Water Treatment Plant No. 4 (WTP4): Overview of Bull Creek Monitoring,

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Abstract

This study was designed to identify and document baseline biological and physical conditions of headwater tributaries of the Bull Creek watershed in anticipation of the construction of the proposed Water Treatment Plant No. 4 (WTP4). Although the location for the facility was moved from the Bull Creek watershed to the Lake Travis watershed in early 2008, the study was continued to provide data for future analysis that may assist the identification priorities for management of the Bull Creek Preserve and the watershed in general. This report summarizes the City of Austin pre-construction monitoring efforts of two headwater tributaries and one pond during a one year study period, April 2007 to March 2008. Results found minimal variations in baseline water chemistry, benthic macroinvertebrate and diatom data among stream sampling sites, indicating low environmental perturbation. Date collected on the Franklin Pond document a functional wetland environment that is positively affecting chemical and biological measurements within the Bull Creek preserve.

Introduction

Bull Creek (Figure 1) ranks highest in overall health out of all sampled creeks in the City of Austin (Duncan *et al.* 2010). It is home to the Jollyville salamander, the endangered golden-cheeked warbler and black-capped vireo, and an indigenous caddisfly (*Austrotinodes texensis*). For many years prior, Water Treatment Plant No. 4 (WTP4) was planned for construction on a tract of City owned land in the relatively undeveloped headwaters of Bull Creek just upstream of the Balcones Canyonlands Preserve (BCP) Franklin Tract (Tributary 7, Figure 2),. Intensive efforts towards design and construction of the plant began in winter 2006. This area has traditionally been a biological reference site containing the highest number of pollution sensitive aquatic taxa in the Bull Creek Watershed (Duncan *et al.* 2010). The following monitoring study was designed to isolate the watershed impacts of WTP4 at the proposed Upper Bull Creek site and to investigate the impacts of cumulative development on the BCP, Franklin Tract, and aquatic habitat supported by Pit Springs. The proposed construction of WTP4 was moved out of the Bull Creek watershed in 2008; however, the project was continued with a modified objective to collect and analyze background data for the Bull Creek Preserve. In addition to this cursory review of the data, a comprehensive appendix presents all data collected during this one year study period.

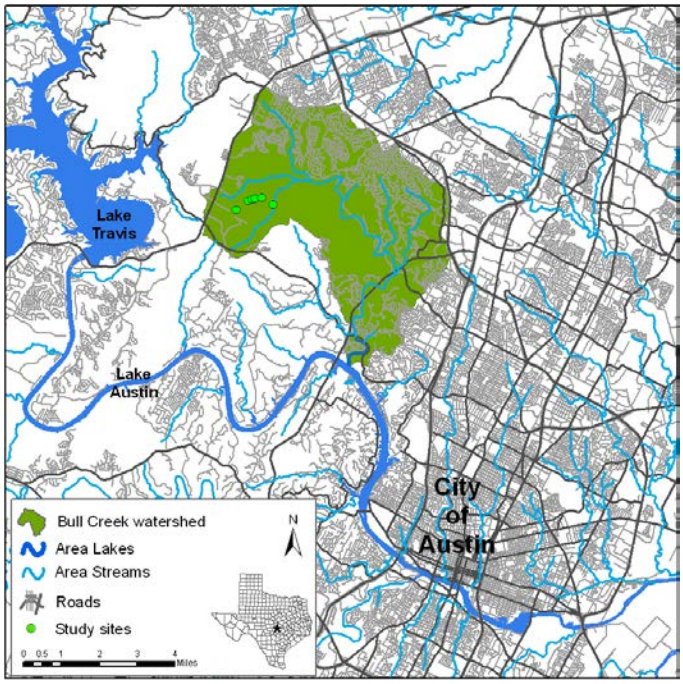

Figure 1. Bull Creek watershed location in Northwest Austin.

Methods

Watershed Description and Site Selection

Currently (2006 land use data), fifty nine percent of the Bull Creek watershed is developed with a distribution of 33% residential, 5% business, 1% civic, 11% parks, and 9% roadway land uses (Figure 2). As of the 2000 census the population in the Bull Creek watershed was ~ 44,000 and at current growth rates it is estimated that by 2030 the population will be near 70,000 (COA-WPD Masterplan, 2001). The Bull Creek Preserve occupies much of the south-western lobe of the watershed and has a some commercial development along the watershed boundary, primarily Hwy 620 and 2222, but is in a relatively natural, undisturbed state (<5% impervious cover).

Four sites were selected (Figure 3) based on both before-after and upstream-downstream study designs, capturing temporal and spatial changes that may have occurred due to the WTP4 construction phase and post-construction were this site to be used. The Above WTP4 site is located on Tributary 7 at the upstream edge of the City of Austin preserve property. The Franklin pond is an inline historic cattle tank, or pond that may have concentrated and/or captured any discharges coming from the WTP4 plant site, and the Below WTP4 site was at the closest downstream site that would have received all drainage from the WTP4 property. The Trib 8 site was located down gradient of the plant and although very little surface run-off drained to this tributary, it was hypothesized that groundwater from the site feeds baseflow to the tributary.

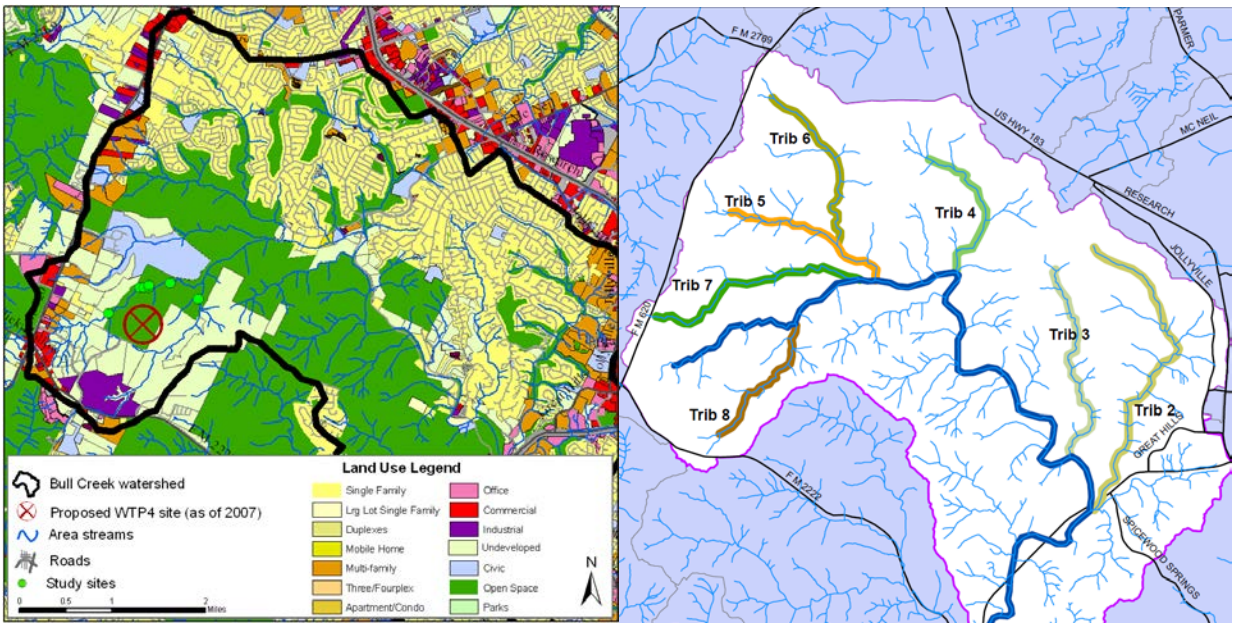

Figure 2. Study area, proposed WTP4 location, land use, and associated tributary names/locations.

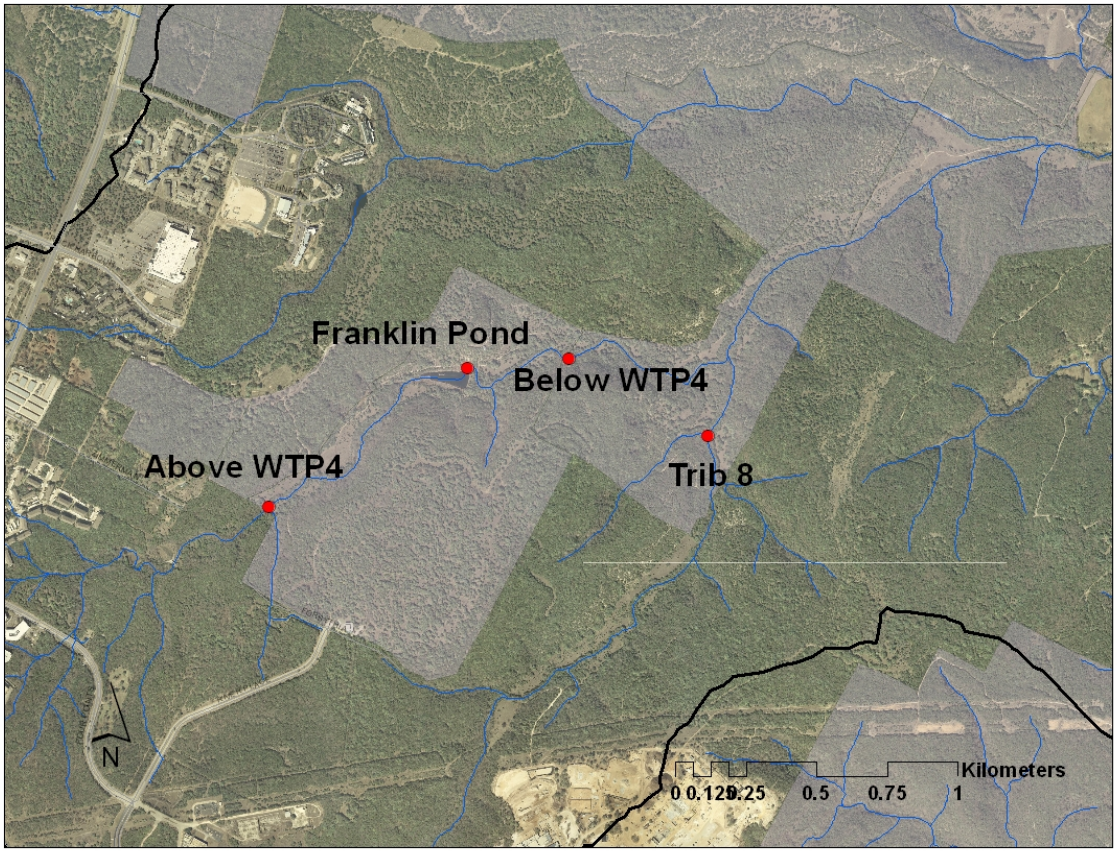

Figure 3. Detailed study area showing the Bull Creek Preserve (shaded) and the four primary study sites: Above WTP4, Below WTP4, Trib 8 and the Franklin Pond.

Physical Habitat Monitoring

Visual habitat quality (Barbour et al 1999) was assessed three times at Trib 8, Above WTP4 and Below WTP4 during the study period and included assessment of bank stability, vegetative protection, channel alteration, flow within the channel, embeddedness, epifaunal substrate, frequency of riffles, riparian zone width, sediment deposition, and the number of velocity/depth categories. Habitat data was compiled and placed into a matrix to calculate the Habitat Quality Index (HQI) for each site. Quantitative transect habitat surveys (WRE SOP section 6.5) were conducted once during the study period and consisted of analyses of canopy cover, instream cover, channel measurements, and a visual riparian vegetation assessment.

Water Quality Monitoring

Water quality monitoring was conducted six times at Trib 8, Above WTP4 and Below WTP4 and three times at Franklin Pond during the study period in accordance with COA standard methods (COA SOP section 3.0), with the following constituents analyzed: ammonia, chloride, conductivity, discharge, dissolved oxygen, *Escherichia coli* (*E. coli*), nitrate, orthophosphate, pH, sodium, sulfate, total suspended solids, turbidity, and water temperature.

Biological Monitoring

Benthic macroinvertebrates and diatoms communities were assessed three times at the three stream sites during the study period in accordance with City of Austin standard procedures (COA SOP, section 5.3-5.4). Benthic macroinvertebrates were collected using a 600µm mesh surber sampler ($1ft^2$). Three surber samples were collected and composited from riffle locations that represent the bottom, middle and top portions of the sample area. Sub-sampling was performed if necessary to obtain 200 (± 20%) individuals. Macroinvertebrates were sorted in the field, preserved in 70% ethyl alcohol and identified to the lowest practical level, usually genus, by City of Austin taxonomists. Diatoms were collected from three rocks representing the bottom, middle and top portions of the sample riffle habitat. Periphyton was scrubbed from a defined area of $47cm^2$ from each rock, composited and preserved with 10% buffered formalin, and sent out for processing and identification by a consulting taxonomist (B. Winsborough). Standard benthic macroinvertebrate and diatom metrics were calculated from raw taxa lists and used to evaluate qualitative spatial patterns (COA SOP section 5.3 and 5.4).

