BANK ARMORING PLAN

This bank protection plan is presented to explain the bank armoring proposed for reservoir bank protection in Phase 1 and Phase 2 that run parallel to the South Platte River channel. Only the reservoir side armoring is being proposed since the river bank lies 150 to 250 feet west of the top of the slope of the permit area.

The attached **Figure 1** shows the cross-section of the area discussed below and details of the armoring to protect the banks along the west side of Phase 1. The west and south banks in Phase 2 will also be armored using this plan. The **Reclamation Plan Maps** have been revised to show the location of the areas to be armored in the mine.

The armor is intended to protect the reservoir banks should a 100-year flood event occur after an area has been reclaimed. On the armored areas a dirty sand and gravel (unprocessed) will be spread over the armoring to fill most of the large voids.

The toe of the slope armoring will be at least 5 feet below the thalweg of the adjacent riverbed. The base of the armoring will average 10 feet below the existing ground surface at the mine. The 100-year Floodplain information has been included on all of the Map Exhibits in the Reclamation Packet.

Armoring material will be recycled concrete fragments with surface rebar removed, so that it meets the definition of Inert Materials. The concrete will be sized 9 to 15 inches averaging 12 inches. Fines will be mixed in to fill voids. This size material will have a Safety Factor of 1.26. See Bank Armoring Calculation page following this text.

The operator will keep enough material stored on the mine to complete armoring needed on any area where sloping is being completed and is ready for armoring. At a minimum, 2,350 cubic yards will be stockpiled on the mine for use in armoring. This is enough to armor a minimum of 1,000 feet of excavation bank. At no time will there be more than 1,000 feet of armoring needing to be placed.

The stockpile of armoring material will be placed parallel to the water flow so it will not interfere with flows in the flood plain if flooding occurs. It will be within the setback between the permit boundary and the mine highwall so it is close to the area where it will be placed.

Reservoir Bank Armoring.

Armoring will be placed inside of the mined areas adjacent to the South Platte River channel (Phases 1 and 2) and along the downstream side of the lateral berm between those areas. The armoring will be placed on the slopes starting from the existing ground surface elevation. The toe of the armoring will be a minimum of 5 feet below the river thalweg, have a 3h to 1v slope and will be 2 feet or more thick. This is approximately 2.35 cyd/lft along the excavation bank slopes. Once sloping begins, the armoring will be installed on 1,000 foot sections until completed. This will leave an armored face along the top of the bank and the slope into the reservoir that is 35 feet wide.

