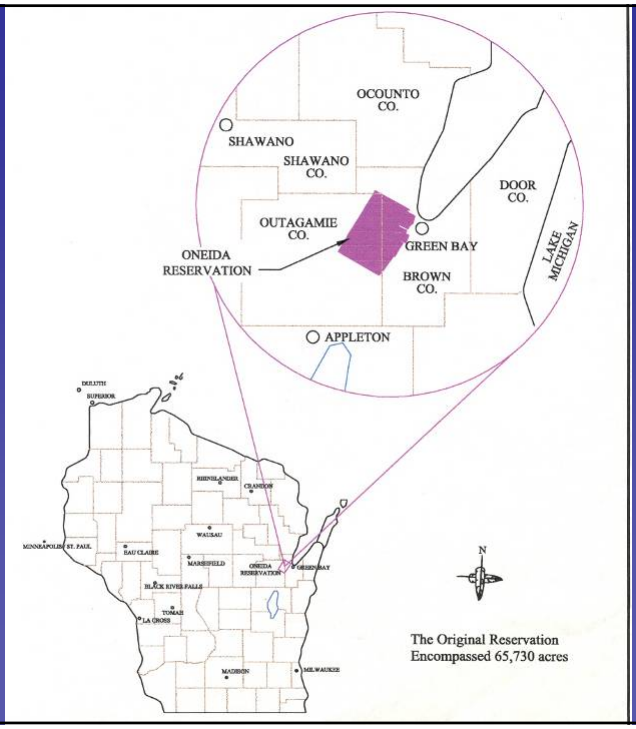
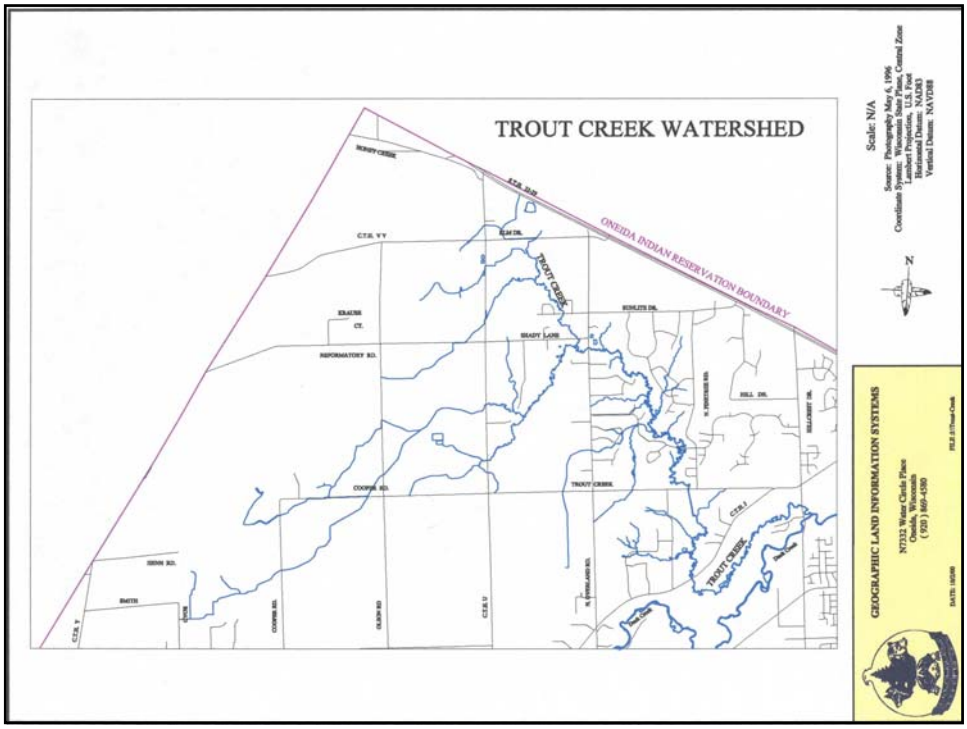
From Headwaters to Mouth: Tribal Stream and Wetland Restoration as a Top-Down Model for Successful Watershed Restoration

J.L. Snitgen and M.J Melchior

inter-fluve, inc.



