STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

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MEMORANDUM

To: Bob Oswald

From: Tim Cazier, P.E.

Date: October 30, 2012

Re: Permit No. M-2012-032, Revenue Mine Surface Water Systems Designs – General Stormwater Comments

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The Division of Reclamation, Mining and Safety (DRMS) engineering staff has reviewed Exhibit E; Exhibit G, Sections 4.4, 4.5, 4.6, and 4.7; and associated maps of the Revenue Mine 112D Application package prepared by Greg Lewicki And Associates received on June 28, 2012. 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, 6.4.21(10) and 7.3.1. Please note that 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).

Exhibit E/Map F-1:

1. Page E-2, 2nd paragraph states all three ponds will be removed. Map F-1 shows no fill in Sed Pond 1, and a Permanent Pond in place of Sed Pond 2 and the Mine Water Pond. Section 9 on p. E-5 again states Sediment Pond 1 will be backfilled. This same paragraph also states Sediment Pond 2 and the Mine Water Pond will not be backfilled.
    a. Please provide clarification as to the ultimate status (reclamation phase) of the three ponds.
    b. If Sed Pond 1 is to be backfilled, please correct Map F-1 to show it is backfilled and graded to drain.

Exhibit G:

2. Page G-17, subparagraph a states Diversions #1 and #1B may not be installed and the "start of the mine". No further schedule criteria are provided. Please commit to constructing Diversions #1 and #1B prior to any mining related disturbance in the existing Atlas Mine tailings area.

3. Table G-6 – Stormwater Basins and Ditches:
    a. There are some discrepancies between Table G-6 (basin data) and the data in Appendix 6 – Stormwater Calculations and Designs:
        i. #2 – curve number and peak discharge differ. Please correct the errors.
        ii. #6 – time of concentration and peak discharge differ. Please correct the errors.
        iii. #7 – the 2.4 minute time of concentration for a 14.4-acre basin is suspect.
        iv. #7B – no calculations found in Appendix 6. Please correct the errors.
        v. #8 – no peak flow calculations found in Appendix 6. Please correct the errors.
    b. Please provide some rationale for the curve number selection used in runoff estimates for all the "Stormwater Basins for Diversion". This should include references to the soil survey in Exhibit I (hydrologic soil group) and vegetation discussed in Exhibit J.
    c. Please provide times of concentration calculations for each Stormwater Basin.
    d. The Collection Ditches appear to be designed to convey only the 10-year design storm. Please provide some narrative to address the consequence of failure for each Collection Ditch. If there is a potential for any impact to off-site or undisturbed areas as a result of a Collection Ditch failure, that Collection Ditch shall be designed to convey the runoff from the 100-year, 24-hour design storm. Examination of Map G-1 suggests that failure of portions of Collection Ditches #1, #3 and #4 along Sneffels Creek would allow impacted water to flow directly into the creek. These sections need to be designed to convey the runoff from the 100-year, 24-hour design storm.
    e. Channel/ditch designs need to address both stability (e.g., maximum channel slope/minimum expected roughness) and capacity (e.g., minimum channel slope/maximum expected roughness). Most references for Manning's roughness coefficients provide a minimum and maximum roughness value for various channel lining material. The DRMS also notes that the ditch alignments presented on Map G-1 suggest most, if not all the ditches have both steep and flat sections. Please address design capacity and stability for each channel segment. For example, a channel cut in rock with smooth and uniform sides would be expected to have a Manning's n = 0.025 for stability and 0.040 for capacity.
    f. The DRMS acknowledges the Office of Surface Mining's (OSM) requirement for 0.3 feet of freeboard. However, the OSM's 1982 Surface Mining Water Diversion Design Manual also recommends a minimum one foot of freeboard. The DRMS realizes that with channels conveying low flows (typically "V" ditches with flow depths less than one foot); one foot of freeboard is excessive. As such, the DRMS requires low flow channels be designed with a minimum of 0.5 feet of freeboard unless the velocity head ($v^2/2g$) is significant, then the minimum required freeboard is half the velocity head, or $v^2/4g$. Please design all the ditches with the appropriate freeboard and provide channel design depths for construction.

g. There are some discrepancies between Table G-6 (ditch data), Map G-1, and the data in Appendix 6 – Stormwater Calculations and Designs:

i. #1, #1B and #2 – Channels with 1H:1V side slopes are not stable in highly weathered rock or soil. Please confirm these ditches will be cut into competent rock or flatten the side slopes to a no steeper than 2.5H:1V.

ii. #1 – The capacity flow of 21.76 cfs flow differs from the 16.31 cfs design flow. As such velocity, depth of flow and freeboard are inaccurate. Please correct the errors.

