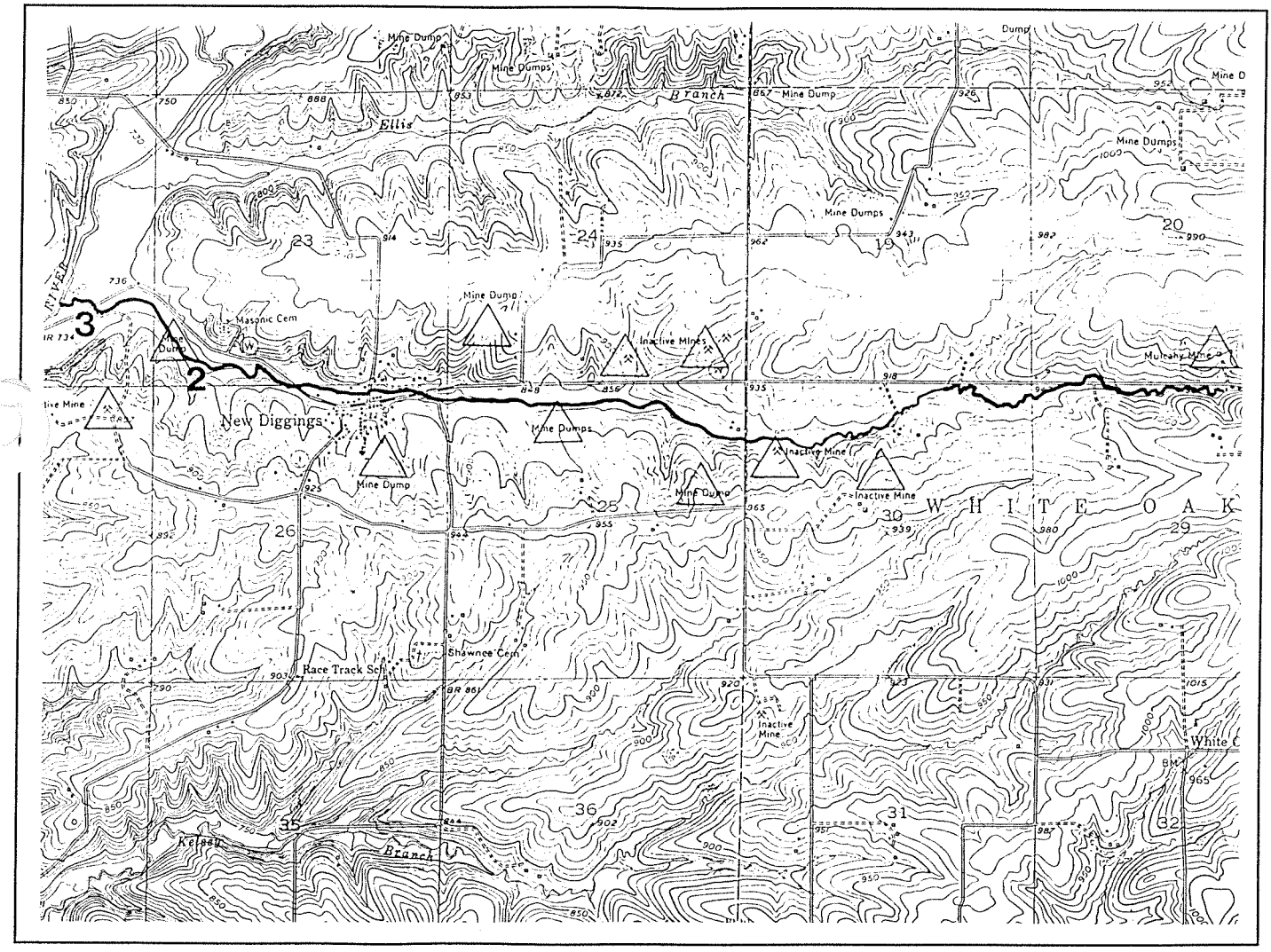
USE CLASSIFICATION OF DIGGINGS CREEK
and
PRELIMINARY MINING WASTE IMPACT ASSESSMENT

Lafayette County, Wisconsin



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RESOURCE DESCRIPTION

Diggings Creek (New Diggings Br.) is a small tributary to the Fever River (Galena) with a baseflow of about 1 - 3 cfs. Stream velocities are moderate to fast and reflect the high gradient nature common to most small "Driftless Region" streams. With an average gradient of 62.5 feet / mile, scouring has exposed bedrock, boulders and rubble along many sections of the stream. The hardpan substrates provide favorable habitat for macroinvertebrate life. Agricultural practices in the 3.9 sq. mile watershed have caused silt deposition in pools and slower areas of the stream, but frequent scouring prevents significant sediment buildup. Low stream flow is somewhat limiting to gamefish, such as smallmouth bass, but water quality is the primary factor preventing full biological potential of the stream. For many years, numerous mine dumps and abandoned mines have leached electrolytes into the stream. In 1966, the stream conductivity was measured at 1119 uhmos/cm and was roughly twice the mean for Lafayette County streams.

