HABITAT IMPROVEMENT AND MONITORING PROJECT

MONITORING YEAR 1 OF 5

DOLAN PROPERTY; COLDWATER RIVER

PREPARED FOR:

SCHREMS WEST MICHIGAN
Environmentally Involved
Since 1962
TROUT UNLIMITED

PREPARED BY:

streamside
ecological services

December, 2011

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INTRODUCTION

Many reaches of the Coldwater River contain high-quality aquatic habitat and healthy fish populations. Thirty-two species of fish, including three species of trout, are known to inhabit the river. Deep pools, clean riffles and large woody debris are prevalent. The stream is very productive and the macroinvertebrate community is characteristic of a high quality coldwater stream.

However, the reach of river adjacent the Dolan Property, which is owned by Schrems West Michigan Chapter of Trout Unlimited (Schrems), has been historically dredged and consists of a straight, incised, wide channel with uniformly shallow water and little to no woody debris or other cover for fish. Streambank erosion is present to varying degrees throughout the reach. Aquatic habitat is severely limited and the reach is barely meeting its coldwater designation. With exception of the lack of quality physical habitat, all other stream attributes including water temperature, dissolved oxygen levels and the macroinvertebrate community are conducive to supporting trout populations.

Along with its partner, the Coldwater River Watershed Council, Schrems identified the Dolan Property as a high priority for improvement and began seeking project funds in the fall of 2009. Successful in the effort, Schrems received a $20,000 grant from the United States Fish and Wildlife Service and $40,750 grant from the National Fish and Wildlife Foundation to supplement approximately $66,250 of local cash, materials and in-kind match to improve aquatic habitat on the Dolan Property. The project is located in Sections 34 and 35 of Bowne Township, in southeast Kent County, Michigan (Figure 1).

In September 2010, a total of 38 trees were harvested from the Dolan Property and used to build 35 structures at 31 distinct locations within the river (Figures 2-4). Approximately 90% of the trees were sycamore, with the remainder being dead ash, basswood and maple. No trees were cut within 25 feet of the ordinary high water mark of the Coldwater River. Construction of the log vanes included excavation of a trench in the river bottom, placement of a large log in the trench, and backfill with the originally excavated material. Excavation occured from within the river due to the high density of large trees on the streambank. Much of the riverbed consists of coarse material, ranging from sand to cobble; thus, downstream impacts from suspended load created from construction were temporary and minimal.

Figure 1. Location map and project area.

