Converse County Oil and Gas Project Final Environmental Impact Statement Groundwater Drawdown Model Simulations Technical White Paper

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TO: Converse County EIS Decision File

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In light of the Court's finding in *Powder River Basin Res. Council v. DOI*, 749 F. Supp. 3d 151 (D.D.C. 2024), that the BLM used an unsupported specific storage value in its groundwater modeling, the BLM has prepared a draft remedial groundwater drawdown modeling analysis for the Converse County Oil and Gas Project. The BLM intends to use the results of this analysis in a NEPA document analyzing the Project's effects on groundwater drawdown.

Introduction

This memo summarizes groundwater model simulations associated with the Converse County Oil and Gas Project Final Environmental Impact Statement (EIS). BLM's goals were 1) to run several existing models to compare BLM's drawdown results to those AECOM provided in the EIS Appendix E Groundwater Model Report and 2) to run the pertinent models again changing only the storage coefficient in model layers 1, 3, and 5 to evaluate any changes in drawdown. No other model modifications were made, and all modeling assumptions were the same as those in AECOM's previous simulations. BLM compared drawdown results with the adjusted specific storage values in layers 1, 3, and 5 to those obtained independently by WWC Engineering (2024). Layers 1, 3, and 5 are aquifers. Layers 2 and 4 are confining layers. The lithostratigraphic units are combined into hydrogeologic units consisting of aquifers and aquitards. In descending order, the Wasatch Formation and the Tongue River Member of the Fort Union Formation are combined into one aquifer referred to in this report as the Wasatch/Tongue River aquifer, which is the same as the Tongue River aquifer of Lewis and Hotchkiss (1981) and the Upper Fort Union aquifer of Long et al. (2014) [referred to as Layer 1]. The Lebo Shale Member of the Fort Union Formation is an aquiclude referred to as the Lebo confining unit and is analogous to the Middle Fort Union hydrogeologic unit of Long et al. (2014) [referred to as Layer 2]. The Tullock Member of the Fort Union Formation is an aquifer referred to as the Lower Fort Union aquifer of Long et al. (2014) [referred to as Layer 3]. The upper portion of the Lance Formation is an aquiclude and is termed the Upper Hell Creek confining unit, which is analogous to the Upper Hell Creek hydrogeologic unit of Long et al. (2014) [referred to as Layer 4]. The lower portion of the Lance Formation and the Fox Hills Sandstone are combined into one aquifer termed the Fox Hills/Lower Hell Creek aquifer [referred to as Layer 5]. These are analogous to the Lower Hell Creek aquifer and Fox Hills aquifer of Long et al. (2014). This White Paper incorporates by reference Appendix E, Converse County Final Environmental Impact Statement (2020) and we refer the reader to that document for additional information and context. Figures 2-1 and Figure 2-2 in Appendix E present the relevant cross-sections for the model area's lithography.

Methods

In this modeling project, the BLM ran a total of nine simulations as listed in Table 1.

Table 1. BLM Simulations (Concentrated Pumping Scenarios, 4,000-ft Well Spacing)

Simulation Description
1. Original AECOM model with all simulated pumping in Layer 1, Specific Storage value 0.001 ft^{-1}
2. Original AECOM model with all simulated pumping in Layer 3, Specific Storage value 0.001 ft^{-1}
3. Original AECOM model with all simulated pumping in Layer 5, Specific Storage value 0.001 ft^{-1}
4. Modified model with all simulated pumping in Layer 1, Specific Storage value 0.00001 ft^{-1}
5. Modified model with all simulated pumping in Layer 3, Specific Storage value 0.00001 ft^{-1}
6. Modified model with all simulated pumping in Layer 5, Specific Storage value 0.00001 ft^{-1}
7. Modified model with all simulated pumping in Layer 1, Specific Storage value 0.00000012 ft^{-1}
8. Modified model with all simulated pumping in Layer 3, Specific Storage value 0.00000012 ft^{-1}
9. Modified model with all simulated pumping in Layer 5, Specific Storage value 0.00000012 ft^{-1}

The BLM ran the concentrated pumping scenario models. Specifically, the models used were those with 4,000-foot well spacing. The dispersed well pumping scenarios were not re-run. The rationale for running only the concentrated pumping scenarios was that the maximum drawdown would likely be higher in the concentrated pumping scenarios than in the dispersed pumping scenarios simply due to the incremental effect of multiple wells pumping in the same area at the same time versus more broadly spaced wells pumping at the same time.

