004810

FILE COPY

Michigan Department of Natural Resources
Surface Water Quality Division
Water Quality Surveillance Section
November 1984

A Benthic Macroinvertebrate Survey of Wheeler Drain and Brooks Creek in Relation to Hess Lake, Newaygo County, Michigan December 6, 1982

Introduction

Water Quality Surveillance Section staff surveyed Wheeler Drain (the major inlet) and Brooks Creek (the outlet from Hess Lake), Newaygo County, Michigan on December 6, 1982. The survey was performed at the request of Richard Mikula, Land Resource Programs Division and George Liddle, District 4, Water Quality Division Engineer. Their request was prompted by a proposal by Edmands Engineering, Inc. to dredge Hess Lake or reroute Wheeler Drain around Hess Lake to Brooks Creek or the Muskegon River.

Conclusions

1. Hess Lake is a shallow lake receiving excessive nutrient loadings and turbidity from watershed agricultural activities. These sources exaserbate an already turbid lake condition resulting from carp and motor boat activity. Together these factors create undesirable water quality conditions.

2. Wheeler Drain is nutrient enriched from watershed agricultural activities. Nutrient expression in the drain is not evident in algal or rooted aquatic plant growth. It is likely that these nutrients express themselves as rooted aquatic plants or as floating or benthic algae in Hess Lake.

3. The degree of Hess Lake water quality improvement with a Wheeler Drain/Hess Lake bypass is very uncertain.

4. Brooks Creek was characterized as a moderately productive warm-water stream with a low nutrient input. Diversion of Wheeler Drain to Brooks Creek would greatly alter the characteristics of Brooks Creek.

Recommendations

1. Work to improve upstream nutrient and erosion control practices in the agricultural watershed of Wheeler Drain.

2. Use chemical application for floating algal control in Hess Lake.

3. Use weed harvesting practices for aquatic weed control in Hess Lake.

4. Request Fisheries Division to remove carp from Hess Lake.

5. Abandon the bypass of Wheeler Drain to Brooks Creek.

Background

Edmands Engineering, Inc., consultant for the Hess Lake Lake Association, has recommended a lake deepening project and a bypass system for Wheeler Drain to improve Hess Lake quality. These actions are being considered since residents on Hess Lake have complained of highly turbid lake water, heavy rooted weed growths and poor fishing.

Methods

Water samples for chemical and physical analysis were collected and preserved according to the "Quality Assurance for Water and Sediment Sampling", (MDNR, 1981) Manual and returned to the Environmental Laboratory for Analysis. Aquatic animals were sampled at two sections using a long-handled triangular dip net and hand picking aquatic substrates until no new organisms were found. Organisms were identified and their abundance estimated in the field. Stream observations were recorded on stream problem assessment cards (Appendix A).

Results and Discussion

Wheeler Drain

Wheeler Drain drains a rather extensive agricultural area and contained levels of nitrogen and phosphorus that were more than adequate to support aquatic plant growth (Table 1). This growth was not expressed as rooted plants, since none were present at Station 1. Sand substrate may have limited growth opportunities for rooted aquatic plants. Filamentous algal growth was sparse to moderate, but did not approach nuisance growth. The turbid condition of Wheeler Drain probably prohibited this growth.

The aquatic insect community was moderately abundant and dominated by nemourid stoneflies, sowbugs, scuds and snails. Also present were blackflies, beetles and heptageniid mayflies. The community was moderately diverse and contained animal groups that are tolerant, facultative, and intolerant of inorganic enrichment. This community indicated moderate water quality.

