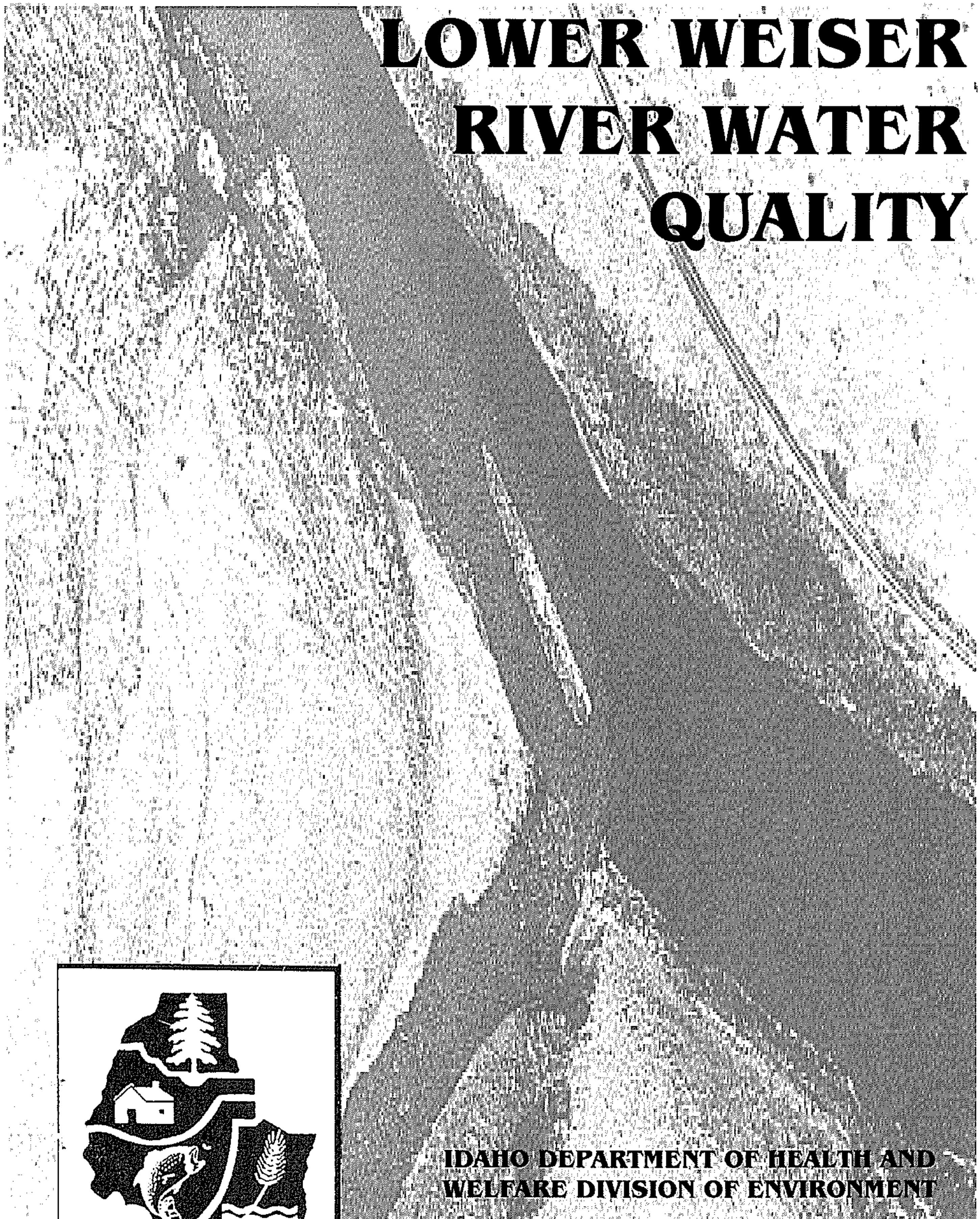
LOWER WEISER RIVER WATER QUALITY



IDAHO DEPARTMENT OF HEALTH AND WELFARE DIVISION OF ENVIRONMENT

1985

WATER QUALITY STATUS REPORT

LOWER WEISER RIVER,

WASHINGTON COUNTY, IDAHO

WILLIAM H. CLARK

1985

IDAHO DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF ENVIRONMENT

Boise, Idaho

In Cooperation with the Weiser River

Soil Conservation District

Weiser, Idaho

Water Quality Series No. 53

TABLE OF CONTENTS

Page

ABSTRACT

The Lower Weiser River (Crane Creek to the mouth at Weiser), Washington County, Idaho and its tributaries and selected irrigation inflows were the subject of a water quality survey conducted by the Idaho Department Of Health and Welfare, Division of Environment for one year during 1983-84. The Weiser River contributes nearly 260,000 tons of annual suspended sediment load to the Snake River. This contribution is equal to 9 percent of the sediment load carried by the Snake River at Weiser. The proposed Galloway Dam could reduce the sediment load to the Snake River by an estimated 111,000-137,000 tons per year. The majority of the suspended sediment load is transported during spring runoff. Agricultural return flows account for less than 1 percent of the suspended sediment in the Lower Weiser River. The agricultural return flows were the divided into the following suspended sediment inputs to the system: Frazier Gulch - 32 percent; Smith Drain - 28 percent; Lower Payette Ditch - 24 percent; Sunnyside Canal - 15 percent; and Unity Drain - 1 percent. Crane Creek, Mann Creek and Monroe Creek also have an inpact on the water quality of the Lower Weiser River accounting for 9 percent of the total suspended sediment input. Streambank erosion is a significant source of sediment to the river. Other pollutants (nutrients, bacteria, pesticides and metals) generally followed the trend of the suspended sediment. Lindane, 2-4D, 2,4,5T, PCP and toxaphene were the major pesticides found in water samples. Analysis of fish tissue showed small concentrations of the breakdown products of DDT, pentachlorophenol and toxaphene primarily. Pesticides found in fish were at levels below the FDA limit and are not believed to pose a threat to human health. Bacterial levels commonly exceeded State standards and were primarily of livestock origin. Mercury was detected in water and fish tissue but not in levels high enough to constitute a public health hazard. Macroinvertebrate collections substantiated the general findings that the lower portion of the river shows a higher degree of disturbance compared with the river above Crane Creek. More pollutant tolerant organisms inhabit the lower reaches of the river.

LIST OF TABLES

Page

LIST OF FIGURES

INTRODUCTION

Various observations, studies and publications have documented poor water quality conditions in the Lower Weiser River both during the "spring runoff" period and the summer irrigation period (Gullidge 1972; U.S. Bureau of Reclamation 1972; Tangarone and Bogue 1975; Young, et al. 1977; Idaho Department of Health and Welfare, Division of Environment (IDHW) 1980b; Weiser River Soil Conservation District (WRSCD) 1982; Bauer 1983; and Idaho Department of Fish and Game 1984). Because of historical water quality problems and the agricultural involvement described below, IDHW, DOE undertook a water quality survey of the river. IDHW (1980b) concluded that the water quality in the Council - Cambridge area (upstream from the present study) was generally good.

The State Agricultural Water Pollution Abatement Plan (Idaho Soil Conservation Commission 1979) identified stream segment priority areas. The only first priority area within the scope of the Boise Field Office, IDHW, DOE listed was the Lower Boise River. Water quality surveys were conducted on this stream segment (Clark and Bauer 1982; and Clark and Bauer 1983). Several second priority stream segments were identified, and the Lower Weiser River was selected for study on the bases of: (1) water quality impacts on the Snake River, (2) water quality impacts on the Lower Weiser River, (3) location of the lower river segment in an intensely farmed area, and (4) the Weiser River Soil Conservation District expressed an interest in working with the problem.

Past Water Quality Studies

Several studies of the water quality or water resources of the Weiser River have been conducted in the past. Sources for water quality data include the following: Idaho Department of Health 1964; Laird 1964; Environmental Protection Agency (EPA) 1973; Houck and Kreizenbeck 1975; Kreizenbeck, et al. 1975; Tangarone and Bogue 1975; Young et al. 1977a, 1977b; DesVoigue and Mills 1978; Falter and Wade 1979; IDHW 1980b; Bauer 1981a and 1981b; WRSCD 1982; and Low 1985. The U.S. Geological

Survey (USGS) publishes annual volumes of water quality data containing information on several Weiser River stations as well as the Snake River and other waters (See Harper et al. 1984 for the most recent issue). In addition, USGS publishes accounts of ground water quality (See Newcomb 1972 for an example). Studies concerning other resources may contain some water quality information, for example: Colbert and Young 1964; U.S. Bureau of Reclamation 1972; U.S. Army Corps of Engineers 1977; Spencer, et al. 1979; Idaho Department of Fish & Game 1984; and Buhler et al. 1984. Pruitt and Nadeau (1978) discussed recommended flows in the Little Weiser River.

Studies are currently being conducted in this area as part of the feasibility study of the Galloway Project (Idaho Department of Water Resources 1985). If this water storage dam is constructed, it would be located in the Galloway area and completed about 1992 (IDWR 1985).

Objectives

The objectives of this water quality study on the Lower Weiser River and its major tributaries are as follows:

1) To determine suspended sediment loadings;

2) To characterize nutrient, bacteria, metal, pesticide and biological parameters; and

3) To identify the sources of suspended sediment, nutrients, bacteria, metals and pesticides.

Drainage Description

The stream segment studied was the Lower Weiser River from the confluence of Crane Creek to its confluence with the Snake River at Weiser, Washington County, Idaho (See Figures 1, 2, and 3). This segment (Midvale to mouth) is designated as #SWB-420 in Idaho Water Quality Standards (IDHW, 1980).

The entire Weiser River drainage in Washington County is composed of 574,592 acres (232,534 hectares) (Cahill 1984). Sub-drainages sampled during our survey were Monroe Creek (39,808 ac; 16,110 ha); Mann Creek (78,464 ac; 31,754 ha); Crane Creek (161,920 ac; 65,528 ha); and Weiser Cove (48,384 ac; 19,581 ha) (Cahill 1984) (See Figure 4). The area is intensely farmed (Figure 9).

Geologically, the Lower Weiser River lies in recent alluvium with much of the Monroe Creek, Mann Creek, and Cove Creek drainages cutting through Pliocene rhyolite (Kirkham 1931) The upper drainages originate in Pliocene Snake River basalt with some granitic intrusives present on the eastern side of the study area.

The upper Weiser River and the upper reaches of Monroe Creek and Mann Creek are forested (See Figure 6) and originate on Payette National Forest Land in Washington and Adams Counties. Crane Creek originates in lower elevations dominated by shrub vegetation. Bear Creek and Cove Creek drain lower lands also.

Descriptions of individual sample stations follow. See Table 1 for locality data and see Figure 1 for station locations.

Lower Weiser River Stations

The Lower Weiser River was selected for study because of the intense agricultural usage of the area and because it was a manageable size for study.

A suitable sample station allowing for integrated depth sampling across the river above the mouth of Crane Creek could not be found. Hence the data for the uppermost station, Weiser River above Crane Creek, is estimated by subtracting the influence of Crane Creek at its mouth from the next main stem station downstream: Weiser River below Crane Creek (at Presley Bridge). The Presley Bridge station was selected because it is the uppermost bridge on the Lower Weiser River. Bear Creek and First Creek enter the river during this reach. The Galloway Diversion Dam is the next downstream sample station after the Presley Bridge station. This site was only used to collect fish for pesticide analysis.

The remaining Weiser River stations were chosen at bridge locations since the bridges were necessary for sampling during high flows. Unity Bridge is a "midpoint" location and is above much of the irrigation return flow to the Weiser River. The bridge is below Smith Drain and Unity Bridge Drain. Cove Creek enters from the south during this reach and is below the Galloway Canal which is on the north side of the river and the Sunnyside Canal on the south side of the river. This bridge is at a 40^{0} angle to the river, so compensation had to be made during flow measurement. The lower station is the State Highway 95 bridge on the south edge of Weiser. This bridge is approximately 0.3 miles above the confluence of the Weiser River and the Snake River. The main inflow below the bridge is Monroe Creek on the north side of the river. So, to obtain the contribution of the Weiser River to the Snake River, the data from Monroe Creek must be added to the Weiser River at Weiser station. The Sunnyside Canal, Frazier Gulch, and the lower Payette River Ditch enter the river from the south side and Mann Creek enters from the north.

Tributary Stations

The uppermost tributary to the Lower Weiser River is Crane Creek (Figure 7). The Crane Creek flow is regulated by discharge from the dam at Crane Creek Reservoir approximately twelve river miles upstream. During the irrigation season Crane Creek can be the major inflow to the Weiser River. Crane Creek, from the source to the mouth, is stream segment SWB-421 (IDHW 1980d) and enters the river from the northeast.

First Creek enters the Weiser River approximately midway between Crane Creek and Presley Bridge from the east side. The creek was sampled several times to characterize its water quality.

Bear Creek enters the east side of the Weiser River at Presley Bridge. Also, like the unnamed creek above, its major flow was during the spring runoff period. These two streams provide minor contributions to the Weiser River. They do not drain irrigated agricultural lands.

Likewise, Cove Creek enters the river from the southeast. It is a larger stream than the two streams mentioned above but is similar in origin and flow regime.

Mann Creek originates on the north side of the river in the Payette National Forest. It forms Mann Creek Reservoir (Spangler Reservoir) approximately eleven miles to the north. A sample station was located below the dam and at the mouth of the creek to characterize inputs in the lower portion of the stream after the settling effects of the reservoir. Mann Creek, from source to mouth, is stream segment SWB-422 (IDHW 1980a) and is a major inflow to the river.

Likewise, Monroe Creek originates in the hills north of the river, flows nearly due south through the city of Weiser, and discharges just west of the Highway 95 Bridge. Figure 12 shows some erosion problems on a dryland farming area in the upper drainage.

Irrigation Inflows

Because of the number of small irrigation inflows to the Lower Weiser River system, only selected ones could be sampled. These were selected for accessibility and diversity.

Smith Drain enters the river from the north above the Unity Bridge. This drain flows year around and is influenced by groundwater inflows. It is impacted during the irrigation season by agriculture.

Unity Bridge Drain enters the river from the south just above the bridge. This drain also carries groundwater and does not seem to have much agricultural impact.

Frazier Gulch enters the river below the Unity Bridge from the south side. It is a very small stream during the irrigation season but carries heavy loads of sediment.

The Sunnyside Canal irrigation return (Figure 8) enters the river below Frazier Gulch. This water is totally regulated and flows only during irrigation season.

The Lower Payette River Ditch flows from the south and contains irrigation water originating from the Payette River. The ditch was sampled above its confluence with the river and above a slough-like settling area installed by the Weiser Soil Conservation District for sediment control. Later, a station was added at its confluence with the Weiser River to determine the efficiency of the settling area.

Irrigation Diversions

There are two main irrigation diversions from the Lower Weiser River: Galloway Canal on the north, and Sunnyside Canal on the south (Figure 1). The Galloway diversion is located about thirteen miles above the river mouth. It carries water from the north side of the river. It parallels the river and heads west past Weiser and into the Weiser Flats area. The Sunnyside Canal serves farms on the south side of the river. The canal takes water from the eastern-most portion of the Lower Weiser River and parallels the river for some distance. On each sample run during the irrigation season, the stage of each of these diversions was recorded so that a water balance could be calculated for the river.

Water quality data for the diversions was provided by Tangarone and Bogue (1975) and was not resampled during this survey. It was assumed that the water quality would be similar to that of the Weiser River at Presley Bridge.

MATERIALS AND METHODS

The water quality surveys were run approximately every two weeks during the irrigation season and three times during the non-irrigation season.

Field parameters were determined with the use of portable meters. Dissolved oxygen and temperature were measured with a Yellow Springs Instrument Company Model 54A meter. The pH was determined with a Photvolt 126A and an Orion Model 231 pH meter. The meters were calibrated at the beginning of each survey and checked for accuracy at the end of the survey.

All chemical samples were collected with DH-48 and DH-59 suspended sediment samplers. (U.S. Interagency committee on Water Resources 1963; and Guy & Norman 1970). Composite samples were collected into a churn splitter. Sub-samples were then dispensed into new one liter cubitainers. One liter was preserved with two ml. of concentrated H_2SO_4 for nutrient analysis; and when trace metals were examined, a liter cubitainer was preserved with 10 ml. of 1:1 distilled HNO_3. For sampling and laboratory quality control, duplicate split samples were taken on several sample dates for both chemical samples and bacteriological samples. This was usually done at the Weiser River at Weiser Station, although, once it was done on Monroe Creek.

Bacterial grab samples were collected into sterile 250 ml. Nalgene bottles. All samples were placed on ice and cooled to 4° C. Chemical and bacteriological analyses were conducted by the State of Idaho, Bureau of Laboratories following Standard Methods (American Public Health Association 1980). Color photographs were taken of a representative stream section and a one liter Imhoff cone sample on most sample dates. These photographs are used to illustrate relative changes in turbidity and suspended sediment concentration as well as water stage.

Flow (discharge in cubic feet per second) was measured with a Marsh-McBirney Model 201 portable water current meter. A bridge board and winch were used during high flows on the Weiser River at Unity Bridge and Highway 95 Bridge stations, as well as the mouth of Mann Creek and Monroe Creek.

The Weiser River at Presley bridge, Crane Creek at the mouth, and Mann Creek below the reservoir have USGS gauges. USGS provided rating tables for flow determination. Galloway and Sunnyside canals had staff gauges and rating tables provided by the Weiser Soil Conservation District for flow determination.

