

Final Report
For
2016 Jordan River Bioassessment Study

Prepared For:

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INTRODUCTION

Great Lakes Environmental Center, Inc. (GLEC) has completed a bioassessment for the Friends of the Jordan River Watershed, Inc. at five study sites along the Jordan River and its tributaries. The bioassessment consisted of the quantification of physical habitat, macroinvertebrate populations and algal assemblages at each of the five sites. The study was conducted to document existing conditions and serve as a baseline environmental assessment. Ideally, this bioassessment will be repeated annually so that changes (or lack thereof) in the habitat, macroinvertebrate population, or algal assemblage are observed and documented. Listed below are the five study sites, their coordinates, and site location descriptions:

1. Deer Creek at M-32:

Latitude (Lat): 45.13597, Longitude (Lon): -85.11897

All data collected just upstream from the road-stream crossing.

2. Bennett Creek at M-66

Lat: 45.10869, Lon: -85.12691

All data collected downstream from the road-stream crossing. Permission obtained from Frank, property owner on the creek's south side, to access stream here.

3. Green River at Pinney Bridge Road

Lat: 45.01102, Lon: -85.06065

Data collected downstream of the bridge. Both sides are well posted no trespassing.

4. Jordan River, downstream of Fish Hatchery

Lat: 45.02478, Lon: -84.96973

Site required short hike to access, and is directly west from a grassy pull-off on Jordan River Rd. south of the hatchery.

5. Jordan River, upstream of Fish Hatchery

Lat: 45.03271, Lon: -84.96581

All data was collected upstream of the Fish Hatchery. This is a braided channel with some beaver ponding.

METHODS

For each site, a 50 meter stretch of river, centered around the coordinates, served as the study area. The Michigan Department of Environmental Quality (MDEQ) Procedure 51 protocol (MDEQ 2008) was followed for a habitat and macroinvertebrate assessment at each study site. Periphyton samples were also scrapped from subsurface substrates (i.e., rocks, logs etc.) for the algal analysis. Periphyton is the assemblage of soft and hard-bodied algae attached to the substrate.

Macroinvertebrate Collection

The abundance and diversity of aquatic macroinvertebrate communities are commonly used as indicators of the overall quality of a stream. Assessment of the macroinvertebrate communities of five study sites along the Jordan River and its tributaries was completed to characterize the stream condition at each location. All locations were assessed using the Great Lakes and Environmental Assessment Section, Procedure 51, Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers, Revised December 2008 (Procedure 51). Sample collections, and the scoring and interpretation of data, followed Procedure 51 which is accepted by both federal and state agencies as an accurate, consistent, and repeatable sampling and analytical protocol for Michigan streams.

Macroinvertebrate samples were collected from the five study sites on August 2-3, 2016. A D-frame dip net with 500-micron mesh was used to collect macroinvertebrates, in an upstream direction, from a 50 meter length of stream at each site. All available habitats were sampled, including fast and slow moving water areas, hard and soft substrates, vegetated areas, undercut banks, and woody material. Large cobble and logs were sampled by hand picking. Debris collected at each site was composited into a bucket with a 500-micron mesh bottom. Following collection, the debris in the bucket was stirred, and sub-samples of the composited debris were scooped out of the bucket and placed on white trays. Macroinvertebrates were enumerated and identified, to the family level, scoop-by-scoop until a total of 300 ± 60 organisms was reached.

Scoring and interpretation of macroinvertebrate community data also followed the methods outlined in Procedure 51. A set of nine metrics was used to score community data in comparison to sites considered as excellent within the North Central Hardwood Forests Ecoregion. Each

metric was given a score of 1 (better than average), 0 (average), or -1 (worse than average). Scores for each metric were summed for a final site score. The Procedure 51 data results were entered into a spreadsheet and used to calculate the following nine metrics for each station in order to provide a qualitative rating of the macroinvertebrate community.

- Total number of taxa. Taxa (taxa is plural for taxon, which refers to a taxonomic category, such as family, genus, or species) richness and species diversity are standard indicators of healthy and stable biological communities. This metric evaluates the total number of taxa found and rates diverse systems higher than monotypic communities.
- Number of mayfly taxa. The total number of mayfly taxa is used as an overall indicator of stream quality. Mayflies are, as a group, considered to be intolerant to pollution. Their presence, in abundance, is therefore rated high in this metric.
- Number of caddisfly taxa. Like mayflies, caddisflies are pollution intolerant. Areas containing high numbers of caddisflies are given higher metric values. However, several species can tolerate varying degrees of habitat degradation.
- Number of stonefly taxa. Stoneflies are the most sensitive to, and intolerant of, poor water quality. Their presence is often an indicator of excellent water quality.
- Percent mayfly composition. This metric weights the presence of mayflies in relation to the total number of species found. As with the total number of mayfly taxa, the percent composition of mayflies can drastically decline with stream quality degradation.
- Percent caddisfly composition. This metric weights the number of caddisflies found in relation to the total number of species found within the sample area.
- Percent contribution of dominant taxa. This metric calculates the ratio of the number of dominant taxa found to the total number of organisms collected. The results provide an indication of community structure and balance. Those areas dominated by few species, or composed of several taxa but strongly dominated by one, indicate lower quality systems.
- Percent isopods, snails, and leeches. Taxa from these 3 groups are tolerant to a wide variety and range of environmental conditions. High percent abundance of these animals is a good indicator of degraded stream habitats and low water quality.
- Percent surface air breathers. Surface dependent taxa refers to invertebrates that obtain oxygen through direct atmospheric exchange, usually at the air/water interface. High abundance of these animals is an indication of diurnal oxygen changes or other biological or chemical oxygen use. These taxa are also found in streams with higher temperatures and lower, erratic flows that typically have low or fluctuating dissolved oxygen concentrations.

This analysis results in a score based on a scale of -9 to 9; -9 to -5 is rated as Poor, -4 to 4 is rated as Acceptable, and a score greater than 4 is rated as Excellent. Generally speaking, flowing waters which harbor a high diversity of macroinvertebrates, including taxa sensitive to pollution (e.g., mayfly, caddisfly, and stonefly taxa), are of high water and habitat quality. Water bodies with low diversity of the macroinvertebrate community often have very high numbers of tolerant organisms, due to their ability to thrive in degraded conditions with little competition or predation.

Habitat

The physical characteristics of each site were documented using MDEQ's Habitat Assessment Stream Card and Field Data Sheet, included in the 2008 Procedure 51 protocol. The following stream habitat characteristics were documented: riparian vegetation, watershed features, stream characterization, instream features, aquatic vegetation, water quality, and sediment characterization. Ten metrics were used to score habitat quality. Data collection was based on visual observations and best professional judgment.

