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GEOTECHNICAL

Tauranga District Council
Private bag 12022
Tauranga

10 September 2014

For the attention of [REDACTED]

Dear [REDACTED]

Mauao Slopes; Monitoring Report for August 2014

This letter is to report on survey benchmark monitoring and the site geotechnical walkover completed 3 September. Our previous monitoring was in December 2013.

A) Work items completed at this monitoring included:

- Discuss developments with Ranger.
- Walkover reviewing slopes from all tracks. Spring flows, slip movements, rockfall evidence, vegetation development etc. Recorded and photograph.
- Laser EDM survey carried out at 6 benchmark group locations on; West, North, East Bluffs and Zone 6.
- Sets of photos from locations A to M around summit for scour monitoring.
- Check previous slip sites re-vegetation, stability and tension crack development.

B) Summary of findings:

- No significant rockfall or slip events have been reported to the Ranger's staff since the previous monitoring.
- No significant movement was measured on the benchmark surveyed bluffs.
- Detailed photo comparison 2007 vs 2014 shows continued erosional changes and evidence for rockfall from the steep bluffs.

B) Comments

Avalon has now been working on Mauao for TDC for since 2003. We have a good record of slip and rockfall over 12 years.

It might be useful again to review the most significant types of hazard:

1. Larger rockfall events
2. Major soil slips & debris flow
3. Smaller individual rockfall

Previous investigation (see 2006 Risk Review report) determined that the larger scale events (1 & 2) do pose significant risks but these will tend to be concentrated in time, typically being triggered by intense rainfall and/or earthquake. The most practicable mitigation measure, rockfall protection fencing on the camp ground boundary, has been recommended in the past and options have been presented.

As has been said in the past, much of the individual smaller rockfall (3) will also occur during inclement weather and as such the risk will be naturally mitigated to a degree as there will be fewer persons on the tracks at these times, however, there will be a portion of this rockfall that will fall more randomly and we believe it does pose a significant risk to some track sections. The most practicable means of mitigation would continue to be to implement a rock scaling program to clean the loosest material from the most marginally stable rockfall source areas plus to consider discrete catch fences at some locations above the Oruahine track.

To attempt to further illustrate the quantities of material which are eroding we have compared some photographs from 2007 with those taken this month.

The photographs are also attached at full resolution in a .zip file and the changes can be most easily seen if zoomed in and compared side by side.

Please report any slips and/or rockfall events as soon as possible and we can incorporate them into the next monitoring visit or investigate immediately if required.

If you have any queries please don't hesitate to contact me at any time.