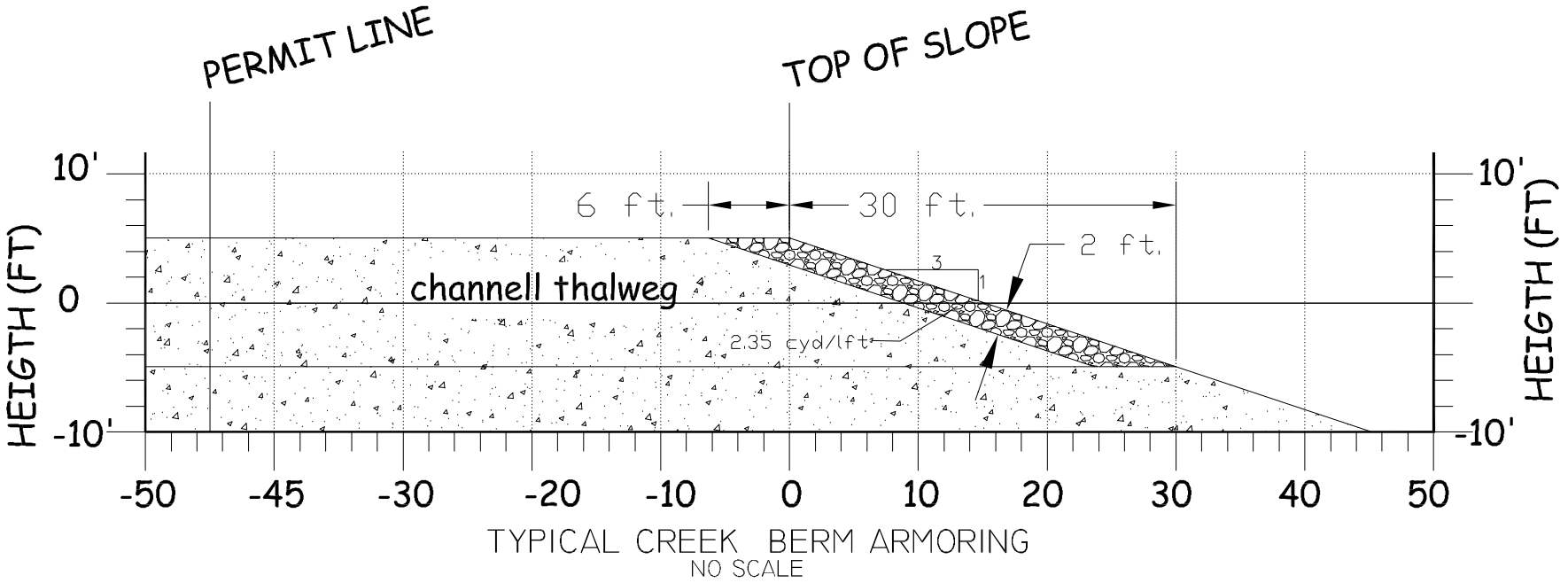
Supplied supporting documents

Figure 1 - Bank Protection Plan cross section (revised)

Safety factor calculation page

BANK ARMORING PLAN

FIGURE 1



TYPICAL CREEK BERM ARMORING
NO SCALE

NOTES:

1. BANK ARMORING SHOWN ON RECLAMATION MAPS IS APPROXIMATE LOCATION. ACTUAL LOCATION WILL DEPEND ON LOCATION OF TOP OF SLOPE AT THE TIME IT IS INSTALLED.

2. MATERIAL USED FOR ARMORING WILL BE WELL AGED BROKE CONCRETE. THAT HAS ALL EXPOSED SURFACE REBAR REMOVED. AT A MINIMUM 2,350 CUBIC YARDS WILL BE STOCKPILED ON THE MINE FOR USE IN ARMORING. THIS IS ENOUGH TO ARMOR MATERIAL TO ARMOR A MINIMUM OF 1000 FEET OF EXCAVATION BANK..

3. STOCKPILES OF ARMORING MATERIAL WILL BE PLACED PARALLEL TO THE RIVERBANK SO IT WILL NOT INTERFERE WITH FLOWS IN THE FLOOD PLAIN. THE STOCKPILES WILL BE PLACED BETWEEN THE PERMIT LINE AND THE TOP OF SLOPE WITHIN 500 FEET TO THE AREA WHERE IT WILL BE PLACED.

4. BANK ALONG THE EXCAVATED AREA WILL ARMORED FROM THE EXISTING SURFACE TO A POINT AT LEAST 5 FEET BELOW THE CHANNEL THALWEG.

5. THE SIZE OF THE MATERIAL WILL FALL IN THE RANGE OF 9 TO 15 INCHES AVERAGING 12 INCHES AS DISCUSSED IN THE BANK ARMORING PLAN AND WILL BE PLACED BELOW GRADE.

6. ON THE ARMORED AREAS A DIRTY SAND AND GRAVEL (UNPROCESSED) WILL BE SPREAD OVER THE ARMORING TO FILL MOST OF THE LARGE VOIDS.

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$$SF = \frac{\cos\theta \tan\emptyset}{n\tan\emptyset + \sin\theta} \qquad \tau_s = \gamma RS \qquad n = \frac{21\tau_s}{(S_s-1)\gamma D_{50}}$$

θ = face slope of pitside bank, in degrees to the horizontal

$\emptyset$ = angle of repose of pitside bank construction materials in degrees

n = stability factor

S_s = specific gravity of riprap particles

γ = specific weight of water = 62.4 lbs/ft^3

D_{50} = median riprap particle size, in feet

R = hydraulic radius at normal depth of flow down pitside slope, in feet

S = face slope of pitside bank, in feet per foot

$$\tau_s = \gamma RS$$

$\gamma = 62.4$

R = 2

S = 0.01

τ_s = 1.248

$$n = \frac{21\tau_s}{(S_s-1)\gamma D_{50}}$$

$\tau_s = 1.248$

$S_s = 2.4$

$D_{50} = 1$

$$n = \frac{26.2}{87.4}$$

n = 0.3

$$SF = \frac{\cos\theta \tan\emptyset}{n\tan\emptyset + \sin\theta}$$

n = 0.3

cosθ = 0.9487

θ = 18.43° tanØ = 0.7002

Ø = 35° sinθ = 0.3161

$$SF = \frac{0.6643}{0.5262}$$

SF = 1.26