COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

Date: **January 16, 2019**

To: **Tim Cazier, P.E.**

From: **Zach Trujillo**

RE: **Pikeview Quarry, DRMS File No. M-1977-211**
Geotechnical Review in Support of Amendment AM-04

Tim,

As requested I have reviewed the items outlined in your memo dated January 14, 2020 in regards to AM-04, Stantec's Pikeview Quarry Backfill Stability Analyses - Exhibit 6.4 (Stantec Report), and previous reports for the Pikeview Quarry. Please see the following comments:

1. *Determine if the Division has all the referenced previous study reports, data and test results needed to support the AM-04 stability analyses.*

    a. *If not, identify what's missing.*

After reviewing previous files, I was able to find the following documents:

- CTL Thompson Inc., 2009 (CTL). Slope Stability Evaluation Pikeview Quarry. Report to Transit Mix Aggregates. May 19. (CTL Report)

- Seegmiller International, 2012 (Seegmiller). Stability Analysis Reclaimed Slope Design, Pikeview Quarry, El Paso County, Colorado. (Seegmiller Report)

    - This includes the laboratory test data from (15) bulk soil samples taken from trenches specific to rock material properties.

I was unable to find the following documents:

- Exponent Failure Analysis Associates, 2011 (Exponent). Investigation of the Pikeview Quarry. Report to Counsel for Continental Materials Corp. September 22. (Exponent Report)

    - Based on discussions within Seegmiller International, 2012. Stability Analysis Reclaimed Slope Design report, this includes laboratory test data specific to soil or soil-like material properties associated with the Pikeview Quarry.

- Core logs for dill holes EXC-1 to EXC-4.

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2. *Make an assessment of and provide a recommendation as to the appropriateness of the strength parameters used in the AM-04 stability analyses.*

Rock Material Properties

Rock material properties used in the Stantec Report are based on the results of Seegmiller's investigation as discussed in the Seegmiller Report. Site specific data was collected and determined by Seegmiller by analyzing 15 field sites adjacent to the Pikeview Quarry in which rock strength characteristics were able to be determined from. These sites are shown on Figure 1 of the Seegmiller Report. The associated results for the rock material properties are included for each of the 15 sites in Appendix 1 of the Seegmiller Report. While rock material properties were calculated in the Exponent Report using soil mechanic principles, Seegmiller expanded on Exponent's results using rock mechanics approach for shear strength which would be deemed more appropriate. The results determined and used in the Seegmiller Report, and then subsequently in the Stantec Report, are within acceptable ranges and I have no concerns regarding the rock material properties used. Rock material strength properties for both Exponent and Seegmiller can be found in Tables 3.1 and 3.2 of the Stantec Report.

Soil Material Properties

Soil material properties used in Stantec's analysis were originally determined by and reported in the Exponent Report and again expanded on in the Seegmiller Report. Using standard soil mechanic principles, Seegmiller agreed with the results provided in the Exponent Report. These same soil material properties were used in Seegmiller Report but to err on the side of caution, Seegmiller increased the unit weight by 5 pcf for soils to add a degree of conservativeness. These adjusted unit weight values and other determined soil material properties were then also used Stantec's analysis. Soil material strength properties for both Exponent and Seegmiller can be found in Tables 3.1 and 3.2 in the Stantec Report.

However, as addressed in item one of this document, I was unable to locate the Exponent Report nor has it been provided in AM-04. As a result, I have no way to review, evaluate and confirm the soil mechanic properties used in the Exponent Report. With that said, the values provided seem reasonable and within acceptable ranges.

3. *Review the seismic coefficient used for the pseudo-static analyses and make a recommendation as to its appropriateness for the site.*

When it comes to the determination of seismic coefficients specific to earthen structures or slopes, there appears to be no individual, widely accepted, standard approach. There have been a numerous studies for determining the most appropriate seismic coefficient for these scenarios but is left to a matter of professional experience and judgement when making this determination. In the Stantec Report, the seismic coefficient was set to 0.030g and appears to have been set by utilizing the peak gravitational acceleration (PGA) and long term spectral acceleration (S_1). However, since determining seismic coefficients is often left to professional judgement, it is my opinion that Stantec should provide additional detail and rational on their determination for the used seismic coefficient. With that said, the use of a seismic coefficient of 0.030g does not see unreasonable.

Based upon my comments and review, please have Pikeview provide and/or address the following comments:

1. Please have Pikeview provide the following documents and information:

    a. Exponent Failure Analysis Associates, 2011 (Exponent). Investigation of the Pikeview Quarry. Report to Counsel for Continental Materials Corp. including laboratory test data specific to soil or soil-like material properties associated with the Pikeview Quarry.

b. Core logs for dill holes EXC-1 to EXC-4.

2. Please have Pikeview/Stantec provide additional detail and rational to justify their determination for the used seismic coefficient.

This concludes my review for the requested items in your memo dated January 14, 2020 in regards to AM-04, Stantec's Pikeview Quarry Backfill Stability Analyses - Exhibit 6.4 (Stantec Report), and previous reports for the Pikeview Quarry. If you have any questions feel free to contact me.

Sincerley,

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