MUNISING BAY WATERSHED RESTORATION PROJECT AND WATER QUALITY MANAGEMENT PLAN

A PROJECT OF THE MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY, SECTION 319, NONPOINT SOURCE PROGRAM
AND
THE ALGER CONSERVATION DISTRICT
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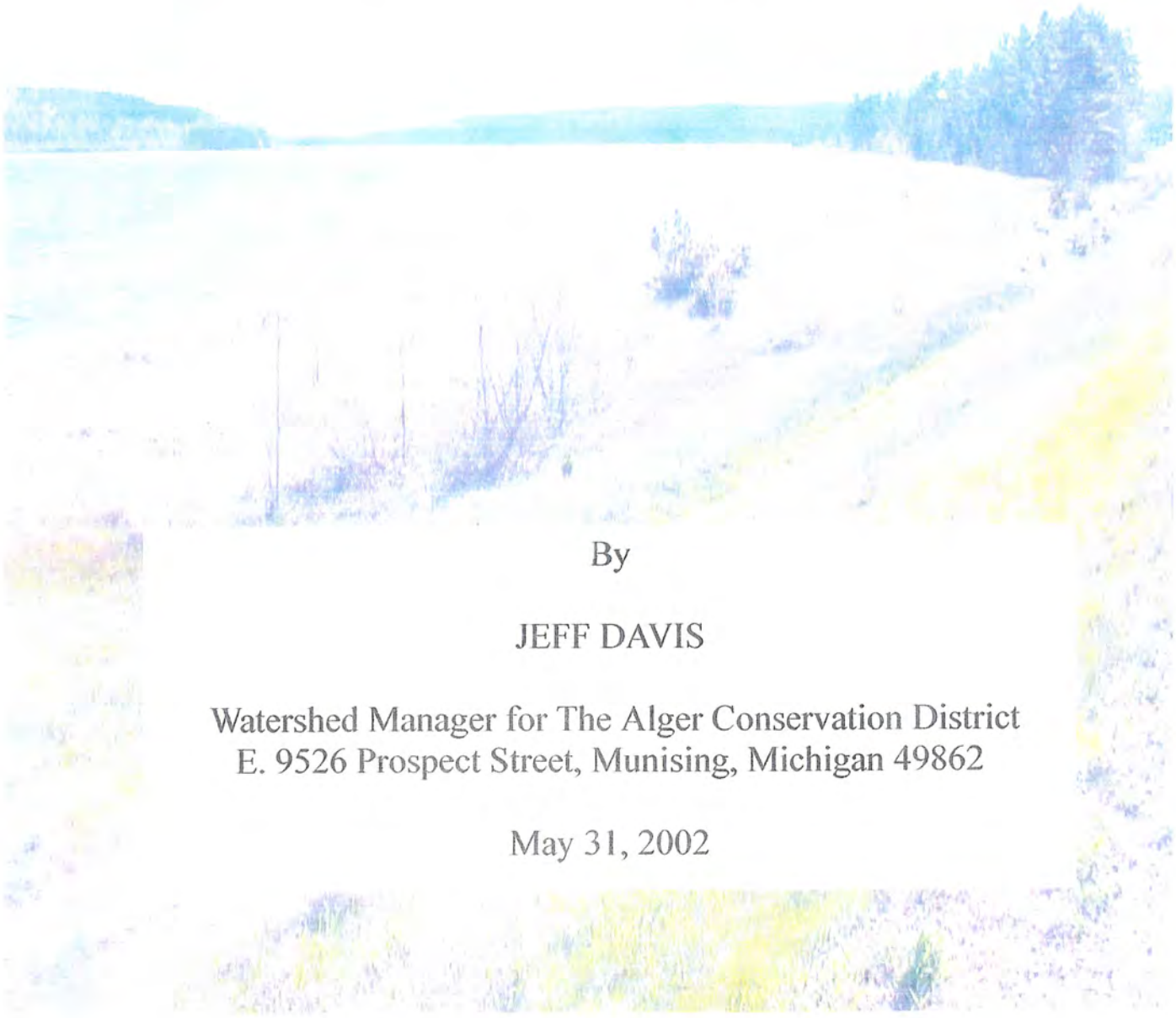

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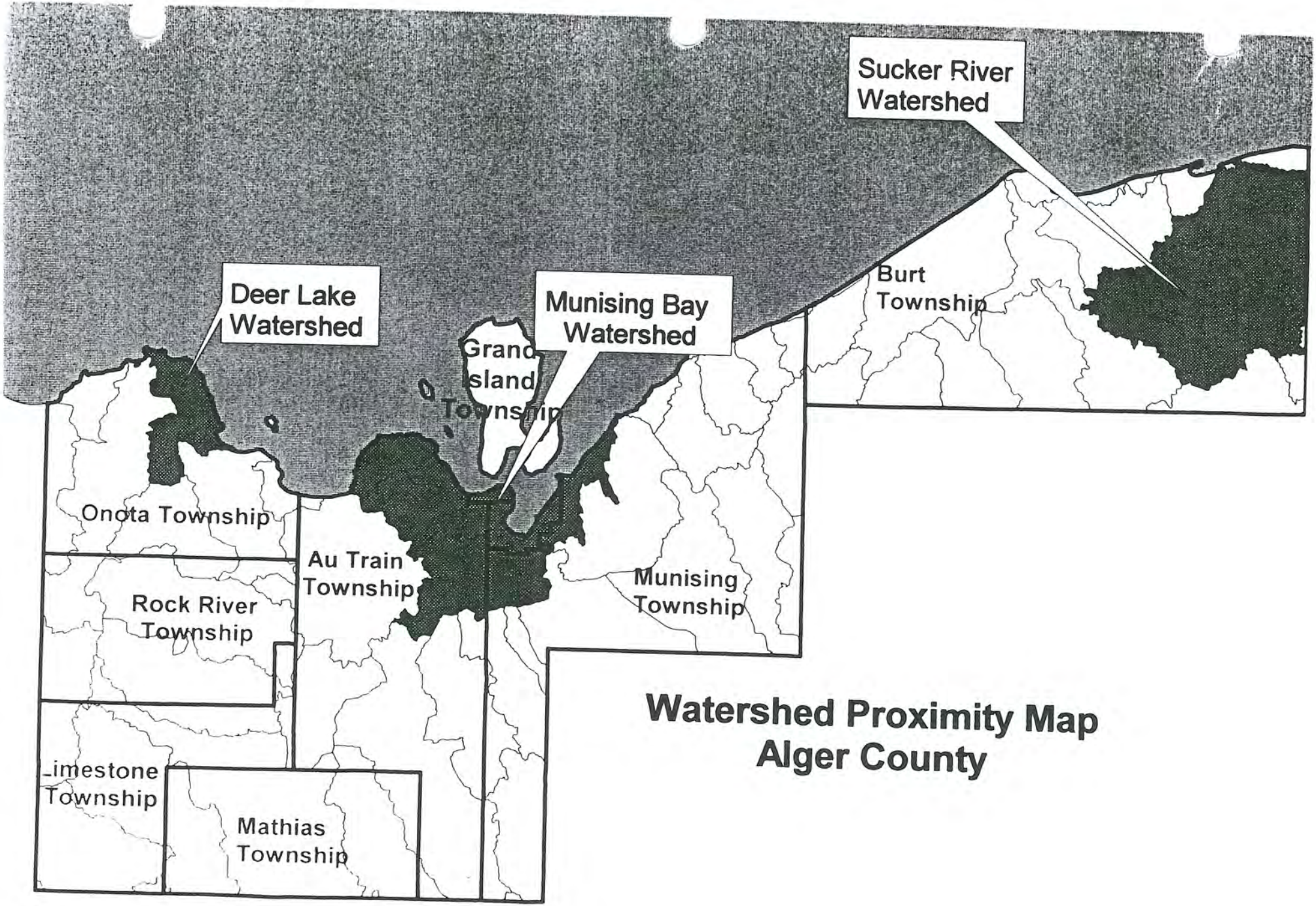

Watershed Proximity Map
Alger County

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Tabular Appendixes with Maps, Critical Area Photo Pages, Data Sheets, and Site Plans

Appendix Categories

Maps, Equipment and Facilities, Information and Education,
Anna River System, Furnace Creek System, Munising Falls Creek, St. Martins Hill,
Sweats Creek, Soil Maps and Type Descriptions

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Introduction

The Munising Bay Watershed Restoration Project is located in north central Alger County, Michigan, and consists of the Anna River system with it's many tributaries, Furnace, Hanson, Gangeau, Munising Falls, and Sweats Creeks, and the numerous drains, wetlands, and upland recharge areas that contribute water (and sediment) to the Munising Bay area. The total surface area encompasses ~30,350 acres including the City of Munising and portions of Munising and AuTrain Townships. The year-round population of the Munising Bay area is about 4000 residents. Numbers climb tremendously as summer residents and large numbers of tourists enjoy the area's recreational, historical, and natural attractions. Tourism, hunting and fishing, and water and snow sport recreation are vital to the economy of the area. According to the U.S. Bureau of Census we can expect a substantial increase in population and development by the year 2020. Since 1998, the Munising area has been one of the fastest growing communities in the Upper Peninsula. We have forged a broad community-based partnership of local stakeholders, area schools, and landowners, to educate and to help identify and resolve existing degradations and help guide new responsible development. Thanks go out to the Alger County Health Department, Alger County Road Commission, Alger County Board of Commissioners, the City of Munising, Munising and AuTrain Townships, Pictured Rocks National Park, Hiawatha National Forest, Lake Superior State Forest, NRCS (Natural Resource Conservation Service) and Michigan State University-Extension. All had the foresight to support the concept and vision of a comprehensive Watershed Restoration Plan. That support enabled the Alger Conservation District to obtain Michigan Department of Environmental Quality, Nonpoint Source Program- Section 319 grant monies. This allowed us to begin planning the Munising Bay Watershed Restoration Project (MBWRP). As other wise communities across the nation organize to monitor, protect, and restore their water resources, our community has recognized that a healthy watershed is vital to long-term economic and environmental health. The community depends on this watershed for drinking water, flood protection, hunting, fishing, boating, swimming, wildlife, and aesthetic values that greatly enhance our quality of life.

Historically, the Munising Bay Watershed has paid a heavy price for enhancing man's condition. From the time when horse roads and narrow gauge railroads were pushed through the wilderness and timber was floated down our streams and rivers to fuel the great American expansion, miners, loggers, farmers, ranchers, and fur traders settled and cleared the land. As the new residents developed the land and built new communities, they took the abundant water resources for granted. It is high time now, to protect and restore those aquifers, rivers, and streams by closing abandoned wells, repairing, replacing, or stabilizing erosion sites and bad road or rail stream crossings, and planting forested buffer zones, wildlife corridors, and filter strips. These efforts, combined with in-stream fisheries enhancements can restore, create, and improve lost fish and wildlife habitat and help rid streams of tons of accumulated sediments, while sustaining the local economy, environmental health, and enhancing recreational opportunities. The Munising Bay Watershed Restoration Project (MBWRP) seeks to accomplish these goals by inventory of the watershed, and through voluntary, non-regulatory action and input of the local community and our watershed partners, community education, and identification and prioritization of water resource problems. With the continued support of our local partners, and through application to the Clean Michigan Initiative Fund, we hope to implement best management practices and physical improvements that will restore designated use of prioritized critical areas. To achieve our goals, we have performed inventories and assessments of stream fish, aquatic insects, hydrology, erosion, sedimentation, and runoff

impacts that we hope will make the watershed eligible for grants to fund a range of improvement projects.

Munising Bay Watershed- Demographics - Stakeholders: Whom Do We Serve?

Population Demography: Alger County had 9,862 people according to the 2000 census, making it the 77th most populous county (of 83 counties total). The population increased by 890 people or 9.9% since the 1990 census. Of the total population, about 16.2% are adults over the age of 65, 60.3% are adults between 18-64 years of age, 18.4% are youth ages 5-17, and 5% are under age 5. The fastest growing age group is 45-64 year-olds, growing by 466 people or 25.3 percent since the 1990 census. Males made up 53.8% of the population, females made up 46.2%. Of 3,337 households in Alger County, 2,671 or 80% owned their own homes, and 666 or 20% rented. On average, one out of every five Michigan citizens experience a disability.

Multiculturism: Cultural statistics for Alger County show the inhabitants are 87.5% Caucasian, 6% black, 3.1% Native American, 1% Hispanic, 1.9% biracial, 0.3% Asian, and 0.2% "other". Two major historic Native American trails and one minor trail were known to converge on the Munising Bay Watershed area during the historic era (1760's), but archaeological site density is listed as "very light" for the area. The watershed area lacks any reservation lands, being a portion of that area ceded to the U.S. Government in the Washington Treaty of 1836. There is one Native American casino operation on the watershed, located in Christmas, Michigan. The Native Americans in Alger County are of the Ojibwa (Chippewa) Tribe.

Education: High School graduation rates in Alger County increased 9.8% since 1980, with 11.5% of the adult population holding a college degree. Alger ranks 36th among the 83 counties for persons with college degrees.

Labor Force: The Alger County labor force has grown from 3,800 to 4,475 from 1990 to 1999. The number of women with school-aged children in the work force increased by 13% Total average unemployment rate for Alger County was 5.9% in 1999.

Employment: Full and part-time jobs increased 21% from 1990 to 1998 to 3,992 jobs in Alger County. Manufacturing (paper & wood products) led employment with 24.7% of the jobs, Services had 22.3%, Retail/Wholesale had 19.8%, Government had 15.6%, Finance, Insurance, and Real Estate had 5.8%, Construction had 5.4%, Transportation had 3.7%, Farm Employment had 1.8%, and Agricultural Services had 0.8% of the jobs. These statistics highlight the area's economic dependence on recreational tourism, services and related

How Do We Serve? Public Input: Interested citizens were invited to join in formation of a Watershed Committee, and each locally elected government within the watershed boundary was asked to provide a designated representative to serve on the committee. This consisted of the City of Munising, and Munising and AuTrain Townships. The same was asked of each state or federal agency, and these were; Michigan State Univ. Extension, LMAS Health Dept., Hiawatha National Forest, and Pictured Rocks National Lakeshore Park. Some Department of Natural Resource and State Parks personnel also served to provide permission, technical advice, and instruction for fisheries inventories. Citizen resource concerns were taken by mailing out survey forms in two newsletters, in which we asked for natural resource concerns, and natural resource related recreation, and fishing preferences. In addition to watershed committee meetings, citizen input was gained by attending and making presentations and updates at county, township, and city board meetings. We received 160 completed surveys, about 1.6 % of the 9,862 estimated adult population ages 18-85+ in Alger County. This was short of our goal of a minimum of 5%. However, through the survey, we did receive 62 offers of volunteer help for in-stream or erosion control work, a single $50 cash donation, and overwhelming support for the goals of the district and the watershed plan

History and Current Condition of The Watershed

Overall, the Munising Bay Watershed has 76 public and private, road or railroad crossings on its streams. We are very fortunate that of those, only 10 have been identified as critically eroding sites currently in need of replacement or other mitigation. The relatively small stream scale, and high quality year round flow, makes the watershed a prime candidate, and economically feasible for restoration. The largest of the stream systems, the Anna River system is about 6 miles long, with about 18 miles of tributaries draining an area of about 20 square miles. The Anna was formerly renowned as one of the better Brook trout streams in the area, and at one time provided excellent spawning habitat for salmonids. The Anna system also contributed to recruitment of Rainbow and Brown Trout, and Coho and Chinook Salmon once these species were introduced.

In 1960-61 a State highway project on M-28 caused heavy sand erosion into the lower part of the Anna River from the Wagner Creek tributary to the mouth. Today, because of the low gradient, flat nature of the lower river and floodplain, the lower 2 miles still has a heavy sand streambed load, that covers about 90% of the former spawning gravels. The only existing gravel/cobble spawning area left on the lower Anna, exists intermittently (depending on time of year) at and below the junction of Horseshoe Falls Creek where the extra flow is able to flush the annual deposition of sand from a small area. The streambed sand loading of 12"- 24" in depth, has caused instability in the form of increased meander, channel widening, bank erosion, and has reduced the overall river depth. Many local residents and officials blame this reduced depth for the unprecedented flooding that occurred in the spring of 1978, and flooded many homes near the lower Anna. Since the highway sediment event, the river goes over the bankfull stage, inundating the floodplain much more frequently.

In the mid 1980's a private artesian well blew out, eroding significant sand deposits into the middle section of the upper Anna, and in the early 1990's two railroad crossings failed causing two large sediment events. All three of these events added to the prior bed loading on the lower two miles and solidly choked the middle to upper reaches as well. Wisconsin Central Railroad was litigated by the State of Michigan, and forced to stabilize both crossings and improve others, and put in two 300' sediment trap areas on the middle Anna River below the failed crossings. They also had to install 6 gravel-spawning riffles to replace natural ones that were inundated with sand. The landowner that had the well blow out, hosted one of the sand traps on his property and allows access for cleanouts. The sand traps are scheduled for 2 more years of cleanouts by the railroad (5 yrs total). Generally, the sand traps continue to fill up 3-4 months before their annual cleanouts, allowing further downstream movements of sediments to the lower section. They also are eroding and widening the river channel slightly at the trap locations due to the mechanical removals.

In our estimation the sediment bed loading on the upper portion of the river will have diminished only about 50-60% by the time scheduled trap maintenance ends. One exception is the portion just south of the second sand trap, where the placed spawning riffles remain clear and channel deepening (down cutting) is also occurring in other areas between spawning beds, uncovering more spawning substrates and creating deep holes. On the upper Anna River headwaters, at the Perch Lake Road crossings of the north and south branches, two inadequate and partly deformed culverts exist. These two crossings allow considerable sediment to erode directly from the dirt road surface, and the road ditching during flashy rain events and high flow times. The inadequate culvert diameter also causes ponding upstream of the road crossings, eroding around and under the culverts. Both culverts are also the same width as the roadbed (too short) and the roadside lacks any slope for good effect with riprap

Above this point the river is undeveloped except for one stable railroad crossing on the South Branch. Although the upper reaches beyond the road crossings are well wooded again, and the stream appears fairly pristine for a post-logging era stream, some sand bed loading (61-77%) remains from the early days of timber harvesting. Though the entire river corridor was cutover at one time, this is unlikely to pose a problem in the future due to the nature of private and vacation home development on the river corridor in the years since.

The lower Anna has some other problems that add to sedimentation, exacerbate instability, and add to the flooding and tendency to meander. At the Wagner Creek junction, a large hole has developed that functions through the low flow times of the year as a natural sediment trap, but is flushed downstream periodically during winter and spring high flow times. This natural "sand trap" has easy road access directly to the streambank, and acts to intercept sediment moving down from the midsection and would allow clean out of annual deposits without digging a trap. About a mile below the Wagner tributary, DNR-Fisheries (George Madison), landowner Bruce Cromell, and other members of the local "Fishing Committee" placed a electric salmon exclusion weir just above a private bridge crossing on the Cromell property. This was meant to block salmon access to the upper Anna in an attempt to improve the Brook Trout population and decrease competition for forage fish, insects, and spawning areas. Though this was abandoned after several years, it remains in place, and has caused significant erosion and instability at the site. The orientation of the weir narrows the river channel, increasing velocities, and directs the flow at the eastern end of the bridge abutment. This has caused over 6 feet of undercutting and partial subsidence of the wooden bridge structure. The bridge now blocks flows at high flow times, and causes further bank erosion. Near the mouth area of the Anna River, just below the county highway H58 crossing, there is an old abandoned wooden bridge structure that blocks ice during spring breakup. This restricts flow and causes ice and water damming and increases the likelihood of flooding upstream. At the mouth itself, bank erosion on the west side of the river, along the Kimberly-Clark sediment basin is another chronic but lower priority problem The sandy beachhead across from it contributes as much, if not more sediment to the river and Munising Bay. Wagner Creek from below the falls to the Anna, is high quality salmonid habitat, with a rocky substrate and abundant aquatic insects. Above the falls, Wagner Creek is bisected by an eroding road crossing and forms two large ponds known as "Cox Ponds". The Cox Ponds are the central element of Munising Township's Robert McQuisten Recreation Area development.

In the city of Munising, we have the critically eroding slope known as St. Martin's Hill, as the major sediment problem in the city. This large, steeply sloping hill, has a slope nearly 2650' long. This site chronically erodes with every rain event, and sediment is carried downslope to overwhelm the city storm water system and carry fines all the way into the Munising Bay of Lake Superior. Previous attempts to stabilize the hill with rip rap and erosion fabric have been unsuccessful, though the fabric placement and amount of riprap was insufficient and improperly installed. Sediment plumes are visible in the lake with every rain event. The sediment negatively impacts benthic fisheries resources on the floor of the bay.

On the west side of the watershed, Furnace Creek (about ½ mile in length) has a few problems other than the contaminants from road and highway M-28 runoff. There is also a remnant Lamprey Weir, which causes some sediment deposition and scouring, and the inadequate culvert diameter at its source, the outlet of Furnace/Carr Lake. The U.S. Fish and Wildlife Service (USFWS) has long wanted to place a Sea Lamprey barrier in the outlet of Furnace/Carr Lake to deny access to the rich sediments associated with the wetland soils of the lake basin. The USFWS has offered $10,000 toward the replacement of the culvert outlet and construction of a removable lamprey barrier. The culvert diameter at this site is inadequate for the seasonal high flows, and flows overtop the culvert and road occasionally,

by as much as 6". The Furnace Creek drainage system consists of two streams, the Gangeau Creek with an east and west branch, and Hanson Creek. The Gangeau is the most pristine of the two, and has three critically eroding road stream crossings, due to short and undersized culverts that can't handle storm flows. Two improperly installed, and undersized culverts are located on the east and west branches of the Gangeau at the Carr Lake development road. One other critically eroding road stream crossing of the Gangeau is located at the county-owned Ridge Road upstream of the Carr lake development. Hanson creek has numerous well-established private crossings upstream of Carr Lake, including only one severely eroding site on the Jurmu property known as Hanson Estates. This is the site of a poorly designed road crossing a riparian floodplain, lacks ditching or vegetation on the new roadsides, and is made of a cut in half old steel tank. According to DEQ storm flow calculations, the homemade culvert is of inadequate width for the streambed, by several feet. Another undersized culvert is in place on Hanson Creek downstream from Hanson Estates, on the Carr Development road.

These are all critical crossings because of the current erosion and high continuous use, and the expected increase in traffic and development. A Native American casino is now located in Christmas, Michigan, and is driving explosive home and business development in the area. All of the Carr development stream crossing sites are located on an access road to a sand and gravel pit operation used as a material source by private developers and occasionally by the county road commission, as well as serving as a logging access road to interior forestland. One new problem with the Furnace System has arisen with the impact of sudden snowmelt and heavy rains in the last week of April 2002. A 29 acre site owned by Mr. Kevin Kolbus, and developed as a dirt racetrack, experienced major slope failures, gullying and rills, and resulted in sediment inundation of a small wetland on adjacent property owned by Shelter Bay Forests. Because of the high clay content of the soil, clay-laden water flowed downslope along an intermittent but well vegetated topographic drainage channel to the headwaters of the west branch of Gangeau Creek. Most of the heavy sediment was intercepted by vegetation and trapped by the roadside ditches and the adjacent wetland area, so did not make it to the permanent stream channel. Suspended fines transported as clay-laden water did flow through the channel directly into Carr/Furnace Lake, and then on into Lake Superior for a period of about 2 days. Subsequent rains washed evidence of the fine silt from the vegetation but flow patterns were clearly evident. Lake Residents were alarmed by the entire lake turning pink and quickly alerted DEQ, the soil erosion permit office and the watershed manager. The Alger County Road Commission has recently installed a culvert where this intermittent flowage crossed Perch Lake Road and dug sediment trap basins at either end as an emergency stopgap measure. I toured and photographed the site on 5/1/02, with the DEQ and Alger County Soil Erosion Agent

Methods

General: Watershed maps were created by the watershed manager using ArcView 3.2a software. The software and digital air photos were provided by the NRCS, after attending two training sessions. Reports were done in Microsoft Word & Excel. Newsletters and photo pages were created using Microsoft Publisher. All available written material on the Munising Bay Watershed was gathered and studied for analysis. Historic Flow measures came from USGS and USFWS-Lamprey Control, and DEQ reports. Over 900 runs of historic fisheries survey data also came from Lamprey Control. Sediment suspension was measured when possible, with a "Lawrence Enterprises" 60 cm Secchi-tube, and new flow measurements were made by the float method using a variant of the Emdahl, 1927 method, provided on formatted data forms by DNR-Fisheries. Streams were watched carefully and flows were taken when "channel-forming" or "bankfull" conditions occurred, to facilitate hydrological analysis, as well as during insect/fish inventory. Use of a 3 foot length float distance, a digital stopwatch, careful choice of location (for uniformity) and measurement of the 3' wide stream cross section assured accurate flow assessment. Temperatures were taken using digital thermometers accurate to 0.1 degree F or C. PH was taken with wide range PH paper strips, of O.5 PH units 0-14 PH range. The readings were confirmed or refined by drop titration using a Hach Model 17-N PH test colorimetric kit. Dissolved Oxygen was taken using a Hach model OX-2-P DO, "reagent powder pillow" kit. All supplies for the aforementioned testing, except the secchi tube and digital stopwatches, were loaned to the watershed by "Turtle Springs Research" of Marquette, Michigan. PH testing by school students was performed hands-on with the "PH-Hydrion" strips, and under adult supervision when using the PH and DO chemical test kits. A LaMott's "Pondwater Tour" water analysis kit was furnished to the Mather Middle School, for use in student analysis of nitrates/nitrites, oxygen, and PH.

For long term water quality monitoring plans, inventory, and future information and education endeavors and (some items) inclusion in our two school loan boxes, several water test meters, supplies and kits were purchased, as well as a refill kit for the "Pondwater Tour" water analysis kit. Water monitoring equipment purchased included; ISO 9001 certified-Oakton "rough duty" double junction, waterproof PH tester with replacement electrode, Oakton waterproof electrical conductivity tester with replacement electrode (PH & EC meters, and DO chem kit is not included in the school loan boxes); LaMotte Dissolved Oxygen test kit model EDO #7414 with refill chemicals; Coralife "Deep Six" hydrometers for salinity testing; and pHydrion "brilliant" (PH 0.0-13) paper strip dispensers; "Accurite" Mercury-free digital thermometers (2); and "Athletic Works" digital stopwatches (2) for stream flow determinations. Rounding out our "loan boxes", each also contains minnow traps (3) with labeled floats, small animal live trap (1), 100 count box of latex gloves, insect sorting tray, flexible, and floating foam yardsticks. Accessories to the loan boxes include; D-ring aquatic insect nets (1 each), D-ring fish capture nets (3 each), watershed map displays, stream ecology posters, aquatic insect ecology and stream rating guide displays with PH guide. Schools (or the watershed manager) furnish the "floats" for stream gauging (medium oranges!) and the watershed furnishes a 100' open reel fiberglass tape for measuring cross sections and transects.

Sedimentation/Pollution Inventory: Each stream in the watershed was walked where possible, using waders, from headwater areas to their junctions with larger streams, lakes, or their mouths at Lake Superior. Because of the forested nature of the upper reaches of the streams, little was found in terms of erosion sites other than natural undercut banks, and sediment deposition in beaver ponds, or in stream beds below blown out beaver dams such as

occurs on the Valley Spur tributary to the Anna River, and the west branch of Gangeau Creek. The most severe erosion sites found were at a few of the many road-stream crossings, below which sediment bed loading had increased, and also below some of the already mitigated railroad-stream crossings. Much of the upper and middle of the Anna River system was formerly "hardened" and straightened or channelized by construction of the Wisconsin-Central Railroad. Due to large amounts of coarse woody debris and small stream size, little of the watershed is navigable, even by canoe or kayak. The navigable areas include; Furnace/Carr Lake and Furnace Creek below highway M-28 to the mouth, and the Anna River from below the Bruce Cromell property to the mouth at Lake Superior. No livestock access, irrigation withdrawal, or industrial inputs were found. The primary impairments seem to be sedimentation from road and rail crossings, and possibly runoff from parking areas, a snowmobile trail, roads, and highways. Just above highway H-58, on the lower Anna, is Munising's municipal sewage treatment plant, which contributes traces of heavy metals, and treated wastewater, but conforms to current regulatory requirements. Some increase in algal growth occurs below this point, but seems to have little effect on the overall riverine ecology because of the cold water, high flow scouring action, and heavy sand bed loading in this area.

Fisheries Inventory: A MI-DNR Fisheries Biologist, George Madison, who was familiar with the streams of this watershed, set forth general requirements for inventory of fish and aquatic invertebrates. Because of the small size of the streams on the watershed, the directions included establishing two or more 300' survey transect areas on each major stream or river system within the project area. Yellow plastic, numbered, "pig-sized" animal ear tags were lag screwed to a tree to mark the beginning point of each transect. Each transect was marked out by measuring distance along the waterway with a "Hip Chain" and flagging at each 50' interval. At each interval marker, a 3' wide cross-section of the stream bottom was to be measured and sampled for embedment (sediment) and for aquatic insects using a standard EPA-certified rapid-bioassay kick net, and two D-ring aquatic insect nets. In addition, any small to medium rocks, sticks, logs, or removable items found on each 3' wide cross section, were to be immersed and scrubbed with a brush in a bucket of water, to detach and collect invertebrate colonizers. Invertebrates were to be collected, identified, counted, and representative samples of each species were to be preserved. Most collected invertebrates were returned to the transect area immediately after identification and counting. Some invertebrates to be preserved, or needing further sorting or identification, were taken to the Turtle Springs Research Lab in Marquette for processing. The loan of this facility was necessary because we are prohibited from using alcohols or solvents (insect preservatives) in our office at the Health Dept. Turtle Springs Research provided a ventilated work area, sorting tables with illuminated magnifiers, dissecting and regular microscopes, and storage, mixing, and use of insect preservative.

Each transect was subjected to a single pass electro-fishing survey to identify native fishes present before other data was taken. Students helped capture stunned fish and helped the manager measure, record species and total length, and release them. Due to the watershed manager's prior qualifications, training, and work experience (including operation of fish shocker units and teaching native fish and insect identification in a university setting) the manager was able to borrow a Fish-Shocker from the U.S. Fish and Wildlife Service, Lamprey Control, at the Marquette, Michigan Biological Station. By agreement with the USFWS, No students were allowed to use the fish shocker.

Public Input- Interested citizens were invited to join in formation of a Watershed Committee, and each locally elected government within the watershed boundary was asked to provide designated representatives to serve on the committee. This consisted of the City of Munising, and Munising and AuTrain Townships. The same was asked of each state or federal agency, and these were; Michigan State Univ. Extension, LMAS Health Dept., Hiawatha National Forest, and Pictured Rocks National Lakeshore Park. Some Department of Natural Resource and State Parks personnel also served to provide permission, technical advice, and instruction for fisheries inventories. Citizen resource concerns were taken by mailing survey forms in two issues of newsletters, asking for natural resource concerns, recreation, and fishing preferences. In addition to watershed committee meetings, updates and citizen input was gained by attending and making presentations at county, township, and city board meetings, as well as by attending several meetings of the Munising Bay Fishing Committee. Though we mailed out approximately 8700 newsletters to the entire county, we only received 160 completed surveys, approximately 1.6 % of the estimated 9,862 adults (ages 18-85+) in Alger County, short of our goal of a minimum of 5%. However, we did receive 62 offers of volunteer help for in-stream or erosion control work, and overwhelming support for the goals of the district and the watershed plan from those who responded. The Resource, Recreation, and Fishing Preferences survey form and all results are included in the Information and Education appendix section.

Methods for Determining Stream Hydrology:

To determine the stability or changes in stability of any stream or river system, it is necessary to perform measurements that allow derivation of several important ratios. The most useful measurements are stream channel flow, depth, and channel width at "**Bankfull**" stage and flood stages. Stream flow at Bankfull stage is defined as the "channel-forming flow" or a flood stage occurring at 1.5 year intervals or sooner (67% probability of occurrence any year), and is characterized as the stage when the flow just begins to overtop its normal banks. Another description is when the stream level reaches the first depositional floodplain zone, or the level of lower limit of terrestrial plant growth along the banks on streams lacking layered floodplains. We were able to take bankfull measurements on all streams of the watershed as they were receding from flood stages of several days duration, at well over the bankfull stage. Changes in the Following Ratios Determine Stability State.

Width to Depth Ratio- Bankfull width (ft) divided by bankfull depth (ft)

Entrenchment Ratio- Flood Prone width (ft) divided by bankfull depth (ft). Flood Prone width is derived by finding the width at the hypothetical stream surface level at 2 times the bankfull depth.

Meander Width Ratio- Meander width (ft) divided by Bankfull width (ft)

Sinuosity Ratio- Channel Length (ft) divided by Valley Length (ft)

Stream Balance Equation- Q_W multiplied by S = Q_S multiplied by D_{10}

Q_W = Stream Flow (at Bankfull) Q_S = Sediment Load

S = Stream Slope D_{50} = Sediment Particle Size

Methods-Educational Innovations:

My strategy was to combine inventory with information and education efforts to enhance our long-term management strategy and visibility, and to build community support. I didn't want to hire contractors for the inventory work, a single use expenditure with a one time yield, since I was told DNR-Fisheries couldn't do it within our 2-yr time frame. For assistance with stream inventory, electro-fishing, and middle school presentations, we utilized an "at-risk" high school volunteer assistant, who received release time from classes and school credit. We also hired a watershed-experienced college student the during the first

year inventory. Our high school student then qualified for the Michigan Works Program after graduating, and served as a part-time, subsidized watershed intern for 12 weeks of the second summer.

To accomplish the surveys, we purchased survey equipment (detailed above in the general and inventory portions of Methods) for long-term and continued supervised use by youth participating in stream inventories. This also provides the means for long term monitoring efforts. Preparatory presentations, field excursions, and follow-up presentations as "courses" were designed to meet requirements of the Michigan Science Model for middle and elementary schools. The courses served an introduction to watershed concepts, cycles, and ecology, the scientific method, and included hands-on survey experience. We fostered teamwork, critical and analytical thinking, and guided the development of conclusions based on our experiences. In this way we hoped to also instill a sense of community ownership, responsibility, and stewardship ethic for watershed resources, while entertaining and teaching youth in a creative learning project. I am proud of the fact that during the 2 years of the planning project we provided exciting hands-on, 3-hour, watershed related field experiences for over **1,720** youth! Photos from some of the field trips are shown in the information and education and stream system appendixes following the body of this document.

For Graphic presentation, I produced several compact, accordion-folding display boards with topographic and GIS-ArcView derived map displays, watershed concepts, and graphics on fish and aquatic insect ecology and Stream BMP's. I also created a dual carousel regular slide show tour of the watershed for Township, Watershed Committee, and other meetings. Some of the slides were later digitized for inclusion in power point presentations.

Equipment for inventory and school volunteer use was low tech and included; a single EPA-certified Rapid Bio-Assay Kicknet, 2-Dframe insect nets, 6- fish dip nets, 6 minnow traps, assorted sizes of rubber knee boots, waders, an all-important wader dryer, digital thermometers, turbidity tube, water test kits, digital thermometers, and a stopwatch. We borrowed a GPS unit, food-grade plastic pails with lids (for collecting buckets), meter sticks, 100m reel tape, marking ribbon, and rubber gloves from Turtle Springs Research, and were given glass insect sample vials (discarded Health dept water sample mailer kits). Through competitive grant writing to the Michigan Association of Conservation Districts (MACD), the watershed manager was able to purchase a digital camera and GPS unit for watershed and district use in the future.

The Pictured Rocks National Lakeshore's, Educational Officer and watershed partner, Dave Kronk, helped supervise teams for most of the field and classroom presentations and brought extra nets and waders. The Mather Middle School provided bus transportation and drivers. We worked with the teachers to forge each 6 or 7th grade science class into sets of teams each assigned specific tasks during field inventory, then shared in the findings. Each class received an entertaining presentation of conceptual and practical use, before the inventory excursion, then a follow up presentation to present findings, ask students to analyze results, and help lead them to the proper conclusions. We finish with a fun aquatic ecology game played in a gym or outside. Each class rated the inventory site they worked on by various parameters described above, including the Isaac Walton league stream quality guide.

Our educational outreach included high school journalism and science students who accompanied and "reported" on the Middle school watershed activities, and who later participated in storm drain stenciling in Munising during the summer "Watershed Appreciation Day" sponsored by the Central Lake Superior Watershed Partnership. This event was one part of the week-long "Life of Lake Superior Youth Program" created by our watershed partner, MSU-Extension of Alger County. I created a "Watershed's and Wildlife" presentation as another part of their Youth Program, and presented out on Grand Island in

Lake Superior! Later we used this same presentation and a field excursion as an activity for area Seniors, sponsored by NMU- Center For Lifelong Learning, Manistique Middle School, Munising's Central Elementary and Mather Middle Schools, Marquette Conservation District's Annual Conservation Festival, and the Marquette-Alger Intermediate School District's "Young Authors Program". See the photos in the information and education appendix.

Munising Bay Watershed: Physical Description

Physiographic Region: The Munising Bay Watershed area contains about 30,000 acres around the communities of Munising and Christmas in Alger County, Michigan. This entire area is contained within the general Michigan Landform type 6a, the Schoolcraft Plain.

Elevation: A narrow region of the watershed along Lake Superior, and most of Grand Island is located at less than 600 feet above mean sea level. About 75% of the watershed lies at 600-800 feet above mean sea level, and a tiny portion 2-5% lies at 1000-1200 feet above mean sea level.

Glaciation: The watershed area was completely covered by ice at 11,000 years before present. Final deglaciation took place between then and 9,500 years ago.

Geologic Age of Bedrock: Most of the watershed (~70%) lies on Cambrian Period bedrock of about 600 million years of age. Some (~30%) of the watershed (southeastern portion) lies on Ordovician Bedrock of about 500 million years of age.

Surface Formations: Most (~75%) of the watershed is composed of glacial moraine, while some (~25%), mostly located along Lake Superior is composed of lacustrine plain.

Bedrock Surface Altitude: Grand Island, the northwest corner of the watershed, and the shoreline from the Anna River to Sand Point lie at 600-800 feet above mean sea level. A small part of the watershed that is within the eastern part lies at 400-600 feet above mean sea level, and the rest (majority) lies at 200-400 feet above mean sea level.

Suitability For Farming: Less than 5% of the watershed is currently composed of farmland, with ~40% being poorly suited for farming, ~30% well suited, ~10% unsuited, and about ~20% moderately suited.

Presettlement Forest: All of the watershed area was originally composed of the Northern Hardwoods type known as Maple-Beech-Birch-Hemlock complex association.
Present Forest Type: Most of the watershed area (~70%) remains the Maple-Beech-Birch-Hemlock complex association. About 30% is now composed of Pine-Oak-Aspen and Spruce-Fir complex associations.

Mean Annual Temperature: All of the watershed falls within 42-44 degrees fahrenheit mean annual average.

Soil & Slope Associations:

Soils, Slopes, and Hydrology are intimately related and interact to affect each other. The hydrological effect is discussed in the Hydrology section below. Each of the soil types listed has management or activity limitations imposed by engineering considerations, its structure, and prevailing permitting requirements. Current (Apr. 2002) soil maps and type/limitation description lists are included in an attached appendix. In general terms, the majority (~85%) of the watershed is overlain with Haplorthod and Fragiorthod soils of the **H2** (Keweenaw, Kalkaska, Gogebic), **H3** (Emmet, Trenary, Leelenau), and **H6** (Munising, Skanee, Keweenaw) types. A small portion of the watershed is overlain with Histosols (Roscommon, AuGres, organic soil). All of these soils are easily eroded if not stabilized with vegetation or tree cover or are exposed by activity or construction. Most of the lower reaches of the Furnace Creek and Anna River systems are of zero to little slope, making historic and chronic sediment deposits hard to flush out of stream beds and contributing to continued stream instabilities. Some of the high elevation sandy deposits have a high clay content. Detailed soil type, from mouth to headwater, for the two main stream systems on the watershed are reported with their slope category below:

Anna River System Soils/Slopes:

The first 400m (1300') upstream of the mouth to just above the County Road H58 bridge, the river cuts through soil "type 232b"; Shelldrake sand (0% slope). From that point, 900m (2,095') upstream to just upstream of the State Highway M94 bridge, the soil is "type 93"; Tawas-Deford Mucks (0-1% slope). From that point, 1275m (4,144') upstream to Alger Falls Creek tributary, soils are of "type 57"; Carbondale, Lupton, and Tawas Mucks (0% slope). From that point upstream 3,450m (11,212') to the Pasineault property is soil "type 93"; Tawas-Deford Mucks (0-1% slopes). From that point upstream 160m (520') the Anna crosses a soil "type 76c"; Garlic-BlueLake-Okeefe Complex (1-12% slope, dissected). From there upstream another 1180m (3,835') past the tiny Mud Lake tributary to the Schumaker property, the soil is of "type 71b"; Evart-Pelkie-Sturgeon Complex (0-4% slope). From the Schumaker property upstream 870m (2,827') to the power line corridor the soil is "type 76e"; Garlic-BlueLake-Okeefe Complex (8-35% slopes, dissected). From that point upstream 550m (1,787') is the North Branch tributary, past and including the **Perch Lake Road crossing #1, and is of soil "type 76c"; Garlic-BlueLake-Okeefe Complex (1-12% slopes, dissected)**. From that point upstream 670m (2,177') and including the entire South Branch tributary and **Perch Lake Road crossing #2, is of soil "type 76e";Garlic-BlueLake-Okeefe Complex (8-35% slopes, dissected)**. From there upstream about 1430m (4,647') to point of origin at Anna Marsh, is of soil "type 57"; Carbondale, Lupton, and Tawas Mucks (0% slope).

Furnace Creek System Soils/Slopes:

Hanson Creek: From the mouth of Hanson Creek, upstream 250m (812') is of soil "type 60"; Histosols & Aquents, Ponded (0% slope). From there upstream 400m (1300') including the **Hanson Creek Road crossing on Carr Road is of soil "type 57"; Carbondale, Lupton, and Tawas Mucks (0% slope)**. From that point upstream 1600m (5,200') is of "type 72e"; Deerton-Trout Bay Complex (8-35% slopes, dissected). From there upstream 300m (975') is soil "type 72c"; Deerton-Trout Bay Complex (1-12% slopes, dissected). From that point upstream 2500m (8,125'), including **Hanson Creek crossing at Hanson Estates is soil "type 57"; Carbondale, Lupton and Tawas Mucks (0% slope)**. The next 200m (650') is of soil "type 221b"; Jeske-AuTrain-

Gangeau Complex (1-12% slopes). The next 675m (2194') upstream which crosses State highway M-28 at about 250m, is of soil "type 196e"; Frohling-Tokiahok-Onota Complex (8-35% slopes, dissected). North of the highway, the next 400m (1300') upstream is of soil "type 17a"; AuGres Sand (0-3% slope). The last 850m (2,762') upstream to the headwater source is of soil "type 57"; Carbondale, Lupton, and Tawas Mucks (0% slope).
Gangeau Creek: The first 600m upstream from Furnace/Carr lake of the **east branch tributary road crossing is in soil "type 57"; Carbondale, Lupton, and Tawas Mucks (0% slope)**. At that point due Southwest of Furnace Lake, and including the **west branch road crossing, there is a small soil lens that runs 400m (1300') of soil "type 60; Histosols and Aquents, Ponded (0% slope)**. From there upstream 1700m (5,525') soils are "type 196F"; Frohling-Tokiahok-Onota (15-65% slopes, dissected).
From that point upstream 700m (2,275') soils are "type 158c"; Munising-Onota-Yalmer Complex (1-12% slopes, dissected, stony). From that point upstream 350m (1137') including the **Ridge Road crossing, is of soil "type 241"; Cathro-Gay Complex (0% slope)**. From there upstream 1750m (5687') to the point of origin is soil "type 57"; Carbondale, Lupton, and Tawas Mucks (0% slope).

General Hydrology

The Munising Bay Watershed stream systems developed, and draw their clear, cold waters, from the same type of rugged upland recharge areas. These are composed of permeable deposits of sand and gravel known as the Munising Moraine. In natural low areas during glacial dewatering, fines settled out in some areas, depositing clay lenses, fragipans, mucks, or other organic soils, as found around Furnace, Perch, and Mud Lakes, as well as other scattered low wetland areas. Clean gravelly sand and cobble was deposited on the barely sloping outwash plains such as the lower Anna River. Other organic soil complexes and mucks developed within the outwash plains as Lake Superior levels varied over long periods creating successive beachheads and changing stream meander near the mouth. These stream drainages were well incised into the rocky outwash or organic substrate 3' to 6' and have been slowly, actively meandering in response to hydrological (snowmelt & rain) and biological events (beaver) for thousands of years. The rate of stream meander has varied with the degree of tree cover, beaver activity, and bank stabilization that existed.

We know this historic meander would have continued to decline as a mature forest and well stabilized banks developed from the original post-glacial condition. When man denuded this watershed, had log drives, and constructed primitive road and rail crossings in the early part of the 19th century, we can expect that both the erosion and meander rate increased considerably and continues to this day. We now have a forest in middle age, and much of the upper reaches of the watershed is well wooded once again, with stable banks. If we can stabilize banks on the lower stretches through bioengineering and recover the gravel spawning areas on the lower Anna, heal the hydrological limitations at a few critically eroding stream crossings, and stabilize other eroding areas that could affect future changes in hydrology, we have a chance to restore the quality streams of the watershed to their full potential.

Minimum Infiltration Rates: About 90% of the 30,000 acre watershed has soil properties that allow 4-8 inches per hour of water infiltration, while the rest of the area allows 1-2 inches per hour.

Water Holding Capacity: This is the water capacity of the upper 3 feet of soil, and represents water available to trees and plants. About 85% of the watershed is of the 6.5-9.0 inches of water holding capacity, while 15% is of the 3.75-6.5 inch capacity.

Water Availability from Bedrock: About 50% of the watershed is of bedrock that will make 10-100 gallons per minute, the other half is of bedrock that will make less than 10 gallons a minute.

Water Availability from Glacial Deposits: About 70% of the watershed area is of glacial deposits that will make 10-100 gallons per minute, with 30% of glacial deposits that will make less than 10 gallons per minute.

Mean Annual Precipitation: About 30% of the watershed gets an estimated 34-36 inches of rain per annum average, and about 70% gets 32-34 inches of rain per annum on average. Average number of Thunderstorm days (Flash events) is 28-32 days per year.

Total Annual Runoff: About 85% of the watershed has an estimated 15-18 inches per year of runoff, with about 15% of the watershed having 12-15 inches per year on average.

Average Annual Snowfall: All of the watershed area usually receives 100-120 inches of snow per year with an average of 120-140 days with 1" of snow or more. Some exceptional years (the winter of 2001-2002 for instance) can exceed 300 inches of snow.

Watershed: All 30,00 acres of the watershed falls within the Great Lakes Drainage Basin and is of the general type considered to be "short drainages directly to the Great Lakes (Lake Superior). The watershed restoration project focuses mainly on two main high quality stream systems, the Anna River and tributaries, and the Furnace Creek and tributaries. Another small stream, Sweat's Creek, another small tributary to Munising Bay, and once renowned for Smelt runs, is also under consideration for improvements. Munising Falls Creek is another Munising Bay source we are monitoring for educational purposes, and have transects above the fall on Pictured Rocks National Lakeshore property, and below the falls within the City of Munising, on the Hospital grounds.

