

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

January 5, 2004

TO: Internal File

THRU: Daron R. Haddock, Permit Supervisor

FROM: Gregg A. Galecki, Reclamation Specialist III - Hydrology

RE: HCI Groundwater Model Report in PHC, Canyon Fuel Company, LLC, Skyline Mine, C/007/005, Task ID #1752

SUMMARY:

The following is a review of a proposed amendment to the Skyline Mine Mining and Reclamation Plan (MRP) received by the Division on October 9, 2003. The current submittal proposes modifications to the MRP to include a summary report addressing a numeric hydrologic model prepared by Hydrologic Consultants Inc. for the Skyline Mine. For the modeling report to be incorporated into the currently approved MRP, additional modifications to the Probable Hydrologic Consequences (PHC) section of the MRP need to be completed. The model report is not subject to being deficient, however items will be outlined that, if provided, would increase the confidence in the reliability/acceptance of the model. The following review addresses only hydrologic aspects of the regulations. The amendment is currently considered deficient and requires additional modification prior to Division approval.

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TECHNICAL ANALYSIS:

ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR 783., et. al.

GEOLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR 784.22; R645-301-623, -301-724.

Analysis:

Plate II of the HCI modeling report has been submitted to illustrate the boundaries of the potential source area of the water being encountered in the Skyline Mine. As outlined in the model, the boundaries are the Pleasant Valley Fault in the east, Gooseberry Fault in the west, Fish Creek Graben in the north, and generally the Left Fork of Huntington Creek in the south. This map provides a much needed regional perspective of the area as it relates to geology.

To help formulate the hydrologic model, considerable geologic research was conducted in finding and studying existing geologic drill logs, primarily deep exploration gas wells penetrating the Star Point Sandstone. This work (Kravits, 2003), at a minimum the location of the described 17 gas exploration holes and 30 coal exploration holes, needs to be provided to the Division.

Findings:

Information provided does not adequately address the minimum requirements of the Geologic Resource Information section of the regulations. Prior to approval, the Permittee must provide the following in accordance with:

R645-301-622, Provide the geologic work conducted by Kravits (2003).

HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

Analysis:

Modeling

Appendix J – HCI Ground Water Flow Modeling of Skyline Mine and Surrounding Area, is being proposed to be included as part of the Skyline Mine PHC. The modeling report is being adopted into the MRP as supporting evidence for the Skyline Mine PHC determination. It is not subject to a typical Division technical analysis outlining deficiencies as it was developed for the law firm Manning, Curtis, Bradshaw and Bednar LLC, of Salt Lake City Utah. However, the Division review suggests improvements and comments identifying its relative importance.

For the proposed hydrogeologic numeric ground water model to be adopted as an appendix into the MRP, the reader is reminded numerous times in both the PHC section of the MRP and the HCI report itself of the limiting factors of the model. The surface and ground water hydrology of the Skyline area are poorly understood due to the limited availability of data and the nature of geologic faulting in the area. As stated in the PHC, “One purpose of the model is to help the mine define the recharge and discharge locations of the Star Point Sandstone aquifer and the determine the potential impacts, if any, to surface waters and their beneficial uses.” Due to limited availability of data, the model needed to make significant assumptions on the volume, porosity, and transmissivity of the aquifer, which affects the accuracy of the model.

One general item that needs clarification is that the proposed Appendix J is not the hydrologic model itself, but a summary report. The model is proprietary and not available to the public, although the parameters used and results of the model have been presented in the report.

Although comprehensive summary, the modeling report was lacking in documentation. The conceptual portion of the model assumes the water pumped from the fault and mine inflow water is primarily derived from groundwater, the impacts of concern are drawdown, potential subsidence associated with drawdown, and impacts of drawdown on water users in the permit area. Calibration for HCI’s model was a process of adjusting the conceptual model parameters and boundaries to reasonably replicate field observed conditions for pre-mining water levels and estimated stream baseflows.

The support documentation that is absent from the report necessary to provide a qualitative and quantitative evaluation includes the following: 1) a table with the measured heads and simulated heads with the associated locations; 2) a discussion whether or not data was weighted, based on higher confidence of data from a particular location or stratigraphic unit; 3) a detailed water budget quantifying overall model inflow and outflow from the sources and sinks, and any critical model fluxes related to the model objective (i.e. water gained or lost at Electric Lake). Additional useful information would include contour maps of measured and simulated water levels for the various aquifers simulated. With the measured and simulated values,

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statistical information such as the mean absolute error, root mean squared error, and graphics of the error distribution could all be generated. All of these would add support to the adequacy of the calibration process and whether the conceptual model is adequately represented in the numeric model.

