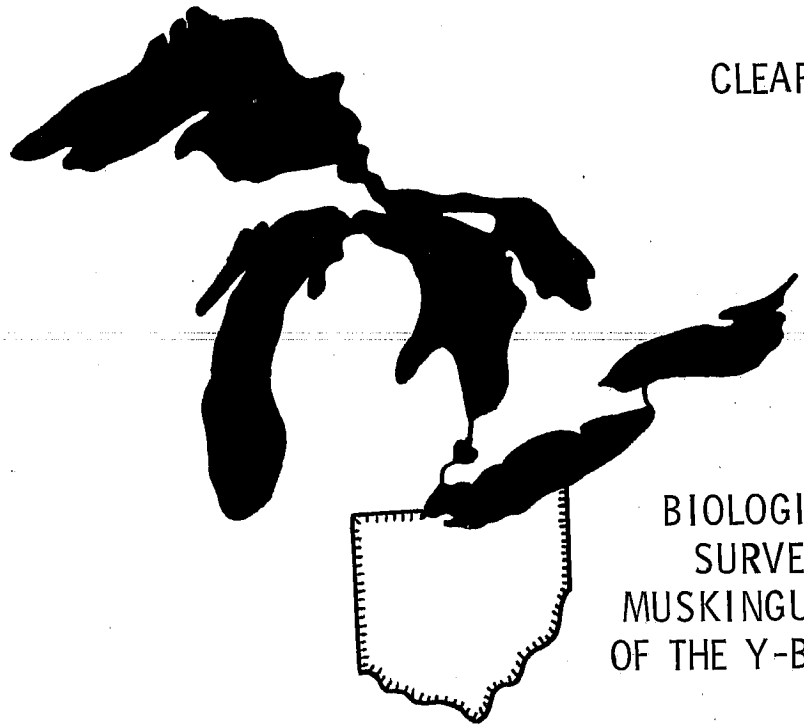

CLEAR TECHNICAL REPORT NO. 217

BIOLOGICAL AND WATER QUALITY SURVEY OF THE LICKING AND MUSKINGUM RIVERS IN THE VICINITY OF THE Y-BRIDGE AT ZANESVILLE, OHIO

Prepared by

Charles E. Herdendorf
C. Lawrence Cooper
Jeffrey M. Reutter

Prepared for

Franklin Consultants, Inc.
Columbus, Ohio

CENTER FOR LAKE ERIE AREA RESEARCH
THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO

MARCH 1981

TABLE OF CONTENTS

INTRODUCTION

The following report documents the biological and water quality characteristics near the confluence of the Licking and Muskingum Rivers in the vicinity of the Y-Bridge in Zanesville, Ohio (Figure 1). The site is being considered for highway and bridge improvements. In March 1981, a field survey was conducted to obtain the data necessary for documentation of environmental conditions and for an assessment of the potential environmental impacts of construction.

PROCEDURES

Location of Sampling Stations

The study area is located in Muskingum County, Ohio, within the city limits of Zanesville. On the west side of this city, the Licking River enters the southward flowing Muskingum River from the northwest. The historic Y-Bridge is located at the confluence of these rivers. The sampling stations were established in the vicinity of the Y-Bridge for water quality and biological measurements and samples (Figure 1):

Station No.	Location
Z-1	Licking River, right bank, 300 ft. upstream of Y-Bridge
Z-2	Muskingum River, right bank, 300 ft upstream of Y-Bridge
Z-3	Muskingum River, left bank, 300 ft. downstream of Y-Bridge

Ecosystem Description

The general features of the ecosystem in the vicinity of the site were documented through field reconnaissance surveys and review of pertinent literature. This included basic geological information such as bedrock, surface materials, topography and stream characteristics. The various habitats and biological communities present at the site were described and mapped. A search of scientific reports was conducted to obtain additional information on the site or nearby areas with similar characteristics. This information was integrated with data obtained from the present survey to present a comprehensive statement of the ecological status of the site.

Water Quality

Water quality determinations for 17 parameters were made at three stations (Z-1, Z-2 and Z-3). Time-dependent determinations (such as temperature, dissolved oxygen and pH) were made in the field. Water samples were collected for laboratory analysis for the other

parameters. All tests were performed using techniques prescribed in Standard Methods for Water Analysis (APHA 1975) or approved by the U.S. Environmental Protection Agency.

Aquatic Life

Plankton

Phytoplankton and zooplankton were sampled at three stations (Z-1, Z-2 and Z-3) in the Licking and Muskingum Rivers (Figure 1). Whole water samples were collected for phytoplankton species, preserved with Lugol's solution and transported to the laboratory for microscopic examination. Zooplankton samples were taken by passing a 10 to 25 liter water sample through a 32-μ mesh net and preserving the retained organisms in five percent formalin solution for microscopic examination. Analysis was accomplished with the use of inverted and compound microscopes in conjunction with counting cells. Standard texts, which are listed in the "Literature Cited" section of this report were used to confirm plankton identification. Samples are presently being maintained in the Center for Lake Erie Area Research sample library.

Rooted Aquatic Plants

A thorough visual search was conducted along the banks of the Licking River and the Muskingum River to locate and subsequently identify the resident species of vascular aquatic plants.

