STATE OF NEW MEXICO
BEFORE THE WATER QUALITY CONTROL COMMISSION

In the Matter of:	)	
PROPOSED AMENDMENT TO 20.6.2 NMAC (Copper Rule)	)	**No. WQCC 12-01(R)**

EXHIBIT SCOTT – D-7

PIT SLOPE MANUAL

chapter 9

WASTE EMBANKMENTS

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determine the average and lower limits of the shear strength for the materials. Sufficient control should be provided during construction to ensure that materials placed within the embankment conform to the standards assumed in design. Instrumentation should be installed to monitor pore water pressures within the embankment and the foundation if these presssures are significant in determining their stability. Pore water pressures significantly higher than those assumed in design may necessitate a modification of the design.

296. The factors of safety listed below are suggested minimum values for design purposes. The values presuppose that the stability analysis has been sufficiently comprehensive to locate the critical failure surface and that the parameters used in the analysis are known with reasonable certainty to be representative of actual conditions in the embankment.

297. Suggested factors of safety for the downstream slope for long-term steady seepage conditions are given in Table 12.

298. Where the ratio of residual to peak shear strengths is 0.9 or greater, the embankment design can be based on the peak strength values using the appropriate factors of safety as listed.

299. Where the number of field and laboratory tests, on either the embankment fill or the foundations is small, or where the scatter of test results within individual strata or zones is large, conservative values of strength and pore water pressures should be selected for the design, or, alternatively, an increased factor of safety should be used.

300. Where a waste pile is constructed on a steeply sloping foundation, the suggested minimum factors of safety should be increased by at least 10%.

Table 12: Minimum factors of safety for the downstream slope

Assumptions	I*	II**
Using peak shear strength parameters	1.5	1.3
Using residual shear strength parameters	1.3	1.2
Including the loading for a 100-year earthquake	1.2	1.1
For horizontal sliding on the base of embankments retaining tailings in earthquake areas assuming shear strength of tailings behind the dam reduced to zero	1.3	1.3

*I - where it is anticipated that severe damage would occur as a result of an embankment failure.

**II - where it is anticipated that severe damage would not occur as a result of an embankment failure.

SETTLEMENT ANALYSES

301. If the foundations beneath an embankment consist of dense glacial till, dense sand and gravel or rock, vertical deformations under the weight of the embankment will be largely elastic. Settlement will occur as the loads are applied but their magnitude will be so small as to be insignificant with respect to performance of the embankment.

302. If, however, the foundations beneath the embankment contain layers or strata of normally consolidated fine-grained sediments, such as clays and silts, significant vertical deflection of the foundation may occur under the weight of the embankment fill as the fine-grained sediments consolidate. The magnitude of foundation settlement will depend on the height of the embankment, the depth and thickness of the compressible strata within the foundation, and their compression indices. The rate at which foundation settling occurs will depend on the magnitude of the change in vertical stress, ie, the rate of fill construction, on the permeability of the compressible material, and on the drainage characteristics of the foundation.