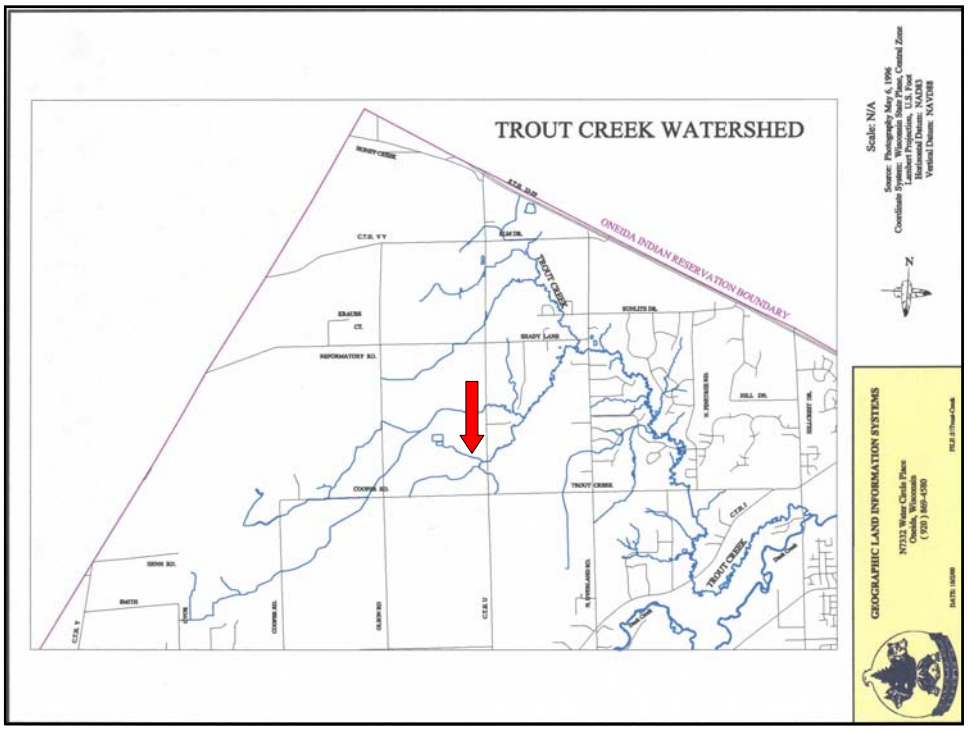


Methods

- Addressed largest impact to stream first
- Formed partnerships
- Conducted Fluvial Geomorphic survey of entire system to identify hierarchy of stressors to be addressed
- Began implementing BMPs in headwaters
- Conducted water quality and biological monitoring to gauge efficacy of BMPs (performance indicators)
- Working our way downstream implementing BMPs, gaining constituency along the way

First project:

Installation of a manure containment system at State Farm



Largest stressor to Trout Creek was manure runoff

Prior to manure containment system being built….

A chance to monitor benthos community downstream of manure pit (before and after installation)

Methods

- Qualitative sampling of substrate types representative of 25m sampling reach. Same substrates sampled during both sampling events.
- Macroinvertebrates were identified to lowest practical taxonomic level
- Macroinvertebrate metrics calculated included Hilsenhoff Biotic Index (HBI), Taxa Richness and Ephemeroptera , Plecoptera, Trichoptera (EPT) Index.

Methods (continued)

- Ambient WQ parameters were collected using the Hydrolab Datasonde 4a.
- Nutrient grab samples were taken during runoff event (1999), pre-restoration (2002), and post-restoration (2004).
- Nutrient grab samples were collected by Oneida staff and analyzed by contracted laboratory.

Explanation of Metrics

The Hilsenhoff Biotic Index (HBI) was developed to determine organic loading in streams, but is also useful to illustrate the relative tolerance of the insects, isopods and amphipods in benthos samples. Only distinct taxa are included in the index, which is calculated by summing the number of organisms in each distinct taxa multiplied by their tolerance value, then dividing by the total number of organisms in those taxa. The number of organisms in each taxa is limited to ten to eliminate the effects of seasonality.

Taxa Richness illustrates the biological integrity of the stream as an indication of diversity. It is simply the number of distinct taxa within the sample. It will decrease as a result of organic, toxic, or thermal pollution, as well as flow disruption. It may be affected by sedimentation as well.

The Ephemeroptera, Plecoptera, Trichoptera (EPT) Index illustrates the biological integrity of the stream by summing the distinct taxa in each of those orders. These three orders generally represent the least tolerant organisms found in stream benthos samples. This index will decrease as a result of organic, toxic, or thermal pollution, as well as flow disruption. It may be affected by sedimentation as well.

Response in Benthic Macroinvertebrate Community

- HBI scores improved from 6.79 “fairly poor” to 5.28 “good”.
- Taxa Richness increased 9%.
- EPT score improved from 0 to 4 (400% increase). No organisms in these orders in “before” sample, 132 individuals in these orders in “after” sample.