Benthic Macroinvertebrates

Samples were collected from three sampling stations above and below the Y-Bridge (same as plankton and water quality stations) using a 6-inch by 6-inch Eckman Dredge on 6 March 1981. This technique was supplemented by classical qualitative dip netting techniques and by overturning rocks and hand-picking with forceps. This hand sampling technique was also used in a small tributary immediately above the Y-Bridge on the Licking River. However, this tributary appeared to be completely devoid of benthic macroinvertebrates. Samples collected with the Eckman Dredge were sieved through a standard United States number 40 soil sieve, preserved in 10 percent formalin with the other samples and returned to the laboratory for identification. Identifications were made to the lowest taxonomic level practicable using standard reference texts and taxonomic keys listed in the "Literature Cited" section of this report. The Zoology Museum at The Ohio State University was also visited and mollusc populations near the Y-Bridge were discussed with Dr. David Stansberry.

Fish

A nylon minnow seine (17 ft x 4 ft with ¼-inch Ace mesh) and dip nets were used to sample fish communities in the stream on 6 March 1981. A literature survey was also conducted to locate previous records of fishes in the study area, thereby identifying species potentially

present in the study area but not collected in the present survey. Field identifications were verified using Trautman (1957). All fish collected were identified and enumerated, and the total length and weight of each fish were determined. Mean length, length range, mean weight, and total weight were determined for each species. A voucher collection of each species from each site was deposited at the CLEAR laboratories in Columbus until completion of construction.

Terrestrial Life

Flora

Trees, shrubs, and herbaceous vegetation were surveyed in the vicinity of the existing Y-Bridge. Banks and adjoining unpaved areas extending a minimum of 200 ft upstream of the bridge abutments along the Muskingum River, 500 ft downstream, and 500 ft along the Licking River upstream of the fernix of the two streams were also surveyed. The results of this survey are presented as a list of dominant species present along with a discussion of their relative abundance.

Fauna

During the site visit, March 6, visual surveys were conducted to record actual sightings and other evidence (tracks, scats, burrows) of use of available wildlife habitat. The results of these surveys are presented as a list of observed avifauna and a discussion of mammals, birds, reptiles and amphibians sighted within or near the study area or believed occurring in the study area. Identification of species encountered were confirmed with the use of standard field guides.

GENERAL DESCRIPTION OF ECOSYSTEM

Geological Setting

Muskingum County, located in southeastern Ohio, is within unglaciated Allegheny Plateau physiographic province (Fenneman 1938). The study area is at Zanesville, which lies on the Muskingum River at its confluence with the Licking River. This area is about eleven miles east of the terminal moraine produced by the Illinoian glacier.

The Lower Mercer Limestone outcrops in the Muskingum River at an elevation of 675 feet above sea level, the Putnam Hill Limestone (on Putnam Hill adjacent to the study area) at 740 feet, and the Middle Kittanning Coal (on Putnam Hill) at 845 feet (Stout et al. 1943). The city of Zanesville thus lies on rocks of the Pottsville Formation (Pennsylvanian System).

The study area lies on a terrace approximately 1.5 to 2.0 miles wide which was built by glacial melt waters between the flanking hills to the east and west of the city. The terrace has an elevation of about 720 to 780 ft above sea level and the flanking hills rise to over 940 feet. The present streams have cut through the sand and gravel outwash

deposit to an elevation of 675 feet. The total thickness of these deposits range from 50 to 80 feet (Stout et al. 1943).

Stream Characteristics

The Muskingum River has a total length of 111.9 miles and a drainage area of 8,038 square miles. The river has an elevation of 738 feet above sea level at its source (Coshocton County) and 585 feet at its mouth at the Ohio River. This yields an average fall of 1.3 feet per mile. The U.S. Geological Survey (1980) has gaged the Muskingum River at Dresden (12 miles upstream of Zanesville) since 1921. The average discharge rate during this period was 6,265 cfs. The maximum discharge of 100,000 cfs was recorded on August 9, 1925 and the minimum flow of 335 cfs was measured on June 25, 1925. Water quality measurements for this station are presented later in this report.

The Licking River, which flows into the Muskingum River at the Zanesville Y-Bridge, has a total length of 67.5 miles and a drainage basin of 780 square miles. This river has a source elevation of 1,296 feet above sea level (Licking County) and enters the Muskingum River at an elevation of 679 feet. The average gradient for this stream is 9.1 feet per mile. The U.S. Geological Survey (1980) has gaged the Licking River near Hebron (25 miles upstream from Zanesville) since 1939. The average discharge rate during this period was 151 cfs. The maximum discharge of 4,120 cfs was recorded on March 6, 1945 and the minimum flow of 0 cfs was observed on August 22, 1942. Water quality measurements for this station are presented later in this report.

Both streams in the vicinity of the Y-Bridge were found to have a sandy bottom at the sampling locations. The Licking River had considerable silt mixed with the sand, while the Muskingum River had more cobbles and boulders.

Biological Habitats

Wetlands

No wetland areas were apparent during the site visit. The lack of apparent sites may, in part, be due to their complete inundation by high water conditions. If any wetland sites exist, they would be riverine or palustrine in nature and limited to the area adjacent to the southwestern abutment of the Y-Bridge.

Terrestrial

The study site is located in an urban setting with the Licking and Muskingum Rivers separating the commercial district of the City of Zanesville. The eastern shoreline within the study area is vertical stone or rock walls. At the top of the rockwall on the eastern shore are park-like open areas. A small sandy area occurs at the foot of the stone wall south of the eastern abutment.