Data Analysis

The distribution of water quality, benthic macroinvertebrate and diatom data was checked for normality using the Shapiro-Wilks test in SAS (SAS institute, 2005). The Kruskal-Wallis test was performed on parameters to examine whether or not a difference existed among sites. To compare means where a significant difference existed, a multiple comparison test was used. Lab water quality measures below detection level were set to the detection limit for calculation of means using PROC MEANS in SAS. All alpha levels were set to 0.05 for these analyses.

Franklin Pond Approach

In addition to the water quality parameters listed above, Franklin Pond was also sampled for benthic macroinvertebrates using a lentic, or lake monitoring method (COA SOP section 5.3). The pond was divided into three habitat zone transects (Fig. 4), and sampled with a kick net (500µm) on each side of the littoral zone (up to 1m depth), compositing each transect into one sample.

For more details concerning City of Austin habitat, water quality, and biological sampling protocols refer to City of Austin WRE Standard Operating Procedures, sections 3, 4, 5, and 6 respectively.

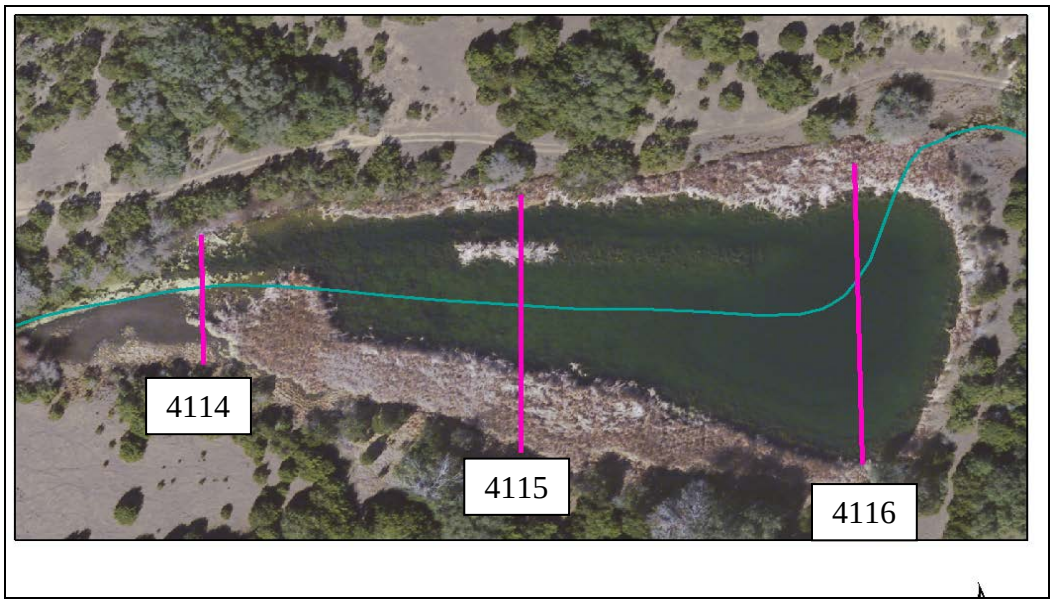

Figure 2. Franklin Pond with 3 transects in pink, Bull Creek is shown in blue as it flows through the pond. Transects were selected to represent the three habitat zones within the pond, upstream (#4114), mid-pond (#4115) and downstream (#4116).

Results/Discussion

Overview of Bull Creek Watershed

Bull Creek is evaluated as part of the City of Austin's Environmental Integrity Index (EII), a program that combines biological, physical and chemical measures to compare all area creeks (45 catchments) on a biannual basis. Bull Creek was most recently evaluated in 2007 when it scored highest of all creeks sampled for overall watershed EII score (Figure 3).

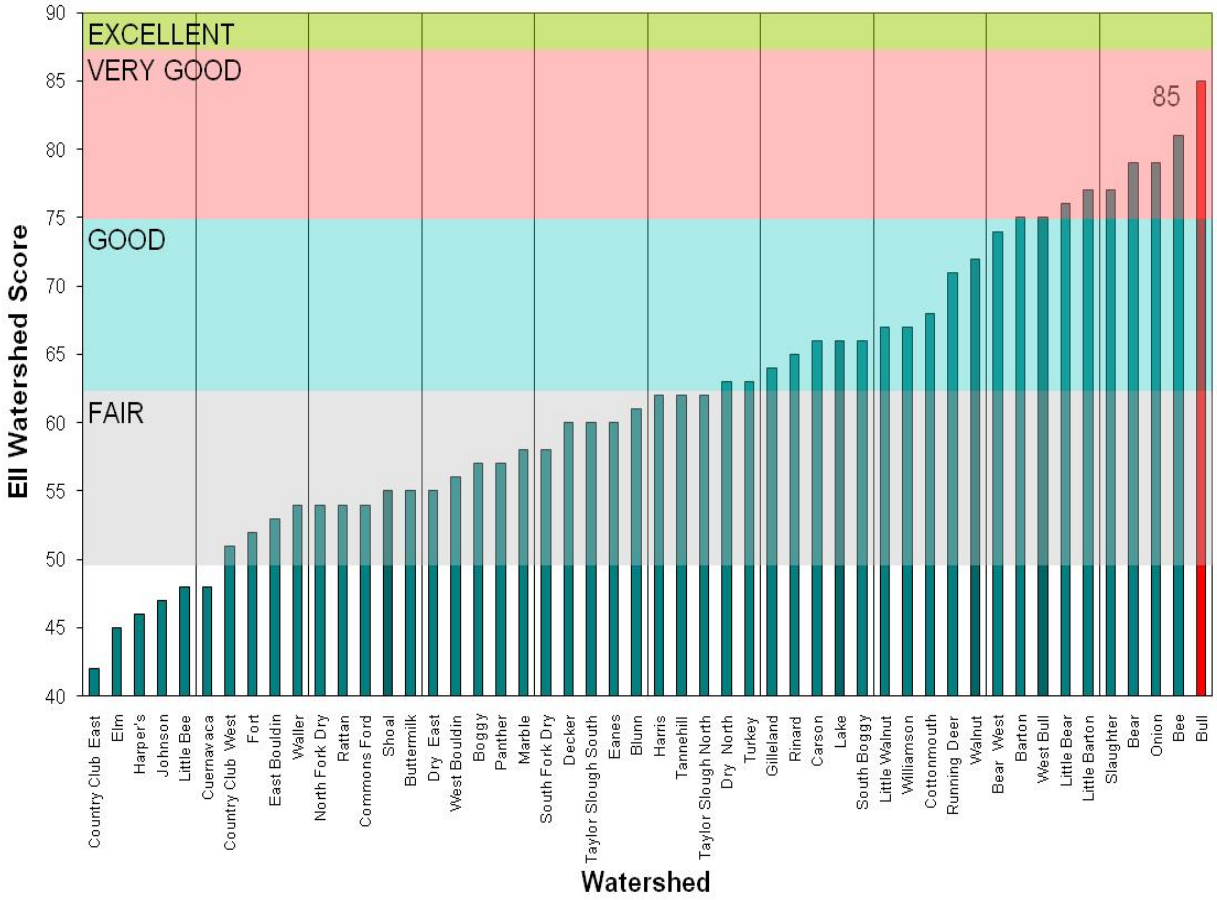

Figure 3. 2007 EII watershed scores for all watersheds, with Bull Creek in red.

Physical Habitat Overview

The EPA's visually based Habitat Quality Index (HQI) scored all Bull Creek sites in the optimal range (16-20 points) over the sampling period (Table 2). Above WTP4 site had the lowest average score (16) and the highest frequency of suboptimal scores (4 out of 10 in the 10-15 point range). There were no significant differences in HQI scores among sites. In addition to the HQI, three transect habitat surveys were conducted to understand spatial variation among study sites and for interpretation of biological data. There were no major differences in width and depth, instream cover, bankfull measurements and visual riparian cover (Table 3). A small reduction in canopy cover was observed at the Below WTP4 site, compared to Above WTP4 and Trib 8. There was some variation in dominant substrate among these sites, but generally they were all weighted towards either gravel or cobble size classes (Table 3). Bed substrate size, as measured using a 100 point pebble count, varied little among sampling sites, with slightly larger substrate at the Below WTP4 site than the other two (Figure 4). Generally the substrate size was predominantly (+40%) coarse gravel to small cobble (22-90mm) with 15-20% boulder at all three sampling locations.

Table 2. EPA's visually based Habitat Quality Index (HQI) for Bull Creek sites 2007-2008.

PARAMETER	Above WTP4	Below WTP4	Trib 8
EPIFAUNAL SUBSTRATE	14	16	16
EMBEDDEDNESS	14	18	18
VELOCITY/DEPTH REGIMES	15	16	15
SEDIMENT DEPOSITION	18	16	16
CHANNEL FLOW STATUS	18	18	14
CHANNEL ALTERATION	18	20	20
FREQUENCY OF RIFFLES	17	12	17
BANK STABILITY	15	18	18
VEGETATIVE PROTECTION	17	20	18
RIPARIAN VEGETATIVE ZONE WIDTH	19	20	20
AVERAGE	16	17	17

Table 3. Transect habitat means for 3 surveys at 3 Bull Creek sites, 2007-2008.

Category	Parameter	Above WTP4	Below WTP4	Trib 8
Bank/Channel Measurements (ft)	Total Wetted Width	5.5	8.3	8.9
	Average Bank Full Width	12.0	16.7	16.8
	Thalwag Depth (Wet)	0.7	0.6	0.7
	Bank Full Thalwag Depth	1.5	1.5	2.7
Canopy Cover (%)	Canopy Cover Center	81	67	63
	Canopy Cover Right Bank	85	60	92
	Canopy Cover Left Bank	82	73	92
Instream Cover	Undercut Banks	0.2	0.8	0.5
1-4 scale:	Large Woody Debris	0.6	0.4	0.2
1=Sparse (0-10%)	Small Woody Debris	14.5	1.1	1.6
2=Moderate (10-40%)	Roots	1.2	1.2	1.1
3=Heavy (40-75%)	Bedrock Ledges	0.0	0.9	0.7
4=Dense (>75%)	Algae Cover	0.4	1.2	0.8
	Macrophyte Cover	0.5	1.2	0.0
	Terrestrial Vegetation	1.2	1.3	1.1
	Cobble and Boulder Instream Cover	0.7	1.2	1.3
Dominant Substrate (class)	Substrate at 25% of Bankfull	Leaf	Gravel	Cobble
	Substrate at 50% of Bankfull	Gravel	Cobble	Cobble
	Substrate at 75% of Bankfull	Gravel	Gravel	Gravel
Riparian Vegetation Cover	Canopy (>5M) Vegetation Type	3.0	3.2	3.0
	Canopy Big Diameter (>0.3M)	2.4	1.2	2.6
1-4 scale:	Canopy Small Diameter (<0.3M)	2.2	2.0	2.2
1=Sparse (0-10%)	Understory Vegetation Type (0.5-5M)	3.0	2.8	3.0
2=Moderate (10-40%)	Understory Woody Shrubs/Saplings	2.7	2.6	2.7
3=Heavy (40-75%)	Understory Non-Woody Herbs/Grasses Right Bank	0.6	0.6	0.2
4=Dense (>75%)	Ground Cover Woody Shrubs/Saplings (<0.5M)	2.1	1.8	1.9
	Ground Cover Non-Woody Herbs/Grasses (<0.5M)	1.1	1.1	1.2
	Ground Cover Stable (<0.5m)	0.1	0.7	0.8

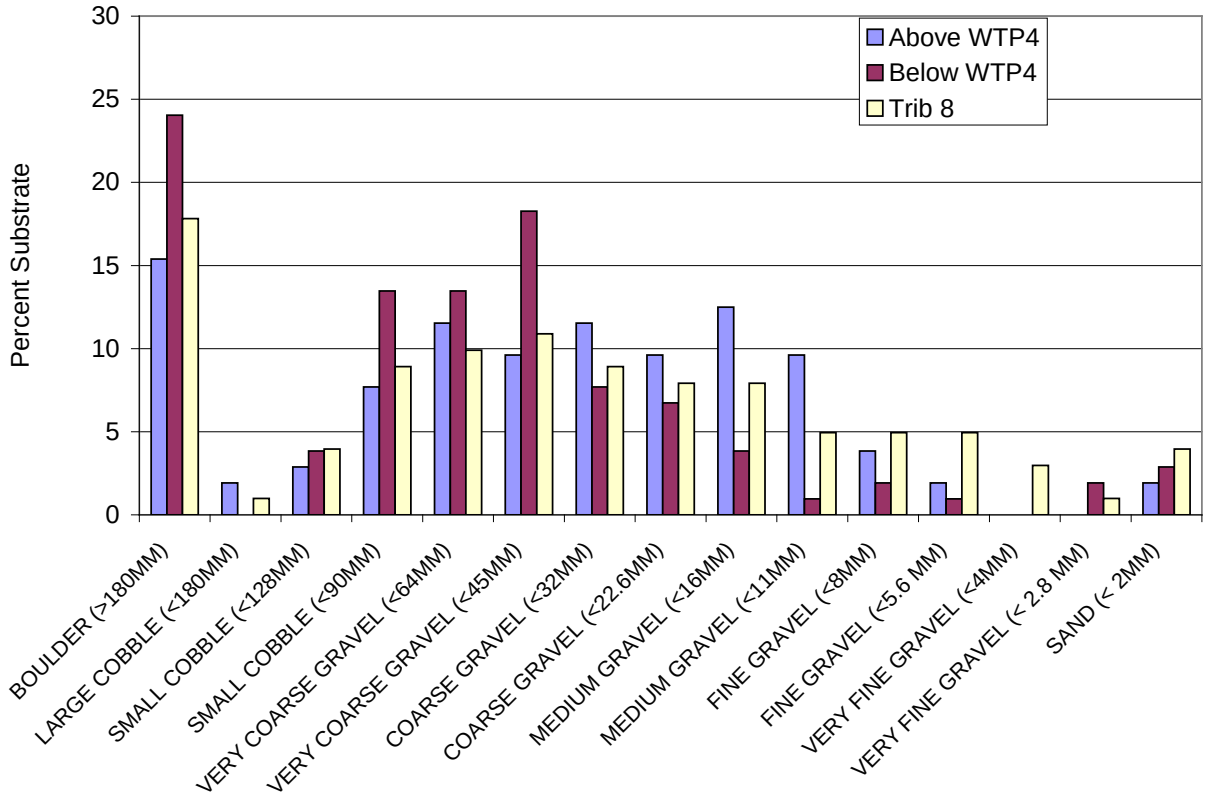

Figure 4. Pebble count results from October 2007 at 3 Bull Creek sites.