HBI Values in 2002 and 2004

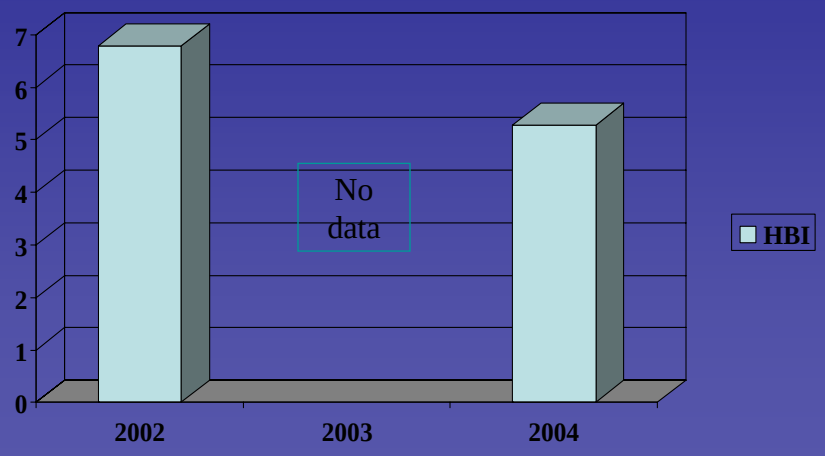
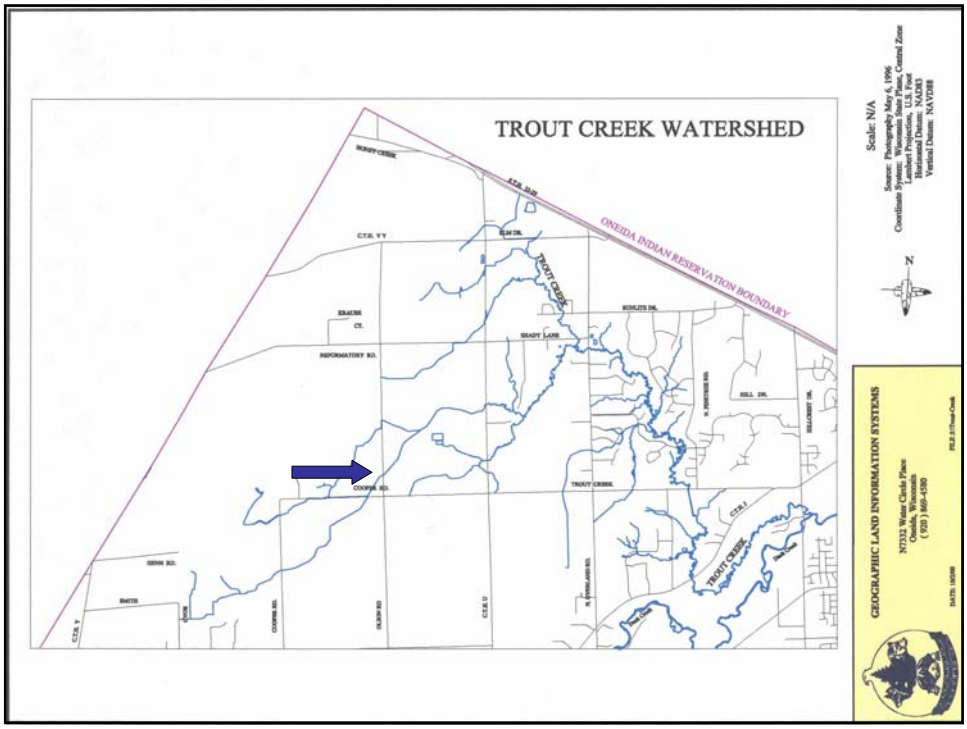


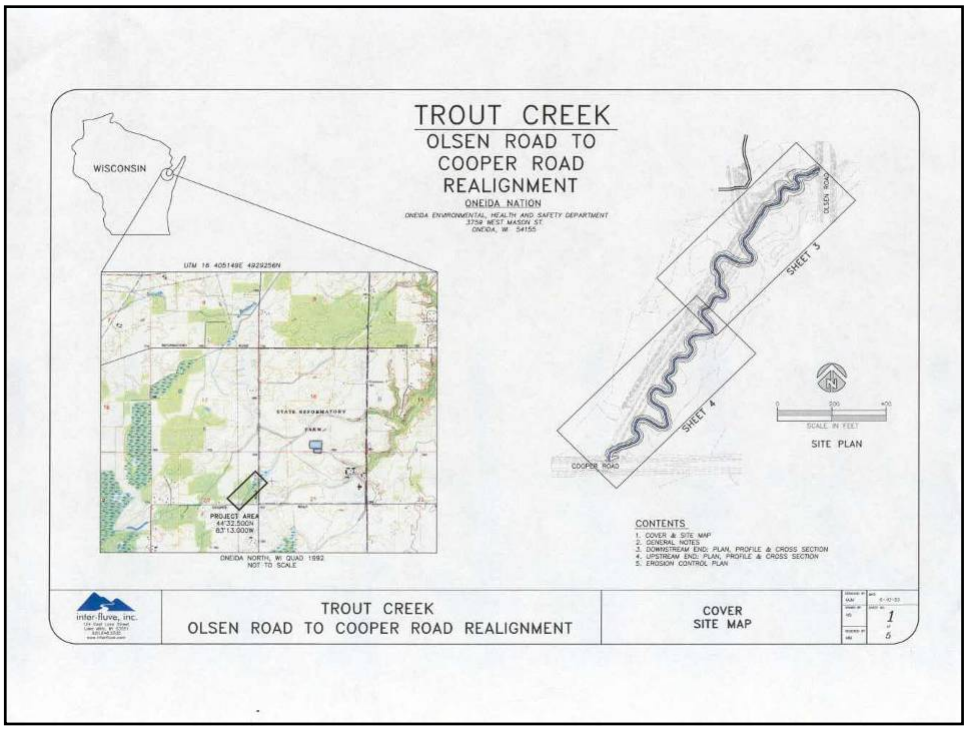
Table 1. Water quality ratings for HBI values (from Hilsenhoff 1987)