Algae

In addition to the common Procedure 51 metrics, an algal community assessment was also conducted in each study area. Using a 12-cm² area delimiter (3.8 cm diameter PVC pipe, 3 cm tall) and a stiff-bristle toothbrush, algae was scrubbed from the area inside of the delimiter from the upper surface of three substrates based on the relative abundance of that substrate in the sampling reach. For example, if the reach was heavily dominated by cobble substrate, all three sub-samples were taken from cobble. If the reach had an equal mixture of cobble, sand, and woody debris, one sub-sample was taken from each type of substrate. The three sub-samples were composited into a 500 mL plastic bottle by rinsing the scrubbed substrate from each sub-sample with site water into the plastic bottle. After the composite sample was collected, the bottle was homogenized and a 50 mL aliquot was poured into a labeled 60 mL sample tube. The samples were stored on ice until return to the laboratory. Once in the laboratory, the samples were preserved with formalin and refrigerated until analysis. Algae are often split into two groups when assessing water quality; soft algae and diatoms. Diatoms are algae with silica cell walls in the division Bacillariophyta. All other algal taxa are considered soft algae. In a full

bioassessment analysis, a soft algae count is performed and diatoms are cleaned and counted (a full count consists of 600 valves) separately for species-level data. For this project, GLEC suggested an analysis consisting of a normal soft algae count and identification of all diatoms to the lowest possible taxonomic level. After examination in the laboratory of the collected algal samples, this method was modified because all of the samples were strongly dominated by diatom cells (>90%) and it was our expert opinion that the original method, which included a soft algae count, would yield very little useful information. Instead, the soft algae count was not conducted and an abbreviated diatom count (300 valves instead of 600) and identification to species-level was completed to provide a baseline community composition that may be compared to later samples. In the laboratory, diatom cells were cleaned in nitric acid, dried onto coverslips and mounted onto microscope slides using Naphrax, a mounting medium with a high refractive index. At 1000 magnification, 300 diatom valves (each diatom cell consists of two diatom valves) were identified to the lowest possible level, mostly species. This abbreviated diatom count was necessary to stay within the project's resources. A full count may be done in the future if desired.

RESULTS

Macroinvertebrate Assessment

Macroinvertebrate samples from the five study sites in the Jordan River Watershed contained 39 different taxa. Mayflies dominated the sample collections in three of the five study sites; Deer Creek, Jordan River downstream of the fish hatchery, and Jordan River upstream of the fish hatchery. Bennett Creek was dominated by caddisflies and black flies and Green River was dominated by amphipods (scuds) and mayflies (Appendix 1). Invertebrates considered sensitive to poor water and habitat quality (i.e., mayflies, caddisflies, or stoneflies) were collected at all five sites. Species richness ranged from 15 to 26 taxa per site. The macroinvertebrate community scores at all five sites scored as acceptable tending towards excellent, with the exception of Deer Creek which scored as acceptable tending towards poor (Table 1).

Table 1. Macroinvertebrate Community Ratings for the Jordan River Watershed

Study Site	Macroinvertebrate Community Score and Rating, August 2016
Deer Creek at M-32	-1 (Acceptable tending towards Poor)
Bennett Creek at M-66	4 (Acceptable tending towards Excellent)
Green River at Pinney Bridge Rd.	1 (Acceptable tending towards Excellent)
Jordan River, downstream of fish hatchery	3 (Acceptable tending towards Excellent)
Jordan River, upstream of fish hatchery	3 (Acceptable tending towards Excellent)

A description of the macroinvertebrate samples and community ratings from each site is provided below.

Deer Creek at M-32

Mayflies dominated the macroinvertebrate sample (45%) at this site. A total of 18 different taxa were present including three families of mayflies and five families of caddisflies. These organisms are considered sensitive to poor water and habitat quality. Stonefly taxa were not found. The macroinvertebrate community score rated as -1 (acceptable tending towards poor) at this location. The slightly lower score at this location is due to the absence of stoneflies, the low proportion of caddisflies, and the dominance of one taxa (the mayfly Baetidae) (see Appendix 1).

Bennett Creek at M-66

Blackflies (Simuliidae) were the dominant taxa in this sample (35%) followed closely by caddisflies (32%). Eighteen total taxa were found at this site including three families of mayflies, three families of caddisflies, and two families of stoneflies. The macroinvertebrate community score rated as 4 (acceptable tending towards excellent) for Bennett Creek.

Green River at Pinney Bridge Road

Although the Green River site was dominated by mayflies (43%), amphipods (scuds) represented a significant proportion of the organisms found (29%). A total of 15 different taxa were found in the Green River including three families of mayflies, four families of caddisflies, and four families of stoneflies. The Green River community score for this location rated as 1 (acceptable tending towards excellent).

Jordan River, downstream of fish hatchery

The Jordan River downstream of the fish hatchery was dominated by mayflies (47%). Twenty different taxa were found including four families of mayflies, four families of caddisflies, and three families of stoneflies. The macroinvertebrate community score rated as 3 (acceptable tending towards excellent) for this location.

Jordan River, upstream of fish hatchery

Upstream of the fish hatchery, the Jordan River was dominated again by mayflies (51%). At this location, 26 different taxa were found including four families of mayflies, four families of caddisflies, and four families of stoneflies. The Jordan River above the fish hatchery had a macroinvertebrate community score rating of 3 (acceptable tending towards excellent).

Habitat Assessment

The study sites were located in Michigan's North Central Hardwood Forest ecoregion. At the time of observation and sampling, all streams were running at stable, baseflow discharges with average depths ranging between 0.5 and 1.5 feet. All five study sites were rated as Excellent during the rapid physical habitat assessment. Habitat scores are presented in Table 2 and copies of the habitat field datasheets are included in Appendix 2.

Trees dominated the riparian vegetation at Bennett Creek, the Green River and at both of the Jordan River sites while herbaceous vegetation dominated the riparian zones surrounding Deer Creek. In-stream aquatic vegetation was sparse at most of the study sites with the exception of Deer Creek. Deer Creek had multiple beds of rooted emergent and submergent aquatic vegetation throughout the reach; approximately 45% of the reach contained aquatic vegetation. The reaches sampled in Bennett Creek and the Green River were void of in-stream aquatic vegetation while between 2% and 15% of the Jordan River reaches downstream and upstream of the fish hatchery, respectively, contained aquatic vegetation.

Stream substrates for all five study sites consisted of a mixture of sand, gravel, and cobble. Deer Creek and the Jordan River upstream of the fish hatchery were mostly sand with some gravel and cobble present, while Bennett Creek, the Green River, and the Jordan River downstream of the hatchery consisted of a more even distribution of sand, gravel, and cobble. Large woody debris

was present in moderate amounts at Deer Creek, Bennett Creek, and the Green River and in extensive amounts in both of the Jordan River sites. Undercut banks and overhanging vegetation were present in moderate to sparse amounts at all sites.

Table 2. Habitat Characterization Ratings for the Jordan River Watershed

Study Site	Rapid Habitat Score and Rating, August 2016
Deer Creek at M-32	165 (Excellent)
Bennett Creek at M-66	177 (Excellent)
Green River at Pinney Bridge Rd.	177 (Excellent)
Jordan River, downstream of fish hatchery	183 (Excellent)
Jordan River, upstream of fish hatchery	167 (Excellent)

Algal Assessment

Since the algal samples collected were strongly dominated by diatom cells (>90%), an abbreviated full diatom count (300 valves) was conducted in order to provide a baseline community composition that may be compared to later samples. Table 3 shows the percent abundance of diatom species that were most dominant (the species represented 5% or more of the sample). The species *Achnantheidium minutissimum* and *Amphora pediculus* were present at all five study sites and, when added together, made up between 28% and 30% of the abundance in the samples. A cursory, non-statistical look at the diatom community indicates nothing unusual about these communities. The dominance of *A. minutissimum* and *A. pediculus* and the overall community may indicate slight eutrophication but there are no indicators of severe impairment. A full diatom count and statistical analysis would be required to infer less extreme differences among these communities.

Table 3. Percent abundance of dominant* algal species at each study site, Jordan River Watershed.