A significant finding in the HCI report states (Page 44, Section 5.1), “The most significant finding of the model simulations is that it is possible to account for essentially 100 percent of the inflow into the Skyline Mine by depletion of storage in the deep groundwater system.” The report also stated (Page 45) that given the conceptual parameters, “the hydraulic conductivity of the fault could not be increased in any portion of the fault other than between the lake and the mine -- an unusual constraint -- without causing significant, unmeasured drawdown in the Blackhawk Formation.” This suggests the majority of water, according to the model, could not be supplied from Electric Lake. However, the ‘weighted value or qualifiers’ of this statement is subjective based on 1) assumptions made in the conceptual model, 2) a limited understanding of groundwater recharge and discharge in the area, 3) insufficient documentation to evaluate model calibration, 4) insufficient documentation to evaluate the sensitivity analysis, and 5) a lack of model verification.

Given the conceptual parameters of the model, the building of the numeric model adequately illustrated it is a reasonable scenario that the water can be derived from the deep groundwater system. However given the limited availability of data, use of the model as a predictive tool is questionable. It is not ‘unreasonable’ that another model could be constructed using different conceptual constraints that produced different results. Use of the model as reliable predictive tool would be questionable due to the numerous assumptions necessary because of limited data. Additional modeling is not warranted because acquisition of additional, meaningful data is not possible. The model serves to bolster the Mine’s PHC asserting that the water encountered in the mine is being sourced by the Star Point Sandstone.

Probable Hydrologic Consequences Determination

The Skyline Mine PHC determination has been modified primarily to the degree that it has incorporated/modified date-sensitive statements relative to the final submittal of the HCI modeling report. The modeling report is considered supporting evidence to the Mine’s position that the majority of water being encountered in-mine is being sourced from the regional Star Point Sandstone aquifer. The model is not considered by the Division to be conclusive evidence, only supportive evidence suggesting the majority of water encountered in-mine could be sourced from the Star Point Sandstone.

Significant recent events that will potentially affect the inflows being encountered in the Mine are completion of mining in the southern portion of Mine #2 and the resulting flooding of the mine workings up to the 6-Left area. The flooding of the mine workings will raise the water in the mine to an elevation of approximately 8280 feet (msl), resulting in approximately 240-feet

of hydrostatic head on the inflows being encountered in the mine (10 Left elevation 8040-feet; HCI Table 3).

The following items are discussion topics within the PHC that could use additional clarification:

- 1) On bottom of page PHC A-7 states, 'By June 2002, the 6 Left B panel....', should read 2004.
- 2) On page PHC A-9 when talking about the performance of the pump in JC-3 the last sentence states, 'variable frequency drive to allow for lower volumes to be pumped', but does not give any reference to what types of volumes are being considered.
- 3) Page PHC A-19 paragraph 2 has dated statements indicating, 'tritium has declined to 1.71 TU.'
- 4) Clean copies do not match redline-strikeout copies (i.e. four paragraphs before "Effects on Surface Waters"
- 5) When talking about Appendix J (Page PHC A-23, paragraph 1 redline) refer to it as a 'summary report' not the completed model since the information necessary to operate the model is not available.
- 6) PHC A-23 paragraph 2, outline why boundaries were established where they are (why reasonable). Also, if the recharge area to the aquifer is 'the northern portion of Joe's Valley Graben', state whether any of the Star Point Sandstone formation (exposed at the surface) will be affected by long term drawdown. As an example, based on the life of the mine or a systematic drawdown of the Star Point regional aquifer to approximately the 8,300 foot elevation (elevation of West Mains), identify what portions of the Star Point Sandstone will be impacted (if any).
- 7) PHC A-24 paragraph 1, reference/discuss Appendix F or update with current conditions.
- 8) PHC A-29 paragraph 2, when discussing conditions for operation of JC-3 include water quality.
- 9) PHC A-30 when discussing outlet pipe of JC wells into Electric Lake discuss armoring done by Pacificcorp.

Findings:

The information provided does not adequately address the minimum requirements of the Hydrologic Resource Information section of the regulations. Prior to approval, the Permittee must provide the following in accordance with:

R645-301-728.100, -728.334, -728.340, -728.350, -121.200, Provide additional clarification to the nine (9) items outlined in the PHC determination section of this technical analysis.

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MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION

Regulatory Reference: 30 CFR 783.24, 783.25; R645-301-323, -301-411, -301-521, -301-622, -301-722, -301-731.

Analysis:

Subsurface Water Resource Maps

Should the PHC determine the potentially affected area extends to areas of the Star Point Sandstone not currently addressed on drawing 2.3.5.2-1 (Ground Water Rights on and Adjacent to the Skyline Property), modifications to the drawing may be necessary.

Surface Water Resource Maps

Should the PHC determine the potentially affected area extends to areas of the Star Point Sandstone not currently addressed on drawing 2.3.5.1-1 (Surface Water Rights on and Adjacent to the Skyline Property), modifications to the drawing may be necessary.