Bedload sediment samples were collected with a Helley-Smith bedload sampler (Helley and Smith 1971; and Emmett 1979). Samples were first air dried, then oven dried, and weighed in the laboratory. It was not possible to measure bedload during high flows. Bedload sediment load (tons/day) was calculated by multiplying dry weight (grams/minute) times stream width (feet), times a factor to convert the result to tons per day as follows:

$$\underset{\text{(tons/day)}}{\text{Bedload sediment}} = \underset{\text{(g/min.)}}{\text{dry weight}} \times \underset{\text{(ft.)}}{\text{stream width}} \times 0.00635$$

Suspended sediment and nutrient loadings were calculated according to "Method A" of Whitfield (1982). In this method the concentration data is assumed to have a unimodal normal distribution and to be independent of discharge. The mean load (L_A) is the product of the mean concentration (c) and the sum of the daily discharges (ΣF_k) (daily discharges are only available for the Weiser River below Crane Creek station. Survey discharges had to be used for the remaining stations):

$$L_A = c\,\Sigma F_k$$

where:

the mean load (L_A) is the product of the mean concentration (c) and the sum of the daily discharges (ΣF_k).

Fish collections for organic (pesticide) analysis were collected with electro-fishing equipment and help from the Idaho Department of Fish and Game. Samples were wrapped in hexane-rinsed aluminum foil and placed on dry ice for freezing. Water samples for pesticides were collected into hexane rinsed, one-gallon, brown glass jugs.

Macroinvertebrates were collected on the Weiser River above Crane Creek and at the Lower Weiser River station to characterize the benthic community and the impact of agricultural return flows on it. Five samples were taken at each station with a Hess sampler.

The period of our study was divided into two nearly equal time periods in an attempt to determine the effects of irrigated agriculture on the water quality of the Lower Weiser River. April 15 through October 15 was considered to be the "Irrigation season" although this may vary somewhat between years. The period from October 16 to April 14 was considered the "non-irrigation season"; water flow present in agricultural drains during this period is considered the base flow or groundwater runoff (Novotny & Chester 1981). This method worked well on the Lower Boise River Drains (Clark and Bauer 1982, 1983). The Boise River is regulated by Lucky Peak Dam while the Weiser River is unregulated. On the Weiser River, the flows and sediment loadings for the first portion of the irrigation season (April-June) are heavily influenced by Weiser River runoff (Figure 13).

Complete water quality data for this survey is on file with the Division of Environment, Boise.

<u>Quality Control</u>

The Idaho Department of Health and Welfare, Bureau of Laboratories has an ongoing, extensive quality control program to assume precision and accuracy of sample analyses within the laboratory.

Field sampling and laboratory quality assurance were also measured on each survey by the collection of duplicate chemical and bacteriological samples at the Weiser River at Weiser (Highway 95) station.

RESULTS AND DISCUSSION

SEDIMENT

Suspended Sediment

Suspended sediment consists of solid material (mineral or organic) that is in suspension and is being transported by water 3 inches (7.5 cm) above the stream bottom to the top of the water column. Suspended sediment is used as an indicator or key parameter for water quality studies involving agricultural return flows (Clark and Bauer 1982) and is important to land management agencies, landowners, and the State's Division of Environment. Soil retained on the land will benefit the landowner and the stream water quality.

The suspended sediment loadings in the Lower Weiser River show an opposite response to those of the Lower Boise River compared on an annual basis (Clark & Bauer; 1982 and 1983) over time (see Figure13). On the Lower Boise River (a regulated stream) suspended sediment loadings are high during the summer when agricultural return flows are major sediment contributors. The Lower Weiser River by contrast is an unregulated stream. The major suspended sediment loadings occur during peak runoff and other high river flows during "spring runoff" which, from a hydrologic standpoint, may occur anytime from December through June. Figure 13 shows that the highest suspended sediment loadings occured during peak runoff (April 25, 1983) and during the spring runoff period (March 23 - June 7, 1983). The survey was conducted in a year (1983) which exceeded average precipitation (Tables 17 and 19). Daily precipitation for Weiser during 1983 is shown in Table 20. The precipitation occured mainly in November, March, January and October.

The Weiser River is a significant impact on the Snake River (Figure 14 and Table 2). During 1983, the Weiser River at the Highway 95 Bridge sample station contributed an average of 9 percent (708 tons/day) of the suspended sediment load to the Snake River which averages (7585 tons/day (Figure 14). To obtain a total Weiser River contribution to the Snake River, the loading from Monroe Creek must be added. This gives an annual grand total annual suspended sediment loading to the Snake River of 711.4 tons/day or 259,662 tons/year (Table 3). This was calculated using the Weiser River Highway 95 Bridge station and the U.S. Geological Survey (USGS) station located below the Weiser River. This is especially significant when comparing the drainage areas of the two drainages: approximately 69,200 mi^2 (179,230 Km^2) for the Snake River at Weiser, and approximately 1,460 mi^2 (3,780 km^2) for the Weiser River at Presley Bridge (Harper et al. 1984). The total drainage area downstream at the Highway 95 Bridge would be somewhat longer. The Weiser River makes up approximately 2 percent of the drainage area of the Snake River at Weiser and thus provides a disproportionate amount of the sediment load. Stream storage of sediment along the Snake River was not taken into account for this estimate. Idaho Department of Health (1964) showed that the Weiser River accounted for approximately 9 percent of the total flow at the Snake River gauging station below Weiser.

The suspended sediment loadings in the Weiser River varied from a minimum of 4.7 tons/day during summer low flows to a maximum of 6,760 tons/day during peak runoff periods. The total annual suspended sediment loading for the Weiser River for calendar year 1983 was 258,238 tons. This is significantly greater than the 80,000 tons/year reported for the regulated Boise River (Clark and Bauer 1982).

The drought year of 1977 provided an opportunity to view Idaho surface water quality under low flow conditions. These conditions would approximate conservative water use by agriculture because of reduced flow and a corresponding reduction in suspended sediment and give an indication of the importance of nonpoint source pollution in the State (Bauer 1983). The Lower Weiser River was one of the rivers which showed improved water quality during the 1977 low water year (Bauer 1983).

Suspended sediment loading for the three Weiser River stations are shown in Figure 15 and Table 3. This figure and table illustrate the importance of the tributary and irrigation inflow contribution of sediment between Unity Bridge and the mouth of the Weiser River. The total annual suspended loadings for the stations are: Weiser River below Crane Creek - 152,018 tons; Weiser River at Unity Bridge - 154,794; and Weiser River at the mouth (including the Monroe Creek contribution) - 259,662 tons. The Little Weiser River is believed to be the major source of sediment to the Weiser River above Crane Creek, but annual sediment loadings have not been published (Tangararone and Bogue 1975; and IDHW 1980b). The relative importance of the five irrigation inflows sampled are shown in Figure 16. The combined irrigation inflows accounted for less than 1 percent of the total suspended sediment loading to the Weiser River. This contribution is not significant when compared to the total Weiser River sediment load, but because high suspended sediment concentrations are found during the summer low flow conditions, a chronic turbidity condition is created for the river over and above the "natural" background turbidity to which the aquatic life has become adapted. The turbid condition has an adverse effect on aquatic life.

The five irrigation inflows contributed a total of 353 tons of suspended sediment to the Lower Weiser River during 1983. Frazier Gulch had the highest annual loading of 113.5 tons; followed by Smith Drain - 98 tons; Lower Payette River Ditch - 84 tons; Sunnyside Canal - 52 tons; and Unity Drain - 5.2 tons (Table 4). The tributaries to the Lower Weiser River (Crane Creek, First Creek, Bear Creek, Cove Creek, Mann Creek and Monroe Creek) contribute about 9 percent of the total annual suspended sediment load. This amount exceeds 23,000 tons (Table 4).

A major factor in the suspended sediment situation on the Weiser River will be the construction of the Galloway Dam. If the dam is constructed, it can be expected to have a significant effect on the Lower Weiser River. Several surveys of reservoir sedimentation in the United States have been made (Dendy et al. 1967 and 1973; Dendy 1974; and Dendy and Cooper 1984). Dendy (1974), in a survey of 17 small reservoirs from 3.9 to 3237 acre feet in size, found sediment trap efficiencies ranging from 81-98 percent. The sedimentation in reservoirs results in a depletion of reservoir storage capacity. If Dendy's figures are applied to the Weiser River suspended sediment data for the Presley Bridge station (the nearest sample station to the proposed damsite), then sediment reduction estimates can be made. The current suspended sediment and the estimated suspended sediment reduction by the proposed Galloway Dam would be as follows:

Current Contribution

Weiser River Below Crane Creek:	152,018 tons/year

Estimated Contribution

With 81 percent reduction:	28,883 tons/year
With 98 percent reduction:	3,040 tons/year

This estimated suspended sediment reduction upstream would result in the following reductions at the confluence of the Weiser and Snake Rivers:

Current Contribution

Weiser River, Mouth:	259,662 tons/year

Estimated Contribution

With 81 percent reduction:	136,527 tons/year
With 98 percent reduction:	110,684 tons/year

Using the above data and 1983 suspended sediment values, it is estimated that 123,000 to 149,000 tons per year would be deposited behind the Galloway Dam.

Bedload Sediment

Bedload sediment is sediment that is transported on or near the streambed. Sediment moving 3 inches (7.5 cm) above the streambed is part of the bedload. Sampling at the river and tributary stations was limited to low flow periods because of the use of a hand held bedload sampler. Not all stations were sampled for bedload, especially if they were at low flow, had a low turbidity, and no visible bedload was being transported.

The bedload sediment data for tributaries and irrigation returns are found on Table 18. Measurable bedload sediment did not exist on all stations sampled. The tributaries on the east side of the study area (First Creek, Bear Creek and Cove Creek) contributed nearly 75 percent of the measured bedload sediment (Table 18).

Bedload was only significant during spring (March and April samples) reflecting the dryland farming practices that predominate in this area. During the rest of the year the streams are at very low flow regimes. Sufficient data on bedload sediment in this area does not exist but it appears that it comprises approximately one percent of the total sediment load of the Lower Weiser River.

The bedload sediment found in the agricultural drains was highly variable and probably dependant on individual landowner watering schedules and practices. Bedload sediment was not as significant as was found in some of the Lower Boise River Drains where the contribution ranged from 20-200 percent of the total sediment loading (Clark and Bauer 1982 and 1983).

Streambank Erosion

Streambank erosion is a natural phenomenon in the scour and fill processes of a river (Leopold and Maddock 1953; Emmett and Thomas 1978; and Andrews 1982).

Streambank erosion has been believed to be a major source of sediment to the Lower Weiser River (Weiser River Soil Conservation District (WRSCD) 1982). Figures 9 and 10 show examples of streambank erosion on the Lower Weiser River. WRSCD (1982) estimated that one large undercut bank that fell into the river during their study near the mouth of Sunnyside Canal contained an estimated 21,000 tons of "soil." The report noted that similar banks were found elsewhere along the river.

The WRSCD conducted a Lower Weiser River Channel Erosion Study during 1983. A reach of the river was analyzed from river mile 4.4 to 8.1 and extrapolated to the entire 13 miles (20.8 km) of the Lower Weiser River below the Galloway Diversion Dam. An estimated 29,000 tons/year were obtained by this method (Table 5). The material is all recent alluvium, but the size fraction is not known. Therefore, the percentage of the material that will appear in the suspended sediment and bedload sediment fractions is unknown, but it appears that the streambank sediment contribution is significantly (98 percent) larger than the total contribution of the irrigation return flows during 1983. A portion of this bank sediment will remain in the stream in storage (Table 4). This streambank contribution is a major source of sediment to the Lower Weiser River.

Martin (1984) surveyed streambank erosion along Rock Creek in Twin Falls County, Idaho. He estimated that, in the four areas studied, 62,606 tons of sediment were contributed to Rock Creek during 1984. Martin (1984) also points out that the 1984 spring runoff period was a 100-year event. He found that 61 percent of the bank material was classified as silt loam and 39 percent was sand and gravel. The survey was confined to four problem areas along Rock Creek.

Not much can be concluded concerning streambank erosion except that it appears to be very variable and is a major source of sediment to the Lower Weiser River.

Total Sediment

The total sediment load for the Weiser River survey would, in theory, be determined by adding the bedload sediment values, to suspended sediment values and the sediment contribution of the eroding streambanks. The bedload and streambank erosion values are so variable and so incompletely known that the sediment values will represent the total sediment loading.

NUTRIENTS

Nutrients are a major concern when examining the water quality of a stream. An excess supply of nutrients may cause a "polluted" stream containing an over-abundance of plant and animal biomass, especially of undesirable species or communities. The nutrients examined during this survey are phosphorus and nitrogen.

Phosphorus

To prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphorus as phosphorus (P) should not exceed 0.05 mg/l in a stream where it enters a lake or reservoir (U. S. Environmental Protection Agency 1977). Since the water will enter the Snake River and eventually several reservoirs, this criteria could have some significance. A desired goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments is 0.1 mg/l total phosphorus (MacKenthun 1973). Although instream criteria are difficult to obtain and may not apply equally to all surface waters, a range of 0.05-0.01 mg/l of total phosphorus is a good indicator concentration for the Weiser River. Total phosphorus levels exceed the values at all sample stations for nearly all dates sampled.

The importance of the Weiser River as a source of total phosphorus to the Snake River varies from 1 to 29 percent (Table 2). The total annual contribution during the present survey was 768 tons (Table 3). The annual loading for the Weiser River stations was as follows: below Crane Creek - 420 tons; Unity Bridge - 548 tons; and at Weiser - 761 tons (plus 7.3 tons Monroe Creek contribution) (Table 3). From these data it can be determined that 348 tons (45 percent) of the total phosphorus of the Lower Weiser River enters the reach below Crane Creek. Of this amount only a minor portion (1.6 tons) was related to the irrigation inflows directly sampled (Table 4). The tributary streams make up a larger portion of the total phosphorus contribution but still only account for 59 tons (17 percent) discounting the 34.2 tons contribution of Crane Creek which enters above the first river station sampled (Table 4). This leaves approximately 80 percent of the total phosphorus entering the Lower

Weiser River unaccounted for by the tributary and irrigation inflow sampling. Much of the discrepancy can be attributed to the contribution of river bank erosion and a less significant amount to the irrigation drains that were not sampled.

Nutrient loss to irrigated lands results in higher costs and loss in crop yield to the landowner. By using the following formula, the 1982 value of the total phosphorus discharged into the Snake River at Weiser can be estimated (from Clark and Bauer 1982):

TP X 2.3 X $0.25 = Fertilizer value of TP

TP = Total phosphorus in pounds.

2.3 = Factor which converts the TP to its fertilizer equivalent of P_2O_5.

$0.25 = 1982 cost per pound of the fetilizer.

An annual estimated value (based on current application costs for the TP) is $883,545. Of this amount, however, only $1,840 is attributed to the loss in the five irrigation drains sampled. The amount is more significant if application costs are calculated and if loss in crop yields are included.

Inorganic Nitrogen

Nitrogen is another important nutrient and can cause water quality problems when it occurs in excess. A concentration of total inorganic nitrogen (nitrate, nitrite, and ammonia) of 0.3 mg/l is considered the limit for preventing the development of biological nuisances and the acceleration of cultural eutrophication (IDHW 1980c). Nitrate usually comprises the major portion of total inorganic nitrogen and is often the only form of nitrogen considered when evaluating the 0.3 mg/l limit. The agricultural inflows usually exceeded the 0.3 mg/l limit, while the Weiser River was usually under the limit. Past studies have indicated that little can be done to reduce inorganic nitrogen (dissolved form) loss from irrigated lands (Clark and Bauer 1982 and 1983; and Martin 1984).

METALS AND OTHER WATER QUALITY PARAMETERS

Metals

Trace (heavy) metals were monitored in the water column on an approximate quarterly basis (Tables 6-8). Mercury was of special interest because of the known deposits in the area (Ross 1956) (See Figure 5 for a map of the proximity of these deposits to the study streams) and because of the toxicity of the element (Greeson 1970; and Ferens 1974). Larson (1983), as well as others, has documented the influence of geology on the chemical composition of rivers. This is shown in the results of the April 26, 1983, Cove Creek sample shown below. The results of mercury analyses in water samples were erratic (Tables 6-8). Positive samples were obtained at the following stations:

STATION	HG (µg/l)	DATE
Weiser River, Weiser	2.4	August 2, 1983
Weiser River, Presley Bridge	0.7	March 23, 1983
Monroe Creek, mouth	1.6	March 23, 1983
Mann Creek, below reservoir	0.7	March 23, 1983
Mann Creek, mouth	1.5	March 23, 1983
Cove Creek, mouth	5.5	April 26, 1983

Cove Creek had the highest value of the water samples. Its drainages began in the area of the largest mercury deposits (Figure 5).

Often mercury concentrations in water are at detection limits (Hildebrand et al. 1980), so fish make a good indicator of mercury presence. Apparently most fish obtain mercury from the water as tissue accumulation by ingestion (Olson, G. F., et al. 1975). Huckabee et al. (1979) indicate that food and water are major sources of mercury to fish. Fish were collected on August 18-19, 1983 for pesticide and mercury analysis. The edible portion of the fish tissue was analyzed and mercury ranged from 0.05 to 0.75 mg/kg wet weight ($\bar{x}$ = 0.21; n = 43). None of the fish sampled were negative for mercury. None of the fish exceeded the 5 mg/kg recommended limit for human consumption set by the U.S. Food and Drug Administration (1979). Two fish with high values were: (1) a channel catfish (0.75 mg/kg) and (2) a carp (0.53 mg/kg). Gebhards, et al. (1970) surveyed 160 fish in 19 species within 18 separate areas of Idaho. They found mercury in 98% of the fish tested. The values found by the present survey are within the range of values obtained by Gebhards and associates. Apparently, mercury is a commonly occuring metal in Idaho fishes.

Buhler et al. (1984) examined mercury levels in soil, sediments, and fish tissue. They found mean values of mercury in Weiser River sediments to be 0.054 mg/kg (dry weight) and 1.30 mg/kg for the sediments in small tributary streams. Crane Creek sediments averaged 0.94 mg/kg. Bear Creek sediments had mercury concentrations of 0.90 mg/kg. Soil samples taken in the vicinity of the proposed Galloway Reservoir site had mercury concentrations averaging from 0.083 to 0.108 mg/kg.