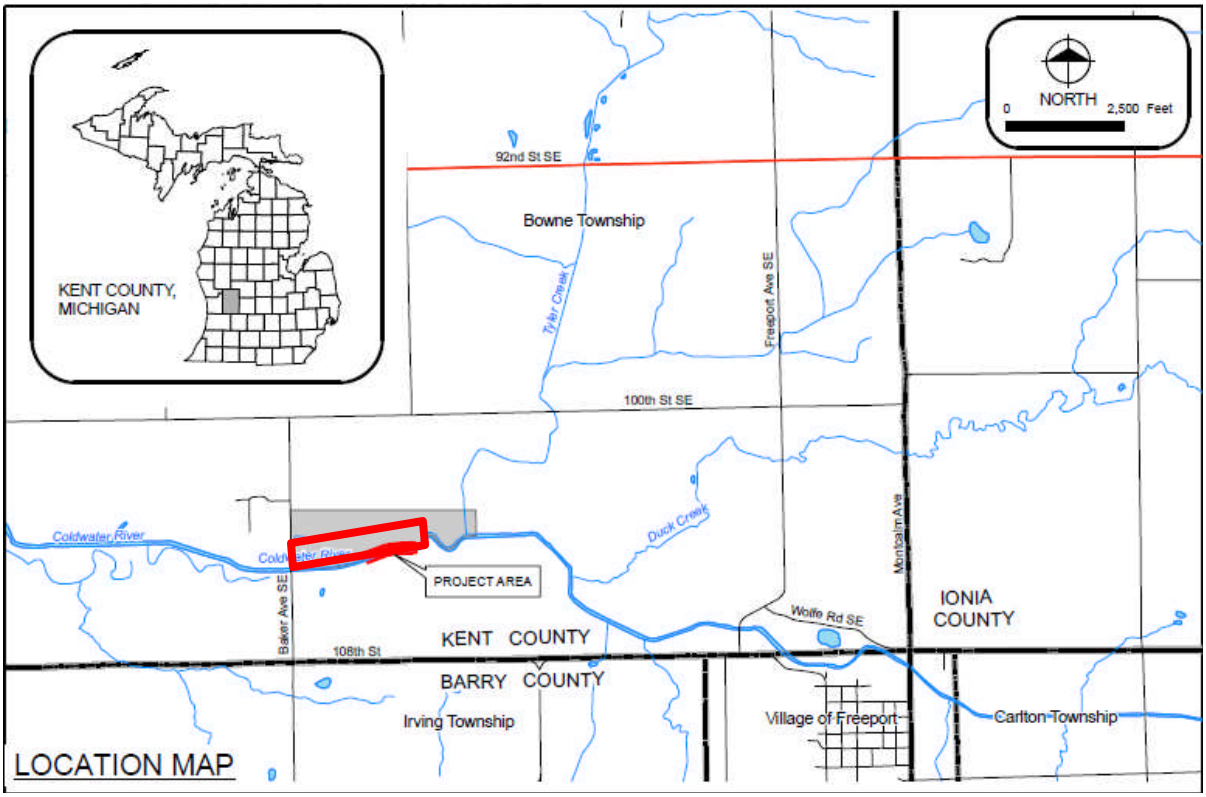
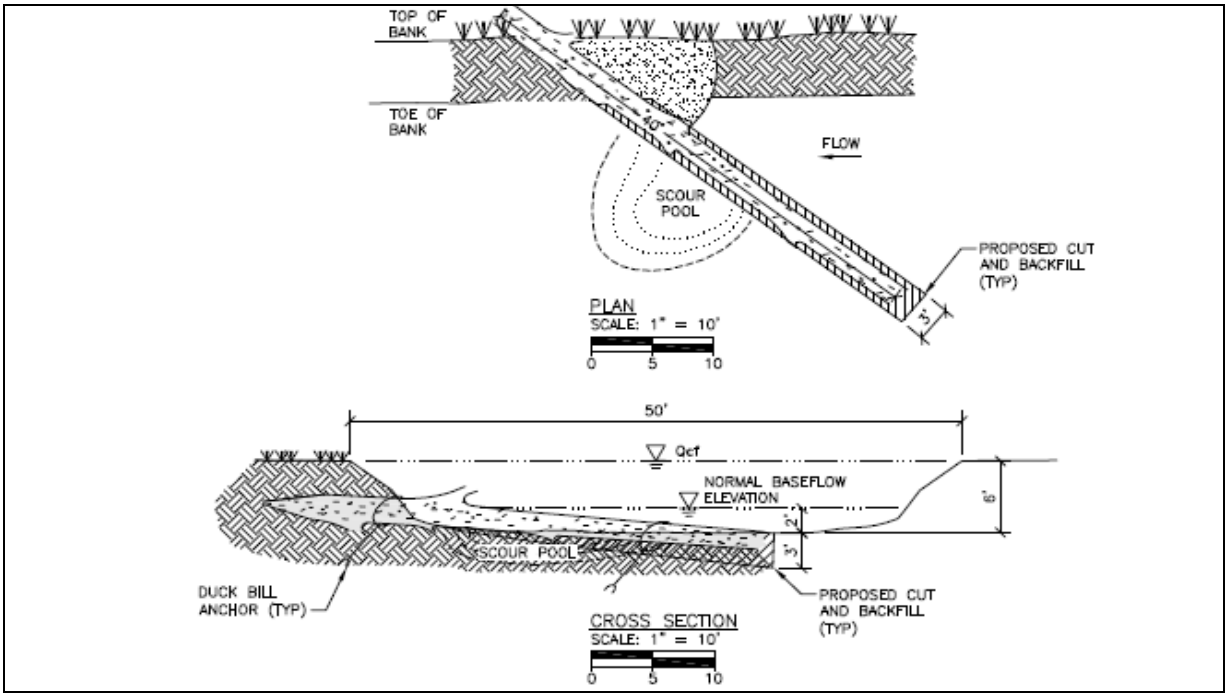


Figure 2. Typical log habitat structure



Figures 3. Location of monitoring cross sections, bank pins and scour chains. (West portion of project area).