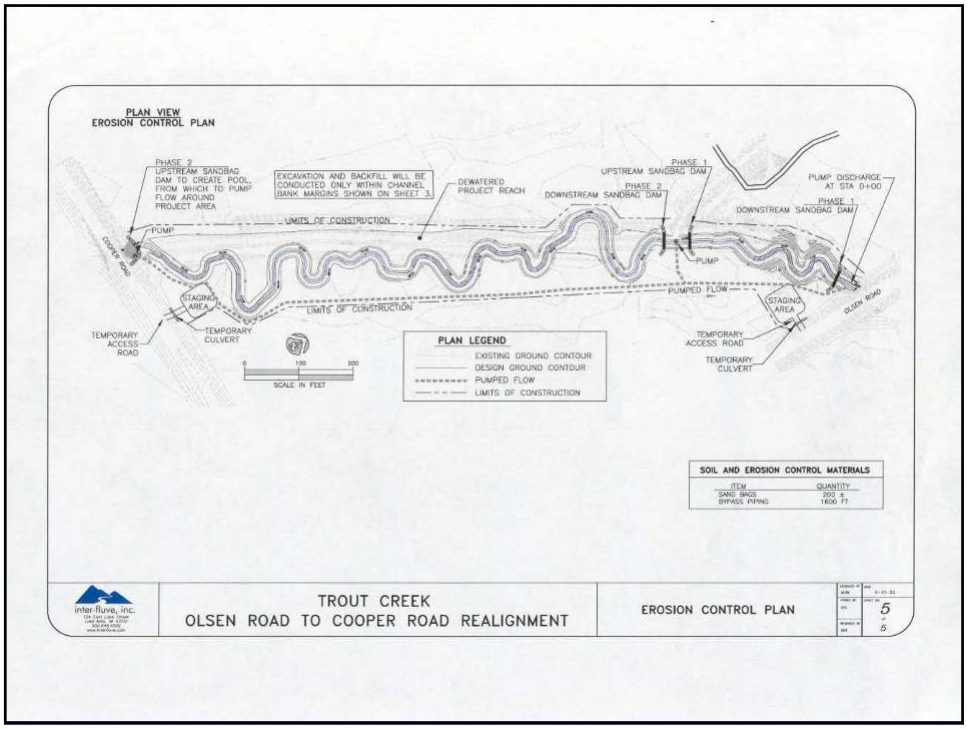
HBI Value	Water Quality Rating	Degree of Organic Pollution
≤ 3.50	Excellent	None Apparent
3.51-4.50	Very Good	Possible Slight
4.51-5.50	Good	Some
5.51-6.50	Fair	Fairly Significant
6.51-7.50	Fairly Poor	Significant
7.51-8.50	Poor	Very Significant
8.51-10.00	Very Poor	Severe

Second Project:

Enhance headwater tributary habitat by constructing meanders and installing large woody habitat


TROUT CREEK WATERSHED
ONEIDA INDIAN RESERVATION BOUNDARY
TROUT CREEK
COOPER RD.
REFORMATORY RD.
GEOGRAPHIC LAND INFORMATION SYSTEMS
Scale: N/A


TROUT CREEK
OLSEN ROAD TO
COOPER ROAD
REALIGNMENT
ONEIDA NATION
WISCONSIN
SHEET 3
SHEET 4
SITE PLAN
CONTENTS
TROUT CREEK
OLSEN ROAD TO COOPER ROAD REALIGNMENT
COVER
SITE MAP


