Crescent Road Culvert

Rockland County, NY

Application of Stream Biological Impairment Criteria

Sample Date: September 2018
Report Date: May 2019

Prepared for
ROCKLAND COUNTY SOIL WATER CONSERVATION DISTRICT

Prepared by

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Background

This study was performed to provide baseline biological data and assess impact to macroinvertebrate communities at a road crossing culvert on Minisceongo Creek. Biological impairment criteria developed by the New York State Department of Environmental Conservation Stream Biomonitoring Unit (NYS DEC SBU) (Bode et al. 1990), used to assess potential impact of point and non-point source discharges on resident benthic macroinvertebrates, were applied to communities at a segregate reference location and above, and below the culvert.

Road crossing culverts, depending on their construction, can fragment the benthic macroinvertebrate and other aquatic communities by physically altering the stream channel and natural flow patterns. The physical alteration that culverts may have upon the stream is seen in geomorphic changes within, upstream, and downstream of the structure. These alterations include the retention of fine sediments during high discharge events with increased accumulation of fine sediments downstream or upstream of the culvert, and the creation of pools just below the culvert. Culvert replacement has become a focus of restoration activity in the United States.

In September 2018, replicate benthic macroinvertebrate samples were collected by Rockland County Soil and Water Conservation District. The data was collected and analyzed in anticipation of a future road crossing culvert upgrade and will be used to document any improvements in resident benthic community structure. Sample collection, sample processing, metric calculation, and stream biological impairment criteria analysis followed NYS DEC SBU procedures (Bode et al. 2002, Bode et al. 1990). Stations for assessment were selected by Rockland County Soil Water Conservation District. Watershed Assessment Associates conducted the lab and metric analysis and produced this written report.

Methods

Upstream/Reference Site Selection

The Crescent Road culvert is located on an unnamed tributary of the Minisceongo Creek. Two reference locations were selected. One reference site was approximately 0.4 miles above the Crescent Road culvert on the unnamed tributary upstream from the potential impact of the investigative stations. The other Reference site was located on the Minisceongo Creek main stem and above where the Crescent Road unnamed tributary enters

the Minisceongo Creek. Where upstream conditions do not meet reference site criteria (e.g. recently disturbed areas, areas of dense macrophyte growth, areas within one mile of an impoundment release), a reference site may be selected in a comparable watershed (Bode et al. 1990).

The Above Crescent Road culvert station was located 0.4 miles downstream from the Reference_1 station. The Below culvert station was located ~100 feet downstream from the Above Crescent Road Culvert station and the Downstream station was located ~320 feet below the Above Crescent Road Culvert station (See Figure 1).

Reference and investigative stations must meet habitat comparability criteria. The median substrate particle size between the stations cannot deviate by more than 3 phi units; substrate embeddedness cannot differ by more than 50%; current velocity should be within 30-150 cm/s and velocity cannot differ by more than 50% between the stations; and canopy cover cannot differ by more than 50% between the stations. In addition, both stations must be sampled using the same collection method (Bode et al. 1990). The habitat comparability criteria were satisfied between the Reference_2, Above, and Downstream stations except velocity did not meet the criteria between the Reference_2 and Above stations locations as sampling was done on different days of the month (Table 2 and 4).

Field Collection

Three replicate macroinvertebrate samples were collected from five stations in the Minisceongo Creek watershed (Figure 1), following methods outlined by NYS SBU (Bode et al. 2002). An additional fourth replicate was also collected in case of replicate similarity concerns. Ambient water quality parameters were collected (dissolved oxygen, temperature, specific conductance, salinity, and pH) and qualitative habitat assessments were performed concurrently with macroinvertebrate collections (Bode et al. 2002).

Sorting and Organism Identification

Sample sorting and identification followed NYS DEC laboratory methods (Bode et al. 2002). The subsamples were rinsed with tap water in a U.S. number 40 standard sieve to remove fine particles and the remaining material was placed in a 12 x18 pan and evenly distributed with water. A small amount of the sample was randomly removed with a spatula and placed in a Petri dish with water. These portions were then examined under a dissecting microscope to separate organisms from debris (Bode et al. 2002). Macroinvertebrates were then placed in vials containing 70% alcohol. This sorting procedure was repeated for each subsample until 100 organisms were removed. Organisms were identified to lowest taxonomic

resolution as outlined in the NYS DEC SBU Quality Assurance Work Plan (QAWP) (Bode et al. 2002), unless specimens were immature or damaged, and enumerated using a dissecting microscope. Oligochaetes and chironomids were slide-mounted in CMCP-10 mounting medium and viewed using a compound microscope.

Replicate Similarity

There must be at least 50% similarity between replicates in order to accurately assess any type of biological impairment (Bode et al. 1990). Bray-Curtis cluster analyses were performed on all taxa abundances (square root transformed) to reveal similarities between replicate samples for all stations. A dendrogram was generated using the Bray-Curtis cluster analysis to visually determine replicate similarity.

Macroinvertebrate Metrics and Impairment Criteria Analysis

The following metrics were calculated for each replicate, then averaged for numerical comparison among stations: Taxa richness, biotic index, species dominance, EPT richness, and percent model affinity.

Violation of one or more of the criteria (Table 1), based on averaged metric results, between the suspected impacted and downstream stations, and between impacted and reference stations indicates provisional impairment (Bode et al. 1990). If metric results suggest provisional impairment, then a Student's T-test is performed to determine if the results are statistically significant (α=0.05). If the test results are statistically significant then biological impairment is indicated (Bode et al. 2002). Biological impairment criteria is used in this study to assess the influence that physical habitat due to culvert design may have on benthic macroinvertebrate community structure.

Results

Replicate Similarity

Similarity analysis results between replicate samples met the required ≥50% similarly for at least 3 replicates per station. (Figures 2a and 3a) and therefore these were used in the analysis. Two stations were not assessed for biological impairment due to either lack of samples meeting minimum subsample requirements and/or the station location was in close proximity to the Above station location. The station and replicates used in this analysis are: Reference_2 station

replicates A, B, and C; Above station replicates A, B, and C; and Downstream station A, B, and D.

Macroinvertebrate Parameters and Impairment Criteria Analysis

The following parameters were calculated for each replicate, and then averaged for comparison: Species richness, biotic index, species dominance, EPT richness, and percent model affinity (Table 3).