Hess Lake

The turbidity in Hess Lake results from a combination of boating activity, sediment resuspension by fish, watershed runoff and planktonic algae. The watershed (primary agricultural) contributes sediments and heavy nutrient loads via several drains including Wheeler Drain. Partial nutrient removal by bypassing Wheeler Drain may reduce some algal turbidity, but whether or not it would be a noticeable reduction is unknown. Lake modeling efforts suggest that a noticeable change would occur, but since the model conditions cannot be met in Hess Lake, modeling results are questionable. If Wheeler Drain was diverted, other drains would continue to be nutrient sources and algal blooms would continue to occur. The proposed bypass would simply shift nutrients and sediments from Hess Lake to Brooks Creek. The lake board would be open to civil suits from downstream property owners if Brooks Creek were degraded by the bypass from Wheeler Drain.

If nutrient loadings were reduced water clarity still may not improve because of carp and boating activity. Carp removal may be necessary. Because this is a shallow lake, an improvement in water clarity may cause rooted aquatic plants, which are already abundant, to become profuse.

Hess Lake is slowly filling in from inorganic and organic materials. This is the natural process of eutrophication. The eutrophication of Hess Lake has apparently been speeded up by fertilization and sedimentation from its agricultural watershed. To reverse this eutrophication process, the lake would have to be deepened and the watershed management practices changed to reduce nutrient loadings to the lake. Dredging is an extremely expensive and not economically feasible. The cost of dredging Lake Lansing, a 450 acre lake in Ingham County was approximately $3.2 million. Hess Lake is nearly twice the size of Lake Lansing. Fishing in Hess Lake is not expected to improve without intensive fish management which is not presently planned by the Michigan Department of Natural Resources Fisheries Division. In summary, the proposed dredging appears to be too expensive and the proposed bypass too risky. There is no guarantee that either would resolve the problem experienced by local residents.

Brooks Creek

Brooks Creek is the outlet from Brooks and Hess lakes to the Muskegon River at Newaygo. At M-82 (Station 2), Brooks Creek had no visible periphyton or filamentous algae. The clear water and sand silt muck substrate allowed abundant macrophyte growth. Aquatic insects were also abundant and diverse in variety, indicating a moderately productive warmwater stream. Sowbugs, scuds, fingernail clams and damselflies dominated the community. Midges, snails, heptageniid mayflies and philopotamid and hydropsychid caddisflies were common and hydrophillid beetles and silad megalopterans were sparse.

Field Work: David Kenaga, District Biologist
Carey Johnson, District Aquatic Biologist
Laboratory Analysis: Environmental Laboratory
Report by: David Kenaga, District Aquatic Biologist
Surface Water Quality Division
Michigan Department of Natural Resources

Literature Cited: Environmental Protection Bureau, 1981 Quality Assurance for Water and Sediment Sampling, Michigan Deaprtment of Natural Resources