Buhler et al. (1984) used sample data obtained by the IDHW, DOE in the current study to demonstrate mercury levels in fish. However, their sample of fish in Crane Creek provided data for a tributary that we were unable to sample. For the Crane Creek sample, they found a mean concentration of 0.096 mg/kg (wet weight) mercury for all fish (n = 11). They found the following mean concentrations for individual species: black crappie - 0.086 mg/kg; carp - 0.158 mg/kg; and largescale sucker - 0.047 mg/kg. Their obtained values were generally less than those found in the current sampling.

Mann Creek fish were sampled (Buhler et al. 1984) and found to contain an overall mean of 0.130 mg/kg (wet weight) (n=19). A mean of 0.235 was derived from data obtained from our sampling of fish in Mann Creek in 1983. By removing the high value (0.75 mg/kg - channel catfish), the obtained mean is the same as that obtained by Buhler et al. (0.132 mg/kg) (n = 5).

For comparison, Buhler et al. (1984) examined 20 fish (6 species) from Lucky Peak Reservoir (Boise River Drainage). They found higher mean values for mercury (0.239 mg/kg) in those samples than in the Weiser River drainage samples. No explanation was offered for this apparent difference.

Philips and Buhler (1980) found total mercury concentrations of 1.1 to 1.4 mg/kg in rainbow trout stocked in Antelope Reservoir (Southeastern Oregon) and attributed the levels to mining activities in the Silver City, Idaho area. Mercury was used in gold processing in Jordan Creek.

Other Water Quality Paramenters

Table 15 lists nocturnal temperature, dissolved oxygen and pH measurements made the night of August 10 -11, 1983. As can be seen from the table there is no dissolved oxygen problem during the night. Dissolved oxygen was above the 6 mg/l State Standard (IDHW 1985). The pH was within the range of 6.5 - 9 of the State water quality standards (IDHW 1985). Temperatures in the lower river are high (27° C was the maximum recorded during the survey, September 1, 1983 at 1900 hours). Water temperatures of 22° C or less are required for cold water biota and 13° C or less for salmonid spawning (IDHW 1985).

Table 16 shows a comparison of Weiser River water quality for a station above Crane Creek taken by the Bureau of Land Management. Data obtained from stations below Crane Creek and at Weiser from the same date are included for comparison. An indication of the impact of Crane Creek (increase in turbidity of 98 percent) and of the inflows to the Lower Weiser River (increase in suspended sediment of 54 percent and of mercury of 100 percent) can be seen from the table.

BACTERIA AND PESTICIDES

Bacteria

Fecal coliform and fecal streptococcus bacteria are found in the intestinal tract of warm-blooded animals and are, therefore, used as indicators of contamination and the possible presence of other disease-causing organisms. The Idaho Water Quality Standards (IDHW 1985) protect the Lower Weiser River for primary contact recreation. For consistency, the standards for primary contact recreation will be used for instream criteria for all the sample stations in this report, although these standards may not apply in a legal sense. Standards for primary contact recreation specify that the geometric mean for fecal coliforms shall not exceed 50/100 mls or 500/100 mls at any one time.

A summary of the bacterial data collected on the Lower Weiser River and its tributaries is presented in Table 9 and indicates that most, if not all, of the contamination results from livestock activities. Comparing the ratio of fecal coliform bacteria to fecal streptococcus bacteria provides an indication of the source of bacteria. A fecal coliform/fecal streptococcus ratio less than 0.7 is indicative of animal wastes; a ratio which exceeds 4 is an indicator of contamination from human wastes (Clausen et al. 1977).

Table 9 shows that Crane Creek has an influence on the Weiser River by apparently causing an increase in bacteria below the confluence of the two water courses. The tributary with the greatest bacterial input is Monroe Creek. Monroe Creek enters the Weiser River below the lowest sample station, so its influent is not reflected in the Weiser River near Weiser data (Table 9).

The irrigation return flows show the highest concentrations of bacteria (Table 9) as might be expected. Sunnyside Canal had the highest fecal coliform value for the survey (54,000/100 ml) and Frazier Gulch had the highest fecal streptococcus density (17,000/100 ml). The data for the Lower Payette ditch show that the bacterial levels leaving the settling pond area are larger than the incoming ditch water. This indicates that the pond area is no longer functioning as it was planned.

The State standard for primary contact recreation (single sample) was exceeded on four of the six irrigation return flow sample stations at all times indicating influence from livestock. Only Smith Drain and Unity Drain ever had times when they were within the standard (Table 9).

First Creek, Bear Creek and Cove Creek show no major bacterial problems.

The Weiser River below Crane Creek exceeded the 50/100 ml standard for fecal coliforms 87 percent of the time, again, showing the influence of Crane Creek on the river. The standard was exceeded 40 percent of the sample dates at Unity Bridge and 60 percent of the sample dates for the Weiser River at Weiser.

Pesticides

A variety of pesticides were sampled for and found in both water samples (Table 10) and in fish tissue (Table 11) in August 1983. Pesticides were detected (usually at low concentrations) at all of the river, tributary and irrigation inflow stations sampled. The most commonly found pesticide (36 percent occurrence) in the water column was 2,4D. Lindane, PCP, and 2,4,5T were next in order of frequency, each being found in 27 percent of the stations sampled. Toxaphene, dicamba and B-BHC were each found at two stations. Silvex, oxychlordane, heptachlorepoxide and tordon were only found at one station each.

The edible portion of fish tissue is a good indicator for pesticides since fish accumulate the chemicals. The results then are comparable to U. S. Food and Drug Administration standards (USFDA 1979). A broad range of these chemical was detected in the tissue of several fish species (Table 11). The most frequent pesticides encountered were analogs of DDT (100 percent occurrence) and Pentachlorophenol (95 percent occurrence). Concentrations were relatively small, however, and did not exceed the 5 mg/kg limit set by FDA. The maximum level of Total DDT and its analogs found was 0.349 mg/kg; Pentachlorophenol was 0.012 mg/kg and Toxaphene was 1.9 mg/kg. The levels found are not high enough to constitute human health problems. Much higher levels of pesticides have been found in fish tissue in the Lower Boise River drains (Clark and Bauer 1982; 1983).

The very low ratio of DDT to its breakdown products indicates that the chemical is not now being used in the Weiser River area, but that persistent residuals are still present.

FISH AND MACROINVERTEBRATES

Fish

A total of 14 species of fish was observed in the Lower Weiser River (Table 12), its tributaries, and drains during August 1983. The fish were collected for pesticide and metal analysis as well as for species composition data. The species collected were: Salmonidae -- mountain whitefish (Prosopium williamsoni); Cyprinidae -- chiselmouth (Acrocheilus alutaceus), carp (Cyprinus carpio), northern squawfish (Ptychocheilus oregonensis), longnose dace (Rhinichthys cataractae), redside shiner (Richardsonius balteatus); Catostomidae -- largescale sucker (Catostomus macrocheilus), mountain sucker (Catostomus platyrhynchus); Ictaluridae -- channel catfish (Ictalurus punctatus), tadpole madtom (Noturus gyrinus), pumpkinseed (Lepomis gibbosus), warmouth (Lepomis gulosus), smallmouth bass (Micropterus dolomeiui), and sculpin (Cottus sp.). The fish names used in this study follow those used by Simpson and Wallace (1978).

Mercury and pesticides found in fish tissue were discussed earlier in this report.

Macroinvertebrates

Macroinvertebrates are the larger (>thirty mesh) invertebrates (predominantly insects, but including such groups as snails and worms) found living in streams and rivers. They are important as water quality indicators since they spend all or part of their life cycles in the water and thus reflect long-term conditions. Although accurate for many situations, chemical and physical analysis alone can't give enough biological information to predict long-range effects or to monitor change over time.

The study area was bracketed by upstream samples (Weiser River above Crane Creek) and downstream samples (Weiser River near Weiser in late summer 1983.

Winget and Mangum (1979) have developed a biotic condition index resulting in macroinvertebrate tolerance quotients (TQ). These numbers reflect a taxon's tolerance to levels of alkalinity, sulfate, sediment and stream gradient. Tolerance quotients range from 2 to 108. The more tolerant a particular taxon is to environmental stress, the higher the index number. If an organism has a high TQ it does not mean that it is restricted to a polluted habitat. Tolerance quotients of Winget and Mangum (1979) are presented for the macroinvertebrates collected at the Weiser River above Crane Creek and Weiser River near Weiser (Tables 13 and 14). TQ's are given for all but three organisms at each station. These organisms were not encountered by Winget and Mangum (1979), but it appears that each would be at or near the high end of the TQ scale.

Means taken of the TQ's at a given locality give a Community Tolerance Quotient (CTQ). The CTQ value for the upstream station (Weiser River above Crane Creek) was 60.5 (n = 16, range 2 to 108), while the CTQ value for the lower station was 92.4 (n = 28, range 24 to 108) (Figure 17). The more fragile taxa (TQ < 24) have been eliminated from the lower station. These data clearly show a degradation in water quality downstream. The upper station contained 5 pollution tolerant taxa (31 percent) while the lower station contained 20 pollution tolerant taxa (71 percent). The data show that the lower reach of the Weiser River is under a significantly greater amount of environmental stress. Presumably this is the result of increased sediment and associated materials as well as elevated water temperature.

The macroinvertebrates collected during the present survey were divided into functional feeding groups (trophic groups) based on Merritt and Cummins (1984); Pennak (1978); and Edmondson (1959) (Tables 13 and 14; and Figures 18 and 19). This system of classification is based on morpho-behavioral mechanisms of food acquisition. Food intake will change from season to season, habitat to habitat, and with the growth state of the organism. In addition, most aquatic organisms are ominivorous, but they can still be classed according to their major feeding habits. Hence the most common method of food acquisition is listed for a taxon or, as in some cases, multiple categories are listed to adequately describe the orgaism. The functional group classification distinguishes aquatic organisms that perform different functions within aquatic ecosystems with respect to the processing of nutritional resource categories.

The present study was conducted on a river of larger order; smaller headwater streams were not included in the study. Hence, no great differences were found between the trophic groups of the upper and lower sample stations. Both stations are dominated by the collector, scraper, and gatherer groups that feed primarily on the fine particulate matter and periphyton of mid-sized and larger rivers.

The functional group known as scrapers did not increase in taxa downstream as might be expected (Figures 18 and 19). The increase in turbidity and sediment downstream may account for this decrease in taxa. The scraper group did, however, increase in total numbers (Tables 13 and 14; Figures 20 and 21). The other major changes between the upper and lower stations are as follows: collectors dropped from 42 percent to 31 percent; filterers were reduced from 32 percent to 5 percent; and predators increased from 4 percent to 21 percent (Figures 20 and 21). The reduction in collectors was primarily caused by a change in _Hydropsyche_ populations. The dramatic reduction in numbers of filterers was due to smaller Trichoptera populations near Weiser. The predator populations increased downstream with an increase of the following pollution tolerant predatory Diptera and the addition of Hirudinea and Odonata.

CONCLUSIONS AND RECOMMENDATIONS

The Lower Weiser River transports a large amount of suspended sediment and other pollutants. The majority of this transport occurs during spring runoff. Approximately 9 percent of this sediment is contributed by the tributaries to the Lower Weiser River. The agricultural contribution to the total suspended sediment load is estimated at less than 1 percent; yet, this may be important because it contributes to a chronic sediment problem in the river.

From past studies the estimated reduction in pollutants from improved agricultural practices (BMP's) is:

Suspended sediment	75%
Phosphorus	30 - 40%
Bacteria	70%
Toxics (pesticides & metals)	65%

Based on the water quality survey the following specific recommendations are made:

1. The major sediment load to the Lower Weiser River is from the watershed above the confluence of Crane Creek. This area should be a very high priority for land use management practices for erosion reduction.

2. The stream bank stability problem should be addressed, but care must be taken when employing any potential solutions to this problem so that additional problems, either up or downstream, are not created.

3. The watershed above Crane Creek Reservoir should be subjected to erosion reduction practices. Because of the colloidal nature of the sediment, it is very difficult to treat after it reaches a water course.

4. The present State cost share grant project on the Lower Weiser River should be completed. Installation of Best Management Practices (BMP's) on the farms within the Lower Weiser River drainage will both preserve the soil for agricultural purposes and reduce significantly the pollution input into the Lower Weiser River and the Snake River.

5. The Weiser Soil Conservation District, as a part of the State cost share program, should work with the local landowners to manage pesticide use according to the manufacturer's label instructions and the Environmental Protection Agency's guidelines for container disposal.

6. A buffer strip of streamside vegetation should be allowed to grow on the banks of any water courses not now supporting such growth. This will help reduce sediment in the stream, will help stabilize the banks and provide fish habitat. This will also have the additional advantage of providing wildlife habitat. Fencing may be required.

7. Any drainages from confined livestock operations that presently discharge into the river, its tributaries, and drains should be eliminated. This would help eliminate bacteria, nutrients and sediment to the Lower Weiser and Snake Rivers.

8. The sediment retention facility on the Lower Payette Ditch should be upgraded and maintained.

9. A water quality assessment must be made following application of best available management practices to determine the effectiveness of those practices.

ACKNOWLEDGEMENTS

I thank the following persons for assistance with field surveys: Steve Bauer, Lloyd Bradshaw, Art Correia, RaNae Hardy, Greg Heitman, Dan Herrig, Frank Kline, Larry Koenig, Jane Luther, Monty Marchus, Pat Olmstead, Barry Pharaoh, Pat Rayne, Will Reid, Craig Shepard, Karen Stringer, Elton Tarter, and George Varin.

Mark Jensen provided the channel erosion data for the Lower Weiser River. Steve Bauer, RaNae Hardy, Greg Heitman, and Don Martin assisted with data analysis. Colleen Sweeney assisted with word processing, data analysis, and review of this report. Steve Bauer, Frank Kline and Ken Schuster provided valuable comments on the draft report.

The following organizations assisted with various aspects of this study: United States Department of Agriculture, Soil Conservation Service and the Weiser Soil Conservation District, Water Quality Planning Project; Idaho Department of Health and Welfare Bureau of Laboratories, Bureau of Water Quality and Boise Field Office; Idaho Department of Fish and Game; United States Department of Interior, Fish and Wildlife Service; Bureau of Land Management; United States Department of Defense, Army Corps of Engineers; and the United States Environmental Protection Agency.

LITERATURE CITED

American Public Health Association 1980. Standard methods for the examination of water and wastewater. American Public Health Association, American Water Works Association, Water & Pollution Control Federation, Washington, D.C. 15th Edition. 1,134 pp.

Andrews, E. D. 1982. Bank stability and channel width adjustment, East Fork River, Wyoming. Water. Resour. Res. 18:1184-1192.

Bauer, S. B. 1981a. Attached algae biomass (periphyton) at Water Quality Trend Stations, 1978 and 1979. IDHW-Division of Environment, Boise. 11 pp.

________ 1981b. Stream bottom samples (Macroinvertebrate) from Water Quality Trend Stations, 1978 and 1979. IDHW-Division of Environment, Boise. 29 pp.

________ 1983. Summary of Agricultural Water Quality Problems in Idaho. IDHW-Division of Environment, Boise. 16 pp.

Buhler, D. R., R. L. Reed, and R. S. Caldwell. 1984. An assessment of projected mercury levels in the proposed Galloway Dam project on the Weiser River, Idaho. U. S. Army Corps of Engineers, Walla Walla, WA, 107 pp.

Cahill, J., Jr. 1984.. Pre-application for Weiser River subwatershed planning unit Idaho Agricultural Water Quality Program. Weiser Soil Conservation District, Weiser, ID. 18 pp.

Clark, D.R., and A. J. Krynitsky. 1983. DDT: Recent Contamination in New Mexico and Arizona? Environment. 25(5): 27-31.

Clark, W.H., and S.B. Bauer. 1982. Water Quality status report, Conway Gulch, Canyon County, Idaho. Water Quality Series 50. IDHW-Division of Environment, Boise. 61 pp.

———— 1983. Water quality status report, Lower Boise River Draines, Canyon County, Idaho. Water Quality Series 50. IDHW-Division of Environment, Boise. 101 pp.

Clausen, E.M., B.L. Green, and W. Litsky. 1977. Fecal streptococci: indicators of pollution IN: A. W. Hoadley and B.J. Dutka, Eds. Bacterial indicators/health hazards associated with water. American Society Testing Materials No. 635: 247-264.

Colbert, J. L., and L. L. Young. 1964. Review of Waterpower Withdrawals in Weiser River Basin, Idaho. U.S. Geol. Surv. Open-file Rpt. 64-39, 34 pp.

Dendy, F. E. 1974. Sediment trap efficiency of small reservoirs. Trans. ASAE 17:898-901 and 908.

————, W. A. Champion, and R. B. Wilson. 1973. Reservoir sedimentation surveys in the United States, pp. 349-357. IN: W. C. Ackermann et al. eds. Man-made lakes: their problems and environmental effects. Geophy. Mono. Ser. 17, Amer. Geophy. Union, Washington, D.C.

————, and C. M. Cooper. 1984. Sediment trap efficiency of a small reservoir. Jour. Soil Water Cons. 39:278-280.

————, J. A. Spraberry, and W. A. Champion. 1967. Sediment deposition in reservoirs in the United States.

DesVoigne, D., and W. Mills. 1978. Nutrient analysis of the Snake River and its Major Tributaries from above Palisades Reservoir in Wyoming to Weiser, Idaho (River Miles 941 to 351). Parametrix, Bellevue, WA. 158 pp. plus Appendicies.

Edmondson, W. T., ed. 1959. Fresh-water biology. John Wiley and Sons, Inc., New York. 1248 pp.

Emmett, W. W., and W. A. Thomas. 1978. Scour and deposition in Lower Granite Reservoir, Snake and Clearwater Rivers near Lewiston, Idaho. Jour. Hydraul. Res. 16:327-345.

