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Cross section, scour chain and particle size data for Gulungul and Ngarradj Creeks: 2006 to 2009

MJ Saynor, R Houghton,
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April 2010

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Contents

Executive summary

Stream channel stability studies have been conducted in Gulungul and Ngarradj Creeks in the Magela Creek catchment for several years to establish baseline conditions against which mining impact can be assessed.

Data have been collected in the Ngarradj catchment since 1998 and were scaled following the 2004 dry season measurements. Data collection in Ngarradj Creek was increased again following Cyclone Monica in April 2006 and the large flood in February 2007. Bed material samples and cross sections were surveyed from only a few selected locations in 2008 and 2009. This report contains cross section and bed material samples from Ngarradj Creek for the period 2006 to 2009.

There are 12 permanently monumented (marked) cross sections installed on Gulungul Creek that have been surveyed during the dry seasons of 2002 to 2009. An additional cross section (DG12) has been generated using the data obtained from velocity area river gaugings for the culvert at the Arnhem Highway. Bed material grab samples for particle size analysis were collected each year at each of the cross sections (excluding DG12). Scour chains were installed and measured at some of the cross sections to provide information about the scour and fill that occurs during each wet season. Cyclone Monica impacted on the Gulungul Catchment in 2006 and there was a large flood during the 2007 wet season in late February/early March. This report contains data collected during the dry season Gulungul Creek for the period 2006 to 2009.

Acknowledgments

There have been many people that have helped with the gathering and collation of this data set. Thanks to Niki Lee, for help in the field, Jabiru Field Station Staff (JFS) and Dean Weldon for assistance with equipment used extensively in the field work.

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Cross section, scour chain and particle size data for Gulungul and Ngarradj Creeks: 2006 to 2009

MJ Saynor, R Houghton, WD Erskine, BL Smith & E Crisp

1 Introduction

This report contains the dry season channel stability data collected between 2006 and 2009 for Ngarradj and Gulungul Creeks. The research program on Gulungul Creek has run for the period 2002 to 2009 whilst the work program in the Ngarradj catchment (which started in 1998) had been greatly reduced in 2005 compared with previous years. Following Cyclone Monica on 25 April 2006 and then large floods in late February 2007 the work program in Ngarradj Creek was increased to pre 2005 levels for 2006 and 2007 Some selected cross sections in Ngarradj have been surveyed and sampled in 2008 and 2009. This is a data report – analysis and results will be presented in different reports.

1.1 Ngarradj Creek

The first field inspections were conducted in the Ngarradj catchment during the dry season of 1998 as initial work on the Jabiluka project had commenced. Erskine et al (2001) proposed that a sediment budget framework should be adopted by ***eriss*** to assess the physical impacts, if any, of the Jabiluka project on the Ngarradj catchment (Fig 1). During these field trips, various fluvial erosion processes were identified (Erskine et al 2001). Bank erosion and scour and fill of the sandy creek beds were observed as active processes.

To measure the amount of large-scale bank erosion, permanently marked channel cross sections were installed on the project area tributaries (Tributaries North and Central) and at the three ***eriss*** gauging stations (Moliere et al 2002) (Fig 1). Scour chains were used at some of the above cross sections to measure scour and fill (Saynor 2000, Erskine et al 2001). Bulk samples of bed material were collected for particle size analysis from each cross section (Saynor 2000, Erskine et al 2001). The complete ***eriss*** field program initiated in the Ngarradj catchment to assess the physical impacts of the Jabiluka project is described in Saynor et al (2001).

The data and some results for the annual cross section surveys, bulk bed material particle size distribution and scour and fill measurements in the Ngarradj catchment between 1998 and 2005 are presented in the following reports:

- Cross section change data, 1998 to 2001 – Saynor et al (2002a);
- Scour and fill by scour chains, 1998 to 2001 – Saynor et al (2002b);
- Cross section and scour chain data, 2002 to 2003 – Saynor et al (2004a);
- Bed material grain size data, 1998 to 2003 – Saynor et al (2004b);
- Analysis of cross section and scour and fill changes, 1998 to 2003 - Saynor et al (2004c);
- Analysis of bed material grain size changes, 1998 to 2003 – Saynor et al (2006);
- Cross section, scour chain and particle size data in the Ngarradj catchment for 2004 – Saynor and Smith (2005).

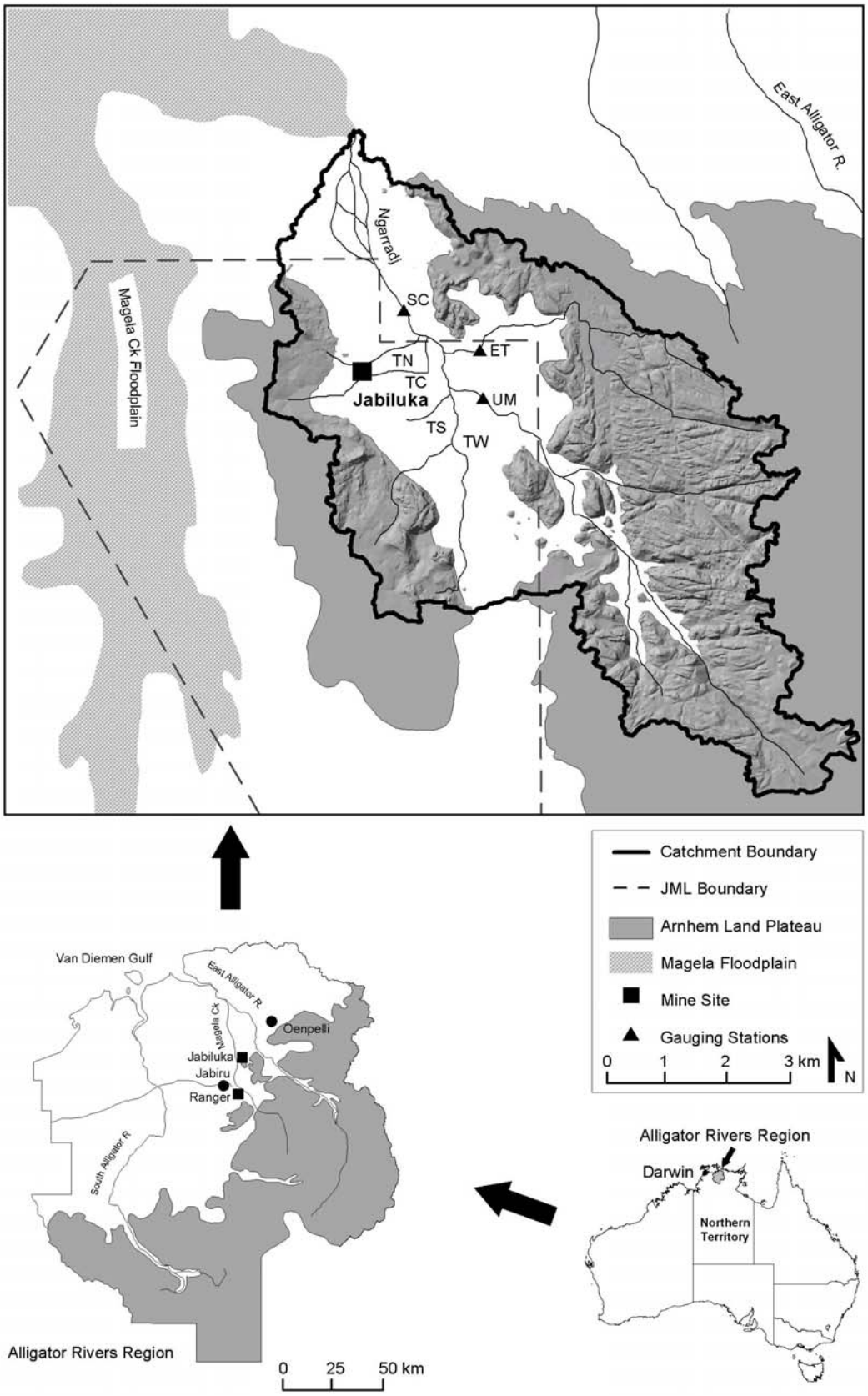

Figure 1 The Ngarradj catchment showing the location of the Jabiluka Mineral Lease, ***eriss***'s gauging stations and local creek names. SC refers to Swift Creek gauging station, TN Tributary North, ET East Tributary gauging station, TC Tributary Central, TS Tributary South, TW Tributary West and UM upper Swift Creek gauging station.

The channel stability work in Ngarradj Creek is being finalised and the work program is winding down. During the 2005 dry season only limited cross section surveys and bed material particle size analysis samples were completed. The cross section surveys and bed material samples were completed in 2006 following Cyclone Monica and in 2007 following the large flood that occurred in the catchment. This report contains the cross section data and particle size distributions for the Ngarradj catchment for 2006 to 2009 inclusive.

1.2 Gulungul Creek

A research program similar to that proposed by Erskine et al (2001) for the Ngarradj catchment was established in Gulungul Creek in 2002. Ranger mine lies partly within the catchment of Gulungul Creek, a small left bank tributary of Magela Creek (Fig 2). Current mine infrastructure in the catchment includes part of the tailings dam and minor road works and the final rehabilitated landform will also lie partly within the catchment. A program of geomorphic research and monitoring in Gulungul Creek is required both to provide information on channel stability and sediment loads and to determine a baseline and assessment strategy for future monitoring of the final rehabilitated landform.

Initial field inspections were conducted in the Gulungul Creek catchment during the dry season of 2002. In order to measure the amount of large-scale bank erosion along Gulungul Creek, permanently marked channel cross sections were established (Fig 3). Bulk bed material samples at each of the cross sections were collected and scour chains were used at some of the cross sections to measure scour and fill. The initial set up of cross sections and survey data are described in Crossing (2002) and more recent data are presented in Saynor et al (2005a) and Saynor and Smith (2005).

Data for the annual cross section surveys, bulk bed material samples and scour chain measurements on Gulungul Creek made for the dry seasons of 2006 to 2009 inclusive are presented in this report. Data reports (Internal Reports) are produced to provide a formal compilation of the data.

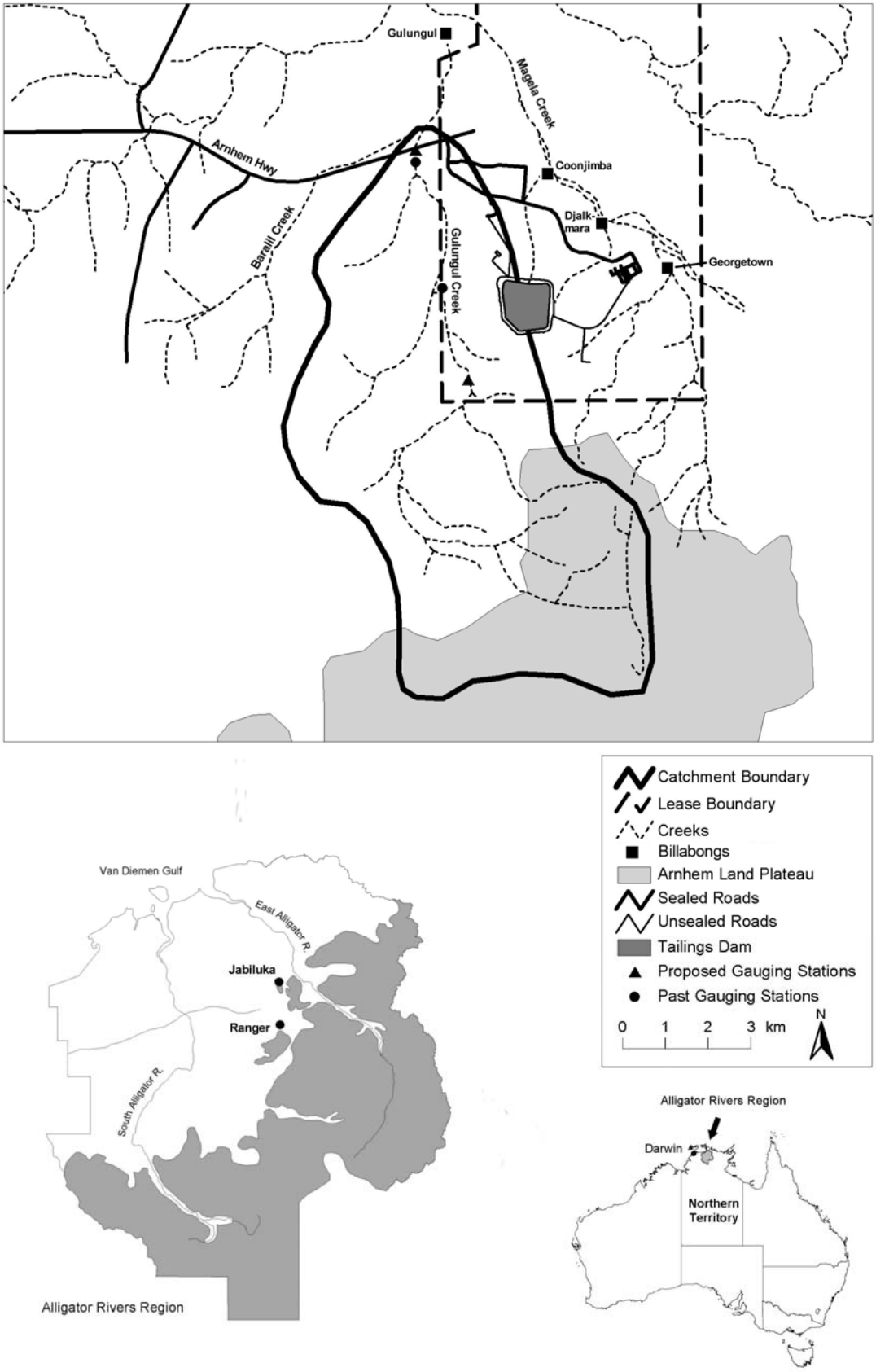

Figure 2 Gulungul Creek catchment showing the main creeks and tributaries, Ranger Mineral Lease and mine infrastructure, gauging stations and the Arnhem Land Plateau. Sourced from Crossing (2002).

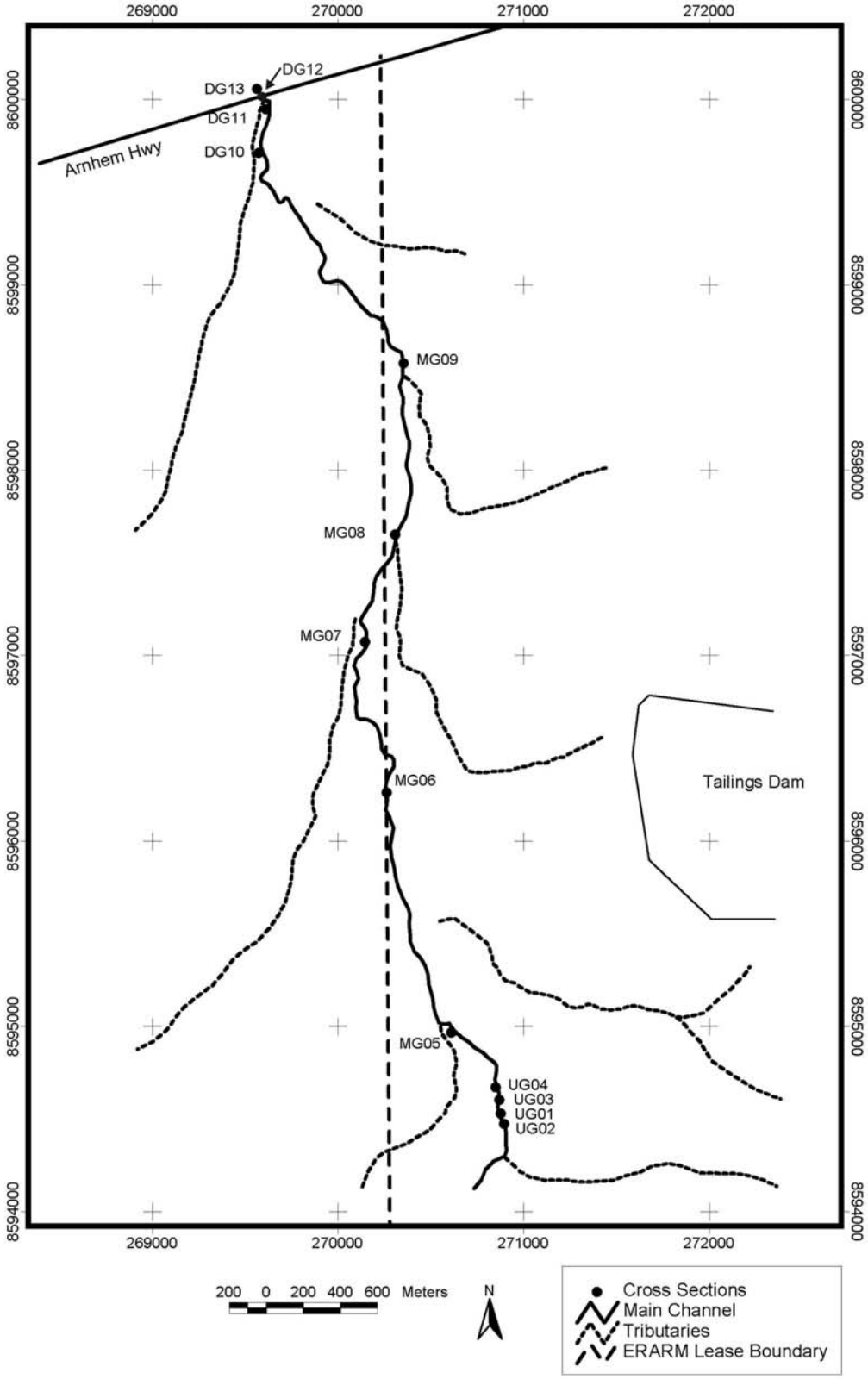

Figure 3 Gulungul Creek showing location of cross sections. Sourced from Crossing (2002).

2 Methods

The methods described here relate to the continuing work being undertaken on Gulungul Creek. The work that has been completed in Ngarradj Creek is of a very similar nature and has been described in the publications listed above.

2.1 Cross section survey

Twelve cross sections were installed along Gulungul Creek at different sites between the upstream lease boundary and the junction with Baralil Creek (approximately 100 m downstream of the Arnhem Highway (Fig 2)). The locations of these sections are shown in Figure 3. These sections were installed and surveyed in the 2002 dry season and are surveyed on an annual basis to provide a baseline for monitoring change in the channel banks and bed over time. A 13th cross section (DG12) has be added to the cross sections on Gulungul Creek using the distance and depth measurements from velocity area river gaugings at the culvert on the Arnhem Highway.

The cross-sections were surveyed using two concrete plinths on either side of the main channel as bench marks. Some sections were surveyed only between these two plinths, while others extended away from the channel beyond one or both plinths, using the same instrument set up. A star picket was used to mark the end of the cross-section in these cases. UG01 is a longer section with 5 plinths, and involved three instrument setups. Details of survey setup points are given in Table 1. Table 1 is adapted from Crossing (2002) with some changes to the original Table to correct transcription errors.

Table 1 Details of the cross-section surveys carried out in the 2002 dry season. This information should be used whenever the cross-sections are re-surveyed.

Section	Instrument set up	Arbitrary coordinates (m) [a]			Sighted to	Sighting angle (degrees)
		North	East	Height		
UG01 – A	Plinth 1 (RB)	5000	2000	50	Plinth 3	270
UG01 – B	Plinth 3[a]	1864.60	5000	50.43	Plinth 1	90
UG01 – C	Plinth 4[a]	1747.45	5000	49.88	Plinth 3	Approx. 90 [b]
UG02	RB plinth	3000	1000	50	LB plinth	270
UG03	RB plinth	3000	1000	50	LB plinth	270
UG04	RB plinth	3000	1000	50	LB plinth	270
MG05	RB plinth	3000	1000	50	LB plinth	270
MG06	RB plinth	3000	1000	50	LB plinth	270
MG07	LB plinth	3000	1000	50	RB plinth	90
MG08	LB plinth	3000	1000	50	RB plinth	90
MG09	RB plinth	3000	1000	50	LB plinth	270
DG10	RB plinth	3000	1000	50	LB plinth	270
DG11	RB plinth	3000	1000	50	LB plinth	270
DG12	Surveyed along the upstream side of the culvert at the Arnhem Highway					
DG13	RB plinth	3000	1000	50	LB plinth	270

a The coordinates for Plinth 3 and 4 on cross-section UG01 are not arbitrary, and were measured from the coordinates at Plinth 1 on cross section UG01. It should be noted that apart from these cross sections, no other cross sections can be related to each other.

b The backsight for Section UG01 – C was sighted on Plinth 3, but rather than specifying a sighting angle, the coordinates of Plinth 3 were entered.

Section UG01 is located through the upstream gauging station (Fig 3). A gauging station was installed prior to the 2003–04 wet season and stage-discharge gauging measurements have been carried out each wet season since. The sections immediately upstream and downstream of UG01 (UG02, 03 and 04) were chosen to ensure the channel reach around the gauging station is adequately characterised. Plots of the cross section surveys are contained in Section 3 and the survey data are shown in Appendix A.

2.2 Bed material field collection for particle size analysis

Bulk samples of specific depositional environments are the accepted method of sampling fluvial sediments. This involves the collection of all material from a predetermined volume within a specific depositional or geomorphic environment (Kellerhals & Bray 1971). Where collection of all sediment from a specific depositional environment is impossible because the mass is too large for collection, transport and/or analysis, sub-sampling is practised. Nevertheless, there are potential problems with bulk sampling that must be recognised. Very large sample masses are required to obtain reproducible measures of the grain size distributions of samples containing individual large clasts or gravels (de Vries 1970, Church et al 1987, Gale & Hoare 1992, Ferguson & Paola 1997). Recommended minimum sample mass also depends on sediment sorting or grading (Gale & Hoare 1994, Ferguson & Paola 1997). For a particular depositional environment, poorly sorted sediments, such as found in mixed sand-bed and gravel-bed rivers, require larger masses than better sorted samples (Gale & Hoare 1994, Ferguson & Paola 1997). Bulk sampling is also usually restricted to small areas that may not be representative of all of a specific depositional environment (Wolman 1954, Muir 1969). This is a major concern on large rivers with spatially variable depositional environments (Mosley & Tindale 1985) but is not a problem on the smaller channels in the Gulungul Creek catchment.

During the dry seasons of 2006 to 2009 bed material samples were collected each of the 12 cross sections on Gulungul Creek and for some of the sections on Ngarradj Creek. Bulk bed material samples were collected by a trowel or small spade from between 5 and 8 equally spaced points across the stream bed and then combined into a single sample for each section.

2.3 Particle size analysis laboratory methods

All bulk bed-material samples were oven dried at 105°C for 24 hours before being subjected to particle size analysis. Initial field observations indicated that there was little mud (ie < 0.063 mm in diameter) present. The phi (ϕ) notation system is often used to describe the grain size of clastic sediment by sedimentologists. It is a logarithmic scale in which each grade limit is twice as large as the next smaller grade limit (Folk 1974) and is denoted by:

$$\phi = -\log_2 d \qquad (1)$$

where d is the grain diameter in mm.

Any gravel fraction of the samples was manually sieved in its entirety at $\phi/2$ intervals. If the fraction less than 2 mm in diameter (fine earth fraction) was greater than 150 g it was passed through a riffle box to obtain a sample of approximately 100 g to ensure that the analytical stainless steel sieves were not damaged by excessive loading. This sub-sample was then dry sieved through a nest of stainless steel sieves at $\phi/2$ intervals using a 15 minutes shake time. For the fine earth fraction sample masses less than 150 g, the sample was sieved in its entirety.

2.4 Sediment texture

The sediment textural classification used for fluviatile samples in this report is that of Folk (1954, 1974, 1980) for unconsolidated materials and is based on a ternary diagram showing

the proportions of gravel, sand and mud (Fig 4). This texture triangle is split into 15 groups and the median diameter is determined, where possible, for each component fraction. Each sediment fraction can be expressed in terms of one of the Wentworth size classes (Table 2). To place a sample into one of the 15 major groups, only two properties need to be determined, namely the gravel percentage (boundaries at 80, 30, 5 and a trace or 0.01 %) and the ratio of sand to mud with boundaries at 9:1, 1:1 and 1:9 (Folk 1954, 1974, 1980). The gravel content is partly a function of the highest current velocity and the maximum grain size of the supplied sediment. The sand:mud ratio reflects the amount of winnowing (washing away of fine sediment) that has occurred. For samples lacking gravel, a further ternary diagram (Fig 5) is used which expands the bottom tier of Figure 4. It is based on the proportions of sand, silt and clay (see Folk 1954, 1974, 1980).

Table 2 The Wentworth grain size scale for sediments (after Folk 1974)

Finest grain size (mm)	Finest grain size (ϕ)	Wentworth size class
256	-8	Boulder
64	-6	Cobble
4	-2	Pebble
2	-1	Granule
1.00	0	Very coarse sand
0.50	1	Coarse sand
0.25	2	Medium sand
0.125	3	Fine sand
0.0625	4	Very fine sand
0.031	5	Coarse silt
0.0156	6	Medium silt
0.0078	7	Fine silt
0.0039	8	Very fine silt
0.00006	14	Clay

2.5 Scour chains

Depths of scour and fill can be measured by scour chains, as described by Emmett and Leopold (1963) and Emmett (1965). Scour chains were installed in various reaches of the Gulungul Creek catchment (Table 3) during the late dry season of 2002. The chains were installed with all links vertical. Table 3 contains information on the number of scour chains installed and at which cross sections. The scour chains were always located on a surveyed cross section. After each wet season, the elevation of the stream bed was resurveyed and the bed was excavated until the chain was exposed (Fig 6). The difference between the existing bed elevation and the horizontal chain was the depth of fill. If no scour had occurred, the amount of fill was the depth of sediment above the top of the buried chain. If the amount of fill equalled scour, there was no net change in bed level although scour and fill had occurred.

Table 3 Number of scour chains installed and on which cross sections in Gulungul Creek

Cross Section name	No. of scour chains	Cross Section name	No. of scour chains
UG02	2	MG08	3
UG03	3	DG10	2
MG06	3	DG11	2

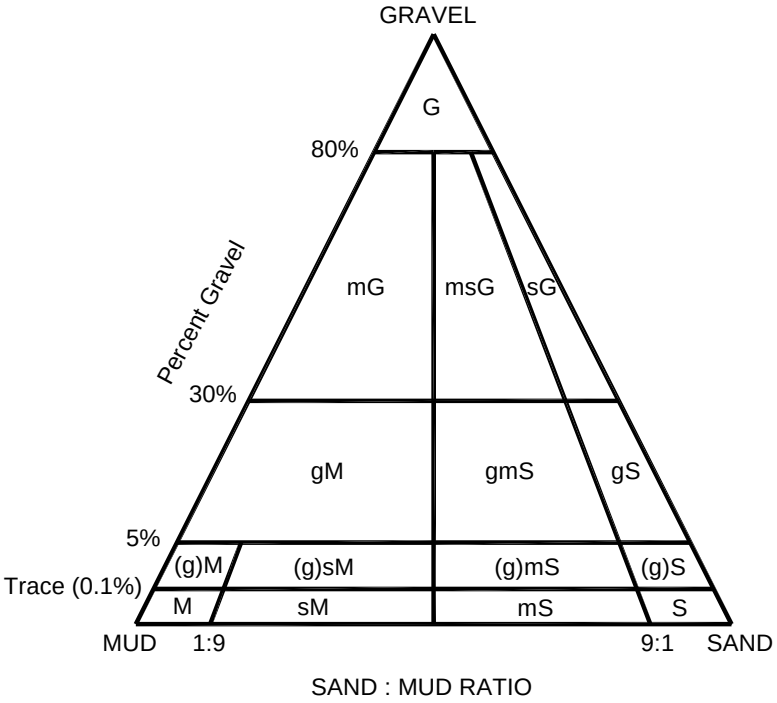

Figure 4 Folk's (1974) textural groups. G is gravel; sG sandy gravel; msG muddy sandy gravel; mG muddy gravel; gS gravelly sand; gmS gravelly muddy sand; gM gravelly mud; (g)S slightly gravelly sand; (g)mS slightly gravelly muddy sand; (g)sM slightly gravelly sandy mud; (g)M slightly gravelly mud; S sand; mS muddy sand; sM sandy mud; M mud.

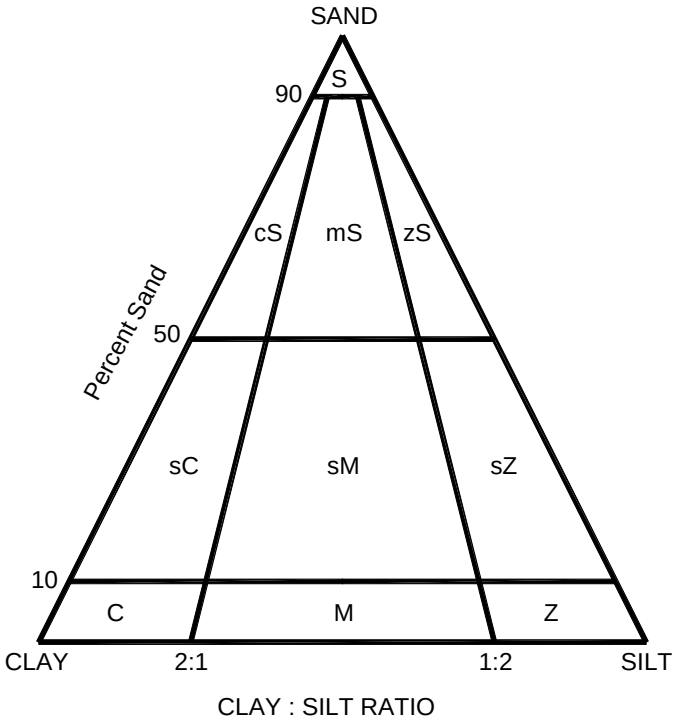

Figure 5 Folk's (1974) expansion of the bottom tier of Figure 3 to show textural classes for sediments lacking gravel. S is sand; zS silty sand; mS muddy sand; cS clayey sand; sZ sandy silt; sM sandy mud; sC sandy clay; Z silt; M mud; and C clay.

Late in each dry season when the water table was at its lowest, the scour chains were relocated (using the measurements in Saynor et al (2005)) and, more importantly, a metal detector. The metal detector was particularly effective in locating the chains. Measurements of the depth to the scour chain and the bed surface level were obtained. Figure 6 shows an example of an excavated scour chain.

Figure 6 Scour chain orientated essentially downstream at MG08-3 on 24 November 2004. Arrow marked on paper indicates flow direction.

A wooden board was positioned over the upstream face of the excavation and all measurements were taken to the bottom of this board which equated to the then bed level. A photograph was usually taken to show the position of the chain and an indication of the direction of flow was given by a trowel, arrow on paper, pen or ruler pointing downstream. As the scoured part of the chain was not always lying horizontal, two measurements were taken to determine the scour depth (Fig 7):

- Depth to top of first link (ie the link to which flagging tape had been tied)
- Depth to the first vertical link

After these measurements were made, the chain was carefully straightened and then a further measurement made:

- Depth to straightened chain (DSC) from the base of the wooden board

All measurements were made as positive values except when the straightened chain was higher than the current bed level (wooden board) when the value was assigned a negative value. These measurements are used to determine scour and fill and are explained in the next section. Once all the measurements had been made, the chain was reset. If the chain could not be reset for any reason the difference was noted so that adjustments could be made to the measurements and calculations in the following years.

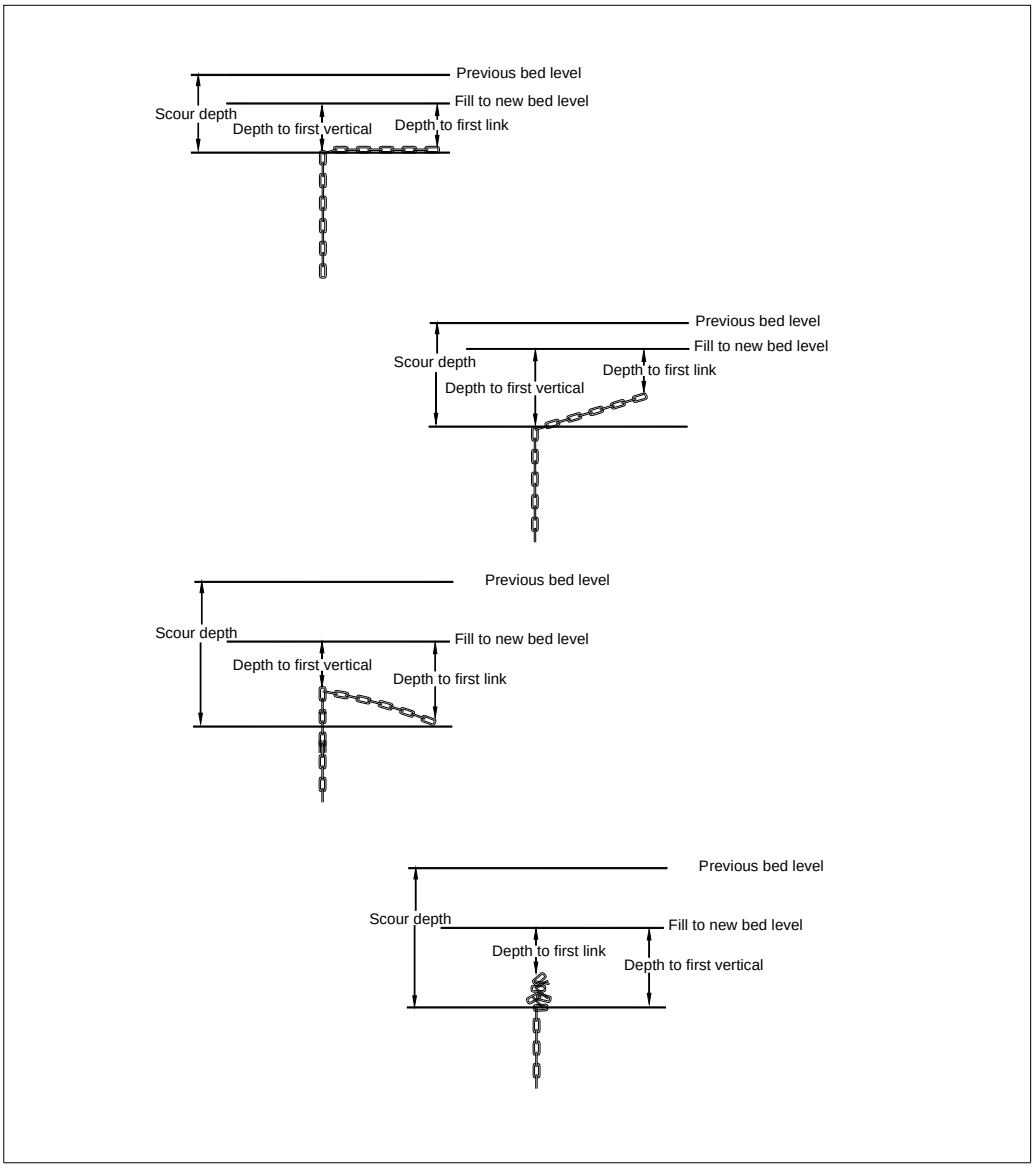

Figure 7 Diagrammatic representation of the full range of scour chain behaviour when there was net scour depicted by the middle example in Figure 8.

2.6 Scour and fill calculations

The top of the highest link of each chain is the zero datum for the next wet season. The values are all made to this datum even though some of the measurements are made to the bed level for year 2 (Fig 8). Once the scour chains are reset the datum is then also reset and the bed level is called Year 1 for the following year (Fig 8) ie the DSC value for net fill is +ve and for net scour is –ve.

The maximum amount of fill (F_M) is the actual fill during the wet season. The depth to the straightened chain (DSC) is used in equation 1 to determine the maximum scour depth (S_M) and it is essential to keep the mathematical signs as shown in Figure 7.

$$S_M = F_M - DSC \qquad (2)$$

The net change in bed level (BL_N) is determined by equation 3:

$$BL_N = F_M - S_M = DSC \qquad (3)$$

A positive value indicates net fill from year 1 to year 2 and a negative value, net scour. This convention of positive values for fill and negative values for scour has been used by, among others, Emmett (1965), Leopold et al (1966), Roberts (1991), Fowler and Wilson (1995) and Locher (1997). Figure 8 shows the three possible situations, net fill, net scour and no net change.

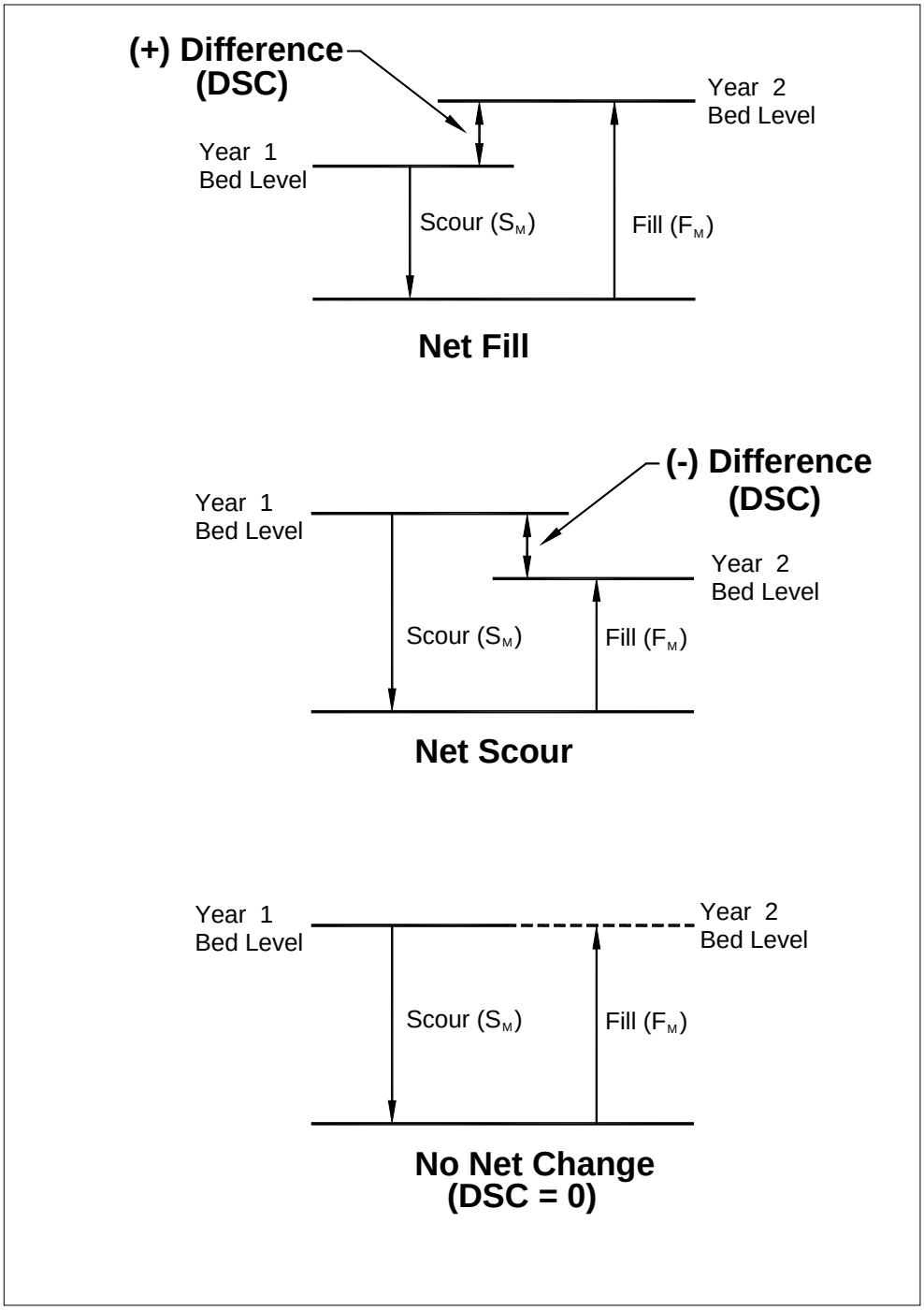

Figure 8 Three examples of net channel bed change during the wet season measured by scour chains. Net fill occurs when the bed level for the 2nd year is higher than for the 1st (top). Net scour occurs when the bed level for the 2nd year is lower than for the 1st (middle). No net change occurs when the bed level for the 1st and 2nd years is the same (bottom).

3 Gulungul Creek results

3.1 Gulungul Creek annual cross section survey

The plots of the 12 cross sections for the period 2002 to 2009 inclusive are shown in downstream order in Figures 9–20. All cross sections are orientated looking downstream. The location of the cross sections is shown in Figure 3. The cross section survey data for all sections for 2006 to 2009 are contained in Appendix A. An additional cross section (DG12) at the Arnhem Highway road culvert has been added to this report using data obtained from various gaugings that have been made at various times during the wet seasons. The plot of this section is shown in Figure 21.

3.2 Gulungul Creek particle size analysis

Figure 3 shows the location of the channel cross sections at which the bed material was bulk sampled. Sample masses for each year are summarised in Table 4. From the criteria of de Vries (1970), Church et al (1987) and Gale and Hoare (1992), the sample masses were adequate to obtain reproducible measures of the grain size distribution for these bed-material sediments.

Table 4 Summary of oven dry bulk bed-material sample masses collected on Gulungul Creek for each year of the sediment program

Sample mass	2002	2003	2004	2005	2006	2007	2008	2009
Mean (g)	1523.3	2197.8	2634.0	1893.3	2139.0	1890.0	2213.3	3871.6
Standard error of estimate (g)	113.7	103.8	176.7	154.67	157.0	115.4	75.8	315.8
Minimum (g)	1104.5	1459.9	1664.7	1067.4	1314.5	1312.2	1760.9	5236.1
Maximum (g)	2486.5	2859.8	3582.1	2950.3	3314.1	2627.5	2708.7	2189.8

Saynor et al (2005) investigated the mud content of the bed material. Four of the 2002 samples were dispersed and wet sieved through a 63 μm sieve. All four samples had less than 5% mud, bed-material samples were oven dried and dry sieved in subsequent years. The grain size statistics for Gulungul Creek for the period 2006 to 2009 inclusive are shown in Tables 5 to 8 respectively. The cumulative frequency grain size distributions and Folk (1954, 1974) texture group for each sediment sample collected on Gulungul Creek are contained in Appendix B.

