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McPherson IGUCA Review

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Today I will present information on the review of the McPherson Intensive Groundwater Use Control Area. This is the first in a series of periodic IGUCA Reviews by the State of Kansas which will present the evidence and analyses relied upon by the Kansas Department of Agriculture, Division of Water Resources in its review and evaluation of the performance of the McPherson IGUCA. This review was performed pursuant to K.A.R. 5-20-2 which prescribes in part that the state shall have the burden of proving the need for continuance of the IGUCA designation. Guidelines from K.A.R 5-20-2 have been used to develop recommendations related to the McPherson IGUCA for the Chief Engineer through the public hearing process.

The following KDA-DWR staff members were on the review team for this report:

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The review team would like to thank GMD #2 staff, particularly Tim Boese, Steve Flaherty and the GMD No. 2 Board of Directors for assisting in preparing the review report and Don Whittemore of the Kansas Geological Survey, for data and technical assistance.

The review team prepared this report independently from and without counsel or direction from the Chief Engineer's team.

In addition to the McPherson IGUCA review document, the review team would like to add the following documents to the written record:

- 1980 McPherson IGUCA order
- 2013 MYFA amendment
- A Model Study of the McPherson Moratorium Area in Groundwater Management District #2, McElwee et al, 1979
- Geochemical Identification of Sources of Salinity in Ground Waters of the High Plains Aquifer South of McPherson, Kansas, Whittemore, 2004
- Fate and identification of oil-brine contamination in different hydrogeologic settings, Whittemore, 2007

To begin with, I will provide some background information on the IGUCA, then go over data used in the review and the procedure GMD No. 2 uses to review new applications in the area and finally walk through the IGUCA Review Criteria, as stated in K.A.R. 5-20-2, along with the Review Team's recommendations and conclusions.

Moving on to how the IGUCA was formed

On March 17, 1978, GMD #2 requested that DWR stop processing new applications to appropriate water in the McPherson area. GMD #2 subsequently formally requested an IGUCA hearing on February 13, 1979 because they felt

that groundwater levels were declining and had declined excessively and that the rate of withdrawal of groundwater in the control area exceeded the rate of recharge. The IGUCA hearing was held in the fall of 1979.

On March 28, 1980 the chief engineer ordered an IGUCA for the area in the vicinity of McPherson, Kansas. The order:

1. Closed the McPherson IGUCA to further groundwater appropriations except for domestic and any use authorized by temporary permit granted under the authority of K.S.A. 82a-727
2. Required flow meters to be installed on all existing water wells except for domestic and temporary wells.
3. Prescribed annual reviews of all water use and static water level information by the GMD #2 board of directors, and that if further information or data warranted, GMD #2 may request a rehearing on the McPherson IGUCA.

For this IGUCA review the review team analyzed...

Groundwater levels, precipitation, groundwater rights, groundwater use, compliance and enforcement, and annual reviews of the data by GMD #2.

For Groundwater Levels...

KGS, GMD #2 and DWR together measure 26 monitoring wells within the McPherson IGUCA (**Figure 2**) and measurements are available on the KGS' Wizard website. When directly comparing water level measurements over the years, every effort was made to compare winter, or static, measurements for consistency. Measurements began in the early 1970s in some areas. The most recent measurements considered were from February, 2015.

Comparisons of the rates of groundwater level change before and after the implementation of the IGUCA show steeper declines, especially west of the City of McPherson, from 1972-1980 (pre-IGUCA) than from 1980-2015 (post-IGUCA) (**Figure 3**). In short, declines are still persisting after the IGUCA, but at a slower rate.

*/*Precipitation*/*

Precipitation values were obtained from a weather station directly east of both the city of McPherson and the IGUCA. This analysis used a forty three-year span from 1971 – 2014 (**Figure 4**). Precipitation values varied annually, but pre- and post-IGUCA averages were rather similar.

*/*Groundwater Rights*/*

The McPherson IGUCA had 75 active groundwater rights as of March 9, 2016, most of which are for irrigation use, and represent 22,700 authorized acre-feet per year. There is more development on the western half of the IGUCA than in the eastern half of the IGUCA (**Figure 5**).

*/*Groundwater Use*/*

The groundwater use analysis is based on information stored in DWR's water rights information system (WRIS) database. The data was queried on September 11, 2015.

Because water flowmeters and mandatory water use were both required by 1988, the review team has confidence in the accuracy of the data available after about 1990. Groundwater use in the McPherson IGUCA has continued to increase over time (**Figure 6**).

*/*Compliance and Enforcement*/*

Within the McPherson IGUCA, there have been 6 over-pumping warnings issued, 1 over-pumping penalty, 3 drought-term over-pumping penalties, and 3 additional warnings for poor water use reporting and water use report falsification levied since 2005.

Looking at GMD #2's Annual Review of IGUCA Data...

Pursuant to the IGUCA order, GMD #2 submitted annual reports to the chief engineer until 2002 when budget constraints required them to stop. The reports included water level measurements, water use and later reports included precipitation. Attached to the reports were letters stating that the board approved the report and the current management status of the McPherson IGUCA and did not recommend any changes in the management of the control area. Now I will step through the IGUCA Review Criteria as set forth in K.A.R. 5-20-2 and the review team's recommendations for each item:

Item (1) Continue the IGUCA with its original or current corrective control provisions.