<i>Species</i>	Deer Creek at M-32	Bennett Creek at M-66	Green River at Pinney Bridge Rd.	Jordan River, downstream of fish hatchery	Jordan River, upstream of fish hatchery
<i>Achnanthydium gracillimum</i>				11%	7%
<i>Achnanthydium minutissimum</i>	8%	17%	18%	19%	19%
<i>Amphora pediculus</i>	20%	12%	12%	9%	11%
<i>Cocconeis neothumensis</i>	6%				
<i>Cocconeis placentula</i>			11%		
<i>Cocconeis pseudothumensis</i>		9%	9%		8%
<i>Encyonopsis microcephala</i>	5%				
<i>Eolimna minima</i>				5%	6%
<i>Gomphonema sp.</i>				5%	
<i>Karayevia clevei</i>	11%		7%	5%	
<i>Platessa bahlsii</i>	5%				
<i>Pseudostaurosira brevistriata</i>	5%	12%			8%
<i>Sellaphora seminulum</i>		5%			
<i>Staurosira construens</i> var. <i>venter</i>			5%		
<i>Staurosirella spp.</i>			7%		
<i>Staurosirella rhomboides</i>			10%		

*species with $\geq 5\%$ abundance were included in table

CONCLUSIONS

GLEC staff completed a macroinvertebrate, habitat, and algal assessment for five study sites in the Jordan River Watershed: Deer Creek, Bennett Creek, the Green River, and the Jordan River downstream and upstream of the fish hatchery. Sample collections, and the scoring and interpretation of data, followed MDEQ Procedure 51, which describes qualitative biological and habitat survey protocols for wadeable streams. Summaries of the assessments and Procedure 51 results are presented in Tables 1-3.

All five study sites rated as Acceptable when assessing the macroinvertebrate community and Excellent when assessing the habitat. Deer Creek scored slightly lower during the macroinvertebrate assessment than the other four sites most likely due to the absence of stoneflies at this location and the dominance of one taxa (the mayfly Baetidae). The high percentage of sandy substrate and low percentage of coarser substrates such as gravel and cobble would inhibit the colonization of stoneflies. Bennett Creek, the Green River and the Jordan River consisted of a mix of sand, gravel, and cobble, and as a result supported multiple families of mayflies, stoneflies, and caddisflies at each site. The algal community assessment identified two species present in high proportions at all sites as well as multiple other species contributing to the unique community composition at each site.

REFERENCES

Michigan Department of Natural Resources (MDEQ). 2008. Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers (Procedure 51). Great Lakes and Environmental Assessment Section, Revised December 2008. Michigan Department of Natural Resources. Lansing, Michigan.

APPENDIX 1

Macroinvertebrate Communities

Macroinvertebrate Communities

Order	Taxa	Deer Creek	Bennett Creek	Green River	Jordan River, downstream of hatchery	Jordan River, upstream of hatchery
	Oligochaeta		1	4	1	4
	Amphipoda	26	54	94		1
	Decapoda	1				
	Isopoda	5	2	21		
	Hydracarina	20		4	9	18
Ephemeroptera	Baetidae	151	46	92	121	111
	Caenidae		2			
	Ephemerellidae	5		8	17	4
	Heptageniidae	3	3	39	4	
	Tricorythidae				19	44
	Leptophlebiidae					12
Odonata	Aeshnidae	1			1	2
	Cordulegastridae		2			1
	Calopterygidae	7				6
Plecoptera	Leuctridae		1		1	
	Perlodidae				9	5
	Perlidae					2
	Pteronarcyidae			2	6	3
	Nemouridae		1	20		
Hemiptera	Gerridae		1		1	1
Megaloptera	Corydalidae		3		3	
Trichoptera	Brachycentridae	3		1	10	7
	Hydropsychidae	11	105	8	30	21
	Limnephilidae	2				
	Phryganeidae	12			1	
	Polycentropodidae					1
	Philopotamidae	2	20	4		2
	Rhyocophilidae		2			
	Uenoidae			1	1	
Coleoptera	Dytiscidae	1				
	Elmidae	10	5		5	5
	Gyrinidae					1
	Haliplidae					1
Diptera	Athericidae				7	4
	Chironomidae	19	11	2	62	32
	Culicidae					6
	Simuliidae	71	141	23	37	39
	Tipulidae					1
Pelecypoda	Sphaeriidae		1			
	Total Individuals	350	401	323	345	334
	Total Taxa	18	18	15	20	26

Macroinvertebrate Scores for five study sites in the Jordan River Watershed
Ecoregion: North Central Hardwood Forest
Dates sampled: August 2-3, 2016

Deer Creek		Score
Total Taxa	18	0
Mayfly Taxa	3	0
Caddisfly Taxa	5	0
Stonefly Taxa	0	-1
% Mayfly	45.4%	1
% Caddisfly	8.6%	-1
% Dominance	43.1%	-1
% Isopod, Snail, Leech	1.4%	0
% Surface Dependent	0.3%	1
	Total Score	-1 Acceptable tending towards Poor

Bennett Creek		Score
Total Taxa	18	1
Mayfly Taxa	3	1
Caddisfly Taxa	3	0
Stonefly Taxa	2	1
% Mayfly	13.0%	0
% Caddisfly	32.0%	0
% Dominance	35.0%	0
% Isopod, Snail, Leech	1.0%	0
% Surface Dependent	0.0%	1
	Total Score	4 Acceptable tending towards Excellent

Green River		Score
Total Taxa	15	0
Mayfly Taxa	3	0
Caddisfly Taxa	4	0
Stonefly Taxa	2	1
% Mayfly	43.0%	1
% Caddisfly	4.0%	-1
% Dominance	29.0%	0
% Isopod, Snail, Leech	7.0%	-1
% Surface Dependent	0.0%	1
	Total Score	1 Acceptable tending towards Excellent

Jordan, downstream of hatchery		Score
Total Taxa	20	0
Mayfly Taxa	4	0
Caddisfly Taxa	4	0
Stonefly Taxa	3	1
% Mayfly	46.7%	1
% Caddisfly	12.2%	-1
% Dominance	35.1%	0
% Isopod, Snail, Leech	0.0%	1
% Surface Dependent	0.3%	1
	Total Score	3 Acceptable tending towards Excellent

Jordan, upstream of hatchery		Score
Total Taxa	26	1
Mayfly Taxa	4	0
Caddisfly Taxa	4	0
Stonefly Taxa	3	1
% Mayfly	51.2%	1
% Caddisfly	9.3%	-1
% Dominance	33.2%	0
% Isopod, Snail, Leech	0.0%	1
% Surface Dependent	2.1%	0
	Total Score	3 Acceptable tending towards Excellent

APPENDIX 2
Habitat Evaluation

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME DEER CREEK		LOCATION (road crossing) UST M-32 CROSSING	
COUNTY/TOWNSHIP		T R S	
LAT(dd)	LONG(dd)	RIVER BASIN JORDAN RIVER	
STORET #	HUC-CODE	ECOREGION	
INVESTIGATOR(S) J. STRICKO M. VAN DEN BRAND	DATE 8/2/2016 TIME 930 AM PM	REASON FOR SURVEY <input type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____	

WEATHER CONDITIONS

Current Sunny Partly Cloudy Cloudy Rainy

Has there been a significant rain in the last 7 days?
 Yes No Don't Know

Air Temperature **70** °F

WATERSHED FEATURES

Predominant Surrounding Land Use
 Forest Commercial Field/Pasture Industrial Agricultural Residential Other _____

Local Watershed NPS Pollution
 No evidence Some potential sources Obvious Sources

Local Watershed Erosion
 None Moderate Heavy

RIPARIAN VEGETATION

Indicate the dominant type and record the dominant species
 Trees Shrubs Grasses Herbaceous **150** Species: _____

Estimate buffer width (left) **300** ft (right) **300** ft

STREAM CHARACTERIZATION

Stream Subsystem
 Perennial Intermittent Lake Outlet Influenced Dam Influenced

Stream Origin
 Spring Fed Lake/Pond Swamp, Marsh, Bog Mixture of origins Other _____

Stream Modifications
 None Dredged Canopy Removal Snagging Impounded Relocated Bank Stabilization Habitat Improvement

Stream Type
 Coldwater Warmwater

INSTREAM FEATURES

Avg. Stream Width **15** ft Avg. Stream Depth **1.0** ft

Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg)