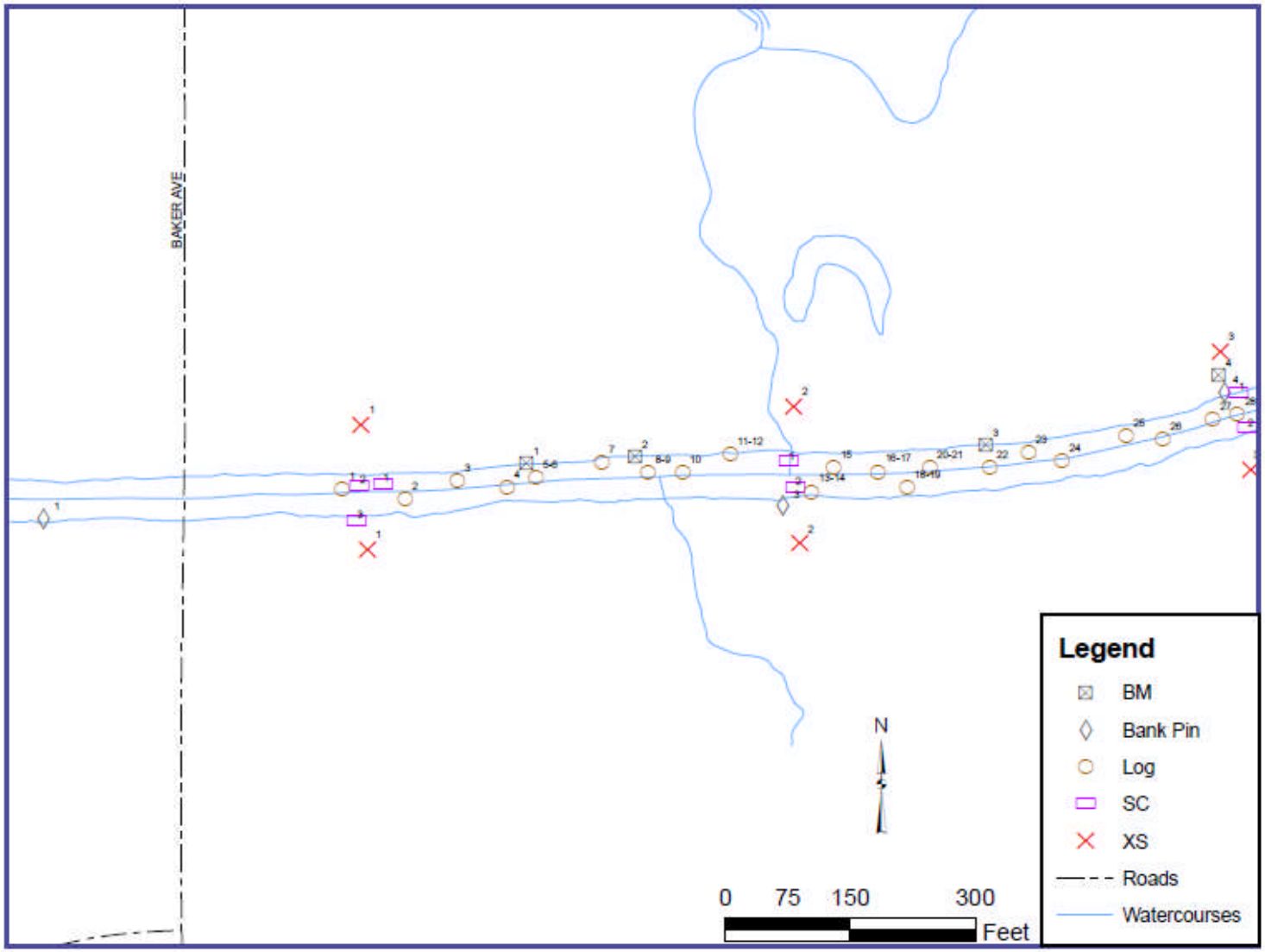
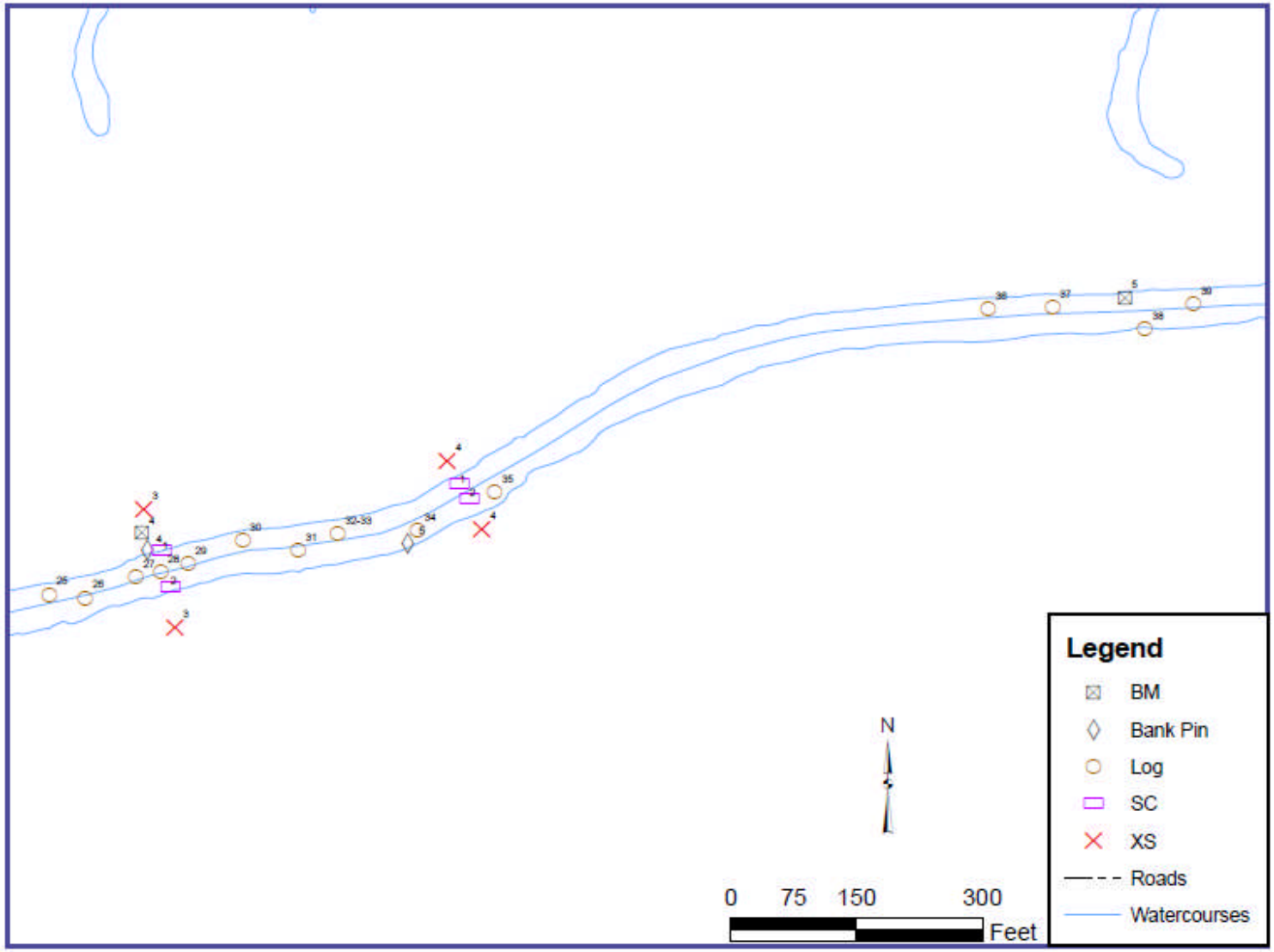


Figure 4. Location of monitoring cross sections, bank pins and scour chains. (East portion of project area).



