Some Causes of Erosion and Sediment Deposition in the Lower Reaches of Cubberla Creek and Photopoint Monitoring of Change

By Ray E. Kelly

Ray Kelly holds a Master of Environmental Science from Griffith University. Ray has had a professional career in the field of land and catchment management. When with the Soil Conservation Authority in Victoria he was responsible for reporting on the condition of the large Hume Catchment and for the management of alpine land. His experience in land resource studies was applied in assisting the Land Conservation Council in determining land-use for all public lands, and in the planning for the Albury-Wodonga Development Area. In Queensland, Ray was responsible for planning environmental monitoring and land rehabilitation programs in the Bowen Basin coalfields, and for environmental studies Australia-wide. Since retirement, he maintains a hands-on involvement with water sampling and analysis for WaterWatch and with mapping. He is also keenly interested in the sport of orienteering as well as other community projects.

Abstract

The need for water from Cubberla Creek was recognised in early 1800s when land in the catchment was opened for agriculture. Early plans show that the creek was used as a property boundary to provide access to farm water. The survey plans show accurately the alignment of the creek.

With change to urban land use, serviced water supply was provided, and the creek was used for storm water disposal. Modifications to the creek alignment were made by piping and straightening to accommodate this different use of the land. One meandering section was shortened to nearly half of its original by the construction of a straight channel. The new course increased the bed gradient and caused erosion and sedimentation problems in the lower creek reaches

The paper documents some of the changes and describes a photopoint monitoring program.

Introduction

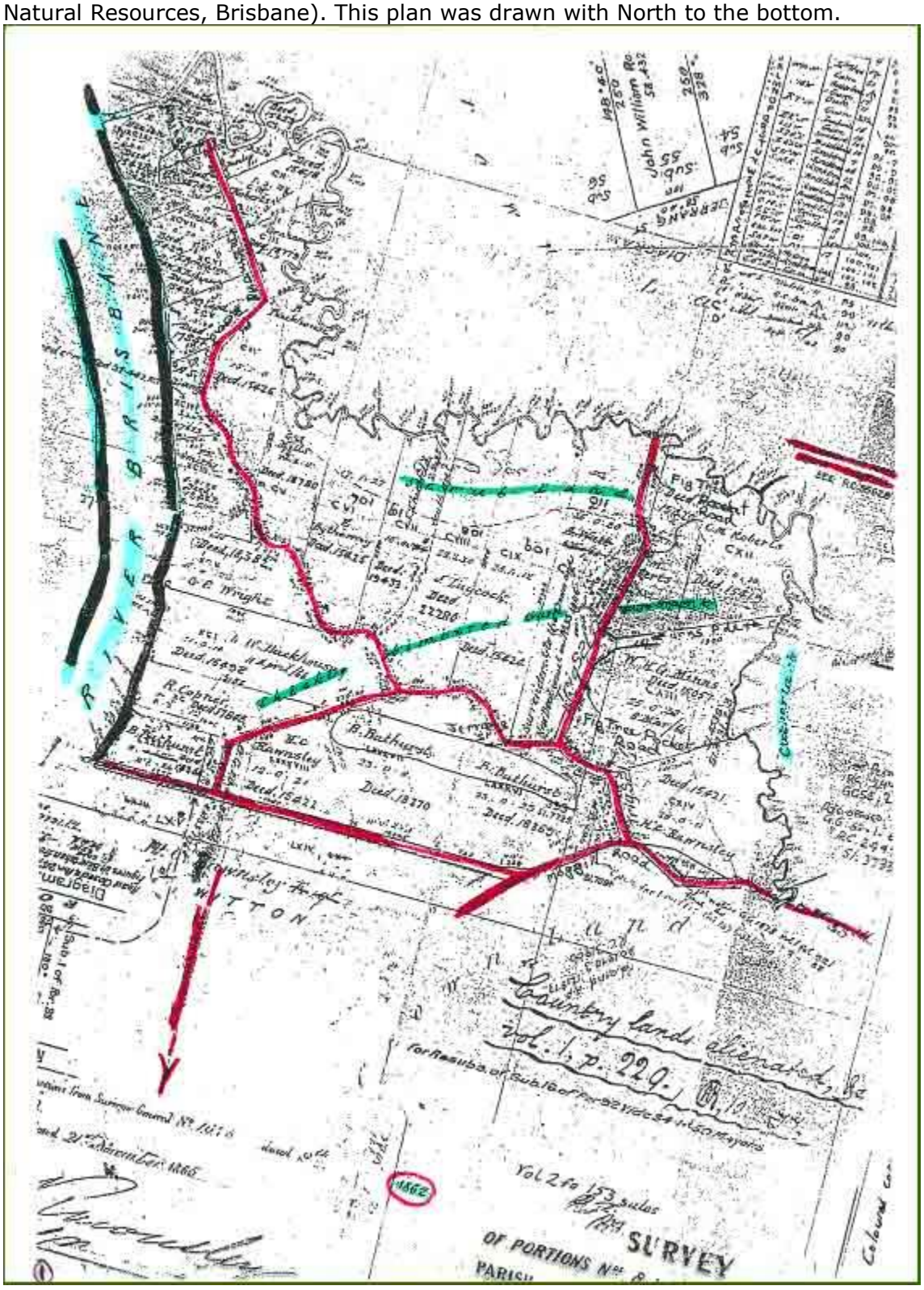
In a recent paper Robin Trotter (Trotter unpublished) shows some of the earliest surveyed maps of sections of Cubberla Creek (**Fig. 1**). Survey plans, dated 1862, show the alignment of the creek as the boundary of property titles from the Brisbane River to Moggill Road. Recent aerial photography, and of course visual observation, shows that the creek, for most of its length, flows in locations created by realignment, diversion and other engineered works.