iii. #1B – no calculations found in Appendix 6. No difference in parameters between #1 and #1B. Map G-1 suggests Basin SWB2 contributes runoff to #1B. Please correct the errors.

iv. #2 – The capacity flow of 36 cfs flow is less than the 40.77 cfs design flow. As such velocity, depth of flow and freeboard are inaccurate. The wetted perimeter, flow area and velocity in Appendix 6 are all 0.00. Please correct the errors.

v. #3 – The Manning's n = 0.300 is in error, please provide a correction and explain the reason behind the difference in "rock" lining for ditches #1, #1B, and #2; and the "excavated (no veg)" lining for ditch #3 (note that design velocities above five feet/second will require revetment protection).

vi. Map G-1 suggests both basins SWB 4 and SWB 5 contribute flows to the east portion of Ditch #3. Please reflect the additional flow in the calculations.

vii. There are two rows labeled #3 with identical information. Is the second row intended to summarize the design for the portion of DIV #3 that also includes runoff from SWB5?

viii. All Collection Ditches – Channels with rounded rock and/or fines with steep (greater than 2.5H:1V) side slopes are not stable under flowing conditions. Please flatten the side slopes to a no steeper than 2.5H:1V.

ix. #2 – "COLL #2" could not be located on Map G-1. Please label COLL #2 on Map G-1.

x. #4 – Appendix 6 states Collection Ditch #4 is the same as Collection Ditch #3, but the design parameters in Table G-6 are different. Please make corrections.

xi. Collection Ditches #5, #6, and #7 could not be found in either Appendix 6 or on Map G-1. Please update both Appendix 6 and Map G-1.

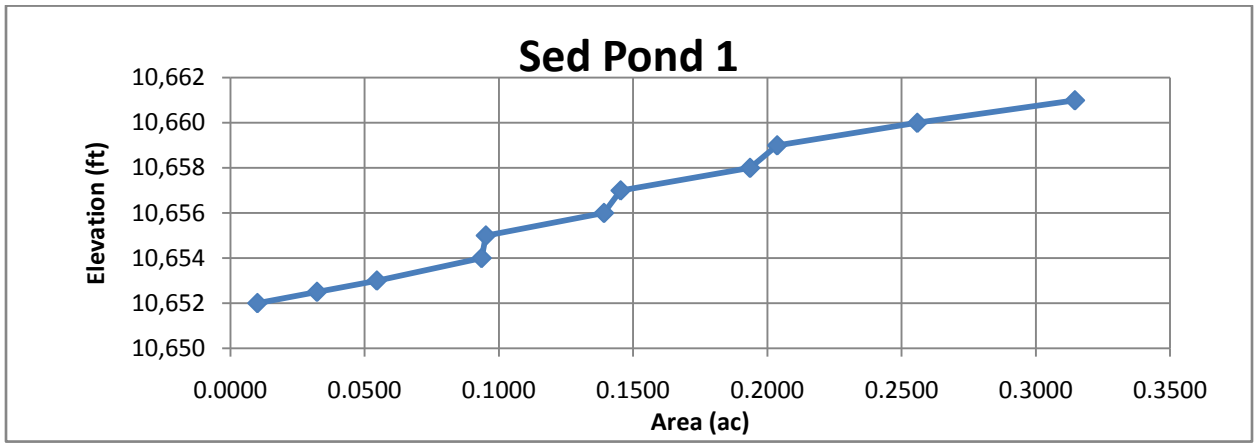
4. Section 4.6 Sediment Pond Designs. The 10-year, 24-hour runoff volume criteria used for sizing storage in the ponds is acceptable. However, the spillways need to be designed to pass the peak flow resulting from the 100-year, 24-hour design storm. According to Maps G-2, G-3 and G-4; the valves on the principal/primary spillway pipes are usually closed. As such, the emergency spillway for each pond needs to be designed to convey 100-year peak flow, assuming the ponds are full (to the emergency spillway invert elevation) at the onset of the design storm. Please provide analyses and designs to demonstrate the emergency spillways have the capacity to pass the peak flow resulting from the 100-year, 24-hour design storm.

