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## EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2

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April 27, 2018

David Barfield, Chief Engineer  
Division of Water Resources  
1320 Research Park Dr.  
Manhattan, KS 66502

Re: City of Wichita Aquifer Storage and Recovery Project Proposed Permit Modifications

Dear Mr. Barfield:

The Equus Beds Groundwater Management District No. 2 Board of Directors reviewed the draft proposed conditions regarding the City of Wichita Aquifer Storage and Recovery (ASR) Project proposed permit modifications, as identified in your March 22, 2018 letter, at the Special Board of Directors meeting on April 19, 2018. Following your presentation regarding the proposed modifications, District staff reviewed the proposed conditions and provided information and District staff comments to the Board. Additionally, District staff provided information and comments to the Board regarding Aquifer Maintenance Credits legal and policy issues.

Upon review of the information and comments District staff provided to the Board, it was the decision of the Board to document and forward the information and comments to you as requested in your March 22, 2018, letter. For ease of review, the information and comments have been separated into four attachments as noted below:

- Attachment A: GMD2 review and comments regarding the draft conditions as listed in the March 22, 2018, Chief Engineer's letter.
- Attachment B: GMD2 review and comments regarding the draft Proposed Replacement Findings & Order for ASR phase II.
- Attachment C: AMC Legal questions and comments.
- Attachment D: Possible AMC accumulation and use policy considerations.

Please contact the District should you have any questions regarding the enclosed information.

Sincerely,  
EQUUS BEDS GROUNDWATER  
MANAGEMENT DISTRICT NO. 2

Tim Boese  
Manager

TDB/db

Enclosure

pc: Alan King, City of Wichita  
Equus Beds GMD2 Board of Directors  
Tom Adrian, Equus Beds GMD2 Attorney  
Brian Meier, Burns & McDonnell

## Attachment A

**GMD2 review and comments regarding the draft conditions as listed in the March 22, 2018 Chief Engineer's letter. Letter original text in black, GMD2 comments in red.**

1. That the locations of the index wells and the index water levels for the basin storage area ("BSA") shall remain as set forth in Attachments 3 and 4 to the Original Order, In the Matter of the City of Wichita's Applications to Operate an Aquifer Storage and Recovery Project in Harvey and Sedgwick Counties, Kansas dated August 8, 2005, except for proposed lower index cell levels in the Phase II ASR Findings and Order\_\_\_\_\_2018 (see Table 2-11: Proposed ASR Minimum Index Levels in the City's proposal "ASR Permit Modification Proposal Revised Minimum Index Levels & Aquifer Maintenance Credits").

**GMD2 Comment: GMD2 needs to review the proposed ASR Minimum Index Levels and will provide comment during their official review of the proposal.**

2. That AMCs will be assigned to index cells annually through the following accounting methodology, unless otherwise modified by formal written approval of the Chief Engineer.

- AMCs will be assigned by dividing the total volume of water diverted from the Little Arkansas River to the City's Main Water Treatment Plant by the total number of points of diversion within the Equus Beds Wellfield in service that year (excluding Phase I recharge and recovery infrastructure). This will ensure equal AMC distribution across the active production wells, which could have pumped water from the aquifer.

**GMD2 Comment: Is this source water as measured from the Little Arkansas River surface water intake or as treated water leaving the ASR water treatment plant? This should be measured treated water leaving the ASR water treatment plant, as this is the water that would have been measured as a Physical Recharge Credit if the water was physically recharged. Using the total volume of raw water diverted from the Little Arkansas River over-estimates the amount of water that would have been physically recharged. Also, source water from the Little Arkansas River must be treated at the ASR water treatment plant, as raw source water from the Little Arkansas River cannot be pumped directly to the City without treatment.**

**Is the AMC quantity divided between all of the City's production wells in the Basin Storage Area, or only wells that have been physically converted to ASR recharge / recovery wells? Should AMCs be accumulated at wells that haven't been converted to recharge / recovery wells, as these wells cannot physically recharge water?**

- A one-time, five percent (5%) initial loss will be deducted from the total number of AMCs applied in each index cell. This initial loss accounts for losses to the aquifer inherent in the injection and recovery process.

