



Client Name: **Treble Cone Ski Area**

Report: **May 2018 Annual Bridge Inspection Report & Review of Bluffs above**

Site Address: **Treble Cone Ski Area Access Road, Wanaka**

BMC Reference: 1105-1197



Date Issued: 10 July 2018

Treble Cone Ski Area

2018 Access Road Annual Bridge Inspection Report & Review of Bluffs above

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Rev. No	Date	Description	Prepared by	Reviewed by
A	10/07/18	First Issue	GRM	

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Bridge Inspection Report Treble Cone Ski Area Access Road, Wanaka – June 2018.



Photo 1 – new no stopping sign (uphill approach)



Photo 2 – Speed/weight limit (uphill approach)



Photo 3 – Speed/weight limit (downhill approach)



Photo 4 - signage (downhill approach)

1. INTRODUCTION

It is noted that a new management team is in place including Operations staff and it is therefore important that the new staff become familiar with previous reports and the Inspection regime for both the Bridge & the Bluffs rock face (2017 Inspection Report to be sent with the 2018 report).

David Rutledge (new Head of Assets & Operations at Treble Cone Ski Area), requested that BMC Ltd carry out an inspection of the existing road bridge on the access road to Treble Cone Ski Area and also an inspection of the Bluffs (with Geotech input), directly adjacent the bridge using drone technology (drones introduced 2016).

This was carried out on Friday 8 June 2018 by Graham McDougall, Chris Mawson (BMC) & Leon Gerrard (of Geosolve who are responsible for the rock Bluffs area).

Previous Inspections have been carried out in June 2006 by McDougall Consulting & BMC Ltd in June 2009, May 2011, June 2012, Jan 2013, Oct 2013, May 2014, May 2015, May 2016 and May 2017. Geosolve have also carried out a number of inspections in conjunction with and independent of the BMC reports with particular focus on the rock bluff area above the bridge which has been prone to minor rock falls.

The previous year's report (May 2017) recommended a number of specific remedial actions as listed below (items actioned/instructions completed in **red** below).

1. *Ensure 'Weekly Visual Inspection Process' of Bridge abutment area (and adjacent bluffs) is carried out as per previous winter season. Inspection Record Sheets to be filled in and collated. **Advised this was actioned by Paulien Leijnse via email on 13 June 2017.***
PLEASE NOTE: Specific rock Bluffs areas are to be viewed from the road and to be particularly noted in the weekly inspection (and/or after significant rain/snow events).
2. *Regrade gravel thickness on timber bridge boards to approx. 150mm deep and ensure adequate height to top of outer wheel timber guard log / board to prevent car wheel riding up on this board. **Advised this was actioned by Paulien Leijnse via email on 13 June 2017.***
3. *Pack / tamp hardfill around loosened concrete surrounds to timber post foundations of cable side protection (approx. 4 posts affected - see Photo 5) and instruct grader driver to be wary of concrete edge to posts. **Assumed this was actioned***
4. *Ensure Road / Parking control personnel are advised of 'No Parking zone' in area between 'Pub Corner' & 'Harliwich's Hole'. Temporary signage to be installed as required. **Advised this was actioned by Paulien Leijnse via email on 13 June 2017.***
5. *Related to Geosolve input. Toppling Schist rock feature approx. 50m from downhill bridge end and the area at the head of this where erosion has occurred (see Photo 13) and the rock wedge (see Photo 12) to be inspected / scaled prior to the start of 2017 winter season to ensure no loosening or undermining of rock blocks has occurred. Inspection to utilise same resource as 2016. Geosolve (G Halliday) will need to be involved when this work is undertaken. **Inspected & scaled prior to and on 7/08/2017 following minor rock falls***
6. *Inspect and measure 'pins' adjacent to the Item 5. rock feature head to ensure there is no creep movement occurring. **Inspected on 7/08/2017 following minor rock fall (measurements noted on email of 8/08/2017 to Geosolve).***
7. *Inspect cable and anchor points to rock that was secured 2016 (approx. half way down the toppling schist feature in Item 5. above). **Has been inspected in 2018.***
8. *Drone video footage of the rock bluff to be downloaded (3GB file) onto Treblecone electronic filing system (see link to video footage held on Dropbox).*
9. *Treble Cone staff to inspect Corner 6 drain / bulldozer track to ensure water can track to end of path (in 2013 drain was blocked and caused slip to road). Assumed this was carried out. **Assumed has been carried out.***

10. BMC plans of 'Preventative Works for Outer Beam Stabilization' Ref: 1105-1197, Sheet S1, dated 06.10.14 are held on file and can be enacted as/if required.

