APPENDIX I
SEDIMENT & HABITAT ASSESSMENT METHODS AND DATA

This section provides a brief description of field methods used to collect morphological, habitat, and in-stream sediment data. The primary objectives of the data collection were to verify the sediment impairment status for the 303(d) Listed water bodies within the Shields TPA and gather data to evaluate conditions within the watershed relative to sediment targets that can continue to be monitored after TMDL implementation. Because of the amount of data collected, data tables included in this appendix are limited to parameters used for TMDL development. Data collected for other parameters are available by request from DEQ.

I.1 Sampling Reach Selection

Sediment and habitat sampling occurred within representative stream reaches based on the results of an aerial assessment (**Appendix A, Map A-14**).

I.2 Monitoring Base Parameters

The base parameters for sediment and habitat are a suite of measures of the stream morphology, riparian structural composition, substrate composition, and habitat that are described in the sections that follow. Sampling methods and protocols used in field data collection followed established methods, but were slightly modified in some cases. Sampling reach length for base parameter data collection was based on the bankfull width of the channel (**Table I-1**).

Table I-1. Base parameter reach lengths based on bankfull channel width.

Bankfull channel width	Reach length
<20 feet	800 feet
20 – 29.9 feet	1,000 feet
30-39.9	1,500 feet
40-49.9	2,000 feet
50-74.9 feet	3,000 feet
>75 feet	4,000 feet
<20 feet	800 feet

I.2.1 Cross Sections

Cross section measurements were collected using standard methods as described by Rosgen (1996). Cross sections were measured at five riffle locations along each sampling reach. Channel morphology measures from each cross section included channel bankfull width, maximum bankfull depth, and floodprone width. Cross section measurements are used to calculate cross sectional area, mean bankfull depth, channel entrenchment, and width-to-depth ratio. Cross section measurements were also used to determine the Rosgen channel type of each reach.

I.2.2. Riparian Line Transect

The riparian assessment was based on methods described by Winward (2000). At each of the five cross section stations, crews measured riparian cover types across the floodprone width. If the floodprone width extended greater than 100 feet from each bank, riparian vegetation was measured for 100 feet from the bankfull channel margin on both left and right banks. Cover types included bare ground, herbaceous, and woody vegetation. Vegetation zones included ground cover (<0.5 meters), understory (0.5 - 5 meters), and overstory (>5 meters).

I.2.3 Morphology/Habitat Profile

This portion of the base parameter field assessment involved collecting data on channel morphology features (i.e. pools, run, riffles, glides), habitat unit lengths, and large woody debris locations, aggregations, and diameters. These measurements allow calculation of pool density, pool/riffle ratios, residual pool depths and volumes, and large woody debris density. Measurements were collected as described by Rosgen (1996) and Kershner et al. (2002). Channel habitat measures included:

- Habitat unit lengths
- Pool widths
- Maximum pool depth
- Pool crest depth
- Presence of undercut banks
- Large woody debris count
- Large woody debris aggregate count

I.2.4 Pebble Counts

Pebble counts were used to collect data on sediment gradations from representative riffles, pools, and bars for each assessment site. A modified Wolman pebble count (Wolman 1954) was used to determine particle size distribution within riffles, runs, and pools. Field personnel collected sediment particle size information using a gravelometer from 100 locations representative of each morphologic type. Particles were measured along their intermediate axis (B-axis, **Figure I-1)**. The results were then used to determine the cumulative particle size distribution, including the percent <2mm and <6mm representative of riffles, bars, and pools from each assessment site.

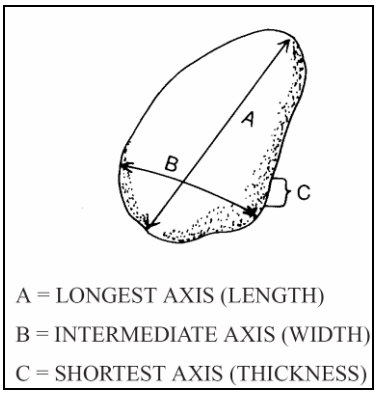

Figure I-1. Intermediate axis measurement (from Harrelson et al. 1994).