Environmental Protection Agency. 1973. Water quality investigations of Snake River and principal tributaries from Walters Ferry to Weiser, Idaho. U.S.E.P.A., Denver, CO. 42 pp.

Falter, C. M., and D. T. Wade. 1979. Colonization of benthic invertebrates in the Snake, Spokane, Clark Fork, and Bear River drainages, 1977. North Amer. Planning Group, Moscow, ID. 17 pp.

Ferens, M.C. 1974. A review of the physiological impact of Mercurials. EPA Ecol. Res. Ser. 660/3-73-022. U.S. Environ. Prot. Agency, Washington, D.C. 54 pp.

Fleming, W. J., D. R. Clark, Jr., and C. J. Henny. 1983. Organochlorine Pesticides and PCB's: a Continuing Problem for the 1980's. pp. 186-199. IN: Transactions of the 48th North American Wildlife and Natural Resources Conference. The Wildlife Management Institute, Washington, D. C.

Gebhards, S., J. Cline, F. Shields, and L. Pearson. 1970. Mercury Residue in Idaho Fishes -- 1970. ID Dept. H & W, Boise, unpubl. Rpt. 13 pp.

Greeson, P.E. 1970. Biological factors in the chemistry of Mercury. pp. 32-34. IN: U.S. Geological Survey. Mercury in the Environment. U.S. Geol. Surv. Prof. Pap. 713.

Gullidge, E. J. Ed. 1972. Main report Columbia-North Pacific Region comprehensive framework study. Pacific NW River Basins Comm., Vancouver, Washington. 373 pp.

Guy, H.P., and V. W. Norman. 1970. Field methods for measurement of fluvial sediment: U.S. Geol. Surv. Tech. Water-Resour. Invest. Book 3, Chapter C2, 59 pp.

Harper, R. W. , H. G. Sisco, I. O'Dell, and S. C. Cordes. 1984. Water Resources Data, Idaho, Water Year 1983. U. S. Geol. Surv. Water-Data Rpt. ID-83-1. 515 pp.

Helley, E. J., and W. Smith. 1971. Development and calibration of a pressure-difference bedload sampler: U.S. Geol. Surv. Open-File Rpt, 18 pp.

Hildebrand, S. G., R. H. Strand, and J. W. Huckabee. 1980. Mercury accumulation in fish and invertebrates of the North Fork Holston River, Virginia and Tennessee. Jour. Environ. Qual. 9: 393-400.

Houck, D., and R. Kreizenbeck. 1975. Water quality analysis of the Upper-Middle Snake River, May, 1973-May, 1974. U.S. E.P.A., 910/8-75-093, Seattle, WA. 256 pp.

Huckabee, J. W., J. W. Elwood, and S. G. Hildebrand. 1979. Accumulation of mercury in freshwater biota, pp. 277-302. IN: Nriagu ed. The biochemistry of mercury in the environment. Elsevier Sci. Publ. Co., Amsterdam.

Idaho Department of Fish & Game. 1984. 1981-1985 Fisheries Management Plan. ID Dept. Fish & Game, Boise. 234 pp.

Idaho Department of Health. 1964. Water quality and pollution report, Middle Snake River, Adrian to Weiser (River Mile 397-345, Idaho-Oregon, 1961-1964). ID Dept. Health, Boise. 48 pp.

Idaho Department of Health and Welfare. 1980a. Idaho Water Quality Standards and Wastewater Treatment Requirements. IDHW - Division of Environment, Boise. 72 pp.

________. 1980b. Weiser River Study, Adams and Washington Counties. Water Quality Summary 6. Idaho Department of Health and Welfare, Division of Environment, Boise. 51 pp.

________. 1980c. Idaho Water Quality Status Report. Idaho Department of Health and Welfare, Division of Environment, Boise, Idaho. 63 pp.

________. 1985. Idaho Water Quality Standards and Wastewater treatment requirements. IDHW-Division of Environment, Boise. 72 pp.

Idaho Department of Water Resources. 1985. Status report, Weiser River Galloway Project. Idaho Department of Water Resources, Boise. 72 pp.

Idaho Soil Conservation Commission.. 1979. Idaho Agricultural Pollution Abatement Plan, Idaho SCC, Boise. 79 pp.

Jensen, J. 1982. Big Lost River Water Quality Plan. Butte Soil Cons. Dist., Arco, ID. 130 pp.

Kirkham, V.R.D. 1931. Revising of the Payette and Idaho Formations. Jour. Geol. 39:193-239.

Kreizenbeck, R., R. Hauck, and D. Houck. 1975. River basin water quality status report: upper/Middle Snake River basin. U.S. E.P.A., Seattle, WA. 408 pp.

Laird, L. B.. 1964. Chemical Quality of the Surface Waters of the Snake River Basin. Geol. Surv. Prof. Pap. 417-D. U. S. Geol. Surv., Washington, D.C. 47 pp.

Larson, A.G. 1983. The influence of geology on the chemical composition of two Washington rivers. NW Sci. 57: 256-266.

Leopold, L. B., and T. Maddock, Jr. 1953. The hydraulic geometry of stream channels and some physiographic implications. U.S. Geol. Surv. Prof. Pap. 252. 57 pp.

Low, W. 1985. Solute distribution in ground and surface water in the Snake River Basin, Idaho and Eastern Oregon. USGS Open File Rpt. 85-167. 2 plates.

Mackenthun, K. M. 1973. Toward a cleaner environment. U. S. Environmental Protection Agency, Washington, D. C.

Martin, D.M. 1983. Rock Creek Comprehensive Monitoring and Evaluation Rural Clean Water Program, Ann. Rpt. ID Dept. H & W., Boise. 85 pp.

________. 1984. Rock Creek Rural Clean Water Program comprehensive monitoring and evaluation Annual Report. ID Dept. H & W., Boise. 151 pp.

________, and S. Bauer. 1982. Water Quality Monitoring Assessment of the Rural Clean Water Program: First year baseline report, Rock Creek, Water Year 1981. IDHW-Div. of Environment, Boise. 68 pp.

Merritt, R.W., and K.W. Cummins, eds. 1984. An introduction to the aquatic insects of North America. Kendall/Hunt Publ. Co., Dubuque, IA. 722pp.

Newcomb, R. C. 1972. Quality of the Ground Water in Basalt of the Columbia River Group, Washington, Oregon, and Idaho. Geol. Surv. Water Supply Pap. 1999-N. U. S. Geol. Surv., Washington, D.C. 71 pp.

Novotny, V., and G. Chester. 1981. Handbook of nonpoint pollution sources and management. Van Nostrand Reinhold Company, NY. 550 pp.

Olson, G. F., D. I. Mount, V. M. Snarski, and T. W. Thorslund. 1975. Mercury residues in flathead minnows, Pimephales promelas Rafinesque, chronically exposed to methylmercury in water. Bull. Environ. Cont. Tox. 14:129-134.

Pennak, R.W. 1978. Fresh-water invertebrates of the United States. 830 pp.

Phillips, G. R., and D. R. Buhler. 1980. Mercury accumulation in and growth rate of rainbow trout, Salmo gairdneri, stocked in an Eastern Oregon reservoir. Arch. Environm. Contam. Toxicol. 9:99-107.

Pruitt, T. A., and R. L. Nadeau. 1978. Recommended stream resource maintenance flows on seven southern Idaho streams. Instream Flow Info. Pap. 8. U. S. Fish and Wildlife Service, Ft. Collins, CO. 60 pp.

Ross, C.P. 1956. Quicksilver deposits near Weiser, Washington County, Idaho. U.S. Geol. Surv. Bull. 1042-D:79-104.

Simpson, J. C., and R. L. Wallace. 1978. Fishes of Idaho. Univ. Press of Idaho. Moscow. 237 pp.

Spencer, S.G., B.F. Russell, J.F. Sullivan, eds. 1979. Potential use of Geothermal Resources in the Snake River basin: an environmental overview. EGG-2001, vol 1. EG & G Idaho, Inc., Idaho Falls. 81 pp.

Tangarone, D.R., and B. Bogue. 1975. Weiser-Lower Payette water quality surveys. EPA Working Pap. 910-8-76-098. Seattle, Washington. 192 pp.

U. S. Army Corps of Engineers. 1977. Flood Plain Information, Weiser River, Weiser, Idaho and Vicinity. U. S. Army Corps of Engineers, Walla Walla, Washington. 27 pp.

U.S. Bureau of Reclamation. 1972. Weiser River Division Southwest Idaho Water Development Project, Idaho. U.S. Bur. Reclam., Boise, ID. 118 pp.

U. S. Environmental Protection Agency. 1977. Quality criteria for water. Office of Water and Hazardous Materials, U. S. Environmental Protection Agency, Washington, D. C. 256 pp.

U.S. Food and Drug Administration. 1979. Action levels for poisonous or deleterious substances in human food and animal feed. Food and Drug Administration, Washington, D.C. 13 pp.

U.S. Interagency Committee on Water Resources. 1963. Determination of fluvial sediment discharge: Rpt. no 14. 151 pp.

Weiser River Soil Conservation District. 1982. Lower Weiser River sediment study (Sunnyside Canal Company area). Weiser River Soil Cons. Dist., Weiser, ID. 42 pp.

Whitfield, P.H. 1982. Selecting a method for estimating substance loadings. Water Res. Bull. 18:203-210.

Williams, R.P., and P.J. Krupin. 1984. Erosion, channel charge, and sediment transport in the Big Lost River, Idaho U.S. Geol. Surv. Water- Res. Invest. Rpt. 84-4147. 87 pp.

Winget, R. N., and F. A. Mangum. 1979. Biotic condition index: integrated biological, physical, and chemical stream parameters for management. U. S. Forest Service, Ogden, UT. 51 pp.

Young, H.W., W. A. Harenberg, and H.R. Seitz. River Basin, west central Idaho. 1977a. Water resources of the Weiser U.S. Geol. Surv. Open-File Rpt. 77-418.

________ . 1977b. Water resources of the Weiser River basin, west-central Idaho. ID Dept. Water Resources. Water Info. Bull. 44. 104 pp.

Table 1. List of Survey Stations and Locations for Lower Weiser River Survey, 1983-84.

DESCRIPTION	LATTITUDE/LONGITUDE	RIVER MILE	ELEVATION feet	meters	STORET no.
<u>WEISER RIVER STATIONS</u>					
(Weiser R. above Crane Creek)*	44°17'40"/116°47'20"	324.30/351.80/17.0	2,400	(730)	2040339
Weiser R. below Crane Creek, USGS Gage	44°16'00"/116°46'00"	324.30/351.80/14.80/ 15.80	2,220	(675)	2040340
Weiser R. at Galloway Diversion Dam**	44°15'00"/116°46'30"	324.30/351.80/16.70/ 14.20	2,240	(681)	2040343
Weiser R. at Unity Bridge	44°14'15"/116°51'25"	324.30/351.80/8.10	2,160	(657)	2040341
Weiser R. at Weiser Hwy. 95 Bridge	44°14'35"/116°57'25"	324.30/351.80/.80	2,100	(638)	2040342
<u>TRIBUTARY STATIONS</u>					
Crane Creek at Mouth, USGS Gage	44°17'24"/116°46'50"	324.30/351.80/16.70/ 0.30	2,260	(687)	2040346
Mann Creek near Mouth	44°14'55"/116°52'00"	324.30/351.80/6.80/ 1.40	2,180	(663)	2040347
Mann Creek below Reservoir	44°23'42"/116°53'30"	324.30/351.80/6.80/ 11.80	2,840	(863)	2040348
Monroe Creek at Mouth	44°14'40"/116°57'35"	324.30/351.80/.60/.20	2,100	(638)	2040349
First Creek at Mouth	44°16'10"/116°46'00"	324.30/351.80/14.80	2,220	(675)	2040350
Bear Creek	44°16'30"/116°46'10"	324.30/351.80/15.40/ .30	2,360	(717)	2040351
Cove Creek at Mouth	44°13'50"/116°48'37"	324.30/351.80/10.80	2,190	(666)	2040357
<u>IRRIGATION INFLOWS</u>					
Sunnyside Canal Irrigation Return	44°13'25"/116°53'10"	324.30/351.80/6.40	2,140	(651)	2040352
Frazier Gulch	44°13'55"/116°51'50"	324.30/351.80/7.60	2,130	(648)	2040353
Smith Drain	44°14'25"/116°49'55"	324.30/351.80/9.50	2,170	(660)	2040354
Unity Bridge Drain	44°14'10"/116°51'20"	324.30/351.80/8.40	2,160	(657)	2040355
Lower Payette River Ditch	44°14'30"/116°56'15"	324.30/351.80/1.30/50	2,110	(638)	2040356
Lower Payette Ditch at River	44°14'50"/116°56'25"	324.30/351.80/2.0	2,100	(641)	2040358

* Data for this station was estimated by subtracting Crane Creek from the Weiser River below Crane Creek.
** Station sampled for pesticides (fish tissue) only.

TABLE 2. Mean annual suspended sediment and total phosphorus loadings (tons/year) for the mouth of the Weiser River and the Snake River below the Weiser River for the years 1978 - 1984.

Year	Weiser River Near Weiser		Snake River at Weiser	
	Suspended Sediment	Total Phosphorous	Suspended Sediment	Total Phosphorous
1978	66,795	102	554, 800	1519
1979	117,348	32	886,340	1693
1980	894,250	29	1,084,415	2148
1981	333,245	173	495,046	1295
1982	790,908	762	1,488,470	2617
1983	258,238	719	2,768,525	4012
1984	203,123	674	3,671,900	5170

TABLE 3. Mean annual suspended sediment and total phosphorus loadings, Weiser River Survey 1983-84.

Sample Station	Suspended Sediment (Tons/Day)	Suspended Sediment (Tons/Year)	Total Phosphorus (Tons/Day)	Total Phosphorus (Tons/Year)
Weiser River below Crane Creek	413.0	152,018	1.2	420.0
Weiser River at Unity Bridge	424.0	154,794	1.5	547.5
Weiser River near Weiser	707.5	258,238	2.1	761.0
[Plus Monroe Creek contribution]	[3.9]	[1,424]	[0.02]	[7.3]
TOTAL CONTRIBUTION TO SNAKE RIVER	**711.4**	**259,662**	**2.12**	**768.3**

TABLE 4. Mean annual suspended sediment and total phosphorus loadings for tributary streams and irrigation return flows for Weiser River Survey, 1983-84.

Sample Station	Suspended Sediment (Tons/Day)	Suspended Sediment (Tons/Year)	Total Phosphorus (Tons/Day)	Total Phosphorus (Tons/Year)
<u>Tributary</u>				
Crane Creek	14.5	5,305	0.09	34.19
Mann Creek near mouth	39.3	14,341	0.12	39.4
Monroe Creek	3.86	1,409	0.02	5.97
First Creek	0.069	25	0.0007	0.26
Bear Creek	0.064	23.3	0.001	0.354
Tributary Total	63.6	21,103.0	0.27	93.1
<u>Irrigation Inflow</u> *				
Sunnyside Canal	0.29	52	0.0015	0.28
Frazier Gulch	0.62	113.46	0.0015	0.28
Smith Drain	0.54	98.1	0.003	0.53
Unity Drain	0.03	5.2	0.0003	0.062
Lower Payette Ditch above pond	[7.8]	[1,428.0]	[0.016]	[2.9]
Lower Payette Ditch at river	0.46	83.9	0.002	0.44
Inflow Total	1.94	450.16	0.0083	1.6

* Calculated on an estimated average irrigation season of 183 days.

TABLE 5. Estimated Annual Stream Bank Erosion of the Lower Weiser River (River miles 4.4 - 8.1). Data provided by Weiser River Soil Conservation District.

Cut Depth (ft)	Cut Length (ft)	Estimated Cut Width/Year	Sediment/ Year (ft^3)
8	300	1	2,400
5	200	1	1,000
5	100	1	500
6	200	1	1,200
6	100	1	600
5	200	1	1,000
7	250	1	1,750
2	300	1	600
7	100	1	700
8	250	1	2,000
5	200	1	1,000
4	200	1	800
8	200	1	1,600
8	800	10	64,000
10	1200	10	120,000
5	500	1	2,500
6	300	1	1,800
3	200	1	600
8	100	5	4,000
2	100	1	200
		Total Volume (ft^3/yr)	208,250

(208,250 ft^3/yr) (80 lb/ft^3) (ton/2000 lb) = 8330 tons/yr

Estimate Entire Reach (13 miles) = 3.7 mi/13 mi = (8330 T/yr) / [X (T/yr)]

X = 29,268 T/yr

ESTIMATE = 29,000 tons/year

TABLE 6. Trace metal occurrence in the Lower Weiser River, 1983. All values µg/l for total metals.

Metals	Weiser River Stations		
	Near Weiser	Unity Bridge	Below Crane Creek
Arsenic			
N	12	3	3
Max.	10	10	10
Min.	10	10	10
Mean	10.0	10.0	10.0
Boron			
N	11	3	3
Max.	207	191	104
Min.	30	62	47
Mean	122.3	124.3	73.7
Cadmium			
N	1	3	3
Max.	2.6	1	1
Min.	2.6	1	1
Mean	2.6	1	1
Chromium			
N	12	1	1
Max.	50	50	50
Min.	50	50	50
Mean	50.0	50.0	50.0
Copper			
N	5	2	1
Max.	20	30	30
Min.	10	10	30
Mean	14.0	20.0	30
Iron			
N	11	3	3
Max.	7400	15000	12930
Min.	490.	320	310
Mean	1569.1	5273.3	4573.3

TABLE 6. Continued.

