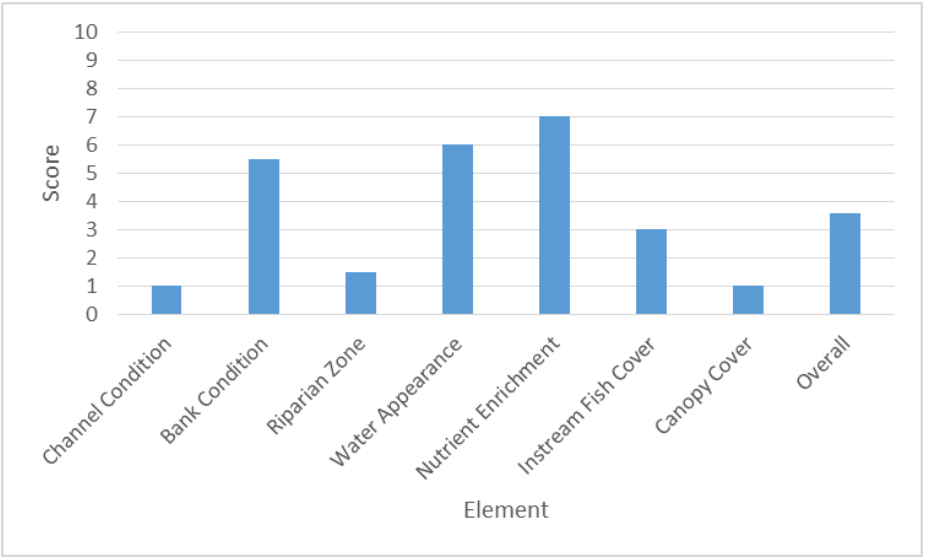
	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	0.0	Severely Degraded	2.0	Severely Degraded
Bank Condition (average)	1.0	Severely Degraded	1.0	Severely Degraded
Riparian Zone (average)	0.5	Severely Degraded	1.0	Severely Degraded
Water Appearance	3.0	Poor	2.0	Severely Degraded
Nutrient Enrichment	6.0	Fair	6.0	Fair
Instream Fish Cover	3.0	Poor	4.0	Poor
Canopy Cover	1.0	Severely Degraded	1.0	Severely Degraded
Overall Score	2.1	Severely Degraded	2.4	Severely Degraded

Table 3.14 Reach 21 2016 versus 2019 SVAP Comparisons

	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	2.0	Severely Degraded	2.0	Severely Degraded
Bank Condition (average)	1.5	Severely Degraded	2.0	Severely Degraded
Riparian Zone (average)	1.0	Severely Degraded	1.5	Severely Degraded
Water Appearance	3.0	Poor	4.0	Poor
Nutrient Enrichment	6.0	Fair	5.0	Fair
Instream Fish Cover	5.0	Fair	5.0	Fair
Canopy Cover	1.0	Severely Degraded	1.0	Severely Degraded
Overall Score	2.8	Severely Degraded	2.9	Severely Degraded

Table 3.15 Reach 22 2016 versus 2019 SVAP Comparisons

	2016		2019	
SVAP Element	**Score**	**Rating**	**Score**	**Rating**
Channel Condition	2.0	Severely Degraded	5.0	Fair
Bank Condition (average)	7.0	Good	9.0	Excellent
Riparian Zone (average)	1.0	Severely Degraded	4.5	Poor
Water Appearance	7.0	Good	7.0	Good
Nutrient Enrichment	7.0	Good	8.0	Good
Instream Fish Cover	0.0	Severely Degraded	4.0	Poor
Canopy Cover	2.0	Severely Degraded	2.0	Severely Degraded
Overall Score	3.7	Poor	5.6	Fair