I.2.5 Percent Fines in Pool Tails

Bed morphology features referred to as "glides" or "pool tail-outs" are typically associated with the early life stage habitat of salmonids. The amount of fine sediment accumulation upon the surface of these bed features was evaluated using the 49-point grid toss method**.** The metal lattice, excluding the perimeter of the grid, forms a total of 49 interior grid intersections, and the grid intersections are approximately 6mm (**Figure I-2**). Within each pool tail, the metal grid was randomly tossed four times. After each toss, the grid intersections were evaluated in order to count how many grid intersections had sediment particles directly below them that were smaller than the (6 mm) intersections of the grid. The total number of evaluations varied depending on the number of pool tails per assessment reach.

Figure I-2. Grid design used for grid tosses to determine percent fines in pool tails.

I.3 Raw Data

The following tables contain raw data collected during sampling in 2004.

Table I-2. Cross section measurements and calculations.

Reach Name	Transect	Bankfull Width (ft)	Max Bankfull Depth (ft)	Mean Bankfull Depth (ft)	W/D Ratio	Entrenchment Ratio	Floodprone Width (ft)
SR02	A	13.0	1.1	0.8	17.3	3.1	40.0
SR02	B	14.0	1.5	0.7	19.2	1.8	25.5
SR02	C	18.5	1.3	1.0	17.7	2.4	43.5
SR02	D	21.7	1.1	0.8	26.9	2.2	48.7
SR02	E	16.5	1.1	0.5	34.0	2.5	40.5
SR02R	A	14.0	2.1	1.2	11.2	2.9	40.0
SR02R	B	13.8	1.6	1.1	12.7	2.1	29.2
SR02R	C	19.0	1.8	1.2	15.4	5.3	100.0
SR02R	D	13.8	1.5	1.0	13.8	2.4	32.8
SR02R	E	16.3	1.0	0.7	24.8	2.6	42.2
SR04	A	29.0	2.0	1.5	19.8	4.4	129.0
SR04	B	15.5	2.5	1.3	12.2	7.6	117.5
SR04	C	30.4	1.7	0.9	33.3	3.3	100.0
SR04	D	36.0	1.3	1.1	33.9	1.1	40.0
SR04	E	37.0	1.7	0.6	65.6	1.1	41.0
SR07	A	30.0	1.7	1.2	25.9	2.3	69.7
SR07	B	35.5	1.7	1.0	34.4	2.8	100.0
SR07	C	43.0	2.0	1.2	34.8	2.3	100.0
SR07	D	39.2	1.6	1.0	39.4	2.6	100.0
SR07	E	21.3	1.4	1.1	18.8	2.8	59.3
SR10	A	34.9	2.9	1.8	19.4	2.9	100.0
SR10	B	72.0	2.2	0.7	99.0	2.8	200.0
SR10	C	63.4	1.4	0.9	74.1	3.2	200.0
SR10	D	50.0	1.9	1.3	39.2	4.0	200.0
SR10	E	33.0	1.8	1.4	23.1	3.5	117.0
SR11	A	39.8	1.9	1.3	30.9	4.7	189.0
SR11	B	47.0	2.9	1.5	31.3	1.5	70.5
SR11	C	53.5	4.6	1.5	35.1	1.4	77.5
SR11	D	33.5	1.9	1.3	26.0	3.1	102.5
SR11	E	46.0	1.6	0.9	49.9	1.3	58.0
SR14	A	48.0	2.2	1.7	28.7	2.1	100.0
SR14	B	52.0	1.8	1.0	54.3	1.1	56.7
SR14	C	50.0	1.5	1.1	46.5	2.0	100.0
SR14	D	54.0	1.4	0.9	61.1	1.9	100.0
SR14	E	46.2	1.9	1.1	40.4	2.2	100.0
SR17	A	63.8	1.9	1.0	60.9	1.6	100.0
SR17	B	62.6	2.5	1.1	55.3	1.5	96.0
SR17	C	69.0	2.6	1.5	47.0	1.4	95.2
SR17	D	113.0	2.5	1.4	81.5	0.9	100.0

Table I-2. Cross section measurements and calculations.