A similar vertical, stone wall forms the western shoreline from the weir on the Muskingum River to the mouth of the Licking River. At

the top stone wall, surface roadways, walkways and parking areas predominate. The shoreline of the Licking River is a hydric flood-plain green belt. The western shoreline of the Muskingum River, south of the fernix of the Licking River, is a riverbank area and is periodically cut-over area dominated by grasses and saplings.

WATER QUALITY

The results of water quality analyses at the three stations are presented in Table 1. These samples were collected on March 3, 1981. U.S. Geological Survey records for water chemistry on the Muskingum River at Dresden (12 miles upstream of Zanesville) and near Hebron on the Licking River (25 miles upstream of Zanesville) are available for 1976 and 1977. These data are summarized in Table 2.

These two rivers have been designated as warmwater habitat streams by the Ohio Environmental Protection Agency (1978). Water quality standards have been established for such streams by this agency. The quality of the streams did not exceed the maximum permissible concentration established by Ohio EPA on the dates sampled. However, moderate nutrient enrichment (nitrogen and phosphorus) is evident and some oxygen depletion occurs during the summer months.

AQUATIC LIFE

Plankton

Phytoplankton

Nineteen taxa (16 genera) of algae were identified from plankton samples from the Licking River and 30 taxa (22 genera) from the plankton samples from the Muskingum River. Diatoms were the most abundant group in the streams, with Cryptophytes being the next most common group in the Licking River and blue-green algae in the Muskingum River (Table 3). Population sizes were moderate in both streams, with the number of individual cells 2-3 times greater in the Muskingum River. The presence of a relatively high number of blue-green cells indicates a moderate level of nutrient enrichment (Palmer 1977).

Zooplankton

Only five taxa of planktonic animals were identified from the Licking and Muskingum Rivers (Table 4). Rotifers were the most abundant group with copepods accounting for the rest of the zooplankton population. The low populations can be attributed to the early season and relatively rapid flow of the stream on the sampling date. No taxa specificially associated with degraded water quality were detected.

Rooted Aquatic Vascular Plants

No vascular aquatic plants were observed during this survey. Within the study area, very little habitat favorable for the

development of such plants occurs and that which may exist was inundated.

Benthic Macroinvertebrates

Benthic macroinvertebrate populations in the vicinity of the Y-Bridge in Zanesville, Ohio were dominated by oligochaetes and dipterans (primarily chironomids) (Table 5). No endangered species were collected and all forms were listed as common or "widespread" by Merritt and Commins (1978). Dangerously high water precluded sampling the center of the stream. It is expected that caddisflies, mayflies, water pennys and hellgrammites would be found in this habitat.

Dr. David Stansberry of The Ohio State University's Museum of Zoology visited this site in 1960 collecting molluscs. Of this location, Dr. Stansberry wrote in his field notes, "Licking River is polluted (sight and smell), dead and dying fish where it joins the Muskingum at Zanesville. The Muskingum seems to be in good shape with both Physa sp. and Goniobasis sp. snails in abundance. Naiad shells few, crayfish common. Below Y-Bridge the southwest side of the Muskingum seems to carry most of the polluted Licking River water. G. complanata were found on polluted side below bridge in or upon a gravel-silt-sand substrate exposed at low water. Hellgrammites abundant on clean side of Muskingum as were Sphaeridae." (Dr. David H. Stansberry, Field Collection Data Record, Collection Number: DHS: 1960:39). Dr. Stansberry (personal communication) felt that it was unlikely that any endangered species would be found near the Y-Bridge and said that naiad densities there were quite sparse compared to areas further downstream.

Based on the above information, it is felt that Y-Bridge replacement in Zanesville, Ohio will not have a significant adverse environmental impact on benthic macroinvertebrate populations in the vicinity, no endangered species will be affected, and recolonization of areas disturbed during construction should be rapid.

Fish

Sampling efforts during the survey yielded three species (Table 6) which had all been previously reported from the area by Trautman (1981). All three are common Ohio stream species. Trautman reported 49 species from the area prior to 1955 and has observed 29 species since 1955 (Table 7). It is quite probable that the 29 species observed since 1955 still inhabit the bridge area, reside nearby, or migrate past the bridge. None of the species collected during this survey or reported by Trautman appear in the Ohio Department of Natural Resources Publication 316, "Ohio's Endangered Wild Animals."

It is quite likely that this area is a spawning habitat for many of the species observed since 1955. However, due to Stansberry's observations of poor water quality in the area which improves farther downstream, it is felt that this is not a quality spawning habitat.

Based on the above information, it is felt that Y-Bridge replacement in Zanesville, Ohio will not have a significant adverse

environmental impact on the fish population of the area. Those which are displaced by construction activities or the associated increased turbidity levels will rapidly return, as will benthic macroinvertebrates, when the bridge is completed.

TERRESTRIAL LIFE

Flora

A park area on the eastern shore is dominated by grasses. The sandy area at the foot of the stone wall located south of the bridge abutment harbors scattered willows (Salix sp.) and silver maples (Acer saccharinum) as well as riverbank grape vines (Vitus riparia).

The shorelines of the Licking River are forested greenbelt approximately 100-200 ft in width. The greenbelt on the north is bordered by a parking lot and a railroad bed while that on the south is bordered by a series of parking lots. The dominant vegetation comprising this wooded greenbelt is willow, silver maple, and cottonwood (Populus deltoides) trees.