PLEASE NOTE: A number of actions were defined by Geosolve in email of 10 August 2017 in relation to inspections and scaling in August 2017. These actions included,

- Routine drone inspections at weekly intervals during the ski-season and following any large rainfall events, including examination of watercourses on the face, which appear to be a prime source of rockfalls;
- Abseil inspection and scaling of any potential high risk features identified by the drone;
- Morning road inspections, as already instituted, with immediate drone/Geosolve inspections if debris found on road, or if rockfall occurs during the day;
- In the event of similar future significant rainfall events, observers to be stationed at safe distances from the rockfall area to report on any rockfall and control traffic;
- Observers to be stationed following future rockfalls until scaling works completed;
- Drone inspections following abseil operations to confirm effectiveness of night-time scaling, as recommended by Nick Flyvjerg of Active Exposure Ltd.
- We note that no stopping signage has now been installed as instructed.
- As discussed we are currently collating existing factual data to undertake a more detailed risk assessment.

This work has had ongoing input by Geosolve (Leon Gerrard) directly with Treble Cone prior to 2018 season start.

The findings/actions from the 2017 reporting and activities that are relevant to 2018 Remedial Works are included in the actions identified below in Section 3.

2. OBSERVATIONS & FINDINGS FROM JUNE 2018 INSPECTION

It was noted that scaling operations at the eastern end of the Bluffs area were in progress on the day of our inspection (works halted while we carried out the inspection). Inspection under the bridge & abutments was carried out (safety ropes used for inspection person)

- a. The BMC May 2017 Report items appear to have been carried out in the period from May 2017 as noted above. Regular inspection records of the Bridge (recording sheet provided previously) were not viewed however David Rutledge advised the same system is in place and staff have been briefed for the 2018 season.
- b. 'Guard Rail' cables generally 'tight', anchor points secure but some timber post concrete surrounds have been undermined and/or knocked by grader blade (see Photo 7.).
- c. Area adjacent abutments and beam support areas under the bridge relatively dry with no evidence of any issues / undue movement / degradation / water flow or silt build up and no apparent regression of the surface slip. This area has considerable grass growth indicating the area is not being constantly flushed with water (see Photos 5., 10. & 11. below).
- d. The road gravel depth over the bridge boards is greater than 150mm on the outer edge and it is possible for a wheel to climb the side guard logs / board (see Photo 8. Same issue as last year

- e. The concrete dish channel that has been installed to exit beyond west/uphill end of bridge pipe has been completely covered with hardfill (see Photo 8. below). Similar issue as last year.
- f. The sump area for the exit pipe from the concrete dish channel ((located at uphill end of bridge) was completely filled in and needs to be cleaned out (see Photo 9. below). Similar issue to last year.
- g. The upslope Bluff area appears to be in relatively good condition. Rock bolting to slabs above bridge and rocks supported by cables installed appear to be working well (see drone inspection video).
- h. Scaling works were in progress in apparent active areas of Bluff face.
- i. Drone was operated close to rock face and generally over the face. Images viewed on site have subsequently been reviewed by Leon Garrard (Geosolve) from link provided by BMC to Leon on 08/06/2018. The same area of potential instability identified in 2016 & 17 appears to have some soil erosion at the head with potential loosening of boulders there (see Photos 12.- 16. below). These areas to be closely watched.
- j. Signage in place including new 'No Stopping' sign installed in 2017 (see Photos 1. – 4. above). Noted that the uphill approach rock fall sign is wrong handed (upside down) and 'No Stopping' plaque missing.
- k. Please note there are areas beyond the Bridge and Bluff face that were not observed or inspected as part of this inspection but do have 'Remedial Work Actions for 2018 Winter Season' identified below (Section 3. Items 7., 8. & 10.)

