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Aquatic Macroinvertebrates Collected at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998

Water-Resources Investigations Report 99-4202

U.S. Department of the Interior
U.S. Geological Survey

COVER: Pond succeeding to a wetland, Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. (Photo provided by Ohio Army National Guard; photographer unknown.)

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By John S. Tertuliani

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1999

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CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
inch (in)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
millimeter (mm)	0.03937	inch
micrometer (µm)	0.00003937	inch
square inch (in^2)	6.452	square centimeter
square foot (ft^2)	0.09290	square meter
acre	0.4047	hectare
square mile (mi^2)	2.590	square kilometer
foot per second(ft/s)	0.3048	meter per second

Temperature: Temperature is given in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by use of the following equation:

$$°F=1.8(°C) + 32$$

Dissolved oxygen units used in this report: Dissolved oxygen concentrations in water are reported in milligrams per liter (mg/L). Milligrams per liter is a unit expressing the concentration of chemical constituents as weight (milligrams) of chemical per unit volume (liter) of water.

Specific conductance units are reported in microsiemens per centimeter (µS/cm) standardized at 25 degrees Celsius

Other Abbreviations:

EOLP: Erie-Ontario Lake Plain
EPT: Ephemeroptera, Plecoptera, Trichoptera
HD: Hester-Dendy, a multiple-plate sampler representing 1 ft^2 of artificial substrate
ICI: Invertebrate Community Index
ODNR: Ohio Department of Natural Resources
OEPA: Ohio Environmental Protection Agency
RVAAP: Ravenna Army Ammunition Plant

Aquatic Macroinvertebrates Collected at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998

By John S. Tertuliani

Abstract

The results of a survey of macroinvertebrate communities in the Ravenna Army Ammunition Plant, were used as an indicator of disturbance in streams flowing through or near the training areas at the Plant. The data were interpreted using the Invertebrate Community Index (ICI), a multiple-metric index developed by the Ohio Environmental Protection Agency and based on the structural and functional characteristics of the macroinvertebrate community.

Quantitative samples of the macroinvertebrate were collected for ICI determination from three streams—South Fork Eagle Creek, Sand Creek, and Hinkley Creek—flowing through the study area. These samples were collected using Hester-Dendy type artificial substrate samplers, which were placed in the streams during a 6-week sampling period, June 2 through July 15, 1998. A qualitative-dipnet sample from the natural substrates also was collected at each station on July 15, 1998, the last day of the sampling period.

The macroinvertebrate communities at all three stations met the criterion designated for warmwater habitat aquatic life use, and communities at two of the three stations exceeded the criterion. The ICI scores were 42 at South Fork Eagle Creek, 50 at Sand Creek, and 48 at Hinkley Creek. The density of macroinvertebrates at South Fork Eagle Creek was 1,245 per square foot and represented 38 distinct taxa. The density at Sand Creek was 246 per square foot and represented 29 distinct taxa. The density at Hinkley Creek was 864 per square foot and represented 36 distinct taxa.

Qualitative samples were also collected at 21 other sites using a D-framed dipnet. The qualitative sites encompassed three main environments: stream, pond, and swamp-wetland. All available habitat types in each environment were sampled until no new taxa were evident during coarse examination. The highest number of taxa were collected from the streams. The total number of taxa collected in streams ranged from 25 to 76; the mean was 60 and median 64. The total taxa collected from ponds ranged from 32 to 60; the mean was 42 and median 41. The total taxa collected from swamp-wetland areas ranged from 6 to 30; the mean was 20 and median 23. The results are listed in phylogenetic order in this report and establish baseline data for future studies.

Introduction

The Ohio Army National Guard trains troops on Areas A through H and J at the Ravenna Army Ammunition Plant (RVAAP), near Ravenna, Ohio (fig. 1). Within the context of its training mission, the Ohio Army National Guard must conserve the biological diversity on the land and water under its jurisdiction. The Ohio

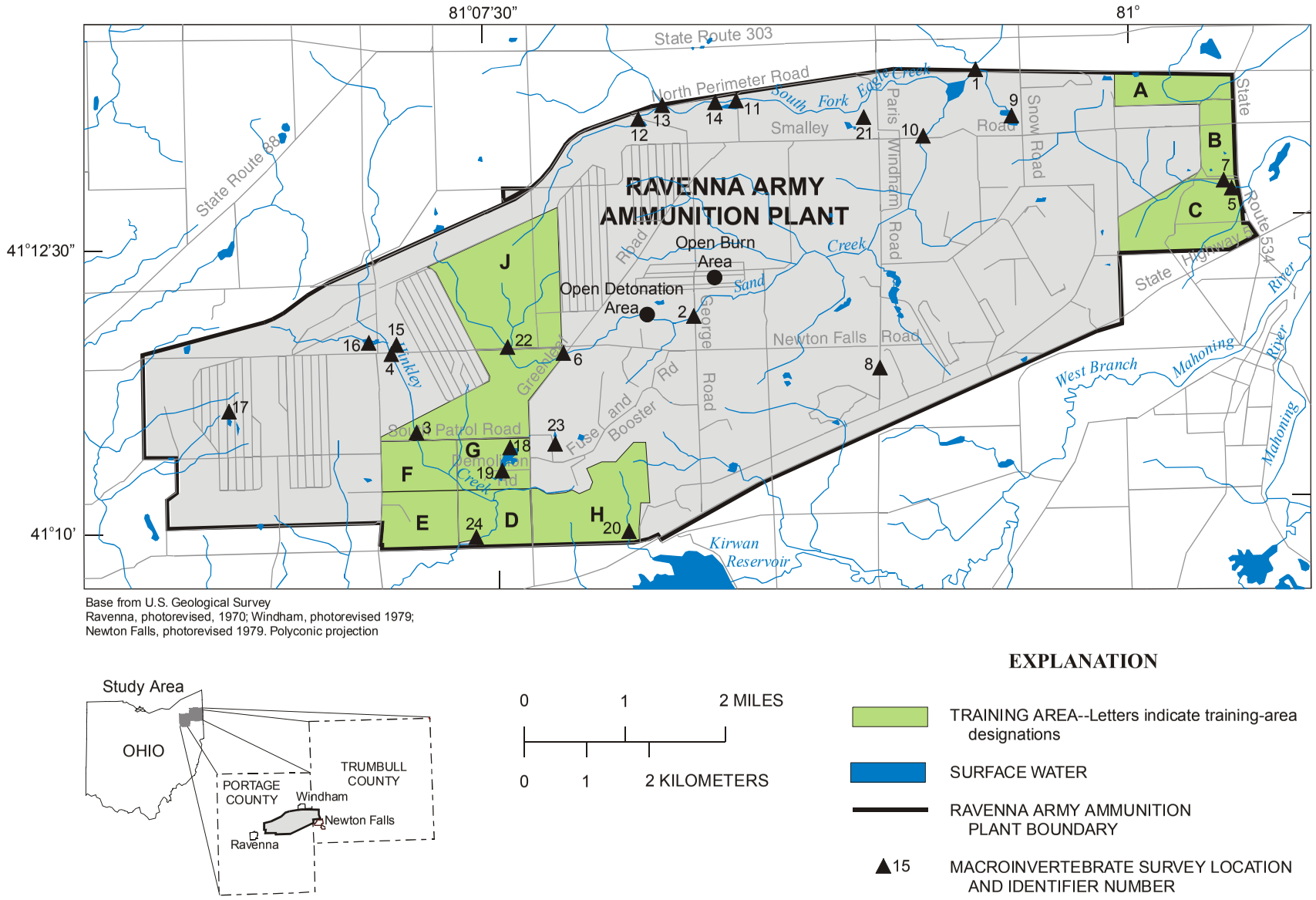

Figure 1. Location of training areas and macroinbertebrate survey sites at Ravenna Army Ammunition Plant, Ravenna, Ohio, 1998.

Army National Guard strives to understand the natural resources at the RVAAP and to comply with Army Regulation 200-3 concerning fish and wildlife management. Chapter 6, section 7 of that regulation concerns habitat management and states, "Habitat management efforts will***conserve, protect, and sustain biological diversity while supporting the accomplishment of the military mission. Activities will be directed towards management to maintain healthy ecosystems, and restore degraded ecosystems to their historic functions and values" (Department of the Army, 1995).

Adherence to this conservation mandate requires sufficient data to determine the potential of an activity to cause an environmental disturbance and affect the biological communities. For example, movement of troops, equipment, and vehicles throughout the training areas may loosen soils and increase sediment loading to streams flowing through RVAAP. The movement of heavy vehicles during such exercises can increase considerably the amount of sediment leaving military boundaries (Sample and others, 1998). These streams eventually flow into the Mahoning River and Michael Kirwan Reservoir. Thus, suspended sediments from training exercises may have adverse effects on downstream ecosystems (Trautman, 1981).

In 1992, biologists working for the Ohio Department of Natural Resources surveyed the flora and fauna at RVAAP. The report describing these results (Ohio Department of Natural Resources, 1993) included aquatic macroinvertebrates[1] only from the insect order Odonata. More data were needed on aquatic insects at RVAAP because such data can provide information on whether an area has been disturbed and how severe the disturbance is (Yoder, 1989). Macroinvertebrate communities are good indicators of stream disturbance because the community is sedentary and sensitive to local activity (Berkman and others, 1986; Yoder, 1991).

In response to the need for macroinvertebrate data, the U.S. Geological Survey (USGS), in cooperation with Ohio Army National Guard, surveyed the macroinvertebrates in three streams at RVAAP. Principal products of the survey were a taxonomic list and an Invertebrate Community Index (ICI) profile, both of which will facilitate environmental planning for training activities and construction on lands in RVAAP, and will provide baseline data useful for comparing pre- and post-training or construction activities. The ICI, developed by the Ohio Environmental Protection Agency (OEPA) for use in Ohio waters is considered more accurate than would be similar indices designed and developed for regional or national analyses (Rankin, 1995). In addition, the macroinvertebrate stations established by this survey, both quantitative (ICI) and qualitative, can be used for land-condition trend analysis as part of the National Guard Bureau policy on the Integrated Training Area Management program and environmental stewardship. This program provides guidance to the Army National Guard for optiumum use of training areas while sustaining and protecting the biological integrity of those areas.

Purpose and scope

This report presents the results of the USGS survey of macroinvertebrates at RVAAP. Specifically, the report summarizes the biological integrity of 3 streams and presents qualitative data from 21 other sites. The study was executed in stages, as follows:

1. Hydrologic data were used to choose ICI sampling locations in the drainages of the training areas.
2. Artificial-substrate samplers were set at ICI stations for 6 weeks.
3. Trees and vegetative communities were identified at the ICI stations to provide background information on each station and its riparian corridor.
4. Artificial-substrate samplers were retrieved and a qualitative sample was collected at each ICI station.
5. Qualitative samples were collected at other RVAAP locations.
6. The data from the ICI stations were interpreted to determine whether training activities caused biological disturbances to the receiving streams, and if so, to assess the magnitude of the disturbances.

A total of 27 macroinvertebrate samples, 3 quantitative and 24 qualitative, were collected. The 3 quantitative samples and 3 of the 24 qualitative samples were used for ICI calculations. The 6-week sampling period for quantitative samples was June 2 through July 15, 1998. The 24 qualitative samples were collected from July 13 through July 30, 1998. Only 1 quantitative and 1 qualitative sample were col-

[1]Macroinvertebrates are defined as animals that lack a backbone and are too large to pass through a U.S.A. Standard No. 30 sieve, 600 micrometer-mesh (0.6-mm).

lected from the 3 ICI stations, and a single qualitative sample was collected from each of the 21 other sites.

Description of study area

RVAAP is in northeastern Ohio, in eastern Portage County and western Trumbull County (fig. 1). The city of Ravenna is about 1 mi west of RVAAP. Water flowing from RVAAP drains into the basin of West Branch Mahoning River. The major streams on RVAAP are Hinkley Creek, which flows southward through the western part; Sand Creek, which flows eastward through the center; and South Fork Eagle Creek, which flows eastward along the north boundary to a confluence with Sand Creek (fig. 2). The watersheds of these three streams cover about 14,700 acres or 69 percent of RVAAP (Schalk and others, 1999). The Ravenna Army Ammunition Plant is in the Erie/Ontario Lake Plain (EOLP) ecoregion (Omernik, 1987). The ecoregion is characterized as follows:

- The land-surface form is an irregular plains and tableland having a gentle slope, lying on a glacial plain underlain by sandstone and siltstone.
- The soil parent material is a low-lime glacial drift. The soils are mostly Udalfs and Aqualfs, somewhat poorly drained and formed in fine textured glacial till and lacustrine sediments.
- Potential natural vegetation is beech-maple and oak-hickory forest. In moist areas, the associated species are American basswood, American elm, red maple, eastern hemlock, white ash, black cherry, white pine, northern red oak, balsam fir, and white spruce. In wetter areas, American elm, black ash, and red maple are dominant species, and silver maple, pin oak, swamp white oak, sycamore, tupelo, and cottonwood are less abundant (Larsen and others, 1986, 1988; Whittier and others, 1987). Braun (1989) classified woody vegetation in this region as beech-maple forest.
- The land use is a mixture of agricultural, residential, and woodland areas.

Previous studies

Because RVAAP is a secured military compound, access has been restricted since its construction in the early 1940's. For various reasons, including national security, few biological surveys have been published. A macroinvertebrate survey was done at RVAAP in May 1992 (U.S. Army Environmental Hygiene Agency, 1992). Macroinvertebrate samples were collected from the Open Burn Area and the Open Detonation Area, a required process of the Resource Conservation and Recovery Act to operate burning trays (Timothy Morgan, Industrial Operations Command, written commun., 1999).

More recent macroinvertebrate samples were collected by a graduate student from Kent State University (Benjamin Foote, Kent State University, oral commun., 1997). Another recent sample includes caddisflies collected from ponds in RVAAP (Brian Armitage, Ohio Biological Survey, written commun., 1997). The Ohio Environmental Protection Agency (1996) completed a biological and water-quality study of the Mahoning River Basin where one station on West Branch Mahoning River, downstream from Michael J. Kirwan Reservoir, was sampled. Other samples collected at RVAAP since the Ohio Department of Natural Resources (1993) report include fish samples from South Fork Eagle Creek; crayfish also were collected and preserved during this sampling but were not identified (Marc Smith and Roger Thoma, Ohio Environmental Protection Agency, oral commun., 1998).