Mean metric results for the Above and Downstream stations, when compared to the Reference_2 station, indicated that there is provisional biological impairment based on the EPT richness, biotic index, taxa richness (except for the Downstream station) and percent model affinity. Biological impairment was confirmed at the Above and Downstream stations compared to the Reference_2 station using the Student's T-test of significance which indicated biological impairment for EPT richness, biotic index, taxa richness (except for the Downstream station), and the percent model affinity with p's <0.05.

Ambient Water Quality Parameters

Temperature, dissolved oxygen, dissolved oxygen saturation, and pH results were comparable among all stations. Specific conductance was variable between stations which may be due in part to sample collection occurring on different days during the month (Table 5).

Discussion

The Reference_2 station community structure consisted of a diverse group of riffle riverine benthic macroinvertebrates including the Plecoptera *Acroneuria abnormis*.; the Ephemeroptera *Baetis flavistriga*, *Isonychia bicolor*, *Acentrella sp*., and *Maccaffertium sp.*; the Trichoptera *Cheumatopsyche sp*., *Chimarra aterrima*, *Polycentropus sp*., *Ceratopsyche bronta,* and *Hydropsyche betteni* (Appendix and Table 4). These taxa are composed mostly of clean water taxa and their presence usually indicates good to very good water quality conditions.

The Reference_2 community structure was dissimilar to both the Above and Downstream Crescent Road culvert station with significant changes occurring in the community structure (Table 4). The Bray Curtis similarity (Figures 2 a and b) provides a visual of the community dissimilarity and grouping between these stations. A significant difference in the community structure at the Above and Downstream culvert station compared to the Reference_2 station is evident with mass extinction of the Plecoptera, Ephemeroptera, and Trichoptera (EPT) taxa (Table 3 and 4). The community

at the Above and Below Crescent Road culvert station shifts to a more degraded water quality community that is dominated by the flat worm Turbellaria and the Oligochaeta (worm) family Tubificidae. Biological impairment is indicated at the Above and Downstream stations compared to the Refernece_2 station based on the changes in EPT richness, biotic index, taxa richness, and percent model affinity metrics (Table 3).

In summary, the application of stream biological impairment criteria analysis indicates that the Above and Downstream Crescent Road culvert stations are biologically impaired relative to the Reference_2 station. This tributary in general, based on the benthic macroinvertebrate community structure, has significant degraded water quality. The extent that the Crescent Road culvert is the major influence of the degraded water quality conditions is questionable and difficult to discern. Further investigation into potential causes of the degraded water quality of the Crescent Road tributary is suggested.

Literature Cited

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Smith, A.J. 2018. Quality assurance work plan for biological stream monitoring in New York State. Stream Biomonitoring Unit, Division of Water, New York State Department of Environmental Conservation, Albany, NY.

Clesceri, L.S., A.E. Greenberg, and A.D. Eaton, editors. 1998. Standard methods for examination of water and wastewater, 20th edition. American Public Health Association, Washington, D.C.

Environmental Protection Agency. 1993. Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

Hilsenhoff, W.L. 1987. An improved biotic index of organic stream pollution. *Great Lakes Entomol*. 20:31-39.

Tables and Figures

Table 1. Descriptions of the metrics calculated for each replicate sample and criteria required to indicate impairment

Metric	Description	**Impairment Criteria (**difference between reference and impacted stations**)**
Taxa Richness	Taxa richness is the total number of unique species or taxa found in the sub-sample. Higher taxa richness values are generally associated with undisturbed sediment conditions	-8
EPT Richness	EPT richness is the total number of taxa represented by Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These groups are composed largely of mostly clean water taxa and their presence usually indicates good water quality conditions.	-4
Biotic Index	Biotic Index, or the Hilsenhoff Biotic Index (Hilsenhoff 1987), is calculated by multiplying the number of individuals of each species or taxa by its assigned tolerance value to organic material in the substrate, summing these products, and dividing by the total number of individuals. Tolerance values range from intolerant (0) to tolerant (10). High biotic index values are suggestive of organically enriched condition, while low values indicate naturally occurring, ambient conditions.	+1.5
Percent model affinity	Percent model affinity measures the similarity to a model non-impacted community based on the abundance of 7 taxa groups (Bode et al. 2002). Kick sample model community is composed of 40% Ephemeroptera, 5% Plecoptera, 10% Trichoptera, 10% Coleoptera, 20% Chironomidae, 5% Oligochaeta, and 10% Other.	-20
Species dominance	Species dominance is a measure of community balance, or how evenly the most numerous species contribute to the community. High dominance values indicate unbalanced communities strongly dominated by one or more numerous species.	+15

Table 2. Crescent Road culvert habitat comparability criteria results.

Station	Referecnce_2	Above	Downstream	Difference Ref & Above	Difference Ref & Below	Criteria	Meets criteria
Current (cm/sec)	96.15	27.17	53.19	68.98	42.96	<50%	No/Yes
Canopy (%)	70	72	96	2	26	<50%	Yes/Yes
Embeddedness (%)	30	50	16	20	14	<50%	Yes/Yes
% Rock	0.10	0.10	0.10				
% Rubble	0.30	0.20	0.40				
% Gravel	0.40	0.30	0.30				
% Sand	0.20	0.40	0.20				
% Silt	0.00	0.00	0.00				
Median particle size	-3.55	-2.2	-3.9	1.35	0.35	≤3 units	Yes/Yes

Table 3. Summary of the average community metric results for Crescent Road culvert.

