

22 September 2014

The Manager, Engineering

Private Bag 1954

Dunedin

Attn. Ramon Strong

Dear Ramon:

Clutha River Track, Albert Town

Introduction

The following comments are in response to your request for detailed observations of a slipped area about 240 m upstream of the SH 6 Albert Town bridge true right abutment. The brief was received by email dated 19 September 2014 and had attached a recent survey of river bed and river banks that compared with earlier surveys dated 2003 and 2004.

In the intervening time, buttressing and armouring of the true right bank has been undertaken in response to slope movements immediately upstream of the bridge in 2003 and further slope movement has occurred in the area 240 m upstream of the bridge in 2013. The latter incident was reported to QLDC's contractors (Asplundh) in our letter dated 17 July 2013 (also forwarded to you). Additional movement has since been noted this winter.

Current Observations

There is some evidence for renewed or ongoing activity since our previous inspection 14 months previously. There seems to be an increase in lateral scarp heights where they cut the track, however, this is a subjective assessment. On this occasion, scarp heights of 1200 mm (upstream end) and 350 mm (average, downstream end) were measured. A new rear scarp had developed a metre upslope from the previous rear scarp with a combined displacement of up to 0.5 m.

No evidence was found for any disturbance of the terrace surface to the rear or any lateral extension along the track.

It was noted that heavy rock armouring had been placed on the river bank from approximately Ch 90 downstream to the bridge (see Figure 1). From the surveyed cross sections (e.g. Ch 100), the armouring reaches down to around RL 370 compared to the deepest part of the channel which is at RL 367.45. Upstream of Ch 90, the river bed appears to be lined with cobbles up to 300-400 mm in a fine grained matrix.

Causes of Failure

The location of the slip on an oversteepened slope facing the outside bank of a bend in the river appears to have played a significant role in slip development through gradual removal of toe material. Scouring and bank oversteepening would play a key role in initiating failure. However, no evidence for scouring could be seen in the parts of the river channel nearest the bank although the deepest part of the channel was not visible. The survey comparisons (see below) of the river channel were of limited extent and inconclusive.

Ground saturation following prolonged or heavy rainfall is a known trigger in initiating slope failure and is likely to have been a contributing factor. No evidence was found for elevated groundwater levels in the vicinity of the slip. Given the proximity of the gully to the west and its role in drawing down the local groundwater table, it would seem that an elevated water table is an unlikely cause of failure.

Groundwater could be temporarily raised during times of flooding and left elevated as river levels fall faster than groundwater can recede. A recommendation to install counterfort drains to assist drainage was made in our earlier report but has not been implemented to date.

Comparison of Survey Results

The recent survey by TL Survey Services of the banks and other features took place on the 26 and 27 May and the echo sounding survey was undertaken on 13 June of this year. The recent hydrographic survey does not extend as far upstream as the full width of the slip such that comparisons with earlier surveys cannot be made within much of the river channel lying opposite the slip.

No meaningful movements could be discerned on either the terrestrial part of the terrace riser or that part of its river channel extension which has been surveyed. The small changes indicated by the surveys are within the bounds of survey error or can be accounted for by differences in accuracy between the two surveys. It is possible that further movement has occurred since the date of the recent survey but the magnitude of such (as determined by field inspection) would be small compared to the overall movement.

Further Monitoring of Slip Movement

Several surface markers have been installed along the axis of the slip from which steel tape measurements can be taken. The positions of these markers are shown on Figure 2. Measurements taken on 19 September were as follows:

Peg 1 – Peg 2	7.749 m
Peg 2 – willow tree	8.720 m

Measurement accuracy is probably of the order ± 2 mm.

Conclusion

The slip has developed in an area of weak sediments subject to river scouring and only partially protected by man-made armouring. Movement appears to have continued by small amounts since the previous inspection 14 months ago with ongoing downslope displacement and retrogression of the rear scarp. There appear to be no immediate threats to either track users or to property owners on the terrace above.

Survey comparisons over the last ten years have not provided any meaningful results with regard to slip movement or causes of failure. Further surveys are likely to provide more accurate results due to the improved techniques now available. It is recommended that future hydrographic surveys be extended upstream to Ch 30 to provide more information on channel changes below the slip. Repeat tape monitoring of surface markers is likely to provide the best information on slip displacement in the near future.