WATER QUALITY INFORMATION (1993 - 1995)

In 1993, WDNR Southern District Wastewater staff sampled two roaster pile sites in the Diggings Creek watershed. Surface leachate water contained extremely high metals concentrations and zinc levels ranged from 1,400 to 33,000 ug/l. Both of these sites are located within close proximity to the stream. At least eight other mine dumps and abandoned mines have been identified throughout the watershed.

In Spring of 1994 and 1995, Southern District Water Resources Management staff sampled stream benthic invertebrate communities. Just east of New Diggings, a small tributary flows past one of the roaster piles sampled in 1993. Tributary macroinvertebrates indicated "fair" water quality in 1994 and "very good" water quality in 1995, based on the Hilsenhoff Biotic Index (HBI). Just west of New Diggings lies the other roaster pile sampled in 1993. Just upstream of the roaster pile in Diggings Creek, HBI values indicated "fairly poor" water quality in 1994 and "good" water quality in 1995. Below the roaster pile and near the confluence with the Fever River, HBI values also reflected "fairly poor" water quality in 1994 and "good" water quality in 1995. At all three sites, water quality improved in 1995 based on the HBI (Figure 4). Invertebrate community structure also indicated improved water quality in 1995 based on chironomid reductions (Figure 5) and mayfly, stonefly and caddisfly increases (Figure 6) at all three sites. In general, macroinvertebrates at Diggings Creek site near the Fever River indicated the most disturbed conditions and large roaster pile impacts.

The fish community was also sampled in April, 1994 using an AbP-3 pulse DC shocker. Nine species were found at the three site (Table 1) and reflect a fairly diverse forage fishery in spite of the mining waste contaminants.

Stream water chemistry data for Diggings Creek is somewhat limited, but lowflow values generally indicate high zinc and conductivity levels at all three sites. Oddly enough, these levels did not increase downstream. Instead, higher zinc levels were actually found above the large roaster pile west of New Diggings. Macroinvertebrates and high iron were the only indicators which discriminated water quality effects contributed by the large roaster pile compared to other mining wastes in the watershed. High iron concentrations below the roaster pile are consistent with observations that the downstream substrate was covered with more iron precipitate than other sites in the watershed.

DISCUSSION OF MINING WASTE IMPACTS

Although a thorough evaluation can not be made with the available information, a review of existing chemical, biological and physical data suggest that Diggings Creek water quality is variable and likely reflects seasonal weather conditions. Macroinvertebrates indicated much better water quality in 1995, compared to 1994. Since 1993 was a record runoff year, the benthic community was likely exposed to more toxic runoff than normal. Macroinvertebrates are good indicators of relatively long term water quality and the Spring, 1994 benthic community can be considered representative of 1993 conditions. Significantly less toxic runoff in 1994 resulted in a healthier benthic community in 1995.

Fish were not sampled in 1995, so a two year comparison can not be made. Considering just the 1994 data alone, a surprisingly high diversity of fish were found in spite of the toxic runoff. The mere presence of numerous fish reflect two likely factors. First, baseflow toxicity is not severe since the stream supports numerous forage fish species at all three sites. Second, fish are highly mobile and can seek out refuges during temporary stress periods. Unlike Diggings Creek, sustained baseflow toxicity in Brewery Creek prior to mining waste containment prevented all but a few incidental fish and invertebrates from inhabiting the stream. Baseflow zinc concentrations in Brewery Creek ranged from 2100 to 4900 ug/l compared to maximum levels less than 1000 ug/l in Diggings Creek. Even following the mining waste containment project, baseflow zinc concentrations in Brewery Creek are not significantly different than current Diggings Creek levels. While zinc concentrations are chronically toxic in Brewery Creek, higher hardness concentration in Diggings Creek probably reduces the zinc toxicity. Macroinvertebrates are healthier in Diggings Creek and appear to reflect lower toxicity. Clearly, mining wastes deposited in Mineral Point created more severe toxicity in Brewery Creek than we have observed so far in Diggings Creek.

Although just a few baseflow water chemistry samples have been collected from Diggings Creek so far, why were higher zinc levels observed above the large roaster pile compared to below? Perhaps groundwater seepage below the roaster pile may be diluting otherwise higher zinc levels downstream. The samples also indicate

that a relatively moderate level of pollution (compared with Brewery Creek) occurs during baseflow conditions. Consistent with other streams degraded by mining wastes, more substantial pollution and toxicity will likely occur during periods of runoff. The 1994 and 1995 macroinvertebrate communities are probably the best indicators we currently have concerning potential toxicity in Diggings Creek. The benthic community clearly suffered following the floods of 1993.

To chemically assess the impacts of abandoned mining wastes or the effectiveness of any waste containment project, an expensive event monitoring program would be required to detect subtle water quality changes. Unfortunately, establishing a continous monitoring station is well beyond our monitoring budget. A modest baseflow sampling effort, such as we conducted on Brewery Creek in Mineral Point, would not be effective for evaluating current or post containment pollutant loads in Diggings Creek. Sampling macroinvertebrates may be more effective, but annual variability associated with variable runoff may mask actual water quality changes.