Site	N	EPT Richness	Biotic Index	Taxa Richness	Percent Model Affinity	Species Dominance
Reference_2	3	11.33	4.49	20.67	52.00	31.67
Above	3	1.67	6.76	11.00	30.00	34.33
Downstream	3	1.67	6.47	17.00	29.67	35.67
Criteria		-4	+1.5	-8	-20	+15
Biological Impact		Yes/Yes	Yes/Yes	Yes/No	Yes/Yes	No/No

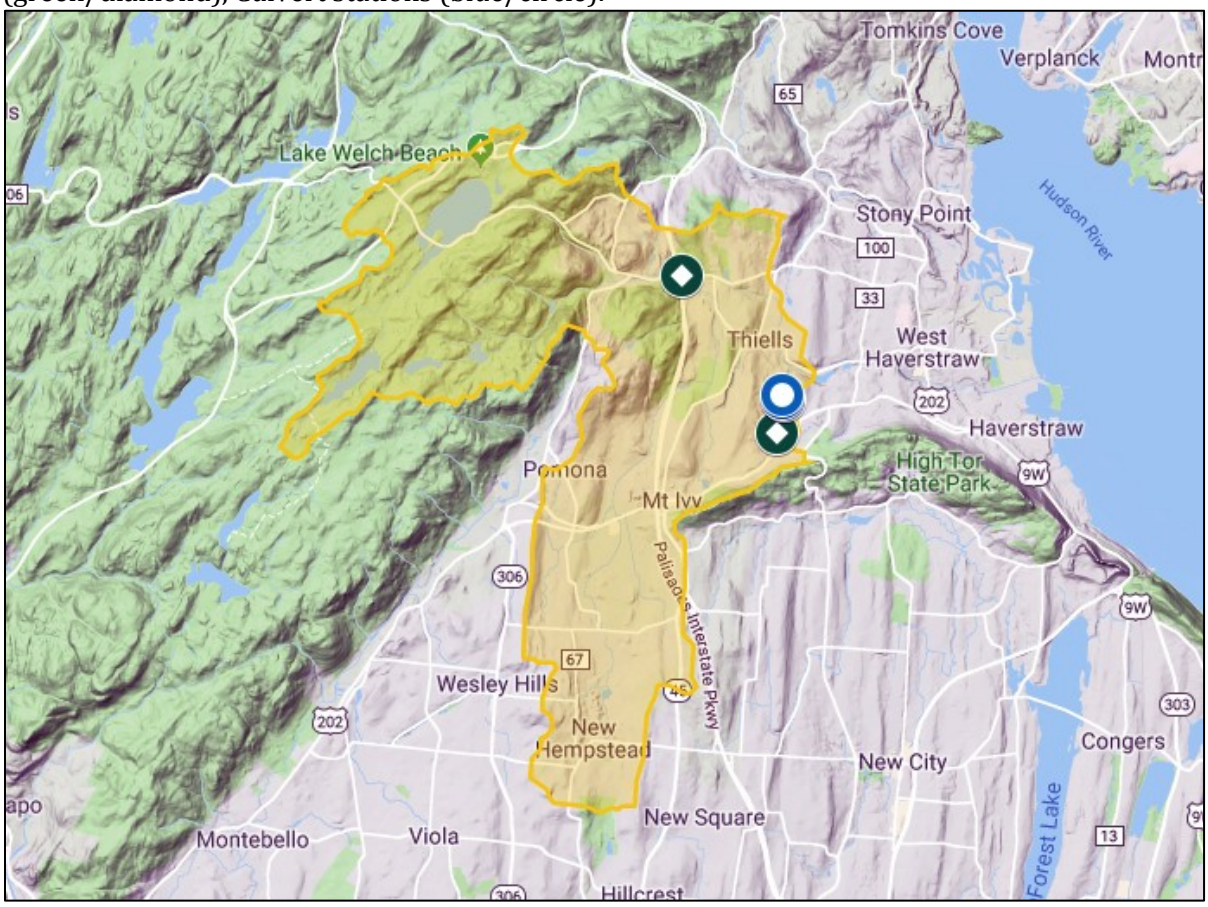
Table 4. Abbreviated benthic macroinvertebrate taxa list.

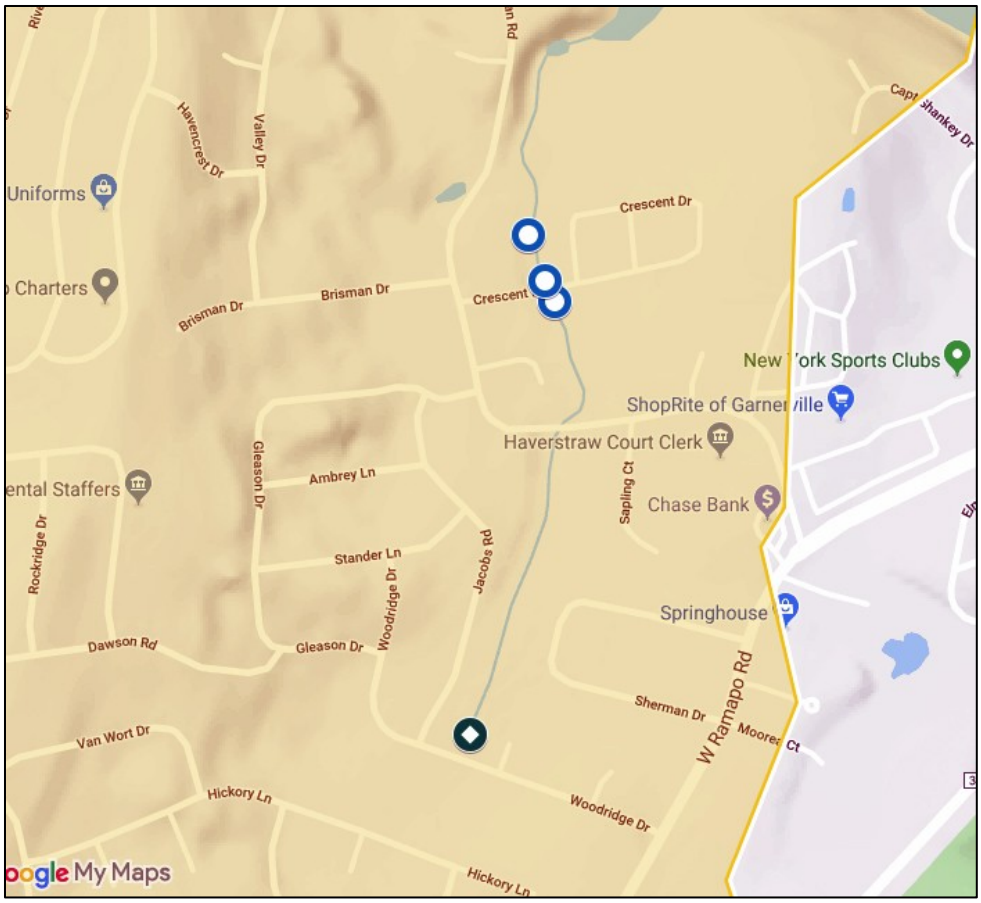
Taxon/Station	Reference_2	Above	Downstream
Cheumatopsyche sp.	98	1	4
Isonychia bicolor	78		
Hydropsyche betteni	39	1	1
Chimarra aterrima?	23	8	1
Baetis flavistriga	12		4
Ceratopsyche bronta	8		1
Undet. Tubificidae w/o cap. setae	8	49	
Psephenus herricki	7		45
Undetermined Lumbriculidae	2	13	
Undetermined Turbellaria		142	121
Crangonyx sp.		42	
Dicrotendipes sp.		37	