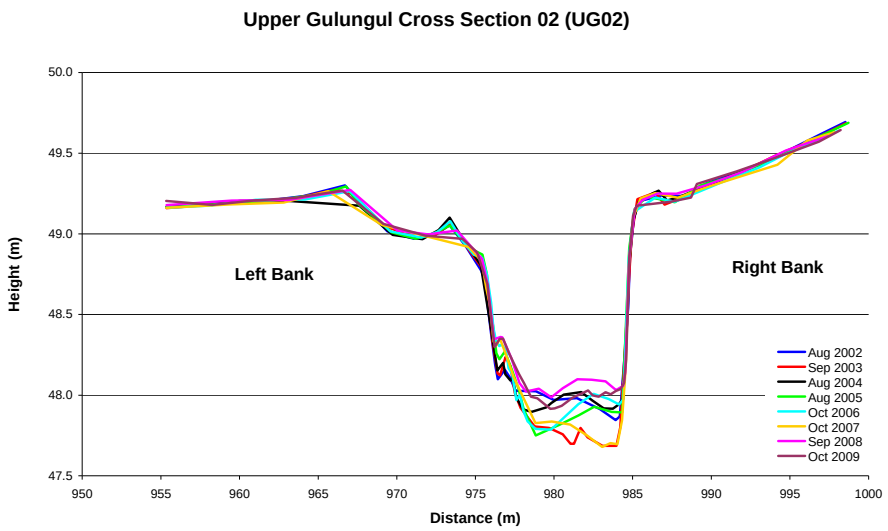

Figure 9 Cross section plot of upper Gulungul Cross section 02 (UG02) for the period 2002 to 2009 inclusive

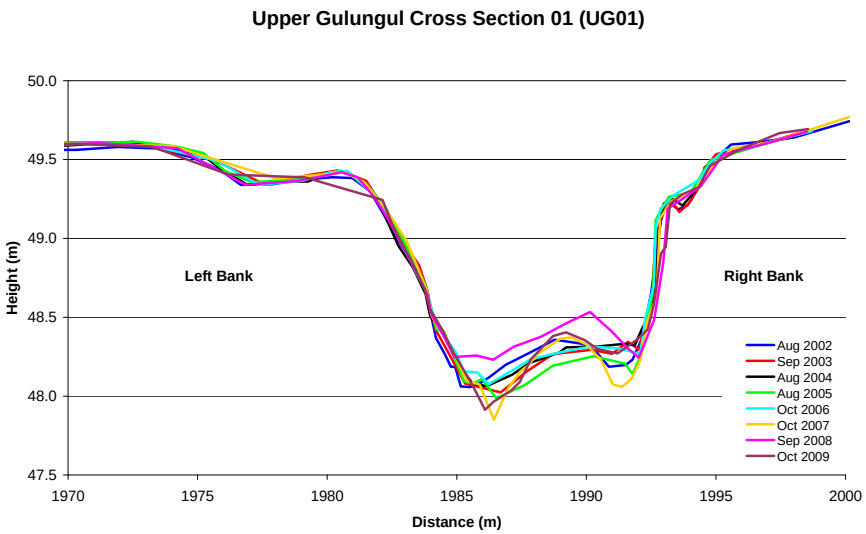

Figure 10 Cross section plot of upper Gulungul Cross section 01 (UG01) for the period 2002 to 2009 inclusive

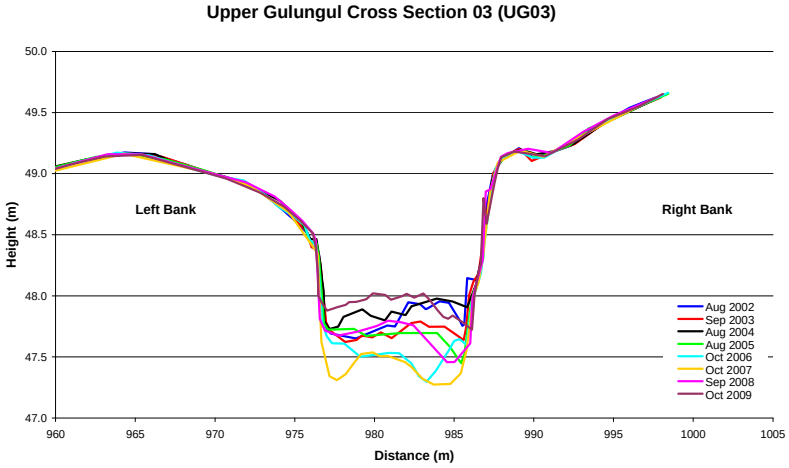

Figure 11 Cross section plot of upper Gulungul Cross section 03 (UG03) for the period 2002 to 2009 inclusive

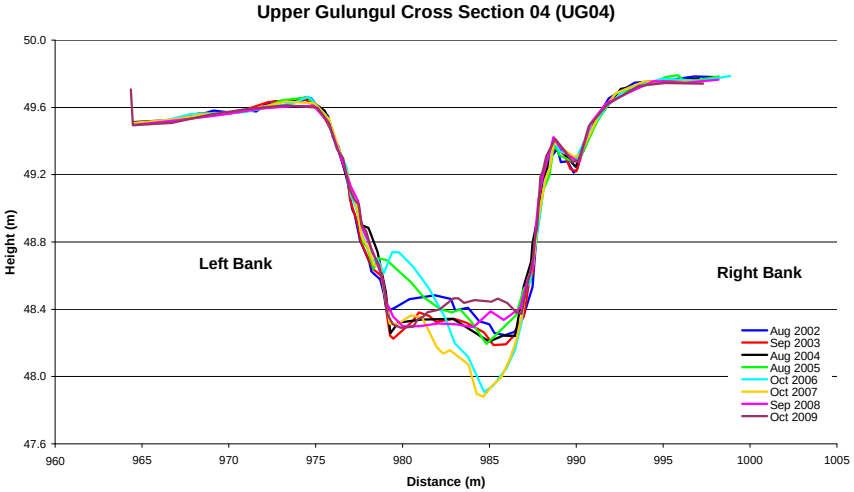

Figure 12 Cross section plot of upper Gulungul Cross section 04 (UG04) for the period 2002 to 2009 inclusive

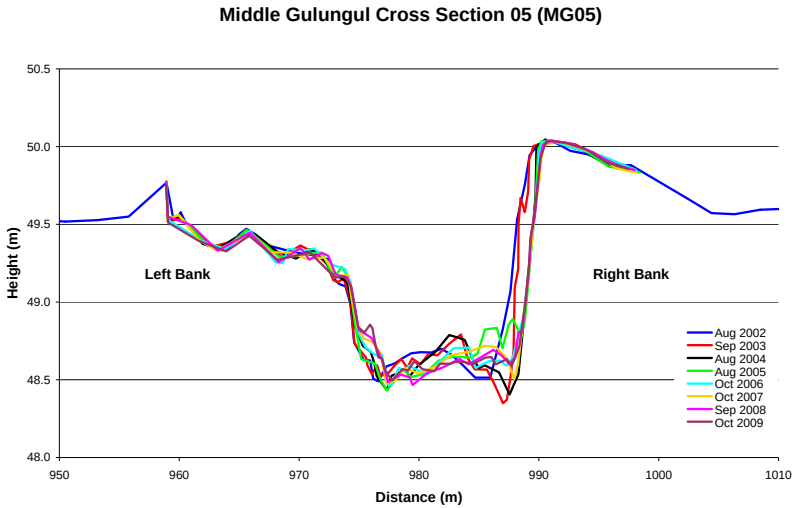

Figure 13 Cross section plot of Middle Gulungul Cross section 05 (MG05) for the period 2002 to 2009 inclusive

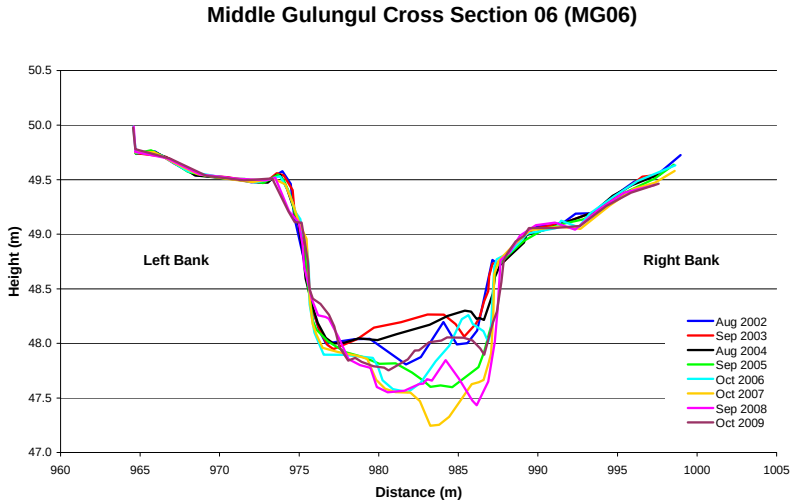

Figure 14 Cross section plot of Middle Gulungul Cross section 06 (MG06) for the period 2002 to 2009 inclusive

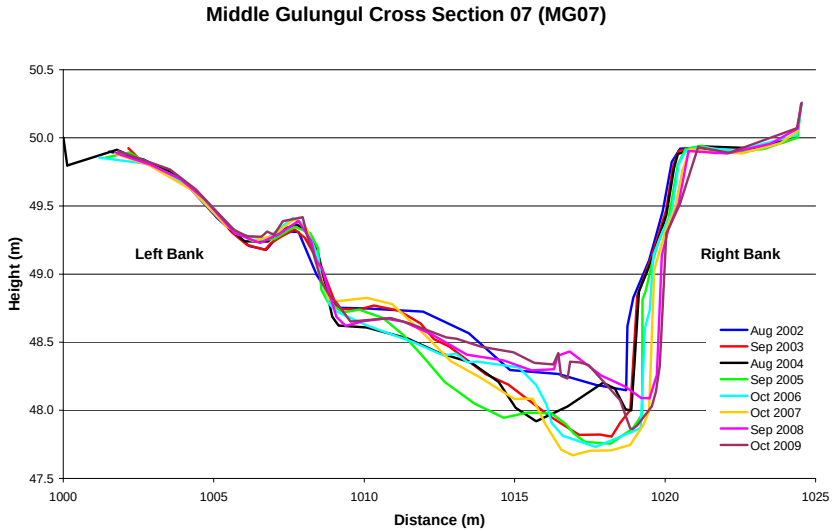

Figure 15 Cross section plot of Middle Gulungul Cross section 07 (MG07) for the period 2002 to 2009 inclusive

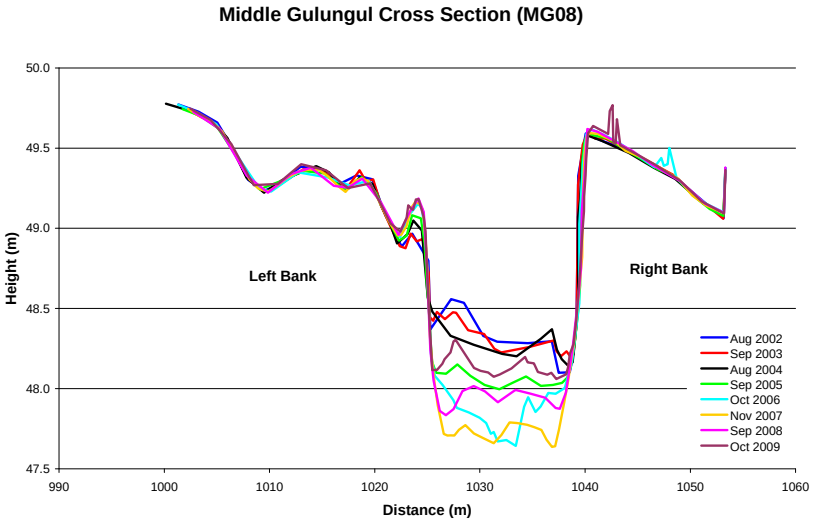

Figure 16 Cross section plot of Middle Gulungul Cross section 08 (MG08) for the period 2002 to 2009 inclusive

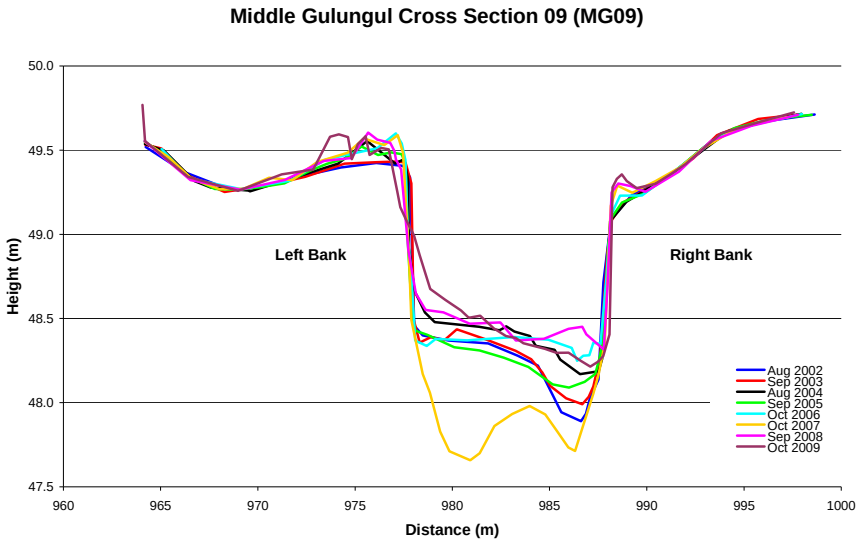

Figure 17 Cross section plot of Middle Gulungul Cross section 09 (MG09) for the period 2002 to 2009 inclusive

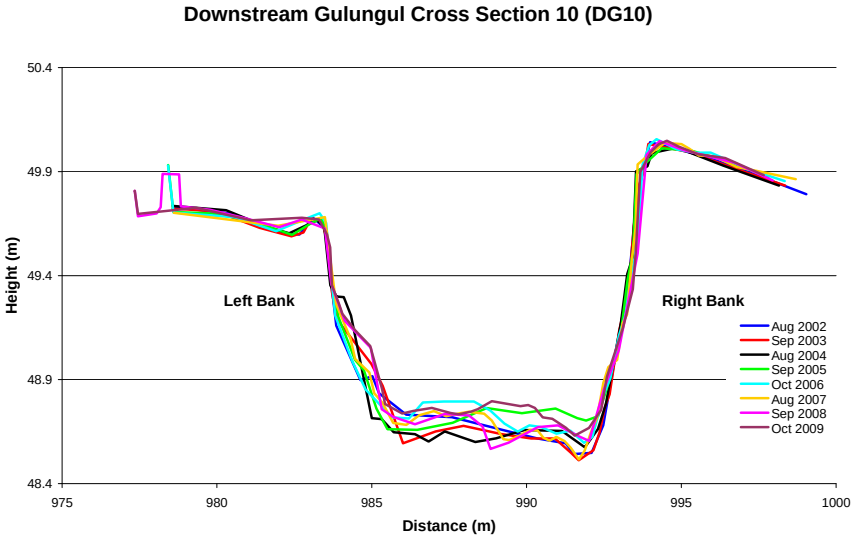

Figure 18 Cross section plot of Downstream Gulungul Cross section 10 (DG10) for the period 2002 to 2009 inclusive

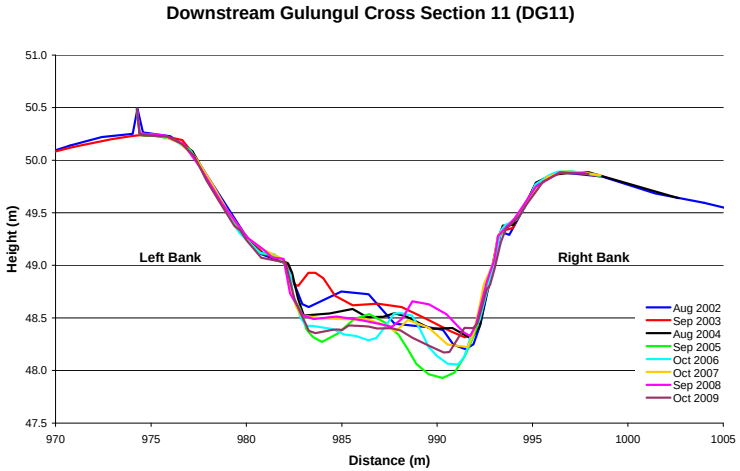

Figure 19 Cross section plot of Downstream Gulungul Cross section 11 (DG11) for the period 2002 to 2009 inclusive

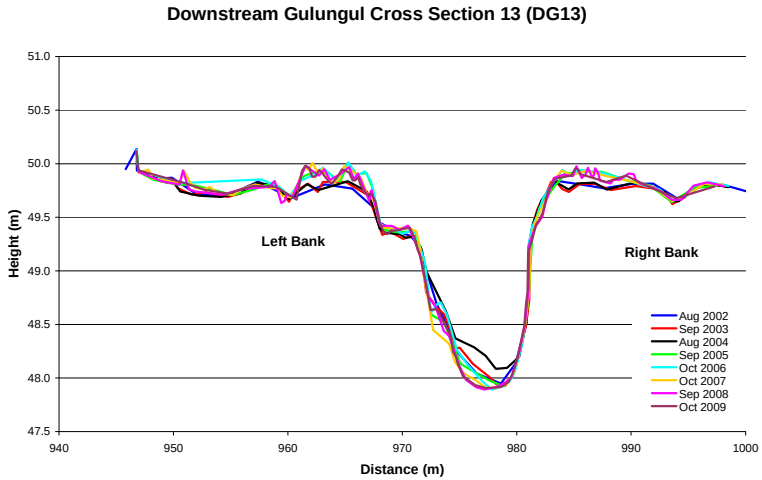

Figure 20 Cross section plot of Downstream Gulungul Cross section 13 (DG13) for the period 2002 to 2009 inclusive

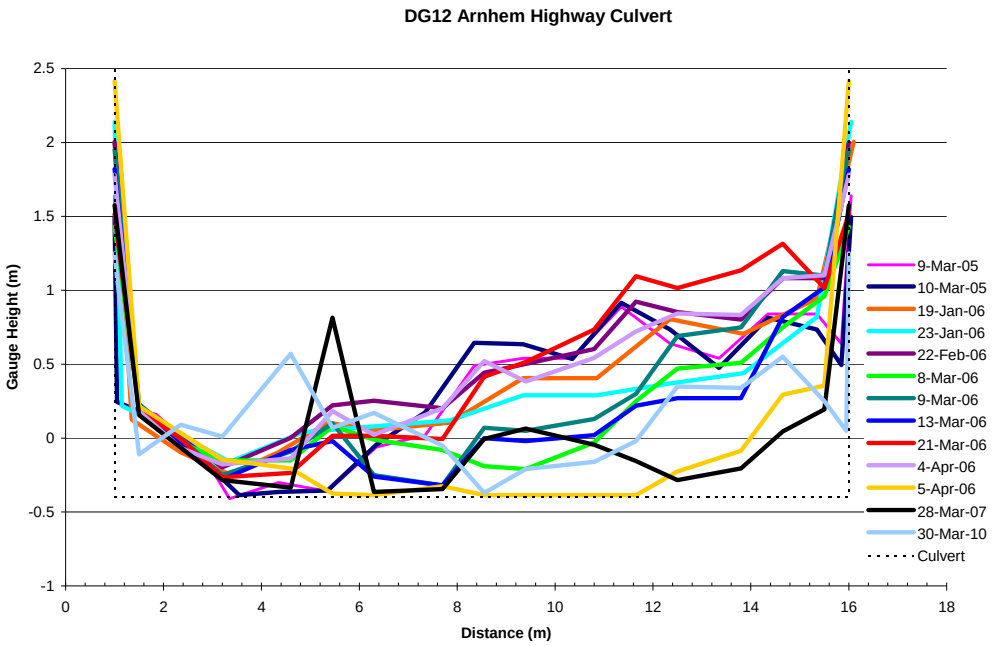

Figure 21 Cross section plot of the main culvert at the Arnhem highway. It is called DG12.

Table 5 Grain size statistics for Gulungul Creek 2006

Date collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
26-Oct-06	UG01	0.98	0.51	0.07	1.03	0.51
26-Oct-06	UG02	0.97	0.52	0.10	1.12	0.53
26-Oct-06	UG03	1.01	0.50	0.06	1.04	0.51
26-Oct-06	UG04	1.03	0.55	0.01	1.07	0.52
23-Oct-06	MG05	1.06	0.55	0.08	0.99	0.50
23-Oct-06	MG06	1.18	0.60	0.08	0.96	0.49
23-Oct-06	MG07	1.12	0.53	0.16	0.99	0.50
26-Oct-06	MG08	1.07	0.68	0.11	1.01	0.50
26-Oct-06	MG09	0.89	0.69	0.01	1.10	0.52
26-Oct-06	DG10	1.12	0.52	0.02	0.99	0.50
26-Oct-06	DG11	1.08	0.62	0.12	1.03	0.51
26-Oct-06	DG13	1.14	0.59	0.04	0.95	0.49

Table 6 Grain size statistics for Gulungul Creek 2007

Date collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
15-Oct-07	UG01	0.81	0.54	0.03	1.18	0.54
16-Oct-07	UG02	0.96	0.50	0.12	1.07	0.52
	UG03	Sample	Misplaced			
16-Oct-07	UG04	1.11	0.70	-0.12	1.11	0.53
19-Oct-07	MG05	1.10	0.54	0.04	1.00	0.50
19-Oct-07	MG06	0.92	1.13	0.42	3.35	0.77
19-Oct-07	MG07	1.29	0.53	0.00	0.88	0.47
27-Nov-07	MG08	1.11	0.54	0.04	1.00	0.50
19-Oct-07	MG09	1.36	0.61	-0.02	0.95	0.49
23-Aug-07	DG10	1.04	0.52	0.04	1.00	0.50
19-Oct-07	DG11	1.07	0.56	0.06	0.97	0.49
12-Dec-07	DG13	0.62	1.98	-0.68	2.08	0.68

Table 7 Grain size statistics for Gulungul Creek 2008

Date collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
25-Sep-08	UG01	1.01	0.48	0.06	1.01	0.50
25-Sep-08	UG02	0.96	0.50	0.09	1.04	0.51
25-Sep-08	UG03	1.13	0.53	0.05	0.95	0.49
25-Sep-08	UG04	0.94	0.51	0.15	1.07	0.52
26-Sep-08	MG05	1.20	0.57	-0.05	0.91	0.48
26-Sep-08	MG06	1.31	0.77	0.17	1.35	0.57
26-Sep-08	MG07	1.09	0.54	0.05	0.98	0.50
26-Sep-08	MG08	1.15	0.54	-0.03	0.89	0.47
26-Sep-08	MG09	1.11	0.59	0.01	0.98	0.49
26-Sep-08	DG10	1.17	0.52	-0.01	0.93	0.48
26-Sep-08	DG11	1.14	0.54	0.04	0.96	0.49
12-Dec-07	DG13	1.30	0.93	-0.23	1.41	0.58

Table 8 Grain size statistics for Gulungul Creek 2009

Date collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
27-Oct-09	UG01	1.09	0.54	0.04	1.00	0.50
27-Oct-09	UG02	1.08	0.54	0.06	1.00	0.50
27-Oct-09	UG03	1.48	0.54	0.15	1.11	0.53
27-Oct-09	UG04	1.06	0.58	0.11	1.10	0.52
27-Oct-09	MG05	1.45	0.75	0.01	0.99	0.50
27-Oct-09	MG06	1.30	0.78	0.21	1.17	0.54
28-Oct-09	MG07	1.38	0.79	0.20	1.06	0.51
29-Oct-09	MG08	1.25	0.71	0.13	0.97	0.49
29-Oct-09	MG09	1.44	0.95	0.06	1.05	0.51
29-Oct-09	DG10	1.25	0.76	0.19	1.09	0.52
29-Oct-09	DG11	1.20	0.61	0.13	1.09	0.52
29-Oct-09	DG13	1.46	1.02	-0.32	1.88	0.65

Analysis of the grain size statistics will be presented in an separate report.

3.3 Gulungul Creek scour chains

Scour chains were installed during the late dry season of 2002 at six cross sections. The following cross sections had three chains installed in the bed: UG03, MG06 and MG08, while only two chains were installed at: UG02, DG10 and DG11 due to the narrow bed width at these sections. The location of the cross sections is shown in Figure 2. Appendix C has schematic diagrams that can be used to assist with locating the scour chains. Tables 9, 10 and 11 show the scour chain measurements and calculations for 2006, 2007 and 2008.

During 2006 there was late un-seasonal rain that meant that the water table did not drop sufficiently to enable all scour chains to be relocated (noted in Table 9). Similarly in 2007 there were several locations where the water table did not allow for the retrieval of some of the scour chains (Table 10). In some instances it wasn't possible to reset the scour chains to the bed level, (difficult to remove) and therefore some links of the chain were then left on the surface of the channel bed, pointing downstream. The length of chain left on the bed was recorded. In 2008 only the chains at DG10 were located (Table 11) and in 2009 due to other priorites none of the chains were searched for or found.

In scour and fill calculations in subsequent years any length of chain left on the channel bed has to be taken into consideration. Therefore the length of the straightened chain does not necessarily relate directly to the change in bed level and thus there is a separate column in Tables 9, 10 & 11 show the change in bed levels. Also in the years where the scour chains could not be found, but were found in subsequent years, the change in bed level will need to be calculated to the last year that the chain could be located.

Table 9 2006 Scour chain measurements, bed level changes and scour and fill for Gulungul Creek

Section	Location	Date	Depth to (mm)			Length of chain left on bed in 2005 (mm)	Change in bed level relative to 2005 (mm)	Scour (mm)	Fill (mm)	Section average		Notes
			First Link	First Vertical Link	Straightened Chain					Scour (mm)	Fill (mm)	
UG02-1	R Bank	17/11/2006	445	430	100	0	100	345	445	198	259	Chain orientation not noted. Chain reset (0 mm).
UG02-1	L Bank	17/11/2006	63	73	22	0	22	51	73			Chain orientation not noted. Chain reset (0 mm).
UG03-1	R bank	12/12/2006	0	0	-270	0	-270	270	0			Chain orientation not noted. Chain not reset (270 mm left on channel bed).
UG03-2	Middle	17/11/2006	110	112	-180	0	-180	292	112	271	61	Chain orientation not noted. Chain reset (0 mm).
UG03-3	L bank	17/11/2006	70	60	-180	0	-180	250	70			Chain orientation not noted. Chain reset (0 mm).
MG06-1	R bank	17/11/2006				210						In pool of water unable to retrieve.
MG06-2	Middle	17/11/2006				0						In pool of water unable to retrieve.
MG06-3	L bank	17/11/2006				180						In pool of water unable to retrieve.
MG08-1	R bank					0						Not visited due to time constraints.
MG08-2	Middle					0						Not visited due to time constraints.
MG08-3	L bank					0						Not visited due to time constraints.
DG10-1	R bank	14/11/2006	205	250	-15	0	-15	265	250	245	278	Chain orientation not noted. Chain reset (0 mm).
DG10-2	L bank	14/11/2006	306	288	82	0	82	224	306			Chain orientation not noted. Chain reset (0 mm).
DG11-1	R bank	14/11/2006				420						Water table to high prevented recovery.
DG11-2	L bank	14/11/2006	80	95	-240	0	-240	335	95			Chain orientation not noted. Chain not reset (240 mm left on channel bed).

Table 10 2007 Scour chain measurements, bedlevel changes and scour and fill for Gulungul Creek

Section	Location	Date	Depth to (mm)			Length of chain left on bed in 2006 (mm)	Change in bed level relative to 2006 (mm)	Scour (mm)	Fill (mm)	Section average		Notes
			First Link	First Vertical Link	Straightened Chain					Scour (mm)	Fill (mm)	
UG02-1	R Bank	12/12/07	270	295	-155	0	-155	450	295	250	183	In the water table, orientated upstream against the flow. Chain reset (0 mm).
UG02-1	L Bank	12/12/07	55	70	20	0	20	50	70			Orientated downstream. Chain reset (0 mm).
UG03-1	R bank	12/12/07				270						In pool of water unable to retrieve.
UG03-2	Middle	12/12/07				0						In pool of water unable to retrieve.
UG03-3	L bank	12/12/07				0						In pool of water unable to retrieve.
MG06-1	R bank	12/12/07				210						In pool of water unable to retrieve.
MG06-2	Middle	12/12/07	140	155	-235	0	-235	390	155			Orientated perpendicular to flow toward RB. Chain reset (0 mm).
MG06-3	L bank	12/12/07	40	50	-140	180	40	190	50			Orientated downstream. Chain reset (0 mm).
MG08-1	R bank	12/12/07				0	0					Could not locate due to the water table.
MG08-2	Middle	12/12/07				0	0					In water table, could hear on metal detector could not retrieve, depth to water table was 600 mm.
MG08-3	L bank	12/12/07				0	0					Did not search for due to water table.
DG10-1	R bank	22/11/07	225	275	-50	0	-50	325	275	295	265	Upstream then curls to LB. Chain reset (0 mm).
DG10-2	L bank	22/11/07	255	255	-10	0	-10	265	255			Upstream then curls to downstream. Chain not reset (10 mm left on channel bed).
DG11-1	R bank	12/12/07	380	450	0	420	420	30	450	385	360	Orientated downstream. Chain level with bed level, not reset (0 mm).
DG11-2	L bank	12/12/07	260	270	-50	240	190	80	270			Orientated downstream. Chain not reset (50 mm left on channel bed).

Table 11 2008 Scour chain measurements, bedlevel changes and scour and fill for Gulungul Creek

Section	Location	Date	Depth to (mm)			Scour (mm)	Fill (mm)	Section average		Notes
			First Link	First Vertical Link	Straightened Chain (2007 bed level)			Scour (mm)	Fill (mm)	
DG10-1	R bank	02/12/2008	100	160	-30	190	160270	230	205	Towards the right bank and then downstream
DG10-2	L bank	02/12/2008	250	250	-20	270	250			A pile in the stream bed

4 Ngarradj Creek results

4.1 Ngarradj cross section survey

The field program in Ngarradj creek was scaled back in 2005 to only a few cross sections, however following Cyclone Monica in April 2006 and the large flood in February 2007 most of the cross sections were resurveyed. A bed material sample was also taken at the completion of each cross section survey. The knickpoint retreat on Tributary North upstream of NT01 has also been surveyed. The cross section survey data for all of the sections surveyed between 2006 & 2009 are contained in Appendix D

4.1.1 Tributary North cross sections

A total of 13 cross sections were installed on this channel downstream of the Jabiluka project area in the floodout and gullied reaches (Erskine et al 2001). A tributary joins Tributary North on the left bank approximately 30 m upstream of the confluence with Ngarradj. Several cross sections include both the main channel as well as the tributary (Fig 22). TN01 (Fig 23) was the only cross section surveyed in 2006 & 2007 and the Knickpoint retreat was surveyed for 2006, 2007 & 2008 (Fig 24).

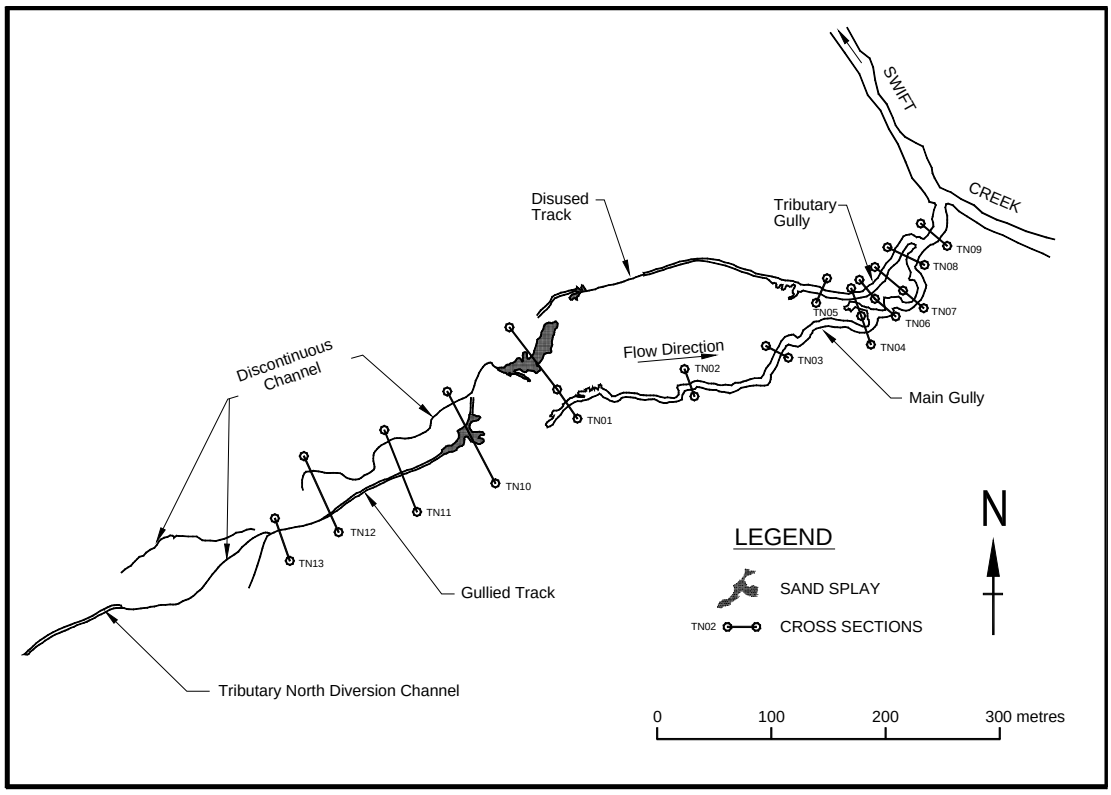

Figure 22 Location of the permanently monumented cross sections on Tributary North

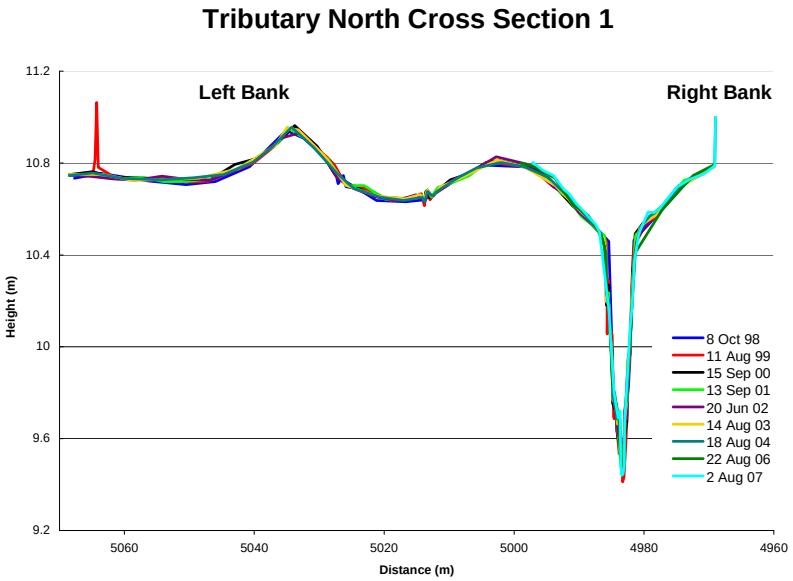

Figure 23 Tributary North cross section 1

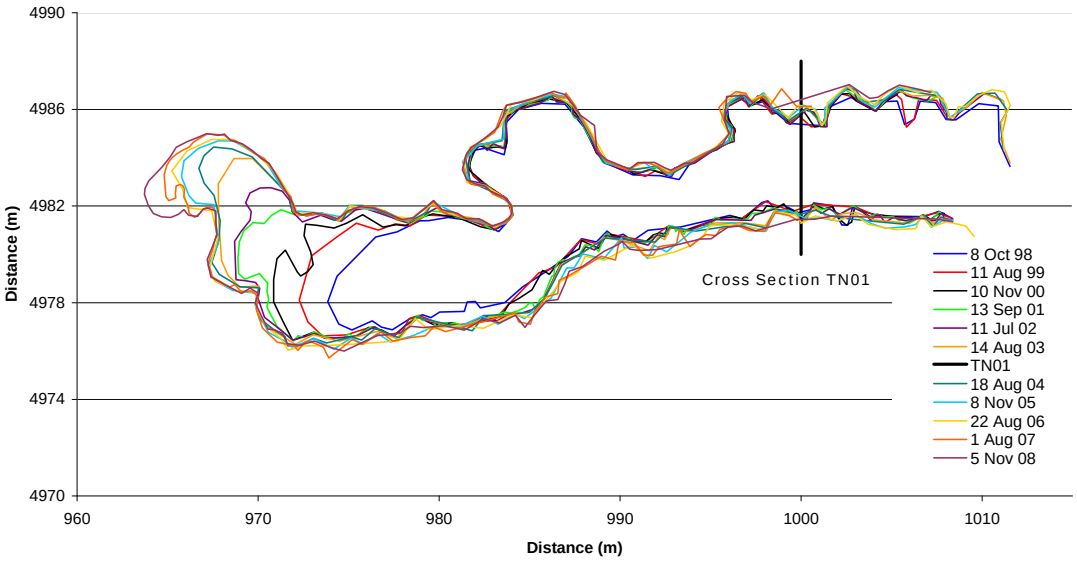

Figure 24 Annual surveys of the primary nickpoint at the head of Erskine et al's (2001) gullied reach on Tributary North. This refers to the main gully.

4.1.2 Tributary Central Cross sections

The locations of the 15 cross sections on Tributary Central downstream of the Jabiluka project area are shown in Figure 24. The most upstream sites, 6 and 7, comprise three cross sections (called A, B & C) on two abrupt angled bends in the sinuous reach (Erskine et al 2001). They were selected to determine the amount of bank erosion and lateral migration on meander loops. The remaining cross sections were located in the large and small capacity reaches (denoted in Figure 25 by the dotted & dashed line) which extend from the sinuous reach to the anabranch of Ngarradj (Erskine et al 2001). Two cross sections (sites TC08 and TC09) were located in the large capacity reach and the remaining six sections were sited in the small capacity reach. Bank height and channel capacity decrease rapidly downstream so

that the channel is poorly defined where Tributary Central joins the anabranch of Ngarradj. On Tributary Central only 4 of the sections (TC06A, TC06B, TC10 & TC11) were surveyed in 2006 and 2007. No survey of the cross sections on Tributary Central was undertaken in 2008 & 2009. The plots of the cross sections are shown in Figures 26 to 29.

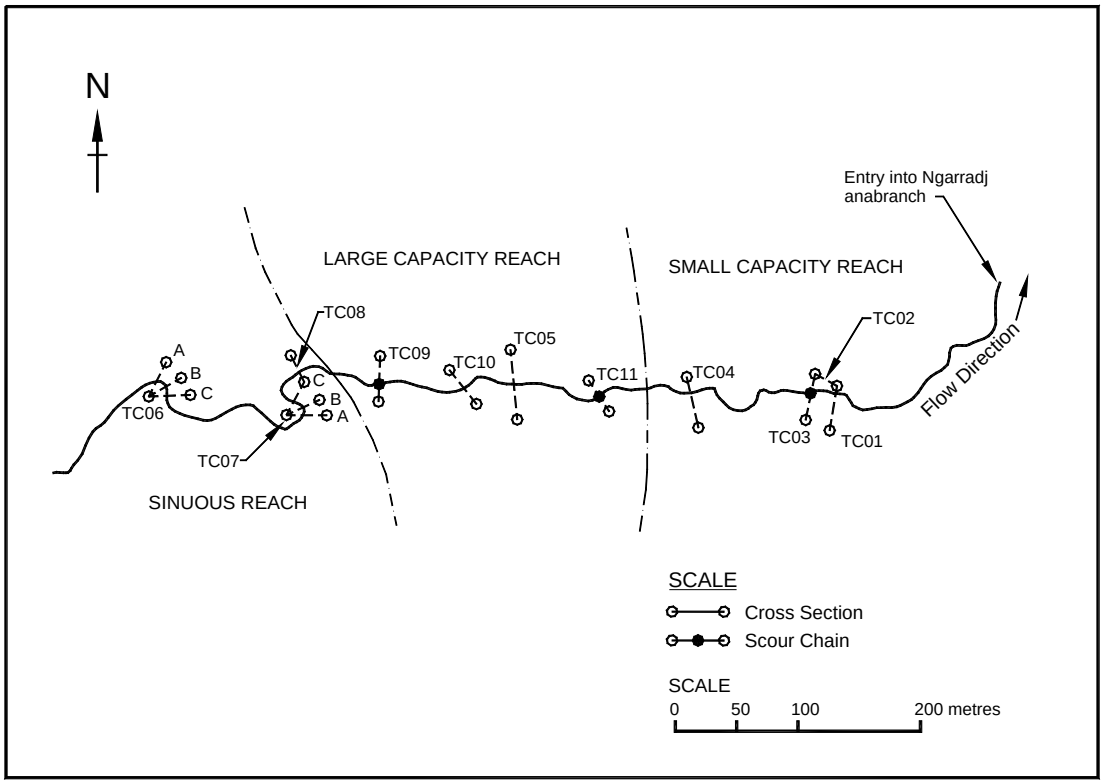

Figure 25 Location of the permanently monumented cross sections on Tributary Central

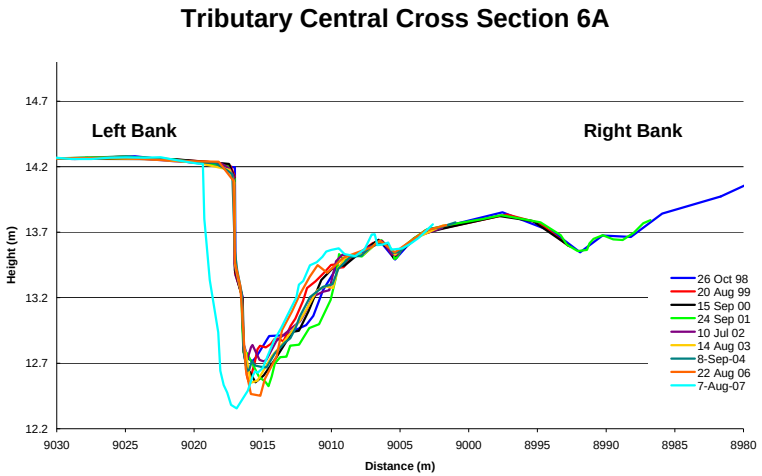

Figure 26 Tributary Central cross section 6A

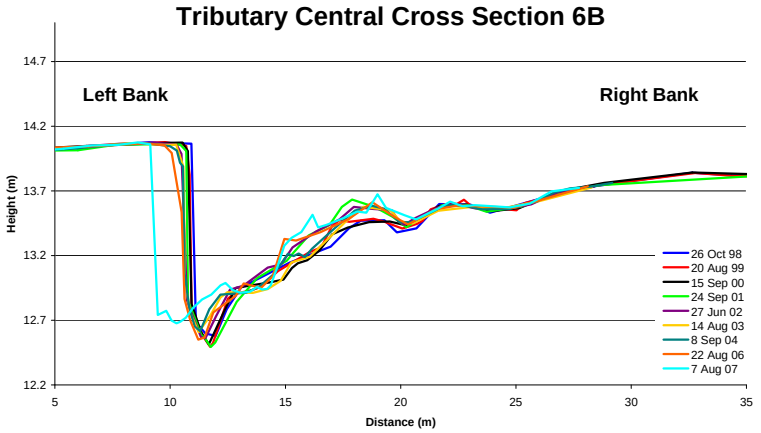

Figure 27 Tributary Central cross section 6B

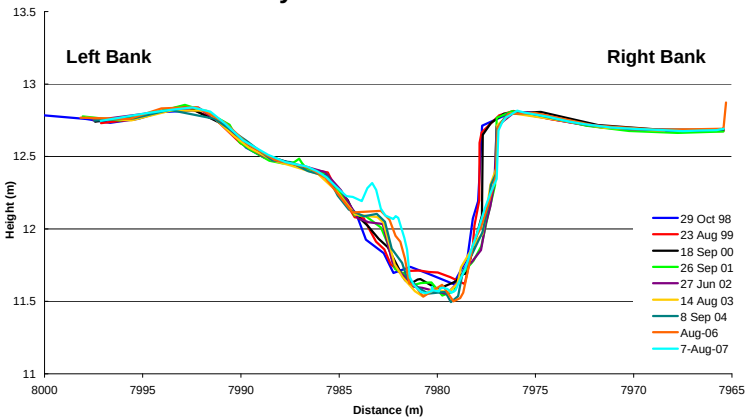

Figure 28 Tributary Central cross section 10

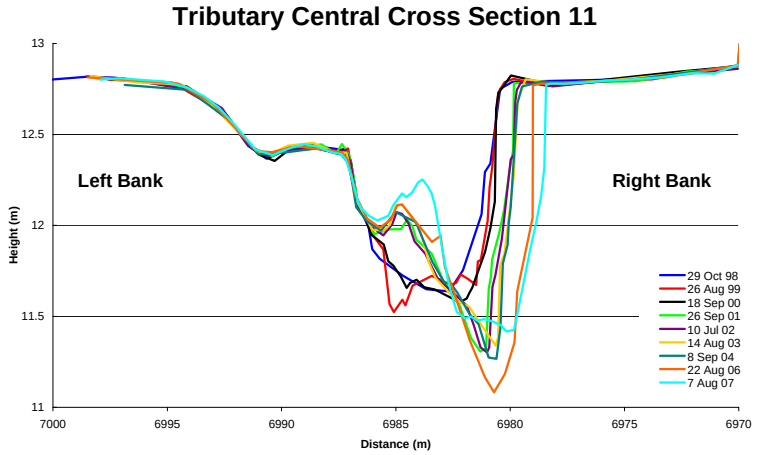

Figure 29 Tributary Central cross section 11

4.1.3 East Tributary Cross sections

The gauging station is located in a forested meandering reach (Erskine et al 2001). Eight cross sections were installed near the gauge during the 1998 dry season. They have been resurveyed during each subsequent dry season. The locations of the cross sections are shown in Figure 30. East Tributary is not impacted by the Jabiluka project and is flanked by a monsoonal vine forest at the gauging station (Erskine et al 2001). The forest stabilises the bank by a high density of tree trunks, roots and root mats. All of the eight cross sections at East Tributary were surveyed in 2006 (Cyclone Monica) & 2007 (large flood). Cross section ET05 is only cross section that has been surveyed each year between 1998 & 2009. The plots of the cross sections are shown in Figures 31 to 38.