In the lower reaches, and in the area that has become known as Rainbow Forest, the stream closely follows the course shown on the early maps. The forest remnant in that section, of approximately 8.25ha, contains a valuable vegetation source and clues to the original stream ecology. The area is now heavily infested with introduced trees (Chinese elm and camphor laurel) and other weeds.

From Rainbow Forest to Moggill Road the creek has been realigned since 1965, to allow for recreational uses. Through Cliveden Park, between Centenary Highway and Rainbow Forest, the stream has been straightened and its length reduced to 55% of the original. There is no evidence to suggest that there has been any major change in stream bank height and reference to detailed contour plans shows a 5m elevation difference between the eastern and western boundaries of Cliveden Park. Earthworks associated with the creek realignment would certainly have affected the stream bed heights. The assessment of the effects of this work is based on a figure of 5m hydraulic head existing at the park extremities.

Detailed measurements of the stream course from the early plans indicate that the bed length in 1862 was approximately 1224 metres. It is not known when the realignment work was done but debris exposed by erosion of the creek bank in December 1996 show plastic fertilizer bags of a design that was known to be used in the 1960s (**Fig. 2**). Cliveden Estate was established early in the 1960's and the development brochure has an aerial oblique photograph that shows Centenary Highway under construction; at that time the creek was in its original course (**Fig. 3**).

Fig. 1 Survey map showing portion of Cubberla Creek 1862 (Source: Department of Natural Resources, Brisbane). This plan was drawn with North to the bottom.



A survey of the line of the creek in 2000 shows that the length of the new channel through Cliveden Park is now 673 metres. The present length is 45% of that 140 years ago. By reducing the length whilst retaining the hydraulic head the overall gradient of the stream has been increased from 1:245 (or 0.41%) to 1: 135 (or 0.74%). A result of the steeper

gradient is that water flow is faster and its extra energy has the ability to cause accelerated erosion of the creek bed and banks (**Fig. 4**). Through recent years this erosion has been very apparent along the creek. Erosion usually takes the form of deepening of the bed or undermining of the banks with the mobilised sediment being transported by the water. When the sediment load increases water velocity will decrease to a point where sediment is released and velocity then increases to a speed at which it will cause erosion again. This explanation may be over simplified but the erosion / deposition, or deepening / aggrading process has been observed through the last few decades. The present situation is that for most of its length through Cliveden Park the bed and banks are relatively well vegetated and erosion is not greatly active. This stability could be changed by flood events during the coming wet season.