Acknowledgments

The author thanks Jack Freda of the Ohio Environmental Protection Agency, Division of Surface Water, Monitoring and Assessment Section, for assistance during project planning and reviewing the report draft. The author also acknowledges David Cashell, Ohio Department of Natural Resources, Division of Water, for providing precipitation data; and Timothy Morgan, Industrial Operations Command, for information and assistance while data were being collected.

Methods of study

Macroinvertebrates were sampled once at the 3 Invertebrate Community Index (ICI) stations and the 21 qualitative sites in June and July 1998. The 6-week sampling period for the ICI stations—June 2 through July 15, 1998—began earlier than the usual June 15 starting date for the methods used in this study because streamflows were lower than normal owing to a lack of rainfall. The OEPA collects Hester-Dendy samples following a 6-week colonization period

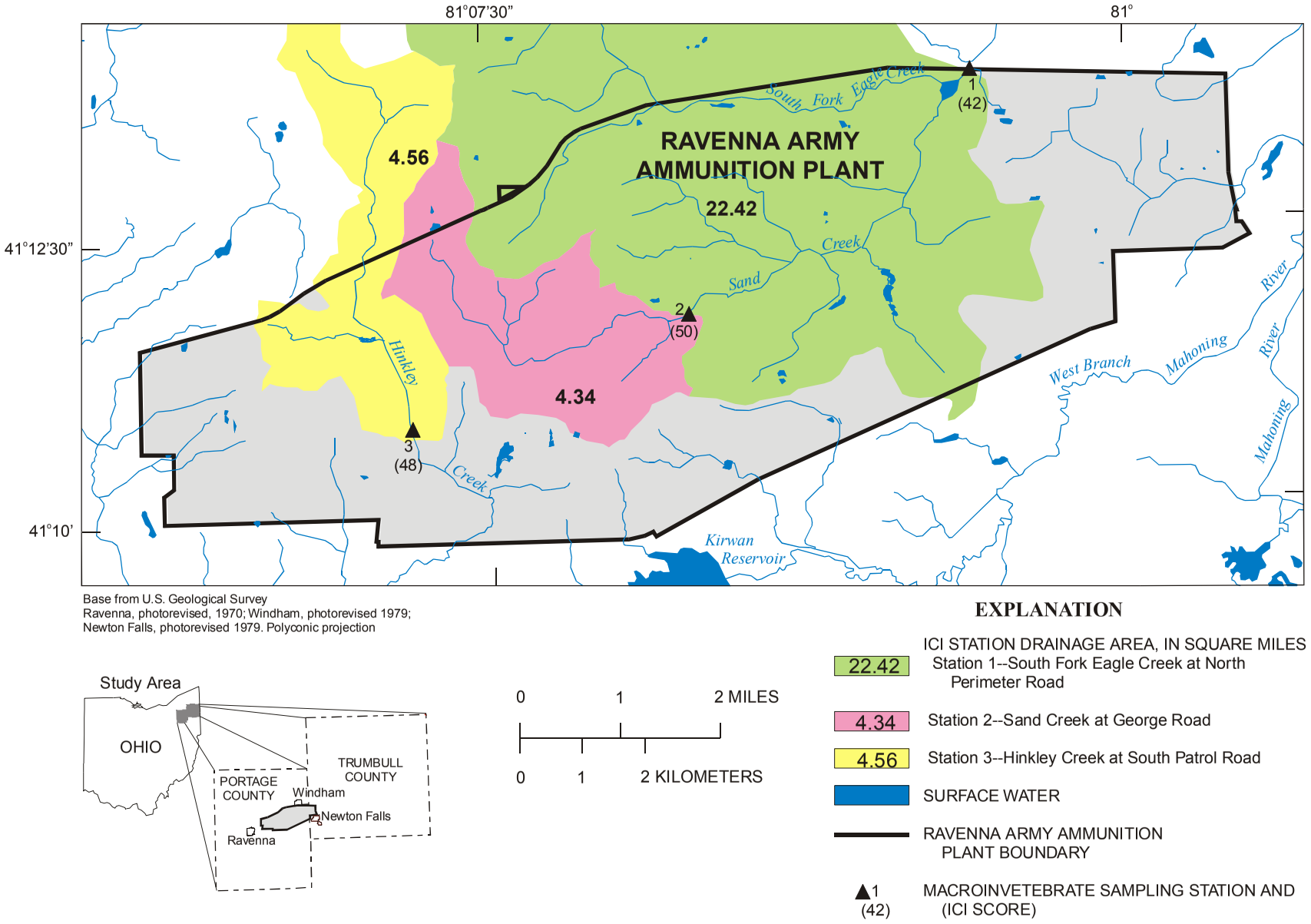

Figure 2. Drainage areas above Invertebrate Community Index (ICI) sampling stations, Ravenna Army Ammunition Plant, Ravenna, Ohio, 1998.

that begins after June 15 and ends sometime before October 15 (Ohio Environmental Protection Agency, 1987). The 21 qualitative samples were collected July 13 through July 30, 1998.

The ICI was developed by the Ohio Environmental Protection Agency and has become a widely accepted method to measure the condition of macroinvertebrate communities. It is modeled after the Index of Biotic Integrity, a method developed by Karr (1981) to measure the condition of fish populations (Ohio Environmental Protection Agency, 1987). The strength of the ICI is that the user can compare a biological community in a study stream to other communities from reference streams with basins of similar size and in the same ecoregion (Karr and others, 1986; DeShon, 1995). ICI scores are consistently reproducible because the index is designed to dampen or eliminate the influences of substrate and habitat variability (Jack Freda, Ohio Environmental Protection Agency, oral commun., 1999).

The ICI consists of 10 scoring metrics that describe various aspects of macroinvertebrate community composition (table 1). Data are collected for each metric at each site and are evaluated by what is expected at an unimpacted or relatively unimpacted (reference) station on a stream in a similar-sized basin and in a comparable geographic region. Each metric receives a possible score of 6, 4, 2, or 0 points. Six points are given for a metric having a value comparable to streams with exceptional macroinvertebrate communities, and a zero is given for a metric deviating far below the range of values considered to be representative of streams having "good" water quality. The ICI of a given sample in the EOLP ecoregion compares the total of the 10 metric scores to a data base of 45 reference stations that are periodically resampled by the Ohio Environmental Protection Agency, Division of Surface Water.

Nine ICI stations were proposed for the survey; however, a drought (estimated recurrence interval of 10 years to 20 years) that began in May 1998 eliminated seven of the original nine sites proposed (Owenby and Ezell, 1992; Willeke and others, 1994). Until this time, rainfall at Ravenna, Ohio, had been normal or above normal. The eliminated stations lacked either adequate depth or current velocity for sampling. (The water at each site must be adequate to cover the artificial samplers for 6 weeks, and a minimum of 0.3 ft/s current velocity is preferred.) The South Fork Eagle Creek station, not among the original nine, was chosen after the seven proposed stations were found unsuitable for artificial samplers. Thus, a total of three stations (fig. 2) were judged suitable for artificial-substrate sampling. The stations were chosen to represent major streams and tributaries in the training areas. On each stream, the stations were located upstream of either a confluence or an outflow point from a training area.

Quantitative samples were collected using modified Hester-Dendy (HD) samplers (Hester

Table 1. Community metrics of the Invertebrate Community Index (ICI)

[A score of 6, 4, 2, or 0 is assigned to each metric value and is based on the deviation from reference conditions. Each metric is calibrated for drainage area, in square miles]

Metric	Description
1. Number of taxa	Species richness
2. Number of mayfly taxa	Intolerant group, sensitive to pollution and disturbance
3. Number of caddisfly taxa	Sensitive group, moderately intolerant of pollution and disturbance
4. Number of Diptera taxa	Large order, varied sensitivity to pollution and disturbance
5. Percent mayflies	Proportion of mayflies in sample
6. Percent caddisflies	Proportion of caddisflies in sample
7. Percent tribe Tanytarsini midges	Proportion of pollution-sensitive Diptera
8. Percent other Diptera and non-insects	Pollution-tolerant Diptera and other organisms
9. Percent tolerant organisms	Organisms normally associated with degraded conditions
10. Number of qualitative EPT Taxa	Ephemeroptera = mayflies, Plecoptera = stoneflies, Trichoptera = caddisflies

and Dendy, 1962). Each HD sampler consists of a series of 8 plates and 12 spacers. One HD sampler represents 1 ft^2 of stream bottom (artificial substrate). The plates and spacers are cut from 1/8-in hardboard. Each plate measures 3 in^2, and each spacer is 1 in^2. The plates and spacers are center drilled and mounted to a 4-in.-long eye bolt and secured by a nut. The spacers separate the plates at different distances and create different velocities across the plates. One spacer is placed between the first three plates, two spacers between the next three plates, and three spacers between the last two plates. Through the Venturi effect, the plates with narrower spaces will have faster velocities than the plates with wider spaces. The differing velocities create a diverse microhabitat, attracting a broader range of macroinvertebrates than would be attracted by a single velocity.

An ICI sampling unit consists of five HD samplers attached to a single concrete block. At each station, two units of samplers are set. Only one unit of five samplers is used for collecting macroinvertebrate data; the second unit is collected only if the first is damaged or missing. During the 6-week sampling period, aquatic macroinvertebrates colonize the available spaces provided by the artificial substrate. The five HD samplers are retrieved and preserved in 10 percent formalin as individual units and are later combined to form a composite sample by the laboratory identifying the samples. From these results, the density of macroinvertebrates per square foot can be determined, as well as a taxonomic list and an ICI score.

The USGS National Water Quality Laboratory, Biological Group, processed and identified the macroinvertebrate samples. Quantitative samples were processed using a 500 fixed-count organism subsampling method and a 425-micrometer-mesh (0.4-µm) sieve. This method follows a random grid and picking approach. Grids are selected by random number until 500 organisms (± 20%) are picked. A picked sample then received a standard taxonomic assessment that identifies most macroinvertebrate groups to the genus level. The exceptions are worms and leeches, identified to the family level, and some aquatic insects identified to the species level. The life-stage and condition of each organism determines which level of taxonomy is possible. The organism must be mature enough to exhibit key features, and these features need to remain undamaged through collecting and processing.

Qualitative samples are collected using a 600-micrometer-mesh (0.6-µm) dip net. The net is used in all available habitats at a given site for about 30 minutes. One qualitative sample was collected at each site on the day that the artificial samplers were retrieved. Qualitative samples are processed through a 2-hour visual sort and standard taxonomic assessment. Sorting is based on organism maturity, condition, and life stage (larva, pupa, adult). The taxa sorted are identified without enumeration.

Qualitative sampling is a substrate- and habitat-dependent method (a method affected by the variety of natural substrates and habitats available). ICI metric 10 is based on qualitative results and is a measure of both habitat quality and diversity, as well as water chemistry (DeShon, 1995). Qualitative samples were also collected at 21 additional sites throughout the nonsensitive areas of RVAAP. A qualitative sample does not represent a defined area. The number of taxa reported at each qualitative station represents the same level of taxonomy as for quantitative samples.

Trees and shrubs were identified in the field. Twig and leaf samples from those species not common or easy to identify were collected and identified later by the author. Braun (1989) and other systematic sources were used to confirm identifications. The known distribution of some species was discussed with an expert on woody plants (Allison Cusick, Ohio Department of Natural Resources, Division of Natural Areas and Preserves). Information on the tree and shrub community growing along a stream, particularly the age and diversity of the community, can reveal disturbances and land-use practices. A mature and diverse tree and shrub community protects and nurtures a stream by shading the channel from direct sunlight, adding nutrients, and inhibiting soil erosion and contamination from surface runoff.

Aquatic macroinvertebrates collected at Ravenna Army Ammunition Plant

Where possible, identifications were made to species level. For some groups, such as Diptera, keys were not available to describe a macroinvertebrate to the species level; thus, identifications were to the genus level. Taxonomic levels for damaged or immature macroinvertebrates may also be above the species level because identifying features may have been absent or undeveloped. Counts of taxa included those identified to the lowest levels (for example, genus or species) but

excluded taxa for which some of the specimens could not be identified further due to their condition or maturity. Thus, actual numbers of taxa at each site could be somewhat higher than those reported here. The taxa lists and ICI computations in this report were reviewed by staff of the Ohio Environmental Protection Agency, Division of Surface Water, Monitoring and Assessment Section, and judged valid (Jack Freda, Ohio Environmental Protection Agency, written commun., 1999).

Field conditions and sampling results at invertebrate community index (ICI) stations

The field conditions during the 6-week sampling period are listed in table 2. These conditions were recorded during three field trips. During the first trip, June 2, the HD samplers were set. On the second trip, June 23 (the halfway point for the 6-week sampling period), the ICI stations were checked for adequate depth and velocity. The third trip, July 15, was the end of the sampling period. Station photos taken during the field trips are shown in figures 3-8.

A qualitative sample was collected on July 15, 1998, at each ICI station after the five HD samplers were retrieved. The qualitative data collected at each ICI station were necessary to calculate the tenth metric. The pollution sensitive members of Ephemeroptera, Plecoptera, and Trichoptera (EPT) were interpreted to distinct taxa.

The macroinvertebrate values and resulting scores for each of the 10 metrics are listed in table 3. In parentheses are the ICI scores assigned to these metric values. The total of the 10 metric scores is the index. A taxonomic list of macroinvertebrates collected quantitatively with HD samplers is presented in the appendix (table A-1).

Station 1: South Fork Eagle Creek at North Perimeter Road. Station 1 is on South Fork Eagle Creek at North Perimeter Road (figs. 1, 3, 4). Railroad tracks run north of, and parallel to, North Perimeter Road (fig. 1). The drainage area above the station is 22.4 mi^2. The stream makes a sharp bend just upstream from the North Perimeter Road bridge. A deep pool (3.9 ft) lies at the foot of this bend. Thick sand deposits line both banks at this site, and orange precipitate is deposited along the edges of the pool. Remnants of a debris line lies high on the banks and in the fence just downstream from the bridge.