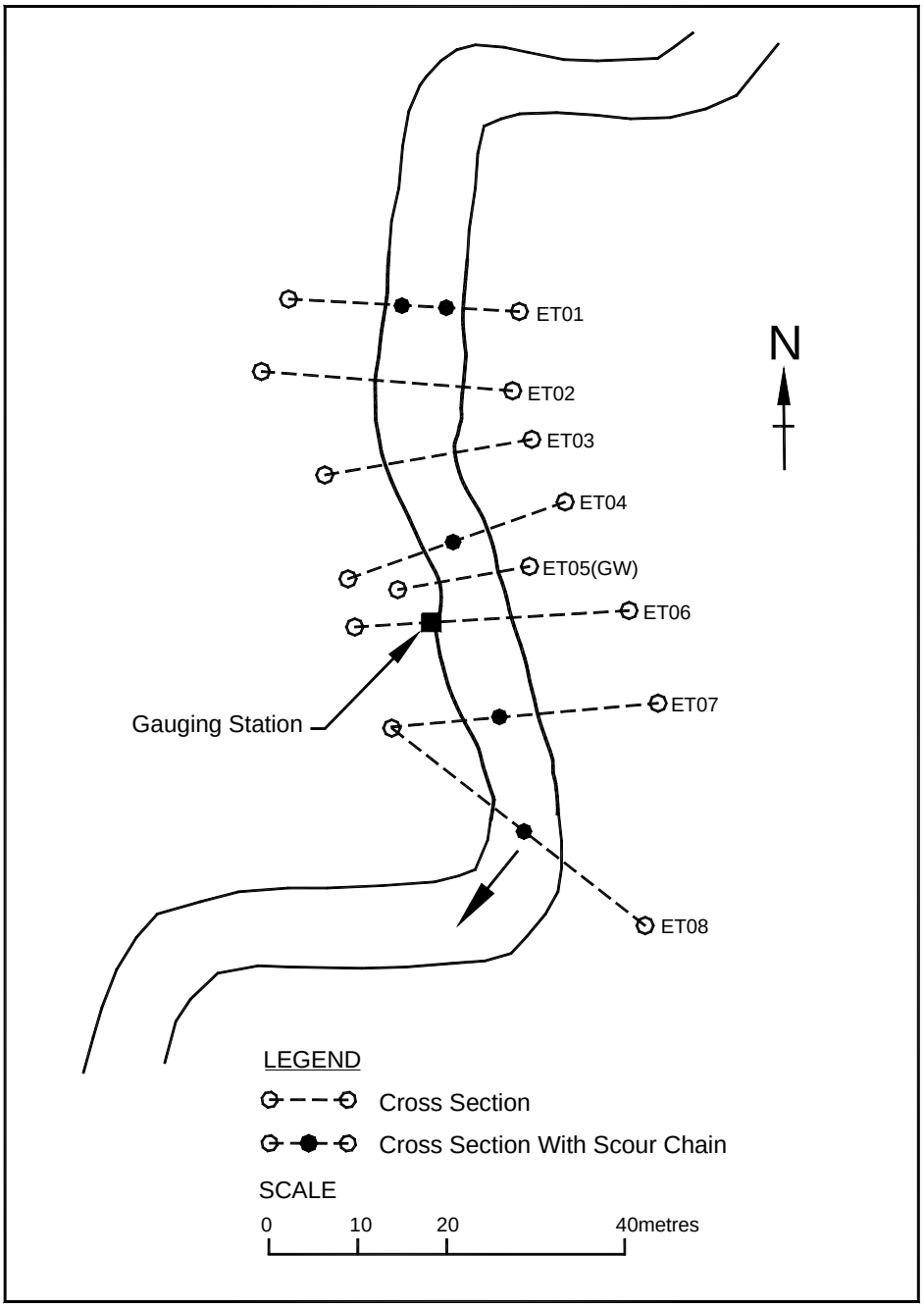

Figure 30 Location of the cross sections on East Tributary at the ***eriss*** gauging station

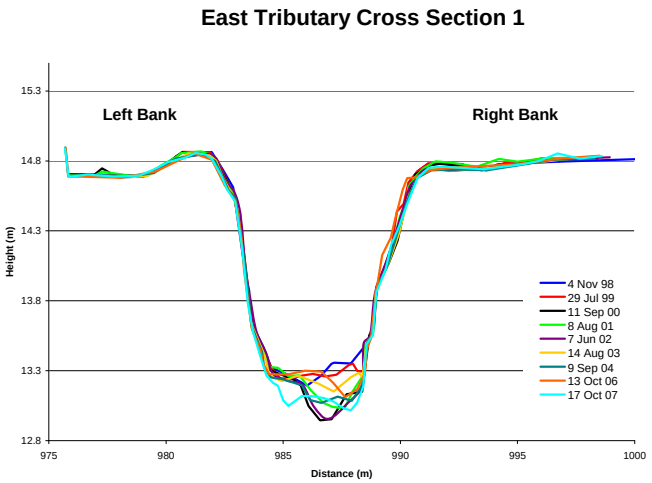

Figure 31 Cross section plot of East Tributary cross section 1 for 1998 to 2007

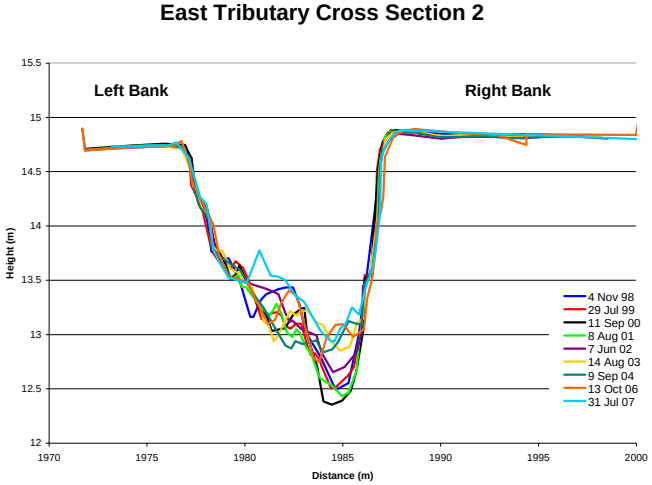

Figure 32 Cross section plot of East Tributary cross section 2 for 1998 to 2007

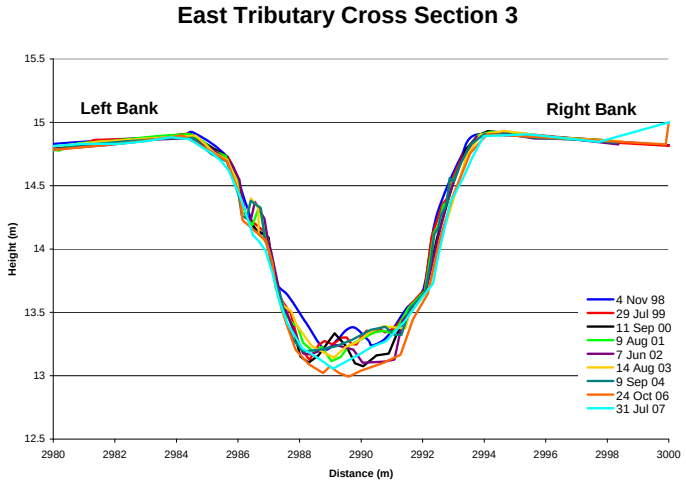

Figure 33 Cross section plot of East Tributary cross section 3 for 1998 to 2007

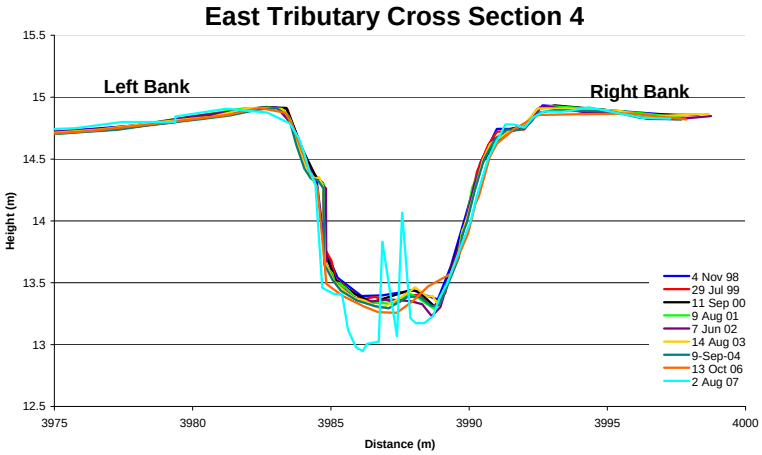

Figure 34 Cross section plot of East Tributary cross section 4 for 1998 to 2007

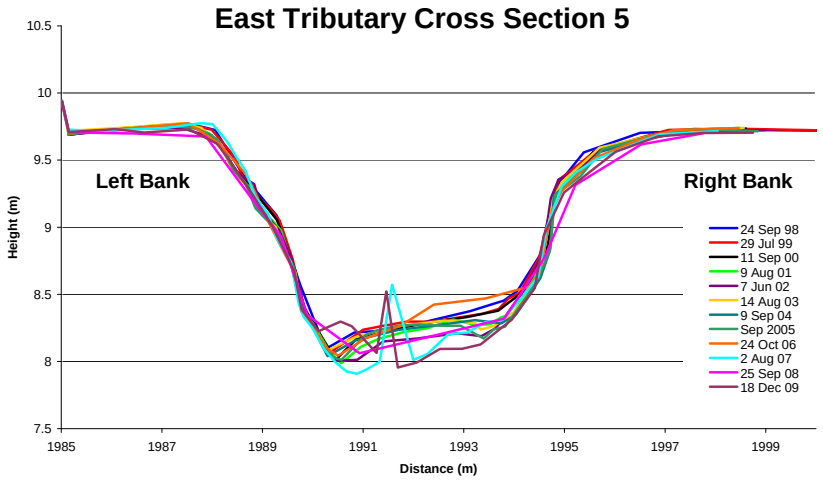

Figure 35 Cross section plot of East Tributary cross section 5 for 1998 to 2009

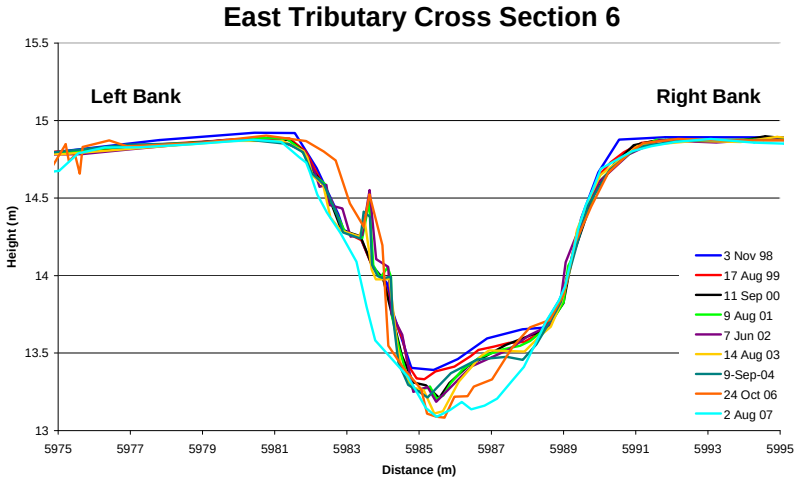

Figure 36 Cross section plot of East Tributary cross section 6 for 1998 to 2008

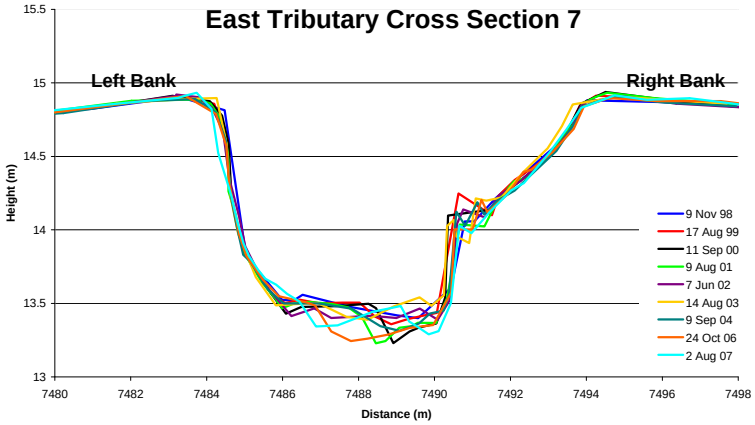

Figure 37 Cross section plot of East Tributary cross section 7 for 1998 to 2007

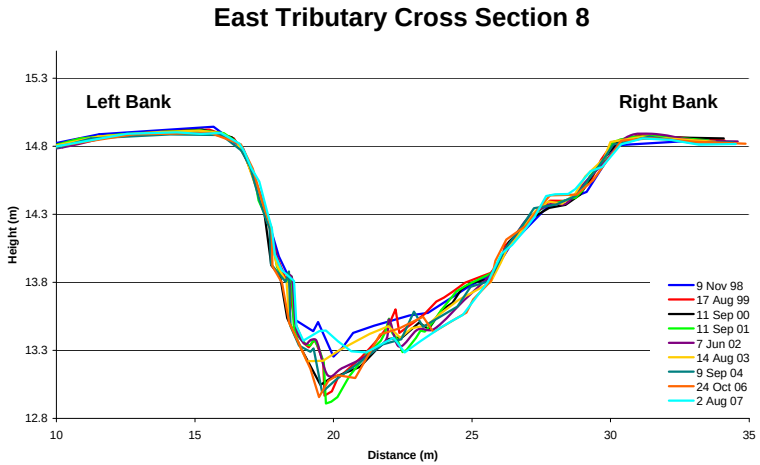

Figure 38 Cross section plot of East Tributary cross section 8 for 1998 to 2007

4.1.4 Upper Swift Creek Cross sections

The gauging station is located on upper Ngarradj in a forested meandering reach (Erskine et al 2001). Seven cross sections were installed at the gauge during the 1998 dry season. The locations of the cross sections are shown in Figure 39. They were resurveyed during each subsequent dry season until 2005. An additional cross section was added in 1999 (the gauging wire). Upper Ngarradj is not impacted by the Jabiluka project and is flanked by a monsoonal vine forest at the gauging station (Erskine et al 2001). Again this forest stabilises the banks. All of the eight cross sections at Upper Swift Creek were surveyed in 2006 (Cyclone Monica) & 2007 (large flood). Cross sections UMGW & UM04 were the only cross sections surveyed in 2008 and no cross sections were surveyed in at this site in 2009. The plots of the cross sections are shown in Figures 40 to 47.

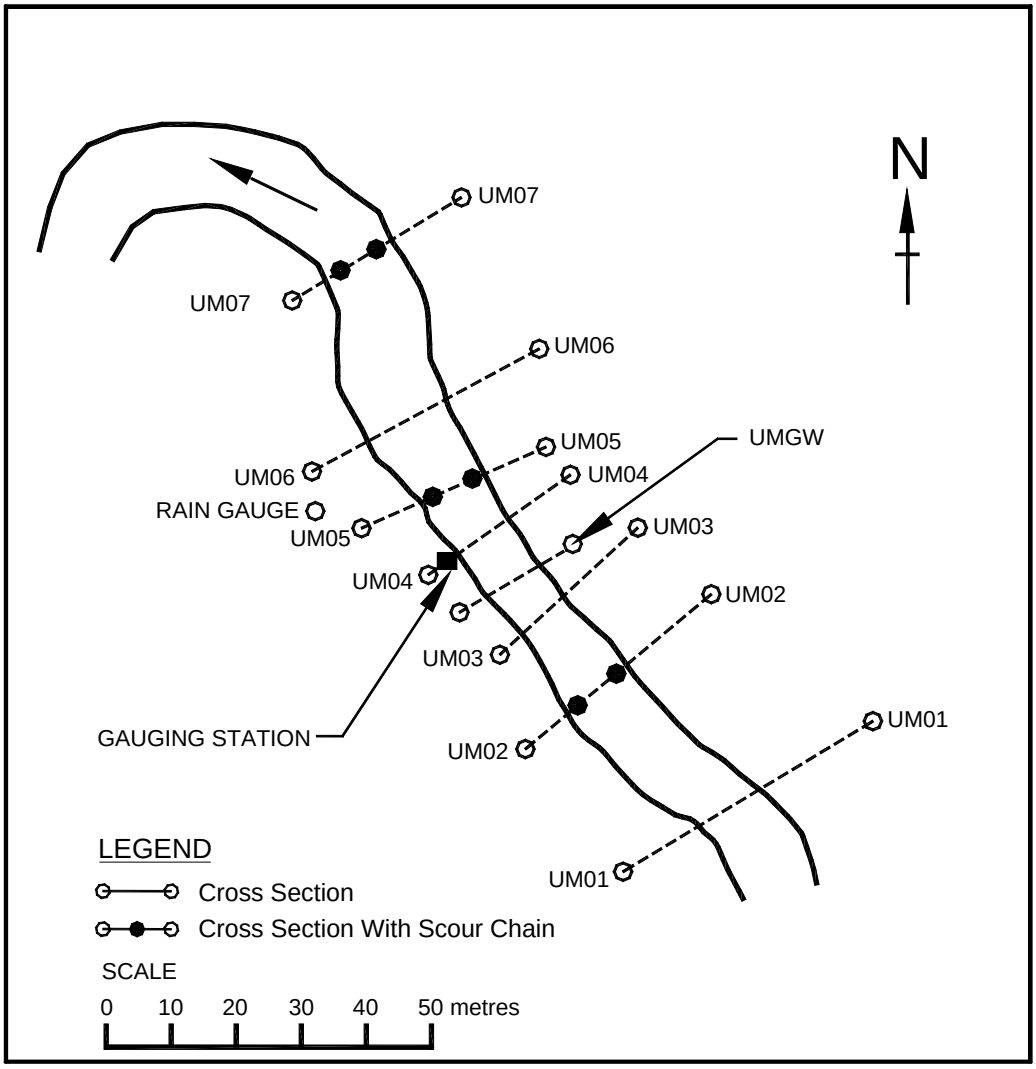

Figure 39 Location of the cross sections at the upper Swift Creek gauge

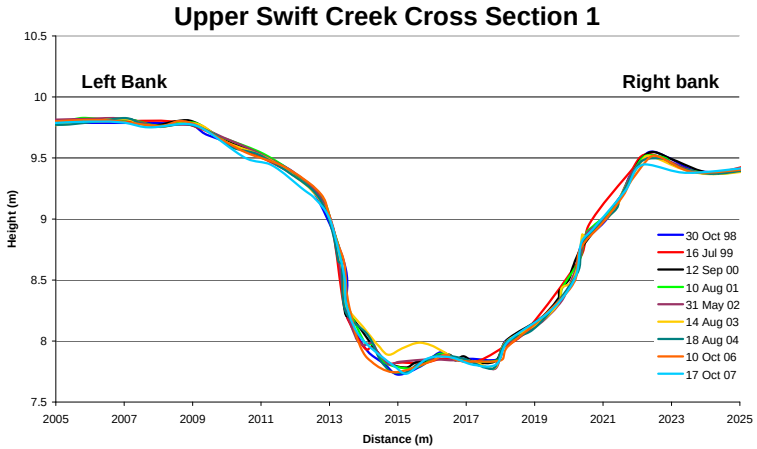

Figure 40 Upper Swift Creek cross section 1

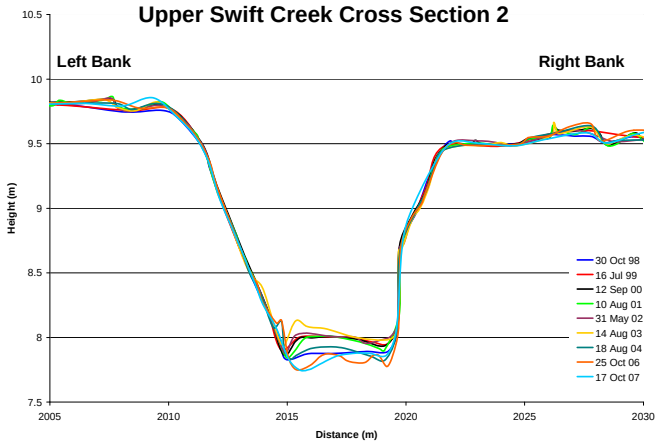

Figure 41 Upper Swift Creek cross section 2

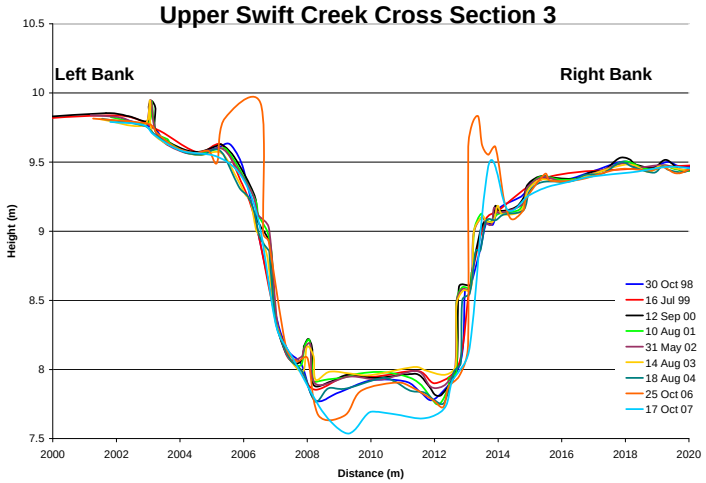

Figure 42 Upper Swift Creek cross section 3

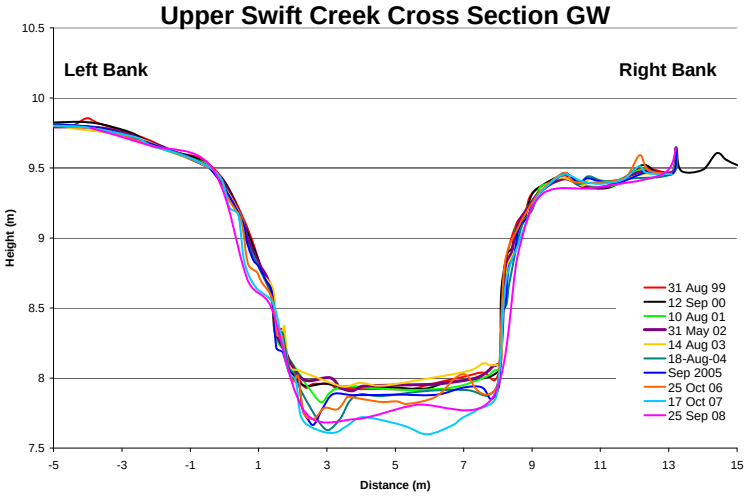

Figure 43 Upper Swift Creek cross section UMGW

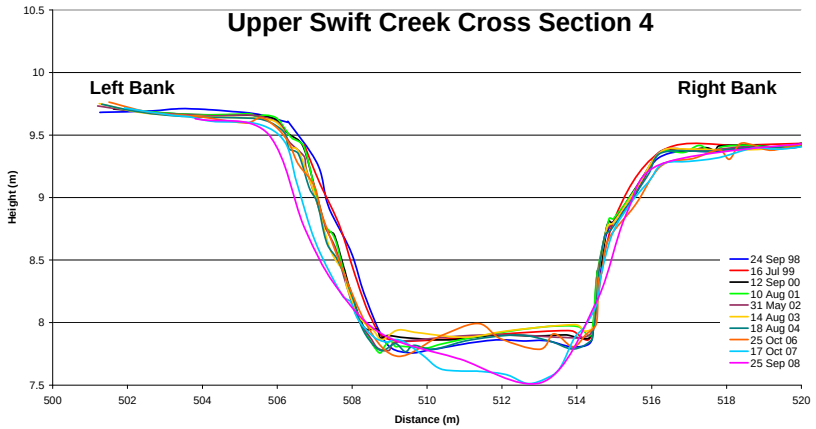

Figure 44 Upper Swift Creek cross section 4

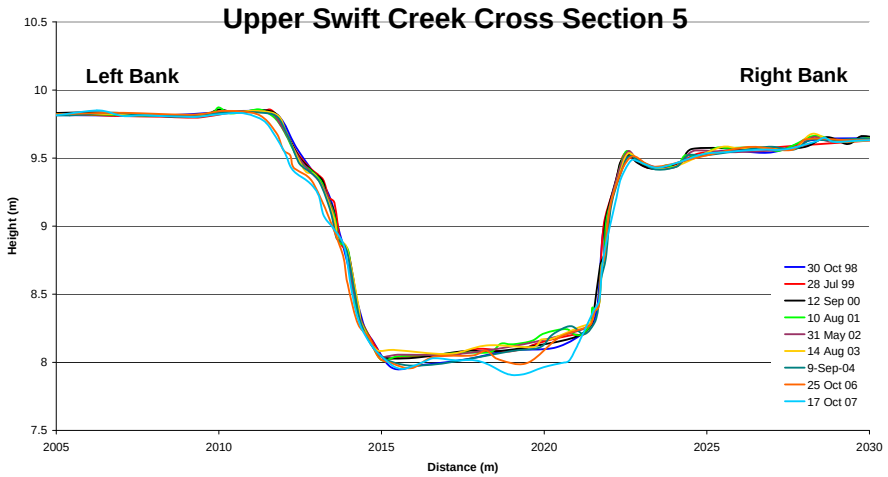

Figure 45 Upper Swift Creek cross section 5

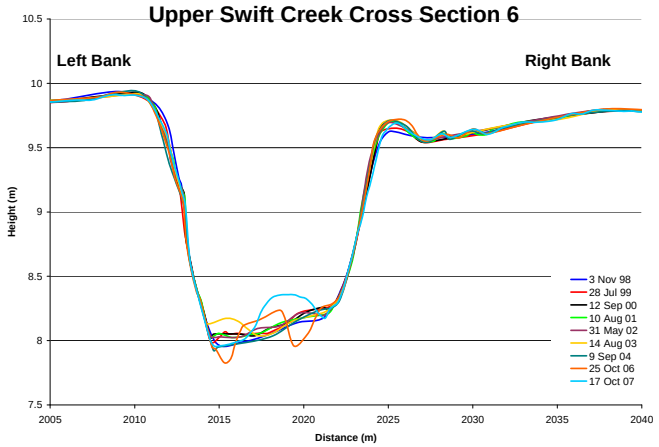

Figure 46 Upper Swift Creek cross section 6

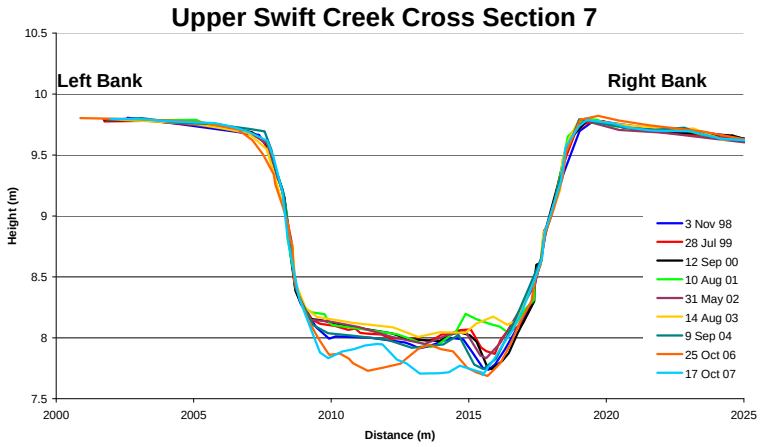

Figure 47 Upper Swift Creek cross section 7

4.1.5 Swift Creek Cross sections

The gauging station is located on Ngarradj in the sinuous reach of Erskine et al (2001). Eight cross sections were installed at the gauge during the 1998 dry season. They were resurveyed during each subsequent dry season. The location of the cross sections is shown in Figure 48. Cross sections SM01 & SM06 were the only cross sections surveyed in 2008 and 2009. The plots of the cross sections are shown in Figures 49 to 56.

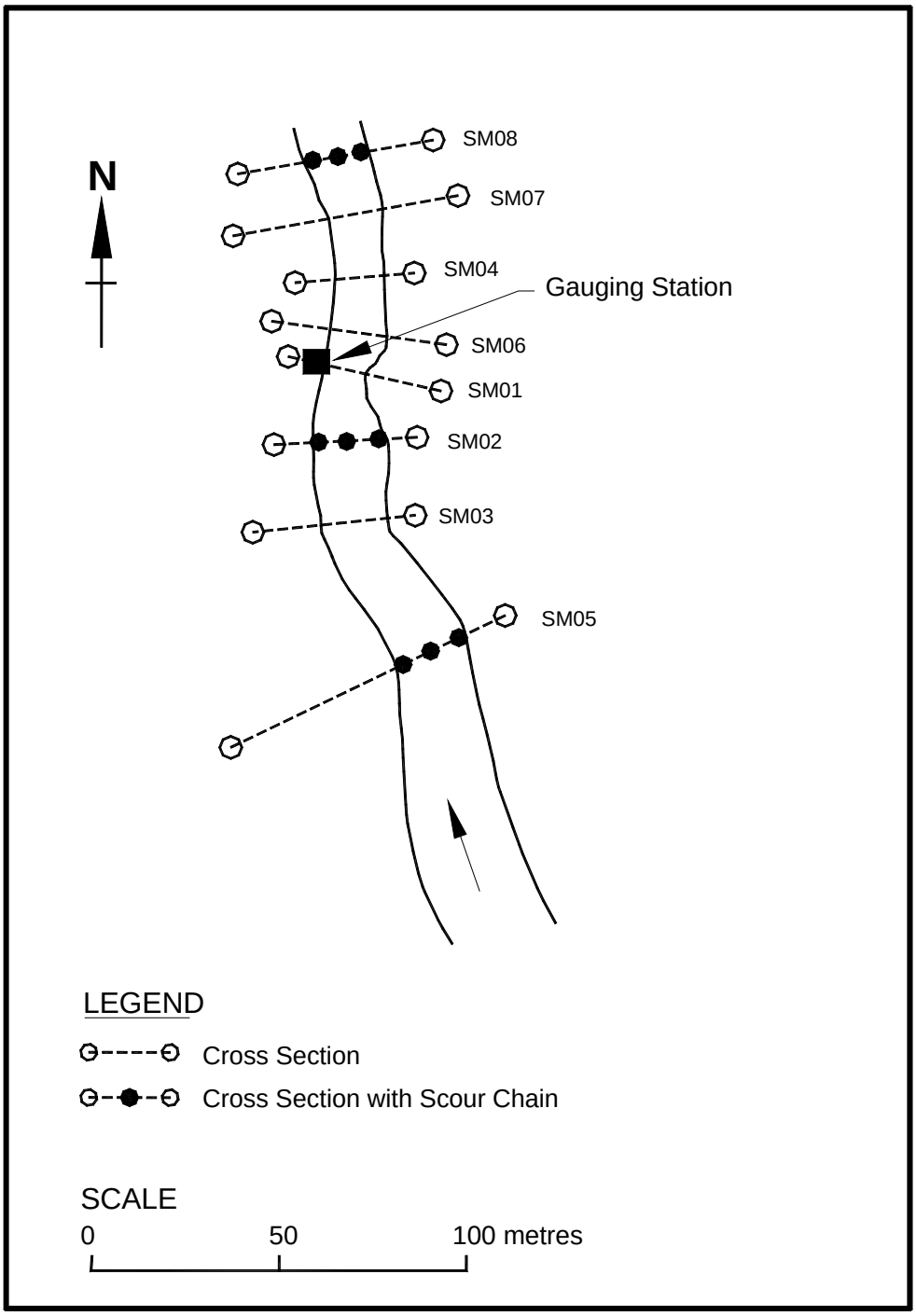

Figure 48 Location of cross sections at the lower Swift Creek gauge

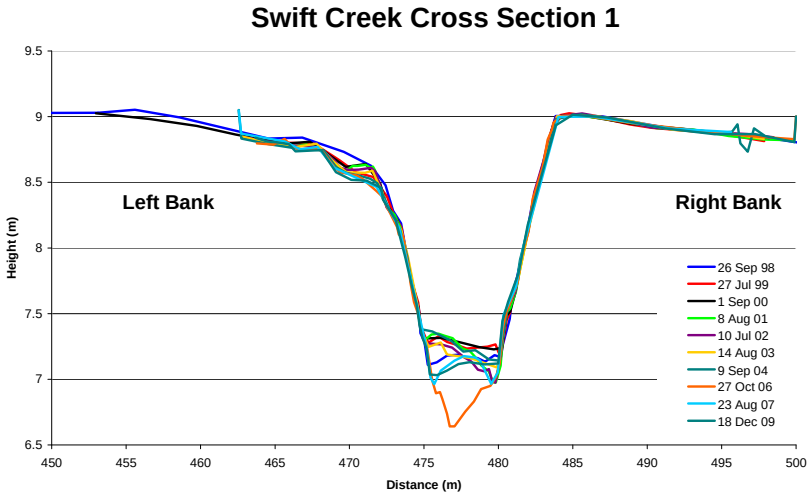

Figure 49 Swift Creek cross section 1

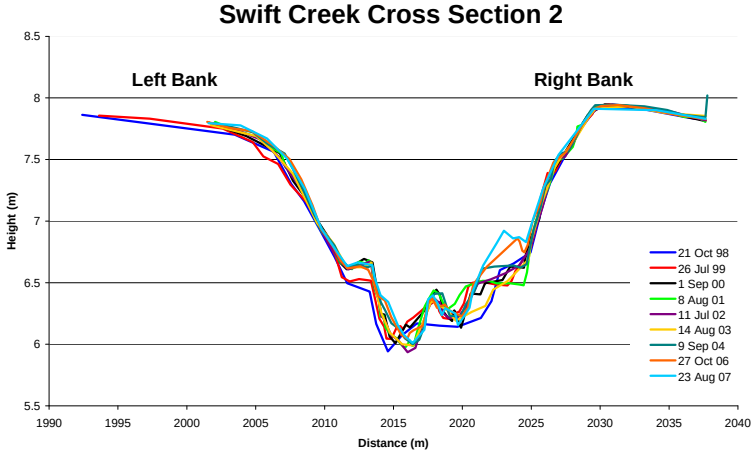

Figure 50 Swift Creek cross section 2

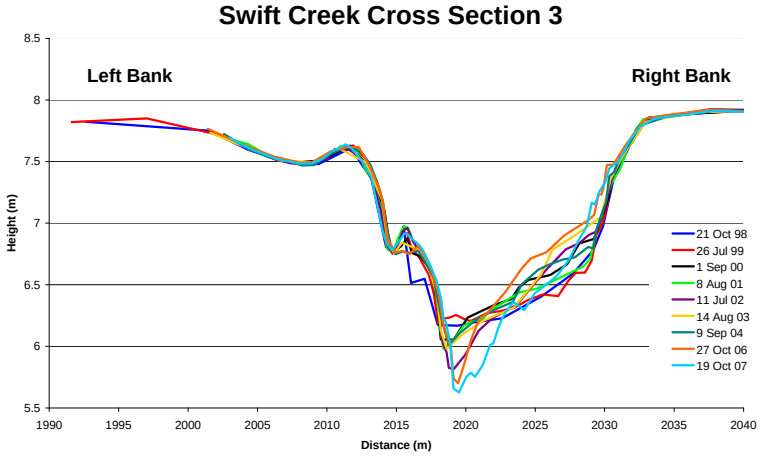

Figure 51 Swift Creek cross section 3

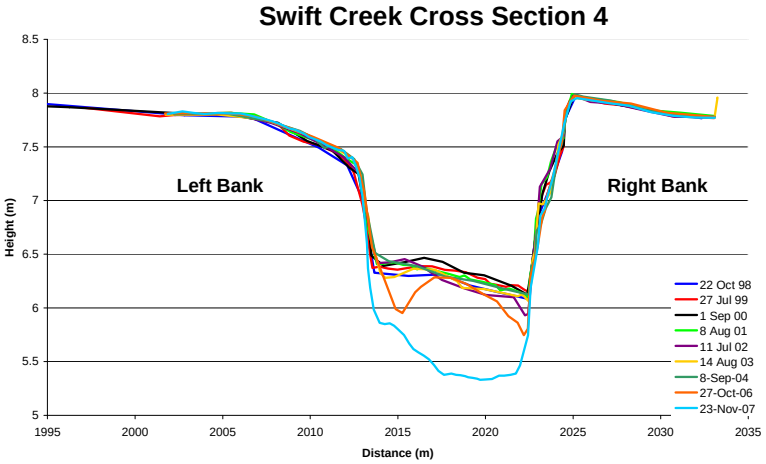

Figure 52 Swift Creek cross section 4

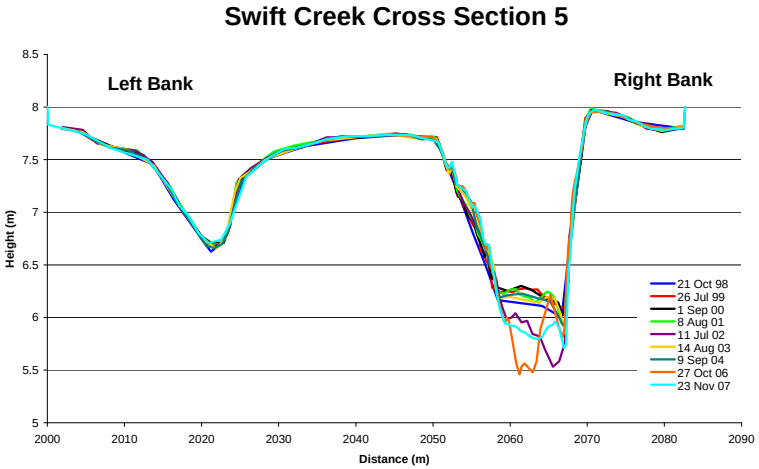

Figure 53 Swift Creek cross section 5

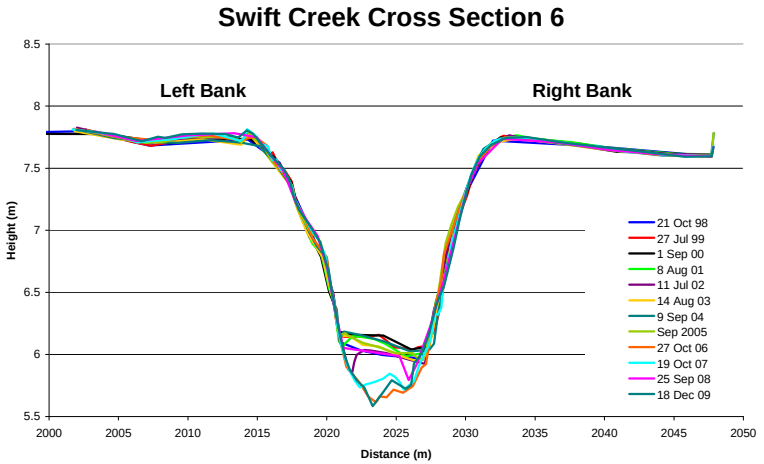

Figure 54 Swift Creek cross section 6

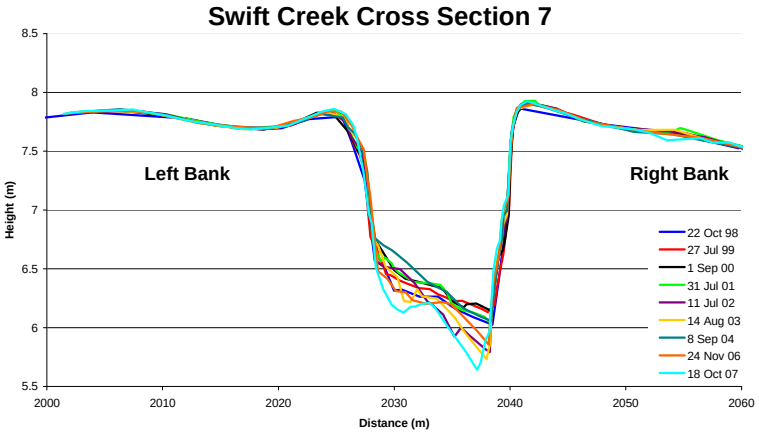

Figure 55 Swift Creek cross section 7

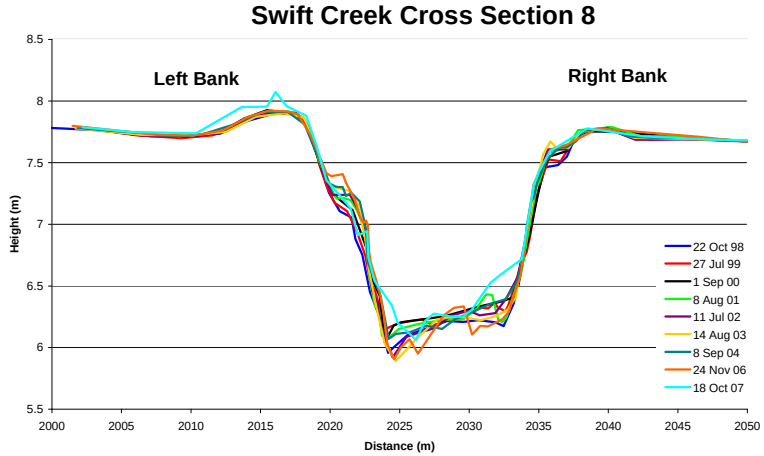

Figure 56 Swift Creek cross section 8

4.2 Ngarradj Creek particle size analysis

As part of the reduced field programme in Ngarradj Creek in 2005 samples were only collected for particle size analysis from the three gauging wire cross sections at each of the ***eriss*** gauging stations. Following Cyclone Monica in 2006 and then a large rainfall and flood event in 2007, bed material samples were collected from all sites at each of the ***eriss*** gauging stations and several sites on the mine site tributaries. The grain size statistics for Ngarradj for 2006 to 2009 inclusive are shown in Tables 12 to 13 respectively. The cumulative frequency grain size distributions and Folk (1954, 1974) texture group for each sediment sample collected on Ngarradj Creek are contained in Appendix E. Bed material samples were not collected for the mine site tributaries in 2006

Table 12 Grain size statistics for North Tributary 2007

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
1-Aug-07	NT01	1.00	1.33	0.10	2.22	0.69

Table 13 Grain size statistics for Tributary Central 2007

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
03-Aug-07	TC-06A	1.29	2.20	-0.08	2.14	0.68
03-Aug-07	TC-06B	-1.99	2.83	0.17	0.61	0.38
03-Aug-07	TC-10	-1.13	2.90	-0.19	0.62	0.38
03-Aug-07	TC-11	1.12	0.88	-0.14	1.18	0.54

Table 14 Grain size statistics for East Tributary 2006 to 2009

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
13-Oct-06	ET01	0.94	0.69	-0.04	1.10	0.52
13-Oct-06	ET02	1.60	0.66	-0.10	1.16	0.54
24-Oct-06	ET03	0.57	1.41	-0.40	1.30	0.57
13-Oct-06	ET04	0.67	1.21	-0.15	0.91	0.48
24-Oct-06	ET05	0.43	1.01	-0.17	1.09	0.52
24-Oct-06	ET06	1.11	1.02	-0.07	1.27	0.56
24-Oct-06	ET07	1.04	1.05	-0.18	1.24	0.55
24-Oct-06	ET08	0.45	1.18	-0.27	1.18	0.54
31-Jul-07	ET01	1.49	0.91	-0.14	1.30	0.57
31-Jul-07	ET02	1.50	0.95	-0.06	1.15	0.53
31-Jul-07	ET03	1.72	0.72	0.06	1.01	0.50
1-Aug-07	ET04	0.96	1.48	-0.26	1.08	0.52
1-Aug-07	ET05	0.95	1.50	-0.31	1.18	0.54
1-Aug-07	ET06	1.76	1.05	0.03	1.27	0.56
1-Aug-07	ET07	0.95	1.29	-0.21	1.28	0.56

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
1-Aug-07	ET08	0.79	1.27	-0.28	1.32	0.57
25-Sep-08	ET05	0.94	1.01	-0.26	1.43	0.59
11-Dec-09	ET05	1.25	0.91	-0.14	1.25	0.56

Table 15 Grain size statistics for Upper Swift Creek 2006 tp 2009

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
	UM01			Not Sampled		
25-Oct-06	UM02	1.16	0.72	-0.04	1.09	0.52
25-Oct-06	UM03	1.00	0.72	-0.04	1.20	0.55
25-Oct-06	UMGW	0.95	0.71	0.00	1.08	0.52
25-Oct-06	UM04	0.98	0.71	0.08	1.09	0.52
25-Oct-06	UM05	1.26	0.98	-0.28	1.68	0.63
25-Oct-06	UM06	0.93	1.00	-0.17	1.65	0.62
25-Oct-06	UM07	-0.44	2.78	-0.66	2.32	0.70
17-Oct-07	UM01	0.62	1.78	-0.40	2.83	0.74
17-Oct-07	UM02	1.12	0.77	0.07	1.04	0.51
17-Oct-07	UM03	0.88	0.79	0.03	1.21	0.55
17-Oct-07	UMGW	1.03	0.63	0.14	1.08	0.52
17-Oct-07	UM04	1.26	0.74	-0.08	0.99	0.50
17-Oct-07	UM05	1.04	0.76	0.06	1.03	0.51
17-Oct-07	UM06	0.98	0.79	0.02	1.10	0.52
17-Oct-07	UM07	0.98	1.73	-0.44	3.40	0.77
25-Sep-08	UMGW	1.06	0.54	0.00	1.03	0.51
25-Sep-08	UM04	0.96	0.72	0.16	1.21	0.55
11-Dec-09	UMGW	0.96	0.55	0.01	1.09	0.52
11-Dec-09	UM04	0.95	0.57	-0.03	1.12	0.53

Table 16 Grain size statistics for Swift Creek Main 2006 to 2009

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
27-Oct-06	SM01	0.92	0.95	-0.15	1.24	0.55
27-Oct-06	SM02	1.23	0.98	-0.29	1.60	0.62
27-Oct-06	SM03	1.09	0.65	-0.12	1.13	0.53
27-Oct-06	SM04	0.72	0.81	-0.18	1.08	0.52
27-Oct-06	SM05	1.15	0.71	-0.01	1.11	0.53
24-Oct-06	SM06	0.96	0.89	-0.17	1.34	0.57
27-Oct-06	SM07	1.09	0.61	-0.05	1.13	0.53
22-Aug-07	SM01	0.76	1.06	-0.28	1.07	0.52

Date Collected	Sample	Graphic mean (ϕ)	Inclusive graphic SD (ϕ)	Inclusive graphic skewness	Graphic kurtosis	Transformed kurtosis
22-Aug-07	SM02	1.13	1.18	-0.43	1.21	0.55
18-Oct-07	SM03	0.68	1.10	-0.64	0.67	0.40
	SM04			Not Sampled		
23-Nov-07	SM05	1.01	0.74	-0.11	1.14	0.53
18-Oct-07	SM06	1.01	0.74	-0.08	1.16	0.54
18-Oct-07	SM07	0.88	0.65	-0.11	1.12	0.53
18-Oct-07	SM08	0.60	1.06	-0.24	1.09	0.52
18-Oct-08	SM06	0.96	0.70	-0.11	1.15	0.53
18-Dec-09	SM01	0.89	1.11	-0.12	1.02	0.50
18-Dec-09	SM06	1.36	0.80	-0.05	1.13	0.53

5 Brief discussion and recommendations

The channel cross-sectional data and grain size statistics for bulk bed material samples collected by ***eriss*** on Ngarradj & Gulungul Creeks for the period of 2006 to 2009 have been presented in this report. Early publications with the data collected for Ngarradj creek catchment and Gulungul Creek catchment were listed in sections 1.1 and 1.2 of this report. Some scour chain data is also presented for Gulungul Creek for this period.

5.1 Gulungul Creek

This report contains cross section, scour chain measurements and bed material samples for the period 2006 to 2009. There are 13 permanently monumented (marked) cross sections installed on Gulungul Creek, 12 of which have been surveyed annually during the dry seasons of 2002 to 2009 to help to determine baseline characteristics of Gulungul Creek. Cross section DG12 has been added to this report and has been generated using depths and distances from the velocity area gaugings. DG12 has not been measured during the dry seasons as part of the standard survey programme.

For each of the 13 cross sections the banks are reasonably stable (some small changes on several sections) with the greatest changes occurring in the bed of the channel. There is a trend of substantial bed scour following the 2006/2007 wet season at most sections, with greatest scour of approximately 0.6 m occurring at MG09. In the two wet seasons following this scour there is a trend of infill of the bed, with approximately 0.8 m of deposition at MG09 in 2007/2008 and approximately 0.2 m at MG03 and MG09 in 2009/2009. A left bank sand bar formed at UG04 in the 2004/2005 wet season, was added to during the 2005/2006 wet season and then totally removed during the 2006/2007 wet season.

The Gulungul Creek cross sections show that it is a highly dynamic creek with sediment being eroded and deposited at intervals along the channel. Pools and runs are significant sediment storages which can be totally reworked by large floods. The significance of the magnitude and number of floods during a wet season for bed scour and fill needs to be examined. This is proposed for 2010 as a collaboration with Professor Erskine.

Bulk bed material samples were collected each year at each cross section to characterise the sediments using particle size analysis. Scour chains have been installed at some of the cross sections to provide information about the scour and fill that occurs during each wet season. The analysis of this data will also be undertaken as a collaboration with Professor Erskine.

5.2 Ngarradj Creek

Cross sectional information collected on Ngarradj Creek were from mainly after above average rainfall years. The collection of data from Ngarradj Creek was reduced after 2004. Following Cyclone Monica in April 2006 the field program was re-introduced with a view to determine what effect the cyclone might have had on channel stability. There was no substantial rain associated with the cyclone and because it occurred late in the wet season of 2005/2006 there was little subsequent rain. During the 2006/207 wet season there was an extremely large rainfall and runoff event (late February early March) (Moliere et al 2007). All of the cross sections at the gauging station reaches and some of the cross sections on mine site tributaries, Tributary North and Tributary Central, were surveyed in 2006 and 2007. The number of cross sections surveyed in 2008 and 2009 were again reduced.

5.2.1 Tributary North

The gully knick point on the Main gully of Tributary North was surveyed in 2006 2007 & 2008 and is shown in Figure 24. It is continuing to erode at an approximate rate of 1.5 my^{-1}. Cross section TN01 was the only cross section surveyed during this period and only for years 2006 & 2007. It has remained relatively stable for the years that it has been surveyed.

5.2.2 Tributary Central

Four cross sections were surveyed on Tributary Central in 2006 and 2007, with each now having 9 years of data. No cross sections were surveyed on Tributary Central in 2008 and 2009. Cross sections TC6A and TC6B are situated on a large angled bend in the sinuous reach (Figure 25) and there was substantial bank erosion on the outside of the bed in the 2007 survey. TC10 and TC 11 are both situated in the Large Capacity Reach. TC10 exhibits some right bank for the survey period and also some deposition (bench) on the left Bank. TC11 is on a slight bend and has been actively migrating for the period of the survey, with bank erosion on the right bank and active point bar development on the left bank.

5.2.3 East Tributary.

Graphs of the eight cross sections located at East Tributary are shown in Figures 31 to 38. For 7 of the sections there are nine years of data and for ET05 (the gauging wire location) there is 12 years of data. The sections exhibit stable banks which is due to the riparian vegetation (Saynor et al 2006). The cyclone caused several trees to fall into and along the channel sections and these are shown on the 2006 surveys as pointed peaks (for example, ET04 & ET05). Generally the surveys of the bed following the cyclone fit within the variation shown in earlier surveys. Some bed scour and bank erosion is shown by the 2008 survey for ET04, ET05 and ET06. At ET04 and ET06 there is a tree lying in the bed parallel with the flow path and ET06 had a large tree knocked over on the left bank which is the only noticeable erosion shown in the surveys. At ET05 the scour in 2007 was followed by some deposition in 2008 followed by scour in 2009. The location of the tree is having some impact on the movement and deposition of sand in the channel.

