

SKYLINE GEOSCIENCE

GEOLOGICAL CONSULTING

Memorandum

Subject: East Vail Parcel Geologic Hazard Analysis – Review of Updated Site Plan**Date:** May 24, 2019**To:** Michael O'Connor, Triumph Development**From:** Julia Frazier, Skyline Geoscience

Skyline Geoscience (Skyline) has reviewed the Grading and Drainage Plan (Plan) by Alpine Engineering, Inc. (Alpine) dated May 17, 2019. This Plan is an update from the Preliminary Grading Plan by Alpine dated January 25, 2019. The Plan shows a 12-foot high earthen rockfall barrier with a 1V:1H slope on either side of the crest, spanning a length of about 620 feet and located upslope from the proposed structures (Figure 1). The location of the berm on the east end of its length has been relocated upslope about 85 to 95 feet from the location previously analyzed for the Geologic Hazard Analysis (original report; February 12, 2019). The Plan also shows changes in the number and location of residential structures, and site grading and drainage.

The Colorado Rockfall Simulation Program (CRSP) analysis for Study Section C has been updated to reflect the relocation of the barrier. Moving the barrier upslope is moving it closer to the rockfall source. The analysis point (AP) is associated with the location of the crest of the proposed barrier. Slope profile parameters were not changed from those stated in the original report. Study Section C was analyzed: 1) in the natural, current condition without a barrier, and 2) with the barrier placed at the location shown on the Plan. The results for the natural condition analysis are reported in Table 1. The maximum estimated values and the 95% and 98% statistical cumulative probability values are reported for velocity, impact energy, and bounce height.

Table 1. Rockfall Analysis Results Study Section C

Rock Size/Shape	Rock Weight (lbs)	Velocity (ft/sec)			Kinetic Energy (kJ)			Bounce Height (ft)
		max	98%	95%	max	98%	95%	max
8' spherical	44,234	25.3	21.7	19.7	730	500	450	1.7
10' spherical	86,394	36.8	28.3	25.7	3,000	1,700	1,500	3.5
10'x4' discoidal	51,836	37.1	26.4	24.1	2,100	980	860	3.2

SS = study section; kJ = kilojoules; AP = analysis point; lbs = pounds; ft/sec = feet per second

A 10-foot high barrier placed at the location shown on the Plan for Study Section C stopped all 10-foot spherical rocks in the CRSP model. Due to overtopping conditions that may occur and due to the size of boulders observed on the ground surface within the property limits, the recommended height of the rockfall barrier is 12 feet (as shown on Figure 1). Based on the results of the CRSP analysis for a spherical, 10-foot diameter limestone rock, the barrier should be designed and constructed to withstand the maximum estimated impact energy of 3,000 kJ (about 2,200,000 ft-lbs), velocity of 36.8 ft/sec, and bounce height of 3.5 ft. These values have increased from those reported in the original report for Study Section C at the location of the proposed berm. Refer to the original report for other recommendations related to rockfall berm system and catchment area construction, maintenance and access. Skyline and Cesare, Inc. (Cesare) should be contacted for additional consultation and review if other rockfall barrier systems are considered or if changes are made to the Plan after the date of this memorandum.

Slope stability was not included in the scope of this study. Skyline understands that a geotechnical investigation by Cesare is planned for the summer of 2019 and that slope stability and other geotechnical considerations will be addressed at that time by that firm.

Thank you for the opportunity to provide this review and update to the geologic hazard analysis for the East Vail Parcel, Town of Vail, Colorado. Please contact Skyline if you have any questions or comments regarding the information provided in this memorandum.

Sincerely,

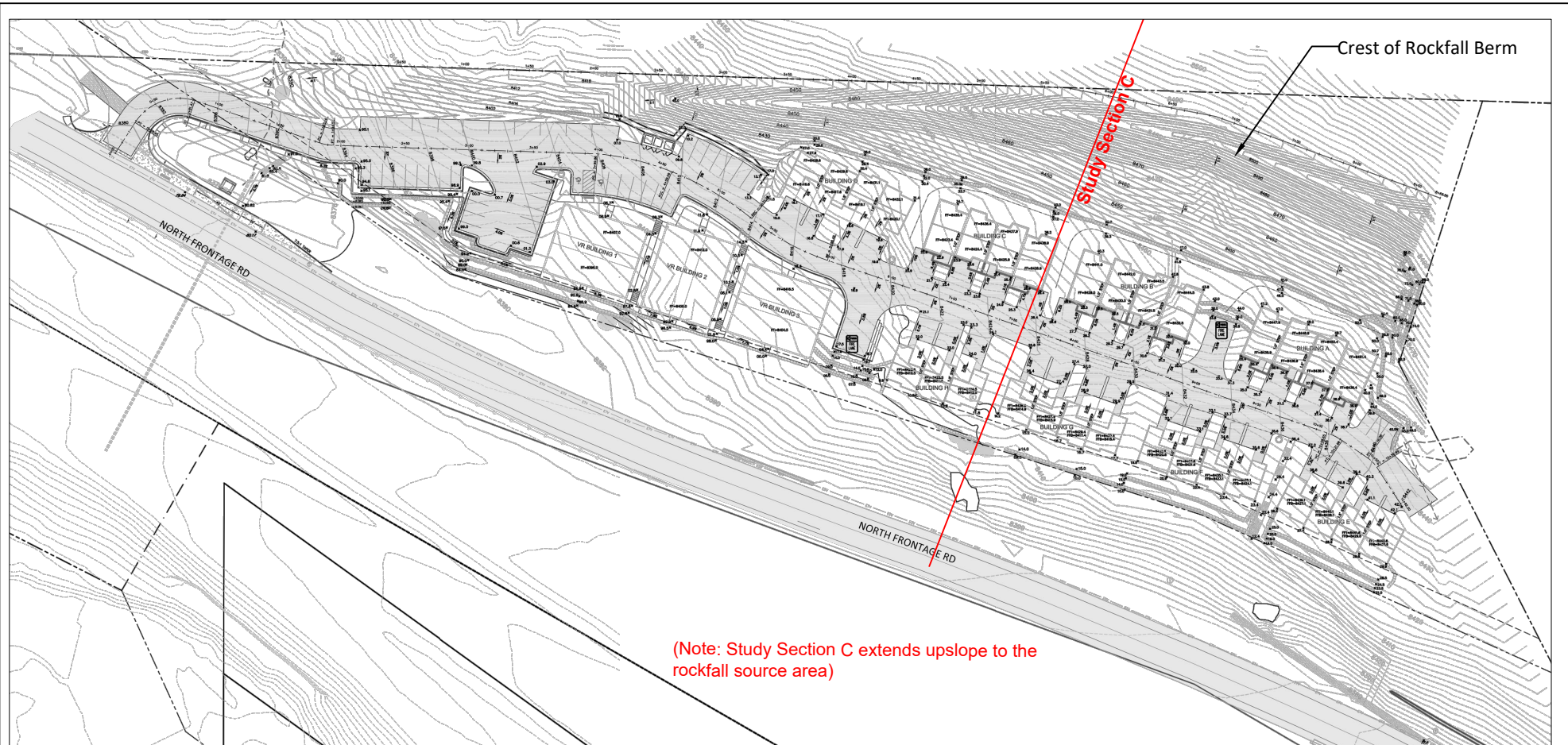
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Map Source: Alpine Engineering (May 17, 2019)

0 120 240
APPROXIMATE SCALE IN FEET



Project No: 18105
Project Name: East Vail Parcel

Date: 05.23.2019

FIGURE 1
Proposed Development

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