STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

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MEMORANDUM

To: Dustin Czapla

From: Tim Cazier, P.E.

Date: January 13, 2014

Re: JD-7 Mine Drainage Design – Second Adequacy Review, Permit No. M-1979-094HR / AM-01

The Division of Reclamation, Mining and Safety (DRMS) engineering staff has reviewed the September 2013 Drainage Design Plan (DDP) for the JD-7 Mine prepared by Whetstone Associates, Inc. The following comments are posed to ensure adequate engineering analyses and design practices are implemented to eliminate or reduce to the extent practical the disturbance to the hydrologic balance expected by the mining operation with respect to water quality and quantity in accordance with Rules 3.1.6(1), 6.4.21(10) and 7.3.1. Please note, as this site is a designated mining operation (DMO), compliance with Rule 7.3.1 is applicable, thus requiring certified designs and specifications for engineered elements associated with the environmental protection plan (EPP).

General Comments:

1. Stormwater runoff estimates or analyses. The DRMS reviewed the hydrologic analyses with respect to diversion channels and sediment ponds, providing the following comments:
    a. Maps delineating contributing subbasins… The response is adequate with the following exceptions:
        i. Diversion channels NECh1 and NECh2 intercept a significant portion of subbasin NE that is not accounted for in the runoff analysis. Please re-delineate subbasin NE (reference Figure 3) or add a re-delineated Basin B4, and revise the runoff model to ensure the appropriate contributing area is included in the runoff analysis.
        ii. Diversion channels NPE_Ch1 and NPE_Ch2 intercept a significant portion of subbasin NPE (reference Figure 34) that is not accounted for in the runoff analysis. Please re-delineate subbasin NPE or add a re-delineated Basin B4, and revise the runoff model to ensure the appropriate contributing area is included in the runoff analysis.

iii. Disturbed area curve numbers (CN). Subbasins delineated within the both the current and planned conditions for the open pit and the open pit waste rock pile use CNs to represent vegetated area (sagebrush w/ grass understory and/or herbaceous range). While this may be appropriate to represent the site as it exists today, once operations resume, vegetation on the dump will be buried and vegetation in the pit will be removed. Please revise the CNs to be void of vegetation for the following subbasins: D1, D7, D8, D9, D10, DP1, DP7, DP8, DP9, DP10, DP17, DP18, DP19, and DP20.

b. Rationale for runoff estimation parameters… The response is adequate.

c. 100-year, 24-hour peak flow calculations/analyses… The response is adequate.

d. 10-year, 24-hour runoff volume… The response is adequate.

2. Stormwater hydraulic analyses or design drawings. The response is partially adequate. The Drainage Design Plan appears to assume the ponds on site are empty at the onset of the 100-year, 24-hour design storm. The DRMS design criteria for passing the 100-year design peak flow through spillways is to assume the pond is full to the invert of the lowest gravity drained outlet at the onset of the design storm (typically the spillway invert). The following items need to be addressed:

a. Sediment Ponds:

i. Stage-storage table to compare with estimated runoff volume… The response is adequate.

ii. Drawing(s) (to scale) with contours demonstrating pond capacity, spillway location, and spillway erosion protection have NOT been provided with the exception of SCN on Plate 3. Please provide these drawings for

1. An improved capacity pit pool,
2. Catchment 001B-A South, and
3. Catchment 001B-A North

iii. Again, please provide design drawing(s) and specifications showing embankment and spillway designs necessary to reduce the potential for scour should the 100-yr design storm pass through the ponds.

iv. Revise the hydrologic analyses assuming the sediment ponds are full to the to the invert of the lowest gravity drained outlet at the onset of the design storm.

v. See attached Tables A-1 and A-2 for additional analyses needed for the ponds.

b. Diversion Channels: The Drainage Design Plan attempts to demonstrate adequate capacity by averaging cross-sections for given existing channels and providing stage tables (e.g., Table 20). This is inadequate for several reasons: a) averaged cross sections do not adequately represent the variability in the current channels (reference the 18 percent difference in channel depth shown in Figure 14), b) Figure 15, along with the aforementioned Figure 14, demonstrate the existing engineered channels are in need of significant maintenance, and c) the Division is unable to adequately assess available freeboard throughout the channel with the

high variability in the condition of these channels. For these reasons, the Division requires a redesign of all existing engineered channels so as to conform to standard prismatic geometry and the Operator to commit to the necessary maintenance and/or reconstruction of these channels such that adequate capacity and stability for the 100-year, 24-hour design peak flow can be assured. The Drainage Design Plan also references the Urban Drainage and Flood Control District Drainage Criteria Manual to justify a flow velocity of 7 ft/s for stability. Tables 22 (p. 49) and 36 (p. 79) indicate the Froude Number (Fr) > 0.8 for all evaluated channels. The UDFCD manual requires the Fr be less than 0.8 in order for flow velocities to be as high as 7 ft/s (reference UDFCD manual Chapter 7; Sections 3.1.3.2, 3.2.3.1, and 4.1.1.1; and Tables MD-2, and MD-3). The following shall be provided in the Operator's response:

i. Drawing(s) (to scale) showing diversion channel locations, cross-section geometry for construction (minimum design depth included).

