

Minnesota
F29-R30(1)
Area 317
Study 3

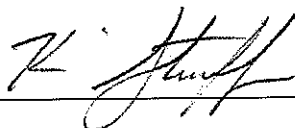
Minnesota Department of Natural Resources
Division of Fish and Wildlife
Section of Fisheries

Stream Survey Report

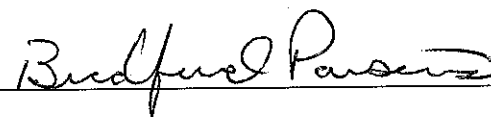
Cascade Creek
2011

By
Jeffrey L. Weiss
Fisheries Management Specialist

Lake City Area Fisheries Office

Approved: 
Area Fisheries Supervisor

Date: April 27, 2012

Approved: 
Regional Fisheries Manager

Date: 6-7-12



Your purchase of fishing equipment
and motor boat fuel supports boating
access and Sport Fish Restoration.



Funded under Federal Aid by the Sportfishing Restoration Act F-29-R

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General Information

Stream Name:	Cascade Creek
Tributary Number:	M-034-071
Counties:	Dodge, Olmsted
Nearest Towns:	Rochester, Byron
Source of Flow:	Drainage ditches and tiles, Dodge County
Stream Length:	19.5 miles
Waterway Sequence	South Fork Zumbro River to Zumbro River to Mississippi River
Ecological Classification:	Class IV-Coolwater/Warmwater

Watershed Name and Number

Major Watershed:	Zumbro River (M-034)
Watershed Number:	41
USGS HUC-8:	07040004
Minor Watershed:	South Fork Zumbro River
Watershed Number:	41071

Metric		
Basin Area	12,878 ac	20.12 mi ²
Basin Length	10.95 mi	
Basin Relief	311 ft	
Basin Relief Ratio	$R_r = 0.0054$	
Basin Shape	$R_c = 0.462$	
Main Stream Order	3	
Main Stem Stream Length	19.5 mi	
Mean Stream Slope	$S_c = 0.0028$	7.61 ft/mi
Drainage Density	2.17 mi/mi ²	
Sinuosity	1.61	

Introduction

Cascade Creek is a warmwater stream that originates in eastern Dodge County and flows 19.5 miles entering the South Fork Zumbro River immediately downstream of the Silver Lake dam in Rochester. A Level I stream survey was conducted in 2011 to evaluate the fish and invertebrate communities and qualitatively assess stream physical features (MNDNR 2006). This survey was conducted as part of a sediment and flood reduction project within the Cascade Creek watershed and is a cooperative endeavor between the City of Rochester, Olmsted County, and the Department of Natural Resources. The project will include the installation of a water retention weir with off channel water storage, one undersized culvert, and rehabilitation of the stream channel through the Meadow Lakes golf course. A comprehensive monitoring plan will be implemented to determine the effects of these structures and channel rehabilitation on stream processes and water quality. In this survey, sampling stations were located downstream from the two structural sites and also within the golf course reach. A reference station was established upstream from the structural sites (Table 1; Figure 1). Stream reach designations follow the 1985 stream survey; however sampling was not conducted in reach I in 2011.

Watershed

Cascade Creek is a third order stream (Figure 2) with a drainage area of 12,878 acres. Land use is dominated by row crops (58%), developed land (17%), and grassland (11%) (Table 2; Figure 3). The lower 3.6 miles of the watershed (reach I) is entirely developed into residential/industrial use and municipal parks. The drainage basin is 10.95 miles-long with a main stream length of 19.5 miles. The stream drops 311 ft in elevation from the source to the mouth. Watershed geomorphology is comprised of dissected bedrock terrains with a lack of glacial landforms (Figure 4). Seven springs are known to occur within the watershed. Soils are dominated by fine-silty loam (Figure 5). A series of former quarry pit ponds is present near the junction of highways 14 and 52 in the City of Rochester. The stream formerly flowed into the ponds but a new channel was constructed in 2007 that diverted Cascade Creek around the ponds. When quarry operations are completed, the ponds will be configured into a single, 100 acre lake that will be managed for multiuse recreation.

