



Parapara River Flows

Flow Information Update: 17 July 2006

Prepared For

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Introduction

This report attempts to address the low flow issues associated with the Parapara River. Data presented herein, updates and follows on from previous Envirolink reports as listed below:

Estimate Of Longer Term Parapara Dam Flows: 28 July 03

Updated Estimate Of Longer Term Parapara Dam Flows: 6 October 2003

Estimation Of Parapara At Dam Flows: 17 February 2004

Parapara River Flows, An Update of Flow Information: 26 July 2005

Data Collection

Continuous flow records have been collected from the Parapara River at a site located 10 metres upstream of the old goldmine dam constructed in the late 19th century. Data extends from 17 May 2003 through to present day with a few periods of missing record as specified in Table 1. The initial recorder was removed in December 2003 but was later reinstated in August 2004. This recorder is still operational, adding further valuable information to the database.

Table 1: Missing record periods and comments

Start Date	End date	Comments
28 Dec 03	1 Aug 04	Recorder removed, but later replaced in August 2004
7 Sep 04	6 Oct 04	Recorder memory overload
26 Jan 05	25 Feb 05	Recorder memory overload
17 Jun 05	27 Jul 05	Recorder memory overload

These periods of missing record do not span any episodes of significant low flow.

Site Information and Flow Measurements

There are several sites on the Parapara River that are gauged at various times but the two uppermost sites are the most frequently visited (see Figure 1). These two gauging sites are adjacent to the waterlevel recorder which is downloaded each visit. Gaugings are usually carried out above and below the dam to check for any possible losses to groundwater or under the dam (see Table 2).

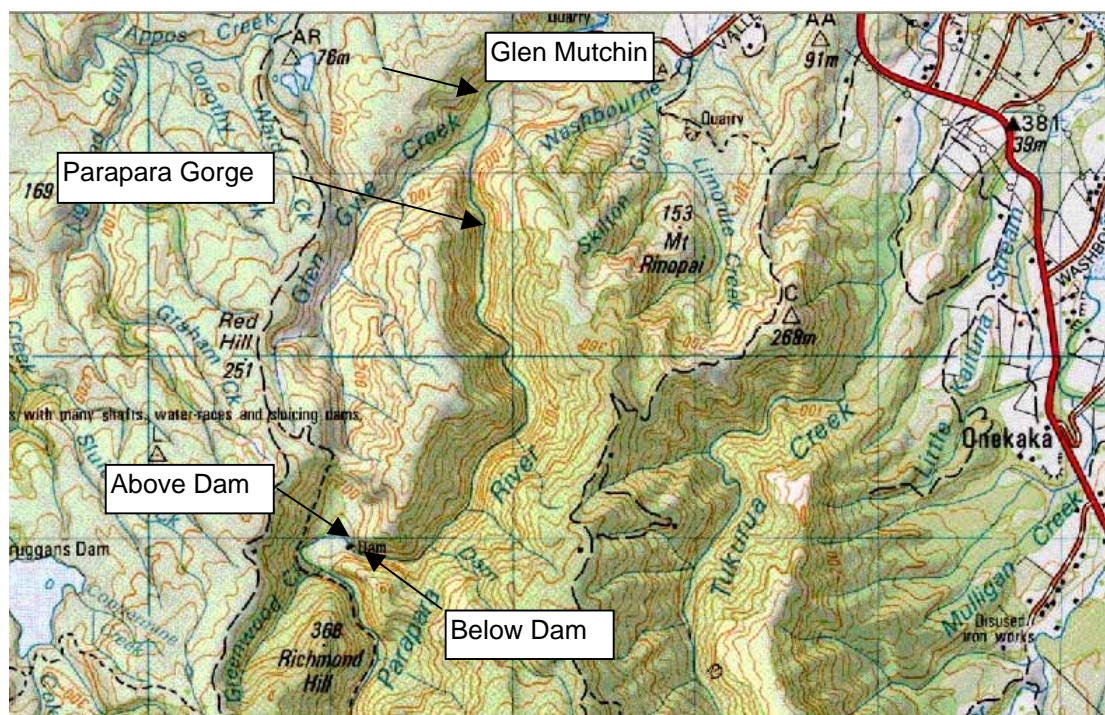


Figure 1: Site location map

Table 2: Summary of all gaugings in the Parapara catchment to date (l/sec)

Date	Time	Parapara Above Dam	Parapara Below Dam	Parapara Gorge Above Glen Gyle	Glen Gyle at Parapara	Parapara at Glen Mutchin	Onekaka Dam
27-May-02	1325		747				199
16-May-03	1440	380				492	94
27-Jun-03	1405		604				204
23-Jul-03	1405	490					136
29-Aug-03	1100	1119					357
23-Sep-03	1115	1214					449
4-Nov-03	1147	1385					
28-Dec-03	0951	11193					
9-Jul-04	1250	965					466
7-Sep-04	1330		633	886	34		167
26-Jan-05	1610	535	421				
17-Jun-05	1205	351	379				78
10-Nov-05	1000	309	331	401		407	44
11-Jul-06	1430	575	524				

Parapara Flow Assessment

The data from the Parapara River spans a period of 3 years with instances of missing record. Whilst this is valuable information, there is not the long-term data available to accurately assess hydrological patterns and characteristics of the Parapara catchment.

