

ASSESSMENT OF BASE FLOW IN CARNE CREEK

Clifton Coney Group

GEOTLCOV23056AA AW
December 2006

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Mr Tony Burg
Clifton Coney Group
Level 18, Citigroup Centre
2 Park Street
Sydney NSW 2000

Attention: Tony Burg

Dear Tony

RE: Emirates Luxury Resort, Wolgan Valley - Base Flow Assessment of Carne Creek

This report provides an assessment of base flow characteristics of Carne Creek, an upper tributary of the Wolgan River within the Wolgan Valley.

For and on behalf of Coffey Geotechnics Pty Ltd

Ross Best

Senior Principal

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1 INTRODUCTION

This report presents an assessment of the base flow characteristics of Carne Creek. The assessment was carried out to support studies of environmental impacts of the proposed development.

Carne Creek is a perennial water course which runs within a southern arm of Wolgan Valley and confluences with the Wolgan River, an ephemeral water course above this confluence which is in the vicinity of the proposed development area. The property is currently owned by the Webb Family who have had a lengthy association with the property and whose family have lived and farmed there since 1929, and owned the property since 1937.

2 SOURCE INFORMATION

Information used to enable base flow interpretation of the Carne Creek tributary have been derived from the following sources

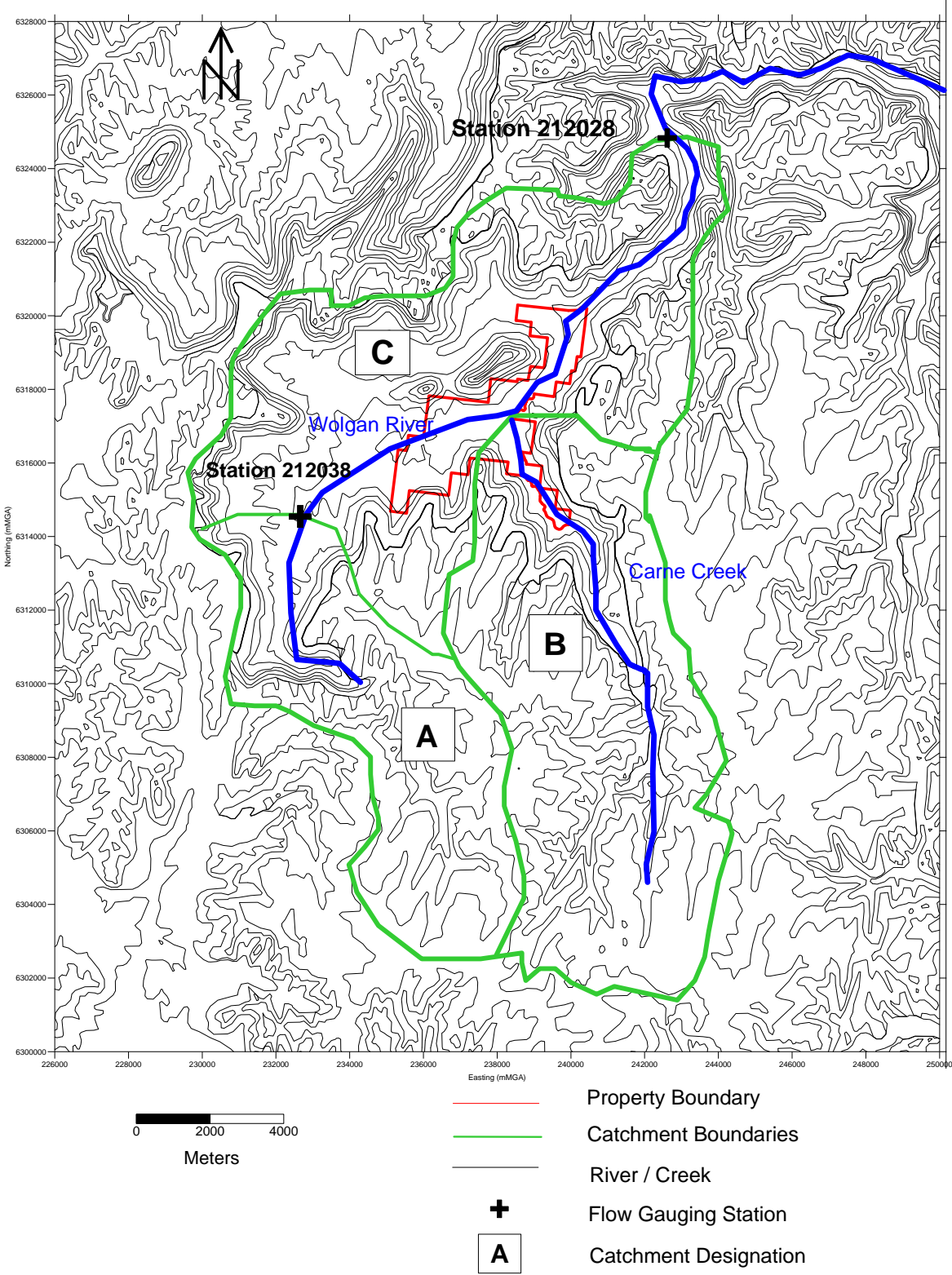
- River Gauging Stations records for 212028 (Wolgan River at Cape Pinnacle) and 212038 (Wolgan River at Newnes). Figure 1 shows gauging station locations and catchment boundaries.
- Topographical interpretation.
- Advice from Mr Nigel Webb, current resident of the Wolgan Valley property.
- Site assessment of flow in Carne Creek.