Rainbow Forest is relatively well vegetated, and has a stream gradient of 1:500 (or 0.2%) (**Fig. 5)**. High stream flows that pick up and carry both sediment and rubbish through Cliveden Park rapidly slow down in Rainbow Forest and the load is deposited just inside the Forest. Large vegetation weirs build up from flood flows and plastic and other consumer rubbish is deposited. Sand and gravel deposition beds that were visible at the upper section of the Forest are now to be seen at least 600 metres downstream. The ecology of forest stream environment is thus being changed from a clay bed to a sandy / gravelly bed, and may result in a change in the local aquatic communities.

Local interest in lower reaches of the creek and adjacent land was consolidated about 6 years ago when 'Friends of Cliveden Park and Rainbow Forest' was formed at a meeting convened by Brisbane City Council. 'The Friends' have had a significant input to Council planning and determining land use for the area. At about the same time the Rainbow Forest Experimental Area became active in selecting a section of the forest and then removing all exotic vegetation from that area. This work has been most valuable in showing the diversity of the native vegetation.

During the Bicentennial Year, 1988, a study was made of the Land of Fig Tree Pocket (Kelly 1988) in which a photograph was shown of a foot-bridge over Cubberla Creek at Cliveden Park (**Fig. 4**). This bridge was undermined in a flood and a replacement was built about 15 metres downstream. The northern abutment concrete block was left *in situ* when the new bridge was built. A photo taken in December 1994 shows the remains of the north side abutment or foundation of the old bridge (**Fig. 6**).

A project was started, in 1995, to record sequentially any change that occurred along the creek between Centenary Highway and the south end of Rainbow Forest (**Fig. 8)**. Seven sites were selected at which photographs have been taken during the first week of each odd numbered month. Photos are obtained at those times and no variation is made to coincide with events such as flood or drought although those special events are also recorded separately. The photopoints are located at-

Site 1- Centenary Highway looking east.
Site 2- Foot-bridge, upstream.
Site 3- Foot-bridge, downstream.
Site 4- Creek bend at Laurel tree, upstream.
Site 5- Upper Rainbow Forest, downstream.
Site 6- Lower Rainbow Forest, upstream.
Site 7- Lower Rainbow Forest, downstream.

Over the six years it has been found that little or no change occurs at Sites 6 and 7 and photos are now taken at irregular intervals, because of the stability of the creek in this locality. The photopoint at Site 1- downstream from Centenary Highway, was changed in 1998 when noise barrier fences obliterated the view. Since the construction of the Bikeway bridge in 2000 the site has been re-established in a similar position.

Fig. 2 Fertilizer bag from 1960s embedded in eroded banks. Photograph taken 1996.

Fig. 4 Eroded creek banks - Cliveden Park. Photograph taken 1988

Fig. 3 Aerial view of Cliveden Park. (Source: *Cliveden Estate Development Plan*)

Fig 5. Diagram showing changes in gradients associated with straightening of the creek.