The riparian corridor farther upstream from this

Table 2. Field conditions during macroinvertebrate sampling for Invertebrate Community Index, Ravenna Army Ammunition Plant, Ravenna, Ohio, 1998

[Abbreviations: ft/s, foot per second; °C, degrees Celsius; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter]

Station and sampling date	Time	Stream velocity (ft/s)	Water temperature (°C)	Air temperature (°C)	pH	Specific conductance (µS/cm)	Dissolved oxygen (mg/L)
			JUNE 2				
1. SF Eagle Creek	1230	0.378	18.2	22.3	7.7	437	9.2
2. Sand Creek	0830	.412	15.7	16.0	7.9	400	9.6
3. Hinkley Creek	1100	.432	18.3	19.0	7.6	374	8.2
			JUNE 23				
1. SF Eagle Creek	1130	.337	21.7	21.5	7.6	417	6.8
2. Sand Creek	1330	.332	22.1	23.2	7.9	370	8.5
3. Hinkley Creek	1000	.418	21.9	21.8	7.3	390	6.7
			JULY 15				
1. SF Eagle Creek	1200	.384	20.8	32.5	8.1	439	7.8
2. Sand Creek	1500	.218[a]	24.0	32.0	8.4	405	8.9
3. Hinkley Creek	1000	.343	19.6	25.0	7.8	371	6.6

[a] Minimum velocity is 0.3 ft/s.

Figure 3. Station 1, South Fork Eagle Creek, Ravenna Army Ammunition Plant, Ohio, view looking upstream.

Figure 4. Station 1, Hester-Dendy samplers at the end of the 6-week sampling period.

Figure 5. Station 2, Sand Creek, Ravenna Army Ammunition Plant, Ohio, view looking downstream.

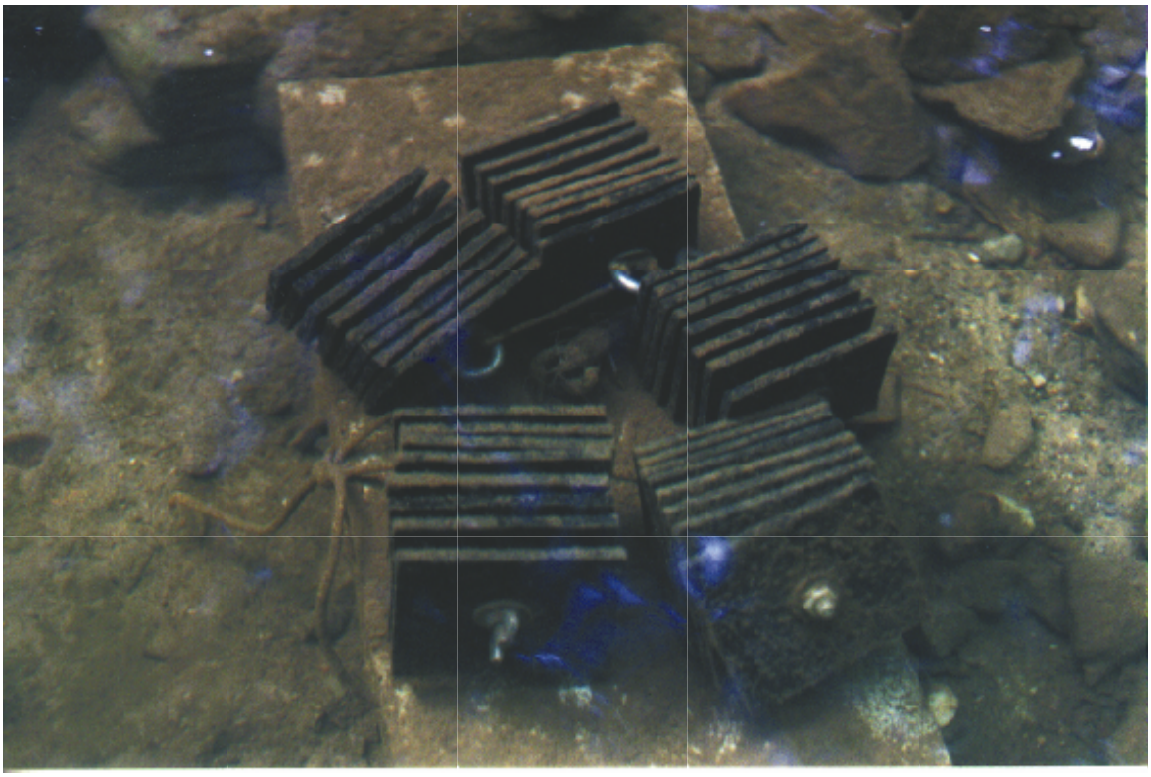

Figure 6. Station 2, Hester-Dendy samplers at the end of the 6-week sampling period.

Figure 7. Station 3, Hinkley Creek, Ravenna Army Ammunition Plant, view looking downstream.

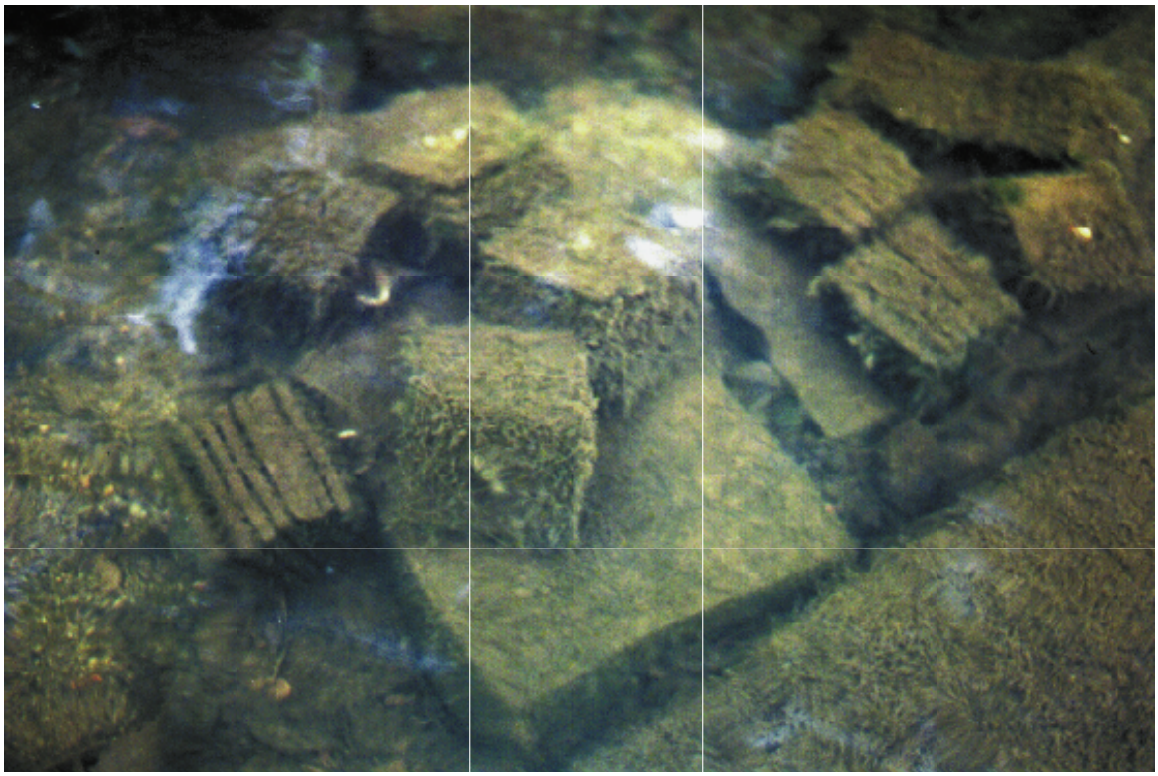

Figure 8. Station 3, Hester-Dendy samplers at the end of the 6-week sampling period.

Table 3. Invertebrate Community Index values and scores for stations 1-3, Ravenna Army Ammunition Plant, Ravenna, Ohio, 1998

[A score of 6, 4, 2, or 0 is assigned to each metric value based on the deviation from reference conditions. Each metric is calibrated for drainage area, in square miles]

Metric	Metric value (ICI score), by station		
	1	2	3
1. Total number of taxa	38 (6)	29 (4)	36 (4)
2. Number of mayfly taxa	2 (0)	4 (2)	4 (2)
3. Number of caddisfly taxa	4 (6)	1 (4)	6 (6)
4. Number of Diptera taxa	23 (6)	20 (6)	20 (6)
5. Percent mayflies	23.0% (4)	43.4% (6)	14.4% (4)
6. Percent caddisflies	2.1% (2)	2.3% (6)	1.7% (6)
7. Percent Tanytarsini midges	24.3% (6)	23.7% (6)	35.3% (6)
8. Percent other Diptera and non-insect	50.0% (2)	30.5% (4)	47.9% (2)
9. Percent tolerant organisms	0.7% (6)	0% (6)	2.9% (6)
10. Qualitative EPT taxa	9 (4)	21 (6)	15 (6)
Invertebrate Community Index	42	50	48

station is inhabited by a dense growth of mature trees and brush. The trees fortify the sandy banks and provide a thick canopy to shade direct sunlight. At the station, however, no trees grow on the banks because right-of-way clearing to maintain the bridge and the north border fence have kept trees from growing close to the stream. *Platanus occidentalis* (American sycamore) grow at the edge of the right-of-way, but not close enough to protect the banks. Erosion has felled some trees on the right bank (looking downstream), upstream from the bridge. The banks are collapsing in the sections lacking woody vegetation.

The HD samplers were set on June 2, 1998, approximately 3 ft upstream of the bridge. The bridge shaded the samplers from afternoon sunlight, when the sunlight intensity was greatest. The channel is quite shallow at the bridge. The only place deep enough for HD samplers was a small scour hole adjacent to and behind several pieces of concrete riprap. Other sections of this stream lacked sufficient velocity or depth.

A total of 6,223 (1,245 /ft^2) macroinvertebrates, from 38 distinct taxa, were collected with five HD samplers at station 1. The ICI for station 1 is 42 (table 3), which reflects good to very good water quality and means the macroinvertebrate community at station 1 met the ICI criterion for warm-water habitat aquatic life use[1]; that is, the 25th percentile of ICI values for the 45 reference sites in the EOLP ecoregion. Attainment means a stream meets the "fishable/swimmable" goals set by the Water Quality Act of 1987 (Ohio Environmental Protection Agency, 1987).

Station 2: Sand Creek at George Road. Station 2 is on Sand Creek at George Road (figs. 1, 5, 6). The drainage area above the station is 4.3 mi^2. A powerline right-of-way was maintained along the east side of George Road. The powerline poles were cut down and the line dropped in May 1998. Pioneering trees and shrubs grow in the former right-of-way. These species include *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Fraxinus americana* (white ash), *Ulmus americana* (American elm), and *Viburnum* sp. More mature trees, 12 in. or more in diameter, grow beyond the right-of-way; their canopy shades the stream and their roots protect the banks. Dominant species include *Quercus rubra* (red oak), *Acer rubrum* (red maple), *Liriodendron tulipifera* (yellow poplar),

[1]A score of at least 34 is needed for attainment. Complete attainment of aquatic life habitat use also requires attainment of the Index of Biotic Integrity (IBI) and the modified Index of Well-Being, per Ohio Water Quality Standards: Ohio Administrative Code, Chapter 3745-1 (Ohio Environmental Protection Agency, 1991).

Acer saccharum (sugar maple), and *Prunus serotina* (wild black cherry).

The canopy is dense beyond the former right-of-way. Dominant species growing in this riparian corridor are red maple, red oak, yellow poplar (in the canopy), black locust, black willow, white ash, American elm (in the more open right-of-way), wild black cherry, and sugar maple. Andreas (1980) describes the plant community here as a more advanced stage of the red maple woods or one that inhabits drier ground (Ohio Department of Natural Resources, 1993). Andreas (1980) also reports that the black locust is common as an edge species, sometimes growing dense enough along roads and rights-of-way to hide the plant communities a short distance away. Black locust trees grow on the ends of the red maple communities inhabiting the powerline and George Road right-of-way.

Station 2 is about 100 ft downstream (east) of the George Road bridge. The dense canopy shades this station from direct sunlight, although water temperatures can rise considerably in the afternoon (table 2). The channel is primarily bedrock. The HD samplers were placed on the left edge of a man-made pool measuring roughly 16 by 20 ft. Numerous boring holes mark the drilling points where someone removed bedrock to create the pool. The pool may have provided a domestic water supply or the cooling source for a springhouse, or the removed slabs of bedrock could have been used for a building foundation.

A total of 1,229 (246 /ft^2) macroinvertebrates, from 29 distinct taxa, were collected with the five HD samplers at station 2. A score of 50 reflects very good to exceptional water quality and means the macroinvertebrate community at station 2 exceeds the ICI criterion designated for warm-water habitat aquatic life use.

Station 3: Hinkley Creek at South Patrol Road. Station 3 is on Hinkley Creek where it flows through two 5-ft culverts under South Patrol Road (figs. 1, 7, 8). The drainage area above the station is 4.6 mi^2. Debris upstream from the culverts directed more of the flow through the right culvert, where the velocity was greater. The channel opens and a pool forms where the culverts empty into Hinkley Creek. The pool is approximately 15 ft wide and 30 ft long and 2.5 ft deep. The channel then narrows at the tail of the pool before flowing under the fence downstream from the culverts.

This station lacks mature trees in the riparian corridor. The banks are not well reinforced by woody vegetation and are collapsing in places near the South Patrol Road bridge. The left bank has young willows growing on it, giving the bank soils some reinforcement. Herbaceous vegetation growing on the right bank does not reinforce the soils because the roots do not grow as deep or as dense as woody vegetation does. Hence, the right bank has collapsed in several places and will likely continue doing so during high streamflows.

The surrounding landscape is more open here at station 3 than at the other ICI stations. The trees are younger and more varied, as if repopulating lands that were previously maintained as open fields. Andreas (1980) classified the general area of this site as a mixed swamp forest community and reported that the disturbed areas along roads and railroad tracks are often inhabited by young examples of a mixed swamp forest.

The riparian corridor has been maintained as a right-of-way for South Patrol Road and a chain-link fence that runs south of the road and parallel to it. Because the riparian corridor is maintained as a right-of-way, no large trees are growing between South Patrol Road and the fence, and the continuous disturbance from maintenance prevents a mixed swamp forest from establishing. The dominant species associated with the early stages of this community are American elm, *Populus tremula* (quaking aspen), *Nyssa sylvatica* (black gum), *Quercus palustris* (pin oak), and red maple. The upstream corridor is less disturbed and supports a young and growing example of a mixed swamp forest as described by Andreas (1980).

Boulders and riprap are strewn about downstream from the culverts. Upstream from the culverts young trees and shrubs (American elm, red maple, *Cephalanthus occidentalis* (button bush), and *Viburnum* sp.) are growing along the riparian corridor. Together these trees and shrubs shade approximately 70 percent of the upstream channel. Downstream from the culverts, *Elaeagnus* sp., a shrub, grows on the right bank. The shrub shades a small part of the stream and provided the only canopy cover at this site.