USE CLASSIFICATION

Even though Diggings Creek receives mining waste leachate from at least 10 sites in the watershed, the stream supports diverse forage fish and macroinvertebrate communities. Perhaps the high hardness values, exceeding 600 mg/l, may have reduced toxicity below the chronic level for most species found in the stream. The classification for the entire stream is *warm water fish and aquatic life*.

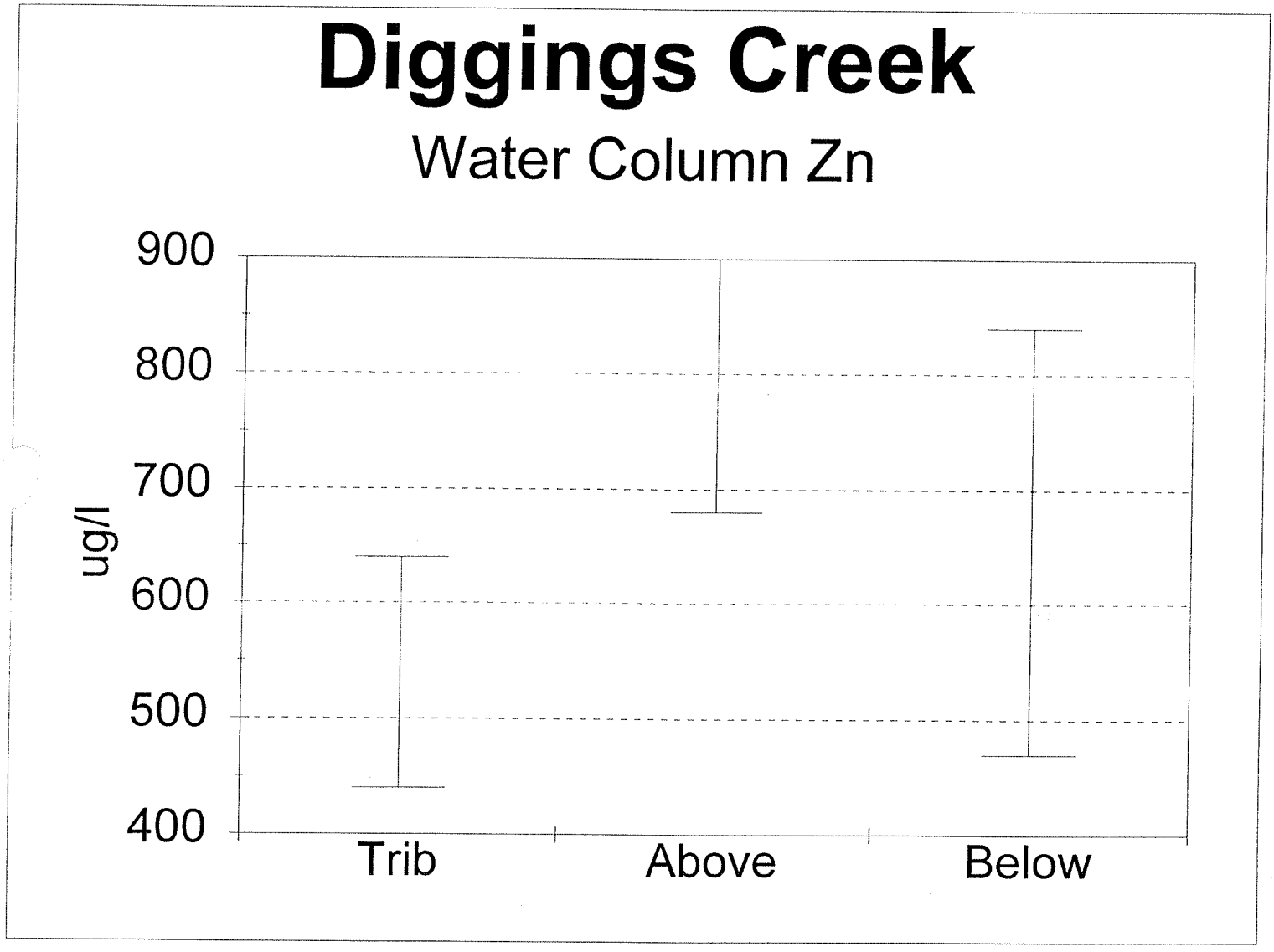
References

Blabaum, Janet M., Brenda L. Howald and Thomas N. Harpt. 1993. Results of the 1993 Spring/Summer Field Survey of the Southwestern Wisconsin Zinc-Lead Mining District. WDNR. Madison, WI.

Marshall, Dave and Steve Fix. 1995. Brewery Creek Water Quality Before and After a Mining Waste Cleanup Project at Mineral Point, WI. WDNR. Madison, WI.