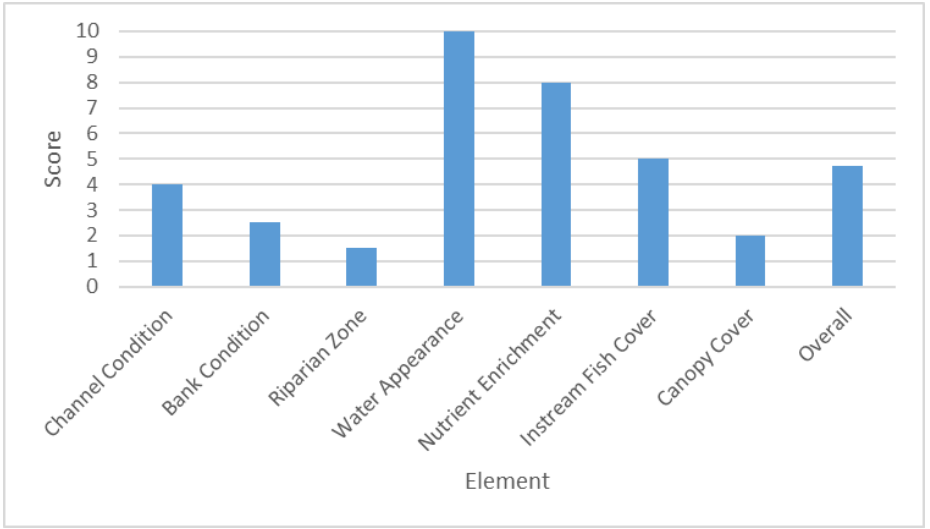
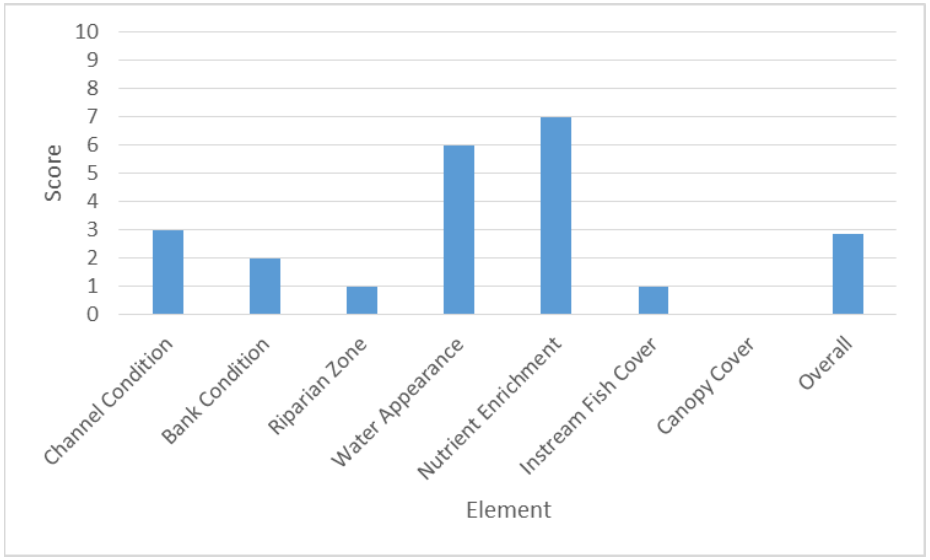


Figure 3.1 Reach 5, located at 42.924°N, -78.85979°W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.