Metals	Weiser River Stations		
	Near Weiser	Unity Bridge	Below Crane Creek
Lead			
N	12	3	3
Max.	75	50	50
Min.	50	50	50
Mean	52.1	50	50
Manganese			
N	11	3	3
Max.	160	350	300
Min.	20	20	10
Mean	63.6	133.3	113.3
Mercury			
N	1	3	3
Max.	2.4	0.5	0.5
Min.	2.4	0.5	0.5
Mean	2.4	0.5	0.5
Silver			
N	12	----*	----*
Max.	1		
Min.	1		
Mean	1.0**		
Zinc			
N	9	2	1
Max.	30	43	31
Min.	2	4	31
Mean	9.7	23.5	31.0

* Parameter not analyzed
** Below detectable limits if < .001

TABLE 7. Trace metal occurrence in the Lower Weiser River tributaries, 1983. All values µg/l for total metals.

Metal	Crane Creek	Mann Creek Near Mouth	Mann Creek Below Res.	Monroe Creek	First Creek	Bear Creek	Cove Creek
	Tributary Stations						
Arsenic							
N	3	2	3	3	1	1	1
Max.	10	23	10	12	18	85	75
Min.	10	10	10	10	18	85	75
Mean	10.0	17.0	10.0	10.7	18.0	85.0	75.0
Boron							
N	3	3	3	3	1	1	1
Max.	210	103	93	201	309	609	2330
Min.	75	52	60	125	309	609	2330
Mean	143.0	81.7	76.0	158.7	309.0	609.0	2330.0
Cadmium							
N	3	3	3	3	1	1	1
Max.	1	1	1	1	1	1	1
Min.	1	1	1	1	1	1	1
Mean	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chromium							
N	1	1	1	1	--*	--*	--*
Max.	50	50	50	50			
Min.	50	50	50	50			
Mean	50.0	50.0	50.0	50.0			
Copper							
N	2	3	3	3	1	1	1
Max.	20	30	10	10	10	10	10
Min.	10	10	10	10	10	10	10
Mean	15.0	16.7	10.0	10.0	10.0	10.0	10.0

* Parameter not analyzed

TABLE 7. Continued

Metal	Tributary Stations						
	Crane Creek	Mann Creek Near Mouth	Mann Creek Below Res.	Monroe Creek	First Creek	Bear Creek	Cove Creek
Iron							
N	3	3	3	3	1	1	1
Max.	6400	9200	4470	5760	250	170	440
Min.	1820	290	290	330	250	170	440
Mean	3823.3	3303.3	1806.7	2146.7	250.0	170.0	440.0
Lead							
N	3	3	3	3	1	1	1
Max.	50	50	50	50	50	50	50
Min.	50	50	50	50	50	50	50
Mean	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Manganese							
N	3	3	3	3	1	1	1
Max.	170	260	90	150	130	130	250
Min.	60	30	30	70	130	130	250
Mean	103.3	113.3	66.7	100.0	130	130.0	250.0
Mercury							
N	3	3	3	3	1	1	1
Max.	0.5	0.5	0.5	0.5	0.5	0.5	5.5
Min.	0.5	0.5	0.5	0.5	0.5	0.5	5.5
Mean	0.5	0.5	0.5	0.5	0.5	0.5	5.5
Zinc							
N	3	3	3	3	1	1	1
Max.	16	15	22	18	1	1	5
Min.	11	2	1	5	1	1	5
Mean	14.0	6.7	8	10.3	1.0	1.0	5.0

TABLE 8. Trace metal occurrence in the Lower Weiser River irrigation inflows, 1983. All values µg/l for total metals.

Metal	Sunnyside Canal	Frazier Gulch	Smith Drain	Unity Drain	Lower Payette River Ditch	Lower Payette Ditch at River
	Irrigation Inflow Stations					
Arsenic						
N	2	2	3	3	2	2
Max.	10	10	10	54	10	10
Min.	10	10	10	24	10	10
Mean	10.0	10.0	10.0	40.0	10.0	10.0
Boron						
N	2	2	3	3	2	2
Max.	122	217	287	692	198	114
Min.	60	140	60	260	50	80
Mean	91.0	178.5	148.3	541.0	124.0	97.0
Cadmium						
N	2	2	3	3	2	2
Max.	1	1	1	1.2	1	1
Min.	1	1	1	1	1	1
Mean	1.0	1.0	1.0	1.1	1.0	1.0
Chromium						
N	1	1	1	1	1	1
Max.	50	30	50	50	50	50
Min.	50	30	50	50	50	50
Mean	50.0	30.0	50.0	50.0	50.0	50.0
Copper						
N	2	2	3	3	2	2
Max.	10	30	10	10	10	10
Min.	10	10	10	10	10	10
Mean	10.0	15.0	10.0	10.0	10.0	10.0

TABLE 8. Continued

Metal	Irrigation Inflow Stations					
	Sunnyside Canal	Frazier Gulch	Smith Drain	Unity Drain	Lower Payette River Ditch	Lower Payette Ditch at River
Iron						
N	2	2	3	3	2	2
Max.	2010	19300	3590	8400	7570	920
Min.	430	50	320	190	1220	280
Mean	1220.0	9675	1706.7	2960	4395.0	600.0
Lead						
N	2	2	3	3	2	2
Max.	50	420	50	50	50	50
Min.	50	50	50	50	50	50
Mean	50.0	235.0	50.0	50.0	50.0	50.0
Manganese						
N	2	2	3	3	2	2
Max.	50	90	120	200	160	70
Min.	30	0.5	60	90	100	10
Mean	40.0	45.25	83.3	133.3	130.0	40.0
Mercury						
N	2	1	3	3	2	2
Max.	0.5	0.5	0.5	0.5	0.5	0.5
Min.	0.5	0.5	0.5	0.5	0.5	0.5
Mean	0.5	0.5	0.5	0.5	0.5	0.5
Zinc						
N	2	2	3	3	2	2
Max.	6	75	8	51	30	7
Min.	2	4	1	1	2	3
Mean	4	39.5	4.3	18.7	16.0	5.0

TABLE 9. Fecal coliform and fecal streptococcus bacteria, Lower Weiser River Survey, 1983-84. Fecal coliform and fecal strep bacteria ratios below 0.7 indicate livestock sources.

Sampling Station	Fecal Coliform Samples				Fecal Strep. Bacteria Samples				FC/FS Ratio
	Num.	Max.	Min.	Mean	Num.	Max.	Min.	Mean	
WEISER RIVER STATIONS									
W. R. below Crane Creek	15	900	30	139.42	15	2800	30	289.26	.48
W. R. at Unity Bridge	15	330	10	60.22	15	600	20	99.67	.60
W. R. near Weiser	16	500	20	109.15	16	2300	10	213.30	.51
TRIBUTARY STATIONS									
Crane Creek at mouth	15	2600	10	321.47	15	3600	20	586.73	.55
Mann Creek below reservoir	15	3000	4	20.77	15	360	7	21.09	.98
Mann Creek near mouth	15	1500	20	246.41	15	2310	20	277.59	.89
Monroe Creek at mouth	15	1900	100	400.70	15	5500	200	1125.19	.36
First Creek at mouth	3	60	33	42.94	3	610	40	191.98	.22
Bear Creek near mouth	4	50	10	22.13	4	560	10	101.39	.22
Cove Creek at mouth	2	40	10	20.00	2	170	30	71.41	.28
IRRIGATION INFLOWS									
Sunnyside Canal	11	54000	170	1098.00	11	8100	600	2700.45	.41
Frazier Gulch	11	3000	130	685.69	10	17000	300	2487.50	.28
Smith Drain	13	1300	10	246.31	13	5300	200	806.40	.31
Unity Drain	13	10000	10	308.76	12	4900	120	953.48	.32
Lower Payette River Ditch	9	800	100	323.24	8	7600	200	1664.83	.19
Lower Payette Ditch at River	6	800	200	371.79	6	6500	800	3008.35	.12

TABLE 10. Incidence of Pesticide Residues in the Water Column -- Weiser River Survey, August 2-3, 1983.

Sampling Stations	Lindane	Toxa-phene	2,4 D	2,4,5-TP (Silvex)	PCP	Dicamba	Diel-drin	2,4,5 T	B-BHC	Other
<u>Weiser River Stations</u>										
Weiser River below Crane Creek	X				X					
Weiser River at Unity Bridge			X							
Weiser River near Weiser				X			X			*
<u>Tributary Stations</u>										
Crane Creek at Mouth			X					X		
Mann Creek below Reservoir			X		X	X		X	X	
Monroe Creek at Mouth	X									
<u>Irrigation Inflows</u>										
Sunnyside Canal Irrig. Canal										**
Frazer Gulch	X									
Smith Drain			X		X	X		X	X	
Lower Payette River Ditch		X								
Lower Payette Ditch at River		X								

* Oxychlordane

** Heptachlor, Heptachlor Epoxide, Tordon

TABLE 11. Incidence of Trace Organics and Mercury in Fish Tissue -- Weiser River Survey, August 18-19, 1985. (Number indicates occurence within the sample).

Sampling Station *	Trace Organics **														Metal
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Hg
Mann Creek, Mouth															
Suckers (3)		3	3				1		3						3
Channel Catfish (3)		3	3				2		3	1	1				4
Monroe Creek															
Chiselmouth Chub (1)	1	1	1				1		1			1			1
Whitefish (1)		1	1						1						1
Squawfish (1)	1	1	1	1	1		1		1	1					1
Lower Payette River Ditch															
Chiselmouth Chub (1)		1	1						1						1
Whitefish (1)		1	1						1						1
Weiser River near Weiser															
Channel Catfish (5)	4	5	5		5	1	5	2	5	1		4	3	1	5
Smallmouth Bass (5)	2	5	5		2		2		5			2			5
Coarsescale Sucker (4)		4	4		2	1	3		3			3			4
Carp (2)	1	2	2		2	2	2	2	2			2	2		2
Weiser River at Galloway Diversion															
Whitefish (5)		5	5		4	2	4		5	2	2	1			5
Coarsescale Sucker (3)		3	3		1		1		3	1					3
Smallmouth Bass (4)		4	4		1		1		3	1					4
Carp (4)		4	3		1	1	1		4						4

* Number in parentheses indicates number of fish of each species tested at that station.

** 1 - Dieldrin
2 - Total DDT & Analogs
3 - p.p' DDE
4 - o.p. DDD
5 - p.p' DDD
6 - o.p. DDT
7 - p.p' DDT
8 - Hexaclorobenzene
9 - Pentachlorophenol
10 - trans is. of nonachlor
11 - Hexachloroyclohexane gamma isomer
12 - Toxaphene
13 - Heptachlor Epoxide
14 - BBHC

TABLE 12. Fish Collected from the Lower Weiser River on August 18-19, 1983.

Fish Species	Sample Stations Weiser R., Galloway Diversion	Weiser R., Near Weiser	Lower Payette Ditch	Monroe Creek, Mouth	Monroe Creek, Camp.Gd.*	Mann Creek, Mouth
Carp	5	2				
Channel Catfish		4				4
Chiselmouth	√	√	1	1		√
Largescale Sucker	5	5				3
Longnose Dace		√				√
Mountain Sucker		√	√			
Mountain Whitefish	5		1	1		
Northern Squawfish				1		1
Pumpkinseed		√				
Redside Shiner						√
Sculpin		√				
Smallmouth Bass	4	5	√			
Tadpole Madtom						√
Warmouth		√				

The numbers indicate fish taken to the State Laboratory for pesticide and mercury analysis. A total of forty-eight fish were submitted to the laboratory. The remaining fish listed were not analyzed but are listed here to complete the list of species found at the individual sample stations.

√ Fish taken, but not analyzed.

* No fish were found in Monroe Creek near Monroe Creek Campground.

TABLE 13. Macroinvertebrates collected at Weiser River above Crane Creek, September 7, 1983. Tolerance quotients (TQ) from Winget and Mangum (1979).

Taxon	Number/Sample 1	2	3	4	Trophic Group	TQ
INSECTA						---
Ephemeroptera						72
Baetidae						72
Baetis alexanderi	14	8	69	17	C-G	72
Baetis tricaudatus	4	2	3	2	SC	72
Heptageniidae						48
Heptagenia sp.		3			SC,C,G	48
Stenonema reesi			18		SC,C,G	48
Tricorythidae						108
Tricorythodes minutus	1		6		C,G	108
Polymitarcidae						48
Ephoron album			1		C,G	48
Trichoptera						---
Hydropsychidae						108
Hydropsyche sp.	29	126	222	58	C-F	108
Cheumatopsyche sp.	3	32	71	24	C-F	108
Helicopsychidae						18
Helicopsyche borealis		2	6			18
Brachycentridae						24
Brachycentrus sp.	31	71	96	86	C-F,SC	24
Leptoceridae						54
Oecetis sp.			6		PR,SH,H	54
Rhyacophilidae						18
Rhyacophila sp.			2		PR,C,SH,H	18
Coleoptera						---
Elmidae						108
Optioservus sp.	11	1	30	13	SC,C-G	108
Heterlimnius sp.				6	C-G,SC	---
Psephenidae						---
Psephenus falli		1	1	6	SC	---
Diptera						
Chironomidae	11	8	45	28	C,PR	108
Athericidae						24
Atherix variegata		1	2	3	PR	24
Sciomyzidae			2		PR	---
Blephariceridae						2
Blepharicera sp.				1	SC	2

Key: C - Collector, F - Filterer, G - Gatherer, H - Herbivore, PR - Predator, SC - Scraper, SH - Shredder

TABLE 14. Macroinvertebrates collected at Weiser River near Weiser, August 17, 1983. Tolerance Quotients (TQ) from Winget and Mangum (1979).

Taxon	Number/Sample 1	2	3	4	5	Trophic Group	TQ
Gastropoda						SC	108
Lymnaea sp.			1			SC	108
Gyraulis sp.			1			SC	108
Physa sp.				1		SC	108
Ancylidae						SC	---
Ferissia sp.			1			SC	---
Nematoda			8	2		PC,PA,H	108
Annelida							108
Hirudinea	1	1		2	2	PR,PA	108
Hellobdella sp. (?)			6			PR,PA,C	---
Oligochaetae			92	10		C,G	108
INSECTA							---
Ephemeroptera							72
Baetidae							72
Baetis alexanderi				1		C-G	72
Baetis tricaudatus	64	48	137	258	55	SC	72
Heptageniidae							48
Stenonema reesi	2	1	4	9	1	SC, C, G	48
Tricorythidae							108
Tricorythodes minutus	1		2	2		C, G	108
Leptophlebiidae							
Choroterpes albiannulata				1		C,G,SC	36
Polymitarcidae							48
Ephoron album	23	9	8	17	16	C, G	48
Hemiptera							---
Corixidae (female)				1		PC-H	108
Odonata							
Coenagrionidae							108
Ischnura sp.		1				PR	108
Gomphidae							108
Ophiogomphus sp.				2		PR	108

Key: C - Collector, F - Filterer, G - Gatherer, H - Herbivore, PA - Parasite, PC - Piercer, PR - Predator, SC - Scraper, SH - Shredder

TABLE 14. Continued.

Taxon	Number/Sample 1	2	3	4	5	Trophic Group	TQ
Trichoptera							---
Hydropsychidae							108
Hydropsyche sp.		6	26	48		C-F	108
Cheumatopsyche sp.	7	4			2	C-F	108
Hydroptilidae							108
Hydroptila sp.	6	10	13	28	2	PC-H, SC	108
Ochrotichia sp.			1	2		C-G, PC-H	108
Brachycentridae							24
Brachycentrus sp.	2	2	1	7	7	C-F, SC	24
Leptoceridae							54
Mystacides sp.	1					C-G, SH-H	54
Lepidoptera							72
Pyralidae							72
Parargyractis sp.	8	9	8	2	1	SH-H	72
Coleoptera							---
Elmidae							108
Optioservus sp.	3	3	18	13	6	SC, C-G	108
Heterlimnius sp.		3				C-G, SC	---
Psephenidae							---
Psephenus falli				1		SC	---
Diptera							---
Chironomidae	41	63	182	205	68	C, PR	108
Simulidae							108
Simulium sp.		5	5	8		C, F	108
Empididae			4	9		PR	108
Ceratopogonidae							108
Dasyhelsea sp.				1		PR, C, G	108

Key: C - Collector, F - Filterer, G - Gatherer, H - Herbivore, PA - Parasite, PC - Piercer, PR - Predator, SC - Scraper, SH - Shredder

TABLE 15. Nocturnal Water Quality of the Lower Weiser River, August 10-11, 1983.

STATION	DATE	TIME	TEMPERATURE (^0C)	DO (mg/l)	pH (su)
Weiser	10	1900	26	8.1	7.78
Unity Bridge	10	2010	25	8.3	7.79
Presley Bridge	10	2040	22	8.7	7.7
Weiser	10	2200	25	7.7	7.2
Unity Bridge	10	2220	23.5	7.5	7.24
Presley Bridge	10	2240	22	8.7	7.4
Weiser	11	0200	23.5	6.9	7.23
Unity Bridge	11	0225	22	7.4	7.29
Presley Bridge	11	0245	20.5	8.5	7.56
Presley Bridge	11	0500	20	8.6	7.38
Unity Bridge	11	0515	21	7.6	7.1
Weiser	11	0530	23	6.8	7.13

TABLE 16. Comparison of Upper and Lower Weiser River water quality concentrations on August 3, 1983. Data from the upper station (ca. 5 miles above Crane Creek) provided by BLM. All parameters mg/l and metals mg/l unless otherwise specified.