The HD samplers were set approximately 10 ft downstream from the right culvert (looking downstream), in the deepest part of the channel between the culverts and the pool. This location is also directly under the *Elaeagnus* sp. shrub, which provided shade fin the afternoon when the sunlight intensity is greatest.

A total of 4,320 (864 /ft^2) macroinvertebrates, from 37 distinct taxa, were collected with the five HD samplers at station 3. The ICI for this station is 48.

A score of 48 reflects very good to exceptional water quality and means the macroinvertebrate community exceeds the criterion designated for warm-water habitat aquatic life use.

Comparisons between ICI stations, based on index metrics

Metric 1: Total number of taxa. A healthy macroinvertebrate community supports a high number of taxa (species richness). Disturbed communities support fewer numbers of taxa; these are often pioneering types that thrive in less hospitable environments but cannot compete within more diverse communities when conditions improve.

The highest number of taxa was collected from station 1 (38), the next highest number was from station 3 (36), and the lowest number was from station 2 (29). Some sensitive taxa may have abandoned station 2 during the 6-week sampling period. During this time, the velocity at station 2 dropped from 0.412 ft/s to 0.218 ft/s, which is below the sampling criterion of 0.3 ft/s (table 2).

Metric 2: Number of mayfly taxa. Mayflies live in a wide variety of running-water habitats and thrive in rocky-bottom, headwater streams (Edmunds, 1984). Mayflies are pollution sensitive and often the first group to decline and disappear from artificial substrate when their environment is disturbed (DeShon, 1995). Their sensitivities make them good indicators of water quality.

Four mayfly taxa were collected at station 2 and at station 3. Two mayfly taxa were collected at station 1. These taxa represent four families of mayflies from station 3, three families from station 2, and two families from station 1. Leptophlebiidae was the most abundant family at all three stations. Heptageniidae was the second most abundant family.

Metric 3: Number of caddisfly taxa. Caddisfly larvae are important mechanisms in transferring energy (nutrients) in aquatic ecosystems, and they are often indicators of environmental quality (Garono and MacLean, 1988). Caddisflies are generally less sensitive to pollution than mayflies and are often a more dominant group in a macroinvertebrate community.

Six caddisfly families were collected from station 3, four families from station 1, and one family from station 2. Polycentropodidae was a dominant family at all three stations, although *Hydroptila* sp., in the family Hydroptilidae, was the most abundant at station 1.

Metric 4: Number of Diptera taxa. The order Diptera is large and as a group is the most diverse in habitat preference and pollution tolerance (Ohio Environmental Protection Agency, 1987). Because Diptera display such a wide range of pollution tolerances, from sensitive to very tolerant, they are quite valuable for evaluating water quality. Diptera normally dominate a macroinvertebrate sample collected by OEPA methods and may also be the only insects collected from very disturbed areas (DeShon, 1995).

Diptera larvae occur in almost every type of aquatic habitat. They swim or suspend themselves in the water column, live among or attached to aquatic vegetation, and live in the mud, sand, or gravel or attach to rocks. Diptera undergo complete metamorphosis: from an egg, to a larva, to a pupa, then to an adult (Teskey, 1984). All three stations supported diverse populations of Diptera: 23 taxa at station 1, 20 taxa at station 2, and 20 taxa station 3.

Metric 5: Percent mayflies. Because mayflies as a group are pollution sensitive, the number of mayflies in a sample can be affected by even minor disturbance (DeShon, 1995). Therefore, the percentage of mayflies in a macroinvertebrate community is a good indicator of water quality.

The highest percentage of mayflies was collected from station 2 (43 percent), the second highest percentage was collected from station 1 (23 percent), and the lowest percentage was collected from station 3 (14 percent).

Metric 6: Percent caddisflies. The number of caddisfly taxa and their percentage in a macroinvertebrate community often correlates with stream size, channel character, and food availability (Vannote and others, 1980). Polycentropodidae, a dominant caddisfly family at all three stations, and Hydropsychidae construct nets at the ends of their retreats (shelters) to strain food items from the water. They are dependent on flowing water to bring food to their fixed retreats. Hydroptilidae, common to station 1 and station 3, construct portable, purse-shaped cases and live in forms of permanent water, including lakes and streams, feeding primarily on algae (Wiggins, 1984).

Caddisflies are intermediate in pollution tolerance between the sensitive mayflies and more tolerant members of Diptera. The percentage of caddisflies was about 2 at all three stations.

Metric 7: Percent Tanytarsini midges. The Tanytarsini are a tribe of midges in the order Diptera. These midges are distinguished from other Diptera in the ICI because of their general sensitivity to pollu-

tion. *Tanytarsus* sp. was the most abundant genus at all three stations. The members of this genus are clingers and burrowers and construct tubes out of available material, such as sand and silt and sometimes detritus, often spinning nets at the ends of their retreats (Coffman and Ferrington, 1984). *Paratanytarsus* sp. and *Rheotanytarsus* sp. were the next most abundant genera. *Paratanytarsus* sp. is a collector-gatherer and *Rheotanytarsus* sp. is a collector-filterer. *Stempellinella* sp., a genus of collector-gatherers, was common at all three stations, but not as abundant as some of the other Tanytarsini.

The percentage of Tanytarsini midges collected from all three stations was exceptional: 24 percent at stations 1 and 2, and 35 percent at station 3.

Metric 8: Percent other Diptera and non-insects. Metric 8 includes all other members of Diptera not belonging to the tribe Tanytarsini. It also includes non-insect members of the community such as hydra, snails, amphipods, and worms. Metric 8 is the first of two negative metrics used in calculating an ICI. A high percentage in this metric means a low score. Although the members representing these groups inhabit healthy communities, they often dominate the communities that have been disturbed.

The lowest percentage (30) was collected from station 2, the second highest percentage (48) was collected from station 3, and the highest percentage (50) was collected from station 1.

Metric 9: Percent tolerant organisms. Metric 9 is the percentage of organisms listed as tolerant by the Ohio Environmental Protection Agency (1987). Those common to Ohio survive through a wide range of disturbances. Tolerant organisms dominate HD samples collected from areas with severe disturbance from toxic substances or gross organic enrichment (DeShon, 1995). As with metric 8, this is a negative metric where a high incidence results in a low score. Disturbed areas will have dominant populations of these groups.

All stations scored 6 (exceptional) for metric 9. The least percentage of tolerant organisms (0) was collected from station 2, where only one organism was found; the second lowest percentage (0.7) was collected from station 1, and the highest percentage (2.9) was collected from station 3.

Metric 10: Qualitative EPT taxa. Metric 10 is based on a qualitative sample collected the day that the HD samplers were retrieved. The EPT represents mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera). The value is the total number of taxa (species richness) from these groups added together. The EPT is dependent on water chemistry as well as habitat; it reflects both the quality and diversity of habitat available at each station.

For the streams in RVAAP, EPT values scored good (4) to exceptional (6). Station 2 was highest with an EPT of 21 taxa; station 3 had 15 taxa, and station 1 had 9 taxa. One of the EPT taxa collected at station 1 was *Stenacron pallidum*. This mayfly, collected with a D-framed dipnet, was the first recorded find of this species in Ohio (Randolph and McCafferty, 1998).

Qualitative samples

Qualitative samples of macroinvertebrates were collected from 24 locations. The names and coordinates for these locations are listed in table 4. Stations 1, 2, and 3 were ICI stations sampled both quantitatively with HD samplers and qualitatively with a D-framed dipnet. Sites 4-24 were only sampled qualitatively. The qualitative taxa lists were generated by the USGS National Water Quality Laboratory, Biology Group, the laboratory identifying the samples (appendix; table A-2). Macroinvertebrate presence is denoted by a "+" and their absence by a "--". When two or more organisms from the same group (such as family or genus) are reported at the same site, these organisms represent several levels of taxonomy and cannot be considered distinct taxa. A delineation to the number of distinct taxa would be less than the number now reported at each qualitative station. Therefore, the total taxa reported for each qualitative sample represents the number of identities, not distinct taxa.

The qualitative sites encompassed three main environments: stream, pond, and swamp-wetland. The highest number of taxa were collected from the streams. The total number of taxa collected in streams ranged from 25 to 76; the mean was 60 and median 64.5. The total number of taxa collected from ponds ranged from 32 to 60; the mean was 42 and median 41. The total number of taxa collected from swamp-wetland areas ranged from 6 to 30; the mean was 20 and and median 23 (table 4).

The stream sample with the greatest diversity (76 taxa) was collected at site 13, South Fork Eagle Creek at the Hemlock Gorge. Station 13 lies in a hemlock-white pine-northern hardwoods forest community. This forest association is common in the Allegheny Plateau section of Ohio (Anderson, 1982; Braun, 1989), where streams cut ravines through limestone and shale outcrops, but uncommon elsewhere in

Table 4. Locations of Invertebrate Community Index stations and qualitative sites at Ravenna Army Ammunition Plant, Ravenna Ohio, 1998

Station or site	Location, collection date, and results of qualitative sampling		
1	South Fork Eagle Creek at North Perimeter Road, Portage County 41°13′49″ 81°01′46″	15 July 98	46 taxa
2	Sand Creek at George Road, Portage County 41°11′46″ 81°05′07″	15 July 98	69 taxa
3	Hinkley Creek at South Patrol Road, Portage County 41°10′44″ 81°08′24″	15 July 98	72 taxa
4	Hinkley Creek at Newton Falls Road, Portage County 41°11′30″ 81°08′41″	16 July 98	65 taxa
5	Unnamed Tributary at Gaging Station in Training Area C, Trumbull County 41°12′43″ 80°58′49″	30 July 98	25 taxa
6	Sand Creek at Greenleaf Road, Portage County 41°11′27″ 81°06′38″	13 July 98	66 taxa
7	Pond in Training Area B, Trumbull County 41°12′46″ 80°58′54″	30 July 98	32 taxa
8	Beaver Swamp at Load Line 12, Portage County 41°11′09″ 81°03′01″	29 July 98	6 taxa
9	Pond near Snow Road, Portage County 41°13′25″ 81°01′23″	29 July 98	41 taxa
10	Sand Creek at Smalley Road, Portage County 41°13′14″ 81°02′25″	28 July 98	64 taxa
11	South Fork Eagle Creek at Stone Arch Bridge, Portage County 41°13′38″ 81°04′35″	27 July 98	57 taxa
12	Pond at North Perimeter Road, Portage County 41°13′30″ 81°05′43″	16 July 98	60 taxa
13	South Fork Eagle Creek in West Hemlock Gorge, Portage County 41°13′37″ 81°04′58″	27 July 98	76 taxa
14	Quarry at Boy Scout Camp, Portage County 41°13′31″ 81°05′16″	28 July 98	33 taxa
15	Trout Pond at Newton Falls Road and Route 80, Portage County 41°11′34″ 81°08′35″	14 July 98	39 taxa
16	Pond at Trout Hatchery, Portage County 41°11′36″ 81°08′58″	28 July 98	52 taxa
17	Quarry in Block A, Portage County 41°10′57″ 81°10′34″	14 July 98	45 taxa
18	Wetland North at Demolition Road in Training Area G, Portage County 41°10′32″ 81°07′22″	14 July 98	30 taxa
19	Wetland South at Demolition Road in Training Area G, Portage County 41°10′26″ 81°07′24″	14 July 98	23 taxa
20	Unnamed Tributary in Training Area H, Portage County 41°09′51″ 81°05′57″	29 July 98	59 taxa

Table 4. Locations of Invertebrate Community Index stations and qualitative sites at Ravenna Army Ammunition Plant, Ravenna Ohio, 1998—Continued

Station or site	Location, collection date, and results of qualitative sampling		
21	Ed's Pond at Paris Windham Road, Portage County 41°13′26″ 81°03′05″	28 July 98	42 taxa
22	Sand Creek at Newton Falls Road in Training Area J, Portage County 41°11′31″ 81°07′19″	16 July 98	69 taxa
23	Water Works Pond #3 near Fuse and Booster Road, Portage County 41°10′40″ 81°06′49″	14 July 98	32 taxa
24	Hinkley Creek at Gaging Station, Portage County 41°09′50″ 81°07′45″	29 July 98	52 taxa

Ohio. Station 13 is a diverse area, rich in habitat, a fact supported by the diverse sample collected there.

The stream sample with the least number of taxa (25) was collected from site 5, Unnamed Tributary at Gaging Station in Training Area C. A thorough sampling was not possible at this site because the stream is not wadeable at the former gaging station. Silt levels made wading too dangerous, so the sample was collected from the banks.

The pond sample with the greatest diversity (60) was collected at site 12, Pond at North Perimeter Road. This pond is fed by an unnamed tributary to South Fork Eagle Creek. It is inhabited by dense stands of vascular aquatic plants, which are valuable to aquatic life.

Two pond samples tied for the least number of taxa (32) collected: site 7, Pond in Training Area B and site 23, Water Works Pond 3. Site 7 is a new pond constructed for catching sediment. Site 23 is an old pond, probably once used as a water supply. Neither pond supported much habitat, in particular, vegetation; however, neither pond was designed to do so (U.S. Department of Agriculture, 1988).

The swamp-wetland area with the greatest number of taxa (30) collected was station 18, Wetland North at Demolition Road in Training Area G. It is a large wetland, rich in vegetation and black muck.

The least number of taxa (6) collected from the swamp-wetland areas was site 8, Beaver Swamp at Load Line 12. This swamp was in the late stages of succession and offered little diversity in habitat. Beaver dams at the site had been abandoned, and the water level was low. The sample was collected during a hot afternoon when the water was hot to the touch. Solar radiation heated the shallow water and dark sediment to extreme levels, which may explain the low diversity at this site.

Summary and conclusions

The macroinvertebrate communities at the Ravenna Army Ammunition Plant were investigated. Three Invertebrate Community Index (ICI) stations were established to collect quantitative and qualitative samples. Qualitative samples were also collected at 21 additional sites, including streams, ponds, and wetland areas. The data supplement earlier biological studies that either did not survey macroinvertebrates or, if macroinvertebrates were surveyed, did not report results in an interpretive manner. The results of this study establish baseline conditions for future studies such as Integrated Training Area Management plans and Land Condition Trend Analysis special-use plots.

The macroinvertebrate communities at all three ICI stations met, and at two stations exceeded, the criterion established for warm-water habitat aquatic life use. An ICI score of at least 34 is necessary to attain this status in the Erie/Ontario Lake Plain ecoregion.

Station 1, South Fork Eagle Creek at North Perimeter Road, received an ICI score of 42; station 2, Sand Creek at George Road, received the highest ICI score of 50; and station 3, Hinkley Creek at South Patrol Road, received a score of 48.