The western shoreline of the Muskingum River is a narrow cut-over zone bordered at the top of the incline by lawns surrounding commercial or municipal buildings and by parking lots. The predominant vegetation of the bank area is grasses (graminoids) and sapling silver maple, cottonwood, box elder (Acer negundo) and black locust (Robinia pseudo-acacia). Vegetation within the study site is summarized in Table 8.

Fauna

A thorough inspection of the study area resulted in the observation of a cottontail rabbit (Sylvilagus floridanus) and observation of the avifauna listed in Table 9. The predominant wildlife observed were rock doves (Columba livia) using the abutments and piers of bridge structure for resting and shelter sites and feeding at the grain elevator located on the northwestern shore. With the exception of the wooded greenbelt along the Licking River, no undeveloped habitat exists within the study area. Habitat suitable for reptiles and amphibians was not readily apparent, possibly due to high water conditions. The study site provides marginal habitat of animals having a high tolerance for man and his machines. The latter includes raccoon (Procyon lotor) and eastern grey squirrel (Sciurus carolininus).

IMPACT ASSESSMENT

Restoration of the historic Y-Bridge at the confluence of the Licking River with Muskingum River in Zanesville will have only minimal impacts on the natural environment. The natural banks and bottoms of these streams have already been significantly altered by the construction of bulkheads, a canal and dam, and other engineering structures. The proposed reconstruction will utilize existing bridge foundations where possible, thereby minimizing further disruption of

the stream bottoms and shore areas. Some disturbance of the area may be necessary if the existing foundations need to be reinforced and if a construction causeway is required.

The water quality and aquatic organisms in the vicinity of the bridge are likely to experience temporary impairment including increased turbidity, loss of benthic habitat and dislocation of fish species. All of these impacts are expected to be small in areal extent and short term, with water quality and fish populations being restored to the area shortly after the completion of the project. Benthic organisms will likely recolonize the bottom within a year after construction. No endangered species or wetlands plants are expected to be impacted by the proposed project.

LITERATURE CITED

American Public Health Association. 1975. Standard Methods for the Examination of Water and Wastewater. 14th ed. APHA, New York. 1193 pp.

Bailey, R.M., J.E. Fitch, E.S. Herald, E.A. Lachner, C.C. Lindsey, R.C. Robins, and W.B. Scott. 1970. A list of common and scientific names of fishes from the United States and Canada. 3rd ed. Amer. Fish. Soc. Spec. Pub. No. 6. 150 pp.

Chengalath, R., C.H. Fernanda, and B.G. George. 1971. The planktonic Rotifera of Ontario with keys to genera and species. Univ. Waterloo Biology Series, Ont. No. 2. 40 pp.

Collins, G.B., and R.O. Kalinsky. 1972. The diatoms of the Scioto River basin. The Ohio State Univ., Columbus, Ohio. The Dept. of Botany. Unnumbered mimeo. 18 pp.

Cowardin, L.M. 1977. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service. 48 pp.

Eddy, S. and A.C. Hodson. 1964. Taxonomic keys to the common animals of the north central states. Burgess Publishing Company, Minneapolis, Minnesota. 162 pp.

Fassett, N.C. 1957. A manual of aquatic plants. Univ. of Wisconsin Press, Madison, Wisconsin. 405 pp.

Fennemen, N.M. 1938. Physiography of eastern United States. McGraw-Hill, New York. 691 pp.

Klemm, D.J. 1972. Biota of freshwater ecosystems identification manual No. 8 Freshwater leeches (Annelida: Hirundinea) of North America. U.S. EPA. 53 pp.

Krolczyk, J.C. 1960. Gazetteer of Ohio Streams. Ohio Dept. Nat. Res., Div. Water, Ohio Water Plan Invent. Rept. No. 12. 179 pp.

Mason, W.T. 1973. An introduction to the identification of chironomid larvae. Fed. Water Poll. Contr. Admin. 89 pp.

Merritt, R.W. and K.W. Cummins, eds. 1978. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Company. Dubuque, Iowa. 441 pp.

Ohio Department of Natural Resources. 1980. Ohio's endangered wild animals. Ohio Dept. of Nat. Res., Div. of Wildlife, Columbus. (Brochure).

Ohio EPA. 1978. Water quality standards. Ohio Environmental Protection Agency, Chapter 3745-1, Administrative Code. 117 pp.

Palmer, C.M. 1977. Algae and water pollution. U.S. Environmental Protection Agency, EPA-600/9-77-036. 124 pp.

Pennak, R.W. 1978. Fresh-water Invertebrates of the United States. 2nd Edition. John Wiley & Sons, New York. 803 pp.

Scheidt, M.E. 1967. Environmental effects of highways. J. Sanit. Eng. Div., Amer. Soc. Civ. Engrs. 93:17-25.

Stein, C.B. 1962. Key to the fresh-water mussels (Family Unionidae) of western Lake Erie. Ohio State Univ. Museum of Zool. Mimeo. 7 pp.

Stout, W. 1941. Dolomites and limestones of western Ohio. Ohio Geol. Survey Bull. 42. 468 pp.

Stout, W., K. Ver Steeg, and G.F. Lamb. 1943. Geology of water in Ohio. Ohio Geol. Survey Bull. 44. 694 pp.

Taft, C.E. and C.W. Taft. 1971. The algae of western Lake Erie. Bull. Ohio Biol. Survey, New Series 4:1-185.