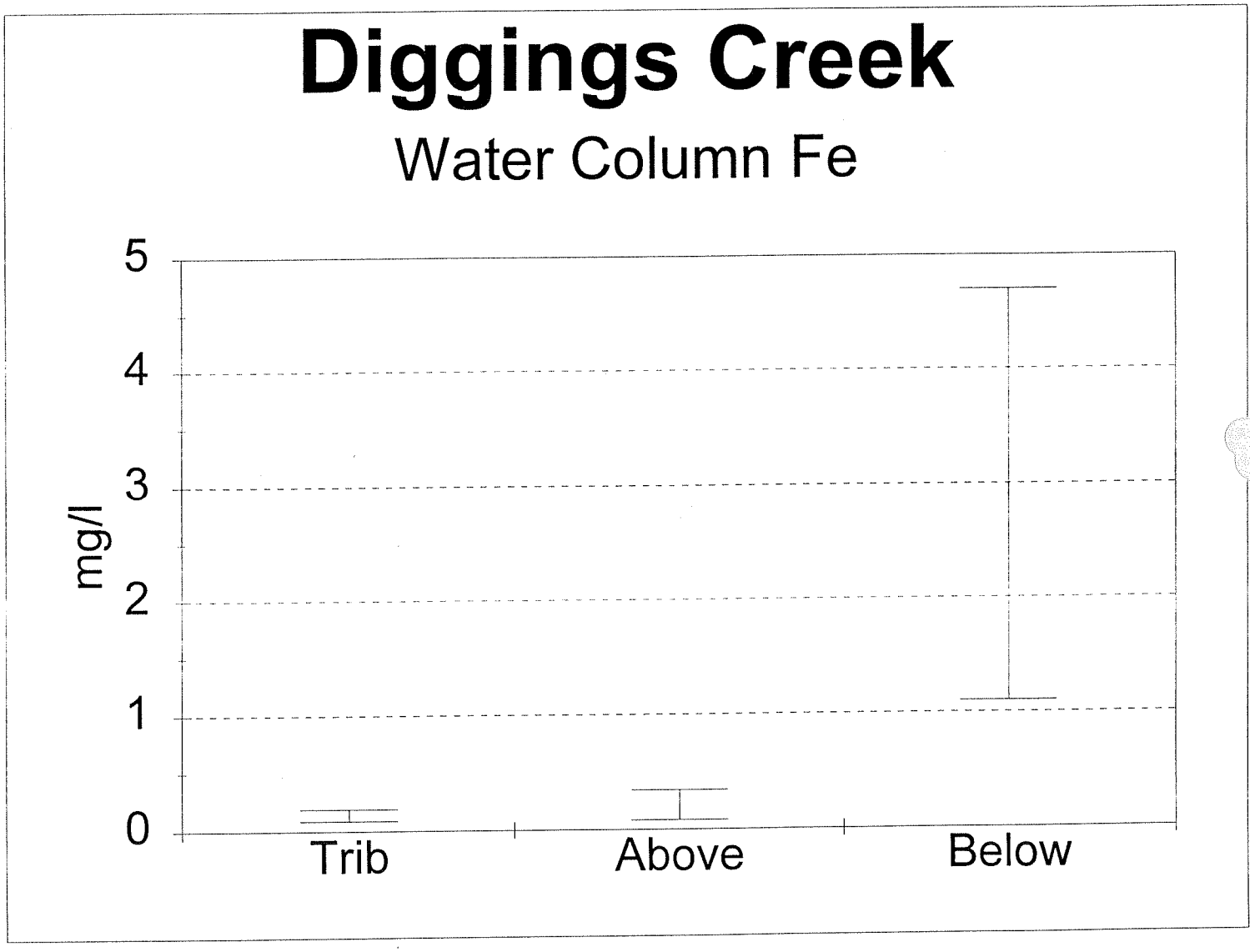
Piening, Ronald, Ronald Poff, and C. W. Threinen. 1967. Surface Water Resources of Lafayette County. WDNR. Madison, WI.