The qualitative results were more varied, a finding that could be expected from the wide-ranging types of aquatic habitat that were sampled at RVAAP. The results establish baseline data for these stations.

In addition to the ICI score, three metrics separate station 2 from the rest. The percentage of mayflies (metric 5) was nearly twice that of station1 and three

times that of station 3. The percentage of other dipteran and non-insect organisms (metric 8) was least at station 2. Lastly, the number of EPT taxa (metric 10) at station 2 was outstanding for a small stream and much higher than the other stations. The ICI score and these metrics in particular indicate that Sand Creek at George Road has exceptional water quality and habitat to support aquatic macroinvertebrates.

The macroinvertebrate communities at station 1 and station 3 were also healthy and diverse, although these stations were not as well protected by a dense riparian corridor. Road and right-of-way maintenance removed trees and vegetation from corridors surrounding stations 1 and 3. The mature trees growing in the riparian corridor at station 2 provide shade and nutrients, fortify the bank with their roots, and filter suspended soils and contaminants. Comparing figures 4 and 8 to figure 6 demonstrates how much protection is provided by the riparian corridor.

All three stations had ICI scores as high or higher than some reference stations in the Erie/Ontario Lake Plain ecoregion of Ohio. The results of this survey indicate the training activities at the Ravenna Army Ammunition Plant are not disturbing the macroinvertebrate communities at South Fork Eagle Creek, Sand Creek, or Hinkley Creek. Station 1, the station with the lowest ICI score, was also the station where the first Ohio record of *Stenacron pallidum* was collected.

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APPENDIXES

APPENDIX A—Taxa list

Table A-1. Quantitative results of macroinvertebrate survey using Hester-Dendy samplers in streams at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998

[Data are number of organisms in taxon (dashes indicate none collected). Stations: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road]

Station			1	2	3
Collection date			27-Jul-98	13-Jul-98	15-Jul-98
Sample type			Quant.	Quant.	Quant.
ORDER	FAMILY	TAXON			
Hydroida	Hydridae	*Hydra* sp.	14	--[1]	29
Gastropoda[2]	Ancylidae	Ancylidae	--	--	10
	Ancylidae	*Ferrissia* sp.[5]	17	1	--
	Physidae	Physidae	--	--	20
Oligochaeta[2]	Naididae	Naididae[5]	--	--	78
Acari		Hydrachnidia	14	--	1
Amphipoda		Amphipoda	--	1	--
	Hyalellidae	*Hyalella azteca* (Saussure)	16	--	--
Ephemeroptera		Ephemeroptera	374	114	10
	Leptophlebiidae	Leptophlebiidae	1042	199	543
	Caenidae	Caenidae	--	--	10
	Baetidae	Baetidae	--	12	--
		Centroptilum/*Procloeon* sp.	--	5	19
	Heptageniidae	Heptageniidae	17	148	38
		Stenacron interpunctatum (Say)	--	30	2
		Stenonema sp.	2	2	--
		Stenonema femoratum (Say)	--	23	--
Odonata	Calopterygidae	*Hetaerina* sp.	14	--	--
	Aeshnidae	*Boyeria vinosa* (Say)	1	--	--
Plecoptera	Perlidae	*Perlesta* sp.	1	--	--
Hemiptera		Heteroptera[4]	--	2	--
Megaloptera	Sialidae	*Sialis* sp.	--	2	--
Trichoptera		Trichoptera	29	--	--
	Hydroptilidae	Hydroptilidae	14	--	--
		Hydroptila sp.	58	--	11
	Hydropsychidae	*Cheumatopsyche* sp.	--	--	1
	Polycentropodidae	Polycentropodidae	14	3	49
		Paranyctiophylax sp.	--	25	--
	Psychomyiidae	Psychomyiidae	14	--	--
	Limnephilidae	*Pycnopsyche* sp.	1	--	1
	Leptoceridae	*Triaenodes*/*Ylodes* sp.	--	--	1
	Helicopsychidae	*Helicopsyche borealis* (Hagen)	--	--	10
Coleoptera	Gyrinidae	*Dineutus* sp.	14	--	--
	Elmidae	*Macronychus glabratus* Say	1	--	31
Diptera	Ceratopogonidae	*Bezzia*/*Palpomyia* sp.	--	--	10
	Chironomidae	Chironomidae	119	22	52
		Chironominae	158	10	154
		Chironomini	29	7	--
		Chironomus sp.[5]	29	--	--
		Dicrotendipes sp.	259	38	221
		Microtendipes sp.	691	43	58
		Nilothauma sp.	43	7	10
		Paratendipes sp.	--	5	--
		Phaenopsectra sp.	43	2	10
		Polypedilum sp.	29	17	192
		Pseudochironomus sp.	14	--	--
		Tanytarsini[3]	158	24	106
		Cladotanytarsus sp.[3]	29	--	--
		Paratanytarsus sp.[3]	58	7	384
		Rheotanytarsus sp.[3]	302	2	221
		Stempellinella sp.[3]	43	2	48
		Tanytarsus sp.[3]	922	256	768
		Orthocladiinae	100	19	134
		Cricotopus/*Orthocladius* sp.	187	2	403
		Corynoneura sp.	58	55	29
		Cricotopus bicinctus group	--	--	19

Table A-1. Quantitative results of macroinvertebrate survey using Hester-Dendy samplers in streams at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data are number of organisms in taxon (dashes indicate none collected). Stations: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road]

Station			1	2	3
Collection date			27-Jul-98	13-Jul-98	15-Jul-98
Sample type			Quant.	Quant.	Quant.
ORDER	FAMILY	TAXON			
Diptera	Chironomidae	*Nanocladius* sp.	43	2	19
		Parametriocnemus sp.	--	5	77
		Rheocricotopus sp.	86	--	--
		Thienemanniella sp.	86	--	--
		Tanypodinae	86	29	125
		Labrundinia/*Nilotanypus* sp.	14	--	--
		Thienemannimyia group sp.	706	36	336
		Ablabesmyia sp.	202	50	10
		Labrundinia sp.	--	2	--
		Nilotanypus sp.	--	2	10
		Paramerina sp.	29	17	48
	Tipulidae	*Antocha* sp.	14	--	--
	Athericidae	*Atherix variegata* Walker	--	--	12
	Empididae	Empididae	--	1	--
		Hemerodromia sp.	29	--	--
		Total	6223	1229	4320

The table is arranged in phylogenetic order as assigned by the USGS National Water Quality Laboratory, Biological Unit; [1], Phylum; [2], Class; [3], Tanytarsini; [4], Suborder; [5], tolerant organism; -- , not found at site; Quant., Quantitative sample representing the number of organisms collected from 5 ft^2 of artificial substrate (five HD samplers composited).

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**1**	**2**	**3**	**4**
Collection date			**15-Jul-98**	**15-Jul-98**	**15-Jul-98**	**16-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Turbellaria[2]		Turbellaria	--	--	--	+
Gastropoda[2]	Hydrobiidae	Hydrobiidae	--	--	+	--
	Ancylidae	*Ferrissia* sp.	+	--	+	--
	Lymnaeidae	*Fossaria* sp.	--	--	--	+
		Physella sp.	--	--	+	+
	Planorbidae	*Helisoma anceps* (Menke)	--	--	+	+
		Planorbella sp.	--	--	+	--
Pelecypoda[2]	Sphaeriidae	Sphaeriidae	--	--	--	+
		Sphaerium sp.	--	--	+	--
Oligochaeta[2]	Tubificidae	Tubificidae	--	--	--	+
Acari		Hydrachnidia	+	--	+	--
Decapoda	Cambaridae	Cambaridae	+	+	+	+
		Orconectes sp.	+	--	--	--
Amphipoda	Hyalellidae	*Hyalella azteca* (Saussure)	+	--	+	+
Collembola		Collembola	--	+	--	--
Ephemeroptera	Leptophlebiidae	Leptophlebiidae	--	--	--	+
		Habrophlebiodes sp.	--	+	--	--
	Ephemeridae	*Ephemera* sp.	+	--	--	--
	Caenidae	*Caenis* sp.	--	--	+	+
		Caenis latipennis Banks	+	--	+	+
		Caenis punctata McDunnough	--	--	+	--
	Baetidae	Baetidae	--	+	--	--
		Centroptilum/*Procloeon* sp.	+	+	+	+
		Acentrella turbida (McDunnough)	--	+	--	--
		Baetis sp.	--	+	--	--
		Baetis flavistriga McDunnough	--	+	+	--
		Baetis intercalaris McDunnough	--	+	+	--
		Callibaetis sp.	--	--	+	--
		Labiobaetis frondalis (McDunnough)	--	--	--	+
		Labiobaetis propinquus (Walsh)	--	+	--	--
	Heptageniidae	*Stenacron* sp.	+	+	+	--
		Stenacron interpunctatum (Say)	--	+	--	+
		Stenacron pallidum (Traver)	+	--	--	--
		Stenonema sp.	+	+	--	--
		Stenonema femoratum (Say)	--	--	--	+
		Stenonema ithaca (Clemens and Leonard)	--	+	--	--
	Isonychiidae	*Isonychia* sp.	--	+	--	--
Odonata		Zygoptera	--	+	--	--
	Calopterygidae	*Calopteryx maculata* (Beauvois)	--	--	--	+
	Coenagrionidae	Coenagrionidae	--	--	+	--
	Aeshnidae	Aeshnidae	--	+	+	--
		Boyeria sp.	--	--	--	+
		Boyeria vinosa (Say)	--	--	--	+
	Gomphidae	Gomphidae	--	--	--	+
		Stylogomphus albistylus (Hagen)	--	+	--	+
Plecoptera	Leuctridae	*Leuctra* sp.	--	+	--	--
	Perlidae	*Perlesta* sp.	--	+	--	--
Hemiptera	Corixidae	Corixidae	+	--	--	+
		Palmacorixa sp.	+	--	+	--
		Sigara sp.	--	--	--	+
	Gerridae	Gerrinae	--	+	--	--
		Aquarius remigis (Say)	--	+	--	--
		Trepobates sp.	+	--	+	--
		Trepobates pictus (Herrich-Schaeffer)	--	+	+	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**1**	**2**	**3**	**4**
Collection date			**15-Jul-98**	**15-Jul-98**	**15-Jul-98**	**16-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Hemiptera	Veliidae	Veliidae	--	+	+	+
		Microvelia sp.	--	--	--	+
		Rhagovelia obesa Uhler	+	+	--	--
Megaloptera	Corydalidae	*Nigronia serricornis* (Say)	+	+	--	--
	Sialidae	*Sialis* sp.	--	--	+	+
Trichoptera	Glossosomatidae	*Glossosoma* sp.	--	+	--	+
	Hydroptilidae	Hydroptilidae	--	--	--	+
		Hydroptila sp.	+	+	+	--
		Hydroptila consimilis Morton	--	--	+	--
	Philopotamidae	*Chimarra* sp.	--	+	--	--
	Hydropsychidae	Ceratopsyche sp.	--	+	--	+
		Ceratopsyche alhedra (Ross)/*sparna* (Ross)	--	--	+	--
		Ceratopsyche slossonae (Banks)	--	+	+	--
		Ceratopsyche sparna (Ross)	--	+	--	--
		Cheumatopsyche sp.	+	--	--	--
		Hydropsyche betteni Ross/*depravata* Hagen	--	+	+	--
	Polycentropodidae	*Polycentropus* sp.	+	+	--	--
	Lepidostomatidae	*Lepidostoma* sp.	--	--	--	+
	Limnephilidae	*Pycnopsyche* sp.	+	+	+	+
	Uenoidae	*Neophylax* sp.	--	--	--	+
	Leptoceridae	*Mystacides sepulchralis* (Walker)	--	--	+	+
		Triaenodes injustus (Hagen)	--	--	+	--
	Odontoceridae	*Psilotreta indecisa* (Walker)	--	+	--	+
	Helicopsychidae	*Helicopsyche borealis* (Hagen)	--	+	+	+
Lepidoptera		Lepidoptera	--	--	+	--
Coleoptera	Dytiscidae	Hydroporinae	--	--	--	+
		Hydroporini	--	--	--	+
	Gyrinidae	*Dineutus* sp.	+	--	--	--
	Haliplidae	*Peltodytes* sp.	--	--	+	--
	Helophoridae	*Helophorus* sp.	--	+	--	--
	Hydrophilidae	*Paracymus* sp.	--	--	--	+
	Scirtidae	Scirtidae	+	--	+	--
	Dryopidae	*Helichus basalis* LeConte	--	+	+	+
	Elmidae	*Dubiraphia* sp.	+	--	+	+
		Dubiraphia bivittata (LeConte)	--	--	+	--
		Dubiraphia minima Hilsenhoff	+	--	+	+
		Dubiraphia quadrinotata (Say)	--	--	+	+
		Dubiraphia vittata (Melsheimer)	--	--	+	--
		Optioservus sp.	--	+	+	+
		Optioservus ovalis (LeConte)	--	+	+	--
		Optioservus trivittatus (Brown)	--	+	+	--
		Stenelmis sp.	+	+	--	+
		Stenelmis crenata (Say)	+	+	+	+
	Psephenidae	*Psephenus herricki* (DeKay)	--	+	--	--
	Lampyridae	Lampyridae	--	--	--	+
Diptera	Ceratopogonidae	Ceratopogonidae	--	--	+	--
	Chironomidae	Chironomidae	+	+	+	+
		Chironominae	--	--	--	--
		Chironomini	+	+	+	--
		Chironomus sp.	+	--	--	+
		Cryptochironomus sp.	+	+	+	+
		Cryptotendipes sp.	+	--	--	--
		Dicrotendipes sp.	+	--	+	+
		Microtendipes sp.	+	+	+	+
		Nilothauma sp.	--	+	--	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**1**	**2**	**3**	**4**
Collection date			**15-Jul-98**	**15-Jul-98**	**15-Jul-98**	**16-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Diptera	Chironomidae	*Paratendipes* sp.	--	--	--	+
		Polypedilum sp.	--	+	+	+
		Pseudochironomus sp.	+	--	--	--
		Tanytarsini[3]	--	--	+	--
		Micropsectra/*Tanytarsus* sp.[3]	+	+	--	--
		Cladotanytarsus sp.[3]	+	--	+	--
		Micropsectra sp.[3]	--	+	--	--
		Paratanytarsus sp.[3]	--	--	--	+
		Tanytarsus sp.[3]	+	+	+	+
		Pagastia sp.	--	--	--	+
		Orthocladiinae	+	+	+	--
		Cricotopus/*Orthocladius* sp.	--	+	+	--
		Brillia sp.	--	+	--	--
		Cardiocladius sp.	--	--	+	--
		Corynoneura sp.	--	--	+	--
		Parakiefferiella sp.	+	--	--	--
		Parametriocnemus sp.	--	+	--	--
		Psectrocladius sp.	+	--	--	+
		Rheocricotopus sp.	--	+	+	--
		Tvetenia sp.	--	+	+	--
		Pentaneurini	--	--	--	+
		Thienemannimyia group sp.	+	+	+	+
		Ablabesmyia sp.	+	--	+	+
		Procladius sp.	+	--	--	+
	Culicidae	*Anopheles* sp.	--	+	+	+
	Dixidae	Dixidae	--	--	--	+
		Dixella sp.	--	+	+	--
	Simuliidae	Simuliidae	--	--	+	--
		Simulium sp.	--	+	+	--
	Tipulidae	*Tipula* sp.	--	--	+	+
		Antocha sp.	--	+	--	--
		Hexatoma sp.	+	+	+	--
	Athericidae	*Atherix lantha* Webb	+	+	+	+
	Empididae	*Hemerodromia* sp.	--	+	--	--
	Ephydridae	Ephydridae	--	--	--	--
	Tabanidae	Chrysops/*Silvius* sp.	+	--	--	--
		Chrysops sp.	--	+	+	+
		Total	46	69	72	65