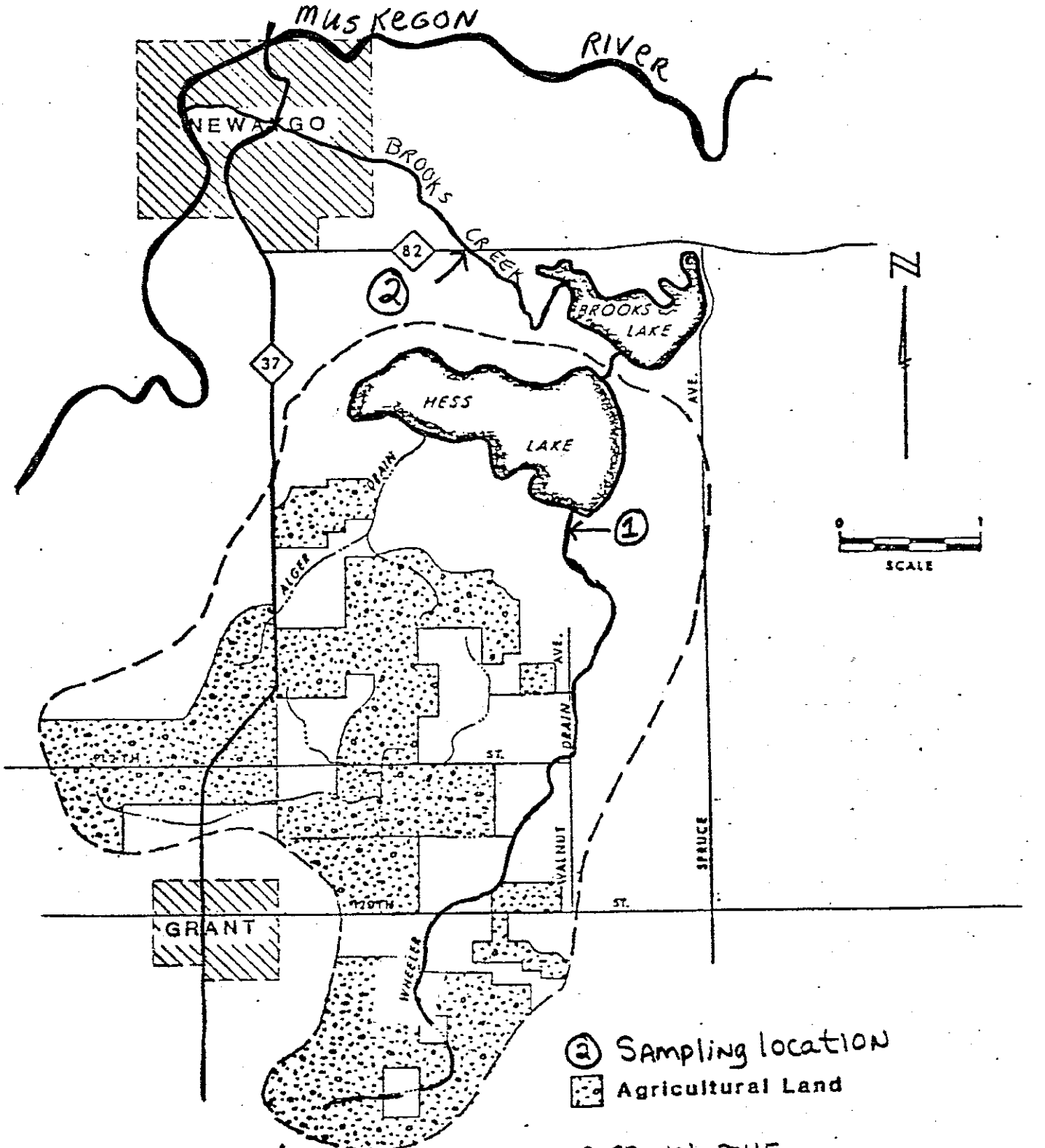


FIGURE 1 LOCATIONS SAMPLED IN THE HESS LAKE DRAINAGE BASIN NEWAYGO COUNTY, DECEMBER 6, 1982.

Table 1. Concentrations of nutrient constituents of Wheeler Drain at Hess Lake, Newaygo County, Michigan, March 1, 1983. Concentrations in mg/l.

Station and Location	Nitrate plus Nitrite	Total Ammonia	Ortho Phosphorus	Total Phosphorus
1 Wheeler Drain at Hess Lake	1.3	0.07	0.024	0.047

Appendix A

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
WATER QUALITY DIVISION

BIOLOGY SECTION
STREAM PROBLEM ASSESSMENT

Station Number 1 Investigator(s) Kenaga, Johnson

Date 12 / 6 / 82 TIME 2:30 pm PHOTOGRAPH NUMBER

BODY OF WATER Wheeler Drain LOCATION at Hess Lake inlet

COUNTY Newaygo T11N R 12W S 4 TWP Brooks

REASON FOR SURVEY Hess Lake enrichment

VICINITY LAND USE: Mostly Forest Mostly Urban Mostly Agriculture Other

AVE. STREAM WIDTH 40 ft AVE. STREAM DEPTH 4 in VELOCITY <0.2 ms STREAM km

STREAM SHADING: Open Partly Open Shaded STREAM TYPE: Coldwater Warmwater

WATER TEMP. 36 °F AIR TEMP. 40 °F WEATHER: Sunny – Partly Cloudy – Cloudy – Rainy DAM u/s: Yes No km