Est. Survey Reach Length **200** ft

Survey Reach Area _____ ft² High Water Mark _____ ft

Canopy Cover: _____ % Shaded

AQUATIC VEGETATION

Rooted emergent Free Floating Rooted submergent Floating algae Rooted floating Attached algae

Portion of the reach with aquatic vegetation **45** %

Nuisance aquatic plants or slimes present? Yes No

Dominant species present: **CECATORHYZUM**

WATER QUALITY

Temperature _____ °F Solids, Turbidity
 Clear Slightly turbid Turbid Floating solids Suspended solids Settleable solids Foams

Water Samples Taken
 None GA MA VOA Other _____ GN MN ON

Color
 Clear Stained Opaque Colored _____ Other _____

Surface Oils
 None Sheen Globbs Flecks Slick Other _____

Water Odors
 Normal/None Sewage Petroleum Chemical Fishy Other _____

SEDIMENT

Sediment Samples Taken
 None MS VOA Other _____ GS OS/BNA

Oils
 Absent Slight Moderate Profuse

Looking at stones that are not deeply embedded, are the undersides black in color? Yes No

Sediment Odors
 Normal/None Sewage Petroleum Chemical Anaerobic Other _____

Deposits
 None Sludge Sawdust Paper fiber Sand Relict shells Other _____

DEER CREEK ①

APPENDIX J (Continued)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Reach
Bedrock			Detritus	Sticks, wood, coarse plant material (CPOM)	
Boulder	>10"		Muck-Mud	black, very fine organic (FPOM)	
Cobble	2.5"-10"	10	Other		
Gravel	0.1"-2.5"	12			
Sand	Gritty (course)	75			
Silt	Gritty (fine)	2			
Clay	slick				

Proportion of Reach Represented by Stream Morphology Types	Additional Structure Available for Macroinvertebrate Colonization			
	Extensive	Moderate	Sparse	Absent
<input type="checkbox"/> Riffle <u>0</u> %	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Run <u>35</u> %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Pool <u>50</u> %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Depositional <u>15</u> %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

SITE LOCATION MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)

Further investigation necessary (explain)
 Obvious pollution source/expression

Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - GLIDE/POOL STREAMS

Habitat Parameter	Condition Category			
	Excellent	Good	Marginal	Poor
1. Epifaunal Substrate/ Available Cover <p>(15)</p>	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization <p>(16)</p>	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability <p>(15)</p>	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition <p>(11)</p>	Little or no enlargement of island or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
5a. Channel Flow Status - Maintained Flow Volume <p>(10)</p>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	(10) 9	8 7 6	5 4 3	2 1 0
5b. Channel Flow Status - Flashiness <p>(10)</p>	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scours stream bank vegetation. Large woody debris (if present) stable and extending laterally across the stream channel.	Some evidence of bank scour approximately 4-8 inches above the waters surface. Large woody debris (if present) mostly stable and extending partially into the active stream channel.	Bank scour evidence 9-18 inches above the waters surface. Large woody debris (if present) tend to lay more against the stream bank rather than extending into the active channel.	Bank scour (>20 inches) along the stream channel. Large woody debris are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.
SCORE	(10) 9	8 7 6	5 4 3	2 1 0
6. Channel Alteration <p>(18)</p>	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.	Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Appendix J (continued)

Habitat Parameter	Condition Category			
	Excellent	Good	Marginal	Poor
7. Channel Sinuosity (19) The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. (Note: lack of sinuosity may be due to channelization)	Channel straight; waterway has been channelized for a long distance.	
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) (15)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 (8) 7 (7) 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream (17)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but 1 class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation has been removed to 2 inches or less in average stubble height.
SCORE (LB)	Left Bank 10 9	8 (8) 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) (19)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.	Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.	Width of riparian zone <10 feet; little or no-riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 165

PERIPHYTON COLLECTED
 1 COBBLE
 1 LWD
 3 SAND
 5 TOTAL

RINSED BRUSH,
 FUNNEL, & DELIMETER, FILLED BOTTLE TO
 LINE # 7, SHAKE BOTTLE 25X
 LET SETTLE 1 MIN, DECANT 50 mL
 STORE ON ICE

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME BENNETT CREEK		LOCATION (road crossing) M-66	
COUNTY/TOWNSHIP		T R S	
LAT(dd)	LONG (dd)	RIVER BASIN	
STORET #		HUC CODE	ECOREGION
INVESTIGATOR(S) J. STRICCO M. VANDENBRAND	DATE 8/2/16	REASON FOR SURVEY	
	TIME 1130 AM PM	<input type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____	

WEATHER CONDITIONS

Current
 Sunny
 Partly Cloudy
 Cloudy
 Rainy

Has there been a significant rain in the last 7 days?
 Yes No
 Don't Know

Air Temperature: **72** °F

WATERSHED FEATURES

Predominant Surrounding Land Use
 Forest
 Commercial
 Field/Pasture
 Industrial
 Agricultural
 Residential
 Other _____

Local Watershed NPS Pollution
 No evidence
 Some potential sources
 Obvious Sources

Local Watershed Erosion
 None
 Moderate
 Heavy

RIPARIAN VEGETATION

Indicate the dominant type and record the dominant species
 Trees Shrubs Species: **MARE**
 Grasses Herbaceous

Estimate buffer width (left) **150** ft (right) **300** ft

STREAM CHARACTERIZATION

Stream Subsystem
 Perennial
 Intermittent
 Lake Outlet Influenced
 Dam Influenced

Stream Origin
 Spring Fed
 Lake/Pond
 Swamp, Marsh, Bog
 Mixture of origins
 Other _____

Stream Modifications
 None
 Dredged
 Canopy Removal
 Snagging
 Impounded
 Relocated
 Bank Stabilization
 Habitat Improvement

Stream Type
 Coldwater
 Warmwater

INSTREAM FEATURES

Avg. Stream Width: **6** ft Avg. Stream Depth: **0.4** ft

Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg)

Est. Survey Reach Length **200** ft

Survey Reach Area _____ ft² High Water Mark _____ ft

Canopy Cover: **85** % Shaded

AQUATIC VEGETATION

Rooted emergent Free Floating
 Rooted submergent Floating algae
 Rooted floating Attached algae

Portion of the reach with aquatic vegetation **0** %
 Nuisance aquatic plants or slimes present? Yes No
 Dominant species present _____

WATER QUALITY

Temperature _____ °F

Water Samples Taken
 None Other _____
 GA GN
 MA MN
 VOA ON

Solids, Turbidity
 Clear
 Slightly turbid
 Turbid
 Floating solids
 Suspended solids
 Settleable solids
 Foams

Color
 Clear
 Stained
 Opaque
 Colored _____
 Other _____

Surface Oils
 None
 Sheen
 Globbs
 Flecks
 Slick
 Other _____

Water Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Fishy
 Other _____

SEDIMENT

Sediment Samples Taken
 None Other _____
 MS GS
 VOA OS/BNA

Oils
 Absent
 Slight
 Moderate
 Profuse

Sediment Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Anaerobic
 Other _____