Findings:

Information provided currently addresses the minimum requirements of the Maps, Plans, and Cross Sections of Resource Information section of the regulations.

OPERATION PLAN

HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

Analysis:

General

Groundwater Monitoring

Concerning continuing drawdown of the Star Point Sandstone aquifer for an extended period, the Division requests any appreciable springs located in the Star Point Sandstone with

elevations above approximately 8,300 feet (msl), that are not included in the current hydrologic monitoring program, but are being monitored, to be submitted.

Surface Water Monitoring

Assuming the Skyline mine continues to discharge water from the Star Point Sandstone aquifer for an extended period of time, affects to the Star Point Sandstone in the proximity of the mine need to be monitored. Generally, stream sites to be considered should be within the Star Point Sandstone, with elevations above approximately 8,300 feet (msl), and preferably be a gaining stream that has flow data prior to 2001.

Plate I of the HCI report identifies Boardinghouse Creek as a stream gage site with current or past continuous monitoring. This information is not currently available in the information Skyline Mine is providing to the Division. It is assumed a majority of the information available comes from the Lodestar – White Oak mine while they were monitoring the site (VC-11). The Division requests this site be added to the Skyline Mine hydrologic monitoring program for flow, and that Skyline Mine provide any flow information not included in the White Oak mine information. The Division also requests the stream located in Finn Canyon (White Oak Mine site VC-12), be added to the Skyline Mine hydrologic monitoring program for flow. Both streams have flow data extending back to 1980, but are no longer monitored as part of the White Oak Mine Plan.

The Division also requests that any flow information currently available on streams downstream of Electric Lake that are not included in the Skyline monitoring program be submitted. The Division recommends flow-monitoring sites be established on streams located in Valentines Gulch and Hughes Canyon.

A considerable amount of focus has been placed on tritium sampling, particularly of JC-1 and the significance of the rising tritium values observed over time. If Electric Lake and the Blackhawk Formation is supplying a portion of this water, a better understanding of the water in Electric Lake and supplying Electric Lake is necessary. Continued sampling of these waters, as outlined in PHC Appendix G, Table 2 is warranted. It is understood that the tritium values of samples being collected in the Lake below James Canyon are compromised by the very low tritium values being encountered in the JC-1 and possibly JC-3 wells.

Findings:

The information provided does not adequately address the minimum requirements of the Operation Plan – Hydrologic Information section of the regulations. Prior to approval, the Permittee must provide the following in accordance with:

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R645-301-728.334, -731.213, Provide any ground water monitoring information of springs not currently being reported in the Monitoring Program that lie in the Star Point Sandstone and are above an approximate elevation of 8,300 feet (msl), or demonstrate with the PHC the monitoring is not warranted.

R645-301-728.334, -731.224, Provide the flow data in Boardinghouse Creek as described in Plate I of the HCI report. Also, the Division requests adding flow-only monitoring sites in Boardinghouse Creek, Finn Canyon, Valentine's Gulch, and Hughes Canyon unless the PHC demonstrates the monitoring is not necessary.

R645-731.200, Make a commitment to collect additional tritium samples of sites identified in PHC Appendix G, Table 2.

MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-512, -301-521, -301-542, -301-632, -301-731, -302-323.

Analysis:

Monitoring and Sampling Location Maps

Any new ground water and surface water monitoring sites need to be added to Plate 2.3.6-1 (Location of Hydrologic Monitoring Stations) of the currently approved MRP.

Findings:

The information provided does not adequately address the minimum requirements of the Maps, Plans, and Cross Sections of Mining Operations section of the regulations. Prior to approval, the Permittee must provide the following in accordance with:

R645-301-730, Provide any updates to Plate 2.3.6-1, Location of Hydrologic Monitoring Stations as necessary.

CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT

Regulatory Reference: 30 CFR Sec. 784.14; R645-301-730.

Analysis:

Based on the information currently submitted, and information submitted to the Division since the last Cumulative Hydrologic Impact Assessment (CHIA) revision, the Division CHIA is in the process of being updated. The modifications are primarily date-sensitive and do not affect the overall current assessment. The information provided is considered supporting evidence to indicate the mining operation has been designed to prevent material damage to the hydrologic balance outside the permit area. The Division has requested additional information concerning possible affects to the Star Point Sandstone regional aquifer that will potentially influence sections of the current CHIA. These requested modifications will need to be submitted prior to a complete updating of the Division CHIA.

Findings:

Information provided does not adequately address the minimum requirements of the Cumulative Hydrologic Impact Assessment section of the regulations. The modifications outlined above need to be completed prior to a current update to the CHIA document.

RECOMMENDATIONS:

The proposed application needs additional modifications prior to being incorporated into the currently approved MRP.