The Munising Bay Watershed Restoration Plan

Our watershed restoration plan has brought together local residents, their community, and local government, over the common issues of watersheds degraded by erosion and sedimentation, impaired fisheries and potential threats to groundwater supplies. The watershed restoration plan is based on a planning process that educated the public through newsletters, information and education activities with the public schools, and gathering local input on watershed, natural resources, and resource-related recreational concerns from as many of the county's citizens as could be coerced into coming to a meeting, and filling and mailing in a resource concern survey. Additional input was received through personal landowner site visits, phone contacts, attending local Fish Committee, township, city, and county board meetings, and consulting with NRCS, MI-DNR, and MI-DEQ. The watershed plan drove investigation and identification of the causes, extent, sources, and degree of degradation or impairment, and herein recommends actions necessary to mitigate, restore, and protect impacted areas through direct mechanical, physical, and bioengineering techniques or protective covenants, conservation easements, or planning and zoning changes. Our watershed plan also seeks to create a network of interested stakeholders and volunteers who will continue to support the watershed goals and maintain installed practices into the future. Our Stakeholders include numerous interested local citizens and volunteers, representatives of a local sport fishing group, landowners, industries, city-township-county boards, road commissions, schools, civic groups, Boy & Girl Scouts, USDA-Forest Service, USDI-National Park Service, MSU-Extension, LMAS-District Health Dept., MDNR, USDA-NRCS, and the Alger Conservation District.

What are the Munising Bay Watershed Restoration Goals and How Were They Prioritized With Local Input?

The goals of the Watershed Restoration Project as evinced by it's project partners, landowners, the Conservation District board, and other local input, are to **restore** and repair, impaired designated uses of the watershed. The desire is to mitigate and protect identified critical areas of the rivers, streams, drainages, and groundwater recharge areas of the watershed, and remove, reduce or minimize impacts or threats to the designated uses of surface flows and groundwater. This Project also seeks to establish long-term local watershed support, monitoring, and cooperative conservation and maintenance of implemented best management practices by volunteers and watershed partners, while furnishing educational opportunities for the local schools. Another desire expressed in words and actions of local units of government and citizens responding to our resource concern surveys, was to enhance recreational opportunities for all citizens while protecting the resources that recreation impacts. The degree of impairments to designated and (and desired) use of water resources were considered by a Watershed Committee. All surface water in Michigan is automatically designated by the State of Michigan and protected for the following designated uses with the exception of #5 below.

1. Agriculture- not impaired, historic use, but none currently or likely, less than 5% agricultural land on the watershed.
2. Industrial Water Supply- not impaired, historic logging use, none currently or likely
3. Public Water Supply- not impaired, historic use, none currently
4. Navigation- impaired by woody debris, but 90% of the watershed streams are too small for practicable navigation.

5. Coldwater Fishery (Special Category)- Streams in the watershed are State Designated, Regulated Trout Waters and are severely IMPAIRED by sedimentation
6. Warm water Fishery- Not applicable
7. Indigenous Aquatic Life and Wildlife- IMPAIRED natural food chain affecting all trophic levels, by sedimentation of stream bottom or "benthic" habitat.
8. Partial Body Contact Recreation- not impaired, wading by sport fishers is common on this watershed.
9. Total Body Contact (May 1- Oct. 31)- not impaired, but not used here due to year-round cold water temps.

Interested citizen stakeholders and some agency representatives serve on the watershed committee. Each agency listed above also has a designated watershed committee member who is either a partner or signatory on the planning grant. The committee and county and township boards are presented with regular updates and findings of the watershed inventory, assessment, and recommended actions. The committee helped guide the prioritization process and helped in choosing cost-effective long-term solutions acceptable to landowners. The main prioritization process was by representatives of the 3 main fiscal partners, AuTrain Township (Supervisor-George Lucier), the City of Munising (Commissioner- Charles Steinhoff), and Munising Township (Twp. Supervisor- Jim "Curly" Wrosch). These three people indicated their approval of the developing plan after reviewing resource concern survey returns, site plans and preliminary proposals and provided financial commitments for further support. The Anna River, being the largest of the stream systems within the watershed, and having portions of which fall within each partners' geopolitical boundary, was prioritized as the primary focus. A great deal of effort at improving the upper reaches of the Anna, has been expended by local landowners, the Boy Scouts, and MI-DNR Fisheries going back to the 1930's. Each of the three main partners then selected critical areas within their respective boundaries that occurred inside the designated topographic watershed boundary as a secondary focus. AuTrain Township agreed with our findings on the Furnace Creek system as a secondary focus due to the rapid development occurring there and the atrocious nature of the road-stream crossings (the only other large stream system within both the designated watershed boundary and theirs). The City of Munising rightly chose St. Martin's Hill erosion site as the major secondary focus of watershed efforts within their boundary, and Munising Township chose their McQuisten Recreation Area development that is a part of the Anna River system. All three entities acknowledge worries about runaway development, perceived coldwater fisheries degradation, and their tourism-dependent economies, fire protection, and a desire for enhanced public recreation and handicap access, and mitigation of known erosion sites. For wholistic and logical analysis, the watershed manager decided stream systems should be "worked" from headwaters to mouth to find problem areas. Problem or "Critical" areas discovered where then presented in a slide show format at township or city board meetings, to take comment both public and official. Findings and proposed critical sites were published in a second newsletter to garner further public comment.

Primary Watershed Concerns	Impaired Designated Uses
1. Eroding Stream Crossings & River Flooding	Aquatic life/Wildlife
2. Poor Fishing	Coldwater Fishery

Pollutants	Sources
1. Nutrients (suspected)	Livestock in Streams (not found)
	Failing Septic Systems (not found)

Residential Fertilizer Use (not in detectable levels)

2. Sediment (known) ---------- Found extensively in Anna River System and Furnace Creek System, and Sweats Creek, below road crossings; St. Martin's Hill site in Munising. Sources are eroding stream crossings, undercut banks, and stream banks at lower sand trap.

3. E.coli bacteria (suspected)-- Failing Septic Systems (not found)

4. Hydrologic Flow (known)-- Urban Storm Water (road and parking lot runoff, snowmobile trail runoff, road salt (chloride in winter)

5. Pesticides/Herbicides (suspected)-- not found, no agriculture on watershed, minor urban use probable.

6. Oils, Grease, Metals (known)-- not tested for, normally present in trace amounts but regulated in treated sewage wastewater, present in road, parking lot, and snowmobile trail runoff.

Impaired Use	Goals
Aquatic life/Wildlife	Restore fishery by sediment reduction
Coldwater Fishery	Restore fishery by sediment reduction

Desired Uses	Goals
Recreational Trails	Harden high use access areas with trails, boardwalks
Protect River Corridor	Encourage buffer plantings and zoning regulations

Problem Statement-

To follow the guidelines laid out in numerous DEQ training sessions, and avoid or address previous "band aid" fixes of problem areas, the interim restoration plan will focus on the following priority actions and critical area treatments. These actions are deemed necessary to **restore** the impaired primary designated use as recreational cold water fisheries, of the Anna River and Furnace Creek systems of the Munising Bay Watershed. The lower stretches of both the Anna and Furnace systems are listed in the 2002 DNR- Inland Trout and Salmon Guide as Type #4 designated trout waters, open to Salmonid fishing all year. The upper stretches and all other streams on the watershed are listed as Type # 1 designated trout waters, with April-September seasons. Sedimentation of gravel and rock substrates has seriously impaired spawning of native fishes, and reduced cover and available habitat for aquatic insects and fish forage species. Sedimentation has provided increased habitat for the invasive non-native Sea Lamprey, facilitating reproduction of this species. Sedimentation has also reduced depth, created hydrologic instability, and widened stream channels, creating further erosion, and increased the frequency and potential for flooding and further property damage to homes and road systems.

Priority One: The Anna River System Restoration

Due to catastrophic sediment events caused by a 1960's highway project, a private artesian well blowout, and the erosion from several failed railroad crossings, the DNR-Fisheries Division litigated stream mitigation with Wisconsin-Central Railroad. This resulted in the installation of two sand traps and six spawning beds on the middle section of the Anna River. The responsible well owner provided a location for one sand trap, then the railroad upgraded their crossings, provided a location for the second sand trap, and built both traps. This was a classic "band aid" fix since the action failed to address sediments entering upstream from the two, very bad Perch Lake road crossings, Valley Spur Creek, and the sediments lost downstream and accumulated historically on the low gradient portion of the lower Anna

River at the time of the catastrophic event. At the time of these most recent sediment events, the Anna had not recovered from the 1960's highway project sediment event that covered at least 60% of available spawning substrates present at the time. The Anna River is barely able to keep up in terms of flushing, with the current annual inputs from natural erosion, tributaries, and existing road-stream crossings, and is unlikely to flush the buried cobble and boulders free from the previous catastrophic inundations without physical assistance. The Hiawatha National Forest has acknowledged the high quality and potential of this river system and recently invested in significant fisheries improvements (6 small k-dams) to the major Valley Spur tributary to the Anna, recently cleaning out the large sediment trap pond they have on the stream just upstream of highway M-94. So a reduction in sediments from the Valley Spur Creek source has already been addressed, with a mechanism in place to trap sediments from any future events. On the Anna River, one Wisconsin-Central sand trap is located immediately below the inlet of Valley Spur Creek on the Pasinaeult property, so interception of sediments from Valley Spur Creek, below the Valley Spur sediment trap, is occurring as long as the traps are cleaned annually. This only leaves two bad upstream road-stream crossings at the Perch Lake Road, the Anna River low gradient area sediment and debris accumulation, bank stabilization, rip rap, filter strip plantings, and removal of the defunct bridges and timber obstructions to address for a wholistic restoration. For a wholistic successful restoration, logic dictates working systematically from upstream end of systems to their mouth, addressing each critical area before moving downstream to the next one.

First Proposed Action: Installation of BMP'S and bottomless culverts at the Perch lake road crossings of the headwaters of the Anna River.

Both upper Anna River road-stream crossings (north and south branch) are located on a private access road (Perch lake Road) owned by Shelter Bay Forests, with deeded access to Perch lake property owners and others in the area. The extant crossings were installed years ago, before Shelter Bay ownership, when the road was narrower. They now are squashed and deformed from logging and gravel hauling traffic, too short for the road width, and have zero slope at culvert ends for riprap stabilization. They are undersized to the extent they back up during storm flows and exacerbate erosion occurring from the embankments, around the culverts, and constantly from the road surface. In addition the approaches slope down to the crossings, resulting in some other visible roadside and ditch erosion reaching the river at and immediately over the culvert ends. The site owner, Shelter Bay Forests, has provided a written commitment to cost share BMP's at both crossings.

The proposed BMP's for the Anna River/Perch Lake Road crossings are:

1. Replacement of the short, squashed, undersized round culverts with a wider and longer reinforced aluminum inverted arch culvert. This will answer several needs for restoration of the system. First it will allow enough culvert length to adequately riprap the culvert ends without expensive wingwalls and headwalls, and allow us to raise the road surface at the crossing to slope the immediate approaches away from the crossing. Use of HS-25 (40-140 tons) load-rated culverts will assure continued resource extraction (logging and gravel) and landowner construction activities without future culvert damage. The wider but similar height profile of the proposed culvert will stop the backup of water during high flow times and the associated erosion problems. The bottomless design will return stream bottom to natural, and aid in fish and aquatic insect migration. The multi-plate assembly with metal footing plates of the ConTech brand culverts, facilitates lower site preparation, assembly and installation expense. This allows quick installations of usually less than one day once the site is prepped

The aluminum arch culverts have the lowest maintenance costs, wider acidity (PH 3-9) resistance than steel culverts, an indefinite life span (+100 years) or more in our water quality) due to their corrosion resistance, and have a proven long-term performance record even in highly abrasive or corrosive situations such as tidal estuaries and salt water environments.

2. Several ditch turnout/diversions consisting of rock-lined channels, would be put in place along the crossing approaches to control down slope erosion of road and ditch surfaces. Rip rapped areas (culvert ends, embankments and turnouts) would be underlain with erosion fabric during installation and staked with native plants or shrubs, and seeded at completion for additional filtering and infiltration capability.

3. We have already had one-half day of engineering measurements taken on these two crossings by an NRCS Watershed Engineer, for site plan development. NRCS Site plans are nearly completed, and we have been informed that the proposed culverts fit the stream profile and road bed perfectly, coming within 3" of current road height, and allowing more road fill.

Second Proposed Action: River Cleanup and Spawning Bed/Habitat Restoration on the lower Anna River. Due to the original native rocky substrate and low gradient on the lower Anna, sediments accumulating on this stretch have proven resistant to flushing. Sediments accumulated suddenly and continued for an extended period before upstream mitigation stopped the main, recent catastrophic sediment sources. This buried much of the native cobble and boulders beyond their ability to flush seasonally to the mouth area. To answer the problem of resistant sediment deposits and restore salmonid spawning and forage insect/fish habitat we would like to initiate the following BMP's.

1. Starting at the confluence of Wagner Creek (a sediment pool) and the Anna River, we would like to purchase and use two small, inexpensive, self-powered diaphragm pumps to systemically desilt the 2 mile long, flush-resistant areas of the lower Anna River down to the mouth area. Care would be taken not to deposit sediment into any wetlands. We would pump sand-laden water into reusable, silt-fence corrals to collect sediment and allow water to leak back over plastic sheeting to avoid any erosion from our actions. We have received offers from landowners, 44 individuals that volunteered for in-stream restoration work, and interest from schools, boy scouts, etc., to accomplish this work at a low cost (materials and supplies). The small diaphragm sediment pumps would also serve our long-range plans and would be used to service the Anna River sand traps and the sediment pool at the Wagner Creek tributary, long after the expiration of the railroad maintenance agreement. The resulting increase in stream depth (6"- 24") should increase stream stability, reduce likelihood, extent, and duration of flooding, increase stream channel velocity, reduce widening, meander and bank erosion, and without the current sediment input from the upper river, facilitate the flushing of annual natural sediment loads.

2. Following or accompanying the sediment removal as we work our way downstream, would be the installation of "velocity" rocks or groups of rock in areas lacking boulder-size cobble. These aid in natural sand flushing during high flow times, and serve as "fish loafing stations" during spawning migrations, and provide cover for forage species. DNR-Fisheries Division would guide final placement of such structures.

3. Once sediments are removed and scour zones are created with the aid of the first two BMP's, areas would be designated for restoration and/or creation of spawning areas. George

Madison of MDNR-Fisheries, estimated there would be an opportunity to restore spawning areas from Wagner Creek downstream, with a minimum of 10,000 square feet of spawning bed on the Horseshoe Falls Creek confluence with the lower Anna River area.

4. Volunteers, landowners, and staff would also be used for a Lower Anna River cleanup, to remove a large amount of old tires, vehicle parts, oil drums, metal, and other unnatural debris. Volunteers and staff would also assist with removal of the old electric salmon weir abutments on the Bruce Cromell property, and old bridge timbers located below highway H-58, with the permission of DNR Fisheries, Regional Supervisor, Steve Scott (received) and DEQ permits. Volunteers, landowners, staff, and the City of Munising would also assist with transport and disposal of debris.

5. Improvements should also include the proposed riparian tree and shrub planting for bank stabilization and shade on the Pasinaeult and Cromell properties, and for filter stripping between the Anna River and the City Snow Dump area near Horseshoe Falls Creek.

Third Proposed Action:
1. Landowner and watershed volunteer, Bruce Cromell, has indicated an interest in cost-sharing the replacement of the small (30' x 9'), subsiding and rotten, wood, access bridge, and stabilizing the associated critically eroding stream banks, undercuts, and the weir sites through native plantings, fascine bundles, and rock rip rap. The bridge is a necessary (and only) access to an occupied rental house. The house has suffered flood damage repeatedly since the sediment deposition of the 1960's highway project decreased the river depth here about 1-1.5'. Since the 9' x 30' bridge is the only access to an occupied building, blocks the river at high flow times, and spring breakup, exacerbating the scour and erosion instability on site, it is a prime candidate for inclusion in our restoration plan.

Fourth Proposed Action:
1. Before we move on downstream on the Anna River system, we should discuss the BMP's planned for the Wagner Creek tributary, at the eroding culvert on the Cox Pond/Robert McQuisten Recreation Area. Due to lower flows and recreational development plans by Munising Township, this site only needs repair, not replacement, with the aim of hardening a high-use area, mitigating erosion occurring on site, and enhancing recreational access. BMP's would consist of pulling back the existing improperly placed riprap, and proper placement of erosion fabric, accompanied by redesign and reshaping of the inlet/outlet area. The township has applied to the Fisheries trust fund for a grant to Plant Brook Trout, dredge the upstream side to facilitate habitat improvement, and installation of a fish barrier to keep planted fish from migrating down over the Wagner Falls. The dredging will facilitate and enhance the placement of a Munising Township dry hydrant for fire protection at this site as well. We intend to use the site for at least two erosion control workshops where participants would engage in hands-on placement of materials, including proper sized riprap. Some provision needs to be made to prohibit vehicle access to the streambed at this point. This may be accomplished through connection to the McQuisten handicap-access boardwalk on the upstream (east end) side, and construction of a fishing access or wildlife viewing deck on the downstream (western end). The township has already secured a large Michigan natural resources trust fund grant for the recreation area development.

Eventual Future Action on the Anna River:
1. Below H-58, to the mouth of the Anna River, we have chronic severe erosion occurring along the Kimberly-Clark Paper Mill settling pond. Old dock or walkway timbers protrude

into the river along the west bank at this site, causing bank scour, slumping, and some subsidence. Many old timbers from historic road crossings or other structures, stick up vertically from the river channel contributing to the ice and water damming and erosional processes that occur at ice breakup, snowmelt, and other high flow periods. We believe the old timbers could be easily removed at no great cost, but the bank erosion along the Mill property needs further study as to the best solution, given its proximity to Lake Superior and frequent inundation. Toward this end we have an erosion-control engineer specialist, (scheduled for May 16, 2002), to tour all the problem sites on the watershed and give recommendations for mitigation techniques, cost savings to proposed BMP's, etc.
2. Further study is necessary, to determine whether additional filter stripping, or installation of perforated drain and (buried) vortex/separator boxes are necessary or prudent between the snowmobile/ATV trail and the Anna River. The trail runs parallel to the river for 300-400 yards, directly crossing two small drains, and the river itself (a wooden bridge), all of which may impact the river with oil and fuel contaminated runoff. The parking areas surrounding the lower Anna also allow runoff to flow directly off surfaces into an open ditch storm drain system that empties directly into the river just below the M-28 bridge.
3. A small stand of the invasive exotic plant, Purple Loosestrife is growing on the lower Anna River corridor near the Hardee's Restaurant. Pictured Rocks is working with the watershed manager to develop a plan for hands-on educational workshops to address this problem starting in the spring-summer of 2002. This would involve consultation with the botanists of the local Forest Service, Park Service, and our Forester to develop remediation.

Priority Two- City of Munising – St. Martin's Hill/Varnum St. Extension:
1. This steep and difficult critical erosion site would be re-shaped with heavy equipment, lined with 2 types of Curlex (aspen sandwiched between mesh) erosion fabric "stapled" or pinned to the slope, and receive at least six rock check dams over the fabrics, and at least six rock-lined diversion-turnouts, seeding, and stakes of native, shade-tolerant shrub species. Shade tolerant shrubs will be staked on the check dams as well to hold them in place and provide increased down slope filtering and infiltration effect. This should effect a long, sloping "grassed" waterway for better infiltration and completely "heal" the site. Fabrics would be anchored and buried at roadside, then the final BMP would be paving (2,640') of the road surface. This large-scale critical erosion area has a high potential as a demonstration site for soft engineering practices.

Priority Three- Furnace Creek System
1. Here we depart from the upstream first priorities used for the Anna river restoration rationale. Due to recurring overtopping problems, and the immediate availability of non-CMI funds ($10,000) from USFWS, First proposed action on this system would be engineering of a site plan and the replacement of the outlet culvert of Furnace/Carr Lake with an longer and wider, arched box culvert. This site has also been selected for installation of a dry hydrant for AuTrain Township fire protection, and placement of a lamprey barrier by USFWS-Lamprey Control. The Landowner has made a written cost-share commitment, and proposed providing the heavy equipment, labor, and culvert installation. The USFWS is willing to put $10,000 toward the costs of materials and installation of the removable lamprey barrier in the new culvert. Other associated BMP's would include erosion fabric, riprap, head and wingwalls, and raising the roadbed to slope away from the crossing. The proposed culvert would be a box arch with bottom, and would offer almost three times the current culvert cross-section, alleviating the overtopping and road erosion occurring frequently at this time. Since the materials and installation would be covered by the landowner and the USFWS, we feel it would be a good use of 319 planning money to immediately proceed with the engineering

and site plan. The USFWS has approved release of the funds for this fiscal year, and the culvert replacement would have to take place at low water time in August or September. All parties are anxious to proceed. The sediments confined in the lake lay below the lake outlet and are attractive to spawning Sea Lamprey. The Lake has a viable Northern Pike population, yet is a thoroughfare for migrating Coho Salmon, Rainbow/Steelhead, Coaster and Inland Brook Trout, Whitefish, Walleye, and White Suckers. We found Coho were able to make it as far upstream as the Ridge Road crossing of the Gangeau Creek, and the M-28 crossing of the Hanson Creek. This is a highly desirable project for restoration of the Furnace Creek System. The Old Lamprey Weir downstream in Furnace Creek needs some study in the future to determine whether it should be removed. Several landowners feel it has caused scour and sediment deposition, and should be removed, since it is no longer used.

2. The next priority action would be replacement of the culvert at the Hanson Creek Crossing of Hanson Estates (Jurmu property), and the three culverts at the Hanson Creek crossing, and two Gangeau Creek crossings located on the Carr Road at the back of Furnace/Carr Lake. The Carr property culverts are "atrocious" crossings and are well known to DEQ enforcement personnel (Joan Duncan, personal communication). They are also perched on elevated sandy roadbeds, placed over wetland soils with considerable perched water all around. The BMP's would include placement of rock substrate and bottomless aluminum arch culverts that match the bankfull width of the stream, and prevent the backup and ponding that chronically erodes the road surfaces into these streams. This road system is in a continuous high use area, close to a casino and housing development, as well as being used to access gravel and sand pits. It also provides an important access point for forest management. All of the culverts on these locations are smaller than DEQ storm calculations show would be advisable for smaller flows upstream. BMP's would include longer culverts, providing for proper roadside slopes for rip rap, erosion fabric, staking and seeding native plants, and adding road fill and gravel, elevating the roadbed at the crossing to slope drainage away from the crossing. This would completely restore the road-stream crossing to as close to natural as possible, with a permanent, no maintenance, high load (HS-25: 40-140 ton) solution. The Hanson at Jurmu crossing mitigation would include pulling caved riprap from where it has fallen into and blocks the flow channels at both ends.

4. The final action on the Furnace Creek system, is the replacement of the single culvert at the Ridge Road crossing of Gangeau Creek with a wider, longer, bottomless aluminum culvert with a high load rating (HS-25). It overly constricts flows, and blocks the upstream migration of salmonids, is undersized and too short, and causes ponding and erosion of organic mucks into the creek upstream of the culvert. BMP's would be similar to the other crossings, including erosion fabric, elevating road surface, extra culvert length to allow riprap at roadside at a proper slope, but would also include two sediment logs or fascine bundles, staked across the upstream roadside sediment pools, and placed at either side of the flow channel. This would stop the migration of muck into the stream at this site, catch the sediments, and allow emergent plants and grasses to eventually vegetate the erosion area.

Furnace Creek System: Future Considerations:

During the last week of April, a major sediment event occurred on and adjacent to a 29 acre site just southeast of Furnace Lake, owned by Mr. Kevin Kolbus. The site was developed illegally without permits, and operates as a dirt racetrack for cars, trucks, motorcycles, ATV's and snowmobiles. As a result of unusual warm weather and sudden snowmelt, it experienced major slope failures, gullying and rills, and resulted in sediment inundation of a small wetland on adjacent property owned by watershed cooperator, Shelter

Bay Forests. Because of the high clay content of the soil, clay-laden water flowed downslope along an intermittent but well vegetated topographic drainage channel to the headwaters of the west branch of Gangeau Creek. Most of the heavy sediment was intercepted by vegetation and trapped by the roadside ditches and the adjacent wetland area, so did not make it to the permanent stream channel. Suspended fines transported as clay-laden water did flow through the channel directly into Carr/Furnace Lake, and then on into Lake Superior for a period of about 2 days. Subsequent rains washed evidence of the fine silt from the vegetation but flow patterns in last years' dead vegetation were clearly evident.

This large-scale site will require further study and analysis as to mitigation options, and may be subject to litigation by DEQ, due to apparent violations of the Soil erosion and Sedimentation Act, Inland Lakes and Streams Act, and the Wetlands Act. The landowner is eager and willing to find a solution, or apply for cost-share practices under the watershed restoration plan, but indicates the racetrack enterprise is virtually insolvent.

Pollutant Sources	BMP Reference	Potential BMP Systems
Road-Stream Crossings	Michigan Guidebook for BMP's & DEQ training notes	stream crossings BMP's
Streambanks	Michigan Guidebook for BMP's & DEQ training notes	stabilization BMP's
Failing Septic Systems	Information & Education	referral to Health Dept.
Residential Fertilizer Use	" "	referral to Cons. District
Residential Herbicide Use	" "	referral to Cons. District
Residential Pesticide Use	" "	referral to Cons. District

Watershed Management in Alger County: Successes & Frustrations
Long-Term Planning

Several successes: We have garnered a lot of local support and attention through establishing a popular educational program for the Mather Middle School described in the methods section of this paper. The schools desire to continue involving science students in watershed and water quality monitoring as a component of their science education. We have began to work with the local High School, and have also worked with the Boy Scouts who desire to be involved with fisheries enhancement efforts, as they have done successfully in the past. We have a significant number of volunteers (62), who have indicated a willingness to work on watershed projects. We now have the testing and survey equipment to continue long term educational efforts, monitoring of water quality, sedimentation, and improvements in populations of aquatic life and wildlife on the watershed. We possess the tools for mapping and photo documentation as well as training and equipment to facilitate reporting. We have assembled a considerable list of reference materials, BMP manuals, DEQ training notes, etc. Throughout the watershed planning process, the Alger Conservation District and its watershed manager have advocated the establishment of a county soil erosion control, and permitting program, to bring the county into compliance with state law, further protect county soil and water resources, and exert some control mechanism over runaway development. The district created sample budgets and offered to take on the role for the county as districts have done in other parts of Michigan. The County Board however, recently designated a ½-time erosion control officer and program, to be administered by the County Road Commission and supported by county money and permit proceeds. The watershed manager is already working with the new enforcement officer, conferring on several site mitigations, and to help develop a rapid response plan and a modest list of

materials and equipment desirable for emergency intercession measures for catastrophic flood and sediment events, oil and gas spills, toxic chemicals, or other likely natural resource emergencies not already covered by other agencies. Such materials could consist of erosion fencing and fabrics, staking, absorbent floating booms for aquatic spills of oils, hydrocarbons, caustics, etc., in common use or transported though our area.

Our hopes of establishing riparian and shoreline buffer language in current new county zoning code developments were not so successful, and have been delayed. The County board turned zoning over to the townships, so all programs are starting from scratch this spring. Most townships have not peopled or convened the necessary boards yet. The township of Rock River, responded by a declaration that there will be no zoning! This unforeseen event will make unified county-wide zoning difficult and maybe impossible. Most townships will enforce some sort of local zoning similar to what has been established, and we will still have a chance to educate the new zoning boards on desirable watershed and well head protection buffer language.

Another success, and attempts at enhancing groundwater protection, resulted in the discovery of 3 abandoned wells through presentations and advertising. Though all three were located outside the set watershed boundary, we are facilitating closure by providing guidelines and technical advice to the State Forest, who is closing the only dangerous, open pit well at their cost. The fate (and ownership) of the other two (a steel pipe and concrete boxed pipe) are of lower priority and yet to be determined. We held a dry hydrant workshop, well attended by county fire departments, and provided guest speakers and printed technical guides, and grant assistance information. Later we located water resource locations for 3 new dry hydrants on area streams for 3 township fire departments. A dry hydrant on the watershed we helped engineer previously has been used several times!

Munising Bay Watershed Restoration Plan Summary

The Munising Bay Watershed Restoration Project fostered a unique partnership between a variety of state, federal, and county agencies, and brought together area residents, community, and local and county government over the issues of watersheds degraded by erosion and sedimentation, impaired fisheries and potential threats to groundwater supplies. The local governments involved, unanimously supported a wholistic vision of watershed restoration efforts, to the point of providing the cash match to secure a Section 319 planning grant. The Restoration-Implementation Plan is based on a planning process that educated the public and gathered local input on watershed, natural resource, and resource-related recreational concerns and priorities. The watershed plan investigated and identified the causes, sources, and degree of degradation or impairment, and recommended action to mitigate, restore designated use, and protect impacted areas through direct physical and bioengineering techniques, conservation easements, or planning and zoning changes. The watershed plan created a network of interested stakeholders, partners, and volunteers who will continue to support the watershed goals and maintain installed practices into the future. The Munising Bay Watershed encompasses ~30,000+ acres comprised of 74% forest, 13% wetlands, 10% urban, and 3% agricultural. The primary designated use for streams on the watershed, are as recreational cold-water sport fisheries.

In addition to providing meaningful progress toward Lake Superior LAMP goals (Lakewide Area Management Plan), the implementation of the restoration plan and best management practices identified for each critical priority site, will greatly enhance and restore severely impaired, designated use of coldwater fish and invertebrate prey habitat through sediment input reduction and removal. This will also improve and increase spawning areas available

for whitefish, walleye, smelt, trout and salmon. Filter strips and riparian buffer plantings will stabilize stream banks and reduce runoff of contaminants from lawns, roads, parking areas, and the municipal snow dump. Boardwalks and fishing platforms will harden high use areas, minimize negative impacts to native vegetation and erodable soils, and enhance public access and multiple-use goals identified by project partners. The stabilization of a critically eroding slope in the City of Munising will greatly reduce direct sediment input into the harbor and fishery of Munising Bay of Lake Superior, and would serve as a great demonstration site for modern bioengineering techniques.

Following this summary is a list of Sites, BMP's, and costs. In the Appendixes for each stream system or individual stream site are data sheets, site plans, photographs of sites or problems. Stream station description data sheets contain water quality, flow data, and stream bottom types and sediment embedment information. Issac Walton League Stream Quality Rating guides based on aquatic insect populations and diversity are also included.

The implementation plan was originally scheduled to occur over a three-year time schedule, as submitted in our implementation grant proposal. It was to be performed by the Watershed Manager and the Alger Conservation District.

Munising Bay Watershed Implementation Projects

Watershed Site | **Practice** | **Cost Estimates**

1. Anna River –Buffers: Plant Buffer Strips of clumps of Native trees and shrubs for shade, wildlife habitat and bank stabilization on several parts of the River Corridor (cage cedar clumps from deer browse)---------- ESTIMATED PROJECT TOTAL -- **$ 2000**

2. Anna River headwaters- North Branch- Replace 24' x (5'4"x 3'5") oval steel culvert with: Contech bottomless aluminum arch culvert **No. 5B (10'6"x 5'7"x 32')**
@ Perch Lake Rd **HS-25 –($240/ft.)** ---------- $ 7,680
Shelter Bay Forests
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 7,080
Engineering ---------- $ 5,500

ESTIMATED PROJECT TOTAL -- **$ 20,260**

3. Anna River headwaters- South Branch- Replace 24' x (5'4"x3'5") oval steel culvert with: Contech bottomless aluminum arch culvert @ Perch Lake Rd
No. 5B (10'6"x 5'7"x 32') HS-25 –($240/ft.) ---------- $ 7,680
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 7,080
Engineering ---- $ 5,500

ESTIMATED PROJECT TOTAL-- **$ 20,260**

4. Anna River Improvements @ Horseshoe Falls Creek- Gravel for Spawning Bed
City of Munising & Large Rock for Fish Loafing Stations---------- $ 3000
Plant vegetative filter strip between stream and snow dump --------- $ 1000
Installation, Permits, -------- $ 3500
Engineering ---------- $ 3000

ESTIMATED PROJECT TOTAL-- **$ 10,500**

5. Gangeau Creek @ Ridge Rd. Replace 34' x 5' round cement culvert with Contech Aluminum
Alger County Road Comm. bottomless aluminum arch culvert **No. 5B (10'6"x 5'7"x 42')**
AuTrain Twp **HS-25 –($240/ft.) loading (40-120tons)**------- $ 10,080

Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 9,500
Engineering ---------- $ 5,500

ESTIMATED PROJECT TOTAL -- **$ 25,080**

6. Gangeau Creek @ Carr Replace 20' x 5'2" round steel culvert with Contech Aluminum
Property West bottomless aluminum arch culvert **No. 5B (10'6"x 5'7"x 28')**
AuTrain Twp. **HS-25 –($240/ft.) loading (40-120tons)-** ------ $ 6,720
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 6,220
Engineering ---------- $ 5,500

ESTIMATED PROJECT TOTAL -- **$ 18,440**

7. Gangeau Creek @ Carr Property Replace 1, 20' x 20" round steel culvert and Replace 1, 20' x 2' round steel culvert with **One** Contech Aluminum bottomless aluminum arch culvert
AuTrain Twp. **No. 5B (10'6"x 5'7"x 28') HS-25 –($240/ft.) loading (40-120tons)**-------- $ 6,720
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 6,220
Engineering ---------- $ 5,500
ESTIMATED PROJECT TOTAL -- **$ 18,440**

8. Hanson Creek @ Hanson Estates: Replace 22' x 10'8" home-made steel "tank" culvert with: Contech bottomless aluminum arch culvert
AuTrain Twp. **No. 17c (12'3"x 4'5"x 30') HS-20 loading (37-40 tons) --($290/ft)** ------ $ 8,700
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 8,200
Engineering ---------- $ 5,500

ESTIMATED PROJECT TOTAL -- **$ 22,400**

9. Hanson Creek @ Carr Rd.: Replace 48' x 6' round steel culvert w/ : Contech bottomless aluminum
AuTrain Twp. **No.13c , (12'1 x 6'7 x 50') HS-25 – loading (40-120tons)** --($340/ft)----------$ 17,000
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap --------- $ 16,500
Engineering ---------- $ 6,000

ESTIMATED PROJECT TOTAL -- **$ 39,500**

10. Furnace Creek @ Carr Rd.: Replace 16' x 6' round steel culvert w/ ------
Furnace/Carr Lake Outlet **No. 13c , (12'1 x 6'7 x 20') HS-25 loading** ------($340/ft)----$ 6,800
AuTrain Twp. **Headwalls and Wings** ---------- $ 3,000
Removable Lamprey Barrier ----------$ 400
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap ---------- $ 9,700
Engineering ---------- $ 6,000

ESTIMATED PROJECT TOTAL-- **$ 25,900**

11. Robert McQuisten Recreation Area @ Wagner Creek (Cox Pond):
Munising Twp. & Natural Resources Trust Fund- Install erosion controls at Road crossing----- $ 1,000
Phase I- Construct handicap accessible boardwalk & fishing platforms on Cox Pond ---------- $ 20,000
For Munising Bay Watershed share match of Phase I Construction and erosion mitigation
Trust Fund Application total for Phase I is $ 261,000

ESTIMATED PROJECT TOTAL-- **$ 21,000**

12. Sweats Creek @Reindeer Run Rd. Replace 29' x 3'5" x 5'8" round culvert w/ Contech
Alger Co. Road Comm bottomless aluminum arch culvert **No. 5B (10'6"x 5'7"x 38')**
AuTrain Twp **HS-25 –($240/ft.) loading (40-120tons)-** ------- $ 9,120
Bioengineering, Geo-membrane, Installation, Permits, Road gravel, Rock Rip-rap -------- $ 8,620
Engineering ---------- $ 5,500

ESTIMATED PROJECT TOTAL-- **$ 23,240**

13. St. Martins Hill @ Varnum St. Extension
City of Munising

6 Rock Checkdams ---------- $ 3,600
6 Armor Turnout Chutes ---------- $ 3,600
Curlex Erosion Blanket: 2,666 sq. yds. Curlex III---------- $ 2,266
1,180 sq yds Recyclex_TRM -------- $ 3,835
Reshape roadside and ditches, Bioengineering (Seeding/Staking), Installation, Permits, ---$ 30,000
Paving (2640')-- ---------- $ 50,000
Engineering ---- $ 15,000

ESTIMATED PROJECT TOTAL-- **$ 108,301**

14. Watershed-Wide: Sediment Removal from inaccessible and historic deposition areas of the watershed, performed by volunteers organized by the watershed project manager.

Sand/ Silt Removal w/ 2- 3" 5.5HP Diaphragm Sediment Pumps ------- **$ 2,600**
Float platforms for 2 pumps ---------- **$ 600**
2- 3" x 15' Coupled Intake hoses ---------- **$ 120**
2- 3" x 25' Coupled Discharge hoses ---------- **$ 80**
2- 3" x 50' Coupled Discharge hoses ---------- **$ 100**
Truck Freight (for 314 pounds) ---------- **$ 150**
2-shovels, 2- contractor wheelbarrows for sand removal by volunteers---- **$ 220**
Silt fence/Stakes for sand trapping (re-use site to site) ---------- **$ 200**

ESTIMATE PROJECT TOTAL -- **$ 4070**

15. Stream Cleanups for Hanson and Lower Anna, including weir and old timber removal add estimated ----------ESTIMATE PROJECT TOTAL- **$2000**

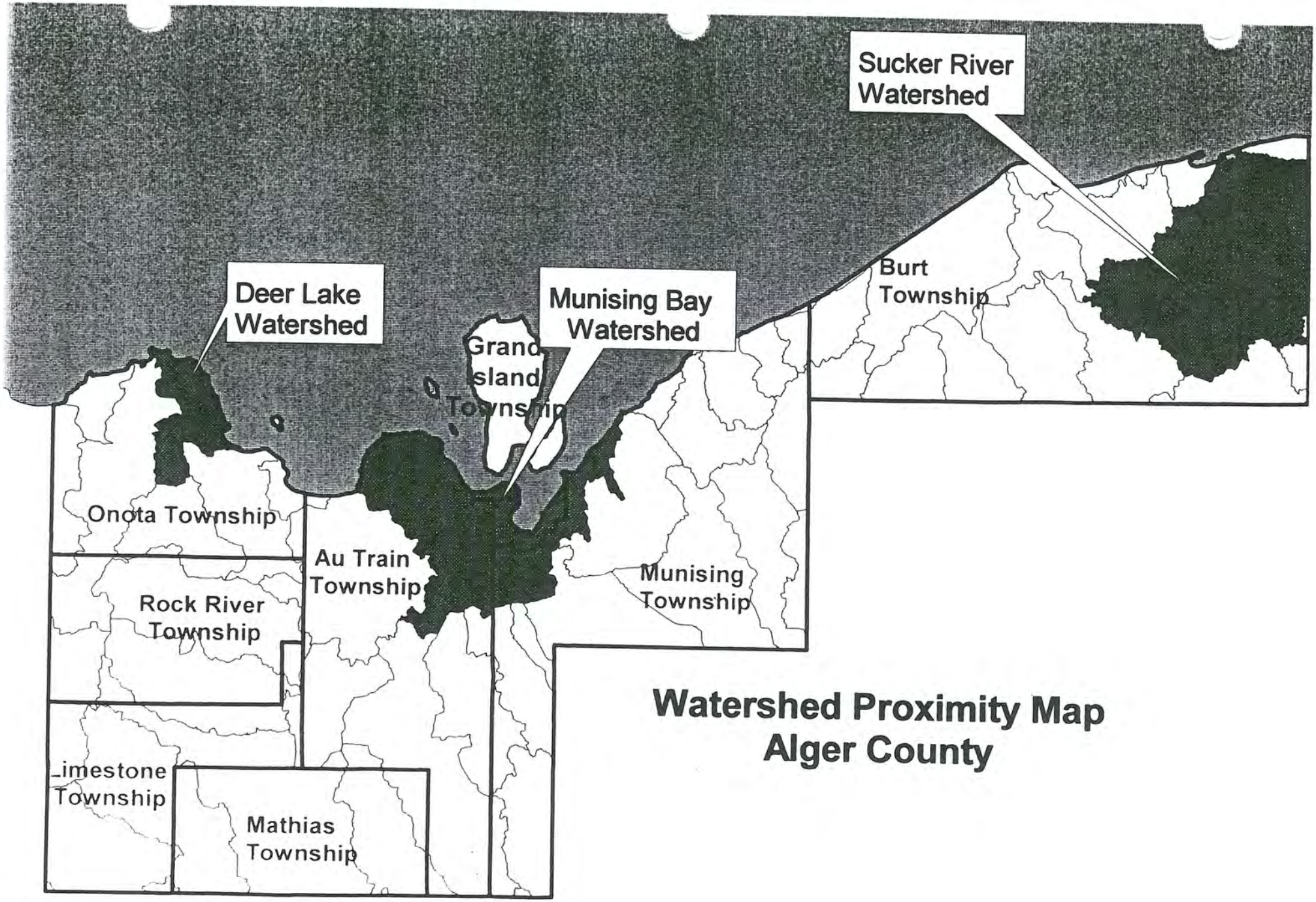
16. Bridge replacement cost-share at Bruce Cromell Property, including rip rap, staking, geomembrane, bank stabilization, ---------- ESTIMATE PROJECT TOTAL- **$7000**

Site #/ Name — May 16/2002 PH & Resistivity -- Soil Type

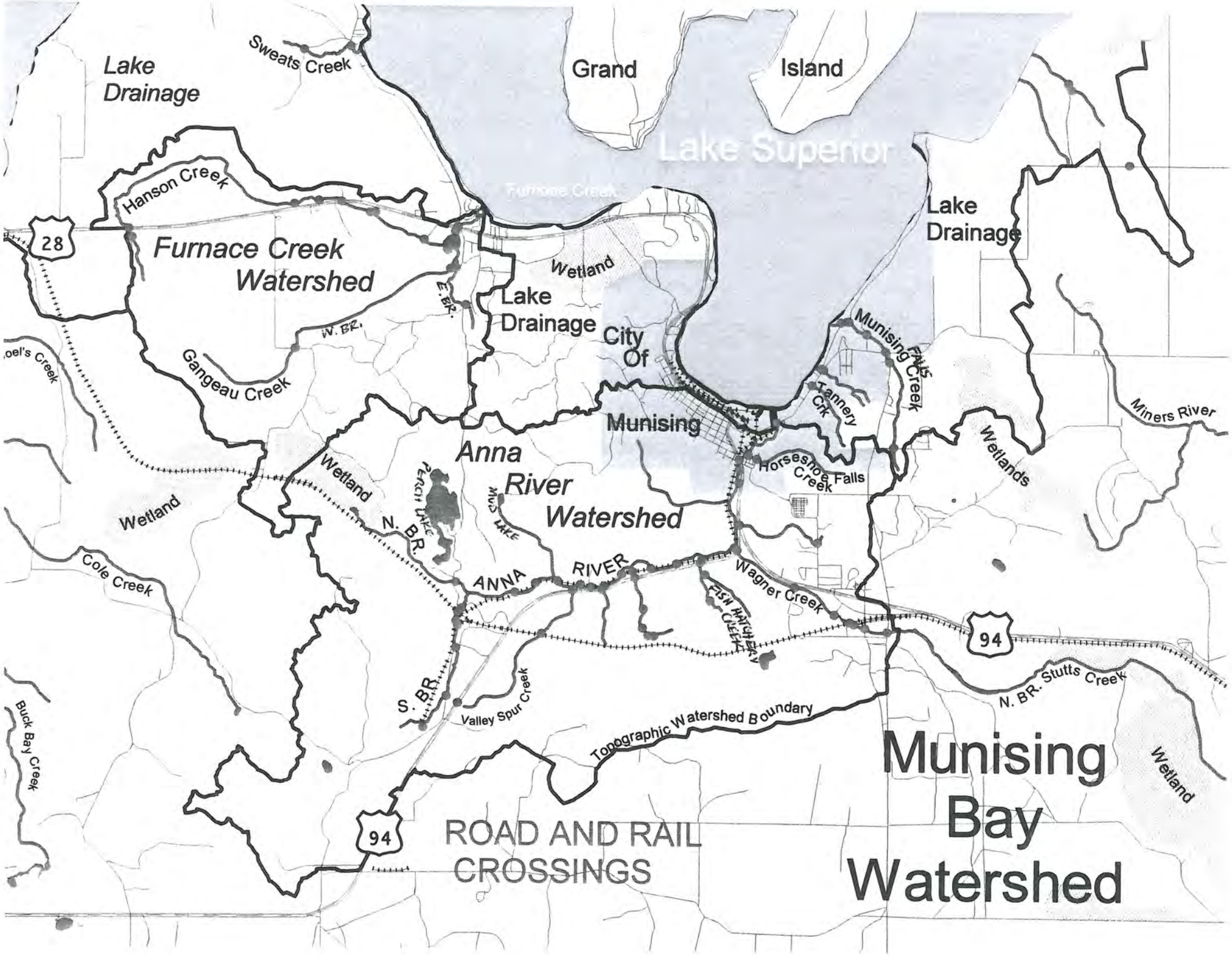
2. Anna River, N. Br.----- PH- 7.86, Resistance- 130 uS -- 76c- Garlic-BlueLake-Okeefe
3. Anna River, S. Br.------ PH- 7.40, Resistance- 107 uS -- 76e – Deerton-TroutBay
5. Gangeau @Ridge Rd.-- PH- 7.01, Resistance- 100 uS-- 57- Carbondale,Lupton,Tawas Mucks
6. Gangeau @Carr west—PH- 7.01, Resistance- 100 uS-- 57-Carbondale,Lupton,Tawas Mucks
7. Gangeau @Carr east--- PH- 7.12, Resistance- 96 uS--- 57- Carbondale,Lupton,Tawas Mucks
8. Hanson @ Hanson Est.- PH- 7.01, Resistance- 135 uS- 57- Carbondale,Lupton,Tawas Mucks
9. Hanson @ Carr Rd-- PH- 7.01, Resistance- 135 uS- 57- Carbondale,Lupton,Tawas Mucks
10. Furnace Crk @Carr-- PH- 7.37, Resistance- 128 uS- 57- Carbondale,Lupton,Tawas Mucks
11. Sweats Crk ---------- PH- 6.50, Resistance- 32 uS- This is a red flag for use of steel culverts, such low resistance, means high conductivity and high dissolved solids. Such conditions quickly corrode galvanized steel culverts.