Water Chemistry Trends

There were significant spatial differences in conductivity, dissolved oxygen (DO), nitrate, pH, and sulfate among sampling sites on Bull Creek (Table 4). The differences in DO and pH are minimal among sites with mean values always exceeding the Texas Commission on Environmental Quality (TCEQ) minimum 24-hour average dissolved oxygen level of 5 mg/L and staying within the pH range of 6.5-9.0 for receiving bodies of Lake Austin, (TCEQ 2009a). Higher levels of conductivity, nitrate, and sulfate (a component of conductivity measurements) at the Above WTP4 site, compared to the Below WTP4 site, could be due to development at the top of the watershed which is then mitigated by wetland processes occurring in Franklin Pond (Mitsch et al. 1999). These concentrations may also be the result of spring discharges of groundwater from formations with higher levels of these constituentswithin the preserve. Values at Trib 8 tended to fall between the two WTP4 sites. Due to variability of background results, it may have been difficult to quantify any subtle baseflow water chemistry impacts that WTP4 may have had under the original study goals.

Table 4. Mean ± Standard Deviation for parameters collected at Bull Creek study sites from 2007-2008. Superscript letters and shaded rows indicate significant differences among study sites.

Parameter	Above	Below	Trib 8
Ammonia as N (mg/l)	0.022 ± 0.021^{A}	0.061 ± 0.089^{A}	0.023 ± 0.022^{A}
Chloride (mg/l)	17.9 ± 2.5^{A}	16.0 ± 2.8^{A}	15.9 ± 2.82^{A}
Conductivity (µS/cm)	614 ± 25^{C}	561 ± 27^{B}	522 ± 15^{A}
Discharge (cfs)	0.49 ± 0.54^{A}	0.68 ± 0.43^{A}	0.35 ± 0.26^{A}
DO (mg/l)	8.2 ± 1.0^{AB}	7.6 ± 1.1^{A}	8.7 ± 0.8^{B}
E Coli (MPN/100ml)	235 ± 404^{A}	18 ± 17^{A}	27 ± 27^{A}
Nitrate (mg/l)	0.80 ± 0.46^{B}	0.04 ± 0.04^{A}	0.22 ± 0.19^{A}
Orthophosphate (mg/L)	0.003 ± 0.0^{A}	0.003 ± 0.0^{A}	0.003 ± 0.0^{A}
pH	7.8 ± 0.2^{AB}	7.7 ± 0.1^{A}	7.9 ± 0.1^{B}
Sodium	10.7 ± 1.0^{A}	9.8 ± 0.9^{A}	9.5 ± 1.1^{A}
Sulfate (mg/L)	22.6 ± 3.5^{B}	17.5 ± 3.8^{A}	16.3 ± 2.1^{A}
TSS (mg/L)	0.3 ± 0.2^{A}	0.4 ± 0.2^{A}	0.4 ± 0.4^{A}
Turbidity	0.5 ± 0.3^{A}	0.6 ± 0.2^{A}	0.6 ± 0.5^{A}
Temperature (ºC)	18.4 ± 3.9^{A}	19.8 ± 5.2^{A}	19.0 ± 4.9^{A}

Benthic Macroinvertebrate Trends. Variation in many of the benthic macroinvertebrate metric values was moderate among sampling sites and sampling events, making it difficult to identify any clear spatial or temporal patterns (Table 5). The TCEQ Aquatic Life Use Score (ALU), which combines a wide range of these indicators, puts all these sites into the Intermediate narrative category, except the final survey of Trib 8, which was at the bottom of the High ALU category (TCEQ SWQM manual). Considering the relatively high biological community scores that are typical in many parts of Bull Creek, it is likely that the intermittent nature of the flow at these WTP4 sites is limiting their ecological potential. The macroinvertebrate community at Franklin pond was somewhat different from the three riffle sites, with higher numbers of taxa, but a more tolerant community (Table 6). Quantifying background status of the macroinvertebrate community in Franklin Pond is potentially a valuable tool for understanding any changes to Bull Creek water quality along the gradient of the preserve and provides an inventory for future temporal comparisons.

Table 5. Benthic macroinvertebrate metric values from Bull Creek study sites during three survey dates.

	April, '07			August, 07'			March, '08		
Parameter	**Above WTP4**	**Below WTP4**	**Trib 8**	**Above WTP4**	**Below WTP4**	**Trib 8**	**Above WTP4**	**Below WTP4**	**Trib 8**
Total No. taxa	14	14	17	26	20	18	16	20	18
No. EPT taxa	6	5	8	10	6	7	7	7	8
No. Ephemeroptera Taxa	4	2	3	2	2	2	1	1	3
No. Diptera taxa	4	2	4	7	3	6	3	4	4
% EPT	72.5	57.4	60.8	41.7	52.5	50.4	35.4	29.4	52.7

Table 5. Benthic macroinvertebrate metric values from Bull Creek study sites during three survey dates. (continued)

Parameter	April, '07 Above WTP4	April, '07 Below WTP4	April, '07 Trib 8	August, 07' Above WTP4	August, 07' Below WTP4	August, 07' Trib 8	March, '08 Above WTP4	March, '08 Below WTP4	March, '08 Trib 8
EPT/EPT + Chironomidae	0.87	0.83	0.82	0.58	0.86	0.99	0.65	0.63	0.91
% Chironomidae	11.2	11.7	13.4	29.9	8.4	0.7	19.4	17.1	5.3
% Elimidae	0	0	0	0	0.66	0	0	4.1	0.5
No. non-insect taxa	2	3	3	5	4	3	4	4	2
No. of Intolerant Taxa	7	4	8	11	8	7	8	9	8
% Tolerant Organisms	0	1.5	0.9	3.7	0	0	0.7	0	0.5
% Dominant Taxon (Top 1 Taxa)	36.4	12.2	17.5	17.5	12.9	11.5	140.4	14.3	16.5
% Dominant Taxon (Top 3 Taxa)	48.8	34.5	35.1	38.8	32.8	32.4	29.9	31.7	38.8
% Dominant Guild (FFG)	82.2	61.4	62.9	52.3	42.4	42.4	58.3	61.1	48.4
Hilsenhoff Biotic Index	4.8	4.27	5.4	5.7	5.6	5.1	4.7	5.5	4.7
% Hydropsychidae to Trichoptera	0	25	12.5	61.5	73.2	47.4	26.0	63.2	36.6
Ratio of Intolerant to tolerant	2.8	1.4	0.9	0.2	0.2	0.6	0.9	0.3	0.6
% Filterers	14.0	61.4	20.6	52.3	31.5	42.4	34.0	41.6	48.4
% Grazers	13.2	25.4	46.4	21.3	30.6	10.1	20.8	11.0	11.7
% Collector/ Gatherers	82.2	25.4	62.9	19.5	34.1	33.8	29.9	18.8	11.7
% Predators	15.1	23.85	18.6	52.0	42.4	28.8	58.3	61.1	44.7
TCEQ Qualitative ALU	22	28	26	27	26	27	26	28	29

Table 6. Benthic macroinvertebrate metrics collected from Franklin Pond on the main stem of Bull Creek from Sept. 2007.

Parameter	4114	4115	4116
Total No. taxa	43	42	38
Total No. organisms	345	278	441
No. EPT taxa	3	1	2
No. Ephemeroptera Taxa	3	1	2
No. Diptera taxa	6	9	6
% EPT	1.4	5.0	3.9
EPT/EPT + Chironomidae	0.083	0.175	0.143
% Chironomidae	15.94	23.74	23.12
% Elimidae	0	0	0
No. non-insect taxa	11	11	8
No. of Intolerant Taxa	3	5	6
% Tolerant Organisms	3.76	10.43	9.29
% Dominant Taxon (Top 1 Taxa)	12.17	11.51	24.03
% Dominant Taxon (Top 3 Taxa)	28.69	28.41	42.85
% Dominant Guild (FFG)	45.5	57.19	47.16
Hilsenhoff Biotic Index	6.69	6.73	7.1
% Hydropsychidae to Trichoptera	0	0	0
Ratio of Intolerant to tolerant	0.24	0.26	0.08
% Filterers	20.3	25.17	23.8
% Grazers	11.59	25.53	11.11
% Collector/ Gatherers	36.23	37.05	47.16
% Predators	45.5	57.19	41.04

Diatom Spatial Trends

Spatial variations in diatom taxa among sampling sites on Bull Creek (Table 7) were consistent enough to suggest that the community at the Above WTP4 site was more degraded than at both the Below WTP4 site and Trib 8. The high percent of motile taxa coupled with the decrease in the pollution tolerance index and Cymbella richness indicate higher siltation and decreases in intolerant species at the Above WTP4 site. These differences could be explained by development in the top reaches of the watershed and some wetland treatment effects from the Franklin Pond, as discussed in the water quality section.

Table 7. Diatom metric values from Bull Creek study sites during April and August 2007.

	Apr 07			Aug 07		
Parameter	**Above**	**Below**	**Trib 8**	**Above**	**Below**	**Trib 8**
Cymbella Richness	1	2	5	3	7	6
Percent Motile Taxa	20.4	0.4	0.4	16.2	4.8	4.4
Pollution Tolerance Index	2.55	2.97	3.13	2.56	2.92	3.07
Number of Taxa	20	15	20	32	19	23
% Similarity to Reference Condition	33.8	43.6	49.5	37.6	38.7	42.7

Summary

Although portions of the Jollyville Transmission Main pipeline corridor are located within the Bull Creek watershed, the main facility site for WTP4 was moved to the Lake Travis watershed following the data collection period of this study. The background data collected in these areas of the Bull Creek preserve represent a fairly comprehensive temporal snapshot of biodiversity and water quality status.

- The EPA's qualitative visual habitat method (HQI) scored all Bull Creek sites in the sub-optimal to optimal range, and quantitative habitat measurements were relatively similar among the three stream sites.
- Benthic macroinvertebrate community metrics place the upper reaches of Bull Creek in the "Intermediate" narrative category, according to TCEQ assessment methods. This may be due to the intermittent nature of these headwater streams and the bias of the method towards perennial communities.
- Variations in baseline water chemistry and diatom community data suggest differences in general stream health between the Above WTP4 site and the two downstream sites, Below WTP4 and Trib 8. It appears that development in the headwaters has degraded water quality before Bull Creek enters the preserve and that instream processes, including the Franklin impoundment; mitigate that impact to some degree at the downstream sites.