PLAN VIEW
EROSION CONTROL PLAN
PHASE 2
UPSTREAM SANDBAG
DAM TO CREATE POOL
FROM WHICH TO PUMP
FLOW AROUND
PROJECT AREA
EXCAVATION AND BACKFILL WILL BE
CONDUCTED ONLY WITHIN CHANNEL
BANK MARGINS SHOWN ON SHEET 3
DEWATERED
PROJECT REACH
PHASE 1
UPSTREAM SANDBAG DAM
PHASE 2
DOWNSTREAM SANDBAG DAM
PUMP DISCHARGE
AT STA 0+00
PHASE 1
DOWNSTREAM SANDBAG DAM
LIMITS OF CONSTRUCTION
PUMP
COOPER ROAD
STAGING
AREA
TEMPORARY
ACCESS
ROAD
TEMPORARY
CULVERT
LIMITS OF CONSTRUCTION
PUMP
PUMPED FLOW
STAGING
AREA
OLSEN ROAD
TEMPORARY
ACCESS ROAD
TEMPORARY
CULVERT
0
100
200
SCALE IN FEET
PLAN LEGEND
EXISTING GROUND CONTOUR
DESIGN GROUND CONTOUR
PUMPED FLOW
LIMITS OF CONSTRUCTION
SOIL AND EROSION CONTROL MATERIALS
ITEM
QUANTITY
SAND BAGS
200 ±
BYPASS PIPING
1600 FT
inter-fluve, inc.
TROUT CREEK
OLSEN ROAD TO COOPER ROAD REALIGNMENT
EROSION CONTROL PLAN
5
5

Methods

- Reach sampled 2nd week of July both years
- Multi-habitat, composite samples of 25m reach
- D-frame dip net (traveling kicks, sweeps) and hand washing of substrates (working from downstream to upstream)
- Samples picked to 300 organisms
- Identified to genus or species if possible

Pre-construction

Diptera - Chironomidae	Diptera - Other	Gastropoda
Ablebesmyia mallochi	Ephydridae	Gyraulus sp.
Ablebesmyia monilis	**Trichoptera**	Physa sp.
Chironomus sp.	(none)	**Oligochaeta**
Cryptochironomus sp.	**Coleoptera**	Aulodrilus limnobius
Endochironomus sp.	Agabus sp.	Enchytraeidae
Micropsectra sp.	Berosus sp.	Limnodrilus hoffmeisteri
Microtendipes pedellus group	**Odonata**	Lumbriculus variegatus
Parametriocnemus sp.	(none)	Naididae
Paratanytarsus sp.	**Isopoda**	Nais communis
Paratendipes sp.	Caecidotea sp.	Nais variabilis
Procladius sp.	**Pelecypoda**	Slavinia appendiculata
Tanypodinae	Pisidium sp.	**Others**
Tanytarsus sp.	Sphaerium sp.	Helobdella stagnalis
	Sphaeriidae	Orconectes sp.

Post construction (1 year)

Diptera - Chironomidae	Diptera - Other	Gastropoda
Chironomini	Simulium sp.	Gyraulus sp.
Chironomus sp.	**Trichoptera**	Lymnaeidae
Conchapelopia sp.	Cheumatopsyche sp.	Physa sp.
Corynoneura sp.	Hydroptila sp.	Stagnicola sp.
Cricotopus bicinctus	Oecetis sp.	**Oligochaeta**
Cryptochironomus sp.	**Coleoptera**	Aulodrilus limnobius
Dicrotendipes neomodestus	Agabus subfuscatus	Enchytraeidae
Micropsectra sp.	Haliplus immaculicollis	**Others**
Microtendipes pedellus group	Heterosternuta sp.	Abliglossiphonia heterocilta
Nanocladius sp.	**Odonata**	Helobdella stagnalis
Paratanytarsus sp.	Aeshna constricta	Orconectes sp.
Phaenopsectra sp.	**Isopoda**	
Procladius sp.	Caecidotea sp.	
Stictochironomus sp.	**Pelecypoda**	
Tanytarsus sp.	Sphaeriidae	
Thienemanniella xena		