5.2.4 Upper Swift Creek

Graphs of the eight cross sections at Upper Swift Creek are shown in Figures 40 to 47. For six of the cross sections there are nine years of data and for the other two there are 10 years of

data (noting that UMGW was installed and survyed first in 1999). No surveys were completed in 2009. During the cyclone, several large *Allosyncarpia ternata* trees fell across the channel. One of these fell across the channel between UM03 and UMGW. The banks are generally stable except for the three cross sections closest to this large bridging tree. UM03 has a large input of wood on the top of both banks from the fallen tree and this is shown clearly for the 2006 survey (orange line). This was lower on the right bank for the 2007 survey due to settling and some break down of the large wood and also a fire had affected the site between the surveys. UM04 is located through the gauging structure and also had a large amount of large wood deposited in the channel by the cyclone. Scour is present at most of the cross sections and is due to the increase in large wood in the channel. A study is currently under way to investigate the impact of the cyclone on large woody debris in Ngarradji Creek and will include analyses of the cross section results.

5.2.5 Swift Creek

Graphs of the eight cross sections at Swift Creek are shown in figures 49 to 56. For six of the cross sections there are nine yars of data and for the other two there are 10 years of data and 12 years of data. The banks of the cross sections are generally stable and there is some over bank deposition evident at a couple of sections. The 2007 flood caused the deepest erosion at three of the sections including for SMO4 a bed scour of approximately 0.4 m below the previous low point. Observation whilst visiting this site in 2008 and 2009 indicate that the SM04 cross section is now located ina deep pool that has held water year round since it was scoured. SM06 has 12 years of record and is located at the gauging wire and also on the upstream lead into the scoured pool that has developed. SM06 exhited scour in 2006 and 2007 to approximately the same level, deposition of approximately 0.2 m then scour to the same levels in 2009 as experienced in 2006 and 2007.

5.3 Recommendations

It is **recommended** that Professor Erskine, with the assistance of HGP staff, include analyses of the above Gulungul Creek geomorphic data as part of his study leave project and that they write it up as a Supervising Scientist Report. The future of the current program will be reviewed in this Supervising Scientist Report.

Channels in the Ngarradj Creek catchment are reasonably low energy (bankfull specific stream powers less than 25 W/m^2 and Froude Numbers $(V_m/(g.Y_m)^{0.5}$ where V_m is mean flow velocity, g is gravitational acceleration constant and Y_m is mean flow depth) much less than 0.5. Therefore, banks, where vegetated by riparian trees, are stable and most energy expenditure is in bed scour. Provided the riparian vegetation is not burnt by intense fires, the channels should remain stable in the short-term. It is **recommended** that the Ngarradj Creek geomorphic program be suspended from 2010 and that the large wood project being conducted by Erskine and Saynor include analyses of the recent cross section surveys and grain size statistics of bed material. Field work for the large wood project will be concluded in October 2010 and analyses of data and final write up will be completed during 2011. It is also **recommended** that the Ngarradj Creek geomorphic program remain suspended until the future of the Jabiluka mine is decided.

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Appendix A
Gulungul Creek survey data for each cross section for 2006 to 2009

This appendix contains the survey data for each cross section for the 2006 to 2009 dry seasons. The cross sections are listed in downstream sequence. Refer to the relevant diagrams in Section 3 to determine where they are located. Cross section DG12 is shown in a separate at the end of appendix A

The datum used for each section is an assumed datum with a horizontal angle of either 0°, 90°, 180°, 270° so that there is a distance (chainage) and a height for each survey point. All measurements are in metres and each cross section is independent of each other cross section. The assumed datum is often different between cross sections.

The location of the data files on SSDX Sharepoint is:

\\Landscape Characterisation and Monitoring\Gulungul Creek\Sediment transport in Gulungul Creek catchment\Data\xsections

Gulungul Creek Cross sections 2006							
UG02 Distance (m)	26-Oct-06 Assumed Height (m)	UG01 Distance (m)	26-Oct-06 Assumed Height (m)	UG03 Distance (m)	26-Oct-06 Assumed Height (m)	UG04 Distance (m)	26-Oct-06 Assumed Height (m)
955.374	49.162	1961.900	49.575	958.84	48.971	964.489	49.502
958.133	49.176	1964.376	49.586	959.007	49.008	966.507	49.527
961.039	49.211	1967.186	49.575	961.112	49.080	967.811	49.561
964.163	49.213	1970.381	49.600	961.057	49.083	969.246	49.566
967.008	49.264	1973.24	49.587	963.834	49.171	970.875	49.571
969.583	49.016	1975.774	49.490	965.883	49.150	972.145	49.600
971.568	48.977	1977.349	49.339	968.428	49.043	973.694	49.625
972.589	49.011	1979.084	49.366	970.376	48.975	974.600	49.664
973.408	49.078	1980.130	49.419	971.814	48.945	975.570	49.555
974.179	48.956	1980.786	49.428	973.212	48.822	975.993	49.431
974.899	48.870	1981.706	49.290	973.951	48.732	976.802	49.236
975.421	48.852	1982.242	49.165	974.965	48.647	977.030	49.078
975.741	48.744	1982.900	48.954	975.617	48.579	977.402	48.982
975.998	48.574	1983.299	48.836	975.949	48.455	977.590	48.863
976.134	48.419	1983.423	48.783	976.218	48.433	977.897	48.791
976.301	48.340	1983.793	48.678	976.453	48.333	978.272	48.692
976.513	48.304	1984.074	48.521	976.733	47.781	978.452	48.682
976.681	48.314	1984.260	48.435	977.014	47.668	978.580	48.694
976.953	48.276	1984.966	48.279	977.344	47.612	978.929	48.616
977.111	48.167	1985.270	48.157	978.108	47.609	979.197	48.688
977.335	48.135	1985.801	48.149	979.112	47.502	979.403	48.740
977.607	47.970	1986.231	48.075	980.926	47.533	979.801	48.737
977.842	48.002	1987.185	48.167	981.556	47.531	980.623	48.652
978.033	47.907	1987.859	48.233	982.315	47.449	981.514	48.525
978.316	47.838	1989.079	48.281	982.797	47.341	982.446	48.350
978.818	47.791	1990.160	48.316	983.267	47.297	983.005	48.199
979.805	47.786	1991.223	48.303	983.835	47.382	983.761	48.117
981.547	47.943	1992.085	48.267	984.618	47.545	984.696	47.909
982.507	48.008	1992.272	48.496	985.001	47.631	985.205	47.945
983.487	47.976	1992.604	48.702	985.324	47.646	985.959	48.045
984.135	47.942	1992.672	49.078	985.767	47.601	986.467	48.158
984.416	47.976	1992.869	49.190	985.952	47.773	986.853	48.321
984.755	48.848	1993.384	49.276	986.113	47.943	987.062	48.527
985.087	49.137	1994.379	49.373	986.300	48.024	987.296	48.551
986.453	49.225	1994.785	49.480	986.687	48.185	987.553	48.720
987.675	49.200			986.804	48.317	988.180	49.163
990.603	49.318			987.267	48.828	988.458	49.239
993.012	49.410			987.601	49.046	988.580	49.349
994.693	49.495			988.135	49.141	988.799	49.385

Gulungul Creek Cross sections 2006							
UG02 Distance (m)	**26-Oct-06 Assumed Height (m)**	**UG01 Distance (m)**	**26-Oct-06 Assumed Height (m)**	**UG03 Distance (m)**	**26-Oct-06 Assumed Height (m)**	**UG04 Distance (m)**	**26-Oct-06 Assumed Height (m)**
998.109	49.639			989.000	49.183	989.027	49.341
				989.948	49.132	990.008	49.301
				990.638	49.131	990.698	49.445
				992.792	49.289	991.725	49.607
				994.871	49.449	992.867	49.708
				998.417	49.662	994.977	49.771
						997.253	49.758
						998.866	49.787

Gulungul Creek Cross sections 2006							
MG05 Distance (m)	23-Oct-06 Assumed Height (m)	MG06 Distance (m)	23-Oct-06 Assumed Height (m)	MG07 Distance (m)	23-Oct-06 Assumed Height (m)	MG08 Distance (m)	23-Oct-06 Assumed Height (m)
958.914	49.162	964.576	49.985	1024.526	50.254	1053.329	49.369
958.914	49.176	964.569	49.985	1024.532	50.254	1053.327	49.369
959.062	49.211	964.722	49.751	1024.38	50.020	1053.187	49.099
961.721	49.213	966.37	49.720	1022.352	49.905	1051.406	49.157
963.826	49.264	968.01	49.576	1021.158	49.932	1049.644	49.251
965.901	49.016	970.23	49.521	1020.693	49.906	1048.692	49.316
968.068	48.977	972.275	49.474	1020.447	49.808	1048.003	49.502
968.656	49.011	973.134	49.503	1020.213	49.445	1047.845	49.400
969.077	49.078	973.802	49.531	1019.920	49.318	1047.474	49.390
970.51	48.956	974.347	49.387	1019.614	49.142	1047.242	49.439
971.261	48.870	974.778	49.200	1019.487	48.732	1046.576	49.381
972.606	48.852	975.064	49.14	1019.323	48.601	1044.933	49.456
973.801	48.744	975.168	49.029	1019.188	47.868	1043.280	49.531
974.275	48.574	975.466	48.899	1017.685	47.731	1042.001	49.576
974.512	48.419	975.601	48.704	1016.600	47.814	1040.636	49.617
974.802	48.340	975.653	48.356	1016.231	47.906	1040.115	49.586
975.045	48.304	975.952	48.100	1016.058	48.040	1039.802	49.403
975.567	48.314	976.538	47.897	1015.720	48.184	1039.451	49.028
976.196	48.276	977.823	47.895	1015.133	48.315	1039.440	48.533
976.607	48.167	979.627	47.868	1013.736	48.357	1038.770	48.172
976.867	48.135	979.948	47.787	1013.437	48.352	1038.062	48.004
977.46	47.970	980.235	47.662	1013.047	48.415	1037.197	47.968
977.718	48.002	980.875	47.582	1012.645	48.403	1036.496	47.973
978.311	47.907	981.832	47.553	1011.612	48.502	1035.767	47.888
978.845	47.838	982.631	47.639	1010.101	48.621	1035.279	47.854
979.145	47.791	983.570	47.835	1009.047	48.729	1034.583	47.946
980.682	49.779	984.426	47.978	1008.837	48.784	1034.201	47.887
981.357	49.779	985.220	48.221	1008.545	48.984	1033.424	47.643
982.907	49.530	985.633	48.259	1008.447	49.142	1032.515	47.679
984.179	49.398	985.916	48.177	1008.101	49.328	1031.705	47.671
984.716	49.340	986.578	48.111	1008.001	49.364	1031.308	47.729
985.834	49.458	986.870	48.014	1007.634	49.411	1031.032	47.718
986.751	49.255	987.029	48.097	1006.737	49.257	1030.594	47.785
987.283	49.251	987.263	48.707	1005.738	49.296	1029.979	47.818
987.789	49.341	987.411	48.771	1004.921	49.474	1028.950	47.852
988.723	49.332	988.266	48.836	1004.076	49.660	1027.801	47.880
989.509	49.344	989.355	49.007	1002.854	49.808	1027.472	47.928
989.866	49.244	991.135	49.058	1001.191	49.855	1026.470	48.021
990.003	49.214	991.466	49.124			1025.717	48.080

Gulungul Creek Cross sections 2006							
MG05 Distance (m)	**23-Oct-06 Assumed Height (m)**	**MG06 Distance (m)**	**23-Oct-06 Assumed Height (m)**	**MG07 Distance (m)**	**23-Oct-06 Assumed Height (m)**	**MG08 Distance (m)**	**23-Oct-06 Assumed Height (m)**
990.242	49.135	992.551	49.064			1025.330	48.223
990.778	49.011	993.253	49.188			1024.965	48.790
992.677	48.849	994.778	49.348			1024.724	49.004
995.139	48.782	996.261	49.488			1024.490	49.124
998.109	48.706	998.636	49.632			1024.137	49.154
		971.227	49.539			1023.305	49.084
		970.862	49.522			1022.408	48.945
						1021.194	49.075
						1020.004	49.224
						1019.460	49.296
						1017.569	49.268
						1015.558	49.317
						1012.719	49.349
						1010.158	49.229
						1009.048	49.246
						1006.675	49.478
						1004.941	49.649
						1003.219	49.720
						1001.313	49.772

Gulungul Creek Cross sections 2006							
MG09	**23-Oct-06**	**DG10**	**26-Oct-06**	**DG11**	**26-Oct-06**	**DG13**	**23-Oct-06**
Distance	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**
(m)	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**
964.061	49.777	978.422	49.929	974.255	50.490	946.779	50.132
964.175	49.552	978.425	49.929	974.253	50.490	946.786	50.132
965.050	49.507	978.594	49.704	974.414	50.248	946.929	49.941
966.521	49.331	980.588	49.681	975.426	50.241	950.537	49.818
969.115	49.269	981.912	49.614	976.315	50.181	957.689	49.853
971.622	49.318	982.902	49.675	977.116	50.079	959.263	49.782
973.478	49.444	983.320	49.700	977.789	49.874	960.146	49.695
974.726	49.477	983.528	49.653	978.576	49.625	961.064	49.839
976.128	49.511	983.646	49.452	979.624	49.312	962.432	49.903
977.092	49.600	983.821	49.207	980.760	49.114	963.068	49.963
977.402	49.540	984.377	48.988	981.441	49.107	964.323	49.835
977.594	49.441	984.805	48.852	981.852	49.055	965.295	50.013
977.72	48.965	985.655	48.719	982.103	48.988	965.988	49.883
977.873	48.795	986.201	48.714	982.317	48.907	966.714	49.929
978.089	48.370	986.650	48.790	982.436	48.738	967.268	49.840
978.687	48.337	987.327	48.795	982.833	48.505	968.117	49.430
979.149	48.379	988.300	48.795	983.114	48.426	969.272	49.396
980.766	48.371	988.829	48.752	983.499	48.424	969.992	49.345
983.184	48.390	989.287	48.689	984.567	48.392	970.758	49.375
984.942	48.374	989.718	48.650	985.113	48.343	971.188	49.351
986.143	48.326	990.097	48.680	985.752	48.329	971.984	49.073
986.420	48.249	990.478	48.672	986.406	48.287	972.516	48.614
986.739	48.278	990.967	48.640	986.817	48.309	973.01	48.685
987.039	48.282	991.417	48.655	987.263	48.413	973.365	48.705
987.255	48.356	991.856	48.596	987.744	48.540	973.916	48.586
987.624	48.349	992.123	48.624	988.113	48.546	974.768	48.261
987.926	48.747	992.493	48.828	988.684	48.523	975.667	48.129
988.163	49.114	992.711	48.908	989.109	48.39	976.956	47.974
988.629	49.230	992.978	49.109	989.556	48.225	977.818	47.891
989.753	49.231	993.202	49.214	989.99	48.139	978.795	47.924
992.242	49.448	993.317	49.348	990.552	48.065	979.403	47.970
993.529	49.566	993.542	49.521	991.102	48.057	979.869	48.068
994.992	49.639	993.639	49.672	991.417	48.130	980.499	48.332
997.986	49.715	993.744	49.935	991.61	48.232	980.745	48.537
		993.965	50.028	991.77	48.344	980.964	48.753
		994.200	50.056	992.233	48.481	981.048	49.251
		994.849	50.007	993.098	49.101	981.326	49.405

Gulungul Creek Cross sections 2006							
MG09 Distance (m)	23-Oct-06 Assumed Height (m)	DG10 Distance (m)	26-Oct-06 Assumed Height (m)	DG11 Distance (m)	26-Oct-06 Assumed Height (m)	DG13 Distance (m)	23-Oct-06 Assumed Height (m)
		995.454	49.991	993.326	49.328	981.764	49.504
		995.947	49.992	993.562	49.385	982.295	49.677
		997.174	49.912	994.160	49.435	982.879	49.779
		998.336	49.855	994.618	49.556	983.984	49.942
				995.151	49.769	984.728	49.893
				995.832	49.854	985.501	49.944
				996.285	49.890	987.541	49.914
				997.064	49.895	989.687	49.845
				998.561	49.853	991.217	49.792
						992.449	49.763
						993.606	49.661
						994.846	49.704
						995.447	49.792
						996.860	49.826
						998.498	49.793

Gulungul Creek Cross sections 2007							
UG02 Distance (m)	**15-Oct-07 Assumed Height (m)**	**UG01 Distance (m)**	**16-Oct-07 Assumed Height (m)**	**UG03 Distance (m)**	**16-Oct-07 Assumed Height (m)**	**UG04 Distance (m)**	**16-Oct-07 Assumed Height (m)**
955.354	49.162	1961.902	49.566	958.824	48.987	964.469	49.508
959.368	49.183	1964.924	49.581	964.296	49.162	966.658	49.526
962.816	49.194	1969.127	49.604	969.932	48.998	968.384	49.556
965.644	49.264	1974.014	49.586	972.255	48.896	970.701	49.574
969.048	49.055	1978.076	49.378	974.614	48.685	973.284	49.635
972.039	48.981	1980.679	49.418	976.441	48.347	974.944	49.624
974.584	48.918	1981.410	49.361	976.676	47.623	975.753	49.532
975.406	48.829	1982.256	49.187	977.188	47.342	976.797	49.210
975.699	48.662	1983.057	48.988	977.643	47.310	977.424	48.981
975.927	48.562	1983.523	48.804	978.204	47.358	977.645	48.834
976.158	48.333	1983.853	48.664	978.759	47.459	978.017	48.764
976.337	48.310	1984.025	48.509	979.166	47.524	978.362	48.662
976.552	48.352	1984.801	48.296	979.905	47.538	978.714	48.652
977.032	48.227	1985.404	48.095	980.334	47.506	979.256	48.314
977.439	48.110	1985.885	48.073	980.873	47.507	979.734	48.314
978.037	47.987	1986.433	47.850	981.902	47.459	980.466	48.363
978.817	47.826	1986.964	48.045	982.318	47.419	981.102	48.353
979.852	47.837	1987.454	48.157	983.004	47.322	981.438	48.287
981.015	47.818	1987.792	48.202	983.716	47.274	981.956	48.177
982.091	47.75	1988.095	48.264	984.762	47.278	982.331	48.137
983.056	47.679	1988.991	48.364	985.411	47.365	982.722	48.156
983.593	47.703	1989.412	48.373	985.783	47.556	983.500	48.095
984.026	47.696	1990.003	48.327	986.197	47.994	983.796	48.070
984.329	47.844	1990.395	48.259	986.527	48.111	984.263	47.897
984.557	48.169	1990.554	48.233	986.837	48.353	984.638	47.880
984.767	48.801	1991.019	48.073	987.251	48.839	985.192	47.949
985.036	49.103	1991.382	48.058	987.734	49.09	985.69	47.994
985.505	49.220	1991.759	48.113	989.17	49.189	986.204	48.111
986.435	49.253	1992.079	48.225	990.607	49.139	986.55	48.218
987.864	49.224	1992.352	48.475	992.973	49.307	986.922	48.393
989.798	49.293	1992.708	48.636	997.485	49.613	987.207	48.577
992.046	49.362	1992.843	49.128			987.526	48.666
994.198	49.428	1993.260	49.233			987.753	48.909
996.120	49.579	1994.232	49.316			988.221	49.173
997.838	49.630	1994.857	49.463			988.475	49.239
		1995.626	49.569			988.700	49.394
		1997.184	49.613			989.872	49.306
						990.223	49.320

Gulungul Creek Cross sections 2007							
UG02 Distance (m)	15-Oct-07 Assumed Height (m)	UG01 Distance (m)	16-Oct-07 Assumed Height (m)	UG03 Distance (m)	16-Oct-07 Assumed Height (m)	UG04 Distance (m)	16-Oct-07 Assumed Height (m)
						990.780	49.440
						991.290	49.556
						992.296	49.686
						993.913	49.755
						997.273	49.753

Gulungul Creek Cross sections 2007							
MG05 Distance (m)	**19-Oct-07 Assumed Height (m)**	**MG06 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**MG07 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**MG08 Distance (m)**	**22-Nov-07 Assumed Height (m)**
959.058	49.537	964.706	49.751	1024.405	50.051	1053.185	49.094
959.959	49.559	965.886	49.752	1023.827	49.961	1051.470	49.144
961.742	49.393	967.201	49.651	1022.537	49.885	1050.164	49.205
963.096	49.334	968.604	49.551	1021.565	49.899	1048.887	49.308
964.444	49.383	970.379	49.510	1020.816	49.917	1047.212	49.374
966.099	49.432	972.062	49.477	1020.567	49.757	1045.451	49.441
967.636	49.320	973.387	49.511	1020.328	49.482	1043.846	49.483
969.451	49.318	974.122	49.458	1020.046	49.339	1042.861	49.541
970.602	49.276	974.607	49.278	1019.737	49.112	1041.177	49.590
972.105	49.287	975.011	49.094	1019.636	49.032	1040.468	49.594
973.131	49.166	975.462	48.957	1019.468	47.992	1040.154	49.576
974.097	49.173	975.677	48.383	1019.270	47.891	1039.955	49.460
974.383	49.027	975.845	48.178	1018.839	47.745	1039.780	49.209
974.884	48.833	976.079	48.082	1018.196	47.705	1039.722	48.821
975.385	48.766	976.471	47.959	1017.495	47.703	1039.247	48.492
976.140	48.743	977.420	47.921	1016.927	47.669	1038.963	48.299
976.783	48.670	978.606	47.887	1016.543	47.712	1038.420	48.059
977.289	48.476	979.276	47.859	1016.034	47.893	1038.027	47.916
978.059	48.497	979.840	47.666	1015.599	48.085	1037.520	47.745
978.839	48.576	980.401	47.584	1014.989	48.083	1037.146	47.640
979.941	48.542	981.042	47.552	1013.822	48.245	1036.837	47.636
981.407	48.584	981.993	47.549	1012.874	48.362	1036.330	47.682
982.699	48.659	982.577	47.472	1011.975	48.562	1035.838	47.742
984.21	48.681	983.229	47.245	1010.926	48.780	1035.835	47.742
985.532	48.719	983.789	47.254	1010.090	48.826	1035.182	47.759
986.409	48.711	984.415	47.327	1009.145	48.802	1034.492	47.775
987.293	48.641	985.158	47.481	1008.823	48.813	1033.531	47.785
987.954	48.505	985.843	47.627	1008.525	48.998	1032.807	47.789
988.265	48.598	986.281	47.644	1008.099	49.332	1032.042	47.711
988.702	48.888	986.587	47.665	1007.669	49.406	1031.325	47.660
989.234	49.241	986.919	47.829	1006.996	49.282	1030.279	47.692
989.705	49.599	987.066	47.907	1006.313	49.244	1029.426	47.720
990.035	49.787	987.198	48.271	1005.450	49.346	1028.616	47.773
990.321	50.004	987.253	48.631	1004.270	49.617	1028.005	47.743
991.527	50.035	987.535	48.756	1002.874	49.798	1027.564	47.707
992.918	50.004	988.375	48.887	1001.715	49.884	1027.222	47.709
994.662	49.959	989.501	49.036			1026.906	47.707
996.475	49.860	991.289	49.069			1026.565	47.717

Gulungul Creek Cross sections 2007							
MG05 Distance (m)	**19-Oct-07 Assumed Height (m)**	**MG06 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**MG07 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**MG08 Distance (m)**	**22-Nov-07 Assumed Height (m)**
998.163	49.833	992.667	49.050			1026.302	47.799
		994.494	49.263			1025.999	47.897
		996.012	49.415			1025.678	48.040
		997.365	49.473			1025.398	48.216
		998.590	49.581			1025.239	48.341
						1025.110	48.624
						1024.889	48.879
						1024.568	49.114
						1024.318	49.149
						1023.880	49.165
						1023.471	49.128
						1023.036	49.016
						1022.531	48.961
						1022.204	48.955
						1021.300	49.047
						1020.624	49.140
						1019.978	49.228
						1019.385	49.294
						1018.800	49.312
						1018.115	49.296
						1017.233	49.227
						1016.591	49.259
						1015.612	49.321
						1014.730	49.364
						1013.819	49.366
						1012.863	49.357
						1011.611	49.312
						1010.746	49.266
						1009.842	49.228
						1008.929	49.248
						1008.121	49.304
						1007.246	49.402
						1006.407	49.502
						1005.505	49.604
						1004.471	49.668
						1003.472	49.694
						1002.274	49.746

Gulungul Creek Cross sections 2007							
MG09 Distance (m)	**19-Oct-07 Assumed Height (m)**	**DG10 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**DG11 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**DG13 Distance (m)**	**19-Oct-07 Assumed Height (m)**
964.087	49.773	978.611	49.702	974.401	50.255	946.935	49.916
964.198	49.548	981.979	49.640	975.644	50.229	947.810	49.946
965.417	49.458	983.490	49.682	976.495	50.164	948.216	49.858
966.607	49.330	983.848	49.263	977.299	50.032	948.767	49.856
968.030	49.268	984.315	49.097	978.200	49.777	949.715	49.835
969.273	49.271	984.466	49.000	978.982	49.526	950.517	49.818
970.572	49.336	984.925	48.935	980.022	49.263	950.913	49.932
971.769	49.322	985.080	48.835	980.938	49.145	951.433	49.832
973.05	49.429	985.344	48.789	981.811	49.066	951.907	49.774
974.614	49.485	985.696	48.692	982.027	49.022	952.773	49.765
975.461	49.570	986.120	48.683	982.308	48.806	953.194	49.785
976.501	49.531	986.533	48.729	982.594	48.610	953.923	49.722
977.189	49.589	987.009	48.749	982.850	48.526	955.239	49.708
977.463	49.484	987.401	48.724	983.979	48.495	955.946	49.764
977.77	48.875	987.860	48.739	985.184	48.487	957.141	49.806
977.895	48.491	988.139	48.746	986.328	48.488	958.309	49.777
978.476	48.170	988.629	48.736	987.302	48.428	959.039	49.767
978.846	48.059	988.875	48.703	987.824	48.372	959.499	49.702
979.375	47.828	989.251	48.614	988.470	48.482	960.302	49.686
979.854	47.711	989.437	48.610	989.576	48.404	960.899	49.822
980.927	47.657	989.772	48.631	990.541	48.247	961.449	49.973
981.41	47.699	990.116	48.659	991.606	48.222	961.818	49.942
982.167	47.861	990.357	48.656	991.904	48.345	962.153	50.006
983.086	47.933	990.545	48.621	992.238	48.625	962.667	49.905
983.979	47.980	990.747	48.607	992.446	48.818	963.047	49.958
984.781	47.930	990.963	48.625	992.791	48.956	963.541	49.872
985.406	47.827	991.223	48.605	992.981	49.056	963.963	49.820
985.973	47.734	991.423	48.573	993.193	49.290	964.495	49.855
986.311	47.713	991.694	48.517	993.650	49.359	964.913	49.978
986.702	47.854	991.876	48.559	994.242	49.486	965.598	49.933
987.248	48.053	992.079	48.646	994.895	49.670	966.378	49.867
987.517	48.164	992.278	48.716	995.776	49.842	966.948	49.712
987.837	48.348	992.483	48.885	996.652	49.892	967.241	49.745
988.151	49.169	992.643	48.961	997.626	49.883	967.971	49.465
988.482	49.290	992.924	48.995	998.552	49.857	968.331	49.405
989.261	49.247	993.104	49.170			969.378	49.393
990.452	49.317	993.246	49.214			970.436	49.406
991.696	49.398	993.403	49.478			971.246	49.367

Gulungul Creek Cross sections 2007							
MG09	**19-Oct-07**	**DG10**	**19-Oct-07**	**DG11**	**19-Oct-07**	**DG13**	**19-Oct-07**
Distance (m)	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**
992.891	49.510	993.520	49.629			971.505	49.231
994.505	49.622	993.589	49.935			971.906	48.937
996.127	49.675	993.894	49.974			972.334	48.687
997.243	49.696	994.468	50.038			972.690	48.448
		995.004	50.032			973.571	48.368
		995.269	50.009			974.104	48.317
		995.557	49.978			974.608	48.148
		996.040	49.974			975.338	48.045
		996.788	49.922			976.451	47.977
		997.445	49.903			977.287	47.911
		998.697	49.864			978.116	47.905
						979.161	47.943
						979.736	48.050
						980.297	48.281
						980.628	48.426
						980.911	48.633
						981.085	48.846
						981.235	49.292
						981.714	49.484
						982.428	49.643
						983.117	49.830
						983.932	49.935
						984.835	49.893
						986.083	49.935
						987.843	49.884
						989.752	49.843
						991.911	49.780
						993.603	49.653
						994.985	49.716
						996.373	49.810
						997.950	49.807

Gulungul Creek Cross sections 2008							
UG02 Distance (m)	**25-Sep-08 Assumed Height (m)**	**UG01 Distance (m)**	**25-Sep-07 Assumed Height (m)**	**UG03 Distance (m)**	**25-Sep-09 Assumed Height (m)**	**UG04 Distance (m)**	**25-Oct-09 Assumed Height (m)**
959.494	49.206	1961.896	49.587	958.822	49.000	964.483	49.495
963.136	49.210	1965.160	49.582	961.409	49.093	967.159	49.525
967.045	49.273	1967.895	49.581	963.257	49.159	969.560	49.556
970.043	49.021	1971.155	49.605	965.414	49.158	971.905	49.594
971.993	48.997	1974.222	49.571	967.352	49.088	973.734	49.608
973.828	49.021	1976.851	49.340	969.579	49.011	974.907	49.608
974.706	48.924	1978.920	49.365	971.926	48.930	975.758	49.506
975.418	48.846	1980.569	49.420	973.740	48.813	976.445	49.302
975.788	48.685	1981.178	49.387	974.797	48.697	977.011	49.132
976.185	48.347	1981.891	49.247	975.488	48.612	977.440	49.043
976.591	48.360	1982.367	49.117	976.169	48.507	977.685	48.881
976.710	48.358	1982.881	48.958	976.330	48.447	978.352	48.725
977.282	48.229	1983.619	48.730	976.574	47.812	978.866	48.578
977.800	48.076	1983.891	48.637	976.893	47.717	979.123	48.414
978.214	48.022	1984.015	48.519	977.714	47.674	979.192	48.418
979.032	48.041	1984.442	48.400	978.910	47.706	979.446	48.357
979.820	47.986	1984.908	48.248	980.147	47.753	980.020	48.299
980.563	48.043	1985.768	48.257	980.860	47.796	980.989	48.300
981.481	48.099	1986.403	48.230	981.686	47.783	982.046	48.316
982.389	48.096	1987.209	48.314	982.450	47.759	983.031	48.311
983.268	48.086	1988.240	48.376	983.529	47.604	984.087	48.294
983.942	48.031	1989.186	48.459	984.554	47.456	985.064	48.388
984.396	48.058	1990.139	48.533	985.024	47.459	985.829	48.337
984.528	48.139	1990.988	48.409	986.006	47.611	986.788	48.408
984.778	48.846	1991.560	48.309	986.156	47.980	987.164	48.563
985.133	49.154	1992.027	48.244	986.320	48.064	987.487	48.644
985.621	49.210	1992.612	48.485	986.787	48.292	987.655	48.858
986.593	49.250	1992.972	48.849	986.979	48.853	987.822	49.054
987.790	49.249	1993.130	49.188	987.276	48.871	988.096	49.205
989.638	49.301	1994.396	49.326	987.940	49.138	988.445	49.327
991.978	49.384	1995.277	49.531	988.366	49.168	988.688	49.423
994.750	49.517	1996.969	49.604	989.633	49.204	989.057	49.362
997.401	49.605	1998.500	49.676	991.131	49.169	989.533	49.317
				993.081	49.342	990.146	49.274
				994.948	49.472	990.808	49.502
				997.762	49.628	991.715	49.624
						993.128	49.694
						994.466	49.757

Gulungul Creek Cross sections 2008							
UG02	**25-Sep-08**	**UG01**	**25-Sep-07**	**UG03**	**25-Sep-09**	**UG04**	**25-Oct-09**
Distance	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**
(m)	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**
						996.309	49.747
						998.187	49.765

Gulungul Creek Cross sections 2008							
MG05 Distance (m)	**26-Sep-08 Assumed Height (m)**	**MG06 Distance (m)**	**26-Sep-08 Assumed Height (m)**	**MG07 Distance (m)**	**26-Sep-08 Assumed Height (m)**	**MG08 Distance (m)**	**26-Sep-08 Assumed Height (m)**
959.048	49.548	964.704	49.756	1024.519	50.248	1053.194	49.097
960.995	49.495	964.702	49.756	1024.400	50.069	1051.397	49.154
963.211	49.330	966.665	49.697	1023.502	49.957	1049.085	49.292
965.897	49.446	968.765	49.548	1022.052	49.885	1046.371	49.396
968.293	49.256	971.046	49.510	1020.781	49.903	1044.502	49.483
970.116	49.348	972.881	49.493	1020.444	49.514	1042.639	49.550
970.853	49.273	973.492	49.518	1020.099	49.324	1041.174	49.603
971.916	49.315	974.373	49.210	1019.887	49.138	1040.209	49.620
972.441	49.297	974.971	49.108	1019.721	48.260	1039.928	49.303
973.067	49.175	975.204	48.911	1019.481	48.088	1039.665	49.102
974.000	49.160	975.312	48.704	1019.198	48.091	1039.606	48.749
974.384	49.089	975.804	48.399	1018.665	48.175	1039.312	48.548
974.978	48.820	976.185	48.257	1017.873	48.256	1038.801	48.246
976.045	48.769	976.647	48.243	1016.824	48.432	1038.164	47.975
976.945	48.624	976.860	48.227	1016.425	48.400	1037.584	47.874
977.410	48.485	977.471	48.055	1016.306	48.301	1037.192	47.879
978.500	48.533	978.099	47.856	1015.560	48.293	1036.209	47.943
979.229	48.516	978.827	47.801	1014.634	48.366	1034.780	47.969
979.458	48.467	979.480	47.776	1013.413	48.408	1033.373	47.992
980.654	48.542	979.873	47.600	1012.259	48.555	1031.714	47.915
981.964	48.579	980.563	47.551	1011.298	48.651	1030.478	47.983
983.376	48.634	981.616	47.567	1010.670	48.673	1029.423	48.016
984.156	48.599	982.530	47.626	1009.960	48.653	1028.342	47.985
985.244	48.648	982.795	47.631	1009.383	48.620	1027.482	47.872
986.218	48.693	983.036	47.672	1009.078	48.686	1026.769	47.834
986.959	48.653	983.342	47.659	1008.596	49.038	1026.191	47.861
987.527	48.601	984.200	47.847	1008.389	49.108	1025.594	48.052
988.011	48.645	985.034	47.677	1008.241	49.244	1025.286	48.240
988.297	48.806	985.881	47.475	1007.818	49.391	1024.951	48.784
988.615	48.810	986.145	47.433	1007.200	49.299	1024.670	49.101
989.149	49.191	986.879	47.651	1006.541	49.229	1024.167	49.186
989.367	49.431	987.286	48.013	1005.693	49.300	1023.374	49.107
989.656	49.547	987.469	48.316	1004.692	49.550	1022.258	48.959
990.164	49.955	987.651	48.763	1003.901	49.696	1020.600	49.161
990.363	50.012	988.192	48.830	1002.898	49.803	1018.816	49.310
991.080	50.039	988.876	48.988	1001.778	49.887	1017.455	49.253
992.479	50.022	989.866	49.084			1016.121	49.265
994.457	49.966	991.070	49.106			1013.925	49.378

Gulungul Creek Cross sections 2008							
MG05 Distance (m)	**26-Sep-08 Assumed Height (m)**	**MG06 Distance (m)**	**26-Sep-08 Assumed Height (m)**	**MG07 Distance (m)**	**26-Sep-08 Assumed Height (m)**	**MG08 Distance (m)**	**26-Sep-08 Assumed Height (m)**
996.271	49.885	992.341	49.042			1012.067	49.338
998.014	49.849	993.767	49.221			1009.847	49.223
		995.426	49.381			1007.816	49.330
		997.375	49.453			1005.277	49.620
						1002.765	49.726

Gulungul Creek Cross sections 2008							
MG09 Distance (m)	**26-Sep-08 Assumed Height (m)**	**DG10 Distance (m)**	**26-Sep-08 Assumed Height (m)**	**DG11 Distance (m)**	**26-Sep-08 Assumed Height (m)**	**DG13 Distance (m)**	**26-Sep-08 Assumed Height (m)**
964.064	49.768	977.45	49.686	974.275	50.487	946.935	49.926
964.175	49.554	978.06	49.699	974.401	50.254	948.951	49.836
966.537	49.322	978.18	49.729	975.725	50.235	950.533	49.805
969.100	49.265	978.25	49.889	976.706	50.156	950.833	49.939
971.378	49.323	978.78	49.887	977.614	49.920	951.351	49.763
973.391	49.437	978.84	49.733	978.709	49.591	951.855	49.741
974.809	49.453	979.77	49.717	980.048	49.263	954.245	49.712
975.672	49.604	980.91	49.676	980.928	49.145	956.122	49.765
976.146	49.563	982.01	49.633	981.353	49.075	958.365	49.784
976.803	49.544	982.74	49.670	981.946	49.061	958.863	49.838
977.026	49.495	983.49	49.627	982.291	48.734	959.420	49.633
977.103	49.444	983.70	49.360	982.950	48.527	959.752	49.657
977.365	49.386	984.13	49.183	983.523	48.490	959.883	49.720
977.562	49.135	984.97	49.053	984.709	48.514	960.146	49.700
977.748	48.900	985.32	48.758	986.023	48.478	960.435	49.699
978.127	48.649	985.70	48.721	987.000	48.441	961.546	49.981
978.620	48.551	986.40	48.686	987.620	48.414	962.703	49.889
979.543	48.536	987.36	48.735	988.167	48.494	963.198	49.949
980.901	48.469	988.14	48.728	988.704	48.659	963.667	49.848
982.468	48.477	988.58	48.675	989.572	48.630	964.606	49.905
983.264	48.369	988.84	48.567	990.493	48.535	965.365	49.968
984.718	48.380	989.42	48.597	991.388	48.365	965.712	49.868
985.982	48.439	990.37	48.672	991.724	48.329	965.904	49.867
986.681	48.451	991.02	48.681	992.022	48.424	966.134	49.911
986.892	48.406	991.70	48.628	992.588	48.836	967.111	49.655
987.788	48.316	992.03	48.606	993.001	49.054	967.322	49.752
987.984	48.694	992.50	48.856	993.190	49.279	968.067	49.419
988.194	49.249	992.98	49.040	993.556	49.351	969.085	49.420
988.543	49.303	993.59	49.507	994.067	49.447	969.782	49.383
989.156	49.287	993.88	49.981	995.169	49.748	970.489	49.422
989.924	49.253	994.29	50.047	996.434	49.885	970.995	49.303
991.653	49.372	995.06	50.004	997.752	49.875	971.517	49.158
993.314	49.555	996.72	49.943			972.295	48.755
995.371	49.644	997.95	49.858			972.900	48.668
997.783	49.710					973.623	48.439
						974.090	48.392
						974.925	48.128
						975.567	47.984

Gulungul Creek Cross sections 2008							
MG09 Distance (m)	26-Sep-08 Assumed Height (m)	DG10 Distance (m)	26-Sep-08 Assumed Height (m)	DG11 Distance (m)	26-Sep-08 Assumed Height (m)	DG13 Distance (m)	26-Sep-08 Assumed Height (m)
						976.468	47.913
						977.186	47.892
						978.217	47.916
						978.986	47.959
						979.546	48.008
						980.250	48.248
						980.704	48.491
						981.039	48.830
						981.103	49.249
						981.609	49.409
						982.239	49.507
						982.507	49.630
						983.241	49.866
						984.094	49.898
						984.909	49.885
						985.220	49.975
						985.682	49.866
						986.021	49.901
						986.221	49.962
						986.568	49.877
						986.718	49.886
						986.862	49.957
						987.116	49.915
						987.278	49.842
						988.207	49.816
						988.441	49.851
						989.030	49.852
						989.787	49.909
						990.231	49.903
						990.421	49.846
						990.798	49.815
						992.425	49.754
						993.547	49.664
						994.385	49.665
						995.461	49.795
						996.646	49.826
						998.120	49.790

Gulungul Creek Cross sections 2009							
UG02 Distance (m)	**27-Oct-09 Assumed Height (m)**	**UG01 Distance (m)**	**27-Oct-09 Assumed Height (m)**	**UG03 Distance (m)**	**27-Oct-09 Assumed Height (m)**	**UG04 Distance (m)**	**27-Oct-09 Assumed Height (m)**
955.347	49.204	1961.907	49.585	958.807	48.997	964.475	49.494
958.255	49.180	1964.314	49.536	960.879	49.072	966.721	49.508
960.936	49.207	1967.057	49.577	963.071	49.141	969.023	49.560
963.545	49.223	1970.126	49.600	965.385	49.153	971.303	49.594
966.542	49.269	1973.241	49.580	968.288	49.050	973.338	49.613
969.138	49.063	1976.186	49.405	970.705	48.959	975.100	49.599
971.831	48.988	1979.143	49.387	972.900	48.841	975.742	49.510
974.174	48.969	1982.140	49.244	974.340	48.729	976.229	49.352
975.114	48.885	1982.558	49.068	975.355	48.616	976.582	49.297
975.762	48.687	1983.230	48.862	976.146	48.512	976.918	49.123
976.037	48.445	1983.762	48.680	976.329	48.399	977.233	49.049
976.224	48.298	1983.958	48.555	976.465	48.172	977.484	49.024
976.543	48.350	1984.439	48.420	976.471	48.005	977.631	48.901
976.759	48.350	1984.880	48.274	976.691	47.946	977.895	48.865
977.155	48.256	1985.556	48.085	977.020	47.879	978.261	48.738
977.776	48.132	1985.830	47.999	977.682	47.907	978.654	48.659
978.093	48.074	1986.086	47.913	978.201	47.925	978.988	48.501
978.531	47.990	1986.419	47.965	978.415	47.948	979.112	48.374
978.937	47.981	1987.089	48.033	978.873	47.950	979.449	48.310
979.767	47.915	1987.427	48.089	979.482	47.972	979.913	48.290
980.034	47.918	1987.857	48.232	979.909	48.020	980.613	48.296
980.482	47.934	1988.712	48.381	980.671	48.008	980.868	48.340
981.168	47.983	1989.211	48.405	981.037	47.968	981.169	48.355
982.165	48.029	1989.930	48.356	981.723	47.996	981.443	48.382
982.461	47.999	1990.416	48.300	982.021	48.017	982.122	48.398
982.829	47.991	1991.198	48.270	982.488	47.985	982.932	48.465
983.267	48.019	1991.925	48.355	983.063	48.019	983.216	48.465
983.605	48.005	1992.366	48.422	983.470	47.967	983.534	48.438
983.939	48.026	1992.596	48.577	983.961	47.882	984.135	48.455
984.237	48.039	1992.876	48.904	984.314	47.829	985.116	48.445
984.448	48.077	1993.057	48.945	984.620	47.812	985.479	48.463
984.586	48.220	1993.230	49.217	984.902	47.839	986.026	48.437
984.794	48.863	1993.696	49.279	985.534	47.784	986.570	48.380
984.916	49.000	1994.327	49.323	986.115	47.723	986.839	48.373
985.025	49.112	1994.769	49.459	986.283	48.008	987.487	48.696
985.255	49.174	1995.884	49.563	986.573	48.225	987.647	48.842
987.418	49.200	1997.456	49.668	986.676	48.262	987.742	48.879
988.708	49.225	1998.557	49.693	986.837	48.799	987.927	49.187
989.078	49.309			987.030	48.591	988.074	49.223

Gulungul Creek Cross sections 2009							
UG02 Distance (m)	**27-Oct-09 Assumed Height (m)**	**UG01 Distance (m)**	**27-Oct-09 Assumed Height (m)**	**UG03 Distance (m)**	**27-Oct-09 Assumed Height (m)**	**UG04 Distance (m)**	**27-Oct-09 Assumed Height (m)**
991.627	49.388			987.535	48.924	988.272	49.311
993.988	49.468			987.735	49.043	988.790	49.413
996.837	49.572			987.961	49.134	989.376	49.336
998.229	49.644			988.774	49.181	989.783	49.275
				990.711	49.143	990.119	49.284
				992.787	49.279	990.469	49.398
				994.638	49.447	990.708	49.488
				996.582	49.549	991.802	49.618
				998.093	49.653	993.599	49.728
						995.116	49.745
						997.296	49.741

Gulungul Creek Cross sections 2009							
MG05 Distance (m)	**27-Oct-09 Assumed Height (m)**	**MG06 Distance (m)**	**27-Oct-09 Assumed Height (m)**	**MG07 Distance (m)**	**29-Oct-09 Assumed Height (m)**	**MG08 Distance (m)**	**29-Oct-09 Assumed Height (m)**
959.054	49.511	964.696	49.779	1024.375	50.071	1053.338	49.362
961.588	49.395	966.878	49.693	1022.122	49.890	1053.198	49.093
963.916	49.326	969.173	49.535	1021.098	49.932	1051.070	49.168
965.827	49.427	971.515	49.494	1020.478	49.508	1048.941	49.302
968.208	49.272	973.305	49.512	1020.041	49.298	1046.596	49.399
970.894	49.319	974.327	49.209	1019.819	48.324	1044.689	49.470
972.998	49.157	974.721	49.112	1019.692	48.137	1043.341	49.518
973.761	49.164	975.145	49.106	1019.562	48.030	1043.029	49.681
974.307	49.105	975.546	48.752	1019.069	47.888	1042.897	49.530
974.920	48.838	975.657	48.494	1018.908	47.861	1042.675	49.540
975.459	48.804	975.851	48.410	1018.839	47.868	1042.620	49.768
975.915	48.854	976.336	48.362	1018.498	48.074	1042.330	49.732
976.122	48.832	976.865	48.261	1017.456	48.331	1042.198	49.589
976.291	48.758	977.203	48.157	1017.161	48.352	1040.758	49.638
976.447	48.693	977.521	47.967	1016.840	48.356	1040.297	49.594
976.643	48.643	978.082	47.842	1016.757	48.232	1040.106	49.433
976.906	48.638	978.515	47.867	1016.539	48.253	1040.040	49.331
977.126	48.572	978.922	47.830	1016.445	48.420	1039.909	49.199
977.488	48.524	979.653	47.791	1016.281	48.336	1039.886	49.107
977.785	48.497	980.332	47.777	1015.654	48.348	1039.725	48.961
978.616	48.569	980.604	47.752	1014.960	48.426	1039.533	48.744
979.073	48.559	981.830	47.855	1013.903	48.466	1039.136	48.419
979.614	48.620	982.263	47.934	1013.062	48.525	1038.894	48.277
980.280	48.569	982.525	47.937	1012.730	48.535	1038.545	48.218
981.292	48.555	983.169	48.011	1011.506	48.638	1038.372	48.130
981.755	48.603	983.933	48.025	1010.883	48.678	1038.194	48.089
982.648	48.603	984.290	48.054	1009.548	48.651	1037.267	48.060
982.967	48.615	985.325	48.052	1009.072	48.792	1036.784	48.099
983.800	48.615	985.890	48.027	1008.843	48.842	1036.403	48.087
984.485	48.601	986.374	47.954	1008.581	48.942	1035.504	48.104
985.526	48.643	986.630	47.897	1008.302	49.160	1035.135	48.158
986.028	48.647	987.168	48.190	1008.139	49.252	1034.533	48.163
986.423	48.599	987.416	48.290	1007.961	49.418	1034.285	48.198
987.330	48.634	987.702	48.561	1007.295	49.388	1032.991	48.126
987.716	48.589	987.851	48.761	1007.003	49.289	1031.864	48.088
988.023	48.644	988.056	48.821	1006.778	49.312	1031.308	48.074
988.375	48.718	988.595	48.933	1006.587	49.274	1030.784	48.101
988.880	48.997	989.134	48.986	1006.129	49.277	1030.065	48.110