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Appendix A: All HQI data collected

	Above WTP4	Below WTP4	Trib 8
Parameter	**21Feb2007**	**21Feb2007**	**26Jan2007**
BANK STABILITY (LEFT BANK)	7	10	10
BANK STABILITY (RIGHT BANK)	7	10	9
CHANNEL ALTERATION	18	19	20
CHANNEL FLOW STATUS	17	17	16
EMBEDDEDNESS	11	18	20
EPIFAUNAL SUBSTRATE	13	14	13
FREQUENCY OF RIFFLES	16	15	14
RIPARIAN VEGETATIVE ZONE WIDTH (LEFT BANK)	10	10	10
RIPARIAN VEGETATIVE ZONE WIDTH (RIGHT BANK)	10	10	10
SEDIMENT DEPOSITION	18	16	20
VEGETATIVE PROTECTION (LEFT BANK)	7	10	10
VEGETATIVE PROTECTION (RIGHT BANK)	7	10	10
VELOCITY/DEPTH REGIMES	14	16	17
Parameter	**11Apr2007**	**11May2007**	**11May2007**
BANK STABILITY (LEFT BANK)	10	8	8
BANK STABILITY (RIGHT BANK)	7	8	8
CHANNEL ALTERATION	16	20	20
CHANNEL FLOW STATUS	20	19	14
EMBEDDEDNESS	18	18	19
EPIFAUNAL SUBSTRATE	17	18	15
FREQUENCY OF RIFFLES	18	10	17
RIPARIAN VEGETATIVE ZONE WIDTH (LEFT BANK)	9	9	10
RIPARIAN VEGETATIVE ZONE WIDTH (RIGHT BANK)	8	10	10
SEDIMENT DEPOSITION	19	16	15
VEGETATIVE PROTECTION (LEFT BANK)	9	9	8
VEGETATIVE PROTECTION (RIGHT BANK)	8	9	8
VELOCITY/DEPTH REGIMES	15	12	12
Parameter	**14Aug2007**	**14Aug2007**	**14Aug2007**
BANK STABILITY (LEFT BANK)	10	9	10
BANK STABILITY (RIGHT BANK)	5	9	10
CHANNEL ALTERATION	20	20	20
CHANNEL FLOW STATUS	16	19	13
EMBEDDEDNESS	13	17	16
EPIFAUNAL SUBSTRATE	13	17	19
FREQUENCY OF RIFFLES	17	11	20
RIPARIAN VEGETATIVE ZONE WIDTH (LEFT BANK)	10	10	10
RIPARIAN VEGETATIVE ZONE WIDTH (RIGHT BANK)	10	10	10
SEDIMENT DEPOSITION	16	17	12
VEGETATIVE PROTECTION (LEFT BANK)	10	10	10
VEGETATIVE PROTECTION (RIGHT BANK)	10	10	10
VELOCITY/DEPTH REGIMES	15	19	16

Appendix B: Transect Habitat data collected

	Above WTP4				
	07Feb2007		21Feb2007		
Parameter	**Transect 1**	**Transect 2**	**Transect 1**	**Transect 2**	**Transect 3**
AVERAGE BANK FULL WIDTH	10.4	9.2	9.3	12	9
AVERAGE SEDIMENT DEPTH	1	0	0.5	0.15	0.15
AVERAGE SUBSTRATE GRAVEL OR LARGER	0	0	0	0	30
BANK FULL THALWAG DEPTH	2.38	0.96	0.73	0.93	0.79
BANK STABILITY (LEFT BANK)	5	7	8.5	7	6
BANK STABILITY (RIGHT BANK)	6	6	8.5	7	6
BEDROCK LEDGES	0	0	0	0	0
CANOPY COVER CENTER	68	63	84	68	92
CANOPY COVER LEFT BANK	77	63	90	84	92
CANOPY COVER RIGHT BANK	70	45	98	86	84
COBBLE AND BOULDER INSTREAM COVER	0	0	0	0	1
DEPTH AT 25 PERCENT OF CHANNEL	1.15	0.26	0.3	0.27	0.05
DEPTH AT 50 PERCENT OF CHANNEL	1.46	0.3	0.34	0.32	0.1
DEPTH AT 75 PERCENT OF CHANNEL	0.78	0.02	0.29	0.08	0.12
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	3.5	6.4	3.4	5.9	3.55
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	2.1	0.63	2.6	3	2.25
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	4.2	1.5	4.2	6	4.5
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	6.3	2.37	5.8	9	6.75
DOMINANT SUBSTRATE TYPE	1	7	2	2	4
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	3	2	3	2	1
INSTREAM COVER	5	20	10	30	30
LARGE WOODY DEBRIS	0	1	0	3	0
LEFT BANK ANGLE	60.7	3.4	20.1	24.8	18.3
MACROPHYTE OR ALGAE COVER	0	0	0	50	15
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	5	1	1	3
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	5	1	1	5
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	5	1	5	1
NATURAL BUFFER LEFT BANK WIDTH	> 20	> 20	> 20	> 20	> 20
NATURAL BUFFER RIGHT BANK WIDTH	> 20	> 20	> 20	> 20	> 20
RIGHT BANK ANGLE	32.5	54.4	7.2	15.9	11
ROOTS	1	1	3	2	0
SEDIMENT CHARACTERIZATION	1	0	6	6	6
SMALL WOODY DEBRIS	0	1	1	2	0
SUBMERGED AQUATIC VEGETATION	0	0	0	3	1
TERRESTRIAL VEGETATION	1	2	1	2	1
THALWAG DEPTH (WET)	1.6	0.4	0.4	0.4	1.9
THALWAG DISTANCE FROM LEFT BANK (WET)	3.1	1.8	2.4	4.3	1.55
TOTAL WETTED WIDTH	8.6	3.5	6.5	8.4	4.7
TRANSECT NUMBER (ID)	1	2	1	2	3
UNDERCUT BANKS	0	0	0	0	0

Appendix B (cont.): Transect Habitat data collected

	Above WTP4				
	11Apr2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
ALGAE CARPET	0	2	0	1	2
AVERAGE BANK FULL WIDTH	13.8	12	13.5	14	14
BANK FULL THALWAG DEPTH	2.5	1.7	2.2	1.28	1.5
BEDROCK LEDGES	0	0	0	0	1
CANOPY (>5M) LEFT BANK VEG TYPE	3	3	3	3	3
CANOPY (>5M) RIGHT BANK VEG TYPE	3	3	3	3	3
CANOPY COVER CENTER	87	72	91	78	74
CANOPY COVER LEFT BANK	79	79	82	88	92
CANOPY COVER RIGHT BANK	84	81	87	90	85
CANOPY LEFT BANK BIG DIAM (>0.3M)	3	2	3	2	3
CANOPY LEFT BANK SMALL DIAM (<0.3M)	2	2	2	3	2
CANOPY RIGHT BANK BIG DIAM (>0.3M)	2	3	3	2	3
CANOPY RIGHT BANK SMALL DIAM (<0.3M)	2	2	2	3	2
COBBLE AND BOULDER INSTREAM COVER	0	1	0	1	2
DEPTH AT 25 PERCENT OF CHANNEL	0	0	0.1	0.31	0
DEPTH AT 50 PERCENT OF CHANNEL	0.67	0.1	1.02	0.32	0.2
DEPTH AT 75 PERCENT OF CHANNEL	1.12	0.1	1.34	0.21	0.1
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	3.8	8.2	4.2	7.4	8.3
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	3.45	3	3.4	3.5	3.5
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	6.9	6	6.75	7	7
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	10.35	9	10.2	10.5	10.5
DOMINANT SUBSTRATE TYPE	2	7	2	7	4
GROUND COVER LEFT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	2	1	1	1
GROUND COVER LEFT BANK STABLE (<0.5M)	0	1	0	0	0
GROUND COVER LEFT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	2	2	2	1
GROUND COVER RIGHT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	2	1	1	1
GROUND COVER RIGHT BANK STABLE (<0.5M)	0	0	0	0	0
GROUND COVER RIGHT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	2	2	2	1
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	3	1	3	2	1
LARGE WOODY DEBRIS	1	0	0	1	0
LEFT BANK ANGLE	43.7	6	35	15	12
MACROPHYTE OR ALGAE COVER	0	0	0	1	1
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	4	1	1	1
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	7	1	5	3
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	5	1	1	5
RIGHT BANK ANGLE		35	11	15	14
ROOTS	1	2	1	1	1
SMALL WOODY DEBRIS	2	2	2	2	2
TERRESTRIAL VEGETATION	1	1	1	1	1
THALWAG DEPTH (WET)	1.25	0.3	1.45	0.39	0.25
THALWAG DISTANCE FROM LEFT BANK (WET)	2.6	2.2	3	5.45	4.2
TOTAL WETTED WIDTH	8.8	5	9	9.5	6
TRANSECT NUMBER (ID)	1	2	3	4	5
UNDERCUT BANKS	0	0	0	0	0

Appendix B (cont.): Transect Habitat data collected

Parameter	Above WTP4 11Apr2007 Transect 1	Transect 2	Transect 3	Transect 4	Transect 5
UNDERSTORY LEFT BANK NON-WOOD HERBS/GRASSES	1	1	0	0	1
UNDERSTORY LEFT BANK VEG TYPE (0.5-5M)	3	3	3	3	3
UNDERSTORY LEFT BANK WOODY SHRUBS/SAPLINGS	2	3	3	2	3
UNDERSTORY RIGHT BANK NON-WOOD HERBS/GRASSES RIGHT BANK	1	1	0	0	1
UNDERSTORY RIGHT BANK VEG TYPE (0.5-5M)	3	3	3	3	3
UNDERSTORY RIGHT BANK WOODY SHRUBS/SAPLINGS	3	3	3	3	3

Parameter	**Above WTP4 20Sep2007 Transect1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
ALGAE COVER	0	1	0	1	0
AVERAGE BANK FULL WIDTH	14	15	15	15	15
BANK FULL THALWAG DEPTH	3.2	2	3	2	2
BEDROCK LEDGES	0	0	0	0	0
CANOPY (>5M) LEFT BANK VEG TYPE	3	3	3	3	3
CANOPY (>5M) RIGHT BANK VEG TYPE	3	3	3	3	3
CANOPY COVER CENTER	90	85	88	75	85
CANOPY COVER LEFT BANK	84	88	86	91	80
CANOPY COVER RIGHT BANK	89	84		84	87
CANOPY LEFT BANK BIG DIAM (>0.3M)	3	2	3	1	1
CANOPY LEFT BANK SMALL DIAM (<0.3M)	2	2	2	2	3
CANOPY RIGHT BANK BIG DIAM (>0.3M)	2	2	3	2	2
CANOPY RIGHT BANK SMALL DIAM (<0.3M)	2	2	2	2	3
COBBLE AND BOULDER INSTREAM COVER	0	1	0	1	1
DEPTH AT 25 PERCENT OF CHANNEL	1.22	0	1.15	0.33	0
DEPTH AT 50 PERCENT OF CHANNEL	0.77	0	0.9	0.3	0.4
DEPTH AT 75 PERCENT OF CHANNEL	0	0.4	0	0.2	0.3
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	4.3	11.2	6.2	8	8
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	3.5	3.75	3.75	3.75	3.75
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	7	7.5	7.5	7.5	7.5
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	10.5	11.25	11.25	11.25	11.25
DOMINANT SUBSTRATE TYPE	2	7	2	7	4
GROUND COVER LEFT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	1
GROUND COVER LEFT BANK STABLE (<0.5M)	0	1	0	0	0
GROUND COVER LEFT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	3	2	3	2
GROUND COVER RIGHT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	1
GROUND COVER RIGHT BANK STABLE (<0.5M)	0	0	0	0	0
GROUND COVER RIGHT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	3	2	2	3	2
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	3	1	3	2	1
LARGE WOODY DEBRIS	0	0	0	1	0
LEFT BANK ANGLE	42	9	37	27	19
MACROPHYTE OR ALGAE COVER	0	1	0	1	1
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	3	1	1	1
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	4	1	5	3
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	5	1	5	1

Appendix B (cont.): Transect Habitat data collected

	Above WTP4				
	20Sep2007				
Parameter	**Transect1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
RIGHT BANK ANGLE	17	33	13	22	18
ROOTS	1	1	1	1	1
SMALL WOODY DEBRIS	2	2	2	2	2
TERRESTRIAL VEGETATION	1	2	1	1	1
THALWAG DEPTH (WET)	1.4	0.4	1.2	0.4	0.4
THALWAG DISTANCE FROM LEFT BANK (WET)	3.3	2.5	3.2	5	3
TOTAL WETTED WIDTH	9	5	7	9	7
TRANSECT NUMBER (ID)	1	2	3	4	5
UNDERCUT BANKS	0	0	0	0	0
UNDERSTORY LEFT BANK NON-WOOD HERBS/GRASSES	0	1	0	0	1
UNDERSTORY LEFT BANK VEG TYPE (0.5-5M)	3	3	3	3	3
UNDERSTORY LEFT BANK WOODY SHRUBS/SAPLINGS	2	3	3	2	2
UNDERSTORY RIGHT BANK NON-WOOD HERBS/GRASSES RIGHT BANK	1	1	0	0	1
UNDERSTORY RIGHT BANK VEG TYPE (0.5-5M)	3	3	3	3	3
UNDERSTORY RIGHT BANK WOODY SHRUBS/SAPLINGS	3	3	3	2	2
	Below WTP4				
	07Feb2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
AVERAGE BANK FULL WIDTH	19.8	10.5	17.7	16.8	12.8
AVERAGE SEDIMENT DEPTH	0	0	0.01	0	0.01
AVERAGE SUBSTRATE GRAVEL OR LARGER	5	20	50	0	2
BANK FULL THALWAG DEPTH	1.35	2.2	1.37	0.5	1.28
BANK STABILITY (LEFT BANK)	10	9	9	10	8
BANK STABILITY (RIGHT BANK)	6	9	9	9	8
BEDROCK LEDGES	2	0	0	0	0
CANOPY COVER CENTER	64	84	49	0	85
CANOPY COVER LEFT BANK	99	86	97	0	47
CANOPY COVER RIGHT BANK	100	100	87	68	77
COBBLE AND BOULDER INSTREAM COVER	0	0	2	0	0
DEPTH AT 25 PERCENT OF CHANNEL	0	1.6	0.5	0.2	0.77
DEPTH AT 50 PERCENT OF CHANNEL	0.2	1.74	0.5	0.12	0.73
DEPTH AT 75 PERCENT OF CHANNEL	0.1	1.57	0.4	0.16	0.41
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	16.45	5.55	13.6	4	5.4
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	5.7	3	3.75	9.4	2.8
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	9.5	2.2	2.5	7.8	5.6
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	13.3	1.4	1.25	5.2	8.4
DOMINANT SUBSTRATE TYPE	6	6	4	6	6
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	2	3	1	2	2
INSTREAM COVER	20	25	50	0	10
LARGE WOODY DEBRIS	1	1	0	0	0
LEFT BANK ANGLE	21	45.6	21	12.3	25
MACROPHYTE OR ALGAE COVER	0	15	30	0	5
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	5	3	5	5
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	5	4	5	5