Table 5. Ambient water quality parameters

Station	Collect Date	Temp (deg C)	Spec Cond (µS/cm)	pH	DO (mg/L)	DO % Sat	Salinity
Reference_1	9/27/2018	17.7	784	8.14	9.42	98	0.39
Reference_2	9/28/2018	16.87	144	7.68	8.38	86.6	0.07
Above	9/20/2018	18.89	877	7.5	8.15	88	0.43
Below	9/24/2018	15.47	1521	7.59	8.66	87.1	0.77
Downstream	9/28/2018	16.08	308	7.77	8.93	91.1	0.15

Figure 1. Maps of Crescent Station watershed and reference locations: Reference stations (green/diamond), Culvert stations (blue/circle).

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Charters
Havencrest Dr
Valley Dr
Brisman Dr
Brisman Dr
Crescent Dr
Crescent
New York Sports Clubs
ShopRite of Garnerville
Haverstraw Court Clerk
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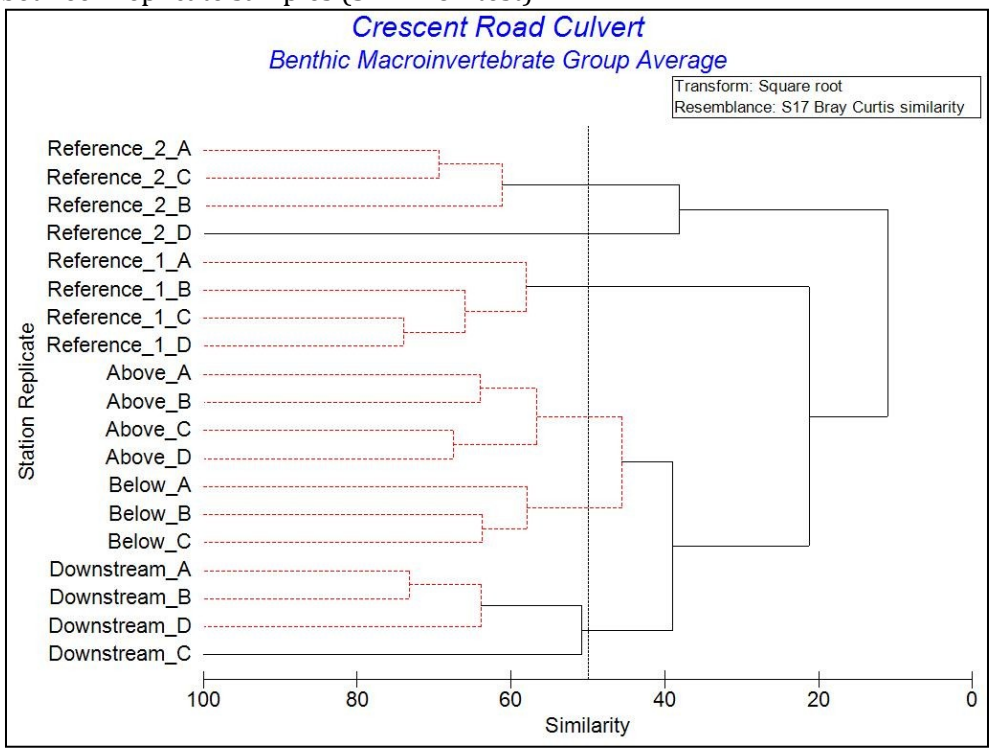
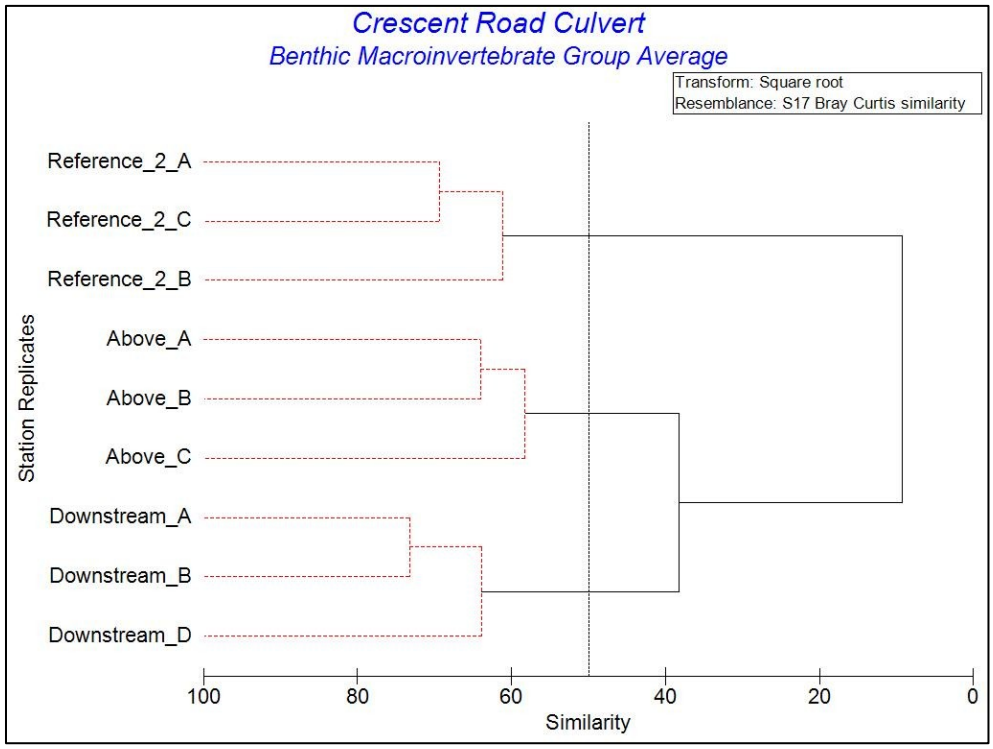
Figure 2. a.) Bray-Curtis dendrogram of macroinvertebrate community structure similarity (at genus/species level) for all the Crescent Road Culvert stations among replicated samples at the Reference 1 and 2, Above, Outlet, and Downstream stations. Dashed red lines indicate a statistically significant similarity between replicate samples (SIMPROF test). b.) Bray-Curtis dendrogram of macroinvertebrate community structure similarity (at genus/species level) for the Reference station 2, Above, and DownStream stations. Dashed red lines indicate a statistically significant similarity between replicate samples (SIMPROF test).