**GMD2 Comment: Need more clarification / justification for the proposed 5% initial loss.**

- In addition, a gradational, recurring loss to AMC's as provided in Figure 15 of the City's proposal would be applied annually across the BSA to account for the migration of recharge credits and losses from the BSA illustrated by the model and historic data. Generally, index cells on the west side would have a one percent (1%) loss, index cells in the central area a three percent (3%) loss, and index cells on the east side a five percent (5%) loss. These losses would be taken from the cumulative total beginning the year after the water is recharged, as they represent losses to migration that occur during the year.

## Attachment A

**GMD2 Comment:** Need more clarification / justification for gradational annual losses ranging from 1% to 5%. Page 4-2 of the ASR Permit Modification Proposal indicates that 85% of the water physically recharged by the ASR Project from 2006-2015 has been retained as recharge credits. However, data from the 2015 Annual Accounting Reports indicates that through the year 2015, there has been 6,818 AF physically recharged, but recharge credits total only 4,978 AF, which is retention of 73%, not the 85% retention rate specified in the Proposal. This may indicate the proposed 1-5% annual loss is not an accurate representation of the historic losses.

3. As is provided for with respect to the accounting for physical recharge credits, that if the City develops an improved model or methodology to account for AMCs that is approved by the Chief Engineer after consideration of the recommendation by GMD 2, that the Chief Engineer may approve such improved methodology without the necessity of holding additional public hearings.

**GMD2 Comment:** This is similar to the language in the current ASR Phase II Findings & Order.

4. That the AMC's may be accumulated only when index cell water levels are at elevations that limit physical recharge into the basin storage area as provided in the ASR's operating plan. AMC accumulation rate is dependent on the quantity of water and rate of diversion authorized under Appropriation of Water, File No. 46,627, which is authorized 14,738.24 million gallons per year at a diversion rate of 41,667 gallons per minute.

**GMD2 Comment:** Also, accumulation of AMCs must be dependent upon physical withdrawal and treatment of the Little Arkansas River source water. Should be metered treated water leaving the ASR water treatment plant, not total water withdrawn from the Little Arkansas at the surface water intake.

5. That physical recharge activities will continue to occur when there is adequate recharge capacity within the aquifer.

**GMD2 Comment:** Further information and review is needed to determine the parameters that require physical recharge to occur and when the accumulation of AMCs would be allowed. See No. 13 next.

13. That the City will develop an annual ASR Operations Plan that will be used to evaluate groundwater levels in the wellfield and the aquifer's physical recharge capacity. This information will determine when AMCs can be accumulated. The Operations Plan calculations will be based on the following parameters:

- Static Groundwater Elevations
- Maximum Groundwater Elevations
- Sustainable Specific injectivity
- Maximum Calculated Sustainable Recharge Rate
- Maximum Well Infrastructure Recharge Rate
- Maximum (**GMD2 Comment: Should this be Minimum?**) Well Infrastructure Recharge Rate

**GMD2 Comment:** The following GMD2 comments are regarding the proposed ASR Physical Recharge & ASR Operations Plan as discussed in Section 3.5 of the proposal, which relates to proposed Condition Nos. 5 and 13.

Based on current elevated groundwater levels and current infrastructure, what is the current total ASR Physical Recharge Capacity in MGD?

## Attachment A

Based on lowered groundwater levels and current infrastructure, what is the total ASR Physical Recharge Capacity in MGD?

Are the recharge basins' recharge capacities included in the ASR Physical Recharge Capacity? If not, why not?

Why use January groundwater level measurements to determine the Physical Recharge Capacity of the aquifer? During irrigation season and increased municipal use, the aquifer levels are lowered and the Physical Recharge Capacity most likely increases, perhaps significantly in some years during summer months.

Additional information and justification is needed to demonstrate that physical recharge cannot occur if the total Physical Recharge Capacity is below 5 MGD. 5 MGD is almost 17% of the ASR Phase II treatment capacity if operating at 30 MGD, and 33% if operating at 15 MGD.