As part of the permitting requirements for this improvement project, Schrems is required to monitor according to the following plan, which was approved by the Michigan Department of Environmental Quality (MDEQ) in 2010:

> *"To document physical effects of the project on streambank and streambed erosion, monitoring will focus on results of erosion pin and scour chain analyses. Sets of erosion pins will be installed at five locations within and adjacent to the project area. Each location will include three four-foot sections of rebar driven horizontally into the bank, in a three foot vertical profile. As the streambank erodes, the ends of the pins will be exposed, indicating the lateral recession during that monitoring period. Erosion at these pins will be measured annually for five years, and the pins will be reset as necessary.*
>
> *Scour chains will be installed in the streambed at three locations. These chains are used to determine the degree of aggradation or degradation in the monitored reach. Chains are driven vertically into the streambed; the amount of chain exposed or the depth of fill over the chain at the end of a monitoring period indicates the channel's tendency to aggrade or degrade. Each monitoring location will include three scour chains approximately evenly spaced across the channel cross section. The chains will be measured on an annual basis for five years.*
>
> *Erosion pins and scour chains will not only be installed within the project area, but also at a control site upstream of the project. This will allow for comparison of project monitoring results to what is "natural" within this stream reach.*
>
> *Each of the log structures that are installed in the stream will be "branded" with a unique identifier and their location surveyed with GPS. This branding, which is being requested by the County Drain Commissioner, will likely be done with a chainsaw on the end of each log. The purpose is to identify if any of the logs break loose from their position and result in erosion, debris jams, or other problems that are considered to be unacceptable to the drain board. Six of the structures will include set benchmarks to be surveyed annually to determine if they have moved vertically.*
>
> *Biological monitoring will focus on the results of fish, macroinvertebrate and physical habitat assessments. P51 macroinvertebrate assessment will take place prior to construction, and for five years following construction, to document changes to the macroinvertebrate community. Similarly, electrofishing studies will be used to document the effects of habitat improvement work on the fish community. These electrofishing studies will be coordinated with Michigan Department of Natural Resources, Fisheries Division. In addition, P51 metrics for physical habitat will be monitored to measure the success of habitat improvement work in stabilizing the streambanks and creating more diverse instream habitat."*

MONITORING

As a means of establishing baseline conditions and as of a condition of the MDEQ permit, a variety of data were collected from the Dolan Property. The following sections outline the surveys that were conducted, along with the methods and results.

Fish Survey

Estimates of the total number of fish in sections of streams can be made reliably and inexpensively by subsampling a portion of the population. A mark-recapture electrofishing survey was conducted within 1,000 feet of river, in accordance with methods set forth in Lockwood and Schneider 2000.

The general process for the mark-and-recapture method involves:

1. Collecting a sample of fish of the target species from a discrete section of stream during an initial "marking run";
2. Giving fish identifying marks, such as a tag or fin clip;
3. Tabulating data by species and size;
4. Releasing fish in good condition back into the same area;
5. Allowing adequate time for marked fish to recover and become mixed in the population;
6. Collecting fish during a subsequent "recapture run";
7. Recording the ratio of marked to unmarked fish;
8. Calculating an estimate of abundance.

2010

A total of 189 fish, representing seven species, were collected during the early morning marking run on July 13 (Table 1). All species of fish were collected, counted and released over the first 500 feet of the study area. Trout were collected, measured, clipped and released over the entire 1,000 feet. The clip consisted of a small, round hole in the caudal fin. A total of 28 trout were marked and released unharmed into the study reach.

Table 1. Results of July 13, 2010 Electrofishing Survey of the Coldwater River.

				SIZE (INCHES)											
RUN NO.	**EFFORT (SEC)**	**SPECIES**	**NO.**	**3**	**4**	**5**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**18**	**20**
1	3585	blackside darter	4												
		brown trout	28	1	1	2	3	4	5	4	4	1	1	1	1
		creek chub	11												
		green sunfish	4												
		johnny darter	9												
		mottled sculpin	110												
		white sucker	23												
2	1555	marked brown trout	4							3	1				
		unmarked brown trout	12		1	1		2		6	1		1		

The recapture run was conducted late in the afternoon of the same day. Only trout were collected during this survey run, and no new species were observed. A total of 16 trout were collected, only four of which had been marked earlier in the day.

Based upon survey results, the estimated population of brown trout was 98 (SE = +/-62 fish) per 1,000 feet of stream, or an equivalent of 190 to 845 trout per mile of stream (Chapman-Peterson estimate). Brown trout ranged from 3 to 20 inches in length, with 65% of the collected fish measuring between 8 to 12 inches in length. The capture of small trout is evidence that natural reproduction is occurring in or near this stream reach. Schrems members have documented spawning brown trout on the Dolan Property for the past several years.

2011

A total of 86 fish, representing ten species, were collected during the early morning marking run on July 19 (Table 2). Many additional sculpins were observed but not captured. All species of fish were collected, counted and released over the first 500 feet of the study area. Trout were collected, measured, clipped and released over the entire 1,000 feet. The clip consisted of a small, round hole in the caudal fin. A total of 47 trout were marked and released unharmed into the study reach.