Hydrology

The hydrology of Cascade Creek is significantly influenced by the installation of drainage tiles in the upper watershed and stormwater runoff in the lower reaches. Artificial drainage of former wetlands combined with runoff from impervious surfaces results in an extremely flashy hydrograph (Figure 6). The stream channel was ditched in several locations, the longest of which is from mile 12.7 to 13.9. A flood control system was designed and completed in the early 1990's within the City of Rochester. As part of this project, three flood control reservoirs were constructed on tributaries to Cascade Creek. The largest reservoir (Kalmar KR-6) is managed for recreational use.

Water Quality

Water quality sampling was not conducted in this survey. However, water quality and flow data is available from MPCA, MNDNR-Waters, and in the United States Environmental Protection Agency STORET database (USEPA 2011). Based upon turbidity measurements obtained through the Citizens Stream Monitoring Program, Cascade Creek was listed as impaired for turbidity in 2006 (MNPCA 2006). A total maximum daily load has been developed for the Zumbro River and includes load ratings for Cascade Creek. A listing of probable sources of suspended solids in this TMDL includes bank erosion, algae growth and death, ditching and stream channelization, row crops, inadequate buffer strips, and livestock in the riparian zone.

Habitat

Physical habitat was qualitatively evaluated in each stream reach using the Minnesota Stream Habitat Assessment protocol (MNDNR 2006). Habitat quality is fair to poor throughout the stream (Table 3). The lowest scores were for surrounding land use and substrate parameters. The high prevalence of row crops was largely responsible for low land use scores. Substrate scores were reduced by the high incidence of sand in pools and runs and moderate embeddedness. The highest habitat quality score was in the reference station where instream cover was more common. Habitat quality has changed little since the previous stream survey in 1985.

Connectivity

Due to the proximity of Cascade Creek to the City of Rochester, the stream and its tributaries are crossed by many roads necessitating a high number of bridges and culverts. Though none of the stream crossings observed appeared to be barriers to fish passage, many of these structures are improperly sized resulting in habitat degradation immediately downstream. Improperly sized bridges and culverts increase water velocity during high flow events causing downcutting and erosion downstream. Lateral connectivity has been influenced by the prevalence of drain tiles. Infiltration to groundwater has been reduced while direct flow to the stream channel has increased. This contributes to the “flashy” nature of the stream hydrograph. The effects of drain tiles on stream water temperature have not been evaluated.

Geomorphology

Cascade Creek is an incised stream throughout much of its flowing length. The stream does not have access to its floodplain and therefore carries a high sediment load that is ultimately deposited into Interlachen Lake in Rochester. The sedimentation of Interlachen Lake was the primary driver of the sediment reduction and flood control project that will be implemented in 2012. A significant portion of the sediment originates in the Meadow Lakes Golf Course reach where stream banks are 8-10 ft high and bare soil. The channel rehabilitation project through the

golf course will reconnect the stream to its floodplain, reduce bank erosion, and alleviate sedimentation of Interlachen Lake.

Fish Community

Fish were sampled with a tote barge using a DC generator in all stations except 3 where two backpack electrofishers were used. Electrofishing was conducted by a single upstream pass. All fish > 1 inch TL were collected. Fish were sorted by species, bulk weighed, and a length range was attained following the Index of Biotic Integrity sampling protocol (MNDNR 2006). Fish populations were evaluated using the Wisconsin warmwater IBI for central and southern Wisconsin (Lyons 1992). The Minnesota Pollution Control Agency is currently developing a new warmwater IBI for southern Minnesota. However, this index was unavailable at the time this report was developed. When available, this new IBI will be applied to Cascade Creek fish data to foster consistency among agencies.

A total of 14 species from six families were collected (Table 4). None of the fish species collected currently hold any special status in Minnesota (MNDNR 2012). Central stoneroller *Campostoma anomalum* was the most abundant fish species comprising 33% of the total catch. Southern redbelly dace *Phoxinus erythrogaster* (19.5%), creek chub *Semotilus atromaculatus* (15%), and white sucker *Catostomus commersoni* (7%) were common. Blacknose dace *Rhinichthys atratulus*, bluntnose minnow *Pimephales notatus*, creek chub, white sucker, and Johnny darter *Etheostoma nigrum* were collected in all stations. Just two darter species were collected; Johnny darter and fantail darter *Etheostoma flabellare*. Fish IBI scores were consistently poor throughout the stream corroborating the low habitat quality scores (Table 5). No intolerant or carnivorous species were collected which reduced IBI scores.