Appendix B (cont.): Transect Habitat data collected

	Below WTP4				
	07Feb2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	5	3	5	5
NATURAL BUFFER LEFT BANK WIDTH	> 20	> 20	> 20	> 20	> 20
NATURAL BUFFER RIGHT BANK WIDTH	> 20	> 20	> 20	> 20	> 20
RIGHT BANK ANGLE	27.9	39.9	70	17.6	26.7
ROOTS	0	1	1	0	1
SEDIMENT CHARACTERIZATION	0	0	1	0	1
SMALL WOODY DEBRIS	1	1	2	0	0
SUBMERGED AQUATIC VEGETATION	0	0.5	2	0	1
TERRESTRIAL VEGETATION	2	1	3	0	0
THALWAG DEPTH (WET)	0.74	1.74	0.625	1.8	0.9
THALWAG DISTANCE FROM LEFT BANK (WET)	13.65	2.55	3.6	1.5	4.7
TOTAL WETTED WIDTH	15.3	3.8	5	10.7	11.3
TRANSECT NUMBER (ID)	1	2	3	4	5
UNDERCUT BANKS	0	2	0	0	0
	Below WTP4				
	12Apr2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
ALGAE CARPET	1	1	0	1	1
AVERAGE BANK FULL WIDTH	25	17	24	20	18
BANK FULL THALWAG DEPTH	3.15	2.1	2.2	1.1	1.51
BEDROCK LEDGES	2	1	1	0	1
CANOPY (>5M) LEFT BANK VEG TYPE	3	3	3	4	3
CANOPY (>5M) RIGHT BANK VEG TYPE	3	3	3	4	3
CANOPY COVER CENTER	87	95	97	3	90
CANOPY COVER LEFT BANK	96	93	94	0	93
CANOPY COVER RIGHT BANK	96	91	77	75	95
CANOPY LEFT BANK BIG DIAM (>0.3M)	1	1	1	0	3
CANOPY LEFT BANK SMALL DIAM (<0.3M)	3	2	3	0	2
CANOPY RIGHT BANK BIG DIAM (>0.3M)	1	1	1	0	3
CANOPY RIGHT BANK SMALL DIAM (<0.3M)	3	2	3	0	2
COBBLE AND BOULDER INSTREAM COVER	1	1	2	1	1
DEPTH AT 25 PERCENT OF CHANNEL	0.18	0	0	0.09	0
DEPTH AT 50 PERCENT OF CHANNEL	0.42	0.61	0.39	0.23	0.25
DEPTH AT 75 PERCENT OF CHANNEL	0.35	0.02	0	0.18	0
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	10	7.1	13.2	7	9.2
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	6.25	4.25	6	5	4.5
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	12.5	7.5	12	10	9
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	18.75	11.75	18	15	13.5
DOMINANT SUBSTRATE TYPE	7	7	5	7	7
GROUND COVER LEFT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	1
GROUND COVER LEFT BANK STABLE (<0.5M)	3	0	0	1	1
GROUND COVER LEFT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	2	0	2	1
GROUND COVER RIGHT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	0
GROUND COVER RIGHT BANK STABLE (<0.5M)	1	0	0	0	3

Appendix B (cont.): Transect Habitat data collected

Parameter	Below WTP4 12Apr2007 Transect 1	Transect 2	Transect 3	Transect 4	Transect 5
GROUND COVER RIGHT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	1	1	2	3
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	2	1	2	2	0
LARGE WOODY DEBRIS		0	0	0	0
LEFT BANK ANGLE	23	10	10	10	1
MACROPHYTE OR ALGAE COVER	1	1	2	0	1
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	3	1	1	5
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	3	5	5	1	5
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	5	1	5	1
RIGHT BANK ANGLE	40	30	15	18	15
ROOTS	1	1	1	1	1
SMALL WOODY DEBRIS	2	1	2	1	1
TERRESTRIAL VEGETATION	1	1	1	1	1
THALWAG DEPTH (WET)	1.2	0.68	0.4	0.27	0.29
THALWAG DISTANCE FROM LEFT BANK (WET)	7	1.7	5.1	2.1	4.7
TOTAL WETTED WIDTH	18	8	7	10.5	7.5
TRANSECT NUMBER (ID)	87	88	89	90	
UNDERCUT BANKS	1	0	0	0	0
UNDERSTORY LEFT BANK NON-WOOD HERBS/GRASSES	1	1	0	1	0
UNDERSTORY LEFT BANK VEG TYPE (0.5-5M)	3	3	3	2	3
UNDERSTORY LEFT BANK WOODY SHRUBS/SAPLINGS	3	3	3	1	3
UNDERSTORY RIGHT BANK NON-WOOD HERBS/GRASSES RIGHT BANK	1	1	0	1	0
UNDERSTORY RIGHT BANK VEG TYPE (0.5-5M)	3	3	3	2	3
UNDERSTORY RIGHT BANK WOODY SHRUBS/SAPLINGS	3	3	3	1	3

Parameter	Below WTP4 20Sep2007 Transect 1	Transect 2	Transect 3	Transect 4	Transect 5
ALGAE COVER	1	1	2	1	1
AVERAGE BANK FULL WIDTH	25	17	24	20	18
BANK FULL THALWAG DEPTH	3.2	2.1	2	1.32	1.5
BEDROCK LEDGES	2	1	1	0	1
CANOPY (>5M) LEFT BANK VEG TYPE	3	3	3	4	3
CANOPY (>5M) RIGHT BANK VEG TYPE	3	3	3	4	3
CANOPY COVER CENTER	94	90	96	3	89
CANOPY COVER LEFT BANK	82	90	91	24	86
CANOPY COVER RIGHT BANK	91	81		70	92
CANOPY LEFT BANK BIG DIAM (>0.3M)	1	1	1	0	3
CANOPY LEFT BANK SMALL DIAM (<0.3M)	3	2	3	0	2
CANOPY RIGHT BANK BIG DIAM (>0.3M)	1	1	1	0	3
CANOPY RIGHT BANK SMALL DIAM (<0.3M)	3	2	3	0	2
COBBLE AND BOULDER INSTREAM COVER	1	1	2	0	1
DEPTH AT 25 PERCENT OF CHANNEL	0.1	0	0	0.05	0
DEPTH AT 50 PERCENT OF CHANNEL	0.4	0.38	0.2	0.3	0.25
DEPTH AT 75 PERCENT OF CHANNEL	0.4	0.3	0	0.22	0
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	12	10	15.3	8	7.6

Appendix B (cont.): Transect Habitat data collected

	Below WTP4				
	20Sep2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	6.25	4.25	6	5	4.5
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	12.5	8.5	12	10	9
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	18.75	12.75	18	15	13.5
DOMINANT SUBSTRATE TYPE	7	7	5	7	7
GROUND COVER LEFT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	1
GROUND COVER LEFT BANK STABLE (<0.5M)	3	1	0	1	1
GROUND COVER LEFT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	2	3	0	2
GROUND COVER RIGHT BANK NON-WOOD HERBS/GRASSES (<0.5M)	2	1	1	1	1
GROUND COVER RIGHT BANK STABLE (<0.5M)	0	1	0	0	1
GROUND COVER RIGHT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	3	2	2	1	2
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	3	2	1	2	2
LARGE WOODY DEBRIS	0	0	0	0	0
LEFT BANK ANGLE	33	13	9	10	13
MACROPHYTE OR ALGAE COVER	1	1	2	2	1
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	3	1	5	1
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	4	5	5	5
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	5	1	5	1
RIGHT BANK ANGLE	30	21	10	20	17
ROOTS	1	1	2	1	1
SMALL WOODY DEBRIS	2	1	1	1	1
TERRESTRIAL VEGETATION	1	1	1	1	1
THALWAG DEPTH (WET)	1.2	0.56	0.31	0.32	0.26
THALWAG DISTANCE FROM LEFT BANK (WET)	8	4	4.3	1	2.6
TOTAL WETTED WIDTH	18.5	7	6	13	7.2
TRANSECT NUMBER (ID)	1	2	3	4	5
UNDERCUT BANKS	1	0	1	0	0
UNDERSTORY LEFT BANK NON-WOOD HERBS/GRASSES	0	1	0	1	0
UNDERSTORY LEFT BANK VEG TYPE (0.5-5M)	3	3	3	2	3
UNDERSTORY LEFT BANK WOODY SHRUBS/SAPLINGS	3	3	3	1	3
UNDERSTORY RIGHT BANK NON-WOOD HERBS/GRASSES RIGHT BANK	1	1	0	1	0
UNDERSTORY RIGHT BANK VEG TYPE (0.5-5M)	3	3	3	2	3
UNDERSTORY RIGHT BANK WOODY SHRUBS/SAPLINGS	3	3	3	1	3

	Trib 8					
	26Jan2007	13Apr2007				
Parameter	**Tran 3**	**Trans 1**	**Tran 2**	**Tran 3**	**Tran 4**	**Tran 5**
ALGAE CARPET		1	1	1	1	2
AVERAGE BANK FULL WIDTH		23	22	16	13	10
AVERAGE SEDIMENT DEPTH	0					
AVERAGE SUBSTRATE GRAVEL OR LARGER	60					
BANK FULL THALWAG DEPTH		4.06	2.32	2.3	2.2	2.5
BANK STABILITY (LEFT BANK)	8.5					
BANK STABILITY (RIGHT BANK)	10					
BEDROCK LEDGES	1	1	0	0	1	1
CANOPY (>5M) LEFT BANK VEG TYPE		3	3	3	3	3

Appendix B (cont.): Transect Habitat data collected

	Trib 8					
	26Jan2007	13Apr2007				
Parameter	**Tran 3**	**Trans 1**	**Tran 2**	**Tran 3**	**Tran 4**	**Tran 5**
CANOPY (>5M) RIGHT BANK VEG TYPE		3	3	3	3	3
CANOPY COVER CENTER	20	91	77	88	94	87
CANOPY COVER LEFT BANK	92	96	100	90	98	99
CANOPY COVER RIGHT BANK	100	96	92	93	94	95
CANOPY LEFT BANK BIG DIAM (>0.3M)		3	3	2	3	2
CANOPY LEFT BANK SMALL DIAM (<0.3M)		2	2	3	2	2
CANOPY RIGHT BANK BIG DIAM (>0.3M)		3	3	2	3	3
CANOPY RIGHT BANK SMALL DIAM (<0.3M)		2	2	3	2	2
COBBLE AND BOULDER INSTREAM COVER	1	1	4	1	1	1
DEPTH AT 25 PERCENT OF CHANNEL		0	0	0.42	0.07	0.29
DEPTH AT 50 PERCENT OF CHANNEL		0.92	0.2	0.02	0.33	0.26
DEPTH AT 75 PERCENT OF CHANNEL		1.57	0	0.01	0.35	0
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL		13.5	8.7	3.4	7.3	3.5
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)		5.75	5.5	4	3.25	2.5
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)		11.5	11	8	6.5	5
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)		17.25	16.5	12	9.75	7.5
DOMINANT SUBSTRATE TYPE	4	4	5	4	4	7
GROUND COVER LEFT BANK NON-WOOD HERBS/GRASSES (<0.5M)		1	1	1	1	3
GROUND COVER LEFT BANK STABLE (<0.5M)		0	0	2	0	0
GROUND COVER LEFT BANK WOODY SHRUBS/SAPLINGS (<0.5M)		1	2	2	2	2
GROUND COVER RIGHT BANK NON-WOOD HERBS/GRASSES (<0.5M)		1	1	1	1	1
GROUND COVER RIGHT BANK STABLE (<0.5M)		0	0	0	3	3
GROUND COVER RIGHT BANK WOODY SHRUBS/SAPLINGS (<0.5M)		2	2	2	1	2
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	1	3	1	1	2	2
INSTREAM COVER	50					
LARGE WOODY DEBRIS	0	0	0	1	0	0
LEFT BANK ANGLE		18	21.6	32.8	30.6	55.6
MACROPHYTE OR ALGAE COVER	0	0	0	0	0	0
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)		3	4	3	7	5
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)		3	4	3	5	5
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)		1	4	3	3	5
NATURAL BUFFER LEFT BANK WIDTH	> 20					
NATURAL BUFFER RIGHT BANK WIDTH	> 20					
RIGHT BANK ANGLE		24.5	10.9	19.8	26.7	9.9
ROOTS	1	1	1	1	2	1
SEDIMENT CHARACTERIZATION	1					
SMALL WOODY DEBRIS	1	3	1	3	3	1
SUBMERGED AQUATIC VEGETATION	0					
TERRESTRIAL VEGETATION	1	2	1	1	1	1
THALWAG DEPTH (WET)		1.57	0.51	0.53	0.43	0.42
THALWAG DISTANCE FROM LEFT BANK (WET)		7.5	3.4	1.9	5.3	3.5
TOTAL WETTED WIDTH		8	11	11.5	10	6.7
TRANSECT NUMBER (ID)	3	91	92	93	94	95
UNDERCUT BANKS	0	0	0	1	1	2