Deposits
 None
 Sludge
 Sawdust
 Paper fiber
 Sand
 Relict shells
 Other _____

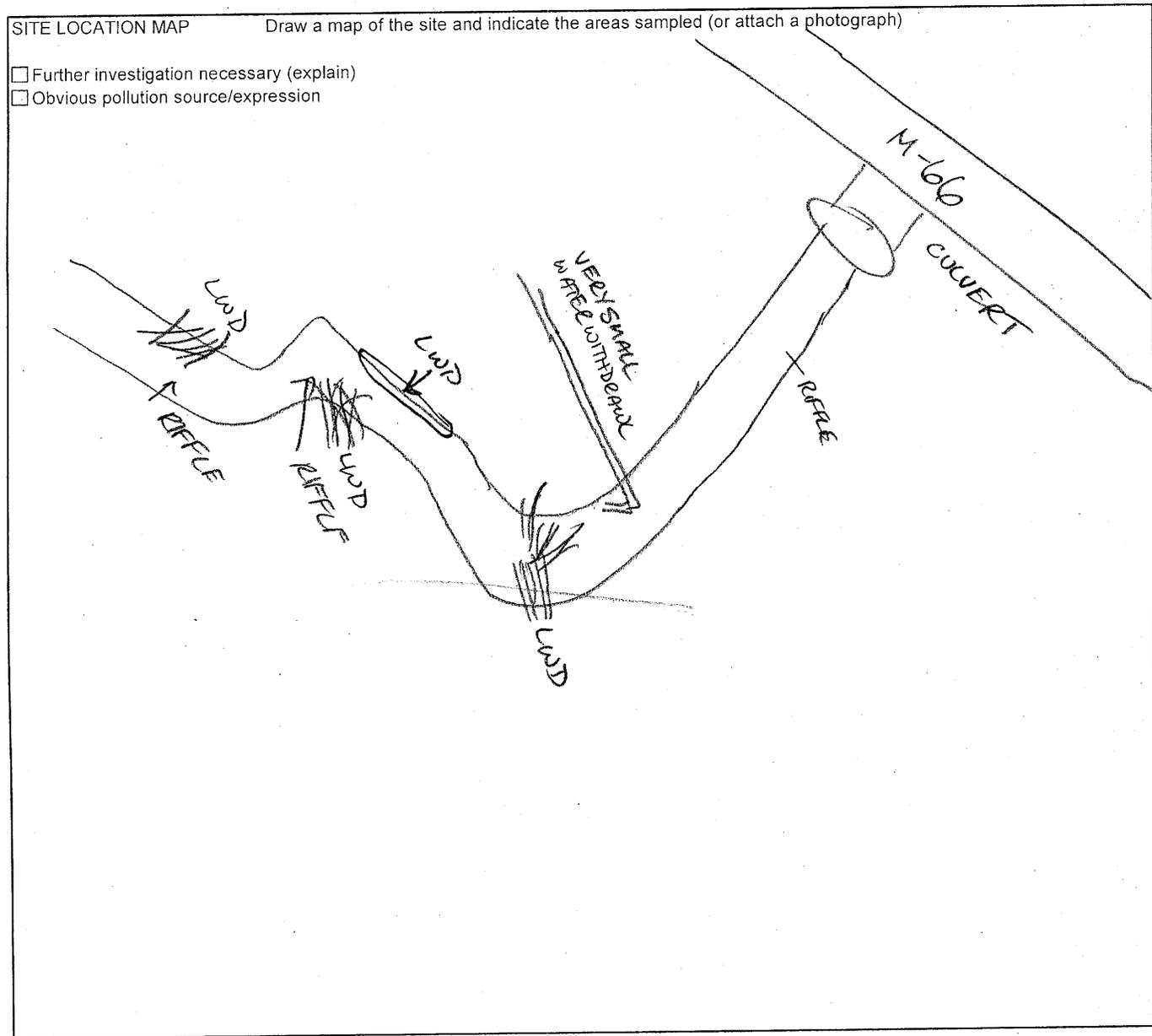
Looking at stones that are not deeply embedded, are the undersides black in color? Yes No

②
Bennett Creek

APPENDIX J (Continued)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Reach
Bedrock			Detritus	Sticks, wood, coarse plant material (CPOM)	25
Boulder	>10"		Muck-Mud	black, very fine organic (FPOM)	10
Cobble	2.5"-10"	15	Other		
Gravel	0.1"-2.5"	48			
Sand	Gritty (course)	35			
Silt	Gritty (fine)	2			
Clay	slick				

Proportion of Reach Represented by Stream Morphology Types	Additional Structure Available for Macroinvertebrate Colonization			
	Extensive	Moderate	Sparse	Absent
<input checked="" type="checkbox"/> Riffle 45 %	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Run 50 %	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Pool 5 %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Depositional 8 %	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Undercut banks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Overhanging vegetation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Large woody debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Rootwads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category			
	Excellent	Good	Marginal	Poor
1. Epifaunal Substrate/ Available Cover (18)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness (17)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime (15)	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft.).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition (16)	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5a. Channel Flow Status - Maintained Flow Volume (9)	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	10	(9) 8 7 6	5 4 3	2 1 0
5b. Channel Flow Status - Flashiness (10)	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.	Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.	Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.	Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.
SCORE	(10) 9	8 7 6	5 4 3	2 1 0

2

Bennet Creek

Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern. (19)	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging (greater than past 20 yr) may be present, but recent channelization is not present.					Channelization is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
	SCORE	20	(19)	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles (or bends) Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. (18)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
	SCORE	20	19	(18)	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Bank Stability (score each bank) Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Note: determine left or right side by facing downstream. (13)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
	SCORE (LB)	Left Bank	10	(9)			8	7	6			5	4	3			2	1	0		
	SCORE (RB)	Right Bank	10	(9)			8	7	6			5	4	3			2	1	0		
9. Vegetative Protection (score each bank) More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. (18)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the stream bank surfaces covered by native vegetation, but 1 class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.					
	SCORE (LB)	Left Bank	10	(9)			8	7	6			5	4	3			2	1	0		
	SCORE (RB)	Right Bank	10	(9)			8	7	6			5	4	3			2	1	0		
10. Riparian Vegetative Zone Width (score each bank riparian zone) Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. (19)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.					Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.					Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.					
	SCORE (LB)	Left Bank	10	(9)			8	7	6			5	4	3			2	1	0		
	SCORE (RB)	Right Bank	(10)	9			8	7	6			5	4	3			2	1	0		

Total Score 177

PERI PHYTON 3 COBBLE
 1 SAND
 1 LWD

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME GREEN RIVER		LOCATION (road crossing) PINEY BRIDGE ROAD	
COUNTY/TOWNSHIP		T R S	
LAT(dd)	LONG (dd)	RIVER BASIN	
STORET #		HUC CODE	ECOREGION
INVESTIGATOR(S) J. STRICKO M. VAN DEN BRAND	DATE 8/2/16 TIME 1330 AM <input checked="" type="radio"/> PM	REASON FOR SURVEY <input type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____	

WEATHER CONDITIONS

Current
 Sunny
 Partly Cloudy
 Cloudy
 Rainy

Has there been a significant rain in the last 7 days?
 Yes No
 Don't Know

Air Temperature **75** °F

WATERSHED FEATURES

Predominant Surrounding Land Use
 Forest
 Commercial
 Field/Pasture
 Industrial
 Agricultural
 Residential **RURAL**
 Other _____

Local Watershed NPS Pollution
 No evidence
 Some potential sources
 Obvious Sources

Local Watershed Erosion
 None
 Moderate
 Heavy

RIPARIAN VEGETATION

Indicate the dominant type and record the dominant species
 Trees Shrubs Species: **WHITE CEDAR**
 Grasses Herbaceous

Estimate buffer width (left) **200** ft (right) **400** ft

STREAM CHARACTERIZATION

Stream Subsystem
 Perennial
 Intermittent
 Lake Outlet Influenced
 Dam Influenced

Stream Origin
 Spring Fed
 Lake/Pond
 Swamp, Marsh, Bog
 Mixture of origins
 Other _____

Stream Modifications
 None
 Dredged
 Canopy Removal
 Snagging
 Impounded
 Relocated
 Bank Stabilization
 Habitat Improvement

Stream Type
 Coldwater
 Warmwater

INSTREAM FEATURES

Avg. Stream Width **20** ft Avg. Stream Depth _____ ft

Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg)