There was little change in fish species composition between the 1985 and 2011 stream surveys (Freiermuth 1986) (Table 6). Black bullhead *Ameiurus melas* and fathead minnow *Pimephales promelas* were only collected in 2011 while black redhorse *Moxostoma duquesnei* was only collected in 1985. Gamefish were not collected in either survey upstream from reach I, where fish from the South Fork Zumbro River can access Cascade Creek.

Invertebrate Community

Invertebrates were collected in all four sampling stations following the MNPCA sampling protocol (MNPCA 2012). A minimum of 51 species were collected from at least 36 families representing 12 orders (Appendix A). The benthic invertebrate IBI (B-IBI) of Wittman and Mundahl (2003) was used to examine the invertebrate community (Table 7). Index scores ranged from 45 (fair) to 70 (excellent) with a mean score of 59 (good). The number of taxa per station ranged from 25 to 36. The Hilsenhoff biotic index is an indicator of organic pollution (Hilsenhoff 1987). Scores for Cascade Creek were very good to good in all stations and corroborated with the B-IBI scores.

Comparison of Habitat Quality and Community Indices

There is good agreement between habitat quality scores and fish IBI scores. However, invertebrate IBI scores do not exhibit the same relationship. The highest invertebrate IBI score occurred in station 4.65 where the lowest habitat quality score occurred. This curious relationship may be due to the qualitative nature of the MSHA and lack of habitat metrics that are important to invertebrates. Fish IBI scores were poor to very poor in all stations indicating poor habitat quality on the scale used or required by fish. It is common for coldwater streams in southeast Minnesota to be listed as impaired for turbidity or bacteria, yet have an abundant brown trout *Salmo trutta* population and high coldwater IBI scores (MNDNR unpublished data). The level of impairment is not exceeding the tolerance levels of brown trout for these parameters. This is further evidence that fish may be better indicators of habitat than water quality.

Summary

Cascade Creek is greatly influenced by land use within its watershed. The stream suffers from excessive runoff from tile drainage and impervious surfaces. As a result, instream habitat is poor in many locations, but there are areas of the stream that could be improved. To this end, rehabilitation of the stream in the Meadow Lakes Golf Course will reduce sedimentation and offer the potential for development of a smallmouth bass population. Easements will be purchased on the entire 4,700 ft-long reach and will provide public access to the stream. This also presents a great opportunity for public education on stream channel rehabilitation and sound land management practices.

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Table 1. Station and reach locations and characteristics for Cascade Creek, 2011.

	<u>Station</u>			
River mile	4.65	11.73	15.03	16.98
utm _x	537725	531591	528607	527191
utm _y	4873948	4871977	4873401	4874123
Length (ft)	660	442	538	430
Width (ft)	14.7	11.9	12.5	12.3

	<u>Reach</u>			
	I	II	III	IV
Mile to mile	0-3.7	3.7-9.1	9.1-15.6	15.6-19.5
Gradient (ft/mi)	13.5	12.6	12.0	20.5
Sinuosity	1.2	1.5	1.6	1.9

+

Table 2. Land cover composition in the Cascade Creek Watershed determined from the 2001 National Land Cover Data Set.

Cover Type	Acres	Percent
Open water	83	0.7
Developed Open Space	1,178	9.2
Developed Low Intensity	828	6.4
Developed Medium Intensity	178	1.4
Developed High Intensity	21	0.2
Deciduous Forest	924	7.2
Evergreen Forest	6	0.05
Grassland/Herbaceous	1,446	11.2
Pasture/Hay	783	6.1
Cultivated Crops	7,427	57.7
Woody Wetlands	1	0.01
Emergent Herbaceous Wetlands	8	0.06

Table 3. Qualitative habitat quality ratings by sampling station determined from the Minnesota Stream Habitat Assessment protocol.

Metric	Station			
	4.65	11.73	15.03	16.98
Land Use				
Max=5	4	0	0	0
Riparian Zone				
Max=15	3	8	10	8
Substrate				
Max=27	9	11	9	8
Cover				
Max=17	6	8	6	12
Channel Morph.				
Max=36	21	24	24	24
MSHA Score				
Max=100	44	51	49	52
Habitat Rating	Poor	Fair	Poor	Fair

Table 4. Fish species and number collected by sampling station in Cascade Creek, 2011.