Torke, B.G. 1974. An illustrated guide to the identification of the planktonic crustacea of Lake Michigan with notes on their ecology. Center for Great Lakes Studies, The Univ. of Wisconsin-Milwaukee, Special Report No. 17. 42 pp.

Trautman, M.B. 1957. The Fishes of Ohio. The Ohio State Univ. Press, Columbus, Ohio. 683 pp.

Trautman, M.B. 1980. The Fishes of Ohio (2nd ed.). The Ohio State Univ. Press, Columbus, Ohio. (In press)

U.S. Fish and Wildlife Service. 1977. Endangered and threatened wildlife and plants. Fed. Regis. 42(135):36429-431.

U.S. Geological Survey. 1977. Water resources data for Ohio: water year 1976. Vol. 1. Ohio River Basin. U.S.G.S. Water-Data Rept. OH-76-1. 611 pp.

U.S. Geological Survey. 1978. Water resources data for Ohio, water year 1977. Vol. 1. Ohio River Basin. U.S.G.S. Water-Data Rept. OH-77-1. 518 pp.

U.S. Geological Survey. 1979. Water resources data for Ohio: water year 1978. Vol. 1. Ohio River Basin. U.S.G.S. Water Data Rept. OH-78-1. 383 p.

U.S. Geological Survey 1980. Water resources data for Ohio: water year 1979. Vol. 1. Ohio River Basin. U.S.G.S. Water Data Rept. OH-79-1. 487 pp.

Usinger, R.L. 1956. Aquatic insects of California. Univ. Calif. Press, Berkeley. 508 pp.

Walker, C.E. 1946. The amphibians of Ohio: Part I, frogs and toads. Ohio State Mus. Sci. Bull. 1(3). 109 pp.

Ward, H.G. and G.C. Whipple. 1959. Freshwater Biology. 2nd ed., ed., W.T. Edmondson. John Wiley and Sons, New York. 1248 pp.

TABLES

TABLE 1

WATER QUALITY OBSERVATIONS FOR THE LICKING AND MUSKINGUM RIVERS AT ZANESVILLE, OHIO

Parameter	Units	Station		
		Z-1	Z-2	Z-3
Date	day	3-6-81	3-6-81	3-6-81
Time	hrs	0940	0930	0920
Depth	cm	100.00	100.00	100.00
Temperature	^{o}C	5.50	4.80	4.70
Transparency	cm	26.00	26.00	24.00
Turbidity	NTJ	46.50	53.20	55.40
Conductivity	µmhos/cm	450.00	560.00	530.00
Dissolved Oxygen	mg/l	13.20	13.60	13.50
Hydrogen-ions	pH	7.60	7.70	7.70
Total Phosphorus	mg/l	0.11	0.17	0.18
Soluble Phosphorus	mg/l	0.11	0.02	0.03
Ammonia Nitrogen	mg/l	Trace	Trace	Trace
Nitrate Nitrogen	mg/l	1.40	1.60	1.40
Total Hardness	mg/l	180.00	168.00	210.00
Total Iron	µg/l	240.00	110.00	120.00
Chloride	mg/l	20.00	27.00	27.00
Sulfate	mg/l	91.00	92.00	29.00
Acidity	mg/l	4.00	2.00	4.00
Alkalinity	mg/l	80.00	72.00	74.00

TABLE 2

WATER QUALITY MEASUREMENTS FOR THE MUSKINGUM AND LICKING RIVERS
IN THE VICINITY OF ZANESVILLE

Parameter	Units	Muskingum River at Dresden USGS Sta. No. 03144500				Licking River at Hebron USGS Sta. No. 03145000			
Date	day	2/23/76	7/22/76	3/21/77	7/13/77	3/2/76	6/15/76	3/10/77	7/7/77
Time	hr	1030	1545	1345	1000	1230	1220	1630	1340
Discharge	cfs	24106.0	4210.0	19700.0	3160.0	65.0	10.0	76.0	21.0
Conductivity	µmhos	370.0	740.0	410.0	640.0	540.0	640.0	595.0	560.0
pH	su	6.9	6.8	7.7	7.7	8.2	7.9	7.9	7.7
Dissolved Oxygen	mg/l	10.4	6.7	11.0	7.6	9.5	5.0	10.6	5.7
Temperature	°C	5.0	24.0	7.0	25.0	12.5	23.5	10.0	27.5
BOD	mg/l	1.9	3.9	3.6	3.7	2.4	2.4	2.3	3.2
Hardness	mg/l	140.0	280.0	150.0	270.0	260.0	240.0	260.0	210.0
Dissolved Calcium	mg/l	38.0	78.0	41.0	76.0	68.0	61.0	66.0	58.0
Dissolved Magnesium	mg/l	10.0	20.0	11.0	19.0	22.0	22.0	22.0	17.0
Dissolved Sodium	mg/l	16.0	44.0	21.0	36.0	16.0	30.0	18.0	24.0
Dissolved Potassium	mg/l	3.3	3.8	3.5	4.8	2.1	3.5	2.3	3.5
Alkalinity	mg/l	58.0	80.0	68.0	115.0	193.0	177.0	210.0	201.0
Carbon Dioxide	mg/l	14.0	25.0	2.6	4.5	2.4	4.4	4.2	6.4
Dissolved Sulfate	mg/l	66.0	170.0	68.0	120.0	60.0	62.0	61.0	47.0
Dissolved Chloride	mg/l	32.0	82.0	37.0	75.0	28.0	47.0	35.0	40.0
Dissolved Fluoride	mg/l	0.2	0.2	0.1	0.3	0.2	0.3	0.2	0.2
Dissolved Silica	mg/l	6.9	8.8	6.9	7.2	5.0	8.8	6.0	8.3
TDS	mg/l	208.0	455.0	230.0	407.0	317.0	341.0	314.0	297.0

TABLE 2 CONT.