ii. Hydraulic analyses evaluating the design capacity and stability of each diversion and/or collection ditch to pass the 100-year, 24-hour design storm peak discharge. The DRMS's criterion for maximum flow velocity in earth-lined channels is 5 ft/s. The DRMS requires channel freeboard be a minimum of 0.5 feet unless the velocity head ($v^2/2g$) is significant, then the minimum required freeboard is half the velocity head, or $v^2/4g$. Please provide the requisite hydraulic analyses for all pit and waste rock diversion channels.

iii. Erosion protection details… Please see new comments below.

New Comments:

3. Section 4.1 and Figure 10. A peak design flow of 75.94 cfs is diverted from subbasin NG to undefined channel. Please discuss impact of additional 76 cfs from "Pit Diversion East" discharge point to the natural drainage (~1,200 ft) in basin B4.
4. Section 4.2, p. 24. Please discuss how the ephemeral pit pond is sized for pit runoff during operations.
5. Section 4.7, p.42. Losses due to channel infiltration during a 100-year design storm are generally considered to be negligible. Please justify the use of channel infiltration in the HydroCAD® models.
6. Section 5.0, Model Results. Please note that the DRMS is only interested in the runoff volume from the 10-year, 24-hour design storm for pond storage requirements and the peak flow from the 100-year, 24-hour design storm for channel and spillway capacity and stability analyses. All hydrologic modeling other results are unnecessary.
7. Section 5.3 and Table 21, pp. 47-48. To reiterate the inadequacy of using "average cross sections" for hydraulic analyses, the 1.55-ft stage for PitDivW (Table 21) does not have the 1 ft of freeboard stated at the end of the paragraph on p. 47 in top cross section of Figure 14 (p. 32).

8. Section 5.5, p. 49. The "negligible outflow" from Catchment 001B-A South demonstrates insufficient storage capacity requiring re-design. Please provide design drawings for both Catchments 001B-A South and 001B-A North.
9. Section 6.3.2 (p. 63) and Plate 2. According to Figure HS-1 – Probable Range of Drop Choices and Heights (UDFCD 2008) vertical drop structures are not acceptable if they are over 3 feet in height. Please limit the vertical hard drop height to 3 feet or less.
10. Plates 1 through 4. Pursuant to Rule 6.4.21(10)(a) of Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal, And Designated Mining Operations, design specifications shall be certified by a licensed professional engineer for all Environmental Protection Facilities. Pursuant to Rule 3.2.3 of the Bylaws and Rules of The (Colorado) State Board of Licensure for Architects, Professional Engineers and Professional Land Surveyors, application of the licensee's seal, signature **and date** shall constitute certification that the work was done by the licensee or under the licensee's responsible charge. Please include a signature and date on all certified drawings, documents and specifications sealed by a licensed professional engineer in the state of Colorado.
11. Plate 3. The Reach Definition Summary Table indicates there is a 50 % contraction in the bottom width of the channel in the downstream direction between Reach WR_DivP1 and WR_DivP2. This condition requires additional hydraulic head to overcome the contraction. Please either demonstrate adequate freeboard is available for this additional head loss in the upstream reach or redesign the upstream and/or downstream reaches to avoid this condition.
12. Plate 4. Please provide riprap specifications for all three rock aprons.

The DRMS requires analyses, certified designs and specifications for the engineered elements associated with the environmental protection plan (EPP). The cover page, all drawings and specifications should be stamped, signed and dated by the responsible engineer.

If either you or the applicants have any questions regarding the comments above, please call me at (303) 866-3567, extension 8169.