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**5**	**6**	**7**	**8**
Collection date			**30-Jul-98**	**13-Jul-98**	**30-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Nematoda[1]		Nematoda	+	--	--	--
Gastropoda[2]	Ancylidae	*Ferrissia* sp.	+	--	--	--
	Physidae	Physidae	+	--	--	--
		Physella sp.	--	--	+	+
	Planorbidae	*Gyraulus* sp.	--	--	+	+
Pelecypoda[2]	Sphaeriidae	Sphaeriidae	+	--	--	--
		Sphaerium sp.	--	+	--	--
Oligochaeta[2]	Naididae	Naididae	--	--	--	+
Acari		Hydrachnidia	--	--	+	--
Decapoda	Cambaridae	*Orconectes* sp.	--	+	--	--
Amphipoda	Hyalellidae	*Hyalella azteca* (Saussure)	+	--	--	--
Collembola		Collembola	--	--	+	--
Ephemeroptera	Leptophlebiidae	*Habrophlebiodes* sp.	--	+	--	--
	Caenidae	*Caenis latipennis* Banks	--	+	--	--
	Baetidae	*Centroptilum*/*Procloeon* sp.	--	+	--	--
		Baetis flavistriga McDunnough	+	+	--	--
		Callibaetis sp.	+	--	+	--
		Fallceon quilleri (Dodds)	--	+	--	--
	Heptageniidae	Heptageniidae	--	+	--	--
		Stenacron sp.	--	+	--	--
		Stenacron interpunctatum (Say)	--	+	--	--
		Stenonema sp.	--	+	--	--
Odonata	Coenagrionidae	*Ischnura* sp.	--	--	+	--
	Aeshnidae	*Boyeria vinosa* (Say)	--	+	--	--
	Gomphidae	*Stylogomphus albistylus* (Hagen)	--	+	--	--
Plecoptera	Leuctridae	*Leuctra* sp.	--	+	--	--
	Perlidae	*Acroneuria* sp.	--	+	--	--
		Perlesta sp.	--	+	--	--
Hemiptera	Belostomatidae	Belostomatidae	--	--	+	--
		Belostoma flumineum Say	--	--	--	--
	Corixidae	Corixidae	+	+	+	--
		Sigara sp.	+	+	+	--
	Gerridae	Gerrinae	--	+	--	--
		Rheumatobates sp.	--	+	--	--
		Rheumatobates rileyi Bergroth	--	+	--	--
		Trepobates sp.	--	+	+	--
		Trepobates pictus (Herrich-Schaeffer)	--	+	--	--
		Trepobates subnitidus Esaki	--	--	+	--
	Mesoveliidae	*Mesovelia* sp.	--	--	+	--
		Mesovelia mulsanti White	--	--	+	--
	Nepidae	*Ranatra* sp.	--	--	+	--
		Ranatra fusca Palisot de Beauvois	--	--	+	--
	Notonectidae	Notonectidae	--	--	+	--
		Buenoa sp.	--	--	+	--
	Veliidae	Veliidae	--	+	+	--
		Microvelia sp.	--	+	--	--
		Rhagovelia obesa Uhler	--	+	--	--
Trichoptera	Hydroptilidae	*Hydroptila* sp.	+	--	--	--
	Philopotamidae	*Chimarra* sp.	--	+	--	--
	Hydropsychidae	Hydropsychidae	--	+	--	--
		Ceratopsyche slossonae (Banks)	--	+	--	--
		Cheumatopsyche sp.	+	+	--	--
		Hydropsyche sp.	+	--	--	--
		Hydropsyche betteni Ross/*depravata* Hagen	+	+	+	--
		Hydropsyche betteni Ross	+	--	--	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**5**	**6**	**7**	**8**
Collection date			**30-Jul-98**	**13-Jul-98**	**30-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Trichoptera	Polycentropodidae	*Paranyctiophylax* sp.	--	+	--	--
		Polycentropus sp.	--	+	--	--
		Polycentropus confusus Hagen	--	+	--	--
	Limnephilidae	*Pycnopsyche* sp.	--	+	--	--
	Uenoidae	*Neophylax* sp.	--	+	--	--
	Leptoceridae	*Mystacides sepulchralis* (Walker)	--	+	--	--
	Odontoceridae	*Psilotreta indecisa* (Walker)	--	+	--	--
Coleoptera	Dytiscidae	Hydroporini	--	--	--	+
		Laccophilus sp.	--	--	+	--
	Haliplidae	*Haliplus* sp.	--	--	+	--
		Peltodytes sp.	--	--	+	+
	Hydrochidae	*Hydrochus* sp.	--	--	+	--
	Hydrophilidae	*Berosus* sp.	--	--	+	--
		Enochrus sp.	--	--	--	+
		Tropisternus sp.	--	--	+	--
		Tropisternus lateralis (Fabricius)	--	--	+	--
	Dryopidae	*Helichus basalis* LeConte	--	+	--	--
	Elmidae	*Dubiraphia* sp.	--	+	--	--
		Dubiraphia minima Hilsenhoff	--	+	--	--
		Dubiraphia quadrinotata (Say)	--	+	--	--
		Optioservus sp.	--	+	--	--
		Optioservus ovalis (LeConte)	--	+	--	--
		Optioservus trivittatus (Brown)	--	+	--	--
		Stenelmis sp.	--	+	--	--
		Stenelmis crenata (Say)	--	+	--	--
	Psephenidae	*Psephenus herricki* (DeKay)	--	+	--	--
	Lampyridae	Lampyridae	+	--	--	--
Diptera	Chironomidae	Chironomidae	--	+	--	--
		Chironominae	+	+	--	--
		Chironomini	--	--	+	--
		Dicrotendipes sp.	--	+	--	--
		Endochironomus sp.	--	--	+	--
		Polypedilum sp.	+	+	+	--
		Stictochironomus sp.[3]	--	+	--	--
		Cladotanytarsus sp.[3]	--	+	--	--
		Paratanytarsus sp.[3]	--	+	--	--
		Tanytarsus sp.[3]	+	+	--	--
		Orthocladiinae	+	+	--	--
		Cricotopus/*Orthocladius* sp.	+	--	--	--
		Parametriocnemus sp.	+	+	--	--
		Rheocricotopus sp.	+	+	--	--
		Tvetenia sp.	+	+	--	--
		Clinotanypus sp.	--	--	+	--
		Pentaneurini	--	+	--	--
		Thienemannimyia group sp.	--	+	--	--
	Culicidae	*Anopheles* sp.	--	--	+	--
		Dixella sp.	--	+	--	--
	Simuliidae	Simuliidae	+	--	--	--
		Simulium sp.	+	--	+	--
	Tipulidae	*Tipula* sp.	--	+	--	--
		Hexatoma sp.	--	+	--	--
	Athericidae	*Atherix lantha* Webb	--	+	--	--
		Total	25	66	32	6

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			9	10	11	12
Collection date			29-Jul-98	28-Jul-98	27-Jul-98	16-Jul-98
Sample type			Qual.	Qual.	Qual.	Qual.
ORDER	FAMILY	TAXON				
Turbellaria[2]		Turbellaria	+	--	--	+
Gastropoda[2]	Viviparidae	*Viviparus* sp.	--	--	+	--
	Lymnaeidae	Lymnaeinae	--	+	--	--
	Physidae	*Physella* sp.	--	+	+	+
	Planorbidae	Planorbidae	--	--	+	--
		Gyraulus sp.	+	--	--	--
		Helisoma anceps (Menke)	--	+	+	--
		Planorbella sp.	+	+	--	+
Pelecypoda[2]	Corbiculidae	*Corbicula* sp.	--	+	--	--
	Sphaeriidae	Sphaeriidae	+	--	--	+
		Sphaerium sp.	--	+	+	+
Oligochaeta[2]	Naididae	Naididae	--	--	+	+
		Stylaria lacustris (Linnaeus)	+	--	--	--
	Tubificidae	Tubificidae	--	+	+	+
Hirundinea[2]	Glossiphoniidae	Glossiphoniidae	--	--	+	+
Acari		Hydrachnidia	--	--	--	+
Decapoda	Cambaridae	Cambaridae	--	+	--	--
		Orconectes sp.	--	--	+	--
Isopoda	Asellidae	*Caecidotea* sp.	--	--	+	+
Amphipoda	Hyalellidae	*Hyalella azteca* (Saussure)	+	+	+	+
Ephemeroptera	Caenidae	*Caenis* sp.	+	+	--	--
		Caenis diminuta Walker	--	+	+	--
		Caenis punctata McDunnough	+	--	--	--
	Baetidae	Baetidae	--	+	--	--
		Centroptilum/*Procloeon* sp.	--	+	--	--
		Acerpenna sp.	--	+	--	--
		Baetis flavistriga McDunnough	--	+	--	--
		Baetis intercalaris McDunnough	--	+	--	--
		Barbaetis cestus (Provonsha and McCafferty)	--	+	--	--
		Callibaetis sp.	+	--	--	+
		Cloeon cognatum Stephens	+	--	--	--
	Heptageniidae	*Stenacron* sp.	--	--	+	--
		Stenacron interpunctatum (Say)	--	--	+	--
		Stenonema sp.	--	+	+	--
		Stenonema luteum (Clemens)	--	--	+	--
	Isonychiidae	*Isonychia* sp.	--	+	--	--
Odonata	Calopterygidae	*Calopteryx* sp.	--	+	--	--
	Coenagrionidae	Coenagrionidae	+	+	+	+
		Ischnura sp.	+	+	--	+
	Aeshnidae	*Anax junius* (Drury)	+	--	--	--
		Boyeria vinosa (Say)	--	+	--	--
	Cordulegastridae	*Cordulegaster* sp.	--	--	--	--
	Corduliidae	Corduliidae	--	+	--	--
		Epitheca sp.	--	--	--	+
	Gomphidae	Gomphidae	--	+	--	--
		Stylogomphus albistylus (Hagen)	--	--	+	--
	Libellulidae	Libellulidae	+	--	--	+
		Libellula sp.	+	--	--	--
		Sympetrum sp.	--	--	--	+
		Tramea sp.	+	--	--	--
Hemiptera	Belostomatidae	Belostomatidae	+	+	--	+
	Corixidae	Corixidae	+	--	--	+
		Palmacorixa sp.	--	--	--	+
		Sigara sp.	--	--	--	+
		Trichocorixa sp.	+	--	--	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**9**	**10**	**11**	**12**
Collection date			**29-Jul-98**	**28-Jul-98**	**27-Jul-98**	**16-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Hemiptera	Gerridae	Gerridae	--	--	--	+
		Aquarius remigis (Say)	--	+	+	--
		Limnoporus canaliculatus (Say)	--	--	--	+
		Trepobates sp.	--	--	+	+
	Hebridae	Hebridae	+	--	--	--
	Mesoveliidae	*Mesovelia* sp.	--	+	--	+
		Mesovelia mulsanti White	--	+	--	+
	Naucoridae	*Pelocoris* sp.	+	--	--	+
	Notonectidae	Notonectidae	+	--	--	+
		Notonecta sp.	+	--	--	+
	Pleidae	Pleidae	--	+	--	--
	Veliidae	Veliidae	--	--	+	+
		Microvelia sp.	--	--	+	--
		Rhagovelia obesa Uhler	--	--	+	--
Megaloptera	Corydalidae	*Nigronia serricornis* (Say)	--	+	+	--
	Sialidae	*Sialis* sp.	--	--	--	+
Trichoptera	Philopotamidae	*Chimarra* sp.	--	--	+	--
	Hydropsychidae	*Ceratopsyche slossonae* (Banks)	--	+	--	--
		Cheumatopsyche sp.	--	+	+	--
		Hydropsyche sp.	--	+	+	--
		Hydropsyche betteni Ross/*depravata* Hagen	--	--	+	+
	Polycentropodidae	*Polycentropus* sp.	--	--	+	--
	Limnephilidae	*Pycnopsyche* sp.	--	--	+	--
	Uenoidae	*Neophylax* sp.	--	--	+	--
	Leptoceridae	*Mystacides sepulchralis* (Walker)	--	--	+	--
		Triaenodes ignitus (Walker)	--	--	+	--
		Triaenodes marginatus Sibley	--	--	--	+
Lepidoptera		Lepidoptera	+	+	--	+
Coleoptera		Coleoptera	--	--	--	+
	Dytiscidae	Hydroporini	--	--	--	+
	Haliplidae	*Haliplus* sp.	--	--	--	+
		Peltodytes sp.	--	--	--	+
	Hydrophilidae	*Crenitis* sp.	--	--	+	--
		Enochrus sp.	--	+	--	--
		Paracymus sp.	+	--	--	+
		Tropisternus sp.	+	+	--	--
	Scirtidae	Scirtidae	--	--	--	+
	Dryopidae	*Helichus basalis* LeConte	--	+	+	--
	Elmidae	*Dubiraphia* sp.	+	+	+	+
		Dubiraphia bivittata (LeConte)	--	+	--	--
		Dubiraphia quadrinotata (Say)	--	+	+	+
		Optioservus sp.	--	--	--	+
		Optioservus ovalis (LeConte)	--	+	--	--
		Optioservus trivittatus (Brown)	--	+	--	--
		Stenelmis sp.	--	+	+	--
		Stenelmis crenata (Say)	--	+	+	--
	Psephenidae	*Ectopria* sp.	--	--	+	--
Diptera	Ceratopogonidae	Ceratopogonidae	+	--	--	+
	Chironomidae	Chironomidae	--	--	+	--
		Chironominae	--	--	+	--
		Chironomini	--	--	+	--
		Dicrotendipes sp.	--	+	--	--
		Lauterborniella sp.	+	--	--	--
		Microtendipes sp.	--	--	+	+
		Phaenopsectra sp.	--	--	+	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**9**	**10**	**11**	**12**
Collection date			**29-Jul-98**	**28-Jul-98**	**27-Jul-98**	**16-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Diptera	Chironomidae	*Polypedilum* sp.	+	+	+	+
		Saetheria sp.	--	+	--	--
		Pseudochironomus sp.	+	--	--	--
		Micropsectra/*Tanytarsus* sp.[3]	--	--	--	+
		Cladotanytarsus sp.[3]	+	--	--	--
		Micropsectra sp.[3]	--	+	--	--
		Rheotanytarsus sp.[3]	--	--	+	--
		Stempellinella sp.[3]	--	+	+	--
		Tanytarsus sp.[3]	--	+	--	--
		Pagastia sp.	--	--	+	--
		Orthocladiinae	+	+	+	+
		Lopescladius sp.	--	+	--	--
		Nanocladius sp.	+	+	+	--
		Paraphaenocladius sp.	--	--	+	--
		Rheocricotopus sp.	--	--	+	--
		Tanypodinae	+	+	+	+
		Clinotanypus sp.	--	--	--	+
		Thienemannimyia group sp.	--	+	+	+
		Ablabesmyia sp.	+	+	--	+
		Guttipelopia sp.	+	--	--	--
		Labrundinia sp.	--	--	--	+
		Larsia sp.	+	+	--	--
		Paramerina sp.	--	+	--	--
		Procladius sp.	+	+	--	+
		Tanypus sp.	+	--	--	+
	Culicidae	*Anopheles* sp.	+	--	--	+
	Dixidae	Dixidae	--	--	--	+
		Dixella sp.	--	--	--	+
	Simuliidae	Simuliidae	--	--	+	--
		Simulium sp.	--	--	+	--
	Tipulidae	Tipulidae	--	--	--	+
		Tipula sp.	--	+	--	--
		Hexatoma sp.	--	+	--	--
	Athericidae	*Atherix lantha* Webb	--	+	--	--
	Sciomyzidae	*Sepedon* sp.	--	--	--	+
	Tabanidae	*Chrysops* sp.	--	+	--	--
		Total	41	64	57	60