CHANNELIZED: Yes No CHANNEL EROSION: None — Slight to Moderate — Severe HIGH WATER MARK ? m

SECCHI DISC TRANS: 4 in TURBIDITY: Clear — Slightly Turbid – Turbid – Opaque WATER COLOR Brown

WATER ODORS: Normal Sewage Petroleum Chemical Other

SURFACE OILS: None Slick Sheen Globs Flecks

SEDIMENT ODORS: Normal Sewage Petroleum Chemical Anaerobic Other

SEDIMENT OILS: Absent Slight Moderate Profuse

DEPOSITS: Sludge Sawdust Paperfiber Sand Relict Shells Other

ARE THE UNDERSIDES OF STONES WHICH ARE NOT DEEPLY IMBEDDED IN SUBSTRATE BLACK? YES NO

SUBSTRATE TYPE	FLOW VELOCITY m/sec	CHARACTERISTICS OR SIZE	PERCENT IN SAMPLING AREA
BOULDERS*	>1.2 (>3 fps)	256 mm (10") dia.	
RUBBLE*	>0.6 (>2 fps)	64-256 mm (2.1-10") dia.	5 (near bridge)
GRAVEL*	>0.3 (>1 fps)	2-64 mm (0.1-2.5") dia.	
SAND	>0.2 (>0.7 fps)	0.06-2.00 mm dia. Gritty texture	90
SILT	>0.12 (>0.4 fps)	0.004-0.006 mm dia.	5
MUCK-MUD	>0.12 (>0.4 fps)	black, very find organic	

*IMBEDDEDNESS: 0 = NONE 1 = 1/3 OR LESS 2 = 2/3 OR MORE

SUBSTRATE TYPE	CHARACTERISTICS OR SIZE	PERCENT IN SAMPLING AREA
CLAY	Slick texture	
MARL	Grey, shell fragments	
DETRITUS	Sticks, wood, coarse plant materials	
FIBROUS PEAT	Partially decomposed plant material	
PULPY PEAT	Finely divided plant material, parts indistinguishable	
LOGS & STICKS		

BIOTA:

PHYTOPLANKTON	~~0~~	1	2	3	4	SLIMES	(0)	1	2	3	4
PERIPHYTON	(0)	1	2	3	4	ZOOPLANKTON	~~0~~	1	2	3	4
FILAMENTOUS ALGAE	0	(1) →	(2)	3	4	MACROINVERTEBRATES	0	1	(2)	3	4
MACROPHYTES	(0)	1	2	3	4	FISH	~~0~~	1	2	3	4