Est. Survey Reach Length **200** ft

Survey Reach Area _____ ft² High Water Mark _____ ft

Canopy Cover: _____ % Shaded

AQUATIC VEGETATION

Rooted emergent
 Rooted submergent
 Rooted floating

Free Floating
 Floating algae
 Attached algae

Portion of the reach with aquatic vegetation **0** %
 Nuisance aquatic plants or slimes present? Yes No
 Dominant species present _____

WATER QUALITY

Temperature _____ °F

Water Samples Taken
 None Other _____
 GA GN
 MA MN
 VOA ON

Solids, Turbidity
 Clear
 Slightly turbid
 Turbid
 Floating solids
 Suspended solids
 Settleable solids
 Foams

Color
 Clear
 Stained
 Opaque
 Colored _____
 Other _____

Surface Oils
 None
 Sheen
 Globbs
 Flecks
 Slick
 Other _____

Water Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Fishy
 Other _____

SEDIMENT

Sediment Samples Taken
 None Other _____
 MS GS
 VOA OS/BNA

Oils
 Absent
 Slight
 Moderate
 Profuse

Looking at stones that are not deeply embedded, are the undersides black in color? Yes No

Sediment Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Anaerobic
 Other _____

Deposits
 None
 Sludge
 Sawdust
 Paper fiber
 Sand
 Relict shells
 Other _____

3
Green River

APPENDIX J (Continued)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Reach
Bedrock			Detritus	Sticks, wood, coarse plant material (CPOM)	10
Boulder	>10"	1	Muck-Mud	black, very fine organic (FPOM)	2
Cobble	2.5"-10"	30	Other		
Gravel	0.1"-2.5"	35			
Sand	Gritty (course)	33			
Silt	Gritty (fine)	1			
Clay	slick				

Proportion of Reach Represented by Stream Morphology Types	Additional Structure Available for Macroinvertebrate Colonization																														
<input type="checkbox"/> Riffle <u>40</u> % <input type="checkbox"/> Run <u>45</u> % <input type="checkbox"/> Pool <u>10</u> % <input type="checkbox"/> Depositional <u>5</u> %	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Extensive</th> <th style="text-align: center;">Moderate</th> <th style="text-align: center;">Sparse</th> <th style="text-align: center;">Absent</th> </tr> </thead> <tbody> <tr> <td>Undercut banks</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Overhanging vegetation</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Large woody debris</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td>Aquatic macrophytes</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> <tr> <td>Rootwads</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table>		Extensive	Moderate	Sparse	Absent	Undercut banks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Overhanging vegetation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Large woody debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Rootwads	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Extensive	Moderate	Sparse	Absent																											
Undercut banks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																											
Overhanging vegetation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>																											
Large woody debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>																											
Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>																											
Rootwads	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>																											

SITE LOCATION MAP Draw a map of the site and indicate the areas sampled (or attach a photograph)

Further investigation necessary (explain)
 Obvious pollution source/expression

Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category			
	Excellent	Good	Marginal	Poor
1. Epifaunal Substrate/ Available Cover <p>(A)</p>	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness <p>(17)</p>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime <p>(15)</p>	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft.).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition <p>(16)</p>	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5a. Channel Flow Status - Maintained Flow Volume <p>(9)</p>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	10	(9) 8 7 6	5 4 3	2 1 0
5b. Channel Flow Status - Flashiness <p>(10)</p>	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.	Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.	Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.	Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.
SCORE	(10) 9	8 7 6	5 4 3	2 1 0

Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
6. Channel Alteration (17)	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging (greater than past 20 yr) may be present, but recent channelization is not present.					Channelization is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
	SCORE	20	19	18	(17)	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles (or bends) (18)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
	SCORE	20	19	(18)	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. (19)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
	SCORE (LB)	Left Bank (10) 9					8	7	6	5	4	3	2	1	0						
	SCORE (RB)	Right Bank (10) 9					8	7	6	5	4	3	2	1	0						
9. Vegetative Protection (score each bank) (19)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the stream bank surfaces covered by native vegetation, but 1 class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.					
	SCORE (LB)	Left Bank (10) 9					8	7	6	5	4	3	2	1	0						
	SCORE (RB)	Right Bank (10) 9					8	7	6	5	4	3	2	1	0						
10. Riparian Vegetative Zone Width (score each bank riparian zone) (18)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.					Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.					Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.					
	SCORE (LB)	Left Bank 10 (9)					8	7	6	5	4	3	2	1	0						
	SCORE (RB)	Right Bank 10 (9)					8	7	6	5	4	3	2	1	0						

PERIPHATON - 3-COBBLE
1-LWD
1-SAND

Total Score 177

4

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME <u>JORDAN RIVER</u>		LOCATION (road crossing) <u>DOWNSTREAM HATCHERY</u>	
COUNTY/TOWNSHIP		T R S	
LAT(dd)	LONG (dd)	RIVER BASIN	
STORET #	HUC CODE	ECOREGION	
INVESTIGATOR(S) <u>J. STRICKO</u> <u>M. VANDENBRANT</u>	DATE <u>8/3/2016</u> TIME <u>1000</u> <u>AM</u> PM	REASON FOR SURVEY <input type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____	

WEATHER CONDITIONS

Current
 Sunny
 Partly Cloudy
 Cloudy
 Rainy

Has there been a significant rain in the last 7 days?
 Yes No
 Don't Know

Air Temperature 71 °F

WATERSHED FEATURES

Predominant Surrounding Land Use
 Forest
 Commercial
 Field/Pasture
 Industrial
 Agricultural
 Residential
 Other _____

Local Watershed NPS Pollution
 No evidence
 Some potential sources
 Obvious Sources

Local Watershed Erosion
 None
 Moderate
 Heavy

RIPARIAN VEGETATION

Indicate the dominant type and record the dominant species
 Trees Shrubs Species: WHITE CEDAR
 Grasses Herbaceous

Estimate buffer width (left) 400 ft (right) 500+ ft

STREAM CHARACTERIZATION

Stream Subsystem
 Perennial
 Intermittent
 Lake Outlet Influenced
 Dam Influenced

Stream Origin
 Spring Fed
 Lake/Pond
 Swamp, Marsh, Bog
 Mixture of origins
 Other _____

Stream Modifications
 None
 Dredged
 Canopy Removal
 Snagging
 Impounded
 Relocated
 Bank Stabilization
 Habitat Improvement

Stream Type
 Coldwater
 Warmwater

INSTREAM FEATURES

Avg. Stream Width 52 ft Avg. Stream Depth 0.8 ft

Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg)

Est. Survey Reach Length 200 ft

Survey Reach Area _____ ft² High Water Mark _____ ft

Canopy Cover: 10 % Shaded

AQUATIC VEGETATION

Rooted emergent Free Floating
 Rooted submergent Floating algae
 Rooted floating Attached algae

Portion of the reach with aquatic vegetation 2 %
 Nuisance aquatic plants or slimes present? Yes No
 Dominant species present _____

WATER QUALITY

Temperature _____ °F

Water Samples Taken
 None Other _____
 GA GN
 MA MN
 VOA ON

Solids, Turbidity
 Clear
 Slightly turbid
 Turbid
 Floating solids
 Suspended solids
 Settleable solids
 Foams

Color
 Clear
 Stained
 Opaque
 Colored _____
 Other _____

Surface Oils
 None
 Sheen
 Globbs
 Flecks
 Slick
 Other _____

Water Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Fishy
 Other _____

SEDIMENT

Sediment Samples Taken
 None Other _____
 MS GS
 VOA OS/BNA

Oils
 Absent
 Slight
 Moderate
 Profuse

Sediment Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Anaerobic
 Other _____

