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October 18, 2012

Matt Hicks
Senior Hydrologist
Groundwater Quality Program
South Dakota Department of Environment & Natural Resources
523 East Capitol Avenue
Joe Foss Building
Pierre, SD 57501-3181

Re: Response to September 19 Technical Comment
Dewey-Burdock Project Groundwater Discharge Plan Application

Dear Mr. Hicks:

On behalf of Powertech (USA) Inc. (Powertech), this letter is provided in response to a technical comment received verbally on September 19, 2012 for the above referenced application for a Groundwater Discharge Plan (GDP). For convenience, the comment is provided below along with the response.

Technical Comment: Address whether prairie dog burrows have the potential to provide a pathway for land application effluent to reach groundwater or to transport land application solutions deeper into the soil column.

Response: Powertech has evaluated the potential for prairie dog burrows to impact groundwater or transport land application solutions deeper into the soil column and has concluded that potential impacts are limited to catchment areas. Following is a description of the extents of prairie dog colonies within the proposed land application and catchment areas, an assessment of potential impacts, and a description of monitoring and mitigation measures that will be implemented to address potential impacts.

Extent of Prairie Dog Colonies within Proposed Land Application Areas

No prairie dog colonies are known to exist within the proposed Burdock land application or catchment areas. Figure 1 (enclosed) depicts the approximate extents of prairie dog colonies within the vicinity of the proposed Dewey land application and catchment areas. The approximate extents are based on high-resolution aerial imagery photographed in 2008 as part of the topographic survey of the project area and wildlife surveys conducted in 2007 and 2008. This figure shows that approximately 50% of the proposed Dewey land application and catchment areas coincide with prairie dog colonies.

Powertech assessed the density of burrow entrances within prairie dog colonies using the 2008 aerial imagery. Using ArcGIS, 1-acre squares were drawn at 12 randomly selected locations within the prairie dog colonies, and the density was determined by counting the number of

burrow entrances within each square. The density was found to range from 4 to 20 burrow entrances per acre, averaging approximately 10 burrow entrances per acre. The Montana Field Guide for the Black-Tailed Prairie Dog (Montana, 2012) indicates that burrow density varies substantially, with a typical range of 20 to 50 burrow entrances per acre. The average density in the project area is lower than this typical range.

According to Hoogland (1995), the average burrow entrance diameter is 4 to 12 inches. Verdolin et al. (2008) show that the maximum burrow depth for the black-tailed prairie dog ranged from about 1.5 to 2.3 meters (4.9 to 7.5 feet) in three previous studies.

Potential Impacts from Prairie Dog Colonies

Powertech evaluated whether the prairie dog burrows will have the potential to transport land application effluent into groundwater or deeper in the soil column. This evaluation included potential impacts in the land application areas and in the catchment areas. The results of the evaluation are described below.

Potential impacts within land application areas generally will be limited to direct capture of the effluent from the sprinklers in the burrow entrances, since the burrow entrances typically are not located in drainages prone to surface runoff. An estimate of the quantity of land application effluent captured by the burrow entrances was calculated as follows. Conservatively assuming a burrow entrance density of 20 entrances per acre (the highest value in the 12 site-specific measurements described previously) and an average diameter of 12 inches (the upper range of the typical values described previously), the total burrow entrance area per acre of prairie dog colony is up to 16 square feet. Multiplying this by 315 acres (the primary pivot area in Table 5.1-1 of the GDP application) times 50% (the proportion of land application area coinciding with prairie dog colonies) yields a total estimated burrow entrance area of up to 2,500 square feet. This is equal to approximately 0.018% of the 315-acre primary pivot area.

The peak design application rate is 653 gpm (Table 5.1-1 of the GDP application). Multiplying this rate by the percentage of the area occupied by burrow entrances (0.018%) yields an estimate of approximately 0.12 gpm of land application effluent entering all of the burrow entrances during the peak land application season. Since this would be distributed over thousands of burrow entrances, Powertech concludes that the potential to transport land application effluent into groundwater or deeper into the soil column will be negligible. It is anticipated that this small amount of water may cause a slight increase in moisture around the burrow entrance, but it will be insufficient to accumulate in the burrows or impact groundwater. The potential impacts are anticipated to decrease during land application system operation, since the prairie dogs likely will relocate from the irrigated fields due to the temporary change in habitat resulting from irrigation. Some of the burrow entrances are anticipated to collapse and fill in due to lack of maintenance.