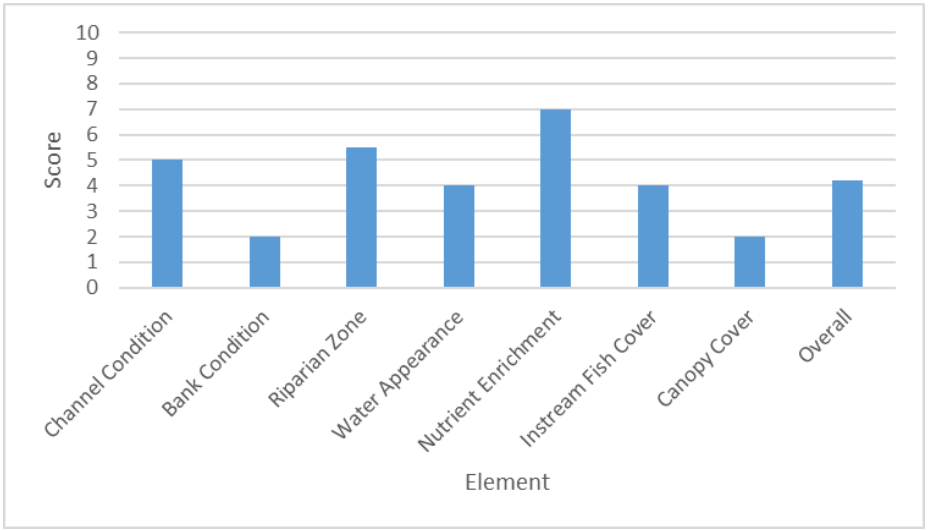
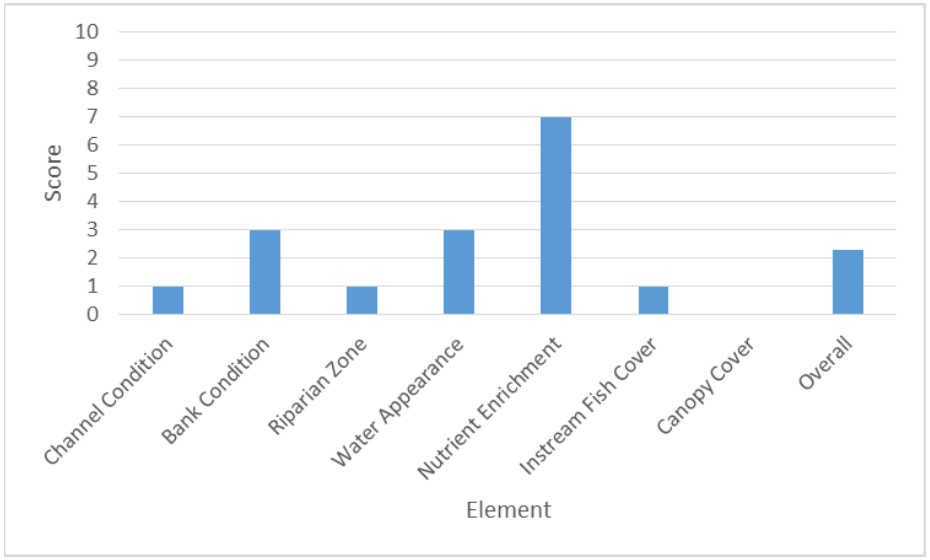


Figure 3.2 Reach 6, located at 42.92413˚N, -78.22˚W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.



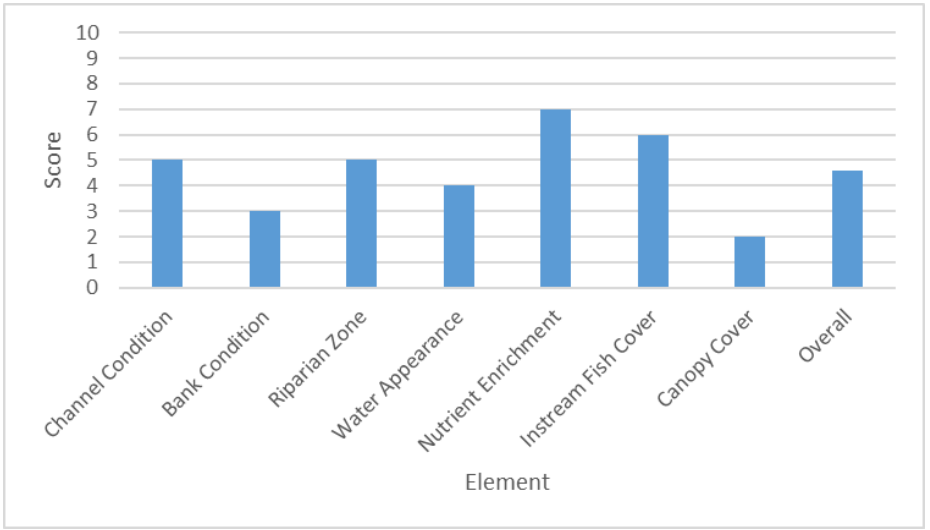
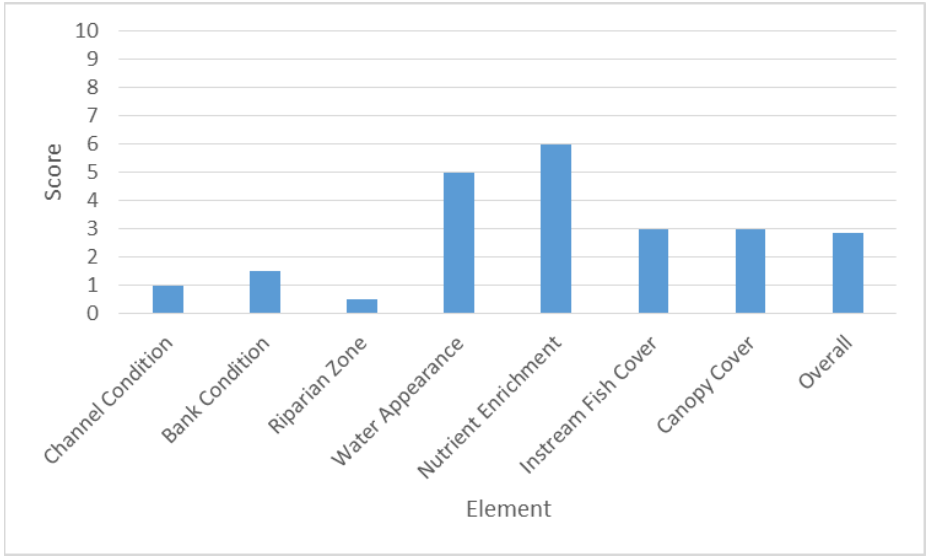