Appendix B (cont.): Transect Habitat data collected

	Trib 8					
	26Jan2007	13Apr2007				
Parameter	**Tran 3**	**Trans 1**	**Tran 2**	**Tran 3**	**Tran 4**	**Tran 5**
UNDERSTORY LEFT BANK NON-WOOD HERBS/GRASSES		0	0	0	0	1
UNDERSTORY LEFT BANK VEG TYPE (0.5-5M)		3	3	3	3	3
UNDERSTORY LEFT BANK WOODY SHRUBS/SAPLINGS		3	2	3	3	3
UNDERSTORY RIGHT BANK NON-WOOD HERBS/GRASSES RIGHT BANK		0	0	0	0	0
UNDERSTORY RIGHT BANK VEG TYPE (0.5-5M)		3	3	3	3	3
UNDERSTORY RIGHT BANK WOODY SHRUBS/SAPLINGS		3	3	3	2	2

	Trib 8				
	20Sep2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
ALGAE COVER	0	1	1	1	1
AVERAGE BANK FULL WIDTH	23	21	17	13	10
BANK FULL THALWAG DEPTH	3.05	2.5	3	2.2	2.45
BEDROCK LEDGES	1	0	0	1	1
CANOPY (>5M) LEFT BANK VEG TYPE	3	3	3	3	3
CANOPY (>5M) RIGHT BANK VEG TYPE	3	3	3	3	3
CANOPY COVER CENTER	89	75	83	85	73
CANOPY COVER LEFT BANK	88	85	93	83	94
CANOPY COVER RIGHT BANK	95	84		83	71
CANOPY LEFT BANK BIG DIAM (>0.3M)	3	3	2	2	2
CANOPY LEFT BANK SMALL DIAM (<0.3M)	2	2	3	2	2
CANOPY RIGHT BANK BIG DIAM (>0.3M)	3	3	2	3	2
CANOPY RIGHT BANK SMALL DIAM (<0.3M)	2	2	3	2	2
COBBLE AND BOULDER INSTREAM COVER	1	3	2	1	0
DEPTH AT 25 PERCENT OF CHANNEL	0	0	0	0	0.75
DEPTH AT 50 PERCENT OF CHANNEL	1.38	0.16	0.35	0.38	0.25
DEPTH AT 75 PERCENT OF CHANNEL	0	0.52	0.7	0.38	0
DISTANCE FROM LEFT BANK TO THALWAG AT BANK FULL	12.85	5.3	3	11.3	1.5
DISTANCE TO LEFT BANK (25 PERCENT OF CHANNEL)	5.75	5.25	4.25	3.25	2.5
DISTANCE TO LEFT BANK (50 PERCENT OF CHANNEL)	11.5	10.5	8.5	6.5	5
DISTANCE TO LEFT BANK (75 PERCENT OF CHANNEL)	17.25	15.75	12.75	9.75	7.5
DOMINANT SUBSTRATE TYPE	4	5	4	7	7
GROUND COVER LEFT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	2
GROUND COVER LEFT BANK STABLE (<0.5M)	0	0	0	0	0
GROUND COVER LEFT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	2	1	2	3	3
GROUND COVER RIGHT BANK NON-WOOD HERBS/GRASSES (<0.5M)	1	1	1	1	1
GROUND COVER RIGHT BANK STABLE (<0.5M)	0	0	2	3	3
GROUND COVER RIGHT BANK WOODY SHRUBS/SAPLINGS (<0.5M)	3	2	1	1	2
HABITAT TYPE (1=RIFFLE,2=RUN,3=POOL)	3	1	1	2	2
LARGE WOODY DEBRIS	0	0	2	0	0
LEFT BANK ANGLE	18	23	35	21	25.5
MACROPHYTE OR ALGAE COVER	0	0	0	0	0
MEAS 1 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	3	3	3	7	5
MEAS 2 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	5	4	3	5	5
MEAS 3 DOM SIZE CLASS (1-7;SILT,LEAF,GRAV,COBB,BEDR,BOUL,SAND)	1	4	3	5	5

Appendix B (cont.): Transect Habitat data collected

	Trib 8				
	20Sep2007				
Parameter	**Transect 1**	**Transect 2**	**Transect 3**	**Transect 4**	**Transect 5**
RIGHT BANK ANGLE	24.7	9	36	40	25.1
ROOTS	1	1	1	1	1
SMALL WOODY DEBRIS	3	1	1	2	1
TERRESTRIAL VEGETATION	1	1	1	1	1
THALWAG DEPTH (WET)	1.42	0.53	0.89	0.43	0.1
THALWAG DISTANCE FROM LEFT BANK (WET)	6.25	2.3	0.6	6.3	0.5
TOTAL WETTED WIDTH	9.8	8.5	11.8	7.5	4.3
TRANSECT NUMBER (ID)	1	2	3	4	5
UNDERCUT BANKS	0	0	1	1	2
UNDERSTORY LEFT BANK NON-WOOD HERBS/GRASSES	0	0	0	1	1
UNDERSTORY LEFT BANK VEG TYPE (0.5-5M)	3	3	3	3	3
UNDERSTORY LEFT BANK WOODY SHRUBS/SAPLINGS	3	3	2	3	3
UNDERSTORY RIGHT BANK NON-WOOD HERBS/GRASSES RIGHT BANK	1	0	0	0	0
UNDERSTORY RIGHT BANK VEG TYPE (0.5-5M)	3	3	3	3	3
UNDERSTORY RIGHT BANK WOODY SHRUBS/SAPLINGS	3	3	2	2	2

Appendix C: Riffle Habitat data collected

Parameter	Above WTP4 22Feb2007	Below WTP4 07Feb2007	Trib 8
AVERAGE BANK FULL WIDTH	8.4	10.8	
BEDROCK	29	10	
BOULDER (>180MM)	0	4	
CANOPY COVER CENTER		49	
CANOPY COVER DOWNSTREAM	73	87	
CANOPY COVER UPSTREAM	84	54	
CHANNEL FLOW STATUS	3		
COARSE GRAVEL (<22.6MM)	9	6	
COARSE GRAVEL (<32MM)	8	9	
FINE GRAVEL (<8MM)	10	3	
LARGE COBBLE (<180MM)	2	4	
MEDIUM GRAVEL (<11MM)	3	2	
MEDIUM GRAVEL (<16MM)	2	7	
RIFFLE AREA	261.8	511.75	
RIFFLE LENGTH	44	89	
SAND (< 2MM)	3		
SILT (<1/16MM)	12	8	
SMALL COBBLE (<128MM)		7	
SMALL COBBLE (<90MM)	9	12	
VERY COARSE GRAVEL (<45MM)	9	10	
VERY COARSE GRAVEL (<64MM)	4	15	
VERY FINE GRAVEL (< 2.8 MM)	0	6	
VERY FINE GRAVEL (<4MM)	2	1	
WETTED WIDTH (DOWNSTREAM)	4.7	6.2	
WETTED WIDTH (UPSTREAM)	7.2	5.3	

Parameter	Above WTP4 11Apr2007	Below WTP4 12Apr2007	Trib 8 13Apr2007
AVERAGE BANK FULL WIDTH	14	22.33	18.67
BIOLOGICAL UNITS (POOLS)	3	8	1
BIOLOGICAL UNITS (RIFFLES)	5	4	3
BIOLOGICAL UNITS (RUNS)	5	11	3
BOULDER (>180MM)	11	76	74
COARSE GRAVEL (<22.6MM)	7	3	6
COARSE GRAVEL (<32MM)	4	6	12
FINE GRAVEL (<5.6 MM)	3		
FINE GRAVEL (<8MM)	7	10	1
LARGE COBBLE (<180MM)	4		5
LENGTH OF REACH	365	1235	408
MEDIUM GRAVEL (<11MM)	3	2	7
MEDIUM GRAVEL (<16MM)	5	3	13
NUMBER OF TRANSECTS	5	5	5
RIFFLE AREA	172.5	1120	1287.5
RIFFLE LENGTH	30	160	103
SAND (< 2MM)	3	6	3
SILT (<1/16MM)	34	76	11

Appendix C (cont.): Riffle Habitat data collected

Parameter	Above WTP4 11Apr2007	Below WTP4 12Apr2007	Trib 8 13Apr2007
SMALL COBBLE (<128MM)	1	5	9
SMALL COBBLE (<90MM)	1	6	9
TRANSECTS - DISTANCE BETWEEN (TRANSECT INTERVAL)	91.25	308.75	102
VERY COARSE GRAVEL (<45MM)	6	4	16
VERY COARSE GRAVEL (<64MM)	8	7	21
VERY FINE GRAVEL (< 2.8 MM)		2	8
VERY FINE GRAVEL (<4MM)	7	2	5
WETTED WIDTH (DOWNSTREAM)	4.5	7	10
WETTED WIDTH (UPSTREAM)	7	7	15
Parameter	**Above WTP4 25Oct2007**	**Below WTP4 25Oct2007**	**Trib 8 25Oct2007**
BOULDER (>180MM)	16	25	18
COARSE GRAVEL (<22.6MM)	10	7	8
COARSE GRAVEL (<32MM)	12	8	9
FINE GRAVEL (<5.6 MM)	2	1	5
FINE GRAVEL (<8MM)	4	2	5
LARGE COBBLE (<180MM)	2		1
MEDIUM GRAVEL (<11MM)	10	1	5
MEDIUM GRAVEL (<16MM)	13	4	8
RIFFLE AREA	253	130	360
RIFFLE LENGTH	43	35	60
SAND (< 2MM)	2	3	4
SMALL COBBLE (<128MM)	3	4	4
SMALL COBBLE (<90MM)	8	14	9
VERY COARSE GRAVEL (<45MM)	10	19	11
VERY COARSE GRAVEL (<64MM)	12	14	10
VERY FINE GRAVEL (< 2.8 MM)		2	1
VERY FINE GRAVEL (<4MM)			3
WETTED WIDTH (DOWNSTREAM)	4.5	3.4	5
WETTED WIDTH (UPSTREAM)	7.25	4	7

Appendix D: All WQ data collected

	Above WTP4	Below WTP4	Trib 8	Above WTP4	Below WTP4	Trib 8
Parameter	**26Jan2007**	**26Jan2007**	**26Jan2007**	**06Feb2007**	**06Feb2007**	**06Feb2007**
AMMONIA AS N				< 0.005	< 0.005	< 0.005
CHLORIDE				21.5	20.3	20.6
CONDUCTIVITY	598.8	600		638.1	596	532.1
DISSOLVED OXYGEN	10.1	9.6		9.94	9.42	10.15
E COLI BACTERIA				2	19	8
FLOW	0.859			1.947	0.9822	0.2858
NITRATE/NITRITE AS N				0.89	0.12	0.39
ORTHOPHOSPHORUS AS P				< 0.003	< 0.003	< 0.003
PH	7.96	7.85		7.93	7.85	7.91
SODIUM				12.1	11.1	11.3
SULFATE				26	23.6	19.5
TOTAL SUSPENDED SOLIDS						
TURBIDITY				0.37	0.44	0.51
WATER TEMPERATURE	12.6	12.97		14.89	13.19	11.63
Parameter	**04Apr2007**	**04Apr2007**	**05Apr2007**	**23Apr2007**	**23Apr2007**	**23Apr2007**
AMMONIA AS N				0.012	0.237	0.008
CHLORIDE				19.4	16.6	16.6
CONDUCTIVITY	601.3	564.6	529	627.8	538.5	533.2
DISSOLVED OXYGEN	8.14	7.6	9.12	7.89	7.19	8.61
E COLI BACTERIA				83	10	27
FLOW	0.6051	1.287	0.6	0.19	0.45	0.29
NITRATE/NITRITE AS N				0.9	0.01	0.5
ORTHOPHOSPHORUS AS P				< 0.003	< 0.003	< 0.003
PH	7.76	7.64	7.75	7.77	7.62	7.88
SODIUM				10.6	9.69	9.51
SULFATE				24.4	20.2	17.7
TOTAL SUSPENDED SOLIDS				0.5	0.3	1
TURBIDITY				1.01	0.43	0.47
WATER TEMPERATURE	17.26	18.86	15.54	18.09	18.87	17.95
Parameter	**13Jun2007**	**13Jun2007**	**13Jun2007**	**06Aug2007**	**06Aug2007**	**06Aug2007**
AMMONIA AS N	0.012	0.013	0.013	0.037	0.038	0.041
CHLORIDE	16.3	13.3	13.7	14.2	12.7	12.4
CONDUCTIVITY	620.1	566	545.1	576	531	501
DISSOLVED OXYGEN	7.24	7.02	8.48	8.5	7.3	8.4
E COLI BACTERIA	91	6	53	170	8	64
FLOW	0.34	1.21	0.4	0.49	1.05	0.6
FLUORIDE				0.128	0.113	0.131
NITRATE/NITRITE AS N	0.43	0.03	0.06	0.14	0.01	0.06
ORTHOPHOSPHORUS AS P	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
PH	7.48	7.55	7.7	7.79	7.61	7.88
SODIUM	9.54	8.91	8.8	10.1	9.06	8.79
SULFATE	19.8	15.8	15.1	17.2	13.7	13.4
TOTAL SUSPENDED SOLIDS	0.2	0.6	0.4	0.1	0.4	0.2
TURBIDITY	0.38	1.26	1.56	0.42	0.8	0.51
WATER TEMPERATURE	21.26	24.51	21.76	23.92	26.8	25.25