Map G-1:

5. Watershed or basin delineation boundaries are perpendicular to elevation contours. The delineations shown for the undisturbed areas on Map G-1 frequently run at as much as 45 degree angles to the contours. As such, the DRMS estimates SWB1 is about a third smaller than it should be; SWB2 should be about three times larger; SWB3 is about twice the size it should be; SWB4 is about half the size it should be; and SWB5 should be about 25 percent larger. Attachments 1 and 2 demonstrate suggested corrected basin boundaries for the basins west and east of the Atlas Drainage, respectively. The red dashed lines are the correct basin delineations, assuming similar start points at the Diversion Ditches. Please correct the basin delineations and revise hydrologic and hydraulic calculations as necessary. Note because of the map scale and the proximity of the diversion and collection ditches, the DRMS is uncertain where the delineation between "DIV #1 and DIV #1B occurs.
6. It is unclear from the calculations and the two subbasins that appear to contribute to ditch DIV #3 if both SWB4 and SWB5 are in fact intended to be diverted by DIV #3. Please provide some clarification as to the intent and calculation corrections if necessary.
7. The DRMS was unable to locate the following ditches on Map G-1: COLL #2, COLL #5, COLL #6, and COLL #7. Please label these ditches listed in Table G-6 on Map G-1.
8. It appears not all of SWB 6 contributes to ditch COLL #1. A small area on the southeast of SWB 6 appears to contribute to an unnamed collector ditch that enters the south end of Sed Pond 1. The Applicant may want to consider splitting out this portion of SWB 6 to avoid over designing COLL #1.
9. It appears not all of SWB 7 contributes to ditch COLL #3. A small area on the southeast of SWB 7 appears to contribute to an unnamed collector ditch that enters the south end of Sed Pond 2. The Applicant may want to consider splitting out this portion of SWB 7 to avoid over designing COLL #3.

Map G-2:

10. The emergency spillway will need to be armored with revetment to at least the toe of the 3H:1V slope to prevent scour from causing the embankment to fail. Please provide appropriate armor sizing calculations, designs and specifications.
11. The collection ditch inlets will need to be armored with revetment to prevent the ditches from head cutting upgradient. Please provide appropriate armor sizing calculations, designs and specifications for the collection ditch inlets.
12. As the site is a DMO, the embankment is considered an environmental protection facility (EPF). Please include embankment material fill and compaction specifications.
13. There appear to be errors in the storage volume computations. Based on the shape of Sediment Pond 1, the relation between the elevation and the area should be nearly linear and smooth. The plot below suggests area errors at elevations 10655, 10657, and 10659. Please review and correct these errors.



Map G-3:

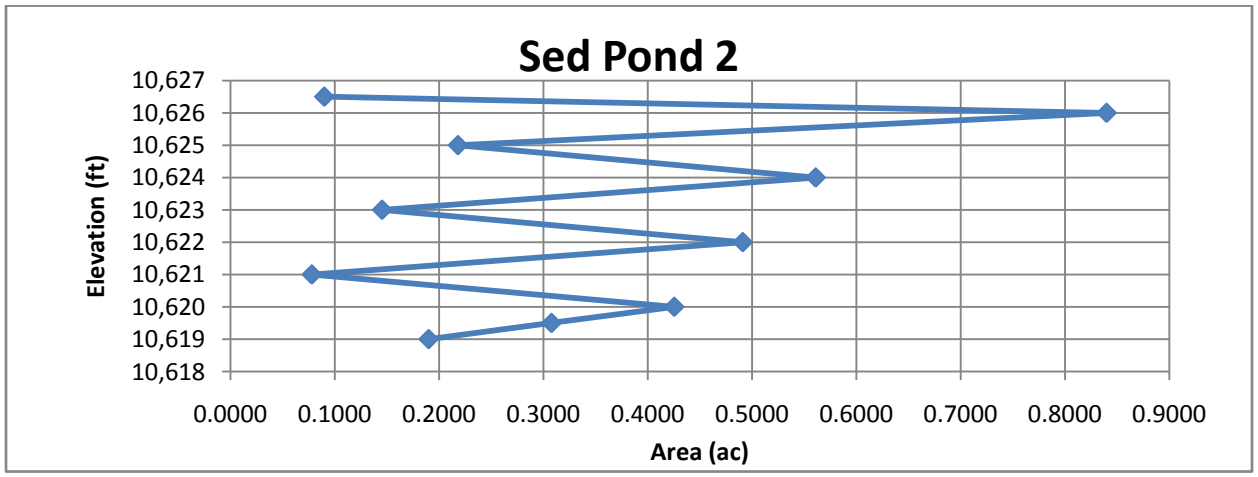
14. The emergency spillway will need to be armored with revetment to at least the toe of the 3H:1V slope to prevent scour from causing the embankment to fail. Please provide appropriate armor sizing calculations, designs and specifications.

15. Please provide some explanation regarding the alignment of the primary spillway pipe. Why is it so long and why does it cross the emergency spillway channel?

16. The collection ditch inlets will need to be armored with revetment to prevent the ditches from head cutting upgradient. Please provide appropriate armor sizing calculations, designs and specifications for the collection ditch inlets.

17. As the site is a DMO, any embankment fill is considered an EPF. Please include embankment material fill and compaction specifications.