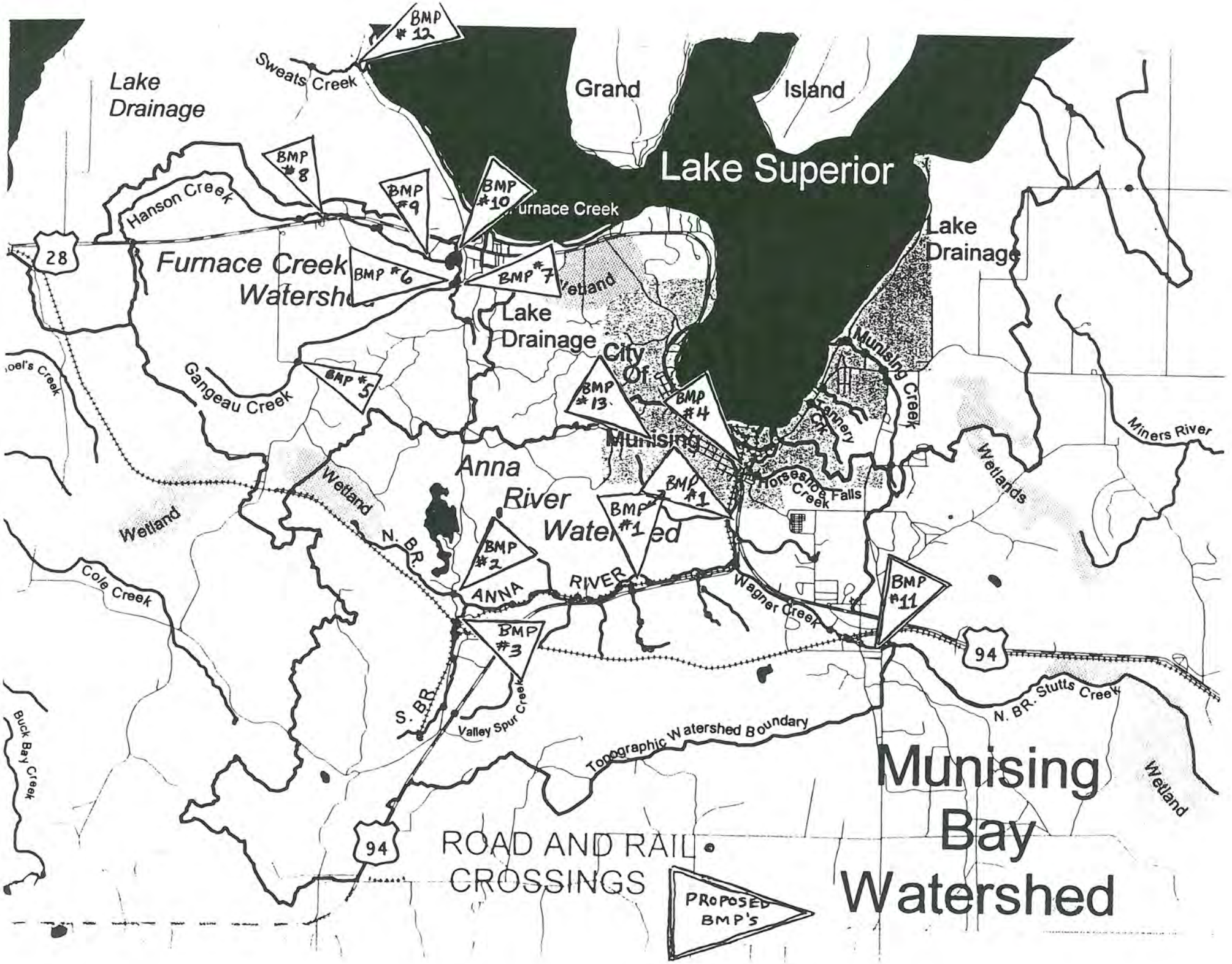
MUNISING BAY WATERSHED RESTORATION PROJECT- HYDROLOGY ESTIMATES

Stream System Segment	**Entrenchment Ratio** Flood Width/Bankfull Depth	**Meander Ratio** Meander Width/Bankfull Width	**Sinuosity Ratio** Channel /Valley Length	**Width to Depth Ratio** Bankfull Width /Bankfull Depth
Lower Anna River H58 bridge to 200' upstream of the M28 bridge	**362'/1.83' = 197.81**	**162'/21.30' = 7.60**	**3,800'/2,095' = 1.81**	**21.30'/1.83' = 11.64**
Middle Anna River From 200' upstream of M28 bridge to Valley Spur Tributary	**127'/1.37' = 74.70**	**110'/5.83' = 18.87**	**14,000'/11,212' = 1.25**	**5.83'/1.37' = 4.25**
Upper Anna River From Valley Spur Trib. To South Branch @ Perch lake Road	**60'/0.81' = 74.07**	**80'/10.33' = 7.74**	**9,000'/6,800' = 1.32**	**10.33'/0.81' = 12.75**
Gangeau Creek West (main) Branch, From Ridge Road to Carr Road	**154'/0.86' = 179.07**	**53'/9' = 5.88**	**13,800'/10,250' = 1.35**	**9'/0.86' = 10.46**
Hanson Creek From Hwy M28 to Furnace Lake @ Carr Property	**143'/0.92' = 155.43**	**45'/9.16' = 4.91**	**6,600'/6,000' = 1.10**	**9.16'/0.92' = 9.95**



Watershed Proximity Map
Alger County


Lake Drainage
Sweats Creek
Grand
Island
Lake Superior
Furnace Creek
Lake Drainage
Hanson Creek
28
Furnace Creek Watershed
E. BR.
W. BR.
Wetland
Lake Drainage
City Of Munising
Munising Creek
Falls
Tannery Crk
Miners River
Wetlands
Horseshoe Falls Creek
Gangeau Creek
Anna River Watershed
Wetland
Wetland
N. BR.
Perch Lake
Mud Lake
ANNA
RIVER
Wagner Creek
Fish Hatchery Creek
Cole Creek
94
N. BR. Stutts Creek
S. BR.
Valley Spur Creek
Topographic Watershed Boundary
Buck Bay Creek
94
ROAD AND RAIL CROSSINGS
Munising Bay Watershed
Wetland

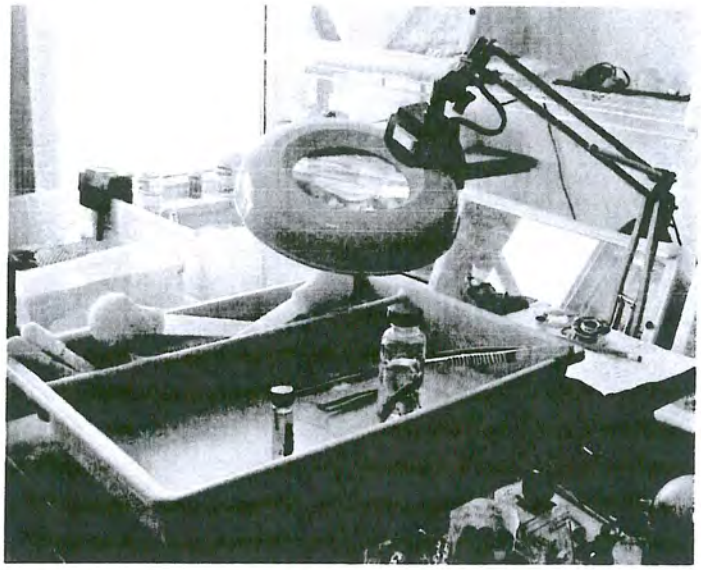

Lake Drainage
Sweats Creek
BMP #12
Grand Island
Lake Superior
BMP #8
BMP #9
BMP #10
Hanson Creek
Furnace Creek
28
Furnace Creek Watershed
BMP #6
BMP #7
Wetland
Lake Drainage
Lake Drainage
City Of Munising
BMP #13
BMP #4
Gangeau Creek
BMP #5
Munising Creek
Miners River
Wetlands
Horseshoe Falls Creek
Anna River Watershed
BMP #1
BMP #1
Wetland
Wetland
N. BR.
BMP #2
ANNA
RIVER
Cole Creek
Wagner Creek
BMP #11
94
BMP #3
S. BR
Valley Spur Creek
N. BR. Stutts Creek
Topographic Watershed Boundary
Buck Bay Creek
Munising Bay Watershed
Wetland
94
ROAD AND RAIL CROSSINGS
PROPOSED BMP's

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

FACILITIES AND EQUIPMENT

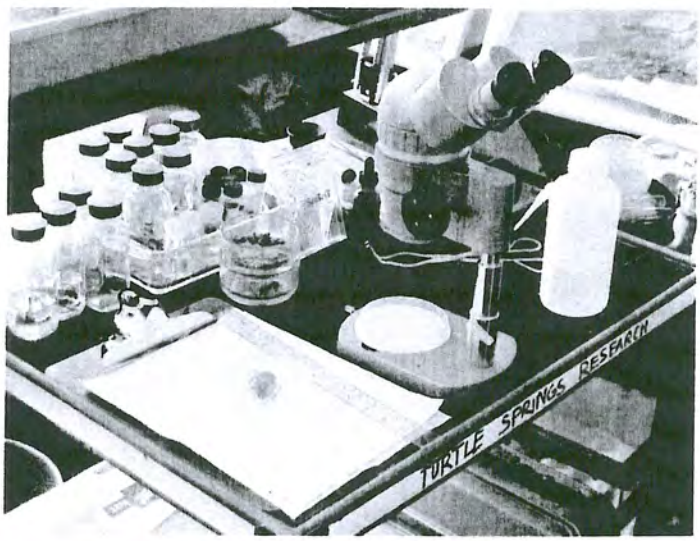
1. Munising office of the Munising Bay Watershed Restoration Project. Note the all-important wader dryer!

2. Turtle Springs Research Lab donated the use of a ventilated insect sorting facility with illuminated magnifyer and sorting trays. Specimens in photo are destined for watershed loan box

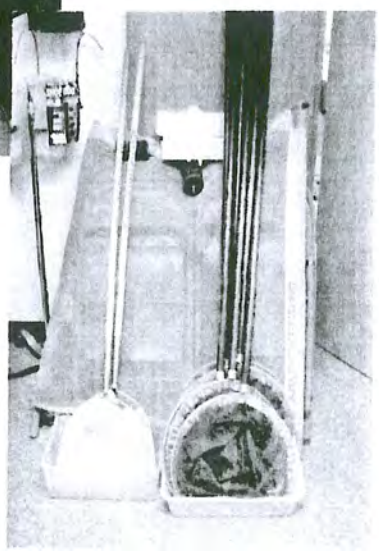


3. We borrow this 12v DC-220volt rectified backpack fish shocker unit from the US Fish and Wildlife Service, Lamprey Control, Marquette Biological Station. Volunteers and kids LOVE to help with inventory work!

4. Turtle Springs Research Lab has Dissecting and Compound Microscopes available for ID of the tiniest midge larvae and aquatic worms. Our solvents used for insect preservative are also stored in this facility.



5. Here we have our 2 insect dipnets (and kick net in the background) and six fish collecting dipnets



ALGER COUNTY NATURAL RESOURCE & RECREATION SURVEY

Number of Surveys Returned = 160

Natural Resource Concerns	# Responses	Percentage
Soil Erosion/Sedimentation	113	70.6%
Groundwater Protection	117	73.1%
Toxic Pollution (Air,Soil,Water)	119	74.4%
Illegal Dumping	129	80.6%
Abandoned Landfills	50	31.3%
Current Landfill	39	24.4%
Junk Cars/Vehicles	90	56.3%
Recycling Programs	94	58.8%
Forest Management	96	60.0%
a. Too much clearcutting	49	30.6%
b. Not enough clearcutting	2	1.3%
c. Clearcuts too large	5	3.1%
d. Habitat/Landscape Fragmented	5	3.1%
e. Against Hardwood Conversion	10	6.3%
f. Inadequate Buffer/Cover on Streams	12	7.5%
g. Replant more Logged Areas	4	2.5%
h. Littering on logging sites	7	4.4%
i. Not Enough Forest Diversity	11	6.9%
j. Improve Conservation Practices	7	4.4%
k. No more Pine Plantations	4	2.5%
l. Stop Closing Roads	6	3.8%
Tree/Shrub Planting	74	46.3%
Windbreak Planting	37	23.1%
Stream/Lake Buffer Plantings	96	60.0%
Wildlife Food/Habitat Planting	102	63.8%
Aesthetics	71	44.4%
Increase General Public Access	35	21.9%
Increase Handicap Access	89	55.6%
Increase Camping facilities	48	30.0%
Increase Hiking Trails	42	26.3%
Maintain Wilderness Areas	107	66.9%
Increase Wilderness Areas	60	37.5%
Too much Wilderness Area	5	3.1%
Shoreline Protection	82	51.3%
Increase Powerboat Access	28	17.5%
Increase Self-Power Boat Access	49	30.6%
Enhance Biodiversity	56	35.0%
Wetland Protection	105	65.6%
Uncontrolled Development	99	61.9%
More Zoning Restrictions	51	31.9%
Agricultural Concerns	22	13.8%
a.animal waste runoff	10	6.3%
b.fertilizer runoff	9	5.6%
c.herbicide runoff	8	5.0%
d.pesticide runoff	10	6.3%
e. rehabilitate old orchards	1	0.6%
f. plant stream buffers	1	0.6%
g. plant more windbreaks	1	0.6%

ALGER COUNTY NATURAL RESOURCE & RECREATION SURVEY

Number of Surveys Returned = 160

Recreation Categories	# Responses	Percentage
Power Boating	52	32.5%
Kayaking/Canoeing	99	61.9%
Sailing	19	11.9%
Jetski	12	7.5%
Hiking	107	66.9%
Camping	103	64.4%
Scenic Tours	89	55.6%
Biking/Mountain Biking	52	32.5%
ATV/Off-Road Motorcycle	35	21.9%
Snowmobiling	50	31.3%
Car/4wd Exploring	85	53.1%
Ice Fishing	77	48.1%
Stream Fishing	114	71.3%
Lake Superior Fishing	87	54.4%
Inland Lake Fishing	105	65.6%
Swimming	112	70.0%
Hunting	117	73.1%
Gun	105	65.6%
Bow	66	41.3%
Deer	100	62.5%
Bear	19	11.9%
Small Game	97	60.6%
Waterfowl	47	29.4%
Hunting with Dogs	27	16.9%
Trapping	2	1.3%
Film/Photography	75	46.9%
Birdwatch/Wildlife Viewing	83	51.9%
Horse/Domestic Animal Riding	11	6.9%
Snow Skiing	67	41.9%
Water Skiing	15	9.4%
Dog Sledding	21	13.1%
Waterfall Tours	4	2.5%
Scuba Diving	8	5.0%
Flying	1	0.6%
Snowshoeing	33	20.6%
Gardening	61	38.1%
Climbing	5	3.1%

ALGER COUNTY NATURAL RESOURCE & RECREATION SURVEY

Number of Surveys Returned = 160

FISHING PREFERENCES	# Responses	Percentage
STREAM FISHING:		
Brook Trout	127	79.4%
Rainbow Trout	99	61.9%
Brown Trout	72	45.0%
Coho Salmon	92	57.5%
American Smelt	120	75.0%
Walleye	120	75.0%
Suckers (White/Redhorse)	64	40.0%
Chubs	61	38.1%
Bait Minnows	85	53.1%
Grayling Restoration	111	69.4%
LAKE FISHING:		
Coaster Brook Trout	119	74.4%
Lake Trout	114	71.3%
Rainbow/Steelhead	91	56.9%
American Smelt	112	70.0%
Coho Salmon	96	60.0%
Whitefish	114	71.3%
Herring	64	40.0%
Walleye	127	79.4%
Yellow Perch	118	73.8%
Bluegill	101	63.1%
Bass	82	51.3%
Northern Pike	97	60.6%
Bait Minnows	82	51.3%
Support In-Stream Fisheries Enhancements and Road Crossing Upgrades		
YES	152	95.0%
NO	2	1.3%
Willing To Volunteer For Enhancement Projects		
YES	62	38.8%
NO	71	44.4%

Fisherman Preference Rating (Stream Fish 1-10)
(Lake Fish 1-13, 1=highest, 13=lowest)
Derived from cumulative score divided by # of responses

Cum.Score	Rating	RANK
188	1.48	1
312	3.15	2
388	5.39	7
365	3.97	5
404	3.37	3
439	3.66	4
522	8.16	9
540	8.85	10
577	6.79	8
488	4.40	6

Cum.Score	Rating	RANK
298	2.50	1
446	3.91	2
361	3.97	3
479	4.28	5
412	4.29	6
532	4.67	7
680	10.63	12
527	4.15	4
655	5.55	8
686	6.79	9
658	8.02	11
773	7.97	10
884	10.78	13

Alger Conservation District: NATURAL RESOURCE, RECREATION, & FISHING SURVEY

1. My recreational activities in Alger County are: Check all that apply !
__Power Boating __Kayaking/Canoeing __Sailing __Jetski __Hiking __Camping __Scenic Tours

__Biking/Mountain Biking __ATV/off-road Motorcycle __Snowmobiling __Car/4WD explore __Flying

__Ice Fishing __Stream Fishing __Lake Superior Fishing __Inland Lake Fishing __Swimming

__Hunting __Bow __Gun __Deer __Bear __Small Game __Waterfowl __Hunting w/Dogs __Climbing

__Film/Photography __Birdwatch/Wildlife Viewing __Horseback or other domestic animal riding __Garden

__Snow Skiing __Water Skiing __Dog Sledding __Scuba Dive __Other: _____

2. Fish Species usually sought or most important to me: Instead of a check, rate these species 1-10 for stream fish, and 1-13 for inland lake/Lake Superior fish (1=most important to you, 13= least imp.).
Stream Fish: __Brook Trout __Rainbow Trout __Brown Trout __Coho Salmon __American Smelt

__Walleye __Suckers (Redhorse, White, etc.) __Chubs __Bait Minnows *__Grayling restoration

Lake Fish: __Coaster Brook Trout __Lake Trout __Rainbow/Steelhead __American Smelt

__Coho Salmon __Whitefish __Herring __Walleye __Perch __Bluegill __Bass __Northern Pike

__Bait Minnows

3. I support in-stream fisheries enhancement projects such as removing sediments, restoring and creating spawning habitats for trout, salmon, and smelt, and upgrading the road crossings responsible for most of our sedimentation problems. __ YES __ NO

4. I am willing to volunteer to work on fisheries restoration projects. __ YES __ NO

5. My Natural Resource Concerns in Alger County include: Check all that apply !
__Soil Erosion and Sedimentation __Groundwater Protection __Toxic Pollution of Soil, Air & Water

__Illegal Dumping __Abandoned Landfills __Current Landfill __Junk Cars __Recycling Programs

__Forest Management (specify concerns): _____

__Tree/Shrub Planting: __Windbreaks __Stream/Lake Buffers __Wildlife Food/Habitat __Aesthetics

__Increased General Public Access __Increased Handicapped Access __Increased Camping facilities

__Increased Hiking trails __Maintain Wilderness Areas __Increase Wilderness Areas

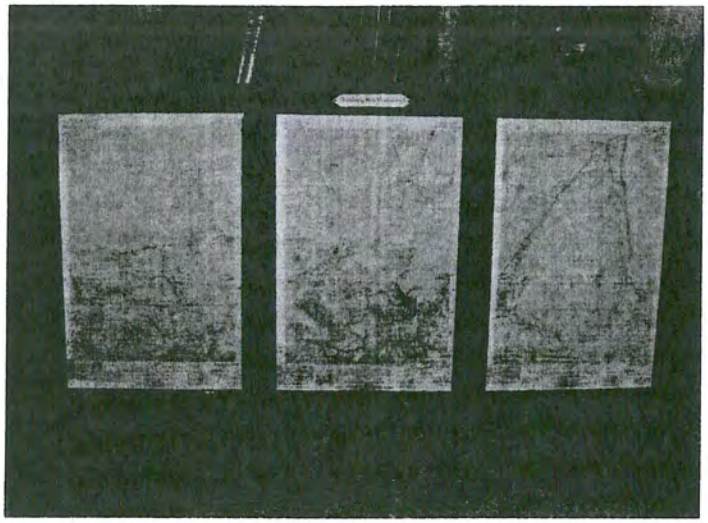
__Shoreline Protection __Increase in Power Boat Access Ramps __Increase in Self-Power Boat Access

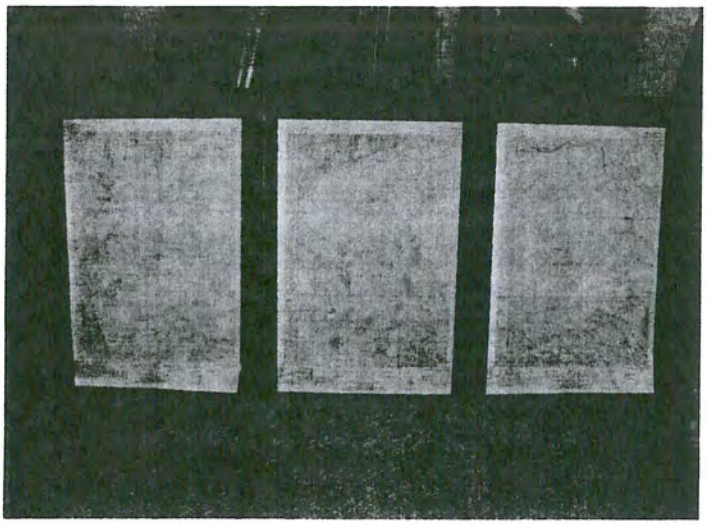
__Enhanced Biodiversity __Wetland Protection __Uncontrolled Development

__More Zoning Restrictions __Agricultural (specify concerns): _____

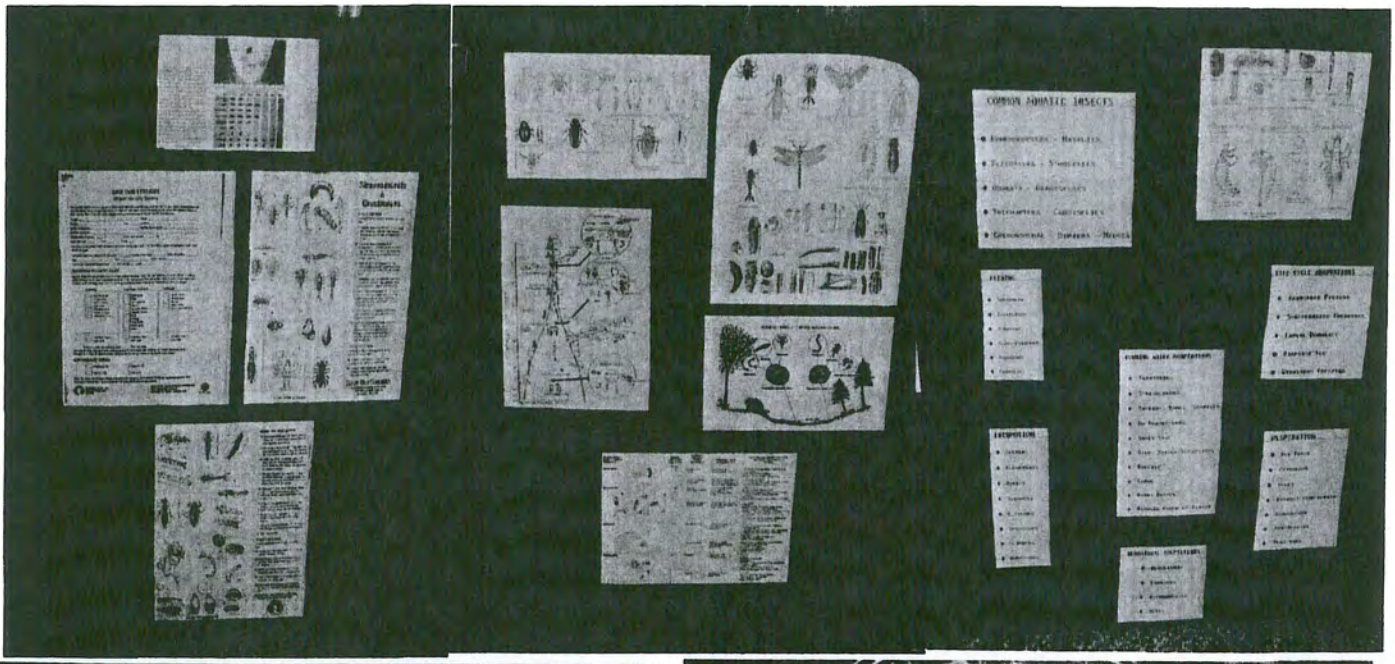
ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

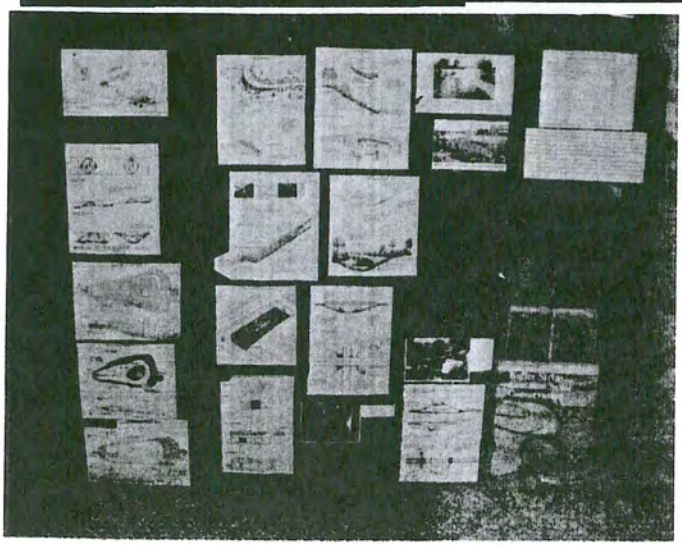
Information and Education: Portable Display Boards

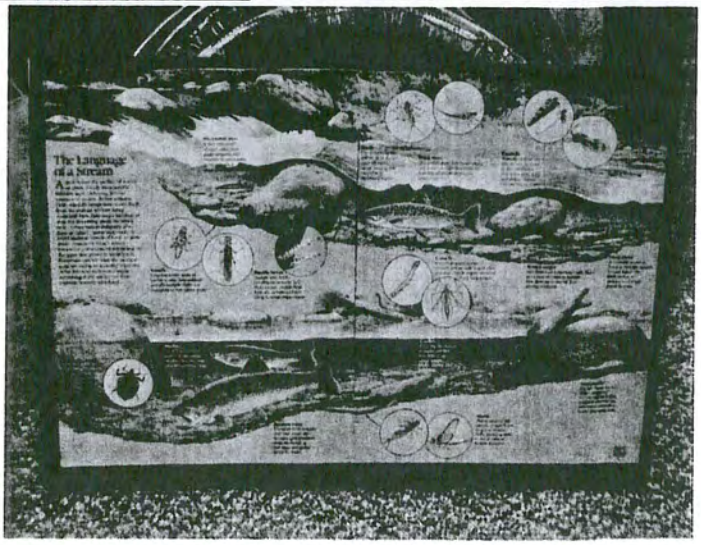




1 & 2: Above: Topographic Map Display Boards of the watershed area with highlighted streams. 3, 4, & 5: Below: Aquatic Insect identification and ecology graphics. Form at left is the Isaac Walton League stream rating guide. 6. Bottom left: Best management practices examples. 7. Bottom right: Stream ecology graphics







ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Munising's Central Elementary at Clear Lake Math-Science Camp
"Watershed Appreciation Day"

Below: Presentation on "Watersheds and Wildlife"

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

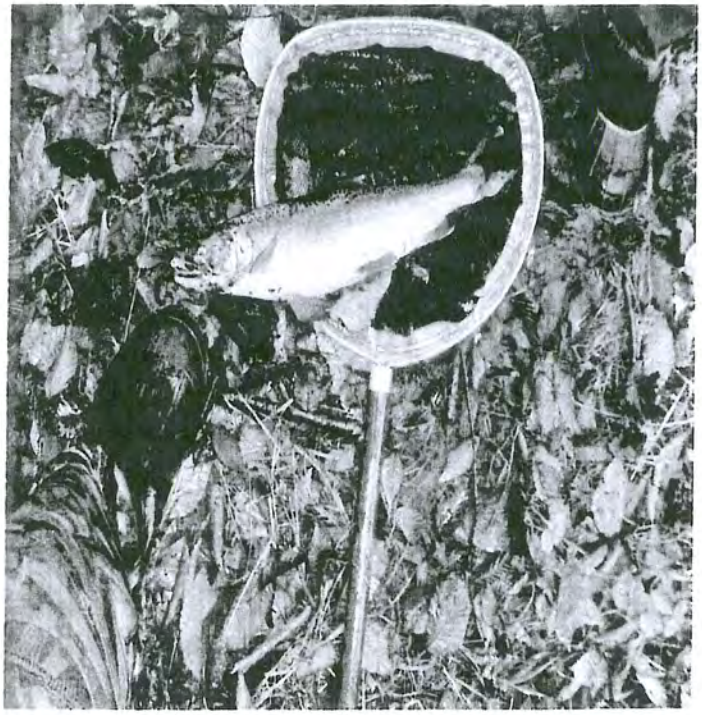
Transect # 46: Sweats Creek , 300' upstream of Reindeer Run Road

1. Beginnng of 300' transect, upstream (west) of Reindeer Run Road culvert. Flourescent flagging marks the first transect. This is another of science teacher Lou Behning's Mather Middle School volunteer classes assisting with fisheries inventory.This eager "kick~n~scrub" insect team is waiting for the fish shocker to finish and the "measuring team" to come back and mark off the the 3' wide cross section before starting.

2. The Fish Interceptors with one of the stunned Coho, preparing to measure it for total length. They were always careful to keep the large and small fish in separate buckets!

3. Some of the caddisfly, dragonfly, and stonefly larvae from the first cross section of the transect.

4. A closeup of the fish team's first fish.



ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Survey Transect Tag # 47 West (main) Branch of Gangeau Creek @ Carr Road

1. This is the watershed manager Electrofishing a 300' transect downstream of culvert on Carr Road. Mather Middle School 6th grade science classes are providing the fish interceptor teams.

2. Gangeau Creek varies from 6-8' wide as at left, to the braided, multiple channels we see below. The stream is almost at bankfull.

3 & 4. Below, Mr. Behning , the science teacher, helps the water quality sampling team set up for PH, Oxygen, and temperature tests.

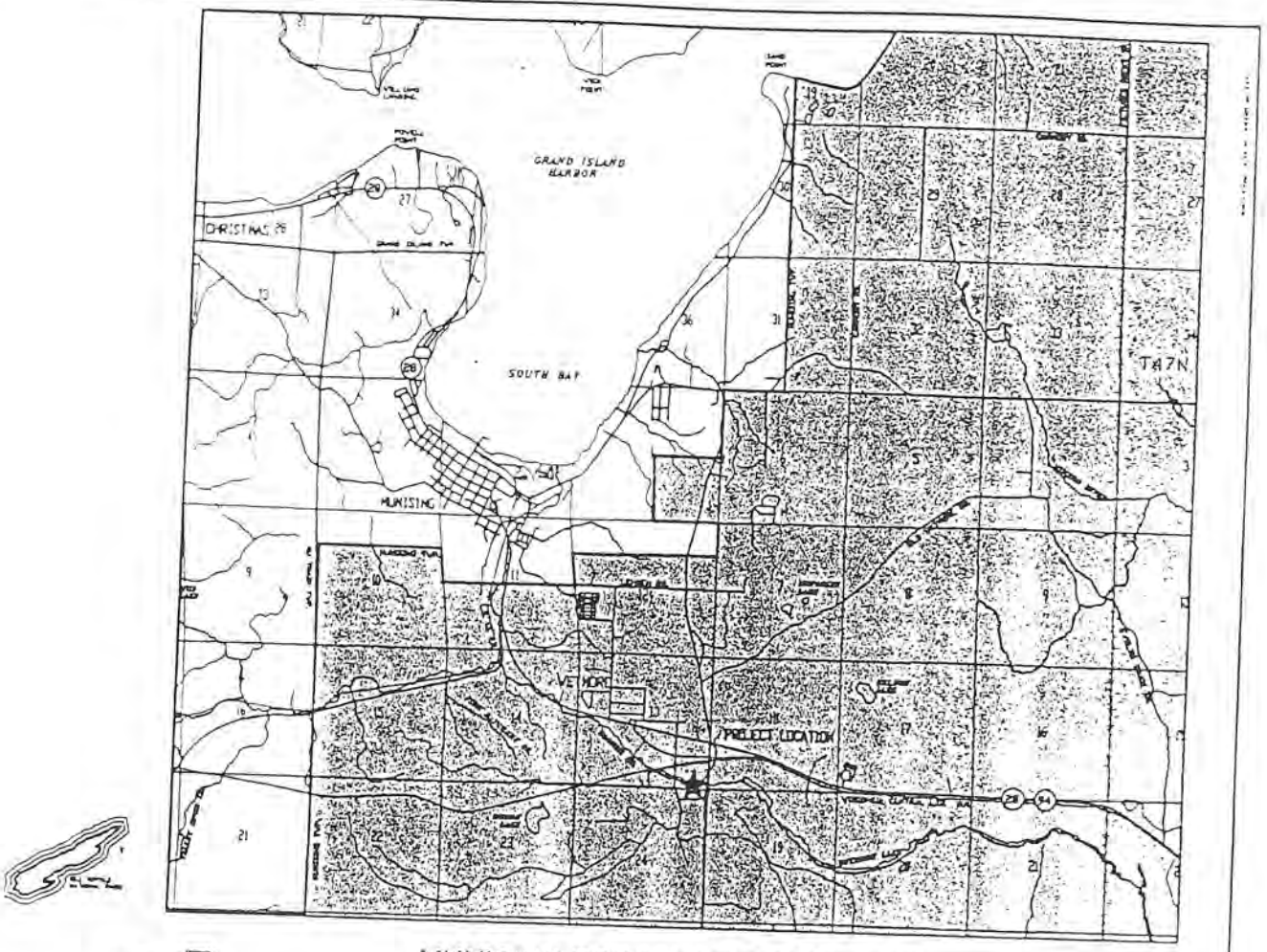
4 & 5. The Fishing and Kick and Scrub teams bring their catch for sorting, ID, and fish measuring by the "bug pickers". And myself. There was lots of wiggly action as you can see by the excitement! Those are Brook Trout and White Suckers.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

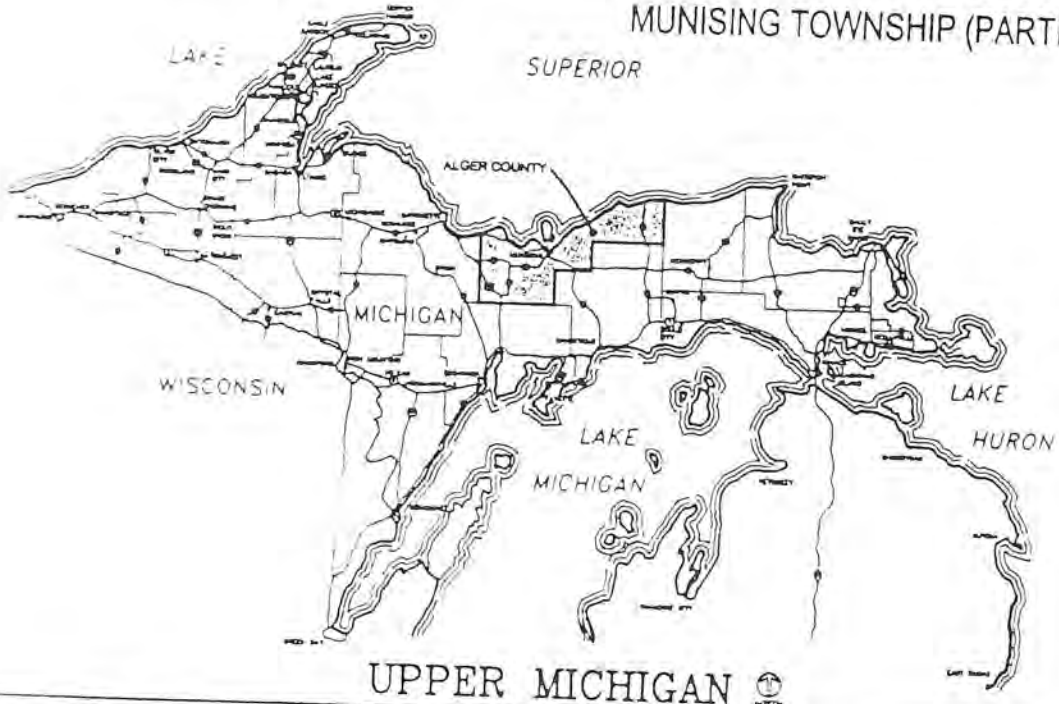
Survey Transect tag # 38 WAGNER CREEK @ Highway M94 below Wagner Falls

3. "Kick-n-Scrub" Aquatic Insect Team

4. Here we are processing the kick-n-scrub samples and straining the water from sample pails through the 400 denier kicknet (spread out on the ground) , where the kids helped to pick off the smallest specimens.



MUNISING TOWNSHIP (PARTIAL)



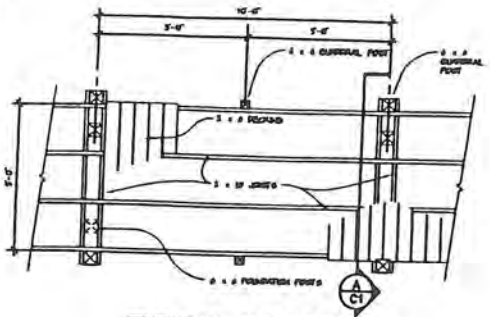
UPPER MICHIGAN

U.P. ENGINEERS & ARCHITECTS, Inc.

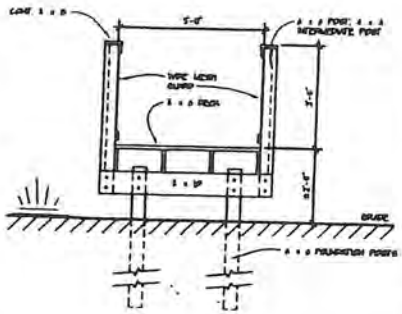
Houghton • Norway
Marquette • Sault Ste. Marie

ROBERT McQUISTEN RECREATIONAL AREA
ANNA RIVER BOARDWALK AND FISHING PIERS
MUNISING TOWNSHIP
MICHIGAN

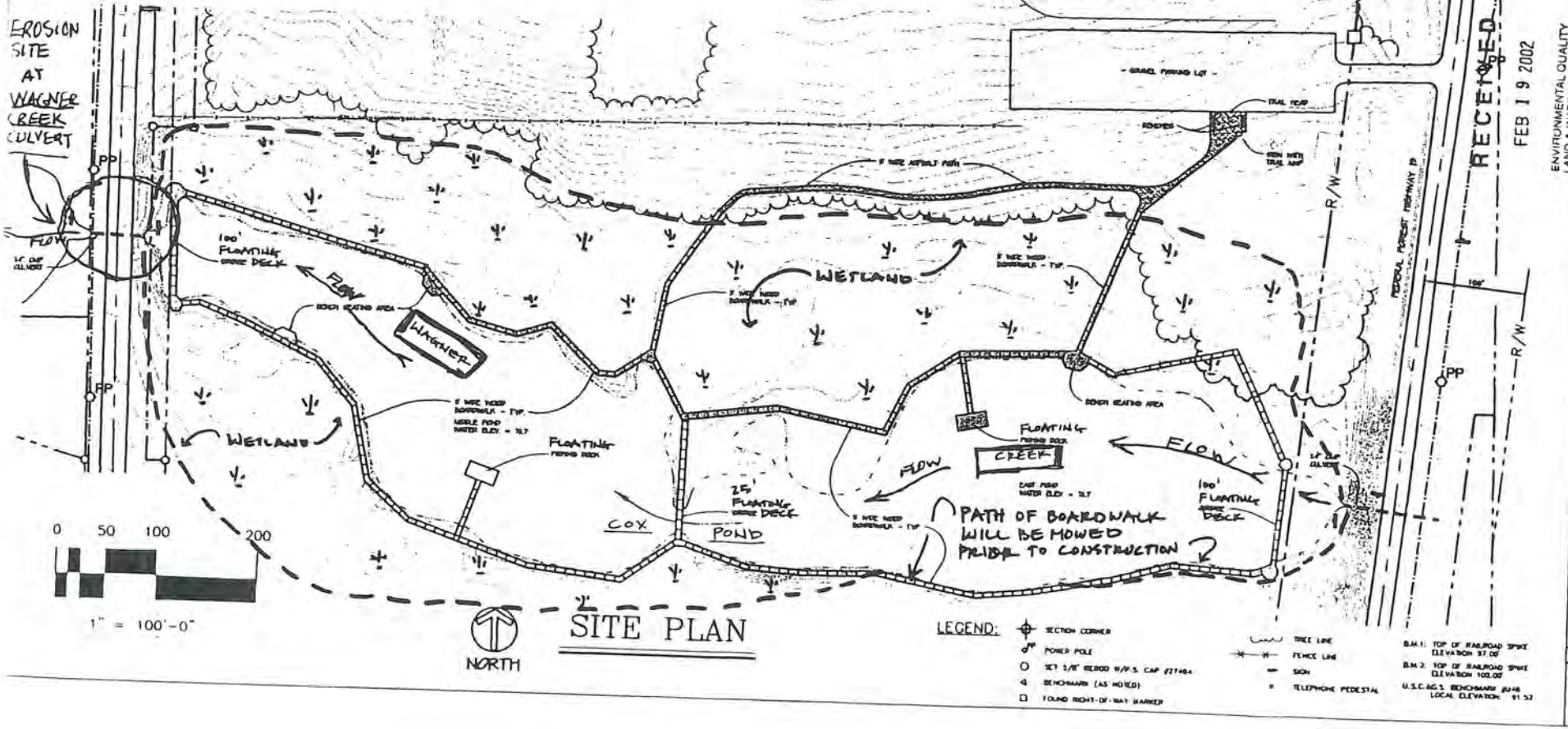
DATE: 1-19-01	SCALE: N.T.S.	DRAWN BY: D.S.	PROJECT NO.: M46-20444	CAD FILE: M46-C2



TYPICAL BOARDWALK FRAMING PLAN



BOARDWALK SECTION



SITE PLAN

LEGEND:
- SECTION CORNER
- POWER POLE
- SET 1/8" REBAR W/P.S. CAP #27484
- BENCHMARK (AS NOTED)
- FOUND RIGHT-OF-WAY MARKER
- TREE LINE
- FENCE LINE
- SIGN
- TELEPHONE PEDESTAL

B.M.1: TOP OF RAILROAD SPIKE ELEVATION 97.00'
B.M.2: TOP OF RAILROAD SPIKE ELEVATION 100.00'
U.S.C.&G.S. BENCHMARK BM48 LOCAL ELEVATION: 91.52

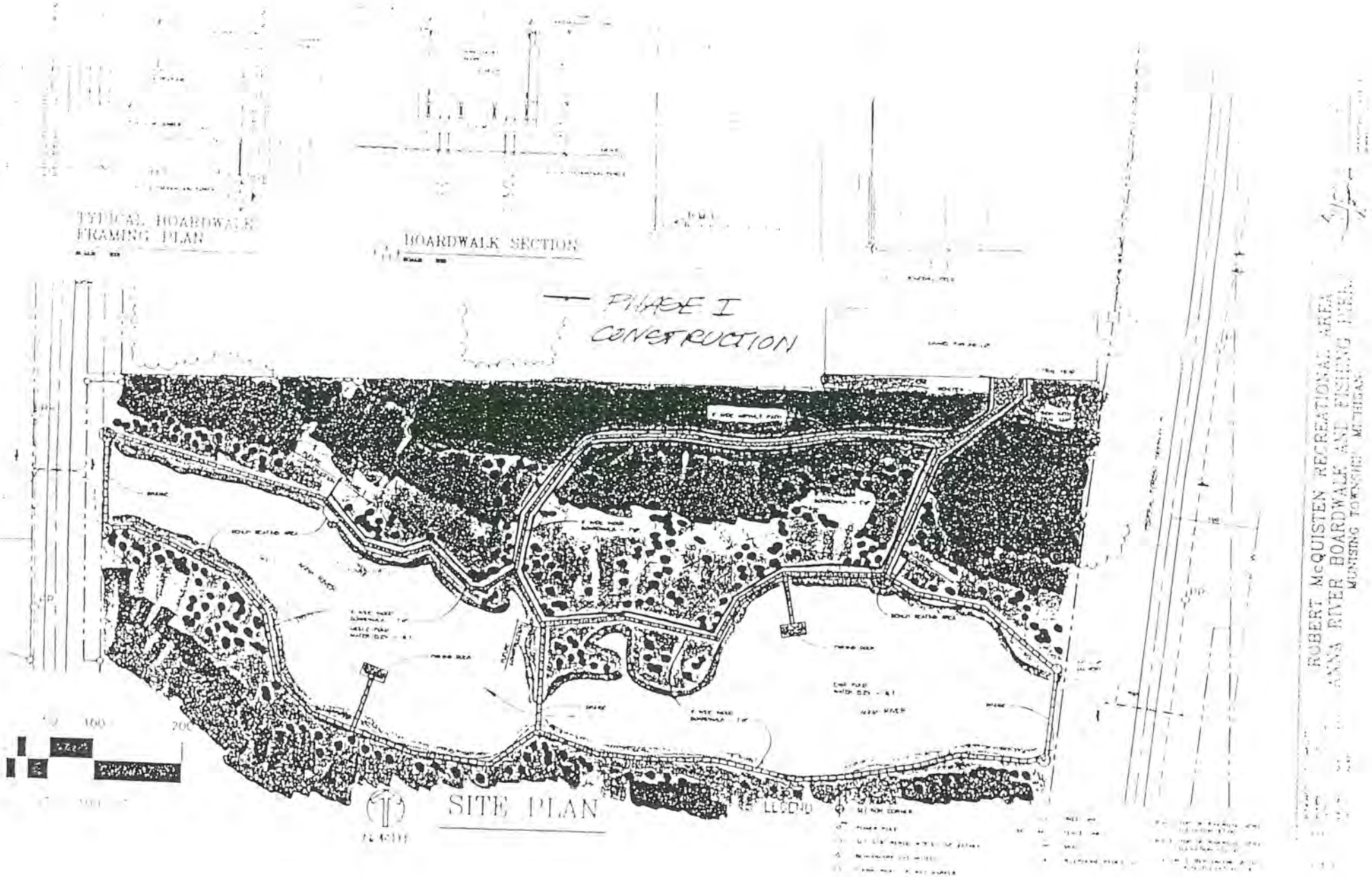
RECEIVED
FEB 19 2002
ENVIRONMENTAL QUALITY
LAND & WATER MGMT-PCU

U.P. ENGINEERS & ARCHITECTS, INC.
HOUGHTON · MARQUETTE · NORWAY · SAULT STE. MARIE

ROBERT McQUISTEN RECREATIONAL AREA
ANNA RIVER BOARDWALK AND FISHING PIERS
MUNISING TOWNSHIP, MICHIGAN

DESIGNED: S. WHITE
DRAWN: UPEA
DATE: 02-22-01
JOB NO: M46-20444
CAD FILE: M46-C1

SHEET No.
C1

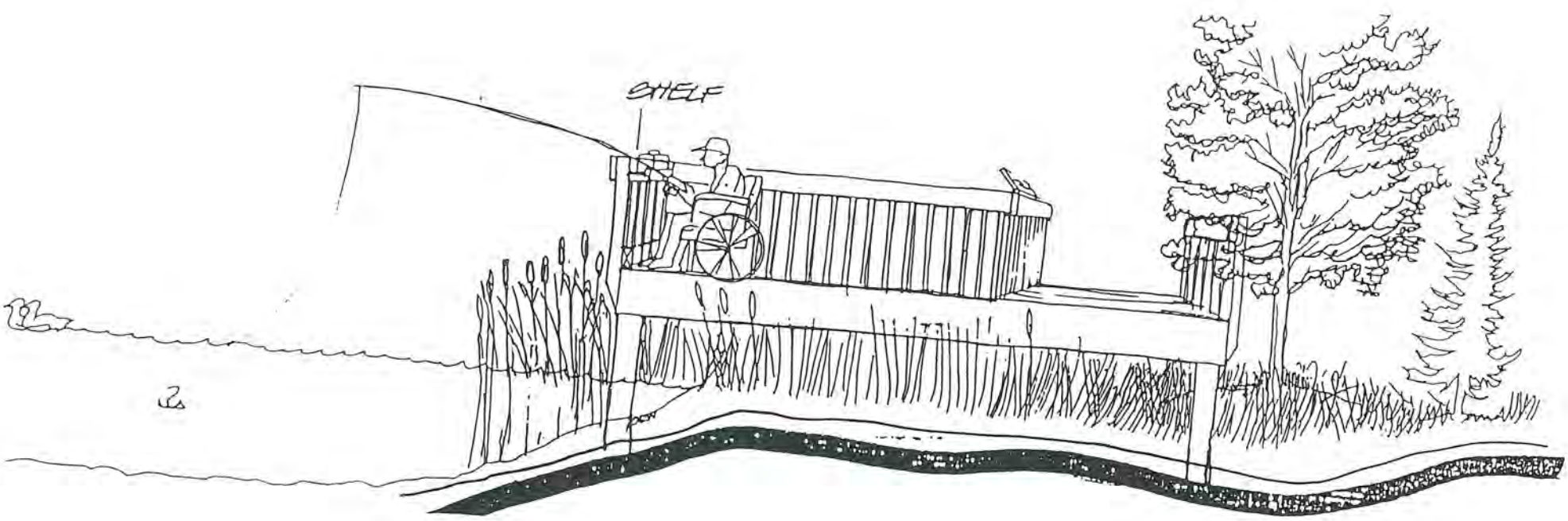

TYPICAL BOARDWALK FRAMING PLAN
BOARDWALK SECTION
PHASE I CONSTRUCTION
SITE PLAN
LEGEND
ROBERT McQUISTEN RECREATIONAL AREA
ANNA RIVER BOARDWALK AND FISHING PIER
MUNISING TOWNSHIP, MICHIGAN

MQUISTON RECREATION AREA
MINERAL TOWNSHIP

SECTION
FISHING DOCK

U.P. ENGINEERED ARCHITECTS, INC
MARQUETTE, MICHIGAN 49855

FISHING DOCK | BOARDWALK

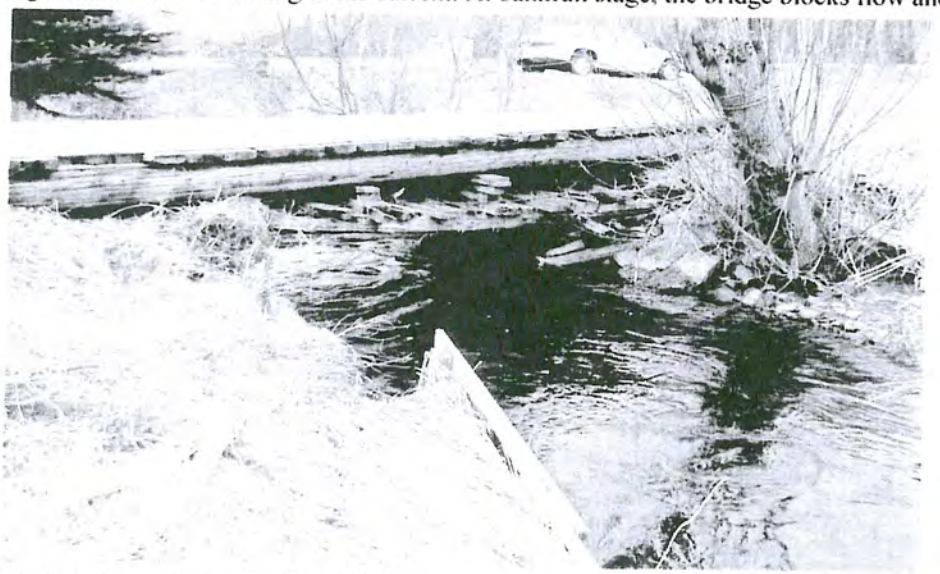


FISHING DECK DETAIL

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Lower Anna River @ Bruce Cromell Bridge and abandoned MI-DNR Coho Weir Site

1. Bridge with sunken east end. Note Coho weir wall in foreground aiming at the bank under the east end of the bridge. Loose metal banding from the weir is waving in the current. At bankfull stage, the bridge blocks flow and erodes banks.