Regards

s 7(2)(a) ... Privacy



Photograph 1; 2007



Photograph 1; 2014



Photograph 2; 2007



Photograph 2; 2014



Photograph 3; 2007



Photograph 3; 2014



Photograph 4; 2007



Photograph 4; 2014



Photograph 5; 2007



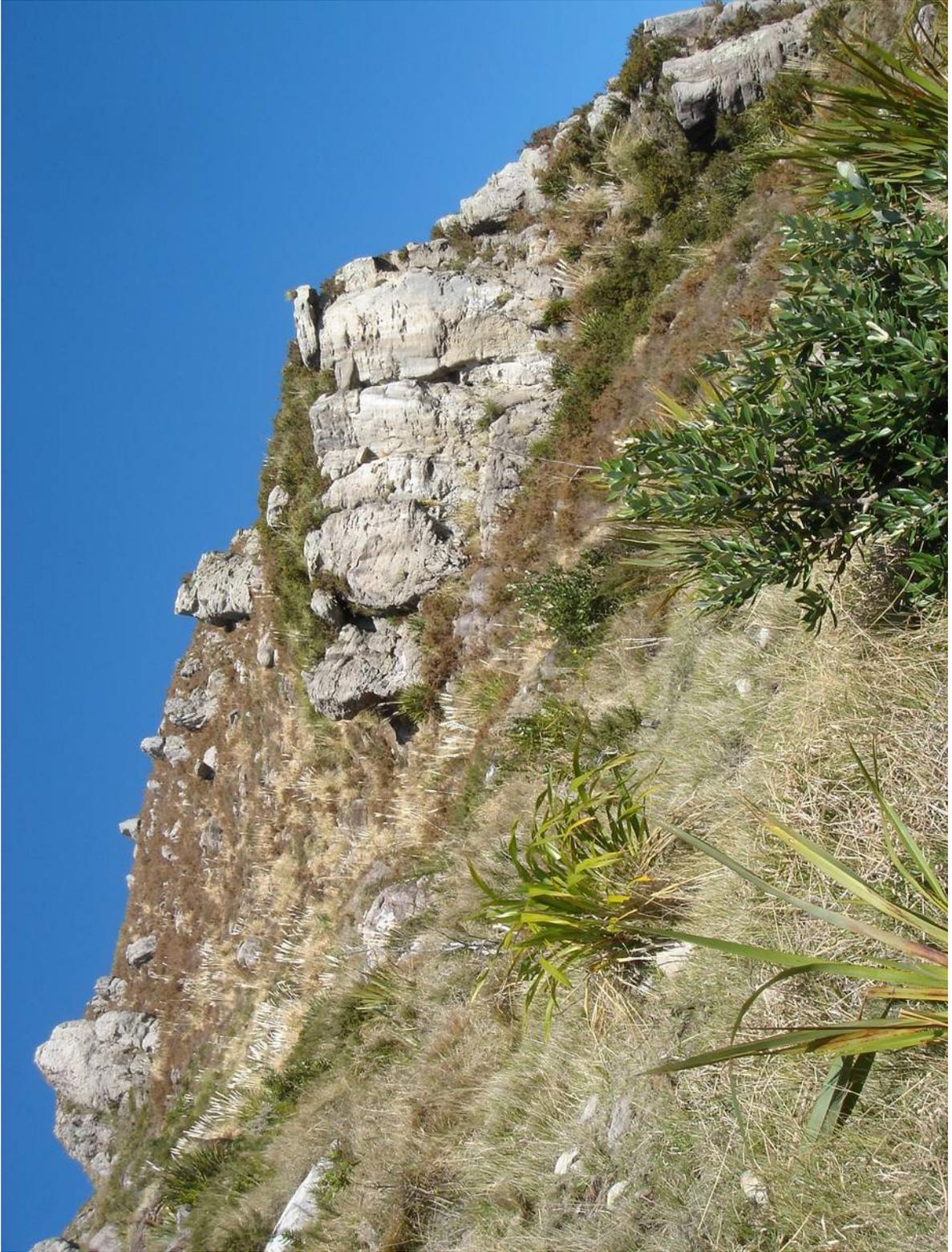
Photograph 5; 2014



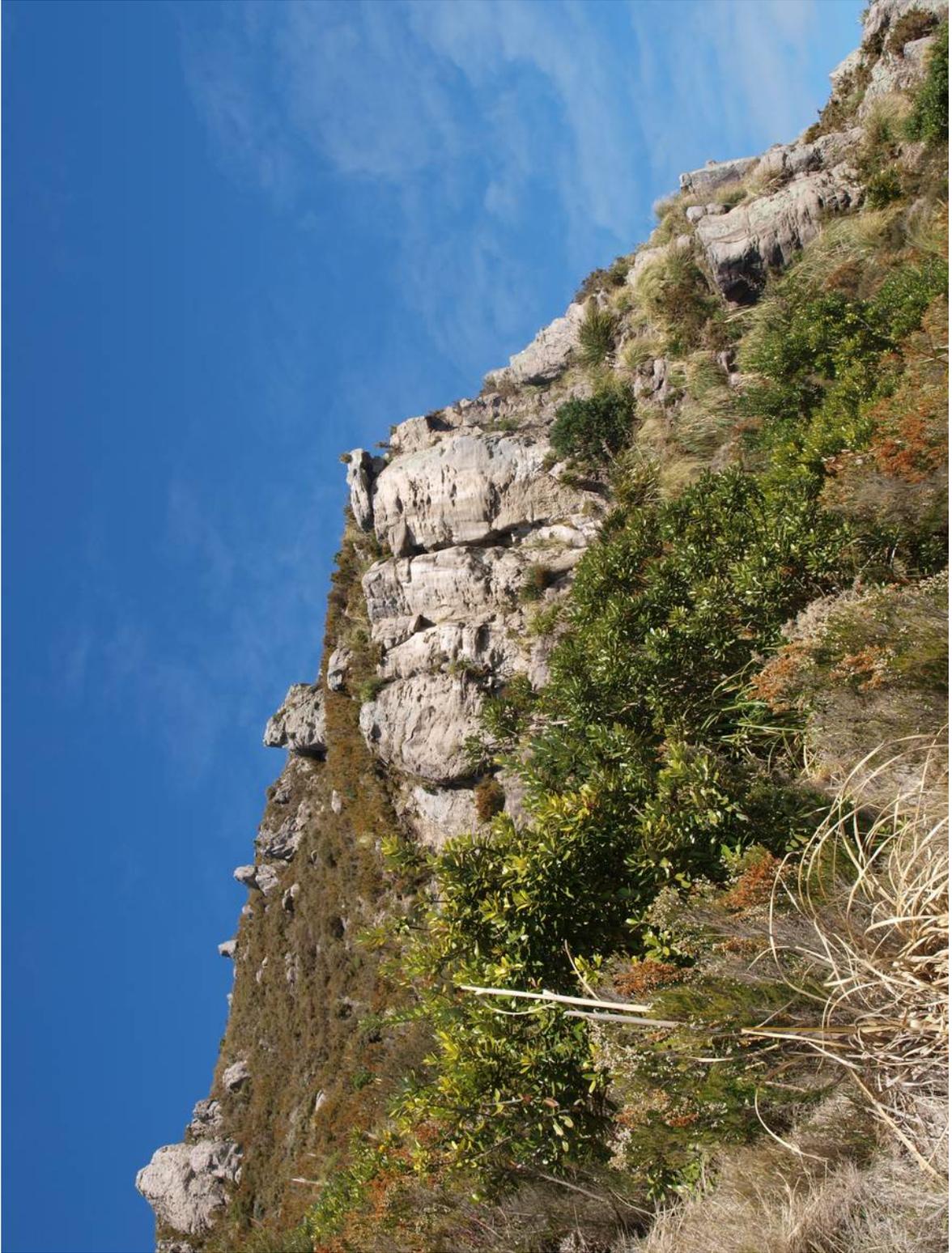
Photograph 6; 2007



Photograph 6; 2014



Photograph 7; 2007



Photograph 7; 2014



Photograph 8; 2007



Photograph 8; 2014



Photograph 9; 2007

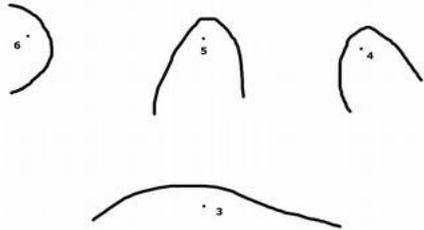


Photograph 9; 2014



Area 1a; "Camp Bluff"

1a The Camp Bluff



- 3 → 4
- 3 → 5
- 3 → 6
- 4 → 5

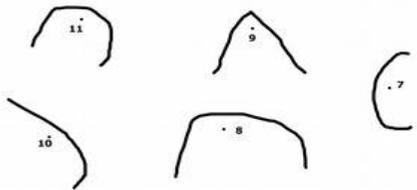
- 3 → 4
- 3 → 5
- 3 → 6
- 4 → 5

Distance measurement mm

Nov-03	Jan-04	Nov-04	Mar-05	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07	Nov-08	Jun-09
	5211	5209	5208	5208	5207	5208	5215	5210	5207	5208
	4320	4320	4321	4321	4320	4323	4323	4319	4322	4322
	5179	5180	5178	5178	5180	5181	5178	5178	5178	5180
	2258	2260	2260	2260	2260	2260	2258	2259	2261	2260
Dec-09	Jun-10	Dec-10	Jul-11	Mar-12	Sept 12	May-13	Dec-13	Aug-14		
5212	5209	5210	5206	5214	5206	5205	5209	5211		
4324	4324	4324	4320	4327	4320	4321	4320	4324		
5182	5183	5182	5178	5171	5182	5182	5182	5178		
2262	2263	2262	2263	2262	2263	2261	2261	2260		

Area 2a; "Blasted Column"

2a Columns



- 8 → 11
- 8 → 9
- 10 → 8
- 10 → 9
- 10 → 11

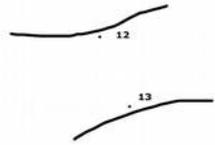
- 8 → 11
- 8 → 9
- 10 → 8
- 10 → 9
- 10 → 11