Deposits
 None
 Sludge
 Sawdust
 Paper fiber
 Sand
 Relict shells
 Other _____

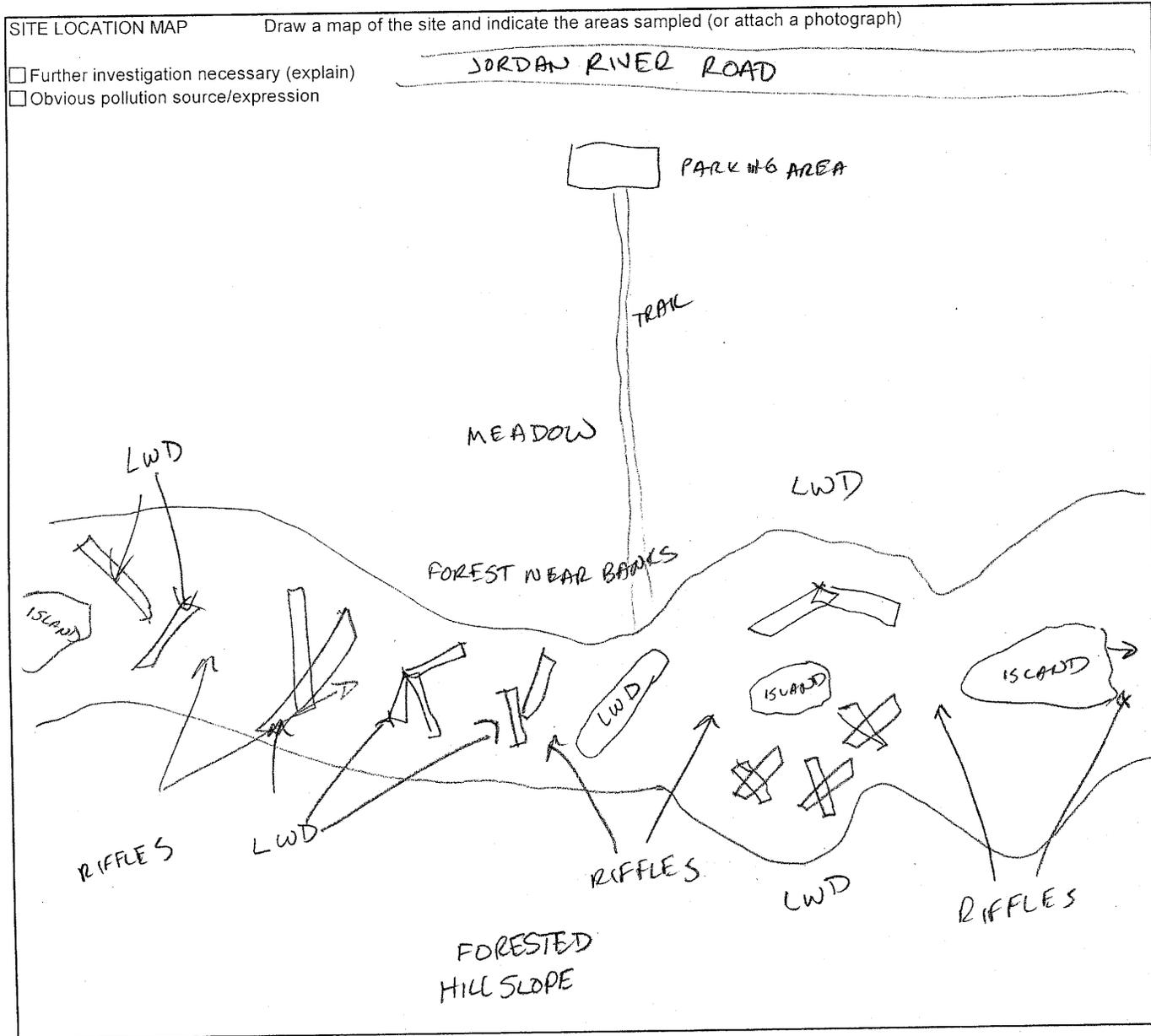
Looking at stones that are not deeply embedded, are the undersides black in color? Yes No

④ Jordan River, ds of hatchery

APPENDIX J (Continued)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Reach
Bedrock			Detritus	Sticks, wood, coarse plant material (CPOM)	40
Boulder	>10"		Muck-Mud	black, very fine organic (FPOM)	1
Cobble	2.5"-10"	10	Other		
Gravel	0.1"-2.5"	50			
Sand	Gritty (course)	40			
Silt	Gritty (fine)				
Clay	slick				

Proportion of Reach Represented by Stream Morphology Types	Additional Structure Available for Macroinvertebrate Colonization			
	Extensive	Moderate	Sparse	Absent
<input type="checkbox"/> Riffle <u>70</u> %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Run <u>22</u> %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Pool <u>5</u> %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Depositional <u>2</u> %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Undercut banks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Overhanging vegetation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Large woody debris	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Aquatic macrophytes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Rootwads	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>



4

Jordan River, ds of hatchery

- Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category			
	Excellent	Good	Marginal	Poor
1. Epifaunal Substrate/ Available Cover (18)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness (16)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime (15)	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition (15)	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5a. Channel Flow Status - Maintained Flow Volume (10)	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	(10) 9	8 7 6	5 4 3	2 1 0
5b. Channel Flow Status - Flashiness (10)	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.	Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.	Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.	Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.
SCORE	(10) 9	8 7 6	5 4 3	2 1 0

PERIPHYTON SAMPLING

2-COBBLE

2-LWD

1-SAND

④ Jordan River, ds of hatchery

Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent				Good				Marginal				Poor								
6. Channel Alteration (20)	Channelization or dredging absent or minimal; stream with normal pattern.				Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging (greater than past 20 yr) may be present, but recent channelization is not present.				Channelization is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.				Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.								
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles (or bends) (19)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.				Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.				Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.				Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.								
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. (20)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.				Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.				Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.				Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.								
	SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0								
	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0								
9. Vegetative Protection (score each bank) (20)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.				70-90% of the stream bank surfaces covered by native vegetation, but 1 class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.				50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.				Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.								
	SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0								
	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0								
10. Riparian Vegetative Zone Width (score each bank riparian zone) (20)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.				Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.				Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.				Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.								
	SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0								
	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0								

Total Score 183

5

Jordan River, US of hatchery

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME <u>JORDAN RIVER</u>		LOCATION (road crossing) <u>OST HATCHERY</u>	
COUNTY/TOWNSHIP		T R S	
LAT(dd)	LONG (dd)	RIVER BASIN	
STORET #	HUG CODE	ECOREGION	
INVESTIGATOR(S) <u>J. STRICKO</u> <u>M. VANDENBRAND</u>	DATE <u>8/3/16</u> TIME <u>1145</u> <input checked="" type="checkbox"/> AM <input type="checkbox"/> PM	REASON FOR SURVEY <input type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____	

WEATHER CONDITIONS

Current
 Sunny
 Partly Cloudy
 Cloudy
 Rainy

Has there been a significant rain in the last 7 days?
 Yes No Don't Know

Air Temperature 75 °F

WATERSHED FEATURES

Predominant Surrounding Land Use
 Forest
 Commercial
 Field/Pasture
 Industrial
 Agricultural
 Residential
 Other _____

Local Watershed NPS Pollution
 No evidence
 Some potential sources
 Obvious Sources

Local Watershed Erosion
 None
 Moderate
 Heavy

RIPARIAN VEGETATION

Indicate the dominant type and record the dominant species
 Trees Shrubs Grasses Herbaceous
 Species: WHITE CEDAR

Estimate buffer width (left) 60 ft (right) 500+ ft

STREAM CHARACTERIZATION

Stream Subsystem
 Perennial
 Intermittent
 Lake Outlet Influenced
 Dam Influenced