2. Weir chute constricts flow, increasing velocities. This is the downstream end facing the bridge, river is at normal depth, average flow.

3. This is the upstream end of the weir. The right angle abutments catch the current, undercutting and eroding the bank.

4. From the Bruce Cromell driveway looking south, the Snowmobile/ATV trail is adjacent to and upslope from the river by 60 to 100 feet for about 400 yards.

5. Snowmobile trail bridge over the Anna near the M-28 Bridge.

Anna River Buffer Plantings

Alger County

Alger
Approx. Acres:
Date 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222

BMP # 1 – ANNA RIVER BUFFERS- Pasineault Property & City of Munising
Stream Stabilization & Shade Buffer

BMP List: Plant Native Tree Shrub Buffer Areas along City Park and Next to Sand Cap on Pasineault Property

N

SDA

3000 0 3000 6000 F

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Transect # 34: Lower Anna River, 300' transect at the Highway M-28 Bridge in the City of Munising

1. At each 50' marker kick and scrub insect teams of samplers, recorders, and bug pickers, wait their turns for the two insect dipnets or the big kicknet.

2. Mr. Gordon Testor, Middle School Science Teacher, with his class, ready for bug picking & sorting action .

3. Electrofishing is done first before anyone else gets in the water. We had four students helping us catch fish downstream of the shocker. Here they hand off a little sculpin to the recovery bucket. Note the sand bed loading here, sand varies 1-2 foot deep over original gravel and cobble.

4. Below: We started just upstream of the bridge, and one cross transect coincided with the bridge abutment. Here the team, overseen by "Ranger Dave" of NPS-Pictured Rocks, is sorting bugs from the aquatic dip net style kick nets.

5. Yes, you have to scrub every stick or stone from the 1m wide cross section, unless we can get it out of the stream.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # 34 Date 10/18/01

Stream Name and Station Location: Anna River, 300' transect, M28 Hwy Bridge

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								WD # Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	run	280	13	19	15		10		90					1
2	50	flat	276	17	21	18				100					2
3	100	flat	265	20	22	19				100					1
4	150	flat	279	14	24	20				100					0
5	200	flat	290	23	20	22.5				100					2
6	250	run	265	21	23.5	24		5		95					0
7	300	pool	280	10	39	36		15		85					2
8															
9															
10															
Total	300		1935	118	168.5	154.5		30	0	670	0				8
Average	50		276.4	16.8571	24.0714	22.0714		4.286	0	95.71	0				1.1

1 Station Surface Area **82,920** sq. ft **1.9** acres
2 Water Types % pool **14.3** %flat **57.2** %riffle **0** %run **28.6** %rapids **0** %glide **0**
3 Spawning Habitat % suitable for anadromous salmonids **0%** Fish present: **Mottled Sculpin**
4 Fish Cover (type, abundance): **Cobble & Woody debris is buried in sand and scarce**
5 Sand Bedload **Very heavy 96%** medium light source: **1960's Hwy Project, 80-90's RR grade blowouts, increased meander**
6 Immediate Banks (height, stability) **1'-4' meandering except bridge site, undercuts common**
7 Riparian vegetation (type, size). **Open with Weeds, Grasses, Sedges, a few Willows at pool**

8 Aquatic vegetation overall abundance **none** predominant types **sand scoured**

9 Invertebrates abundance **scarce** **"Poor" rating w/Isacc Walton guide** predominant types **Scud & Midge larvae,**
Water Striders & Backswimmers

10 Wildlife **muskrat, herring gulls, redwing blackbird**

11 Water color, turbidity,level, flow: **Lt. Amber, good clarity, ~3/4 bankfull, 38.9 cfs,**
12 Water temperature **38.7 F** 13 Air temperature **46 F** 14. Time of day **11:00 am** PH= **7.8** Dissolved Oxygen= **5.5**
15. STREAMFLOW DISCHARGE 45.5 cfs, taken at BANKFULL condition (lightly raining) on 4/18/01
Repeated Discharge transect next day 46.5 cfs, also taken at BANKFULL (no rain) on 4/19/01

Transect	Width	Ave. Depth	Area (WxD)
1	276 in	22 in	6072 sq. in
2	276 in	22 in	6072 sq. in
3	276 in	22 in	6072 sq. in

Float distance = 3 ft.
Float time = 2.5 sec. (Ave. of 3 floats)
Current velocity = 1.2 ft./sec.
Area (sq. in) / 1 sq. ft (144 sq. in) = sq. ft.

Average Area = 42.1 sq. ft Discharge = Area x velocity x roughness coefficient
Discharge = 1.2 ft/sec X 42.1 sq. ft = 50.5 cubic ft/sec (cfs) X .9 = 45.5 cfs

16 Comments

Few forage fish, No minnows present & few sculpins
A few scud, invertebrates scarce except midge larvae in sand.
Probing and walking river revealed Cobble/gravels are buried under 6":24" of sand
Unknown impact of contaminants from adjacent snowmobile trail & road salt
Unknown impact of municipal snow dump
Good Water Quality, oxygen, & flow

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus
WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station # 34 **Date** 10/18/2001

Stream Name & Station Location: **Lower Anna River, 300' transect @ M28 Hwy Bridge**

Gear Electroshocker Backpack

Species	Mottled Sculpin							
Length in cm	59							
	50							
	55							
	71							
	29							
	24							
Total #	6							
Ave. Lgth	38.2							
% of total catch	100							

ANNA @ M28 BRIDGE

SAVE OUR STREAMS
Stream Quality Survey

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream LOWER ANNA RIVER @ M28 HWY Station 4

County ALGER State MI Location BRIDGE

Group or individual J. DAVIS, D. KRONK, G. TESTOR 6th GR. Number of participants MATHER MIDDLE SCHOOL — 110 students

Weather conditions PARTLY CLOUDY TO SUNNY

Stream width (Average) 23 ft. Water depth (in riffle) 28.6 in.

Flow rate: high ____ low ____ normal X 38.91 cfs

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) 3' x 23' Average stream depth 21.6 Water temperature 6.7°C PH - 6.0

Date 10/18/01 Time 11:30 AM Sample Number ____

Type of test: macroinvertebrate count X chemical test X other ELECTROFISH SURVEY, FLOW

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE		SOMEWHAT-SENSITIVE		TOLERANT	
A 3	caddisfly larvae		beetle larvae		aquatic worms
	hellgrammite	A 3	clams		blackfly larvae
	mayfly nymphs		crane fly larvae		leeches
	gilled snails		crayfish	C 120	midge larvae
A 1	riffle beetle adult		damselfly nymphs		pouch (and other) snails
	stonefly nymphs		dragonfly nymphs	A 6	water striders
	water penny larvae	A 7	scuds		
			sowbugs		
			fishfly larvae		
			alderfly larvae		
			atherix		
2 / 6	# of letters times 3 = 6 Index value	2 / 4	# of letters times 2 = 4 Index value	2 / 2	# of letters times 1 = 2 Index value

Now add together the three index values = 12 total index value.

Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

- ☐ Excellent (> 22)
- ☐ Good (17 - 22)
- ☑ 12 Fair (11 - 16)
- ☐ Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

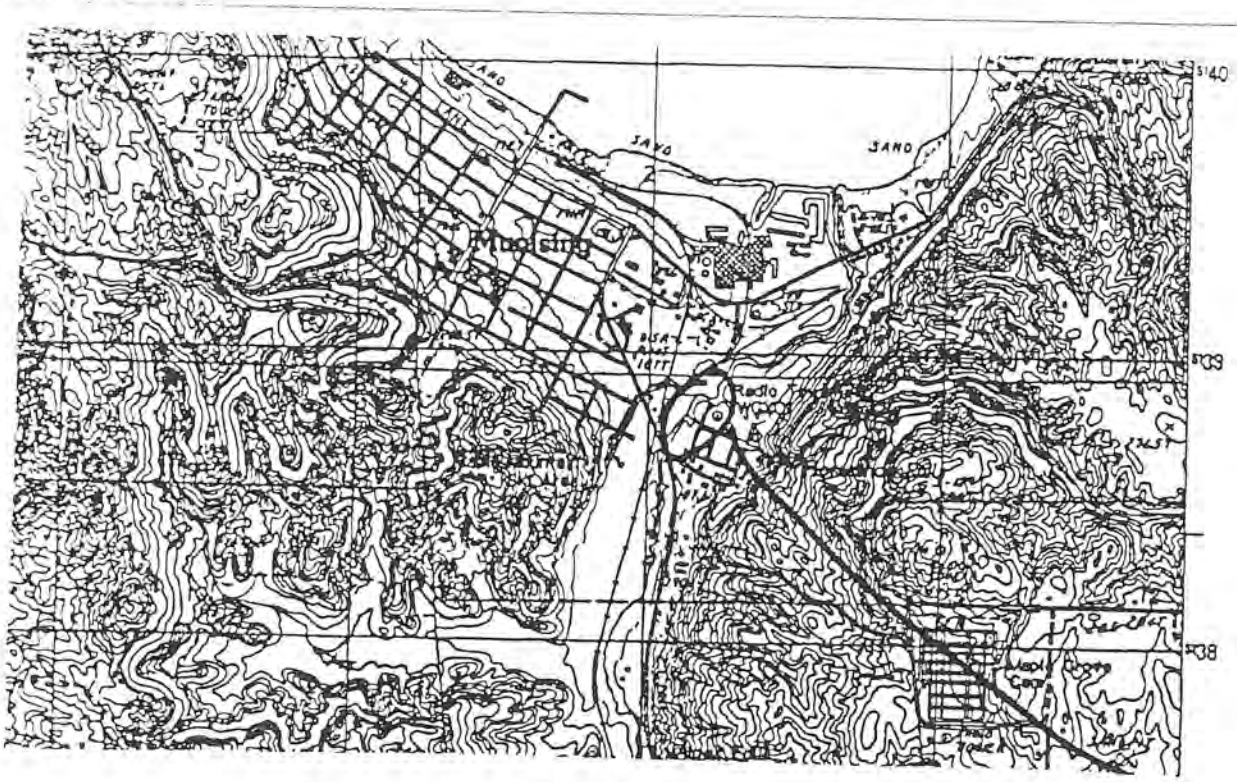
recycled paper

Anna River - Restore

Alger County

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP Practice #4- ANNA RIVER IMPROVEMENTS
@ confluence of Horseshoe Falls Creek

BMP List: Restore Trout & Salmon Spawning Bed

Add Gravel to Substrate (10,000 sq. ft)

Add Large Rocks for Fish Loafing & Sand Scouring
(to flush annual sediments)

Plant Vegetative/Tree filter strip between
City Snow Dump and stream

Legend

SCALE 1:24 000

KILOMETERS 0 1
METERS 0 1000 2000

N

Feet

USDA

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

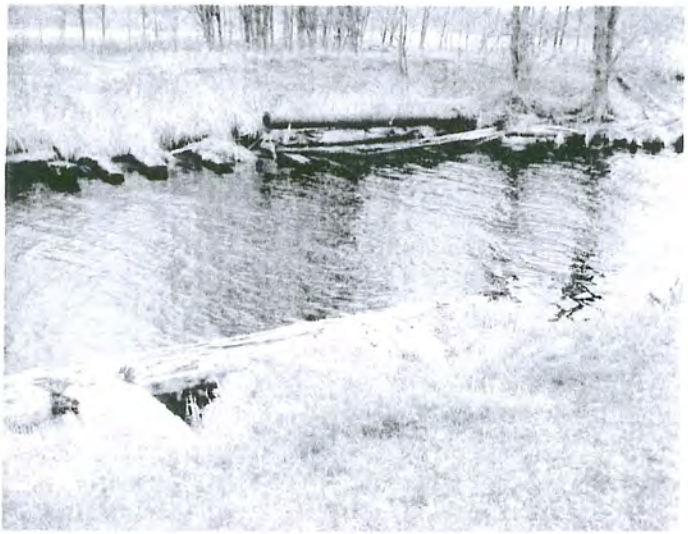
Lower Anna River at Kimberly Clark Corporation Paper Mill, and a City Park, near mouth on Lake Superior

1. Closeup of abandoned bridge about 30 yards downstream of the H-58 Road. This bridge causes ice dams and backups.

2. Shot of same bridge from further downstream toward mouth. Note the timbers from yet another old bridge in foreground.

3. West bank: Note protruding timbers, and bank erosion along this Paper Mill settling pond.

4. West bank further downstream toward mouth: Note old discharge pipe and timbers.



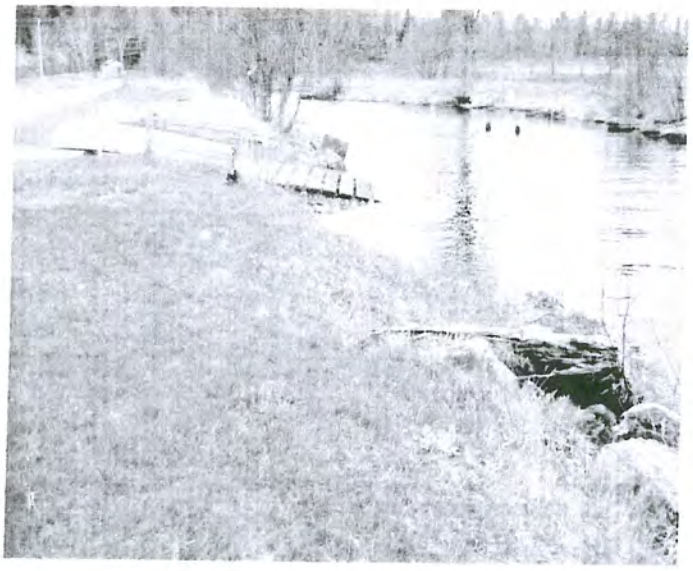
5. More old timbers on this stretch. Lots of erosion occurs in this area when ice breaks up in the spring and blocks flow.

6. View toward mouth, on Munising Bay.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Lower Anna River at Kimberly Clark Corporation Paper Mill, and a City Park, near mouth on Lake Superior

1. Boat launch on Lower Anna, across from Kimberly-Clark Mill.



2. Mouth of the Anna River at Munising Bay,of Lake Superior. Note the old pilings and timbers. This last 100 feet or so is well stabilized with rock.

3. Handicap-Public Access fishing pier and parking lot at the beach head next the mouth of the Anna River. The boat ramp is accessed from this same parking lot. Grand island is seen off across the bay.

4. Another View of the Anna River at the Highway M-28 bridge in the City of Munising. This site is also the lower Anna evaluation transect.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Gangeau Creek, Eastern Tributary at Carr Property

1. Below: Upstream end of road crossing of the eastern tributary of Gangeau Creek. Caving hodge-podge of cement and log rip rap obscures the view of the two small pipe culverts.

2. Below: Close up of same view in #1. Note visible road surface erosion and sediment pool due to water backup at high flows and insufficient size of twin steel culverts.

3. Below: View of Road looking west, culverts are same width as road bed, too short for proper slope for rip rap.

4. Below: View of stream, downstream of road crossing. Good water quality and lots of coarse woody debris provide excellent salmonid habitat and cover.

5. Below: Overhead view of eroding road surface at upstream end of culvert.

6. Below: Close up view of downstream end of road crossing. This site needs a single larger culvert and road surface should be elevated to direct runoff away from the stream.

Gangeau Creek @ Carr - Property East

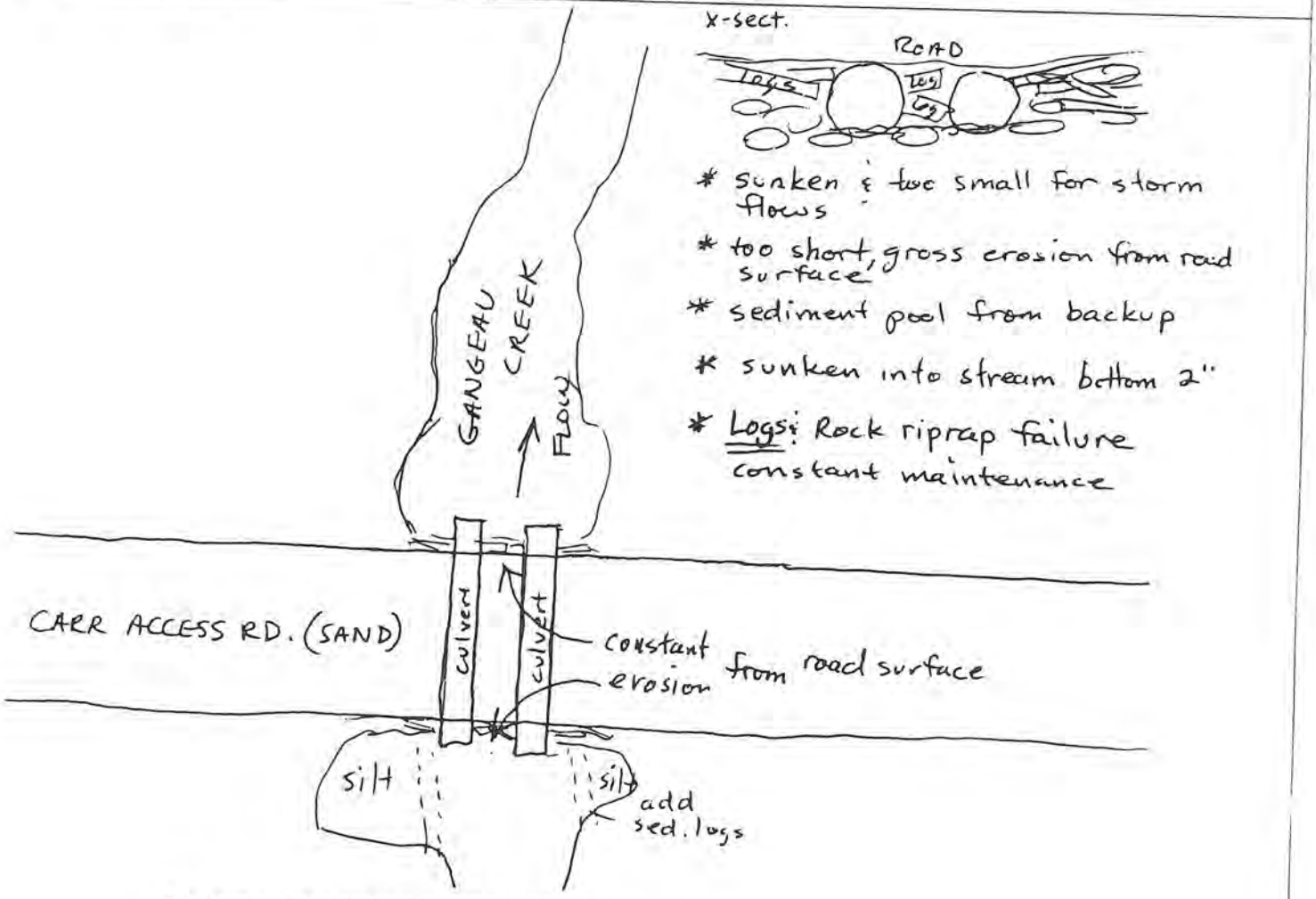
Alger County T47 R19 Sec. 32

Alger

Approx. Acres:

Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 7 – GANGEAU CREEK - @ Carr Access Road East
Stream Crossing

BMP List: Replace two short, (20' x 20" & 20' x 24") steel culverts
W/ one 28' x 10'6" x 5'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap culvert ends and ditch to proper slope
Add gravel to elevate road at crossing & re-grade
No ditches, road elevated fill over wetland area, need to vegetate
Sloped roadsides near crossing
Stake Erosion logs at sediment pool

Legend

N

USDA

20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Survey Transect Tag # 47 GANGEAU CREEK @ West Branch at Carr Property

1. View South of 300' transect, from road crossing. Transect origin is marked with a yellow pig ear tag lag screwed into a tree.

2. South side of road, homemade culvert has insufficient cover & cross section too small for storm flows, road surface constantly eroding into stream.

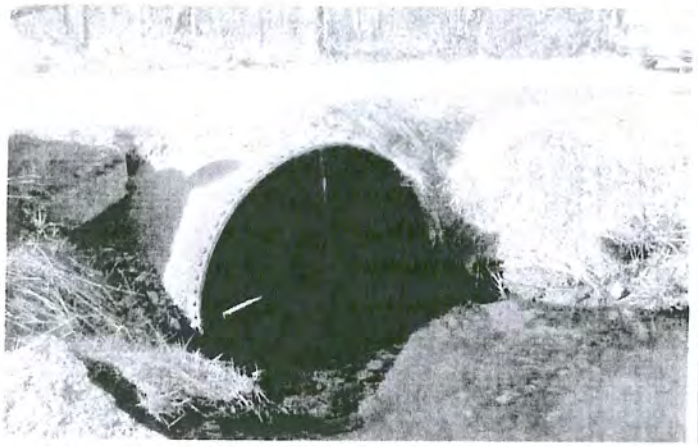
3. North side of road crossing, note visible erosion of road surface on culvert.

4. Close-up of northern end of culvert, looking down at blown out streambank from high flow turbulence.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Transect Tag # 47: Gangeau Creek, Western Tributary at Carr Property

1. Below: View of downstream end of culvert, Note visible erosion from road surface and ditching. Braces had to be installed in this home-made culvert to prevent crushing from the heavy traffic for logging, gravel and sand hauling.



2. Below: Intake, or upstream end of culvert. Note visible erosion from water backup and ponding, due to insufficient culvert diameter to handle storm flows.

3. Below: View of sediment entering stream, due to ponding at upstream end of culvert at high flows.

4. Below: View of road looking west. Note road surface erosion over culvert. Road also needs to be elevated over culvert to direct runoff away from stream crossing.

5. Below: View of Gangeau Creek, western tributary, above the Carr Road crossing. This is the 300' Survey transect (Tag #50). Visible sand is from Ridge Road crossing and an old blown out beaver pond upstream.

6. Below: View of the west tributary of Gangeau Creek below the Carr Road crossing. Note prevalence of abundant coarse woody debris typical of this stream.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # 47 Date 10/26/00

Stream Name and Station Location: Gangeau Creek, 300' transect, West Trib, upstream of Carr Rd.

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	Flat	88	11	13	8			0	30	70				2
2	50	flat	75	13	15.5	9			0	50	50				2
3	100	flat	96	7.5	19.5	8.5			0	50	50				4
4	150	pool	92	9.5	11.5	13			0	0	100				3
5	200	flat	88	12	13	8			0	50	50				8
6	250	pool	115	36	48	48			0	0	100				0
7	300	pool	85	15	22	16			0	0	100				2
8															
9															
10															
Total	300		639	104	20.35714	16.07143									21
Average	50		91	14.8571	20.3571	16.0714			0	25.71	74.29				

1 Station Surface Area _____**2280**_____ sq. ft. _____**0.052**_____ acres
2 Water Types: % pool__**42.9**__ %flat__**57.2**__ %riffle___**0**___ %run__**0**__ %rapids___**0**____ %glide___**0**____
3 Spawning Habitat: % suitable for anadromous salmonids __**0%**__ Fish present: **Brook Trout, Sculpin, White Suckers**
4 Fish Cover (type, abundance) __**woody debris, overhung & undercut banks; Abundant**_
5 Sand/Silt Bedload: heavy__**silt-74%**__medium__**sand-26%**__light ___source___**Ridge Rd crossing & natural, beaver ponds**___
6 Immediate Banks (height, stability) __**0.5-1.0', no undercutting, some braiding, ditch blowout at road, upstream of culvert**__
7 Riparian vegetation (type, size) __ **a few mature Spruce, Sedges, Grasses, & Speckled Alder**__

8 Aquatic vegetation: abundance ___**sparse**___ predominant types__**vallisneria grass, algae**___

9 Invertebrates: abundance __**Common, "Fair" Isaac Walton Guide Rating**__predominant types__**Mayfly, Caddisfly, Scuds, Dragonfly**_

10 Wildlife __**old beaver sign, Redwing Blackbird**

11 Water color, turbidity, level: _**amber, good clarity, ~3/4 bankfull, 7.5 cfs**_ **PH= 7.2** **Dissolved Oxygen= 5.5**
12 Water temperature_____**56.4F**_____ 13. Air temperature ____**68.8F**_____ 14. Time of day ___**2:00pm**__
15. STREAMFLOW DISCHARGE _____11.2_____cfs taken at BANKFULL conditions on 4/17/01

Transect	Width	Ave. Depth	Area (WxD)
1	95 in.	20.4 in.	1938 sq.in
2	95 in.	20.4 in.	1938 sq.in
3	95 in.	20.4 in.	1938 sq.in

Float distance = __3__ ft.
Float time = __3.2__ sec. (Ave. of 3 floats)
Current velocity = __0.93__ ft./sec.

Average = __13.4__ sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge = 0.93 ft/sec X 13.4 sq. ft. = 12.5 cubic ft/sec (cfs) X .9 = 11.2 cfs

16 Comments: Culvert too short, road surface at culvert top, gross erosion
Old beaver ponding upstream holds large accumulation of sediment

---

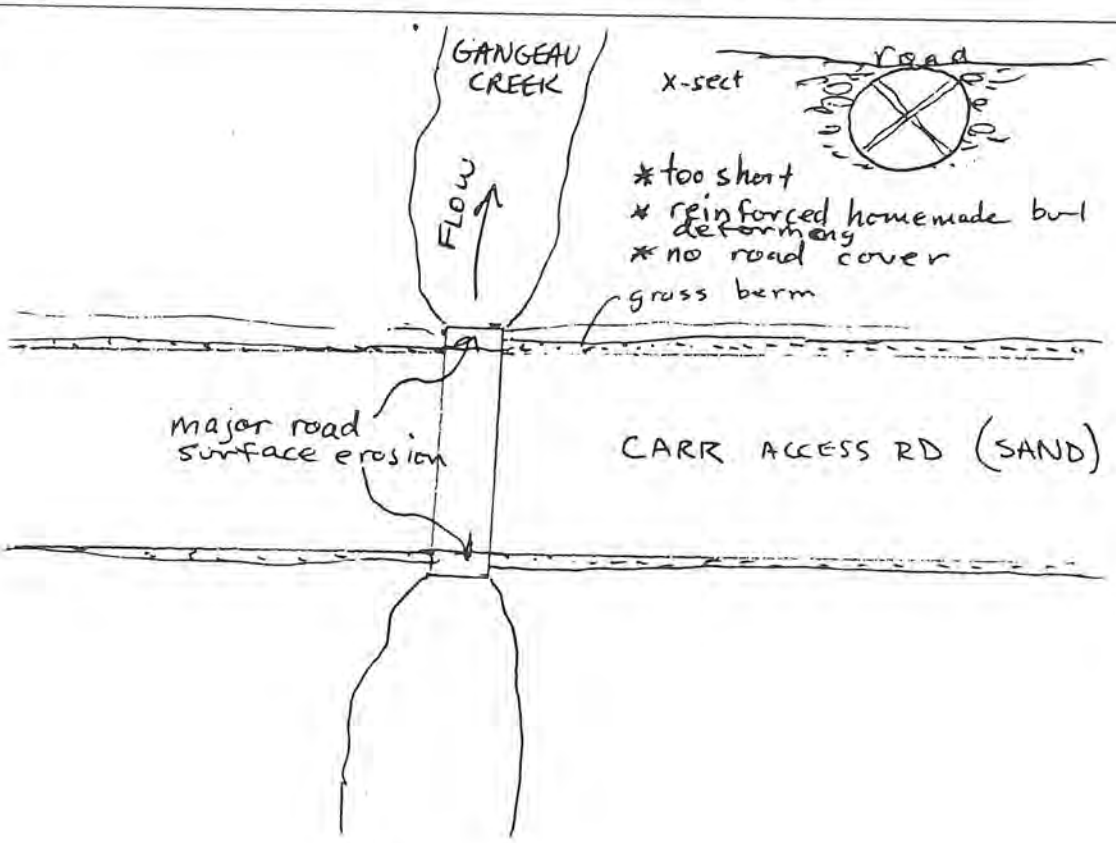
1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Gangeau Creek @ Carr - Property West

Alger County T47 R19 Sec. 32

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 6 – GANGEAU CREEK - @ Carr Access Road West
Stream Crossing

BMP List: Replace too short, (20' x 5'2") home-made steel culvert
W/ 28' x 10'6" x 5'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap culvert ends and ditch to proper slope
Add gravel to elevate road at crossing & re-grade
No ditches, road elevated fill over wetland area, need to vegetate
Sloped roadsides near crossing

Legend

N

USDA

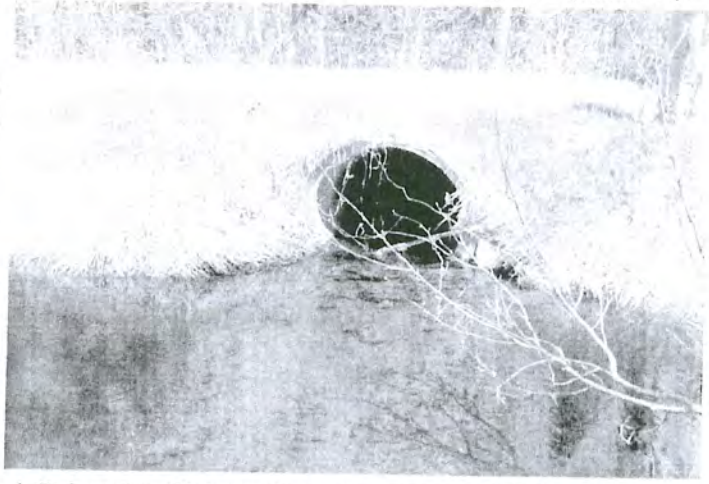
20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Transect Tag # 50: Gangeau Creek at Ridge Road

1. Below: Water backup and ponding during high flows has produced this sediment pool upstream of the Ridge road culvert due to insufficient diameter of culvert.

2. Below: View of upstream end of sectional cement culvert. Note clean gravel along main flow channel. This was the only one of 2 streams on the watershed with forage fish (minnows).



3. Below: View of downstream end of culvert at Ridge Road, the only road crossing on the Gangeau headwaters. There is no development from this point to the Carr Property.

4. Below: Insufficient culvert diameter and high flows during the spring of 2002, caused inundation of the road, undercutting of the first section of culvert, and culvert section separation.

5. Below: Another view of the separation of the culvert section. Water geysered up through the opening and flowed across the road surface carrying sediment into the stream.

Gangeau Creek Headwaters Survey Transect # 50
Downstream View of Culvert at Ridge Road Crossing

Survey transect upstream of Culvert

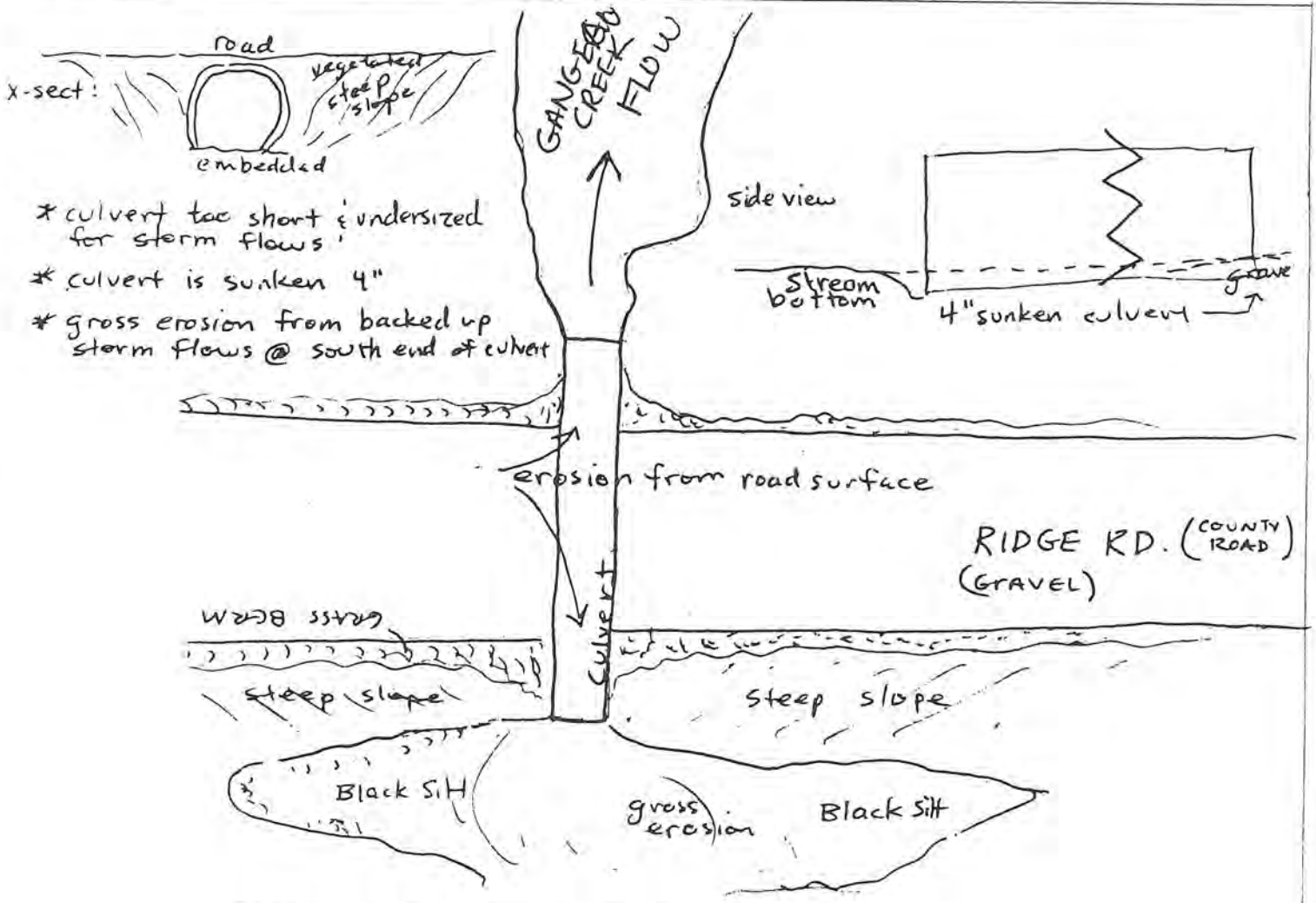
Upstream View of Culvert at Ridge Road Crossing

Gangeau Creek @ Ridge Rd.

Alger County T46 R20 Sec.1

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 5 – GANGEAU CREEK - @ Ridge Road
Stream Crossing

BMP List: Replace narrow, embedded, (34' x 5') cement culvert
W/ 42' x 10'6" x 5'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap culvert ends and ditch to proper slope
Add gravel to elevate road at crossing & re-grade
Stake sediment logs either side of silt pool and vegetate w/ native Shrub willow/dogwood

Legend

N

USDA

20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # ~~GG~~ 50 Date 10/26/00

Stream Name and Station Location: Gangeau Creek transect, 300' upstream of Ridge Rd crossing

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	Glide	114	13	11	8			0	30	70				0
2	50	Glide	75	13	7.5	6.5			0	50	50				0
3	100	flat	108	7.5	9.5	8.5			0	50	50				1
4	150	riffle	96	9.5	11.5	9			30	70	0				1
5	200	flat	88	10	11.5	8			0	50	50				0
6	250	pool	96	10	11.5	8			0	50	50				0
7	300	run	122	12	10.5	9.5			40	60	0				0
8															
9															
10															
Total	300		699	75	10.42857	8.071429									
Average	50		100	10.7143	10.4286	8.07143			10	51.43	38.57				

1 Station Surface Area ____2499____ sq. ft. ____0.057____ acres
2 Water Types % pool__14.3__ %flat__28.6__ %riffle__14.3__ %run__14.3__ %rapids__0__ %glide__28.6__
3 Spawning Habitat: % suitable for anadromous salmonids __10%__ Fish present: Creek Chub, Blacknose Dace, Redbelly Dace, Fathead Minnow, Common Shiner, Rainbow Trout
4 Fish Cover (type, abundance) ____sparse____
5 Sand Bedload heavy_____ medium____51%____ light _____ source____natural above road___
6 Immediate Banks (height, stability) __0.5-1.0', no undercutting, some braiding, ditch blowout at road, upstream of culvert__
7 Riparian vegetation (type, size) __mature Sedges, Grasses, & Speckled Alder__
8 Aquatic vegetation: abundance ___sparse___ predominant types__vallisneria grass, algae___
9 Invertebrates: abundance ___Common___ predominant types__Mayfly, Dragonfly, snails, damselflies, riffle beetle_
10 Wildlife __old beaver sign, Blue heron, Redwing Blackbird, Spring Peeper, Green Frog__
11 Water color, turbidity, level: _amber, good clarity, 3/4 bankfull, 7.5 cfs_ PH= 7.2 Dissolved Oxygen= 5.5
12 Water temperature_____55.4F_____ 13. Air temperature ____68.8F_____ 14. Time of day ___2:00pm__
15. STREAMFLOW DISCHARGE _____10.5_____cfs taken at BANKFULL conditions on 4/17/01

Transect	Width	Ave. Depth	Area (WxD)
1	108	10.4	1123
2	108	10.4	1123
3	108	10.4	1123

Average = ___7.8____ sq ft Discharge = Area x velocity x roughness coefficient
Discharge = 1.5 ft/sec X 7.8 sq. ft = 11.7 cubic ft/sec (cfs) X .9 = 10.5 cfs

Float distance = _____3_____ ft.
Float time = _____2_____ sec. (Ave. of 3 floats)
Current velocity = _____1.5_____ ft./sec.

16 Comments: Old sectional cement culvert sunken, inadequate diameter for storm flows, backs up water- ponding at upstream end of culvert where an 8' x 34' sediment pool has developed. High flow backups have blown out the bank and are pulling organic, mucky soils adjacent to the roadbed. The survey transect is level old beaver marsh, open or with Speckled Alder. Only stream tested that had high numbers of forage fish. One large Coho Salmon escaped downstream during inventory

---

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station# 50 **Date** 10/26/2000

Stream Name & Station Location Gangeau Creek

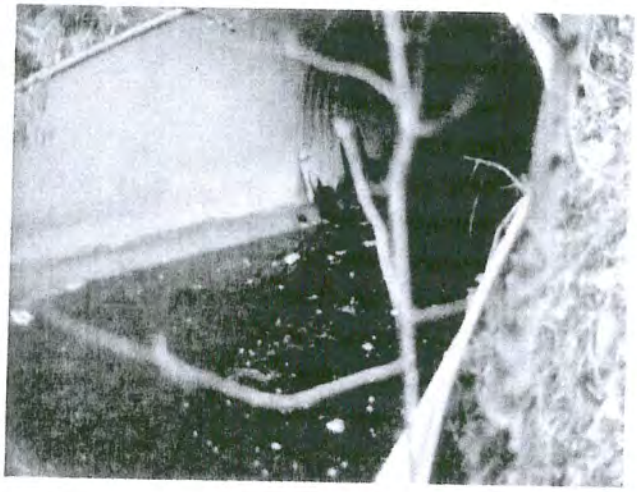
Gear Electroshocker Backpack

Species	Creek Chub	Common Shiner	Blacknose Dace	Redbellied Dace	Golden Shiner	Rainbow Trout	Fathead Minnow
Length in mm	148	41	72	64	72	147	67
	100	71	70	65	66		80
	92	65	73	68	44		40
	83	67	61	42			
	97	69	81	54			
		57	64	60			
		74	47	49			
		49	36	46			
		46	50	24			
		30	49	22			
			43	36			
			85	25			
			74	23			
			81	34			
			59				
			22				
			53				
			45				
			32				
Total #	4	10	19	14	3	1	3
Ave. Lgth	105.8	56.9	57.7	43.7	60.7	147	62.3
% of total catch	7.4	18.5	35.2	25.9	5.6	1.9	5.6

Hanson Creek Headwaters Survey Transect # 49 below Hwy M28

Downstream View of Culvert at Hwy M28

Closeup of Rusted Out Culvert Under Hwy M28



ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # **49** Date **11/2/00**

Stream Name and Station Location: **Hanson Creek, 300' transect, downstream of M-28 & LaCombe Rd.**

Transect No	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	riffle	69	3.5	6	3	95		5						0
2	50	pool	42	3	3.5	3			60	40					0
3	100	pool	74	8	10	6			10	45	45				2
4	150	riffle	71	2	4.5	3			50	50					4
5	200	run	78	5	6	8				100					7
6	250	pool	52	4	3	2.5			20	80					0
7	300	run	58	5	4	3				100					0
8															
9															
10															
Total	1050		444	30.5	37	28.5	95		145	415	45				13
Average	**50**		**63.4**	**4.36**	**5.29**	**4.07**	**13.6**		**20.7**	**59.3**	**6.42**				

1 Station Surface Area **1585** sq. ft. **.361** acres
2 Water Types: % pool **42.9** %flat **0** %riffle **28.6** %run **28.6** %rapids **0** %glide **0**
3 Spawning Habitat: % suitable for anadromous salmonids **21%** Fish present: **Brook Trout, Coho Salmon**
4 Fish Cover (type, abundance) **Woody debris, Rocks, Common**
5 Sand Bedload: heavy_____ medium **69%** light _____ source: **rusted out bottom of M28 culvert & natural**
6 Immediate Banks (height, stability): **0.5'-12', heavily undercutting some areas**
7 Riparian vegetation (type, size): **Mature second growth Maple, some Hemlock & Balsam**

8 Aquatic vegetation abundance **sparse** predominant types **algae & mosses**

9 Invertebrates abundance **sparse, poor Isaac walton Guide rating** predominant types **Caddisfly**

10 Wildlife **Ravens, Red Squirrel, Eastern Chipmunk, Wood Frog**

11 Water color, turbidity, level: **Dark Amber; clear but reddish flocculent present in pools; 3/4 bankfull, 3.2 cfs**
12 Water temperature **50.6 F** 13 Air temperature **65.7 F** 14 Time of day **11:00 am** **PH=6.1** **Dissolved Oxygen= 5.0 ppm**
15. Streamflow discharge 4.5 cfs, taken at BANKFULL condition on 4/17/01

Transect	Width	Ave. Depth	Area (WxD)
1	60"	10"	600 sq.in.
2	60"	10"	600 sq.in.
3	60"	10"	600 sq.in.

Float distance = **3** ft
Float time = **2.5** sec (Avg. of 3 floats)
Current velocity = **1.2** ft./sec

Average = **4.16** sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge= 1.2 ft/sec X 4.16 sq.ft. = 5.0 cubic ft/sec (cfs) X 0.9 = 4.5 cfs

16 Comments: Some sewage-like odor during light rains, none during heavy rain.
Aquatic insects few, mostly caddis cases protected under stones.

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft. common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station# 49 **Date** 11/2/2000

Stream Name & Station Location Hanson Creek

Gear Electroshocker Backpack

Species	Brook Trout	Coho Salmon				
Length in mm	600	550				
	650	68				
	50	63				
	106	75				
	120	67				
	137					
	160					
	178					
Total #	8	5				
Ave. Lgth	250	165				
% of total catch	61.5	38.5				

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Survey Transect Tag # 48 HANSON CREEK @ Jurmu Property/ Hanson Estates

1. View West upstream of crossing, at 1st 50 meters of survey transect, yellow pig ear tag # 48 is lag screwed to a tree at starting point of 300m.