Metrics Examined

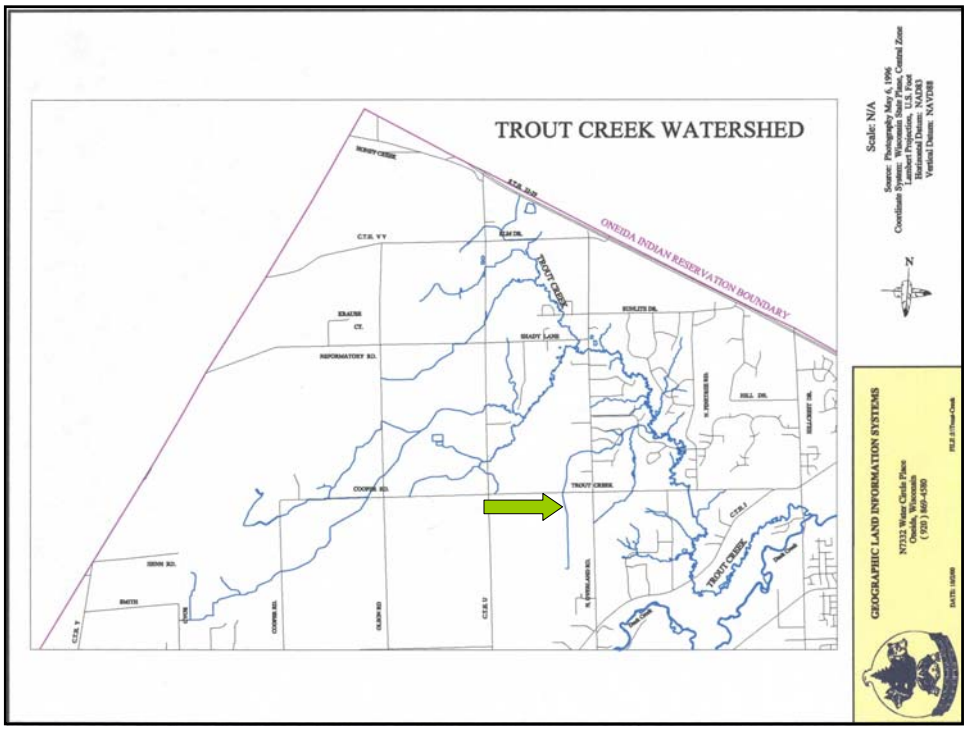
- Hilsenhoff Biotic Index (HBI)
- Taxa Richness
- The Ephemeroptera, Plecoptera, Trichoptera (EPT) Index
- % Predators
- Lentic to lotic taxa shift

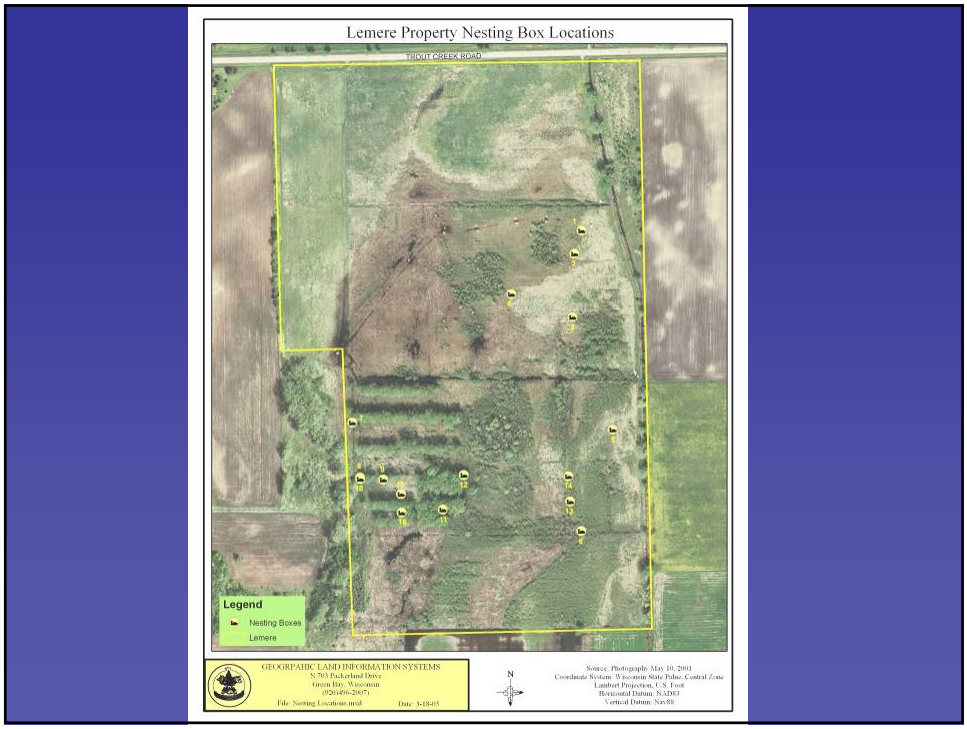
Results

Metric	Pre-construction	Post-construction
HBI	7.18	6.66
Taxa richness	29	34
EPT	0	3
% Predators	7.8	17.5
% Simulium sp.	0	18

Third project:

Enhancement of previously farmed, headwater wetland




Lemere Property Nesting Box Locations
TROUT CREEK ROAD
Legend
Nesting Boxes
Lemere
GEOGRPAHIC LAND INFORMATION SYSTEMS
N 703 Packerland Drive
Green Bay, Wisconsin
(920)496-2007)
File: Nesting Locations.mxd
Date: 3-18-05
N
Source: Photography May 10, 2001
Coordinate System: Wisconsin State Palne, Central Zone
Lambert Projection, U.S. Foot
Horizontal Datum: NAD83
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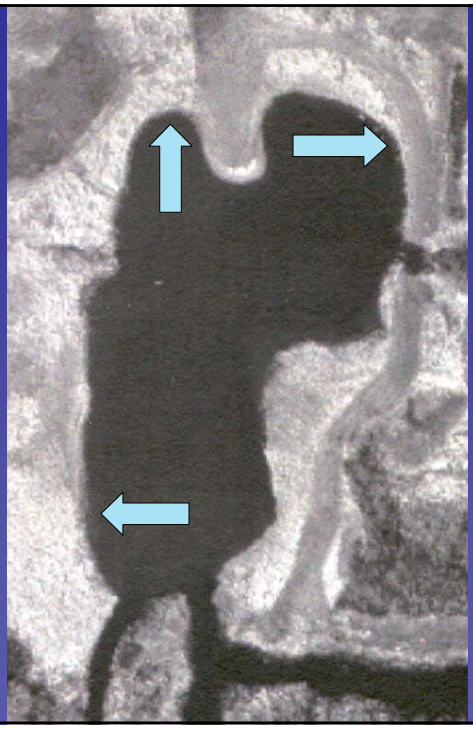
Locations of dip net sweeps one year and two years post construction



Methods

- Multi-habitat, qualitative composite sample
- 500 micron mesh D-Frame dip net
- Sweeps of sediments, submergent and emergent vegetation at set locations
- Samples picked to 300 organisms

One year post-construction

Diptera - Chironomidae	Pseudochironomus sp.	**Pelecypoda**
Chironomus sp.	Tanytarsus sp.	(none)
Chironominae	**Diptera - Other**	**Gastropoda**
Cladopelma sp.	Bezzia/Palpomyia	Gyraulus sp.
Cladotanytarsus sp.	**Trichoptera**	Physa sp.
Corynoneura sp.	**(none)**	
Cricotopus ornatus	**Ephemeroptera**	
Cryptochironomus sp.	Caenis latipennis	**Oligochaeta**
Dicrotendipes modestus	Callibaetis sp.	Nais variabilis
Dicrotendipes sp.	**Coleoptera**	
Endochironomus sp.	Berosus sp.	
Glyptotendipes species group A	Haliplus sp.	
Labrundina neopilosella	Tropisternus sp.	**Others**
Larsia sp.	**Odonata**	(none)
Parachironomus arcuatus group	(none)	
Parachironomus sp.	**Hemiptera**	
Paratanytarusus sp.	Palmacorixa buenoi	
Polypedilum sp.	**Amphipoda**	
Procladius sp.	(none)	

Two years post construction

Diptera - Chironomidae	**Diptera - Other**	**Pelecypoda**
Ablebesmyia sp.	Bezzia/Palpomyia	Sphaerium sp.
Acricotopus sp.	Hedriodiscus/Odontomyia	**Gastropoda**
Chironominae	**Trichoptera**	Gyraulus sp.
Chironomus sp.	Agraylea sp.	Helisoma sp.
Corynoneura sp.	**Ephemeroptera**	Physella sp.
Cricotopus tricinctus	Baetis sp.	Stagnicola sp.
Demeijerea sp.	Caenis latipennis	**Oligochaeta**
Dicrotendipes modestus sp.	Callibaetis sp.	Chaetogaster diaphanus
Dicrotendipes sp.	**Coleoptera**	Imm. Tubificidae w/o hair chaetae
Endochironomus sp.	Enochrus sp.	Limnodrilus claparedeinanus
Larsia sp.	Peltodytes sp.	Limnodrilus hoffmeisteri
Orthocladiinae	Tropisternus sp.	**Others**
Parachironomus sp.	**Odonata**	Collembola
Paratanytarsus sp.	Aeshnidae	Hydra sp.
Polypedilum sp.	Enallagma sp.	
Procladius sp.	Leucorrhinia proxima	
Pseudochironomus sp.	**Amphipoda**	
Tanytarsus sp.	Hyalella azteca	