Figure 3.3 Reach 7, located at 42.92432°N, -78.86079°W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.



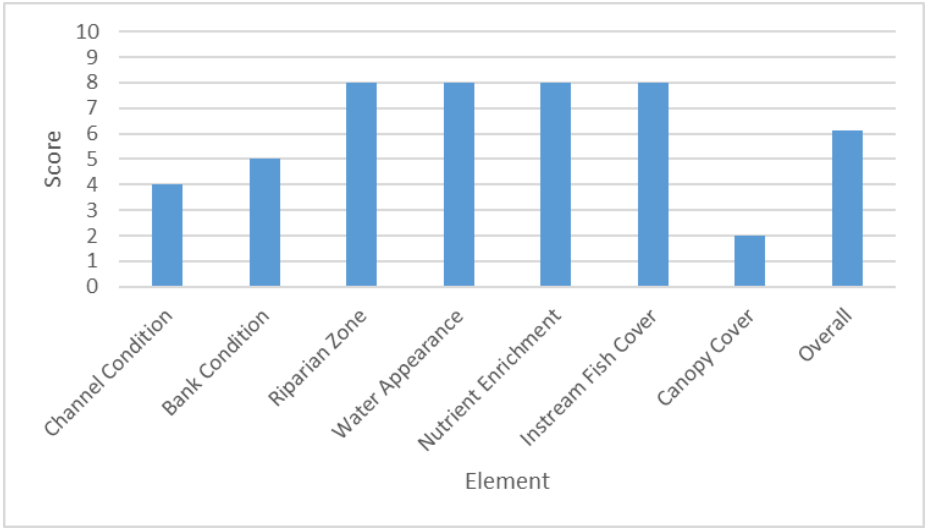
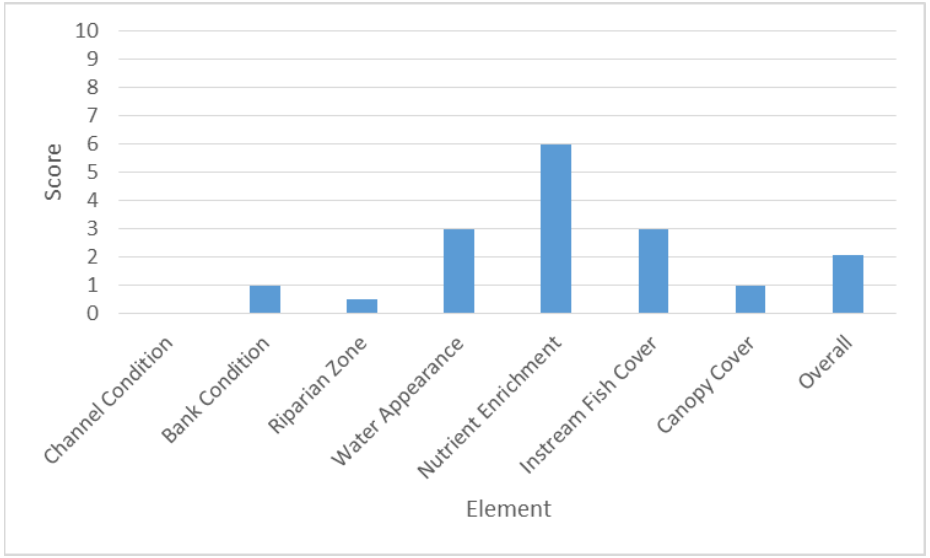