The recapture run was conducted late in the afternoon of the same day. Only trout were collected during this survey run, and no new species were observed. A total of 40 trout were collected, only seven of which had been marked earlier in the day.

Table 2. Results of July 19, 2011 Electrofishing Survey of the Coldwater River.

				SIZE (INCHES)										
RUN NO.	**SPECIES**	**NUMBER**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1	blacknose dace	1												
	blackside darter	2												
	bluegill	2												
	brown trout	47	2	6	7	13	4	4	2	2	3	3		1
	creek chub	14												
	green sunfish	2												
	Native lamprey sp.	4												
	mottled sculpin	7												
	rainbow trout	2					1		1					
	white sucker	5												
2	marked brown trout	7			1	1	1		1	1		1		1
	unmarked brown trout	33	3	5	5	8	3	4	1	1	2	1		

Based upon survey results, the estimated population of brown trout was 246 (SE = +/-98 fish) per 1,000 feet of stream, or an equivalent of 781 to 1,816 trout per mile of stream (Chapman-Peterson estimate) (Table 3). Brown trout ranged from 2 to 13 inches in length, with 28% of the collected fish measuring between 8 to 12 inches in length. Many more small fish were observed in 2011 than in 2010.

Table 3. Annual Monitoring Results of Trout Populations at the Dolan Property [Population estimate (standard error)].

COMMUNITY	**2010**	**2011**
Trout	98 (+/-62)	246 (+/-98)

Macroinvertebrate Survey

The abundance and diversity of aquatic macroinvertebrates are commonly used as indicators of the overall quality of a stream. As such, assessment of the benthic community was completed to characterize the quality of the Coldwater River, and to provide baseline information necessary for comparison to future monitoring results. Great Lakes and Environmental Assessment Section (GLEAS) Procedure #51, *Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers (1997),* with 2008 revisions (Procedure 51) was used to collect organisms and analyze the macroinvertebrate community. Procedure 51 is accepted by both federal and state agencies as an accurate, consistent and repeatable sampling and analytical protocol for Michigan streams.

2010

The July 2010 survey resulted in collection of 292 organisms representing 19 taxa, and the site scored +5, for a Procedure 51 rating of Excellent (Table 4). The community contains a diversity of mayflies, stoneflies and caddisflies and is representative of a stream with high water quality.

2011

The July 2011 survey resulted in collection of 304 organisms representing 26 taxa, and the site scored +8, for a Procedure 51 rating of Excellent. The number of taxa found and the overall score improved fairly substantially over the course of a year.

Table 4. Annual Results of Macroinvertebrate Sampling on the Dolan Property

TAXA	**2010**	**2011**
Annelida (segmented worms)		
Hirudinea (leeches)		1
Crustacea		
Amphipoda (scuds)	20	32
Decapoda (crayfish)	8	17
Insecta		
Ephemeroptera (mayflies)		
Baetiscidae	2	7
Baetidae	20	18
Heptageniidae	8	11
Isonychiidae		1
Odonata		
Anisoptera (dragonflies)		
Aeshnidae		2
Zygoptera (damselflies)		
Calopterygidae		3
Plecoptera (stoneflies)		
Perlidae	14	8
Pteronarcyidae		3
Taeniopterygidae	2	2
Hemiptera (true bugs)		
Gerridae		4
Notonectidae		1
Megaloptera		
Corydalidae (dobson flies)	4	3
Trichoptera (caddisflies)		
Brachycentridae	24	19

Table 4. (Continued)

TAXA	**2010**	**2011**
Hydropsychidae	38	42
Limnephilidae	12	14
Rhyacophilidae	8	7
Uenoidae	78	53
Coleoptera (beetles)		
Dytiscidae (total)	4	9
Gyrinidae (adults)	2	3
Elmidae	18	13
Diptera (flies)		
Chironomidae	8	11
MOLLUSCA		
Gastropoda (snails)		
Physidae	2	5
Pelecypoda (bivalves)		
Sphaeriidae (clams)	20	15
TOTAL INDIVIDUALS	292	304
METRIC	Value	Value
TOTAL NUMBER OF TAXA	19	26
NUMBER OF MAYFLY TAXA	3	4
NUMBER OF CADDISFLY TAXA	5	5
NUMBER OF STONEFLY TAXA	2	3
PERCENT MAYFLY COMP.	10.27	12.17
PERCENT CADDISFLY COMP.	54.79	44.41
PERCENT DOMINANT TAXON	26.71	17.43
PERCENT ISOPOD, SNAIL, LEECH	0.68	1.97
PERCENT SURF. AIR BREATHERS	2.05	5.59
TOTAL SCORE	5	8
MACROINV. COMMUNITY RATING	EXCELLENT	EXCELLENT

Physical Habitat Survey

A total of 11 metrics were scored at one representative site based on Procedure 51 rating tables for riffle/run streams. Scoring for each metric was based on visual observation and best professional judgment.

2010

Physical habitat scored a total of 123 points, for an overall score of good (Table 5). Metrics with obvious impairments include: epifaunal substrate/available cover, due to lack of woody debris, larger boulders or undercut banks; velocity/depth regime due to the uniform depth throughout the reach; flashiness; channel alteration; frequency of riffles/bends and; vegetative protection.