Appendix A: Field and Benthic Data Summary Sheets

Stream Field Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch** Latitude: **41.19665**
River Basin: **Minisceongo** Station: **Reference_1** Longitude: **-74.01454**
County/State: **Rockland/NY** Coll Date: **9/27/2018** Field Crew: **NL, BR**
Site description: **Off Woodridge Road, Downstream of Double Round Culvert**

Physical Characteristics	
Depth (meters):	**0.05**
Width (meters):	**1.51**
Current (cm/sec):	**22.83**
Canopy (%):	**94**
Substrate	
Rock (%):	**5**
Rubble (%):	**35**
Gravel (%):	**40**
Sand (%):	**20**
Silt (%):	**0**
Embeddedness (%):	**35**

Chemical Measurements	
DO (mg/L):	**9.42**
DO sat. (%):	**98**
Temperature (C):	**17.7**
Spec. Conduct. (umhos):	**784**
Baro pressure:	
pH:	**8.14**
Salinity (PSS):	**0.39**

Biological Attributes	
Aquatic vegetation	
Macrophytes:	**No**
Diatoms:	**Yes**
Algae-suspended:	**No**
Algae-filamentous:	**Yes**
Occurance of macroinvertebrates	
Ephemeroptera:	
Plecoptera:	
Trichoptera:	**X**
Coleoptera:	**X**
Megaloptera:	
Odonata:	
Chironomidae:	
Simuliidae:	**X**
Decapoda:	
Gammaridae:	
Mollusca:	**X**
Oligochaeta:	**X**
Other macro's:	**Planaria**
Field Faunal Condition:	**Very Poor**

Flow

Flow

Notes/observations::

Downstream riffle right bank; wider segment than inlet site

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Reference_1_A**
Collection Date: **9/27/2018** WAA ID: **680.4-001**

Order	Family	Final Determination	Total #
BASOMMATOPHORA	Physidae	Undetermined Physidae	23
	Planorbidae	Undetermined Planorbidae	1
COLEOPTERA	Psephenidae	Psephenus herricki	1
DIPTERA	Simuliidae	Simulium sp.	4
	Tipulidae	Limonia sp.	1
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	2

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Reference_1_B**
Collection Date: **9/27/2018** WAA ID: **680.4-002**

Order	Family	Final Determination	Total #
BASOMMATOPHORA	Physidae	Undetermined Physidae	30
DIPTERA	Chironomidae	Dicrotendipes sp.	1
	Simuliidae	Simulium sp.	2
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	5
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	2
TUBIFICIDA	Tubificidae	Undet. Tubificidae w/o cap. setae	3

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Reference_1_C**
Collection Date: **9/27/2018** WAA ID: **680.4-003**

Order	Family	Final Determination	Total #
BASOMMATOPHORA	Physidae	Undetermined Physidae	17
DIPTERA	Chironomidae	Thienemannimyia gr. spp.	1
	Simuliidae	Simulium sp.	1
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	7
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	2
	Tubificidae	Undet. Tubificidae w/o cap. setae	1

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Reference_1_D**
Collection Date: **9/27/2018** WAA ID: **680.4-004**

Order	Family	Final Determination	Total #
BASOMMATOPHORA	Physidae	Undetermined Physidae	23
DIPTERA	Chironomidae	Diamesa sp.	1
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	6
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	1
	Naididae	Undetermined Naididae	3
	Tubificidae	Undet. Tubificidae w/o cap. setae	1

0 = taxon identified in large/rare scan

Stream Field Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Mainstem** Latitude: **41.22023**

River Basin: **Minisceongo** Station: **Reference_2** Longitude: **-74.0334**

County/State: **Rockland/NY** Coll Date: **9/28/2018** Field Crew: **NL, BR**

Site description: **Downstream of Overpass near PIP exit 14 N on ramp; ~3 miles upstream from Crescent Drive Culvert**

Physical Characteristics

Depth (meters):	**0.23**
Width (meters):	**5.67**
Current (cm/sec):	**96.15**
Canopy (%):	**70**
Substrate	
Rock (%):	**10**
Rubble (%):	**30**
Gravel (%):	**40**
Sand (%):	**20**
Silt (%):	**0**
Embeddedness (%):	**30**

Chemical Measurements

DO (mg/L):	**8.38**
DO sat. (%):	**86.6**
Temperature (C):	**16.87**
Spec. Conduct. (umhos):	**144**
Baro pressure:	
pH:	**7.68**
Salinity (PSS):	**0.07**

Biological Attributes

Aquatic vegetation	
Macrophytes:	**Yes**
Diatoms:	**Yes**
Algae-suspended:	**No**
Algae-filamentous:	**Yes**
Occurance of macroinvertebrates	
Ephemeroptera:	**X**
Plecoptera:	**X**
Trichoptera:	**X**
Coleoptera:	**X**
Megaloptera:	**X**
Odonata:	**X**
Chironomidae:	
Simuliidae:	
Decapoda:	
Gammaridae:	
Mollusca:	
Oligochaeta:	
Other macro's:	**Tipulidae, Crayfish**
Field Faunal Condition:	**Very Good**

Flow

Flow

Notes/observations::

high, fast flow

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Mainste**
Station/Replicate: **Reference_2_A**
Collection Date: **9/28/2018** WAA ID: **680.4-005**