Nov-03	Jan-04	Nov-04	Mar-05	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07	Nov-08	Jun-09
	7917	7910	7907		7906	7915	7905	7906	7905	7910
		9968	9969		9970	9968	9968	9964	9973	9971
		3111	3111		3112	3126	3126	3126	3114	3114
		11636	11636		11633	11635	11634	11634	11634	11630
		8325	8325		8325	8325	8325	8320	8327	8325
Dec-09	Jun-10	Dec-10	Jul-11	Mar-12	Sept 12	May-13	Dec-13	Aug-14		
7913	7913	7910	7912	7908	7912	7912	7912	7912		
9971	9968	9963	9966	9963	9964	9964	9964	9966		
3113	3115	3113	3115	3114	3113	3112	3112	3112		
11636	11636	11637	11632	11630	11634	11642	11637	11634		
8326	8323	8330	8334	8336	8335	8320	8320	8318		

Area 2i: "Elephants Joint"

2i Elephant joint

12 → 13



Mar-03 2885	Nov-03	Jan-04 2884	Nov-04 2882	Mar-05 2887	Dec-05 2887	Mar-06 2887	Nov-06 2887	Jul-07 2885	Nov-07 2885	Nov-08 2887	Jun-09 2889	Dec-09 2883	Jun-10 2886
Dec-10 2885	Jul-11 2883	Mar-12 2886	Sept 12 2885	May-13 2881	Dec-13 2882	Aug-14 n/a							

3a Bluff top

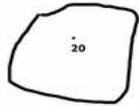
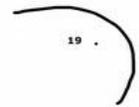


			Mar-03	Nov-03	Nov-04	1/03/200	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07	Nov-08	Jun-09
14	→	17	8110		8122	8124	8129	8129	8135	8130	8132	8128	8130
15	→	17	5050		5050	5049	5050	5050	5056	5056	5054	5058	5063
16	→	17	4868		4874	4877	4879	4879	4868	4869	4880	4880	4882
15	→	16	3575		3581	3571	3577	3577	3575	3575	3573	3581	3583
15	→	14	7560		7478	7488	7485	7485	7484	7486	7486	7488	7487
			Dec-09	Jun-10	Dec-10	Jul-11	Mar-12	Sept 12	May-13	Dec-13	Aug-14		
14	→	17	8132	8129		8127	8129	8130	8132	8130	8127		
15	→	17	5066	5064	5068	5058	5061	5056	5068	5059	5060		
16	→	17	4879	4880	4877	4878		4880	4883	4877	4879		
15	→	16	3579	3575	3576	3576	3572	3572	3574	3574	3573		
15	→	14	7486	7482	7490	7493	7485	7490	7497	7491	7490		

Blocks above Area 3d

North Promentary

Above 3d



18	→	19	Mar-03	Nov-03	Nov-04	1/03/200	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07	Nov-08	Jun-09
			5248		5265	5256	5256	5254		5253	5253	5255	5256
20	→	19	3380		3385	3373	3376	3376	3377	3375	3374	3376	3379
20	→	18	8038		8065	8050	8056	8050	8053	8053	8054	8057	8056
18	→	19	Dec-09	Jun-10	Dec-10	Jul-11	Mar-12	Sept 12	May-13	Dec-13	Aug-14		
			5255	5257	5254	5256	5248	5257	5253	5252	5252		
20	→	19	3378	3377	3378	3379	3378	3382	3380	3378	3378		
20	→	18	8062	8057	8052	8055	8050	8056	8056	8055	8057		

Zone 6 Boulder 6b

23 (LH outcrop) 22 (RH Outcrop)

21 (boulder)

21	→	23	Dec-05	Mar-06	Nov-06	Jul-07	Nov-07	Nov-08	Jun-09	Dec-09	Jun-10	Dec-10	Jul-11	Mar-12	Sept 12	May-13	Dec-13	Aug-14
			7560	7590	7615	7663	7639	7649	7655	7659	7660	7665	7671	7679	7699	7700	7702	7706
21	→	22	5799	5830	5865	5999	5891			5911	5914	5920	5929	5939	5959	5962	5968	5973