Family		Station				
Common Name	<i>Genus species</i>	4.65	11.73	15.03	16.98	Total
Cyprinidae						
Common shiner	<i>Luxilus cornutus</i>	6	16		7	29
Bigmouth shiner	<i>Notropis dorsalis</i>	3	13	3		22
Central stoneroller	<i>Campostoma anomalum</i>	97	17		255	369
Blacknose dace	<i>Rhinichthys atratulus</i>	26	38	18	20	102
Southern redbelly dace	<i>Phoxinus erythrogaster</i>		26	3	192	221
Bluntnose Minnow	<i>Pimephales notatus</i>	8	7	1	39	55
Fathead minnow	<i>Pimephales promelas</i>	2			5	7
Creek chub	<i>Semotilus atromaculatus</i>	50	64	4	53	173
Catostomidae						
White sucker	<i>Catostomus commersoni</i>	48	8	3	25	84
Ictaluridae						
Black bullhead	<i>Ameiurus melas</i>				4	4
Gasterosteidae						
Brook stickleback	<i>Culaea inconstans</i>				15	15
Centrarchidae						
Green sunfish	<i>Lepomis gulosus</i>	8			2	10
Percidae						
Fantail darter	<i>Etheostoma flabellare</i>		6	9	1	16
Johnny darter	<i>Etheostoma nigrum</i>	19	2	4	1	26
Total Number per Station		267	197	45	619	1,133
Number of Species		10	10	8	13	14

Table 5. Fish index of biotic integrity scores by sampling station in Cascade Creek determined from the warmwater IBI of Lyons (1992) for central and southern Wisconsin. BP=Backpack electrofisher.

	<u>Station</u>			
	4.65	11.73	15.03	16.98
Gear	Barge	Barge	2 BP	Barge
Length (ft)	515	442	438	430
Width (ft)	14.7	11.9	12.5	12.3
Metric				
Native spp.	10	10	8	13
Darter spp.	1	2	2	2
Sucker spp.	1	1	1	1
Sunfish spp.	0	0	0	1
Intolerant spp.	0	0	0	0
% Tolerant	50	59	58	23
% Omnivores	22	8	9	11
% Insectivores	10	18	36	2
% Carnivores	0	0	0	0
% Lithophils	29	44	53	39
IBI Score	17	20	15	25
IBI Rating	Very Poor	Poor	Very Poor	Poor

Table 6. Fish species presence/absence by stream mile and year in Cascade Creek.

Species (year)	Stream Mile from Mouth							
	4.65 (2011)	4.9 (1985)	7.5 (1974)	11.73 (2011)	11.8 (1985)	15.03 (2011)	16.98 (2011)	17.8 (1985)
Common carp			x					
Common shiner	x	x	x	x	x		x	
Bigmouth shiner	x	x	x	x	x	x		x
Central stoneroller	x	x	x	x			x	
Blacknose dace	x	x	x	x	x	x	x	x
Southern redbelly dace			x	x		x	x	x
Bluntnose Minnow	x	x	x	x	x	x	x	
Fathead minnow	x		x				x	
Creek chub	x	x	x	x	x	x	x	x
White sucker	x	x	x	x	x	x	x	x
Black redhorse		x						
Silver redhorse			x					
Black bullhead							x	
Brook stickleback							x	x
Green sunfish	x	x	x				x	
Fantail darter		x	x	x	x	x	x	x
Johnny darter	x	x	x	x	x	x	x	x
Total Species	10	11	14	10	8	8	13	8

Table 7. Benthic invertebrate index of biotic integrity scores by sampling station in Cascade Creek determined from the benthic IBI of Mundahl (2003) for southeast Minnesota streams.