Gulungul Creek Cross sections 2009							
MG05 Distance (m)	**27-Oct-09 Assumed Height (m)**	**MG06 Distance (m)**	**27-Oct-09 Assumed Height (m)**	**MG07 Distance (m)**	**29-Oct-09 Assumed Height (m)**	**MG08 Distance (m)**	**29-Oct-09 Assumed Height (m)**
989.012	49.108	989.433	49.057	1005.689	49.321	1029.439	48.129
989.196	49.251	990.990	49.058	1004.972	49.489	1027.688	48.304
989.286	49.405	992.641	49.076	1004.406	49.622	1027.491	48.294
989.641	49.574	994.301	49.259	1003.546	49.768	1027.201	48.225
990.135	49.924	995.847	49.380	1001.831	49.903	1026.646	48.184
990.373	49.981	997.592	49.463			1026.434	48.155
990.642	50.038					1025.916	48.117
992.184	50.024					1025.477	48.116
993.889	49.985					1025.174	48.459
995.748	49.895					1025.015	48.699
997.518	49.855					1024.919	48.822
						1024.819	48.981
						1024.671	49.069
						1024.176	49.181
						1023.922	49.180
						1023.641	49.115
						1023.470	49.122
						1023.191	49.143
						1023.033	49.067
						1022.438	48.980
						1021.493	49.031
						1020.543	49.156
						1019.565	49.280
						1017.453	49.251
						1015.377	49.362
						1013.018	49.400
						1010.788	49.277
						1008.505	49.269
						1006.365	49.527
						1004.402	49.676
						1002.485	49.747

Gulungul Creek Cross sections 2009							
MG09 Distance (m)	**29-Oct-09 Assumed Height (m)**	**DG10 Distance (m)**	**29-Oct-09 Assumed Height (m)**	**DG11 Distance (m)**	**29-Oct-09 Assumed Height (m)**	**DG13 Distance (m)**	**26-Oct-09 Assumed Height (m)**
964.065	49.769	977.344	49.808	974.255	50.490	946.944	49.938
964.200	49.554	977.450	49.697	974.408	50.241	951.054	49.817
966.411	49.341	979.332	49.726	975.86	50.224	952.626	49.759
968.982	49.259	981.091	49.666	976.588	50.157	954.730	49.719
971.230	49.357	982.745	49.678	977.254	50.043	956.960	49.793
972.845	49.385	983.299	49.670	977.910	49.808	958.984	49.784
973.714	49.580	983.553	49.599	978.561	49.611	960.759	49.665
974.165	49.594	983.655	49.536	979.380	49.374	961.218	49.929
974.633	49.578	983.717	49.354	979.682	49.332	961.542	49.982
974.832	49.447	983.945	49.265	980.034	49.234	961.861	49.962
975.150	49.536	984.051	49.217	980.776	49.073	962.119	49.879
975.545	49.583	984.477	49.136	981.810	49.035	962.417	49.878
975.744	49.471	984.949	49.062	982.040	49.033	962.725	49.942
976.345	49.513	985.334	48.856	982.512	48.682	963.045	49.906
976.731	49.505	985.431	48.783	982.788	48.568	963.613	49.828
977.167	49.255	985.981	48.738	983.278	48.376	963.848	49.813
977.324	49.161	986.341	48.750	983.622	48.354	964.413	49.891
977.601	49.093	986.937	48.764	984.522	48.387	964.719	49.947
978.036	48.993	987.549	48.740	984.761	48.391	965.339	49.920
978.326	48.876	987.818	48.733	985.023	48.386	965.672	49.844
978.864	48.675	988.211	48.747	985.367	48.429	965.876	49.844
979.637	48.611	988.424	48.758	986.120	48.422	966.156	49.874
980.441	48.548	988.877	48.797	986.418	48.417	966.319	49.813
980.848	48.505	989.803	48.773	986.854	48.400	966.786	49.723
981.433	48.517	990.050	48.778	987.623	48.403	967.290	49.716
982.130	48.441	990.271	48.765	988.092	48.379	967.661	49.648
982.757	48.396	990.523	48.719	988.701	48.312	968.008	49.459
983.261	48.385	990.829	48.712	989.581	48.235	968.357	49.366
983.657	48.353	991.275	48.669	990.351	48.172	968.691	49.342
984.765	48.319	991.554	48.631	990.649	48.175	968.983	49.372
985.361	48.296	992.014	48.668	991.429	48.405	969.754	49.382
985.983	48.297	992.410	48.754	991.882	48.402	970.656	49.403
986.609	48.249	992.592	48.914	992.108	48.447	971.051	49.311
987.098	48.214	993.110	49.148	992.301	48.576	971.342	49.197
987.497	48.244	993.433	49.335	992.585	48.767	971.568	49.139
987.756	48.277	993.527	49.509	992.776	48.814	971.774	49.041
988.080	48.405	993.677	49.899	992.996	48.954	972.020	48.897
988.238	49.279	994.017	49.995	993.335	49.220	972.465	48.634

Gulungul Creek Cross sections 2009							
MG09	**29-Oct-09**	**DG10**	**29-Oct-09**	**DG11**	**29-Oct-09**	**DG13**	**26-Oct-09**
Distance (m)	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**
988.461	49.33	994.276	50.032	993.596	49.341	972.997	48.643
988.716	49.357	994.534	50.049	994.141	49.438	973.238	48.604
988.977	49.317	994.894	50.022	994.341	49.477	974.214	48.396
989.484	49.275	995.533	49.984	994.626	49.562	974.437	48.246
990.449	49.301	996.414	49.966	995.558	49.797	974.709	48.194
991.249	49.359	997.665	49.883	996.444	49.881	974.847	48.137
991.998	49.418			997.933	49.870	975.100	48.070
993.839	49.601					975.302	48.017
995.757	49.667					976.385	47.933
997.573	49.724					977.300	47.907
						978.642	47.916
						979.299	47.963
						979.666	48.050
						980.015	48.167
						980.488	48.403
						980.667	48.486
						980.804	48.697
						980.939	48.796
						981.002	49.173
						981.286	49.267
						981.706	49.438
						982.002	49.481
						982.284	49.547
						982.747	49.745
						982.991	49.795
						983.360	49.861
						984.795	49.891
						985.092	49.955
						985.330	49.949
						985.588	49.902
						987.840	49.829
						989.548	49.888
						991.735	49.777
						993.942	49.678
						997.275	49.787

Gulungul Creek Cross sections DG12							
DG12 Distance (m)	09-Mar-05 Assumed Height (m)	DG12 Distance (m)	10-Mar-05 Assumed Height (m)	DG12 Distance (m)	19-Jan-06 Assumed Height (m)	DG12 Distance (m)	23-Jan-06 Assumed Height (m)
1.000	1.64	1.000	1.495	1.000	2.005	1.00	2.14
1.050	0.24	1.050	0.245	1.350	0.125	1.15	0.22
1.350	0.2	1.850	0.135	2.350	-0.095	2.35	0.02
1.850	0.16	2.850	-0.165	3.350	-0.245	3.35	-0.16
2.850	-0.14	3.550	-0.385	4.350	-0.095	4.85	0.04
3.350	-0.41	4.350	-0.365	5.350	0.105	6.35	0.08
4.350	-0.3	5.350	-0.355	6.350	0.055	7.85	0.12
5.350	-0.36	6.350	-0.045	7.850	0.105	9.35	0.29
6.350	-0.06	7.350	0.175	9.350	0.405	10.85	0.29
7.350	0.02	8.350	0.645	10.850	0.405	12.35	0.37
8.350	0.49	9.350	0.635	12.350	0.805	13.85	0.44
9.350	0.54	10.350	0.535	13.850	0.705	15.35	0.82
10.350	0.54	11.350	0.915	15.350	0.945	16.05	2.14
11.350	0.89	12.350	0.735	16.100	2.005		
12.350	0.64	13.350	0.475				
13.350	0.54	14.350	0.815				
14.350	0.84	15.350	0.735				
15.350	0.84	15.850	0.495				
15.850	0.64	16.050	1.495				
16.050	1.64						

Gulungul Creek Cross sections DG12							
DG12 Distance (m)	22-Feb-06 Assumed Height (m)	DG12 Distance (m)	8-Mar-06 Assumed Height (m)	DG12 Distance (m)	9-Mar-06 Assumed Height (m)	DG12 Distance (m)	23-Mar-06 Assumed Height (m)
1.000	2.003	1.000	1.430	1.000	1.950	1.000	1.820
1.500	0.203	1.500	0.200	1.500	0.230	1.500	0.180
2.350	0.002	2.350	-0.030	2.350	0.000	2.350	-0.040
3.200	-0.198	3.200	-0.150	3.200	-0.250	3.200	-0.280
4.600	0.002	4.600	-0.150	4.600	-0.090	4.600	-0.080
5.450	0.223	5.450	0.080	5.450	0.100	5.450	-0.020
6.300	0.253	6.300	-0.010	6.300	-0.250	6.300	-0.260
7.700	0.203	7.700	-0.080	7.700	-0.320	7.700	-0.320
8.550	0.443	8.550	-0.190	8.550	0.070	8.550	0.000
9.400	0.503	9.400	-0.210	9.400	0.050	9.400	-0.020
10.800	0.603	10.800	-0.030	10.800	0.130	10.800	0.020
11.650	0.923	11.650	0.250	11.650	0.300	11.650	0.220
12.500	0.853	12.500	0.470	12.500	0.690	12.500	0.270
13.800	0.803	13.800	0.510	13.800	0.750	13.800	0.270

Gulungul Creek Cross sections DG12							
DG12 Distance (m)	22-Feb-06 Assumed Height (m)	DG12 Distance (m)	8-Mar-06 Assumed Height (m)	DG12 Distance (m)	9-Mar-06 Assumed Height (m)	DG12 Distance (m)	23-Mar-06 Assumed Height (m)
14.650	1.083	14.650	0.750	14.650	1.130	14.650	0.820
15.500	1.083	15.500	0.960	15.500	1.100	15.500	1.020
16.000	2.003	16.000	1.430	16.000	1.950	16.000	1.820

Gulungul Creek Cross sections DG12							
DG12 Distance (m)	21-Mar-06 Assumed Height (m)	DG12 Distance (m)	8-Mar-06 Assumed Height (m)	DG12 Distance (m)	5-Apr-06 Assumed Height (m)	DG12 Distance (m)	27-Mar-07 Assumed Height (m)
1.000	1.515	1.000	1.7825	1.000	2.415	1.000	1.575
1.500	0.195	1.500	0.1825	1.500	0.215	1.500	0.155
2.350	-0.005	2.350	-0.0675	2.350	0.035	2.350	-0.065
3.200	-0.265	3.200	-0.1775	3.200	-0.145	3.200	-0.285
4.600	-0.235	4.600	-0.1375	4.600	-0.205	4.600	-0.335
5.450	0.015	5.450	0.1825	5.450	-0.375	5.450	0.815
6.300	0.015	6.300	0.0225	6.300	-0.385	6.300	-0.365
7.700	-0.005	7.700	0.2025	7.700	-0.325	7.700	-0.345
8.550	0.415	8.550	0.5225	8.550	-0.385	8.550	-0.005
9.400	0.515	9.400	0.3825	9.400	-0.385	9.400	0.065
10.800	0.735	10.800	0.5425	10.800	-0.385	10.800	-0.045
11.650	1.095	11.650	0.7225	11.650	-0.385	11.650	-0.155
12.500	1.015	12.500	0.8425	12.500	-0.225	12.500	-0.285
13.800	1.135	13.800	0.8325	13.800	-0.085	13.800	-0.205
14.650	1.315	14.650	1.0825	14.650	0.295	14.650	0.045
15.500	1.015	15.500	1.1025	15.500	0.355	15.500	0.195
16.000	1.515	16.000	1.7825	16.000	2.415	16.000	1.575

Gulungul Creek Cross sections DG12						
DG12 Distance (m)	30-Mar-10 Assumed Height (m)	DG12 Distance (m)	30-Mar-10 Assumed Height (m)	DG12 Distance (m)	30-Mar-10 Assumed Height (m)	
1.000	1.250	7.700	-0.050	6.300	0.170	
1.050	1.090	8.550	-0.370	14.650	0.550	
1.500	-0.110	9.400	-0.210	15.500	0.250	
2.350	0.090	10.800	-0.160	15.950	0.050	
3.200	0.010	11.650	-0.020	16.000	1.250	
4.600	0.570	12.500	0.350			
5.450	0.070	13.800	0.340			

Appendix B
Cumulative frequency grain size distributions for bulk bed-material samples on Gulungul Creek for 2006 to 2009

Table B1 Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2006

Sample	UG02	Gravel Mass = 18.69 g	
Date	26-Oct-06	Remaining Mass = 1295.84 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	18.69	1.42
-0.5	1.4 mm	1.14	2.13
0.0	1.0 mm	4.88	4.45
0.5	710 μm	21.43	14.72
1.0	500 μm	89.41	56.90
1.5	355 μm	136.10	85.87
2.0	250 μm	153.99	96.97
2.5	180 μm	157.77	99.31
3.0	125 μm	158.57	99.81
3.5	90 μm	158.73	99.91
4.0	63 μm	158.80	99.95
<4.0	<63 μm	158.88	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG01	Gravel Mass = 4.14 g	
Date	26-Oct-06	Remaining Mass = 1061.48 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	4.14	0.24
-0.5	1.4 mm	0.54	0.76
0.0	1.0 mm	2.80	2.90
0.5	710 μm	15.96	15.41
1.0	500 μm	57.34	54.73
1.5	355 μm	89.50	85.29
2.0	250 μm	103.64	98.73
2.5	180 μm	104.80	99.83
3.0	125 μm	104.88	99.90
3.5	90 μm	104.92	99.94
4.0	63 μm	104.94	99.96
<4.0	<63 μm	104.98	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG03	Gravel Mass = 4.81 g	
Date	26-Oct-06	Remaining Mass = 2027.45 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	4.81	0.24
-0.5	1.4 mm	0.76	0.77
0.0	1.0 mm	2.96	2.31
0.5	710 μm	15.91	11.41
1.0	500 μm	73.07	51.54
1.5	355 μm	120.33	84.72
2.0	250 μm	139.71	98.32
2.5	180 μm	141.79	99.78
3.0	125 μm	141.96	99.90
3.5	90 μm	142.03	99.95
4.0	63 μm	142.06	99.97
<4.0	<63 μm	142.10	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG04	Gravel Mass = 23.82 g	
Date	26-Oct-06	Remaining Mass = 1630.32 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	23.82	1.44
-0.5	1.4 mm	2.11	2.56
0.0	1.0 mm	6.81	5.06
0.5	710 μm	24.80	14.62
1.0	500 μm	91.12	49.86
1.5	355 μm	151.87	82.14
2.0	250 μm	180.61	97.42
2.5	180 μm	184.86	99.68
3.0	125 μm	185.32	99.92
3.5	90 μm	185.40	99.96
4.0	63 μm	185.44	99.98
<4.0	<63 μm	185.47	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table B1 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2006

Sample	MG05	Gravel Mass = 5.25 g	
Date	23-Oct-06	Remaining Mass = 2093.43 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	5.25	0.25
-0.5	1.4 mm	0.58	0.66
0.0	1.0 mm	3.22	2.54
0.5	710 μm	17.79	12.89
1.0	500 μm	69.07	49.32
1.5	355 μm	111.57	79.52
2.0	250 μm	136.13	96.97
2.5	180 μm	140.04	99.74
3.0	125 μm	140.35	99.96
3.5	90 μm	140.39	99.99
4.0	63 μm	140.40	100.00
<4.0	<63 μm	140.40	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG06	Gravel Mass = 8.64 g	
Date	23-Oct-06	Remaining Mass = 3305.67 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	8.64	0.26
-0.5	1.4 mm	0.33	0.59
0.0	1.0 mm	1.52	1.78
0.5	710 μm	9.42	9.66
1.0	500 μm	41.4	41.57
1.5	355 μm	70.9	71.01
2.0	250 μm	92.46	92.53
2.5	180 μm	98.68	98.73
3.0	125 μm	99.72	99.77
3.5	90 μm	99.89	99.94
4.0	63 μm	99.93	99.98
<4.0	<63 μm	99.95	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG07	Gravel Mass = 1.74 g	
Date	23-Oct-06	Remaining Mass = 2469.55 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	1.74	0.07
-0.5	1.4 mm	0.17	0.18
0.0	1.0 mm	1.34	0.94
0.5	710 μm	10.74	7.00
1.0	500 μm	71.22	46.05
1.5	355 μm	121.13	78.26
2.0	250 μm	146.01	94.33
2.5	180 μm	153.14	98.93
3.0	125 μm	154.54	99.83
3.5	90 μm	154.72	99.95
4.0	63 μm	154.78	99.99
<4.0	<63 μm	154.80	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG08	Gravel Mass = 18.01 g	
Date	23-Oct-06	Remaining Mass = 2664.63 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	18.01	0.67
-0.5	1.4 mm	1.59	1.64
0.0	1.0 mm	7.27	5.09
0.5	710 μm	28.07	17.72
1.0	500 μm	80.02	49.26
1.5	355 μm	120.73	73.98
2.0	250 μm	150.78	92.23
2.5	180 μm	160.80	98.31
3.0	125 μm	162.77	99.51
3.5	90 μm	163.28	99.82
4.0	63 μm	163.43	99.91
<4.0	<63 μm	163.58	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table B1 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2006

Sample	MG09	Gravel Mass = 37.48 g	
Date	26-Oct-06	Remaining Mass = 2239.14 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	37.48	1.65
-0.5	1.4 mm	2.65	3.34
0.0	1.0 mm	10.85	8.56
0.5	710 μm	37.18	25.35
1.0	500 μm	90.53	59.37
1.5	355 μm	125.46	81.64
2.0	250 μm	147.38	95.62
2.5	180 μm	152.90	99.14
3.0	125 μm	153.74	99.67
3.5	90 μm	154.06	99.88
4.0	63 μm	154.16	99.94
<4.0	<63 μm	154.25	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	DG10	Gravel Mass = 2.41 g	
Date	26-Oct-06	Remaining Mass = 1686.13 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	2.41	0.14
-0.5	1.4 mm	0.38	0.49
0.0	1.0 mm	1.84	1.85
0.5	710 μm	9.26	8.73
1.0	500 μm	46.15	42.92
1.5	355 μm	84.83	78.77
2.0	250 μm	104.52	97.02
2.5	180 μm	107.42	99.70
3.0	125 μm	107.66	99.93
3.5	90 μm	107.69	99.95
4.0	63 μm	107.72	99.98
<4.0	<63 μm	107.74	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG11	Gravel Mass = 42.95 g	
Date	26-Oct-06	Remaining Mass = 1990.03 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	42.95	2.16
-0.5	1.4 mm	0.02	2.17
0.0	1.0 mm	5.89	4.45
0.5	710 μm	34.49	15.60
1.0	500 μm	121.79	49.61
1.5	355 μm	190.52	76.39
2.0	250 μm	235.40	93.87
2.5	180 μm	246.57	98.22
3.0	125 μm	249.36	99.31
3.5	90 μm	250.23	99.65
4.0	63 μm	250.56	99.78
<4.0	<63 μm	251.13	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG13	Gravel Mass = 8.75 g	
Date	26-Oct-06	Remaining Mass = 2441.69 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	8.75	0.36
-0.5	1.4 mm	0.68	0.79
0.0	1.0 mm	3.21	2.41
0.5	710 μm	17.57	11.57
1.0	500 μm	68.07	43.80
1.5	355 μm	114.73	73.57
2.0	250 μm	147.46	94.46
2.5	180 μm	154.83	99.16
3.0	125 μm	155.87	99.83
3.5	90 μm	156.04	99.94
4.0	63 μm	156.07	99.96
<4.0	<63 μm	156.14	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table B2 Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2007

Sample	UG02	Gravel Mass = 5.18 g	
Date	15-Oct-07	Remaining Mass = 1630.26 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	1.01	0.07
-1.5	2.8 mm	2.23	0.14
-1.0	2.0 mm	5.18	0.34
-0.5	1.4 mm	0.77	0.74
0.0	1.0 mm	4.59	2.77
0.5	710 μm	26.67	14.46
1.0	500 μm	108.69	57.89
1.5	355 μm	163.35	86.83
2.0	250 μm	184.58	98.07
2.5	180 μm	187.72	99.74
3.0	125 μm	188.05	99.91
3.5	90 μm	188.16	99.97
4.0	63 μm	188.20	99.99
<4.0	<63 μm	188.22	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG01	Gravel Mass = 3.92 g	
Date	16-Oct-07	Remaining Mass = 1587.54 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	0.23	0.01
-1.5	2.8 mm	0.65	0.04
-1.0	2.0 mm	3.92	0.25
-0.5	1.4 mm	1.60	1.11
0.0	1.0 mm	10.19	5.74
0.5	710 μm	42.15	22.96
1.0	500 μm	125.24	67.74
1.5	355 μm	169.01	91.32
2.0	250 μm	183.78	99.28
2.5	180 μm	184.84	99.85
3.0	125 μm	184.98	99.93
3.5	90 μm	185.04	99.96
4.0	63 μm	185.09	99.99
<4.0	<63 μm	185.11	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG03	Gravel Mass = g	
Date	Oct-06	Remaining Mass = g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	Sample collected, however	
-1.5	2.8 mm	It was misplaced in transit	
-1.0	2.0 mm		
-0.5	1.4 mm		
0.0	1.0 mm		
0.5	710 μm		
1.0	500 μm		
1.5	355 μm		
2.0	250 μm		
2.5	180 μm		
3.0	125 μm		
3.5	90 μm		
4.0	63 μm		
<4.0	<63 μm		

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG04	Gravel Mass = 53.07 g	
Date	16-Oct-07	Remaining Mass = 1702.16 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	16.32	0.93
-1.5	2.8 mm	32.79	1.87
-1.0	2.0 mm	53.07	3.02
-0.5	1.4 mm	1.73	4.61
0.0	1.0 mm	4.84	7.45
0.5	710 μm	15.16	16.89
1.0	500 μm	44.96	44.13
1.5	355 μm	75.89	72.41
2.0	250 μm	100.29	94.72
2.5	180 μm	104.97	99.00
3.0	125 μm	105.58	99.56
3.5	90 μm	105.77	99.73
4.0	63 μm	105.93	99.88
<4.0	<63 μm	106.06	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table B2 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2007

Sample	MG05	Gravel Mass = 4.75 g	
Date	19-Oct-07	Remaining Mass = 1743.85 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	4.75	0.27
-0.5	1.4 mm	0.60	0.81
0.0	1.0 mm	2.66	2.67
0.5	710 μm	11.29	10.46
1.0	500 μm	50.04	45.41
1.5	355 μm	86.51	78.31
2.0	250 μm	106.70	96.52
2.5	180 μm	110.07	99.56
3.0	125 μm	110.41	99.86
3.5	90 μm	110.49	99.94
4.0	63 μm	110.53	99.97
<4.0	<63 μm	110.56	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG06	Gravel Mass = 8.16 g	
Date	19-Oct-07	Remaining Mass = 2176.95 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	1.14	0.05
-1.5	2.8 mm	3.04	0.14
-1.0	2.0 mm	8.16	0.37
-0.5	1.4 mm	1.12	1.05
0.0	1.0 mm	5.78	3.87
0.5	710 μm	29.7	18.35
1.0	500 μm	99.85	60.80
1.5	355 μm	141.65	86.10
2.0	250 μm	160.07	97.25
2.5	180 μm	163.93	99.58
3.0	125 μm	164.16	99.72
3.5	90 μm	164.41	99.87
4.0	63 μm	164.52	99.94
<4.0	<63 μm	164.62	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	MG07	Gravel Mass = 5.17 g	
Date	19-Oct-07	Remaining Mass = 1910.96 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	3.60	0.19
-1.5	2.8 mm	4.26	0.22
-1.0	2.0 mm	5.17	0.27
-0.5	1.4 mm	0.11	0.35
0.0	1.0 mm	0.76	0.82
0.5	710 μm	6.51	4.96
1.0	500 μm	39.7	28.90
1.5	355 μm	88.37	64.00
2.0	250 μm	129.17	93.42
2.5	180 μm	136.77	98.90
3.0	125 μm	138.04	99.82
3.5	90 μm	138.21	99.94
4.0	63 μm	138.26	99.98
<4.0	<63 μm	138.29	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG08	Gravel Mass = 5.36 g	
Date	27-Nov-07	Remaining Mass = 2498.93 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	0.42	0.02
-1.5	2.8 mm	1.73	0.07
-1.0	2.0 mm	5.36	0.21
-0.5	1.4 mm	0.59	0.60
0.0	1.0 mm	2.92	2.10
0.5	710 μm	15.23	10.06
1.0	500 μm	68.98	44.79
1.5	355 μm	120.71	78.22
2.0	250 μm	147.92	95.80
2.5	180 μm	153.16	99.19
3.0	125 μm	154.11	99.80
3.5	90 μm	154.26	99.90
4.0	63 μm	154.36	99.96
<4.0	<63 μm	154.42	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table B2 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2007

Sample	MG09	Gravel Mass = 5.05 g	
Date	19-Oct-07	Remaining Mass = 1878.18 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	2.42	0.13
-1.5	2.8 mm	3.48	0.19
-1.0	2.0 mm	5.02	0.27
-0.5	1.4 mm	0.16	0.42
0.0	1.0 mm	0.90	1.14
0.5	710 μm	5.83	5.91
1.0	500 μm	27.87	27.25
1.5	355 μm	58.10	56.52
2.0	250 μm	88.73	86.17
2.5	180 μm	99.63	96.73
3.0	125 μm	102.16	99.18
3.5	90 μm	102.69	99.69
4.0	63 μm	102.90	99.89
<4.0	<63 μm	103.01	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG10	Gravel Mass = 2.41 g	
Date	26-Oct-06	Remaining Mass = 1686.13 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	2.33	0.14
-1.0	2.0 mm	3.93	0.24
-0.5	1.4 mm	0.56	0.52
0.0	1.0 mm	3.52	2.03
0.5	710 μm	23.09	11.96
1.0	500 μm	95.61	48.77
1.5	355 μm	161.37	82.15
2.0	250 μm	193.24	98.32
2.5	180 μm	196.08	99.77
3.0	125 μm	196.22	99.84
3.5	90 μm	196.29	99.87
4.0	63 μm	196.38	99.92
<4.0	<63 μm	196.54	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG11	Gravel Mass = 3.74 g	
Date	19-Oct-07	Remaining Mass = 2623.80 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	1.00	0.04
-1.0	2.0 mm	3.74	0.14
-0.5	1.4 mm	0.75	0.56
0.0	1.0 mm	4.39	2.59
0.5	710 μm	23.13	13.06
1.0	500 μm	86.05	48.18
1.5	355 μm	140.21	78.42
2.0	250 μm	173.01	96.73
2.5	180 μm	178.12	99.58
3.0	125 μm	178.70	99.91
3.5	90 μm	178.79	99.96
4.0	63 μm	178.83	99.98
<4.0	<63 μm	178.87	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG13	Gravel Mass = 234..96 g	
Date	12-Dec-07	Remaining Mass = 1077.19 g	
Phi		Mass (g)	Cumulative %
-5.00	32 mm	0.00	0.00
-4	16 mm	66.28	5.05
-3.25	9.5 mm	109.6	8.35
-2.0	4.0 mm	193.45	14.74
-1.5	2.8 mm	234.33	17.86
-1.0	2.0 mm	234.96	17.91
-0.5	1.4 mm	1.62	18.84
0.0	1.0 mm	3.54	19.95
0.5	710 μm	8.34	22.72
1.0	500 μm	24.58	32.08
1.5	355 μm	54.33	49.23
2.0	250 μm	107.54	79.91
2.5	180 μm	132.61	94.37
3.0	125 μm	139.62	98.41
3.5	90 μm	141.15	99.29
4.0	63 μm	141.74	99.63
<4.0	<63 μm	142.38	100.00

Folk (1974) Texture Group: Granular medium sand

Table B3 Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2008

Sample	UG02	Gravel Mass = 3.69 g	
Date	25-Sep-08	Remaining Mass = 2475.17 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	3.69	0.15
-0.5	1.4 mm	1.52	0.64
0.0	1.0 mm	7.22	2.49
0.5	710 μm	46.49	15.21
1.0	500 μm	174.11	56.54
1.5	355 μm	269.28	87.36
2.0	250 μm	304.91	98.90
2.5	180 μm	307.96	99.89
3.0	125 μm	308.24	99.98
3.5	90 μm	308.27	99.99
4.0	63 μm	308.29	99.99
<4.0	<63 μm	308.31	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG01	Gravel Mass = 1.49 g	
Date	25-Sep-08	Remaining Mass = 2236.27 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	1.49	0.07
-0.5	1.4 mm	0.62	0.28
0.0	1.0 mm	3.98	1.41
0.5	710 μm	32.2	10.94
1.0	500 μm	150.08	50.76
1.5	355 μm	251.75	85.11
2.0	250 μm	292.74	98.96
2.5	180 μm	295.6	99.92
3.0	125 μm	295.75	99.97
3.5	90 μm	295.77	99.98
4.0	63 μm	295.8	99.99
<4.0	<63 μm	295.83	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG03	Gravel Mass = 4.59 g	
Date	25-Sep-08	Remaining Mass = 2185.19 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	4.59	0.21
-0.5	1.4 mm	0.63	0.44
0.0	1.0 mm	3.23	1.37
0.5	710 μm	23.04	8.52
1.0	500 μm	119.11	43.17
1.5	355 μm	212.33	76.79
2.0	250 μm	266.56	96.34
2.5	180 μm	275.18	99.45
3.0	125 μm	276.1	99.78
3.5	90 μm	276.39	99.89
4.0	63 μm	276.54	99.94
<4.0	<63 μm	276.7	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UG04	Gravel Mass = 4.42 g	
Date	25-Sep-08	Remaining Mass = 2026.39 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	4.42	0.22
-0.5	1.4 mm	1	0.62
0.0	1.0 mm	5.71	2.51
0.5	710 μm	39.31	16.00
1.0	500 μm	149.91	60.42
1.5	355 μm	215.02	86.56
2.0	250 μm	243.72	98.09
2.5	180 μm	247.96	99.79
3.0	125 μm	248.27	99.92
3.5	90 μm	248.36	99.95
4.0	63 μm	248.42	99.98
<4.0	<63 μm	248.48	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table B3 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2008

Sample	MG05	Gravel Mass = 9.06 g	
Date	26-Sep-08	Remaining Mass = 2542.11 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	9.06	0.36
-0.5	1.4 mm	1.09	0.70
0.0	1.0 mm	5.6	2.10
0.5	710 μm	30.48	9.87
1.0	500 μm	119.56	37.66
1.5	355 μm	220.22	69.07
2.0	250 μm	300.97	94.27
2.5	180 μm	316.11	98.99
3.0	125 μm	318.77	99.82
3.5	90 μm	319.13	99.93
4.0	63 μm	319.26	99.98
<4.0	<63 μm	319.34	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG06	Gravel Mass =2.88 g	
Date	26-Sep-08	Remaining Mass = 2136.54 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	2.88	0.13
-0.5	1.4 mm	0.75	0.40
0.0	1.0 mm	3.34	1.30
0.5	710 μm	19.79	7.07
1.0	500 μm	91.76	32.28
1.5	355 μm	173.72	61.00
2.0	250 μm	247.61	86.89
2.5	180 μm	275.97	96.82
3.0	125 μm	282.63	99.16
3.5	90 μm	284.52	99.82
4.0	63 μm	284.84	99.93
<4.0	<63 μm	285.04	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG07	Gravel Mass = 3.72 g	
Date	26-Sep-08	Remaining Mass = 2225.35 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	3.72	0.17
-0.5	1.4 mm	0.72	0.42
0.0	1.0 mm	4.51	1.78
0.5	710 μm	30.16	10.93
1.0	500 μm	128.46	46.00
1.5	355 μm	220.32	78.77
2.0	250 μm	270.68	96.74
2.5	180 μm	278.35	99.48
3.0	125 μm	279.58	99.91
3.5	90 μm	279.69	99.95
4.0	63 μm	279.77	99.98
<4.0	<63 μm	279.82	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG08	Gravel Mass = 3.49 g	
Date	26-Sep-08	Remaining Mass = 2705.2 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	3.49	0.13
-0.5	1.4 mm	0.62	0.43
0.0	1.0 mm	3.77	1.97
0.5	710 μm	20.1	9.95
1.0	500 μm	84.1	41.22
1.5	355 μm	149.13	72.99
2.0	250 μm	201.42	98.54
2.5	180 μm	203.67	99.64
3.0	125 μm	204.27	99.94
3.5	90 μm	204.27	99.94
4.0	63 μm	204.29	99.95
<4.0	<63 μm	204.4	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table B3 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2008

Sample	MG09	Gravel Mass = 11.04 g	
Date	26-Sep-08	Remaining Mass = 2014.16 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	11.04	0.55
-0.5	1.4 mm	1.87	1.33
0.0	1.0 mm	7.4	3.63
0.5	710 μm	31.67	13.76
1.0	500 μm	106.5	44.98
1.5	355 μm	180.25	75.74
2.0	250 μm	226.96	95.23
2.5	180 μm	236.38	99.16
3.0	125 μm	238.07	99.87
3.5	90 μm	238.24	99.94
4.0	63 μm	238.3	99.96
<4.0	<63 μm	238.39	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG10	Gravel Mass = 1.72 g	
Date	26-Sep-08	Remaining Mass = 1759.16 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	1.72	0.10
-0.5	1.4 mm	0.51	0.32
0.0	1.0 mm	2.82	1.33
0.5	710 μm	17.86	7.93
1.0	500 μm	88.2	38.76
1.5	355 μm	169.42	74.35
2.0	250 μm	221.26	97.08
2.5	180 μm	227.52	99.82
3.0	125 μm	227.81	99.95
3.5	90 μm	227.83	99.96
4.0	63 μm	227.92	100.00
<4.0	<63 μm	227.93	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG11	Gravel Mass = 1.28 g	
Date	26-Sep-08	Remaining Mass = 2095.45 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	1.28	0.06
-0.5	1.4 mm	0.71	0.33
0.0	1.0 mm	4.08	1.60
0.5	710 μm	24.54	9.34
1.0	500 μm	113.25	42.87
1.5	355 μm	200.72	75.93
2.0	250 μm	253.08	95.72
2.5	180 μm	263.41	99.63
3.0	125 μm	263.96	99.83
3.5	90 μm	264.25	99.94
4.0	63 μm	264.33	99.97
<4.0	<63 μm	264.4	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG13	Gravel Mass = 126.07 g	
Date	26-Sep-08	Remaining Mass = 1826.34 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	126.07	6.46
-0.5	1.4 mm	2.05	7.30
0.0	1.0 mm	6.34	9.08
0.5	710 μm	21.12	15.18
1.0	500 μm	65.52	33.53
1.5	355 μm	120.78	56.36
2.0	250 μm	186.74	83.61
2.5	180 μm	212.85	94.39
3.0	125 μm	222.49	98.38
3.5	90 μm	224.95	99.39
4.0	63 μm	226.19	99.90
<4.0	<63 μm	226.42	100.00

Folk (1974) Texture Group: Granular medium sand

Table B4 Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2009

Sample	UG02	Gravel Mass = 11.42 g	
Date	27-Oct-09	Remaining Mass = 3820.97 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	11.42	0.30
-0.5	1.4 mm	0.71	0.93
0.0	1.0 mm	2.32	2.37
0.5	710 μm	12.5	11.48
1.0	500 μm	52.89	47.60
1.5	355 μm	88.67	79.59
2.0	250 μm	108.08	96.95
2.5	180 μm	111.18	99.72
3.0	125 μm	111.39	99.91
3.5	90 μm	111.44	99.96
4.0	63 μm	111.46	99.97
<4.0	<63 μm	111.49	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG01	Gravel Mass = 14.26 g	
Date	27-Oct-09	Remaining Mass = 4233.82 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	14.26	0.34
-0.5	1.4 mm	0.69	0.86
0.0	1.0 mm	2.88	2.52
0.5	710 μm	13.96	10.92
1.0	500 μm	60.3	46.04
1.5	355 μm	103.43	78.74
2.0	250 μm	127.01	96.61
2.5	180 μm	130.84	99.51
3.0	125 μm	131.26	99.83
3.5	90 μm	131.38	99.92
4.0	63 μm	131.44	99.97
<4.0	<63 μm	131.48	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UG03	Gravel Mass = 4.59 g	
Date	27-Oct-09	Remaining Mass = 2185.19 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	4.59	0.21
-0.5	1.4 mm	0.67	0.62
0.0	1.0 mm	1.58	1.19
0.5	710 μm	5.37	3.54
1.0	500 μm	23.87	15.00
1.5	355 μm	91.69	57.04
2.0	250 μm	135.26	84.05
2.5	180 μm	153.2	95.17
3.0	125 μm	159.17	98.87
3.5	90 μm	160.77	99.86
4.0	63 μm	160.89	99.93
<4.0	<63 μm	161	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UG04	Gravel Mass = 8.69 g	
Date	27-Oct-09	Remaining Mass = 5498.28 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	8.69	0.16
-0.5	1.4 mm	0.8	0.60
0.0	1.0 mm	3.07	1.87
0.5	710 μm	19.13	10.85
1.0	500 μm	83.78	46.97
1.5	355 μm	132.96	74.46
2.0	250 μm	160.56	89.88
2.5	180 μm	172.39	96.49
3.0	125 μm	176.07	98.55
3.5	90 μm	177.74	99.48
4.0	63 μm	178.2	99.74
<4.0	<63 μm	178.67	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table B4 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2009

Sample	MG05	Gravel Mass = 14.15 g	
Date	27-Oct-09	Remaining Mass = 2542.11 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	14.15	0.55
-0.5	1.4 mm	0.85	1.20
0.0	1.0 mm	2.23	2.25
0.5	710 μm	9.6	7.84
1.0	500 μm	36.86	28.52
1.5	355 μm	68.11	52.23
2.0	250 μm	102.07	77.99
2.5	180 μm	121.58	92.79
3.0	125 μm	127.8	97.51
3.5	90 μm	130.02	99.20
4.0	63 μm	130.57	99.61
<4.0	<63 μm	131.08	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG06	Gravel Mass = 7.57 g	
Date	27-Oct-09	Remaining Mass = 4886.50 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	7.57	0.15
-0.5	1.4 mm	0.93	0.73
0.0	1.0 mm	3.08	2.05
0.5	710 μm	13.48	8.43
1.0	500 μm	60.73	37.44
1.5	355 μm	103.99	63.99
2.0	250 μm	135.44	83.30
2.5	180 μm	153.27	94.25
3.0	125 μm	159.62	98.15
3.5	90 μm	161.48	99.29
4.0	63 μm	162.03	99.63
<4.0	<63 μm	162.64	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG07	Gravel Mass = 20.7.24 g	
Date	28-Oct-09	Remaining Mass = 5024.27 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	20.72	0.41
-0.5	1.4 mm	1.1	1.18
0.0	1.0 mm	2.78	2.37
0.5	710 μm	10.71	7.94
1.0	500 μm	48.08	34.23
1.5	355 μm	87.27	61.79
2.0	250 μm	113.05	79.93
2.5	180 μm	127.15	89.84
3.0	125 μm	135.94	96.03
3.5	90 μm	139.78	98.73
4.0	63 μm	140.86	99.49
<4.0	<63 μm	141.59	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	MG08	Gravel Mass = 14.48 g	
Date	29-Oct-09	Remaining Mass = 5221.65 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	14.48	0.28
-0.5	1.4 mm	1.55	1.13
0.0	1.0 mm	4.36	2.67
0.5	710 μm	20.23	11.39
1.0	500 μm	73.78	40.81
1.5	355 μm	118.51	65.39
2.0	250 μm	153.87	84.82
2.5	180 μm	171.03	94.25
3.0	125 μm	177.08	97.57
3.5	90 μm	180.08	99.22
4.0	63 μm	180.83	99.63
<4.0	<63 μm	181.5	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table B4 (Cont.) Cumulative frequency grain size distributions for bulk bed-material samples on the Gulungul Creek for 2006

Sample	MG09	Gravel Mass = 66.54 g	
Date	29-Oct-09	Remaining Mass = 4876.74 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	66.54	1.35
-0.5	1.4 mm	3.08	3.99
0.0	1.0 mm	5.15	5.76
0.5	710 μm	13.86	13.23
1.0	500 μm	39.51	35.22
1.5	355 μm	62.24	54.71
2.0	250 μm	84.22	73.55
2.5	180 μm	100	87.08
3.0	125 μm	108.93	94.74
3.5	90 μm	113.13	98.34
4.0	63 μm	114.04	99.12
<4.0	<63 μm	115.07	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG10	Gravel Mass = 16.37 g	
Date	29-Oct-09	Remaining Mass = 3622.06 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	16.37	0.45
-0.5	1.4 mm	1.36	1.59
0.0	1.0 mm	3.52	3.40
0.5	710 μm	12.68	11.08
1.0	500 μm	48.92	41.45
1.5	355 μm	79.62	67.18
2.0	250 μm	98.65	83.13
2.5	180 μm	108.84	91.67
3.0	125 μm	115.09	96.91
3.5	90 μm	117.61	99.02
4.0	63 μm	118.31	99.61
<4.0	<63 μm	118.78	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	DG11	Gravel Mass = 7.05 g	
Date	29-Oct-09	Remaining Mass = 4119.40 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	7.05	0.17
-0.5	1.4 mm	0.39	0.54
0.0	1.0 mm	1.63	1.69
0.5	710 μm	8.25	7.88
1.0	500 μm	42.59	39.95
1.5	355 μm	78.27	73.28
2.0	250 μm	96.57	90.38
2.5	180 μm	103.67	97.01
3.0	125 μm	105.91	99.10
3.5	90 μm	106.49	99.65
4.0	63 μm	106.68	99.82
<4.0	<63 μm	106.87	100.00

Folk (1974) Texture Group: Slightly granular medium sand

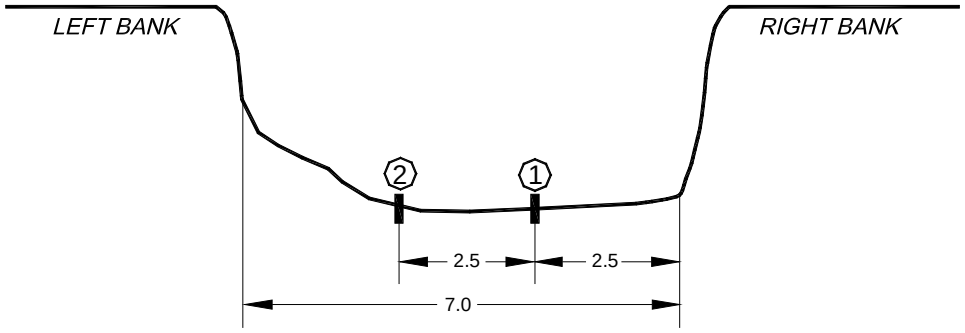
Sample	DG13	Gravel Mass = 200.89 g	
Date	29-Oct-09	Remaining Mass = 3365.97 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0	0.00
-3.25	9.5 mm	42.74	1.20
-2.0	4.0 mm	149.27	4.18
-1.5	2.8 mm	178.75	5.01
-1.0	2.0 mm	200.89	5.63
-0.5	1.4 mm	4.53	9.35
0.0	1.0 mm	5.49	10.13
0.5	710 μm	8.46	12.57
1.0	500 μm	22.44	24.03
1.5	355 μm	49.96	46.58
2.0	250 μm	89.36	78.88
2.5	180 μm	106.99	93.33
3.0	125 μm	111.71	97.20
3.5	90 μm	113.57	98.72
4.0	63 μm	156.07	99.96
<4.0	<63 μm	115.13	100.00

Folk (1974) Texture Group: Slightly granular medium sand

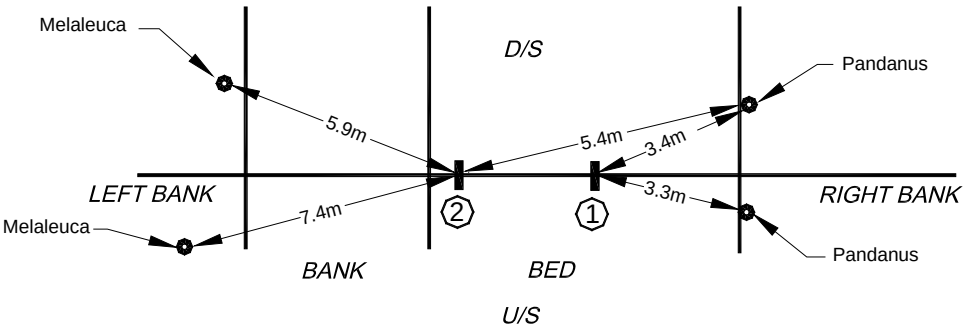
Appendix C
Schematic diagrams to locate the scour chains in Gulungul Creek