Figure 3.4 Reach 8, located at 42.92459°N, -78.86149°W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.



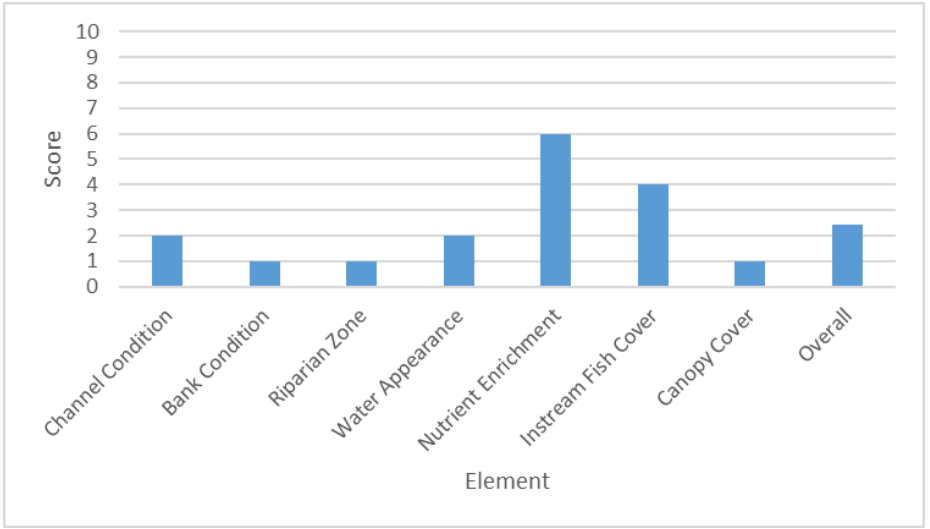
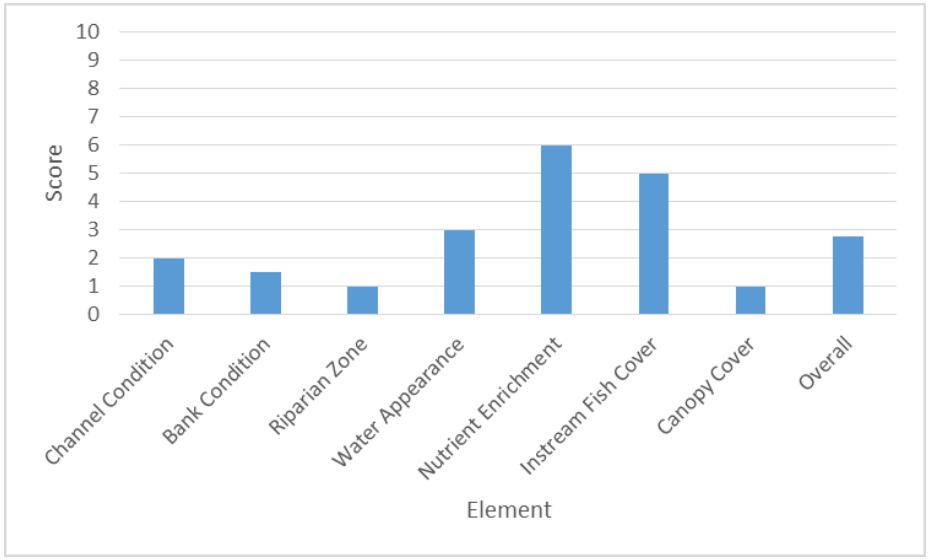


Figure 3.5 Reach 20, located at 42.9278°N, -78.86447°W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.