In circumstances like these, it is a common procedure to correlate data collected so far with a more robust long-term record from an adjacent or nearby catchment. In this case, Onekaka River has been selected for correlative purposes and relevant gaugings from the Onekaka are presented in Table 2. The Onekaka recorder has been in operation since August 1998. There are no comparative gaugings in the Onekaka to compare for 2006, thus the correlation remains as it was for the previous report. Further correlations may be possible with Onekaka once generation flows are known.

The recently downloaded data (July 2006) indicates periods of low flow during November/December 2005 and March 2006 (see Figure 4). Whilst these flows are the lowest recorded in the catchment, they should not significantly alter the low flow statistics produced in Table 3. Figure 4 also shows the flashy nature of the catchment, with an average interval of about 10 days between storms.

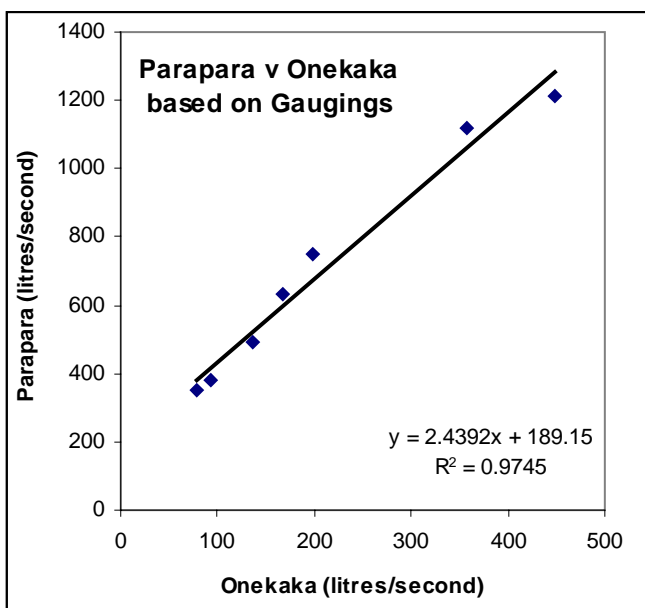


Figure 2: Parapara v Onekaka correlation, low flows only

The correlation developed using the flows from the two catchments indicates that a good relationship is present and places confidence in the derived formulae. This equation is applied to the Onekaka record to produce a good estimate of the low flow scenarios in the Parapara River (Table 3).

Table 3: Derived low flow statistics for Parapara at dam based on correlations with Onekaka

Site Name	Min	MALF	5yr LF	10yr LF
Onekaka (Pre Gen) (Aug 97 to Oct 03)	49	61	55	51
Parapara at Dam	312	337	323	313

As this correlation is based on gaugings carried out during low to medium flow conditions, it not suitable for estimating high flow statistics. These values are estimated using catchment areas and assuming similar rainfall patterns. Data is presented in Table 4.

Table 4: Derived high flow statistics for Parapara at dam based on correlations with Onekaka

Site Name	Max	Mean	75%	Median	25%	5%
Onekaka (Pre Gen) (Aug 97 to Oct 03)	12657	468	114	223	436	1997
Parapara at Dam	67918	2465	468	1149	2295	10673

Other Flow Information

1. On 7 September 2004 gaugings were carried out at the dam and the lower end of the gorge (above Glen Gyle confluence), and in Glen Gyle itself to try and assess the natural inflows through the gorge (Refer Table 1).

The gaugings indicated a significant inflow between the dam and the Glen Gyle confluence of 253 l/sec on that day. This apparent inflow was surprisingly high considering the local topography and only three small tributaries between the two sites. Four possible reasons were considered for this.

1. Gauging error due to the poor gauging cross section in the Gorge
2. Gauging error at the dam site (below the dam). Neither gauging cross sections were ideal.
3. Leakage under the dam.
4. Resurgence flows somewhere in between (extensive marble formation exists in the catchment).