UG02

Chains Initially Installed 30 Oct 02

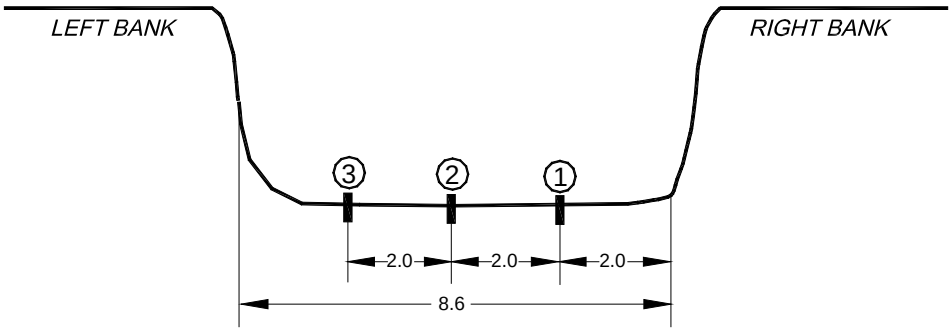


SCOUR CHAIN 1 1.0m All Links Vertical
SCOUR CHAIN 2 1.0m All Links Vertical

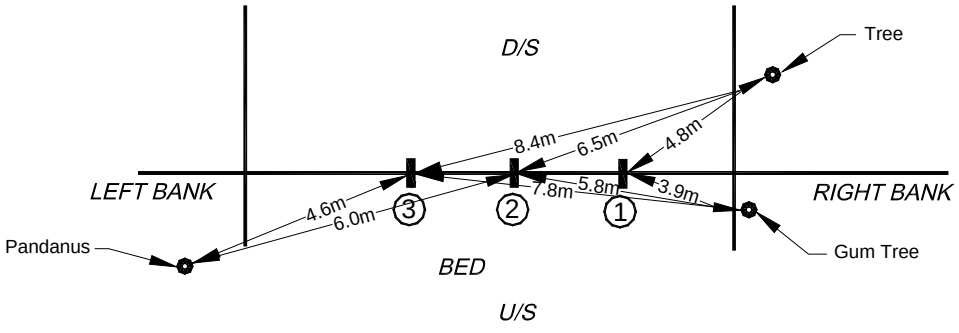


UG03

Chains Initially Installed 30 Oct 02

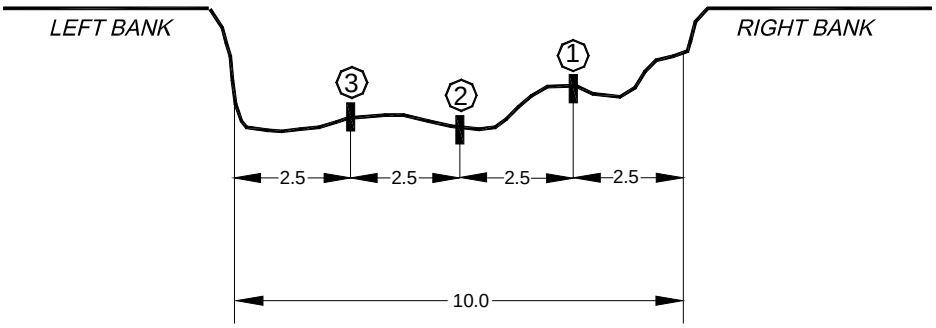


SCOUR CHAIN 1 1.0m All Links Vertical
SCOUR CHAIN 2 1.0m All Links Vertical
SCOUR CHAIN 3 1.0m All Links Vertical

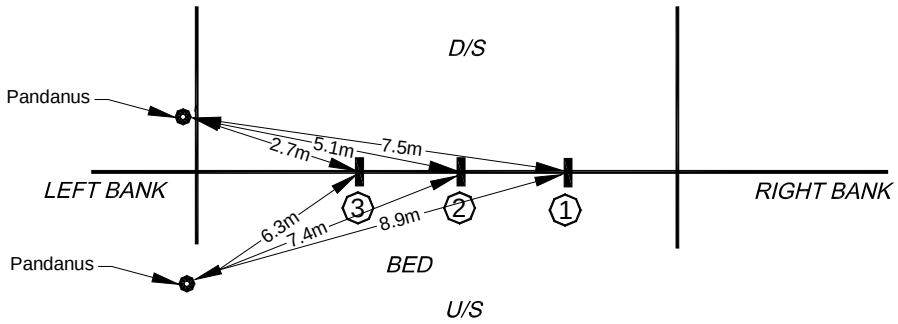


MG06

Chains Initially Installed 30 Oct 02

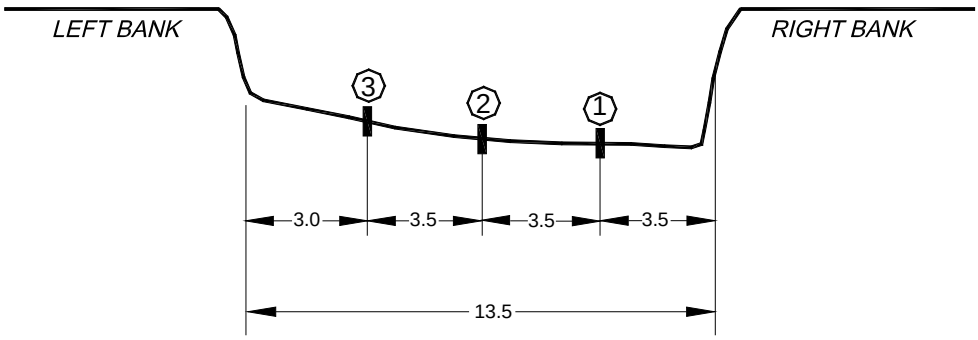


SCOUR CHAIN 1 1.0m All Links Vertical
SCOUR CHAIN 2 0.6m All Links Vertical
SCOUR CHAIN 3 1.0m All Links Vertical

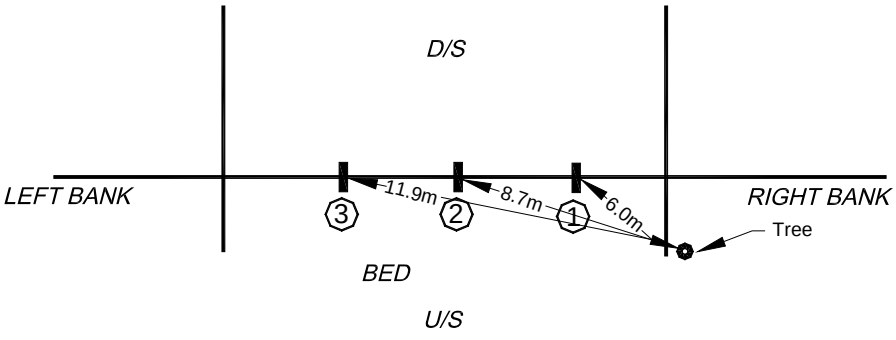


MG08

Chains Initially Installed 30 Oct 02

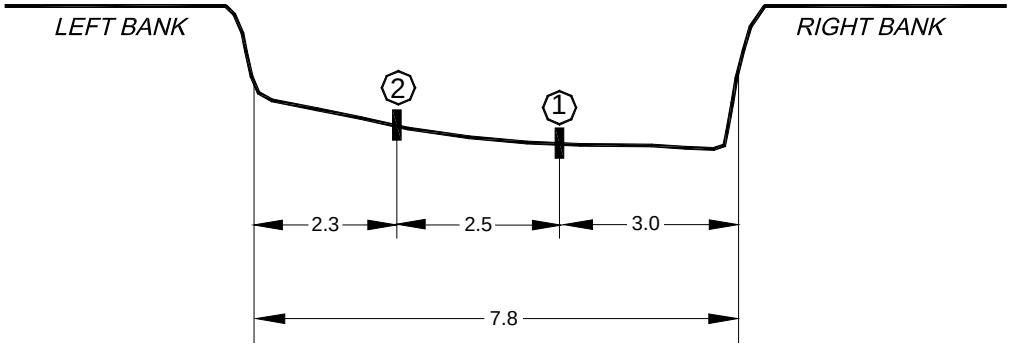


SCOUR CHAIN 1 1.0m All Links Vertical
SCOUR CHAIN 2 1.0m All Links Vertical
SCOUR CHAIN 3 1.0m All Links Vertical

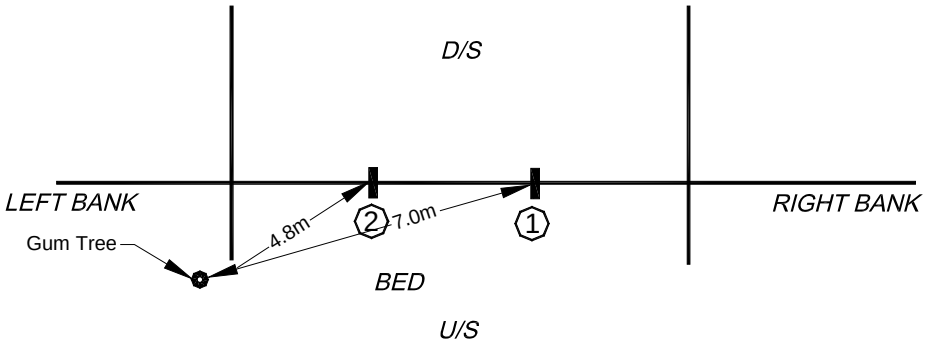


DG10

Chains Initially Installed 30 Oct 02

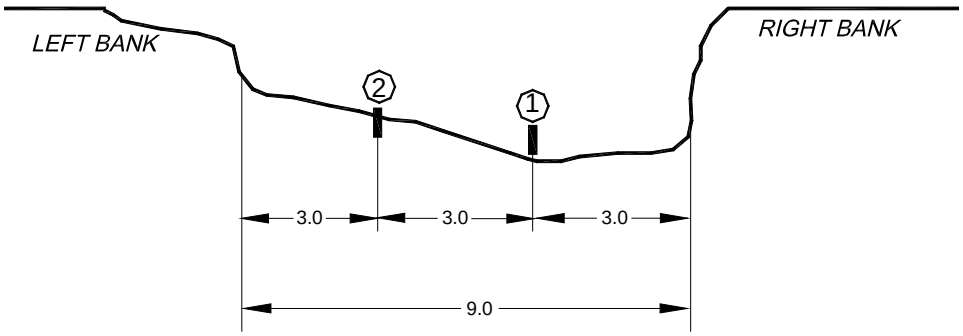


SCOUR CHAIN 1 0.8m All Links Vertical
SCOUR CHAIN 2 0.8m All Links Vertical

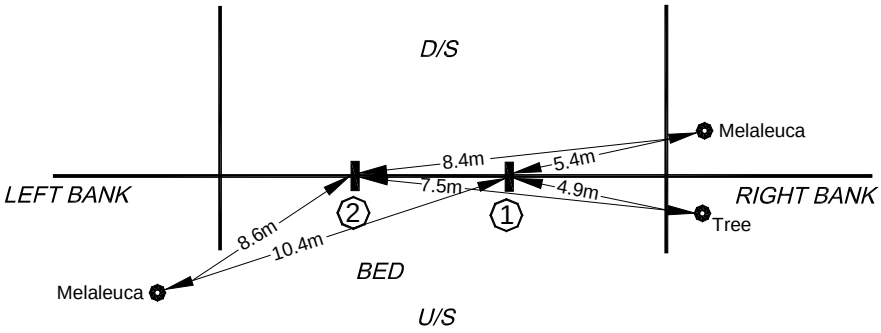


DG11

Chains Initially Installed 30 Oct 02



SCOUR CHAIN 1 1.0m All Links Vertical
SCOUR CHAIN 2 1.0m All Links Vertical



Appendix D Survey data for Ngarradj cross sections surveyed during the 2006 to 2009 dry seasons

This appendix contains the survey data for four cross sections surveyed during the 2006 & 2007 dry seasons.

The data files are located on Sharepoint at:

\\Landscape Characterisation and Monitoring\Jabiluka\(Dry) Channel stability in the Ngarradj catchment\Data\Survey xsections*location*

where *location* refers to one of the five sites at which the cross sections are located, namely Tributary North, Tributary Central, East Tributary, Upper Swift Creek and Swift Creek.

Tributary North Cross section 2006							
TN01 Distance (m)	**22-Aug-06 Assumed Height (m)**	**GULLYPLAN Easting (m)**	**PART 1 Northings (m)**	**22-Aug-06 Easting (m)**	**PART 2 Northings (m)**	**Easting (m)**	**PART 3 Northings (m)**
4969.104	10.794	1000.043	4981.298	965.238	4983.448	991.35	4983.813
4972.437	10.746	999.712	4981.639	966.080	4984.289	992.178	4983.649
4977.219	10.596	999.007	4981.701	967.422	4984.755	992.801	4983.412
4981.343	10.410	998.535	4981.744	968.572	4984.754	994.189	4983.935
4982.181	10.032	998.065	4981.005	969.777	4984.247	995.168	4984.385
4982.669	9.809	996.506	4981.216	971.015	4983.366	996.040	4984.929
4982.961	9.720	994.974	4981.197	971.808	4982.389	995.615	4985.513
4983.045	9.522	994.554	4980.724	972.168	4981.696	995.762	4986.263
4983.207	9.452	994.026	4980.405	972.957	4981.716	996.595	4986.722
4983.572	9.525	993.034	4980.102	973.724	4981.653	997.285	4986.400
4983.840	9.680	991.666	4979.844	974.519	4981.429	998.020	4986.612
4984.508	9.794	990.678	4980.390	975.087	4982.004	999.283	4985.649
4984.820	9.832	989.127	4979.763	976.489	4981.906	999.862	4986.185
4985.333	10.130	988.071	4979.922	977.436	4981.588	1000.705	4986.032
4985.787	10.260	987.683	4979.27	978.423	4981.478	1000.951	4985.765
4986.074	10.436	986.744	4978.891	979.723	4982.119	1001.152	4985.330
4986.601	10.489	985.158	4977.373	980.284	4981.763	1001.372	4985.572
4988.594	10.572	984.075	4977.509	981.465	4981.483	1001.450	4986.261
4990.935	10.619	982.456	4976.943	982.356	4981.423	1002.544	4986.981
4993.713	10.735	980.968	4977.048	982.718	4981.231	1003.347	4986.468
4997.242	10.788	979.427	4976.890	983.191	4981.161	1004.064	4986.222
4998.977	10.800	978.696	4977.341	984.050	4981.586	1004.660	4986.666
		977.745	4976.422	983.976	4981.971	1005.404	4986.983
		975.975	4976.312	983.627	4982.354	1006.410	4986.708
		973.817	4976.230	982.658	4982.767	1007.221	4986.792
		972.476	4976.210	981.539	4982.976	1007.995	4986.250
		971.660	4976.035	981.340	4983.835	1008.211	4985.695
		971.269	4976.508	981.723	4984.443	1008.430	4985.656
		970.507	4976.970	982.627	4984.790	1008.690	4986.099
		969.892	4977.789	983.405	4985.324	1009.086	4986.131
		969.912	4978.431	984.014	4986.224	1009.761	4986.556
		968.818	4978.499	985.231	4986.398	1010.538	4986.820
		967.607	4978.891	986.187	4986.696	1011.245	4986.728
		967.321	4979.378	986.874	4986.400	1011.560	4986.159
		967.774	4980.686	987.508	4986.109	1011.060	4983.813
		967.433	4981.811	988.161	4985.383	1011.230	4983.649
		966.106	4981.932	989.273	4983.895	1009.565	4980.750
		965.821	4982.713	990.412	4983.520	1009.099	4981.180

East Tributary Cross sections 1 to 4 2006							
ET01 Distance (m)	**13-Oct-06 Assumed Height (m)**	**ET02 Distance (m)**	**13-Oct-06 Assumed Height (m)**	**ET03 Distance (m)**	**24-Oct-06 Assumed Height (m)**	**ET04 Distance (m)**	**13-Oct-06 Assumed Height (m)**
975.712	14.892	1971.699	14.897	2977.894	14.789	3974.137	14.894
975.718	14.891	1971.834	14.696	2980.158	14.785	3974.130	14.894
975.835	14.691	1973.978	14.723	2982.587	14.843	3974.269	14.694
978.057	14.680	1975.692	14.731	2984.192	14.897	3976.401	14.730
979.545	14.724	1976.404	14.742	2984.985	14.789	3978.853	14.790
981.179	14.855	1976.765	14.783	2985.627	14.698	3981.273	14.857
981.957	14.810	1976.928	14.704	2986.057	14.429	3982.400	14.913
982.517	14.622	1977.149	14.579	2986.147	14.228	3983.347	14.875
982.956	14.518	1977.296	14.415	2986.903	14.068	3983.595	14.782
983.093	14.391	1978.055	14.131	2987.117	13.895	3984.316	14.349
983.222	14.255	1978.392	14.011	2987.224	13.705	3984.517	14.270
983.336	14.018	1978.677	13.734	2987.506	13.460	3984.840	13.490
983.530	13.763	1979.179	13.527	2987.871	13.207	3985.422	13.395
983.666	13.598	1979.539	13.523	2988.301	13.091	3986.179	13.310
984.038	13.444	1980.097	13.477	2988.766	13.022	3986.712	13.262
984.129	13.359	1981.189	13.099	2988.991	13.074	3987.381	13.257
984.391	13.275	1981.551	13.134	2989.286	13.022	3987.970	13.353
985.176	13.272	1981.849	13.288	2989.596	12.993	3988.513	13.471
985.944	13.300	1982.256	13.407	2989.994	13.039	3989.341	13.573
986.636	13.293	1982.652	13.356	2990.711	13.101	3989.971	13.901
987.144	13.210	1983.522	12.780	2991.283	13.166	3990.222	14.135
987.648	13.111	1983.803	12.746	2991.693	13.450	3990.363	14.205
988.171	13.169	1984.174	12.967	2992.168	13.645	3990.754	14.518
988.492	13.281	1984.629	13.091	2992.548	14.065	3991.009	14.626
988.576	13.457	1985.018	13.095	2992.957	14.403	3991.637	14.743
988.747	13.530	1985.531	12.978	2993.541	14.755	3992.510	14.856
988.948	13.848	1986.087	13.050	2994.101	14.906	3993.689	14.861
989.221	14.127	1986.251	13.332	2999.898	14.826	3995.858	14.868
989.592	14.252	1986.505	13.520	3000.000	15.000	3997.856	14.820
989.765	14.376	1986.674	13.781				
990.098	14.594	1986.722	14.011				
990.294	14.677	1986.945	14.128				
990.639	14.682	1987.073	14.272				
991.279	14.735	1987.155	14.635				
992.330	14.754	1987.624	14.834				
994.910	14.776	1988.135	14.876				
996.801	14.818	1988.657	14.893				
998.504	14.837	1991.582	14.846				
		1992.822	14.842				

East Tributary Cross sections 1 to 4 2006							
ET01 Distance (m)	13-Oct-06 Assumed Height (m)	ET02 Distance (m)	13-Oct-06 Assumed Height (m)	ET03 Distance (m)	24-Oct-06 Assumed Height (m)	ET04 Distance (m)	13-Oct-06 Assumed Height (m)
		1994.380	14.746				
		1994.382	14.845				
		1999.980	14.839				
		2000.130	14.897				
		1971.699	14.696				
		1971.834	14.723				
		1973.978	14.731				
		1975.692	14.742				
		1976.404	14.783				
		1976.765	14.704				
		1976.928	14.579				
		1977.149	14.415				
		1977.296	14.131				
		1978.055	14.011				
		1978.392	13.734				
		1978.677	13.527				
		1979.179	13.523				
		1979.539	13.477				
		1980.097	13.099				
		1981.189	13.134				
		1981.551	13.288				
		1981.849	13.407				
		1982.256	13.356				
		1982.652	12.780				
		1983.522	12.746				
		1983.803	12.967				
		1984.174	13.091				
		1984.629	13.095				
		1985.018	12.978				
		1985.531	13.050				
		1986.087	13.332				
		1986.251	13.520				
		1986.505	13.781				
		1986.674	14.011				
		1986.722	14.128				
		1986.945	14.272				
		1987.073	14.635				
		1987.155	14.834				
		1987.624	14.876				

East Tributary Cross sections 1 to 4 2006							
ET01 Distance (m)	**13-Oct-06 Assumed Height (m)**	**ET02 Distance (m)**	**13-Oct-06 Assumed Height (m)**	**ET03 Distance (m)**	**24-Oct-06 Assumed Height (m)**	**ET04 Distance (m)**	**13-Oct-06 Assumed Height (m)**
		1988.135	14.893				
		1988.657	14.846				
		1991.582	14.842				
		1992.822	14.746				
		1994.380	14.845				
		1994.382	14.839				
		1999.980	14.897				

East Tributary Cross sections 5 to 8 2006							
ET05 Distance (m)	24-Oct-06 Assumed Height (m)	ET06 Distance (m)	24-Oct-06 Assumed Height (m)	ET07 Distance (m)	24-Oct-06 Assumed Height (m)	ET08 Distance (m)	24-Oct-06 Assumed Height (m)
1985.1510	9.700	5968.687	14.702	7470.870	14.723	0.010	14.532
1986.6010	9.744	5968.678	14.707	7473.056	14.737	0.167	14.371
1987.5180	9.774	5971.109	14.769	7475.219	14.797	4.315	14.580
1988.1510	9.620	5973.417	14.773	7476.509	14.770	7.645	14.714
1988.6740	9.391	5973.642	14.653	7478.804	14.812	10.276	14.808
1988.8630	9.250	5974.312	14.612	7480.010	14.800	12.762	14.887
1989.1130	9.043	5974.805	14.691	7481.932	14.863	15.556	14.897
1989.3660	8.856	5975.211	14.848	7483.438	14.911	16.663	14.813
1989.5790	8.706	5975.297	14.738	7484.245	14.788	17.089	14.635
1989.7500	8.411	5975.471	14.778	7484.519	14.571	17.505	14.344
1989.7660	8.376	5975.602	14.657	7484.590	14.319	17.769	14.199
1990.1000	8.200	5975.683	14.829	7484.853	13.968	17.802	13.918
1990.2650	8.102	5976.416	14.872	7485.049	13.822	18.147	13.796
1990.5020	8.043	5976.909	14.834	7485.479	13.662	18.394	13.505
1991.0440	8.173	5978.986	14.856	7485.898	13.549	18.769	13.342
1991.7300	8.264	5980.765	14.902	7486.648	13.505	19.163	13.165
1992.4040	8.423	5981.869	14.868	7486.859	13.485	19.478	12.957
1993.4370	8.471	5982.355	14.800	7487.279	13.310	19.815	13.077
1994.2880	8.556	5982.690	14.743	7487.799	13.244	20.150	13.118
1994.5060	8.659	5983.084	14.466	7488.237	13.260	20.782	13.097
1994.7520	9.125	5983.465	14.316	7488.797	13.289	21.681	13.416
1994.9480	9.273	5983.621	14.524	7489.341	13.333	22.369	13.461
1995.5890	9.514	5983.980	14.196	7489.965	13.353	23.235	13.547
1996.4600	9.648	5984.146	13.548	7490.443	13.575	23.609	13.435
1997.1660	9.722	5984.597	13.395	7490.528	14.004	24.398	13.531
1998.4660	9.739	5985.063	13.267	7491.006	14.003	24.797	13.578
		5985.220	13.110	7491.238	14.204	25.043	13.674
		5985.478	13.090	7491.396	14.119	25.690	13.812
		5985.703	13.084	7491.931	14.243	25.844	13.959
		5985.979	13.219	7492.348	14.395	26.235	14.114
		5986.341	13.222	7492.552	14.407	26.945	14.216
		5986.514	13.284	7493.109	14.528	27.381	14.337
		5987.019	13.330	7493.666	14.687	27.813	14.439
		5987.584	13.537	7493.935	14.840	28.778	14.445
		5988.071	13.666	7494.589	14.897	29.368	14.550
		5988.614	13.714	7495.869	14.876	29.879	14.696
		5989.003	13.880	7497.540	14.876	30.392	14.841
		5989.321	14.210	7498.589	14.842	31.466	14.859

East Tributary Cross sections 5 to 8 2006							
ET05	**24-Oct-06**	**ET06**	**24-Oct-06**	**ET07**	**24-Oct-06**	**ET08**	**24-Oct-06**
Distance	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**
(m)	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**
		5989.766	14.446			33.089	14.833
		5990.240	14.665			34.867	14.818
		5990.813	14.787				
		5991.202	14.854				
		5992.167	14.881				
		5993.601	14.872				
		5995.587	14.873				
		5998.292	14.828				

Upper Swift Creek cross sections 1 to GW 2006							
UM01 Distance (m)	**10-Oct-06 Assumed Height (m)**	**UM02 Distance (m)**	**25-Oct-06 Assumed Height (m)**	**UM03 Distance (m)**	**25-Oct-06 Assumed Height (m)**	**UMGW Distance (m)**	**25-Oct-06 Assumed Height (m)**
2042.904	9.992	2038.570	9.888	2029.559	9.727	13.084	9.454
2042.795	9.791	2038.435	9.702	2029.420	9.561	12.406	9.483
2038.411	9.602	2037.172	9.676	2028.001	9.598	12.153	9.591
2033.284	9.543	2036.798	9.633	2025.618	9.549	11.770	9.442
2029.435	9.538	2036.125	9.635	2024.007	9.542	11.202	9.401
2025.288	9.410	2034.991	9.560	2023.461	9.508	10.268	9.398
2023.650	9.384	2034.358	9.620	2022.852	9.583	9.926	9.463
2022.686	9.505	2032.996	9.518	2021.164	9.452	9.180	9.309
2022.367	9.505	2031.740	9.568	2020.674	9.519	8.581	9.067
2021.812	9.308	2029.598	9.604	2019.705	9.419	8.199	8.811
2021.584	9.189	2028.206	9.520	2019.191	9.463	8.005	7.956
2020.998	8.973	2027.766	9.656	2018.772	9.439	7.728	7.883
2020.324	8.749	2026.878	9.631	2017.794	9.448	7.399	7.911
2020.142	8.474	2025.980	9.559	2016.550	9.372	7.070	8.023
2019.185	8.185	2025.141	9.547	2015.636	9.366	6.760	8.001
2018.200	7.949	2024.749	9.495	2015.472	9.414	6.178	7.865
2018.020	7.842	2022.597	9.488	2014.883	9.235	5.356	7.815
2017.142	7.832	2022.080	9.508	2014.804	9.154	5.049	7.833
2016.694	7.847	2021.547	9.445	2014.428	9.086	4.543	7.830
2016.358	7.887	2020.841	9.130	2014.204	9.209	3.608	7.868
2015.929	7.829	2020.659	9.036	2013.922	9.606	3.585	7.863
2014.885	7.744	2020.238	8.926	2013.696	9.553	3.310	7.777
2014.161	7.846	2019.781	8.692	2013.495	9.625	2.925	7.786
2013.848	7.993	2019.688	8.073	2013.379	9.828	2.626	7.710
2013.662	8.181	2019.399	7.838	2013.192	9.781	2.329	7.745
2013.509	8.390	2019.185	7.776	2013.064	9.611	2.155	8.015
2013.433	8.640	2018.874	7.857	2013.053	8.161	2.018	7.975
2013.207	8.830	2018.626	7.861	2012.794	7.960	1.795	8.117
2012.975	9.049	2018.240	7.805	2012.435	7.870	1.683	8.300
2012.804	9.183	2017.578	7.816	2012.273	7.728	1.540	8.307
2012.348	9.307	2017.208	7.857	2011.925	7.783	1.402	8.564
2011.578	9.441	2016.701	7.874	2011.282	7.872	1.087	8.683
2010.525	9.549	2016.374	7.852	2010.787	7.905	0.951	8.756
2009.458	9.715	2015.987	7.787	2009.692	7.845	0.692	8.814
2009.009	9.783	2015.399	7.750	2009.178	7.667	0.536	9.066
2008.581	9.802	2015.057	7.841	2008.340	7.672	0.431	9.161
2008.011	9.763	2014.758	8.133	2008.011	8.081	0.099	9.285
2006.348	9.811	2014.548	8.111	2007.694	8.059	-0.145	9.432
2004.339	9.797	2013.964	8.273	2007.342	8.152	-0.654	9.535

Upper Swift Creek cross sections 1 to GW 2006							
UM01	**10-Oct-06**	**UM02**	**25-Oct-06**	**UM03**	**25-Oct-06**	**UMGW**	**25-Oct-06**
Distance (m)	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**
2001.479	9.795	2013.723	8.419	2006.786	8.927	-2.185	9.665
		2013.313	8.561	2006.616	8.984	-3.529	9.770
		2012.516	8.934	2006.535	9.924	-5.146	9.801
		2012.014	9.185	2005.397	9.811		
		2011.689	9.383	2005.169	9.497		
		2011.171	9.552	2004.899	9.580		
		2010.777	9.644	2004.451	9.566		
		2009.966	9.777	2003.843	9.609		
		2008.803	9.774	2003.264	9.713		
		2007.653	9.837	2003.004	9.777		
		2006.345	9.827	2001.269	9.815		
		2004.981	9.813				
		2003.140	9.817				
		2001.297	9.814				

Upper Swift Creek cross sections 4 to 7 2006							
UM04 Distance (m)	**25-Oct-06 Assumed Height (m)**	**UM05 Distance (m)**	**25-Oct-06 Assumed Height (m)**	**UM06 Distance (m)**	**25-Oct-06 Assumed Height (m)**	**UM07 Distance (m)**	**25-Oct-06 Assumed Height (m)**
527.891	9.518	2031.503	9.655	2040.536	9.791	2031.911	9.625
525.973	9.527	2029.618	9.631	2037.942	9.801	2028.760	9.642
524.566	9.491	2028.099	9.639	2035.568	9.751	2026.835	9.618
523.316	9.491	2027.573	9.558	2033.008	9.678	2025.251	9.619
521.961	9.454	2026.282	9.581	2030.829	9.609	2023.501	9.692
521.646	9.497	2024.858	9.512	2030.026	9.646	2021.555	9.743
520.846	9.490	2023.399	9.436	2029.186	9.576	2020.450	9.784
519.266	9.380	2022.641	9.504	2028.430	9.602	2019.704	9.821
518.701	9.422	2022.064	9.181	2027.276	9.552	2019.053	9.789
518.347	9.429	2021.861	8.783	2026.791	9.590	2018.533	9.522
518.076	9.306	2021.755	8.695	2026.363	9.676	2018.407	9.312
517.790	9.381	2021.678	8.414	2025.854	9.719	2018.085	9.054
517.123	9.313	2021.544	8.373	2025.040	9.704	2017.774	8.856
516.257	9.255	2021.443	8.281	2024.462	9.630	2017.638	8.626
515.583	8.950	2021.275	8.255	2024.114	9.521	2017.416	8.475
514.843	8.663	2020.448	8.180	2023.838	9.283	2017.282	8.303
514.672	8.406	2019.476	7.994	2023.142	8.803	2016.878	8.133
514.573	8.331	2018.596	8.022	2022.447	8.437	2016.515	7.946
514.526	7.999	2018.225	8.085	2022.187	8.352	2016.147	7.791
514.244	7.905	2017.781	8.050	2021.681	8.287	2015.685	7.687
513.894	7.807	2016.625	8.042	2021.042	8.255	2015.289	7.714
513.393	7.911	2015.919	7.957	2020.646	8.164	2014.955	7.753
513.013	7.787	2015.297	7.995	2020.253	8.057	2014.425	7.888
511.967	7.871	2014.907	8.037	2019.438	7.957	2014.007	7.906
511.358	7.993	2014.619	8.183	2018.958	8.147	2013.568	7.942
510.342	7.891	2014.265	8.289	2018.689	8.230	2013.200	7.915
509.182	7.732	2013.940	8.593	2018.352	8.229	2012.655	7.815
508.322	8.019	2013.754	8.832	2017.419	8.164	2012.523	7.787
507.259	8.805	2012.902	9.316	2016.506	8.123	2011.890	7.755
507.000	9.086	2012.312	9.426	2016.261	8.078	2011.330	7.728
506.557	9.270	2012.193	9.520	2015.947	7.976	2010.796	7.790
506.310	9.436	2011.981	9.560	2015.694	7.861	2010.645	7.828
505.989	9.558	2011.759	9.687	2015.288	7.830	2010.317	7.870
505.555	9.640	2011.200	9.820	2014.792	7.934	2009.923	7.859
505.156	9.597	2010.154	9.846	2014.575	7.952	2009.518	8.000
503.914	9.646	2009.152	9.818	2014.150	8.178	2009.169	8.141
502.608	9.682	2006.706	9.832	2013.879	8.319	2008.824	8.342
501.505	9.763	2003.383	9.809	2013.637	8.387	2008.645	8.480
		2001.718	9.809	2013.303	8.576	2008.584	8.756

Upper Swift Creek cross sections 4 to 7 2006							
UM04 Distance (m)	**25-Oct-06 Assumed Height (m)**	**UM05 Distance (m)**	**25-Oct-06 Assumed Height (m)**	**UM06 Distance (m)**	**25-Oct-06 Assumed Height (m)**	**UM07 Distance (m)**	**25-Oct-06 Assumed Height (m)**
		2000.125	9.808	2013.027	8.795	2008.496	8.815
		2000.000	10.000	2012.917	9.036	2008.451	8.920
				2012.766	9.124	2008.231	9.084
				2012.383	9.262	2007.975	9.256
				2012.152	9.401	2007.907	9.341
				2011.772	9.569	2007.528	9.503
				2011.278	9.746	2007.134	9.622
				2010.724	9.877	2006.605	9.710
				2009.939	9.915	2005.259	9.770
				2008.902	9.930	2002.958	9.793
				2007.972	9.894	2000.879	9.803
				2006.423	9.879		
				2004.526	9.863		
				2003.018	9.845		
				2001.067	9.805		

Swift Creek Cross sections 1 to 4 2006							
SM01 Distance (m)	**27-Oct-06 Assumed Height (m)**	**SM02 Distance (m)**	**27-Oct-06 Assumed Height (m)**	**SM03 Distance (m)**	**27-Oct-06 Assumed Height (m)**	**SM04 Distance (m)**	**27-Oct-06 Assumed Height (m)**
463.786	8.797	2037.648	7.828	2040.521	7.905	2033.061	7.778
464.901	8.786	2035.374	7.866	2037.635	7.922	2030.326	7.818
465.642	8.830	2033.231	7.916	2034.724	7.881	2028.306	7.902
466.069	8.778	2031.313	7.942	2032.976	7.850	2026.633	7.928
466.655	8.748	2030.085	7.935	2032.184	7.739	2025.070	7.976
467.810	8.754	2029.516	7.908	2031.435	7.622	2024.522	7.841
468.202	8.733	2028.707	7.781	2030.627	7.474	2024.362	7.553
469.030	8.609	2027.551	7.563	2030.157	7.472	2023.939	7.278
469.381	8.576	2026.601	7.475	2029.917	7.287	2023.506	7.041
470.489	8.552	2025.922	7.275	2029.775	7.233	2023.388	6.906
470.887	8.524	2025.653	7.147	2029.557	7.231	2023.242	6.845
471.784	8.436	2025.090	6.998	2029.241	7.069	2022.971	6.568
472.143	8.398	2024.736	6.805	2028.829	7.025	2022.568	6.290
473.204	8.159	2024.499	6.746	2028.213	6.980	2022.420	5.805
473.308	8.101	2024.357	6.760	2027.072	6.899	2022.188	5.747
473.587	8.093	2024.161	6.836	2025.802	6.764	2021.839	5.863
473.765	7.961	2023.993	6.860	2024.667	6.713	2021.300	5.925
473.961	7.872	2022.842	6.740	2023.990	6.626	2020.656	6.061
474.098	7.739	2021.793	6.630	2022.817	6.437	2019.882	6.128
474.338	7.586	2020.795	6.487	2021.571	6.274	2018.932	6.222
474.612	7.496	2020.411	6.299	2021.093	6.235	2018.034	6.281
474.773	7.393	2019.968	6.227	2020.763	6.167	2017.084	6.284
475.217	7.240	2019.002	6.278	2020.351	6.043	2016.318	6.197
475.336	7.153	2018.732	6.323	2019.882	5.855	2015.989	6.146
475.560	6.991	2018.155	6.295	2019.447	5.702	2015.262	5.953
475.817	6.894	2017.807	6.374	2019.124	5.738	2014.879	5.990
476.081	6.902	2017.502	6.330	2018.947	5.973	2013.902	6.405
476.236	6.850	2017.168	6.152	2018.321	6.203	2013.529	6.566
476.549	6.738	2016.459	6.113	2018.062	6.423	2013.073	7.086
476.738	6.643	2016.182	6.092	2017.337	6.682	2012.889	7.205
477.056	6.643	2016.007	6.045	2016.580	6.819	2012.700	7.352
477.772	6.754	2015.559	6.077	2015.931	6.747	2011.618	7.490
478.352	6.831	2014.837	6.220	2015.414	6.774	2010.180	7.592
478.842	6.926	2014.376	6.355	2014.912	6.762	2008.851	7.675
479.462	6.950	2013.877	6.392	2014.373	6.872	2006.912	7.781
479.845	7.017	2013.540	6.515	2014.197	7.021	2005.667	7.808
480.084	7.123	2013.167	6.605	2014.053	7.163	2003.886	7.813
480.194	7.281	2012.588	6.634	2013.791	7.276	2001.714	7.811
480.335	7.407	2011.678	6.616	2013.026	7.472		

Swift Creek Cross sections 1 to 4 2006							
SM01 Distance (m)	**27-Oct-06 Assumed Height (m)**	**SM02 Distance (m)**	**27-Oct-06 Assumed Height (m)**	**SM03 Distance (m)**	**27-Oct-06 Assumed Height (m)**	**SM04 Distance (m)**	**27-Oct-06 Assumed Height (m)**
480.553	7.516	2011.161	6.677	2012.286	7.618		
481.301	7.741	2010.634	6.791	2011.541	7.618		
481.499	7.893	2009.717	6.943	2010.307	7.586		
481.753	8.019	2009.125	7.129	2008.958	7.495		
482.035	8.126	2008.307	7.339	2008.113	7.491		
482.306	8.374	2007.449	7.504	2006.207	7.540		
482.464	8.427	2006.236	7.616	2003.850	7.643		
482.969	8.621	2004.721	7.731	2001.421	7.766		
483.312	8.826	2003.125	7.756				
483.607	8.902	2001.482	7.806				
483.700	8.953						
484.263	9.006						
485.629	9.009						
488.699	8.955						
492.702	8.902						
496.688	8.853						
499.882	8.828						
500.005	9.000						

Swift Creek Cross sections 5 to 8 2006							
SM05 Distance (m)	**27-Oct-06 Assumed Height (m)**	**SM06 Distance (m)**	**27-Oct-07 Assumed Height (m)**	**SM07 Distance (m)**	**24-Nov-06 Assumed Height (m)**	**SM08 Distance (m)**	**24-Nov-06 Assumed Height (m)**
2082.528	7.809	2047.685	7.599	2060.478	7.522	2052.814	7.680
2079.980	7.795	2043.788	7.610	2056.671	7.610	2050.327	7.666
2076.801	7.839	2040.402	7.654	2052.502	7.657	2046.444	7.710
2073.535	7.937	2037.344	7.702	2049.605	7.699	2039.254	7.777
2071.548	7.962	2034.287	7.745	2046.753	7.750	2037.086	7.649
2070.389	7.946	2032.828	7.748	2044.210	7.850	2035.853	7.608
2069.802	7.832	2031.687	7.665	2042.079	7.901	2035.046	7.430
2069.490	7.756	2030.783	7.536	2040.583	7.869	2034.624	7.320
2069.295	7.614	2030.030	7.315	2040.199	7.694	2034.317	7.079
2068.889	7.469	2029.355	7.109	2039.854	7.099	2033.950	6.785
2068.665	7.379	2028.731	6.903	2039.473	7.002	2033.698	6.587
2068.373	7.295	2028.441	6.807	2039.269	6.902	2033.204	6.427
2068.110	7.171	2028.242	6.604	2039.106	6.676	2032.856	6.292
2067.895	6.988	2027.560	6.246	2038.979	6.588	2032.386	6.230
2067.836	6.798	2027.369	6.070	2038.559	6.386	2031.343	6.172
2067.615	6.72	2027.139	5.923	2038.265	6.057	2030.783	6.176
2067.327	6.434	2026.828	5.894	2038.165	5.855	2030.204	6.106
2067.178	6.09	2026.197	5.745	2037.190	5.969	2029.609	6.335
2067.077	5.905	2025.501	5.691	2035.794	6.112	2028.903	6.322
2066.814	5.814	2024.805	5.717	2034.884	6.201	2028.204	6.265
2066.297	5.913	2024.292	5.655	2034.147	6.217	2027.784	6.197
2065.884	6.031	2023.816	5.663	2032.760	6.202	2026.319	5.951
2065.220	6.214	2023.545	5.615	2031.581	6.233	2025.705	6.068
2064.724	6.092	2022.985	5.661	2030.994	6.299	2025.092	6.003
2064.261	5.974	2022.345	5.776	2030.146	6.310	2024.616	5.905
2063.907	5.885	2021.407	5.902	2029.413	6.415	2024.122	6.027
2063.439	5.582	2020.975	6.104	2028.606	6.479	2023.805	6.299
2062.928	5.479	2020.695	6.328	2027.917	7.132	2023.565	6.450
2061.851	5.563	2020.134	6.633	2027.706	7.251	2022.923	6.693
2061.509	5.538	2020.018	6.782	2027.542	7.379	2022.797	6.780
2061.224	5.459	2018.999	6.935	2027.372	7.516	2022.716	6.992
2060.774	5.573	2018.449	7.091	2026.893	7.599	2022.589	7.030
2060.419	5.724	2017.623	7.271	2026.349	7.715	2022.388	7.013
2059.829	5.976	2017.447	7.364	2025.448	7.836	2022.153	7.059
2059.544	6.002	2016.558	7.505	2024.319	7.838	2021.751	7.205
2059.461	5.966	2015.972	7.580	2022.843	7.788	2021.125	7.340
2059.149	5.97	2015.737	7.680	2021.283	7.757	2020.907	7.406
2058.976	6.036	2014.833	7.752	2019.151	7.692	2020.088	7.390
2058.655	6.102	2013.731	7.726	2016.810	7.704	2019.733	7.414

Swift Creek Cross sections 5 to 8 2006							
SM05 Distance (m)	**27-Oct-06 Assumed Height (m)**	**SM06 Distance (m)**	**27-Oct-07 Assumed Height (m)**	**SM07 Distance (m)**	**24-Nov-06 Assumed Height (m)**	**SM08 Distance (m)**	**24-Nov-06 Assumed Height (m)**
2058.076	6.333	2011.450	7.763	2014.130	7.728	2019.380	7.511
2057.664	6.441	2009.172	7.744	2011.019	7.784	2018.586	7.727
2057.451	6.524	2007.145	7.731	2008.331	7.835	2017.653	7.894
2057.322	6.667	2004.499	7.759	2004.996	7.847	2016.900	7.915
2057.215	6.692	2001.762	7.818	2001.625	7.819	2015.584	7.922
2056.932	6.645					2013.986	7.866
2056.470	6.76					2012.306	7.761
2056.223	6.861					2010.110	7.719
2055.700	6.97					2007.487	7.727
2055.388	7.089					2001.492	7.799
2054.948	7.08						
2054.302	7.201						
2053.811	7.25						
2053.312	7.239						
2053.123	7.267						
2053.005	7.337						
2052.677	7.406						
2052.448	7.463						
2051.984	7.418						
2051.351	7.54						
2050.736	7.651						
2049.955	7.714						
2047.299	7.727						
2043.796	7.735						

Tributary North Cross section 2007							
TN01	**2-Aug-07**	**GULLYPLAN**	**PART 1**	**2-Aug-07**	**PART 2**		**PART 3**
Distance	**Assumed**	**Easting**	**Northings**	**Easting**	**Northings**	**Easting**	**Northings**
(m)	**Height (m)**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**	**(m)**
4969.097	10.788	999.810	4981.410	978.454	4976.559	966.815	4981.724
4970.761	10.753	999.362	4981.605	977.436	4976.409	966.495	4981.537
4972.962	10.729	998.934	4981.680	976.788	4976.786	966.200	4981.706
4974.939	10.695	998.577	4981.714	976.374	4976.585	966.110	4982.042
4977.567	10.603	997.984	4980.948	975.735	4976.275	965.904	4982.374
4978.454	10.584	997.147	4980.983	975.222	4976.482	965.934	4982.695
4979.369	10.587	996.444	4981.203	973.917	4975.714	965.846	4982.841
4980.579	10.508	995.508	4981.035	973.598	4976.158	965.692	4982.894
4980.825	10.486	995.305	4980.783	972.928	4976.386	965.473	4982.832
4981.105	10.436	994.757	4980.818	972.628	4976.394	965.434	4982.513
4981.454	10.378	994.330	4980.625	972.206	4976.030	965.456	4982.338
4981.838	10.177	993.869	4980.322	972.013	4976.204	965.076	4982.222
4982.139	10.081	993.480	4980.763	971.629	4976.276	964.912	4982.389
4982.549	9.875	993.287	4981.030	971.058	4976.362	964.815	4983.303
4982.830	9.740	993.118	4980.429	970.239	4976.954	964.955	4983.675
4982.985	9.672	992.166	4980.325	969.903	4977.712	965.126	4983.896
4983.046	9.482	991.800	4979.967	969.996	4978.261	965.276	4984.020
4983.221	9.447	991.300	4979.974	969.642	4978.488	965.509	4984.164
4983.401	9.441	990.777	4980.486	969.076	4978.452	965.839	4984.315
4983.532	9.475	989.956	4980.552	968.712	4978.754	966.208	4984.452
4983.696	9.721	989.742	4979.765	968.439	4978.648	966.408	4984.640
4983.960	9.689	988.960	4979.922	967.803	4978.928	966.819	4984.829
4984.609	9.800	988.225	4979.582	967.455	4979.075	967.188	4984.988
4985.170	10.057	987.200	4979.132	967.393	4979.308	967.619	4984.965
4985.398	10.161	986.631	4978.930	967.237	4979.567	968.126	4984.936
4986.838	10.501	986.552	4978.372	967.236	4979.566	968.491	4984.739
4987.472	10.533	985.876	4978.233	967.319	4979.827	968.730	4984.713
4988.391	10.561	985.459	4977.762	967.483	4980.169	969.218	4984.520
4989.387	10.593	985.274	4977.616	967.603	4980.557	969.741	4984.207
4990.397	10.622	985.054	4977.104	967.706	4980.836	970.339	4983.973
4991.591	10.668	984.423	4977.194	967.636	4981.296	970.764	4983.567
4992.327	10.684	984.188	4977.563	967.653	4981.659	971.005	4983.266
4993.945	10.746	980.375	4976.807	967.506	4981.941	971.468	4982.621
4995.566	10.768	979.705	4976.992	967.222	4981.960	971.823	4982.369
4997.100	10.803	979.233	4976.626	966.982	4981.877	971.944	4981.775