Order	Family	Final Determination	Total #
COLEOPTERA	Elmidae	Stenelmis sp.	1
	Psephenidae	Psephenus herricki	1
DIPTERA	Chironomidae	Rheotanytarsus exiguus gr.	1
	Empididae	Undetermined Empididae	1
EPHEMEROPTERA	Baetidae	Baetis flavistriga	2
		Baetis intercalaris	1
	Ephemerellidae	Eurylophella sp.	1
	Heptageniidae	Maccaffertium sp.	2
	Isonychiidae	Isonychia bicolor	15
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	1
MEGALOPTERA	Corydalidae	Nigronia serricornis	4
ODONATA	Coenagrionidae	Argia sp.	1
PLECOPTERA	Perlidae	Acroneuria abnormis	2
TRICHOPTERA	Hydropsychidae	Ceratopsyche bronta	2
		Hydropsyche betteni	23
		Cheumatopsyche sp.	34
	Philopotamidae	Chimarra aterrima?	7
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	1

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Mainste**
Station/Replicate: **Reference_2_B**
Collection Date: **9/28/2018** WAA ID: **680.4-006**

Order	Family	Final Determination	Total #
COLEOPTERA	Elmidae	Stenelmis sp.	4
		Macronychus glabratus	1
	Psephenidae	Psephenus herricki	5
DIPTERA	Chironomidae	Rheotanytarsus pellucidus	1
		Diamesa sp.	2
	Tipulidae	Tipula sp.	1
EPHEMEROPTERA	Baetidae	Baetis intercalaris	2
		Baetis flavistriga	2
	Heptageniidae	Maccaffertium vicarium	7
	Isonychiidae	Isonychia bicolor	18
ODONATA	Coenagrionidae	Argia sp.	1
TRICHOPTERA	Hydropsychidae	Ceratopsyche sparna	1
		Ceratopsyche bronta	3
		Hydropsyche betteni	10
		Cheumatopsyche sp.	30
	Lepidostomatidae	Lepidostoma sp.	1
	Philopotamidae	Chimarra aterrima?	7
	Psychomyiidae	Psychomyia sp.	3
VENEROIDEA	Pisidiidae	Pisidium sp.	1

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Mainste**
Station/Replicate: **Reference_2_C**
Collection Date: **9/28/2018** WAA ID: **680.4-007**

Order	Family	Final Determination	Total #
AMPHIPODA	Talitridae	Hyalella sp.	1
COLEOPTERA	Elmidae	Macronychus glabratus	1
		Promoresia tardella	1
	Psephenidae	Psephenus herricki	1
DIPTERA	Chironomidae	Diamesa sp.	1
		Rheotanytarsus exiguus gr.	1
	Tipulidae	Tipula sp.	1
EPHEMEROPTERA	Baetidae	Baetis intercalaris	2
		Acentrella sp.	1
		Baetis flavistriga	1
	Ephemerellidae	Eurylophella sp.	4
	Heptageniidae	Maccaffertium sp.	3
	Isonychiidae	Isonychia bicolor	19
HOPLONEMERTEA	Tetrastemmatidae	Undetermined Nemertea	1
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	1
MEGALOPTERA	Corydalidae	Nigronia serricornis	4
ODONATA	Calopterygidae	Calopteryx sp.	6
	Gomphidae	Stylogomphus sp.	1
PLECOPTERA	Perlidae	Acroneuria abnormis	1
TRICHOPTERA	Hydropsychidae	Hydropsyche betteni	6
		Ceratopsyche bronta	3
		Ceratopsyche sparna	2
		Cheumatopsyche sp.	31
	Philopotamidae	Chimarra aterrima?	6
	Polycentropodidae	Polycentropus sp.	1

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Mainste**
Station/Replicate: **Reference_2_D**
Collection Date: **9/28/2018** WAA ID: **680.4-008**

Order	Family	Final Determination	Total #
BASOMMATOPHORA	Physidae	Undetermined Physidae	2
COLEOPTERA	Elmidae	Macronychus glabratus	1
	Hydrophilidae	Undetermined Hydrophilidae	2
DIPTERA	Chironomidae	Rheotanytarsus exiguus gr.	1
		Cricotopus/Orthocladius Complex	1
		Rheocricotopus sp.	1
		Cricotopus bicinctus	3
	Tipulidae	Tipula sp.	10
EPHEMEROPTERA	Baetidae	Baetis flavistriga	7
		Baetis intercalaris	2
	Ephemerellidae	Eurylophella sp.	1
	Isonychiidae	Isonychia bicolor	26
ODONATA	Gomphidae	Stylogomphus sp.	3
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	3
	Philopotamidae	Chimarra aterrima?	3
TUBIFICIDA	Naididae	Undetermined Naididae	2
	Tubificidae	Undet. Tubificidae w/o cap. setae	8

0 = taxon identified in large/rare scan

Stream Field Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch** Latitude: **41.20168**
River Basin: **Minisceongo** Station: **Above** Longitude: **-74.01324**
County/State: **Rockland/NY** Coll Date: **9/20/2018** Field Crew: **NL, BR, AO**
Site description: **Inlet of six-structure culvert at 105 Crescent Drive**

Physical Characteristics

Depth (meters):	**0.064**
Width (meters):	**2.25**
Current (cm/sec):	**27.17**
Canopy (%):	**72**
Substrate	
Rock (%):	**10**
Rubble (%):	**20**
Gravel (%):	**30**
Sand (%):	**40**
Silt (%):	**0**
Embeddedness (%):	**50**

Chemical Measurements

DO (mg/L):	**8.15**
DO sat. (%):	**88**
Temperature (C):	**18.89**
Spec. Conduct. (umhos):	**877**
Baro pressure:	
pH:	**7.5**
Salinity (PSS):	**0.43**

Biological Attributes

Aquatic vegetation	
Macrophytes:	**No**
Diatoms:	**Yes**
Algae-suspended:	**No**
Algae-filamentous:	**Yes**
Occurance of macroinvertebrates	
Ephemeroptera:	
Plecoptera:	
Trichoptera:	**X**
Coleoptera:	**X**
Megaloptera:	
Odonata:	**X**
Chironomidae:	**X**
Simuliidae:	**X**
Decapoda:	
Gammaridae:	**X**
Mollusca:	
Oligochaeta:	**X**
Other macro's:	**Planaria, Tipulidae**
Field Faunal Condition:	**Poor**