0 - Absent 1 - Sparse 2 - Moderate 3 - Abundant 4 - Profuse

FISH GAME FISH

ROUGH FISH

FORAGE FISH

AQUATIC PLANTS | PERIPHYTON | FILAMENTOUS ALGAE

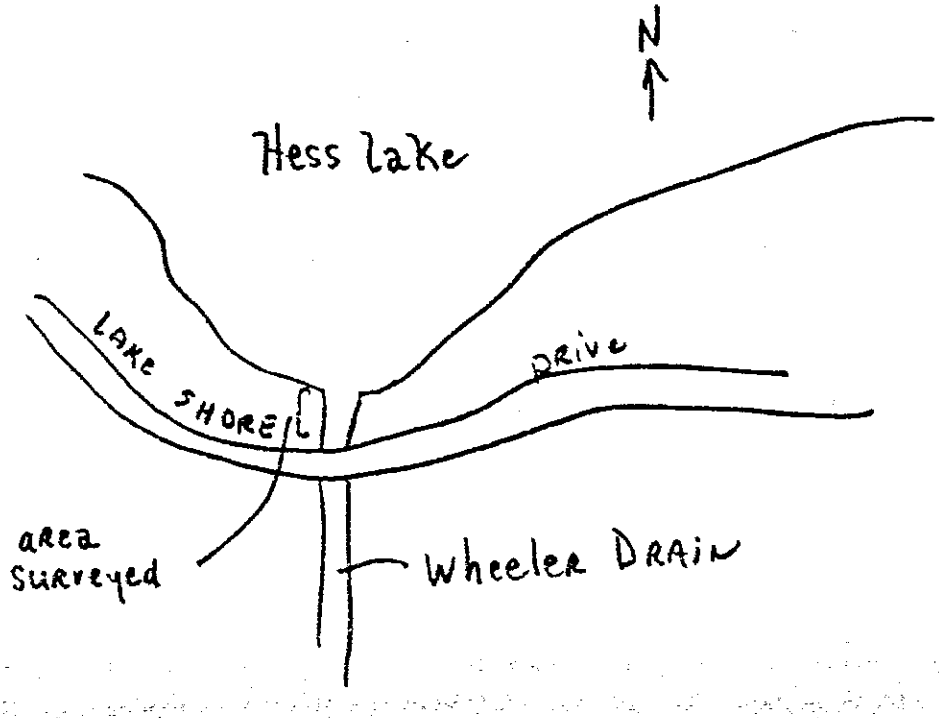
MACROPHYTES | Cladophora

STREAMBANK VEGETATION: GRASSES BRUSH HERBACEOUS CONIFERS DECIDUOUS BARREN OTHER_____

MACROBENTHOS QUALITATIVE SAMPLE CHECK LIST (INDICATE DOMINANT GROUPS)

SPONGES	DRAGONFLIES	RATTAILED MAGGOTS
HYDRA	DAMSELFLIES	MIDGES
FLATWORMS	TRUE BUGS	STONEFLIES nemourids VA
ROUNDWORMS	BEETLES C	MAYFLIES
LEECHES	AQUATIC CATTERPILLARS	-BURROWERS Heptegeniids C
WATER MITES	ALDERFLIES	-SWIMMERS
SOWBUGS A	HELLGRAMITES	-CLINGERS, SPRAWLERS
SCUDS A	CRANEFLIES	CADDISFLIES
CRAYFISH	NO-SEE-UMS	-FREE LIVING
SNAILS-LIMPETS A	BLACKFLIES C	-PURSE CASE MAKERS
CLAMS	DEERFLIES	-TUBE CASE MAKERS
AQUATIC EARTHWORMS	MOSQUITOES	-SADDLECASE MAKERS
	SNIPEFLIES	-NET SPINNERS OR RETREATMAKERS

NOTES, ETC.



MICHIGAN DEPARTMENT OF NATURAL RESOURCES
WATER QUALITY DIVISION

BIOLOGY SECTION
STREAM PROBLEM ASSESSMENT

Station Number 2 Investigator(s) Kenaga, C. Johnson

Date 12 / 6 / 82 TIME 3:30 PHOTOGRAPH NUMBER

BODY OF WATER Brooks Creek LOCATION M-82

COUNTY Newaygo T12N R 12W S 29 TWP Brooks

REASON FOR SURVEY Hess Lake enrichment

VICINITY LAND USE: Mostly Forest Mostly Urban Mostly Agriculture Other open fields

AVE. STREAM WIDTH 25 ft AVE. STREAM DEPTH 3 ft VELOCITY <0.2 ms STREAM km

STREAM SHADING: Open Partly Open Shaded STREAM TYPE: Coldwater Warmwater

WATER TEMP. 38 °F AIR TEMP. 40 °F WEATHER: Sunny – Partly Cloudy – Cloudy – Rainy OAM u/s: Yes No 3/4 mi Lake upstream

CHANNELIZED: Yes No CHANNEL EROSION: None — Slight — Moderate — Severe HIGH WATER MARK 1 ft

SECCHI DISC TRANS: > 4 ft TURBIDITY: Clear — Slightly Turbid — Turbid — Opaque WATER COLOR clear greenish