WATER QUALITY MEASUREMENTS FOR THE MUSKINGUM AND LICKING RIVERS IN THE VICINITY OF ZANESVILLE

Parameter	Units	Muskingum River at Dresden USGS Sta. No. 03144500				Licking River at Hebron USGS Sta. No. 03145000			
Total Nitrate	mg/l	1.90	1.00	2.40	1.30	1.70	1.50	2.50	2.10
Total Nitrite	mg/l	0.04	0.01	0.03	0.01	0.05	0.05	0.03	0.07
Total Ammonia	mg/l	0.07	0.04	0.10	0.03	0.15	0.55	0.29	0.34
Total Phosphorus	mg/l	0.21	0.19	0.26	0.28	0.14	0.48	0.11	0.29
Total Arsenic	µg/l	5.00	5.00	2.00	2.00	2.00	5.00	2.00	4.00
Total Chromium	µg/l	20.00	20.00	10.00	30.00	<10.00	10.00	10.00	<10.00
Total Copper	µg/l	10.00	20.00	9.00	18.00	10.00	10.00	13.00	13.00
Dissolved Iron	µg/l	40.00	0.00	60.00	20.00	30.00	30.00	30.00	10.00
Total Lead	µg/l	4.00	10.00	9.00	19.00	1.00	3.00	12.00	14.00
Total Manganese	µg/l	190.00	100.00	110.00	60.00	30.00	120.00	90.00	60.00
Total Mercury	µg/l	<0.50	≤0.50	0.00	0.00	<0.50	<0.50	0.00	0.00
Total Zinc	µg/l	30.00	50.00	50.00	90.00	30.00	20.00	10.00	20.00
Total Organic Carbon	mg/l	8.60	10.00	----	7.10	8.00	12.00	8.10	6.40

Data Source: U.S. Geological Survey (1977, 1978).

TABLE 3

PHYTOPLANKTON TAXA FROM THE LICKING AND MUSKINGUM RIVERS AT ZANESVILLE, OHIO

Phytoplankton Taxa	Organism Per ml		
	Station Z-1	Station Z-2	Station Z-3
Bacillariophyta (Diatoms)			
Cyclotella sp.		5	10
Melosira distans	25	333	363
Melosira varians		10	15
Melosira sp.	29	44	39
Centric diatoms		15	15
Synedra sp.	328	44	74
Cocconeis sp.			5
Navicula sp.	10	127	74
N. tripunctata			29
N. cryptocephale	15	34	44
Surrella oxata		5	5
Diatoma sp.		20	15
Gomphonema pariculum		15	5
Gomphonema sp.		10	
Cymbella sp.	5	10	10
Nitzschia sp.	5	83	64
Achnanthes sp.		5	
Rhorasphenia eureata		5	
Pinnularia sp.		5	
Total Bacillariophyta	204.5	770	794
Dinoflagellates			
Peridinium sp.			5
Unidentified Dinoflagellates	10		5
Cryptophytes			
Cryptomonas sp.	167	64	5
Rhodomonas sp.	5	10	
Chrysophytes			
Dinobryon sp.	59	29	25
Trachelomonas sp.	5	20	10
Chlorophytes (green algae)			
Ankistrodesmus falcatus	44	49	98
Chlamydomonas sp.	44	78	15

TABLE 3 CONT.

PHYTOPLANKTON TAXA FROM THE LICKING AND MUSKINGUM RIVERS AT ZANESVILLE, OHIO

Phytoplankton Taxa	Organism Per ml		
	Station Z-1	Station Z-2	Station Z-3
Actinastrum sp.			5
Chlorella sp.	5	10	
Scenedesmus guadricauda	5		
Scenedesmus sp.	10		
Cynanophytes (blue-green algae)			
Oscillatoria sp.	88	794	466
Marssoniella elegans	20		
Total Dinoflagellates	10	0	10
Total Cryptophytes	167	64	5
Total Chrysophytes	54	49	35
Total Chlorophytes	108	137	113
Total Cyanophytes	108	794	466
Summary of Algal Population			
Total Diatoms	205	770	794
Percent Diatoms	31.6	42.5	55.8
Total Blue-Green Algae	108	794	466
Percent Blue-Green Algae	16.5	43.8	32.8
Total Green Algae	108	137	113
Percent Green Algae	16.5	7.5	7.9
Total Dinoflagellates	10	0	10
Percent Dinoflagellates	1.5	0	0.7
Total Cryptophytes	167	64	5
Percent Cryptophytes	25.7	3.5	0.4
Total Chrysophytes	54	49	35
Percent Chrysophytes	8.2	2.7	2.4
Total Algae	652	1814	1423

TABLE 4

ZOOPLANKTON TAXA FROM THE LICKING AND MUSKINGUM RIVERS AT ZANESVILLE, OHIO

Taxa	Organisms per Liter					
	Station Z-1		Station Z-2		Station Z-3	
	No.	Percent	No.	Percent	No.	Percent
Polyarthra sp.	20,000	78	1,500	37.5	3,000	46
Keratella sp.	3,000	12	1,000	25	2,500	38
Brachionus sp.	500	2				
Nauplii	2,000	8	1,500	37.5	500	8
Cyclopoid Copepods					500	8
Total	25,500	100%	4,000	100%	6,500	100%