Flow

Flow

Notes/observations::

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Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Above_A**
Collection Date: **9/20/2018** WAA ID: **680.4-009**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	29
BASOMMATOPHORA	Planorbidae	Undetermined Planorbidae	1
DIPTERA	Chironomidae	Micropsectra/Tanytarsus Complex	1
		Dicrotendipes sp.	9
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	6
TRICHOPTERA	Philopotamidae	Chimarra aterrima?	3
	Polycentropodidae	Polycentropus sp.	1
TRICLADIDA		Undetermined Turbellaria	37
TUBIFICIDA	Tubificidae	Undet. Tubificidae w/o cap. setae	3

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Above_B**
Collection Date: **9/20/2018** WAA ID: **680.4-010**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	4
DIPTERA	Chironomidae	Dicrotendipes sp.	2
	Empididae	Hemerodromia sp.	1
TRICHOPTERA	Philopotamidae	Chimarra aterrima?	2
	Polycentropodidae	Polycentropus sp.	2
TRICLADIDA		Undetermined Turbellaria	33
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	3
	Tubificidae	Undet. Tubificidae w/o cap. setae	2
		Undet. Tubificidae w/ cap. setae	1

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Above_C**
Collection Date: **9/20/2018** WAA ID: **680.4-011**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	5
COLEOPTERA	Dytiscidae	Undetermined Dytiscidae	2
DIPTERA	Chironomidae	Procladius sp.	1
		Zavrelimyia sp.	2
		Dicrotendipes sp.	11
	Empididae	Hemerodromia sp.	1
	Simuliidae	Simulium sp.	1
	Tipulidae	Tipula sp.	3
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	3
TRICHOPTERA	Philopotamidae	Chimarra aterrima?	1
TRICLADIDA		Undetermined Turbellaria	33
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	1
	Naididae	Undetermined Naididae	5
	Tubificidae	Undet. Tubificidae w/ cap. setae	1
		Undet. Tubificidae w/o cap. setae	30

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Above_D**
Collection Date: **9/20/2018** WAA ID: **680.4-012**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	4
COLEOPTERA	Dytiscidae	Undetermined Dytiscidae	2
DIPTERA	Chironomidae	Paratanytarsus sp.	1
		Micropsectra/Tanytarsus Complex	2
		Parametriocnemus sp.	2
		Polypedilum flavum	2
		Dicrotendipes sp.	15
		Thienemannimyia gr. spp.	1
		Cricotopus/Orthocladius Complex	2
	Simuliidae	Simulium sp.	1
	Tipulidae	Tipula sp.	3
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	4
TRICHOPTERA	Hydropsychidae	Hydropsyche betteni	1
		Cheumatopsyche sp.	1
	Hydroptilidae	Hydroptila sp.	1
	Philopotamidae	Chimarra aterrima?	2
TRICLADIDA		Undetermined Turbellaria	39
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	3
	Tubificidae	Undet. Tubificidae w/o cap. setae	14

0 = taxon identified in large/rare scan

Stream Field Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch** Latitude: **41.20193**
River Basin: **Minisceongo** Station: **Below** Longitude: **-74.0134**
County/State: **Rockland/NY** Coll Date: **9/24/2018** Field Crew: **NL, BR**
Site description: **1st riffle after outlet at 105 Crescent Drive**

Physical Characteristics	
Depth (meters):	**0.04**
Width (meters):	**1.24**
Current (cm/sec):	**11.42**
Canopy (%):	**60**
Substrate	
Rock (%):	**5**
Rubble (%):	**50**
Gravel (%):	**20**
Sand (%):	**25**
Silt (%):	**0**
Embeddedness (%):	**30**

Chemical Measurements	
DO (mg/L):	**8.66**
DO sat. (%):	**87.1**
Temperature (C):	**15.47**
Spec. Conduct. (umhos):	**1521**
Baro pressure:	
pH:	**7.59**
Salinity (PSS):	**0.77**

Biological Attributes	
Aquatic vegetation	
Macrophytes:	**No**
Diatoms:	**Yes**
Algae-suspended:	**No**
Algae-filamentous:	**Yes**
Occurance of macroinvertebrates	
Ephemeroptera:	
Plecoptera:	
Trichoptera:	**X**
Coleoptera:	**X**
Megaloptera:	
Odonata:	**X**
Chironomidae:	**X**
Simuliidae:	
Decapoda:	
Gammaridae:	**X**
Mollusca:	
Oligochaeta:	**X**
Other macro's:	**Planaria, Tipulidae**
Field Faunal Condition:	**Very Poor**

Flow

Flow

Notes/observations::

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Below_A**
Collection Date: **9/24/2018** WAA ID: **680.4-013**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	6
DIPTERA	Chironomidae	Micropsectra/Tanytarsus Complex	1
		Dicrotendipes sp.	18
		Paratanytarsus sp.	11
		Cricotopus/Orthocladius Complex	3
		Cricotopus bicinctus	3
		Thienemannimyia gr. spp.	1
		Thienemanniella sp.	1
		Polypedilum illinoense	1
		Polypedilum flavum	1
		Nanocladius sp.	1
	Tipulidae	Limonia sp.	6
ODONATA	Calopterygidae	Calopteryx sp.	4
TRICHOPTERA	Philopotamidae	Chimarra aterrima?	1
TRICLADIDA		Undetermined Turbellaria	36
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	6

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Below_B**
Collection Date: **9/24/2018** WAA ID: **680.4-014**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	1
DIPTERA	Chironomidae	Paratanytarsus sp.	1
		Dicrotendipes sp.	12
		Eukiefferiella claripennis gr.	1
	Tipulidae	Limonia sp.	3
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	2
ODONATA	Calopterygidae	Calopteryx sp.	3
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	1
TRICLADIDA		Undetermined Turbellaria	8
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	2

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Below_C**
Collection Date: **9/24/2018** WAA ID: **680.4-015**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	10
BASOMMATOPHORA	Physidae	Undetermined Physidae	1
DIPTERA	Chironomidae	Dicrotendipes sp.	40
		Paratanytarsus sp.	10
		Cricotopus/Orthocladius Complex	1
	Tipulidae	Limonia sp.	1
		Tipula sp.	2
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	4
ODONATA	Calopterygidae	Calopteryx sp.	3
TRICHOPTERA	Hydropsychidae	Hydropsyche betteni	1
		Cheumatopsyche sp.	1
TRICLADIDA		Undetermined Turbellaria	16
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	10