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**13**	**14**	**15**	**16**
Collection date			**27-Jul-98**	**28-Jul-98**	**14-Jul-98**	**28-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Turbellaria[2]		Turbellaria	--	--	+	--
Nematoda[1]		Nematoda	--	--	+	--
Gastropoda[2]	Valvatidae	*Valvata* sp.	--	--	--	+
	Viviparidae	*Viviparus* sp.	--	--	+	--
	Hydrobiidae	Hydrobiidae	--	--	--	+
	Lymnaeidae	Lymnaeinae	+	--	--	--
		Fossaria/*Stagnicola* sp.	+	--	--	--
	Physidae	*Physella* sp.	+	--	+	+
	Planorbidae	Planorbidae	--	--	--	+
		Helisoma anceps (Menke)	+	--	+	+
		Planorbella sp.	--	--	--	+
Pelecypoda[2]	Sphaeriidae	Sphaeriidae	--	+	+	--
		Pisidium sp.	--	--	--	+
		Musculium sp.	--	--	+	--
Oligochaeta[2]	Lumbriculidae	Lumbriculidae	--	--	+	--
		Stylaria lacustris (Linnaeus)	--	--	+	+
	Tubificidae	Tubificidae	--	+	--	--
Hirundinea[2]	Glossiphoniidae	Glossiphoniidae	--	--	+	--
Acari		Hydrachnidia	+	+	+	--
Decapoda	Cambaridae	Cambaridae	+	+	--	--
Amphipoda	Hyalellidae	*Hyalella azteca* (Saussure)	+	+	+	+
Collembola		Collembola	+	--	--	--
Ephemeroptera	Caenidae	*Caenis* sp.	--	+	+	+
		Caenis diminuta Walker	+	+	+	+
		Caenis latipennis Banks	+	--	--	--
	Baetidae	Baetidae	--	+	--	--
		Centroptilum/*Procloeon* sp.	+	--	--	--
		Baetis tricaudatus Dodds	+	--	--	--
	Heptageniidae	*Stenacron* sp.	+	--	--	--
		Stenacron interpunctatum (Say)	+	--	--	--
		Stenonema sp.	+	--	--	--
		Stenonema femoratum (Say)	+	--	--	--
		Stenonema vicarium (Walker)	+	--	--	--
Odonata	Calopterygidae	*Calopteryx* sp.	+	--	--	--
	Coenagrionidae	Coenagrionidae	+	+	+	+
		Argia sp.	+	--	--	--
		Chromagrion conditum (Selys)	+	--	--	--
		Ischnura sp.	--	+	+	--
	Aeshnidae	Aeshnidae	--	--	--	+
		Anax junius (Drury)	--	--	--	+
	Gomphidae	Gomphidae	+	--	--	--
	Libellulidae	Libellulidae	--	--	+	+
		Sympetrum sp.	--	--	+	--
Plecoptera	Leuctridae	*Leuctra* sp.	+	--	--	--
Orthoptera	Gryllidae	Gryllidae	--	--	--	+
Hemiptera	Belostomatidae	Belostomatidae	--	--	--	+
		Belostoma flumineum Say	--	--	--	+
	Corixidae	Corixidae	--	+	--	+
		Palmacorixa sp.	--	--	--	+
		Palmacorixa nana Walley	--	--	+	--
		Trichocorixa sp.	--	+	+	+
	Gerridae	Gerrinae	+	--	--	--
		Aquarius remigis (Say)	+	--	--	--
		Trepobates sp.	+	--	+	+
		Trepobates subnitidus Esaki	--	+	+	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**13**	**14**	**15**	**16**
Collection date			**27-Jul-98**	**28-Jul-98**	**14-Jul-98**	**28-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Hemiptera	Hydrometridae	*Hydrometra* sp.	--	--	+	--
	Mesoveliidae	*Mesovelia* sp.	--	+	--	+
		Mesovelia mulsanti White	--	+	--	+
	Naucoridae	*Pelocoris* sp.	--	--	+	+
	Nepidae	*Ranatra kirkaldyi* Torre-Bueno	--	--	+	+
	Notonectidae	Notonectidae	--	--	--	+
		Notonecta sp.	--	--	--	+
	Pleidae	Pleidae	--	--	--	+
		Neoplea sp.	--	--	--	+
	Veliidae	Veliidae	+	--	--	--
		Microvelia sp.	+	--	--	--
		Rhagovelia obesa Uhler	+	--	--	--
Megaloptera	Corydalidae	*Nigronia serricornis* (Say)	+	--	--	--
	Sialidae	*Sialis* sp.	+	--	--	--
Trichoptera	Glossosomatidae	*Glossosoma* sp.	+	--	--	--
	Hydroptilidae	*Ochrotrichia* sp.	+	--	--	--
		Oxyethira sp.	--	--	+	--
	Philopotamidae	*Chimarra* sp.	+	--	--	--
	Hydropsychidae	*Ceratopsyche* sp.	+	--	--	--
		Ceratopsyche slossonae (Banks)	+	--	--	--
		Ceratopsyche sparna (Ross)	+	--	--	--
		Cheumatopsyche sp.	+	--	--	--
		Hydropsyche sp.	+	--	--	--
		Hydropsyche betteni Ross/*depravata* Hagen	+	--	--	--
	Uenoidae	*Neophylax* sp.	+	--	--	--
	Leptoceridae	Leptoceridae	--	+	--	--
		Oecetis cinerascens (Hagen)	--	--	+	--
Lepidoptera	Pyralidae	Nymphulini	--	--	--	+
Coleoptera		Coleoptera	--	--	--	+
	Dytiscidae	Dytiscidae	--	--	--	+
		Acilius semisulcatus Aubé	--	--	--	+
		Laccornis sp.	--	--	--	+
		Celina sp.	--	--	+	--
	Gyrinidae	*Gyrinus lecontei* Fall	+	--	--	--
	Haliplidae	*Haliplus* sp.	--	--	+	--
		Peltodytes sp.	--	+	+	+
	Noteridae	*Hydrocanthus* sp.	--	--	--	+
	Helophoridae	*Helophorus* sp.	+	--	--	--
	Hydrophilidae	Hydrophilidae	--	--	--	+
		Enochrus sp.	--	--	--	+
		Paracymus sp.	--	--	--	+
		Tropisternus sp.	--	--	--	+
	Dryopidae	*Helichus basalis* LeConte	+	--	--	--
	Elmidae	*Dubiraphia* sp.	+	--	--	--
		Dubiraphia quadrinotata (Say)	+	--	--	--
		Optioservus sp.	+	--	--	--
		Stenelmis sp.	+	--	--	--
	Psephenidae	*Ectopria* sp.	+	--	--	--
Coleoptera	Curculionidae	Curculionidae	--	--	--	+
Diptera	Chironomidae	Chironomidae	+	+	--	--
		Chironominae	+	+	+	--
		Chironomini	+	+	--	--
		Cladopelma/*Cryptotendipes* sp.	--	--	--	+
		Chironomus sp.	+	--	--	--
		Cladopelma sp.	--	+	--	+

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			13	14	15	16
Collection date			27-Jul-98	28-Jul-98	14-Jul-98	28-Jul-98
Sample type			Qual.	Qual.	Qual.	Qual.
ORDER	FAMILY	TAXON				
Diptera	Chironomidae	*Dicrotendipes* sp.	+	+	--	--
		Einfeldia sp.	--	+	+	--
		Microtendipes sp.	+	--	+	+
		Paratendipes sp.	+	--	--	--
		Phaenopsectra sp.	+	--	--	--
		Polypedilum sp.	--	+	--	+
		Stictochironomus sp.	+	--	--	--
		Tribelos sp.	+	--	--	--
		Pseudochironomus sp.	--	+	+	+
		Micropsectra/Tanytarsus sp.[3]	+	--	--	--
		Cladotanytarsus sp.[3]	+	+	--	+
		Rheotanytarsus sp.[3]	+	--	--	--
		Stempellinella sp.[3]	+	--	--	--
		Tanytarsus sp.[3]	+	+	+	--
		Diamesa sp.	+	--	--	--
		Pagastia sp.	+	--	--	--
		Parametriocnemus sp.	+	--	--	--
		Tanypodinae	+	+	--	+
		Clinotanypus sp.	--	+	+	+
		Thienemannimyia group sp.	+	--	+	--
		Ablabesmyia sp.	+	+	+	+
		Labrundinia sp.	--	--	+	+
		Larsia sp.	--	+	--	--
		Procladius sp.	+	+	--	--
		Tanypus sp.	--	+	--	--
	Culicidae	*Anopheles* sp.	+	--	--	--
	Dixidae	*Dixella* sp.	+	--	--	--
	Tipulidae	*Tipula* sp.	+	--	--	--
		Antocha sp.	+	--	--	--
	Athericidae	*Atherix lantha* Webb	+	--	--	--
		Total	76	33	39	52

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**17**	**18**	**19**	**20**
Collection date			**14-Jul-98**	**14-Jul-98**	**14-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Gastropoda[2]	Hydrobiidae	Hydrobiidae	--	--	--	+
	Physidae	*Physella* sp.	--	+	+	+
	Planorbidae	Planorbidae	--	+	+	--
		Gyraulus sp.	--	+	--	--
		Helisoma anceps (Menke)	+	--	--	--
		Planorbella sp.	--	+	+	--
Pelecypoda[2]	Sphaeriidae	Sphaeriidae	+	--	+	+
		Pisidium sp.	+	--	--	+
		Musculium sp.	+	--	+	--
Oligochaeta[2]		Megadrile	--	--	--	+
	Naididae	Naididae	+	+	+	--
	Tubificidae	Tubificidae	--	--	--	+
Hirundinea[2]	Glossiphoniidae	Glossiphoniidae	+	+	--	--
	Erpobdellidae	Erpobdellidae	--	--	+	--
Acari		Hydrachnidia	+	--	+	--
Decapoda	Cambaridae	Cambaridae	--	--	--	+
Isopoda	Asellidae	*Caecidotea* sp.	--	--	+	--
Amphipoda	Hyalellidae	*Hyalella azteca* (Saussure)	+	+	+	+
Ephemeroptera		Ephemeroptera	--	--	--	+
	Leptophlebiidae	Leptophlebiidae	--	--	--	+
		Paraleptophlebia sp.	--	--	--	+
		Caenis diminuta Walker	+	+	--	--
	Baetidae	Baetidae	+	--	--	--
		Baetis flavistriga McDunnough	--	--	--	+
		Callibaetis sp.	+	+	--	--
		Cloeon cognatum Stephens	+	--	--	--
		Fallceon quilleri (Dodds)	--	--	--	+
Odonata	Coenagrionidae	Coenagrionidae	+	--	+	--
		Ischnura sp.	--	+	--	--
	Aeshnidae	*Anax* sp.	+	--	--	--
		Anax junius (Drury)	+	--	--	--
	Libellulidae	*Libellula* sp.	--	+	--	--
Plecoptera	Leuctridae	*Leuctra* sp.	--	--	--	+
	Perlidae	*Perlesta* sp.	--	--	--	+
Hemiptera	Belostomatidae	Belostomatidae	--	+	+	--
	Corixidae	Corixidae	+	+	--	+
		Hesperocorixa sp.	+	+	+	--
		Sigara sp.	+	+	--	+
		Trichocorixa sp.	--	+	--	--
	Gerridae	Gerrinae	--	--	--	+
		Aquarius remigis (Say)	--	--	--	+
		Trepobates sp.	--	--	--	+
	Naucoridae	*Pelocoris* sp.	--	+	--	--
	Nepidae	*Ranatra* sp.	+	--	--	--
	Notonectidae	Notonectidae	+	--	--	--
		Notonecta sp.	+	--	--	--
	Pleidae	Pleidae	--	+	--	--
		Neoplea sp.	--	+	+	--
	Veliidae	Veliidae	--	--	--	+
Megaloptera	Sialidae	*Sialis* sp.	--	--	--	+
Trichoptera	Philopotamidae	*Dolophilodes* sp.	--	--	--	+
		Dolophilodes distinctus (Walker)	--	--	--	+
	Hydropsychidae	Hydropsychidae	--	--	--	+
		Diplectrona modesta Banks	--	--	--	+
		Ceratopsyche slossonae (Banks)	--	--	--	+