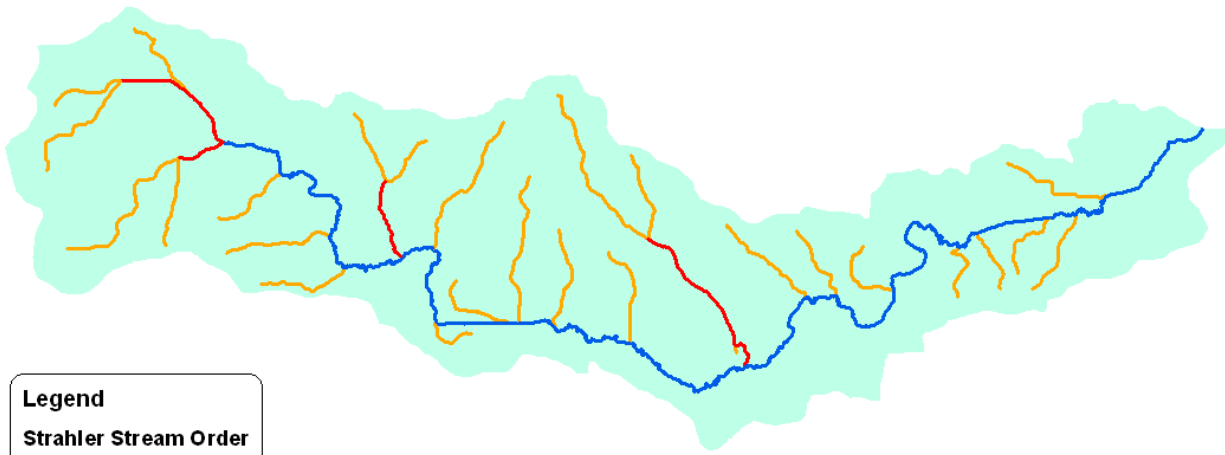
Metric	<u>Station</u>			
	4.65	11.73	15.03	16.98
Total No.	2108	926	1444	2104
No. Taxa	25	26	28	36
No. Plecoptera	2	0	0	0
No. Trichoptera	4	4	5	5
No. Diptera	7	4	8	8
No. Long-lived	2	2	2	3
No. Intolerant	4	1	3	2
No. Filterer	8	7	6	7
% Plecoptera	0.28	0	0	0
% Predators	2.61	6.37	7.48	7.70
% Long-lived	0.28	1.51	0.14	4.28
B-IBI Score	70	45	60	60
B-IBI Rating	Excellent	Fair	Good	Good
Hilsenhoff Index	4.49	4.84	4.55	4.96
Hilsenhoff Rating	Very Good	Good	Good	Good

Note: % Plecoptera, % Predator, and % Long-lived is of individuals not taxa.




Figure 1.
Cascade Creek Sampling Stations



Figure 2. Cascade Creek Watershed Stream Order



Legend
Strahler Stream Order

-  1
-  2
-  3

Stream Identification Information

Major Watershed 41, Zumbro River
Minor Watershed 41065, Cascade Creek
Kittle Number M-034-071, Cascade Creek
Dodge and Olmsted Counties