Reach Name	Transect	Bankfull Width (ft)	Max Bankfull Depth (ft)	Mean Bankfull Depth (ft)	W/D Ratio	Entrenchment Ratio	Floodprone Width (ft)
SR17	E	64.0	2.4	1.6	41.0	2.6	166.0
SR20	A	53.5	3.1	1.5	35.2	1.9	100.0
SR20	B	75.0	3.3	1.7	42.9	1.1	85.8
SR20	C	74.3	2.4	1.4	51.7	1.2	85.6
SR20	D	82.0	2.4	1.9	43.1	1.1	88.9
SR20	E	95.4	2.4	1.6	59.8	1.0	100.0
SR22	A	69.5	2.9	2.3	30.6	2.4	169.5
SR23	B	66.0	2.4	1.6	40.2	2.5	166.0
SR24	C	64.0	2.3	1.7	36.8	1.6	105.0
SR25	D	76.0	3.6	1.5	49.5	2.6	200.0
SR26	E	92.0	2.1	1.3	70.8	1.2	112.0
PT05	A	6.8	1.8	1.2	5.6	10.9	74.0
PT05	B	27.5	2.0	1.4	19.9	1.9	53.5
PT05	C	7.0	1.6	1.2	5.9	19.3	135.0
PT05	D	5.0	1.4	1.2	4.3	40.0	200.0
PT05	E	6.0	1.8	1.1	5.2	2.8	17.0
PT07	A	11.0	2.2	1.7	6.4	18.2	200.0
PT07	B	15.0	1.7	1.4	10.8	13.3	200.0
PT07	C	5.5	1.6	1.1	4.8	21.4	117.7
PT07	D	16.0	2.1	1.3	11.9	12.5	200.0
PT07	E	7.0	1.8	1.2	5.6	28.6	200.0
PT08	A	13.5	1.4	1.0	13.3	2.6	35.0
PT08	B	14.0	1.5	1.3	10.7	1.7	24.0
PT08	C	14.0	1.7	1.3	10.7	1.9	27.0
PT08	D	13.5	1.8	1.4	9.7	1.1	15.0
PT08	E	13.0	1.6	1.4	9.6	2.2	28.0
PT08R	A	13.9	1.4	1.0	13.7	2.0	28.4
PT08R	B	17	1.4	1.1	15.7	0.8	14.4
PT08R	C	12.7	1.4	1.3	10.1	1.4	18.2
PT08R	D	12.3	1.3	1.2	10.5	1.2	14.5
PT08R	E	12.8	1.5	1.2	11.1	2.2	28.6
AC04	A	4	0.9	0.6	6.6	1.6	6.5
AC04	B	5.1	0.7	0.4	14.3	3.5	19.4
AC04	C	7	1.9	1.1	6.4	11.3	79
AC04	D	6.3	1.3	0.8	7.8	11.2	70.3
AC04	E	6	1.4	1.0	5.9	10.6	63.5
AC07	A	6.4	2.3	1.5	4.2	15.6	100
AC07	B	10.8	3.0	1.7	6.5	9.3	100
AC07	C	11.9	2.6	1.2	9.6	8.4	100
AC07	D	6.2	2.2	1.5	4.1	16.1	100
AC07	E	7.3	2.0	1.3	5.6	5.5	40.3

Table I-3. Percent fines in riffles.