0 = taxon identified in large/rare scan

Stream Field Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch** Latitude: **41.20245**
River Basin: **Minisceongo** Station: **Downstream** Longitude: **-74.01364**
County/State: **Rockland/NY** Coll Date: **9/28/2018** Field Crew: **NL, BR**
Site description: **Below Riprap Pool**

Physical Characteristics	
Depth (meters):	**0.17**
Width (meters):	**4.06**
Current (cm/sec):	**53.19**
Canopy (%):	**96**
Substrate	
Rock (%):	**10**
Rubble (%):	**40**
Gravel (%):	**30**
Sand (%):	**20**
Silt (%):	**0**
Embeddedness (%):	**16**

Chemical Measurements	
DO (mg/L):	**8.93**
DO sat. (%):	**91.1**
Temperature (C):	**16.08**
Spec. Conduct. (umhos):	**308**
Baro pressure:	
pH:	**7.77**
Salinity (PSS):	**0.15**

Biological Attributes	
Aquatic vegetation	
Macrophytes:	**No**
Diatoms:	**Yes**
Algae-suspended:	**No**
Algae-filamentous:	**Yes**
Occurance of macroinvertebrates	
Ephemeroptera:	
Plecoptera:	
Trichoptera:	**X**
Coleoptera:	**X**
Megaloptera:	
Odonata:	**X**
Chironomidae:	**X**
Simuliidae:	**X**
Decapoda:	
Gammaridae:	**X**
Mollusca:	**X**
Oligochaeta:	**X**
Other macro's:	**Planaria**
Field Faunal Condition:	**Poor**

Flow

Flow

Notes/observations::

Water flowing through structures 1,3 and 4 after heavy rains; as opposed to only flow through structure 4.; water is also flowing through typically dry rip rap cascade.

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Downstream_A**
Collection Date: **9/28/2018** WAA ID: **680.4-016**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	8
BASOMMATOPHORA	Physidae	Undetermined Physidae	1
COLEOPTERA	Dytiscidae	Undetermined Dytiscidae	3
DIPTERA	Chironomidae	Thienemannimyia gr. spp.	4
		Dicrotendipes sp.	2
		Chaetocladius sp.	1
		Micropsectra/Tanytarsus Complex	5
	Simuliidae	Simulium sp.	1
	Tabanidae	Undetermined Tabanidae	1
	Tipulidae	Tipula sp.	14
		Limonia sp.	1
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	34
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	1
	Philopotamidae	Chimarra aterrima?	1
TRICLADIDA		Undetermined Turbellaria	1
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	5
	Naididae	Undetermined Naididae	1
	Tubificidae	Undet. Tubificidae w/o cap. setae	16

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Downstream_B**
Collection Date: **9/28/2018** WAA ID: **680.4-017**

Order	Family	Final Determination	Total #
		Undetermined Nematoda	1
AMPHIPODA	Crangonyctidae	Crangonyx sp.	2
BASOMMATOPHORA	Physidae	Undetermined Physidae	1
DIPTERA	Chironomidae	Thienemannimyia gr. spp.	5
		Chaetocladius sp.	1
		Cricotopus/Orthocladius Complex	1
		Tvetenia bavarica gr.	1
		Thienemanniella sp.	1
		Diamesa sp.	1
		Micropsectra/Tanytarsus Complex	4
	Empididae	Hemerodromia sp.	1
	Simuliidae	Simulium sp.	1
	Tipulidae	Tipula sp.	17
		Limonia sp.	2
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	40
TRICHOPTERA	Hydropsychidae	Hydropsyche betteni	1
		Cheumatopsyche sp.	1
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	8
	Tubificidae	Undet. Tubificidae w/o cap. setae	11

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Downstream_C**
Collection Date: **9/28/2018** WAA ID: **680.4-018**

Order	Family	Final Determination	Total #
		Undetermined Nematoda	3
AMPHIPODA	Crangonyctidae	Crangonyx sp.	3
BASOMMATOPHORA	Physidae	Undetermined Physidae	4
	Planorbidae	Undetermined Planorbidae	3
DIPTERA	Chironomidae	Thienemannimyia gr. spp.	1
		Micropsectra/Tanytarsus Complex	1
	Empididae	Hemerodromia sp.	1
	Simuliidae	Simulium sp.	9
	Tabanidae	Undetermined Tabanidae	1
	Tipulidae	Tipula sp.	7
		Limonia sp.	2
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	14
ODONATA	Calopterygidae	Calopteryx sp.	2
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	2
	Philopotamidae	Chimarra aterrima?	2
TRICLADIDA		Undetermined Turbellaria	17
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	12
	Tubificidae	Undet. Tubificidae w/ cap. setae	15
VENEROIDEA	Pisidiidae	Pisidium sp.	1

0 = taxon identified in large/rare scan

Lab Data Summary

Watershed Assessment Associates
Environmental Services / Biomonitoring / Invertebrate Taxonomy / Professional Training

Waterbody: **Minisceongo Creek Branch**
Station/Replicate: **Downstream_D**
Collection Date: **9/28/2018** WAA ID: **680.4-019**

Order	Family	Final Determination	Total #
AMPHIPODA	Crangonyctidae	Crangonyx sp.	12
BASOMMATOPHORA	Physidae	Undetermined Physidae	7
COLEOPTERA	Dytiscidae	Undetermined Dytiscidae	1
DIPTERA	Chironomidae	Diamesa sp.	1
		Micropsectra/Tanytarsus Complex	5
		Chaetocladius sp.	2
		Thienemannimyia gr. spp.	1
	Stratiomyidae	Undetermined Stratiomyidae	1
	Tipulidae	Tipula sp.	1
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	33
TRICHOPTERA	Philopotamidae	Chimarra aterrima?	1
TRICLADIDA		Undetermined Turbellaria	15
TUBIFICIDA	Enchytraeidae	Undetermined Enchytraeidae	2
	Tubificidae	Undet. Tubificidae w/o cap. setae	18

0 = taxon identified in large/rare scan