Figure 1: Diggings Creek Water Column Zn Levels



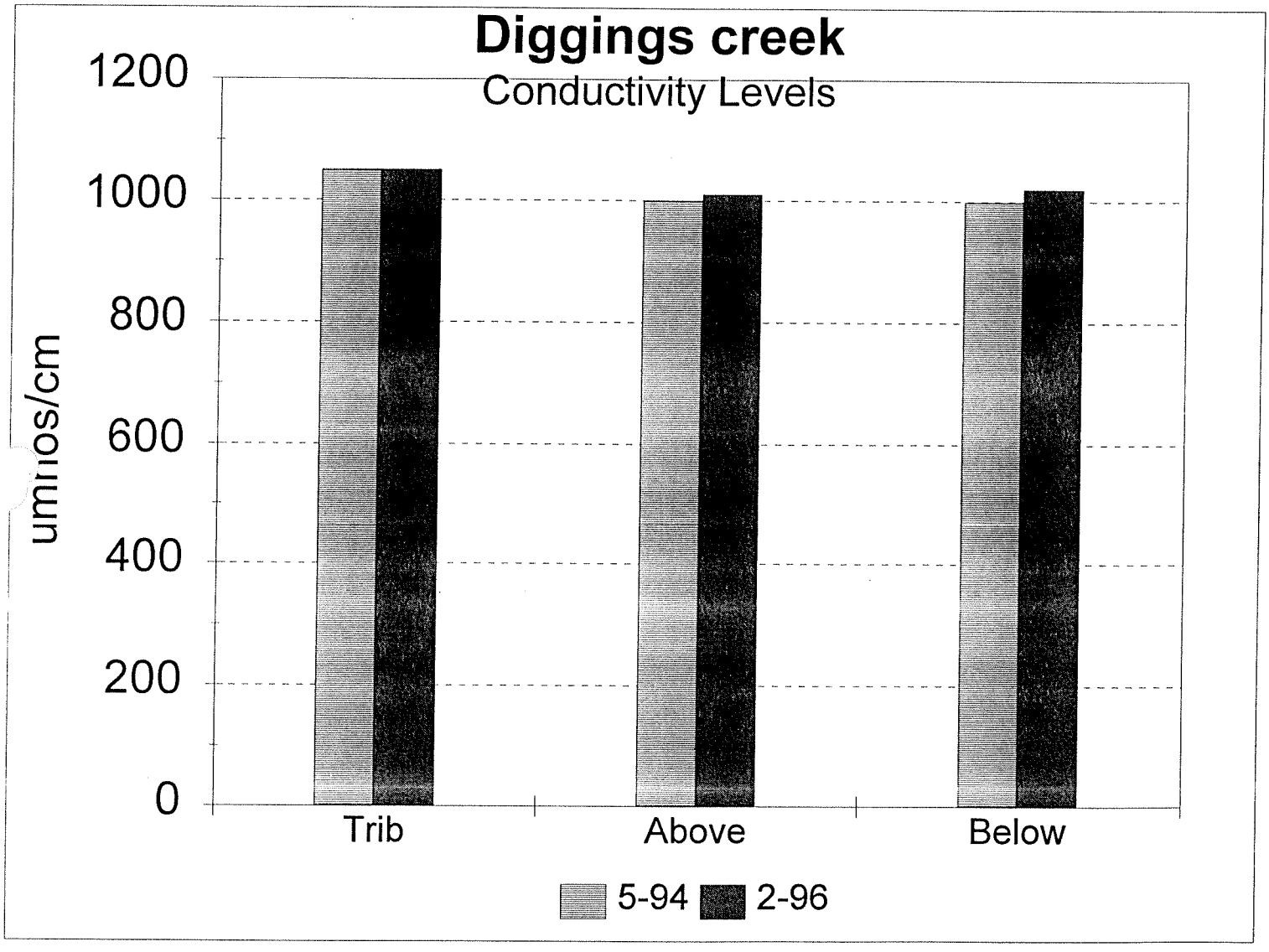
Range (N = 3 / site)

Figure 2: Diggings Creek Water Column Fe Levels



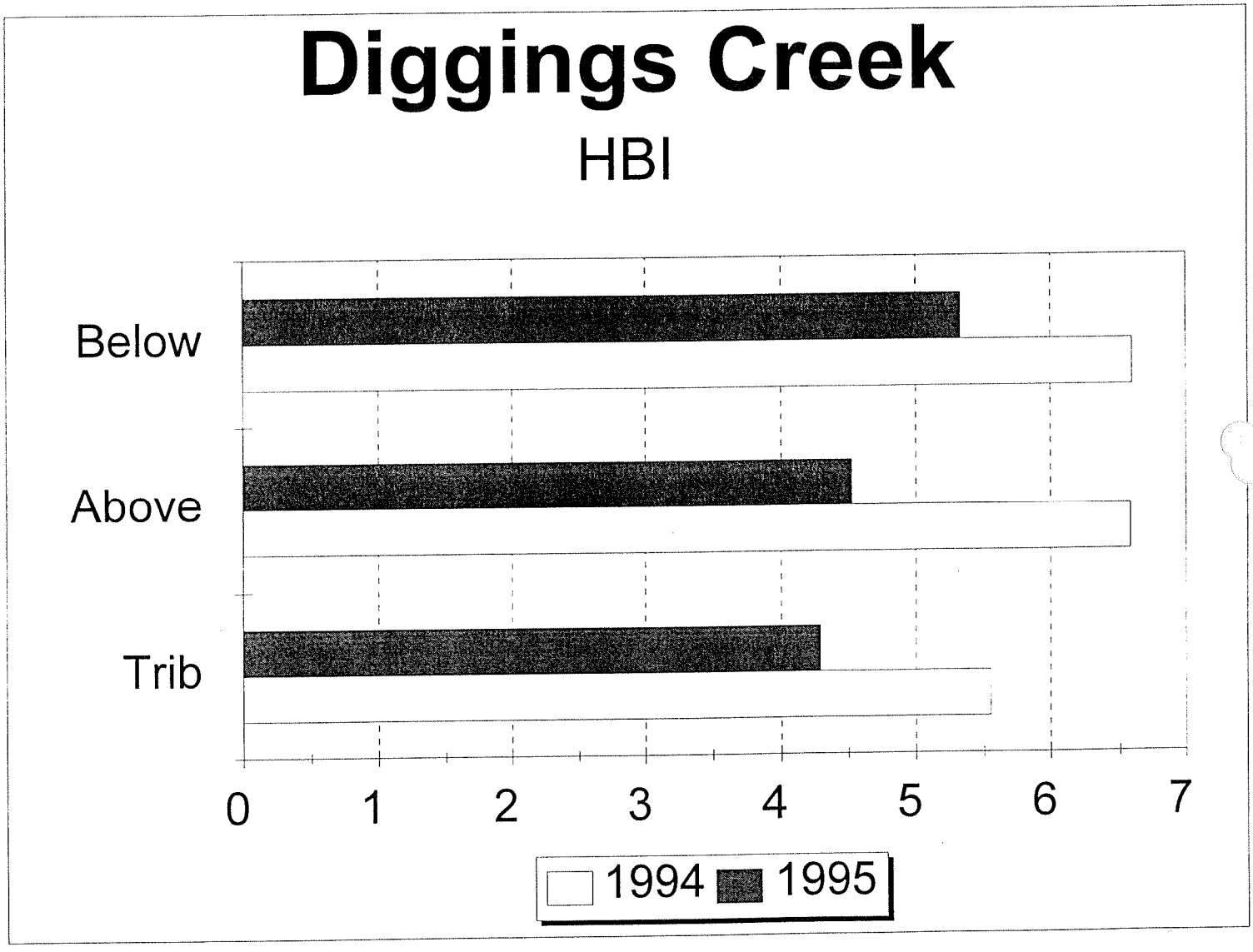
Range (N = 3 / site)

Figure 3: Diggings Creek Conductivity Levels



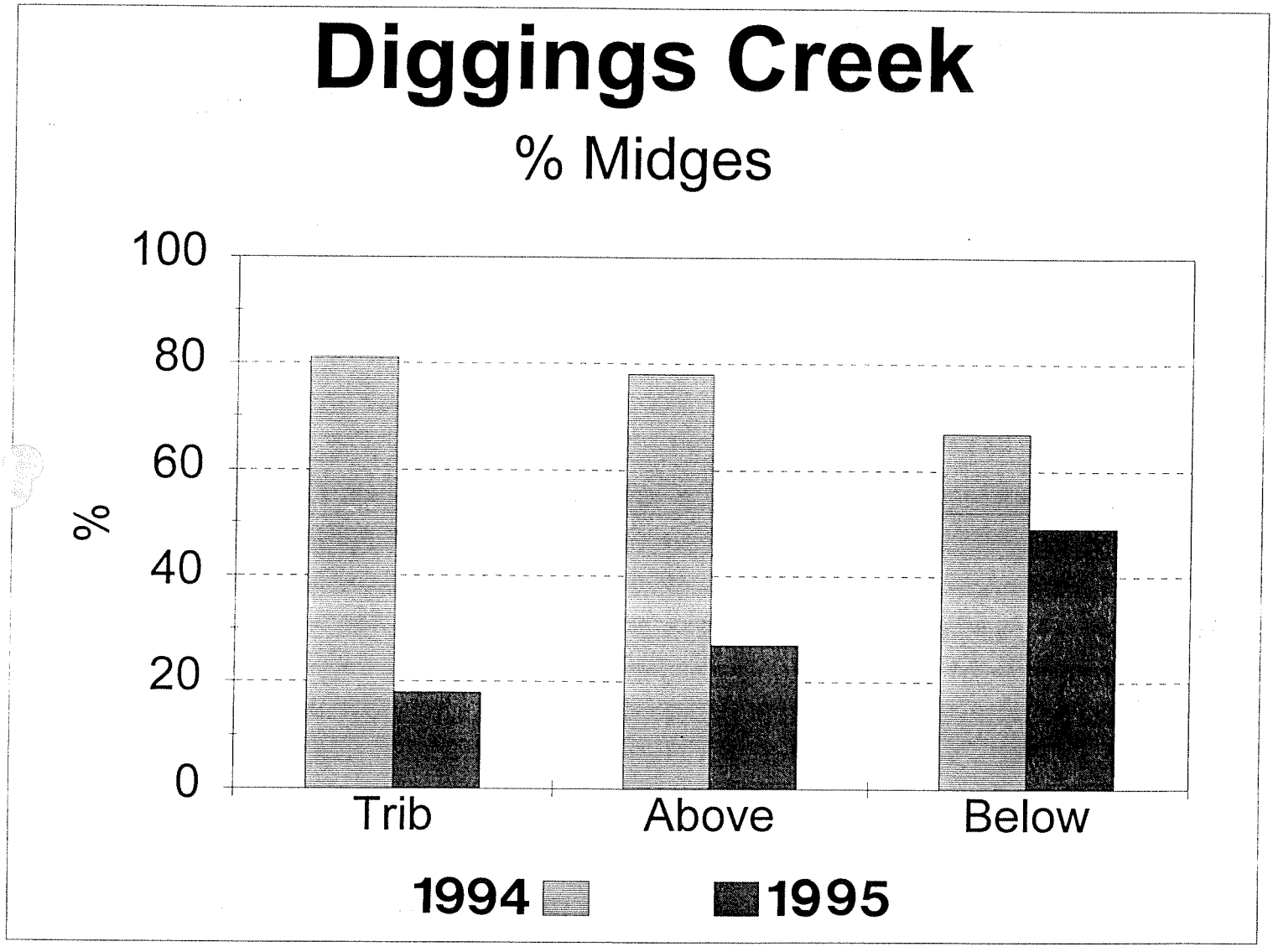
At 25 degrees C

Figure 4: Diggings Creek Macroinvertebrates