18. There appear to be errors in the storage volume computations. Based on the shape of Sediment Pond 2, the relation between the elevation and the area should be nearly linear and smooth. The plot below suggests several area errors. Please review and correct these errors.



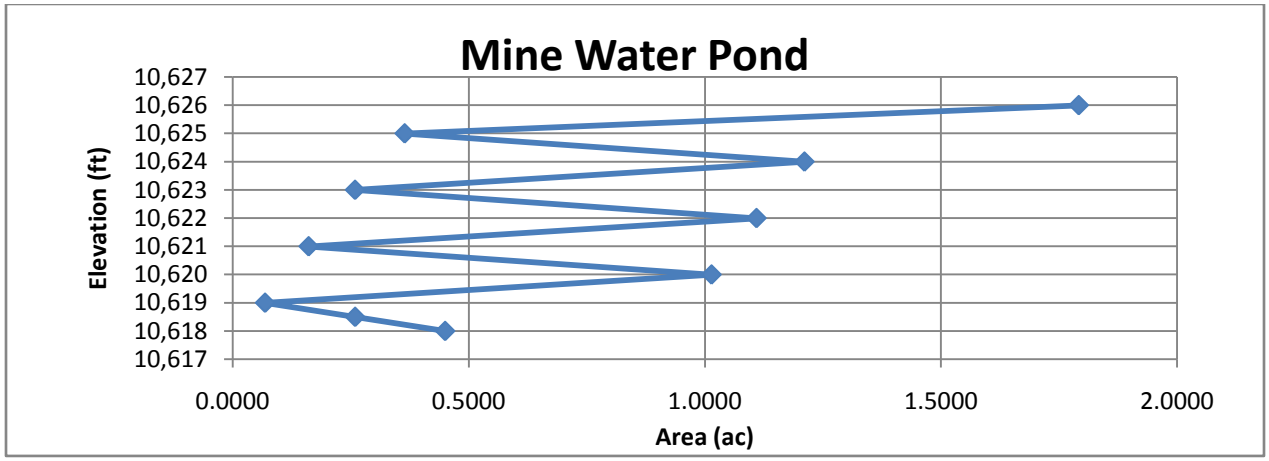
Map G-4:

19. The emergency spillway will need to be armored with revetment to at least the toe of the 3H:1V slope to prevent scour from causing the embankment to fail. Please provide appropriate armor sizing calculations, designs and specifications.

20. Please describe the purpose of the 12-inch HDPE pipe to Pond #3. Where does this pipe come from? Where is Pond #3?

21. As the site is a DMO, any embankment fill is considered an EPF. Please include embankment material fill and compaction specifications.

22. There appear to be errors in the storage volume computations. Based on the shape of the Mine Water Pond, the relation between the elevation and the area should be nearly linear and smooth. The plot below suggests several area errors. Please review and correct these errors.



Appendix 6 (Note – refer to Comment 5 to correct subwatershed areas):

23. Page 6-1, SWB-2. The rainfall depth is 2.2 inches instead of the 3.3 inches required for the 100-year storm. Please provide a corrected calculation sheet.

24. Page 6-3, SWB-6. The collection ditch should be designed for the 100-year event using a rainfall depth of 3.3 inches. Please provide a corrected calculation sheet.

25. Page 6-5, SWB-7. The collection ditch should be designed for the 100-year event using a rainfall depth of 3.3 inches. Please provide a corrected calculation sheet.

26. Page 6-8, Diversion Ditch #2. The wetted perimeter, flow area and velocity are all 0.00. Please provide a corrected calculation sheet.

27. Page 6-11, General Culvert Designs. A flow and size for a corrugated steel pipe is presented. Where is the culvert to be located? Please provide a location on Map G-1.

28. Pages 6-12 and 6-13, Pond Volumes. Based on Comments 13, 18 and 22, please provide updated calculation sheets.

General Comments:

29. Pursuant to Rules 6.4.21(10)(a)(ii) and (iii), the applicant shall provide design specifications certified by a licensed professional engineer for all Environmental Protection Facilities intended to convey, transport or divert surface water and capture and/or retain surface water runoff from areas affected by the Designated Mining Operation. As such, please provide a ditch design summary drawing to include channel details (maximum and minimum slopes, channel lining, minimum design depth, side slopes, and channel lining) for each ditch. Specifications need to be provided for revetment if necessary.

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

Enclosures: Attachment 1
Attachment 2

Attachement 1. Suggested edits to Diversion Ditch Basin boundaries SWB1 and SWB2 shown as red dashed line: ----------

Attachement 2. Suggested edits to boundaries SWB3, SWB4 & SWB5: ----------