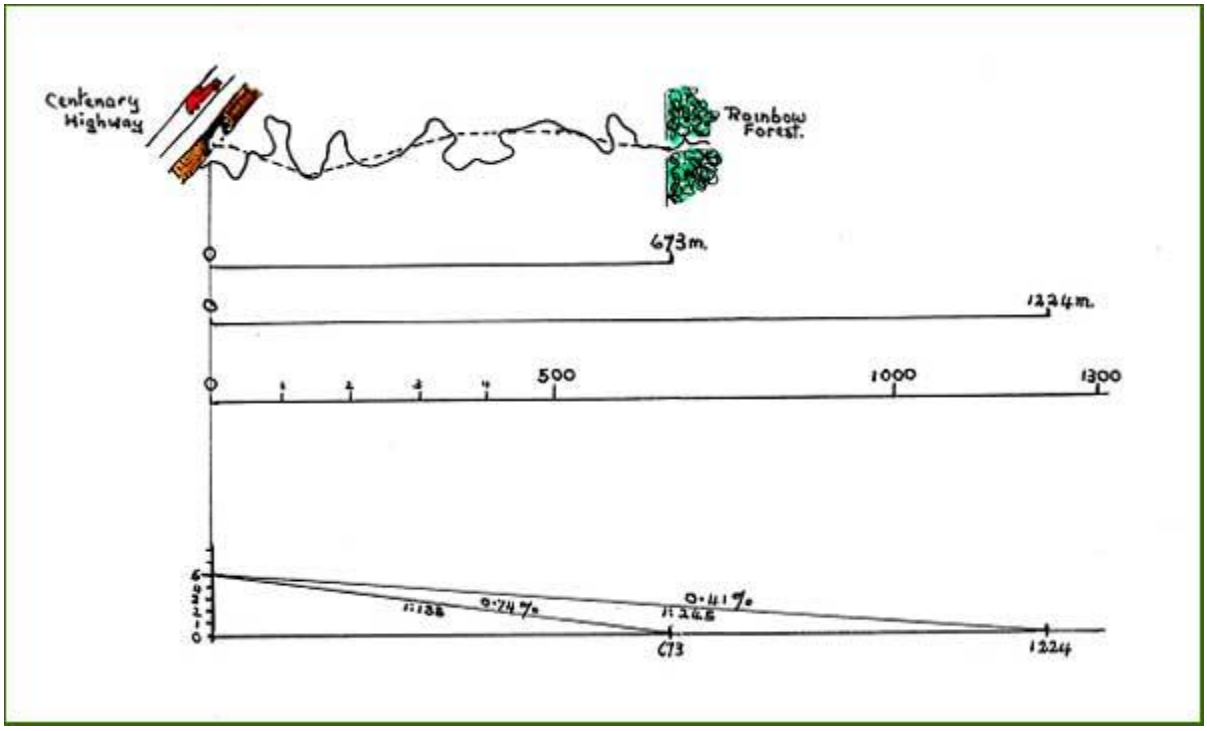
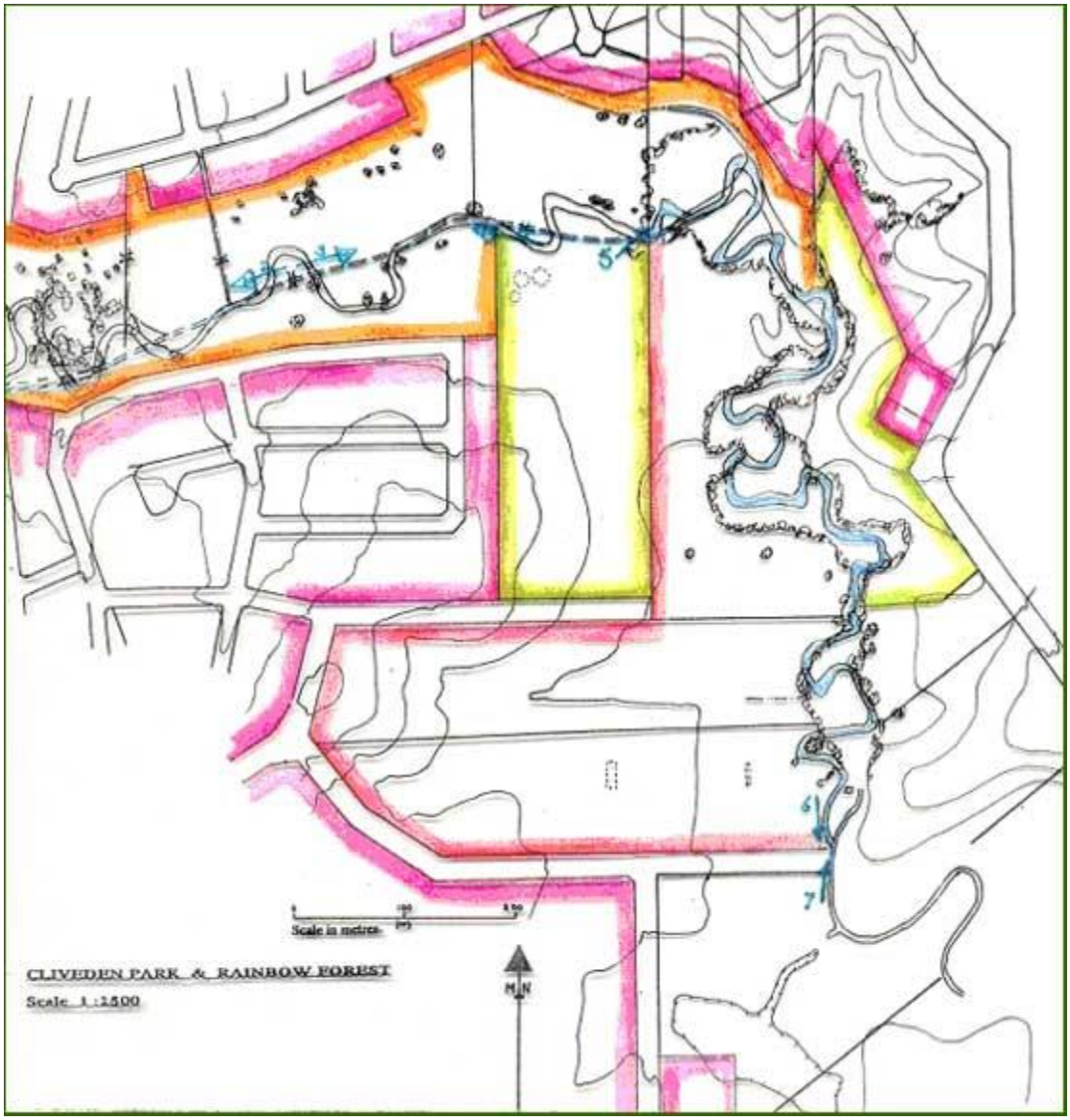