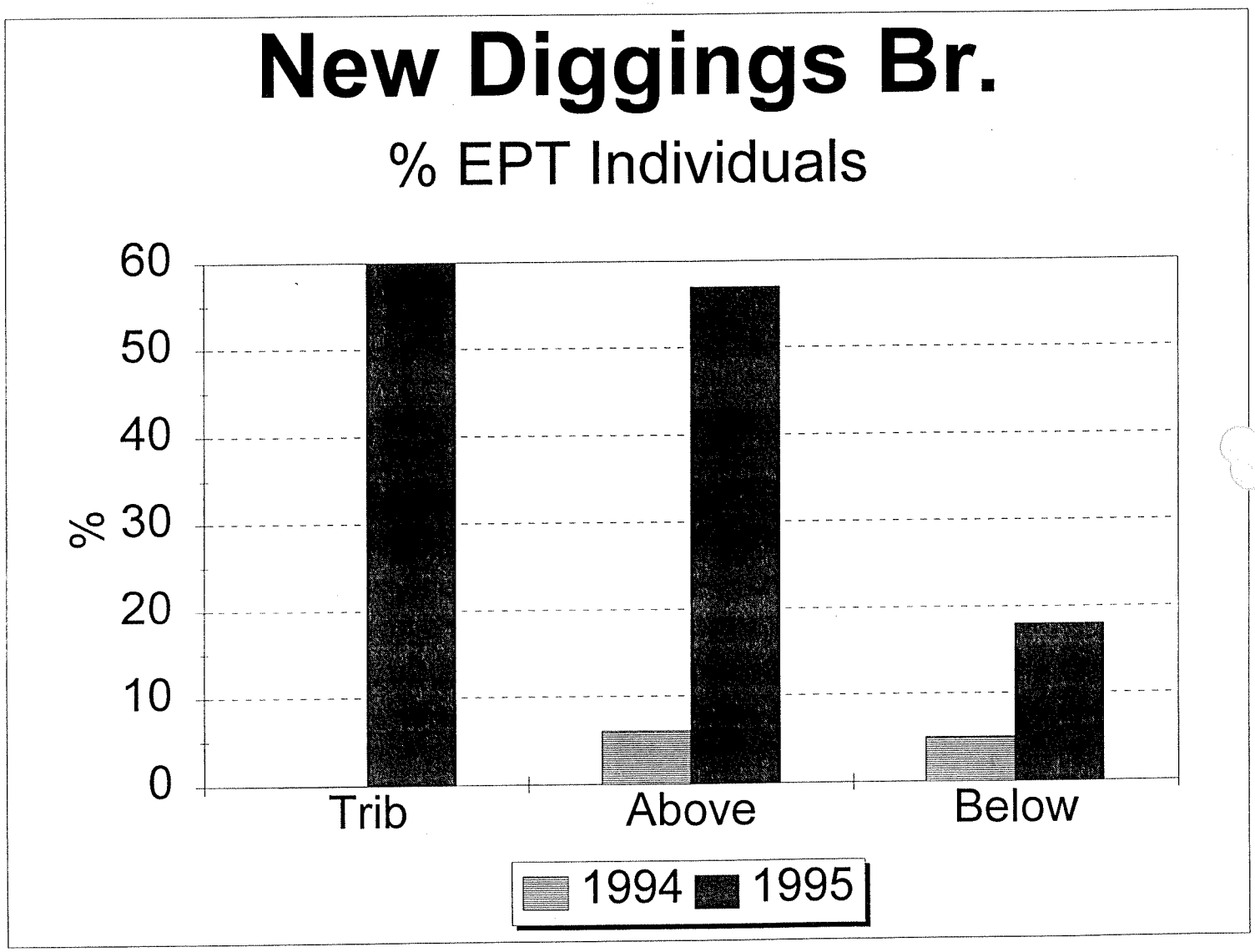
(3.51-4.5 = very good, 4.51-5.5 = good, 5.51-6.5 = fair, 6.51-7.5 = fairly poor water quality)