Metrics Examined

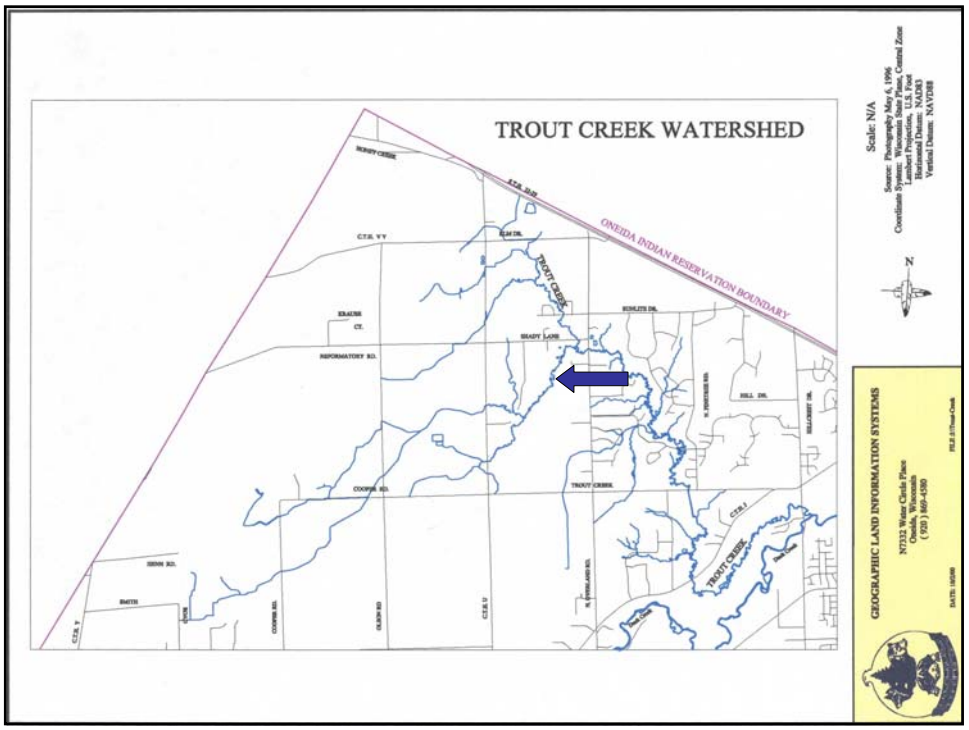
- **Taxa Richness**
- **EPT Index**
- **% Predators**

Results

Metric	1st year post-construction	2nd year post-construction
Taxa richness	28	39
EPT	2	4
% Predators	8.6	32.5

Fourth project:

Habitat enhancement using engineered log jams

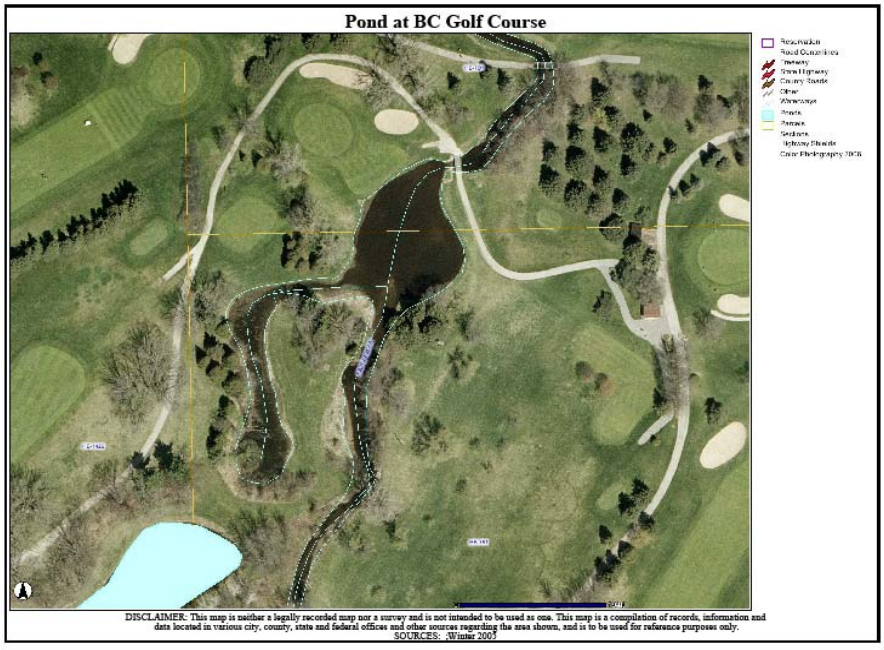


Summary

- Two more projects have also been completed, at least one more planned
- Using fish community response as performance indicator for two most recent projects
- Last project planned is is the routing of the stream around a barrier to fish passage (pond with impoundment)
- Reintroduction of brook trout will be next step
- Performing projects and educating community has led to a broad constituency where previously there was distrust and unwillingness to participate

Summary (continued)

- Initiating watershed restoration in the headwaters makes ecological sense, builds momentum and gains community constituency as you move downstream. Larger, main channel projects are thus easier to “sell” as a result.



Partners in Trout Creek watershed restoration:

- Brown County
- Outagamie County
- Wisconsin Department of Natural Resources
- Wisconsin Department of Corrections
- U.S. Fish and Wildlife Service
- Glacierland R, C and D
- NRCS