Parameter	Sample Stations			% Change **
	Weiser River above Crane Creek	Weiser River below Crane Creek	Weiser River at Weiser	Upstream vs. Downstream
NUTRIENTS (Total as N or P)				
Ammonia	*	0.014	0.027	48
Nitrate	0.02	-.-	-.-	N/A
Nitrate/Nitrate	-.-	0.09	0.23	61
Kjeldahl Nitrogen	0.15	-.-	0.77	80
Ortho Phosphate	0.04	0.081	0.085	53
Phosphorus	-.-	0.72	0.4	-44
MINERALS				
Sp. Cond. (μmhos/cm)	140.0	136.0	216.0	35
Hardness as $CaCO_3$	60.0	-.-	74.0	19
Alkalinity, T. as $CaCO_3$	72.0	-.-	95.0	24
Alkalinity, Bicarb. as $CaCO_3$	87.84	-.-	95.0	8
Alkalinity, Carb. as $CaCO_3$	*	-.-	*	N/A
Calcium	14.4	-.-	19.0	24
Magnesium	5.76	-.-	7.8	26
Chloride	2.0	-.-	4.0	50
Sulphate	12.0	-.-	15.0	20
RESIDUE				
Total	-.-	-.-	200.0	
Filterable	148.0	-.-	147.0	- 1
Suspended Solids	7.0	-.-	-.-	N/A
Suspended Sediment	-.-	21.0	39.0	54
TOTAL METALS (μg/l)				
Iron	280.0	-.-	1250.0	78
Lead	*	-.-	*	N/A
Manganese	30.0	-.-	80.0	62
Mercury	*	-.-	2.4	100
Zinc	2.0	-.-	4.0	50
MISCELLANEOUS				
Turbidity (NTU)	0.9	28.0	24.0	98
pH (SU)	7.4	-.-	7.7	4
Fecal Coliform (#/100 ml)	13.0	900.0	500.0	97
Fecal Strep (#/100 ml)	*	1200.0	500.0	-58
Total Coliform (#/100 ml)	490.0	-.-	-.-	N/A

-.- Parameter not analyzed
* Below detectable limits
** Values positive unless otherwise indicated

TABLE 17. Discharge in acre feet of the Weiser River below Crane Creek (at Presley Bridge) for the survey year (1983) and preceeding years. Data from U.S.G.S.

YEAR	DISCHARGE (ACRE-FEET) Calendar Year [a]	Water Year [b]
1984	unavailable	576,303
1983	**684,921**	**1,397,000**
1982	1,348,000	1,331,000
1981	737,600	708,900
1980	852,100	780,700
1979	530,100	517,300
1978	863,000	929,400
1977	163,700	98,690
1976	713,000	770,400
1975	906,700	859,300
1974	1,199,000	1,379,000
1973	694,700	546,000
1972	968,600	970,500
Totals:	9,661,421 [c]	10,864,493 [d]
Means:	805,118.4	835,730.2

[a] - January 1 - December 31
[b] - October 1 - September 30
[c] - Total for 12 years
[d] - Total for 13 years

TABLE 18. Bedload sediment for selected tributaries and irrigation drains for selected dates, 1983-84, Weiser River Survey.

TRIBUTARY/DRAIN	DATE	BEDLOAD SEDIMENT (TONS/DAY) Daily	Mean for Survey
TRIBUTARY STREAMS			
First Creek	March 23, 1983	8.8	
	April 25, 1983	6.9	7.85
Bear Creek	March 23, 1983	4.8	
	April 25, 1983	5.3	5.05
Cove Creek	March 28, 1984	38.0	38.0
Mann Creek			
Below Reservoir	July 18, 1983	0.01	0.01
Mouth	July 18, 1983	0.3	
Mouth	August 2, 1983	0.36	0.42
Monroe Creek	June 22, 1983	0.3	0.3
IRRIGATION DRAINS			
Smith Drain	July 6, 1983	0.74	
	July 18, 1983	0.98	
	August 2, 1983	3.8	1.84
Sunnyside Canal	May 11, 1983	1.5	
	May 25, 1983	0.04	0.77
Lower Payette Ditch	May 25, 1983	0.02	
	June 22, 1983	0.08	0.05

TABLE 19. Annual precipitaion for Weiser, Idaho, 1948-1983.

YEAR	TOTAL ANNUAL PRECIPITATION (inches)	YEAR	TOTAL ANNUAL PRECIPITATION (inches)
1948	4.25	1968	11.61
1949	4.95	1969	9.93
1950	9.70	1970	16.28
1951	13.49	1971	11.70
1952	10.45	1972	10.94
1953	11.63	1973	12.85
1954	7.47	1974	8.09
1955	11.10	1975	12.21
1956	12.16	1976	5.37
1957	12.01	1977	9.99
1958	12.53	1978	15.26
1959	10.97	1979	3.61
1960	10.33	1980	--.--
1961	9.71	1981	10.36
1962	11.90	1982	12.29
1963	8.93	1983	13.71
1964	14.07		
1965	10.00	MEAN ANNUAL PRECIPITATION	
1966	7.70	11.40 INCHES	
1967	11.32		

Table 20. Daily precipitation (inches) for Weiser, Idaho, 1983.

DATE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1			0.12		0.19		0.40		0.05		0.10	0.05
2			0.30	0.40							0.03	
3			0.02								0.12	
4											0.05	
5					0.28							
6	0.90										0.05	
7			0.31									
8			0.29		0.26					0.10		
9				0.13	0.13					0.40	0.11	
10	0.05					0.45				0.40	0.13	
11			0.28								0.82	0.10
12			0.06									0.10
13			0.43									
14							0.18					0.03
15											0.32	
16											0.32	
17			T								0.40	
18										0.10		
19	0.33			T				0.30				
20				T								
21								0.30				
22			0.08				T				0.05	
23			0.09	0.20								
24	0.36		0.28	0.25				0.09			0.90	
25			0.02	0.03							0.20	
26	0.02		0.27									
27												
28												
29			0.15			0.18						
30			0.20									
31					0.05					0.40		
MONTHLY TOTALS	1.66	0.00	2.90	1.01	0.91	0.63	0.58	0.69	0.05	1.40	3.60	0.28

T = Trace

Total Annual Precipitation = 12.71 inches

Figure 1. Major drainage basins in Idaho, showing relative size and location of the Weiser River drainage.

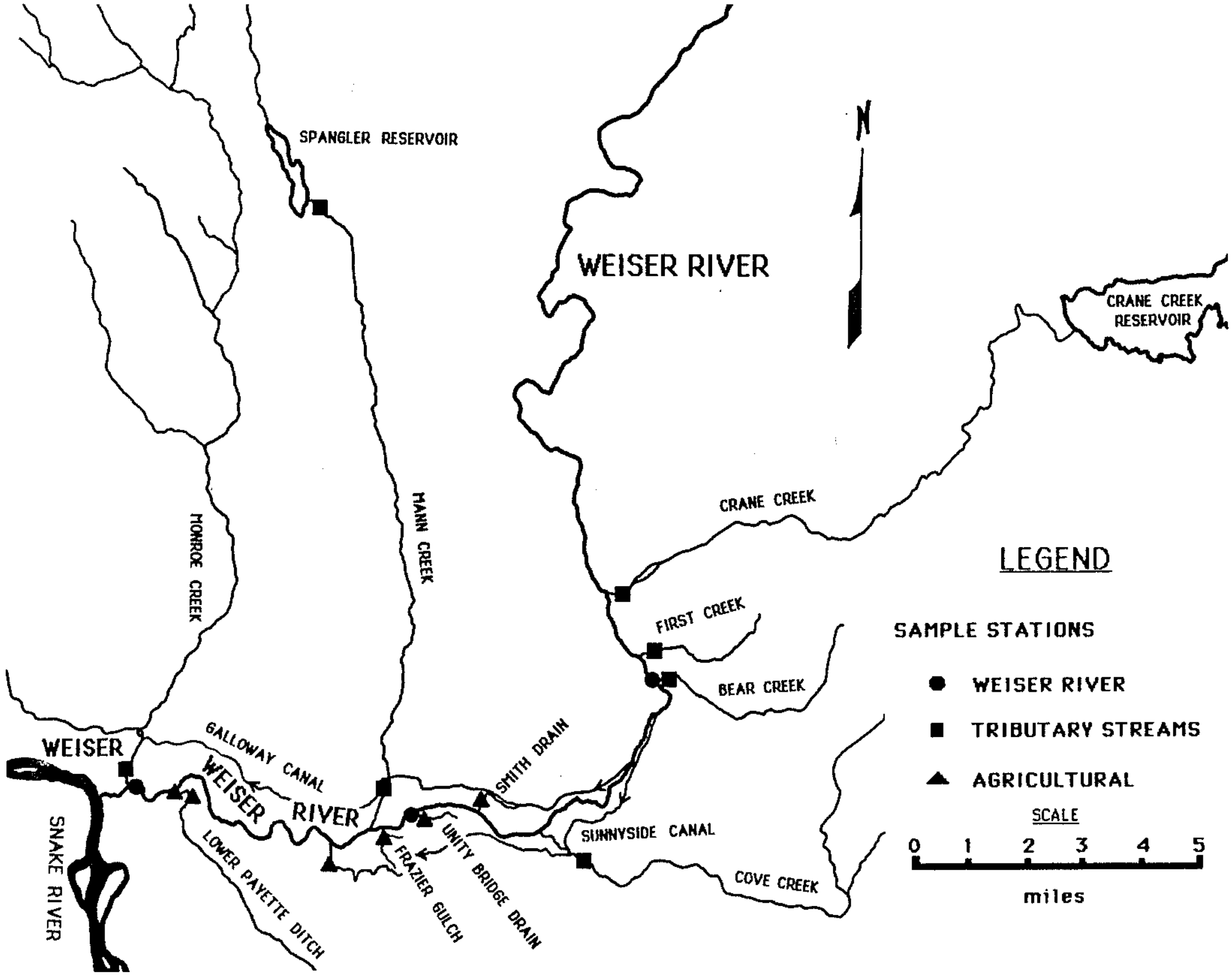


Figure 2. Map of Lower Weiser River Water Quality Survey Area. Sample stations are indicated as are major tributaries to the river.

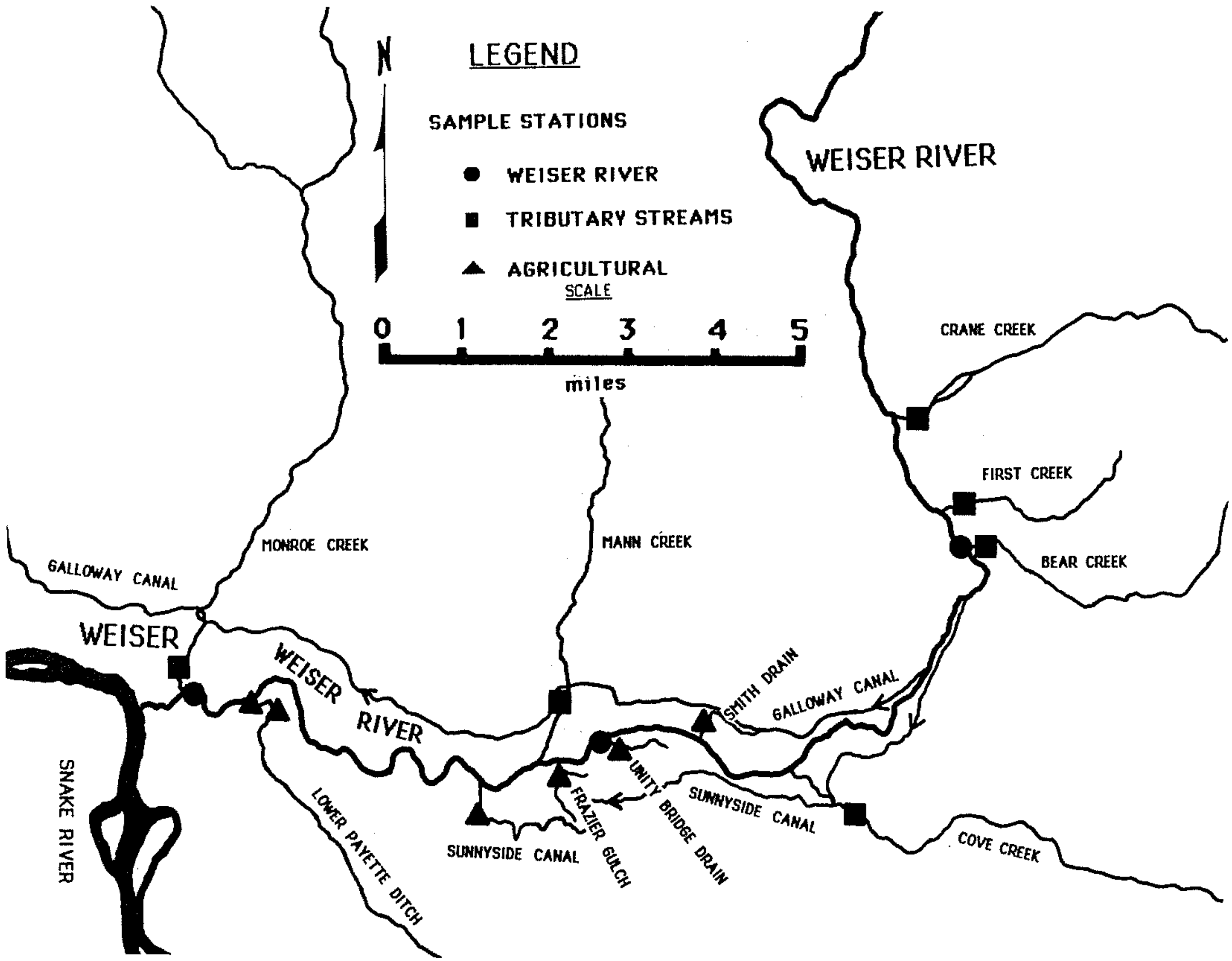


Figure 3. Map of Lower Weiser River Water Quality Area. This is enlarged from Figure 2 showing the sample stations.

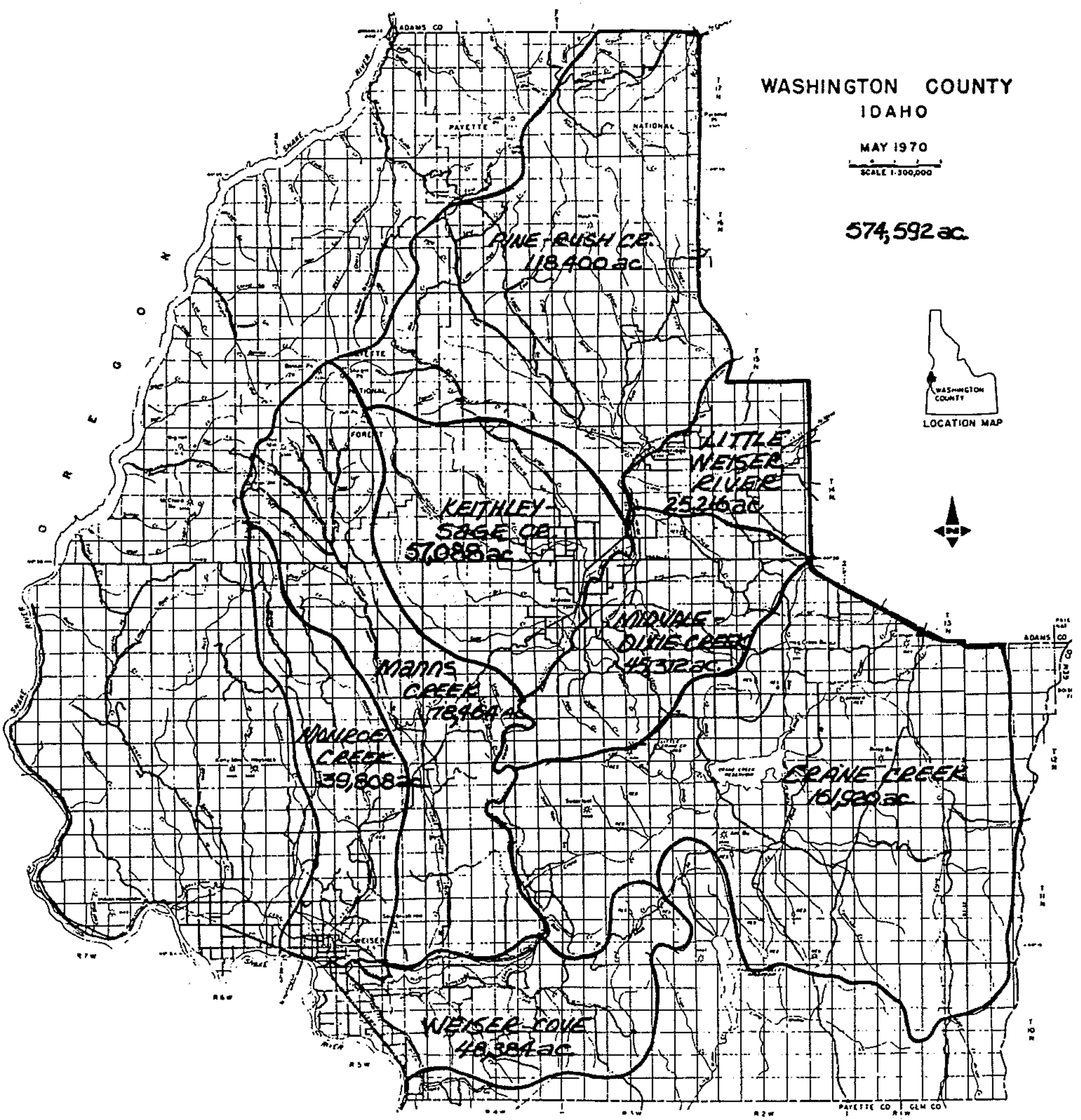


Figure 4. Map of Washington County, Idaho, showing the drainage areas that impact the Weiser River. Map courtesy of Weiser River Soil Conservation District.