Appendix D (cont.): All WQ data collected

	Above WTP4	Below WTP4	Trib 8	Above WTP4	Below WTP4	Trib 8
Parameter	**14Aug2007**	**14Aug2007**	**14Aug2007**	**20Sep2007**	**20Sep2007**	**20Sep2007**
CONDUCTIVITY	620.8	556.6	515.7	598	552	498
DISSOLVED OXYGEN	6.91	6.95	7.36	7.91	6.7	8.22
FLOW	0.2502	0.715	0.2485	0.32	0.41	0.84
PH	7.73	7.6	7.93	7.92	7.66	7.99
TURBIDITY				0.58		0.63
WATER TEMPERATURE	22.51	26.16	25.33	23.71	25.75	24.49
Parameter	**25Oct2007**	**25Oct2007**	**25Oct2007**	**19Dec2007**	**19Dec2007**	**19Dec2007**
AMMONIA AS N	0.058	0.058	0.06	< 0.005	0.013	0.012
CHLORIDE	18	16.2	16.3	17.8	16.8	15.7
CONDUCTIVITY	647.2	586.9	532.2	644.6	566.6	520
DISSOLVED OXYGEN	7.64	6.59	8.89	8.15	7.67	9.45
E COLI BACTERIA	1050	51	5	12	13	2
FLOW	0.04	0.08	0.14	0.05	0.17	0.06
FLUORIDE	0.105	0.092	0.114	0.084	0.083	0.099
NITRATE/NITRITE AS N	0.95	0.02	0.1	1.47	0.03	0.22
ORTHOPHOSPHORUS AS P	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
PH	7.6	7.59	7.88	7.46	7.58	7.94
SODIUM				10.9	10	9.11
SULFATE	22.5	14.6	15.9	25.5	17.3	16.3
TOTAL SUSPENDED SOLIDS	0.4	0.4	0.5	< 0.1	0.1	< 0.1
TURBIDITY	0.62	0.32	0.32	0.26	0.25	0.19
WATER TEMPERATURE	17.07	18.69	16.88	16.41	15.96	14.64
Parameter	**24Mar2008**	**24Mar2008**	**24Mar2008**			
CONDUCTIVITY	577.6	514.9	513.6			
FLOW	0.35	0.42	0.08			
PH	7.91	7.82	7.92			
WATER TEMPERATURE	14.6	15.99	16.45			

Appendix E: Raw macroinvertebrate taxa count

	Above WTP4	Below WTP4	Trib 8
PARAMETER	4-Apr-07	4-Apr-07	5-Apr-07
MARILIA	1		1
CHIMARRA		48	2
HELICOPSYCHE			1
HYDROPTILA	2		
PHYLLOICUS ORNATUS			3
SURAGINA CONCINNA			1
CAMELOBAETIDIUS	1	1	
FALLCEON	151	48	14
OSTRACODA	2		
SIMULIUM	5	34	4
SMICRIDEA		3	
STENONEMA / MACCAFFERTIUM	21		20
HYDATICUS	7		
ARGIA	1		
ARGIA IMMUNDA		17	3
ARGIA PLANA		5	
ARGIA TRANSLATA		1	
CHEUMATOPSYCHE		13	1
CHIRONOMINAE	13	6	1
LYMNAEIDAE			1
ORTHOCLADIINAE	13	15	9
TANYPODINAE	3	1	3
BEZZIA / PALPOMYIA	2		
CAENIS	11		17
HELISOMA ANCEPS		1	
EUPARYPHUS			1
LIBELLULA			1
OLIGOCHAETA	24		9
PHYSELLA		1	5
AQUARIUS		1	
COLLEMBOLA		1	
TANYTARSINI		1	

Appendix E: (cont.) Raw macroinvertebrate taxa count

PARAMETER	Above WTP4 4-Apr-07	Below WTP4 4-Apr-07	Trib 8 5-Apr-07
EPT/EPT+CHIRONOMIDAE	0.866	0.831	0.819
HILSENHOFF BIOTIC INDEX	4.75	4.27	5.43
NUMBER OF DIPTERA TAXA	4	2	4
NUMBER OF EPHEMEROPTERA TAXA	4	2	3
NUMBER OF EPT TAXA	6	5	8
NUMBER OF INTOLERANT TAXA	7	4	8
NUMBER OF NONINSECT TAXA	2	3	3
NUMBER OF ORGANISMS	258	197	97
NUMBER OF TAXA	14	14	17
PERCENT DOMINANCE (TOP 1 TAXA)	36.43	12.18	17.52
PERCENT DOMINANCE (TOP 3 TAXA)	48.83	34.51	35.05
PERCENT OF TOTAL AS CHIRONOMIDAE	11.24	11.67	13.4
PERCENT OF TOTAL AS COLLECTOR/GATHERER	82.17	25.38	62.88
PERCENT OF TOTAL AS DOMINANT GUILD (FFG)	82.17	61.42	62.88
PERCENT OF TOTAL AS ELMIDAE	0	0	0
PERCENT OF TOTAL AS EPT	72.48	57.36	60.82
PERCENT OF TOTAL AS FILTERERS	13.95	61.42	20.61
PERCENT OF TOTAL AS GRAZERS (PI AND SC)	13.17	25.38	46.39
PERCENT OF TOTAL AS PREDATOR	15.11	23.85	18.55
PERCENT OF TOTAL AS TOLERANT ORGANISMS	0	1.52	5.15
PERCENT OF TRICHOPTERA AS HYDROPSYCHIDAE	0	25	12.5
RATIO OF INTOLERANT TO TOLERANT ORGANISMS	2.79	1.38	0.9
TCEQ QUALITATIVE AQUATIC LIFE USE SCORE	22	28	26
TCEQ QUANTITATIVE AQUATIC LIFE USE SCORE	29	33	33
MARILIA	2		
CHIMARRA	17	11	21
HELICOPSYCHE			4
HYDROPTILA		15	
MICROCYLLOEPUS PUSILLUS		2	
PHYLLOICUS ORNATUS	8		
POLYCENTROPUS / CERNOTINA	1		
SURAGINA CONCINNA	2	7	8
XIPHOCENTRON	2		3
CAMELOBAETIDIUS		9	4
FALLCEON	50	116	9
HYDROPTILIDAE	3		
MAYATRICHIA	2		
OCHROTRICHIA			2
OSTRACODA	1		
PERITHEMIS		1	
SIMULIUM	1	7	7
STENONEMA / MACCAFFERTIUM	4		
TRICHOPTERA (CADDISFLY)		4	
CERATOPOGONIDAE	1		
DASYHELEA	1		
ARGIA	67	115	11
BRECHMORHOGA MENDAX	2	11	8
CHEUMATOPSYCHE	56	82	27
CHIRONOMINAE	77	38	
HETAERINA	1	8	

Appendix E: (cont.) Raw macroinvertebrate taxa count

	Above WTP4	Below WTP4	Trib 8
PARAMETER	4-Apr-07	4-Apr-07	5-Apr-07
ORTHOCLADIINAE	1		
RHAGOVELIA		1	
TANYPODINAE	26		1
CALOPARYPHUS	1		20
CULICOIDES			2
STENELMIS		1	
DUGESIA TIGRINA	2	5	8
EUPARYPHUS			1
HYALELLA		14	
OLIGOCHAETA	3	3	1
TIPULA	1		
PHYSELLA	13		
EPT/EPT+CHIRONOMIDAE	0.582	0.862	0.986
HILSENHOFF BIOTIC INDEX	5.65	5.6	5.06
NUMBER OF DIPTERA TAXA	7	3	6
NUMBER OF EPHEMEROPTERA TAXA	2	2	2
NUMBER OF EPT TAXA	10	6	7
NUMBER OF INTOLERANT TAXA	11	8	7
NUMBER OF NONINSECT TAXA	5	4	3
NUMBER OF ORGANISMS	348	451	139
NUMBER OF TAXA	26	20	18
PERCENT DOMINANCE (TOP 1 TAXA)	17.52	12.86	11.51
PERCENT DOMINANCE (TOP 3 TAXA)	38.79	32.81	32.37
PERCENT OF TOTAL AS CHIRONOMIDAE	29.88	8.42	0.71
PERCENT OF TOTAL AS COLLECTOR/GATHERER	19.54	34.14	33.81
PERCENT OF TOTAL AS DOMINANT GUILD (FFG)	52.29	42.35	42.44
PERCENT OF TOTAL AS ELMIDAE	0	0.66	0
PERCENT OF TOTAL AS EPT	41.66	52.54	50.35
PERCENT OF TOTAL AS FILTERERS	52.29	31.48	42.44
PERCENT OF TOTAL AS GRAZERS (PI AND SC)	21.26	30.59	10.07
PERCENT OF TOTAL AS PREDATOR	52.01	42.35	28.77
PERCENT OF TOTAL AS TOLERANT ORGANISMS	3.73	0	0
PERCENT OF TRICHOPTERA AS HYDROPSYCHIDAE	61.53	73.21	47.36
RATIO OF INTOLERANT TO TOLERANT ORGANISMS	0.18	0.2	0.6
TCEQ QUALITATIVE AQUATIC LIFE USE SCORE	27	26	27
TCEQ QUANTITATIVE AQUATIC LIFE USE SCORE	35	33	29

Appendix E: (cont.) Raw macroinvertebrate taxa count

	Above WTP4	Below WTP4	Trib 8	Above Trib 7
PARAMETER	24-Mar-08	24-Mar-08	24-Mar-08	24-Mar-08
MARILIA	8	1		2
PERLESTA				1
CHIMARRA	1	17	47	
HYDROPTILA	5	2	1	
MICROCYLLOEPUS PUSILLUS		1		
PHYLLOICUS ORNATUS	1	1	1	1
POLYCENTROPUS / CERNOTINA		4		1
SURAGINA CONCINNA	18	13	5	14
XIPHOCENTRON	5		3	
FALLCEON	24	18	12	19
OSTRACODA	8			
PSEPHENUS				25
SIMULIUM		8	1	
STENONEMA / MACCAFFERTIUM			4	1
CALOPTERYGIDAE				1
LEPTOCERIDAE				2
TRICORYTHODES				1
ARGIA	24	92	55	12
BRECHMORHOGA MENDAX		1	8	4
CHEUMATOPSYCHE	7	43	30	
CHIRONOMIDAE	27	41	10	13
RHAGOVELIA	1	2	4	1
TANYPODINAE	1	9		3
BEZZIA / PALPOMYIA	1	2		6
CAENIS			1	2
STENELMIS		10	1	1
DUGESIA TIGRINA	10	11	2	3
EUPARYPHUS			2	
HYALELLA		4		1
OLIGOCHAETA		8		5
PHYSELLA	1		1	
PSYCHODIDAE				1