WATER ODORS: Normal Sewage Petroleum Chemical Other

SURFACE OILS: None Slick Sheen Globs Flecks

SEDIMENT ODORS: Normal Sewage Petroleum Chemical Anaerobic Other

SEDIMENT OILS: Absent Slight Moderate Profuse

DEPOSITS: Sludge Sawdust Paperfiber Sand Relict Shells Other

ARE THE UNDERSIDES OF STONES WHICH ARE NOT DEEPLY IMBEDDED IN SUBSTRATE BLACK? YES NO

SUBSTRATE TYPE	FLOW VELOCITY m/sec	CHARACTERISTICS OR SIZE	PERCENT IN SAMPLING AREA
BOULDERS*	>1.2 (>3 fps)	256 mm (10") dia.	
RUBBLE*	>0.6 (>2 fps)	64-256 mm (2.1-10") dia.	
GRAVEL*	>0.3 (>1 fps)	2-64 mm (0.1-2.5") dia.	10
SAND	>0.2 (>0.7 fps)	0.06-2.00 mm dia. Gritty texture	70
SILT	>0.12 (>0.4 fps)	0.004-0.006 mm dia.	10
MUCK-MUD	>0.12 (>0.4 fps)	black, very find organic	10

*IMBEDDEDNESS: 0 = NONE 1 = 1/3 OR LESS 2 = 2/3 OR MORE

SUBSTRATE TYPE	CHARACTERISTICS OR SIZE	PERCENT IN SAMPLING AREA
CLAY	Slick texture	
MARL	Grey, shell fragments	
DETRITUS	Sticks, wood, coarse plant materials	
FIBROUS PEAT	Partially decomposed plant material	
PULPY PEAT	Finely divided plant material, parts indistinguishable	
LOGS & STICKS		

BIOTA:

PHYTOPLANKTON	~~0~~	1	2	3	4	SLIMES	(0)	1	2	3	4
PERIPHYTON	(0)	1	2	3	4	ZOOPLANKTON	~~0~~	1	2	3	4
FILAMENTOUS ALGAE	(0)	1	2	3	4	MACROINVERTEBRATES	0	1	2	(3)	4
MACROPHYTES	0	1	2	(3)	4	FISH	(0)	1	2	3	4

0 - Absent 1 - Sparse 2 - Moderate 3 - Abundant 4 - Profuse

9 OF 10

FISH GAME FISH

ROUGH FISH

FORAGE FISH

AQUATIC PLANTS PERIPHYTON FILAMENTOUS ALGAE

MACROPHYTES

STREAMBANK VEGETATION: GRASSES BRUSH HERBACEOUS CONIFERS DECIDUOUS BARREN OTHER

MACROBENTHOS QUALITATIVE SAMPLE CHECK LIST (INDICATE DOMINANT GROUPS)

SPONGES	DRAGONFLIES S	RATTAILED MAGGOTS
HYDRA	DAMSELFLIES A	MIDGES C
FLATWORMS	TRUE BUGS	STONEFLIES
ROUNDWORMS	BEETLES Hydrophillids S	MAYFLIES
LEECHES	AQUATIC CATTERPILLARS	-BURROWERS
WATER MITES	ALDERFLIES	-SWIMMERS
SOWBUGS VA	HELLGRAMITES Sialids S	-CLINGERS, SPRAWLERS Heptageniids C
SCUDS VA	CRANEFLIES	CADDISFLIES
CRAYFISH	NO-SEE-UMS	-FREE LIVING
SNAILS-LIMPETS C	BLACKFLIES	-PURSE CASE MAKERS
CLAMS VA	DEERFLIES	-TUBE CASE MAKERS
AQUATIC EARTHWORMS	MOSQUITOES	-SADDLECASE MAKERS
	SNIPEFLIES	-NET SPINNERS OR RETREATMAKERS

NOTES, ETC.

Philopotamidae C
Hydropsychids C