As described in Table 1, the first three simulations repeated runs of existing models with no modifications. In the second three simulations, the specific storage value in layers 1, 3, and 5 was lowered by two orders of magnitude from 0.001 ft^{-1} to 0.00001 ft^{-1}. An additional set of three simulations was repeated using a specific storage value of 0.00000012 ft^{-1}. The 0.001 ft^{-1} specific storage value was the value used in the original modelling effort and was cited in the 2006 Powder River Basin Coal Review report. The 0.00001 ft-^{1} value was the maximum model-specific storage value used in the 2006 Powder River Basin Coal Review report for the Wasatch/Fort Union formation (Layer 1). The 0.00001 ft-^{1} value was also used in the 2014 Calibration of the Phase II Groundwater Model for the Powder River Basin Report and the 2017 Calibration of the Groundwater Model for the Powder River Basin, Wyoming Report. The 0.00000012 ft^{-1} value used in this updated groundwater drawdown model was cited in the original Converse County Environmental Impact Statement modeling report (Appendix E) and is sourced from the 2014 Calibration of the Phase II Groundwater Model for the Powder River Basin report.

All models simulated pumping for 10 years followed by a 20-year period of no pumping. Model results were compared at the 10-year point because that was the time of maximum drawdown.

Results

As shown in Table 2, drawdown results obtained by the BLM's new modeling simulations are close to those reported by AECOM and WWC Engineering for the original model scenarios and are close to, or the same as, those reported by WWC Engineering for the modified model simulations.[1]

Table 2. Comparison of AECOM, WWC, and BLM Groundwater Model Results (Concentrated Pumping Scenario, 4,000-ft well spacing, drawdown is at 10 years of simulated pumping)

	Original Model			**Modified Model 1**		**Modified Model 2**
Simulation Completed By	AECOM	WWC	BLM	WWC	BLM	BLM
Specific Yield (Sy) Value (Used in Layer 1)	0.15	0.15	0.15	0.15	0.15	0.15
Specific Storage (Ss) Value (Used in Layers 2 - 5)	0.001 ft^{-1}	0.001 ft^{-1}	0.001 ft^{-1}	0.00001 ft^{-1}	0.00001 ft^{-1}	0.00000012 ft^{-1}
Maximum Drawdown with All Simulated Pumping in Layer 1	41.9'	39.4'	46.2'	44.4'	50.7'	52.4'
Maximum Drawdown with All Simulated Pumping in Layer 3	10.8'	10.8'	11.7'	47.6'	47.8'	55.1'
Maximum Drawdown with All Simulated Pumping in Layer 5	5.8'	5.8'	6.2'	58.8'	58.8'	73.2'

Discussion

BLM drawdown results for the original model re-run and use of the .00001 $ft^{-1}$are comparable to those obtained by AECOM and WWC Engineering which helps to confirm the adequacy of the BLM's re-modeling effort. It is not entirely clear why model BLM results are not identical to those of AECOM and WWC. One factor that may account for the different drawdown results is that AECOM and WWC appear to have taken the drawdown in Well 25 to be the maximum drawdown in each scenario. The BLM examined the results given in the drawdown contour range within the Groundwater Vistas software (Environmental Simulations, Inc.) and reported

[1] The WWC Engineering report was included as an Exhibit to a filing by Intervenor-Defendants [Doc 138] in *Powder River Basin Resource Council v. DOI, et al.*, No. 22-cv-2696 (D.D.C.).

the maximum drawdown in the layer regardless of the location within the model or the association with one of the pumping wells.

In the modified model run using 0.00001 ft^{-1}, drawdown increased in Layer 1, Layer 3, and Layer 5 pumping scenarios compared to the original model, but was never more than 60 feet. In other words, reducing the specific storage value by two orders of magnitude in model layers 1, 3, and 5 did increase the drawdown in Layers 1, 3, and 5 by up to approximately 50 feet. As a result, the drawdowns in Layers 1, 3, and 5 were within the same order of magnitude as simulated for Layer 1 in the original model.

In the modified model run using 0.00000012 ft^{-1}, drawdown increased in Layer 1, Layer 3, and Layer 5 pumping scenarios compared to the results using higher specific storage values. As with the results of modified model 1, the predicted drawdowns remain within the same order of magnitude as the original drawdowns in Layer 1. The additional drawdowns in Layers 1, 3, and 5 were less than 2 feet, less than 8 feet, and less than 15 feet, respectively as compared to the Modified Model 1 results. The maximum predicted drawdown using this lower specific storage value is 73.2 feet in Layer 5.

Based on these results, drawdown does not appear to be particularly sensitive to the specific storage value based on the original model data inputs in Layer 1 but is influenced more so in Layers 3 and 5.

References

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