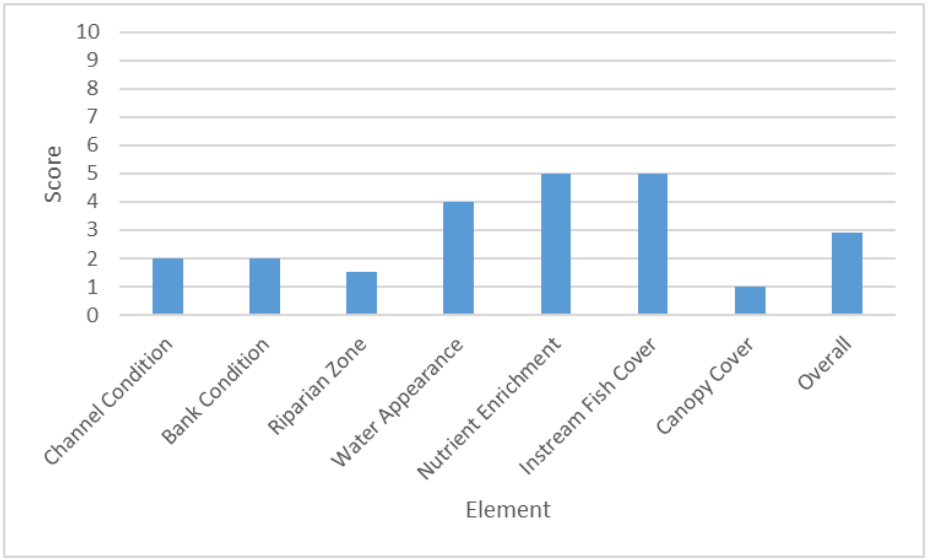
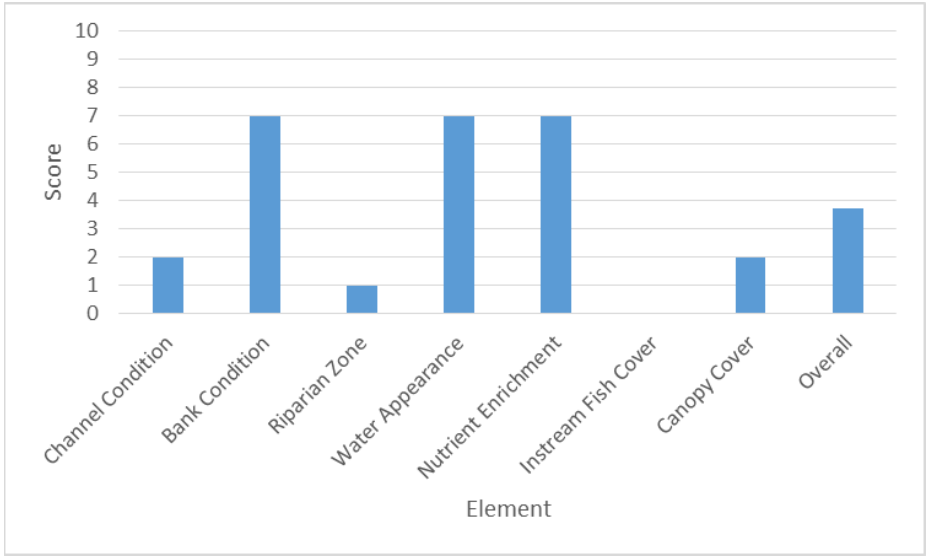


Figure 3.6 Reach 21, located at 42.92825°N, -78.8648°W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.