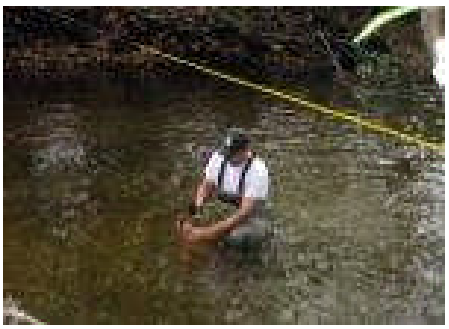
Table 5. Physical Habitat Scores (P51) for the Dolan Property.

HABITAT METRIC	**2010**	**2011**
Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover	11	15
Embeddedness*	16	16
Velocity/Depth Regime*	9	13
Channel Morphology		
Sediment Deposition	18	18
Flow Status - Maint. Flow Volume	7	7
Flow Status - Flashiness	4	4
Channel Alteration	11	11
Frequency of Riffles/Bends*	7	7
Riparian and Bank Structure		
Bank Stability (L)	7	8
Bank Stability (R)	7	7
Vegetative Protection (L)	4	4
Vegetative Protection (R)	4	4
Riparian Veg. Zone Width (L)	8	8
Riparian Veg. Zone Width (R)	10	10
TOTAL SCORE (200):	123	132
HABITAT RATING:	GOOD	GOOD
	(SLIGHTLY IMPAIRED)	(SLIGHTLY IMPAIRED)

2011

Physical habitat scored a total of 132 points, for an overall score of good. Metrics that improved from pre to post-construction included the availability of Epifaunal Substrate and Cover, Velocity/Depth Regime and Bank Stability. Improvements in habitat score were directly related to the placement of log structures.

Geomorphic Survey



To document physical effects of the project on streambank and streambed erosion, monitoring is focused on results of cross sectional surveys and erosion pin and scour chain analyses.

Four permanent cross sections were established within the project area (Figures 3 and 4). Little change was found in the cross sections during the period immediately following construction until one-year post construction (Figures 5-8).

Figure 5. Annual Survey of Cross Section 1 on the Dolan Property.

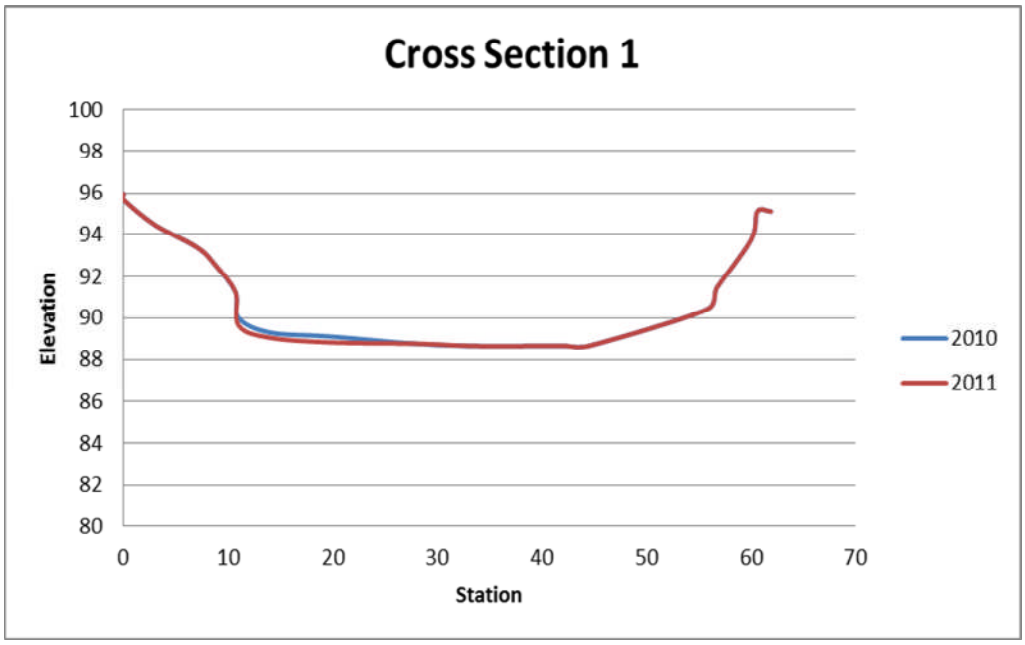


Figure 6. Annual Survey of Cross Section 2 on the Dolan Property.