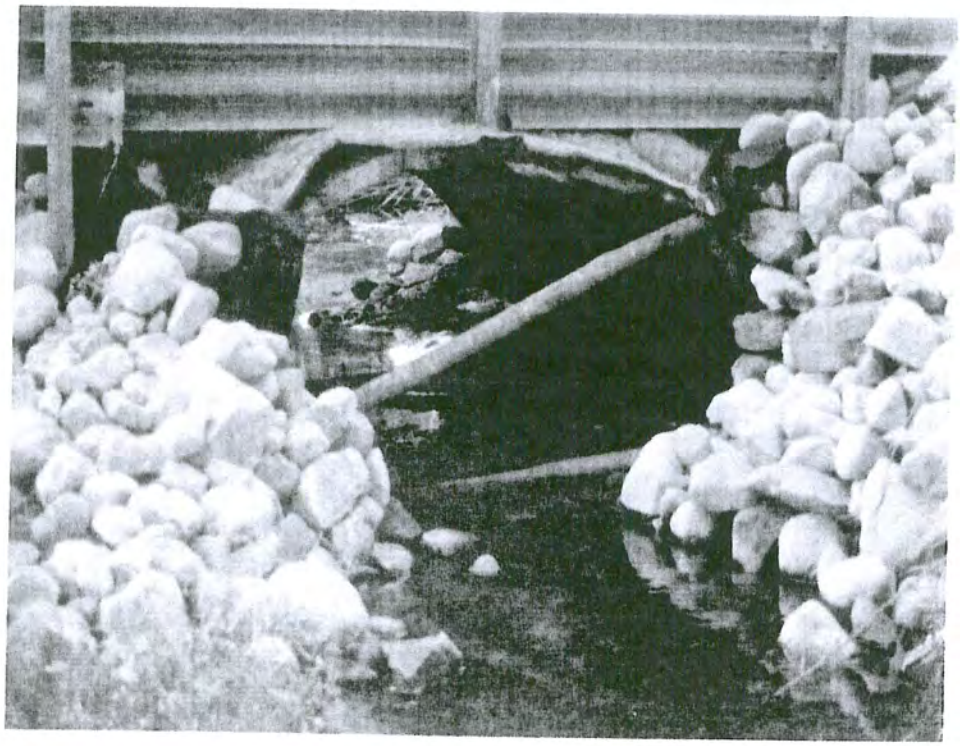
2. View East downstream of crossing note sand bedload from road crossing. Water is about at 3/4 bankfull level after recent rain.

3. View west of the middle of the 300' transect, upstream of the road crossing.

4. Homemade undersized culvert, improperly installed, note exposed erosion fabric, raw soil, caving riprap blocking stream flow. The transect begins a few yards upstream of the culvert.

Hanson Creek at Hanson Estates
Downstream View of Culvert at Private Drive

Upstream View of Culvert at Private Drive at Hanson Estates



ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # 48 Date 11/1/01

Stream Name and Station Location: **Hanson Creek, 300' transect, upstream of Hanson Estates Drive**

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	# Lo
1	0	riffle	120	3	7	10			50	50					1
2	50	run	100	3	11	7			0	100					0
3	100	pool	88	8	10	6			30	70					2
4	150	riffle	92	9	8.5	3			60	40					3
5	200	pool	110	5	16	8			50	25	25				4
6	250	pool	99	4	13	12.5			30	70					0
7	300	run	89	5	11.5	3			0	100					3
8															
9															
10															
Total	300		698	37	77	49.5			220	405	25				13
Average	50.0		99.7	5.3	11.0	7.1			31.4	57.8	3.6				

1 Station Surface Area **2490** sq ft. **0.057** acres
2 Water Types % pool **42.9** %flat **0** %riffle **28.6** %run **28.6** %rapids **0** %glide **0**
3 Spawning Habitat % suitable for anadromous salmonids **31.4%** Fish present: **Brook Trout, Coho Salmon**
4 Fish Cover (type abundance) **Woody debris, Common**
5 Sand Bedload heavy_____ medium **57.8%** light _____ source: **highway culvert & waterfall scour upstream**
6 Immediate Banks (height, stability) **0.6'-2.0', heavily undercutting some areas**
7 Riparian vegetation (type, size) **medium age second growth Maple, no conifers**
understory no vegetation, thick leaf mold, mosses, grasses & sedges at waters edge
8 Aquatic vegetation abundance **sparse** predominant types **algae & mosses**

9 Invertebrates abundance **sparse, "Fair" Isaac walton Guide rating** predominant types **Caddisfly, Dragonfly, Clams**

10 Wildlife **Ravens, Red Squirrel, Eastern Chipmunk, Wood Frog**

11 Water color, turbidity, level **Dark Amber; clear but reddish flocculent present in pools; ~1/2 bankfull, 3.8 cfs**
12 Water temperature **50.6** F 13 Air temperature **65.7** F 14 Time of day **11:00 am** PH= **6.1** Dissolved Oxygen= **5.0 ppm**
15 **Streamflow discharge 6.2 cfs, taken at BANKFULL condition on 4/17/01**

Transect	Width	Ave Depth	Area (WxD)
1	110 in	11 in	1210 sq.in
2	110 in	11 in	1210 sq.in
3	110 in	11 in	1210 sq.in

Float distance = **3** ft.
Float time = **3.2** sec. (Avg. of 3 floats)
Current velocity = **0.93** ft./sec.

Average = **8.4** sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge= 0.93 ft/sec X 8.4 sq.ft. = 7.8 cubic ft/sec (cfs) X 0.8 = 6.2 cfs

16 Comments: Some sewage-like odor during light rains, none during heavy rain.
Aquatic insects few, mostly caddis cases protected under stones.
Rip on homade culvert caving into flow channel, road surface eroding through guardrail
High Flow Backup & ponding of water pulling soils from unstabilized raw roadsides

---

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station # 48 **Date** 11/1/2001

Stream Name & Station Location: Hanson Creek @ Jurmu Property (Hanson Estates)

Gear: Electroshocker Backpack

Species	Rainbow Trout	Coho Salmon	Mottled Sculpin	Lamprey ammocete	Brook Trout			
Length in mm	97	490	75	108	42			
	86	380	21		120			
	89	510	16		83			
	94	450						
		88						
		102						
		44						
Total #	4	7	3	1	3			
Ave. Lgth	91.5	294.9	37.3	108.0	81.7			
% of total catch	22.0	38.5	16.5	5.5	16.5			

SAVE OUR STREAMS
Stream Quality Survey

MR. BEHNING'S SCIENCE CLASS
HANSON CREEK @ JURMU PROP

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream HANSON CREEK @ JURMU PROP. Station HANSON #HC#2
County ALGER (Au Train Twp.) State MI Location T.47N., R.20W., SEC. 25, SE¼ of NE¼
Group or individual J.S. DAVIS, MATHER MIDDLE SCHOOL Number of participants 29
Weather conditions OVERCAST TO SUNNY, 58°F AIR TEMP
Stream width (Average) ____ ft. Water depth (in riffle) ____ in.
Flow rate: high ____ low ____ normal X

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) ____ Average stream depth ____ Water temperature ____
Date 10/30/01 TUESDAY Time 9:00-12:00 Sample Number ____
Type of test: macroinvertebrate count ____ chemical test 1 other ____

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE		SOMEWHAT-SENSITIVE		TOLERANT	
C	102 caddisfly larvae		beetle larvae	A	2 aquatic worms
			hellgrammite	A	9 clams		blackfly larvae
			mayfly nymphs	A	1 crane fly larvae		leeches
			gilled snails		crayfish	A	1 midge larvae
A	1 riffle beetle adult		damselfly nymphs				pouch (and other) snails
			stonefly nymphs	A	6 dragonfly nymphs		
			water penny larvae	A	1 scuds		
					sowbugs		
					fishfly larvae		
					alderfly larvae		
					atherix		
2 # of letters times 3 = 6		4 # of letters times 2 = 8		2 # of letters times 1 = 2	
6 Index value		8 Index value		2 Index value	

Now add together the three index values = 16 total index value.
Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

- ☐ Excellent (> 22)
- ☐ Good (17 - 22)
- ☒ 16 Fair (11 - 16)
- ☐ Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

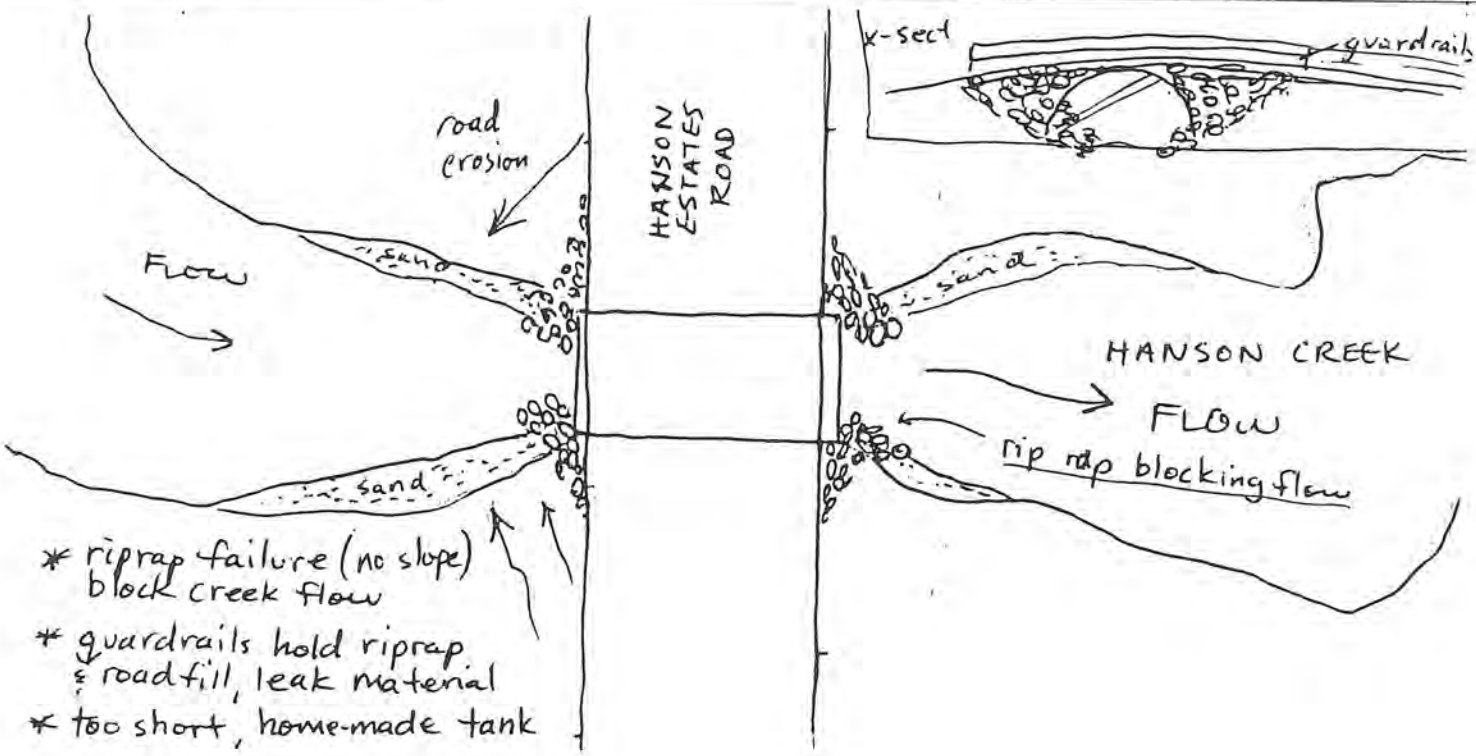
recycled paper

Hanson Creek @ Hanson Estates

Alger County T47N R20W Sec. 25

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 8 – HANSON CREEK - @ HANSON ESTATES
Stream Crossing

BMP List: Replace short, (22' x 10'8")home-made steel "tank" arch
W/ 30' x 12'3" x 4'5" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap culvert ends and ditch to proper slope
Add gravel and re-grade
Pull existing riprap out of blocked stream channel
No ditches, road elevated fill over floodplain area
Need to vegetate and slope roadside

Legend

N

USDA

20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Hanson Creek @ Carr Road

1. Below: Downstream view of undersized Hanson Creek culvert at Carr access road to sand/gravel pit. Note deformation and rusted condition.

2. Below: Upstream view of Hanson Creek culvert at Carr access road. This road gets high use and heavy loads. In addition to being undersized, the culvert is somewhat embedded.

3. Below: Downstream view of Hanson Creek below culvert. Beaver blockages must be frequently removed from this site as well.

4. Roadside slopes toward stream and surface flows into stream during heavy rains. Recently, during the snowmelt runoff event that went over the road at the Furnace Lake outlet, the stream also ran over the road here, due to the inability of this culvert to handle storm flows.

Anna River North Branch Survey Transect #26
Downstream View of Culvert at Perch Lake Road Crossing

Upstream View of Culvert at Perch Lake Road Crossing

Upper Anna River - South Branch

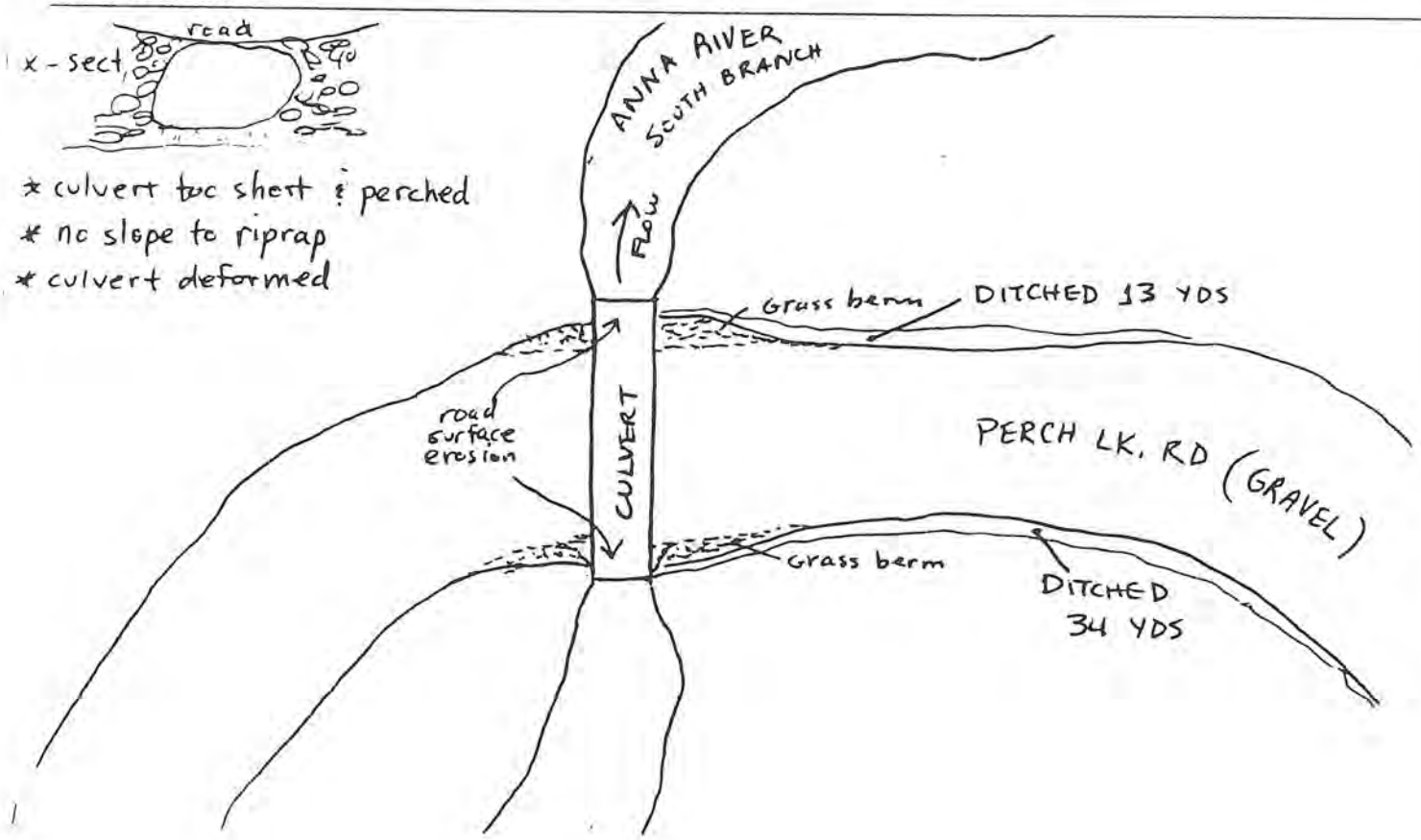
Alger County T 46 R19 Sec17

Alger

Approx. Acres:

Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 3 – ANNA RIVER HEADWATERS- South Branch
Stream Crossing

BMP List: Replace narrow deformed, short (24' x 5'4" x 3'5") culvert
W/ 32' x 10'6" x 5'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap to proper slope
Add gravel to elevate road at crossing & re-grade

Legend

N

USDA

20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # 27 **Date** 10/26/00

Stream Name and Station Location: **S Branch Anna River, 300' transect-upstream of Perch lake Rd. crossing**

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								WD # Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	riffle	105	6	9.5	6			40	60					9
2	50	glide	96	5.5	9	6				50	50				2
3	100	riffle	78	8.5	12	8			50	50					2
4	150	glide	90	8	8	7				50	50				0
5	200	pool	84	9	14	4			20	80					2
6	250	riffle	124	12	5	5			50	50					0
7	300	pool	127	10	13.5	10.5			10	90					3
8															
9															
10															
Total	300		704	59	71	46.5			170	430	100				
Average	50		100.6	8.43	10.14	6.64			24	61.4	14				

1. Station Surface Area **2515.0** sq. ft. **0.576** acres
2. Water Types: % pool **29** %flat **0** %riffle **43** %run **0** %rapids **0** %glide **29**
3. Spawning Habitat: % suitable for anadromous salmonids **24%** Fish present: **Brook Trout, Coho Salmon, Sculpin**
4. Fish Cover (type, abundance) **common**
5. Sand Bedload: heavy _____ medium **61%** light _____ source **ditches, natural**
6. Immediate Banks (height, stability) **1'-6' mostly stable w/some undercuts**
7. Riparian vegetation (type, size) **Northern Hardwoods w/ Cedar, spruce, Balsam, medium to old growth streamside understory is sedges, mosses, grasses, ferns**
8. Aquatic vegetation: overall abundance **sparse** predominant types **algae, mosses, liverworts**
9. Invertebrates: abundance **common, "Good" rating w/Isacc Walton guide** predominant types **Stonefly, Caddisfly, Mayfly**
10. Wildlife **no beaver, whitetail deer, raccoon, American toad**
11. Water color, turbidity and level **Lt. Amber, good clarity, 3/4 bankfull** **PH= 7.0, Dissolved Oxygen= 5.8**
12. Water temperature **48.6 F** 13. Air temperature **56.6 F** 14. Time of day **11:00 am**
15. **STREAMFLOW DISCHARGE 6.49 cfs, taken at BANKFULL condition on 4/18/01**

Transect	Width	Ave. Depth	Area (WxD)
1	124 in	9.75 in	1209 sq. in
2	124 in	9.75 in	1209 sq in
3	124 in	9.75 in	1209 sq in

Average = 8.39 sq. ft. Discharge = Area x velocity x roughness coefficient

Discharge = 0.86 ft/sec X 8.39 sq. ft = 7.21 cubic ft/sec (cfs) X .9 = 6.48 cfs

Float distance = 3 ft.
Float time = 3.5 sec. (Ave. of 3 floats)
Current velocity = 0.86 ft./sec.

16. Comments: At high flows, Water held back and undermining culvert at road/stream crossing due to undersized culvert.
Road surface and substrate around culvert eroding constantly into stream at crossing.
Ponding next to road at high flows pulling soils from unvegetated ditching
Fish have difficulty traveling through culvert at high flow (bankfull and up)
Low numbers of forage fish (sculpins), no minnows taken
Need to increase cross sectional area of culvert & match bottomless arch width to bankfull width of stream
Need to raise road level at crossing and put turnouts (flow diverters) along approaches, north ditches well vegetated
Bottomless Arch culvert would facilitate fish/insect migration, sediment flushing, alleviate backup

---

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station# 27 **Date** 10/26/2000

Stream Name & Station Loc South Branch Anna River

Gear Electroshocker Backer

Species	Rainbow Trout	Brook Trout	Coho Salmon	Sculpin
Length in mm	102	97	630	81
	80	103	66	15
	450	118	63	
	80	154	69	
	113	140	95	
		103	504	
		105	96	
		122	90	
		55	68	
		100	73	
			57	
			75	
Total #	5	10	12	2
Ave. Lgth	165	109.7	157.2	48
% of total catch	17.2	34.4	41.4	6.9

SAVE OUR STREAMS
Stream Quality Survey

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream ANNA RIVER (South Branch) Station #20
County ALGER State MI Location T46N, R4W, NW¼ of SW¼ Sec. 17
Group or individual _____ Number of participants _____
Weather conditions _____
Stream width (Average) _____ ft. Water depth (in riffle) _____ in.
Flow rate: high X low _____ normal _____

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) X Average stream depth _____ Water temperature 48.6
Date 10-17-00 Time 9:30-11:30 Sample Number #27
Type of test: macroinvertebrate count X chemical test X other X PH

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE	SOMEWHAT-SENSITIVE	TOLERANT
[A] caddisfly larvae	[A] beetle larvae	[A] aquatic worms
[ ] hellgrammite	[ ] clams	[A] blackfly larvae
[A] mayfly nymphs	[ ] crane fly larvae	[ ] leeches
[ ] gilled snails	[ ] crayfish	[ ] midge larvae
[A] riffle beetle adult	[ ] damselfly nymphs	[ ] pouch (and other) snails
[A] stonefly nymphs	[A] dragonfly nymphs	
[ ] water penny larvae	[ ] scuds	
	[ ] sowbugs	
	[A] fishfly larvae	
	[A] alderfly larvae	
	[ ] atherix	
[12] # of letters times 3 = ____ index value	[8] # of letters times 2 = ____ index value +	[2] # of letters times 1 = ____ index value +

Now add together the three index values = 22 total index value.

Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

- [ ] Excellent (> 22)
- [X] Good (17 - 22)
- [ ] Fair (11 - 16)
- [ ] Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

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Anna River South Branch Survey Transect # 27
Downstream View of Culvert at Perch lake Road Crossing

Upstream View Of Culvert at Perch lake Road

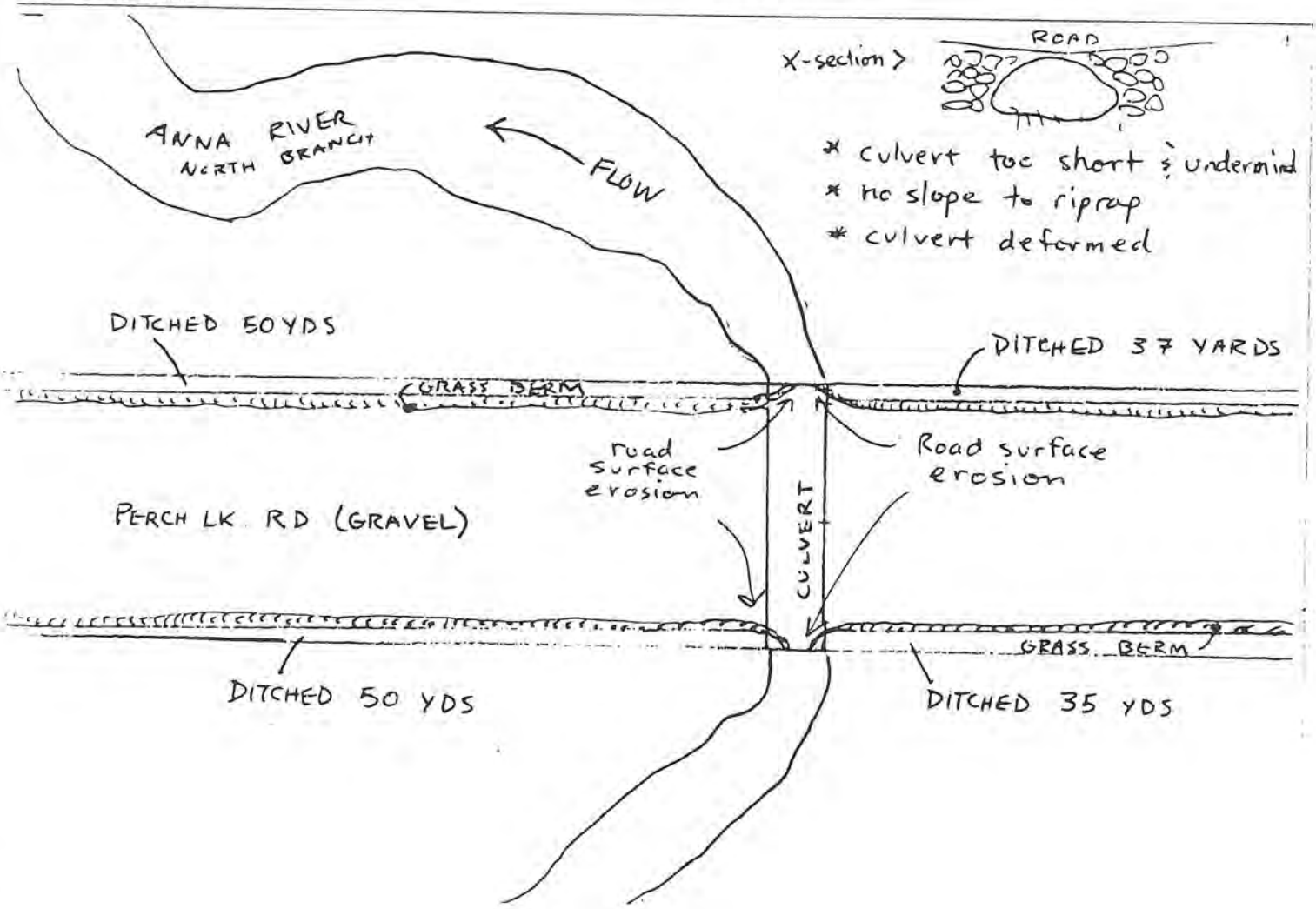
Road Surface Erosion, Culvert too short

Upper Anna River - North Branch

Alger County T46 R19 Sec. 17

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906)387-2222



BMP # 2 – ANNA RIVER HEADWATERS- North Branch
Stream Crossing

BMP List: Replace narrow deformed, short (24' x 5'4" x 3'5") culvert
W/ 32' x 10'6" x 5'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap to proper slope
Add gravel to elevate road at crossing & regrade

Legend

N

USDA

20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # 26 Date 10/26/2000

Stream Name and Station Location N. Branch Anna River, 300' transect-upstream of Perch Lake Rd.crossing

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in)	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	riffle	88	10.5	11.5	7.5			20	80					0
2	50	flat	132	5.5	10	9			30	70					3
3	100	pool	198	12	14	13.5			50	50					6
4	150	glide	135	8	21	7.5			20	80					0
5	200	riffle	127	13.5	9	8			75	25					4
6	250	pool	144	7.5	18	22.5			30	70					9
7	300	pool	139	12.5	14	9			20	80					8
8															
9															
10															
Total	300		963	69.5	97.5	77			195	455					
Average	50		137.6	9.07	13.93	11			27.9	65					

1 Station Surface Area 3439.3 sq. ft. .788 acres
2 Water Types: % pool 43 %flat 14 %riffle 29 %run 0 %rapids 0 %glide 14
3 Spawning Habitat: % suitable for anadromous salmonids 28% Fish present: Brook & Rainbow Trout, Coho Salmon, Sculpin
4 Fish Cover (type, abundance) common
5 Sand Bedload heavy medium 65% light source natural above road
6 Immediate Banks (height, stability) 1'-6' mostly stable w/some undercutting
7 Riparian vegetation (type, size) Northern Hardwoods, Cedar, Spruce, Balsam; medium to old growth
streamside understory is sedges, mosses, grasses, ferns
8 Aquatic vegetation: overall abundance sparse predominant types algae, mosses, liverworts
9 Invertebrates abundance sparse, Fair rating w/Isacc Walton guide predominant types Caddis, Mayfly, Stonefly
10 Wildlife No beaver sign, Ravens, Whitetail Deer, American Toad & Wood Frog
11 Water color, turbidity and level Lt. Amber, good clarity, 3/4 bankfull PH= 7.4, Dissolved Oxygen= 6.7
12 Water temperature 49.9 F 13. Air temperature 67.9 F 14. Time of day 11:00_am
15. STREAMFLOW DISCHARGE 5.69 cfs taken at BANKFULL condition on 4/18/01

Transect	Width	Ave. Depth	Area (WxD)
1	96 in	9.5 in	912 sq in
2	96 in	9.5 in	912 sq in
3	96 in	9.5 in	912 sq in

Float distance = 3 ft.
Float time = 3 sec. (Ave. of 3 floats)
Current velocity = 1 ft./sec.

Average = 6.33 sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge = 1 ft/sec X 6.33 sq. ft. = 6.33 cubic ft/sec (cfs) X .09 = 5.69 cfs

16 Comments: At high flows, Water held back and undermining culvert at road/stream crossing due to undersized culvert.
Road surface and substrate around culvert eroding constantly into stream at crossing.
Ponding next to road at high flows pulling organic soils from west ditch (exacerbated by spring seep)
Fish have difficulty traveling through culvert at high flow (bankfull and up)
Low numbers of forage fish (sculpins), no minnows taken
Need to increase cross sectional area of culvert & match bottomless arch width to bankfull width of stream
Need to raise road level at crossing and put turnouts (flow diverters) along approaches, ditches well vegetated
Bottomless Arch culvert would facilitate fish/insect migration, sediment flushing, alleviate backup

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus
WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station# 26 **Date** 10/26/2000

Stream Name & Station Location North Branch Anna River

Gear Electroshocker Backpack

Species	Rainbow Trout	Brook Trout	Coho Salmon	Sculpin	
Length in mm	144	103	74	50	
		100	79	25	
		85		24	
		110		16	
				18	
Total #	1	4	2	5	
Ave. Lgth	144	99.5	37	26.6	
% of total catch	8.3	33.3	16.6	41.7	

SAVE OUR STREAMS
Stream Quality Survey

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream ANNA RIVER (North Branch) Station #2b

County ALGER State MT Location T46N, R19W, SE¼ of NW¼, Sec. 17

Group or individual GROUP Number of participants 19

Weather conditions OVERCAST

Stream width (Average) _____ ft. Water depth (in riffle) _____ in.

Flow rate: high X low _____ normal _____

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) _____ Average stream depth _____ Water temperature 44.6

Date 10-18-00 Time 9:30-11:30 Sample Number 2b

Type of test: macroinvertebrate count X chemical test X other X pH

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE	SOMEWHAT-SENSITIVE	TOLERANT
[B] caddisfly larvae	[ ] beetle larvae	[A] aquatic worms
[ ] hellgrammite	[ ] clams	[A] blackfly larvae
[S] mayfly nymphs	[A] crane fly larvae	[ ] leeches
[ ] gilled snails	[ ] crayfish	[ ] midge larvae
[ ] riffle beetle adult	[ ] damselfly nymphs	[ ] pouch (and other) snails
[A] stonefly nymphs	[ ] dragonfly nymphs	
[ ] water penny larvae	[ ] scuds	
	[ ] sowbugs	
	[ ] fishfly larvae	
	[ ] alderfly larvae	
	[ ] atherix	
[9] # of letters times 3 = ____ index value +	[2] # of letters times 2 = ____ index value +	[2] # of letters times 1 = ____ index value

Now add together the three index values = 13 total index value.

Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

[ ] Excellent (> 22) [ ] Good (17 - 22)

[X] Fair (11 - 16) [ ] Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

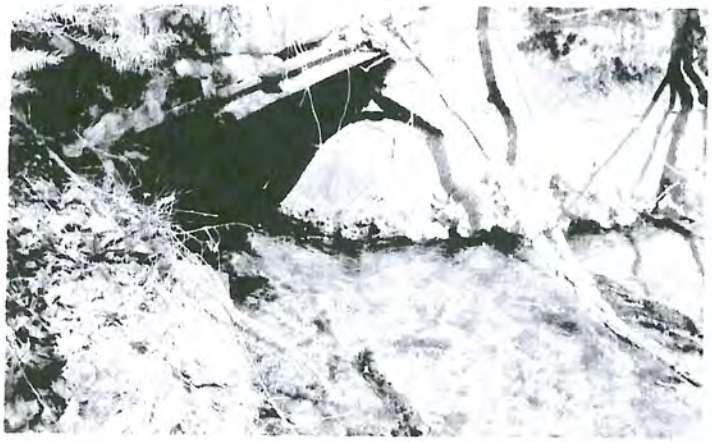
recycled paper

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

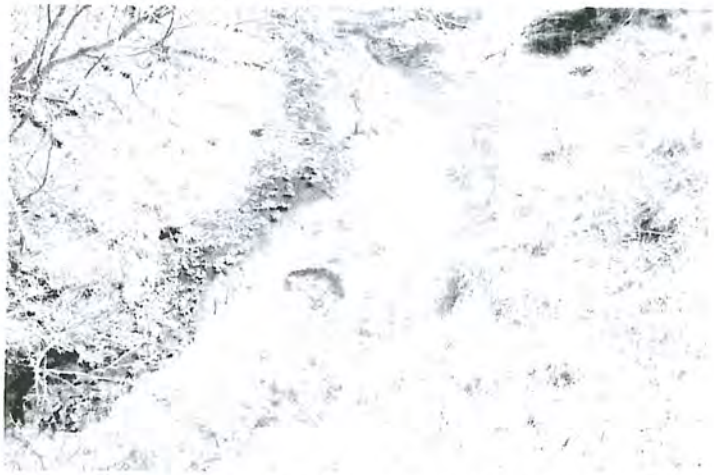
Survey Transect Tag # 29: Valley Spur Creek Headwaters

1. Left and Below: At the foot of the railroad grade slope, just above the culvert, is this ear tag marking the Valley Spur Creek evaluation transect.

2. Below: This is the mouth of the mortared rock and steel-roofed culvert that runs about 200 feet under the railroad grade. Note the nice gravel substrate that dominates this streambed.

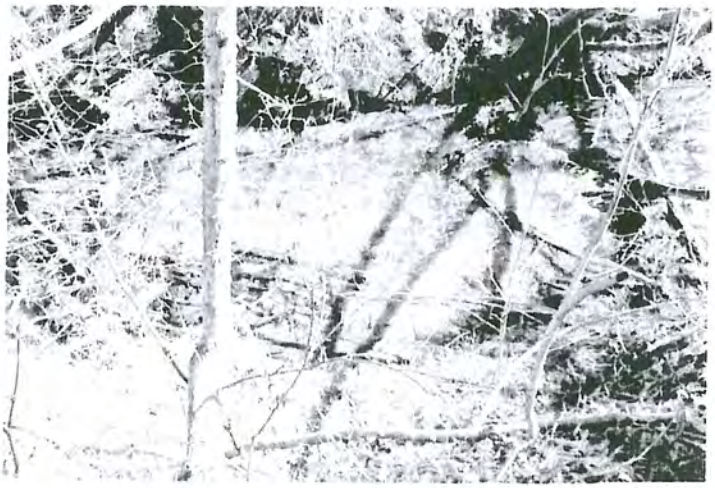


3. The first 50 foot transect above the culvert has a considerable amount of shallow sand and silt bed loading from a blown out beaver pond 300 feet upstream.



4. Continuing upstream, the sand bed loading is intermittent due to a large amount of woody debris that helps scour and move the sand and silt downstream.

5. Here a ribbon marks one of the cross sections at a gravel riffle. We noted a large number of little brook trout throughout the lower area of the survey transect.



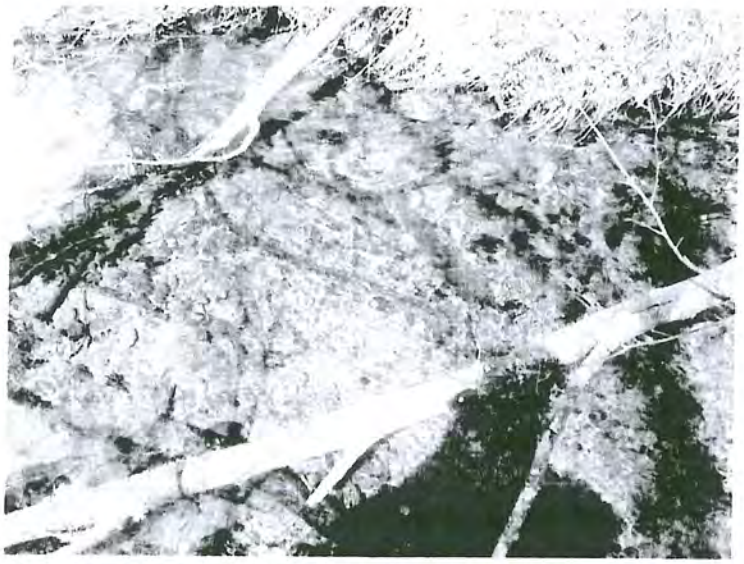
ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Survey Transect Tag # 29: Valley Spur Creek Headwaters

6. Below: This is a view of the old beaver dam and original stream channel predating the dam blowout.

7. Below: This curve is the intersection of the old and new stream channel. The dam blowout and stream re-route directed the flow at this bank which failed to hold.

8. Below: Just above the intersection of the old and new stream channel is this exposed gravel riffle



9. Below: The 300 foot transect ends at the old beaver pond, now almost completely filled with sediment to 3-4 foot depth. Note the clean sand washing out of the exit channel, which has re-routed the stream about 50 feet south of it's original course.

ALGER CONSERVATION DISTRICT
Munising Bay Watershed Project
Stream Station Description

Station # 29 Date 7/1/01

Stream Name and Station Location: Valley Spur Creek

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	P	8'5"	22"	11"	9"			30	70					
2	50	RN	8'2"	12"	10"	9"				100					
3	100	RN	13'	4"	14"	16"			10	90					
4	150	R	10'	10 1/2"	10"	6""			50	50					
5	200	R	7'6"	8"	12"	9"			100						
6	250	P	20'	14"	26"	31"			30	70					
7	300	R	19'	13"	24"	14"					100				
8															
9															
10															
Total															
Average															

1. Station Surface Area _____ sq. ft. _____ acres
2. Water Types % pool_____ %flat_____ %riffle_____ %run_____ %rapids_____ %glide_____
3. Spawning Habitat: % suitable for anadromous salmonids _____ resident salmonids _____
4. Fish Cover (type, abundance) _____
5. Sand Bedload heavy_____ medium_____ light _____ source_____
6. Immediate Banks (height, stability) _____
7. Riparian vegetation (type, size) _____
8. Aquatic vegetation: overall abundance _____ predominant types_____
9. Invertebrates: overall abundance _____ predominant types_____
10. Beaver activity, wildlife _____
11. Water color, turbidity and level _____
12. Water temperature_____ 13. Air temperature 82°F 14. Time of day _____
15. Streamflow discharge 4.19 cfs

Transect	Width	Ave. Depth	Area (WxD)
1	84 in	10.66 in	895.4 sq. in
2	84 in	10.66 in	895.4 sq. in

Float distance = 3 ft.
Float time = 4 sec. (Ave. of 2 floats)
Current velocity = ft./sec. = 0.75 ft./sec.

Average = 6.21 sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge = 6.21 sq ft X 0.75 ft./sec X 0.9 = 4.19 cu. Ft./sec (0.8 of 0.9)

16. Comments

* Stream @ 3/4 of "Bankfull" conditions

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station# 29 **Date** 6/14/2001

Stream Name & Station Location Valley Spur Creek

Gear Electroshocker Backpack

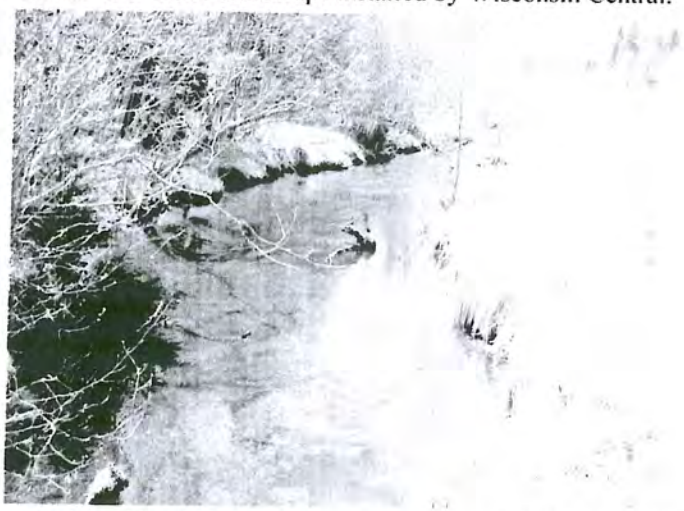
Species	Brook Trout	Rainbow	Coho	Sculpin	Stickleback			
Length in cm	3.1	5.8	10.4	6.5	5.5			
	5.5	4.9	4.7	3.1	5.4			
	9.8	5.5	7	4.2				
	4.2	3.3	6.5	4.5				
	15		5					
	3.5		4.8					
	4.1		5.7					
	3.5		5					
	4.1		5.9					
	3.2		5.1					
	4.4		3.9					
	15.5		3.6					
	4.2		3					
	3.3		4.3					
	3.2		2.9					
	3		5.5					
	12.1		6.7					
	4.9		10.2					
	5.8							
	8.2							
	14.3							
Total #	20	4	18	4	2			
Ave. Lgth	6.42	4.88	5.57	4.58	5.45			
% of total catch	41.67%	8.33%	37.50%	8.33%	4.17%			

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

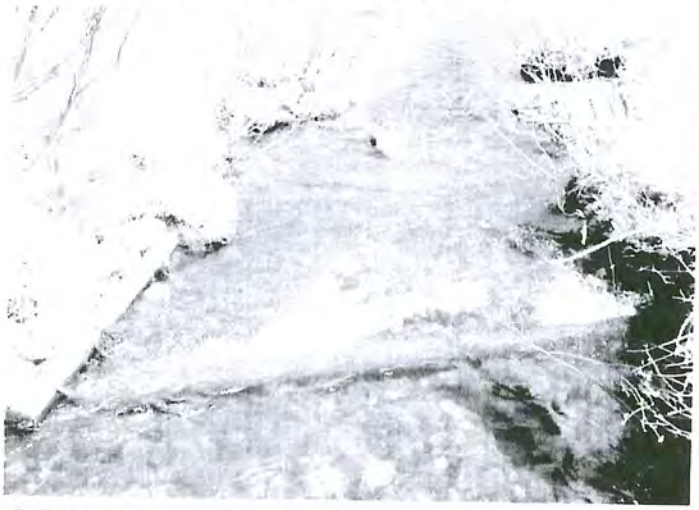
Survey Transect Tag # 33: Anna River at the Harry Lindquist property

1. Below: Anna River at the Lindquist property. Survey transect starts 50 feet downstream of the private crossing. This is a view west (upstream) of the crossing.

2. Below: This is a view of the upstream end of the transect, looking west. The adjoining Pasineault property is the location of one of two sand traps installed by Wisconsin Central.



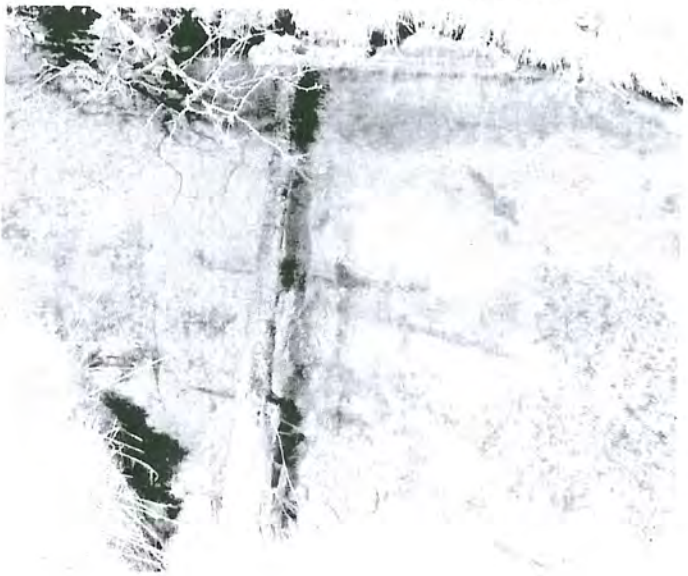
3. Below: This is one of the small log K-dams installed by Boy Scouts on Anna at the Lindquist property



4. Below: This is the Anna River downstream of the transect, as it turns south, toward and next to highway M-94.

5. Below: Anna River at M-94, displaying the typical sand bed loading of the middle section of the river. Note small log K-dams placed across the river to scour sand.

6. Below: Close up of one of the K-dam digger logs which has stripped the sand and created a 3 foot deep hole.



ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station Tag # 33 Date 10/19/01

Stream Name and Station Location: **Anna River, 300' transect-upstream of Harry Lindquist crossing** below second sand trap on Pasinaeult Prop.

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %							WD # Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	riffle	48	10	13	8		20	80	20					9
2	50	glide	58	14	12.5	11		25	75						2
3	100	riffle	50	8.5	12	8		30	70						2
4	150	glide	66	8	13	7		10	80	10					0
5	200	pool	84	9	14	4		20	80						2
6	250	riffle	51	12	13.8	5		25	75						0
7	300	pool	127	10	15	10.5		10	80	10					3
8															
9															
10															
Total	300		484	71.5	93.3	53.5		140	540	40	0				18
Average	50		69.14285714	10.2143	13.3286	7.64286		20	77.14	5.714	0				2.5714286

1 Station Surface Area **20742** sq. ft. **0.476** acres
2 Water Types. % pool **28.6** %flat **0** %riffle **42.9** %run **0** %rapids **0** %glide **28.6**
3 Spawning Habitat. % suitable for anadromous salmonids **77%** Fish present: **Brook Trout, Coho Salmon, Sculpin**
4 Fish Cover (type, abundance): **Rocks, Woody debris, k-dam; common**
5 Sand Bedload: heavy_____ medium_____ **Very light 6%** source **sand escaping upstream trap, & natural**
6 Immediate Banks (height, stability) **1'-2' stable/hardened by RR grade north side, some undercuts south side**
7 Riparian vegetation (type, size): **Sparse Northern Hardwoods w/ Cedar, spruce, Balsam, Young to medium growth Mostly open w/grasses & sedges north side along track, streamside understory is sedges, mosses, grasses, ferns**
8 Aquatic vegetation:overall abundance **sparse** predominant types **algae, mosses**
9 Invertebrates. abundance **common, "Fair" rating w/Isacc Walton guide** predominant types **Caddisfly, Scuds, Midge larvae,**
10 Wildlife **beaver, American toad**
11 Water color, turbidity,level, flow **Lt. Amber, good clarity, ~3/4 bankfull, 14.2 cfs, PH= 7.8, Dissolved Oxygen= 5.5**
12 Water temperature **38.7 F** 13. Air temperature **46 F** 14. Time of day **11:00 am** PH= **8.0** Dissolved Oxygen= **5.5**
15. **STREAMFLOW DISCHARGE 21.6 cfs, taken at BANKFULL condition (lightly raining) on 4/18/01**
Repeated Discharge transect next day **21.0** cfs, also taken at BANKFULL (no rain) on 4/19/01

Transect	Width	Ave. Depth	Area (WxD)
1	70 in	16.5 in	1155 sq. in
2	70 in	16.5 in	1155 sq. in
3	70 in	16.5 in	1155 sq. in

Float distance = 3 ft.
Float time = 1.0 sec. (Ave. of 3 floats)
Current velocity = 3 ft./sec.
Area (sq. in) / 1 sq. ft (144 sq. in) = sq. ft.