TABLE 5

BENTHIC MACROINVERTEBRATES COLLECTED[1] IN THE VICINITY OF THE Y-BRIDGE IN ZANESVILLE, OHIO - 6 MARCH 1981

Species	Station[2]		
	Z-1	Z-2	Z-3
COLEMBOLLA			
Isotomurus palustris	X		
ANNELIDA			
Oligochaeta			
Hair setae			X
No hair setae	X		X
ARTHROPODA			
Decapoda			
Orconectes sanborni			X
Diptera			
Palpomyia sp.	X		
Chironomus sp.		X	X
Endochironomus sp.		X	X
Stenochironomus		X	X

[1]Samples were collected with a 6-inch by 6-inch Eckman Dredge in addition to the standard qualitative techniques of dip netting and rock turning.

[2]See Table 1 for a description of each station.

TABLE 6

FISH SPECIES COLLECTED[1] IN THE VICINITY OF

THE Y-BRIDGE IN ZANESVILLE, OHIO - 6 MARCH 1981

Species	No.	Length (mm) Mean	Range	Weight (gms) Mean	Total
Bluntnose Minnow	2	40	39-41	0.5	1.0
Sand Shiner	2	33	33-33	0.5	1.0
Striped Shiner	1	38		0.5	0.5
Total	5				2.5

[1]Collected with seines of varying lengths and dip nets.

TABLE 7

HISTORICAL REVIEW OF FISH SPECIES COLLECTED IN THE VICINITY OF THE Y-BRIDGE, ZANESVILLE, OHIO

Common Name	Scientific Name
Least Brook Lamprey	*Lampetra aepyptera*[2]
Longnose Gar	*Lepisosteus osseus*[2]
Gizzard Shad	*Dorosoma cepedianum*[1,2]
Grass Pickerel	*Esox americanus vermiculatus*[1]
Muskellunge	*Esox masquinongy*[1]
Quillback	*Carpiodes cyprinus*[1]
Silver Redhorse	*Moxostoma anisurum*[1]
Golden Redhorse	*M. erythrurum*[1]
Shorthead Redhorse	*M. macrolepidotum*[1]
Northern Hog Sucker	*Hypentelium nigricans*[1,2]
White Sucker	*Catastomus commersoni*[1]
Common Carp	*Cyprinus carpio*[1,2]
Golden Shiner	*Notemigonus crysoleucas*[1]
River Chub	*Nocomis micropogon*[1,2]
Bigeye Chub	*Hybopsis amblops*[1]
Gravel Chub	*H. x-punctata*[1,2]
Speckled Chub	*H. aestivalis*[1]
Creek Chub	*Semotilus atromaculatus*[2]
Suckermouth Minnow	*Phenacobius mirabilis*[2]
Emerald Shiner	*Notropis athernoides*[1,2]
Silver Shiner	*N. photogenis*[1]
Rosyface Shiner	*N. rubellus*[1,2]
Striped Shiner	*N. chrysocephalus*[1]
Spotfin Shiner	*N. spilopterus*[1,2]
Sand Shiner	*N. stramineus*[1,2]
Mimic Shiner	*N. volucellus*[1,2]
Ghost Shiner	*N. buchanani*[1]
Silverjaw Minnow	*Ericymba buccata*[1]
Bullhead Minnow	*Pimephales vigilax*[1,2]

TABLE 7 CONT.

HISTORICAL REVIEW OF FISH SPECIES COLLECTED IN THE VICINITY OF THE Y-BRIDGE, ZANESVILLE, OHIO

Common Name	Scientific Name
Bluntnose Minnow	*P. notatus*[1,2]
Central Stoneroller	*Campostoma anomalum*[1,2]
Channel Catfish	*Ictalurus punctatus*[1]
Flathead Catfish	*Pylodictus olivaris*[1]
Stonecat	*Noturus flavus*[1,2]
Brindled Madtom	*N. miurus*[1]
American Eel	*Anguilla rostrata*[1]
Trout-perch	*Percopsis omiscomaycus*[1]
Brook Silverside	*Labidesthes sicculus*[1,2]
White Crappie	*Pomoxis annularis*[1]
Black Crappie	*P. nigromaculatus*[1]
Rock Bass	*Ambloplites rupestris*[1]
Smallmouth Bass	*Micropterus dolomieui*[1]
Green Sunfish	*Lepomis cyanellus*[1]
Bluegill	*L. macrochirus*[1,2]
Orangespotted Sunfish	*L. humilis*[2]
Longear Sunfish	*L. megalotis*[2]
Sauger	*Stizostedion canadense*[1]
Walleye	*S. vitreum vitreum*[1]
Logperch	*Percina caprodes*[1,2]
Eastern Sand Darter	*Ammocrypta pellucida*[1]
Johnny Darter	*Etheostoma nigrum*[1,2]
Greenside Darter	*E. blennioides*[1,2]
Banded Darter	*E. zonale*[1,2]
Variegate Darter	*E. variatum*[1,2]
Rainbow Darter	*E. caeruleum*[2]
Fantail Darter	*E. flabellare*[2]
Freshwater Drum	*Aplodinotus grunniens*[1]

Source: Trautman (1981, in press) and Robins, et al. (1980).

[1]Reported from the area prior to 1955.