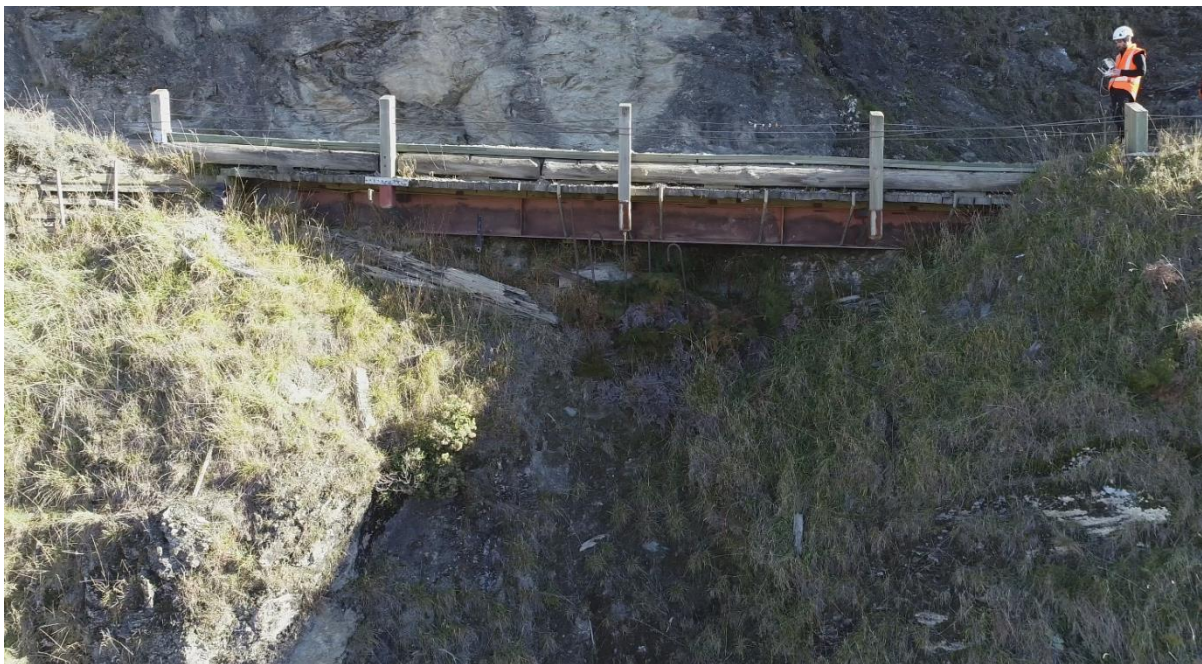


Photo 5 – No indication of movement / slips around abutment or old sluff area



Photo 6 – Guard cables relatively tight



Photo 7 – Hardfill to deep next to guard log



Photos 8 – Concrete Dish channel blocked



Photos 9 – Dish channel sump area filled in



Photos 10 & 11 – No apparent further regression of 'sluff' under washing of silt under uphill end



Photo 12 & 13 – Bluff area Grid reference C1 (see BMC Bluff Elevation drawing G01 Rev C attached as Appendix), to be monitored in 2018 (in particular)



Photos 14 & 15 - Bluff area Grid reference B3 (see BMC Bluff Elevation drawing G01 Rev C attached as Appendix), to be monitored in 2018 (in particular)



Photo 16 – Three particular areas to be monitored in 2018, also includes Grid reference A2 adjacent the measurement waratahs (far left circle on photo above)

3. REMEDIAL WORKS / ACTIONS FOR 2018 WINTER SEASON

Please note the stability and issues associated with the bluff / rock face are the subject of a separate reporting by Geosolve (Geosolve Ref: 160330, May 2016). The findings / actions from this report are included in the actions identified below.

PLEASE NOTE: Action Items 1-6 below have been advised to Dave Rutledge by email dated 11/06/2018 (subsequently confirmed have been dealt with by David Rutledge by phone conversation).

1. The overall depth of the hardfill on the deck is too high on the outer edge such that the log & top edge board will not be effective in deflecting a wheel into the road (rather than climbing over it). There still needs to be a small cross fall to the inside and the overall minimum depth of hardfill is best known to the roading contractor.
2. The concrete dish between the last bridge board and the vertical bluff face needs to be exposed such that water will flow down it (toward the west) and into the entry area for the drainage pipe that goes under the road.