Recommendation: **Yes**

While the rate of decline is not as great as prior to the IGUCA order, the water levels still show a decline (**Figure 3**).

Also, the GMD No. 2 Water Flowmeter Requirement Regulation K.A.R. 5-22-4a required all nondomestic, non-temporary wells in the District to be equipped with flowmeters by the end of 2015; therefore, the review team recommends that the water flowmeters requirements remain in place.

The team concludes that the provisions are essential for protecting the public interest by reducing groundwater level decline.

Item (2) Reduce the restrictions imposed by one or more corrective control provisions within the scope and goals specified in the original IGUCA order.

Recommendation: **No**

The review team does not recommend a reduction in the corrective control provisions. Full authorized quantity has not yet been used in the area and decadal averages for groundwater use in the 1990s, 2000s and 5-year averages in the 2010s continue to show increasing average use (**Table 2**). The IGUCA restrictions prevent further groundwater development and more severe declines. The review team recommends the area remain closed because of the persisting declines in water levels (**Figure 3**) and the rise in groundwater use (**Figure 6**).

Item (3) Reduce the IGUCA boundaries.

Recommendation: **No**

The review team does not recommend reducing the boundaries of the McPherson IGUCA. All active wells within the McPherson IGUCA boundary have shown a decline in water level from their first available reading to 2015 static water level measurements. Any reductions in the IGUCA boundaries could lead to further groundwater development and more declines in water levels.

Item (4) Increase any allocations within the IGUCA.

Recommendation: **No**

The McPherson IGUCA did not have any allocations written into the original order. If the desire is for the McPherson IGUCA to reach safe yield, reductions will be needed. Groundwater use is greater than annual recharge within the IGUCA boundaries.

Item (5) Address any other issues that have been identified in the review.

Recommendations: **The review team did not identify any other issues to discuss in this review.**

Item (6) Revoke the IGUCA order and implement alternative measures, if necessary, to address the water issues in the affected areas.

Recommendation: **No**

The review team does not recommend revoking the McPherson IGUCA order. At present, the IGUCA order has limited further development within the IGUCA and also requires accurate reporting of water use due to the flowmeter requirement.

Item (7) The restrictions imposed by current corrective control provisions may need to be increased or additional corrective control provisions may be needed.

Recommendation: **Yes**

As mentioned previously in criteria (4), if the goal is safe yield, reductions will need to be implemented since the groundwater use is higher than recharge. The McPherson Board of Public Utilities, which supplies municipal water from a well field in the McPherson IGUCA to the City of McPherson and surrounding area, is actively seeking an additional water source from outside the McPherson IGUCA. The McPherson Board of Public Utilities has filed three water permit applications for a well field to be located approximately 16 miles south of the southern edge of the McPherson IGUCA. If the water permit applications are approved and developed, the McPherson BPU could reduce water use from the McPherson IGUCA by up to 2,909 acre-feet per year by utilizing the new south well field. The refinery has also

implemented actions to reduce groundwater use, including using treated wastewater effluent from the McPherson BPU and treating and using oil production brine (chloride) contaminated groundwater. The plume is located south of the city.

The primary source of this saline groundwater has been identified as oil-production brine. Chloride concentrations in the groundwater were found to be substantially greater near the bottom of the High Plains Aquifer. The plume has migrated west following the sloping bedrock surface, but water level declines from pumping have increased the flow rate (Whittemore, 2007). These water use reduction actions could significantly assist in achieving safe yield water use in and near the current McPherson and refinery well fields in the IGUCA.

Item (8) The boundaries of the IGUCA may need to be increased.

Recommendation: **Yes**

Jeff Lanterman, DWR Water Commissioner, Stafford Field Office, and Tim Boese, GMD #2 Manager, noted concerns about declining water levels south of the IGUCA. Because of this concern, the review team prepared monitoring well data for the area south of the IGUCA (**Figure 7**). All the monitoring wells fall within or near the GMD #2 boundaries.

In order to help illustrate wells on the Southern edge of the IGUCA, two tiers were defined based on proximity to the McPherson IGUCA (**Figure 7**). Tier 1 displays monitoring wells directly south of the IGUCA and Tier 2 displays monitoring wells directly south of Tier 1. Tier 1 and 2 included wells that had five or more feet of groundwater decline from 1972 to 2015.

Groundwater trends in Tier 1 and 2 have continued to increase since the 1980 IGUCA order (**Figure 20 and Table 3**).

Based on the declining water levels in Tier 1 and Tier 2 and the continued increase in water use (**Figures 32 and 33**) the review team suggest expanding the McPherson IGUCA to include all or parts of Tier 1 and Tier 2.

To Conclude

The review teams finds that the McPherson IGUCA corrective controls have been effective in protecting the public interest by preventing over-appropriation of water and increasing data quality within the IGUCA. Safe yield is being exceeded within the McPherson IGUCA and the boundaries of the IGUCA have been recommended to increase.