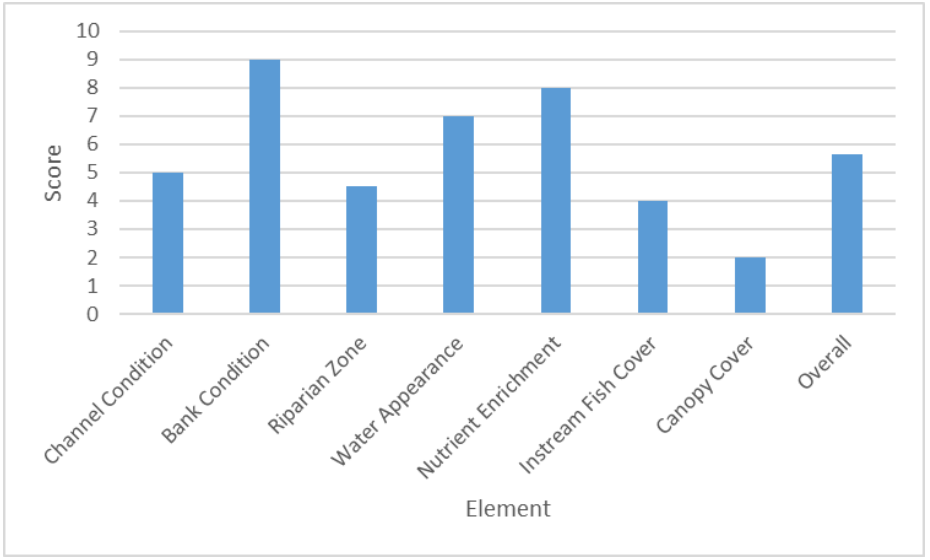


Figure 3.7 Reach 22, located at 42.92853°N, -78.86523°W. Pre-construction SVAP on left (Frothingham et al., 2017) and post-construction on right.

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Appendix 1
SVAP Field Sheet

Stream Visual Assessment Protocol

Field Crew _____ Date _____Time _____

Stream Name ___Scajaquada Creek_____ Reach Name_____

Reach GPS Coordinates _____ Photo number(s)_____

Weather conditions today _____ Past 2-5 days _____

_____

Reach length _____ ft; Lowflow channel depth _____ ft; Lowflow channel width _____ ft

Bankfull channel depth _____ ft; Bankfull channel width _____ ft

Dominant bed substrate _____ silt/clay _____ sand _____ gravel _____ cobble _____ boulder _____ bedrock/concrete

Channel Condition

Natural channel with established vegetation. No channelization (with or without straightening and/or with or without riprap/concrete/other hard structures). No evidence of incision (e.g., downcutting; vertical banks). No evidence of aggradation (e.g., filling in; lateral migration/bank erosion; wide, shallow channel; multiple bars in channel).	Evidence of past channelization OR incision, but with significant recovery of channel form and vegetation. Bankfull channel and floodplain are connected in most areas; inundated seasonally. Minimal aggradation; some lateral migration and bank erosion; minimal bar formation (< 3 bars).	Altered channel; <50% of the reach channelized and/or with hard structures. Bankfull channel appears to be disconnected from the floodplain, with infrequent or no inundation. Active incision evident; steep banks with some bank failures, point bars located adjacent to steep banks. Moderate aggradation; moderate lateral migration and bank erosion, deposition of sediments causing channel to be very shallow in places; 3-4 bars in channel.	Altered channel; >50% of the reach channelized and/or with hard structures. Little or no connection between floodplain and stream channel and no inundation. Active incision; steep banks and bank failures prominent; headcuts or surface cracks on banks; point bars, if present, located adjacent to steep banks Severe aggradation; severe lateral channel migration and bank erosion; deposition of sediments causing channel to be very shallow in reach; braided channels (5 or more bars in channel).
10 9	8 7 6	5 4 3	2 1 0

Channelization: Straightened Yes / No — Riprap/concrete/other hard structures Yes / No

Channel incision and/or Aggradation/widening

Bank Condition **(orient left & right facing downstream)**

Banks are stable; protected by roots of natural vegetation, wood, and rock. No fabricated structures present on bank. No excessive erosion or bank failures. No recreational or livestock access.	Banks are moderately stable, protected by roots of natural vegetation, wood, or rock or a combination of materials. Limited number of structures present on bank. Evidence of erosion or bank failures, some with reestablishment of vegetation. Recreational use and/or grazing do not negatively impact bank condition.	Banks are moderately unstable; very little protection of banks by roots of natural wood, vegetation, or rock. Fabricated structures cover more than half of reach or entire bank. Excessive bank erosion or active bank failures. Recreational and/or livestock use are contributing to bank instability.	Banks are unstable; no bank protection with roots, wood, rock, or vegetation. Riprap and/or other structures dominate banks. Numerous active bank failures. Recreational and/or livestock use are contributing to bank instability.
LB: 10 9	8 7 6	5 4 3	2 1 0
RB: 10 9	8 7 6	5 4 3	2 1 0