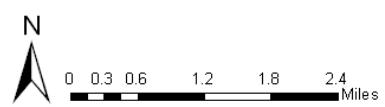


Figure 3. Cascade Creek Watershed Landuse

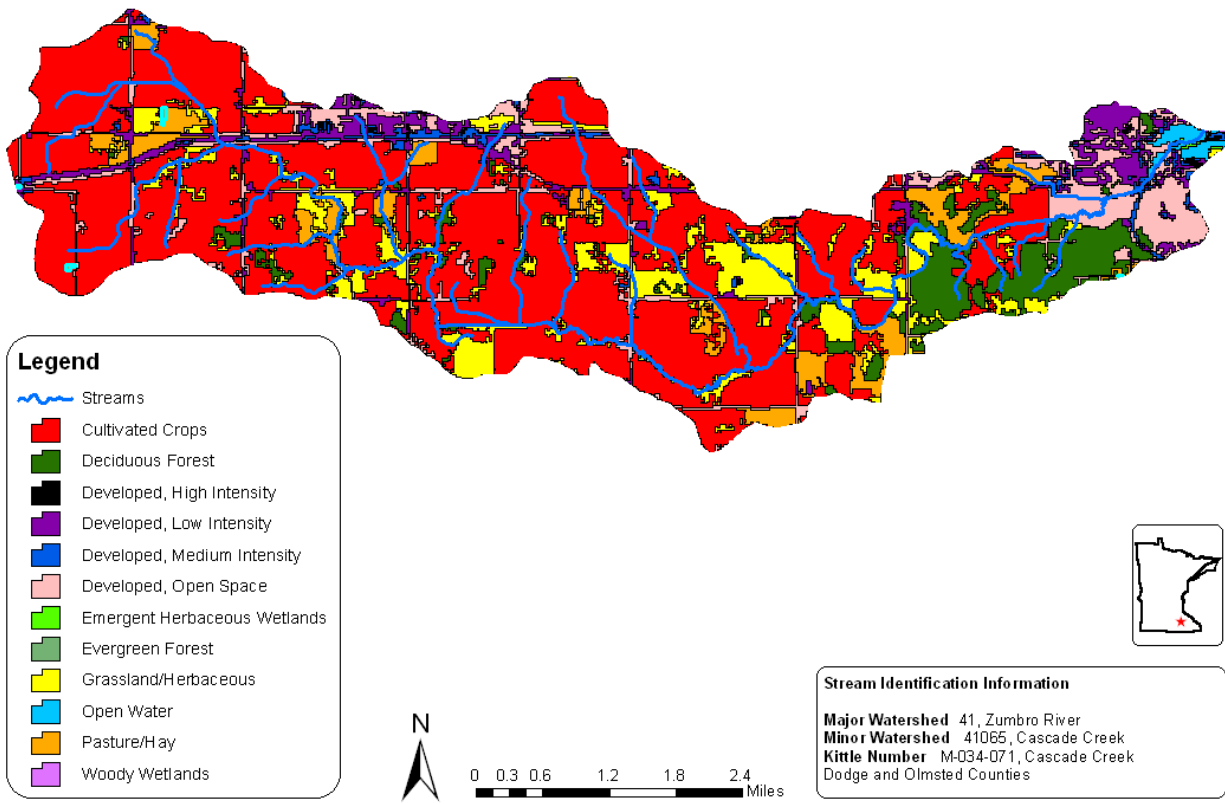


Figure 4. Cascade Creek Watershed