Gaugings were checked and appeared acceptable within the constraints of conditions available. Up to 10% error could be attributed to the poor gauging conditions. A further three pairs of gaugings above and below the dam were carried out to check for dam leakage. The first pair (refer 26 January 2005 in Table 1) suggested significant leakage, the second pair indicated no significant leakage (17 June 2005), while the third pair (11 July 2006) also confirmed no significant leakage or flow loss. This discounts the earlier contention that leakage may show up only at higher flows (above 600 l/sec) such as on 7 September and 26 January. The two downstream gauging runs can be considered:

- a. The gauging pair on 16 May 2003, when the flows were low, showed a gain of 112 l/sec (29%). The Glen Mutchin site is near the estuary and includes the three small gorge streams mentioned above, the Glen-Gyle Stream and a further minor tributary further down. Assuming Glen-Gyle Stream was only producing 20 l/sec that day (flow levels were generally 60% of the 7 September levels), and the four small streams produced a combined 20 l/sec, then 72 l/sec, or 19% of the dam flow, is unexplained, and strongly suggests resurgent flows.
- b. The gaugings 7 September, when flows were higher, show a gain down the gorge to Glen-Gyle of 253 l/sec (40% of dam flow). Assuming the three gorge tributaries contribute no more than 50 l/sec, then approximately 200 l/sec or 31% of the dam flow is unexplained.

At this point, and until further gaugings at low flows are carried out, the conclusion of the writers is that there is growing evidence that significant gains from unidentified sources (probably marble associated resurgences) are occurring below the dam. Due to access difficulties, Envirolink staff have not sighted the three small gorge streams to check for their contribution.

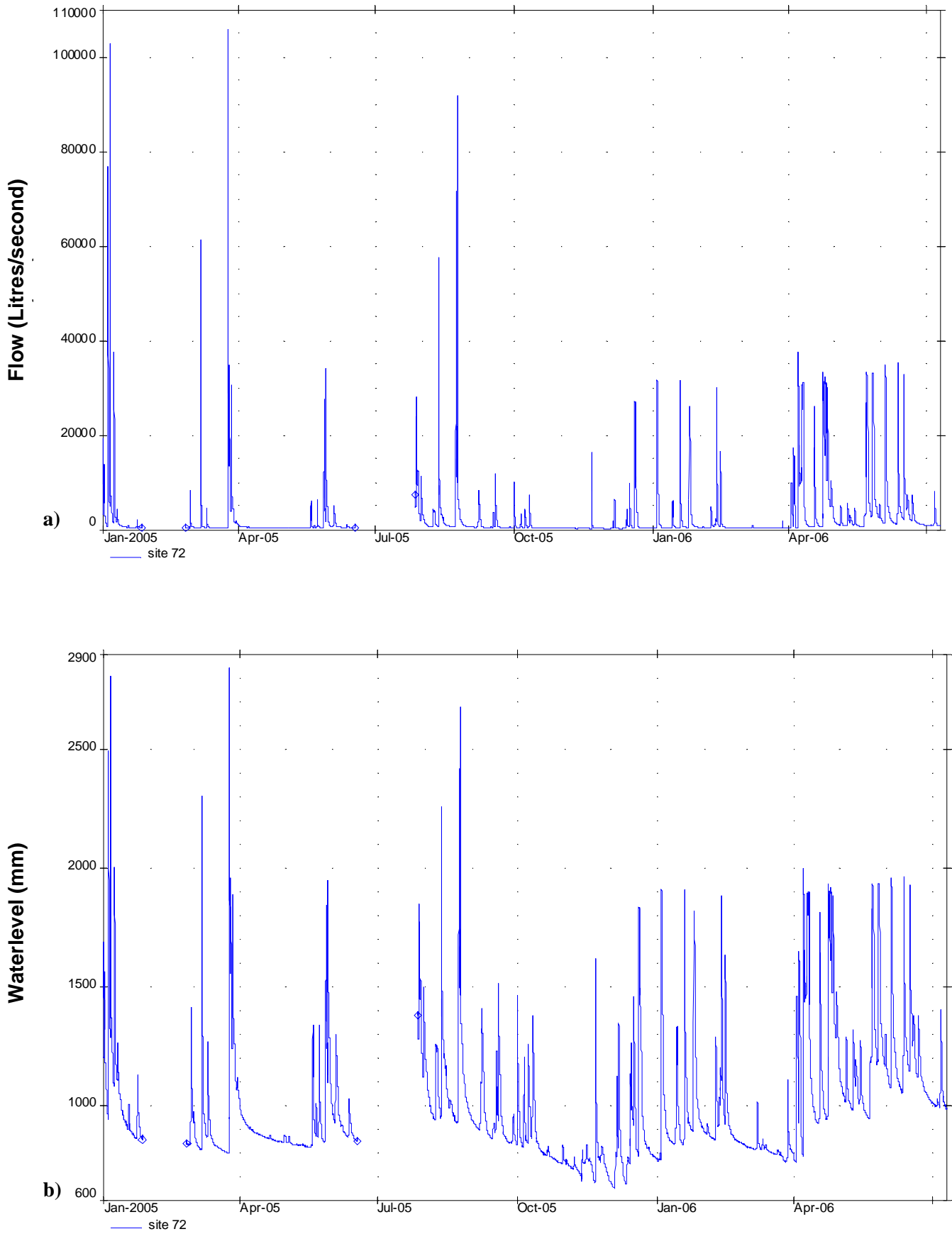


Figure 4: Recorded waterlevel in the Parapara River (a) and its derived flow (b)