In the catchment areas, the prairie dog burrows could result in increased potential to impact groundwater if the entrances coincide with ponded water and if the burrows overlie alluvial groundwater. The potential impacts to groundwater quality will be limited by the following factors:

- Quality of ponded water: As described in the GDP application, Powertech will operate the land application solutions to prevent water from accumulating in the catchment areas during normal operations (i.e., dry conditions). If land application effluent accumulates in the catchment areas, Powertech will implement a dewatering program. Therefore, water in the catchment areas primarily will consist of runoff and snowmelt, the quality of which generally will be higher than that of the alluvial groundwater.
- Quantity of ponded water: As described in the GDP application, Powertech will maintain adequate freeboard volume in the catchment areas for the 100-year, 24-hour storm event. Powertech will adjust the land application rate or pump water from the catchment areas if the freeboard capacity limits are approached. Maintaining freeboard for the 100-year, 24-hour storm event will limit the areal extents of ponded water in the catchment areas.
- Burrow depth: Based on ambient monitoring from July through October 2012, the average depth to water in the Dewey alluvial compliance wells ranged from about 11 to 20 feet and averaged approximately 16.5 feet. By comparison, the maximum burrow depth from previous studies ranges from approximately 4.9 to 7.5 feet. Therefore, even where a burrow entrance within a catchment area could be submerged, it would not provide a direct conduit to groundwater.

To further limit potential impacts, Powertech commits to evaluating prairie dog burrow entrances during final catchment area design and determining whether the potential exists to provide a pathway to groundwater. The evaluation will consist of mapping burrow entrances within each catchment area, evaluating the likelihood that one or more burrow entrances will be submerged, and evaluating the proximity to groundwater. If the potential exists to impact groundwater, Powertech will mitigate specific burrow entrances during the construction of the catchment areas. Typically grading within the catchment areas is anticipated to be sufficient to plug the entrances. If needed, additional measures may be used such as plugging the burrow with bentonite slurry.

Potential impacts to groundwater will be monitored using the various monitoring systems described in the GDP application. These include suction lysimeters beneath each land application pivot area and catchment area to monitor potential impacts to vadose-zone groundwater quality, interior wells to detect potential changes in alluvial water quality within the POP zone, and compliance wells to assess compliance with the permitted allowable limits at the edge of the POP zone.

References

Hoogland, J.L., 1995, *The Black-Tailed Prairie Dog: Social Life of a Burrowing Mammal*, The University of Chicago Press.

Montana, 2012, Montana Field Guide for the Black-tailed Prairie Dog - *Cynomys ludovicianus*. Available from the Internet as of September 2012: http://fieldguide.mt.gov/detail_AMAFB06010.aspx.

Verdolin, J.L., K. Lewis and C.N. Slobodchikoff, 2008, Morphology of Burrow Systems: A Comparison of Gunnison's (*Cynomys gunnisoni*), White-Tailed (*C. leucurus*), Black-Tailed (*C. ludovicianus*), and Utah (*C. parvidens*) Prairie Dogs, The Southwestern Naturalist 53(2):201-207, June 2008.

Please direct any questions regarding this comment response to Richard Blubaugh at (303) 790-7528 or Jack Fritz at (307) 672-0761.