Geomorphology and Karst Features

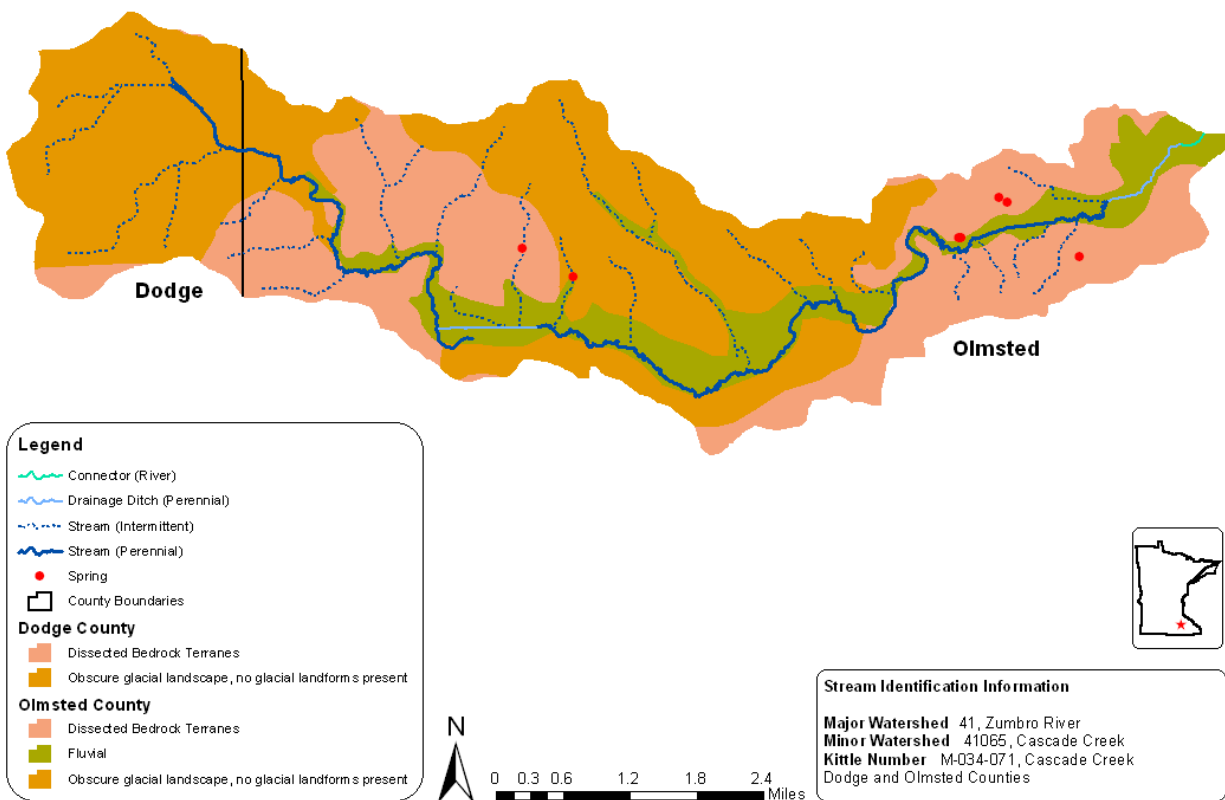
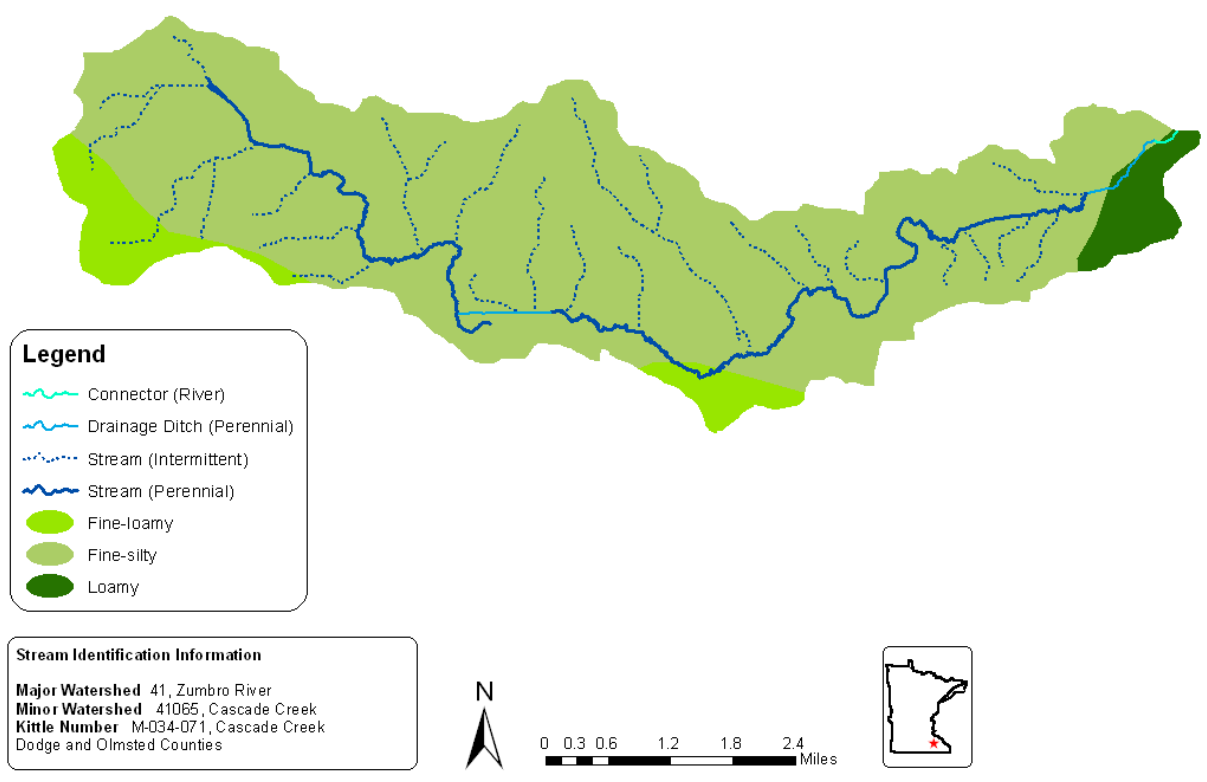
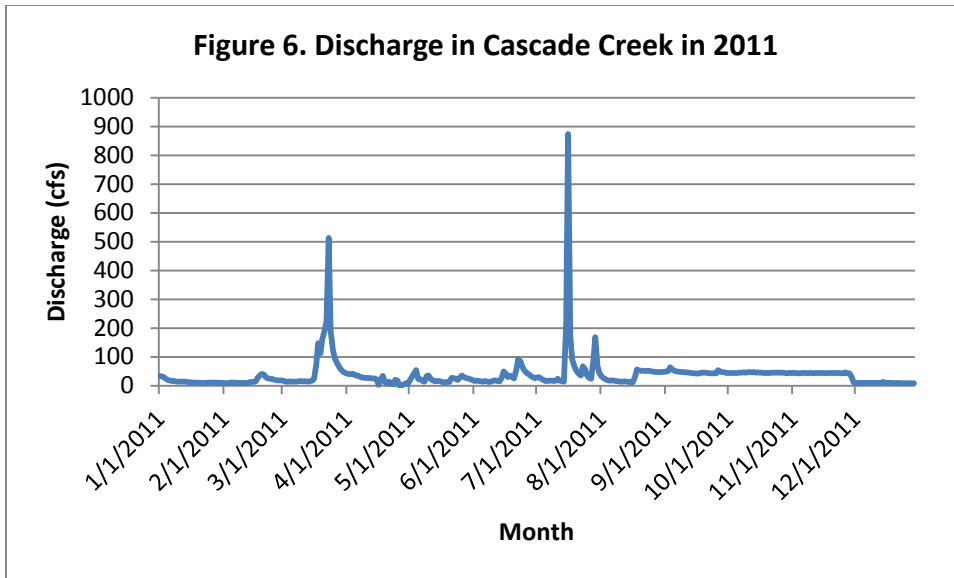