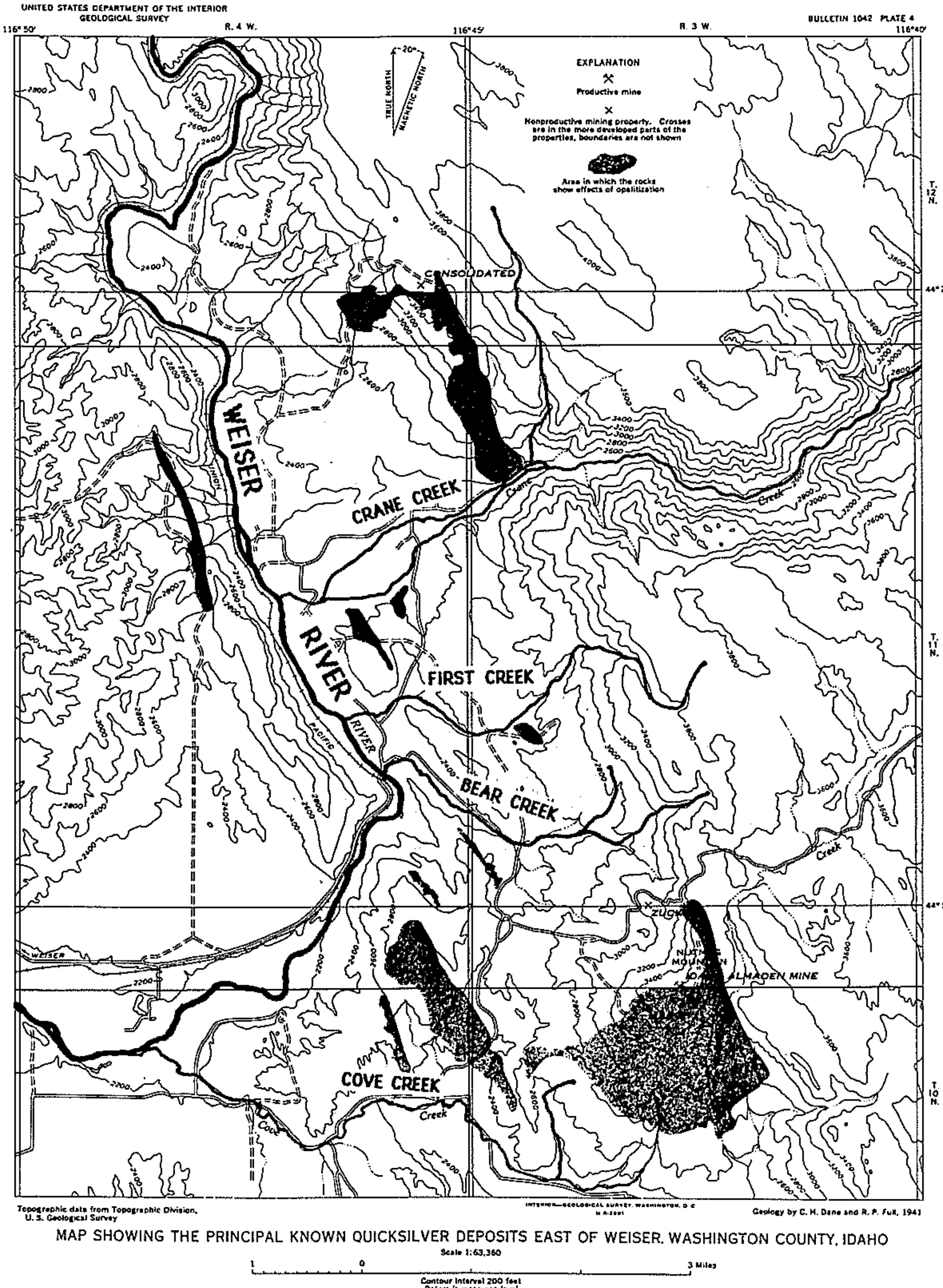


Figure 5. Map of the known Quicksilver (Mercury) deposits in the Lower Weiser River Drainage in relation to the streams on the eastern side of the study area. Map modified from and courtesy of Ross (1956).

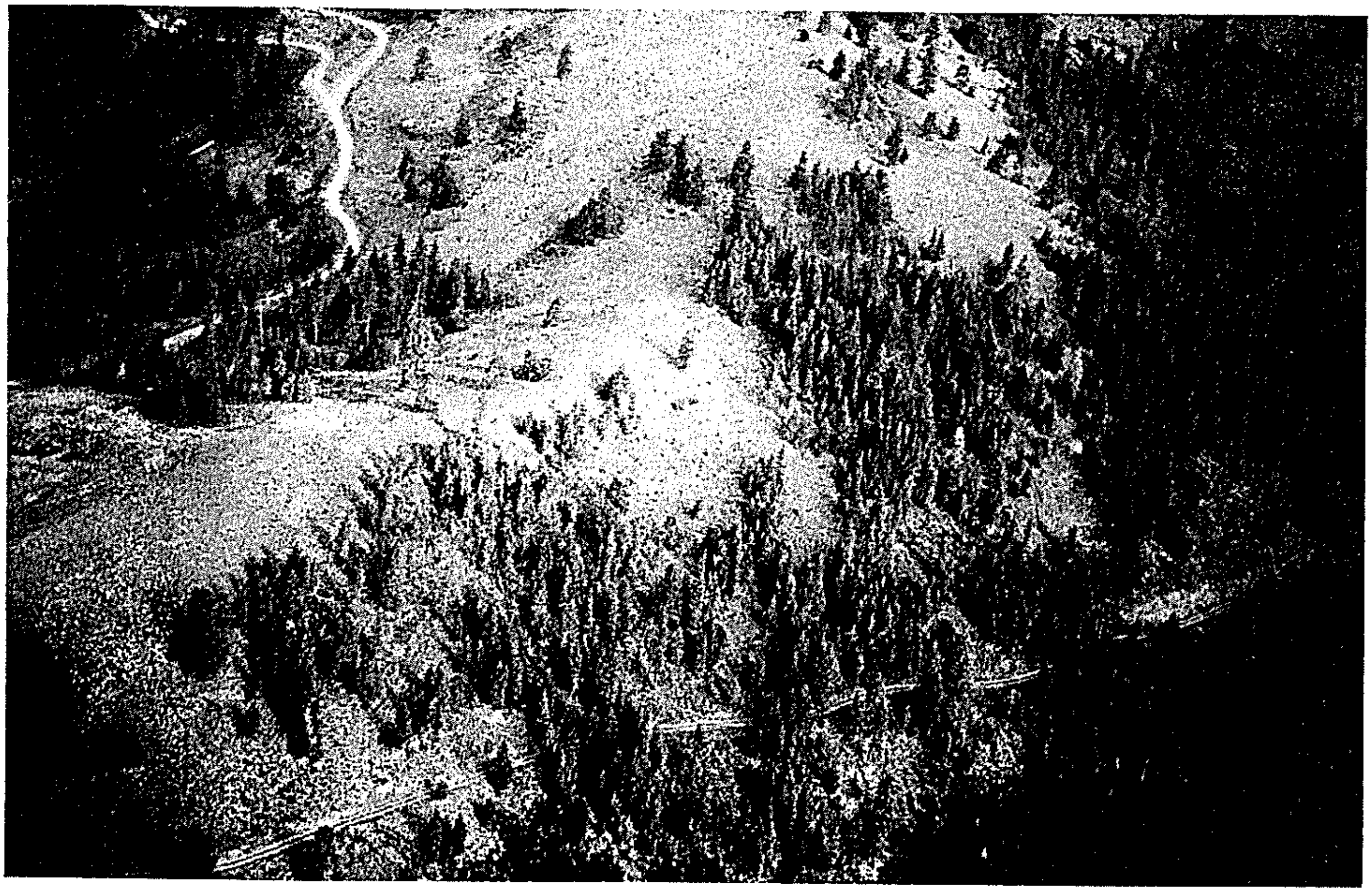


Figure 6. Forested upper watershed of Mann Creek. Photographed July 28, 1983.

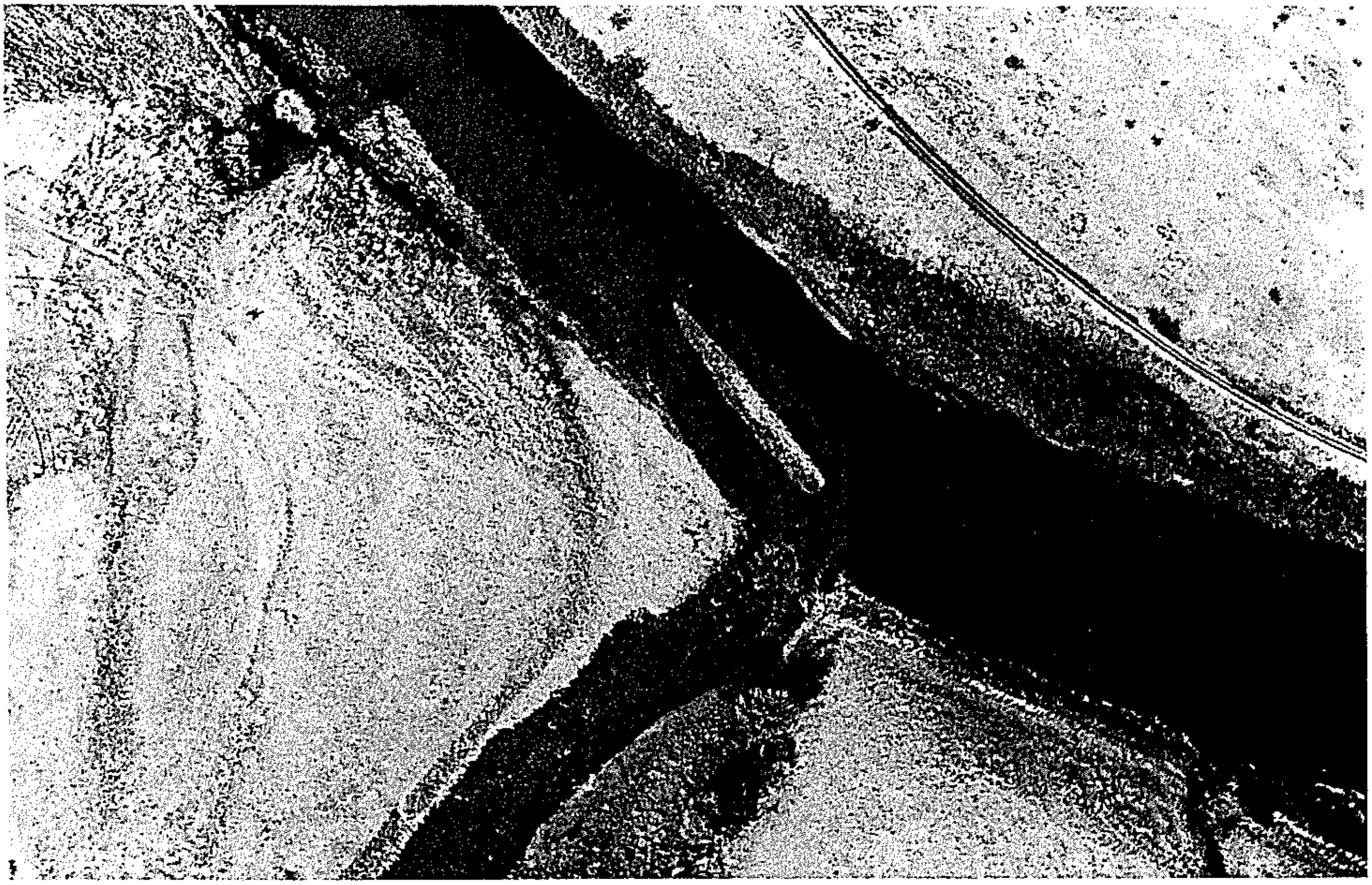


Figure 7. The confluence of Crane Creek and the Weiser River, July 28, 1983. The extremely turbid water in Crane Creek indicates that water is being released from Crane Creek Reservoir to augment flows for irrigation purposes on the Lower Weiser River.

Figure 8. Sunnyside Canal near its return to the Lower Weiser River. Suspended sediment can be seen in this photograph.

Figure 9. Area of intense agricultural use along the Lower Weiser River. An example of stream bank erosion is shown.

Figure 10. Area of severe streambank erosion in the midsection of the Lower Weiser River. The bare bank visible is the south bank.

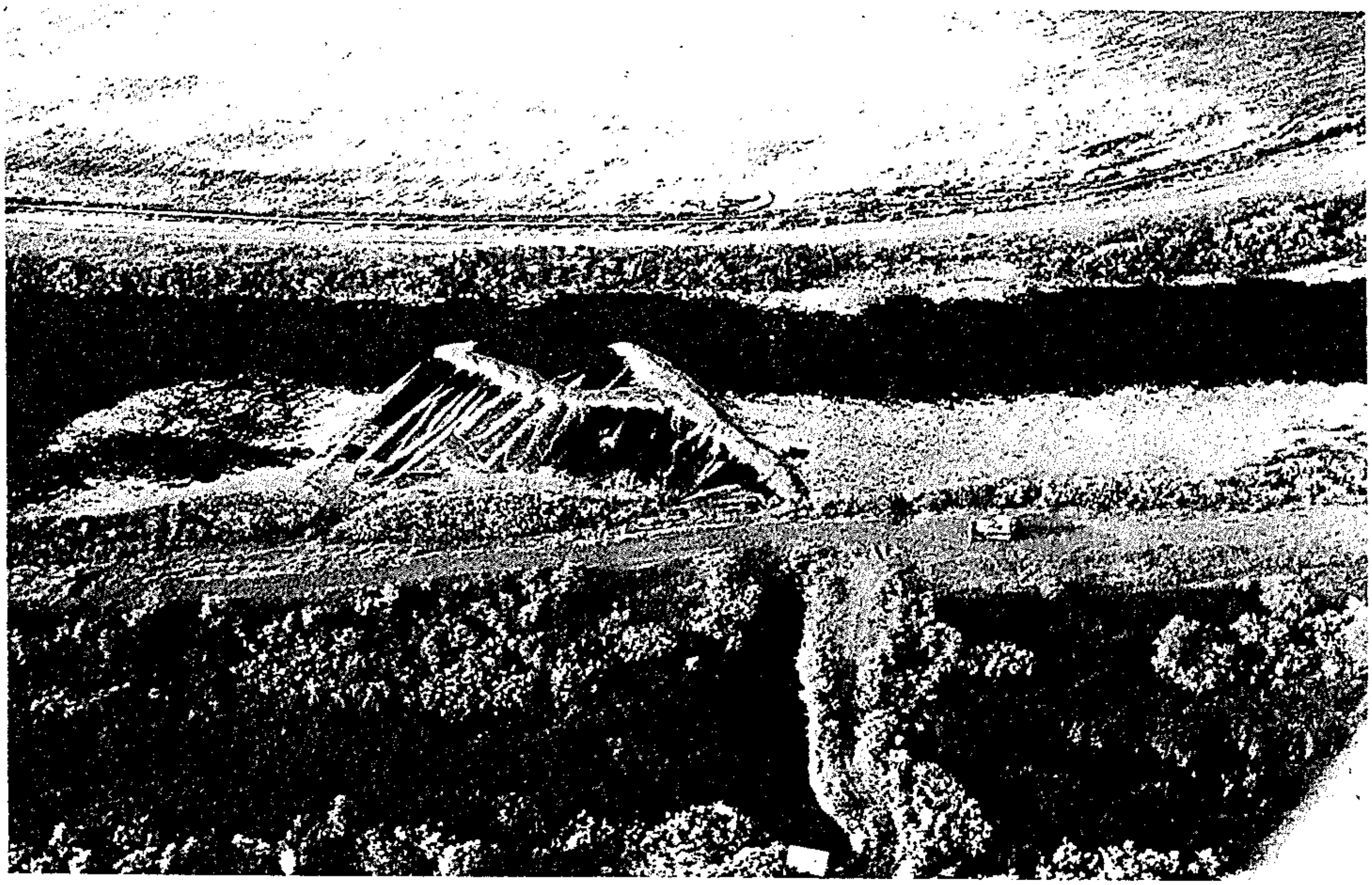


Figure 11. Gravel removal operation on the Lower Weiser River, July 28, 1983.

Figure 12. Upper watershed area of Monroe Creek showing an eroded dry-land farm. Photograph taken March 14, 1983.

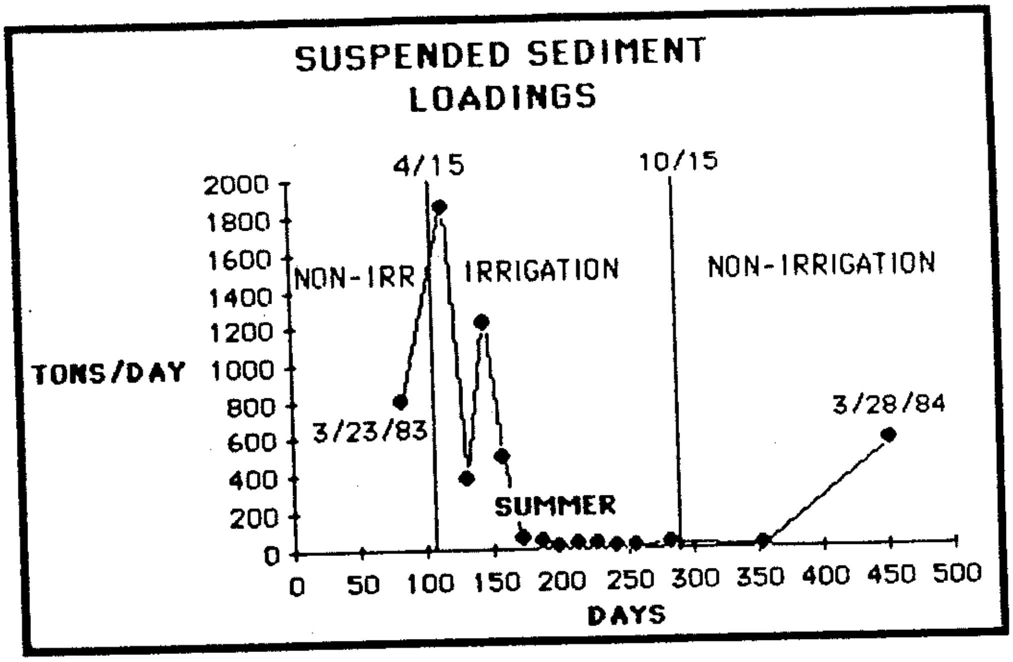


Figure 13. Suspended sediment loadings, Weiser River at Weiser, 1983-84.