Tributary North Cross section 2007					
GULLYPLAN Easting (m)	**PART 4 Northings (m)**	**2-Aug-07 Easting (m)**	**PART 5 Northings (m)**	**2-Aug-07 Easting (m)**	**PART 6 Northings (m)**
972.283	4981.660	982.348	4984.727	998.920	4986.855
972.708	4981.588	983.069	4985.045	999.763	4986.114
973.148	4981.662	983.489	4985.892	1000.568	4986.133
973.849	4981.616	983.720	4986.185		
974.431	4981.458	984.504	4986.317		
974.896	4981.798	985.179	4986.467		
975.241	4981.891	985.748	4986.569		
975.867	4982.001	986.182	4986.706		
976.426	4981.947	986.618	4986.512		
977.174	4981.715	986.912	4986.475		
977.672	4981.462	987.016	4986.676		
978.013	4981.404	987.507	4986.176		
978.452	4981.430	987.972	4985.502		
978.842	4981.699	988.426	4984.936		
979.709	4982.180	988.859	4984.232		
979.947	4981.938	989.241	4983.855		
980.242	4981.742	989.798	4983.708		
980.735	4981.769	990.409	4983.499		
981.183	4981.569	991.070	4983.778		
981.862	4981.425	991.614	4983.773		
982.221	4981.415	992.132	4983.617		
982.935	4981.161	992.507	4983.384		
983.704	4981.326	992.860	4983.411		
984.043	4981.593	993.661	4983.739		
984.017	4982.027	994.600	4984.154		
983.766	4982.218	995.329	4984.399		
983.542	4982.305	996.035	4985.009		
982.964	4982.489	995.621	4985.800		
982.613	4982.805	995.467	4986.087		
982.148	4982.854	995.952	4986.489		
981.772	4982.911	996.407	4986.736		
981.564	4983.084	996.938	4986.670		
981.464	4983.246	997.237	4986.310		
981.340	4983.612	997.921	4986.564		
981.544	4984.207	998.311	4986.188		

Tributary Central Cross sections 2007							
TC06A Distance (m)	**22-Aug-07 Assumed Height (m)**	**TC06B Distance (m)**	**22-Aug-07 Assumed Height (m)**	**TC10 Distance (m)**	**22-Aug-07 Assumed Height (m)**	**TC11 Distance (m)**	**22-Aug-07 Assumed Height (m)**
14.451	9031.359	14.008	0.116	7965.416	12.691	6970.033	12.881
14.451	9031.355	13.976	0.590	7965.784	12.681	6971.093	12.834
14.277	9031.234	13.971	1.542	7966.563	12.679	6972.057	12.836
14.268	9030.075	14.003	2.582	7967.502	12.674	6973.470	12.813
14.260	9028.877	14.002	3.821	7968.618	12.683	6974.652	12.802
14.260	9027.465	14.026	5.378	7970.075	12.692	6975.818	12.796
14.268	9026.163	14.051	6.625	7971.174	12.701	6976.995	12.783
14.271	9024.958	14.055	7.719	7972.367	12.72	6977.662	12.778
14.268	9023.615	14.074	8.599	7973.291	12.741	6977.957	12.780
14.272	9022.429	14.06	9.135	7974.338	12.773	6978.263	12.779
14.254	9021.502	13.501	9.276	7975.568	12.803	6978.424	12.773
14.239	9020.651	12.74	9.459	7975.939	12.817	6978.508	12.316
14.225	9019.779	12.772	9.828	7976.172	12.796	6978.652	12.159
14.221	9019.362	12.697	10.059	7976.332	12.782	6978.860	12.019
13.801	9019.250	12.676	10.274	7976.501	12.77	6979.125	11.868
13.640	9019.112	12.688	10.438	7976.701	12.735	6979.537	11.607
13.335	9018.858	12.720	10.675	7976.887	12.679	6979.826	11.426
12.935	9018.242	12.798	11.006	7976.980	12.345	6980.168	11.417
12.642	9018.090	12.860	11.388	7977.270	12.255	6980.415	11.452
12.533	9017.839	12.897	11.786	7977.585	12.138	6980.789	11.473
12.476	9017.588	12.970	12.180	7977.761	12.064	6981.136	11.485
12.382	9017.315	12.988	12.405	7977.971	11.972	6981.438	11.477
12.355	9016.901	12.933	12.720	7978.244	11.867	6981.712	11.499
12.491	9016.073	12.913	13.047	7978.577	11.722	6981.984	11.490
12.605	9015.718	12.921	13.459	7978.725	11.684	6982.335	11.525
12.638	9015.540	12.957	13.760	7978.909	11.629	6982.497	11.594
12.628	9015.361	12.937	13.989	7979.077	11.576	6982.707	11.690
12.663	9014.998	12.942	14.211	7979.286	11.558	6982.953	11.858
12.768	9014.588	12.971	14.368	7979.481	11.586	6983.286	12.109
12.869	9014.199	13.126	14.677	7979.728	11.595	6983.440	12.177
12.968	9013.662	13.275	14.950	7979.847	11.591	6983.622	12.218
13.073	9013.171	13.338	15.267	7979.919	11.569	6983.839	12.252
13.202	9012.557	13.381	15.685	7980.212	11.575	6984.023	12.237
13.299	9012.358	13.515	16.177	7980.268	11.600	6984.289	12.181
13.327	9012.052	13.417	16.418	7980.29	11.570	6984.539	12.155
13.448	9011.558	13.436	16.765	7980.582	11.557	6984.729	12.175
13.471	9011.074	13.478	17.371	7980.828	11.563	6985.114	12.110
13.513	9010.652	13.540	18.124	7981.183	11.612	6985.328	12.053

Tributary Central Cross sections 2007							
TC06A Distance (m)	22-Aug-07 Assumed Height (m)	TC06B Distance (m)	22-Aug-07 Assumed Height (m)	TC10 Distance (m)	22-Aug-07 Assumed Height (m)	TC11 Distance (m)	22-Aug-07 Assumed Height (m)
13.553	9010.366	13.532	18.506	7981.402	11.667	6985.810	12.027
13.565	9010.014	13.674	18.995	7981.536	11.858	6986.174	12.052
13.577	9009.471	13.569	19.362	7981.681	11.938	6986.485	12.092
13.533	9009.048	13.512	20.170	7981.992	12.076	6986.624	12.121
13.517	9008.267	13.479	20.670	7982.117	12.089	6986.813	12.204
13.571	9007.573	13.562	21.616	7982.241	12.068	6986.954	12.272
13.682	9007.063	13.617	22.149	7982.653	12.093	6987.180	12.359
13.684	9006.847	13.581	22.682	7982.872	12.14	6987.366	12.390
13.602	9006.658	13.59	23.217	7983.113	12.269	6987.897	12.405
13.605	9006.287	13.579	24.216	7983.322	12.317	6988.393	12.431
13.622	9005.863	13.572	24.735	7983.561	12.282	6988.995	12.445
13.568	9005.625	13.602	25.603	7983.841	12.192	6989.552	12.429
13.576	9004.867	13.696	26.542	7984.299	12.221	6990.408	12.386
13.609	9004.293	13.723	27.731	7984.635	12.226	6991.144	12.417
13.657	9003.651			7985.188	12.294	6992.012	12.548
13.761	9002.620			7985.642	12.357	6992.742	12.647
				7986.101	12.397	6993.407	12.710
				7986.653	12.431	6994.123	12.757
				7987.718	12.46	6995.131	12.791
				7988.611	12.512	6995.984	12.798
				7989.902	12.612	6997.097	12.808
				7990.77	12.723	6997.938	12.801
				7991.553	12.810		
				7992.457	12.838		
				7993.518	12.824		
				7994.764	12.800		
				7995.969	12.772		
				7997.144	12.746		

East Tributary Cross sections 1 to 4 2007							
ET01 Distance (m)	**13-Oct-07 Assumed Height (m)**	**ET02 Distance (m)**	**31-Jul-07 Assumed Height (m)**	**ET03 Distance (m)**	**31-Jul-07 Assumed Height (m)**	**ET04 Distance (m)**	**2-Aug-07 Assumed Height (m)**
975.844	14.687	1973.172	14.735	2978.592	14.806	3974.556	14.720
976.663	14.703	1974.048	14.733	2979.875	14.811	3975.742	14.740
977.759	14.689	1975.292	14.743	2980.942	14.831	3977.452	14.748
978.865	14.696	1976.089	14.742	2982.123	14.829	3979.375	14.799
979.602	14.749	1976.509	14.771	2983.014	14.851	3979.373	14.799
980.091	14.794	1977.148	14.623	2983.800	14.882	3981.216	14.843
980.826	14.824	1977.72	14.265	2984.438	14.866	3982.705	14.906
981.264	14.857	1978.042	14.203	2984.824	14.804	3983.501	14.876
981.679	14.846	1978.395	13.78	2985.160	14.756	3983.835	14.788
981.951	14.816	1978.686	13.669	2985.449	14.697	3984.028	14.670
982.352	14.698	1979.159	13.526	2985.697	14.621	3984.201	14.551
982.609	14.596	1980.088	13.475	2986.115	14.388	3984.437	14.417
982.954	14.510	1980.349	13.592	2986.493	14.107	3984.692	14.297
983.220	14.211	1980.558	13.69	2986.675	14.064	3985.125	13.459
983.356	14.006	1980.746	13.775	2986.898	13.984	3985.403	13.408
983.496	13.780	1981.11	13.628	2987.118	13.814	3985.623	13.406
983.718	13.574	1981.332	13.544	2987.330	13.599	3985.909	13.119
984.019	13.407	1981.725	13.533	2987.597	13.416	3986.144	12.979
984.286	13.265	1982.065	13.501	2988.087	13.217	3986.305	12.947
984.579	13.212	1982.606	13.356	2988.598	13.138	3986.732	13.006
984.773	13.194	1983.014	13.304	2989.090	13.056	3986.864	13.025
984.997	13.090	1983.422	13.172	2989.959	13.171	3987.390	13.832
985.222	13.048	1983.872	13.034	2990.337	13.226	3987.579	13.068
985.804	13.119	1984.363	12.943	2990.812	13.271	3987.877	14.067
986.221	13.118	1984.568	12.935	2991.411	13.428	3988.071	13.214
986.740	13.105	1984.885	13.06	2991.957	13.612	3988.373	13.173
987.137	13.080	1985.149	13.096	2992.337	13.726	3988.700	13.175
987.620	13.028	1985.475	13.249	2992.507	13.944	3988.920	13.231
987.889	13.017	1985.829	13.184	2992.904	14.370	3989.204	13.375
988.152	13.071	1986.225	13.472	2993.317	14.565	3989.480	13.495
988.417	13.187	1986.348	13.516	2993.624	14.727	3989.758	13.661
988.553	13.489	1986.58	13.667	2993.986	14.891	3990.044	13.830
988.830	13.555	1986.695	13.794	2995.438	14.905	3990.278	13.988
988.974	13.858	1986.899	14.11	2997.729	14.846	3990.694	14.200
989.377	14.026	1986.951	14.599	2999.998	15.000	3990.952	14.512
989.610	14.201	1987.082	14.688	3000.000	15.000	3991.134	14.627
989.935	14.326	1987.294	14.765			3991.312	14.701
990.290	14.493	1987.472	14.816			3991.507	14.779
990.732	14.677	1987.648	14.86			3991.692	14.779

East Tributary Cross sections 1 to 4 2007							
ET01	**13-Oct-07**	**ET02**	**31-Jul-07**	**ET03**	**31-Jul-07**	**ET04**	**2-Aug-07**
Distance (m)	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**	**Distance (m)**	**Assumed Height (m)**
991.209	14.752	1987.884	14.878			3991.996	14.776
991.756	14.760	1988.131	14.884			3992.307	14.754
992.765	14.750	1988.525	14.879			3992.714	14.837
993.575	14.741	2000	14.801			3993.321	14.884
994.406	14.760					3993.650	14.882
995.218	14.777					3994.321	14.890
995.925	14.802					3995.436	14.919
996.711	14.853					3996.280	14.869
997.649	14.818					3997.278	14.832
998.596	14.835					3998.240	14.827

East Tributary Cross sections 5 to 8 2007							
ET05 Distance (m)	2-Aug-07 Assumed Height (m)	ET06 Distance (m)	2-Aug-07 Assumed Height (m)	ET07 Distance (m)	2-Aug-07 Assumed Height (m)	ET08 Distance (m)	2-Aug-07 Assumed Height (m)
1985.016	9.937	5968.563	14.865	7470.857	14.723	0.000	14.528
1985.148	9.726	5968.675	14.727	7470.857	14.723	2.224	14.451
1985.800	9.715	5969.240	14.726	7471.356	14.723	3.909	14.539
1986.379	9.728	5969.815	14.729	7472.172	14.735	5.373	14.680
1987.085	9.741	5970.370	14.759	7473.062	14.732	6.583	14.680
1987.758	9.774	5972.274	14.771	7473.729	14.697	8.010	14.726
1988.003	9.768	5973.369	14.757	7474.553	14.753	10.184	14.806
1988.160	9.701	5973.687	14.699	7475.513	14.792	12.554	14.891
1988.319	9.626	5974.085	14.669	7476.728	14.781	14.348	14.903
1988.477	9.525	5974.492	14.660	7478.495	14.773	15.209	14.890
1988.663	9.421	5975.028	14.675	7481.527	14.856	15.936	14.897
1988.852	9.230	5975.556	14.788	7483.242	14.898	16.606	14.820
1989.109	9.099	5976.297	14.826	7483.486	14.916	16.795	14.756
1989.280	8.916	5977.311	14.827	7483.735	14.933	17.039	14.639
1989.567	8.738	5977.312	14.828	7484.126	14.824	17.321	14.540
1989.716	8.434	5978.649	14.846	7484.305	14.523	17.596	14.327
1989.815	8.333	5979.463	14.860	7484.656	14.228	17.778	14.192
1989.993	8.249	5980.405	14.876	7484.805	14.055	17.875	14.007
1990.232	8.088	5981.182	14.863	7484.970	13.908	18.137	13.888
1990.459	7.991	5981.695	14.760	7485.113	13.823	18.577	13.809
1990.673	7.926	5981.872	14.728	7485.354	13.729	18.665	13.477
1990.873	7.908	5981.978	14.664	7485.546	13.667	18.916	13.372
1991.078	7.943	5982.178	14.523	7485.831	13.628	19.497	13.442
1991.327	7.997	5982.447	14.407	7486.116	13.565	19.731	13.446
1991.575	8.572	5982.816	14.276	7486.438	13.515	20.162	13.367
1991.996	8.013	5983.262	14.089	7486.880	13.344	20.647	13.293
1992.278	8.057	5983.545	13.800	7487.449	13.351	21.167	13.284
1992.694	8.204	5983.784	13.582	7487.930	13.399	22.172	13.393
1993.067	8.215	5984.695	13.345	7488.372	13.444	22.568	13.284
1993.419	8.291	5984.898	13.265	7488.794	13.466	23.153	13.369
1993.763	8.310	5985.187	13.147	7489.112	13.483	23.854	13.466
1994.167	8.483	5985.487	13.089	7489.336	13.377	24.241	13.513
1994.482	8.634	5985.852	13.132	7489.551	13.342	24.665	13.560
1994.647	8.996	5986.179	13.185	7489.846	13.29	25.564	13.801
1994.947	9.302	5986.444	13.138	7490.110	13.312	26.071	14.012
1995.252	9.415	5986.812	13.162	7490.435	13.503	26.447	14.074
1995.638	9.509	5987.162	13.207	7490.654	14.028	26.882	14.180
1996.129	9.579	5987.570	13.321	7490.973	13.978	27.271	14.285
1996.593	9.649	5987.900	13.411	7491.449	14.119	27.675	14.434

East Tributary Cross sections 5 to 8 2007							
ET05 Distance (m)	**2-Aug-07 Assumed Height (m)**	**ET06 Distance (m)**	**2-Aug-07 Assumed Height (m)**	**ET07 Distance (m)**	**2-Aug-07 Assumed Height (m)**	**ET08 Distance (m)**	**2-Aug-07 Assumed Height (m)**
1996.903	9.692	5988.190	13.547	7492.023	14.27	27.998	14.447
1998.046	9.716	5988.519	13.707	7492.358	14.318	28.474	14.449
		5988.868	13.837	7493.027	14.526	28.732	14.486
		5989.042	13.931	7493.474	14.683	29.274	14.616
		5989.414	14.308	7493.867	14.83	29.691	14.648
		5989.613	14.453	7494.745	14.915	30.374	14.814
		5989.805	14.551	7495.592	14.885	31.148	14.857
		5990.034	14.689	7496.717	14.896	32.206	14.846
		5990.901	14.802	7498.034	14.853	33.185	14.811
		5991.435	14.835			34.516	14.816
		5992.104	14.863				
		5993.081	14.881				
		5994.280	14.857				
		5995.093	14.851				
		5996.101	14.860				
		5997.467	14.843				
		5998.520	14.816				

Upper Swift Creek cross sections 1 to GW 2007							
UM01 Distance (m)	**17-Oct-07 Assumed Height (m)**	**UM02 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UM03 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UMGW Distance (m)**	**17-Oct-07 Assumed Height (m)**
2042.900	9.986	2038.569	9.888	2029.420	9.546	13.091	9.454
2042.800	9.784	2038.437	9.695	2027.778	9.599	12.356	9.464
2040.345	9.648	2037.183	9.697	2025.182	9.548	12.132	9.512
2037.166	9.570	2036.738	9.631	2023.797	9.503	11.679	9.418
2034.708	9.554	2035.972	9.622	2023.224	9.501	11.007	9.387
2031.323	9.497	2034.954	9.577	2022.806	9.555	10.473	9.404
2027.321	9.483	2034.328	9.592	2021.723	9.506	9.946	9.452
2023.622	9.378	2033.336	9.53	2020.644	9.443	9.422	9.366
2022.164	9.445	2032.105	9.543	2019.434	9.467	9.079	9.257
2021.642	9.228	2031.63	9.608	2018.229	9.427	8.597	8.957
2020.724	8.923	2031.063	9.623	2016.933	9.395	8.223	8.665
2020.365	8.805	2029.783	9.578	2016.205	9.356	7.968	7.876
2020.184	8.519	2028.439	9.506	2015.53	9.318	7.439	7.779
2019.484	8.252	2027.614	9.585	2014.954	9.257	6.938	7.712
2018.239	8.001	2025.857	9.533	2014.300	9.153	6.687	7.665
2017.880	7.809	2024.611	9.485	2013.702	9.478	5.935	7.598
2017.215	7.804	2023.064	9.503	2013.096	8.147	5.285	7.657
2016.543	7.866	2022.06	9.518	2012.571	7.923	4.389	7.71
2015.878	7.857	2021.416	9.412	2012.327	7.724	3.946	7.716
2015.277	7.733	2020.319	9.022	2011.691	7.647	3.579	7.658
2014.912	7.790	2019.85	8.728	2010.836	7.673	3.206	7.609
2014.149	7.959	2019.602	8.066	2010.170	7.694	2.714	7.631
2013.751	8.099	2019.18	7.864	2009.896	7.680	2.251	7.717
2013.479	8.319	2018.442	7.878	2009.492	7.563	2.089	7.977
2013.448	8.507	2017.764	7.877	2009.222	7.539	1.867	8.049
2013.236	8.780	2017.076	7.856	2008.797	7.609	1.688	8.255
2012.975	9.020	2016.436	7.799	2008.343	7.746	1.423	8.531
2012.580	9.167	2015.949	7.754	2007.479	8.110	0.917	8.648
2012.197	9.251	2015.499	7.751	2007.019	8.319	0.589	8.823
2011.326	9.439	2015.02	7.844	2006.488	9.056	0.407	9.161
2010.532	9.502	2014.541	8.071	2005.945	9.392	0.143	9.218
2009.388	9.725	2013.974	8.257	2005.182	9.538	-0.062	9.406
2008.792	9.779	2013.641	8.414	2004.023	9.583	-0.377	9.495
2007.733	9.750	2012.95	8.726	2003.188	9.697	-0.934	9.563
2006.908	9.792	2012.139	9.081	2002.848	9.768	-1.502	9.613
2005.811	9.797	2011.677	9.364	2001.807	9.791	-2.132	9.656
2004.206	9.781	2011.109	9.557			-2.636	9.72
2002.224	9.802	2010.36	9.706			-4.022	9.789
		2009.343	9.856			-5.143	9.803

Upper Swift Creek cross sections 1 to GW 2007							
UM01 Distance (m)	**17-Oct-07 Assumed Height (m)**	**UM02 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UM03 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UMGW Distance (m)**	**17-Oct-07 Assumed Height (m)**
		2008.06	9.793				
		2006.467	9.812				
		2004.602	9.807				
		2002.545	9.833				

Upper Swift Creek cross sections 4 to 7 2007							
UM04 Distance (m)	**17-Oct-07 Assumed Height (m)**	**UM05 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UM06 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UM07 Distance (m)**	**17-Oct-07 Assumed Height (m)**
527.902	9.529	2030.978	9.639	2040.690	9.973	2032.090	9.818
527.163	9.500	2029.600	9.627	2040.544	9.790	2031.927	9.621
526.091	9.547	2028.929	9.618	2039.377	9.784	2030.559	9.638
525.934	9.590	2028.600	9.649	2038.732	9.783	2029.838	9.631
525.497	9.625	2028.333	9.620	2037.252	9.793	2027.920	9.647
525.279	9.529	2027.397	9.564	2036.459	9.761	2027.071	9.614
524.614	9.510	2026.582	9.561	2035.829	9.764	2025.425	9.614
524.159	9.545	2025.503	9.542	2034.880	9.713	2024.154	9.634
523.614	9.536	2024.865	9.528	2033.765	9.697	2023.059	9.694
522.884	9.459	2024.009	9.459	2032.919	9.697	2021.643	9.701
522.101	9.434	2023.434	9.429	2031.710	9.654	2020.816	9.724
521.672	9.471	2022.906	9.473	2031.711	9.654	2020.192	9.761
521.280	9.459	2022.669	9.481	2030.872	9.603	2019.298	9.787
520.809	9.496	2022.358	9.348	2030.049	9.643	2019.017	9.738
520.186	9.418	2022.205	9.192	2028.761	9.580	2018.729	9.642
519.360	9.386	2021.814	8.760	2028.147	9.607	2018.514	9.558
518.735	9.397	2021.699	8.463	2027.400	9.560	2018.346	9.283
517.788	9.319	2021.518	8.379	2026.494	9.602	2018.093	9.103
516.997	9.290	2021.248	8.237	2025.596	9.688	2017.760	8.861
516.440	9.283	2020.980	8.103	2025.159	9.671	2017.657	8.650
516.182	9.246	2020.763	8.012	2024.851	9.628	2017.363	8.461
515.964	9.144	2020.528	7.994	2024.640	9.591	2016.905	8.200
515.495	8.977	2019.988	7.964	2024.397	9.474	2016.585	8.056
514.978	8.730	2019.370	7.913	2024.135	9.322	2016.265	7.953
514.681	8.424	2018.880	7.913	2023.912	9.206	2015.917	7.822
514.522	8.146	2018.292	7.983	2023.719	9.117	2015.495	7.693
514.197	7.965	2017.847	8.015	2023.439	8.945	2015.553	7.708
513.927	7.873	2017.315	8.014	2023.159	8.827	2014.675	7.770
513.557	7.640	2016.625	8.031	2022.880	8.666	2014.270	7.717
513.223	7.560	2016.337	8.007	2022.584	8.523	2013.933	7.708
512.692	7.513	2015.784	7.957	2022.355	8.408	2013.221	7.706
512.114	7.584	2015.477	7.958	2022.024	8.297	2012.735	7.789
511.405	7.610	2015.148	8.012	2021.788	8.271	2012.390	7.820
510.909	7.613	2014.719	8.116	2021.513	8.240	2011.862	7.945
510.337	7.633	2014.328	8.281	2021.251	8.174	2011.666	7.948
509.902	7.735	2014.093	8.510	2020.850	8.216	2011.219	7.936
509.393	7.846	2013.858	8.845	2020.475	8.285	2010.812	7.906
509.112	7.864	2013.552	8.973	2020.126	8.327	2010.402	7.887
508.908	7.845	2013.228	9.076	2019.795	8.339	2009.895	7.832

Upper Swift Creek cross sections 4 to 7 2007							
UM04 Distance (m)	**17-Oct-07 Assumed Height (m)**	**UM05 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UM06 Distance (m)**	**17-Oct-07 Assumed Height (m)**	**UM07 Distance (m)**	**17-Oct-07 Assumed Height (m)**
508.564	7.888	2013.065	9.227	2019.471	8.356	2009.592	7.880
508.163	8.023	2012.788	9.318	2019.001	8.357	2009.171	8.123
507.950	8.171	2012.269	9.412	2018.563	8.354	2008.840	8.320
507.741	8.215	2012.021	9.543	2018.110	8.333	2008.565	8.632
507.033	8.635	2011.707	9.671	2017.732	8.277	2008.418	8.823
506.533	9.106	2011.446	9.759	2017.464	8.220	2008.231	9.189
506.202	9.445	2011.150	9.802	2017.157	8.118	2007.911	9.477
505.474	9.589	2010.665	9.831	2016.761	8.048	2007.669	9.618
504.289	9.609	2009.884	9.819	2016.462	8.009	2007.007	9.689
503.618	9.648	2009.223	9.802	2015.947	7.986	2006.429	9.731
503.172	9.659	2007.702	9.813	2015.534	7.970	2005.760	9.762
501.922	9.716	2007.014	9.809	2015.120	7.960	2005.004	9.768
		2006.252	9.849	2014.715	7.957	2004.085	9.777
		2004.667	9.808	2014.470	8.006	2003.078	9.793
		2003.131	9.820	2014.084	8.183	2001.976	9.797
		2001.493	9.816	2013.744	8.351		
		2000.666	9.809	2013.492	8.478		
		2000.106	9.848	2013.252	8.647		
		2000.002	10.000	2012.991	9.057		
				2012.786	9.160		
				2012.533	9.282		
				2012.312	9.373		
				2012.068	9.503		
				2011.887	9.608		
				2011.412	9.735		
				2010.991	9.838		
				2010.586	9.889		
				2009.940	9.908		
				2009.360	9.905		
				2008.733	9.911		
				2008.162	9.895		
				2007.412	9.868		
				2006.503	9.870		
				2005.088	9.855		
				2003.895	9.863		
				2002.564	9.827		

Swift Creek Cross sections 1 to 4 2007							
SM01 Distance (m)	**23-Aug-07 Assumed Height (m)**	**SM02 Distance (m)**	**23-Aug-07 Assumed Height (m)**	**SM03 Distance (m)**	**18-Oct-07 Assumed Height (m)**	**SM04 Distance (m)**	**23-Aug-07 Assumed Height (m)**
462.575	9.047	2037.670	7.830	2040.524	7.902	2033.093	7.771
462.720	8.870	2034.091	7.901	2039.280	7.906	2031.997	7.772
465.671	8.810	2029.543	7.912	2037.733	7.911	2030.742	7.788
466.689	8.750	2026.982	7.538	2036.374	7.889	2029.454	7.823
467.861	8.769	2025.864	7.265	2034.790	7.868	2028.217	7.882
468.974	8.610	2025.126	7.011	2033.610	7.850	2027.134	7.905
471.830	8.465	2024.624	6.830	2032.547	7.783	2025.228	7.954
473.353	8.153	2024.120	6.870	2031.844	7.679	2024.858	7.922
475.188	7.238	2023.680	6.860	2030.977	7.497	2024.503	7.719
475.446	7.012	2023.011	6.922	2030.336	7.446	2024.223	7.506
475.687	6.963	2022.475	6.820	2030.056	7.338	2023.827	7.202
476.132	7.066	2021.501	6.640	2029.575	7.248	2023.527	7.035
477.041	7.141	2020.745	6.427	2029.322	7.152	2023.376	6.926
477.680	7.177	2020.515	6.297	2029.074	7.166	2023.133	6.859
478.446	7.166	2020.098	6.225	2028.699	6.971	2022.984	6.571
478.767	7.144	2019.682	6.157	2028.139	6.867	2022.802	6.396
479.511	6.966	2019.487	6.248	2027.414	6.700	2022.573	6.185
479.959	7.052	2018.753	6.293	2026.534	6.569	2022.426	5.745
480.342	7.488	2018.511	6.237	2025.792	6.502	2021.975	5.465
481.189	7.710	2018.171	6.339	2024.968	6.432	2021.735	5.389
481.649	8.002	2017.864	6.397	2024.216	6.295	2021.430	5.377
483.146	8.623	2017.517	6.364	2023.437	6.360	2021.069	5.370
484.028	8.998	2017.244	6.117	2023.009	6.301	2021.069	5.370
486.336	9.001	2016.391	6.009	2022.586	6.222	2020.776	5.369
491.589	8.908	2015.786	6.072	2022.268	6.127	2020.372	5.339
495.624	8.883	2015.322	6.154	2021.986	6.025	2019.982	5.334
495.626	8.883	2014.625	6.344	2021.755	6.010	2019.697	5.331
		2014.063	6.399	2021.184	5.842	2019.529	5.341
		2013.642	6.539	2020.654	5.753	2019.278	5.348
		2013.465	6.643	2020.373	5.785	2019.013	5.355
		2012.393	6.665	2020.056	5.756	2018.837	5.365
		2011.646	6.635	2019.507	5.626	2018.573	5.373
		2010.892	6.751	2019.116	5.658	2018.322	5.378
		2009.790	6.935	2018.891	6.013	2018.057	5.388
		2008.556	7.264	2018.587	6.186	2017.635	5.377
		2007.255	7.510	2018.383	6.235	2017.313	5.414
		2005.828	7.671	2018.221	6.385	2017.061	5.468
		2003.903	7.777	2017.903	6.533	2016.779	5.521
		2001.569	7.795	2017.502	6.642	2016.484	5.556

Swift Creek Cross sections 1 to 4 2007							
SM01 Distance (m)	**23-Aug-07 Assumed Height (m)**	**SM02 Distance (m)**	**23-Aug-07 Assumed Height (m)**	**SM03 Distance (m)**	**18-Oct-07 Assumed Height (m)**	**SM04 Distance (m)**	**23-Aug-07 Assumed Height (m)**
				2016.928	6.778	2016.161	5.587
				2016.621	6.827	2015.884	5.618
				2016.144	6.870	2015.659	5.667
				2015.812	6.911	2015.352	5.748
				2015.588	6.917	2015.003	5.802
				2015.337	6.877	2014.788	5.835
				2015.027	6.826	2014.535	5.856
				2014.671	6.780	2014.253	5.850
				2014.287	6.838	2013.963	5.862
				2013.996	6.947	2013.626	5.984
				2013.473	7.227	2013.422	6.186
				2013.190	7.372	2013.295	6.368
				2012.493	7.511	2013.242	6.592
				2011.759	7.607	2013.109	6.822
				2011.339	7.639	2012.972	7.040
				2010.860	7.609	2012.812	7.213
				2010.322	7.580	2012.604	7.323
				2009.639	7.519	2012.400	7.403
				2008.873	7.484	2012.146	7.391
				2007.965	7.484	2011.930	7.462
				2006.364	7.521	2011.580	7.473
				2004.529	7.600	2010.933	7.516
				2002.993	7.691	2010.569	7.552
						2010.246	7.571
						2009.920	7.592
						2009.637	7.622
						2009.146	7.658
						2008.785	7.672
						2008.289	7.710
						2007.807	7.740
						2007.368	7.759
						2006.978	7.773
						2006.464	7.796
						2006.010	7.810
				Continued		2005.573	7.810
				SM04 Distance (m)	**23-Aug-07 Assumed Height (m)**	2004.722	7.814
						2003.970	7.807
						2003.360	7.815
				2001.866	7.807	2002.705	7.83

Swift Creek Cross sections 5 to 8 2007							
SM05 Distance (m)	**23-Nov-07 Assumed Height (m)**	**SM06 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**SM07 Distance (m)**	**18-Oct-07 Assumed Height (m)**	**SM08 Distance (m)**	**18-Oct-07 Assumed Height (m)**
2082.708	8.000	2047.716	7.598	2060.508	7.521	2052.807	7.679
2082.683	8.000	2046.608	7.601	2058.921	7.574	2047.933	7.686
2082.534	7.806	2045.368	7.607	2057.531	7.573	2042.539	7.713
2082.088	7.800	2044.226	7.606	2056.434	7.611	2038.489	7.778
2081.114	7.790	2043.040	7.628	2053.572	7.593	2035.829	7.593
2080.266	7.782	2041.839	7.628	2051.987	7.658	2035.004	7.427
2079.439	7.788	2040.700	7.646	2050.720	7.685	2034.632	7.314
2078.267	7.795	2039.498	7.680	2049.373	7.699	2033.786	6.718
2077.196	7.828	2038.400	7.680	2047.885	7.714	2032.375	6.601
2076.350	7.864	2037.072	7.707	2046.161	7.768	2031.533	6.526
2075.468	7.880	2035.854	7.722	2044.886	7.817	2030.180	6.305
2074.649	7.920	2034.686	7.741	2043.682	7.853	2029.530	6.250
2073.674	7.931	2033.757	7.747	2042.283	7.901	2028.630	6.252
2072.741	7.941	2032.875	7.744	2041.486	7.924	2027.452	6.275
2071.823	7.957	2032.075	7.721	2040.895	7.894	2026.851	6.220
2070.946	7.977	2031.442	7.658	2040.557	7.826	2026.170	6.063
2070.488	7.954	2030.912	7.582	2040.286	7.727	2025.262	6.163
2070.192	7.933	2030.451	7.463	2040.018	7.563	2024.862	6.198
2069.907	7.888	2030.056	7.330	2039.845	7.129	2024.429	6.345
2069.543	7.751	2029.770	7.209	2039.481	7.042	2023.187	6.543
2069.313	7.668	2029.494	7.098	2039.284	6.921	2022.753	6.733
2069.025	7.544	2029.196	6.972	2039.110	6.737	2022.660	6.944
2068.670	7.362	2028.990	6.900	2038.873	6.672	2022.021	6.912
2068.436	7.251	2028.732	6.745	2038.572	6.497	2021.478	7.128
2068.246	7.112	2028.381	6.560	2038.239	5.968	2020.746	7.229
2068.048	6.901	2028.250	6.377	2037.884	5.889	2019.727	7.356
2067.904	6.737	2027.998	6.319	2037.460	5.701	2019.019	7.639
2067.714	6.543	2027.761	6.330	2037.154	5.642	2018.284	7.88
2067.550	6.447	2027.578	6.189	2036.853	5.688	2016.863	7.958
2067.248	5.745	2027.324	6.067	2036.206	5.792	2016.077	8.074
2066.996	5.710	2026.954	5.991	2034.622	6.006	2015.465	7.954
2066.541	5.843	2026.632	5.905	2034.148	6.077	2013.644	7.952
2066.334	5.912	2026.281	5.784	2033.472	6.175	2010.365	7.737
2066.159	5.922	2025.885	5.748	2033.004	6.211	2005.667	7.749
2065.963	5.958	2025.555	5.716	2032.356	6.2	2002.217	7.787
2065.807	5.960	2025.270	5.775	2031.814	6.18		
2065.500	5.929	2024.933	5.819	2031.408	6.176		
2065.070	5.921	2024.528	5.845	2030.797	6.127		
2064.701	5.890	2024.046	5.804	2030.240	6.155		

Swift Creek Cross sections 5 to 8 2007							
SM05 Distance (m)	**23-Nov-07 Assumed Height (m)**	**SM06 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**SM07 Distance (m)**	**18-Oct-07 Assumed Height (m)**	**SM08 Distance (m)**	**18-Oct-07 Assumed Height (m)**
2064.143	5.817	2023.596	5.785	2029.776	6.195		
2063.688	5.792	2023.209	5.771	2029.049	6.326		
2062.941	5.806	2022.811	5.759	2028.410	6.516		
2062.431	5.827	2022.391	5.735	2028.038	6.888		
2061.959	5.857	2022.045	5.786	2027.800	6.975		
2061.367	5.870	2021.645	5.869	2027.349	7.329		
2061.028	5.899	2021.317	5.967	2026.812	7.6		
2060.564	5.920	2021.021	6.087	2026.475	7.717		
2060.129	5.921	2020.725	6.252	2025.823	7.814		
2059.676	5.941	2020.496	6.444	2024.808	7.86		
2059.305	5.945	2020.116	6.632	2023.796	7.839		
2058.937	6.020	2019.891	6.799	2022.480	7.783		
2058.654	6.079	2019.412	6.922	2020.861	7.719		
2058.365	6.193	2018.889	7.000	2019.286	7.7		
2058.161	6.276	2018.326	7.122	2017.579	7.686		
2057.851	6.417	2017.714	7.243	2016.327	7.697		
2057.562	6.516	2017.441	7.368	2014.281	7.729		
2057.301	6.674	2017.010	7.461	2012.788	7.75		
2057.108	6.696	2016.681	7.488	2011.531	7.774		
2056.767	6.700	2016.381	7.571	2010.343	7.803		
2056.481	6.760	2016.068	7.564	2009.020	7.824		
2056.169	6.933	2015.766	7.676	2007.393	7.854		
2055.818	6.993	2015.233	7.699	2005.536	7.845		
2055.486	7.054	2014.972	7.754	2003.348	7.842		
2055.178	7.047	2014.540	7.791	2001.439	7.817		
2054.833	7.099	2014.264	7.814				
2054.261	7.202	2014.041	7.745				
2053.161	7.258	2013.775	7.720				
2052.864	7.357	2012.889	7.748				
2052.458	7.481	2011.836	7.779				
2052.151	7.422	2010.973	7.769				
2051.844	7.428	2009.003	7.736				
2051.520	7.489	2007.165	7.717				
2051.094	7.587	2006.352	7.707				
2050.692	7.669	2005.402	7.747				
2047.061	7.733	2003.368	7.790				
2044.543	7.735	2001.689	7.812				
2041.918	7.726						
2038.906	7.720						

Swift Creek Cross sections 5 to 8 2007							
SM05 Distance (m)	**23-Nov-07 Assumed Height (m)**	**SM06 Distance (m)**	**19-Oct-07 Assumed Height (m)**	**SM07 Distance (m)**	**18-Oct-07 Assumed Height (m)**	**SM08 Distance (m)**	**18-Oct-07 Assumed Height (m)**
2036.348	7.697						
2033.893	7.644						
2032.284	7.613						
2030.804	7.604						
2028.730	7.519						
2027.470	7.447						
2025.747	7.332						
2023.681	6.894						
2022.535	6.740						
2020.941	6.708						
2019.567	6.806						
2018.255	6.971						
2017.178	7.059						
2016.114	7.219						
2013.011	7.499						
2008.336	7.607						
2005.016	7.740						
2002.199	7.794						
2000.151	7.831						
2000.013	8.004						

Ngarradj Cross sections 2008							
ET05	**25-Sep-08**	**SM06**	**25-Sep-08**	**UMGW**	**25-Sep-08**	**UM04**	**25-Sep-08**
Distance	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**	**Distance**	**Assumed**
(m)	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**	**(m)**	**Height (m)**
1985.004	9.928	2047.836	7.672	13.212	9.638	528.025	9.731
1985.015	9.928	2047.719	7.594	13.212	9.638	527.874	9.507
1985.150	9.707	2044.521	7.607	13.214	9.637	524.793	9.499
1986.440	9.699	2040.456	7.645	12.804	9.454	520.956	9.454
1987.873	9.676	2036.622	7.708	10.824	9.359	516.310	9.274
1988.749	9.231	2032.647	7.737	9.297	9.313	515.345	8.883
1989.373	8.927	2030.861	7.536	8.611	8.907	514.512	8.156
1989.890	8.346	2030.087	7.323	7.848	7.860	513.099	7.525
1990.927	8.061	2029.292	6.972	5.583	7.807	510.814	7.714
1992.320	8.185	2028.397	6.586	3.802	7.706	508.779	7.912
1993.802	8.319	2027.461	6.229	2.333	7.764	507.563	8.292
1994.602	8.772	2026.454	5.915	1.356	8.511	506.739	8.751
1995.216	9.315	2025.902	5.793	0.679	8.699	505.733	9.515
1996.528	9.618	2025.224	5.987	-0.362	9.502	503.803	9.631
1997.758	9.700	2023.548	6.014	-2.245	9.664		
		2021.195	6.053	-3.921	9.787		
		2020.593	6.357				
		2020.039	6.696				
		2019.342	6.954				
		2018.578	7.078				
		2017.785	7.218				
		2016.836	7.486				
		2015.928	7.607				
		2014.957	7.750				
		2013.335	7.782				
		2010.054	7.765				
		2006.311	7.718				
		2003.327	7.796				

Ngarradj Cross Gully Planform 2008							
GULLYPLAN	PART 1	5-Nov-08	PART 2		PART 3		PART 4
Easting (m)	Northings (m)	Easting (m)	Northings (m)	Easting (m)	Northings (m)	Easting (m)	Northings (m)
1000.000	4968.967	972.302	4976.231	969.125	4984.574	983.528	4985.708
1009.294	4980.720	971.599	4976.310	969.621	4984.332	983.729	4986.171
1008.387	4981.362	971.353	4976.735	970.188	4983.972	984.612	4986.308
1007.449	4981.461	970.908	4976.876	970.610	4983.764	985.247	4986.458
1001.749	4981.589	970.541	4976.912	971.063	4983.218	985.747	4986.596
1000.749	4981.458	970.181	4977.452	971.535	4982.598	986.351	4986.749
999.670	4981.438	969.845	4977.983	971.920	4982.119	986.958	4986.616
997.509	4980.979	969.985	4978.395	972.085	4981.774	987.567	4986.027
996.711	4981.183	969.569	4978.612	972.425	4981.624	987.807	4985.763
995.962	4981.130	969.098	4978.379	973.043	4981.722	988.582	4985.338
995.401	4980.841	968.219	4978.720	973.740	4981.631	988.718	4984.267
995.033	4980.649	967.397	4979.063	974.371	4981.475	989.264	4983.912
994.437	4980.633	967.189	4979.789	975.011	4981.796	989.816	4983.750
992.045	4980.202	967.434	4980.242	975.603	4981.980	990.531	4983.528
991.062	4980.168	967.735	4980.813	976.365	4981.910	990.988	4983.798
990.548	4980.207	967.669	4981.332	977.192	4981.681	991.901	4983.810
990.127	4980.538	967.668	4981.799	977.947	4981.438	992.455	4983.583
989.843	4980.384	967.217	4981.914	978.586	4981.517	992.802	4983.478
989.112	4980.124	966.952	4981.863	979.252	4981.918	993.575	4983.774
987.923	4979.502	966.654	4981.571	979.693	4982.232	993.984	4983.794
987.186	4979.299	966.147	4981.618	980.160	4981.853	994.962	4984.255
986.937	4978.767	965.903	4981.853	981.022	4981.703	995.661	4984.563
986.558	4978.129	965.602	4981.664	981.498	4981.469	996.022	4985.006
985.926	4978.074	965.168	4981.526	982.212	4981.470	995.776	4985.545
985.227	4977.450	964.667	4981.552	982.942	4981.168	995.891	4986.537
984.748	4976.979	964.211	4981.695	983.492	4981.324	996.882	4986.581
984.224	4977.486	963.938	4982.025	983.879	4981.485	997.325	4986.298
983.345	4977.166	963.722	4982.478	984.034	4981.769	998.369	4986.022
982.480	4977.332	963.750	4982.728	983.976	4982.010	1002.667	4987.030
981.402	4976.861	963.964	4983.051	983.629	4982.351	1003.784	4986.458
980.293	4977.053	964.681	4983.604	982.847	4982.615	1004.242	4986.505
979.151	4976.969	965.129	4984.016	982.515	4982.831	1004.819	4986.780
979.151	4976.970	965.489	4984.438	982.039	4982.905	1005.431	4987.007
978.429	4977.025	966.088	4984.671	981.530	4983.098	1006.538	4986.822
977.796	4976.722	966.618	4984.827	981.285	4983.508	1007.162	4986.705
976.595	4976.639	967.170	4984.997	981.475	4984.085	1000.012	4968.949
975.797	4976.368	967.800	4984.926	981.753	4984.422		
974.757	4975.999	968.133	4984.979	982.418	4984.743		
974.022	4976.144	968.480	4984.717	983.254	4985.267		

Ngarradj Cross sections 2009							
ET05 Distance (m)	**18-Dec-09 Assumed Height (m)**	**SM01 Distance (m)**	**18-Dec-09 Assumed Height (m)**	**SM06 Distance (m)**	**18-Dec-09 Assumed Height (m)**	**SM06 - Cont. Distance (m)**	**18-Dec-09 Assumed Height (m)**
1985.011	9.934	500.004	9.000	2047.721	7.595	2014.248	7.805
1985.018	9.933	499.879	8.806	2045.785	7.592	2013.631	7.747
1985.151	9.709	497.231	8.867	2042.991	7.630	2012.671	7.776
1986.066	9.730	494.550	8.866	2040.096	7.667	2011.05	7.779
1986.646	9.706	491.215	8.909	2037.258	7.704	2009.577	7.772
1987.544	9.728	487.288	8.993	2034.413	7.751	2008.370	7.745
1988.097	9.622	484.998	9.014	2032.889	7.745	2007.846	7.753
1988.365	9.485	483.860	8.935	2031.803	7.686	2006.673	7.717
1988.795	9.246	482.992	8.586	2031.019	7.595	2004.693	7.776
1989.194	9.006	481.963	8.174	2030.392	7.446	2001.977	7.808
1989.627	8.672	481.344	7.804	2029.983	7.270		
1989.779	8.386	480.659	7.591	2029.589	7.097		
1990.117	8.226	480.271	7.442	2029.125	6.856		
1990.553	8.298	479.995	7.120	2028.472	6.562		
1990.774	8.263	479.057	7.113	2027.896	6.404		
1991.266	8.064	478.051	7.131	2027.357	6.161		
1991.462	8.522	477.316	7.116	2026.773	5.997		
1991.691	7.955	476.539	7.067	2026.278	5.930		
1992.063	7.992	475.884	7.032	2026.070	5.754		
1992.526	8.094	475.395	7.037	2025.692	5.723		
1992.967	8.095	475.169	7.236	2024.677	5.792		
1993.331	8.126	474.909	7.315	2024.084	5.700		
1993.954	8.312	474.716	7.408	2023.305	5.584		
1994.411	8.546	474.514	7.569	2022.706	5.734		
1994.590	8.939	474.193	7.708	2022.184	5.788		
1994.990	9.258	473.745	7.931	2021.669	5.873		
1995.452	9.395	473.096	8.213	2021.311	5.983		
1996.021	9.562	472.254	8.368	2020.946	6.157		
1996.864	9.677	472.136	8.458	2020.561	6.395		
1997.744	9.702	471.146	8.513	2020.105	6.680		
1998.751	9.705	470.129	8.519	2019.538	6.901		
		469.086	8.577	2018.808	7.031		
		468.109	8.745	2018.000	7.167		
		466.380	8.736	2017.594	7.283		
		465.930	8.790	2017.395	7.377		
		465.059	8.805	2016.925	7.491		
		464.507	8.809	2015.901	7.613		
		463.678	8.839	2014.671	7.779		

Appendix E
Cumulative frequency grain size distributions for bulk bed-material samples on Ngarradj Creek for 2006 and 2007