In a telephone interview with on 1st December 2006 Mr Nigel Webb, one of the current owners of the property advised Mr Rob Turner of Coffey Geotechnics that :

- He has worked the farm since 1979
- The Webb family have been involved with the property since 1929 and owned the property since 1937.
- Carne Creek has never stopped flowing since 1979 and Nigel has not heard of it ever stopping flow in the time since his family has been there.
- Flow stops in the western branch of the Wolgan River, but not in Carne creek
- The rate of flow was low in 1981, 19831 and 1992-94.
- The water in Carne Creek is always been of a good quality although the water quality in the western branch of Wolgan River is variable because of water from discharging mines.

It is noted by Mr Ross Best of Coffey Geotechnics during a site meeting on 17 October 2006 that Wolgan River was currently not flowing and Carne Creek was flowing at a rate of approximately 8 ML/day. The area is presently suffering the effects of an extended drought and this suggests that Carne Creek has the capacity to sustain appreciable flows.

Figure 1: Topographical map showing catchment boundaries and drainage features.



3 ANALYSIS OF FLOW GAUGING RECORDS

Figure 1 shows the catchment areas for Department of Natural Resources (DNR) gauging stations 212028 and 212038 as well as the sub-catchment area of the Carne Creek arm of the Wolgan Valley. Station 212028 located on the Wolgan River at Newnes and has a catchment area of approximately 238 km² and measures the entire flow characteristics of the Wolgan valley above this point which includes the upper Wolgan river and Carne creek respectively which flow through the proposed development property. DNR station 212038 located in the upper reaches of the Wolgan Valley has a catchment area 46 km² (21% of total catchment area of 212028) and the sub-catchment area which discharges to Carne Creek is 81 km² (38% of total catchment area for 211028).

For the purposes of discussion, three catchment areas have been identified in Figure 1:

- Catchment A – catchment of the Wolgan River above station 212038
- Catchment B – catchment of the Carne Creek above the confluence with the Wolgan River
- Catchment C – catchment of the Wolgan River above station 212028

Table 1: DNR Gauging Stations within Wolgan Valley and Catchment Areas.

DNR Gauge	Location	Catchment Area km ²	Catchment Codes
211028	Wolgan River - Newnes	238	A
212038	Wolgan River – Cape Pinnacle	46	B
N/A	Carne Creek	85	C