Average Area = 8.0 sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge = 3 ft/sec X 8 sq. ft = 24 cubic ft/sec (cfs) X .9 = 21.6 cfs

16 Comments

Few forage fish, No minnows present & few sculpins
Invertebrates common, but mostly caddis or scuds.
Stoneflies and Mayflies still low to nonexistent due to frequent sand inundation
Sand trap upstream fills up long before before cleanout, then continually "leaks" downstream
Good Water Quality, oxygen, flow, gravel spawning riffles in narrowed channel stays clear of sand

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1/ pool, flat, riffle, run rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station# 33 **Date** 10/19/01

Stream Name/Station Location **Anna River, 300' transect -upstream of H. Lindquist bridge**

Gear Electroshocker Backpack

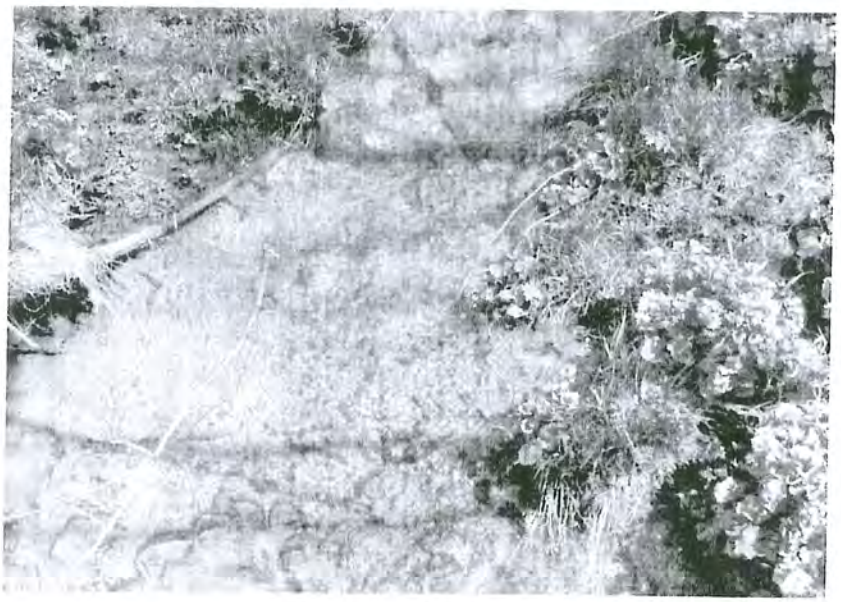
Species	Brook Trout	Coho Salmon	Mottled Sculpin					
Length in mm								
	150	490	60					
	104	400	52					
	96	520	57					
	123		71					
	110		30					
	88		25					
Total #	6	3	6					
Ave. Lgth	111.8	470.0	49.2					
% of total catch	40	20	40					

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Transect Tag # 32: Fish Hatchery Creek, 300' below highway M-94

1. Below: Concrete in lower foreground is the culvert abutment for the highway crossing. This was the only open area on a heavily wooded stream with lots of coarse woody debris and gravel riffles. Water clarity and temperature as well as abundant benthic invertebrates provide excellent salmonid habitat. The cover made it so dark away from the highway corridor, most of our photos upstream did not turn out.

2. Below: Close up of gravel and cobble near culvert and a small spring flow bringing organic silt into the stream where the highway berm damns downslope flow, forcing it laterally into the stream at the highway. Many spring seeps flow north, downslope in this area toward the river valley. Before the highway was built most sediment was probably intercepted by wetland meadow vegetation and probably lacked enough flow in any one area to produce visible flow channels like the one we see here. This small erosion site could be easily fixed with some shrubstaking and a couple of fascine bundles.



ALGER CONSERVATION DISTRICT
Munising Bay Watershed Project
Stream Station Description

Station # 32 **Date** _____

Stream Name and Station Location: Fish Hatchery creek

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	R	6'4"	11 1/2"	12"	9"			10	90					
2	50	R	8'8"	11"	9"	11"			40	60					
3	100	P	10'	8"	13"	15"			40	60					
4	150	P	7'8"	13 1/2"	16 1/2"	18"			50	50					1
5	200	R	20'7"	10"	13"	12 1/2"			30	70					12
6	250	RnP	8'6"	18"	19"	15"			70	30					2
7	300	R	10'10"	10"	6"	7"			80	20					4
8															
9															
10															
Total															
Average															

1 Station Surface Area _____ sq. ft. _____ acres
2 Water Types % pool_____ %flat_____ %riffle_____ %run_____ %rapids_____ %glide_____
3 Spawning Habitat: % suitable for anadromous salmonids _____ resident salmonids _____
4 Fish Cover (type, abundance) _____
5 Sand Bedload: heavy_____ medium_____ light _____ source_____
6 Immediate Banks (height, stability) _____
7 Riparian vegetation (type, size) _____
8 Aquatic vegetation: overall abundance _____ predominant types_____
9 Invertebrates: overall abundance _____ predominant types_____
10 Beaver activity, wildlife _____
11 Water color, turbidity and level _____
12 Water temperature__46.1 F_____ 13 Air temperature___76.1 F_____ 14. Time of day _____
15 Streamflow discharge __4.89____cfs

Transect	Width	Ave. Depth	Area (WxD)
1	84 in	7"	588 sq in
2	84 in	7"	588 sq in

Float distance = ____3_____ ft.
Float time = _____2_____ sec. (Ave. of 2 floats)
Current velocity = ft./sec. = ___1.5_____ ft./sec.

Average = __4.08_____ sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge = 4.08 sq.ft. X 1.5 ft/sec X 0.8 = 4.89 cu. Ft./sec. (0.8 of 0.9)

16 Comments

* Stream @ 3/4 of "Bankfull" Conditions

1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft., common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Survey Transect tag # 38 WAGNER CREEK @ Highway M94 below Wagner Falls

1. The Highway M-94 culvert in the background is a few yards from the beginning of the 300' transect. Dave Kronk, NPS– Pictured Rocks is helping keep the teams on track.

2. 2nd row of Fish Interceptors, working below the fish shocker and the first two interceptors. The fellow on the bank is holding a bucket of clean stream water for a holding and recovery tank.

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT
Stream Station Description

Station # 38 **Date** "10/26/00

Stream Name and Station Location: **Wagner Creek, 300' transect upstream of Hwy M-94**

Transect No.	Distance from Origin (ft.)	Water Type	Channel Width (in.)	Channel Depth (in.)			Bottom Type %								# Logs
				1/4	1/2	3/4	B	BC	G	S	ST	M	PD	C	
1	0	rapids	107	8	8.5	8		10	80	10					0
2	50	riffle	108	12.5	13	9			80	20					0
3	100	pool	120	9.5	14	18	10		20	70					4
4	150	glide	131	5	7	9			50	50					0
5	200	glide	108	9	11	7			50	50					0
6	250	riffle	176	4	9	8			70	30					3
7	300	riffle	108	8.5	10	9			50	50					4
8															
9															
10															
Total	300		858	56.5	72.5	68	10	10	400	280					11
Average	50		122.6	8.0714	10.357	9.7143	1.43	1.4	57.1	40					

1. Station Surface Area **3065** sq. ft. **.07** acres
2. Water Types: % pool **14.3** %flat **0** %riffle **42.9** %run **0** %rapids **14.3** %glide 28.6
3. Spawning Habitat: % suitable for anadromous salmonids **57%** Fish present: **Brook & Rainbow Trout, Coho Salmon, Sculpin**
4. Fish Cover (type, abundance): **Woody debris & tree roots, undercuts, rocks; common**
5. Sand Bedload: heavy_____ medium_____ light **40%** source **natural, plus occasional from footpath**
6. Immediate Banks (height, stability) **8"-1.5', stable w/pools and undercuts**
7. Riparian vegetation (type, size) **Mature Northern Hardwoods & Cedar, Spruce, Balsam, Speckled Alder**
understory of grasses, sedges, ferns, mosses, liverworts
8. Aquatic vegetation: abundance **scarce** predominant types **algae, mosses**
9. Invertebrates: abundance **Abundant** predominant types **Caddisfly, Cranefly, Stonefly, Dragonfly, Aquatic Worms**
10. Wildlife **no beaver, mink sign (tracks), Green Frog**
11. Water color, turbidity, level, norm. flow **Lt. Amber, very good clarity, ~3/4 bankfull, 4.7 cfs**
12. Water temp **53.1 F** 13. Air temp **69.1 F** 14. Time **3:00pm** **PH=7.4** **Dissolved Oxygen=5.9**
15. Streamflow discharge 6.35 cfs, taken at BANKFULL condition on 4/18/01

Transect	Width	Ave. Depth	Area (WxD)
1	64 in.	10.6 in	678.4 sq.in
2	64 in.	10.6 in.	678.4 sq in
3	64 in.	10.6 in	678.4 sq in

Float distance = 3 ft.
Float time = 2 sec. (Ave.of 3 floats)
Current velocity = 1.5 ft./sec.

Average = 4.71 sq. ft. Discharge = Area x velocity x roughness coefficient
Discharge = 1.5 ft/sec X 4.71 sq. ft. = 7.05 cubic ft/sec (cfs) X 0.9 = 6.3 (0.8 of 0.9)

16. Comments: This is an example of quality habitat, abundant inverts but low on forage fish

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1/ pool, flat, riffle, run, rapids, glide
2/ B-Bedrock, BC-Boulder-cobble (>3"), G-Gravel (1/8-3"), S-Sand, ST-Silt, M-Muck, PD-Peat or detritus WD-Woody debris, C-Clay
3/ Sparse - less than 5% of stream bed area, common - 5-30% of area, abundant - more than 30% of area
4/ Sparse -less than 10 organisms per cu. ft, common 10-50 per cu. ft., abundant-more than 50 per cu. ft.

Catch Summary

Station # 38 **Date** 10/26/2000

Stream Name & Station Location: **Wagner Creek, 300' transect upstream of Hwy M94**

Gear Electroshocker: 12VDC-rectified 220vA/C Backpack

Species	Rainbow Trout	Coho Salmon	Sculpin	Brook Trout	
Length in mm	505	605	89	83	
	484	101	102		
	434	84			
	409	74			
	535	55			
	90	52			
	84				
	89				
	87				
	70				
	75				
	76				
	81				
	89				
	74				
	97				
	70				
	63				
	58				
	57				
	62				
	89				
Total #	22	6	2	1	
Ave. Lgth	167.2	161.8	95.5	83	
% of total catch	70.9	19.8	6.5	3.2	

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Robert McQuisten Recreation Area: Cox Pond Road Crossing

1. The west end of the Cox Ponds culvert, located between the two ponded areas of Wagner Creek, in Wetmore. This was the only eroding stream crossing found on the Wagner Creek system. Note the "beaten" heavy use, inadequate rip rap, and exposed erosion fabric. This is a great area for a couple of hands-on erosion control workshops for volunteers and school groups working with the watershed restoration project. This west end pond may have potential as another handicap access fishing area.

2. West culvert end. Note tracks coming down from the road on both sides where four wheelers have been driving through the creek. Any improvements must include keeping vehicles out. This flat area around the culvert endcould eventually host a wildlife or fishing platform raised to road level. That would keep vehicls and foot traffic from eroding the banks. There is a large pond to the right of this photo.

3. East end of culvert looking north. Same eroding inadequate stabilization effort. Part of the development scheduled for this stream crossing is placement of a dry hydrant at roadside whose intake will be immediately off shore of this culvert. The first phase of the Robert McQuisten Recreation Area development also plans a boardwalk very close to this end of the second large pond on the Wagner Creek and may add an access to it from this roadside site.

Hanson Creek @ Carr Rd

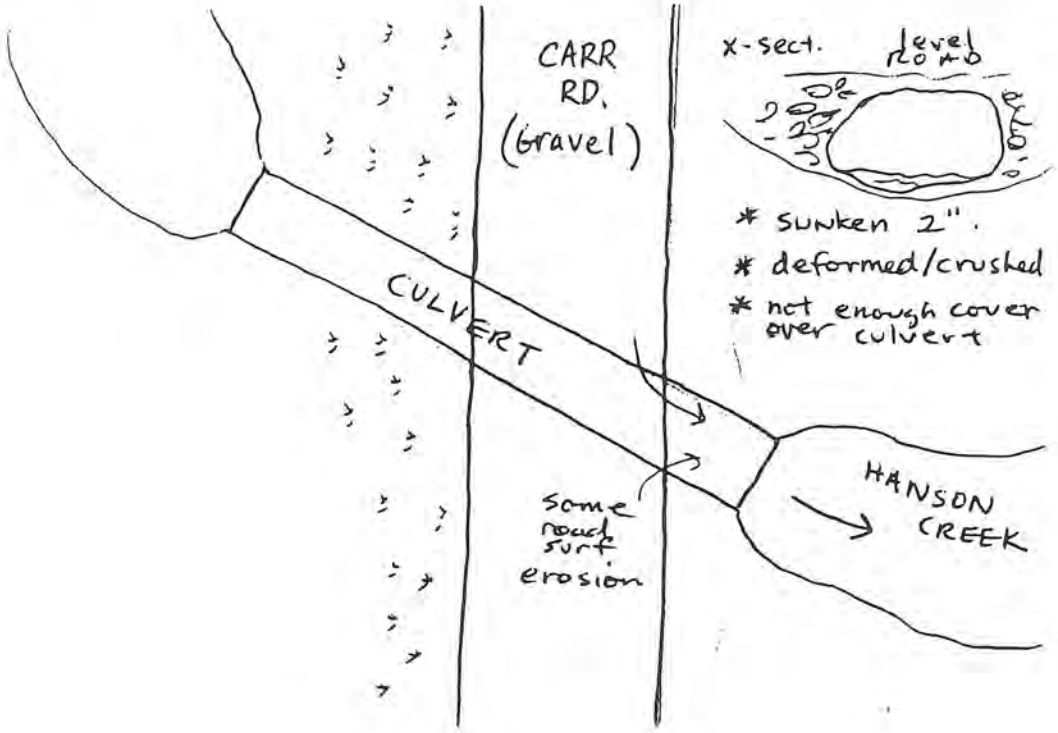
Alger County T47 R19 Sec. 29

Alger

Approx. Acres:

Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 9 – HANSON CREEK - @ CARR ROAD (gravel pit access)
Stream Crossing

BMP List: Replace undersized (48' x 6') deformed steel culvert
W/ 50' x 12'1" x 6'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap culvert ends and ditch to proper slope
Add gravel to elevate road surface and re-grade

Legend

N

USDA

20 0 20 40 Feet

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Furnace/Carr Lake at Outlet: Furnace Creek Source April 19, 2002

1. Furnace/Carr Lake Outlet: Furnace Creek view south from highway M-28. Waters are receding from flood stage.

2. Closeup of same oveertopped culvert at downstream (north) end. Water was 6 inches over the road surface overnight.

3. Upstream side of stream crossing. Only constant addition of gravel all during the night and attendance with a bull dozer kept this

4. Close up of Lake side at completely submerged culvert intake

5. View of west approach to crossing

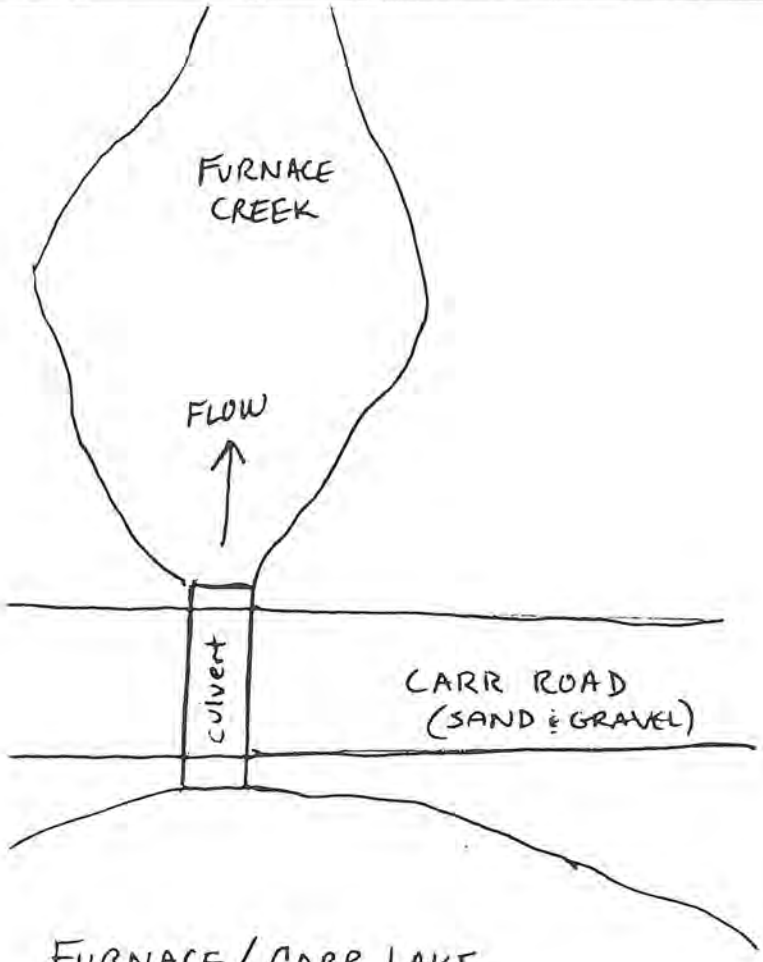
6. View of east approach

Furnace Creek @ Carr Rd

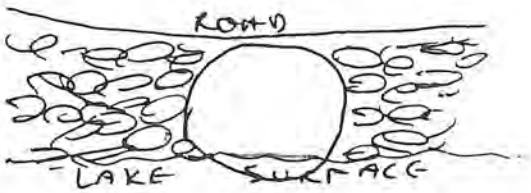
Alger County T47 R 19 Sec 29

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



FURNACE / CARR LAKE



* too short of a culvert
* too near surface of rd.
* USFWS wants Lamprey Barrier
* gross erosion from road surface (sand)
* constant maintenance
* too small for DEQ storm calculations backups erode banks during flood stage

BMP # 10 – FURNACE CREEK - @ CARR ROAD (gravel pit access)
Stream Crossing & Outlet of Furnace/Carr Lake

BMP List: Replace too short, undersized (16' x 6') steel culvert
W/ 20' x 12'1" x 6'7" solid-bottom aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Add aluminum headwalls & wingwalls
Add seasonally removable Lamprey Barrier
Geomembrane & Riprap culvert & wings to proper slope
Add gravel to elevate road surface and re-grade

Legend

N

USDA

20 0 20 40 Feet

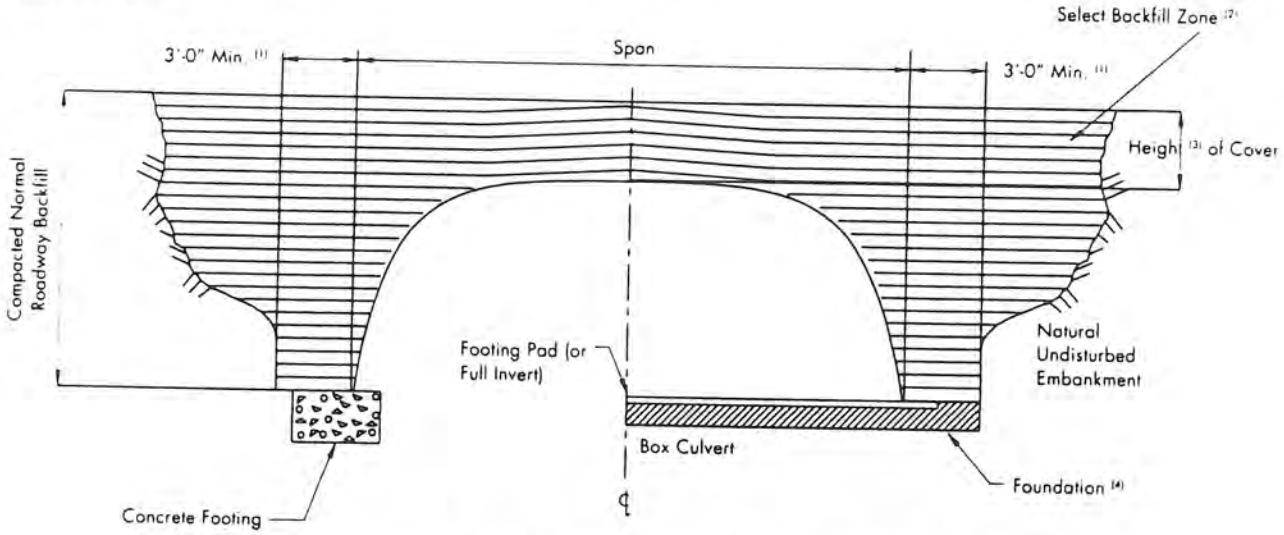
BMP #10

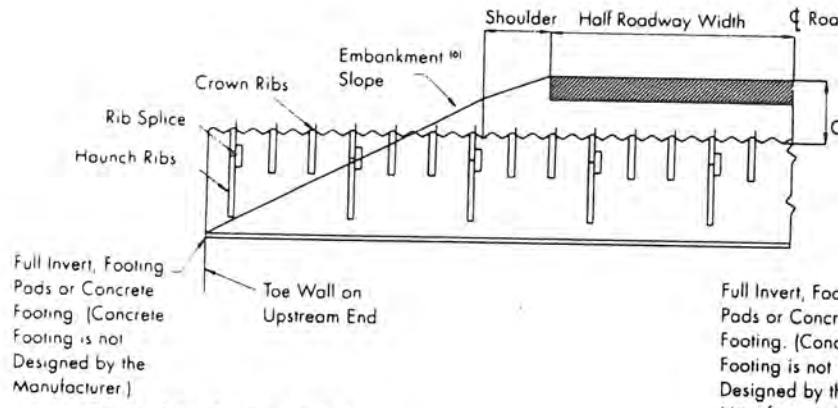
CONTECH

Design Details
Sheet 4

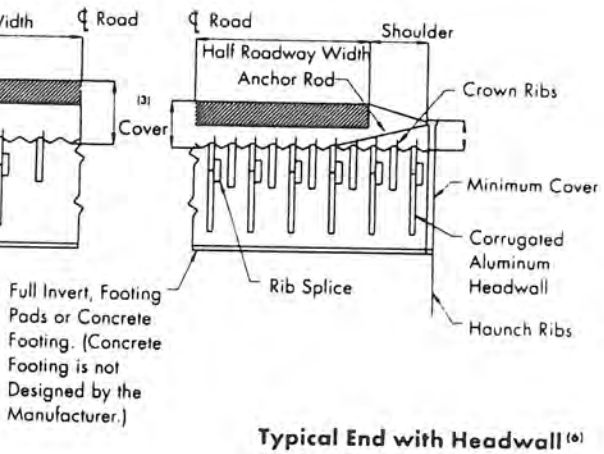
CONTECH® Aluminum Box Culvert

Typical Backfill Cross Section



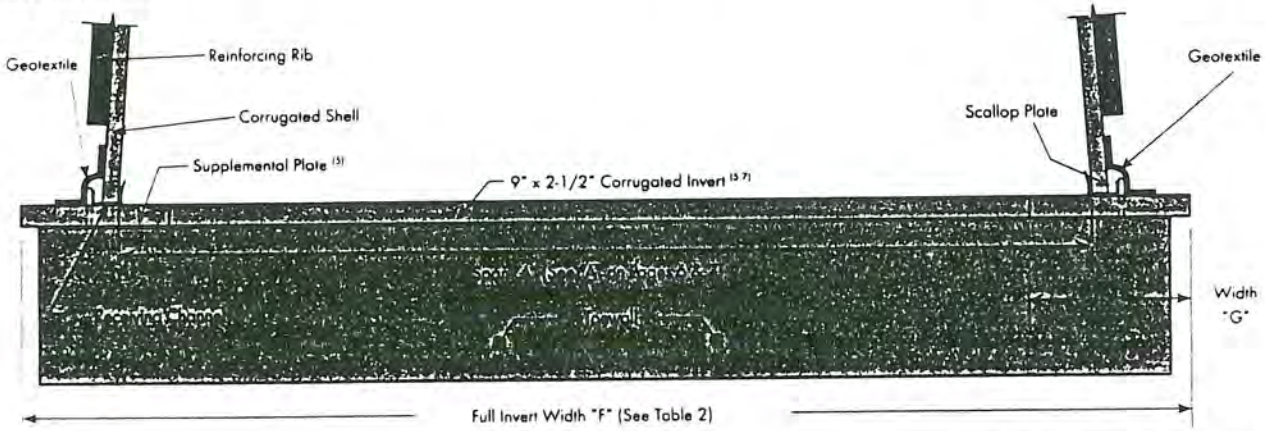


Typical Projecting End [6]

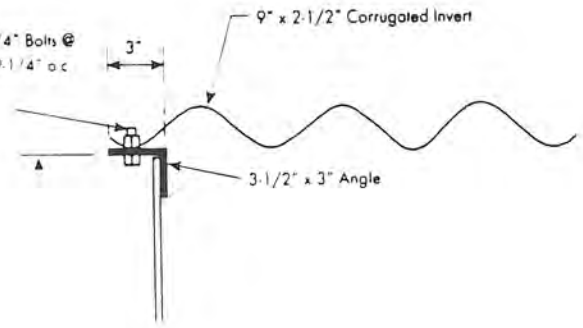


Typical End with Headwall [6]

Notes - Installation



Aluminum Full Invert Option [2,3,5,6]



Note: Flat sheet toewalls are available only for structures having a full corrugated aluminum invert.

STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF ENVIRONMENTAL QUALITY

"Better Service for a Better Environment"

HOLLISTER BUILDING, PO BOX 30473, LANSING MI 48909-7973

INTERNET: www.deq.state.mi.us

RUSSELL J. HARDING, Director

REPLY TO:

LAND & WATER MANAGEMENT DIVISION
PO BOX 30458
LANSING MI 48909-7958

RECEIVED
U.S. FISH & WILDLIFE SERVICE
FEB
LUDINGTON BIOLOGICAL STATION
LUDINGTON, MICHIGAN

February 5, 1998

Ms. Ellie Koon
United States Fish & Wildlife Service
229 S. Jebavy Drive
Ludington, MI 49431

Dear Ms. Koon:

We have estimated the flood frequency discharges requested in your letter of November 26, 1997, (Process No. H-97237), as follows.

> Gongeau Creek at Furnace Lake Outlet, Section 29, T47N, R19W, Hiawatha Township, Alger County, has a total drainage area of 9.6 square miles and a contributing drainage area of 9.1 square miles. The 10%, 2% and 1% chance peak flows are estimated to be 70 cubic feet per second (cfs), 150 cfs and 210 cfs, respectively. (Watershed Basin No. 39L).

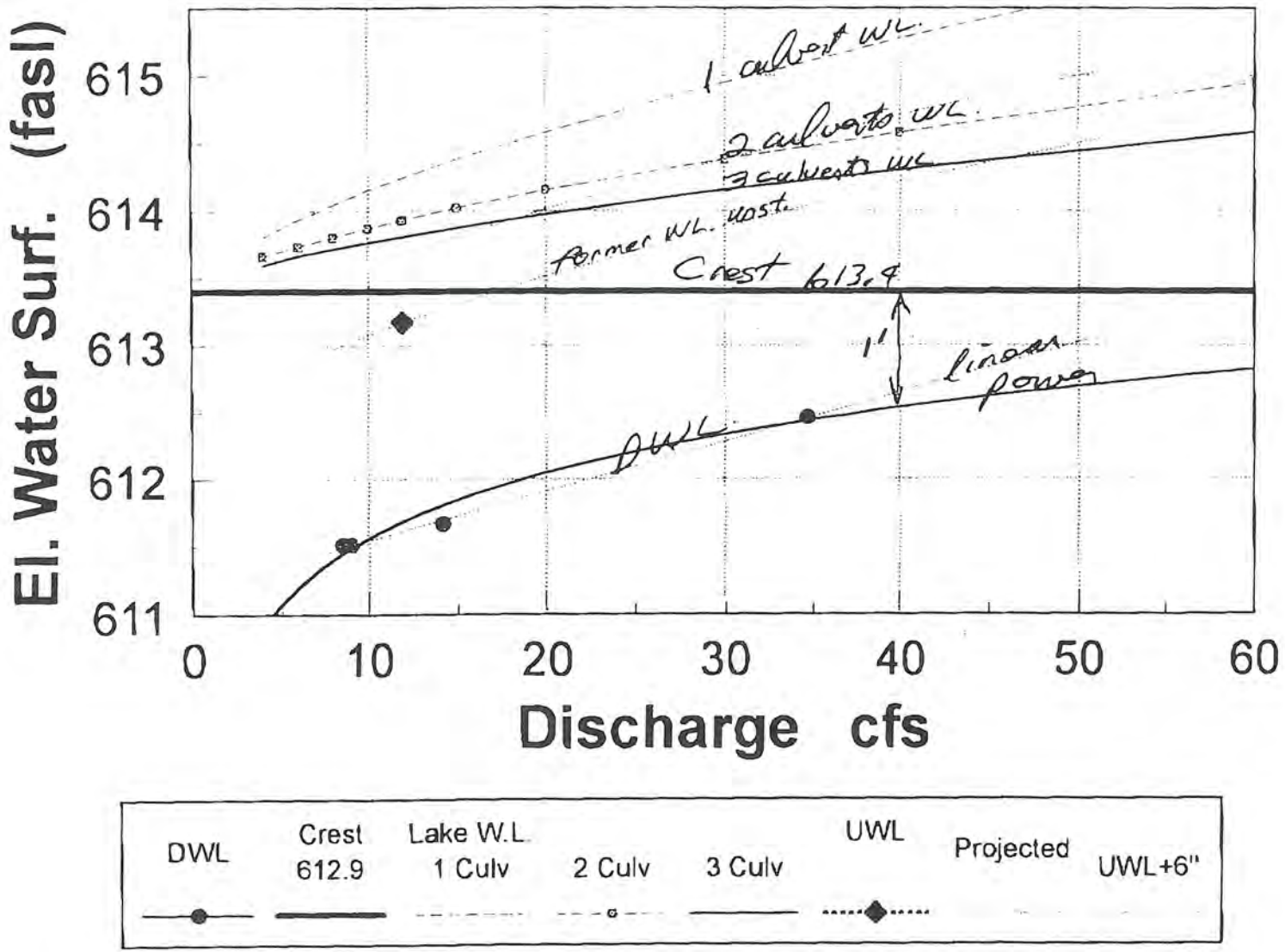
Please include a copy of this letter with your application for permit. These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please do not hesitate to contact me. Any questions concerning the hydraulics or the proper procedure for filing for a permit should be directed to Ms. Sheila Meier, of our Ishpeming Office, at 906-485-1031.

Sincerely,

Richard C. Sorrell, P.E., Acting Chief
Hydrologic Studies Unit
Land and Water Management Division
517-335-3176
E-mail: sorrell@state.mi.us

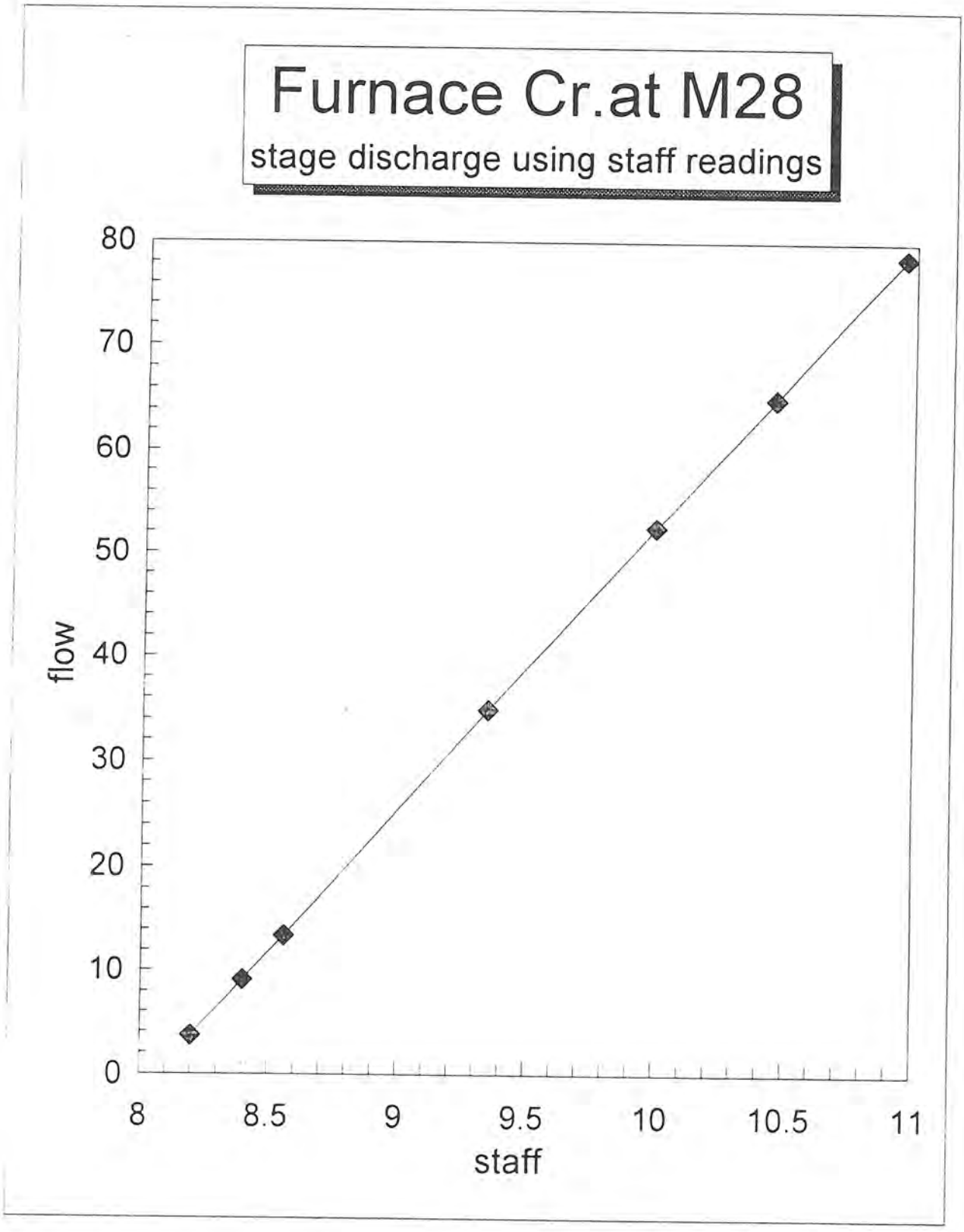
RCS:MS:bmw
cc. Ms. Sheila Meier, Ishpeming Office, DEQ (E-16-NW)

Furnace Cr. Lamprey Barrier - Preliminary Hydraulics



T. McAuley 12/09/97

SEA LAMPREY ... LUDINGTON 002



FURNACE.WK4 09/18/97 11:18 AM

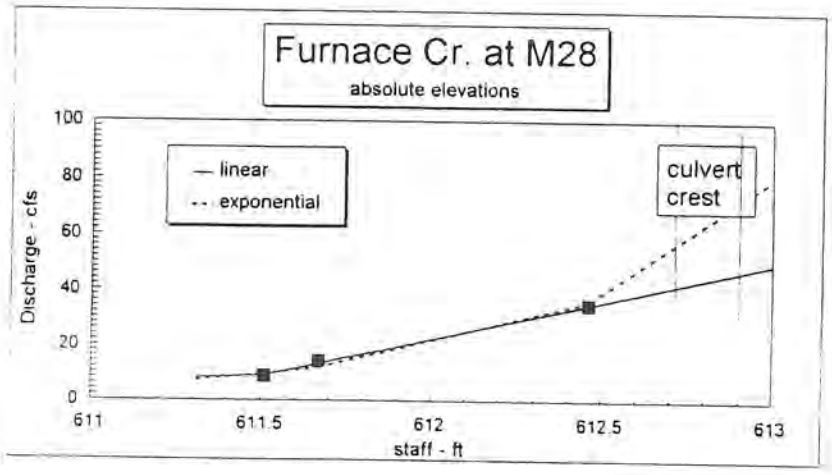
Furnace Creek
Stage-discharge relationship for culvert upstream of M28 on Carr property

upstream side of M-28 culvert, bottom, = 610.67' elevation from MDOT plans
top of M28 abutment then = 615.17' [add 4'6"shown on plans]
top of M28 abutment defined by Tom as 100.00' relative elevation
So: correct relative elevation to actual by adding 515.17'
when surveyed 7/96 water level was 96.43' below culvert, 96.15' on upstream end of M28 culvert
water surface elevation of 96.43' = 8.49' on staff gage (about 12 cfs)
So convert staff gage elevation to relative el. by adding 87.94', then add 515.17' to get absolute el.

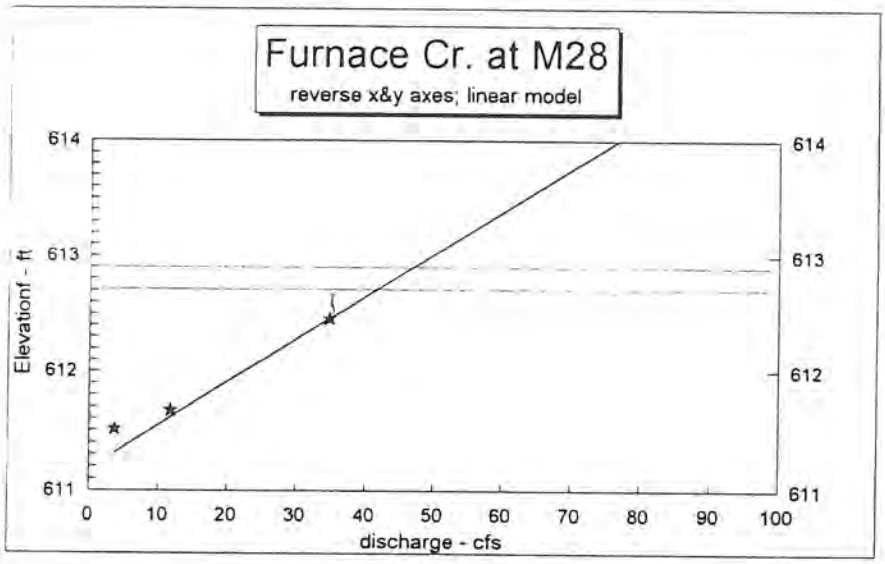
	Staff gage	elevation relative	elevation absolute	discharge (actual)	linear fit discharge	exponential discharge
Lake level @ est. 12 cfs flow		98	613.17			
Carr culvert crest -new1		97.5	612.67			
Carr culvert crest -new2			612.9			
below Carr culvert water level @ est. 12 cfs		96.43	611.6			
water surface at M28 culvert @ est 12 cfs		96.15	611.32			
dummy value	8.2	96.14	611.31		8.20	7.14
gaging 05/16/95	8.4	96.34	611.51	8.5	9.07	9.45
gaging 9/28/95	8.4	96.34	611.51	9	9.07	9.45
gaging 5/3/95	8.56	96.5	611.67	14.2	13.41	11.83
gaging 5/3/96	9.35	97.29	612.46	34.7	34.83	35.85
dummy value	10	97.94	613.11		52.45	89.22
dummy value	10.46	98.4	613.57		64.92	170.13
dummy value	10.96	98.9	614.07		78.48	343.10

Linear fit y = -218.66 + 27.111x
r2 = 0.996

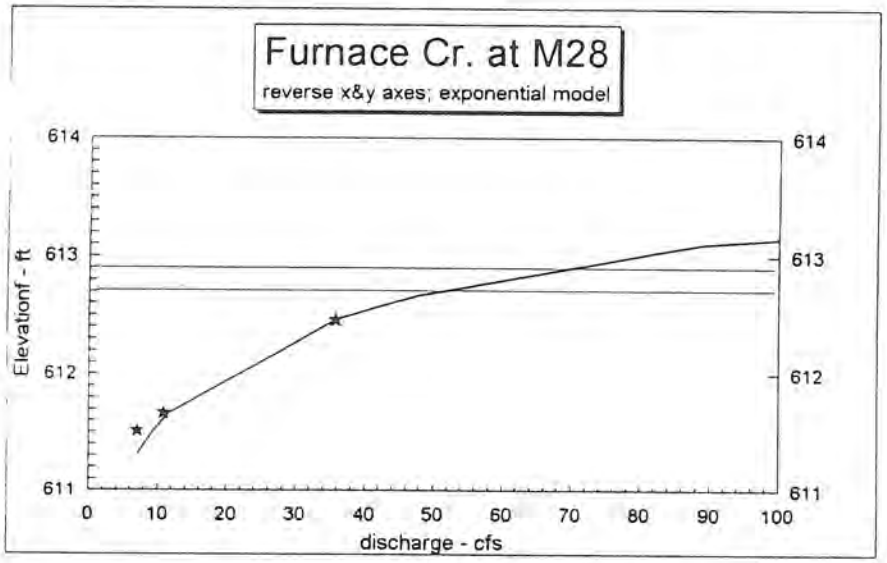
Exponential fit y = .0000720 * @EXP(1.403 * x)
r2 = 0.94



NEW CREST AT
612.7' OR 612.9'



NEW CREST AT
612.7' OR 612.9'



NEW CREST AT
612.7' OR 612.9'

Calculated lines

staff	absolute elevation	Q-exponent	Q-linear	actual Q	actual ele
8.2	611.31	7.1	3.7		
8.4	611.51	9.4	9.1	9	611.51
8.4	611.51	9.4	9.1		
8.49	611.6	10.7	11.5		
8.5	611.61	10.9	11.8		
8.56	611.67	11.8	13.4	14.2	611.67
8.56	611.67	11.8	13.4		
9.35	612.46	35.8	34.8		
9.35	612.46	35.8	34.8	34.7	612.46
9.46	612.57	41.8	37.8		

Ellie Koon
10/26/2000 02:38 PM

To: Jeff Davis,
cc:
Subject: Furnace Creek

Jeff-- As I'm sure you will recall, I was going to send you some of the hydraulic calculations that we did for Furnace Creek at the lake outlet culvert. The reason that I have not done so, is that the data mostly resides in a computer at the desk of my former colleague, Tom McAuley, in an old software program. However, I'm sure that the engineers at North Country Engineering are perfectly capable of reproducing the calculations. If they are not confident in doing so, Andy Hallett, Tom's successor will be glad to work with them.

The bottom line is that we determined that we needed a crest height (elevation) for a lamprey barrier of about 613.4' in order to produce at least a 12-inch vertical drop from the crest to the tailwater from mid-April to July. Tom's calculations showed that this would result in a rise in the lake level of 12" during low flows (less during high flows), but the calculations were based on two five-foot diameter round culverts set at the same slope as the existing single culvert. We need to redo the calculations anyway based on having a box culvert(s), perhaps trying different widths and slopes. The height of the box culvert will depend partly on whether we still need to maintain the road across it.

Andy and I would be glad to meet with you and the engineers to discuss this. If you want to meet, please call me and we can work out a date.

Thanks,

Ellie

Ellie Koon
U.S. Sea Lamprey Barrier Coordinator
U.S. Fish and Wildlife Service
229 S. Jebavy Dr.
Ludington, MI 49431
phone: 231-845-6205
fax : 231-843-8468

2/21/01

Jeff - I decided to send this stuff anyway after our phone call today. The stage discharge curves were derived ~~#~~ from gaugings ~~that~~ referenced to a wooden staff gage that is no longer in place

Ellie

April 26, 2002: 29 acre + Kevin Kolbus Property and Perch Lake Road.

Racetrack Erosion Site: Carr/Furnace Lake residents reported the entire Lake turned red from the clay laden runoff running overland into the swamp at the southeast end of the Lake, some 1/4 mile away. An unknown large amount of sediment ran downslope onto Shelter Bay Forest property, and filled a wetland adjacent to the west of the Kolbus property.

1. & 2. Problems: 4 years ago, 29 upland acres were scalped, for a vehicle, ATV, snowmobile, motorcycle dirt racetrack complex, complete with elevated jumps. Though this was all done without permitting of any kind, many local contractors who help "landscape this project with their equipment", prominently display their logos as sponsors on the racetrack spectator fence.

3. Right: County Road Commission has had to install and dig these emergency traps out 3 times so far .

4. Below: Racetrack operator has this raw ditch connect up to the ditch at the Perch Lake Rd.

5. Below: Alger County Rd. Commission had to widen and riprap the south ditch, and install a culvert with sediment traps at either end. Previously, this was a well vegetated intermittent runoff flowage rarely evident as moving surface water. None of this erosion was present on our previous visit of May of 2000

6. Left: Raw earth ditch is carrying flow from emergency Sediment Trap installed when sudden hot weather melted heavy snowpack, and ponded water from the oval , concave racetrack surface, caused catastrophic slope failures. The soil is sandy, but with a high pink clay content. We have scheduled access for an official visit for Wednesday, May 1, at 10am. Owner agreed to meet all interested parties at once, including DEQ and the Alger Soil Erosion Permit office.

Completely filled culvert, Perch Lk Rd

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

May 1, 2002 Site Visit: Kolbus Property Racetrack

1. View of access road and portion of settling pond, note eroding hillside in background.

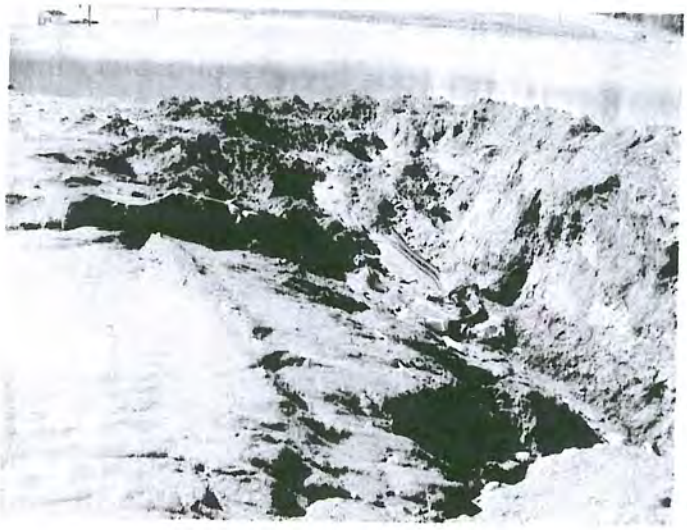
2. Sediment inundation of wetland area on Shelter Bay Forest property. Adjacent (west of) to the Kolbus property. This connects topographically to Gangeau Creek.

3. More hillside erosion., contributing to sediment flow.

4. View down hill toward sediment trap, blown out berm for racetrack in foreground.

5. Closeup of "outlet" of oval racetrack.

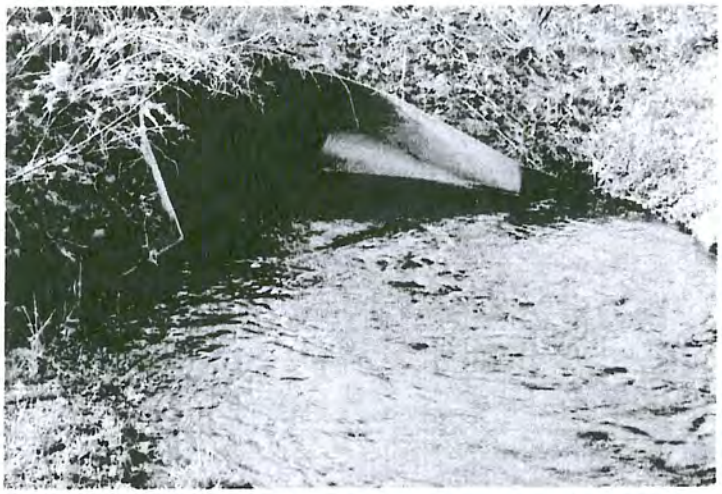
6. Sediment flooded wetland next to (North of) Perch Lake Road. The Headwaters of Gangeau Creek,east branch, are right behind me as I took this picture toward the road.



ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Transect Tag # 42: Munising Falls Creek below Falls, 300' at Hospital Grounds, Munising

1. Below: Ribbon at Culvert marks the beginning of the 300' survey transect on the lower portion of Munising Falls Creek.

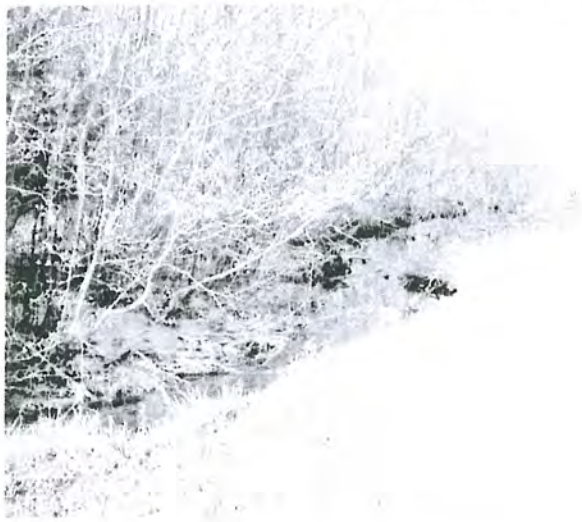


2. Below: Heavy cobble, gravel, and old furnace slag dominate the streambed on most of this portion of the stream.

3. Below: The west bank is completely wooded, while the east bank is entirely Hospital grounds lawn. Brook Trout and Coho Salmon were taken here in this highly oxygenated water.

4. Below: Though there is little evident erosion other than undercut banks, there is a low number and variety of benthic invertebrates (insects), and no forage fish (minnows).

5. Below: The low numbers of insects are probably due to winter salt runoff from the road and parking areas, and possibly from lawn fertilizers, pesticides, or herbicides.



MUNISING FALLS CREEK @ SAND PT. RD (HOSPITAL)
(Below FALLS)

SAVE OUR STREAMS
Stream Quality Survey

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream MUNISING FALLS CREEK @ SAND PT ROAD Station (1)
County ALGER State MI Location
Group or Individual JS. DAVIS, D. KRAUK, G. TESTER, 6TH GR. Number of participants MATHER MIDDLE SCHOOL – 22 students
Weather conditions CLOUDY TO SUNNY,
Stream width (Average) 6.10" ft. Water depth (in riffle) 8.5 in.
Flow rate: high ____ low ____ (normal X) 3.26 cfs

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) 3' x 6'10" Average stream depth 8.5 Water temperature 7.2°C PH 6.0
Date 10/16/01 Time 11:30 am Sample Number 1
Type of test: macroinvertebrate count X chemical test X other ELECTROFISH SURVEY, FLOW

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE		SOMEWHAT-SENSITIVE		TOLERANT	
B [63]	caddisfly larvae	[ ]	beetle larvae	A [4]	aquatic worms
[ ]	hellgrammite	[ ]	clams	[ ]	blackfly larvae
[ ]	mayfly nymphs	A [1]	crane fly larvae	[ ]	leeches
[ ]	gilled snails	[ ]	crayfish	[ ]	midge larvae
[ ]	riffle beetle adult	[ ]	damselfly nymphs	[ ]	pouch (and other) snails
A [2]	stonefly nymphs	[ ]	dragonfly nymphs		
[ ]	water penny larvae	A [6]	scuds		
		A [1]	sowbugs		
		[ ]	fishfly larvae		
		[ ]	alderfly larvae		
		[ ]	atherix		
[2] # of letters times 3 = 6		[3] # of letters times 2 = 6		[1] # of letters times 1 = 1	
[6] Index value +		[6] Index value +		[1] Index value	

Now add together the three index values = 13 total index value.
Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

[ ] Excellent (> 22) [ ] Good (17 - 22)
[13] Fair (11 - 16) [ ] Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

printed on recycled paper

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Transect # 40: Munising Falls Creek, 300' Transect above Munising Falls; Pictured Rocks National Lakeshore property

1 & 2. Left and Below: 7th Grade Science students from Mather Middle School. Dark water , because of overcast skies, and well undercut banks, made this stream tough fishing. Here the kick and scrub team is working hard at aquatic insect collection.

3. Left: Getting every last insect out of the crevices of a waterlogged branch. All debris was returned to the 1m wide cross section from which it came.

SAVE OUR STREAMS
Stream Quality Survey

MR. TESTOR'S SCCENCE CLASS

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream MUNISING FALLS CREEK (ABOVE FALLS) Station MFC#2 (1st Run)

County ALGER (Munising Twp) State MI Location _____

Group or individual J.S. DAVIS, D. KRONK, Mather Mid. School Number of participants _____

Weather conditions OVERCAST, NO RAIN, 48°F AIR TEMP

Stream width (Average) _____ ft. Water depth (in riffle) _____ in.

Flow rate: high _____ low _____ normal _____

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) _____ Average stream depth _____ Water temperature _____

Date _____ Time _____ Sample Number _____

Type of test: macroinvertebrate count _____ chemical test _____ other _____

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE			SOMEWHAT-SENSITIVE			TOLERANT		
A	4	caddisfly larvae			beetle larvae	A	3	aquatic worms
		helligrammite			clams			blackfly larvae
A	2	mayfly nymphs	A	1	crane fly larvae			leeches
A	2	gilled snails			crayfish			midge larvae
		riffle beetle adult			damselfly nymphs			pouch (and other) snails
A	1	stonefly nymphs	A	5	dragonfly nymphs	B	16	WATER BOATMEN
		water penny larvae	A	12	scuds			
					sowbugs			
					fishfly larvae			
					alderfly larvae			
					atherix			
4 / 12	# of letters times 3 = 12 Index value		3 / 6	# of letters times 2 = 6 Index value		2 / 2	# of letters times 1 = 2 Index value	

Now add together the three index values = 20 total index value.

Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

- ☐ Excellent (> 22)
- ☒ 20 Good (17 - 22)
- ☐ Fair (11 - 16)
- ☐ Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

recycled paper

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

St. Martin's Hill– Varnum Street Extension Erosion Site

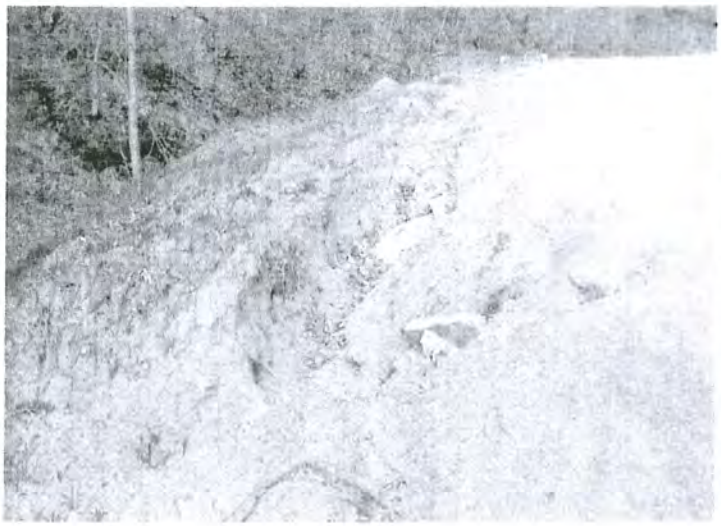
1. Below: Foot of St. Martin's Hill just above sediment basin. Note runoff flow channel to left of the mound and eroded road bed to the right.

2. Below: View of runoff channel and road side erosion just uphill of the mound.

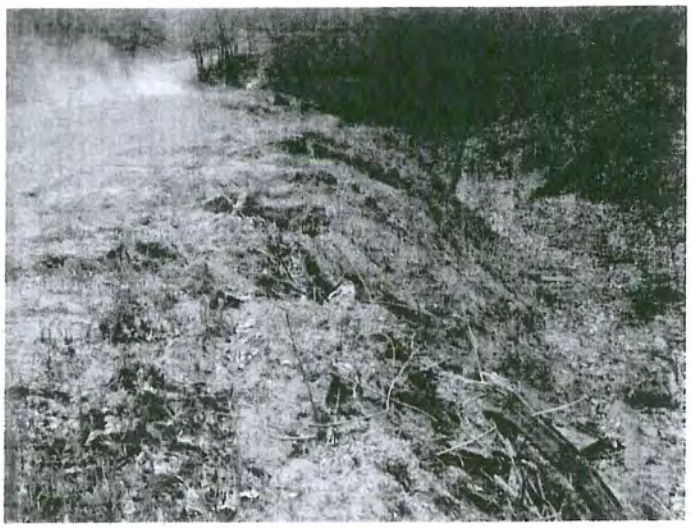
3. Below: Moving uphill, a view of more of the runoff channel and gulleys at road side.

4. Below: View of deep gulleying, looking downslope just above the point in picture #3.

5. Below: Moving upslope, a close up view of a deep gulley located just before the main curve of the hill.



6. Below: View looking down slope just above curve in picture #5.



St. Martin's Hill– Varnum Street Extension Erosion Site

7. Below: View upslope of curve at original turnout, now blown out.

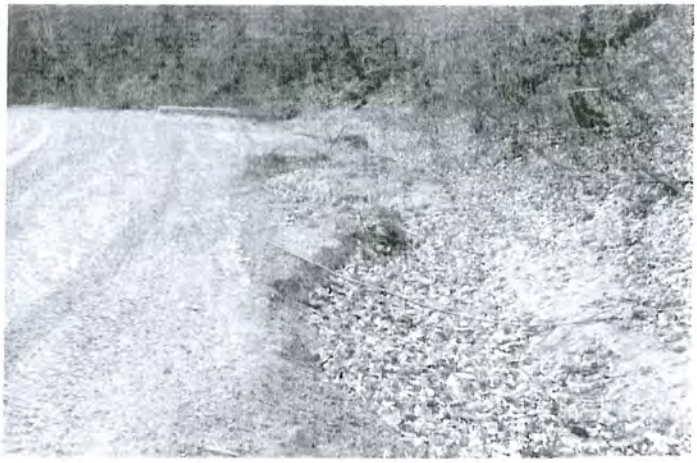
8. Below: Close up view of gulleying at the road side below the area in photo # 7.

9. Below: This view of an old car buried in the runnoff flow channel just below the turnout, gives an idea of the depth of this channel from road surface. Note guleying throughout.

10. Below: More of the gulleying and severe erosion occurring along the road and runoff channel in this area.

11. Below: View of brush pushed into channel just below the guardrail and turnout, a vain attempt to hold sediment moving down the channel.

12. Below: Moving upslope, a view downhill toward the guardrail and turnout.



ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

St. Martin's Hill– Varnum Street Extension Erosion Site

13. Below: View at top of hill looking downslope, green stake marks 12" culvert placed under the road at the "Y".

14. Below: View upslope of "Y" , mouth of culvert in photo # 13 is located just above the "Y".

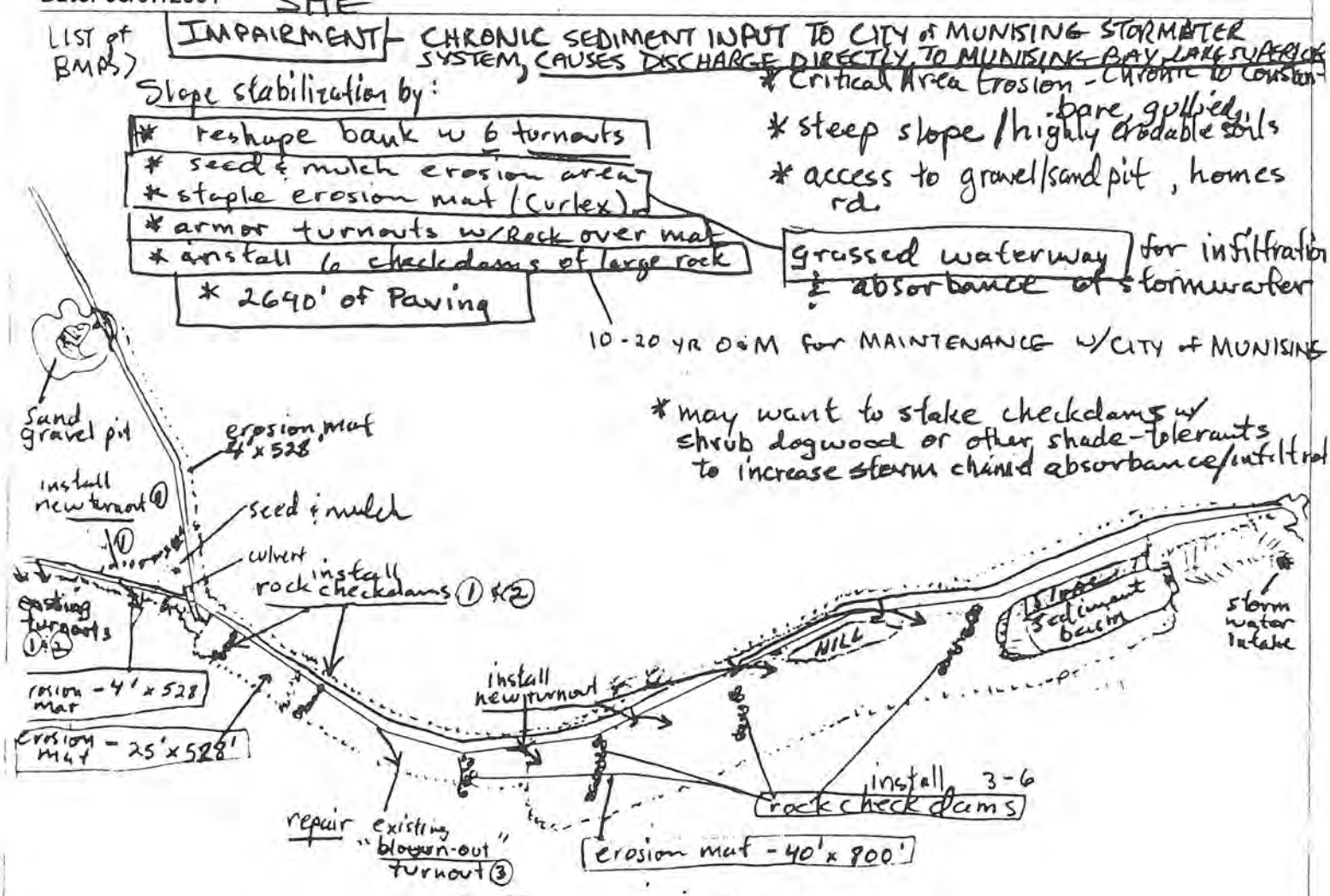
15. Below: Including all of the eroding slope from just above the "Y" area to the foot of the road at the sediment basin is approximately 2,640 feet. The eroding runoff channel is fairly narrow at either side of the road , from this point down to the turnout and guardrail area.

St. Martins Hill @ Varnum Extension

Alger County

Alger
Approx. Acres:
Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 13- SLOPE STABILIZATION- St. Martin's Hill @ Varnum St. Extension
City of Munising

BMP List: Install 6 rock Checkdams
Install 6 rock armor Turnouts
Geotextile- 2,666 sq. yds Curlex III Erosion Blanket
Geotextile- 1,180 sq. yds Recyclex TRM
Reshape roadside and ditches,
Bioengineering- seed and mulch, stake check dams w/shrubs
Add Gravel to Grade and Pave 2640 feet of hill

Legend
Roads_new1.shp
Highway
Interstate
Residential/County
..... = HIGH EROSION CHANNEL AREA

N

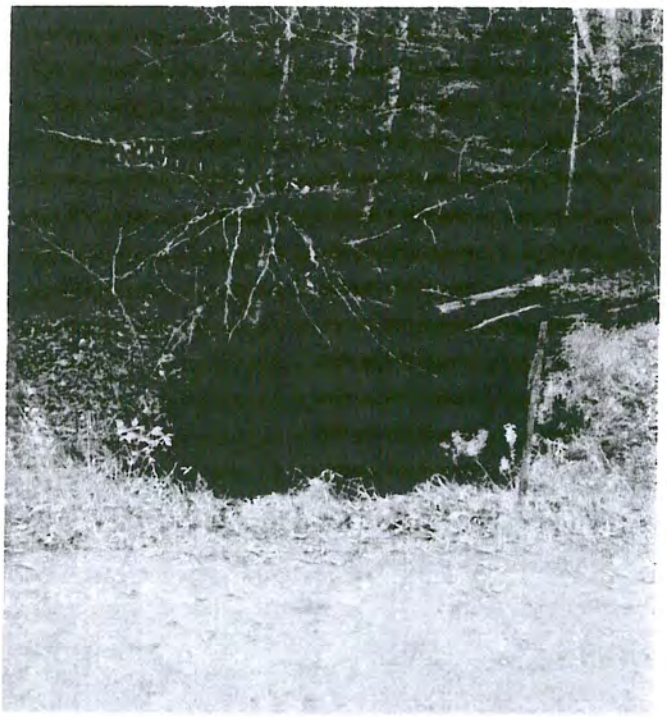
USDA

400 0 400 800 Fee

ALGER CONSERVATION DISTRICT
MUNISING BAY WATERSHED RESTORATION PROJECT

Survey Transect Tag # 46 SWEATS CREEK @ Reindeer Run Rd.

1. View West of beginning of 300' transect. Heavy cover and total shade were the rule here. Note eroding road surface and close proximity to water. Culvert is too short.

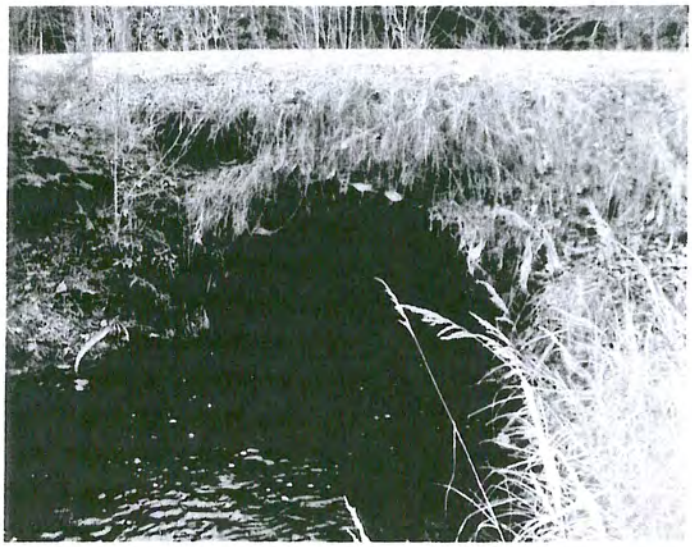


2. This close-up of the west or upstream end of the culvert shows the rusted out bottom and stream operating outside the culvert. This culvert also has inadequate cross section for storm flows.

3. View east or downstream of road crossing, note eroding road surface.

4. View of east or downstream end of road crossing &

5. Close-up of east end of culvert and visible erosion



SAVE OUR STREAMS
Stream Quality Survey

MR. BEHNING'S SCIENCE CLASS
J. DAVIS

The purpose of this form is to aid you in gathering and recording important data about the health of your stream. By keeping accurate and consistent records of your observations and data from your macroinvertebrate count, you can notice and document changes in water quality. Refer to the SOS insect card and instructions to learn how to trap and identify the organisms.

Stream SWEATS CREEK (North Branch) Station SC #1 @ REINDEER RUN RD.
County ALGER (AuTrain Twp.) State MI Location T47N, R.19W, SEC. 18, W½ of SW¼
Group or individual J.S. DAVIS & MATHER MIDDLE SCHOOL Number of participants 26
Weather conditions CLEAR TO OVERCAST 60°F AIR TEMP
Stream width (Average) ____ ft. Water depth (in riffle) ____ in.
Flow rate: high ____ low ____ normal ____

You should select a riffle where the water is not running too fast (ideal depth is 3 - 12 inches), and the bed consists of cobble-sized stones or larger.

Monitored riffle area (should be 3 foot square) ____ Average stream depth ____ Water temperature ____
Date 11/2/01 FRIDAY Time 9:00 - 12:00 Sample Number ____
Type of test: macroinvertebrate count ____ chemical test ____ other ____

MACROINVERTEBRATE COUNT

Use the stream monitoring instructions to conduct a macroinvertebrate count. Use letter codes (A = 1 - 9, B = 10 - 99, C = 100 or more) to record the numbers of organisms found in a 3 foot by 3 foot area. Then add up the number of letters in each column and multiply by the indicated index value. The following columns are divided based on the organism's sensitivity to pollution.

SENSITIVE		SOMEWHAT-SENSITIVE		TOLERANT	
C 100	caddisfly larvae		beetle larvae	A 1	aquatic worms
	hellgrammite		clams		blackfly larvae
	mayfly nymphs		crane fly larvae		leeches
	gilled snails		crayfish	A 1	midge larvae
A 1	riffle beetle adult		damselfly nymphs		pouch (and other) snails
	stonefly nymphs	B 13	dragonfly nymphs	A 1	water scorpion
	water penny larvae	B 13	scuds	A 1	whirligig beetle
			sowbugs		
			fishfly larvae		
			alderfly larvae		
			atherix		
2 # of letters times 3 = 6 index value		2 # of letters times 2 = 4 index value		4 # of letters times 1 = 4 index value	

Water scorpion
Horsehair worm

Now add together the three index values = 14 total index value.

Compare this total index value to the following numbers to determine the water quality of your stream. Good water quality is indicated by a variety of different kinds of organisms, with no one kind making up the majority of the sample.

WATER QUALITY RATING

- ☐ Excellent (> 22)
- ☐ Good (17 - 22)
- ☒ Fair (11 - 16)
- ☐ Poor (< 11)

Note: You should test at least 3 different riffles within a 24-foot area to ensure that you have a truly representative sample which includes all key organisms. Record results from the sample which gives the best diversity.

Defenders of Soil, Air, Woods, Waters and Wildlife

Izaak Walton League of America, SOS Program
1401 Wilson Blvd., Level B,
Arlington, Va. 22209 (703)528-1818

printed paper

Sweats Creek @ Reindeer Run Rd

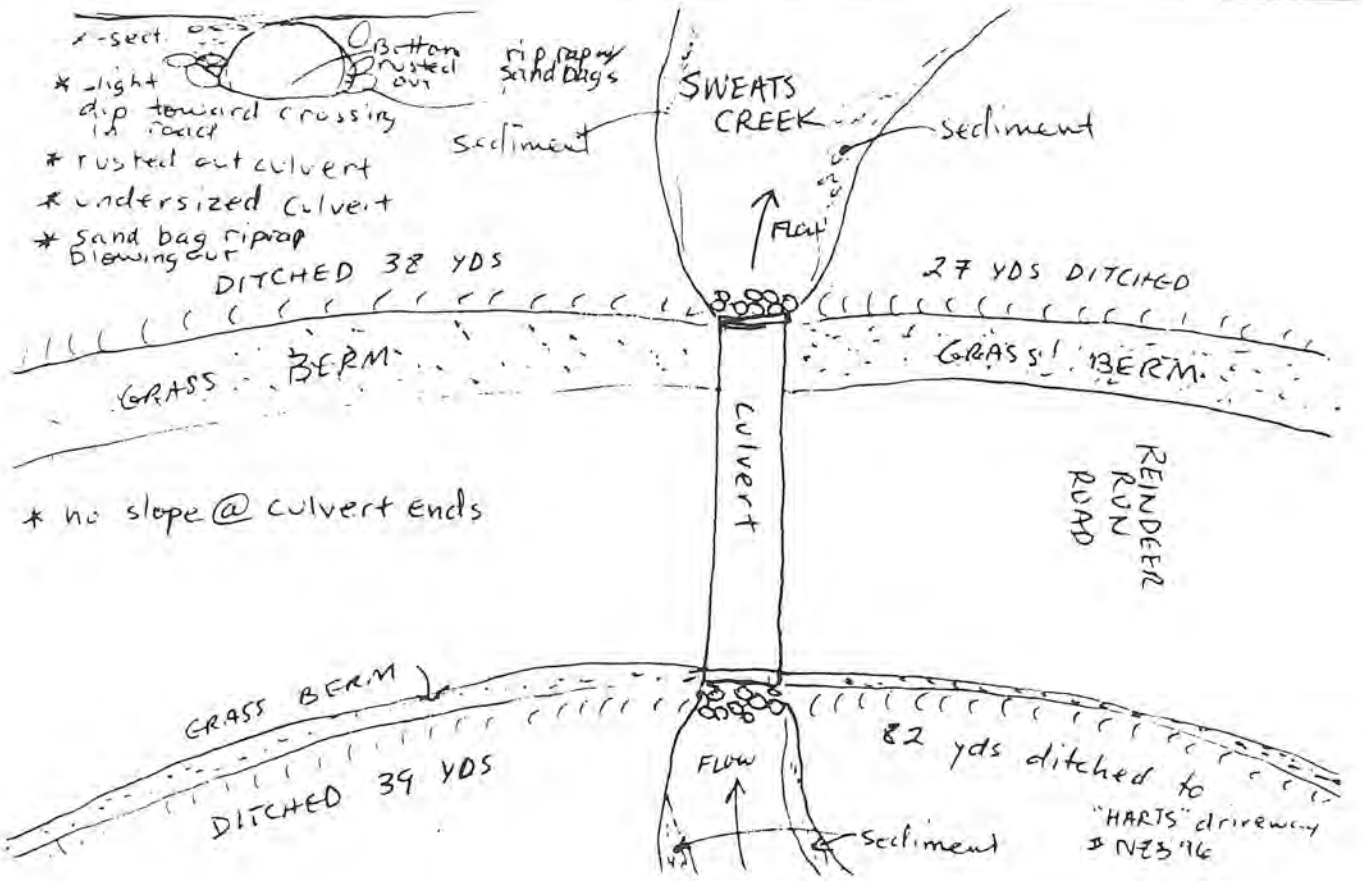
Alger County T47 R 19 Sec. 18

Alger

Approx. Acres:

Date: 08/07/2001

Alger
Alger Conservation District
Jeff Davis
(906) 387-2222



BMP # 12 – SWEATS CREEK - @ REINDEER RUN ROAD (gravel pit access)
Stream Crossing

BMP List: Replace too short, undersized (29' x 3'5" x 5'8") rusted out and deformed steel culvert
W/ 38' x 10'6" x 5'7" bottomless aluminum arch culvert
HS-25 Load Rating (40-120 tons)
Geomembrane & Riprap to proper slope
Add gravel to elevate road surface and re-grade

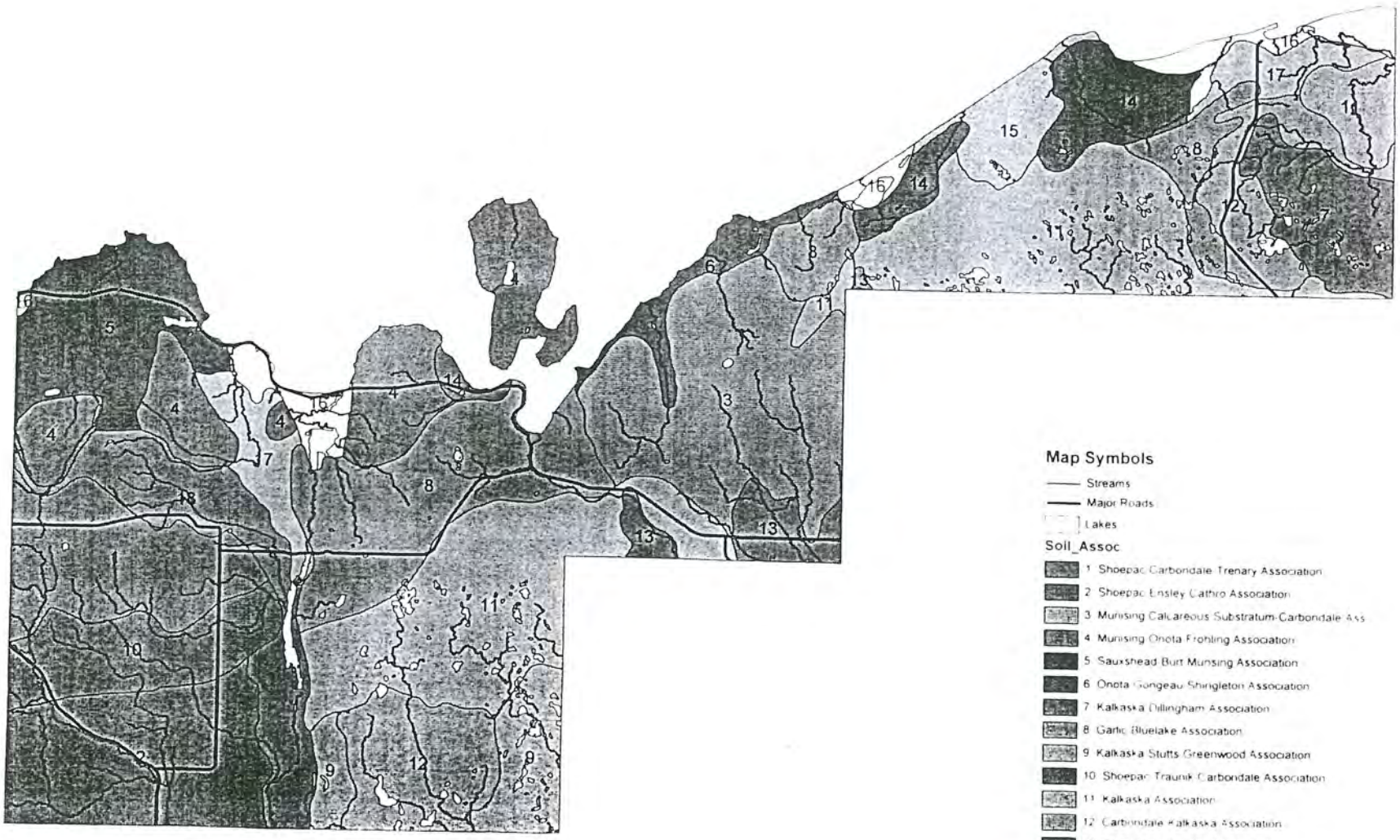
Legend

N

USDA

20 0 20 40 Feet

AlgerGeneralSoilsDraft1



1,432,353

ALGER COUNTY GENERAL SOILS MAP LEGEND AND MINOR COMPONENTS

1. **SHOEPAC-CARBONDALE-TRENARY ASSOCIATION** – Minor components – Charlevoix, Ensley, Nahma, Read, Chippeny, Traunik and McMaster.
2. **SHOEPAC-ENSLEY-CATHRO ASSOCIATION** – Minor components – Trenary, Reade, Charlevoix, Nahma and Traunik.
3. **MUNISING calcareous substratum- CARBONDALE-GREYLOCK ASSOCIATION** – Minor components – Escanaba, Cookson, Keweenaw, Halfaday, Ensley, Nahma, Charlevoix, AuGres, and Deford
4. **MUNISING-ONOTA-FROHLING ASSOCIATION** – Minor components – Gongeau, Trout Bay, Carbondale, Tawas, AuTrain, Jeske, Jacobsville, and Waiska.
5. **SAUXSHEAD-BURT-MUNISING ASSOCIATION** – Minor components – Paavola, Chocolay, Skandia, Carbondale, Tawas, Shelterbay, Jeske and Gongeau.
6. **ONOTA-GONGEAU-SHINGLETON ASSOCIATION** – Munising cal. substratum phase, AuTrain, Jeske, Tawas, DeerPark, Greylock, and Shelldrake.
7. **GARLIC-BLUE LAKE ASSOCIATION** – Minor components – Carbondale, Tawas, Waiska, Steuben, Munising, Paquin, Finch, Fence, Greenwood, and Dawson.
8. **KALKASKA-DILLINGHAM ASSOCIATION** – Minor components – Greenwood, Tawas, Paquin, Deford and Finch
9. **KALKASKA-STUTTS-GREENWOOD ASSOCIATION** – Minor components – Greenwood, Rousseau, Deford and Finch.
10. **SHOEPAC-TRAUNIK-CARBONDALE ASSOCIATION** – Minor components – Kalkaska, Ensley, Trenary, Chippeny, Nahma, Waiska, and Blue Lake.
11. **KALKASKA ASSOCIATION** – Carbondale, Tawas, Greenwood, Dawson, Paquin, Cusino, Kinross and Finch.
12. **CARBONDALE-KALKASKA ASSOCIATION** – Minor components – Kinross, AuGres, Halfaday, and Rubicon.
13. **CARBONDALE-AUGRES ASSOCIATION** – Minor components – Paquin, Deford and Kalkaska.
14. **KALKASKA-CARBONDALE ASSOCIATION** – Au Gres, Deford, Croswell, Paquin, Finch and Grand Sable.
15. **RUBICON ASSOCIATION** – Minor components – Tawas, Deford, Greenwood, Dawson, and Kalkaska.
16. **DEERPARK ASSOCIATION** – Minor components – Croswell, Deford, Tawas, Greenwood, Dawson, Skanee, Jacobsville, Sauxshead and Finch.
17. **KALKASKA –TAWAS-GONGEAU ASSOCIATION** – Minor soils – Paquin, Wallace, Ruse, GrandMarais, Sundell, AuGres, Waiska and Deford
18. **CHATHAM-CHIPPENY-RUSE ASSOCIATION** – Minor components - Shoepac, Trenary, Ensign, Nahma, Ensley Carbondale, Tawas and Reade.

3. **Munising calcareous substratum - Carbondale - Greylock Association**

Very deep, nearly level to rolling, moderately well drained , very poorly drained and well drained loamy and mucky soils on ground moraines

Setting

Landform: Ground moraines
Slope range: 0 to 15 percent

Composition

Extent of the association:
10 percent of the survey area

Extent of the soils in the association:
Munising and similar soils--30 percent
Carbondale and similar soils--30 percent
Greylock and similar soils--20
Minor soils--20 percent

Soil Properties and Qualities

Munising calcareous substratum
Depth class: Very deep
Drainage class: Moderately well drained
Parent material: Loamy till
Surface textural class: fine sandy loam
Slope: Gently undulating

Carbondale
Depth class: Very deep
Drainage class: Very poorly drained
Parent material: Organic deposits
Surface textural class: Muck
Slope: Nearly level

Greylock

Depth class: Very deep
Drainage class: Well drained
Parent material: Loamy till
Surface textural class: fine sandy loam
Slope: Gently undulating

Minor Soils

. Cookson, Escanaba, and Keweenaw soils on landscape positions similar to Munising calcareous substratum and Greylock
. AuGres, Charlevoix and Halfaday soils on nearly level to gently undulating areas
. Deford, Ensley and Nahma soils in depressions and drainageways

Use and Management

Major uses: Woodland
Management concerns: Equipment limitation, seedling mortality, windthrow hazard, plant competition
Management measures: Access is easiest on the Carbondale soil, during the winter when the soil is frozen or has adequate snow cover

. Skidders should not be used during wet periods when ruts form easily. Year-round logging roads require a gravel base. Culverts are needed to maintain the natural drainage system.

. Harvest methods that do not leave the remaining trees widely spaced helps reduce the windthrow hazard

. Site preparation helps reduce plant competition

4. **Munising-Onota-Frohling Association**

Very deep to moderately deep, nearly level to very steep, moderately well drained to well drained, loamy, soils on bedrock controlled moraines

Setting

Landform: Bedrock controlled moraines
Slope range: 1 to 65 percent

Composition

Extent of the association:
10 percent of the survey area

Extent of the soils in the association:
Munising and similar soils--40 percent
Onota and similar soils--20 percent
Frohling and similar soils--15 percent
Minor soils--25 percent

Soil Properties and Qualities

Munising
Depth class: Very deep
Drainage class: Moderately well drained
Parent material: Loamy till
Surface textural class: Fine sandy loam
Slope: Nearly level to moderately sloping

Onota
Depth class: moderately deep
Drainage class: Well drained
Parent material: Loamy till
Surface textural class: Fine sandy loam
Slope: Nearly level to steep

Frohling
Depth class: Very deep
Drainage class: Well drained
Parent material: Loamy till
Surface textural class: Fine sandy loam
Slope: Moderately steep to very steep

Minor Soils

Shingleton, Sauxhead and Waiska soils on nearly level to very steep areas
Carbondale, Gay, Gongeau, Gay, Jacobsville, Jeske and Skanee soils in depressions and drainageways

Use and Management

Major uses: Woodland
Management concerns: Erosion hazard, equipment limitation, windthrow hazard, plant competition
Management measures:
. The risk of erosion can be reduced by building roads on the contour, seeding logging roads, landings, areas that have been cut and filled, and by installing culverts and water bars. Skidders should not be used during periods when ruts form easily. Year-round logging roads require a gravel base
. Selective cutting helps reduce the windthrow hazard
. Site preparation helps reduce plant competition

6. **Onota-Gongeau-Shingleton Association**

Moderately deep to shallow, nearly level to very steep, well drained, poorly drained and somewhat excessively drained loamy and sandy soils on bedrock benches

Setting

Landform: Bedrock benches
Slope range: 1 to 70 percent

Composition

Extent of the association:
1 percent of the survey area

Extent of the soils in the association:
Onota and similar soils--30 percent
Gongeau and similar soils--20 percent
Shingleton and similar soils--20 percent
Minor soils--30 percent

Soil Properties and Qualities

Onota
Depth class: Moderately deep to sandstone
Drainage class: Well drained
Parent material: Loamy till over sandstone
Surface textural class: Fine sandy loam
Slope: Gently undulating to steep

Gongeau
Depth class: Shallow to sandstone
Drainage class: Poorly drained
Parent material: Sandy outwash over sandstone
Surface textural class: Muck
Slope: Nearly level to gently sloping

Shingleton
Depth class: Shallow
Drainage class: Somewhat excessively drained
Parent material: Sandy outwash over sandstone
Surface textural class: Sand
Slope: Nearly level to very steep

Minor Soils

Trout Bay and Jeske soils in depressions and drainageways
Au Train, Deerton and Greylock soils on landscape positions similar to the Onota and Shingleton soils
Deer Park and Munising calcareous substratum soils on nearly level to gently sloping areas

Use and Management

Major uses: Woodland
Management concerns: Erosion hazard, equipment limitation, windthrow hazard, and plant competition
Management measures:
.The risk of erosion can be reduced by building roads on the contour, seeding logging roads, landings, and areas that have been cut and filled, and by installing culverts and water bars
. The seasonal high water table on the Gongeau soil restricts the use of equipment to midsummer or winter
. Because of wetness, and plant competition trees are generally not planted on the Gongeau soils
. Harvest methods that do not leave the remaining trees widely spaced reduce the windthrow hazard

8. Garlic-Blue Lake Association

Very deep, nearly level to very steep, well drained sandy soils on ice margin complexs

Setting

Landform: Ice margin complexs
Slope range: 1 to 70 percent

Composition

Extent of the association:
14 percent of the survey area

Extent of the soils in the association:
Garlic and similar soils--45 percent
Blue Lake and similar soils--35 percent
Minor soils--20 percent

Soil Properties and Qualities

Garlic
Depth class: Very deep
Drainage class: Well drained
Parent material: Sandy outwash
Surface textural class: sand
Slope: Nearly level to very steep

Blue Lake
Depth class: Very deep
Drainage class: Well drained
Parent material: Sandy till
Surface textural class: Loamy sand
Slope: Nearly level to very steep

Minor Soils

- Cusino, Fence, Munising and Waiska soils on landscape positions similar to Garlic and Blue Lake soils
- Finch and Paquin soils on nearly level and gently undulating areas
- Carbondale, Deford and Tawas soils in depressions and drainageways

Use and Management

Major uses: Woodland
Management concerns: Erosion hazard, equipment limitation, plant competition
Management measures: Skid trails and roads should be located in the less sloping areas between the ravines
- Seeding logging roads helps prevent excessive soil loss
- Special logging methods, such as yarding with a cable may be needed on the very steep areas
- Site preparation helps reduce plant competition

14. Kalkaska-Carbondale Association

Very deep, nearly level to very hilly, somewhat excessively drained and very poorly drained sandy and mucky soils on kame terraces

Setting

Landform: Kame terraces
Slope range: 0 to 60 percent

Composition

Extent of the association:
5 percent of the survey area

Extent of the soils in the association:
Kalkaska and similar soils--55 percent
Carbondale and similar soils--20 percent
Minor soils--25 percent

Soil Properties and Qualities

Kalkaska
Depth class: Very Deep
Drainage class: Somewhat excessively drained
Parent material: Sandy outwash
Surface textural class: Sand
Slope: Nearly level to very hilly

Carbondale
Depth class: Very Deep
Drainage class: Very poorly drained
Parent material: Organic deposits
Surface textural class: Muck
Slope: Nearly level

Minor Soils

. Cusino and Garlic soils on landscape positions similar to Kalkaska soils
. Augres, Croswell, and Paquin soils on nearly level to gently undulating areas
. Deford soils in depressions and drainageways

Use and Management

Major uses: Woodland
Management concerns: Erosion hazard, equipment limitation, windthrow hazard, and plant competition
Management measures: Building roads on the contour, installing water bars and seeding logging roads help prevent excessive soil loss
. Access is easiest on the Carbondale soil during the winter when the soil has adequate snow cover, year-round logging roads require a gravel base. Culverts are needed to maintain the natural drainage system.
. Harvest methods that do not leave remaining trees widely spaced help reduce the windthrow hazard

NUMERICAL LEGEND
ALGER COUNTY SOIL SURVEY

February 19, 2002

11C	Deer Park sand, 1 to 10 percent slopes
11D	Deer Park sand, 10 to 25 percent slopes
11F	Deer Park sand, 25 to 60 percent slopes
12B	Rubicon sand, 0 to 6 percent slopes
12D	Rubicon sand, 6 to 15 percent slopes
12E	Rubicon sand, 15 to 35 percent slopes
12F	Rubicon sand, 35 to 60 percent slopes
13B	Kalkaska sand, 0 to 6 percent slopes
13D	Kalkaska sand, 6 to 15 percent slopes
13E	Kalkaska sand, 15 to 35 percent slopes
13F	Kalkaska sand, 35 to 60 percent slopes
14B	Rousseau fine sand, 0 to 6 percent slopes
14D	Rousseau fine sand, 6 to 15 percent slopes
14E	Rousseau fine sand, 15 to 35 percent slopes
15A	Croswell sand, 0 to 3 percent slopes
16A	Paquin sand, 0 to 3 percent slopes
17A	Au Gres sand, 0 to 3 percent slopes
18	Kinross muck
19	Deford muck
21A	Ingalls sand, 0 to 3 percent slopes
22B	Alcona loamy very fine sand, 0 to 6 percent slopes
23	Beaches
24B	Munising fine sandy loam, 1 to 6 percent slopes
24D	Munising fine sandy loam, 6 to 15 percent slopes
25B	Munising-Yalmer complex, 1 to 6 percent slopes
25D	Munising-Yalmer complex, 6 to 15 percent slopes
26A	Skanee cobbly fine sandy loam, 0 to 3 percent slopes, stony
27	Gay muck, stony
28B	Keweenaw loamy sand, 1 to 6 percent slopes
28D	Keweenaw loamy sand, 6 to 15 percent slopes
28E	Keweenaw loamy sand, 15 to 35 percent slopes
29B	Yalmer fine sand, 1 to 6 percent slopes
29D	Yalmer fine sand, 6 to 15 percent slopes
30A	Assinins loamy sand, 0 to 3 percent slopes
31D	Trenary silt loam, 6 to 15 percent slopes
31E	Trenary silt loam, 15 to 35 percent slopes
32A	Charlevoix silt loam, 0 to 3 percent slopes
33	Ensley muck
35B	Munising fine sandy loam, calcareous substratum phase, 1 to 6 percent slopes
35D	Munising fine sandy loam, calcareous substratum phase, 6 to 15 percent slopes
36B	Grandmarais very fine sandy loam, 1 to 6 percent slopes, stony
37B*	Grandsable loamy very fine sand, 1 to 6 percent slopes
37D*	Grandsable loamy very fine sand, 6 to 15 percent slopes
37E*	Grandsable loamy very fine sand, 15 to 35 percent slopes
38A*	Sundell Variant, poorly drained complex
39B	Amasa fine sandy loam, 1 to 6 percent slopes
39D	Amasa fine sandy loam, 6 to 15 percent slopes
39E	Amasa fine sandy loam, 18 to 35 percent slopes
40B	Waiska cobbly loamy sand, 0 to 6 percent slopes, very stony (Most of the Waiska in 93B has a very stony surface phase)
40D	Waiska cobbly loamy sand, 6 to 18 percent slopes, very stony
42	Minocqua
44B	Carlshend fine sandy loam, 0 to 6 percent
45A	Zeba cobbly fine sandy loam, 0 to 3 percent slopes, very stony
46	Jacobsville muck, very stony
47B	Deerton sand, 1 to 6 percent slopes
47D	Deerton sand, 6 to 15 percent slopes
48	Burt muck
49B	Cookson fine sandy loam, 1 to 6 percent slopes
50A	Sundell loam, 0 to 3 percent slopes
51	Nahma muck
52B	Summerville fine sandy loam, 1 to 6 percent slopes

53A	Ensign fine sandy loam, 0 to 3 percent slopes
54	Ruse muck
55B	Rubicon-Dawson complex, 0 to 6 percent slopes
57	Carbondale, Lupton and Tawas mucks
58	Dawson, Loxley and Greenwood peats
59	Chippeny-Nahma mucks
60	Histosols and Aquents, ponded
61	Pits, borrow
62B	Udorthents and Udipsamments nearly level to gently sloping
63C	Chocolay very cobbly fine sandy loam, 1 to 12 percent slopes, dissected, very stony
64B	Karlin variant, 1 to 6 percent slopes (This unit was mainly mapped by DJ east of Trenary, LC has transected some units, Kiva or Stutts
64D	Karlin variant, 6 to 15 percent slopes
64E	Karlin variant, 15 to 35 percent slopes
65D	Jeske-Gongeau-Deerton complex, bedrock terrace phase, 1 to 20 percent slopes
65F	jeske-Gongeau-Deerton complex, bedrock terrace phase, 1 to 45 percent slopes
66D	Ruse-Ensign-Nykanen complex, bedrock terrace phase, 1 to 20 percent slopes
66F	Ruse-Ensign-Nykanen complex, bedrock terrace phase, 1 to 45 percent slopes
67B	Longrie variant, 1 to 6 percent slopes (This unit could also be mapped as Cookson)
68	Pits, quarry
69B	Escanaba loamy fine sand, 1 to 6 percent slopes (I transected some of these units and many areas have sandy substratum phases)
69D	Escanaba loamy fine sand, 6 to 15 percent slopes
71B	Evart-Pelkie-Sturgeon complex, 0 to 4 percent slopes (We need to transect this unit, dominantly PD)
72C	Deerton-Trout Bay complex, 1 to 12 percent slopes, dissected
72E	Deerton-Trout Bay complex, 8 to 35 percent slopes, dissected
72F	Deerton-Trout Bay complex, 15 to 60 percent slopes, dissected
76C	Garlic-Bluelake-Okeefe complex, 1 to 12 percent slopes, dissected (We need a pedon of Okeefe)
76E	Garlic-Bluelake-Okeefe complex, 8 to 35 percent slopes, dissected
76F	Garlic-Bluelake-Okeefe complex, 15 to 60 percent slopes, dissected
77D	Garlic-Okeefecomplex, 6 to 15 percent slopes (Need to review transect data)
77E	Garlic-Okeefe complex, 15 to 35 percent slopes " "
78C	Keweenaw-Kalkaska complex, 1 to 12 percent slopes, dissected (Need to review data and may combine with 254
78E	Keweenaw-Kalkaska complex, 8 to 35 percent slopes, dissected " "
78F	Keweenaw-Kalkaska complex, 15 to 60 percent slopes, dissected " "
85A	Solona fine sandy loam, 0 to 3 percent slopes
86B	Cunard fine sandy loam, 1 to 6 percent slopes
88	Cathro-Ensley mucks
93	Tawas-Deford mucks
94B	Keweenaw-Kalkaska complex, 1 to 6 percent slopes (Review data and may combine with 214)
94D	Keweenaw-Kalkaska complex, 6 to 15 percent slopes " "
94E	Keweenaw-Kalkaska complex, 15 to 35 percent slopes " "
95B	Liminga fine sand, 0 to 6 percent slopes (Need a reference pedon)
95D	Liminga fine sand, 6 to 15 percent slopes
95E	Liminga fine sand, 15 to 35 percent slopes
97A	Iosco sand, 0 to 3 percent slopes (Need to show a pedon)
104C	Fence very fine sandy loam, 1 to 12 percent slopes, dissected
105C	Munising fine sandy loam, 1 to 12 percent slopes, dissected
109E	Rousseau-Dawson comples, 0 to 15 percent slopes
110D	Nadeau-Mancelona comples, 6 to 15 percent slopes
117B	Fence very fine sandy loam, 1 to 6 percent slopes
118A	Croswell-Deford complex, 0 to 4 percent slopes
119D	Yalmer-Kalkaska complex, 6 to 15 percent slopes
120B	Kalkaska-Munising complex, 1 to 6 percent slopes
121B	Onota fine sandy loam, 1 to 6 percent slopes
121D	Onota fine sandy loam, 6 to 15 percent slopes
128B	Kalkaska-Waiska complex, 1 to 6 percent slopes
128D	Kalkaska-Waiska complex, 6 to 15 percent slopes
128E	Kalkaska-Waiska complex, 15 to 35 percent slopes
128F	Kalkaska-Waiska complex, 35 to 60 percent slopes
129C	Kalkaska-Munising complex, 1 to 12 percent slopes, dissected
135B	Munising calcareous substratum phase -Ensley complex, 0 to 6 percent slopes
144B	Farquar gravelly sandy loam, 0 to 4 percent slopes (DJ mapped this near Grand Marais, combine with Waiska or Grandmarais)
145C	Munising-Yalmer complex, 1 to 12 percent slopes, dissected, very stony
146B	Munising-Skanee complex, 0 to 6 percent slopes, stony
147A	Skanee-Gay complex, 0 to 3 percent slopes, very stony
148B	Shoepac-Ensley complex, 0 to 6 percent slopes
149	Evart-Cathro complex (Transect unit to see if needed)
151B	Spear silt loam, 0 to 3 percent slopes