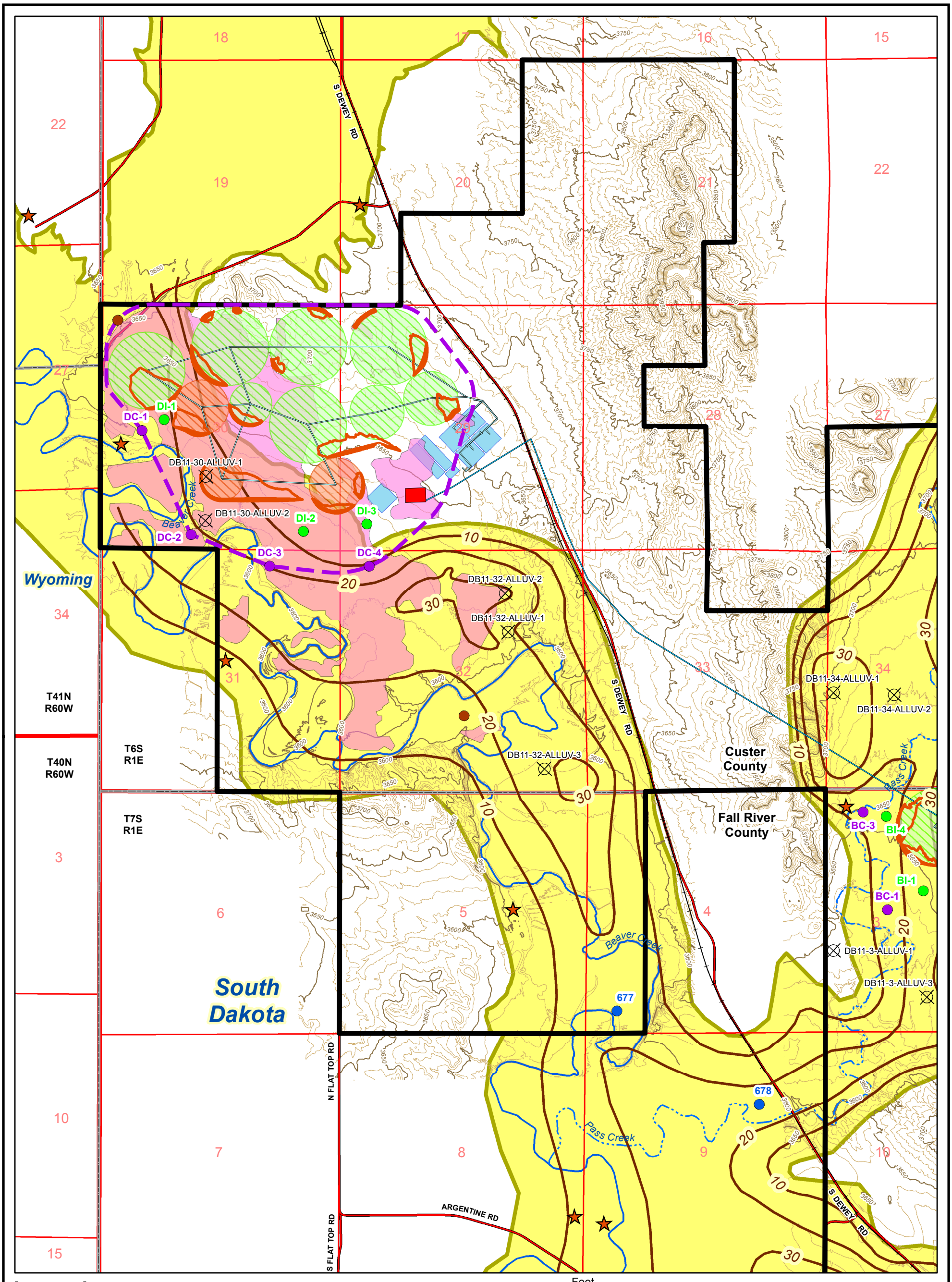
Sincerely,

Jack A. Fritz

Jack Fritz, P.E.
WWC Project Manager

cc: Richard Blubaugh (via email)
Mark Hollenbeck (via email)
John Mays (via email)
Ronald Burrows, U.S. NRC
Valois Shea, U.S. EPA, Region 8
Marian Atkins, BLM

Encl: Figure 1: Approximate Extents of Prairie Dog Colonies



Legend

- Residences
- Project Boundary
- Dewey POP Zone
- Catchment Areas (Preliminary Design)
- Pipelines
- BNSF Railroad
- County Roads
- Mapped Alluvium
- Processing Plants
- Ephemeral Streams
- Perennial Streams
- Land Application
- Standby Land Application
- Structure Contour Line
- Ponds
- Geotechnical Hole
- Existing Alluvial Well
- Proposed Compliance Well
- Proposed Interior Well
- Proposed Other Alluvial Monitor Well
- Approximate Extent of Prairie Dog Colonies

Feet
0 1,000 2,000 4,000
0 500 1,000
Meters

N

Figure 1

Approximate Extents of Prairie Dog Colonies

Dewey-Burdock Project

DRAWN BY	S. Hetrick
DATE	17-Oct-2012
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Powertech (USA) Inc.