[2]Reported from the area between 1955 and 1978.

TABLE 8

LISTING OF VASCULAR FLORA
VICINITY OF Y-BRIDGE, ZANESVILLE, OHIO

Common Name	Scientific Name
Trees:	
Black Willow	*Salix nigra*
Willow	*Salix* sp.
Cottonwood	*Populus deltoides*
American Elm	*Ulmus americana*
Black Locust	*Robinia pseudo-acacia*
Silver Maple	*Acer saccharinum*
Red Maple	*Acer rubrum*
Box Elder	*Acer negundo*
Sycamore	*Platanus occidentalis*
Herbs:	
Grasses	*Gramineae*
Ground-ivy	*Glechoma hederacea*
Joe-pye-weed	*Eupatorium purpureum*
Goldenrod	*Solidago* sp.

TABLE 9

LISTING OF AVIFAUNA

VICINITY OF Y-BRIDGE, ZANESVILLE, OHIO

Common Name	Scientific Name
Mallard	*Anas platyrhynchos*
Rock Dove	*Columbia livia*
Belted Kingfisher	*Megaceryle alcyon*
Robin	*Turdus migratorius*
Starling	*Sturnus vulgaris*
House Sparrow	*Passer domesticus*
Cardinal	*Richmondea cardinalis*
Song Sparrow	*Melospiza melodia*

FIGURE

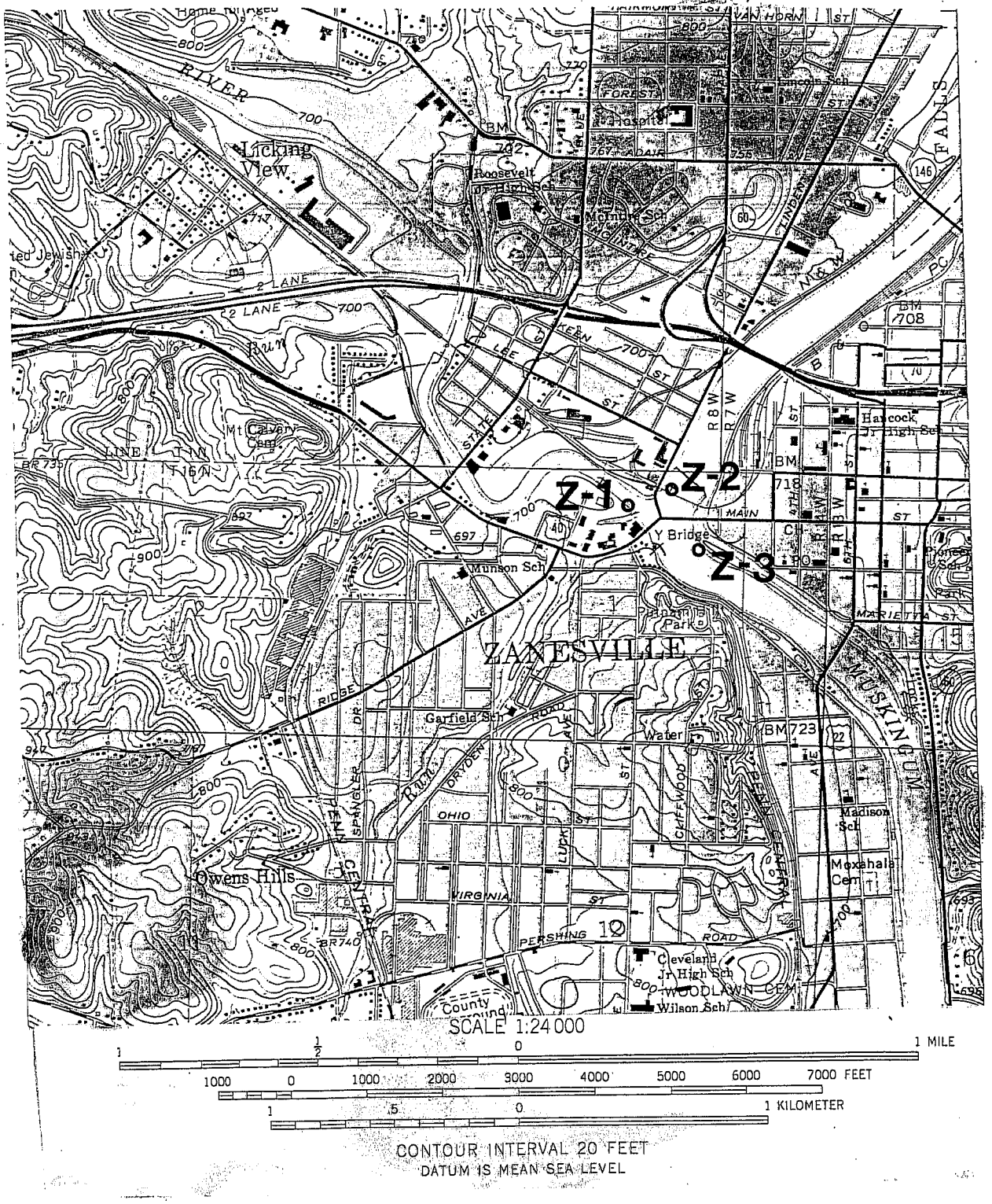

Figure 1. Location Map of Sampling Stations on the Licking and Muskingum Rivers at Zanesville, Ohio.

Map Source: U.S. Geological Survey, Zanesville West Quadrangle