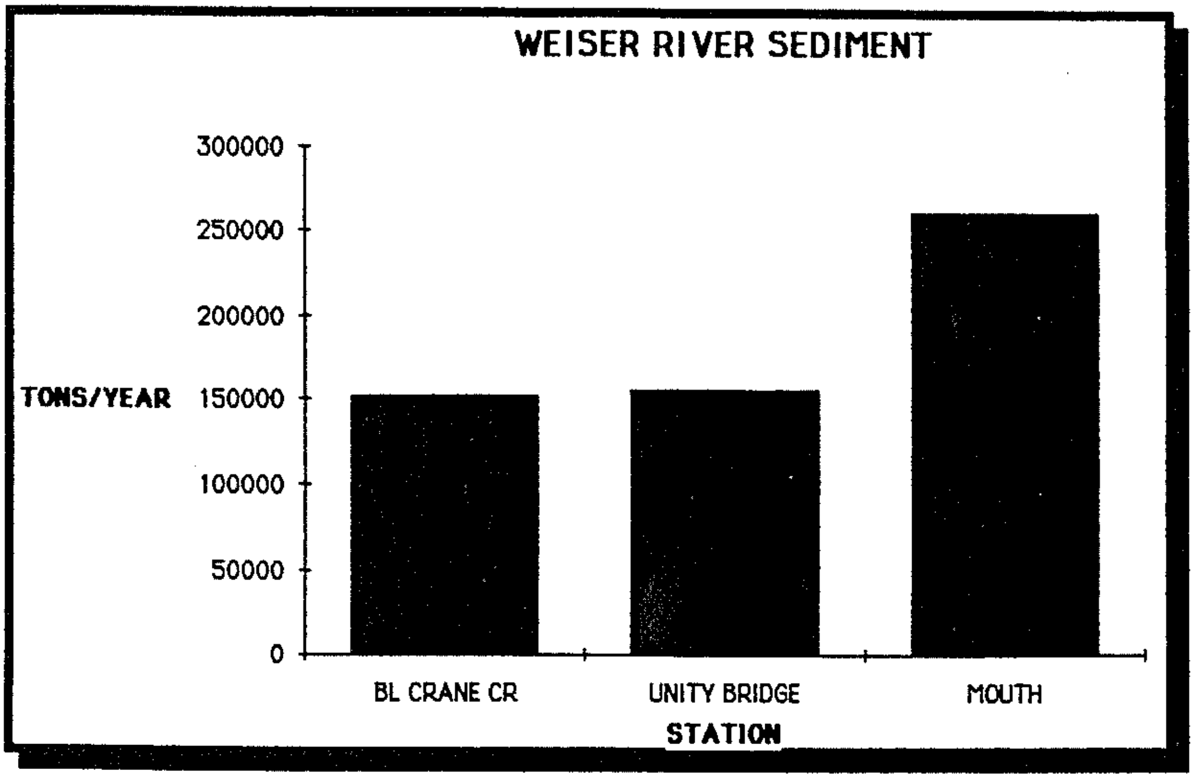


Figure 15. Mean annual suspended sediment loadings for the Weiser River sample stations, 1983-84.

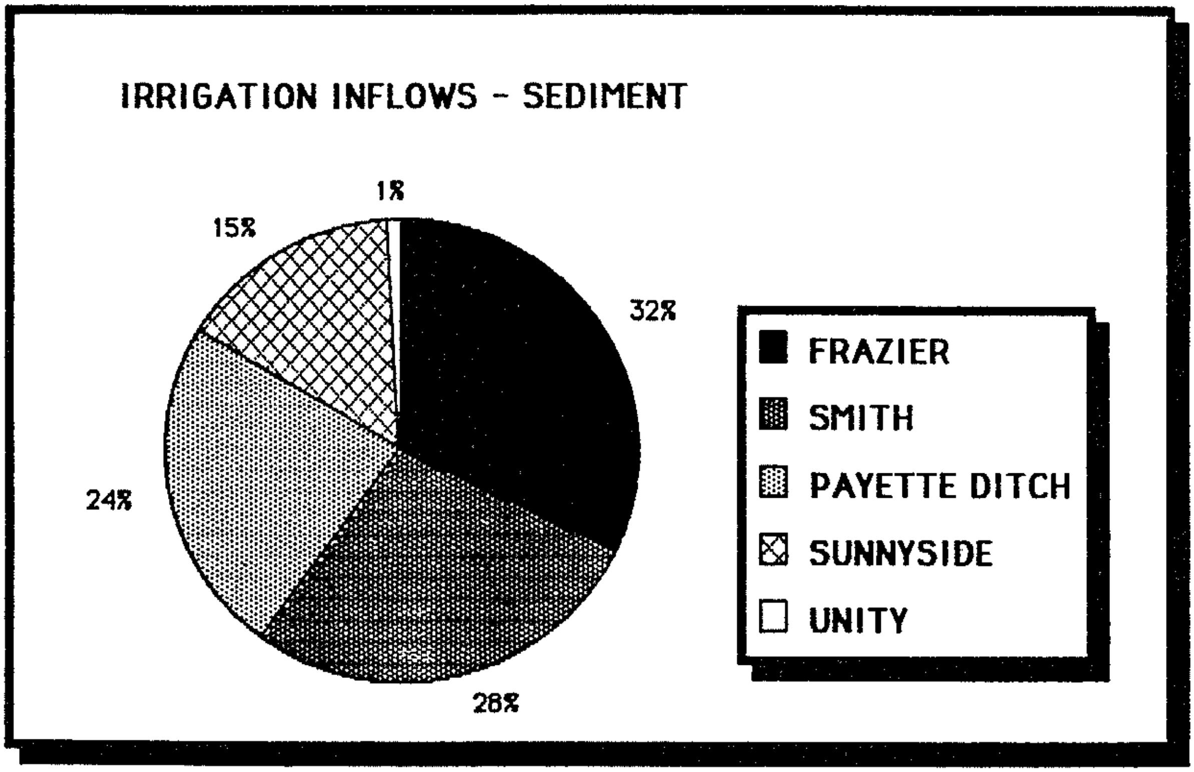


Figure 16. Suspended sediment loadings for irrigation return flows sampled during 1983 (% of total).

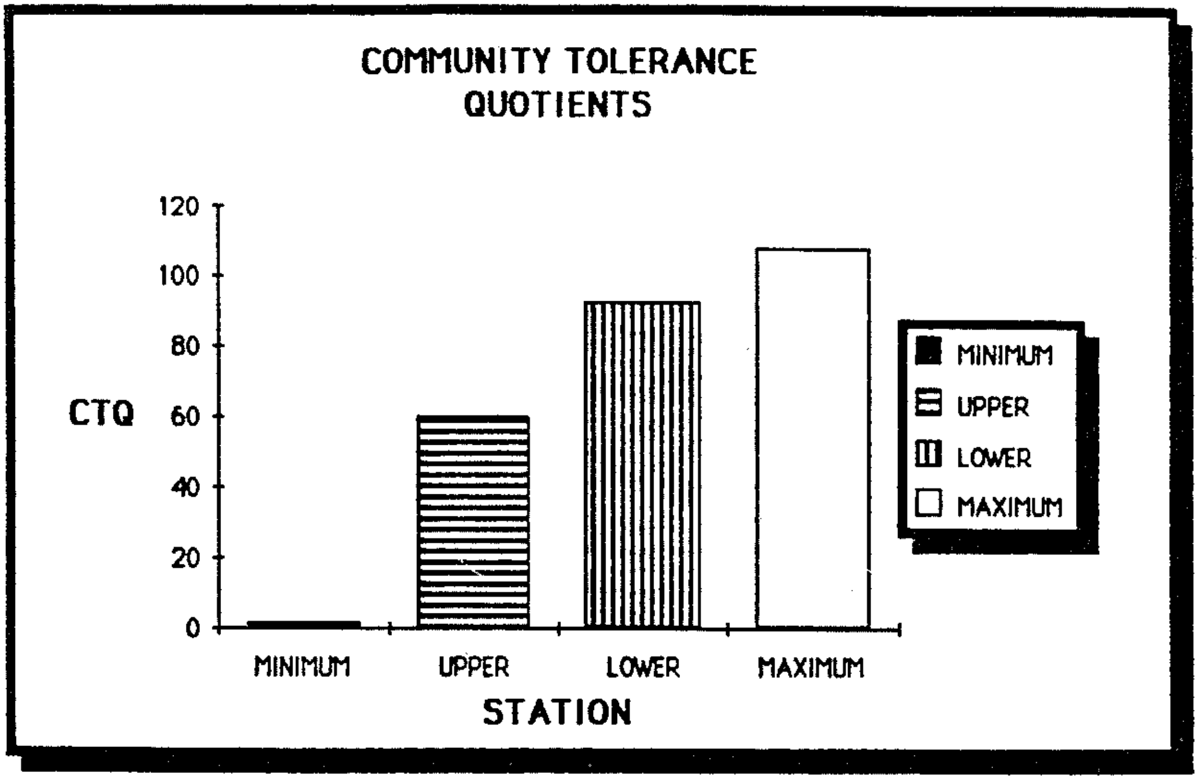


Figure 17. Community tolerance quotients (CTQ's) for upper station (Weiser River above Crane Creek) and lower station (Weiser River near Weiser). The minimum possible CTQ of 2 and the maximum possible CTQ of 108 are shown for reference.

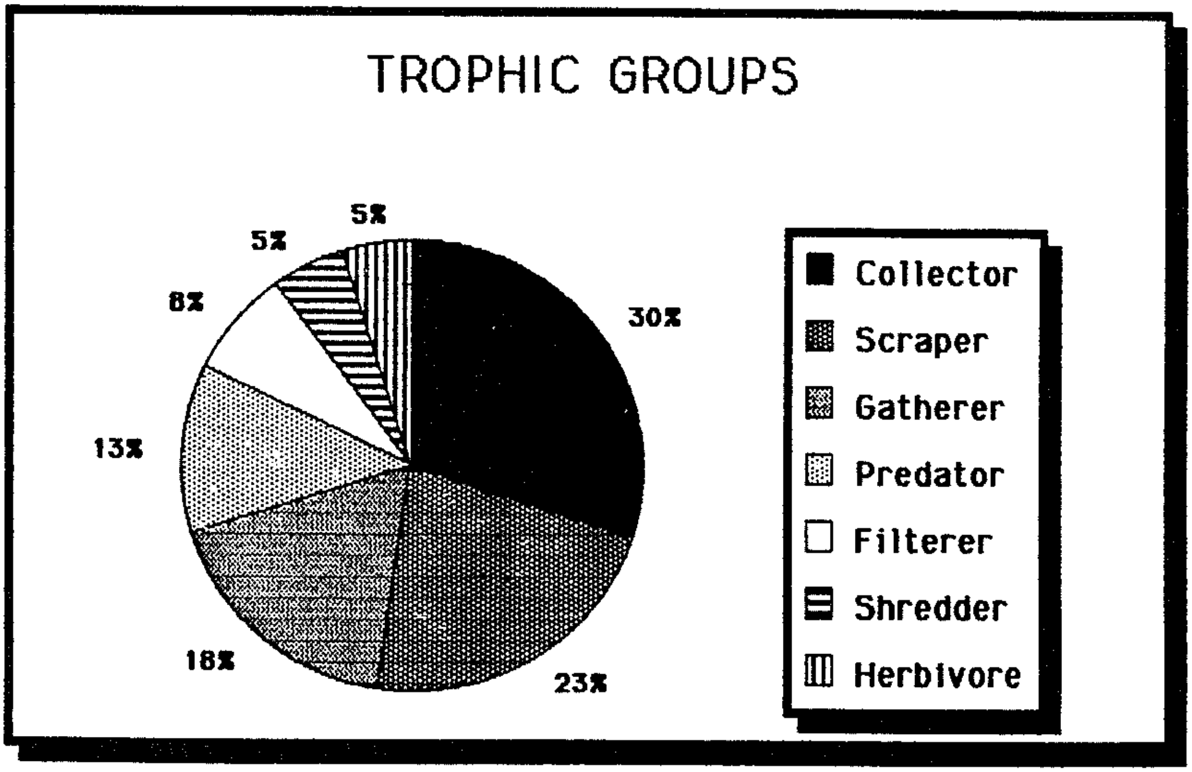


Figure 18. Trophic groups (% occurrence by taxa) of macroinvertebrates collected at Weiser River above Crane Creek, September 7, 1983.

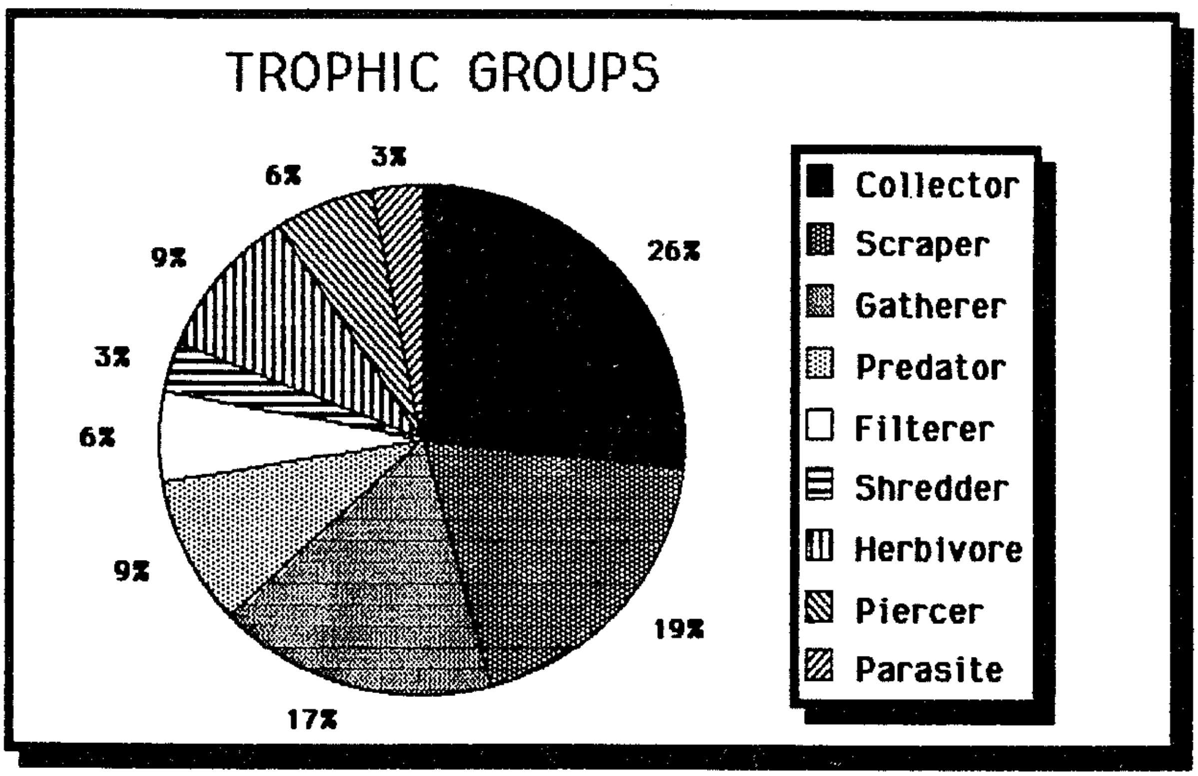


Figure 19. Trophic groups (% occurrence by taxa) of macroinvertebrates collected at Weiser River near Weiser, August 17, 1983.

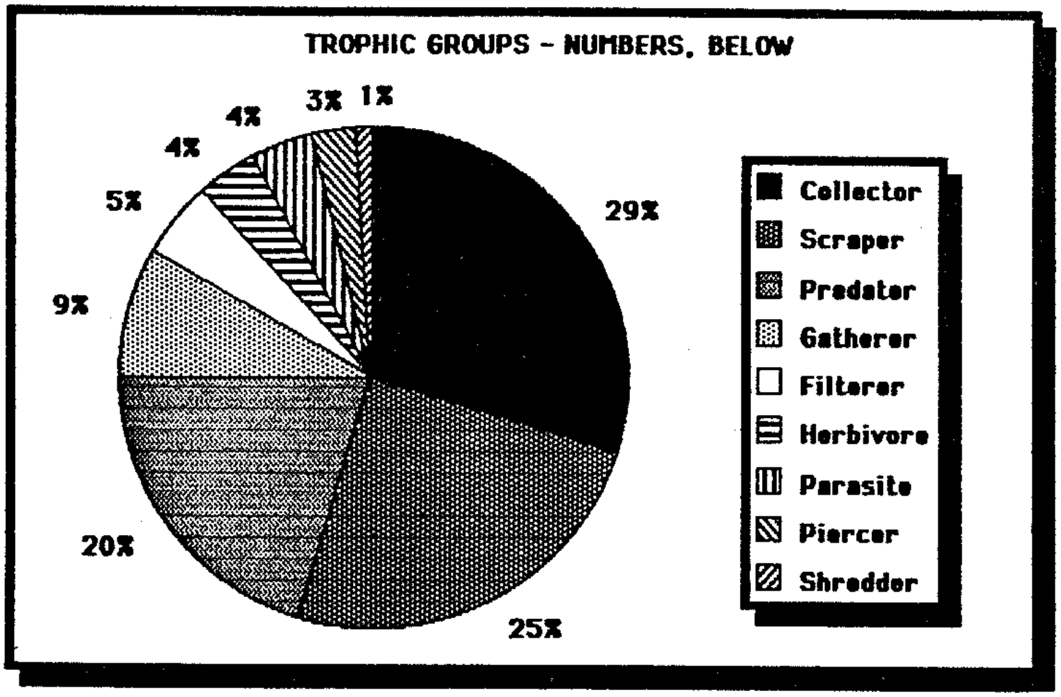


Figure 21. Trophic groups (% occurrence by numbers of individuals) of macroinvertebrates collected at Weiser River below Crane Creek, September 7, 1983.