155A Zeba-Jacobsville complex, 0 to 3 percent slopes, very stony
156B Duel loamy sand, 1 to 6 percent slopes, very stony (Combine with 282B unit)
157B Reade-Nahma complex, 0 to 6 percent slopes, stony (Transect unit)
158C Munising-Onota-Yalmer complex, 1 to 12 percent slopes, dissected, stony (Review transects, Abbaye may be a better fit)
159A Jeske sand, 0 to 4 percent slopes (Combine with 221B)
160B Paquin-Finch sands, 0 to 6 percent slopes
161B Yellowdog very channery sand, 0 to 6 percent slopes, stony
161D Yellowdog very channery sand, 6 to 18 percent slopes, stony
162B Buckroe very channery loamy sand, 0 to 6 percenyt slopes, stony
162D Buckroe very channery loamy sand, 6 to 15 percent slopes, stony
163A LaVassuer very channery sand, 0 to 3 percent slopes, very stony (Review data)
165B Chocolay-Waiska complex, 1 to 6 percent slopes, stony
165D Chocolay-Waiska complex, 6 to 18 percent slopes, stony
166 Skandia mucky peat
167 Skandia-Jacobsville complex, stony
168B Yellowdog-Burt complex, 0 to 6 percent slopes
170B Chocolay very cobbly fine sandy loam, 1 to 6 percent slopes, very stony
170D Chocolay very cobbly fine sandy loam, 6 to 15 percent slopes, very stony
170E Chocolay very cobbly fine sandy loam, 15 to 35 percent slopes, very stony (Combine with 170D, probably not mod. Wet)
171B Paavola very gravelly loamy sand, 0 to 6 percent slopes, very stony
171D Paavola very gravelly loamy sand, 6 to 15 percent slopes, very stony
171E Paavola very gravelly loamy sand, 15 to 35 percent slopes, very stony
172D Buckroe-Rock outcrop complex, 6 to 25 percent slopes, very bouldery
172F Buckroe-Rock outcrop complex, 25 to 70 percent slopes, very bouldery
176B Greenwood-Croswell complex, 0 to 6 percent slopes
177E Frohling fine sandy loam, 8 to 35 percent slopes, dissected
180E Kalkaska-Frohling complex, 8 to 35 percent slopes, dissected
181E Frohling-Tokiahok complex, 8 to 35 percent slopes, dissected, very stony
185B McMaster fine sandy loam, 0 to 4 percent slopes
186B Chatham cobbly fine sandy loam, 1 to 6 percent slopes, stony
186D Chatham cobbly fine sandy loam, 6 to 15 percent, stony
186F Chatham cobbly fine sandy loam, 15 to 35 percent slopes, stony
187B Reade very fine sandy loam, 0 to 4 percent slopes (Need to transect unit)
188B Eben very cobbly fine sandy loam, 1 to 6 percent slopes, stony
188D Eben very cobbly fine sandy loam, 6 to 15 percent slopes, stony
188E Eben very cobbly fine sandy loam, 15 to 35 percent slopes, stony
191B Nahma-Sundell complex, 0 to 4 percent slopes (Need to transect, possibly combine with 157B)
193E Frohling-Tokiahok complex, 18 to 35 percent slopes
196E Frohling-Tokiahok -Onota dissected, 8 to 35 percent slopes (Need transects)
196F Frohling-Tokiahok-Onota dissected, 15 to 65 percent slopes " "
197B Shoepac-Trenary silt loams, 1 to 6 percent slopes
198B Shoepac-Reade complex, 1 to 4 percent slopes
200A Charlevoix-Ensley complex, 0 to 3 percent slopes
201B Sauxhead-Jacobsville complex, 0 to 6 percent slopes, very stony
202B Sauxhead sandy loam, 1 to 6 percent slopes, very stony
203A AuGres-Deford complex, 0 to 3 percent slopes
206B Traunik gravelly fine sandy loam, 1 to 6 percent slopes
206D Traunik gravelly fine sandy loam, 6 to 15 percent slopes
206E Traunik gravelly fine sandy loam, 15 to 35 percent slopes
209B Garlic-Okeefe complex, 1 to 6 percent slopes (Need transects)
210A Kawbawgam fine sandy loam, 0 to 3 percent slopes

211B Munising-Onota, fine sandy loam, 1 to 6 percent slopes
211E Munising-Onota, fine sandy loam, 15 to 35 percent slopes
213B Kiva sandy loam, 1 to 6 percent slopes
214B Kalkaska-Bluelake complex, 1 to 6 percent slopes
214D Kalkaska-Bluelake complex, 6 to 15 percent slopes
214E Kalkaska-Bluelake complex, 15 to 35 percent slopes
214F Kalkaska-Bluelake complex, 35 to 60 percent slopes
220 Brevort muck
221B Jeske-Autrain-Gongeau complex, 0 to 4 percent slopes
222A Jeske-Burt complex, 0 to 3 percent slopes
223E Onota-Skandia complex, 0 to 35 percent slopes
224B Onota-Deerton complex, 0 to 6 percent slopes (Need transects)
225B Cusino loamy sand, 0 to 6 percent slopes
225D Cusino loamy sand, 6 to 15 percent slopes

225E	Cusino loamy sand, 15 to 35 percent slopes
226B	Kalkaska-Cusino complex, 0 to 6 percent slopes
226D	Kalkaska-Cusino complex, 6 to 15 percent slopes
226E	Kalkaska-Cusino complex, 15 to 35 percent slopes
226F	Kalkaska-Cusino comples, 35 to 60 percent slopes
227A	Halfaday sand, 0 to 3 percent slopes
228B	Mancelona loamy sand, 0 to 6 percent slopes
229B	Otisco loamy sand, 0 to 6 percent slopes
230	Roscommon mucky sand (Combine with 19)
232B	Shelldrake sand, 0 to 8 percent slopes

233B	Chocolay-LaVasseur complex, 0 to 6 percent slopes, very stony (Need transects, new series)
234A	Burt-LaVasseur complex, 0 to 3 percent slopes, very stony (Need transects)
235B	Sauxhead-Burt complex, 0 to 4 percent slopes, extremely stony
236B	Shelter Bay stony loamy fine sand, 1 to 6 percent slopes, extremely stony
236D	Shelter Bay stony loamy fine sand, 6 to 15 percent slopes, extremely stony
237B	Chatham-Ensley complex, 0 to 6 percent slopes
238A	Channing-Minocqua complex, 0 to 3 percent slopes (Need transects)
239B	Reade fine sandy loam, deep variant, 1 to 6 percent slopes (Need transects)
239D	Reade fine sandy loam, deep variant, 6 to 15 percent slopes
239E	Reade fine sandy loam, deep variant, 15 to 35 percent slopes
240F	Trout Bay-Gongeau-Shingleton rock outcropcomplex, 1 to 70 percent slopes
241	Cathro-Gay complex
242B	Kalkaska sand, 1 to 6 percent slopes, burned
242D	Kalkaska sand, 6 to 15 percent slopes, burned
242F	Kalkaska sand, 35 to 70 percent slopes, burned
243	Markey mucky peat
245	Trout Bay muck
246B	Garlic fine sand, 1 to 6 percent slopes
246D	Garlic fine sand, 6 to 15 percent slopes
246E	Garlic fine sand, 15 to 35 percent slopes
246F	Garlic fine sand, 35 to 60 percent slopes
247	Spot muck
248B	Escanaba-Greylock complex, 1 to 6 percent slopes
248D	Escanaba-Greylock complex, 6 to 15 percent slopes
248E	Escanaba-Greylock complex, 15 to 35 percent slopes
248F	Escanaba-Greylock complex, 35 to 60 percent slopes
249B	Sauxhead-Skandia complex, 0 to 4 percent slopes
250B	Chocolay-Jacobsville complex, 0 to 6 percent slopes, extremely stony
251B	Greylock fine sandy loam, 1 to 6 percent slopes
251D	Greylock fine sandy loam, 6 to 15 percent slopes
251E	Greylock fine sandy loam, 15 to 35 percent slopes
252A	AuGres-Kinross complex, 0 to 3 percent slopes
253B	Garlic-Dillingham complex, 1 to 6 percent slopes
253D	Garlic-Dillingham complex, 6 to 15 percent slopes
253E	Garlic-Dillingham complex, 15 to 35 percent slopes
253F	Garlic-Dillingham complex, 35 to 70 percent slopes
254C	Kalkaska-Blue Lake complex, 1 to 12 percent slopes, dissected
254E	Kalkaska-Blue Lake complex, 8 to 35 percent slopes, dissected
254F	Kalkaska-Blue Lake complex, 35 to 70 percent slopes, dissected
255B	Wallace sand, 1 to 6 percent slopes
255D	Wallace sand, 6 to 18 percent slopes
256A	Hiawatha sand, 0 to 2 percent slopes
265B	Munising-Gay complex, 0 to 6 percent slopes, very stony
266A	Finch-Spot complex, 0 to 3 percent slopes
267A	Finch sand, 0 to 3 percent slopes
268C	Munising calcareous substratum phase-Onota complex, 1 to 12 percent slopes, dissected
269E	Munising calcareous substratum phase-Onota complex, 8 to 35 percent slopes, dissected
270A	Misery fine sandy loam, 0 to 3 percent slopes
271	Gongeau muck
272C	Munising fine sandy loam, calcareous substratum phase, 1 to 12 percent slopes, dissected
273B	Munising-Yalmer complex, calcareous substratum phases, 1 to 6 percent slopes, dissected
274B	Misery variant-Ensley complex (Combine with Charlevoix-Ensley complex)
275B	Munising calcareous substratum-Cookson complex, 1 to 6 percent slopes
276E	Munising calcareous substratum-Garlic complex, 8 to 35 percent slopes, dissected
277C	Munising-Yalmer loamy sands, calcareous substratum, 1 to 12 percent slopes, dissected
280C	Shelldrake sand, 1 to 15 percent slopes

281E	Mongo silt loam, 8 to 45 percent slopes, dissected
282B	Furlong-Shingleton loamy sands, 1 to 6 percent slopes
283B	Kalkaska-Stutts complex, 1to 6 percent slopes
283D	Kalkaska-Stutts complex, 6 to 15 percent slopes
283E	Kalkaska-Stutts complex, 15 to 35 percent slopes
284B	Steuben-Bluelake-Kalkaska complex, 1 to 6 percent slopes
284D	Steuben-Bluelake-Kalkaska complex, 6 to 15 percent slopes
284E	Steuben-Bluelake-Kalkaska complex, 15 to 35 percent slopes
285B	Halfday-Kinross complex, 0 to 4 percent slopes
286B	Greylock-Cookson complex, 1 to 6 percent slopes
287B	McMaster-Davies complex, 0 to 4 percent slopes
288B	Yalmer-Dillingham complex, 1 to 6 percent slopes
290A	Ruse-Namur complex, 0 to 2 percent slopes
292B	Mashek fine sandy loam, sandy substratum phase, 0 to 4 percent slopes
293	Trout Bay-Gongeau complex
294B	Frohling-Yalmer calcareous substratum phases complex, 1 to 6 percent slopes
295B	Crowell sand, 1 to 6 percent slopes
296D	McMillan-Kalkaska-Steuben complex, 6 to 15 percent slopes
296E	McMillan-Kalkaska-Steuben complex, 15 to 35 percent slopes
297B	Rubicon sand, 0 to 6 percent slopes, burned
297D	Rubicon sand, 6 to 15 percent slopes, burned
297E	Rubicon sand, 15 to 35 percent slopes, burned
298B	Wirthsmith-Deford complex, 1 to 4 percent slopes

Final Report Summary
Project: Munising Bay Watershed Restoration Project
MDEQ Tracking Code # 2000-0041
Grantee: Alger Conservation District

Introduction

The Munising Bay Watershed Restoration Project is located in north central Alger County, Michigan, and consists of the Anna River system with it's many tributaries, Furnace, Hanson, Gangeau, Munising Falls, and Sweats Creeks, and the numerous drains, wetlands, and upland recharge areas that contribute water (and sediment) to the Munising Bay area. The total surface area encompasses ~30,350 acres including the City of Munising and portions of Munising and AuTrain Townships. The year-round population of the Munising Bay area is about 4000 residents. Numbers climb tremendously as summer residents and large numbers of tourists enjoy the area's recreational, historical, and natural attractions. Tourism, logging, hunting and fishing, and water and snow sport recreation are vital to the economy of the area. According to the U.S. Bureau of Census we can expect a substantial increase in population and development by the year 2020, and thus an increase in development, recreational use, traffic, and pressure (impacts) on local natural resources. Since 1998, the Munising area has been one of the fastest growing communities in the Upper Peninsula. The local community has recognized that a healthy watershed is vital to long-term economic and environmental health. The community depends on this watershed for drinking water, flood protection, hunting, fishing, boating, swimming, wildlife, and aesthetic values that greatly enhance our quality of life.

We have forged a broad community-based partnership of local stakeholders, area schools, and landowners, to educate and to help identify and resolve existing degradations, and help guide new responsible development. Thanks go out to our partners who include; the Alger County Health Department, Alger County Road Commission, Alger County Board of Commissioners, the City of Munising, Munising and AuTrain Townships, Pictured Rocks National Park, Hiawatha National Forest, Lake Superior State Forest, Natural Resource Conservation Service, Michigan State University Extension, and the Central Upper Peninsula Watershed Partnership. All had the foresight to support the concept and vision of a comprehensive Watershed Restoration Plan. That support enabled the Alger Conservation District to begin planning the Munising Bay Watershed Restoration Project (MBWRP).

Historically, the Munising Bay Watershed has paid a heavy price for enhancing man's condition. Horse roads and narrow gauge railroads were pushed through the wilderness and timber was floated down our streams and rivers to fuel the great American expansion and the rebuilding of Chicago after the great fire. The influx of new inhabitants settled and cleared the land, building new communities. All took the abundant water resources for granted. In our small watershed area there are about 78 stream crossings by roads and railroads and bridges (foot or vehicular). We are fortunate that of those crossings only 10 have been identified as critically eroding areas. Of 3 abandoned wells located, none where within the watershed boundaries, one is in the process of being closed by the Lake Superior State Forest, and the other two have been referred to our Americorp Groundwater Technician for followup.

Watershed Goals and Objectives

It is high time now, to protect and restore the aquifers, rivers, and streams of our watershed by closing abandoned wells, repairing, replacing, or stabilizing erosion sites and bad road or rail stream crossings, and planting forested buffer zones, wildlife corridors, and filter strips. These efforts, combined with in-stream fisheries enhancements can restore impaired designated uses, create, and improve lost fish and wildlife habitat and help rid streams of tons of accumulated sediments, while sustaining the local economy, environmental health, and enhancing recreational opportunities. The Munising Bay Watershed Restoration Project (MBWRP) seeks to accomplish these goals by inventory of the watershed, and through voluntary, non-regulatory action and input of the local community and our watershed partners. This was combined with community education, and identification and prioritization of water resource problems. With the continued support of our local partners, and through application to the Clean Michigan Initiative Fund, we hope to implement best management practices and physical improvements that will restore designated use of prioritized critical areas. To achieve our goals, we have performed inventories and assessments of abandoned wells, stream fish, aquatic insects, hydrology, erosion, sedimentation, and runoff impacts, that we hope will help make the watershed eligible for grants to fund a variety of improvement projects.

Munising Bay Watershed- Demographics - Stakeholders: Whom Do We Serve?

Population Demography: Alger County had 9,862 people according to the 2000 census, making it the 77th most populous county (of 83 counties total). The population increased by 890 people or 9.9% since the 1990 census. Of the total population, about 16.2% are adults over the age of 65, 60.3% are adults between 18-64 years of age, 18.4% are youth ages 5-17, and 5% are under age 5. The fastest growing age group is 45-64 year-olds, growing by 466 people or 25.3 percent since the 1990 census. Males made up 53.8% of the population, females made up 46.2%. Of 3,337 households in Alger County, 2,671 or 80% owned their own homes, and 666 or 20% rented. On average, one out of every five Michigan citizens experience a disability, highlighting a need for more handicap access for recreational purposes.

Multiculturism: Cultural statistics for Alger County show the inhabitants are 87.5% Caucasian, 6% black, 3.1% Native American, 1% Hispanic, 1.9% biracial, 0.3% Asian, and 0.2% "other". Two major historic Native American trails and one minor trail were known to converge on the Munising Bay Watershed area during the historic era (1760's), but archaeological site density is listed as "very light" for the area. The watershed area lacks any reservation lands, being a portion of that area ceded to the U.S. Government in the Washington Treaty of 1836. There is one Native American casino operation on the watershed, located in Christmas, Michigan. The Native Americans in Alger County are of the Ojibwa (Chippewa) Tribe.

How Do We Serve? Public Education and Input: Interested citizens were invited by advertising and through personal contact, to join in formation of a Watershed Committee, and each locally elected government or partner within the watershed boundary was asked to provide a designated representative to serve on the committee. This consisted of the City of Munising, and Munising and AuTrain Townships. The same was asked of each state or federal agency, and these were; Michigan State Univ. Extension, LMAS Health Dept., Hiawatha National Forest, and Pictured Rocks National Lakeshore Park. The

Health Department, Natural Resource Conservation Service, and Michigan Department of Natural Resource- State Parks and Fisheries Division, provided technical support, and instruction for aquatic and erosion inventories, best management practices, and abandoned well closure guidelines. Pictured Rocks National Lakeshore and the Michigan State University Extension provided educational assistance and workshops that directly facilitated watershed education both in the local public school districts, and summer activities. The Central Upper Peninsula Watershed Partnership and MSU-Extension sponsored a local Storm Drain Stenciling Project. Citizen resource concerns were taken by mailing out survey forms in two newsletters, in which we asked for natural resource concerns, and natural resource related recreation and fishing preferences. In addition to watershed committee meetings, citizen input was gained by attending and making presentations and updates at watershed committee meetings and open house demonstrations, and at county, township, and city board meetings. We received 160 completed surveys, about 1.6 % of the 9,862 estimated adult population ages 18-85+ in Alger County. This was short of our goal of a minimum of 5%. However, through the survey, we did receive 62 direct offers of volunteer help for in-stream or erosion control work, and overwhelming support for the goals of the district and the watershed plan

Munising Bay Watershed Restoration Goals: Prioritized With Local Input

The goals of the Watershed Restoration Project as evinced by it's project partners, landowners, the Conservation District board, and other local input, are to **restore** and repair, impaired designated uses of the watershed. The desire is to mitigate and protect identified critical areas of the rivers, streams, drainages, and groundwater recharge areas of the watershed, and remove, reduce or minimize impacts or threats to the designated uses of surface flows and groundwater. This Project also established long-term local watershed support, monitoring, and cooperative conservation and maintenance of implemented best management practices by volunteers and watershed partners, while furnishing educational opportunities for the local schools. Another desire expressed in words and actions of local units of government and citizens responding to our resource concern surveys, was to enhance recreational opportunities for all citizens while protecting the resources that are impacted as a result. The degree of impairments to designated (and desired) use of surface water resources were considered by a Watershed Committee and our technical advisors. All surface water in Michigan is automatically designated by the State of Michigan and protected for the following designated uses with the exception of #5 below.

1. **Agriculture-** not impaired, historic use, but none currently or likely, less than 5% agricultural land on the watershed, none on riparian corridors.
2. **Industrial Water Supply**- not impaired, historic logging use, none currently or likely
3. **Public Water Supply**- not impaired, historic use, none currently
4. **Navigation-** impaired by woody debris, but 90% of the watershed streams are too small for practicable navigation.
5. **Coldwater Fishery (Special Category)-** Streams in the watershed are State Designated, Regulated Trout Waters and are severely IMPAIRED by sedimentation
6. **Warm water Fishery**- Not applicable
7. **Indigenous Aquatic Life and Wildlife-** IMPAIRED natural food chain affecting all trophic levels, by sand sedimentation of stream bottom or "benthic" habitat.

8. Partial Body Contact Recreation- not impaired, wading by sport fishers is common on this watershed.

9. Total Body Contact (May 1- Oct. 31)- not impaired, but not used here due to year-round cold water temps.

The committee, partners, and county and township boards were presented with regular updates and findings of the public input effort, watershed inventory, assessment, and recommended actions. The committee helped guide the prioritization process and helped in choosing cost-effective long-term solutions acceptable to partners and landowners. The main critical area prioritization process was by representatives of the 3 main fiscal partners, AuTrain Township (Supervisor-George Lucier), the City of Munising (Commissioner-Charles Steinhoff), and Munising Township (Twp. Supervisor-Jim "Curly" Wrosch). These three people indicated their approval of the developing plan after reviewing resource concern survey returns, site plans and preliminary proposals after discussions with our NRCS technical advisor and Resource Conservationist, Mike Lapointe. All three boards provided financial commitments for further support through a 3-year implementation process. The Anna River, being the largest of the stream systems within the watershed, and having portions of which fall within each partners' geopolitical boundary, was prioritized as the primary focus. Each of the three main partners then selected critical areas within their respective boundaries that occurred inside the designated topographic watershed boundary as a secondary focus. AuTrain Township agreed with our findings on the Furnace Creek system as a secondary focus due to the rapid development occurring there and the atrocious nature of the road-stream crossings (the only other large stream system within both the designated watershed boundary and theirs). The City of Munising rightly chose St. Martin's Hill erosion site as the major secondary focus of watershed efforts within their boundary, and Munising Township chose their McQuisten Recreation Area development that is a part of Wagner Creek, a tributary to the Anna River system. All three entities acknowledge worries about runaway development, perceived coldwater fisheries degradation, their tourism-dependent economies, local fire protection, and a desire for enhanced public recreation and handicap access, and mitigation of known erosion sites. For wholistic and logical analysis, the watershed manager decided stream systems should be "worked" from headwaters to mouth to find problem areas. Problem or "Critical" areas discovered where then presented in a slide show format at county, township, city board, and watershed committee meetings, to take comment both public and official. Findings and proposed critical sites were published in a second newsletter to garner further public comment. The Health Department provided technical details for well closures and contacted landowners with suspected malfunctioning septic systems.

Watershed Planning Products

1. Munising Bay Watershed Restoration and Water Quality Management Plan

2. Loan Boxes (2): GIS-based watershed maps, and Graphic and Water Quality and Fish-Insect Inventory Materials for loan to schools and other groups

3. Educational Presentations: "Watersheds and Wildlife", "Watershed Appreciation Field Days", "Storm Drain Stenciling", "Dry Hydrant Workshop", "Erosion Control Workshop", "Biodiversity Value, Buffer Sizes, and Forest Management of Vernal Wetlands, Riparian Corridors, and Lakeshores"

4. Watershed Newsletters; 2 completed issues, and 1 tentative draft issue

Primary Watershed Concerns	Impaired Designated Uses
1. Sediment (Sand) deposits and current input to streams -----	Aquatic Life/Wildlife
2. Poor Fishing----------	Coldwater Fishery
3. Sediment input to Munising Bay of Lake Superior ---------	Coldwater Fishery
4. River Flooding ----------	Human Habitation
5. Groundwater/Wellhead Protection -------Drinking Water Supply-NOT IMPAIRED	
6. Invasive/Exotic Species ----------moderately impaired- 2 plant species 1 animal species	

Pollutants	Sources
1. Nutrients (suspected) -------	Livestock in Streams (not found) Failing Septic Systems (not found or corrected) Residential Fertilizer Use (below detectable levels)
2. Sediment (known) ----------	Sources in streams are eroding stream crossings, undercut banks, and stream banks at lower sand trap. A large Upland slope in Munising, and 30 acre dirt racetrack site.
3. E.coli bacteria (suspected)--	Failing Septic Systems (not found or corrected)
4. Hydrologic Flow (known)--	Urban Storm Water (road and parking lot runoff, snowmobile trail runoff, road salt
5. Pesticides/Herbicides (suspected)--	not found, no agriculture on watershed, minor urban use probable.
6. Oils, Grease, Metals (known)--	not tested for, normally present in trace amounts but regulated in treated sewage wastewater, present in road, parking lot, and snowmobile trail runoff.

Impaired Use	Goals
Aquatic life/Wildlife	Restore aquatic ecosystem function by sediment reduction
Coldwater Fishery	Restore coldwater fishery by sediment reduction
Exotic Species	Restore coldwater fishery: Sea Lamprey barrier/reduce sediment Remove small amount of Purple Loosestrife Study and formulate plan to reduce Spotted Knapweed

Desired Uses	Goals
Recreational Trails	Harden & Enhance high use access areas with riprap, trails, fishing platforms, and boardwalks, enhance handicap access
Protect River Corridors	Encourage buffer plantings and zoning regulations Education/Enhance Awareness for reducing pesticide, herbicide, oils and grease, and other toxic inputs

Project Sustainability: All project partners have indicated continued support. The City of Munising and townships, through their willingness to provide local match money and 10-year operation and maintenance (O&M) agreements. Cooperative landowner partners will also agreed to O&M agreements in their cost-share agreements. The Mather Middle school, Central Elementary, and Munising High School are interested in long term educational monitoring activities on the watershed. Pictured Rocks and MSU-Extension will continue to participate and facilitate educational activities.

Measurement of Implementation Project Success: Success of BMP's used in the restoration plan will be measured by the amount of sediment reduction and increases in spawning habitat, populations of fish, aquatic invertebrates, and erosion stabilization.

Fact Sheet

Munising Bay Watershed Restoration Project
And Water Quality Management Plan
DEQ –Section 319 Planning Grant- Tracking Code #2000-0041

Planning Grant Funds Expended: $
Matching Local Grant Funds Provided: $
Applicant: Alger Conservation District
E. 9526 Prospect St., Munising, MI 49862
(906) 387-2222
Contact Person: Danita Rask, Executive Director

Project Partners:
City of Munising, and Munising and AuTrain Townships.
Michigan State Univ. Extension, LMAS Health Dept.
Hiawatha National Forest, and Pictured Rocks National Lakeshore
Natural Resource Conservation Service, MDNR- State Parks and Fisheries Divisions
Shelter Bay Forests, Carr/Furnace Lake Development

Impaired Use	**Goals**
Aquatic life/Wildlife	Restore aquatic ecosystem function by sediment reduction
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STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

STEVEN E. CHESTER
DIRECTOR

August 28, 2003

Ms. Danita Rask
Alger Conservation District
E9526 Prospect Street
Munising, Michigan 49862

RECEIVED SEP 9 2003

Dear Ms. Rask:

I am pleased to inform you that the Department of Environmental Quality (DEQ) has completed the review process of applications submitted August 17, 2001, for funding under the Clean Michigan Initiative, Nonpoint Source Pollution Control Grant Program. Your application for the Munising Bay Watershed Implementation has been awarded $91,226. The grant has also been approved by the State Administrative Review Board.

This award is contingent upon the finalization of a grant agreement between your organization and the DEQ. The grant agreement will contain the terms and conditions for the expenditure of funds. You will soon be contacted by Ms. Susan Erickson, Chief, Environmental Stewardship Grants and Loans Unit, Environmental Science and Services Division, DEQ.

If you have questions regarding this grant award, please contact Ms. Erickson at 517-241-8707.

Sincerely,

Steven E. Chester
Director
517-373-7917

cc: Senator Jason Allen
Representative Stephen F. Adamini
Mr. Stanley F. Pruss, Deputy Director, DEQ
Ms. JoAnn Merrick, Executive Assistant to the Director, DEQ
Ms. Carol Linteau, Legislative Liaison, DEQ
Mr. Dennis Fedewa, DEQ
Ms. Amy A. Butler, DEQ
File #2002-0039

TETRA TECH, INC.
2000 Warrington Way
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Telephone: (502) 569-9028
Telefax: (502) 584-5696

MEMORANDUM

To: Elizabeth Coyne
Alger County (Michigan) Conservation District

Date: August 28, 2006

cc: Barry Tonning

From: Ward Wilson

Subject: Munising Bay Watershed Plan Review
Michigan Watershed Plan Reviews, Tetra Tech project 17310

Enclosed here is our current draft of the review of your watershed plan, including revisions made after our meeting on July 31, 2006:

Munising Bay Watershed Restoration Project and Water Quality Management Plan; A Project of the Michigan DEQ, Section 319 NPS Program and the Alger Conservation District; Tracking Code #2000-0041. by Jeff Davis, Watershed Manager for the Alger Conservation District, May 31, 2002.

I will be looking for information that you could use for your plan revisions, including methods for estimating sediment loads from unpaved roads and culvert/road construction techniques. I have also enclosed a copy of the Kentucky Erosion Prevention and Sediment Control Field Guide that we discussed in my visit.

I will be calling you, but don't hesitate to contact me if you have questions or comments on the review.

DRAFT

Watershed Plan Review Summary
Comparison with USEPA Watershed-Based Planning guidance

Reviewer name - affiliation:	Ward Wilson, Steve Pennington, Kyle Paulson, and Elizabeth Hansen - Tetra Tech, Inc.
Review date:	Monday, July 31, 2006 updated after meeting with Elizabeth Coyne at Alger County CD on 7/31/06
Watershed Plan title - date:	Munising Bay Watershed Restoration Project and Water Quality Management Plan, May 2002
Watershed name and location:	Munising Bay Watershed; Alger County, Michigan

(a) Identification of the causes and sources of impairment or threats to the waterbody
Plan should contain a section on water quality, including a table or narrative citing use designations and attainment status for specific water bodies and reaches. Water quality criteria should be provided with this information. Pollutant loads should be identified by sources and quantified.

(b) Estimate of the load reductions expected from the proposed management measures
Load reductions should be quantified by source type or area or management measure.

(c) Description of the management measures needed to achieve the proposed load reductions
Management measures are described, but not tied to specific load reductions.

(d) Estimate of the amount of technical, financial, and regulatory assistance needed
Adequate, would be improved with more details on amounts of funding by agency.

(e) Public information, education, and participation
A plan is needed. Conservation District has requested 319 funding for this from MDEQ.

(f) Reasonably expeditious schedule for implementation
Short and long-term projects should be scheduled.

(g) Interim measurable milestones for implementing the management measures
Priority projects need interim milestones to measure progress.

(h) Criteria to determine whether or not load reductions are being achieved
Specific criteria are needed.

(i) Monitoring component to evaluate the effectiveness of implementation
Monitoring plan is needed.

Summary Comments
The plan is detailed and specific about some planned measures, but does not provide specific plans for public outreach and monitoring. Load estimation and plans for reductions are needed. Conservation District has implemented many of the plan BMPs with CMI grant funding that will extend to 2008. The District has partnered with the city and the road commission. Additional funding for a plan update has been requested from MDEQ (319 grant).

Watershed Plan Review
Comparison with USEPA Watershed-Based Planning guidance

Reviewer name - affiliation: Ward Wilson, Steve Pennington, Kyle Paulson, and Elizabeth Hansen - Tetra Tech, Inc.

Review date: Monday, July 31, 2006 updated after meeting with Elizabeth Coyne at Alger County CD on 7/31/06

Watershed Plan title - date: Munising Bay Watershed Restoration Project and Water Quality Management Plan, May 2002

Watershed name and location: Munising Bay Watershed; Alger County, Michigan

Each element of the USEPA guidance is presented below, with specific review criteria for subelements.

Score Key

1 incomplete
2 partially complete
3 adequate
4 exceeds requirements
5 outstanding

(a) Identification of the causes and sources of impairment or threats to the waterbody

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. Water body use designations (from relevant Water Quality Standards) are listed for waters in the planning area	3	Use designations and impairments are described, but not for specific reaches. Desired uses are listed. Impairments to navigation, coldwater fishery, aquatic life, and wildlife uses.	pp. 15-17	Use designations should be listed in a table for specific reaches of streams (and for lakes) in the watershed. A map would help illustrate the extent and number of impairments.
2. Water quality criteria (from relevant Water Quality Standards) for the use designations are cited	1	WQS and criteria are not provided.	pp. 15-17	Plan should contain a section on water quality, including a table or narrative citing specific Water Quality Criteria (e.g, numeric concentrations for DO, fecal coliform, temperature, metals, etc.; narrative criteria with or without quantifiable translator) for applicable water body uses. Make clear that MDEQ has not listed impairments, but local council believes that problems exist and has desired uses as well. Add Michigan's narrative criteria for suspended solids to pgs 15-16. (rule 323.1050)

(a) Identification of the causes and sources of impairment or threats to the waterbody (continued)

3. Impaired, partially impaired, and threatened uses (from state 303[d] report) are listed by water segment or area	2	Streams and segments are not provided for each impairment, other than general statements like "90% of watershed" and "the watershed." Review of Michigan's 2004 report shows that the Anna River and Wagner Creek are listed as in attainment (Some uses are met but there is insufficient data to determine if remaining uses are met). Nonattainment/TMDL required list includes no streams in Alger County and Au Train, Echo, Grand Sable, Nawakwa and West Branch lakes. Monitoring planned for 2005-2006 in the area.	pp. 15-17	Determine whether monitoring has been done to assess impairment. Cite the Michigan 303(d) lists for any waterbodies in the watershed if applicable. If not applicable breakout impairments linked to your priority segments.
4. Specific causes and sources (303[d]) of impairments and threats are listed by waterbody segment or area	2	Causes are listed; information is specific for priority sites, not by water body.	pp. 16-17, 21-22	Listing or table is needed that matches water bodies with impairments, problems, causes, and sources. This could be incorporated in the table recommended in a.1. above.
5. Causes of threats/impairment are listed as loads, WQC exceedance amounts/ percentages, or via other quantifiable method	1	Causes of site specific high sediment are discussed in detail in the watersheds history, but there is no breakdown of specific TSS loads from causes		Plan should quantify loads or otherwise provide an indication of the level of effort needed to address impairments/threats. Simple modeling, load duration analysis, etc. methods could be used to quantify specific loads for each cause of impairment
6. Sources of impairments/threats are mapped or identified by area, category/subcategory, facility type, etc.	1	pg 23... what is the purpose of this pollutant source listing? What causes/sources does each relate to?		Maps of stressor sources with clear labeling, tables that list facilities or source areas along with impairment causes (e.g., sediment from construction sites), or other approaches that explain geographically which stressors come from what areas are all acceptable.
7. Contributions from each source location or category is quantified by load, percentage, priority, or other method	1	Areas were prioritized for management by the community forums.		Add citations of mass or weight-based or percentage loads from source areas (e.g., 300 lbs per month [or 30%] of the load is coming from construction sites, ag lands, or stream bank erosion) or source categories (e.g., 50% of the bacteria load is attributable to livestock); or by land use type; other methods are also OK. Collecting TSS data throughout the watershed and applying loads to sources would help to meet this criteria.
8. Estimates, assumptions, or data used in the analysis is presented or cited and appears reasonable	1			Monitoring and/or assessment data should be summarized and/or referenced; quantification schemes should be clearly laid out; they don't have to be overly detailed or sophisticated, but should be reasonable - show logical steps to make the case for the problem and approach. Use of best professional judgment is OK – names and qualifications of BPJ contributors should be cited. Pg. 7 states that all available written material was studied for analysis. Compiling all the sediment data from those reports and including a data summary would help to address most of the above criteria.
Number incomplete	**7**			

(b) Estimate of the load reductions expected from the proposed management measures

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. Load reductions needed to address each impairment and threat are listed, and are quantified by weight, concentration, percentage reduction needed, etc	1	No information on load quantities.		Loads need to be quantified and described in more detail before reductions can be quantified. Load Duration Analysis using available data or simple modeling efforts to provide reasonable loads could serve as a starting point for load reductions. Also, use GIS to show available data.
2. Listed load reductions are linked to each cause and source location or category	1	No information on load quantities.		Load reductions should be tied to each impairment or water quality threat cause (stressor) and source. Translators may be used for narrative criteria impairments, such as use of chlorophyll a when no nutrient criterion exists. For flow corrections: present required flow rates and flow rates for old and new culvert; however, need to specifically describe the problem...flow can be a stressor and tied into sediment deposition, but actions should be associated with a demonstrated problem.
3. Load reductions will achieve water quality criteria, address threats, or achieve other goals	1	pg 20, #4... for example, need to link the removal of tires, vehicle parts, etc. to restoration of an impairment or achievement of a goal... it is a good action, but has no 'driver' in the plan (also pg 21, #3)		Load reductions, concentration reductions, stressor remediation, or WQ threat elimination scheme should target achievement of WQ criteria in a reasonable manner. Excessive detail and precision is not as important as a logical presentation of the needed scope and level of effort. If other, non-WQS goals are listed, remediation proposals should reasonably address achieving those goals (e.g., aesthetics, visual amenities, non-contact recreation, etc.). TSS standards need to be decided upon in the watershed, then determine if recommended BMPs will meet the standard.
4. Estimates, assumptions, or data used in the analysis is presented or cited and appears reasonable	2	Stream survey sheets with photos, drawings, and detailed data are provided in attachments to plan, after the newsletters section	no page nos. on attachments	Load reduction or stressor remediation information or data should be clearly presented. Quantification methods should be logical and understandable. Methods don't have to be overly detailed or sophisticated, but should be reasonable. Use of best professional judgment is OK – names and qualifications should be cited. While reasonable the attached data does not address the load reduction analysis. A compilation of available TSS and perhaps a year long study of the watershed to provide data for analysis is recommended.
Number unacceptable	4			

(c) Description of the management measures needed to achieve the proposed load reductions

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. Water quality and other watershed goals are listed for each water body segment in the planning area	3	Management measures are described for four priority 1 areas, priority 2 and 3 areas.	pp. 17-23	Tie the measures to impairments and loads more specifically.
2. Management measures needed to address each cause and source are listed, described, and prioritized	3		pp. 17-23	
3. Proposed management measures are applicable to causes and sources and are feasible	3	Measures seem reasonable, but may overestimate the longevity of aluminum culvert	pp. 17-23	
4. Critical locations or high-priority sites for each management measure are mapped or described	3		pp. 17-23 and maps after numbered pages	
5. Load reductions linked to each management measure are listed and quantified	2			Projected BMP performance or other stressor remediation impacts (i.e., load reductions) should be summarized; e.g., streambank stabilization along X miles will reduce sediment loadings by Y tons (or %) per month; implementing nutrient management plans on X number of farms in Y sub-basin will reduce nutrient loads by Z pounds per day.
6. Estimates, assumptions, or data used in the analysis is presented or cited and appears reasonable	3		pp. 26-28	
Number incomplete	1			

(d) Estimate of the amount of technical, financial, and regulatory assistance needed

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. Type and amount of technical assistance needed to implement the management measures are listed	3	Conservation District has most resources; NRCS and MI DNR have already assisted	pp.15-24	Could be more specific. A table would help illustrate.
2. Actual or potential sources of the needed technical assistance are identified	3	Conservation District has most resources; NRCS and MI DNR have already assisted	pp. 15-24	
3. Costs for implementing, operating, and maintaining the management measures are estimated and listed	3		pp. 26-28	More on maintenance.
4. Sources of financial assistance needed to implement the management measures are listed	3	Conservation District plans to fund most actions and will also get assistance from volunteers, CMI funding, USFWS, MI DNR Trust Fund grant, etc.	pp. 15-24	More specifics.
5. Regulatory or other authorities responsible for (or needed) to implement the management measures are listed; entities exercising the regulatory or other authorities are identified	2	Permitting is mentioned in BMP cost summaries, but not in the Plan explicitly	pp. 23-24; 26-28	Management measures or BMPs requiring regulatory authority (e.g., non-structural practices like erosion control ordinances for construction sites) should specify the type of authority to be employed and responsible agency or entity; e.g., construction site inspections, ordinance dealing with stream buffer protection, agricultural water quality laws or regulations, timber harvest rules, etc.
Number incomplete	1			

(e) Public information, education, and participation

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. Information, education, and public participation goals and objectives for the management program are listed	2	A lot of good products and input summaries, but need to link to project goals and objectives.	pp. 15, 16, 23, and attached newsletters	A summary of the type of education and participation activities should be presented; the goals and objectives should be linked to implementation of the proposed management measures or WQ goals.
2. A strategy or plan for the public information, education, and participation component is provided	2	Watershed Committee, surveys, newsletters are provided. Future efforts/ongoing outreach plans are not detailed.	pp. 15, 16, 23, and attached newsletters	Public information/education and public participation activities should broadly note their objectives, target audiences, and format or activities. Specific plans should include implementation schedule and responsibilities.
Number incomplete	**2**			

(f) Reasonably expeditious schedule for implementation

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. A timeline or schedule showing dates for developing and implementing each management measure is presented	2	Prioritized projects; three year schedule for all projects is mentioned on p. 25.	pp. 17-25	Table or chart is needed. More detail needed. Long-term plans are needed.
2. The timeline or schedule indicates the specific actions, steps, or accomplishments associated with implementing the management measures	2	Prioritized projects; three year schedule for all projects is mentioned on p. 25.	pp. 17-25	Table or chart is needed. More detail needed. Breakdown of costs a good start, should be spelled out in order of occurence with respective dates and time to complete for each.
3. The timeline or schedule follows a logical sequence for implementing the management measures	3	Prioritization is logical	pp. 17-25	Table or chart is needed. More detail needed.
4. The timeline or schedule lists short-term (up to 3 yrs) and long-term (up to 10 yrs) implementation steps	2	Prioritized projects are in first 3 yrs. Long-term plans are not detailed. Attainment of goals may take much longer...system to come into equilibrium with new lower sediment inputs, unforseen problems, new sources.	pp. 17-25	Table or chart is needed. More detail needed.
Number incomplete	**3**			

(g) Interim measurable milestones for implementing the management measures

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. A list of reasonable and attainable interim milestones, benchmarks, phases, or steps for implementing each group of management measures or control actions is provided	3	Priority projects descriptions serve this purpose, but need interim milestones.	pp. 17-23; 26-28	Need to identify milestones. (need to identify for all groups what milestones might look like.)
2. A logical sequence of dates for achieving the milestones, benchmarks, phases, or steps is listed	2	Dates not given.		Will be complete once dates are added to check against anticipated progress.
Number incomplete	1			

(h) Criteria to determine whether or not load reductions are being achieved

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. Criteria are identified that are linked to the causes and/or sources of impairments/threats	2	Plans for water quality monitoring, erosion inspection, photo documentation. Only criteria is sediment reduction. Contributing loads by source not given. Load reduction by management measure not cited.	p. 23	Measurements (or narrative descriptions) of WQ criteria cited in the impairment or threats noted in section a (e.g., DO, TSS, turbidity, FC bacteria, metals, etc.). Less helpful but still acceptable are activity measures – number of miles of streambank that have been stabilized, number of AFOs with manure management plans, # of acres of row crops under conservation practices, etc. Calculate contributing loads by source. Calculate load reduction by management measure. Need discussion of numbers in narrative, table, etc.
2. The listed criteria include numeric and/or narrative water quality criteria, instream physical habitat assessment criteria, or other measurable criteria linked to the causes/sources	1	Water quality data was collected but does not appear to have been linked to priority sites and management measures. What is going to be measured to gauge the success of the projects?		Link priority sites and management measures to monitoring strategies.
3. Listed criteria include those incorporated into any TMDLs developed or to be developed for waterbodies addressed by the plan	1			
4. Provisions for reviewing progress and revising the plan or any TMDLs involved	1			
Number incomplete	4			

(i) Monitoring component to evaluate the effectiveness of implementation

Review Criteria	Score (1-5)	Comments	Page and Section	Recommendations
1. A approach for establishing monitoring sites or procedures and relevant parameters is provided	1	Monitoring is mentioned, but not explained in detail.	p. 23	For WQ parameters, a description of likely sampling parameters and general sampling locations is adequate. If specific projects will be undertaken during the short term (i.e., 0-3 yrs), more specific information on parameters, sampling protocols, sites, and etc. should be presented.
2. Non-environmental monitoring parameters are clearly identified and provide a reasonable yardstick for measuring progress toward implementing the management measures	1			Plans should summarize how outreach, education, public participation, and activity-based measures will be evaluated, e.g., pre/post tests of watershed awareness, knowledge of WQ problems, number of people involved in planning and implementation activities, number and range of partners or stakeholders, extent of news media coverage, etc. Generally, activity based measures measure effectiveness of activities measure change in attitudes measure change in environment establish milestones
3. Monitoring parameters include the criteria identified in (h) and the milestones, benchmarks, phases, or steps cited in (g) above	1			Monitoring or evaluation mechanisms or protocols should cite the criteria, milestones, steps, and etc. in sections h and g. Information on evaluation measures and monitoring or tracking approaches can be summarized in a table, or via a text template with categories for management measure, type of measure, intent of measure, performance target or objective, effectiveness measures, etc. Need to develop a monitoring plan for all pollutants.
4. Frequency of monitoring or schedule for assessing implementation progress is included in the plan	1			A general plan or schedule for tracking the indicators, criteria, benchmarks, and etc. should be presented; more information on short term (i.e., 0-3 yrs) should be included, such as "quarterly WQ sampling at sites X, Y, and Z for parameters A, B, and C."
5. Parties responsible for implementing the monitoring program are listed	1			Need to assign responsibility. Parties can be identified by agency, by position (e.g., watershed manager, volunteers, etc.) or individually.
6. Quality Assurance Project Plans for water quality parameters are referenced or cited, if appropriate	1			These are not necessarily required, but if QAPPs are being used to conduct monitoring for the project they should be cited or referenced as part of the plan.
Number incomplete	**6**			