Table A-1. JD-7 Drainage Design Review Summary
Current Condition

Diversion Channel	Figure # for Location	Contributing Basin ID	Contributing Area (Ac)	Hydrologic Analysis Adequate?	V10 (ac-ft)	Q100 (cfs)	Capacity Check Adequate?(1)	Stability Check Adequate?(2)	Comments
Pit Diversion East	10	NG	132.91	Yes		117.55	NO	NO	Averaged cross section used; Fr > 0.8 & V > 5 fps
Pit Diversion East in Basin B4	10	N/A	TBD	No		75.94+TBD	N/A	N/A	Basin B4 is labeled in Figure 3. Need to discuss impact of additional 75.94 cfs between PDEOut & Culvert CV4 (both on Fig 10)
Pit Diversion West	10	NF	109.11	Yes		70.96	NO	NO	Averaged cross section used; Fr > 0.8 & V > 5 fps
NECh2	10	NF+part of NE	109.11+~35	No, Portions of basin NE ignored		70.96+TBD	NO - N/A	NO - N/A	NR
NECh1	10	NF+part of NE	109.11+~52	No, Portions of basin NE ignored		70.96+TBD	NO - N/A	NO - N/A	NR
Waste Rock Diversion 1, a.k.a. OPWRD	10	NE & D1+D8	372.93	Uncertain, no model output provided		188.49	NO - N/A	NO - N/A	NR
Waste Rock Diversion 2, a.k.a. OPWRD	10	NF+NE+ND, & D1+D8+D9	386.87	Uncertain, no model output provided		244.55	NO - N/A	NO - N/A	NR
Mine yard/Under-ground waste rock pile berm	11	D5, D6	3.26	NR		NR	NO - N/A	NO - N/A	NR
001B-A North	11	D-16	1.55	TBD, RO vol. NR	0.054 (no output provided)	inflow NR	Pond redesign adequate	NO	Pond must be full to invert of lowest gravity outlet when 100-year storm is routed through pond for stability check
001B-A South	11	D-17	0.43	Questionable since 001B lies in both Basins D-17 & D-7 (see Fig. 11)	0.021 (no output provided)	1.17 (no output provided)	NO	NO	Negligible outflow (p.49) indicates insufficient 10-yr storm capacity. No discussion of freeboard. Also, pond must be full to invert of lowest gravity outlet when 100-year storm is routed through pond for stability check
Pit Pool	10	D-1	82.25	NO, CN too low for bare soil after operations resume	NR	146.5	NO	NO	Pit pool must store the 10-yr strom runoff and pass the 100-yr storm peak flow, assuming its full to the invert of the lowest gravity outlet structure.

(1) Capacity check for ponds must demonstrate capacity to store 10-yr, 24-hr storm RO volume.
(2) Stability check for ponds must demonstrate ability to pass the 100-yr, 24-hr storm peak flow
N/A - Not Available
NR - Not Reported
RO - Runoff
TBD - to be determined (nothing to review as yet)

Table A-2. JD-7 Drainage Design Review Summary
Planned Condition

Diversion Channel	Figure # for Location	Contributing Basin ID	Contributing Area (Ac)	Hydrologic Analysis Adequate?	V10 (ac-ft)	Q100 (cfs)	Capacity Check Adequate?(1)	Stability Check Adequate?(2)	Comments
Open pit diversion ditch – east (PDEP)	33, 34	NPG	150.25	NO, NR		NR	NO - NR	NO - NR	A comparison of Table 35 and Plate 3 does not conclusively demonstrate adequate capacity. Fr > 0.8 for all channels summarized in Table 36.
Pit Diversion East in Basin B4	33, 34	N/A	TBD	No		N/A	NO - N/A	NO - N/A	Need to discuss impact of additional contributing area from Basin B4 shown in Figure 3.
Open pit diversion ditch – west (PDWP)	33, 34	NPF	40.33	NO, NR		NR	NO - NR	NO - NR	A comparison of Table 35 and Plate 3 does not conclusively demonstrate adequate capacity. Fr > 0.8 for all channels summarized in Table 36.
NPE_Ch1	34	NPF+part of NPE	40.33+~10±	No, Portions of basin NPE ignored		NR	NO - N/A	NO - N/A	A comparison of Table 35 and Plate 3 does not conclusively demonstrate adequate capacity. Fr > 0.8 for all channels summarized in Table 36.
NPE_Ch2	34	NPF+part of NPE	40.33+~15±	No, Portions of basin NPE ignored		NR	NO - N/A	NO - N/A	A comparison of Table 35 and Plate 3 does not conclusively demonstrate adequate capacity. Fr > 0.8 for all channels summarized in Table 36.
Open pit waste rock pile diversion (OPWRDP)	34	DP1, DP8, DP9, DP10, DP20 & NPF, NPE, NPD, NPC, NPD, NPB, NPA, NPH	From 325.14 up to 632.12	NO, NR		174.3 (not sure where this is)	NO - NR	NO - NR	A comparison of Table 35 and Plate 3 does not conclusively demonstrate adequate capacity. Fr > 0.8 for all channels summarized in Table 36.
Pit Pool→OPWRD	N/A	DP1	160.71	No, none presented		NR	NO - NR	NO - NR	Pit pool must store the 10-yr strom runoff and pass the 100-yr storm peak flow, assuming its full to the invert of the lowest gravity outlet structure.
Pit Pool	N/A	DP1	160.71	No, none presented	NR	NR	NO - NR	NO - NR	Pit pool must store the 10-yr strom runoff and pass the 100-yr storm peak flow, assuming its full to the invert of the lowest gravity outlet structure.
SCN	34, Plate 4	DP1, DP8, DP9, DP10, DP20 & NPF, NPE, NPD, NPC, NPD, NPB, NPA, NPH & DP4-7, DP12 & DP17-19	805.8	NO - NR	NR	NR	NO - NR	NO - NR	No model output presented

(1) Capacity check for ponds must demonstrate capacity to store 10-yr, 24-hr storm RO volume.
(2) Stability check for ponds must demonstrate ability to pass the 100-yr, 24-hr storm peak flow
N/A - Not Available
NR - Not Reported
RO - Runoff
TBD - to be determined (nothing to review as yet)