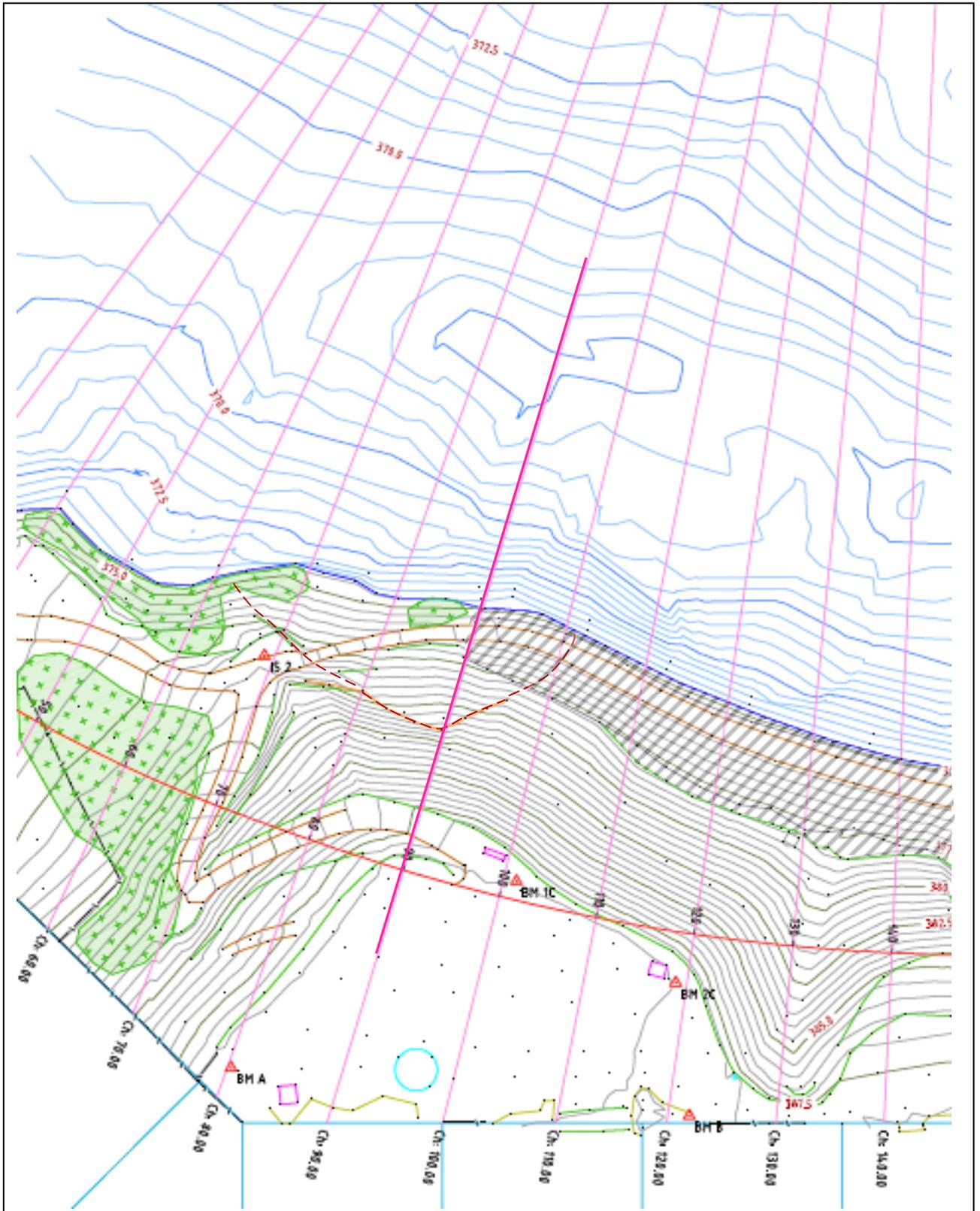
Sincerely,

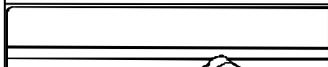
Geoconsulting Ltd



per J.M.Bryant

M.Sc. F.G.S.



	<p>PROJECT: Clutha River Track; slip between Ch 60-100</p>	<p>FIGURE: 1</p>
<p>JEFF BRYANT GEOCONSULTING LTD</p>	<p>DESCRIPTION: Slip scarp marked by red dashed line. Overbank armouring marked by hatched area. See Figure 2 for section line along Ch 90.</p>	<p>Scale: 1:666.67</p> <p>Report:</p> <p>Date: 23/09/2014</p>