LB Condition:	Natural or Riprap/concrete/other hard structures	Bank slope class: gentle; moderate; steep; undercut (0-29°; 30-49°; 50-90°; portion of bank > 90°)

RB Condition:	Natural or Riprap/concrete/other hard structures	Bank slope class: gentle; moderate; steep; undercut (0-29°; 30-49°; 50-90°; portion of bank > 90°)

Riparian Zone **(orient left & right facing downstream)**

Vegetation extends at least two bankfull channel widths from the top of the bankfull channel. Vegetation is generally contiguous along the entire length of the reach.	Vegetation extends one bankfull channel width from the top of the bankfull channel. Vegetation gaps do not exceed 10% of the reach length.	Vegetation extends half of the bankfull channel width from the top of the bankfull channel. Vegetation gaps do not exceed 30% of the reach length.	Vegetation extends a third of the bankfull channel width from the top of the bankfull channel. Vegetation gaps exceed 30% of the reach length.	Vegetation extends less than a third of the bankfull channel width from the top of the bankfull channel. Vegetation gaps exceed 30% of the reach length.
LB: 10 9	8 7	6 5	4 3 2	1 0
RB: 10 9	8 7	6 5	4 3 2	1 0

Water Appearance

Water is very clear, or clarity appropriate to site. Submerged objects (rocks, wood) are visible at depths 3 to 6 ft.* No oil sheen on surface; no evidence of metal precipitates in stream.	Water is slightly turbid (cloudy), especially after storm event, but clears after weather clears. Submerged objects are visible at depth 1.5 to 3 ft. No oil sheen on surface; no evidence of metal precipitates in stream.	Water is turbid most of the time. Submerged objects visible to depth 0.5 to 1.5 ft. and/or Oil sheen is present on water surface or areas of slackwater and/or There is evidence of metal precipitates in stream.	Water is very turbid or has a muddy appearance most of the time. Objects visible to depth <0.5 ft. and/or Oil sheen is present on water surface or areas of slackwater.
10 9 8	7 6 5	4 3 2	1 0

*Use depth that the objects are visible to only if the stream is deep enough to evaluate turbidity using this approach.

Nutrient Enrichment

Clear water along entire reach. Little algal growth present. Diverse aquatic plant community includes low quantities of many species of aquatic plants.	Fairly clear or slightly greenish water along entire reach. Moderate algal growth on stream substrates.	Greenish water along entire reach, especially in slow sections. Abundant algal growth, especially during warmer months. Overabundance of lush green aquatic plants, especially in slow sections.	Water is a pea green color. Severe algal blooms create thick algal mats in stream. Dense stands of aquatic plants clog stream.
10 9	8 7 6	5 4 3	2 1 0

Algal growth Dense aquatic plant beds Both

Instream Fish Cover

>7 cover types available	6 to 7 cover types available	4 to 5 cover types available	2 to 3 cover types available	None to 1 cover type available
10 9	8 7	6 5	4 3	2 1 0

Cover types: Logs/large woody debris, deep pools, overhanging vegetation, boulders/cobble, riffles, undercut banks, thick root mats, dense macrophyte beds, isolated/backwater pools, other: _____.

Canopy Cover—*score only if applicable**

Warmwater fishery

50% to 75% of water surface shaded within the length of the reach.	> 75% of water surface shaded within the length of the reach.	49 to 20% of water surface shaded within the length of the reach.	< 20% of water surface shaded within the length of the reach.
10 9	8 7 6	5 4 3	2 1 0

*Do not assess if active channel width is > 50 ft wide and if woody vegetation is naturally absent (e.g., wet meadow)

Additional Notes: