WILLOW CREEK

319 WATERSHED PROJECT

DATA REVIEW & ANALYSIS

REPORT

Prepared
for the

Uinta County Conservation District

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by

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Executive Summary

Lost Iguana Consulting Inc. was contracted by the Unita County Conservation District in March 2001 to provide data analysis and reporting services for water quality related data obtained during monitoring activity undertaken during 1996 through 1998. Data supplied to the consultant included:

a) Beneficial Use Reconnaissance Protocol Field Data Sheets partially completed in 1996 by Craig Thompson and Doug Collins
b) Section 319 Draft Watershed Project Final Report, dated January 1, 1999 prepared by Benita Gustafson.
c) Stream Status Report, dated November 13, 1996 prepared by Craig Thompson and Doug Collins.
d) Benthos Monitoring Report, dated January 1998 prepared by Craig Thompson including lab analysis results from a macroinvertrabrate sample obtained August 1996. Lab analysis was completed by Aquatic Biology Associates, Corvallis OR.
e) Historic Water Quality Data Report, no date given, prepared by Earl DeGroot.

This report is presented in sections. The first section, Data Analysis Methodology, describes how the physical, biological and chemical data was analyzed. The second section, Data Analysis Findings, discusses what the data indicated. The report concludes with recommendations that are also summarized here.

One of the objectives for water quality monitoring program was to determine the success of BMP implementation. To reflect trends, multiple years of data must be obtained for comparative analysis. Of the data supplied for this analysis, only water chemistry and fisheries data covered multiple years. The chemical data indicated a potential phosphorus issue that may be attributed too high discharge volumes experienced during that particular year during which the levels of phosphorus were elevated. Soil chemistry within the sub-watershed may also have an impact. Fisheries data for the period did indicate an improving condition. Physical data was obtained in only one year and was incomplete and therefore does not have a high degree of confidence. Biological data was collected in 1996 and provides information regarding biological conditions found in the monitored streams for that year.

Credible data consists of physical, biological and chemical data, all three of which were obtained in 1996. While the physical data obtained during monitoring may not be to the degree of accuracy required it does represent a baseline with a moderate degree of confidence. Therefore, it is recommended that another full BURP bioassessment, including physical, biological and chemical data, should be performed and the data from which can be compared to the data obtained in 1996. Additionally, water chemistry from Willow Creek during the spring runoff period should be obtained, focusing on total phosphorus and associated constituents. Soil samples from the drainage affecting Willow Creek should also be obtained and analyzed for phosphorus content.

Data Analysis Methodology

Physical – The physical aspects of Rapid Bioassessment and Beneficial Use Reconnaissance Protocol (BURP) assessment are primarily focused on three physical habitat attribute areas of the monitored reach; primary, secondary, and tertiary. Once each physical aspect of the monitored reach is evaluated, a value is assigned to each attribute allowing for comparison of the monitored location to a control or reference location. Primary parameters assess micro-habitat characteristics such as substrate composition, embeddedness, velocity/depth, instream cover and channel flow status which directly affect macroinvertrabrate community structure. Secondary parameters examine stream morphology characteristics such as channel shape, pool/riffle ratio, channelization and width to depth ratio all of which indirectly impacts macroinvertrabrate community structure. Tertiary parameters assess terrestrial conditions adjacent to the monitored reach such as bank stability, vegetative cover, disruptive pressures and riparian zone. Values for each of the aforementioned parameters are then totaled for the site under investigation and evaluated against a reference or control location that serves as a benchmark for waterbodies of similar characteristics.

For this analysis stream reference location MRW56, West Fork Smiths Fork 1997, was selected from the WDEQ Reference Stream Project given its temporal and spatial proximity to the selected sites for this study. The WDEQ Reference Stream Project provides monitoring sites that are geologically and hydrologically comparable to other locations being evaluated and are considered to be in the best condition that can be expected given the particular physical characteristics of the site thus providing a benchmark to which all similar locations can be compared. In addition to providing a benchmark, comparison can also provide spatial information and if degradation is occurring longitudinally through the watershed. For this report, an additional comparative analysis was completed utilizing the best reference stream data available, MRW45 Middle Creek 1994. Results of that supplemental analysis did indicate a generally lower set of comparative values biologically, which was expected given the exceptionally high quality of the data set for the reference stream. However, results did not indicate biological of physical conditions significantly lower than when compared to a local reference stream. Given that Middle Creek is located in a different watershed and the results were not sufficiently dissimilar from the original comparative analysis, they are not included in this report.

Preliminary review of the BURP data sheets produced from monitoring activity performed under the 319 grant revealed inconsistent evaluation techniques, when compared to current BURP protocols, and incomplete data sets. Therefore, in order to evaluate the physical data in a comparable and meaningful manner, a number of considerations were required to be taken.

Substrate Composition. Field investigators for the Willow Creek project utilized a methodology of substrate assessment inconsistent with that currently employed by the Wyoming Department of Environmental Quality (WDEQ). WDEQ methodology for mean substrate composition consists of qualitative spatial assessment of the percentage of each size of the streambed material found in eight randomly selected one sq. ft sections within a 100' riffle, for a total of eight square feet assessed per one hundred foot riffle. Evaluation of the available substrate data revealed that Willow Creek field investigators evaluated substrate composition linearly by stretching a tape measure across the stream reach in 10 equidistant cross selections then estimating the number of inches each substrate material size occurred in that cross section. The data obtained from the linear methodology was converted from feet of a given substrate type, to percentage of substrate type by calculating the total linear distance of each substrate composite type found in the 10 cross sections and then dividing that total by the total width of all ten cross sections in the monitored reach. Once converted, the percentage of each substrate type was assessed to determine what the mean substrate composition was present in the reach during that monitoring event thus allowing the data to be graphed and compared to other similar data.

Embeddedness. WDEQ methodology for assessing mean embeddedness within each monitored reach is required to occur simultaneously with the substrate composition assessment. Embeddedness is rated 1- 5 (1 indicating highest embeddedness and 5 the least) at each of the eight randomly selected sections in the riffle. These ratings are then documented in a table provided with the BURP field data sheets. Mean values are calculated and an overall rating is recorded in the habitat assessment section. The tables in the Willow Creek field data sheets provided for this review were not completed. It is assumed that because the spatial evaluation methodology was not utilized to assess the riffles, that embeddedness data was not obtainable. While the field investigators did assign a mean embeddedness value to each monitoring location in the habitat assessment section, confidence in the value is low given the generally subjective nature of the data.

Instream Cover. Instream cover data was not recorded because it was not a normally monitored parameter at the time of the assessment. Therefore this parameter was eliminated from the evaluation.

Aside from the three instances noted above, physical habitat data for each monitored location was totaled and compared with WDEQ reference site MRW56 in order to categorize the monitored location into one of four categories; comparable, supporting, partially supporting, or not supporting. Tables and charts containing the data comparisons can be found at the end of this report.

Biological – Because macroinvertrabrates inhabit streams year-round, the composition of the macroinvertrabrate community is the best indicator of overall stream condition. Essentially, macroinvertrabrate communities are comprised of three basic groups: predators, scrapers, and collectors. Within these three general groups of macroinvertrabrates, sub-species exist which have varying tolerances to a variety of non-point source pollutants. Presence, or lack of presence, of a given specie(s) is a good indicator of the biological condition of the stream being monitored. Study of macroinvertrabrate communities has provided what the expected composition or "mix" of the various groups and sub-species would be found in a variety of habitats in the absence of human activity. Currently there are two commonly used sets of expected "mixes" or matrices against which the composition of the known macroinvertrabrate community can be evaluated. Results of the evaluation provide a data point that is graphed as a *Percent of Reference.*

One of the two matrices is relatively new and the consultant does not have extensive experience with it nor were the two methodologies readily comparable. Therefore both matrices, referenced in this report as WDEQ (new) and King (employed for 10+ years), were utilized in this evaluation of the biological data obtained during this investigation. The WDEQ matrices methodology assigns values of 1 through 100 to the quantity of macroinvertrabrates found in seven categories and a community index (HBI). These values are then scored and totaled for an index value for the data set obtained from that particular macroinvertrabrate sample location. That index is then rated as good, fair or poor and evaluated against the control or reference location. The King matrices methodology consists assigning a value of 1, 3, or 5 to the quantity of macroinvertrabrates found in seven categories and two community indices. The results are also compared to the control or reference site in the same manner as that of the WDEQ methodology.

For the purposes of this review and analysis both analysis protocols were utilized and the results of which are contained herein.

Chemical – Water Chemistry sampling occurred at four locations on Willow Creek between May 1996 and October 1998. The sites are coded WC 1, 2, 3 & 4 with WC1 representing the monitoring location at the highest point in the watershed, and WC4 lowest in the watershed. GPS coordinates of the sampling sites were available but attempts to map the coordinates accurately were unsuccessful. Written directions to the sampling sites were not found however there are photos which local staff may be able to use to specifically site the sampling locations. There was sufficient data to place the sampling site in its relationship to other stations within the watershed.

Water chemistry data was collected for: Discharge, Temperature, pH, Dissolved Oxygen, Total Suspended Solids, Total Dissolved Solids, Conductivity, Phosphorus, and Nitrates. Water quality standards for temperature, pH, dissolved oxygen, phosphorus and nitrates have been set by the Wyoming Department of Environmental Quality and are found in the table below. Specific standards for the other water chemistry parameters sampled during the study have not been established.

Parameter	**Standard**
Temperature	(a) For Class 1, 2 and 3 waters, effluent attributable to or influenced by the activities of man shall not be discharged in amounts which change ambient water temperatures to levels which result in harmful acute or chronic effects to aquatic life, or which would not fully support existing and designated uses. (b) When ambient temperatures are above 60 degrees F in all Class 1, 2AB, and 2B waters which are cold water fisheries, effluent attributable to or influenced by the activities of man shall not be discharged in amounts which will result in an increase of more than 2 degrees F (1.1 degree C) in existing temperatures.
pH	(a) For all Wyoming surface waters, wastes attributable to or influenced by the activities of man shall not be present in amounts which will cause the pH to be less than 6.5 or greater than 9.0 standard units.
Minimum Dissolved Oxygen Criteria	Cold Water Criteria-Mg/l
Minimum	- Early Life Stages[1] 8.0, Other Life Stages 4.0
7 day mean min.	- Early Life Stages NA, Other Life Stages 5.0
7 day mean	- Early Life Stages 9.5, Other Life Stages NA
30 day mean	- Early Life Stages NA, Other Life Stages 6.5
Phosphorus	0.1 mg/l
Nitrate	10 mg/l

[1] Up to 30 days following hatching.

Stream Reclassification

The waterbodies evaluated under the Section 319 study program were the East and West Forks of the Smiths Fork, Willow Creek, Gilbert Creek and Archie Creek. Since the study was undertaken these waterbodies have been reclassified 2AB by the Wyoming Department of Environmental Quality (WDEQ). Appropriate stream classification is important as it carries with it specific water quality standards that provide specific levels of protection for the designated use by definition.

As defined in Chapter 1 of the WDEQ Rules and Regulations:

Class 2 - Fisheries and Drinking Water. *Class 2 waters are waters, other than those designated as Class 1, that are known to support fish or drinking water supplies or where those uses are attainable. Class 2 waters may be perennial, intermittent or ephemeral and are protected for the uses indicated in each sub category listed below. There are four subcategories of Class 2 waters.*

(i) Class 2AB. *Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands. Class 2AB waters include all permanent and seasonal game fisheries and can be either "cold water" or "warm water" depending upon the predominance of cold water or warm water species present. All Class 2AB waters are designated as cold water game fisheries unless identified as a warm water game fishery by a "ww" notation in Appendix A. Unless it is shown otherwise, these waters are presumed to have sufficient water quality and quantity to support drinking water supplies and are protected for that use. Class 2AB waters are also 36protected for nongame fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture and scenic value uses. protected for nongame fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture and scenic value uses.*

Fisheries Data

Data obtained through fish surveys completed by the Wyoming Game & Fish Department in 1987, 1996 and 1998, can be found in Draft Watershed Project Final Report (pgs 11 & 12) completed by Benita Gustafson and was utilized for this section of the report. There were three stations on Willow Creek that were sampled, the Upper, Middle and Lower. Refer to the table below for specific data.

In summary:

Upper station - While the quantity of fish counted in 1998 decreased when compared to 1987, the general trend is improving since a low in 1990. However, because the average size of the fish counted in 1998 increased an average of 29% over the fish in 1987, the pounds of fish per mile data in 1998 was the highest recorded.

Middle Station – The increases in fish numbers and pounds per mile at this station between 1987 and 1996 were around three-fold.

Lower Station – Similar increases were identified.

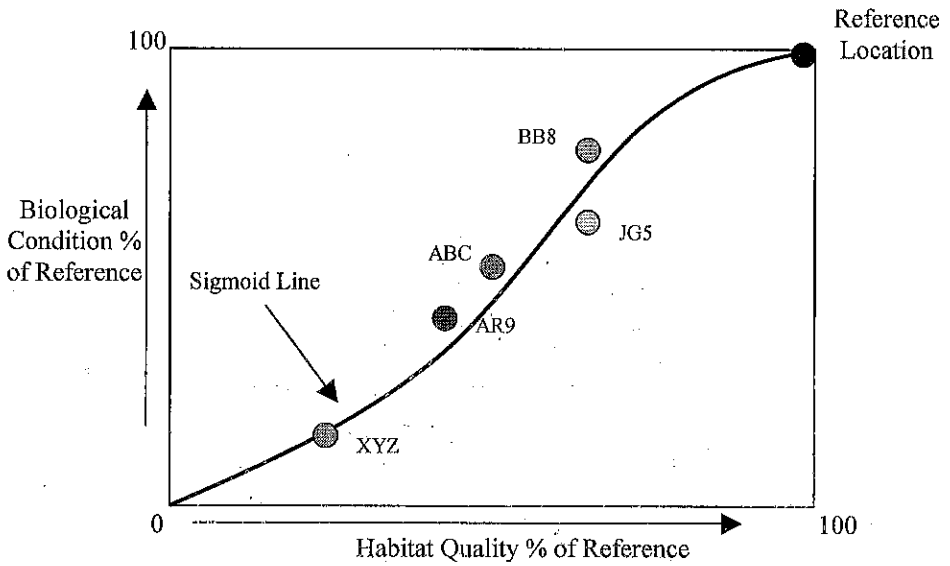
Results of Standard Stream Surveys Conducted at Three Stations on Willow Creek from 1987 to 1998[2].

Date	No.	Average Length (inches)	Number Fish/Mile	Pounds Fish/Acre	Pounds Fish/Mile	Number Fish/Mile ≥ 6 inches	Pounds Fish/Acre ≥ 6 inches	Pounds Fish/Mile ≥ 6 inches
				UPPER STATION				
1998	37	5.3	473	32.5	37.8	153		
1996	49	4.3	523	22.1	20.9	75	10.3	9.8
1993	22	4.1	340	9.0	10.2			
1990	30	4.1	381	9.3	11.4	25	1.7	2.0
1987	87	4.1	742	27.8	22.3	77	10.5	8.5
				MIDDLE STATION				
1996	25	8.0	327	102.4	117.7	236	79.8	92.0
1987	9	6.2	113	7.2	11.3	50	4.8	7.5
				LOWER STATION				
1996	7	8.1	78	19.3	18.7	56	18.3	17.9
1987	2	6.7	25	2.3	2.5	25	2.3	2.5

[2] Willow Creek GR841095UA AS – Aquatic Resources Survey, Fish Population Monitoring FX-GR-3SF-512 Wyoming Department Game & Fish Department.

Data Analysis Findings

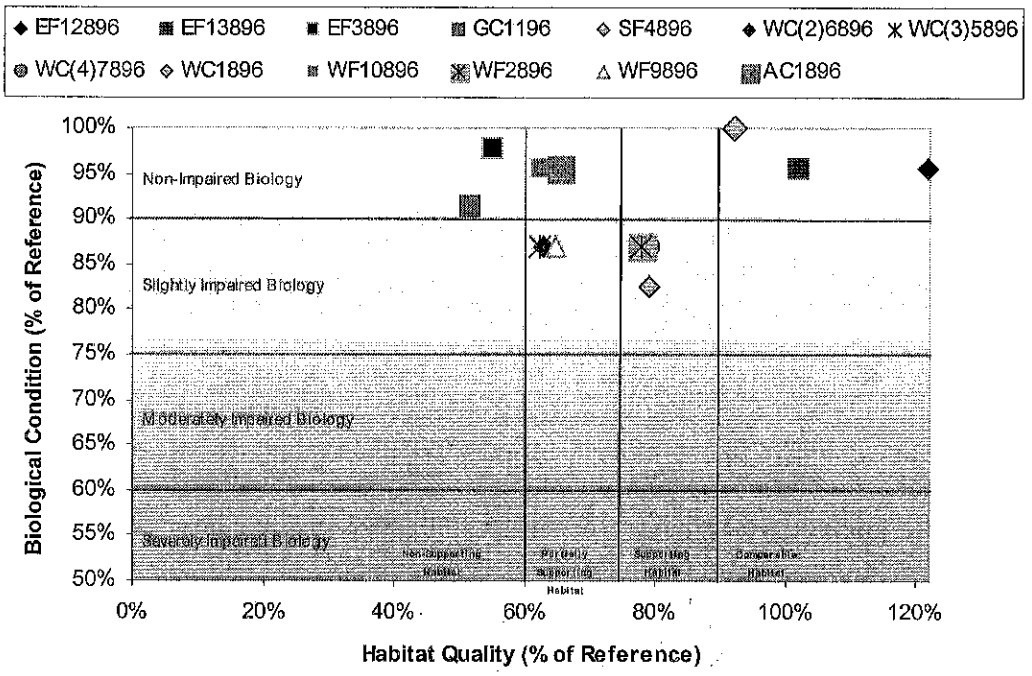
Physical/Biological – There is a very strong correlation between physical habitat quality and biological condition of a waterbody. In the absence of the influence of impaired water chemistry, physical and biological conditions should degrade or improve at corresponding rates. For example, when physical *% of Reference* data and biological *% of Reference* data are compared and plotted graphically, (with no water chemistry problems present) theoretically the data point should fall near a sigmoid line on a graph representing the relationship between the number (and quality) of macroinvertrabrates present and their dependence upon the quality of the habitat in which they reside.



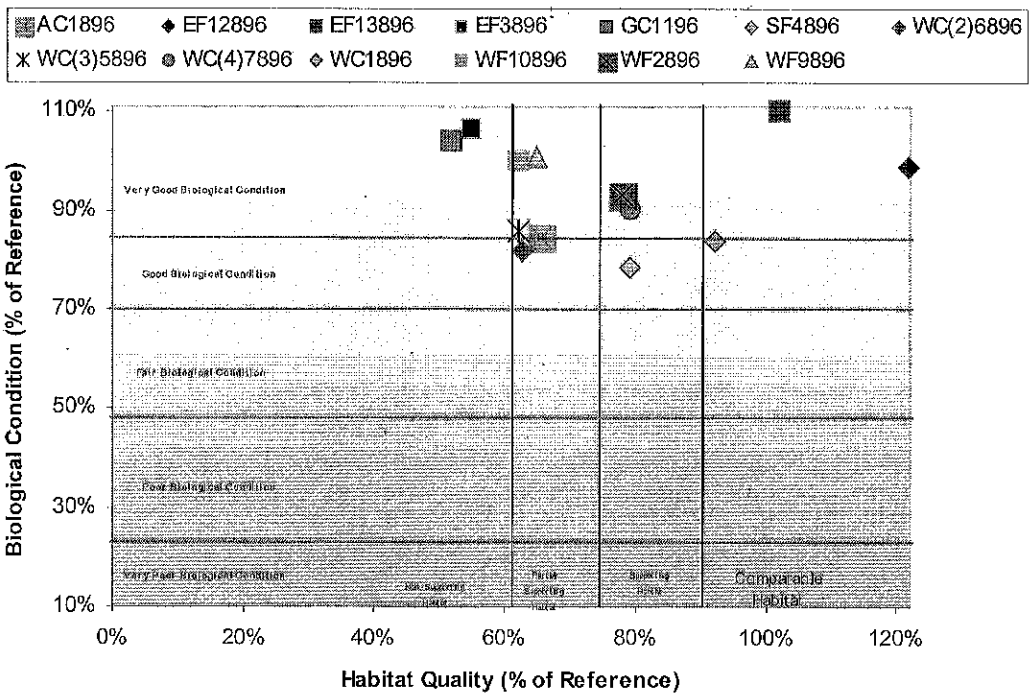
Example of Theoretical Relationship Between Biological Condition and Habitat Quality
(Standard Water Chemistry Assumed)

Deviation from this pattern can indicate an imbalance created by a number of factors. In the case of the Willow Creek project (charts on the following page) it is apparent that the excessively degraded condition of the physical habitat as assessed would not normally support the generally good biological condition found at the monitoring locations.

1996 Willow Creek Bioassessment
% of Reference (West Fork Smiths Fork - *King Methodology*)

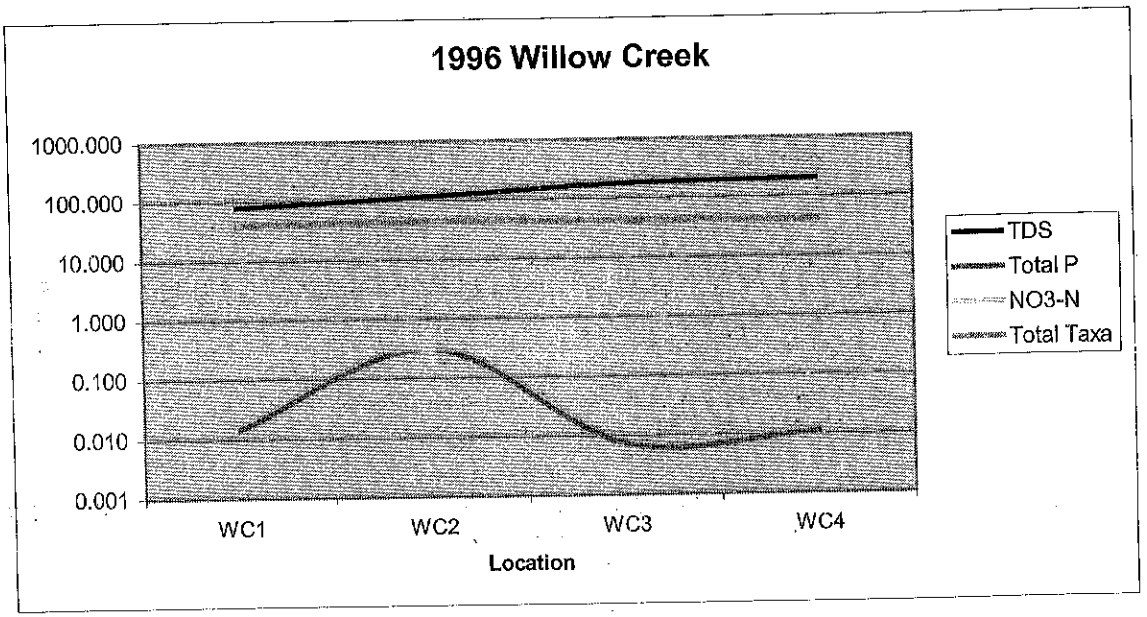


1996 Willow Creek Bioassessment
% of Reference (West Fork Smiths Fork - *WDEQ Methodology*)



Typically, if habitat quality of the assessed locations is generally inferior when compared to the reference location and biological condition of the locations is not generally reduced, it is an indicator of introduction of organic material and nutrients to the waterbody. This usually occurs in high mountain streams that are naturally low in dissolved solids and nutrients as they progress to lower elevations.

Analysis of the Willow Creek locations, chosen for this example because it had the most monitoring stations of all the waterbodies monitored, indicates the total number of macroinvertrabrate taxa (species) present does not increase from the top of the watershed to the bottom which would be expected if an increased level of nutrients and dissolved solids became available. This is supported by the graph below. The Total Dissolved Solids do increase slightly but neither of the nutrients sampled suggests similar increases.



As assessed in 1996 (refer to chart on previous page), two of the monitoring locations were found to have optimal biological condition but non-supporting physical habitat. Five of the monitoring locations were found to have optimal to slightly impaired biological condition but only partially supporting physical habitat. Three monitoring locations with optimal to slightly impaired biological condition and supporting physical habitat and three monitoring locations with optimal biological condition and physical habitat that was comparable to the reference location.

However, the general trend indicated, significant degradation, by the physical assessment data results are not supported by a correspondingly degraded biological condition. Additionally, there is insufficient data support from theoretical increases in Macroinvertrabrate Taxa, Total Dissolved Solids, and Nutrients to account for the physical/biological relationship variance from the top to the bottom of the Willow Creek watershed. Therefore, given the relative unfamiliarity with the Beneficial Use

Reconnaissance Protocol (BURP) for Rapid Bioassessment by the Field Investigators, substantiated by the incomplete and incorrectly completed BURP field data sheets, the physical assessment data for some of the monitoring locations may have been inadvertently skewed and therefore should not be considered an accurate assessment of the physical conditions found at the monitored sites in 1996.

Biological – Utilizing both the WDEQ and the King biological assessment methodologies and the results of comparative analysis from both reference sites, all of the monitored locations, with the exception of WC1896 (Willow Creek #1), were found to have at a minimum *Good/Slightly-Impaired* biological condition, with the majority of locations indicating *Very Good/Non-Impaired* biological condition. WC1896, when compared to the best reference location MRW45 (Middle Creek) and using WDEQ methodology, was found to have *Fair* biological condition.

Chemical – The available water chemistry data provided that there were exceedances of the pH standard twice in May of 1997. Low pH's of 6.03 and 6.45 at monitoring location Willow Creek #2 were recorded. Also, the standard for Total Phosphorus was exceeded on a number of occasions in 1997. At monitoring location Willow Creek #3, a phosphorus level of .114 was recorded in May. At monitoring location Willow Creek #4, phosphorus levels of .171, .119, .115 and .112 in February, April and May (2) respectively. Dissolved Oxygen levels, while not exceeding standards, were also lower than normal during the Spring of 1997. Discharge levels for streamflow in Willow Creek were at their highest point under record for the time period covered by this study. This would indicate that phosphorus was picked up from surface runoff during that year in the lower reaches of the watershed.

Recommendations

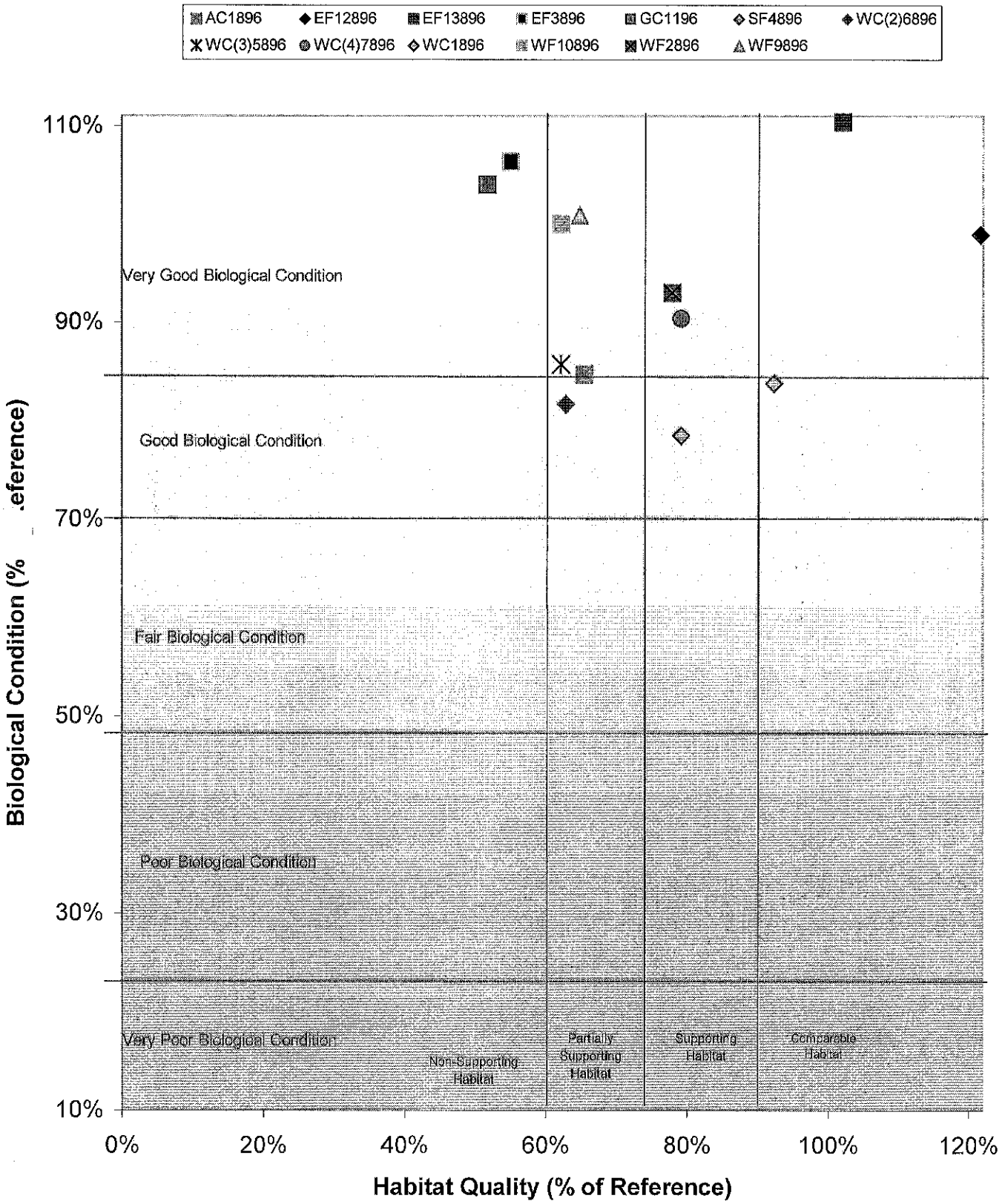
One of the objectives for water quality monitoring during this program was to determine the success of BMP implementation. To reflect a trend, multiple years of data must be obtained for comparative analysis. Of the data supplied for this analysis, only water chemistry and fisheries data covered multiple years. It can be noted that preliminary analysis of the fisheries data did indicate an improvement for the time period covered. Historical water quality data also contained extensive water chemistry data but trend identification was inconclusive. However, if determining change in stream condition is a program objective, more than water chemistry and fisheries data is required.

Credible data consists of physical, biological and chemical data, all three of which were obtained in 1996. While the physical data obtained during monitoring may not be to the degree of accuracy required it does represent a baseline with a moderate degree of confidence. Therefore, it is recommended that another full BURP bioassessment, including physical, biological and chemical data, should be performed and the data from which can be compared to the data obtained in 1996. Additionally, water chemistry from Willow Creek during the spring runoff period should be obtained, focusing on total phosphorus and associated constituents. Soil samples from the drainage affecting Willow Creek should also be obtained and analyzed for phosphorus content.

DATA

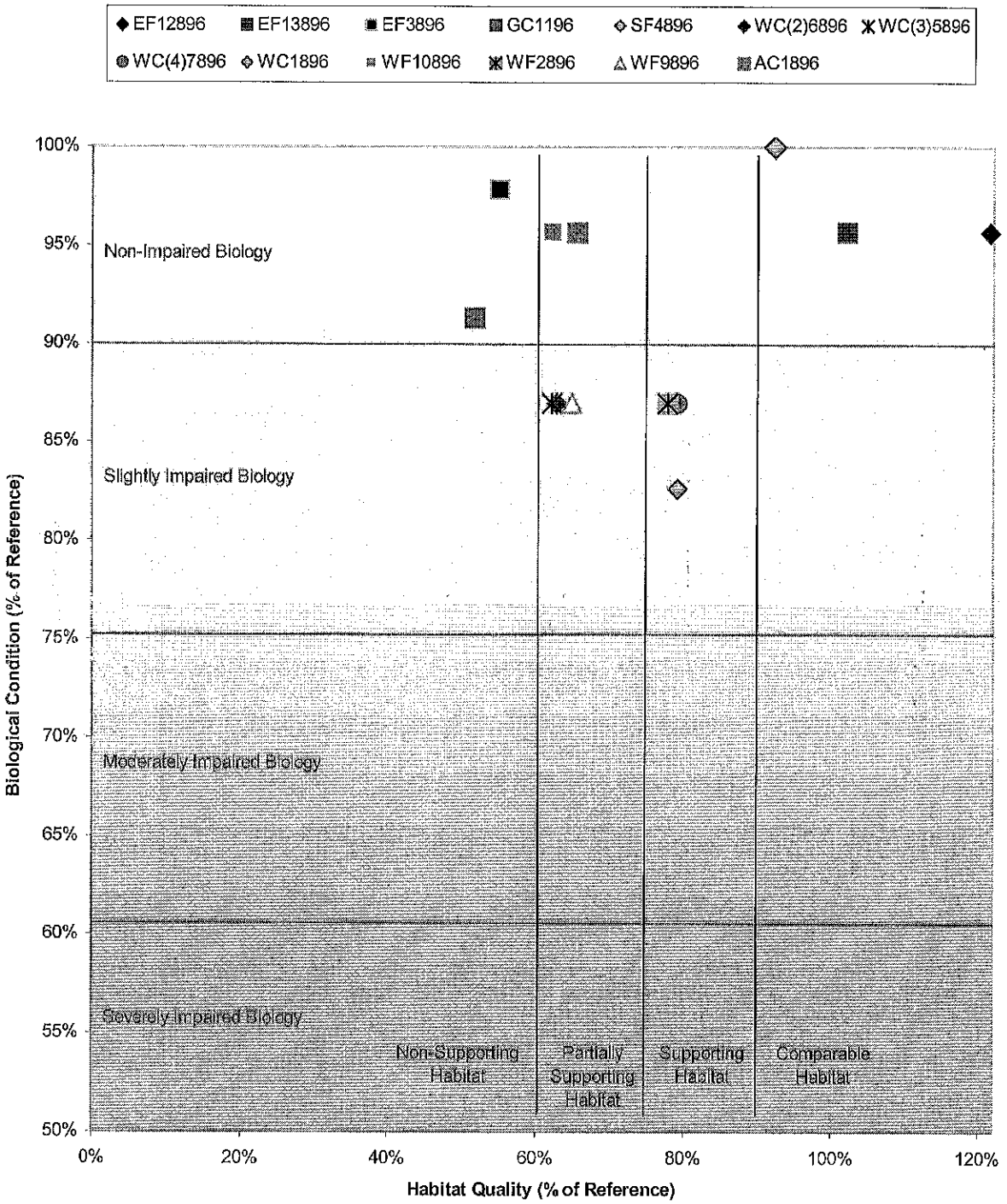
1996 Willow Creek Bioassessment

% of Reference (West Fork Smiths Fork - *WDEQ Methodology*)



1996 Willow Creek Bioassessment

% of Reference (West Fork Smiths Fork - *King Methodology*)



Archie Creek
Benthos Site # 8

WDEQ Metric ROCKIES	AC1996	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	6	50.0
Insect taxa	100*metric / 95th%ile	45	29	64.4
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	100.0
% Ephemeroptera	100*metric / 95th%ile	69.8	18.28	26.2
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100.0
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	54.31	91.0
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.91	70.8
% scrapers	100*metric / 95th%ile	56.1	11.16	19.9
			Index score	65.3
			sample rating	fair

King Metrics	Metric Value		Relative % Comparison		Bio Score	
Location	AC1996	MRW56	AC1996	MRW56	AC1996	MRW56
Metric						
EPT Taxa	16	26	61.54%	100%	5	5
% Plecoptera	3.57	4.16	85.82%	100%	1	3
% Chironomidae	22.86	22.98	99.48%	100%	5	5
Predator Taxa	8	12	66.67%	100%	5	5
% Scrapers	11.16	21.84	51.10%	100%	5	5
Modified HBI	3.91	3.56	109.83%	100%	5	5
Biotic Condition Index (a)	66.17	65.37	101.22%	100%	3	3
Shannon H (Log base 2)	4.08	4.64	87.93%	100%	5	5
% Multivoltine	21.57	28.03	76.95%	100%	5	5
% Univoltine	52.54	51.95	101.14%	100%	5	5
				Total	44	46

Comparison Location Biological Conditon Category
Non-Impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category
Non-Impaired. Comparable to the best expected within this eco-region.

Archie Creek
Benthos Site # 8

	Comparison Location	Control Location
	AC1996	MRW56
Habitat	Score	Score
Bottom Substrate	18	11
Embeddedness	18	8
Instream Cover	4	2
Velocity/Depth	1	14
Channel Flow Status		8
Primary Parameter Sub-total	41	35
Channel Shape	10	8
Pool/Riffle Sequence	9	15
Channelization/Alteration	10	3
Width to Depth	2	8
Secondary Parameter Sub-total	31	34
Bank Vegetation Protection Left	2	7
Bank Vegetation Protection Right	2	7
Bank Stability Left	6	9
Bank Stability Right	6	9
Disruptive Pressure Left	4	10
Disruptive Pressure Right	4	10
Riparian Zone Width Left	2	12
Riparian Zone Width Right	2	12
Tertiary Parameter Sub-total	28	76
Total	100	145

Habitat Quality : *Comparable*

AC1996	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	150	126	204	127	108	184	120	100	186	108	1413
Boulder	70	66	62	76	37	82	96	52	37	79	49.5%
Cobble	40	42	111	46	60	82	23	41	130	19	42.0%
Coarse	40	8	27	5	11	15	0	7	19	6	9.8%
Fine	0	0	4	0	0	0	0	0	0	0	0.3%
Sand	0	0	0	0	0	5	1	0	0	4	0.7%
Silt	0	2	0	0	0	0	0	0	0	0	0.1%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

Gilbert Creek
Benthos Site #11

WDEQ Metric ROCKIES	GC1996	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	12	100
Insect taxa	100*metric / 95th%ile	45	41	91.1
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	90
% Ephemeroptera	100*metric / 95th%ile	69.8	23.71	34
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	45.66	100
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.59	86.2
% scrapers	100*metric / 95th%ile	56.1	22.83	40.7
			Index score	80.2
			sample rating	good

King Metrics	Metric Value		Relative % Comparison		Bio Score	
Location	GC1996	MRW56	GC1996	MRW56	GC1996	MRW56
Metric						
EPT Taxa	22	26	84.62%	100%	5	5
% Plecoptera	1.09	4.16	26.20%	100%	1	3
% Chironomidae	15.63	22.98	68.02%	100%	5	5
Predator Taxa	5	12	41.67%	100%	3	5
% Scrapers	22.83	21.84	104.53%	100%	5	5
Modified HBI	2.59	3.56	72.75%	100%	5	5
Biotic Condition Index (a)	66.88	65.37	102.31%	100%	3	3
Shannon H (Log base 2)	4.49	4.64	96.77%	100%	5	5
% Multivoltine	18.04	28.03	64.36%	100%	5	5
% Univoltine	64.02	51.95	123.23%	100%	5	5
				Total	42	46

Comparison Location Biological Conditon Category
Non-Impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category
Non-Impaired. Comparable to the best expected within this eco-region.

Gilbert Creek
Benthos Site #11

	Comparison Location	Control Location
	GC1996	MRW56
Habitat	Score	Score
Bottom Substrate	10	11
Embeddedness	10	8
Instream Cover	4	2
Velocity/Depth	10	14
Channel Flow Status		8
Primary Parameter Sub-total	34	43
Channel Shape	10	8
Pool/Riffle Sequence	6	15
Channelization/Alteration	5	3
Width to Depth	2	8
Secondary Parameter Sub-total	23	34
Bank Vegetation Protection Left	3	7
Bank Vegetation Protection Right	3	7
Bank Stability Left	2	9
Bank Stability Right	2	9
Disruptive Pressure Left	2	10
Disruptive Pressure Right	2	10
Riparian Zone Width Left	4	12
Riparian Zone Width Right	4	12
Tertiary Parameter Sub-total	22	76
Total	79	145

Habitat Quality: *Not Supporting*

% of Control
51.63398693

GC1996	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	180	144	152	175	125	163	170	120	52	130	1411
Boulder	50	80	60	120	50	80	70	30	30	70	43.9%
Cobble	82	61	65	30	60	85	40	60	18	37	38.1%
Coarse	18	3	15	25	10	14	60	30	4	15	13.7%
Fine	0	0	12	0	5	4	0	0	0	5	1.8%
Sand	20	0	0	0	0	0	0	0	0	3	1.6%
Silt	10	0	0	0	0	0	0	0	0	0	0.7%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

East Fork Smiths Fork
Benthos Site #3

WDEQ Metric ROCKIES	EF3896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	19	100
Insect taxa	100*metric / 95th%ile	45	34	75.6
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	90
% Ephemeroptera	100*metric / 95th%ile	69.8	39.14	56.1
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	60.18	79.3
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.9	82.6
% scrapers	100*metric / 95th%ile	56.1	40.48	72.2
			Index score	82
			sample rating	good

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	EF3896	MRW56	EF3896	MRW56	EF3896	MRW56
Metric						
EPT Taxa	19	26	73.08%	100%	5	5
% Plecoptera	0.44	4.16	10.58%	100%	1	3
% Chironomidae	5.74	22.98	24.98%	100%	5	5
Predator Taxa	6	12	50.00%	100%	5	5
% Scrapers	40.48	21.84	185.35%	100%	5	5
Modified HBI	2.9	3.56	81.46%	100%	5	5
Biotic Condition Index (a)	61.61	65.37	94.25%	100%	3	3
Shannon H (Log base 2)	3.9	4.64	84.05%	100%	5	5
% Multivoltine	10.18	28.03	36.32%	100%	5	5
% Univoltine	72.12	51.95	138.83%	100%	5	5
				Total	45	48

Comparison Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

East Fork Smiths Fork
Benthos Site #3

Habitat	Comparison Location EF3896 Score	Control Location MRW56 Score
Bottom Substrate	12	11
Embeddedness	12	8
Instream Cover	6	2
Velocity/Depth	2	14
Channel Flow Status		8
Primary Parameter Sub-total	32	43
Channel Shape	8	8
Pool/Riffle Sequence	4	15
Channelization/Alteration	4	3
Width to Depth	4	8
Secondary Parameter Sub-total	20	34
Bank Vegetation Protection Left	4	7
Bank Vegetation Protection Right	4	7
Bank Stability Left	8	9
Bank Stability Right	8	9
Disruptive Pressure Left	2	10
Disruptive Pressure Right	2	10
Riparian Zone Width Left	2	12
Riparian Zone Width Right	2	12
Tertiary Parameter Sub-total	32	76
Total	84	145

Habitat Quality Not Supporting

% of Control
54.90196078

EF3896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average	
Stream Width	205	268	280	324	292	256	508	391	602	340	3466	
Boulder	200	150	140	180	170	130	210	170	90	140	1570	45.6%
Cobble	0	64	130	80	84	102	150	164	282	142	1178	34.0%
Coarse	0	54	10	64	38	24	48	27	210	34	509	14.7%
Fine	0	0	0	0	0	0	80	20	0	18	118	3.4%
Sand	5	0	0	0	0	0	40	10	50	8	113	3.3%
Silt	0	0	0	0	0	0	0	0	0	0	0	0.0%
Clay	0	0	0	0	0	0	0	0	0	0	0	0.0%

East Fork Smiths Fork
Benthos Site #12

WDEQ Metric ROCKIES	EF12895	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	14	100
Insect taxa	100*metric / 95th%ile	45	31	68.9
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	100
% Ephemeroptera	100*metric / 95th%ile	69.8	44.08	63.2
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	68.2	63.3
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.54	75.1
% scrapers	100*metric / 95th%ile	56.1	22.45	40
			Index score	76.3
			sample rating	good

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	EF12895	MRW56	EF12895	MRW56	EF12895	MRW56
Metric						
EPT Taxa	14	26	53.85%	100%	3	5
% Plecoptera	1.66	4.16	39.90%	100%	1	3
% Chironomidae	15.19	22.98	66.10%	100%	5	5
Predator Taxa	7	12	58.33%	100%	5	5
% Scrapers	22.45	21.84	102.79%	100%	5	5
Modified HBI	3.54	3.56	99.44%	100%	5	5
Biotic Condition Index (a)	75.31	65.37	115.21%	100%	5	3
Shannon H (Log base 2)	3.75	4.64	80.82%	100%	5	5
% Multivoltine	21.83	28.03	77.88%	100%	5	5
% Univoltine	61.02	51.95	117.46%	100%	5	5
				Total	44	48

Comparison Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

East Fork Smiths Fork
Benthos Site #12

Habitat	Comparison Location EF12895 Score	Control Location MRW56 Score
Bottom Substrate	20	11
Embeddedness	20	8
Instream Cover	12	2
Velocity/Depth	18	14
Channel Flow Status		8
Primary Parameter Sub-total	70	43
Channel Shape	10	8
Pool/Riffle Sequence	12	15
Channelization/Alteration	12	3
Width to Depth	10	8
Secondary Parameter Sub-total	44	34
Bank Vegetation Protection Left	10	7
Bank Vegetation Protection Right	10	7
Bank Stability Left	8	9
Bank Stability Right	8	9
Disruptive Pressure Left	8	10
Disruptive Pressure Right	8	10
Riparian Zone Width Left	10	12
Riparian Zone Width Right	10	12
Tertiary Parameter Sub-total	72	76
Total	186	145

% of Control
121.5686275

Habitat Quality Comparable

EF12895	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average	
Stream Width	315	372	334	212	185	256	176	190	310	280	2630	
Boulder	60	90	70	100	190	204	170	144	198	170	1396	53.1%
Cobble	255	136	238	82	60	52	4	46	67	45	985	37.5%
Coarse	0	5	26	22	35	0	2	30	20	50	190	7.2%
Fine	0	24	0	0	0	0	0	0	10	0	34	1.3%
Sand	0	6	0	2	0	0	0	0	15	15	38	1.4%
Silt	0	0	0	6	0	0	0	0	0	0	6	0.2%
Clay	0	0	0	0	0	0	0	0	0	0	0	0.0%

East Fork Smiths Fork
Benthos Site #13

WDEQ Metric ROCKIES	EF13896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	26	100
Insect taxa	100*metric / 95th%ile	45	44	97.8
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	90
% Ephemeroptera	100*metric / 95th%ile	69.8	42.64	61.1
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	53.77	92.1
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.09	92
% scrapers	100*metric / 95th%ile	56.1	26.79	47.8
			Index score	85.1
			sample rating	good

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	EF13896	MRW56	EF13896	MRW56	EF 13896	MRW56
Metric						
EPT Taxa	26	26	100.00%	100%	5	5
% Plecoptera	1.71	4.16	41.11%	100%	1	3
% Chironomidae	9.83	22.98	42.78%	100%	5	5
Predator Taxa	10	12	83.33%	100%	5	5
% Scrapers	26.79	21.84	122.66%	100%	5	5
Modified HBI	2.09	3.56	58.71%	100%	5	5
Biotic Condition Index (a)	63.54	65.37	97.20%	100%	3	3
Shannon H (Log base 2)	4.33	4.64	93.32%	100%	5	5
% Multivoltine	14.43	28.03	51.48%	100%	5	5
% Univoltine	65.94	51.95	128.93%	100%	5	5
				Total	44	46

Comparison Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

East Fork Smiths Fork
Benthos Site #13

	Comparison Location	Control Location
	EF32896	MRW56
Habitat	Score	Score
Bottom Substrate	18	11
Embeddedness	18	8
Instream Cover	10	2
Velocity/Depth	10	14
Channel Flow Status		8
Primary Parameter Sub-total	56	43
Channel Shape	8	8
Pool/Riffle Sequence	6	15
Channelization/Alteration	15	3
Width to Depth	3	8
Secondary Parameter Sub-total	32	34
Bank Vegetation Protection Left	10	7
Bank Vegetation Protection Right	10	7
Bank Stability Left	6	9
Bank Stability Right	6	9
Disruptive Pressure Left	6	10
Disruptive Pressure Right	6	10
Riparian Zone Width Left	12	12
Riparian Zone Width Right	12	12
Tertiary Parameter Sub-total	68	76
Total	156	145

Habitat Quality Comparable

% of Control
101.9607843

EF13896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	230	320	372	365	410	350	240	282	286	287	314.2
Boulder	100	190	200	170	170	270	150	132	180	190	55.8%
Cobble	102	108	100	95	95	70	70	130	60	87	26.2%
Coarse	22	22	30	77	60	10	20	16	8	20	9.1%
Fine	6	0	14	23	45	0	0	0	18	0	3.4%
Sand	0	0	20	0	26	0	0	4	20	0	2.2%
Silt	0	0	4	0	14	0	0	0	0	0	0.6%
Clay	0	0	2	0	0	0	0	0	0	0	0.1%

Willow Creek
Benthos Site#1

WDEQ Metrics ROCKIES	WC13896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	14	100
Insect taxa	100*metric / 95th%ile	45	34	75.6
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	6	50
% Ephemeroptera	100*metric / 95th%ile	69.8	1.65	2.4
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	89.37	61
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.61	62.7
% scrapers	100*metric / 95th%ile	56.1	18.28	32.6
			Index score	60.5
			sample rating	fair

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	WC13896	MRW56	WC13896	MRW56	WC13896	MRW56
Metric						
EPT Taxa	14	26	53.85%	100%	3	5
% Plecoptera	0.33	4.16	7.93%	100%	1	3
% Chironomidae	40.18	22.98	174.85%	100%	3	5
Predator Taxa	6	12	50.00%	100%	5	5
% Scrapers	18.28	21.84	83.70%	100%	5	5
Modified HBI	4.61	3.56	129.49%	100%	3	5
Biotic Condition Index (a)	80.08	65.37	122.50%	100%	5	3
Shannon H (Log base 2)	3.75	4.64	80.82%	100%	5	5
% Multivoltine	44.63	28.03	159.22%	100%	5	5
% Univoltine	34.63	51.95	67.05%	100%	3	5
				Total	38	46

Comparison Location Biological Conditon Category
Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

Willow Creek
Benthos Site#1

	Comparison Location	Control Location
	WC13896	MRW56
Habitat	Score	Score
Bottom Substrate	15	11
Embeddedness	10	8
Instream Cover	10	2
Velocity/Depth	8	14
Channel Flow Status		8
Primary Parameter Sub-total	43	43
Channel Shape	8	8
Pool/Riffle Sequence	8	15
Channelization/Alteration	8	3
Width to Depth	6	8
Secondary Parameter Sub-total	30	34
Bank Vegetation Protection Left	8	7
Bank Vegetation Protection Right	8	7
Bank Stability Left	8	9
Bank Stability Right	8	9
Disruptive Pressure Left	4	10
Disruptive Pressure Right	4	10
Riparian Zone Width Left	4	12
Riparian Zone Width Right	4	12
Tertiary Parameter Sub-total	48	76
Total	121	145

Habitat Quality Supporting

WC13896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	40	60	66	48	120	65	24	68	15	70	57.8
Boulder	10	16	36	34	76	27	22	46	0	40	53.1%
Cobble	18	20	20	10	36	29	2	0	10	12	27.2%
Coarse	3	18	12	4	8	5	0	9	0	11	12.1%
Fine	0	6	0	0	0	0	0	0	0	3	1.6%
Sand	4	0	0	0	2	6	0	2	2	2	3.1%
Silt	3	0	0	0	0	0	0	0	2	2	1.2%
Clay	2	0	0	0	0	0	0	1	1	0	0.7%

Willow Creek
Benthos Site#6

WDEQ Metric ROCKIES	WC6895	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	16	100
Insect taxa	100*metric / 95th%ile	45	39	86.7
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	3	80
% Ephemeroptera	100*metric / 95th%ile	69.8	2.38	3.4
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	66.46	66.8
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.73	61.3
% scrapers	100*metric / 95th%ile	56.1	3.25	5.8
			index score	62
			sample rating	fair

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	WC6896	MRW56	WC6896	MRW56	WC6896	MRW56
Metric						
EPT Taxa	16	26	61.54%	100%	5	5
% Plecoptera	1.09	4.16	26.20%	100%	1	3
% Chironomidae	56.06	22.98	243.95%	100%	3	5
Predator Taxa	9	12	75.00%	100%	5	5
% Scrapers	3.25	21.84	14.88%	100%	3	5
Modified HBI	4.73	3.58	132.87%	100%	3	5
Biotic Condition Index (a)	76.54	65.37	117.09%	100%	5	3
Shannon H (Log base 2)	3.62	4.64	78.02%	100%	5	5
% Multivoltine	46	28.03	164.11%	100%	5	5
% Univoltine	45.99	51.95	88.53%	100%	5	5
				Total	40	46

Comparison Location Biological Conditon Category
Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

Willow Creek
Benthos Site#6

Habitat	Comparison Location WC6896 Score	Control Location MRW56 Score
Bottom Substrate	18	11
Embeddedness	18	8
Instream Cover	8	2
Velocity/Depth	6	14
Channel Flow Status		8
Primary Parameter Sub-total	50	43
Channel Shape	10	8
Pool/Riffle Sequence	6	15
Channelization/Alteration	10	3
Width to Depth	2	8
Secondary Parameter Sub-total	28	34
Bank Vegetation Protection Left	2	7
Bank Vegetation Protection Right	2	7
Bank Stability Left	2	9
Bank Stability Right	2	9
Disruptive Pressure Left	3	10
Disruptive Pressure Right	3	10
Riparian Zone Width Left	2	12
Riparian Zone Width Right	2	12
Tertiary Parameter Sub-total	18	76
Total	96	145

Habitat Quality Partially Supporting

% of Control
62.74509804

WC6896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	48	54	46	150	40	65	44	28	109	77	661
Boulder	0	0	25	50	20	10	10	10	20	32	26.8%
Cobble	0	3	15	35	17	50	20	16	75	40	41.0%
Coarse	0	0	6	15	4	5	7	0	8	0	6.7%
Fine	0	0	1	5	0	0	0	0	0	0	0.9%
Sand	40	45	0	30	0	0	5	2	0	0	18.5%
Silt	8	6	0	15	0	0	2	0	6	5	8.4%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

Willow Creek
Benthos Site#5

WDEQ Metric ROCKIES	WC6895	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	16	100
Insect taxa	100*metric / 95th%ile	45	37	82.2
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	7	40
% Ephemeroptera	100*metric / 95th%ile	69.8	5.77	8.3
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	58.65	82.4
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	5.12	56.7
% scrapers	100*metric / 95th%ile	56.1	33.41	59.6
			index score	66.1
			sample rating	fair

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	WC6896	MRW56	WC6896	MRW56	WC6896	MRW56
Metric						
EPT Taxa	16	26	61.54%	100%	5	5
% Plecoptera	0.24	4.16	5.77%	100%	1	3
% Chironomidae	19.93	22.98	86.73%	100%	5	5
Predator Taxa	4	12	33.33%	100%	3	5
% Scrapers	33.41	21.84	152.98%	100%	5	5
Modified HBI	5.12	3.58	143.82%	100%	1	5
Biotic Condition Index (a)	79.05	65.37	120.93%	100%	5	3
Shannon H (Log base 2)	4.08	4.64	87.93%	100%	5	5
% Multivoltine	24.88	28.03	88.76%	100%	5	5
% Univoltine	53.73	51.95	103.43%	100%	5	5
				Total	40	46

Comparison Location Biological Conditon Category
Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category
Non-impaired. Comparable to the best expected within this eco-region.

Willow Creek
Benthos Site#5

Habitat	Comparison Location WC6896 Score	Control Location MRW56 Score
Bottom Substrate	12	11
Embeddedness	18	8
Instream Cover	2	2
Velocity/Depth	10	14
Channel Flow Status		8
Primary Parameter Sub-total	42	43
Channel Shape	10	8
Pool/Riffle Sequence	12	15
Channelization/Alteration	12	3
Width to Depth	3	8
Secondary Parameter Sub-total	37	34
Bank Vegetation Protection Left	2	7
Bank Vegetation Protection Right	2	7
Bank Stability Left	2	9
Bank Stability Right	2	9
Disruptive Pressure Left	2	10
Disruptive Pressure Right	2	10
Riparian Zone Width Left	2	12
Riparian Zone Width Right	2	12
Tertiary Parameter Sub-total	16	76
Total	95	145

Habitat Quality Partially Supporting

% of Control
62.09150327

WC6896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	67	110	no data	no data	no data	no data	no data	no data	no data	no data	[illegible]
Boulder	47	0	58	10	40	128	70	60	40	30	[illegible]
Cobble	0	24	30	46	120	25	40	35	89	30	[illegible]
Coarse	0	60	70	14	10	0	0	0	17	0	[illegible]
Fine	0	10	24	0	0	0	0	0	10	0	[illegible]
Sand	16	8	10	20	0	0	0	10	0	6	[illegible]
Silt	0	0	0	24	0	0	10	0	6	44	[illegible]
Clay	4	8	0	0	0	0	0	2	6	0	[illegible]

[illegible]

Willow Creek
Benthos Site#7

WDEQ Metric

ROCKIES	WC7896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	15	100
Insect taxa	100*metric / 95th%ile	45	39	86.7
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	90
% Ephemeroptera	100*metric / 95th%ile	69.8	12.23	17.5
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	52.4	94.8
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.56	63.3
% scrapers	100*metric / 95th%ile	56.1	3.06	5.5
			index score	69.7
			sample rating	fair

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	WC7896	MRW56	WC7896	MRW56	WC7896	MRW56
Metric						
EPT Taxa	15	26	57.69%	100%	5	5
% Plecoptera	4.37	4.16	105.05%	100%	3	3
% Chironomidae	47.6	22.98	207.14%	100%	3	5
Predator Taxa	16	12	133.33%	100%	5	5
% Scrapers	3.06	21.84	14.01%	100%	3	5
Modified HBI	4.56	3.56	128.09%	100%	3	5
Biotic Condition Index (a)	70.8	65.37	108.31%	100%	3	3
Shannon H (Log base 2)	4.35	4.64	93.75%	100%	5	5
% Multivoltine	44.65	28.03	159.29%	100%	5	5
% Univoltine	42.69	51.95	82.18%	100%	5	5
				Total	40	46

Comparison Location Biological Condition Category
Slightly impaired. Community structure and composition less than expected.

Control Location Biological Condition Category
Non-impaired. Comparable to the best expected within this eco-region.

Willow Creek
Benthos Site#7

	Comparison Location	Control Location
	WC7896	MRW56
Habitat	Score	Score
Bottom Substrate	18	11
Embeddedness	18	8
Instream Cover	6	2
Velocity/Depth	6	14
Channel Flow Status		8
Primary Parameter Sub-total	48	43
Channel Shape	10	8
Pool/Riffle Sequence	10	15
Channelization/Alteration	5	3
Width to Depth	6	8
Secondary Parameter Sub-total	31	34
Bank Vegetation Protection Left	3	7
Bank Vegetation Protection Right	3	7
Bank Stability Left	4	9
Bank Stability Right	4	9
Disruptive Pressure Left	4	10
Disruptive Pressure Right	4	10
Riparian Zone Width Left	10	12
Riparian Zone Width Right	10	12
Tertiary Parameter Sub-total	42	76
Total	121	145

Habitat Quality Supporting

% of Control
79.08496732

WC7896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	119	68	210	360	78	65	180	82	112	188	1462
Boulder	0	0	30	0	0	10	0	10	0	40	6.2%
Cobble	0	60	145	0	72	54	22	42	14	8	26.5%
Coarse	0	8	9	0	6	1	18	10	6	12	4.8%
Fine	0	0	20	0	0	0	0	12	6	12	3.4%
Sand	0	0	0	120	0	0	15	8	26	8	12.1%
Silt	119	0	8	240	0	0	125	0	60	108	45.1%
Clay	0	0	6	0	0	0	0	0	0	0	0.4%

West Fork Smiths Fork
Benthos Site #2

WDEQ Metrics

ROCKIES	WF2896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	19	100
Insect taxa	100*metric / 95th%ile	45	33	73.3
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	100
% Ephemeroptera	100*metric / 95th%ile	69.8	17.13	24.5
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	71.55	56.7
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.15	91.3
% scrapers	100*metric / 95th%ile	56.1	15.47	27.6
			index score	71.7
			sample rating	good

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	WF2896	MRW56	WF2896	MRW56	WF2896	MRW56
Metric						
EPT Taxa	19	26	73.08%	100%	5	5
% Plecoptera	1.17	4.16	28.13%	100%	1	3
% Chironomidae	6.33	22.98	27.55%	100%	5	5
Predator Taxa	7	12	58.33%	100%	5	5
% Scrapers	15.47	21.84	70.83%	100%	5	5
Modified HBI	2.15	3.56	60.39%	100%	5	5
Biotic Condition Index (a)	66.18	65.37	101.24%	100%	3	3
Shannon H (Log base 2)	3.21	4.64	69.18%	100%	3	5
% Multivoltine	12.4	28.03	44.24%	100%	5	5
% Univoltine	22.21	51.95	42.75%	100%	3	5
				Total	40	46

Comparison Location Biological Condition Category
Slightly impaired. Community structure and composition less than expected.

Control Location Biological Condition Category
Non-impaired. Comparable to the best expected within this eco-region.

West Fork Smiths Fork
Benthos Site #2

	Comparison Location	Control Location
	WF2896	MRW56
Habitat	Score	Score
Bottom Substrate	20	11
Embeddedness	18	8
Instream Cover	5	2
Velocity/Depth	8	14
Channel Flow Status		8
Primary Parameter Sub-total	51	43
Channel Shape	10	8
Pool/Riffle Sequence	3	15
Channelization/Alteration	15	3
Width to Depth	10	8
Secondary Parameter Sub-total	38	34
Bank Vegetation Protection Left	2	7
Bank Vegetation Protection Right	2	7
Bank Stability Left	4	9
Bank Stability Right	4	9
Disruptive Pressure Left	5	10
Disruptive Pressure Right	5	10
Riparian Zone Width Left	4	12
Riparian Zone Width Right	4	12
Tertiary Parameter Sub-total	30	76
Total	119	145

Habitat Quality Supporting

% of Control
77.77777778

WF2896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	360	499	156	264	216	360	504	510	572	608	4049
Boulder	252	210	62	90	91	102	240	315	350	512	54.9%
Cobble	55	95	14	42	79	155	174	105	150	88	23.6%
Coarse	67	10	46	60	30	94	21	60	40	8	10.8%
Fine	0	0	29	30	0	0	19	30	20	0	3.2%
Sand	35	15	5	6	14	9	39	5	12	0	3.5%
Silt	65	30	0	36	6	0	11	0	0	0	3.7%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

Smiths Fork
Benthos Site #4

WDEQ Metrics ROCKIES	SF1896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	20	100
Insect taxa	100*metric / 95th%ile	45	41	91.1
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	6	50
% Ephemeroptera	100*metric / 95th%ile	69.8	9.51	13.6
% Oligochaeta	100*(0.75-arcsin(sqrt[metric]))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	66.3	67.1
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.29	66.4
% scrapers	100*metric / 95th%ile	56.1	16.21	28.9
			Index score	64.6
			sample rating	fair

King Metric	Metric Value		Relative %	Comparison	Bio Score	
Location	SF1896	MRW56	SF1896	MRW56	SF1896	MRW56
Metric						
EPT Taxa	20	26	76.92%	100%	5	5
% Plecoptera	2.34	4.16	56.25%	100%	1	3
% Chironomidae	30.19	22.98	131.38%	100%	5	5
Predator Taxa	7	12	58.33%	100%	5	5
% Scrapers	16.21	21.84	74.22%	100%	5	5
Modified HBI	4.29	3.56	120.51%	100%	5	5
Biotic Condition Index (a)	75.15	65.37	114.96%	100%	5	3
Shannon H (Log base 2)	3.93	4.64	84.70%	100%	5	5
% Multivoltine	30.87	28.03	110.49%	100%	5	5
% Univoltine	47.19	51.95	90.84%	100%	5	5
				Total	46	46

Comparison Location Biological Conditon Category
Non-impaired: Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category
Non-impaired: Comparable to the best expected within this eco-region.

Smiths Fork
Benthos Site #4

Comparison Location	Control Location
SF1896	MRW56
Habitat Score	Habitat Score
Bottom Substrate	20	11
Embeddedness	10	8
Instream Cover	18	2
Velocity/Depth	8	14
Channel Flow Status		8
Primary Parameter Sub-total	56	43
Channel Shape	14	8
Pool/Riffle Sequence	3	15
Channelization/Alteration	2	3
Width to Depth	2	8
Secondary Parameter Sub-total	21	34
Bank Vegetation Protection Left	8	7
Bank Vegetation Protection Right	8	7
Bank Stability Left	10	9
Bank Stability Right	10	9
Disruptive Pressure Left	10	10
Disruptive Pressure Right	10	10
Riparian Zone Width Left	4	12
Riparian Zone Width Right	4	12
Tertiary Parameter Sub-total	64	76
Total	141	145

Habitat Quality Comparable

% of Control
92.15686275

SF1896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	474	369	156	264	216	360	504	510	572	608	4033
Boulder	252	210	62	90	91	102	240	315	350	512	55.1%
Cobble	55	95	14	42	79	156	174	105	150	88	23.8%
Coarse	67	10	46	60	30	94	21	60	40	8	10.8%
Fine	0	0	29	30	0	0	19	30	20	0	3.2%
Sand	35	15	5	6	14	9	39	5	12	0	3.5%
Silt	65	30	0	36	6	0	11	0	0	0	3.7%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

West Fork Smiths Fork
Benthos Site #9

WDEQ Metrics ROCKIES	WF9896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	20	100
Insect taxa	100*metric / 95th%ile	45	45	100
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	100
% Ephemeroptera	100*metric / 95th%ile	69.8	26.81	38.4
% Oligochaeta	100*(0.75-arcsin[sqrt(metric)])/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	47.73	100
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.27	66.6
% scrapers	100*metric / 95th%ile	56.1	9.81	17.5
			Index score	77.8
			sample rating	good

King Metrics	Metric Value		Relative %	Comparison	Bio Score	
Location	WF9896	MRW56	WF9896	MRW56	WF9896	MRW56
Metric						
EPT Taxa	20	26	76.92%	100%	5	5
% Plecoptera	4.9	4.16	117.79%	100%	3	3
% Chironomidae	43.81	22.98	190.64%	100%	3	5
Predator Taxa	10	12	83.33%	100%	5	5
% Scrapers	9.81	21.84	44.92%	100%	5	5
Modified HBI	4.27	3.56	119.94%	100%	5	5
Biotic Condition Index (a)	71.13	65.37	108.81%	100%	3	3
Shannon H (Log base 2)	4.56	4.64	98.26%	100%	5	5
% Multivoltine	48.45	28.03	172.85%	100%	3	5
% Univoltine	38.48	51.95	74.07%	100%	3	5
				Total	40	46

Comparison Location Biological Conditon Category
Slightly impaired: Community structure and composition less than expected.

Control Location Biological Conditon Category
Non-impaired: Comparable to the best expected within this eco-region.

West Fork Smiths Fork
Benthos Site #9

Comparison Location	Control Location
WF9896	MRW56
Habitat Score	Habitat Score
Bottom Substrate	10	11
Embeddedness	10	8
Instream Cover	8	2
Velocity/Depth	8	14
Channel Flow Status		8
Primary Parameter Sub-total	36	43
Channel Shape	10	8
Pool/Riffle Sequence	6	15
Channelization/Alteration	15	3
Width to Depth	2	8
Secondary Parameter Sub-total	33	34
Bank Vegetation Protection Left	2	7
Bank Vegetation Protection Right	2	7
Bank Stability Left	2	9
Bank Stability Right	2	9
Disruptive Pressure Left	4	10
Disruptive Pressure Right	4	10
Riparian Zone Width Left	7	12
Riparian Zone Width Right	7	12
Tertiary Parameter Sub-total	30	76
Total	99	145

Habitat Quality Partially Supporting

% of Control
64.70588235

WF9896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	270	168	137	300	187	105	87	266	296	240	2056
Boulder	85	78	34	52	20	38	49	61	127	77	30.2%
Cobble	134	61	81	227	140	67	38	181	169	125	59.5%
Coarse	40	20	3	10	0	0	0	24	0	0	4.7%
Fine	7	3	0	6	0	0	0	0	0	0	0.8%
Sand	4	3	15	5	27	0	0	0	0	20	3.6%
Silt	0	0	4	0	0	0	0	0	0	18	1.1%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

West Fork Smiths Fork
Benthos Site #10

WDEQ Metrics ROCKIES	WF10896	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	22	100
Insect taxa	100*metric / 95th%ile	45	36	80
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	90
% Ephemeroptera	100*metric / 95th%ile	69.8	31.09	44.5
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	48.75	100
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.61	74.3
% scrapers	100*metric / 95th%ile	56.1	15.9	28.3
			Index score	77.1
			sample rating	good

West Fork Smiths Fork
Benthos Site #10

	Comparison Location WF10896	Control Location MRW56
Habitat	Score	Score
Bottom Substrate	18	11
Embeddedness	18	8
Instream Cover	4	2
Velocity/Depth	1	14
Channel Flow Status		8
Primary Parameter Sub-total	41	43
Channel Shape	10	8
Pool/Riffle Sequence	3	15
Channelization/Alteration	15	3
Width to Depth	2	8
Secondary Parameter Sub-total	30	34
Bank Vegetation Protection Left	2	7
Bank Vegetation Protection Right	2	7
Bank Stability Left	2	9
Bank Stability Right	2	9
Disruptive Pressure Left	6	10
Disruptive Pressure Right	6	10
Riparian Zone Width Left	2	12
Riparian Zone Width Right	2	12
Tertiary Parameter Sub-total	24	76
Total	95	145

Habitat Quality Partially Supporting

% of Control
62.09150327

King Metric	Metric Value		Relative % Comparison		Bio Score	
Location	WF10896	MRW56	WF10896	MRW56	WF10896	MRW56
Metric						
EPT Taxa	22	26	84.62%	100%	5	5
% Plecoptera	3.53	4.16	84.86%	100%	1	3
% Chironomidae	22.6	22.98	98.35%	100%	5	5
Predator Taxa	8	12	66.67%	100%	5	5
% Scrapers	15.9	21.84	72.80%	100%	5	5
Modified HBI	3.61	3.56	101.40%	100%	5	5
Biotic Condition Index (a)	63.05	65.37	96.45%	100%	3	3
Shannon H (Log base 2)	4.37	4.64	94.18%	100%	5	5
% Multivoltine	25.86	28.03	92.33%	100%	5	5
% Univoltine	44.96	51.95	86.54%	100%	5	5
				Total	44	46

Comparison Location Biological Condition Category
Non-impaired: Comparable to the best expected within this eco-region.

Control Location Biological Condition Category
Non-impaired: Comparable to the best expected within this eco-region.

WF10896	Quad 1	Quad 2	Quad 3	Quad 4	Quad 5	Quad 6	Quad 7	Quad 8	Quad 9	Quad 10	Average
Stream Width	182	128	348	212	340	127	566	354	145	172	2574
Boulder	113	90	190	130	49	90	214	106	39	62	42.1%
Cobble	69	36	142	56	266	22	126	232	106	102	45.1%
Coarse	0	0	12	10	16	14	25	14	0	8	3.8%
Fine	0	0	2	6	9	0	19	0	0	0	1.4%
Sand	0	0	2	8	0	1	40	1	0	0	2.0%
Silt	0	0	0	2	0	0	2	1	0	0	0.2%
Clay	0	0	0	0	0	0	0	0	0	0	0.0%

Smiths Fork
Reference Site

WDEQ Metrics ROCKIES	SS Reference	5th or 95th %ile	ENTER	
Metric	Scoring formula	(as per formula)	METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	10	83.3
Insect taxa	100*metric / 95th%ile	45	47	100
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	4	70
% Ephemeroptera	100*metric / 95th%ile	69.8	34.61	49.6
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	100
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	45.46	100
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.56	74.9
% scrapers	100*metric / 95th%ile	56.1	21.84	38.9
			Index score	77.1
			sample rating	good

Yearly Water Chemistry Means

WC1	Temp oC	pH	DO mg/l	Discharge ft³/s
6/7/1996	8.1	8.00	8.00	9.37
6/13/1996	9.0	8.04	8.50	2.78
6/19/1996	17.2	8.30	7.60	1.01
6/26/1996	11.0	8.27	8.50	0.73
7/11/1996	16	8.71	7.10	0.56
7/24/1996	16.5	7.76	6.40	0.15
8/5/1996	14	7.86	6.85	0.38
8/21/1996	14.5	7.50	6.40	0.38
10/7/1996	14	7.12	7.6	0.46
96 Mean	**12.96475**	**7.81490672**	**7.5036686**	**0.78**
6/19/1997	15	7.61	7.6	2.15
97 Mean	**15**	**7.61**	**7.6**	**2.15**
8/12/1998	11	7.6	7	0.68
8/24/1998	18	8.3	7.9	0.52
10/8/1998	9	8.9		0.95
98 Mean	**12.12372**	**8.24949247**	**7.43639698**	**0.659252**

WC1	TSS mg/l	TDS mg/l	Conductivity
6/7/1996	17.5	50.0	60
6/13/1996	6.5	40.0	90
6/19/1996	10.0	45.0	130
6/26/1996	15.3	136.5	140
7/11/1996	16.0	136.5	335
7/24/1996	28.6	127.5	182
8/5/1996	14.8	98.0	170
8/21/1996	22.0	100.5	170
10/7/1996	36.0	64	100
96 Mean	**16.5**	**80.0**	**137.3**
6/19/1997	24.0	44	70
97 Mean	**24.0**	**44**	**70**
8/12/1998	22.0	196	115
8/24/1998	70.0	206	100
10/8/1998	68.0	149	70
98 Mean	**47.1**	**181.5**	**93.0**

WC1	Total P mg/l	NO_3-N mg/l
6/7/1996	0.02	0.33
6/13/1996	0.01	0.28
6/19/1996	0.01	0.16
6/26/1996	0.02	0.27
7/11/1996	0.01	0.26
7/24/1996	0.03	0.16
8/5/1996	0.02	0.28
8/21/1996	0.03	0.24
10/7/1996	0.02	0.20
96 Mean	**0.014794**	**0.23883106**

WC2	Temp oC	pH	DO mg/l	Discharge ft³/s
6/7/96	16.0	8.10	7.40	8.35
6/13/96	16.0	8.60	7.80	2.40
6/19/96	19.0	8.74	7.60	1.06
6/26/96	16.5	8.67	8.00	0.81
7/11/96	21	8.72	6.70	0.54
7/24/96	23	8.83	6.00	0.39
8/5/96	19	8.48	6.30	0.38
8/21/96	19	8.23	6.50	0.28
10/7/96	17	7.75	8.1	0.40
96 Mean	**18.23593**	**8.43993151**	**7.11613004**	**0.790873**
5/9/97	8	6.49	7.6	18.2
5/27/97	9	6.03		6.32
6/19/97	20	7.14	7.4	2.88
8/13/97	16	8.3	8	0.7
97 Mean	**12.12309**	**6.9369275**	**7.66264019**	**3.715805**
8/24/98	20	7.03	7.4	0.56
10/8/98	7	8.7		0.91
98 Mean	**11.83216**	**8.26354409**	**7.4**	**0.713863**

WC2	TSS mg/l	TDS mg/l	Conductivity
6/7/96	26.5	114.0	120
6/13/96	6.0	70.0	172
6/19/96	6.5	70.0	165
6/26/96	7.3	156.0	179
7/11/96	7.8	178.0	340
7/24/96	4.5	131.0	240
8/5/96	0.3	104.0	220
8/21/96	4.5	137.0	215
10/7/96	8.0	162	200
96 Mean	**5.0**	**117.9**	**198.1**
5/9/97	123.5	166	140
5/27/97	12.5	64	190
6/19/97	48.0	46	82
8/13/97	4.0	90	145
97 Mean	**23.3**	**80.2**	**131.6**
8/24/98	72.0	376	140
10/8/98	67.0	170	100
98 Mean	**69.45502**	**252.824049**	**118.321996**

WC2	Total P mg/l	NO_3-N mg/l
6/7/96	0.01	1.22
6/13/96	0.01	0.29
6/19/96	0.01	0.19
6/26/96	0.00	0.37
7/11/96	0.00	0.46
7/24/96	0.01	0.21
8/5/96	0.01	0.29
8/21/96	0.01	0.18
10/7/96	0.01	0.19
96 Mean	**0.005**	**0.309**
5/9/97	0.097	1.49
6/27/97	0.016	0.10
8/19/97		0.2
8/13/97	0.008	0.2
97 Mean	**0.023156**	**0.27785074**
8/24/98	0.01	0.1
10/8/98	0.01	0.1
98 Mean	**0.01**	**0.1**

WC3	Temp oC	pH	DO mg/l	Discharge CFS
5/30/96	8.0	7.40	7.90	25.93
6/7/96	20.0	8.50	7.70	11.69
6/13/96	15.0	8.42	8.50	4.65
6/19/96	13.0	8.76	8.90	3.85
6/26/96	17.0	8.59	8.40	2.89
7/11/96	20	8.69	8.10	2.05
7/24/96	13.6	8.16	10.00	1.42
8/5/96	13	8.62	9.50	0.97
8/21/96	12	8.69	8.25	0.72
10/7/96	16	8.03	8	0.82
96 Mean	**14.29951**	**8.35568039**	**8.13031378**	**2.79284**
4/26/97	6.5	7.87	10.5	5.81
4/29/97	3	7.93	5.5	19.02
5/2/97	5	8.04	7	12.59
5/6/97	4	7.06	6	20.46
5/9/97	12	7.87	9.4	22.76
5/19/97	5		9	30.91
5/27/97	11.5	7.3		11.55
6/3/97	14	7.68	7.2	8.11
6/19/97	20	8.6	10	5.21
8/13/97	18	9.2	7	1.53
97 Mean	**8.093179**	**7.92755578**	**7.52117716**	**10.41051**
8/12/98	8	7.56	8	3.83
8/24/98	17	8.05	7.8	2.42
10/9/98	9	8.6		2.8
98 Mean	**10.69696**	**8.05883089**	**7.89936706**	**2.960675**

WC3	TSS mg/l	TDS mg/l	Conductivity
5/30/96	24.5	138.0	100
6/7/96	18.0	36.0	280
6/13/96	11.5	176.0	550
6/19/96	11.8	205.5	650
6/26/96	3.8	259.5	720
7/11/96	5.0	251.0	600
7/24/96	3.6	247.0	290
8/5/96	0.5	223.0	300
8/21/96	1.3	282.5	690
10/7/96	100.0	154	210
96 Mean	**6.9**	**175.5**	**374.7**
4/26/97	22.0	215	335
4/29/97	63.0	190	345
5/2/97	99.8	250	250
5/6/97	99.0	190	272
5/9/97	82.5	116	250
5/19/97	87.0	128	110
5/27/97	15.0	196	410
6/3/97	54.0	132	350
6/19/97	18.0	160	150
8/13/97	3.0	22.8	186
97 Mean	**36.6**	**138.4**	**244.6**
8/12/98	6.0	348	140
8/24/98	90.0	304	260
10/9/98	34.0	247	160
98 Mean	**26.38098**	**296.175328**	**179.917658**

WC3	Total P mg/l	NO_3-N mg/l
5/30/96	0.06	0.65
6/7/96	0.01	0.05
6/13/96	0.01	0.07
6/19/96	0.01	0.20
6/26/96	0.01	0.33
7/11/96	0.00	0.35
7/24/96	0.01	0.16
8/5/96	0.01	0.27
8/21/96	0.00	0.14
10/7/96	0.01	0.17
96 Mean	**0.008**	**0.185**
4/26/97	0.043	0.2913
4/29/97	0.066	2.258
5/2/97	0.114	2.145
5/6/97	0.081	1.581
5/9/97	0.057	1.49
5/19/97	0.057	
5/27/97	0.017	
6/3/97		0.1
6/19/97		0.16
8/13/97	0.01	0.23
97 Mean	**0.044165**	**0.57657644**
8/12/98	0.013	0.1
8/24/98	0.012	0.1
10/9/98	0.067	0.46
98 Mean	**0.021364**	**0.16631035**

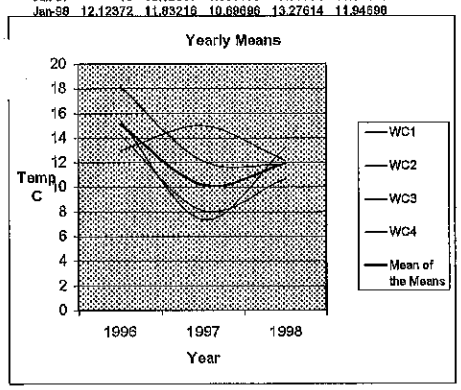
WC4	Temp oC	pH	DO mg/l	Discharge ft³/s
5/30/1996	7.0	8.90	7.75	20.14
6/7/1996	20.0	8.20	7.30	11.21
6/13/1996	15.0	8.50	8.40	6.39
6/19/1996	12.5	8.84	8.45	3.68
6/26/1996	18.0	8.99	8.00	3.13
7/11/1996	23	8.71	7.60	2.50
7/24/1996	24.5	8.64	6.25	1.65
8/5/1996	21	8.20	7.30	1.86
8/21/1996	21	8.52	8.62	0.61
10/7/1996	17	7.96	8.2	2.22
11/8/1996	6	8.89	10.1	3.71
96 Mean	**15.450392**	**8.10141205**	**7.9357869**	**3.318666**
2/22/1997		7.9	6.2	
3/21/1997	4			8.3
4/23/1997	1	9.03	10.2	5.21
4/28/1997	5	7.93	6.5	7.89
4/29/1997	5	7.68	6.4	19.94
5/2/1997		7.75	6.6	11
5/6/1997	7	7.46	8.25	21.67
5/9/1997	13	8.31	7.4	25.89
5/19/1997	4	8.2	8.8	32.57
5/27/1997	13	8.3		10.27
6/3/1997	16	7.19		10.03
6/19/1997	22	8.57	8.6	5.51
8/13/1997	20	8.9	7	1.4
97 Mean	**7.3399397**	**8.00542123**	**7.2535188**	**9.84074**
8/12/1998	13	9.22	8.6	
8/24/1998	18	7.96	7.5	2.43
10/9/1998	10	8.6		3.18
98 Mean	**13.276144**	**8.54093975**	**7.9358236**	**2.77982**

WC4	TSS mg/l	TDS mg/l	Conductivity
5/30/1996	41.5	177.0	240
6/7/1996	28.0	126.0	220
6/13/1996	9.0	195.0	330
6/19/1996	11.0	254.5	432
6/26/1996	3.5	269.4	720
7/11/1996	3.8	225.0	1200
7/24/1996	4.7	218.0	750
8/5/1996	2.0	187.0	350
8/21/1996	4.0	226.0	620
10/7/1996	68.0	288	710
11/8/1996	1.0	268	480
96 Mean	**7.4**	**213.5**	**486.4**
2/22/1997	181.8	364	390
3/21/1997	47.0	210	
4/23/1997	34.5	248	425
4/28/1997	10.0	223	510
4/29/1997		233	400
5/2/1997	65.5	284	312
5/6/1997	172.5	160	320
5/9/1997	116.5	170	197
5/19/1997	114.5		90
5/27/1997	19.5	220	395
6/3/1997	40.0	100	420
6/19/1997	42.0	152	100
8/13/1997	3.0	214	165
97 Mean	**42.7**	**204.8**	**272.0**
8/12/1998	72.0	320	230
8/24/1998	73.0	310	280
10/9/1998	28.0	260	150
98 Mean	**45.210618**	**283.901391**	**185.74176**

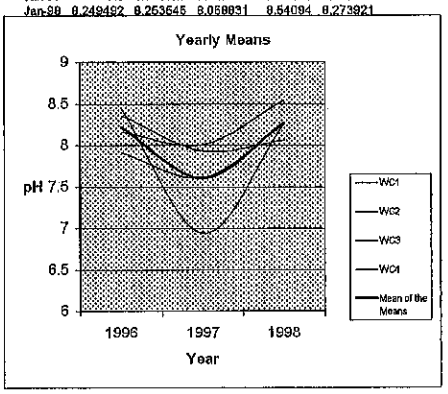
WC4	Total P mg/l	NO_3-N mg/l
5/30/1996	0.07	0.49
6/7/1996	0.01	0.27
6/13/1996	0.01	0.29
6/19/1996	0.01	0.10
6/26/1996	0.01	0.28
7/11/1996		0.29
7/24/1996	0.01	0.18
8/5/1996	0.01	0.19
8/21/1996	0.02	0.25
10/7/1996	0.01	0.26
11/8/1996	0.01	0.15
96 Mean	**0.011**	**0.231**
2/22/1997	0.171	0.29
3/21/1997	0.094	0.122
4/23/1997	0.067	0.241
4/28/1997	0.033	0.4861
4/29/1997	0.119	1.897
5/2/1997	0.059	2.463
5/6/1997	0.115	1.803
5/9/1997	0.083	1.72
5/19/1997	0.112	
5/27/1997	0.044	
6/3/1997	0.005	0.18
6/19/1997	0.007	0.1
8/13/1997	0.007	0.14
97 Mean	**0.0447374**	**0.4432585**
8/12/1998	0.014	0.1
8/24/1998	0.028	0.23
10/9/1998	0.029	0.14
98 Mean	**0.0227496**	**0.14766753**

Yearly Water Chemistry Means

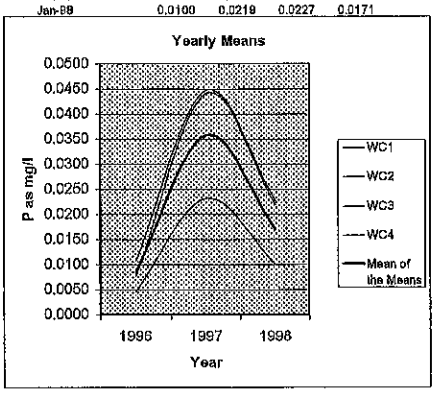
Temp	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	12.96475	18.23593	14.29951	15.45039	15.11779
Jan-97	15	12.12309	8.093179	7.33994	10.19481
Jan-98	12.12372	11.83219	10.69696	13.27614	11.94596



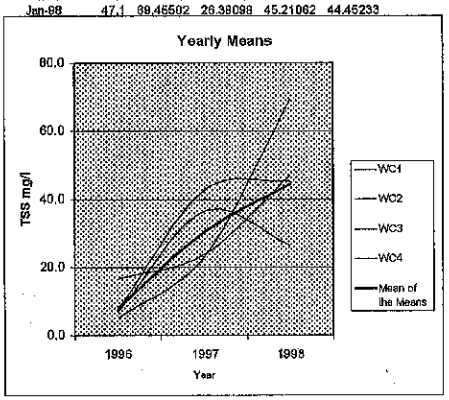
pH	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	7.914907	8.439932	8.35568	8.161412	8.21548
Jan-97	7.6	6.938927	7.927556	8.005421	7.607971
Jan-98	8.249482	8.253645	8.058031	8.54094	8.273921



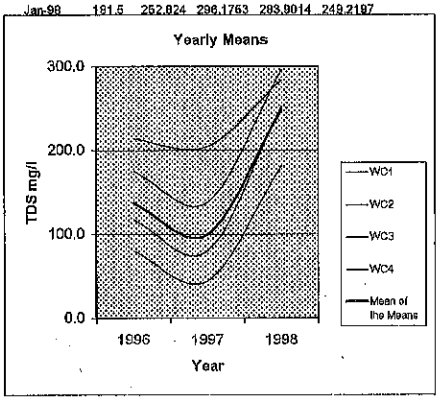
Total P	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	0.0148	0.0046	0.0077	0.0108	0.0086
Jan-97		0.0232	0.0442	0.0447	0.0358
Jan-98		0.0100	0.0219	0.0227	0.0171



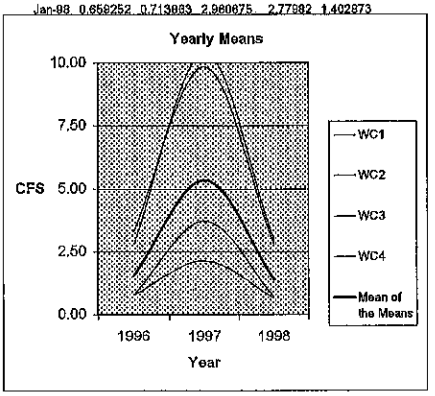
TSS	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	16.5	6.0	6.9	7.4	8.080114
Jan-97	24.0	23.3	36.6	42.7	30.56758
Jan-98	47.1	69.46502	26.38098	45.21062	44.45233



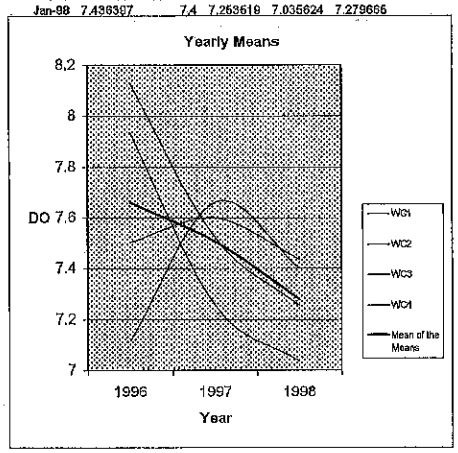
TDS	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	80.0	117.9	175.5	213.5	137.1367
Jan-97	44.0	80.2	138.4	204.8	99.99758
Jan-98	181.5	252.824	296.1763	293.9014	249.2197



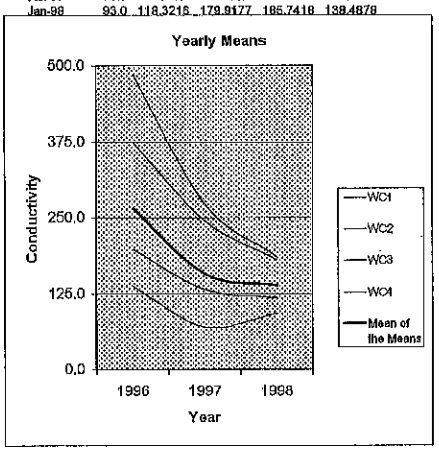
Discharge	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	0.78	0.790873	2.79264	3.318566	1.644411
Jan-97	2.2	3.715806	10.41051	9.84074	5.348895
Jan-98	0.658252	0.713983	2.980675	2.77982	1.402873



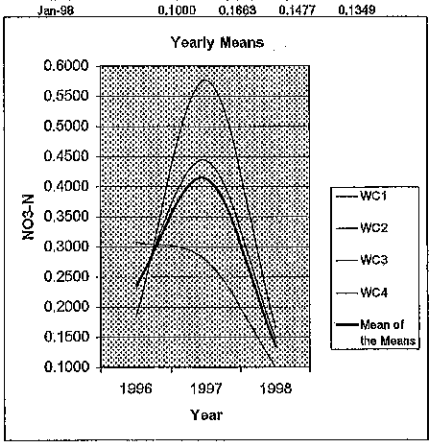
DO	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	7.503669	7.11613	8.130314	7.936707	7.661303
Jan-97	7.6	7.56264	7.521177	7.253619	7.607695
Jan-98	7.436307	7.4	7.253619	7.035624	7.279666

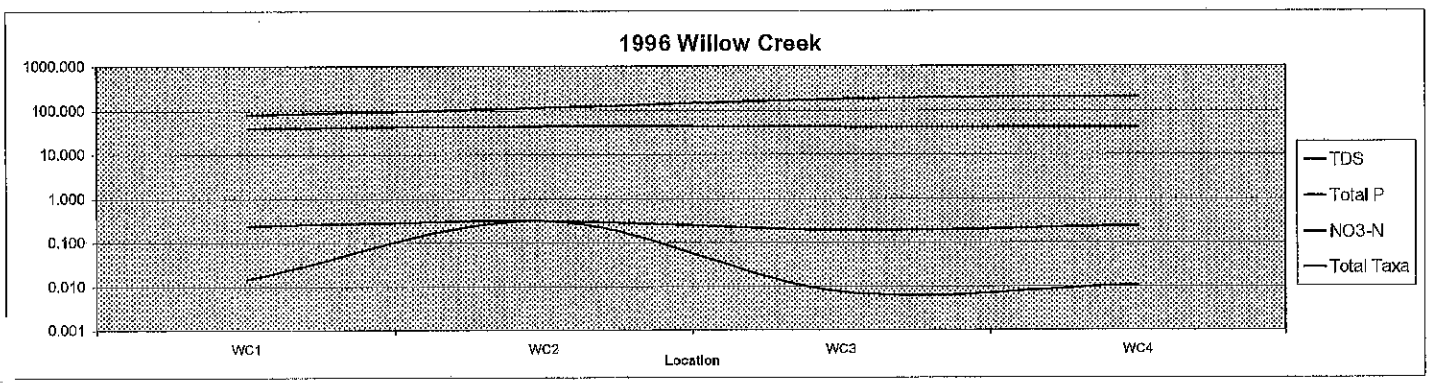


Conductivity	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	137.3	198.1	374.7	486.4	266.3434
Jan-97	70.0	131.6	244.6	272.0	157.3342
Jan-98	93.0	118.3215	179.9177	185.7418	138.4878

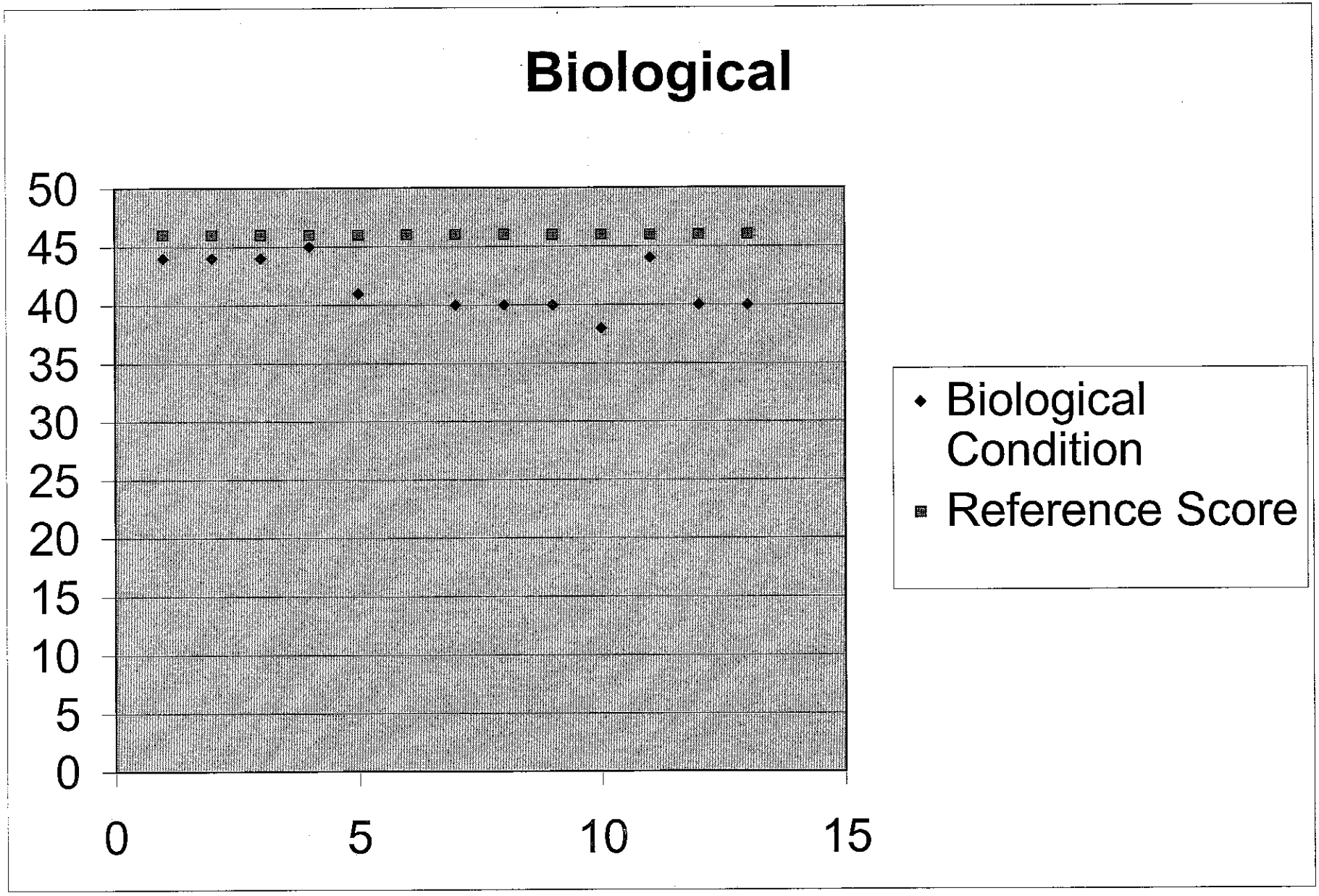


NO_3-N	WC1	WC2	WC3	WC4	Mean of the Means
Jan-96	0.2368	0.3087	0.1847	0.2307	0.2363
Jan-97		0.2779	0.5767	0.4433	0.4141
Jan-98		0.1000	0.1663	0.1477	0.1349





BIOLOGICAL DATA ANALYSIS

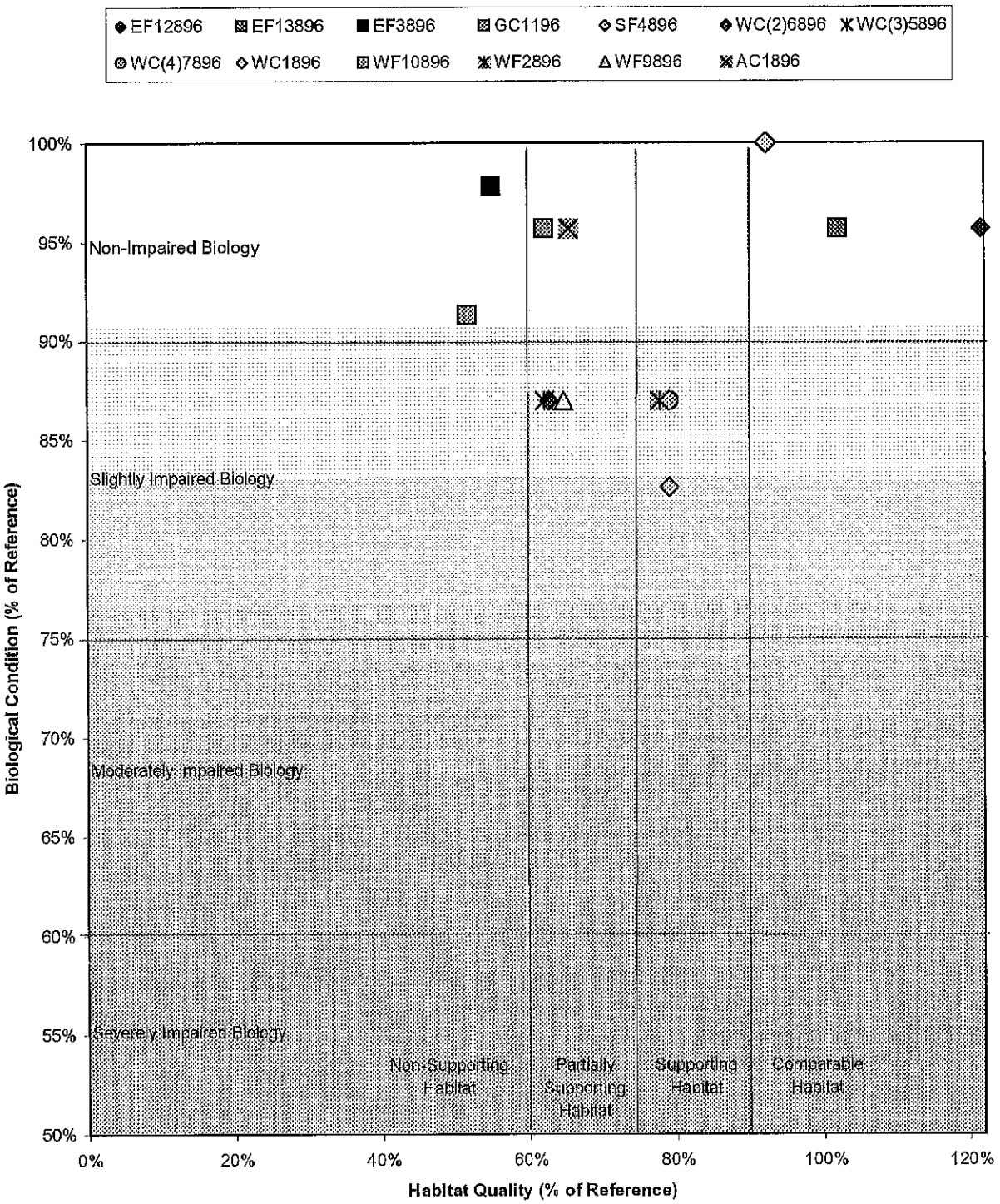

Biological
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
Biological Condition
Reference Score

Site	Habitat Score	Reference Score	Percentage
AC	100	153	65%
EF12896	186	153	122%
EF13896	156	153	102%
EF3896	84	153	55%
GB	79	153	52%
SF4896	141	153	92%
WC(2)6896	96	153	63%
WC(3)5896	95	153	62%
WC(4)7896	121	153	79%
WC1896	121	153	79%
WF10896	95	153	62%
WF2896	119	153	78%
WF9896	99	153	65%

Site Name	DEQ Score	Reference Score	Percentage
AC	65.3	77.1	85%
EF12896	76.3	77.1	99%
EF13896	85.1	77.1	110%
EF3896	82	77.1	106%
GB	80.2	77.1	104%
SF4896	64.6	77.1	84%
WC(2)6896	63	77.1	82%
WC(3)5896	66.1	77.1	86%
WC(4)7896	69.7	77.1	90%
WC1896	60.5	77.1	78%
WF10896	77.1	77.1	100%
WF2896	71.7	77.1	93%
WF9896	77.8	77.1	101%

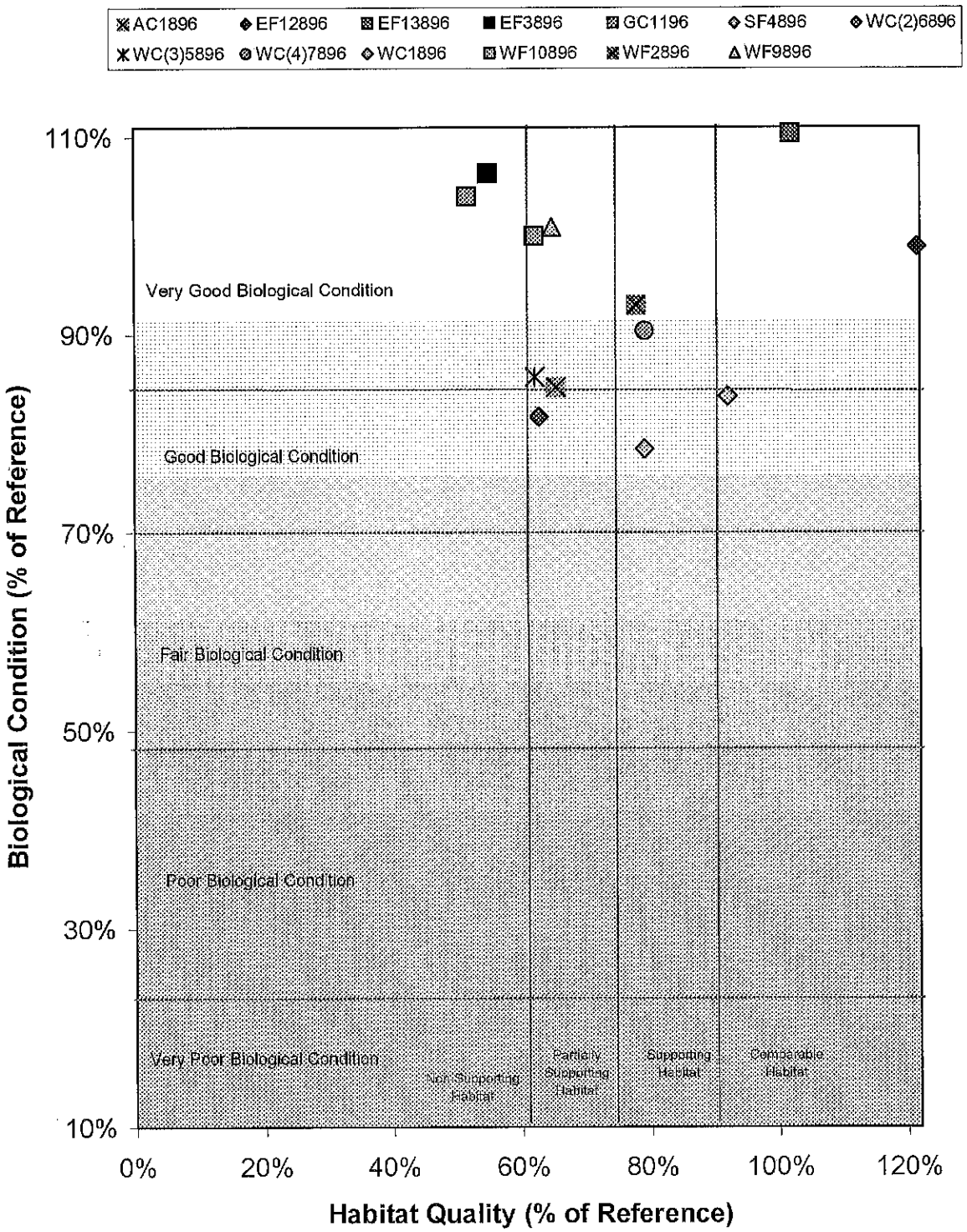
1996 Willow Creek Bioassessment

% of Reference (West Fork Smiths Fork - *King Methodology*)



1996 Willow Creek Bioassessment

% of Reference (West Fork Smiths Fork - *WDEQ Methodology*)



BIOLOGICAL DATA

Site	Lat	Long	
WC1	41-11-269	110-25-919	
WC2	41-04-140	110-30-659	
WC3	41-07-389	110-28-643	
WC4	41-07-389	110-27-573	
EF3	41-05-151	110-24-803	
EF12	40-59-975	110-23-105	
EF13	41-04-445	110-24-468	
SF4	41-11-917	110-25-025	
WF2	41-07-114	110-26-533	
WF9	41-03-904	110-27-995	
WF10	41-02-797	110-29-776	
AC8	41-00-780	110-28-214	Archie Creek
GC11	41-01-532	110-24-494	Gilbert Creek

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	10	**83.3**
Insect taxa	100*metric / 95th%ile	45	47	**100.0**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	4	**70.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	34.61	**49.6**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	45.46	**100.0**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.56	**74.9**
% scrapers	100*metric / 95th%ile	56.1	21.84	**38.9**
			index score	**77.1**
			sample rating	**good**

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location Score	Control Location WFSF97 Score
Primary-	Bottom Substrate		17
Primary-	Embeddedness		2
Primary-	Instream Cover		11
Primary-	Velocity/Depth		8
Primary-	Channel Flow Status		14
	Primary Parameter Sub-total	0	52
Secondary-	Channel Shape		8
Secondary-	Pool/Riffle Sequence		8
Secondary-	Channelization/Alteration		15
Secondary-	Width to Depth		3
	Secondary Parameter Sub-total	0	34
Tertiary-	Bank Vegetation Protection Left		8
Tertiary-	Bank Vegetation Protection Right		8
Tertiary-	Bank Stability Left		7
Tertiary-	Bank Stability Right		7
Tertiary-	Disruptive Pressure Left		9
Tertiary-	Disruptive Pressure Right		9
Tertiary-	Riparian Zone Width Left		10
Tertiary-	Riparian Zone Width Right		10
	Tertiary Parameter Sub-total	0	68
	Total	0	154

% of Control	Habitat Quality
0	***FALSE***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Average*
Cobble	50	90	100	90	100	75	95	0	75
Coarse	0	10	0	10	0	20	5	0	5.625
Fine	0	0	0	0	0	5	0	0	0.625
Sand	0	0	0	0	0	0	0	0	0
Silt	50	0	0	0	0	0	0	0	6.25
Clay	0	0	0	0	0	0	0	88	11
Organic	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	20	0	0	0	0	0	25	5.625
3	0	0	0	30	0	0	0	25	6.875
2	0	20	0	30	0	0	20	50	15
1	100	60	100	40	100	100	80	0	72.5
Velocity	0	0.68	0.51	1.03	0.32	0.52	1.65	0.74	0.68125

Embeddedness

Rating	Mean	Result
5	2	10
4	7	28
3	12	36
2	79	158
1	26.4	26.4
Weighted Value		**51.68**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Water Chemistry

		Location
Date	10/22/1997	West Fork
	Value	
Parameter-Field		
Discharge		
Temperature F	3.5	
Conductivity	203	
Dissolved Oxygen	9.3	
Turbidity	1.6	
pH	7.8	
Parameter-Lab		
Calcium		
Magnesium		
Sodium		
Potassium		
TDS		
TSS	8	
pH	7.8	
Conductivity	203	
Turbidity	1.6	
Carbonate		
Bicarbonate		
Flouride		
Chloride		
Nitrate as N		
Nitrite as N		
Ortho Phosphate		
Sulfate	5	
Total Phosphate	0.05	
Total Alkalinity	80	
Hardness	99	
Total Coliform (EQT)		
E. Coli (EQM)		
Fecal Coliform (EMFC)		

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	13	**100.0**
Insect taxa	100*metric / 95th%ile	45	38	**84.4**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	**90.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	49.84	**71.4**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	65.25	**69.2**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	1.29	**100.0**
% scrapers	100*metric / 95th%ile	56.1	57.87	**100.0**
			index score	**89.4**
			sample rating	**very good**

Less than 6500' Metric Values, Reletive % Comparison, Bioasse

Metric	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location		MRW45		MRW45		MRW45
EPT Taxa		32	0.00%	100%	FALSE	5
% Plecoptera		9.5	0.00%	100%	FALSE	5
% Chironomidae		11.02	0.00%	100%	FALSE	5
Predator Taxa		12	0.00%	100%	FALSE	5
% Scrapers		57.97	0.00%	100%	FALSE	5
Modified HBI		1.29	0.00%	100%	FALSE	5
Biotic Condition Index (a)		39.3	0.00%	100%	FALSE	1
Shannon H (Log base 2)		3.86	0.00%	100%	FALSE	5
% Ephemeroptera		49.84	0.00%	100%	FALSE	5
% Collectors/Filterers		0.01	0.00%	100%	FALSE	5
				Total		46

Comparison Location Biological Conditon Category

FALSE

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location Score	Control Location MRW56 Score
Primary-	Bottom Substrate		18
Primary-	Embeddedness		20
Primary-	Instream Cover		18
Primary-	Velocity/Depth		19
Primary-	Channel Flow Status		13
	Primary Parameter Sub-total	0	88
Secondary-	Channel Shape		12
Secondary-	Pool/Riffle Sequence		14
Secondary-	Channelization/Alteration		15
Secondary-	Width to Depth		13
	Secondary Parameter Sub-total	0	54
Tertiary-	Bank Vegetation Protection Left		9
Tertiary-	Bank Vegetation Protection Right		9
Tertiary-	Bank Stability Left		8
Tertiary-	Bank Stability Right		8
Tertiary-	Disruptive Pressure Left		10
Tertiary-	Disruptive Pressure Right		10
Tertiary-	Riparian Zone Width Left		9
Tertiary-	Riparian Zone Width Right		9
	Tertiary Parameter Sub-total	0	72
	Total	0	214

% of Control	Habitat Quality
0	***FALSE***

Physical

StationID	WEST FORK SMITHS FORK
StreamName	other
Type	22-Oct-97
CollDate	17
pFINES	11
COVER	2
Embed	8
vel/dep	14
chFLOW STATUS	8
chSHAPE	8
Pool/Rlf	15
chALTER	3
wid/DEPTH	8
Bank Veg	7
bankSTAB	9
disruptPRESS	10
ripWIDTH	120
totSCORE	1
CANOPY	107
New Score	100
pCOBBLEs1	50
pCOBBLEs2	90
pCOBBLEs3	100
pCOBBLEs4	90
pCOBBLEs5	100
pCOBBLEs6	75
pCOBBLEs7	95
pCOBBLEs8	0
pCOGRAVs1	0
pCOGRAVs2	10
pCOGRAVs3	0
pCOGRAVs4	10
pCOGRAVs5	0
pCOGRAVs6	20
pCOGRAVs7	5
pCOGRAVs8	0
pFIGRAVs1	0
pFIGRAVs2	0
pFIGRAVs3	0
pFIGRAVs4	0
pFIGRAVs5	0
pFIGRAVs6	5
pFIGRAVs7	0
pFIGRAVs8	0
pSILTs1	50
pSILTs2	0
pSILTs3	0
pSILTs4	0
pSILTs5	0
pSILTs6	0
pSILTs7	0

pSILTs8	0
pSANDs1	0
pSANDs2	0
pSANDs3	0
pSANDs4	0
pSANDs5	0
pSANDs6	0
pSANDs7	0
pSANDs8	0
pCLAYs1	0
pCLAYs2	0
pCLAYs3	0
pCLAYs4	0
pCLAYs5	0
pCLAYs6	0
pCLAYs7	0
pCLAYs8	88
pCOBBLE	6
pCOGRAV	1
pFIGRAV	6
pSILT	0
pSAND	0
pCLAY	0
pORGANIC	0
pPRECIP	0
pRAT5s1	0
pRAT5s2	0
pRAT5s3	0
pRAT5s4	0
pRAT5s5	0
pRAT5s6	0
pRAT5s7	0
pRAT5s8	0
pRAT4s1	0
pRAT4s2	20
pRAT4s3	0
pRAT4s4	0
pRAT4s5	0
pRAT4s6	0
pRAT4s7	0
pRAT4s8	25
pRAT3s1	0
pRAT3s2	0
pRAT3s3	0
pRAT3s4	30
pRAT3s5	0
pRAT3s6	0
pRAT3s7	0
pRAT3s8	25
pRAT2s1	0
pRAT2s2	20
pRAT2s3	0

pRAT2s4	30
pRAT2s5	0
pRAT2s6	0
pRAT2s7	20
pRAT2s8	50
pRAT1s1	100
pRAT1s2	60
pRAT1s3	100
pRAT1s4	40
pRAT1s5	100
pRAT1s6	100
pRAT1s7	80
pRAT1s8	0
rat5MEAN	2
rat4MEAN	7
rat3MEAN	12
rat2MEAN	79
rat1MEAN	26.4
EMBEDval	1.24
VELOCs1	0
VELOCs2	0.68
VELOCs3	0.51
VELOCs4	1.03
VELOCs5	0.32
VELOCs6	0.52
VELOCs7	1.65
VELOCs8	0.74
MeanVel f/s	

Metric scoring spreadsheet
In 4 bioregions of Wyoming March, 2000

Instructions:

1 Go to the sheet for the bioregion of your sample.
2 Delete any metric values under "ENTER METRICS" (gray cells), do not clear scores or per
3 Enter all metric values for your sample.
4 Metric scores, index score, and rating will be calculated.

+6500' Bioassessment Score WC1896

Metric	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WC1896	MRW56	WC1896	MRW56	WC1896	MRW56
EPT Taxa	14	26	53.85%	100%	3	5
% Plecoptera	0.33	4.16	7.93%	100%	1	3
% Chironomidae	40.18	22.98	174.85%	100%	3	5
Predator Taxa	6	12	50.00%	100%	5	5
% Scrapers	18.28	21.84	83.70%	100%	5	5
Modified HBI	4.61	3.56	129.49%	100%	3	5
Biotic Condition Index (a)	80.08	65.37	122.50%	100%	5	3
Shannon H (Log base 2)	3.75	4.64	80.82%	100%	5	5
% Multivoltine	44.63	28.03	159.22%	100%	5	5
% Univoltine	34.83	51.95	67.05%	100%	3	5
				Total	38	46

Comparison Location Biological Conditon Category

Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location WC1896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	15	11
Primary-	Embeddedness	10	8
Primary-	Instream Cover	10	2
Primary-	Velocity/Depth	8	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	43	43
Secondary-	Channel Shape	8	8
Secondary-	Pool/Riffle Sequence	8	15
Secondary-	Channelization/Alteration	8	3
Secondary-	Width to Depth	6	8
	Secondary Parameter Sub-total	30	34
Tertiary-	Bank Vegetation Protection Left	8	7
Tertiary-	Bank Vegetation Protection Right	8	7
Tertiary-	Bank Stability Left	8	9
Tertiary-	Bank Stability Right	8	9
Tertiary-	Disruptive Pressure Left	4	10
Tertiary-	Disruptive Pressure Right	4	10
Tertiary-	Riparian Zone Width Left	4	12
Tertiary-	Riparian Zone Width Right	4	12
	Tertiary Parameter Sub-total	48	76
	Total	121	153

% of Control	Habitat Quality
79.0849673	***Supporting***

Substrate-Embeddedness-Velocity

WC1

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	40	60	68	48	120	65	24	68	15
Boulder	10	16	36	34	76	27	22	46	0
Cobble	18	20	20	10	36	29	2	0	10
Coarse	3	18	12	4	8	5	0	9	0
Fine	0	6	0	0	0	0	0	0	0
Sand	4	0	0	0	2	6	0	2	2
Silt	3	0	0	0	0	0	0	0	2
Clay	2	0	0	0	0	0	0	1	1
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
70	57.8
40	30.7
12	15.7
11	7
3	0.9
2	1.8
2	0.7
0	0.4
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	16	**100.0**
Insect taxa	100*metric / 95th%ile	45	39	**86.7**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	3	**80.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	2.38	**3.4**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	66.46	**66.8**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.73	**61.3**
% scrapers	100*metric / 95th%ile	56.1	3.25	**5.8**
			index score	**63.0**
			sample rating	**fair**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WC(2)6896	MRW56	WC(2)6896	MRW56	WC(2)6896	MRW56
Metric						
EPT Taxa	16	26	61.54%	100%	5	5
% Plecoptera	1.09	4.16	26.20%	100%	1	3
% Chironomidae	56.06	22.98	243.95%	100%	3	5
Predator Taxa	9	12	75.00%	100%	5	5
% Scrapers	3.25	21.84	14.88%	100%	3	5
Modified HBI	4.73	3.56	132.87%	100%	3	5
Biotic Condition Index (a)	76.54	65.37	117.09%	100%	5	3
Shannon H (Log base 2)	3.62	4.64	78.02%	100%	5	5
% Multivoltine	46	28.03	164.11%	100%	5	5
% Univoltine	45.99	51.95	88.53%	100%	5	5
				Total	40	46

Comparison Location Biological Conditon Category

Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location WC2896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	18	11
Primary-	Embeddedness	18	8
Primary-	Instream Cover	8	2
Primary-	Velocity/Depth	6	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	50	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	6	15
Secondary-	Channelization/Alteration	10	3
Secondary-	Width to Depth	2	8
	Secondary Parameter Sub-total	28	34
Tertiary-	Bank Vegetation Protection Left	2	7
Tertiary-	Bank Vegetation Protection Right	2	7
Tertiary-	Bank Stability Left	2	9
Tertiary-	Bank Stability Right	2	9
Tertiary-	Disruptive Pressure Left	3	10
Tertiary-	Disruptive Pressure Right	3	10
Tertiary-	Riparian Zone Width Left	2	12
Tertiary-	Riparian Zone Width Right	2	12
	Tertiary Parameter Sub-total	18	76
	Total	96	153

% of Control	Habitat Quality
62.745098	***Partially Supporting***

Substrate-Embeddedness-Velocity

WC1

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	48	54	46	150	40	65	44	28	109
Boulder	0	0	25	50	20	10	10	10	20
Cobble	0	3	15	35	17	50	20	16	75
Coarse	0	0	5	15	4	5	7	0	8
Fine	0	0	1	5	0	0	0	0	0
Sand	40	45	0	30	0	0	5	2	0
Silt	8	6	0	15	0	0	2	0	6
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
77	66.1
32	17.7
40	27.1
0	4.4
0	0.6
0	12.2
5	4.2
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	16	**100.0**
Insect taxa	100*metric / 95th%ile	45	37	**82.2**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	7	**40.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	5.77	**8.3**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	58.65	**82.4**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	5.12	**56.7**
% scrapers	100*metric / 95th%ile	56.1	33.41	**59.6**
			index score	**66.1**
			sample rating	**fair**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

Metric	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WC(3)6896	MRW56	WC(3)6896	MRW56	WC(3)6896	MRW56
EPT Taxa	16	26	61.54%	100%	5	5
% Plecoptera	0.24	4.16	5.77%	100%	1	3
% Chironomidae	19.93	22.98	86.73%	100%	5	5
Predator Taxa	4	12	33.33%	100%	3	5
% Scrapers	33.41	21.84	152.98%	100%	5	5
Modified HBI	5.12	3.56	143.82%	100%	1	5
Biotic Condition Index (a)	79.05	65.37	120.93%	100%	5	3
Shannon H (Log base 2)	4.08	4.64	87.93%	100%	5	5
% Multivoltine	24.88	28.03	88.76%	100%	5	5
% Univoltine	53.73	51.95	103.43%	100%	5	5
				Total	40	46

Comparison Location Biological Conditon Category

Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location WC3896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	12	11
Primary-	Embeddedness	18	8
Primary-	Instream Cover	2	2
Primary-	Velocity/Depth	10	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	42	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	12	15
Secondary-	Channelization/Alteration	12	3
Secondary-	Width to Depth	3	8
	Secondary Parameter Sub-total	37	34
Tertiary-	Bank Vegetation Protection Left	2	7
Tertiary-	Bank Vegetation Protection Right	2	7
Tertiary-	Bank Stability Left	2	9
Tertiary-	Bank Stability Right	2	9
Tertiary-	Disruptive Pressure Left	2	10
Tertiary-	Disruptive Pressure Right	2	10
Tertiary-	Riparian Zone Width Left	2	12
Tertiary-	Riparian Zone Width Right	2	12
	Tertiary Parameter Sub-total	16	76
	Total	95	153

% of Control	Habitat Quality
62.0915033	***Partially Supporting***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	67	110	no data	no data	no data	no data	no data	no data	no data
Boulder	47	0	58	10	40	128	70	60	40
Cobble	0	24	30	46	120	25	40	35	89
Coarse	0	60	70	14	10	0	0	0	17
Fine	0	10	24	0	0	0	0	0	10
Sand	16	8	10	20	0	0	0	10	0
Silt	0	0	0	24	0	0	10	0	6
Clay	4	8	0	0	0	0	0	2	6
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
no data	17.7
30	48.3
30	43.9
0	17.1
0	4.4
6	7
44	8.4
0	2
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	15	**100.0**
Insect taxa	100*metric / 95th%ile	45	39	**86.7**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	**90.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	12.23	**17.5**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	52.4	**94.8**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.56	**63.3**
% scrapers	100*metric / 95th%ile	56.1	3.06	**5.5**
			index score	**69.7**
			sample rating	**fair**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WC(4)7896	MRW56	WC(4)7896	MRW56	WC(4)7896	MRW56
Metric						
EPT Taxa	15	26	57.69%	100%	5	5
% Plecoptera	4.37	4.16	105.05%	100%	3	3
% Chironomidae	47.6	22.98	207.14%	100%	3	5
Predator Taxa	16	12	133.33%	100%	5	5
% Scrapers	3.06	21.84	14.01%	100%	3	5
Modified HBI	4.56	3.56	128.09%	100%	3	5
Biotic Condition Index (a)	70.8	65.37	108.31%	100%	3	3
Shannon H (Log base 2)	4.35	4.64	93.75%	100%	5	5
% Multivoltine	44.65	28.03	159.29%	100%	5	5
% Univoltine	42.69	51.95	82.18%	100%	5	5
				Total	40	46

Comparison Location Biological Conditon Category

Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location WC4896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	18	11
Primary-	Embeddedness	18	8
Primary-	Instream Cover	6	2
Primary-	Velocity/Depth	6	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	48	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	10	15
Secondary-	Channelization/Alteration	5	3
Secondary-	Width to Depth	6	8
	Secondary Parameter Sub-total	31	34
Tertiary-	Bank Vegetation Protection Left	3	7
Tertiary-	Bank Vegetation Protection Right	3	7
Tertiary-	Bank Stability Left	4	9
Tertiary-	Bank Stability Right	4	9
Tertiary-	Disruptive Pressure Left	4	10
Tertiary-	Disruptive Pressure Right	4	10
Tertiary-	Riparian Zone Width Left	10	12
Tertiary-	Riparian Zone Width Right	10	12
	Tertiary Parameter Sub-total	42	76
	Total	121	153

% of Control	Habitat Quality
79.0849673	***Supporting***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	119	68	210	360	78	65	180	82	112
Boulder	0	0	30	0	0	10	0	10	0
Cobble	0	60	145	0	72	54	22	42	14
Coarse	0	8	9	0	6	1	18	10	6
Fine	0	0	20	0	0	0	0	12	6
Sand	0	0	0	120	0	0	15	8	26
Silt	119	0	8	240	0	0	125	0	60
Clay	0	0	6	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
188	146.2
40	9
8	41.7
12	7
12	5
8	17.7
108	66
0	0.6
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	19	**100.0**
Insect taxa	100*metric / 95th%ile	45	34	**75.6**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	**90.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	39.14	**56.1**
% Oligochacta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	60.18	**79.3**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.9	**82.6**
% scrapers	100*metric / 95th%ile	56.1	40.48	**72.2**
			index score	**82.0**
			sample rating	**good**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

Metric	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	EF3896	MRW56	EF3896	MRW56	EF3896	MRW56
EPT Taxa	19	26	73.08%	100%	5	5
% Plecoptera	0.44	4.16	10.58%	100%	1	3
% Chironomidae	5.74	22.98	24.98%	100%	5	5
Predator Taxa	6	12	50.00%	100%	5	5
% Scrapers	40.48	21.84	185.35%	100%	5	5
Modified HBI	2.9	3.56	81.46%	100%	5	5
Biotic Condition Index (a)	61.61	65.37	94.25%	100%	3	3
Shannon H (Log base 2)	3.9	4.64	84.05%	100%	5	5
% Multivoltine	10.18	28.03	36.32%	100%	5	5
% Univoltine	72.12	51.95	138.83%	100%	5	5
				Total	45	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location EF3896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	12	11
Primary-	Embeddedness	12	8
Primary-	Instream Cover	6	2
Primary-	Velocity/Depth	2	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	32	43
Secondary-	Channel Shape	8	8
Secondary-	Pool/Riffle Sequence	4	15
Secondary-	Channelization/Alteration	4	3
Secondary-	Width to Depth	4	8
	Secondary Parameter Sub-total	20	34
Tertiary-	Bank Vegetation Protection Left	4	7
Tertiary-	Bank Vegetation Protection Right	4	7
Tertiary-	Bank Stability Left	8	9
Tertiary-	Bank Stability Right	8	9
Tertiary-	Disruptive Pressure Left	2	10
Tertiary-	Disruptive Pressure Right	2	10
Tertiary-	Riparian Zone Width Left	2	12
Tertiary-	Riparian Zone Width Right	2	12
	Tertiary Parameter Sub-total	32	76
	Total	84	153

% of Control	Habitat Quality
54.9019608	***Not Supporting***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	205	268	280	324	292	256	508	391	602
Boulder	200	150	140	180	170	130	210	170	90
Cobble	0	64	130	80	84	102	150	164	262
Coarse	0	54	10	64	38	24	48	27	210
Fine	0	0	0	0	0	0	60	20	0
Sand	5	0	0	0	0	0	40	10	50
Silt	0	0	0	0	0	0	0	0	0
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
340	346.6
140	158
142	117.8
34	50.9
16	9.6
8	11.3
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	14	**100.0**
Insect taxa	100*metric / 95th%ile	45	31	**68.9**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	**100.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	44.08	**63.2**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	68.2	**63.3**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.54	**75.1**
% scrapers	100*metric / 95th%ile	56.1	22.45	**40.0**
			index score	**76.3**
			sample rating	**good**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	EF12896	MRW56	EF12896	MRW56	EF12896	MRW56
Metric						
EPT Taxa	14	26	53.85%	100%	3	5
% Plecoptera	1.66	4.16	39.90%	100%	1	3
% Chironomidae	15.19	22.98	66.10%	100%	5	5
Predator Taxa	7	12	58.33%	100%	5	5
% Scrapers	22.45	21.84	102.79%	100%	5	5
Modified HBI	3.54	3.56	99.44%	100%	5	5
Biotic Condition Index (a)	75.31	65.37	115.21%	100%	5	3
Shannon H (Log base 2)	3.75	4.64	80.82%	100%	5	5
% Multivoltine	21.88	28.03	77.88%	100%	5	5
% Univoltine	61.02	51.95	117.46%	100%	5	5
				Total	44	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location EF12896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	20	11
Primary-	Embeddedness	20	8
Primary-	Instream Cover	12	2
Primary-	Velocity/Depth	18	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	70	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	12	15
Secondary-	Channelization/Alteration	12	3
Secondary-	Width to Depth	10	8
	Secondary Parameter Sub-total	44	34
Tertiary-	Bank Vegetation Protection Left	10	7
Tertiary-	Bank Vegetation Protection Right	10	7
Tertiary-	Bank Stability Left	8	9
Tertiary-	Bank Stability Right	8	9
Tertiary-	Disruptive Pressure Left	8	10
Tertiary-	Disruptive Pressure Right	8	10
Tertiary-	Riparian Zone Width Left	10	12
Tertiary-	Riparian Zone Width Right	10	12
	Tertiary Parameter Sub-total	72	76
	Total	186	153

% of Control	Habitat Quality
121.568627	***Comparable***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	315	372	334	212	185	256	176	190	310
Boulder	60	90	70	100	190	204	170	144	198
Cobble	255	136	238	82	60	52	4	46	67
Coarse	0	5	26	22	35	0	2	30	20
Fine	0	24	0	0	0	0	0	0	10
Sand	0	6	0	2	0	0	0	0	15
Silt	0	0	0	6	0	0	0	0	0
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
280	263
170	139.6
45	98.5
50	19
0	3.4
15	3.8
0	0.6
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	26	**100.0**
Insect taxa	100*metric / 95th%ile	45	44	**97.8**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	**90.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	42.64	**61.1**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	53.77	**92.1**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.09	**92.0**
% scrapers	100*metric / 95th%ile	56.1	26.79	**47.8**
			index score	**85.1**
			sample rating	**good**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	EF13896	MRW56	EF13896	MRW56	EF13896	MRW56
Metric						
EPT Taxa	26	26	100.00%	100%	5	5
% Plecoptera	1.71	4.16	41.11%	100%	1	3
% Chironomidae	9.83	22.98	42.78%	100%	5	5
Predator Taxa	10	12	83.33%	100%	5	5
% Scrapers	26.79	21.84	122.66%	100%	5	5
Modified HBI	2.09	3.56	58.71%	100%	5	5
Biotic Condition Index (a)	63.54	65.37	97.20%	100%	3	3
Shannon H (Log base 2)	4.33	4.64	93.32%	100%	5	5
% Multivoltine	14.43	28.03	51.48%	100%	5	5
% Univoltine	65.94	51.95	126.93%	100%	5	5
				Total	44	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location EF13896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	18	11
Primary-	Embeddedness	18	8
Primary-	Instream Cover	10	2
Primary-	Velocity/Depth	10	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	56	43
Secondary-	Channel Shape	8	8
Secondary-	Pool/Riffle Sequence	6	15
Secondary-	Channelization/Alteration	15	3
Secondary-	Width to Depth	3	8
	Secondary Parameter Sub-total	32	34
Tertiary-	Bank Vegetation Protection Left	10	7
Tertiary-	Bank Vegetation Protection Right	10	7
Tertiary-	Bank Stability Left	6	9
Tertiary-	Bank Stability Right	6	9
Tertiary-	Disruptive Pressure Left	6	10
Tertiary-	Disruptive Pressure Right	6	10
Tertiary-	Riparian Zone Width Left	12	12
Tertiary-	Riparian Zone Width Right	12	12
	Tertiary Parameter Sub-total	68	76
	Total	156	153

% of Control	Habitat Quality
101.960784	***Comparable***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	230	320	372	365	410	350	240	282	286
Boulder	100	190	200	170	170	270	150	132	180
Cobble	102	108	100	95	95	70	70	130	60
Coarse	22	22	30	77	60	10	20	16	8
Fine	6	0	14	23	45	0	0	0	18
Sand	0	0	20	0	26	0	0	4	20
Silt	0	0	4	0	14	0	0	0	0
Clay	0	0	2	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
287	314.2
190	175.2
87	91.7
20	28.5
0	10.6
0	7
0	1.8
0	0.2
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	20	**100.0**
Insect taxa	100*metric / 95th%ile	45	41	**91.1**
Non-Insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	6	**50.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	9.51	**13.6**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	66.3	**67.1**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.29	**66.4**
% scrapers	100*metric / 95th%ile	56.1	16.21	**28.9**
			index score	**64.6**
			sample rating	**fair**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

Metric	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	SF4896	MRW56	SF4896	MRW56	SF4896	MRW56
EPT Taxa	20	26	76.92%	100%	5	5
% Plecoptera	2.34	4.16	56.25%	100%	1	3
% Chironomidae	30.19	22.98	131.38%	100%	5	5
Predator Taxa	7	12	58.33%	100%	5	5
% Scrapers	16.21	21.84	74.22%	100%	5	5
Modified HBI	4.29	3.56	120.51%	100%	5	5
Biotic Condition Index (a)	75.15	65.37	114.96%	100%	5	3
Shannon H (Log base 2)	3.93	4.64	84.70%	100%	5	5
% Multivoltine	30.97	28.03	110.49%	100%	5	5
% Univoltine	47.19	51.95	90.84%	100%	5	5
				Total	46	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location SF4896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	20	11
Primary-	Embeddedness	10	8
Primary-	Instream Cover	18	2
Primary-	Velocity/Depth	8	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	56	43
Secondary-	Channel Shape	14	8
Secondary-	Pool/Riffle Sequence	3	15
Secondary-	Channelization/Alteration	2	3
Secondary-	Width to Depth	2	8
	Secondary Parameter Sub-total	21	34
Tertiary-	Bank Vegetation Protection Left	8	7
Tertiary-	Bank Vegetation Protection Right	8	7
Tertiary-	Bank Stability Left	10	9
Tertiary-	Bank Stability Right	10	9
Tertiary-	Disruptive Pressure Left	10	10
Tertiary-	Disruptive Pressure Right	10	10
Tertiary-	Riparian Zone Width Left	4	12
Tertiary-	Riparian Zone Width Right	4	12
	Tertiary Parameter Sub-total	64	76
	Total	141	153

% of Control	Habitat Quality
92.1568627	***Comparable***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	474	369	156	264	216	360	504	510	572
Boulder	252	210	62	90	91	102	240	315	350
Cobble	55	95	14	42	79	156	174	105	150
Coarse	67	10	46	60	30	94	21	60	40
Fine	0	0	29	30	0	0	19	30	20
Sand	35	15	5	6	14	9	39	5	12
Silt	65	30	0	36	6	0	11	0	0
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
608	403.3
512	222.4
88	95.8
8	43.6
0	12.8
0	14
0	14.8
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	19	**100.0**
Insect taxa	100*metric / 95th%ile	45	33	**73.3**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	**100.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	17.13	**24.5**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	71.55	**56.7**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.15	**91.3**
% scrapers	100*metric / 95th%ile	56.1	15.47	**27.6**
			index score	**71.7**
			sample rating	**good**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WF2896	MRW56	WF2896	MRW56	WF2896	MRW56
Metric						
EPT Taxa	19	26	73.08%	100%	5	5
% Plecoptera	1.17	4.16	28.13%	100%	1	3
% Chironomidae	6.33	22.98	27.55%	100%	5	5
Predator Taxa	7	12	58.33%	100%	5	5
% Scrapers	15.47	21.84	70.83%	100%	5	5
Modified HBI	2.15	3.56	60.39%	100%	5	5
Biotic Condition Index (a)	66.18	65.37	101.24%	100%	3	3
Shannon H (Log base 2)	3.21	4.64	69.18%	100%	3	5
% Multivoltine	12.4	28.03	44.24%	100%	5	5
% Univoltine	22.21	51.95	42.75%	100%	3	5
				Total	40	46

Comparison Location Biological Conditon Category

Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location WF2896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	20	11
Primary-	Embeddedness	18	8
Primary-	Instream Cover	5	2
Primary-	Velocity/Depth	8	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	51	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	3	15
Secondary-	Channelization/Alteration	15	3
Secondary-	Width to Depth	10	8
	Secondary Parameter Sub-total	38	34
Tertiary-	Bank Vegetation Protection Left	2	7
Tertiary-	Bank Vegetation Protection Right	2	7
Tertiary-	Bank Stability Left	4	9
Tertiary-	Bank Stability Right	4	9
Tertiary-	Disruptive Pressure Left	5	10
Tertiary-	Disruptive Pressure Right	5	10
Tertiary-	Riparian Zone Width Left	4	12
Tertiary-	Riparian Zone Width Right	4	12
	Tertiary Parameter Sub-total	30	76
	Total	119	153

% of Control	Habitat Quality
77.7777778	***Supporting***

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	20	**100.0**
Insect taxa	100*metric / 95th%ile	45	45	**100.0**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	**100.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	26.81	**38.4**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	47.73	**100.0**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	4.27	**66.6**
% scrapers	100*metric / 95th%ile	56.1	9.81	**17.5**
			index score	**77.8**
			sample rating	**good**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WF9896	MRW56	WF9896	MRW56	WF9896	MRW56
Metric						
EPT Taxa	20	26	76.92%	100%	5	5
% Plecoptera	4.9	4.16	117.79%	100%	3	3
% Chironomidae	43.81	22.98	190.64%	100%	3	5
Predator Taxa	10	12	83.33%	100%	5	5
% Scrapers	9.81	21.84	44.92%	100%	5	5
Modified HBI	4.27	3.56	119.94%	100%	5	5
Biotic Condition Index (a)	71.13	65.37	108.81%	100%	3	3
Shannon H (Log base 2)	4.56	4.64	98.28%	100%	5	5
% Multivoltine	48.45	28.03	172.85%	100%	3	5
% Univoltine	38.48	51.95	74.07%	100%	3	5
				Total	40	46

Comparison Location Biological Conditon Category

Slightly impaired. Community structure and composition less than expected.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location WF9896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	10	11
Primary-	Embeddedness	10	8
Primary-	Instream Cover	8	2
Primary-	Velocity/Depth	8	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	36	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	6	15
Secondary-	Channelization/Alteration	15	3
Secondary-	Width to Depth	2	8
	Secondary Parameter Sub-total	33	34
Tertiary-	Bank Vegetation Protection Left	2	7
Tertiary-	Bank Vegetation Protection Right	2	7
Tertiary-	Bank Stability Left	2	9
Tertiary-	Bank Stability Right	2	9
Tertiary-	Disruptive Pressure Left	4	10
Tertiary-	Disruptive Pressure Right	4	10
Tertiary-	Riparian Zone Width Left	7	12
Tertiary-	Riparian Zone Width Right	7	12
	Tertiary Parameter Sub-total	30	76
	Total	99	153

% of Control	Habitat Quality
64.7058824	***Partially Supporting***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	270	168	137	300	187	105	87	266	296
Boulder	85	78	34	52	20	38	49	61	127
Cobble	134	61	81	227	140	67	38	181	169
Coarse	40	20	3	10	0	0	0	24	0
Fine	7	3	0	6	0	0	0	0	0
Sand	4	3	15	5	27	0	0	0	0
Silt	0	0	4	0	0	0	0	0	0
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
240	205.6
77	62.1
125	122.3
0	9.7
0	1.6
20	7.4
18	2.2
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	22	**100.0**
Insect taxa	100*metric / 95th%ile	45	36	**80.0**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	**90.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	31.09	**44.5**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	48.75	**100.0**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.61	**74.3**
% scrapers	100*metric / 95th%ile	56.1	15.9	**28.3**
			index score	**77.1**
			sample rating	**good**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	WF10896	MRW56	WF10896	MRW56	WF10896	MRW56
Metric						
EPT Taxa	22	26	84.62%	100%	5	5
% Plecoptera	3.53	4.16	84.86%	100%	1	3
% Chironomidae	22.6	22.98	98.35%	100%	5	5
Predator Taxa	8	12	66.67%	100%	5	5
% Scrapers	15.9	21.84	72.80%	100%	5	5
Modified HBI	3.61	3.56	101.40%	100%	5	5
Biotic Condition Index (a)	63.05	65.37	96.45%	100%	3	3
Shannon H (Log base 2)	4.37	4.64	94.18%	100%	5	5
% Multivoltine	25.88	28.03	92.33%	100%	5	5
% Univoltine	44.96	51.95	86.54%	100%	5	5
				Total	44	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Substrate-Embeddedness-Velocity

Quad 10	*Average*
172	257.4
62	108.3
102	116.1
8	9.9
0	3.6
0	5.2
0	0.5
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	6	**50.0**
Insect taxa	100*metric / 95th%ile	45	29	**64.4**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	1	**100.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	18.28	**26.2**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	54.31	**91.0**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	3.91	**70.8**
% scrapers	100*metric / 95th%ile	56.1	11.16	**19.9**
			index score	**65.3**
			sample rating	**fair**

Greater than 6500' Metric Values, Reletive % Comparison, Bioa

Metric	Metric Value		Relative % Comparison		Bio Score	
	Comparison	Control	Comparison	Control	Comparison	Control
Location	AC1896	MRW56	AC1896	MRW56	AC1896	MRW56
EPT Taxa	16	26	61.54%	100%	5	5
% Plecoptera	3.57	4.16	85.82%	100%	1	3
% Chironomidae	22.86	22.99	99.48%	100%	5	5
Predator Taxa	8	12	66.67%	100%	5	5
% Scrapers	11.16	21.84	51.10%	100%	5	5
Modified HBI	3.91	3.56	109.83%	100%	5	5
Biotic Condition Index (a)	66.17	65.37	101.22%	100%	3	3
Shannon H (Log base 2)	4.08	4.64	87.93%	100%	5	5
% Multivoltine	21.57	28.03	76.95%	100%	5	5
% Univoltine	52.54	51.95	101.14%	100%	5	5
				Total	44	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location AC1896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	18	11
Primary-	Embeddedness	18	8
Primary-	Instream Cover	4	2
Primary-	Velocity/Depth	1	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	41	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	9	15
Secondary-	Channelization/Alteration	10	3
Secondary-	Width to Depth	2	8
	Secondary Parameter Sub-total	31	34
Tertiary-	Bank Vegetation Protection Left	2	7
Tertiary-	Bank Vegetation Protection Right	2	7
Tertiary-	Bank Stability Left	6	9
Tertiary-	Bank Stability Right	6	9
Tertiary-	Disruptive Pressure Left	4	10
Tertiary-	Disruptive Pressure Right	4	10
Tertiary-	Riparian Zone Width Left	2	12
Tertiary-	Riparian Zone Width Right	2	12
	Tertiary Parameter Sub-total	28	76
	Total	100	153

% of Control	Habitat Quality
65.3594771	***Partially Supporting***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	150	126	204	127	108	184	120	100	186
Boulder	70	66	62	76	37	82	96	52	37
Cobble	40	42	111	46	60	82	23	41	130
Coarse	40	8	27	5	11	15	0	7	19
Fine	0	0	4	0	0	0	0	0	0
Sand	0	0	0	0	0	5	1	0	0
Silt	0	2	0	0	0	0	0	0	0
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Substrate-Embeddedness-Velocity

Quad 10	*Average*
108	141.3
79	65.7
19	59.4
6	13.8
0	0.4
4	1
0	0.2
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

ROCKIES

Metric	Scoring formula	5th or 95th %ile (as per formula)	ENTER METRICS	Score
Ephemeroptera taxa	100*metric / 95th%ile	12	12	**100.0**
Insect taxa	100*metric / 95th%ile	45	41	**91.1**
Non-insect taxa	100*(11 - metric)/(11 - 5th%ile)	1	2	**90.0**
% Ephemeroptera	100*metric / 95th%ile	69.8	23.71	**34.0**
% Oligochaeta	100*(0.75-arcsin(sqrt(metric)))/(0.75 - 5th%ile)	0	0	**100.0**
% 5 dominant	100*(100-metric)/(100 - 5th%ile)	49.8	45.66	**100.0**
HBI	100*(10-metric)/(10 - 5th%ile)	1.4	2.59	**86.2**
% scrapers	100*metric / 95th%ile	56.1	22.83	**40.7**
			index score	**80.2**
			sample rating	**good**

King Metrics	Metric Value		Relative % Comparison		Bio Score	
Location	GC1196	MRW56	GC1196	MRW56	GC1196	MRW56
Metric						
EPT Taxa	22	26	84.62%	100%	5	5
% Plecoptera	1.09	4.16	26.20%	100%	1	3
% Chironomidae	15.63	22.98	68.02%	100%	5	5
Predator Taxa	5	12	41.67%	100%	3	5
% Scrapers	22.83	21.84	104.53%	100%	5	5
Modified HBI	2.59	3.56	72.75%	100%	5	5
Biotic Condition Index (a)	66.88	65.37	102.31%	100%	3	3
Shannon H (Log base 2)	4.49	4.64	96.77%	100%	5	5
% Multivoltine	18.04	28.03	64.36%	100%	5	5
% Univoltine	64.02	51.95	123.23%	100%	5	5
				Total	42	46

Comparison Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Control Location Biological Conditon Category

Non-impaired. Comparable to the best expected within this eco-region.

Habitat Quality >10% Riffle/Run

Parameter	Habitat	Comparison Location GC1896 Score	Control Location MRW56 Score
Primary-	Bottom Substrate	10	11
Primary-	Embeddedness	10	8
Primary-	Instream Cover	4	2
Primary-	Velocity/Depth	10	14
Primary-	Channel Flow Status		8
	Primary Parameter Sub-total	34	43
Secondary-	Channel Shape	10	8
Secondary-	Pool/Riffle Sequence	6	15
Secondary-	Channelization/Alteration	5	3
Secondary-	Width to Depth	2	8
	Secondary Parameter Sub-total	23	34
Tertiary-	Bank Vegetation Protection Left	3	7
Tertiary-	Bank Vegetation Protection Right	3	7
Tertiary-	Bank Stability Left	2	9
Tertiary-	Bank Stability Right	2	9
Tertiary-	Disruptive Pressure Left	2	10
Tertiary-	Disruptive Pressure Right	2	10
Tertiary-	Riparian Zone Width Left	4	12
Tertiary-	Riparian Zone Width Right	4	12
	Tertiary Parameter Sub-total	22	76
	Total	79	153

% of Control	Habitat Quality
51.6339869	***Not Supporting***

Substrate-Embeddedness-Velocity

	Quad 1	*Quad 2*	*Quad 3*	*Quad 4*	*Quad 5*	*Quad 6*	*Quad 7*	*Quad 8*	*Quad 9*
Stream Width	180	144	152	175	125	163	170	120	52
Boulder	50	80	60	120	50	60	70	30	30
Cobble	82	61	65	30	60	85	40	60	18
Coarse	18	3	15	25	10	14	60	30	4
Fine	0	0	12	0	5	4	0	0	0
Sand	20	0	0	0	0	0	0	0	0
Silt	10	0	0	0	0	0	0	0	0
Clay	0	0	0	0	0	0	0	0	0
Rooted	0	0	0	0	0	0	0	0	0
Filamentous	0	0	0	0	0	0	0	0	0
Silt Cover									
5	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
Velocity	0	0	0	0	0	0	0	0	0

Embeddedness

Rating	Mean	Result
5	0	0
4	0	0
3	0	0
2	0	0
1	0	0
Weighted Value		**0**

Discharge

Width	Depth	Area	Velocity	Discharge
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
0	0	0.00	0	0.000
			Average	**0.000**

Quad 10	*Average*
130	141.1
70	62
37	53.8
15	19.4
5	2.6
3	2.3
0	1
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0
0	0

PROJECT SUMMARY

The Willow Creek CRM was begat by the Uinta County Conservation District approaching area ranchers located on the Willow Creek drainage to see if there were projects needed that would be beneficial to protecting and/or enhancing the water quality of Willow Creek

Broad discussions followed with some hesitations and concerns. It was however, decided to forge ahead with the knowledge that the Willow Creek drainage has had historically good overall management by the affected parties, but that even good management can be improved upon. Given that demands upon the resource have changed and will continue to change, it was viewed that as stewards of the land that this was a sterling opportunity to bolster, enhance, study and fine tune the management program already in effect and to add or instill beneficial new ones.

Funding was to be provided by a DEQ Section 319 grant (Water quality) with matching funds and available contributions from the Uinta County Conservancy District. A steering committee was formed consisting of the BLM, USFS, Wyoming Game and Fish Dept., Wyoming State Forestry and affect permittees, ranchers and landowners. Other entities that were also involved were area schools (science depts.), Utah Division of Wildlife Resources, water specialists, Trout Unlimited, Rocky Mountain Elk Foundation and the Utah Sportsman Association.

Basic goals: To maintain, enhance and/or improve water quality, fisheries, wildlife habitat and forage production.

Methods to accomplish these goals will be attained by but not limited to: livestock distribution and rotation systems, beaver management, brush control (fire and/or chemical application) rejuvenating riparian areas (controlling and removing conifers to promote willow, aspen and browse rejuvenation).

On the ground tours were scheduled and conducted, potential problem areas were identified and specific projects to be instilled were identified.

- Water storage pits built
- Water storage pits cleaned
- Sage brush control
- Spring Development
- Bentonite application
- Snow fences
- Conifer removal
- Fences
- Seeding programs

Water Development

Stock pits built and existing stock pits cleaned: Goal – to better distribute wildlife and livestock to the upland areas for better more even feed (browse and grass) utilization and relieve the need to migrate to WC proper to water. Result: ungulates will spend less time in the riparian and creek areas.

Spring developments: Goal – to provide water to ungulates in upland areas. Result: Better distribution of livestock. Fencing protects immediate area from trampling.
Bentonite application: Goal – to seal an existing pond. Result: less water loss so livestock and wildlife are able to stay on uplands longer.

Snow fences: Goal – to collect snow for snowmelt to ensure stock pits will fill each spring. Result: None were built but it will be a viable option in the future.

Fencing: Goals – to keep livestock in the intended pastures during prescribed grazing periods and to keep them out for the remaining periods. Result: proper grazing utilization allowing for maximum plant growth pre-grazing and allowing regrowth and eliminating over grazing in key areas post grazing.

Fencing of streams was discussed by the steering committee and decided that it would be non-productive with the systems currently instilled.

Livestock fencing of study plots to exclude wildlife and cattle was discussed and decided that it would be a waste of resource funding as the results were already known through previous studies.

Sagebrush control Spike: Goal – to reduce mature decadent stands of big sage. Result: increased forbes, grasses, aspen and shrubs. More feed available to wildlife and livestock and to help relieve pressure on streams and riparian areas.

Fire as a control was discussed but eliminated at this time as being too costly, not enough personnel and proper equipment available, and liability concerns.

Conifer removal: Goal – to produce more browse shrubs , grasses and aspen. Result: better distribution of ungulates away from riparian areas. Establish future water storage from beaver complexes. Available forage returns for beaver consumption there by resulting in higher and longer water tables being created through improved habitat.

Road design- Seeding projects, Erosion control, Silt control: Goal – to allow the least possible soil disturbance and still allow normal activities to occur. Result: Seeding was applied to disturbed areas in a timely fashion to form sod, produce litter and stabilize soils, plus the added benefit of increased feed production and lessening the over encroachment of conifers and better distribution of ungulates.

Specific Contributions:

BLM- NEPA analysis

Transects set: established three upland belts, two green lines, thirteen cages for monitoring and developed a use pattern map.
Goals and objectives for desired plant communities and management practices.
Monitoring sites
Design and approve projects and engineer pits
Management systems proposals
Monitor and measure plant communities
Soil studies
Donate hardware for spring development

Wyoming State Forestry Dept.-

Built one mile of fence (District provided housing and meals/ permittees provided equipment)

Designed a forest stewardship plan for private timber management and sale.

USFS- Built one mile buck and pole fence

Provided bucks for one mile of fence.

Provided expertise in designing private forest management plan.

USFS fisheries biologist provided expertise on fisheries management.

Cooperated with and designed rotational grazing system.

Wyoming Game and Fish Department-

Provided studies on fisheries management, especially Colorado River cutthroat trout.

Suggested fisheries management plan.

Input on game habitat – vegetative enhancement.

Permittees, landowners and ranchers:

Developed springs

Oversaw and managed spike applications

Designed areas to be treated with Spike

Built fences

Oversaw stock pit restoration and construction.

Developed management plans

Seeded stock pit areas, roads, embankments, clear cuts, select cuts, barrow pits, etc.

Bentonited stock pits

Selected pit locations

Sought bids for stock pits

Conifer removal

Helped design erosion control measures and silt management (traps)

Utah Division of Wildlife Resources-

Toured CRM areas and suggested beneficial grass species.

Utah Sportsman Association-

Offered labor for thinning projects and vegetative enhancement programs to be used later.

Louisiana Pacific-

Road design

Labor for seeding

Erosion control

Designs for silt management especially for Colorado River cutthroat protection

Resource management for timber

Craig Thompson, Hydrologist and water quality Specialist-

(Paid by Uinta County Conservation District and 319 grant money)

Water testing

Benita-

Site monitoring

Project coordinator (no small thing)

Water quality testing

Financial management

Rocky Mount Elk Foundation-

Funding possibility to enhance vegetation (aspen restoration).

Trout Unlimited-

Possible funding for fisheries enhancement.

Potential things left to do

Three or more stock pits
More sagebrush control
Fencing
Willow plantings
Rip rap
Barriers (stream)
Impoundment ponds – low water fish sanctuaries
Snow fences
Beaver management
More seeding
Vehicular access limits

Overall results – A feeling of cooperation was mostly achieved in that we were working toward a central goal of what is best for the resource, even though each entity has come from a somewhat different direction. The results from this project have produced and will continue to produce a win-win situation for all users of the resource;

Hunters, sportsmen and fishermen – a stream that should support a healthier and larger population of fish. Big game animals having more abundant habitat therefore stabilizing wildlife populations.

Everyone – a cleaner larger volume of water.

Permittees – More available forage. More stability to each individual operation and the flexibility to manage the federal ranges to better suit each operation.

Federal and state agencies – Allows for a resource that reflects and maintains the mandated objectives of clean air and water, desired plant communities and management practices, i.e. a healthy ecosystem that we all desire.

The goals that were set at the offset of this CRM may have been unrealistically high given that we began with a healthy ecosystem. However we did not fail, even though time has yet to produce all the results from our endeavors. All the studies are not completed but the evidence available to us currently, is very positive. We now better understand the potential and the limits of the resource and that we have improved that resource.

Hopefully we have educated one another and the picture is bigger and broader to us all than when we began. Our ecosystem is an ever-changing system of peaks and valleys, good years and bad. Through projects such as these we can educate the public, the users and the agencies to the extent that through proper management the dips and bottom cycles can at least be mitigated and all users concerns honestly addressed. It is evident that all information needs to be recorded factually and all variables need to be considered. There is a need to analyze all data, correlate the pertinent data and not rush to judgement on the short-term anomalies but to look at the overall long trend, the big picture and address the whole. If one component is overlooked or missing the picture is not complete.

Projects completed-

Agonies-

From the state: a better quicker distribution of funds needs implemented. (Contractors need paid in a timely fashion).

Quicker response by participants with bills and matching time is needed for a smoother operation and to facilitate being paid in a timely fashion.