Figure 5. Cascade Creek Watershed Soils





Appendix A: Cascade Creek, benthos

Olmsted County, September 2011

collection and processing: Jeff Weiss, Lake City

ID: G. Montz, Div Eco & Water Resources

Taxa	<u>Station</u>			
	15.03	11.73	4.65	16.98
EPHEMEROPTERA				
Baetidae		29		
Acentrella sp.		2		
Baetis sp.	307	109	439	149
Baetiscidae				
Baetisca sp.		2		
Caenidae				
Caenis sp.	2	36	1	51
Ephemeridae				
Hexagenia sp.		3		
Heptageniidae		23	60	
?Nixe sp.		2	56	1
Stenonema mediopunctatum			33	
Stenonema vicarium	135	69	213	66
Stenacron sp.	12	3		20
Isonychiidae				
Isonychia sp.	21	1	62	
Leptohyphidae				
Tricorythodes sp.			3	
Leptophlebiidae				
Paraleptophlebia sp.		8		
PLECOPTERA				
Perlidae				
Paragnetina sp.			4	
Pteronarcyidae				
Pteronarcys sp.			2	
TRICHOPTERA				
Brachycentridae				
Brachycentrus occidentalis	7	24	8	14
Helicopsychidae				
Helicopsyche sp.	36		1	262
Hydroptilidae				
Hydroptila sp.		2		12
Hydropsychidae	56	9	195	82

	<u>Station</u>			
	15.03	11.73	4.65	16.98
Ceratopsyche ?alhedra			78	3
Ceratopsyche bronta		8	101	
Ceratopsyche slossone	3	5		7
Cheumatopsyche sp.	142	57	206	125
Hydropsyche bettini	30	37	69	156
Polycentropodidae				
Nyctiophylax sp.	2			
COLEOPTERA				
Dryopidae				
Helichus sp.	1	1	3	2
Elmidae				
Dubiraphia sp.	4			25
Macronychus sp.	1			
Optioservus sp.	287	161	170	226
Stenelmis sp.	73	11	98	87
ODONATA				
Calopterygidae				
Calopteryx sp.	14	5		11
Coenagrionidae				6
Enallagma sp.				17
Aeshnidae				
Boyeria sp.	1			1
HEMIPTERA				
Belostomatidae				
Belostoma sp.				2
Gerridae				
Gerris sp.				1
Nepidae				
Ranatra sp.		1		
DIPTERA				
Athericiidae				
Atherix sp.	24	3	14	22
Ceratopogonidae			9	
Chironomidae	199	258	141	384
Dixidae				
Dixella sp.	4			1
Empididae				
Hemerodromia sp.			2	5
Simuliidae				
?Prosimulium sp.			1	
Simulium sp.	9		97	11
Siimulium vittatum			14	7

	<u>Station</u>			
	15.03	11.73	4.65	16.98
Tabanidae				
Chrysops sp.	2	5		
Tipulidae				
Antocha sp.	1			2
Dicranota sp.	65	45	26	96
Tipula sp.	6		2	42
CRUSTACEA				
AMPHIPODA				
Hyalella azteca				83
MOLLUSKA				
Ferressia sp.				1
Physella sp.	1	13		84
Sphaeriidae	1	1		5
HIRUDINEA				1
OLIGOCHAETA	8			6
HYDRACHNIDA	16	1		25

Note: ? indicate tentative identifications.