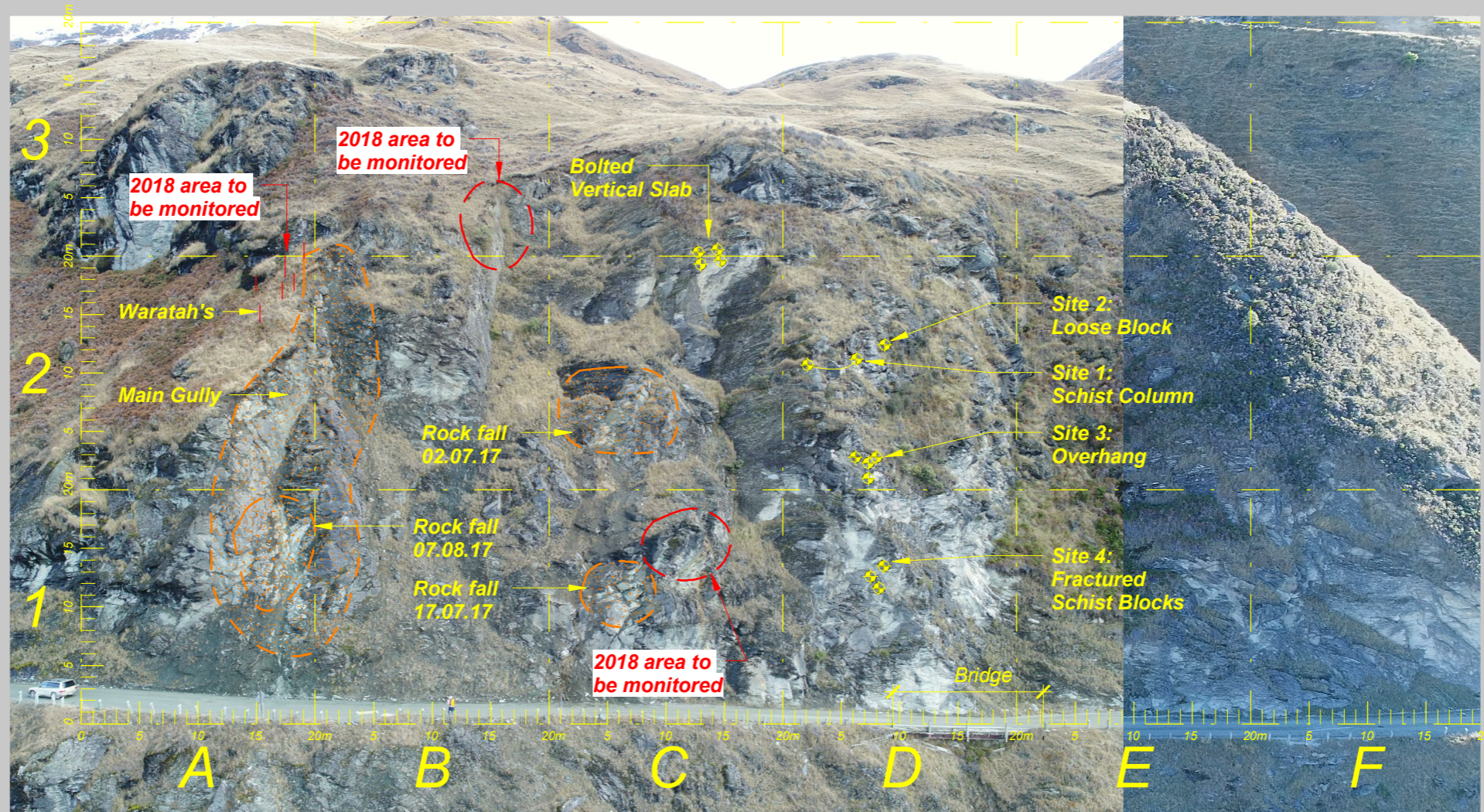
3. This drainage pipe that allows runoff to flow under the road at the west end of the bridge (from the inside edge of the road against the bluffs) has been filled in and needs to be dug out, shaped and lined with some stone to prevent erosion, the pipe end exposed and the pipe cleaned out of debris / silt.
4. Some of the concrete bases to the timber bollards (that have cable wrapped through and around) have been knocked around probably by the grader blade and there needs to be a wind row of road hardfill and/or rubble to protect these. Material to be tampered in place around these.
5. Visual check of all cable clamps to the wire ropes on the outer edge along its length including at anchor block locations.
6. There has previously been a weekly inspection regime established for the bridge and Bluffs area (to be inspected throughout the season by no more than 3 specific individuals). The three particular areas are shown in Photo 16 (Grid references provided – see Appendix for plan showing Grid elevation). PLEASE NOTE: This inspection is to occur directly following significant rain events or as scheduled. Please provide photo evidence of a completed inspection sheet and names of the 'inspectors' for the initiation of the season.
Contacts for any queries related to inspections / observations are Leon Gerrard (Geosolve – 0204 076 4510) or Graham McDougall (BMC – 027 440 1926)
7. Ensure Road / Parking control personnel are advised of 'No Parking zone' in area between 'Pub Corner' & 'Harliwich's Hole'. Temporary signage to be installed as required. Provide photo evidence this is in place
8. Drone video footage link of the rock bluff has been provided on 08/06/2018. This is to be downloaded onto Treble Cone electronic filing system
9. Treble Cone staff to inspect Corner 6 drain / bulldozer track to ensure water cannot track over the lip, water flow must go to end of path (in 2013 this drain was blocked and caused a slip to the road)
10. BMC plans of 'Preventative Works for Outer Beam Stabilization' Ref: 1105-1197, Sheet S1, dated 06.10.14 are held on file and can be enacted as/if required.