Appendix E: (cont.) Raw macroinvertebrate taxa count

	Above WTP4	Below WTP4	Trib 8	Above Trib 7
PARAMETER	24-Mar-08	24-Mar-08	24-Mar-08	24-Mar-08
EPT/EPT+CHIRONOMIDAE	0.646	0.632	0.908	0.644
HILSENHOFF BIOTIC INDEX	4.68	5.5	4.71	4.9
NUMBER OF DIPTERA TAXA	3	4	4	4
NUMBER OF EPHEMEROPTERA TAXA	1	1	3	4
NUMBER OF EPT TAXA	7	7	8	9
NUMBER OF INTOLERANT TAXA	8	9	8	8
NUMBER OF NONINSECT TAXA	4	4	2	3
NUMBER OF ORGANISMS	144	293	188	119
NUMBER OF TAXA	16	20	18	22
PERCENT DOMINANCE (TOP 1 TAXA)	10.41	14.33	16.48	11.76
PERCENT DOMINANCE (TOP 3 TAXA)	29.86	31.74	38.82	27.73
PERCENT OF TOTAL AS CHIRONOMIDAE	19.44	17.06	5.31	13.44
PERCENT OF TOTAL AS COLLECTOR/GATHERER	29.86	18.77	11.7	33.61
PERCENT OF TOTAL AS DOMINANT GUILD (FFG)	58.33	61.09	48.4	50.42
PERCENT OF TOTAL AS ELMIDAE	0	4.09	0.53	0.84
PERCENT OF TOTAL AS EPT	35.41	29.35	52.65	24.36
PERCENT OF TOTAL AS FILTERERS	34.02	41.63	48.4	14.28
PERCENT OF TOTAL AS GRAZERS (PI AND SC)	20.83	10.92	11.7	40.33
PERCENT OF TOTAL AS PREDATOR	58.33	61.09	44.68	50.42
PERCENT OF TOTAL AS TOLERANT ORGANISMS	0.69	0	0.53	0.84
PERCENT OF TRICHOPTERA AS HYDROPSYCHIDAE	25.92	63.23	36.58	0
RATIO OF INTOLERANT TO TOLERANT ORGANISMS	0.94	0.29	0.64	1.28
TCEQ QUALITATIVE AQUATIC LIFE USE SCORE	26	28	29	25
TCEQ QUANTITATIVE AQUATIC LIFE USE SCORE	33	29	25	29

Franklin Pond

	FR Pond Tr 3	FR Pond Tr 2	FR Pond Tr 1
PARAMETER	27-Sep-07	27-Sep-07	27-Sep-07
CALLIBAETIS	2		3
COPEPODA	3	2	2
OSTRACODA	11	2	2
PERITHEMIS			2
ANAX	2	1	
BAETIDAE	1		
CELINA	1		1
CERATOPOGONIDAE	1		
COLEOPTERA		12	3
CYBISTER	2		
DYTISCIDAE	1	2	
ERYTHEMIS	27	1	7
GERRIS			1
THERMONECTUS			1
EPITHECA PRINCEPS	9		1
ARGIA	10	4	14
CHIRONOMINAE	20	7	20
ENALLAGMA	4	4	5
LIMONIA			1

Appendix E: (cont.) Raw macroinvertebrate taxa count

	FR Pond Tr 3	FR Pond Tr 2	FR Pond Tr 1
PARAMETER	27-Sep-07	27-Sep-07	27-Sep-07
ORTHOCLADIINAE		1	
PLANORBIDAE	16		
TANYPODINAE	35	14	13
BEZZIA / PALPOMYIA		2	1
CAENIS	2	9	14
CALOPARYPHUS	1		
CHRYSOPS	6		
CULICOIDES	1		
CYPHON		2	
HELISOMA ANCEPS	12	2	8
PELOCORIS	1		
CULICIDAE			1
DAPHNIIDAE	4	1	
HIRUDINEA	4		
HYALELLA	80	28	167
HYDROPHILUS	1		
LIBELLULA	3	1	5
OLIGOCHAETA	23	1	
PELTODYTES	1		
COENAGRIONIDAE			3
COPELATUS		1	1
ISCHNURA	4	3	10
LIBELLULIDAE	1		
PHYSELLA	6	8	20
BELOSTOMA	1		3
LACCOPHILUS		1	
TROPISTERNUS	1		
ANISOPTERA			2
CAMBARIDAE	2		3
DYTHEMIS	1		
TRAMEA	1		1
COPEPODA			1
ERYTHEMIS		1	1
CHIRONOMINAE		10	66
TANYPODINAE		32	3
CAENIS		2	
HELISOMA ANCEPS		2	
HYALELLA		6	2
OLIGOCHAETA		9	13
COENAGRIONIDAE			1
PHYSELLA		1	1
CULEX		1	

Appendix E: (cont.) Raw macroinvertebrate taxa count

	FR Pond Tr 3	FR Pond Tr 2	FR Pond Tr 1
PARAMETER	27-Sep-07	27-Sep-07	27-Sep-07
EPT/EPT+CHIRONOMIDAE	0.083	0.175	0.143
HILSENHOFF BIOTIC INDEX	6.69	6.73	7.1
NUMBER OF DIPTERA TAXA	6	9	6
NUMBER OF EPHEMEROPTERA TAXA	3	1	2
NUMBER OF EPT TAXA	3	1	2
NUMBER OF INTOLERANT TAXA	3	5	6
NUMBER OF NONINSECT TAXA	11	11	8
NUMBER OF ORGANISMS	345	278	441
NUMBER OF TAXA	43	42	38
PERCENT DOMINANCE (TOP 1 TAXA)	12.17	11.51	24.03
PERCENT DOMINANCE (TOP 3 TAXA)	28.69	28.41	42.85
PERCENT OF TOTAL AS CHIRONOMIDAE	15.94	23.74	23.12
PERCENT OF TOTAL AS COLLECTOR/GATHERER	36.23	37.05	47.16
PERCENT OF TOTAL AS DOMINANT GUILD (FFG)	45.5	57.19	47.16
PERCENT OF TOTAL AS ELMIDAE	0	0	0
PERCENT OF TOTAL AS EPT	1.44	5.03	3.85
PERCENT OF TOTAL AS FILTERERS	20.28	25.17	23.8
PERCENT OF TOTAL AS GRAZERS (PI AND SC)	11.59	25.53	11.11
PERCENT OF TOTAL AS PREDATOR	45.5	57.19	41.04
PERCENT OF TOTAL AS TOLERANT ORGANISMS	3.76	10.43	9.29
PERCENT OF TRICHOPTERA AS HYDROPSYCHIDAE	0	0	0
RATIO OF INTOLERANT TO TOLERANT ORGANISMS	0.24	0.26	0.08
TCEQ QUALITATIVE AQUATIC LIFE USE SCORE	24	22	21
TCEQ QUANTITATIVE AQUATIC LIFE USE SCORE	29	33	27

Appendix F: Raw diatom taxa count

	Above WTP4	Below WTP4	Trib 8
PARAMETER	4-Apr-07	4-Apr-07	5-Apr-07
BRACHYSIRA NEOEXILIS (SERIANS)		4	
CYMBELLA CYMBIFORMIS			18
ENCYONEMA DELICATULA			58
EUCOCCONEIS FLEXELLA			6
FRAGILARIA ACUS		4	
ACHNANTHES BIASOLETTIANA		22	96
ACHNANTHIDIUM MINUTISSIMUM	122	359	58
AMPHORA MONTANA			2
AMPHORA PEDICULUS	18		
BRACHYSIRA VITREA		4	1
CALONEIS SCHUMANNIANA	3		
CYMBELLA LAEVIS			6
DENTICULA KUETZINGII	197	14	79
DIPLONEIS PUELLA		2	
ENCYONEMA EVERGLADIANUM			30
ENCYONEMA SILESIACUM		10	
ENCYONOPSIS MICROCEPHALA		1	25
EUNOTIA BILUNARIS	8		
EUNOTIA PECTINALIS		31	4
FRAGILARIA CAPUCINA		7	24
GOMPHONEMA ACUMINATUM			16
GOMPHONEMA AFFINE	10		25
GOMPHONEMA ANGUSTUM			2
GOMPHONEMA RHOMBICUM		20	26
MERIDION CIRCULARE	4		
NAVICULA CRYPTOCEPHALA	1		
NAVICULA CRYPTOTENELLA	2		
NAVICULA KOTSCHYI	3		
NAVICULA STROEMII	6		2
ACHNANTHES LANCEOLATA	2		
DIPLONEIS PSEUDOVALIS	2		
GOMPHONEMA ANGUSTATUM		6	
NAVICULA VENETA	7		
NITZSCHIA AMPHIBIA		2	
SURIRELLA ANGUSTA	1		
SYNEDRA ULNA	8	14	16
GOMPHONEMA PARVULUM	20		
NAVICULA MINIMA	82		
CYMBELLA RICHNESS			
NUMBER OF ORGANISMS	1	2	5
NUMBER OF TAXA	500	500	500
PERCENT MOTILE TAXA	20	15	20
PERCENT SIMILARITY TO REFERENCE CONDITION	20.4	0.4	0.4
POLLUTION TOLERANCE INDEX	33.767	43.633	49.467
	2.548	2.972	3.134

Appendix F: (cont.) Raw diatom taxa count

	Above WTP4	Below WTP4	Trib 8 ds fence
PARAMETER	14-Aug-07	14-Aug-07	14-Aug-07
ADLAFIA BRYOPHILA		6	
AMPHORA INARIENSIS	12		
BRACHYSIRA NEOEXILIS (SERIANS)	2	14	
DIPLONEIS OBLONGELLA	4		
ENCYONEMA DELICATULA		8	44
ACHNANTHES BIASOLETTIANA	80	161	214
ACHNANTHIDIUM MINUTISSIMUM	44	56	105
AMPHIPLEURA PELLUCIDA		2	
AMPHORA PEDICULUS	4		
BRACHYSIRA VITREA		12	3
CYMBELLA AFFINIS		2	2
CYMBELLA HUSTEDTII	1		
CYMBELLA LAEVIS	16	110	26
DENTICULA KUETZINGII	7		12
DIPLONEIS ELLIPTICA	4		2
ENCYONEMA EVERGLADIANUM		23	12
ENCYONEMA SILESIACUM	3	2	4
ENCYONOPSIS MICROCEPHALA		10	6
EPITHEMIA TURGIDA	2		
EUNOTIA PECTINALIS	6	1	2
FRAGILARIA CAPUCINA	14		
GOMPHONEMA AFFINE	6		1
GOMPHONEMA ANGUSTUM			2
GOMPHONEMA CLAVATUM	2		
GOMPHONEMA RHOMBICUM	3	8	36
NAVICULA CRYPTOCEPHALA		4	
NAVICULA KOTSCHYI	3		
NAVICULA RADIOSA	16		2
NAVICULA STROEMII	9	10	16
NITZSCHIA LINEARIS	1		
RHOICOSPHENIA CURVATA	2		
STAURONEIS SMITHII	2		
CAMPYLODISCUS HIBERNICUS	3		2
GOMPHONEMA ANGUSTATUM	2		
NAVICULA SCHROETERII	14		
NAVICULA VENETA	2		
NITZSCHIA AMPHIBIA	16		2
NITZSCHIA AMPHIBIOIDES	20		
SYNEDRA ULNA	167	61	1
NAVICULA MINIMA		4	
NITZSCHIA PALEA			2

Appendix F: (cont.) Raw diatom taxa count

	Above WTP4	Below WTP4	Trib 8 ds fence
CYMBELLA RICHNESS	3	7	6
NUMBER OF ORGANISMS	500	500	500
NUMBER OF TAXA	32	19	23
PERCENT MOTILE TAXA	16.2	4.8	4.4
PERCENT SIMILARITY TO REFERENCE CONDITION	37.552	38.676	42.657
POLLUTION TOLERANCE INDEX	2.559	2.917	3.071

Appendix G: Sediment chemistry

PARAMETER	3974 Above WTP4	4041 above franklin	4042 u/s trib 8	4043 d/s trib 8	UNIT
Texture Gravel	4.42	44.5	34.5	18.7	(%) Percent
2_4_5-Tp (Silvex)	0.8	0.5	0.6	0.6	UG/KG
Demeton	15	9.6	11	11.6	UG/KG
Ammonia As N	28.5	4.32	0.54	27.1	MG/KG
Organic Carbon	58500	75900	78200	88300	MG/KG
Diazinon	5.4	3.5	4	4.2	UG/KG
Dicamba (Banvel)	1.1	0.7	0.8	0.9	UG/KG
Dinoseb	0.6	0.4	0.5	0.5	UG/KG
Azinphos Methyl (Guthion)	7.3	4.7	5.3	5.6	UG/KG
Demeton-S	8.4	5.4	6.2	6.5	UG/KG
Demeton-O	9	5.7	6.6	6.9	UG/KG
Pentachlorophenol	0.6	0.4	0.5	0.5	UG/KG
2_4-Dichlorophenoxyacetic Acid	0.6	0.4	0.4	0.5	UG/KG
2_4_5-Trichlorophenoxyacetic Acid	0.6	0.4	0.5	0.5	UG/KG
Methyl Parathion	7.3	4.7	5.3	5.7	UG/KG
Percent Moisture	48	19	29	33	(%) Percent
Texture Clay (<0.002mm)	29.6	20.2	14.1	18.5	(%) Percent
Texture Sand (0.05-2.0mm)	41.7	23.3	41.3	54.7	(%) Percent
Texture Silt (0.002-0.05mm)	24.3	12	10	8	(%) Percent