BIOLOGICAL INTEGRITY OF THE SHIELDS RIVER NEAR WILSALL, MONTANA BASED ON THE COMPOSITION AND STRUCTURE OF THE BENTHIC ALGAE COMMUNITY

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SUMMARY

On September 19, 2000, periphyton samples were collected at two stations on the Shields River near Wilsall, Montana for the purpose of assessing whether this stream is water-quality limited and in need of TMDLs. The samples were collected following DEQ standard operating procedures, processed and analyzed using standard methods for periphyton, and evaluated following modified USEPA rapid bioassessment protocols for wadeable streams.

Station 1 had a high siltation index indicating fair biological integrity, moderate impairment, and partial support of aquatic life uses. An abundance of the cyanobacterium *Oscillatoria*, a borderline pollution index, and the absence of diatoms in the family Epithemiaceae also indicate that Station 1 likely suffers from organic nitrogen loading.

The siltation index declined and the pollution index rose significantly between Station 1 and Station 2, indicating an improvement in water quality. Although diatom species diversity and species richness declined somewhat between these two sites, the number of non-diatom genera almost doubled (from 7 to 13). An increase in the percentage of diatom cells in the family Epithemiaceae (from 0 to 6%) indicates that nitrogen was probably limiting at Station 2.

A relatively large number of abnormal diatom valves were counted at both sites. The value at Station 1 approached the threshold for moderate impairment and the value at Station 2 barely exceeded this threshold. The cause of these abnormalities is unknown.

The two sites had less than one third of their diatom associations in common, indicating that a significant floristic change (and water quality improvement?) occurred between them.

INTRODUCTION

This report evaluates the biological integrity, support of aquatic life uses, and probable causes of impairment to those uses, in the Shields River near Wilsall, Montana. The purpose of this report is to provide information that will help the State of Montana determine whether the Shields River is water-quality limited and in need of TMDLs.

The federal Clean Water Act directs states to develop water pollution control plans (Total Maximum Daily Loads or TMDLs) that set limits on pollution loading to water-quality limited waters. Water-quality limited waters are lakes and stream segments that do not meet water-quality standards, that is, that do not fully support their beneficial uses. The Clean Water Act and USEPA regulations require each state to (1) identify waters that are water-quality limited, (2) prioritize and target waters for TMDLs, and (3) develop TMDL plans to attain and maintain water-quality standards for all water-quality limited waters.

Evaluation of use support in this report is based on the species composition and structure of the periphyton (benthic algae, phytobenthos) community at two sites that were sampled on September 19, 2000. The periphyton community is a basic biological component of all aquatic ecosystems. Periphyton accounts for much of the primary production and biological diversity in Montana streams (Bahls et al. 1992).

Plafkin et al. (1989) and Stevenson and Bahls (1999) list several advantages of using periphyton in biological assessments:

- Algae are universally present in large numbers in all streams and unimpaired periphyton assemblages typically support a large number (>30) of species;
- Algae have rapid reproduction rates and short life cycles, making them useful indicators of short-term impacts;

- As primary producers, algae are most directly affected by physical and chemical factors, such as temperature, nutrients, dissolved salts, and toxins;

- Sampling is quick, easy and inexpensive, and causes minimal damage to resident biota and their habitat;

- Standard methods and criteria exist for evaluating the composition, structure, and biomass of algal associations;

- Identification to species is straightforward for the diatoms, for which there is a large body of taxonomic and ecological literature;

- Excessive algae growth in streams is often correctly perceived as a problem by the public.

- Periphyton and other biological communities reflect the *biological integrity*[1] of waterbodies; restoring and maintaining the biological integrity of waterbodies is a goal of the federal Clean Water Act;

- Periphyton and other biological communities integrate the effects of different stressors and provide a measure of their aggregate impact; and

- Periphyton and other biological communities may be the only practical means of evaluating impacts from non-point sources of pollution where specific ambient criteria do not exist (e.g., impacts that degrade habitat or increase nutrients).

Periphyton is a diverse assortment of simple photosynthetic organisms called algae, and other microorganisms that live attached to or in close proximity of the stream bottom. Most algae, such as the diatoms, are microscopic. Diatoms are distinguished by having a cell wall composed of opaline glass--hydrated amorphous silica. Diatoms often carpet a stream bottom with a slippery brown film.

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[1] *Biological integrity* is defined as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats within a region" (Karr and Dudley 1981).

Some algae, such as the filamentous greens, are conspicuous and their excessive growth may be aesthetically displeasing, deplete dissolved oxygen, interfere with fishing and fish spawning, clog water filters and irrigation intakes, create tastes and odors in drinking water, and cause other problems.

PROJECT AREA AND SAMPLING SITES

The project area is located in northern Park County in southcentral Montana. The Shields River heads in the Crazy Mountains (maximum elevation 11,214 feet) and flows west and south for about 40 miles to where it enters the Yellowstone River a few miles downstream from the city of Livingston.

The headwaters of the Shields River are in the Middle Rockies Ecoregion of North America; the lower reaches of this stream pass through the Montana Valley and Foothill Prairies Ecoregion (Woods et al. 1999). The surface geology of the watershed consists of a matrix of Paleocene continental deposits with granitic intrusives of Tertiary age (Renfro and Feray 1972). Vegetation is alpine tundra at the highest elevations, mixed conifer forest at intermediate elevations, and mixed grassland at lower elevations (USDA 1976).

Periphyton samples were collected at two sites on September 19, 2000 (Maps 1 and 2, Table 1). The upper site (Station 1) was located below the National Forest boundary at an elevation of 5,700 feet (Map 1). The lower site (Station 2) was located about 2 miles downstream from the town of Wilsall at an elevation of 4,920 feet (Map 2). The Shields River is classified B-1 in the Montana Surface Water Quality Standards.

METHODS

Periphyton samples were collected by Patrick Newby of the MDEQ Monitoring and Data Management Bureau following standard operating procedures of the MDEQ Planning, Prevention, and Assistance Division.

Using appropriate tools, microalgae were scraped, brushed, or sucked from natural substrates in proportion to the rank of those substrates at the study site. Macroalgae were picked by hand in proportion to their abundance at the site. All collections of microalgae and macroalgae were pooled into a common container and preserved with Lugol's solution.

The samples were examined to estimate the relative abundance and rank by biovolume of diatoms and genera of soft (non-diatom) algae according to the method described in Bahls (1993). Soft algae were identified using Dillard (1999), Prescott (1978), Smith (1950), and Whitford and Schumacher (1984). These books also served as references on the ecology of the soft algae, along with Palmer (1977).

After the identification of soft algae, the raw periphyton samples were cleaned of organic matter using sulfuric acid, and permanent diatom slides were prepared using Naphrax, a high refractive index mounting medium, following *Standard Methods for the Examination of Water and Wastewater* (APHA 1998). Between 400 and 406 diatom cells (800 to 812 valves) were counted at random and identified to species. The following were used as the main taxonomic and autecological references for the diatoms: Krammer and Lange-Bertalot 1986, 1988, 1991a, 1991b; Patrick and Reimer 1966, 1975. Lowe (1974) was also used as an ecological reference for the diatoms.

The diatom proportional counts were used to generate an array of diatom association metrics (Table 2). A metric is a characteristic of the biota that changes in some predictable way with increased human influence (Barbour et al. 1999).

Metric values from the Shields River were compared to numeric biocriteria or threshold values developed for streams in the Rocky Mountain Ecoregions of Montana (Table 3). These criteria are based on metric values measured in least-impaired reference streams (Bahls et al. 1992) and on metric values measured in streams that are known to be impaired by various sources and causes of pollution (Bahls 1993).

The criteria in Table 3 distinguish among four levels of impairment and three levels of aquatic life use support: no impairment or only minor impairment (full support); moderate impairment (partial support); and severe impairment (nonsupport). These impairment levels correspond to excellent, good, fair, and poor *biological integrity*, respectively.

Quality Assurance. Several steps were taken to assure that the study results are accurate and reproducible.

Upon receipt of the samples, station and sample information were recorded in a laboratory notebook and the samples were assigned a unique number compatible with the Montana Diatom Database, e.g., 2013-01. The first part of this number (2013) designates the sampling site (Shields River at McLeod); the second part of this number (01) designates the number of periphyton samples that have been collected at this site for which data have been entered into the Montana Diatom Database.

Sample observations and analyses of soft (non-diatom) algae were recorded in a lab notebook along with station and sample information provided by MDEQ. A portion of the raw sample was used to make duplicate diatom slides. After completing the diatom proportional count, the slide used for the count will be deposited in the University of Montana Herbarium in Missoula. The other slide will be retained by *Hannaea* in Helena.

On completion of the project, station information, sample information, and diatom proportional count data will be entered into the Montana Diatom Database.

RESULTS AND DISCUSSION

Results are presented in Tables 4 and 5, which are located near the end of this report following the Literature Cited section. Spreadsheets containing completed diatom proportional counts, with species' pollution tolerance classes (PTC) and percent abundances, are attached as Appendix A.

SAMPLE NOTES

Station 1 (McLeod). The *Oscillatoria* in this sample was present both as individual filaments and as filaments intertwined in mats of macroscopic size.

Station 2 (Johnstone). The *Oscillatoria* in this sample was the same species as the one at Station 1. Visually dominant diatoms in this sample were *Gomphoneis spp., Cymbella affinis, and Diatoma vulgare.*

NON-DIATOM ALGAE

The samples from both sites contained a mix of diatoms, cyanobacteria, and green algae (Table 4). The cyanobacterium *Oscillatoria* accounted for most of the biovolume at **Station 1**.

Oscillatoria is considered to be quite tolerant of organic pollution (Palmer 1969). Diatoms ranked second at **Station 1** and various genera of green algae ranked third through fifth. Seven genera of non-diatom algae were recorded at Station 1, which is about average for mountain streams in Montana (Bahls 1993).

The sample from **Station 2** contained 13 genera of non-diatom algae. Diatoms dominated the biovolume at this site, followed by the green alga *Oedogonium* and the cyanobacterium *Oscillatoria* (Table 4). *Cladophora* ranked fourth in biovolume.

The non-diatom algae from these sites indicated significant organic loading, especially at the upstream site (**Station 1**). The increase in the number of non-diatom genera at the downstream station may reflect warming water temperatures, slower current velocities, and a conversion of organic nutrients to inorganic nutrients.

DIATOMS

Major diatom species in the Shields River were either sensitive to organic pollution or somewhat tolerant of organic pollution (Table 5). The three tolerant species--*Melosira varians, Navicula capitatoradiata,* and *Navicula reichardtiana*--were all more abundant at **Station 1** than at Station 2.

The pollution tolerance index at **Station 1** (2.55) was low for a mountain stream and borderline on minor impairment. This, plus the abundance of *Oscillatoria* and the absence of diatoms in the family Epithemiaceae, indicate a probable source of organic nitrogen loading above **Station 1**.

The siltation index at **Station 1** was well within the range for **moderate impairment and partial support of aquatic life uses**.

Seven abnormal diatom valves were counted at **Station 1**, placing the site in the minor impairment category. All other diatom metrics indicated full support of aquatic life uses at **Station 1**.

The diatom assemblage at **Station 2** was dominated by *Cymbella affinis*, a common diatom in moderately enriched rivers in western Montana. It is very abundant in the Clark Fork River below Missoula in late summer (Weber 2000). Dominance by *Cymbella affinis* resulted in a rating of minor impairment (Table 5).

Ten abnormal diatom valves were counted at **Station 2**, which indicated moderate impairment and partial support of aquatic life uses. This metric, however, was just above the threshold for minor impairment. The cause and source of this impairment are unknown.

All other diatom metrics at **Station 2** indicated excellent biological integrity, no impairment, and full support of aquatic life uses. The pollution index at **Station 2** was significantly larger than it was at Station 1, and the siltation index was much smaller, indicating that **Station 2** had less organic loading and siltation. The relatively large percentage of diatoms in the family Epithemiaceae indicates that nitrogen was likely the limiting nutrient at **Station 2**.

Diatom species diversity and species richness declined somewhat from Station 1 to Station 2, but these metrics still indicated excellent biological integrity at the downstream site. The two sites shared less than a third of their diatom floras, indicating considerable floristic change and improvement in water quality between them.

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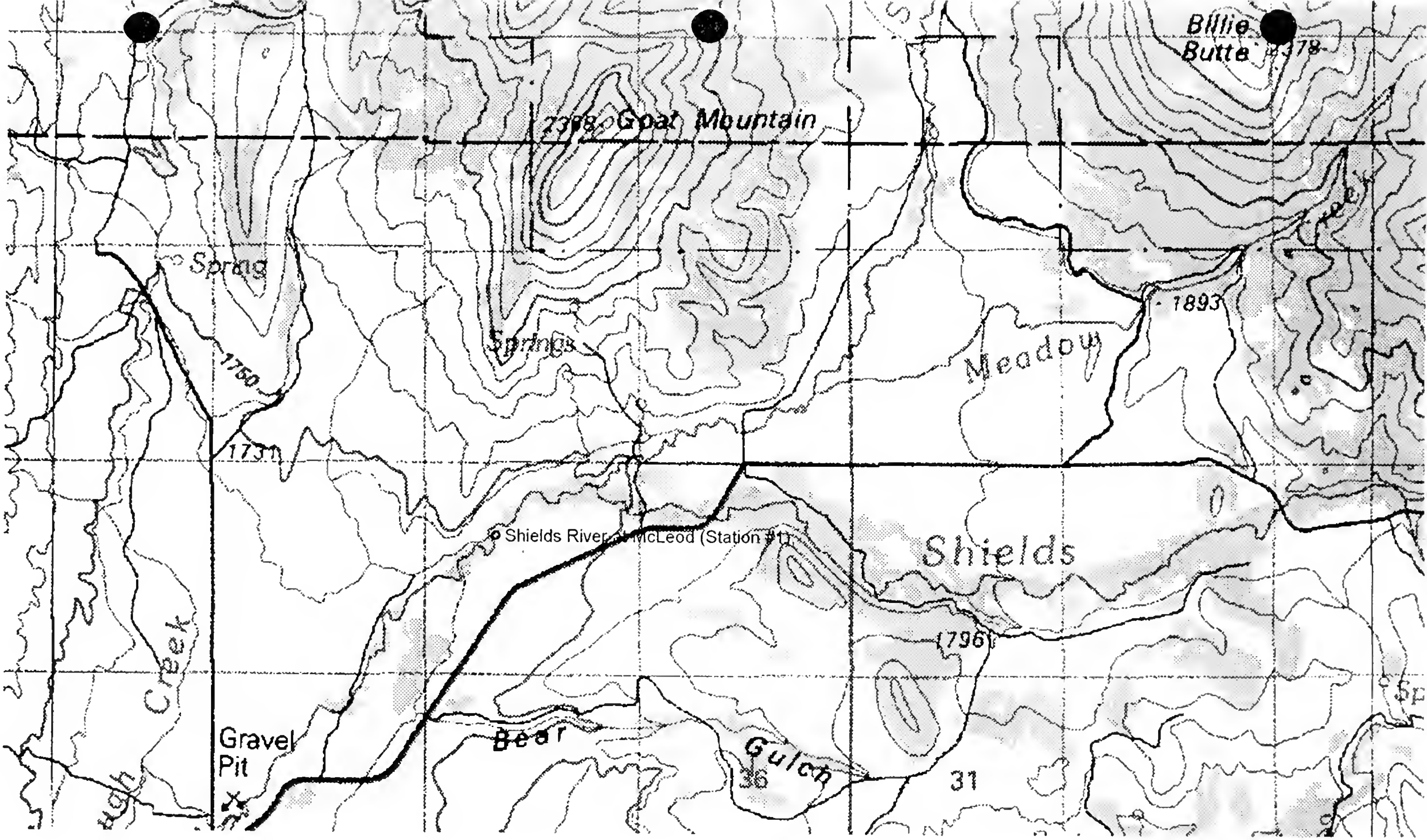
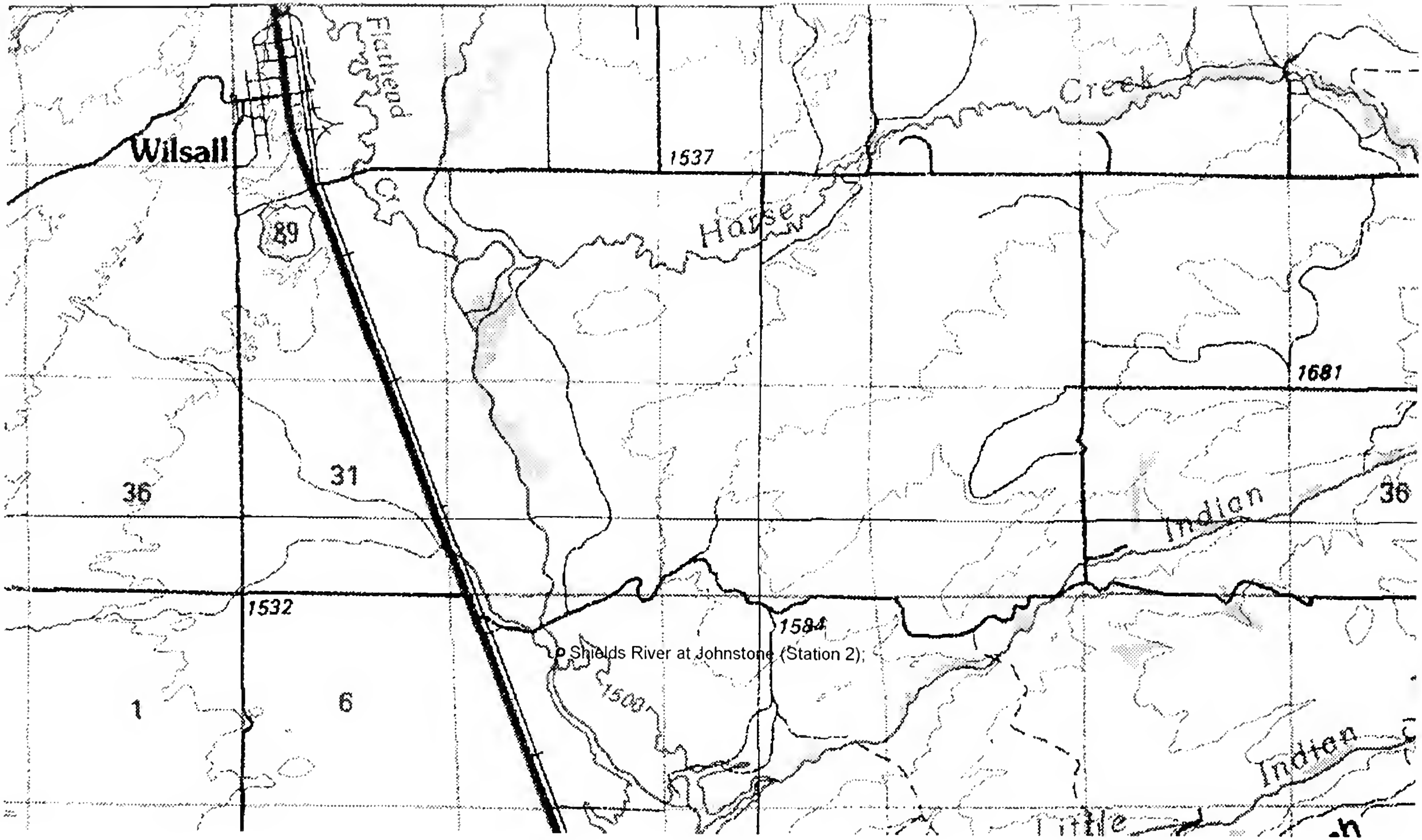


MAP 1

'Ringling 100K; MT'; Scale: 1" = 0.635Mi 1,022Mt 3,354Ft, 1 Mi = 1.574" , 1 cm = 403Mt



MAP 2

o Antelope Creek;

'Livingston 100K; Scale: 1" = 0.635Mi 1,022Mt 3,354Ft, 1 Mi = 1.574" , 1 cm = 403Mt

Table 1. Location of periphyton stations on the Shields River: Station codes, sample numbers in the Montana Diatom Database, latitudes and longitudes, and sample dates. Stations are listed in order from upstream to downstream.

Location	Station Code	Sample Number	Latitude/ Longitude	Sample Date
Shields River at McLeod	Station 1	2013-01	46 09 56 N 110 34 05 W	09/19/00
Shields River at Johnstone	Station 2	2012-01	45 57 21 N 110 37 57 W	09/19/00

Table 2. Diatom association metrics used to evaluate biological integrity in Montana streams: reference, range of values in Montana streams, and expected direction of metric response to increasing anthropogenic perturbation or natural stress.

Metric	Reference	Range of Values	Expected Response
Shannon Species Diversity	Bahls 1979	0.00-5.00+	Decrease[1]
Pollution Index[2]	Bahls 1993	1.00-3.00	Decrease
Siltation Index[3]	Bahls 1993	0.00-90.0+	Increase
Disturbance Index[4]	Barbour *et al*. 1999	0.00-100.0	Increase
No. Species Counted	Bahls 1979, 1993	0-100+	Decrease[1]
Percent Dominant Species	Barbour *et al*. 1999	5.0-100.0	Increase
Percent Abnormal Cells	McFarland *et al*. 1997	0.0-20.0+	Increase
Similarity Index	Whittaker 1952	0.0-80.0+	Decrease
Percent Epithemiaceae	Stevenson & Pan 1999	0.0-80.0+	Decrease
Percent Aerophiles	Johansen 1999	0.0-100	Increase

[1] Shannon diversity and species richness may increase somewhat in naturally nutrient-poor mountain streams in response to slight to moderate increases in nutrients or sediment.

[2] Composite numeric expression of the pollution tolerances assigned by Lange-Bertalot (1979) to the common diatom species.

[3] Sum of the percent abundances of all species in the genera *Navicula*, *Nitzschia*, and *Surirella*.

[4] Percent abundance of *Achnanthes minutissima*.

Table 3. Criteria for rating levels of biological integrity, environmental impairment or natural stress, and aquatic life use support in wadeable **mountain** streams of Montana using selected metrics for benthic diatom associations. The lowest rating for any one metric is the overall rating for the study site.

Biological Integrity/ Impairment or Natural Stress/Use Support	Diversity Index (Shannon)	Pollution Index	Siltation Index	Disturbance Index	Number of Species Counted	Percent Dominant Species	Percent Abnormal Cells	Similarity Index[1]
Excellent None/Full Support	>2.99	>2.50	<20.0	<25.0	>29	<25.0	0.0	>59.9
Good/Minor Full Support	2.00-2.99	2.01-2.50	20.0-39.9	25.0-49.9	20-29	25.0-49.9	>0.0-<1.0	40.0-59.9
Fair/Moderate Partial Support	1.00-1.99	1.50-2.00	40.0-59.9	50.0-74.9	10-19	50.0-74.9	1.0-9.9	20.0-39.9
Poor/Severe Nonsupport	<1.00	<1.50	>59.9	>74.9	<10	>74.9	>9.9	<20.0

[1] The Similarity Index or Percent Community Similarity (Whittaker 1952) may be used to compare a study site to an unimpaired upstream control site on the same stream. This metric measures the degree of floristic similarity between diatom associations at the two sites and is the sum of the smaller of the two percent abundance values for each species that is common to both sites. Adjacent riffles on the same stream, without intervening tributaries or environmental perturbations, will generally have at least 60% of their diatom floras in common (Bahls 1993). PCS may also be used to guage the relative amount of impairment or recovery that occurs between adjacent study sites: >59.9% = very similar floras, no change; 40.0-59.9% = somewhat similar floras, minor change; 20.0-39.9% = somewhat dissimilar floras, moderate change; <20.0% = very dissimilar floras, major change.

Table 4. Relative abundance of cells and rank by biovolume of diatoms and genera of non-diatom algae in periphyton samples collected from the Shields River in 2000.

Taxa	Relative Abundance[1] and (Rank) Station 1	Station 2
Chlorophyta (green algae)		
Ankistrodesmus	common (5)	common (8)
Cladophora		occasional (4)
Closterium	common (3)	rare (14)
Cosmarium		occasional (11)
Enteromorpha		common (6)
Oedogonium		abundant (2)
Pediastrum		common (9)
Scenedesmus		frequent (7)
Selenastrum	occasional (7)	occasional (12)
Staurastrum	common (4)	
Ulothrix		common (5)
Chrysophyta (golden algae)		
Diatoms	frequent (2)	dominant (1)
Cyanophyta (cyanobacteria)[2]		
Merismopedia	rare (8)	common (10)
Oscillatoria	abundant (1)	abundant (3)
Phormidium	occasional (6)	occasional (13)

[1] d = dominant; a = abundant; f = frequent; c = common; o = occasional; r = rare

[2] Formerly known as blue-green algae.

Table 5. Percent abundance of major diatom species[1] and values of selected diatom association metrics for periphyton samples collected from the Shields River in 2000.

Species/Metric (Pollution Tolerance Class)[3]	Percent Abundance/Metric Values[2] Station 1	Station 2
Achnanthes minutissima (3)	4.87	7.39
Cocconeis placentula (3)	8.30	1.07
Cymbella affinis (3)	5.75	37.37
Denticula kuetzingii (3)		6.21
Diatoma vulgaris (3)	0.66	9.53
Melosira varians (2)	5.31	
Navicula capitatoradiata (2)	7.85	1.28
Navicula reichardtiana (2)	5.64	0.21
Navicula tripunctata (3)	13.72	3.53
Nitzschia dissipata (3)	10.51	0.43
Cells Counted	452	467
Total Species	62	51
Species Counted	59	41
Species Diversity	4.68	3.74
Percent Dominant Species	13.72	<u>37.37</u>
Disturbance Index	4.87	7.39
Pollution Index	2.55	2.74
Siltation Index	**52.10**	12.85
Percent Abnormal Cells	<u>0.77</u>	**1.07**
Percent Epithemiaceae	0.00	6.21
Similarity Index	31.22	

[1] A major diatom species is here considered to be one that accounts for 5% or more of the cells in one or more samples of a sample set.

[2] <u>Underlined values</u> indicate good biological integrity, minor impairment, and full support of aquatic life uses; **bold values** indicate fair biological integrity, moderate impairment, and partial support of aquatic life uses; all other values indicate excellent biological integrity, no impairment, and full support of aquatic life uses when compared to criteria for mountain streams in Table 3.

[3] 3 = sensitive to pollution; 2 = tolerant of pollution; 1 = most tolerant of pollution.

APPENDIX A: DIATOM PROPORTIONAL COUNTS

Sample	Genus/Species/Variety	Pollution Tolerance Class	Count	Percent
201301	Achnanthes biasolettiana	3	2	0.22
201301	Achnanthes lanceolata	2	29	3.21
201301	Achnanthes minutissima	3	44	4.87
201301	Amphipleura pellucida	2	9	1.00
201301	Amphora pediculus	3	8	0.88
201301	Aulacoseira distans	3	3	0.33
201301	Aulacoseira granulata	3	1	0.11
201301	Aulacoseira italica	3	1	0.11
201301	Cocconeis placentula	3	75	8.30
201301	Cyclotella meneghiniana	2	5	0.55
201301	Cymbella affinis	3	52	5.75
201301	Cymbella minuta	2	2	0.22
201301	Cymbella naviculiformis	3	2	0.22
201301	Cymbella silesiaca	2	16	1.77
201301	Diatoma mesodon	3	1	0.11
201301	Diatoma vulgaris	3	6	0.66
201301	Fragilaria capucina	2	6	0.66
201301	Fragilaria construens	3	7	0.77
201301	Fragilaria leptostauron	3	2	0.22
201301	Fragilaria vaucheriae	2	4	0.44
201301	Gomphoneis eriense	3	2	0.22
201301	Gomphonema angustatum	2	4	0.44
201301	Gomphonema dichotomum	3	14	1.55
201301	Gomphonema minutum	3	1	0.11
201301	Gomphonema olivaceum	3	4	0.44
201301	Gomphonema pumilum	3	13	1.44
201301	Gomphonema subtile	3	8	0.88
201301	Hannaea arcus	3	0	0.00
201301	Melosira varians	2	48	5.31
201301	Meridion circulare	3	6	0.66
201301	Navicula atomus	1	1	0.11
201301	Navicula capitatoradiata	2	71	7.85
201301	Navicula cryptocephala	3	0	0.00
201301	Navicula cryptotenella	2	13	1.44
201301	Navicula gregaria	2	6	0.66
201301	Navicula lanceolata	2	5	0.55
201301	Navicula minima	1	2	0.22
201301	Navicula pelliculosa	1	4	0.44
201301	Navicula reichardtiana	2	51	5.64
201301	Navicula sp.	2	2	0.22
201301	Navicula tripunctata	3	124	13.72
201301	Navicula trivialis	2	4	0.44
201301	Navicula viridula	2	7	0.77
201301	Nitzschia acicularis	2	8	0.88
201301	Nitzschia dissipata	3	95	10.51
201301	Nitzschia fonticola	2	2	0.22
201301	Nitzschia gracilis	2	5	0.55

Sample	Genus/Species/Variety	Pollution Tolerance Class	Count	Percent
201301	Nitzschia heufleriana	3	5	0.55
201301	Nitzschia inconspicua	2	5	0.55
201301	Nitzschia linearis	2	11	1.22
201301	Nitzschia palea	1	28	3.10
201301	Nitzschia paleacea	2	4	0.44
201301	Nitzschia pura	2	4	0.44
201301	Nitzschia sigmoidea	3	1	0.11
201301	Nitzschia sociabilis	2	2	0.22
201301	Nitzschia vermicularis	2	2	0.22
201301	Nitzschia wuellerstorffii	2	0	0.00
201301	Reimeria sinuata	3	36	3.98
201301	Rhoicosphenia curvata	3	19	2.10
201301	Surirella angusta	1	2	0.22
201301	Surirella minuta	2	7	0.77
201301	Synedra ulna	2	3	0.33

Sample	Genus/Species/Variety	Pollution Tolerance Class	Count	Percent
201201	Achnanthes biasolettiana	3	2	0.21
201201	Achnanthes lanceolata	2	0	0.00
201201	Achnanthes minutissima	3	69	7.39
201201	Amphora libyca	3	2	0.21
201201	Amphora pediculus	3	3	0.32
201201	Aulacoseira italica	3	1	0.11
201201	Cocconeis pediculus	3	1	0.11
201201	Cocconeis placentula	3	10	1.07
201201	Cyclotella meneghiniana	2	3	0.32
201201	Cymbella affinis	3	349	37.37
201201	Cymbella amphicephala	3	2	0.21
201201	Cymbella brehmii	2	2	0.21
201201	Cymbella microcephala	2	6	0.64
201201	Cymbella minuta	2	4	0.43
201201	Cymbella prostrata	3	2	0.21
201201	Cymbella silesiaca	2	20	2.14
201201	Denticula kuetzingii	3	58	6.21
201201	Diatoma moniliformis	2	25	2.68
201201	Diatoma vulgaris	3	89	9.53
201201	Fragilaria capucina	2	9	0.96
201201	Fragilaria construens	3	6	0.64
201201	Fragilaria leptostauron	3	6	0.64
201201	Fragilaria vaucheriae	2	1	0.11
201201	Gomphoneis herculeana	3	14	1.50
201201	Gomphoneis minuta	3	1	0.11
201201	Gomphonema olivaceum	3	18	1.93
201201	Gomphonema parvulum	1	16	1.71
201201	Gomphonema pumilum	3	32	3.43
201201	Gomphonema truncatum	3	1	0.11
201201	Navicula capitatoradiata	2	12	1.28
201201	Navicula cryptotenella	2	28	3.00
201201	Navicula cuspidata	2	1	0.11
201201	Navicula lanceolata	2	3	0.32
201201	Navicula menisculus	2	0	0.00
201201	Navicula pupula	2	3	0.32
201201	Navicula reichardtiana	2	2	0.21
201201	Navicula tripunctata	3	33	3.53
201201	Navicula trivialis	2	2	0.21
201201	Navicula veneta	1	6	0.64
201201	Nitzschia apiculata	2	1	0.11
201201	Nitzschia dissipata	3	4	0.43
201201	Nitzschia fonticola	3	4	0.43
201201	Nitzschia gracilis	2	6	0.64
201201	Nitzschia palea	1	12	1.28
201201	Nitzschia sigmoidea	3	1	0.11
201201	Nitzschia vermicularis	2	2	0.21
201201	Reimeria sinuata	3	4	0.43

Sample	Genus/Species/Variety	Pollution Tolerance Class	Count	Percent
201201	Rhoicosphenia curvata	3	17	1.82
201201	Surirella brebissonii	2	0	0.00
201201	Surirella minuta	2	0	0.00
201201	Synedra ulna	2	41	4.39