Reach	% <2mm	% <6mm
SR02R	27	32
SR04	10	14
SR07	7	10
SR10	3	4
SR11	1	1
SR14	0	0
SR17	5	13
SR20	2	2
SR22	0	3
PT07	27	32
PT08	29	30
PT08R	79	87
AC07	22	56

Table I-4. Pool grid toss results. ND = no data

Site	Toss1	Toss2	Toss3	Toss4	Total % Fines
SR02	44	45	42	48	91
SR02	42	2	5	49	50
SR02	49	47	49	49	99
SR02	49	43	49	49	97
SR02	47	48	49	46	97
SR02R	23	46	43	47	81
SR02R	41	40	45	37	83
SR02R	49	47	46	39	92
SR02R	49	49	49	49	100
SR02R	47	49	49	46	97
SR02R	49	49	49	48	99
SR02R	48	46	41	49	94
SR02R	38	49	41	40	86
SR02R	49	48	44	49	97
SR04	44	47	35	8	68
SR04	34	26	7	7	38
SR04	12	4	11	7	17
SR04	6	3	7	11	14
SR04	4	13	3	5	13
SR04	0	3	9	15	14
SR04	45	43	6	8	52
SR04	45	39	20	5	56
SR04	3	2	25	30	31
SR04	3	1	0	0	2
SR07	4	7	9	11	16
SR07	48	49	45	46	96
SR07	2	2	1	2	4
SR07	12	5	6	7	15

Table I-4. Pool grid toss results. ND = no data

Site	Toss1	Toss2	Toss3	Toss4	Total % Fines
SR07	3	3	1	6	7
SR07	5	8	9	18	20
SR07	49	42	39	10	71
SR07	41	34	11	9	48
SR07	45	38	36	49	86
SR07	13	18	15	6	27
SR07	5	4	8	10	14
SR10	49	47	47	48	97
SR10	7	43	44	34	65
SR10	4	9	49	8	36
SR10	49	49	49	49	100
SR10	44	47	46	47	94
SR10	9	1	13	49	37
SR10	10	11	10	37	35
SR10	3	4	6	49	32
SR10	7	8	1	1	9
SR11	49	49	49	49	100
SR11	49	36	42	44	87
SR11	49	44	28	14	69
SR11	49	47	45	49	97
SR11	49	45	17	35	74
SR11	41	41	39	36	80
SR11	21	49	47	40	80
SR11	48	42	48	49	95
SR14	49	49	49	49	100
SR14	36	47	49	49	92
SR14	49	49	49	49	100
SR14	33	4	4	16	29
SR14	47	49	49	49	99
SR14	23	11	0	19	27
SR14	40	40	29	27	69
SR14	49	49	10	20	65
SR14	47	48	47	44	95
SR14	45	47	49	49	97
SR14	47	43	42	44	90
SR14	41	10	36	41	65
SR14	43	24	12	20	51
SR17	46	47	42	39	89
SR17	47	43	12	45	75
SR17	49	49	49	49	100
SR17	49	49	42	39	91
SR17	4	45	42	39	66
SR17	30	18	31	40	61
SR17	49	40	49	14	78
SR17	40	31	31	7	56

Table I-4. Pool grid toss results. ND = no data

Site	Toss1	Toss2	Toss3	Toss4	Total % Fines
SR20	6	10	8	15	20
SR20	4	30	16	12	32
SR20	16	16	17	25	38
SR20	0	0	0	8	4
SR20	49	15	16	7	44
SR20	49	40	7	5	52
SR22	10	0	0	0	5
SR22	4	0	0	0	2
SR22	4	6	3	0	7
SR22	7	14	5	49	38
SR22	3	3	5	0	6
SR22	0	3	2	0	3
SR22	2	0	0	0	1
SR22	0	49	7	14	36
PTR05	ND	ND	ND	ND	ND
PTR07	49	49	49	49	100
PTR07	49	49	49	49	100
PTR07	49	49	49	49	100
PTR08	49	49	49	49	100
PTR08	49	49	49	49	100
PTR08	49	49	49	49	100
PTR08	49	46	48	44	95
PTR08	49	49	49	49	100
PTR08	49	49	49	49	100
PTR08	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
PTR08R	49	49	49	49	100
AC04	ND	ND	ND	ND	ND
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100

Table I-4. Pool grid toss results. ND = no data

Site	Toss1	Toss2	Toss3	Toss4	Total % Fines
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100
AC07	49	49	49	49	100

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