Stream Origin
 Spring Fed
 Lake/Pond
 Swamp, Marsh, Bog
 Mixture of origins
 Other _____

Stream Modifications
 None
 Dredged
 Canopy Removal
 Snagging
 Impounded
 Relocated
 Bank Stabilization
 Habitat Improvement

Stream Type
 Coldwater
 Warmwater

INSTREAM FEATURES

Avg. Stream Width 33 ft Avg. Stream Depth _____ ft

Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg)

Est. Survey Reach Length 260 ft

Survey Reach Area _____ ft² High Water Mark _____ ft

Canopy Cover: _____ % Shaded

AQUATIC VEGETATION

Rooted emergent Free Floating
 Rooted submergent Floating algae
 Rooted floating Attached algae

Portion of the reach with aquatic vegetation 15 %
 Nuisance aquatic plants or slimes present? Yes No
 Dominant species present _____

WATER QUALITY

Temperature _____ °F

Water Samples Taken
 None Other _____
 GA GN MA MN VOA ON

Solids, Turbidity
 Clear
 Slightly turbid
 Turbid
 Floating solids
 Suspended solids
 Settleable solids
 Foams

Color
 Clear
 Stained
 Opaque
 Colored _____
 Other _____

Surface Oils
 None
 Sheen
 Globbs
 Flecks
 Slick
 Other _____

Water Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Fishy
 Other _____

SEDIMENT

Sediment Samples Taken
 None Other _____
 MS GS VOA OS/BNA

Oils
 Absent
 Slight
 Moderate
 Profuse

Sediment Odors
 Normal/None
 Sewage
 Petroleum
 Chemical
 Anaerobic
 Other _____

Deposits
 None
 Sludge
 Sawdust
 Paper fiber
 Sand
 Relict shells
 Other _____

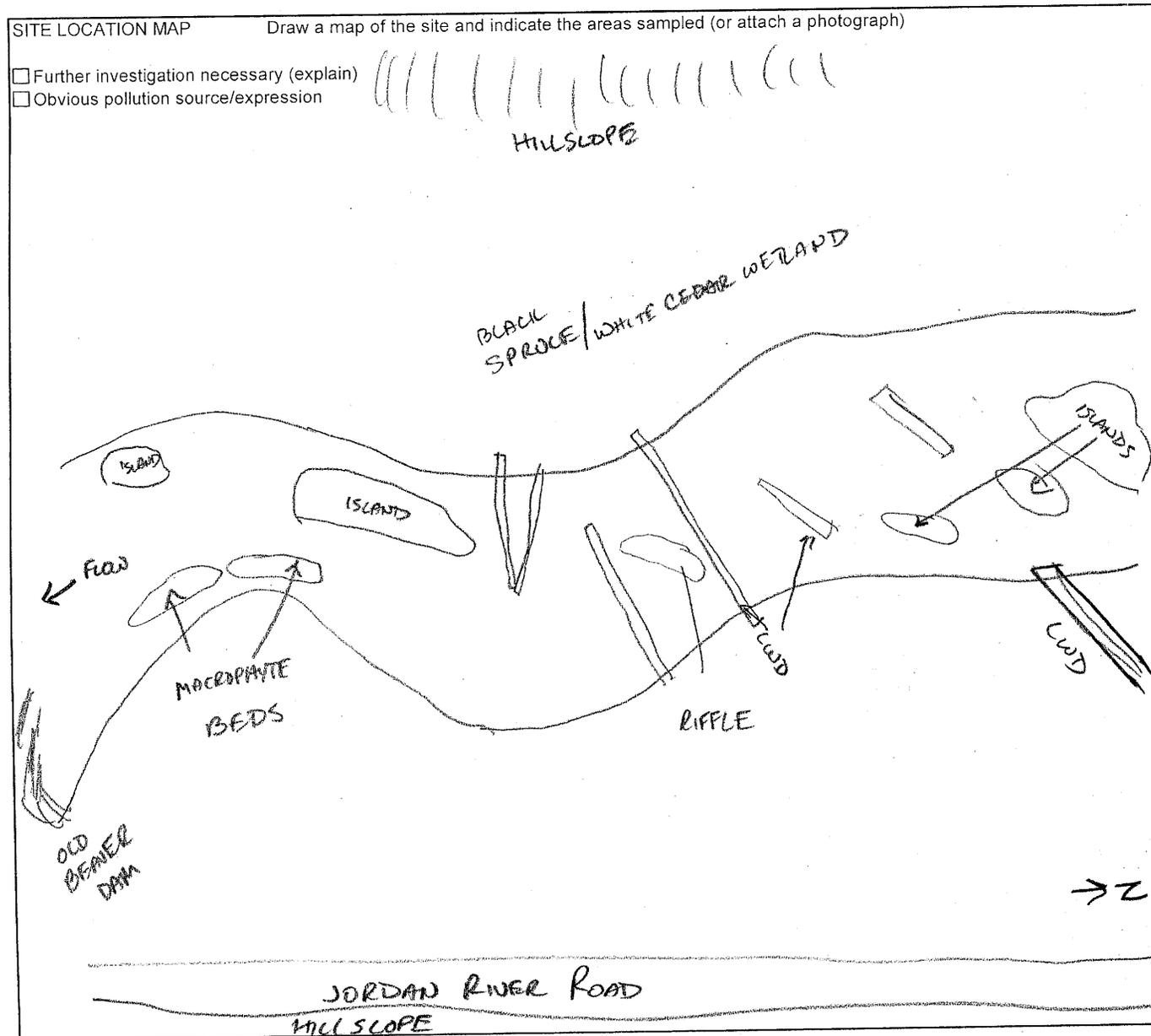
Looking at stones that are not deeply embedded, are the undersides black in color? Yes No

⑤ Jordan River, US of hatchery

APPENDIX J (Continued)

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Reach
Bedrock			Detritus	Sticks, wood, coarse plant material (CPOM)	40
Boulder	>10"		Muck-Mud	black, very fine organic (FPOM)	5
Cobble	2.5"-10"	6	Other		
Gravel	0.1"-2.5"	19			
Sand	Gritty (course)	70			
Silt	Gritty (fine)	5			
Clay	slick				

Proportion of Reach Represented by Stream Morphology Types	Additional Structure Available for Macroinvertebrate Colonization			
	Extensive	Moderate	Sparse	Absent
<input checked="" type="checkbox"/> Riffle 30 %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Run 60 %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Pool 10 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Depositional _____ %	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Undercut banks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Overhanging vegetation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Large woody debris	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Aquatic macrophytes	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Rootwads	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>



HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
1. Epifaunal Substrate/ Available Cover (15)	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness (13)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.					Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.					Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity/Depth Regime (15)	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft.).					Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep).					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment Deposition (15)	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5a. Channel Flow Status - Maintained Flow Volume (10)	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	10	9				8	7	6			5	4	3			2	1	0			
5b. Channel Flow Status - Flashiness (10)	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.					Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.					Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.					Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.					
SCORE	10	9				8	7	6			5	4	3			2	1	0			

Jordan River, us of hatchery

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Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
6. Channel Alteration (18)	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging (greater than past 20 yr) may be present, but recent channelization is not present.					Channelization is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Frequency of Riffles (or bends) (16)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. (20)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
	SCORE (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0				
SCORE (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					
9. Vegetative Protection (score each bank) (20)	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the stream bank surfaces covered by native vegetation, but 1 class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.					
	SCORE (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0				
SCORE (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					
10. Riparian Vegetative Zone Width (score each bank riparian zone) (15)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.					Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.					Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.					
	SCORE (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0				
SCORE (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					

Total Score 167

PERIPAYTON
SAND - 2
LWD - 2
ROCK - 1