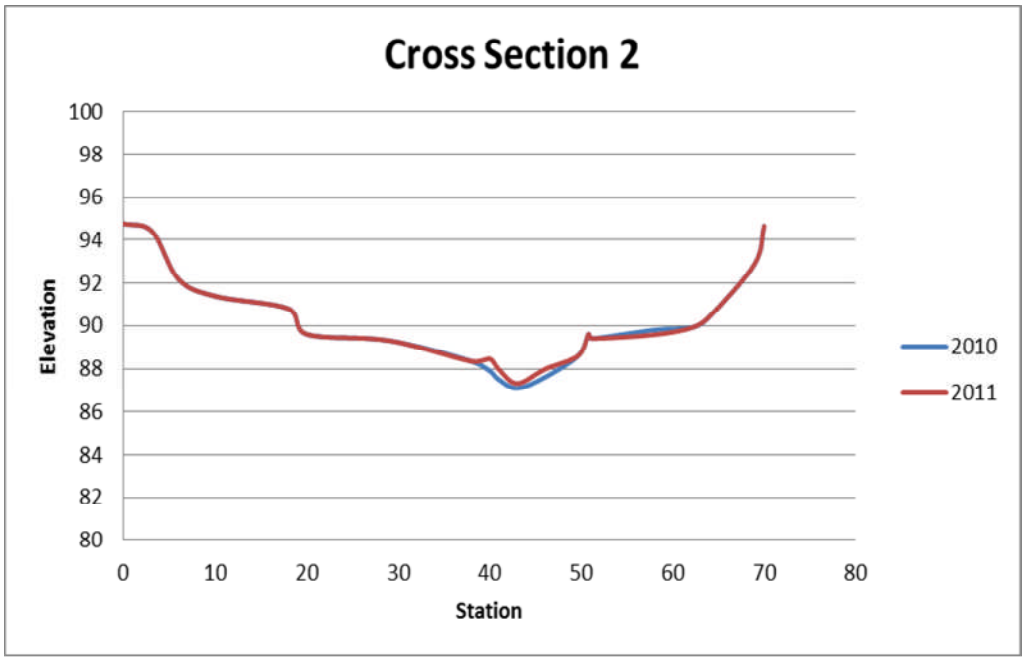


Figure 7. Annual Survey of Cross Section 3 on the Dolan Property.

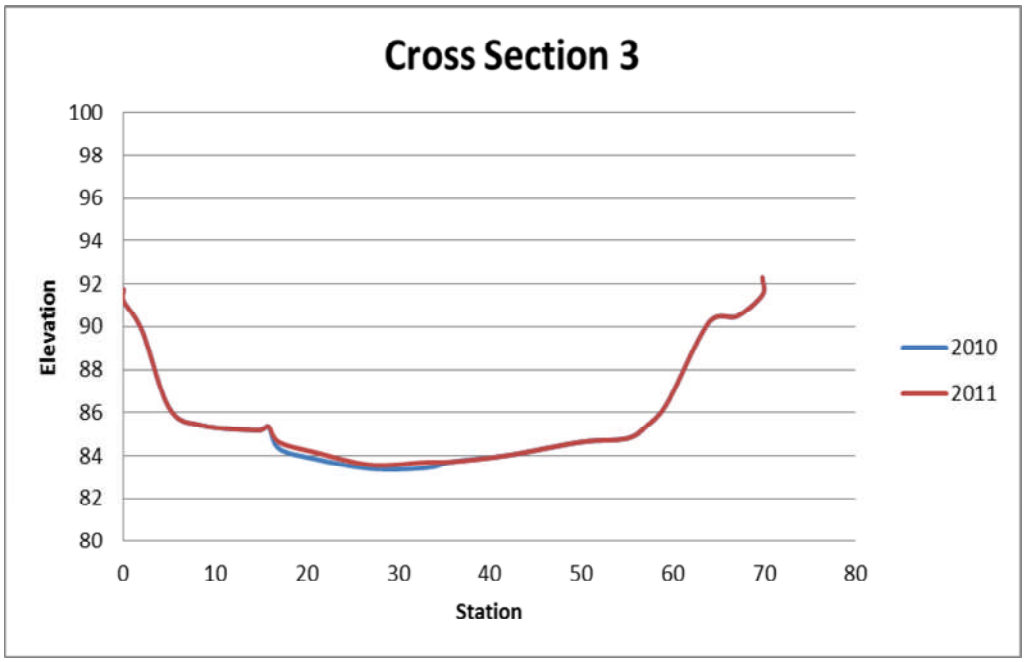
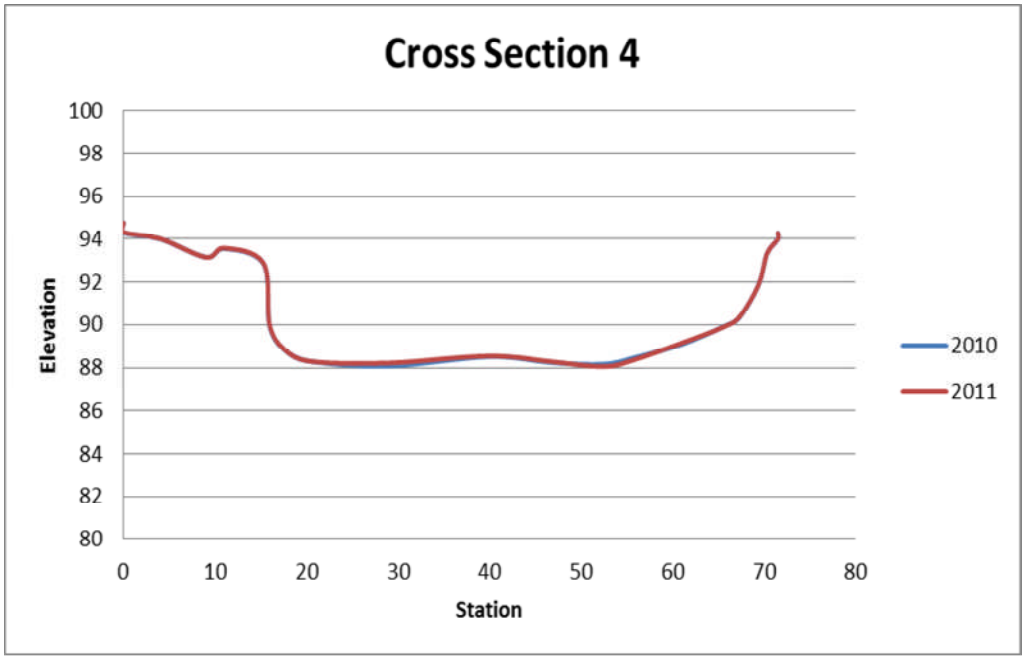
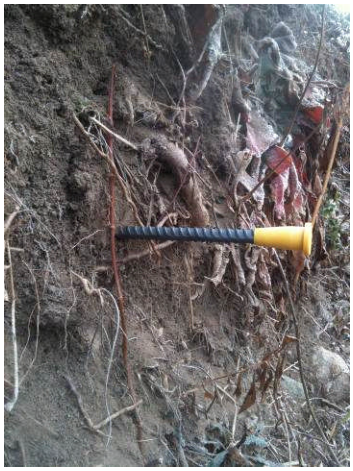