Please note that Treble Cone staff to advise BMC of acknowledgement / completion of all of the above works (Items 1.- 11.) ASAP,



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APPENDIX A – BMC Plan G01 Rev C – Treble Cone Survey – Bluff Elevation



DRAWING INDEX

DWG No.	DRAWING TITLE	REV	ISSUED
G01	Bluff Elevation	C	09/07/18
G02	Area A1/3 to B1/3 - Gully Images 02/07/17 - Sheet 1	A	03/07/17
G03	Area A1/3 to B1/3 - Gully Images 02/07/17 - Sheet 2	A	03/07/17
G04	Area D2 - Schist Column Images 02/07/17	A	03/07/17
G05	Area D1/D2 - Overhang Images 02/07/17	A	03/07/17
G06	Area D3 - Bolted Vertical Slab Images - 02/07/17	A	03/07/17
G07	Area C2 - Rock Fall Area Images 02/07/17	A	03/07/17
G08	Gully Elevation - 07/08/17	A	07/08/17
G09	Gully Views - 07/08/17	A	07/08/17
G10	Area 2 Views - 07/08/17	A	07/08/17
G11	Grid Location C1	A	07/08/17

EL Bluff Elevation

SCALE 1 : 500

- Rock Anchors
- Waratah's

How to use this Elevation:

1. Overall areas should be identified by their grid location, i.e. A/1, B/4 etc.
2. Sub-numbers to be used to pinpoint specific features. This is achieved by using the meter scales along the bottom and sides, i.e:
 A-17/1-15 - pinpoints the area of rock fall dated 07.08.17
 C-07/1-11 - pinpoints the area of rock fall dated 17.07.17

			Project Title	Drawing Name	BATCHELAR MCDUGALL CONSULTING <small>STRUCTURAL & CIVIL ENGINEERS Level 3, Moore Stephens Markhams Building, 335 Lincoln Road, Addington, Christchurch 8024 New Zealand Ph. +64 3 338 3351 Level 3, 99 Ardmore Street, Wanaka 9343 New Zealand Ph. +64 3 443 4531 www.bmconsult.co.nz</small>	Drawn By	CDM	
C	09/07/18	Issued for Information	Treble Cone Bluff Survey	Bluff Elevation		Scale @ A3	1 : 500	
B	07/08/17	Issued for Information				Project Number	Sheet No.	Revision
A	03/07/17	Issued for Information				1105-1197	G01	C
Rev	Date	Amendment				The copyright of this drawing belongs to BMC		