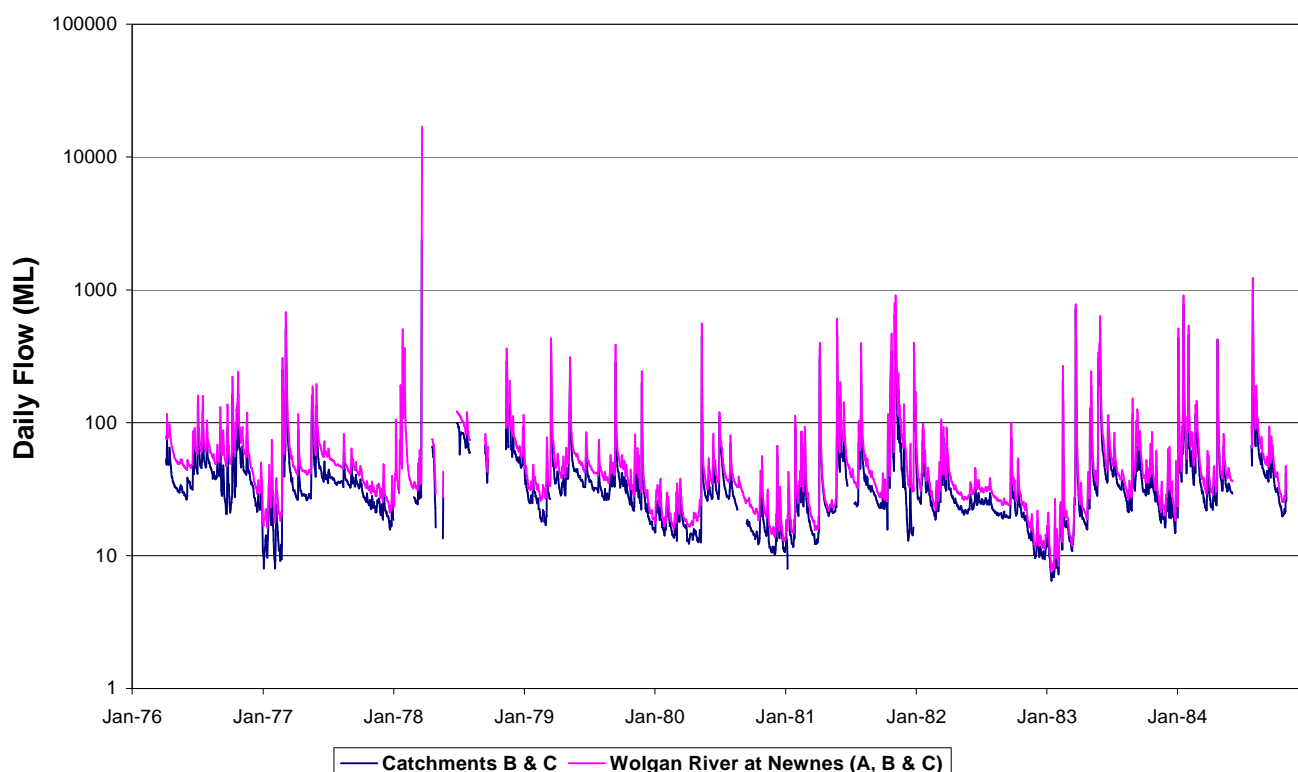
An analysis of stream flow gauging data from two gauging stations on Wolgan River (DNR stations 212038 and 212028, located upstream and downstream of the resort site respectively) indicates an average differential flow (that is, the difference between flow at these stations, or the water contributed by the land between the stations) of 42 ML/day over the period of record (1976 to 1985).

Figure 2 illustrates daily stream flow at the gauging site 212028 and also the calculated differential value for Catchments B and C for a period 1976 to 1985. The differential between the two gauging stations has been interpreted to represent flow predominantly from Carne Creek (catchment B) together with that from the Wolgan River between two gauging stations (catchment C). Low flow periods can be seen during 1977, 1980 and 1983 with the lowest recorded flow of 7 ML per day occurring 1983. Coffey staff (Mr Ross Best, 17 October 2006) have recently visually estimated flow in Carne Creek to be approximately 8 ML/day just upstream of its confluence with the Wolgan River which is consistent with the historical data given the area is being subjected to a lengthy dry period.

The Wolgan River is currently dry and this expected to have occurred historically during drought conditions. However, Figure 1 also shows some separation between the two data sets during the 1977 low flow period which suggests that there is a level of base flow of approximately 2 ML/day occurring

within the upper Wolgan River which is contrary to that which is seen today. A possible explanation for this is historical discharge from underground coal mines operating in this area which discharged into the upper reaches of the Wolgan River. Although there is no documented evidence of this occurring, it is supported by the observations of the Webb Family who observed historical poor quality water flows within the Wolgan River above the confluence with Carne Creek.

Figure 2: Daily stream flow at 212028 (Wolgan R. at Newnes) and Calculated Flow within Carne Creek.



4 ASSESSMENT

Flow attributed to Catchments B and C was recorded as having a low base flow of 7 ML/day in February 1983. This time corresponds to a low flow period recalled by Mr Webb during his 27 year involvement with the land. The proportion of this flow originating from Carne Creek is not measured but from available information, Coffey assess flows from Carne Creek would comprise more than 50% of the base flow from catchments B and C. On this basis, base flow in Carne Creek during periods of low rainfall is assessed to be greater than 3.5 ML/day.

This assessment is based on the interpretation of an eight year record of measurement. However, it is possible that lower base flow could occur under extended drought conditions, more severe than experienced over the monitoring period.