Appendix E

Cumulative frequency grain size distributions for bulk bed material collected in 2006 and 2007. The location of the cross sections where the bulk bed material samples were collected are shown in the relevant sections in the text. The following tables are included in Appendix E:

Table E1 – 2006: East Tributary data

Table E2 – 2006: Upper Swift Creek data

Table E3 – 2006: Swift Creek data

Table E4– 2007: Tributary North main gully data

Table E5 – 2007: Tributary Central data

Table E6 – 2007: East Tributary data

Table E7 – 2007: Upper Swift Creek data

Table E8 – 2007: Swift Creek data

Table E9 – 2008: Swift Creek catchment data

Table E10 – 2008: Swift Creek catchment data

Table E1 Cumulative frequency grain size distributions for bulk bed material samples on East Tributary for 2006

Sample	ET01	Gravel Mass = 18.06 g	
Date	13-Aug-06	Remaining Mass = 1408.55 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	18.06	1.27
-0.5	1.4 mm	2.91	2.97
0.0	1.0 mm	12.64	8.67
0.5	710 μm	36.06	22.39
1.0	500 μm	90.41	54.24
1.5	355 μm	134.73	80.20
2.0	250 μm	160.91	95.54
2.5	180 μm	167.32	99.30
3.0	125 μm	168.23	99.83
3.5	90 μm	168.38	99.92
4.0	63 μm	168.44	99.95
>4.0	<63 μm	168.52	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	ET02	Gravel Mass = 25.54g	
Date	13-Oct-06	Remaining Mass = 1213.66 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm	25.54	2.06
-1.0	2.0 mm	0.48	2.36
-0.5	1.4 mm	2.11	3.37
0.0	1.0 mm	6.51	6.09
0.5	710 μm	23.60	16.68
1.0	500 μm	63.29	41.27
1.5	355 μm	120.07	76.44
2.0	250 μm	148.48	94.04
2.5	180 μm	156.03	98.72
3.0	125 μm	157.36	99.54
3.5	90 μm	157.77	99.80
4.0	63 μm	158.10	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	ET03	Gravel Mass = 228.55 g	
Date	24-Oct-06	Remaining Mass = 1237.89 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	15.66	1.13
-2.0	4.0 mm	109.52	7.92
-1.5	2.8 mm	153.48	11.10
-1.0	2.0 mm	215.47	15.59
-0.5	1.4 mm	5.39	19.92
0.0	1.0 mm	12.05	25.28
0.5	710 μm	22.11	33.37
1.0	500 μm	47.29	53.62
1.5	355 μm	74.59	75.58
2.0	250 μm	94.38	91.50
2.5	180 μm	102.31	97.88
3.0	125 μm	104.58	99.70
3.5	90 μm	104.86	99.93
4.0	63 μm	104.91	99.97
>4.0	<63 μm	104.95	100.00

Folk (1974) Texture Group: Gravelly medium sand

Sample	ET04	Gravel Mass = 118.15 g	
Date	13-Oct-06	Remaining Mass = 1311.85 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	2.38	0.17
-2.0	4.0 mm	25.26	1.84
-1.5	2.8 mm	57.59	4.20
-1.0	2.0 mm	113.42	8.26
-0.5	1.4 mm	12.67	19.32
0.0	1.0 mm	23.20	28.51
0.5	710 μm	35.18	38.97
1.0	500 μm	56.47	57.55
1.5	355 μm	75.25	73.94
2.0	250 μm	91.31	87.96
2.5	180 μm	100.73	96.18
3.0	125 μm	104.00	99.03
3.5	90 μm	104.75	99.69
4.0	63 μm	104.96	99.87
>4.0	<63 μm	105.11	100.00

Folk (1974) Texture Group: Granular medium sand

Table E1 Cumulative frequency grain size distributions for bulk bed material samples on East Tributary for 2006 (Continued)

Sample	ET05	Gravel Mass = 150.54 g	
Date	24-OCT-06	Remaining Mass = 1409.76 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	2.04	0.14
-2.0	4.0 mm	33.91	2.26
-1.5	2.8 mm	69.47	4.62
-1.0	2.0 mm	145.06	9.65
-0.5	1.4 mm	16.41	17.93
0.0	1.0 mm	41.67	30.69
0.5	710 μm	76.51	48.28
1.0	500 μm	125.96	73.24
1.5	355 μm	155.02	87.91
2.0	250 μm	170.50	95.73
2.5	180 μm	177.20	99.11
3.0	125 μm	178.58	99.81
3.5	90 μm	178.81	99.92
4.0	63 μm	178.88	99.96
>4.0	<63 μm	178.96	100.00

Folk (1974) Texture Group: Granular course sand

Sample	ET06	Gravel Mass = 45.05g	
Date	24-OCT-06	Remaining Mass = 1344.19 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	45.05	3.24
-0.5	1.4 mm	7.24	7.53
0.0	1.0 mm	17.00	13.31
0.5	710 μm	31.35	21.81
1.0	500 μm	66.74	42.76
1.5	355 μm	105.66	65.81
2.0	250 μm	135.60	83.54
2.5	180 μm	149.90	92.01
3.0	125 μm	156.95	96.18
3.5	90 μm	159.63	97.77
4.0	63 μm	161.33	98.77
>4.0	<63 μm	163.40	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	ET07	Gravel Mass = 79.46 g	
Date	24-Oct-06	Remaining Mass = 1403.42 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	1.72	0.12
-2.0	4.0 mm	14.20	1.02
-1.5	2.8 mm	32.62	2.33
-1.0	2.0 mm	74.90	5.36
-0.5	1.4 mm	5.21	10.04
0.0	1.0 mm	11.60	15.79
0.5	710 μm	20.64	23.92
1.0	500 μm	42.55	43.63
1.5	355 μm	67.77	66.31
2.0	250 μm	88.44	84.90
2.5	180 μm	98.64	94.07
3.0	125 μm	103.78	98.70
3.5	90 μm	104.95	99.75
4.0	63 μm	105.18	99.96
>4.0	<63 μm	105.23	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	ET08	Gravel Mass = 290.00 g	
Date	24-Oct-06	Remaining Mass = 1983.52 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	19.89	0.90
-2.0	4.0 mm	98.79	4.45
-1.5	2.8 mm	168.56	7.60
-1.0	2.0 mm	282.91	12.76
-0.5	1.4 mm	9.66	19.72
0.0	1.0 mm	22.32	28.85
0.5	710 μm	40.56	42.01
1.0	500 μm	75.57	67.25
1.5	355 μm	100.98	85.58
2.0	250 μm	112.21	93.68
2.5	180 μm	117.12	97.22
3.0	125 μm	119.73	99.10
3.5	90 μm	120.48	99.64
4.0	63 μm	120.79	99.86
>4.0	<63 μm	120.98	100.00

Folk (1974) Texture Group: Granular course sand

Table E2 Cumulative frequency grain size distributions for bulk bed material samples on Upper Swift Creek for 2006

Sample	UM02	Gravel Mass = 26.05 g	
Date	25-Oct-06	Remaining Mass = 1605.65 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	26.05	1.60
-0.5	1.4 mm	1.94	3.29
0.0	1.0 mm	6.04	6.87
0.5	710 μm	16.60	16.09
1.0	500 μm	46.12	41.86
1.5	355 μm	77.60	69.33
2.0	250 μm	102.21	90.82
2.5	180 μm	110.66	98.19
3.0	125 μm	112.25	99.58
3.5	90 μm	112.56	99.85
4.0	63 μm	112.65	99.99
>4.0	<63 μm	112.73	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UM03	Gravel Mass = 26.99g	
Date	25-Oct-06	Remaining Mass = 1965.01 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	26.99	1.35
-0.5	1.4 mm	2.93	3.74
0.0	1.0 mm	9.31	8.95
0.5	710 μm	22.71	19.87
1.0	500 μm	60.14	50.40
1.5	355 μm	94.64	78.53
2.0	250 μm	113.47	93.88
2.5	180 μm	119.15	98.52
3.0	125 μm	120.43	99.56
3.5	90 μm	120.70	99.78
4.0	63 μm	120.84	99.89
>4.0	<63 μm	120.97	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UMGW	Gravel Mass = 28.37 g	
Date	25-Oct-06	Remaining Mass = 2443.64 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	28.37	1.15
-0.5	1.4 mm	3.23	3.23
0.0	1.0 mm	11.70	8.69
0.5	710 μm	34.03	23.09
1.0	500 μm	82.00	54.03
1.5	355 μm	120.19	78.66
2.0	250 μm	145.17	94.77
2.5	180 μm	152.09	99.23
3.0	125 μm	152.98	99.81
3.5	90 μm	153.12	99.90
4.0	63 μm	153.20	99.95
>4.0	<63 μm	153.28	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UM04	Gravel Mass = 25.62 g	
Date	25-Oct-06	Remaining Mass = 2599.62 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	25.62	0.98
-0.5	1.4 mm	2.48	2.57
0.0	1.0 mm	10.12	7.46
0.5	710 μm	30.94	20.81
1.0	500 μm	85.45	55.75
1.5	355 μm	118.62	77.01
2.0	250 μm	145.01	93.93
2.5	180 μm	152.01	98.42
3.0	125 μm	153.90	99.63
3.5	90 μm	154.25	99.85
4.0	63 μm	154.32	99.90
>4.0	<63 μm	154.48	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table E2 Cumulative frequency grain size distributions for bulk bed material samples on Upper Swift Creek for 2006 (Continued)

Sample	UM05	Gravel Mass = 166.34 g	
Date	25-Oct-06	Remaining Mass = 2365.11 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	34.83	1.37
-2.0	4.0 mm	96.35	3.80
-1.5	2.8 mm	144.17	5.69
-1.0	2.0 mm	166.57	6.57
-0.5	1.4 mm	1.89	8.23
0.0	1.0 mm	4.45	10.47
0.5	710 μm	9.82	15.17
1.0	500 μm	29.99	32.82
1.5	355 μm	62.31	61.12
2.0	250 μm	91.32	86.51
2.5	180 μm	103.46	97.14
3.0	125 μm	106.38	99.69
3.5	90 μm	106.68	99.96
4.0	63 μm	106.71	99.98
>4.0	<63 μm	106.73	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	UM06	Gravel Mass = 150.02g	
Date	25-Oct-06	Remaining Mass = 2206.03 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	11.82	0.50
-2.0	4.0 mm	68.03	2.89
-1.5	2.8 mm	125.41	5.32
-1.0	2.0 mm	150.07	6.37
-0.5	1.4 mm	3.72	8.93
0.0	1.0 mm	11.04	13.96
0.5	710 μm	27.04	24.96
1.0	500 μm	67.76	52.97
1.5	355 μm	102.84	77.09
2.0	250 μm	123.69	91.43
2.5	180 μm	132.68	97.61
3.0	125 μm	135.39	99.48
3.5	90 μm	135.88	99.81
4.0	63 μm	136.03	99.92
>4.0	<63 μm	136.15	100.00

Folk (1974) Texture Group: Granular coarse sand

Table E2 Cumulative frequency grain size distributions for bulk bed material samples on Upper Swift Creek for 2006 (Continued)

Sample	**UM07**	**Gravel Mass = 419.82 g**	
Date	**25-Oct-06**	**Remaining Mass = 1758.43 g**	
Phi		**Mass (g)**	**Cumulative %**
-6.25	**76.0 mm**	0.00	0.00
-6.0	**64.0 mm**	189.48	8.70
-5.0	**32.0 mm**	309.75	14.22
-4.0	**16.0 mm**	351.93	16.16
-3.25	**9.5 mm**	358.60	16.46
-2.0	**4.0 mm**	378.90	17.39
-1.5	**2.8 mm**	406.13	18.64
-1.0	**2.0 mm**	419.90	19.27
-0.5	**1.4 mm**	2.40	20.87
0.0	**1.0 mm**	7.85	24.51
0.5	**710 μm**	21.46	33.58
1.0	**500 μm**	52.22	54.09
1.5	**355 μm**	81.78	73.79
2.0	**250 μm**	103.19	88.07
2.5	**180 μm**	114.36	95.51
3.0	**125 μm**	119.11	98.68
3.5	**90 μm**	120.38	99.53
4.0	**63 μm**	120.73	99.76
>4.0	**<63 μm**	121.09	100.00

Folk (1974) Texture Group: Granular coarse sand

Table E3 Cumulative frequency grain size distributions for bulk bed material samples on Swift Main Creek for 2006

Sample	SM01	Gravel Mass = 115.88 g	
Date	27-Oct-06	Remaining Mass = 2117.65 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0.00	0.00
-3.25	9.5 mm	1.40	0.06
-2.0	4.0 mm	18.74	0.84
-1.5	2.8 mm	84.15	3.76
-1.0	2.0 mm	116.12	5.19
-0.5	1.4 mm	5.91	9.39
0.0	1.0 mm	14.86	15.75
0.5	710 μm	29.81	26.38
1.0	500 μm	65.59	51.81
1.5	355 μm	96.17	73.54
2.0	250 μm	122.47	92.24
2.5	180 μm	129.86	97.49
3.0	125 μm	131.75	98.83
3.5	90 μm	132.60	99.44
4.0	63 μm	133.00	99.72
>4.0	<63 μm	133.39	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	SM02	Gravel Mass = 168.01 g	
Date	27-Oct-06	Remaining Mass = 1918.9 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0	0.00
-3.25	9.5 mm	2.67	0.13
-2.0	4.0 mm	21.53	1.03
-1.5	2.8 mm	125.11	5.99
-1.0	2.0 mm	168.28	8.05
-0.5	1.4 mm	1.89	9.68
0.0	1.0 mm	4.45	11.88
0.5	710 μm	9.82	16.51
1.0	500 μm	29.99	33.89
1.5	355 μm	62.31	61.73
2.0	250 μm	91.32	86.72
2.5	180 μm	103.46	97.18
3.0	125 μm	106.38	99.70
3.5	90 μm	106.68	99.96
4.0	63 μm	106.71	99.98
>4.0	<63 μm	106.73	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	SM03	Gravel Mass = 23.62 g	
Date	27-Oct-06	Remaining Mass = 2036.79 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	23.62	1.15
-0.5	1.4 mm	2.62	3.24
0.0	1.0 mm	7.69	7.28
0.5	710 μm	19.14	16.41
1.0	500 μm	53.57	43.87
1.5	355 μm	94.69	76.67
2.0	250 μm	118.63	95.76
2.5	180 μm	123.21	99.42
3.0	125 μm	123.77	99.86
3.5	90 μm	123.84	99.92
4.0	63 μm	123.89	99.96
>4.0	<63 μm	123.94	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	SM04	Gravel Mass = 70.16 g	
Date	27-Oct-06	Remaining Mass = 1790.27 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	70.16	3.77
-0.5	1.4 mm	5.61	8.69
0.0	1.0 mm	15.89	17.71
0.5	710 μm	33.25	32.94
1.0	500 μm	65.88	61.57
1.5	355 μm	92.98	85.34
2.0	250 μm	107.53	98.11
2.5	180 μm	109.42	99.76
3.0	125 μm	109.59	99.91
3.5	90 μm	109.65	99.96
4.0	63 μm	109.66	99.97
>4.0	<63 μm	109.69	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table E3 Cumulative frequency grain size distributions for bulk bed material samples on Swift Main Creek for 2006 (Continued)

Sample	SM05	Gravel Mass = 20.43 g	
Date	27-Oct-06	Remaining Mass = 2156.01 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	20.43	0.94
-0.5	1.4 mm	2.0	2.66
0.0	1.0 mm	6.6	6.61
0.5	710 μm	17.66	16.12
1.0	500 μm	48.08	42.28
1.5	355 μm	81.49	71.01
2.0	250 μm	104.62	90.89
2.5	180 μm	112.22	97.43
3.0	125 μm	114.57	99.45
3.5	90 μm	115.04	99.85
4.0	63 μm	115.17	99.97
>4.0	<63 μm	115.21	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	SM06	Gravel Mass = 74.55 g	
Date	24-Oct-06	Remaining Mass = 1877.19 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	74.55	3.82
-0.5	1.4 mm	4.92	7.90
0.0	1.0 mm	12.51	14.19
0.5	710 μm	24.17	23.86
1.0	500 μm	53.04	47.80
1.5	355 μm	86.73	75.74
2.0	250 μm	106.29	91.96
2.5	180 μm	112.37	97.01
3.0	125 μm	114.44	98.72
3.5	90 μm	115.18	99.34
4.0	63 μm	115.61	99.69
>4.0	<63 μm	115.98	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	SM07	Gravel Mass = 26.33 g	
Date	27-Oct-06	Remaining Mass = 2223.12 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	26.33	1.17
-0.5	1.4 mm	1.91	2.56
0.0	1.0 mm	6.59	5.97
0.5	710 μm	18.50	14.65
1.0	500 μm	60.64	45.37
1.5	355 μm	106.15	78.54
2.0	250 μm	128.95	95.16
2.5	180 μm	134.12	98.93
3.0	125 μm	135.25	99.75
3.5	90 μm	135.47	99.91
4.0	63 μm	135.54	99.96
>4.0	<63 μm	135.59	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	SM08	Gravel Mass = 64.32 g	
Date	27-Oct-06	Remaining Mass = 2107.79 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	64.32	2.96
-0.5	1.4 mm	5.50	6.70
0.0	1.0 mm	18.16	15.31
0.5	710 μm	40.50	30.51
1.0	500 μm	79.04	56.72
1.5	355 μm	112.13	79.22
2.0	250 μm	135.60	95.18
2.5	180 μm	141.36	99.10
3.0	125 μm	142.47	99.86
3.5	90 μm	142.65	99.98
4.0	63 μm	142.67	99.99
>4.0	<63 μm	142.68	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table E4 Cumulative frequency grain size distributions for bulk bed material samples on the main gully of Tributary North for 2007

Sample	**TN01**	**Gravel Mass = 45.2 g**	
Date	**1-Aug-07**	**Remaining Mass = 838.91 g**	
Phi		**Mass (g)**	**Cumulative %**
-3.25	**9.5 mm**	0.00	0.00
-2.0	**4.0 mm**	0.89	0.10
-1.5	**2.8 mm**	18.57	2.10
-1.0	**2.0 mm**	37.15	4.20
-0.5	**1.4 mm**	45.2	5.11
0.0	**1.0 mm**	3.31	8.36
0.5	**710 μm**	8.76	13.71
1.0	**500 μm**	19.39	24.14
1.5	**355 μm**	43.65	47.94
2.0	**250 μm**	66.16	70.03
2.5	**180 μm**	87.66	91.12
3.0	**125 μm**	89.43	92.86
3.5	**90 μm**	89.96	93.38
4.0	**63 μm**	90.07	93.49
>4.0	**<63 μm**	96.71	100.00

Folk (1974) Texture Group: Slightly granular muddy course sand

Table E5 Cumulative frequency grain size distributions for bulk bed material samples on the main gully of Tributary Central for 2007

Sample	TC06A	Gravel Mass = 231.60 g	
Date	3-Aug-07	Remaining Mass = 1586.21 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.5	9.5 mm	116.21	6.39
-2.0	4.0 mm	169.29	9.31
-1.5	2.8 mm	212.60	11.70
-1.0	2.0 mm	231.55	12.74
-0.5	1.4 mm	2.36	14.80
0.0	1.0 mm	6.59	18.49
0.5	710 µm	14.38	25.28
1.0	500 µm	29.21	38.21
1.5	355 µm	45.26	52.20
2.0	250 µm	64.19	68.70
2.5	180 µm	77.54	80.34
3.0	125 µm	84.67	86.56
3.5	90 µm	87.34	88.88
4.0	63 µm	88.99	90.32
8.0	<63 µm	100.09	100.00

Folk (1974) Texture Group: Granular muddy medium sand

Sample	TC06B	Gravel Mass = 797.83 g	
Date	3-Aug-07	Remaining Mass = 630.40 g	
Phi		Mass (g)	Cumulative %
-6.0	64 mm	0.00	0.00
-5.0	32 mm	234.97	16.45
-4.0	16 mm	489.43	34.27
-3.5	9.5 mm	642.41	44.98
-2.0	4.0 mm	735.88	51.53
-1.5	2.8 mm	766.06	53.64
-1.0	2.0 mm	797.78	55.86
-0.5	1.4 mm	5.50	58.82
0.0	1.0 mm	13.13	62.94
0.5	710 µm	24.04	68.81
1.0	500 µm	40.37	77.61
1.5	355 µm	54.44	85.19
2.0	250 µm	68.22	92.61
2.5	180 µm	75.33	96.44
3.0	125 µm	77.81	97.78
3.5	90 µm	78.46	98.13
4.0	63 µm	78.79	98.31
>4.0	<63 µm	81.93	100.00

Folk (1974) Texture Group: Course sandy gravel

Table E5 Cumulative frequency grain size distributions for bulk bed material samples on the main gully of Tributary Central for 2007

Sample	TC10	Gravel Mass = 704.99 g	
Date	3-Aug-07	Remaining Mass = 776.01 g	
Phi		Mass (g)	Cumulative %
-6.0	64.0 mm	0.00	0.00
-5.0	32.0 mm	146.14	9.89
-4.0	16.0 mm	387.76	26.24
-3.25	9.5 mm	521.38	35.29
-2.0	4.0 mm	620.36	41.98
-1.5	2.8 mm	661.79	44.79
-1.0	2.0 mm	703.38	47.60
-0.5	1.4 mm	6.33	51.04
0.0	1.0 mm	12.25	54.25
0.5	710 μm	20.04	58.47
1.0	500 μm	34.46	66.29
1.5	355 μm	51.96	75.78
2.0	250 μm	71.23	86.23
2.5	180 μm	82.48	92.33
3.0	125 μm	88.53	95.61
3.5	90 μm	91.06	96.98
4.0	63 μm	91.94	97.46
>4.0	<63 μm	104.25	100.00

Folk (1974) Texture Group: Medium sandy gravel

Sample	TC11	Gravel Mass = 44.56 g	
Date	3-Aug-07	Remaining Mass = 1439.46 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	44.56	3.00
-0.5	1.4 mm	2.85	5.82
0.0	1.0 mm	8.16	11.06
0.5	710 μm	17.40	20.18
1.0	500 μm	38.42	40.92
1.5	355 μm	64.98	67.13
2.0	250 μm	86.20	88.08
2.5	180 μm	94.08	95.85
3.0	125 μm	96.67	98.41
3.5	90 μm	97.35	99.08
4.0	63 μm	97.69	99.42
>4.0	<63 μm	98.28	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table E6 Cumulative frequency grain size distributions for bulk bed material samples on East Tributary for 2007

Sample	ET01	Gravel Mass = 46.38 g	
Date	31-Jul-07	Remaining Mass = 1829.04 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	46.38	2.47
-0.5	1.4 mm	4.37	4.31
0.0	1.0 mm	11.53	7.33
0.5	710 μm	23.64	12.43
1.0	500 μm	55.03	25.65
1.5	355 μm	106.31	47.25
2.0	250 μm	171.88	74.87
2.5	180 μm	208.26	90.19
3.0	125 μm	223.15	96.47
3.5	90 μm	228.30	98.64
4.0	63 μm	230.62	99.61
>4.0	<63 μm	231.54	100.00

Folk (1974) Texture Group: slightly granular medium sand

Sample	ET02	Gravel Mass = 48.97 g	
Date	31-Jul-07	Remaining Mass = 1539.84 g	
Phi		Mass (g)	Cumulative %
-2.0	4.0 mm		
-1.5	2.8 mm		
-1.0	2.0 mm	48.97	3.08
-0.5	1.4 mm	2.94	4.53
0.0	1.0 mm	7.99	7.01
0.5	710 μm	18.90	12.36
1.0	500 μm	51.99	28.61
1.5	355 μm	96.00	50.23
2.0	250 μm	141.00	72.32
2.5	180 μm	171.50	87.30
3.0	125 μm	188.40	95.60
3.5	90 μm	194.30	98.50
4.0	63 μm	196.44	99.55
>4.0	<63 μm	197.36	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	ET03	Gravel Mass = 12.77 g	
Date	31-Jul-07	Remaining Mass = 1171.29 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	12.77	1.08
-0.5	1.4 mm	0.36	1.31
0.0	1.0 mm	1.34	1.93
0.5	710 μm	4.25	3.79
1.0	500 μm	21.39	14.75
1.5	355 μm	58.88	38.70
2.0	250 μm	104.23	67.68
2.5	180 μm	132.98	86.05
3.0	125 μm	147.39	95.26
3.5	90 μm	152.50	98.52
4.0	63 μm	153.94	99.44
>4.0	<63 μm	154.81	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	ET04	Gravel Mass = 225.31 g	
Date	01-Aug-04	Remaining Mass = 1721.02 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	10.11	0.52
-2.0	4.0 mm	92.02	4.73
-1.5	2.8 mm	150.57	7.74
-1.0	2.0 mm	225.31	11.58
-0.5	1.4 mm	9.52	17.44
0.0	1.0 mm	19.21	23.41
0.5	710 μm	31.55	31.01
1.0	500 μm	53.27	44.40
1.5	355 μm	76.59	58.76
2.0	250 μm	104.80	76.14
2.5	180 μm	125.15	88.68
3.0	125 μm	136.49	95.67
3.5	90 μm	140.77	98.31
4.0	63 μm	142.25	99.22
>4.0	<63 μm	143.52	100.00

Folk (1974) Texture Group: Granular medium sand

Table E6 Cumulative frequency grain size distributions for bulk bed material samples on East Tributary for 2007 (Continued)

Sample	ET05	Gravel Mass = 290.5 g	
Date	1-Aug-07	Remaining Mass = 1963.78 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	5.21	0.23
-2.0	4.0 mm	114.15	5.06
-1.5	2.8 mm	185.66	8.24
-1.0	2.0 mm	290.45	12.88
-0.5	1.4 mm	7.16	17.97
0.0	1.0 mm	13.83	22.70
0.5	710 µm	21.80	28.36
1.0	500 µm	40.64	41.73
1.5	355 µm	63.19	57.73
2.0	250 µm	90.64	77.21
2.5	180 µm	107.43	89.13
3.0	125 µm	115.97	95.19
3.5	90 µm	119.22	97.49
4.0	63 µm	120.76	98.59
>4.0	<63 µm	122.75	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	ET06	Gravel Mass = 30.41 g	
Date	1-Aug-07	Remaining Mass = 1831.61 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	30.41	1.63
-0.5	1.4 mm	2.19	2.89
0.0	1.0 mm	6.75	5.50
0.5	710 µm	13.38	9.31
1.0	500 µm	32.04	20.01
1.5	355 µm	62.88	37.69
2.0	250 µm	107.95	63.54
2.5	180 µm	136.19	79.73
3.0	125 µm	152.21	88.92
3.5	90 µm	160.77	93.83
4.0	63 µm	166.95	97.37
>4.0	<63 µm	171.53	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	ET07	Gravel Mass = 290.5 g	
Date	1-Aug-07	Remaining Mass = 1963.78 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	1.72	0.12
-2.0	4.0 mm	47.07	3.16
-1.5	2.8 mm	90.06	6.05
-1.0	2.0 mm	140.82	9.45
-0.5	1.4 mm	9.44	14.17
0.0	1.0 mm	20.65	19.78
0.5	710 µm	36.37	27.64
1.0	500 µm	73.08	45.99
1.5	355 µm	113.99	66.45
2.0	250 µm	145.48	82.19
2.5	180 µm	164.69	91.80
3.0	125 µm	175.48	97.19
3.5	90 µm	179.29	99.10
4.0	63 µm	180.41	99.66
>4.0	<63 µm	181.10	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	ET08	Gravel Mass = 232.28 g	
Date	1-Aug-07	Remaining Mass = 1818.56 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	5.35	0.26
-2.0	4.0 mm	78.66	3.84
-1.5	2.8 mm	193.66	9.44
-1.0	2.0 mm	232.38	11.33
-0.5	1.4 mm	11.41	16.00
0.0	1.0 mm	24.68	21.43
0.5	710 µm	44.70	29.61
1.0	500 µm	95.25	50.29
1.5	355 µm	149.53	72.50
2.0	250 µm	185.53	87.22
2.5	180 µm	204.19	94.85
3.0	125 µm	212.66	98.32
3.5	90 µm	215.32	99.41
4.0	63 µm	216.37	99.84
>4.0	<63 µm	216.77	100.00

Folk (1974) Texture Group: Granular medium sand

Table E7 Cumulative frequency grain size distributions for bulk bed material samples on Upper Swift Creek for 2007

Sample	UM01	Gravel Mass = 251.59 g	
Date	17-Oct-07	Remaining Mass = 373.34 g	
Phi		Mass (g)	Cumulative %
-6.0	64 mm	0.00	0.00
-5.0	32 mm	249.50	39.92
-4.0	16 mm	249.59	39.94
-3.25	9.5 mm	249.59	39.94
-2.0	4.0 mm	249.85	39.98
-1.5	2.8 mm	250.17	40.03
-1.0	2.0 mm	251.59	40.26
-0.5	1.4 mm	0.74	40.54
0.0	1.0 mm	2.65	41.27
0.5	710 μm	9.5	43.87
1.0	500 μm	57.22	61.99
1.5	355 μm	121.36	86.34
2.0	250 μm	148.22	96.54
2.5	180 μm	154.28	98.85
3.0	125 μm	156.02	99.51
3.5	90 μm	156.72	99.77
4.0	63 μm	157.05	99.90
>4.0	<63 μm	157.32	100.00

Folk (1974) Texture Group: Medium sandy pebble

Sample	UM02	Gravel Mass = 14.23 g	
Date	17-Oct-07	Remaining Mass = 1366.84 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	14.23	1.03
-0.5	1.4 mm	2.12	2.27
0.0	1.0 mm	9.46	6.58
0.5	710 μm	29.65	18.44
1.0	500 μm	77.93	46.78
1.5	355 μm	116.20	69.25
2.0	250 μm	148.73	88.35
2.5	180 μm	161.34	95.75
3.0	125 μm	166.09	98.54
3.5	90 μm	167.54	99.39
4.0	63 μm	168.12	99.99
>4.0	<63 μm	168.58	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UM03	Gravel Mass = 19.68 g	
Date	17-Oct-07	Remaining Mass = 1277.64 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	19.68	1.52
-0.5	1.4 mm	5.24	4.65
0.0	1.0 mm	16.93	11.64
0.5	710 μm	42.41	26.88
1.0	500 μm	95.32	58.53
1.5	355 μm	132.43	80.72
2.0	250 μm	152.05	92.46
2.5	180 μm	159.69	97.03
3.0	125 μm	162.68	98.82
3.5	90 μm	163.81	99.49
4.0	63 μm	164.36	99.99
>4.0	<63 μm	164.66	100.00

Folk (1974) Texture Group: Slightly granular course sand

Sample	UMGW	Gravel Mass = 5.73 g	
Date	17-Oct-07	Remaining Mass = 1318.66 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	651.48	43.89
-0.5	1.4 mm	3.47	45.71
0.0	1.0 mm	7.54	47.83
0.5	710 μm	14.28	51.35
1.0	500 μm	32.23	60.73
1.5	355 μm	60.42	75.47
2.0	250 μm	86.15	88.91
2.5	180 μm	96.56	94.35
3.0	125 μm	101.10	96.72
3.5	90 μm	102.39	97.40
4.0	63 μm	102.89	97.66
>4.0	<63 μm	107.37	100.00

Folk (1974) Texture Group: Slightly granular course sand

Table E7 Cumulative frequency grain size distributions for bulk bed material samples on Upper Swift Creek for 2007 (Continued)

Sample	UM04	Gravel Mass = 9.03 g	
Date	17-Oct-07	Remaining Mass = 1668.08 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	9.83	0.59
-0.5	1.4 mm	1.38	1.98
0.0	1.0 mm	4.94	5.59
0.5	710 μm	13.78	14.55
1.0	500 μm	35.57	36.62
1.5	355 μm	58.59	59.95
2.0	250 μm	85.14	86.85
2.5	180 μm	94.37	96.20
3.0	125 μm	96.68	98.54
3.5	90 μm	97.69	99.56
4.0	63 μm	97.95	99.83
>4.0	<63 μm	98.12	100.00

Folk (1974) Texture Group: Slightly granular Course sand

Sample	UM05	Gravel Mass = 12.11 g	
Date	17-Oct-07	Remaining Mass = 1704.69 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	12.11	0.71
-0.5	1.4 mm	2.88	2.07
0.0	1.0 mm	13.46	7.08
0.5	710 μm	43.50	21.31
1.0	500 μm	103.71	49.84
1.5	355 μm	151.94	72.68
2.0	250 μm	189.68	90.56
2.5	180 μm	205.11	97.87
3.0	125 μm	208.24	99.36
3.5	90 μm	208.96	99.70
4.0	63 μm	209.30	99.86
>4.0	<63 μm	209.60	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UM06	Gravel Mass = 37.19 g	
Date	17-Oct-07	Remaining Mass = 1935.12 g	
Phi		Mass (g)	Cumulative %
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	37.19	1.89
-0.5	1.4 mm	2.08	3.74
0.0	1.0 mm	8.81	9.75
0.5	710 μm	24.95	24.15
1.0	500 μm	56.90	52.67
1.5	355 μm	81.80	74.89
2.0	250 μm	100.12	91.24
2.5	180 μm	108.35	98.58
3.0	125 μm	109.33	99.46
3.5	90 μm	109.71	99.79
4.0	63 μm	109.84	99.91
>4.0	<63 μm	109.94	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UM07	Gravel Mass = 267.46 g	
Date	17-Oct-07	Remaining Mass = 1609.57 g	
Phi		Mass (g)	Cumulative %
-6.25	76	0.00	0.00
-6.0	64 mm	219.60	11.70
-5.0	32 mm	260.30	13.87
-3.25	9.5 mm	260.30	13.87
-2.0	4.0 mm	264.18	14.07
-1.5	2.8 mm	266.53	14.20
-1.0	2.0 mm	267.46	14.25
-0.5	1.4 mm	0.33	14.51
0.0	1.0 mm	1.79	15.64
0.5	710 μm	10.15	22.14
1.0	500 μm	40.29	45.55
1.5	355 μm	74.19	71.89
2.0	250 μm	98.20	90.54
2.5	180 μm	106.73	97.17
3.0	125 μm	109.40	99.25
3.5	90 μm	109.96	99.68
4.0	63 μm	110.20	99.87
>4.0	<63 μm	110.37	100.00

Folk (1974) Texture Group Medium sandy pebble gravel

Table E8 Cumulative frequency grain size distributions for bulk bed material samples on Swift Main Creek for 2007

Sample	SM01	Gravel Mass = 130.08 g	
Date	22-Aug-07	Remaining Mass = 1836.22 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0.00	0.00
-3.25	9.5 mm	3.96	0.20
-2.0	4.0 mm	10.3	0.52
-1.5	2.8 mm	88.38	4.49
-1.0	2.0 mm	130.10	6.62
-0.5	1.4 mm	17.71	13.81
0.0	1.0 mm	38.6	22.29
0.5	710 μm	64.88	32.96
1.0	500 μm	113.34	52.63
1.5	355 μm	171.34	76.18
2.0	250 μm	214.41	93.66
2.5	180 μm	226.65	98.63
3.0	125 μm	229.65	99.85
3.5	90 μm	229.76	99.89
4.0	63 μm	229.91	99.96
>4.0	<63 μm	230.02	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	SM02	Gravel Mass = 98.58 g	
Date	22-Aug-07	Remaining Mass = 1788.13 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0.00	0.00
-3.25	9.5 mm	2.08	0.11
-2.0	4.0 mm	24.13	1.28
-1.5	2.8 mm	79.46	4.21
-1.0	2.0 mm	98.58	5.22
-0.5	1.4 mm	6.69	8.09
0.0	1.0 mm	17.81	12.86
0.5	710 μm	34.65	20.07
1.0	500 μm	67.51	34.15
1.5	355 μm	103.68	49.65
2.0	250 μm	171.35	78.64
2.5	180 μm	206.94	93.89
3.0	125 μm	218.2	98.71
3.5	90 μm	220.51	99.70
4.0	63 μm	220.97	99.90
>4.0	<63 μm	221.21	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	SM03	Gravel Mass = 351.72 g	
Date	22-Aug-07	Remaining Mass = 1921.4 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0.00	0.00
-3.25	9.5 mm	3.64	0.16
-2.0	4.0 mm	76.10	3.35
-1.5	2.8 mm	199.88	8.79
-1.0	2.0 mm	351.72	15.47
-0.5	1.4 mm	10.19	23.41
0.0	1.0 mm	21.89	32.52
0.5	710 μm	36.31	43.76
1.0	500 μm	59.64	61.93
1.5	355 μm	81.75	79.15
2.0	250 μm	101.10	94.23
2.5	180 μm	107.16	98.95
3.0	125 μm	108.30	99.84
3.5	90 μm	108.43	99.94
4.0	63 μm	108.48	99.98
>4.0	<63 μm	108.51	100.00

Folk (1974) Texture Group: Granular coarse sand

Sample	SM05	Gravel Mass = 24.94 g	
Date	22-Aug-07	Remaining Mass = 1384.74 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm		
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	2.72	0.19
-1.5	2.8 mm	8.31	0.59
-1.0	2.0 mm	24.94	1.77
-0.5	1.4 mm	4.93	4.50
0.0	1.0 mm	14.50	9.79
0.5	710 μm	33.90	20.52
1.0	500 μm	84.28	48.40
1.5	355 μm	134.15	75.99
2.0	250 μm	167.73	94.57
2.5	180 μm	176.16	99.23
3.0	125 μm	177.31	99.87
3.5	90 μm	177.45	99.94
4.0	63 μm	177.50	99.97
>4.0	<63 μm	177.55	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Table E8 Cumulative frequency grain size distributions for bulk bed material samples on Swift Main Creek for 2007 (Continued)

Sample	SM06	Gravel Mass = 38.78 g	
Date	22-Aug-07	Remaining Mass = 1842.56 g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	6.13	0.33
-1.5	2.8 mm	16.01	0.85
-1.0	2.0 mm	38.78	2.06
-0.5	1.4 mm	2.78	4.31
0.0	1.0 mm	8.97	9.31
0.5	710 μm	23.41	20.99
1.0	500 μm	58.30	49.20
1.5	355 μm	91.99	76.43
2.0	250 μm	113.56	93.87
2.5	180 μm	119.38	98.58
3.0	125 μm	120.62	99.58
3.5	90 μm	120.84	99.76
4.0	63 μm	120.97	99.86
>4.0	<63 μm	121.14	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	SM07	Gravel Mass = 27.1 g	
Date	22-Aug-07	Remaining Mass = 2065.89 g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	1.47	0.07
-1.5	2.8 mm	6.68	0.32
-1.0	2.0 mm	27.10	1.29
-0.5	1.4 mm	3.29	2.76
0.0	1.0 mm	10.04	9.71
0.5	710 μm	26.30	23.35
1.0	500 μm	64.59	55.45
1.5	355 μm	99.05	84.35
2.0	250 μm	115.54	98.17
2.5	180 μm	117.38	99.71
3.0	125 μm	117.54	99.85
3.5	90 μm	117.62	99.92
4.0	63 μm	117.68	99.97
>4.0	63 μm	117.72	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	SM08	Gravel Mass = 199.34 g	
Date	22-Aug-07	Remaining Mass = 2026.86 g	
Phi		Mass (g)	Cumulative %
-4.0	16.0 mm	0.00	0.00
-3.25	9.5 mm	3.24	0.15
-2.0	4.0 mm	28.65	1.29
-1.5	2.8 mm	135.17	6.07
-1.0	2.0 mm	199.32	8.95
-0.5	1.4 mm	17.39	15.88
0.0	1.0 mm	42.17	25.74
0.5	710 μm	76.64	39.46
1.0	500 μm	136.28	63.19
1.5	355 μm	183.52	81.99
2.0	250 μm	217.71	95.60
2.5	180 μm	226.15	98.96
3.0	125 μm	228.21	99.78
3.5	90 μm	228.60	99.93
4.0	63 μm	228.72	99.98
>4.0	<63 μm	228.77	100.00

Folk (1974) Texture Group: Granular coarse sand

Table E9 Cumulative frequency grain size distributions for bulk bed material samples collected in the Swift Creek catchment for 2008

Sample	ET05	Gravel Mass = 128.48 g	
Date	25-Sep-08	Remaining Mass = 1646.70 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	8.58	0.48
-2.0	4.0 mm	61.27	3.45
-1.5	2.8 mm	90.53	5.10
-1.0	2.0 mm	128.48	7.24
-0.5	1.4 mm	7.58	10.56
0.0	1.0 mm	19.43	15.75
0.5	710 µm	42.31	25.78
1.0	500 µm	93.69	48.29
1.5	355 µm	151.73	73.73
2.0	250 µm	194.54	92.49
2.5	180 µm	207.64	98.23
3.0	125 µm	210.82	99.62
3.5	90 µm	211.56	99.95
4.0	63 µm	211.56	99.95
>4.0	<63 µm	211.68	100.00

Folk (1974) Texture Group: Granular medium sand

Sample	UMGW	Gravel Mass = 3.4 g	
Date	25-Sep-08	Remaining Mass = 1756.12 g	
Phi		Mass (g)	Cumulative %
-4.0	16 mm	0.00	0.00
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	3.4	0.19
-0.5	1.4 mm	1.22	0.74
0.0	1.0 mm	6.22	2.97
0.5	710 µm	27.56	12.51
1.0	500 µm	103.08	46.27
1.5	355 µm	181.15	81.17
2.0	250 µm	216.39	96.92
2.5	180 µm	221.34	99.14
3.0	125 µm	222.58	99.69
3.5	90 µm	222.95	99.86
4.0	63 µm	223.15	99.95
>4.0	<63 µm	223.27	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UM04	Gravel Mass = 6.1 g	
Date	25-Sep-08	Remaining Mass = 1664.37g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	6.1	0.37
-0.5	1.4 mm	2.43	1.49
0.0	1.0 mm	12.29	6.08
0.5	710 µm	47.1	22.26
1.0	500 µm	121.84	57.00
1.5	355 µm	171.55	80.11
2.0	250 µm	194.79	90.91
2.5	180 µm	206.16	96.19
3.0	125 µm	210.97	98.43
3.5	90 µm	213.17	99.45
4.0	63 µm	213.81	99.75
>4.0	<63 µm	214.35	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	SM06	Gravel Mass = 25.6 g	
Date	25-Sep-08	Remaining Mass = 1815.54 g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	25.6	1.39
-0.5	1.4 mm	6.65	4.25
0.0	1.0 mm	18.89	9.52
0.5	710 µm	46.18	21.27
1.0	500 µm	115.7	51.19
1.5	355 µm	181.49	79.51
2.0	250 µm	219.75	95.98
2.5	180 µm	227.69	99.40
3.0	125 µm	228.78	99.87
3.5	90 µm	228.97	99.95
4.0	63 µm	229.03	99.98
>4.0	<63 µm	229.08	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Table E10 Cumulative frequency grain size distributions for bulk bed material samples collected in the Swift Creek catchment for 2009

Sample	ET05	Gravel Mass = 105.06 g	
Date	11-Dec-09	Remaining Mass = 2520.51 g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	105.06	4.00
-0.5	1.4 mm	5.56	6.49
0.0	1.0 mm	13.82	10.18
0.5	710 µm	28.52	16.75
1.0	500 µm	71.04	35.75
1.5	355 µm	128.86	61.59
2.0	250 µm	176.66	82.95
2.5	180 µm	202.7	94.58
3.0	125 µm	211.56	98.54
3.5	90 µm	213.68	99.49
4.0	63 µm	214.42	99.82
>4.0	<63 µm	214.82	100.00

Folk (1974) Texture Group: Slightly granular medium sand

Sample	UMGW	Gravel Mass = 11.58 g	
Date	11-Dec-09	Remaining Mass = 2652.6 g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	11.38	0.43
-0.5	1.4 mm	2.01	1.58
0.0	1.0 mm	8.29	5.16
0.5	710 µm	28.96	16.97
1.0	500 µm	93.48	53.82
1.5	355 µm	149.31	85.70
2.0	250 µm	169.38	97.17
2.5	180 µm	173.36	99.44
3.0	125 µm	174.04	99.83
3.5	90 µm	174.24	99.94
4.0	63 µm	174.31	99.98
>4.0	<63 µm	174.34	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	UM04	Gravel Mass = 12.34 g	
Date	11-Dec-09	Remaining Mass = 2204.97g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	0.00	0.00
-1.0	2.0 mm	12.34	0.56
-0.5	1.4 mm	2.12	1.82
0.0	1.0 mm	8.87	5.86
0.5	710 µm	28.76	17.75
1.0	500 µm	88.40	53.39
1.5	355 µm	141.82	85.32
2.0	250 µm	161.75	97.23
2.5	180 µm	165.49	99.46
3.0	125 µm	166.18	99.87
3.5	90 µm	166.33	99.96
4.0	63 µm	166.39	100.00
>4.0	<63 µm	166.39	100.00

Folk (1974) Texture Group: Slightly granular coarse sand

Sample	SM06	Gravel Mass = 123.78 g	
Date	25-Sep-09	Remaining Mass = 2059.52 g	
Phi		Mass (g)	Cumulative %
-3.25	9.5 mm	0.00	0.00
-2.0	4.0 mm	0.00	0.00
-1.5	2.8 mm	41.99	1.92
-1.0	2.0 mm	123.78	5.67
-0.5	1.4 mm	10.83	12.09
0.0	1.0 mm	24.87	20.40
0.5	710 µm	43.56	31.48
1.0	500 µm	77.10	51.35
1.5	355 µm	107.84	69.56
2.0	250 µm	134.17	85.16
2.5	180 µm	150.09	94.60
3.0	125 µm	156.91	98.64
3.5	90 µm	158.56	99.61
4.0	63 µm	158.94	99.84
>4.0	<63 µm	159.21	100.00

Folk (1974) Texture Group: Gravelly coarse sand

Table E10 Cumulative frequency grain size distributions for bulk bed material samples collected in the Swift Creek catchment for 2009 (Continued)

Sample	**SM06**	**Gravel Mass = 29.69 g**	
Date	**18-Dec-09**	**Remaining Mass = 1795.22 g**	
Phi		**Mass (g)**	**Cumulative %**
-3.25	**9.5 mm**	0.00	0.00
-2.0	**4.0 mm**	0.00	0.00
-1.5	**2.8 mm**	0.00	0.00
-1.0	**2.0 mm**	29.69	1.63
-0.5	**1.4 mm**	4.53	3.20
0.0	**1.0 mm**	12.35	5.93
0.5	**710 μm**	28.98	11.72
1.0	**500 μm**	83.84	30.83
1.5	**355 μm**	159.13	57.05
2.0	**250 μm**	228.52	81.22
2.5	**180 μm**	264.08	93.60
3.0	**125 μm**	276.67	97.99
3.5	**90 μm**	280.33	99.26
4.0	**63 μm**	281.46	99.66
>4.0	**<63 μm**	282.45	100.00

Folk (1974) Texture Group: Slightly granular coarse sand