Fig. 6 Remains of foundations of first bridge

Fig. 7 Photopoint monitoring points

Note: Photopoint number and direction are indicated with No (1). and an arrow indicating the direction of photograph



Cubberla Creek Photograph Points Frequency		# Wet season photos (regular_ + Wet season photos (if required) # Dry season photos	
Wet Season		**Dry Season**	
October		**April**	
November	#	**May**	#
December	+	**June**	
January	#	**July**	#
February	+	**August**	
March	#	**September**	#

Fig. 8-16 Photopoint records of creek, 1995-2001

Fig. 8 July 1995 - Minor erosion of the north bank. Concrete block of the old bridge

Fig. 9 May 1996 High flood - similar to flood in late January 1996

Fig. 10 July 1996 - severe bank erosion. Photopoint changed slightly to reposition the concrete block

Fig. 11 March 1997 bed of creek deepened by 700mm and bank being undercut

Fig. 12 July 1997 Erosion control work placed to stabilise the north bank. concrete block used as a position reference was removed during these works

Fig. 13 July 1998. with the establishment of *Phragmites australis* the creek bed is vegetating

Fig. 14 July 1999. Some high creek flows were experienced.

Fig. 15 July 2000. A well established revegetated creek bed against the rock lined north bank

Fig. 16 July 2001. Kikuya grass on north bank and established *Phragmites* provides protection.

The most useful photopoint sites to show change in the creek have been Sites 2 and 3 located at the foot-bridge (**Figs. 8-16**). A selection of the photographs from Site 2 shows the dynamics of the creek in that area.

The photopoint monitoring will continue at these sites to record change in future years. With the ability now available to scan and digitise such records they can be processed to a form where professionals, planners, historians etc can access them. Frequent requests are now made for this information, and this involves a considerable input to locate films and have prints made.

Conclusion

Any change that is made within a catchment will have effects, beneficial or otherwise. Such changes may be immediately apparent, or, conversely, it may be many years before a reaction is evident. By seeking out and making information available the resultant greater understanding of cause and effect can be of enormous benefit.

Catchment monitoring is not only taking photographs, analysing water quality, identifying flora and fauna, or recording history etc. but also it involves a multi-spectral interest from the community and the ability to use information to make sound environmental decisions. This does not mean restricting the use of land but understanding the consequences of change and the ability to prevent or minimise any degrading effects.

Bibliography

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Source: Robin Trotter (ed.), *Cubberla and Witton Creeks, Their physical characteristics and land use over time, Proceedings of Symposia held in 2000 and 2001 on the Cubberla and Witton Creek Catchments,* 2001 Brisbane, Cubberla-Witton Catchments Network.