Figure 8. Annual Survey of Cross Section 4 on the Dolan Property.





Bank pins were installed at five locations within and adjacent the project area to monitor bank erosion. Each location includes three four-foot sections of rebar driven horizontally into the bank, in a three foot vertical profile. As the streambank erodes, the ends of the pins will be exposed, indicating the lateral recession during that monitoring period (Wolman 1959, Lawler 1993).

2011

Four of five bank pin sites did not change in the first year; one of these sites gained streambank from significant deposition of sediment (Table 6). One site, Site 4 at Cross Section 3, experienced significant, localized erosion of about 0.6 feet of streambank.

Table 6. Bank Pin Survey at the Dolan Property.

STATION	PIN	2011 (recession in ft)
1	Top	0
	Middle	0
	Bottom	0
2 (XS 1)	Top	0
	Middle	0
	Bottom	0
STATION	**PIN**	**2011 (recession in ft)**
3 (XS 2)	Top	sediment deposition
	Middle	sediment deposition
	Bottom	sediment deposition
4 (XS 3)	Top	0
	Middle	1
	Bottom	0.8
5 (XS 4)	Top	0
	Middle	0
	Bottom	0

A total of nine scour chains were installed in the streambed at four locations to determine the degree of aggradation or degradation in the monitored reach. Chains are located within permanent cross sections and were driven vertically into the streambed; the amount of chain exposed or the depth of fill over the chain at the end of a monitoring period indicates the channel's tendency to aggrade or degrade. Each of the four monitoring locations includes two or three scour chains across the channel cross section.

2011

Overall, little change was observed at scour chain sites (Table 7). Cross Sections 1, 2 and 4 experienced small changes in streambed elevations, with nearly four inches of scour occurring near the south bank at Cross Section 2. It should be noted, however, that many stations measuring zero did experience transport of sediment. Several scour chains were found with two links lying horizontally, but covered back up with about three inches of sediment. This scenario indicates that the top three inches of stream bottom are being transported downstream during high-flow events, but the scour chain site is re-covered with the same amount of substrate as the water recedes; long-term degradation or aggradation is not occurring at this time.

Table 7. Scour Chain Survey at the Dolan Property.

STATION	PIN LOCATION	Streambed change (inches)
		2011
1 (XS 1)	19	-3
	32	0
	40	0
2 (XS 2)	30	0
	55.5	-3.75
3 (XS 3)	13	0
	44	0
4 (XS 4)	29	1.5
	50.3	-1.5

SUMMARY

The Dolan Habitat Improvement Project is a unique and innovative effort to restore coldwater habitat to a designated county drain. The project was designed to improve aquatic habitat, while having minimal impact on stream flow and drainage-related function. Thirty five log structures were constructed for this project.

Initial results are encouraging. The logs appear as though they are naturally occurring and have been in place for a long period of time. Water is free flowing through the project reach and, based on Year 1 monitoring results, there are no significant concerns for bank erosion or physical instability of the structures.

Trout populations were found to have increased by about 2.5 times in the first year of monitoring, with an increase in the amount of naturally reproduced fish. Several trout, many of them very large, were observed spawning within the project area during the first week of November, 2010. Macroinvertebrate scores increase by three points, and remain Excellent. A slight increase in physical habitat score is directly related to addition of log structures. Long-term results will dictate the overall success of the project on improving aquatic populations.

Continued project monitoring will be extremely useful for determining wise use of future funds. If the project is determined to be a success, several opportunities for similar projects exist in the area, and throughout the state. It is anticipated that the project will serve as an example of successful coldwater restoration in a designated county drain – two uses of a resource that have traditionally been conflicting.

LITERATURE CITED

GLEAS. 2008. Great Lakes and Environmental Assessment Section (GLEAS) Procedure #51, *Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers (1997)*, with 2008 revisions

Lawler, D.M., 1993. The measurement of river bank erosion and lateral channel change: A review. Earth Surface Processes and Landforms, (18) pp. 777-821.

Lockwood R.N. and J.C. Schneider. 2000. Manual of Fisheries Survey Methods II. Michigan Department of Natural Resources. Lansing, MI.

Rosgen, D.L. (2001). A stream channel stability methodology. *Proc., Seventh Federal Interagency Sedimentation Conference*, Reno, NV. p. II-18 to II-26, on CD.

Wolman MG. 1959. Factors influencing erosion of a cohesive river bank. American Journal of Science. 257:204–16.