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**17**	**18**	**19**	**20**
Collection date			**14-Jul-98**	**14-Jul-98**	**14-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Trichoptera	Hydropsychidae	*Cheumatopsyche* sp.	--	--	--	+
		Hydropsyche betteni Ross/*depravata* Hagen	--	--	--	+
	Lepidostomatidae	*Lepidostoma* sp.	--	--	--	+
	Limnephilidae	*Pycnopsyche* sp.	--	--	--	+
Coleoptera	Dytiscidae	Dytiscidae	+	--	--	--
		Ilybius sp.	+	--	--	--
		Coptotomus sp.	+	--	+	--
		Acilius mediatus (Say)	--	--	--	+
		Graphoderus sp.	+	--	--	--
		Hydroporini	+	+	+	--
		Laccophilus sp.	+	+	--	--
	Gyrinidae	*Dineutus* sp.	+	--	--	--
		Dineutus nigrior Roberts	+	--	--	--
	Haliplidae	*Haliplus* sp.	+	+	+	--
		Peltodytes sp.	+	+	+	--
	Noteridae	*Hydrocanthus* sp.	--	--	+	--
	Hydrochidae	*Hydrochus* sp.	--	+	+	--
	Hydrophilidae	*Enochrus* sp.	--	+	+	--
		Tropisternus sp.	--	+	+	--
	Elmidae	*Dubiraphia quadrinotata* (Say)	--	--	--	+
		Optioservus sp.	--	--	--	+
		Optioservus ovalis (LeConte)	--	--	--	+
	Psephenidae	*Ectopria* sp.	--	--	--	+
Diptera	Chaoboridae	Chaoboridae	+	--	--	--
		Chaoborus sp.	+	--	--	--
	Chironomidae	Chironomidae	+	--	--	+
		Chironominae	+	--	--	--
		Omisus/*Stictochironomus* sp.	--	--	--	+
		Chironomus sp.	--	+	--	+
		Dicrotendipes sp.	+	--	--	--
		Endochironomus sp.	+	--	--	--
		Kiefferulus sp.	+	--	--	--
		Microtendipes sp.	+	--	--	--
		Paracladopelma sp.	--	--	--	+
		Polypedilum sp.	--	+	--	+
		Stictochironomus sp.	+	--	--	+
		Pseudochironomus sp.	+	--	--	--
		Micropsectra/*Tanytarsus* sp.[3]	--	--	--	+
		Micropsectra sp.[3]	--	--	--	+
		Diamesa sp.	--	--	--	+
		Pagastia sp.	--	--	--	+
		Cricotopus/*Orthocladius* sp.	+	--	--	--
		Chaetocladius sp.	--	--	--	+
		Heterotrissocladius sp.	--	--	--	+
		Parametriocnemus sp.	--	--	--	+
		Thienemanniella sp.	--	--	--	+
		Tvetenia sp.	--	--	--	+
		Prodiamesa sp.	--	--	--	+
Diptera	Chironomidae	Tanypodinae	+	+	--	--
		Macropelopia sp.	--	--	--	+
		Thienemannimyia group sp.	--	--	--	+
		Larsia sp.	--	+	--	+
		Trissopelopia sp.	--	--	--	+
		Zavrelimyia sp.	--	--	--	+
		Procladius sp.	+	--	+	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19,Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**17**	**18**	**19**	**20**
Collection date			**14-Jul-98**	**14-Jul-98**	**14-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Diptera	Culicidae	*Anopheles* sp.	+	--	--	--
	Tipulidae	*Dicranota* sp.	--	--	--	+
	Tabanidae	*Chrysops* sp.	--	--	--	+
		Total	45	30	23	59

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

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Station			**21**	**22**	**23**	**24**
Collection date			**28-Jul-98**	**16-Jul-98**	**14-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Gastropoda[2]	Viviparidae	*Viviparus* sp.	--	--	+	--
	Hydrobiidae	Hydrobiidae	--	--	--	+
	Ancylidae	*Ferrissia* sp.	--	+	--	--
	Lymnaeidae	Lymnaeinae	+	--	--	--
	Physidae	*Physella* sp.	--	--	--	+
	Planorbidae	Planorbidae	+	--	--	--
		Gyraulus sp.	+	--	--	+
		Planorbella sp.	+	--	--	--
Pelecypoda[2]	Sphaeriidae	Sphaeriidae	+	+	+	--
		Pisidium sp.	+	--	--	--
		Sphaerium sp.	+	--	--	--
Oligochaeta[2]	Naididae	Naididae	+	--	--	+
		Dero sp.	+	--	--	--
		Stylaria lacustris (Linnaeus)	--	--	--	+
	Tubificidae	Tubificidae	+	+	--	+
Hirundinea[2]	Glossiphoniidae	Glossiphoniidae	--	+	--	+
Acari		Hydrachnidia	+	--	+	+
Decapoda	Cambaridae	*Orconectes* sp.	--	+	--	--
Amphipoda	Hyalellidae	*Hyalella azteca* (Saussure)	+	+	+	+
Collembola		Collembola	--	+	--	--
Ephemeroptera		Ephemeroptera	--	--	--	+
	Leptophlebiidae	Leptophlebiidae	--	+	--	--
	Caenidae	*Caenis* sp.	--	+	--	+
		Caenis diminuta Walker	+	--	+	+
	Baetidae	Baetidae	--	+	--	+
		Centroptilum/*Procloeon* sp.	--	+	+	+
		Acentrella turbida (McDunnough)	--	+	--	--
		Callibaetis sp.	+	--	+	+
		Labiobaetis frondalis (McDunnough)	--	+	--	--
	Heptageniidae	*Stenacron interpunctatum* (Say)	--	+	--	--
		Stenonema femoratum (Say)	--	+	--	--
Odonata	Calopterygidae	Calopterygidae	--	+	--	--
		Calopteryx sp.	--	--	--	+
	Coenagrionidae	Coenagrionidae	+	+	+	+
		Ischnura sp.	--	--	+	+
	Lestidae	*Lestes* sp.	+	--	--	--
	Aeshnidae	*Anax* sp.	--	--	--	+
		Anax junius (Drury)	--	--	--	+
		Basiaeschna janata (Say)	--	--	+	+
		Boyeria vinosa (Say)	--	+	--	--
	Cordulegastridae	*Cordulegaster* sp.	--	+	--	--
		Epitheca sp.	--	--	+	--
	Gomphidae	*Gomphus* sp.	--	--	+	--
	Libellulidae	*Sympetrum* sp.	+	--	+	--
	Macromiidae	Macromiidae	--	--	+	--
Plecoptera	Perlidae	Perlidae	--	+	--	--
Hemiptera	Belostomatidae	Belostomatidae	+	--	--	+
		Belostoma flumineum Say	+	--	--	--
	Corixidae	Corixidae	+	+	--	--
		Hesperocorixa sp.	+	--	--	--
		Palmacorixa sp.	--	--	--	+
		Palmacorixa nana Walley	--	--	+	--
		Sigara sp.	--	+	--	--
		Trichocorixa sp.	+	--	--	+
	Gerridae	*Aquarius remigis* (Say)	--	+	--	--

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			21	22	23	24
Collection date			28-Jul-98	16-Jul-98	14-Jul-98	29-Jul-98
Sample type			Qual.	Qual.	Qual.	Qual.
ORDER	FAMILY	TAXON				
Hemiptera	Gerridae	*Rheumatobates* sp.	--	+	--	--
		Trepobates sp.	--	--	+	--
		Trepobates subnitidus Esaki	--	--	+	--
	Mesoveliidae	*Mesovelia* sp.	+	--	--	--
		Mesovelia mulsanti White	+	--	+	--
	Naucoridae	*Pelocoris* sp.	+	--	+	--
	Notonectidae	*Notonecta* sp.	+	--	--	--
	Pleidae	Pleidae	+	--	--	--
	Pleidae	*Neoplea* sp.	+	+	+	--
	Veliidae	Veliidae	--	+	--	--
		Microvelia sp.	--	+	+	--
Megaloptera	Sialidae	*Sialis* sp.	--	+	--	+
Trichoptera	Hydroptilidae	*Hydroptila* sp.	--	--	--	+
	Philopotamidae	*Chimarra* sp.	--	+	--	--
	Hydropsychidae	*Ceratopsyche slossonae* (Banks)	--	+	--	--
		Cheumatopsyche sp.	--	+	--	--
		Hydropsyche betteni Ross/*depravata* Hagen	--	+	--	--
	Polycentropodidae	*Polycentropus* sp.	--	--	+	+
	Limnephilidae	Pycnopsyche sp.	--	+	--	--
	Uenoidae	Neophylax sp.	--	+	--	--
	Leptoceridae	Leptoceridae	--	--	--	+
		"*Oecetis* sp. A (Floyd, 1995)"	--	--	+	--
		Triaenodes sp.	--	--	--	+
		Triaenodes injustus (Hagen)	--	--	+	--
		Triaenodes marginatus Sibley	--	--	--	+
	Odontoceridae	*Psilotreta* sp.	--	+	--	--
		Psilotreta indecisa (Walker)	--	+	--	--
	Helicopsychidae	*Helicopsyche borealis* (Hagen)	--	+	--	--
Lepidoptera		Lepidoptera	+	--	--	--
Coleoptera	Dytiscidae	Dytiscidae	+	--	--	--
		Hydrovatus sp.	+	--	--	--
	Gyrinidae	*Gyrinus* sp.	--	+	--	--
	Haliplidae	*Haliplus* sp.	--	+	+	--
		Peltodytes sp.	+	+	+	+
	Noteridae	*Hydrocanthus* sp.	+	--	--	--
	Hydraenidae	*Hydraena* sp.	--	+	--	--
	Staphylinidae	Staphylinidae	--	+	--	--
	Hydrophilidae	*Paracymus* sp.	--	+	--	--
	Scirtidae	Scirtidae	--	--	+	--
	Dryopidae	*Helichus basalis* LeConte	--	+	--	--
	Elmidae	*Dubiraphia* sp.	--	+	--	+
		Dubiraphia bivittata (LeConte)	--	--	--	+
		Dubiraphia minima Hilsenhoff	--	+	--	+
		Dubiraphia quadrinotata (Say)	--	+	--	+
		Dubiraphia vittata (Melsheimer)	--	+	--	+
		Optioservus ovalis (LeConte)	--	+	--	--
		Optioservus trivittatus (Brown)	--	+	--	--
		Stenelmis crenata (Say)	--	+	--	--
Coleoptera	Psephenidae	*Psephenus herricki* (DeKay)	--	+	--	--
Diptera	Chironomidae	Chironomidae	--	--	--	+
		Chironomini	--	+	--	--
		Chironomus sp.	+	--	--	--
		Dicrotendipes sp.	--	+	--	+
		Endochironomus sp.	--	--	--	+
		Microtendipes sp.	--	+	--	+

Table A-2. Qualitative results of macroinvertebrate survey with D-framed dipnet at Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio, 1998—Continued

[Data column: +, organism present; --, organism absent. Stations/sites: Station 1, South Fork Eagle Creek at North Perimeter Road; Station 2, Sand Creek at George Road; Station 3, Hinkley Creek at South Patrol Road; Site 4, Hinkley Creek at Newton Falls Road; Site 5, Unnamed tributary at gaging station in Training Area C; Site 6, Sand Creek at Greenleaf Road; Site 7, Pond in Training Area B; Site 8, Beaver Swamp at Load Line 12; Site 9, Pond near Snow Road; Site 10, Sand Creek at Smalley Road; Site 11, South Fork Eagle Creek at Stone Arch Bridge; Site 12, Pond at North Perimeter Road; Site 13, South Fork Eagle Creek in West Hemlock Gorge; Site 14, Quarry at Boy Scout Camp; Site 15, Trout Pond at Newton Falls Road and Route 80; Site 16, Pond at Trout Hatchery; Site 17, Quarry in Block A; Site 18, Wetland North at Demolition Road in Training Area G; Site 19, Wetland South at Demolition Road in Training Area G; Site 20, Unnamed tributary in Training Area H; Site 21, Ed's Pond at Paris Windham Road; Site 22, Sand Creek at Newton Falls Road in Training Area J; Site 23, Water Works Pond 3 near Fuse and Booster Road; Site 24, Hinkley Creek at gaging station in Training Area D]

Station			**21**	**22**	**23**	**24**
Collection date			**28-Jul-98**	**16-Jul-98**	**14-Jul-98**	**29-Jul-98**
Sample type			**Qual.**	**Qual.**	**Qual.**	**Qual.**
ORDER	**FAMILY**	**TAXON**				
Diptera	Chironomidae	*Polypedilum* sp.	+	+	+	+
		Stictochironomus sp.	--	+	--	--
		Pseudochironomus sp.	--	--	+	--
		Paratanytarsus sp.[3]	--	+	--	+
		Rheotanytarsus sp.[3]	--	--	--	+
		Tanytarsus sp.[3]	--	+	+	+
		Cricotopus/*Orthocladius* sp.	--	--	--	+
		Cricotopus bicinctus group	--	--	--	+
		Lopescladius sp.	--	+	--	--
		Parametriocnemus sp.	--	+	--	--
		Tanypodinae	+	--	+	--
		Pentaneurini	--	+	--	--
		Thienemannimyia group sp.	--	+	--	--
		Ablabesmyia sp.	+	+	+	+
		Guttipelopia sp.	+	--	--	--
		Labrundinia sp.	--	--	--	+
		Larsia sp.	+	--	--	--
		Paramerina sp.	--	+	--	+
		Procladius sp.	+	--	--	+
		Tanypus sp.	+	--	--	--
	Culicidae	*Anopheles* sp.	+	+	--	--
	Dixidae	*Dixella* sp.	--	+	--	--
	Athericidae	*Atherix lantha* Webb	--	+	--	--
	Ephydridae	Ephydridae	--	--	--	+
	Tabanidae	Tabanidae	--	+	--	--
		Chrysops sp.	--	--	--	+
		Total	42	69	32	52

The table is arranged in phylogenetic order as assigned by the USGS National Water Quality Laboratory, Biological Unit; [1], Phylum; [2], Class; [3], Tanytarsini; [4], Suborder; --, not sampled at site; Qual., Qualitative sample.