Figure 5: Diggings Creek Macroinvertebrates



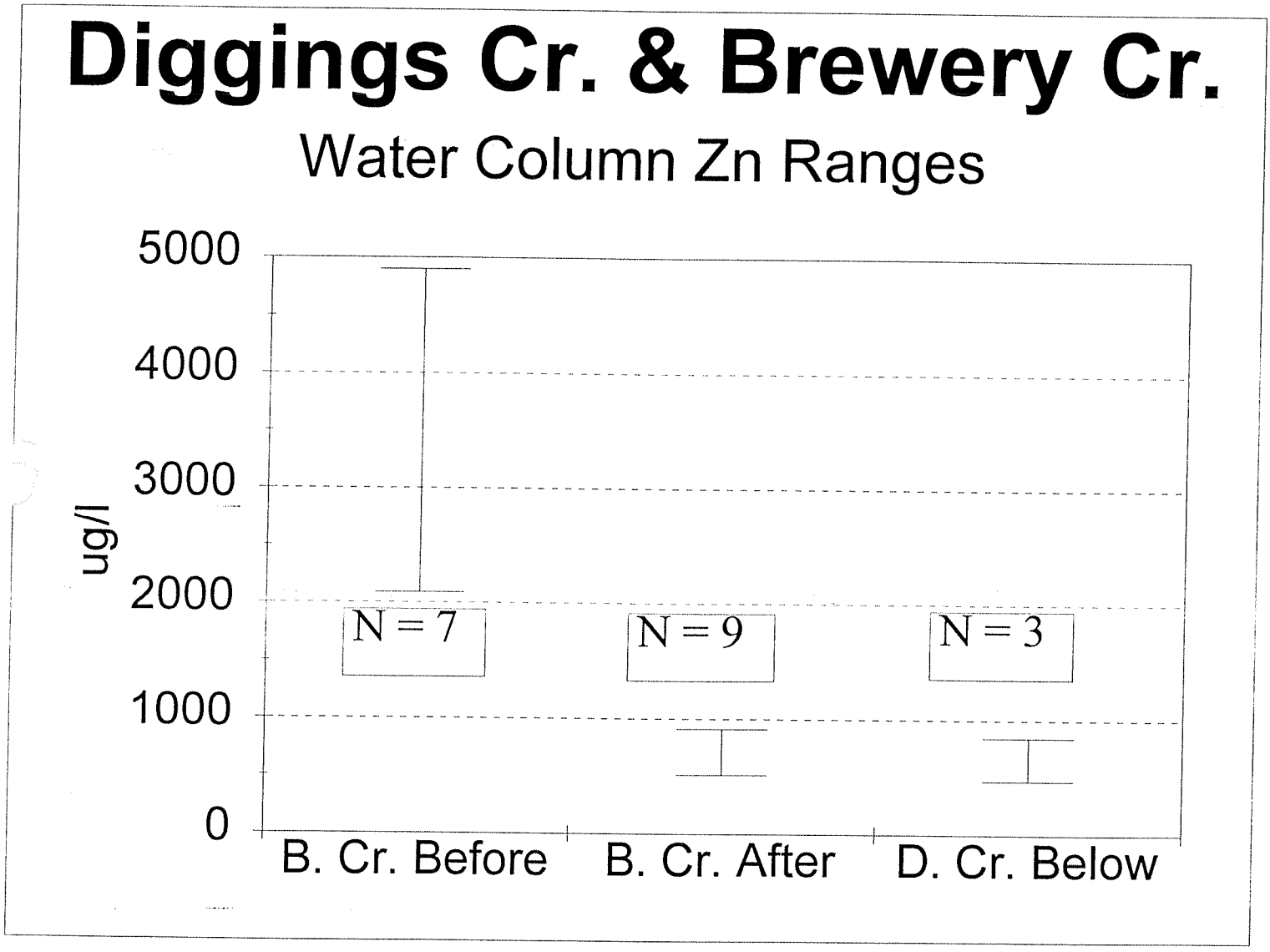
Higher chironomid (midge) percentages indicate disturbed habitat and/or water quality

Figure 6: Diggings Creek Macroinvertebrates



Higher EPT (mayflies, stoneflies, caddisflies) numbers indicate better water quality

Figure 7 Diggings Creek & Brewery Creek Zn Ranges



Brewery Cr. before rehab., Brewery Cr. after rehab., and Diggings Creek below roaster pile.

Table 1: Diggings Creek Fish Survey, April, 1994

Species	Tributary	Above Roaster pile	Below Roaster pile
blacknose dace		3	1
s. redbelly dace	4	9	12
central stoneroller		2	
common shiner			8
fathead minnow			4
bluntnose minnow			1
creekchub	13	14	10
white sucker		1	
brook stickleback	8	12	1

Total 103 Fish

Approximately 75 meters were sampled at each site with an AbP-3 battery powered pulse DC shocker.

Site 1: Unnamed tributary between CTH "W" and confluence with Diggings Creek.

Site 2: Diggings Creek approximately 100 meters above large roaster pile off CTH "W", just west of New Diggings.

Site 3: Diggings Creek approximately 150 meters above confluence with the Galena River, below the large roaster pile.