In Example 3 on page 3-7 of the proposal, it appears to indicate that the ASR treatment plant can run at 30 MGD, but the ASR Physical Recharge capacity is only 15 MGD even at lowered groundwater levels, meaning the City could still accumulate AMCs by running the ASR water treatment plant at 30 MGD, even when aquifer levels are low? This is counter to what has been indicated that AMCs will only be able to be accumulated when the aquifer is full. This appears to indicate that AMCs can be accumulated even when the groundwater levels are low.

What is the City's plan to convert the rest of the City's wells to recharge/recovery wells? Currently, there are pending water permit applications to allow recharge credits to be pumped from the rest of the City's existing production wells, but these wells have not yet been physically converted to dual purpose recharge / recovery wells. If the applications are approved, these wells would currently only be able to physically withdraw credits, not physically recharge water. Having additional recharge wells would facilitate physical recharge. It is not appropriate to be able to accumulate AMCs when the aquifer is low just because of a restriction of the ASR Physical Recharge capacity caused by the City's infrastructure.

If the proposed ASR Physical Recharge & ASR Operations Plan would have been used for the recharge that has occurred, or could have occurred, to date, how much would have still been physically recharged and how much would have been AMCs?

6. That AMCs may be withdrawn from a cell only when AMC's are determined to be available from that cell and the static water level at its index well is at or above the established minimum index level as measured in January of that year.

GMD2 Comment: This is the same condition as the physical recharge credits.

7. That the total accumulation of recharge credits through physical recharge (PRCs) and AMCs combined cannot exceed 120,000 acre-feet, which represents the estimated storage available within the ASR project area during 1993.

GMD2 Comments: Why are 1993 groundwater levels used to determine overall storage capacity? This appears arbitrary based on how much storage capacity was available when the City's Integrated Local Water Supply Plan was implemented and the development of the ASR program started, but what does that have to do with how much total recharge credits the City can accumulate? The drought model runs are based on the 1998 groundwater levels, why not use 1998 groundwater levels to determine overall storage capacity and associated maximum recharge credits? Additionally, The City's drought model indicates the City needs to pump 50,849 AF of recharge credits in an extreme 1% drought. Why does the City need 120,000 AF (more than double the amount needed in a 1% drought) of recharge credits?

## Attachment A

8. That the City in its June 1 reporting each year, shall also report, an accounting of water diverted from the ASR Phase II surface water intake, (GMD2 Comment: Add "treated"), and sent directly to the City's Main Water Treatment Plant; that the Report shall be submitted to the Chief Engineer and GMD 2. The accounting shall use the accounting methodology described herein.

GMD2 Comment: This adds a reporting requirement regarding the surface water treated and sent to the City for municipal use, rather than being physically recharged, to the annual accounting report.

9. That the final determination of available AMCs in each cell in the basin storage area shall be made by the Chief Engineer, upon consideration of the required annual report, and any recommendation by GMD 2. The Chief Engineer shall make the final determination in writing.

GMD2 Comment: This adds AMCs to the Chief Engineer's available recharge credits determination.

10. That each AMC diversion well shall be equipped with a water flow meter, meeting the requirements of K.A.R. 5- 22-4, to separately and accurately record the total quantity of water diverted from the aquifer and counted as an AMC.

GMD2 Comment: This requires the AMC diversion wells to be equipped with water meters.

11. That the available quantity of AMCs for each index cell would be the cumulative total of AMCs accumulated during previous years, minus any recovered quantity of AMCs from the index cell, and annual losses.

GMD2 Comment: This describes the accounting for AMCs.

12. That recovery of AMCs, similar to PRCs, will be measured as the metered recovery of a recharge credit from an authorized point of diversion.

GMD2 Comment: This requires the AMC diversion to be metered.

14. That the ASR Operations Plan shall be submitted to the Chief Engineer and GMD 2 for review within 60 days of approval of the new Phase II applications.

GMD2 Comment: The ASR Operations Plan should be submitted prior to the approval of the new Phase II applications, as the operation plan would be an instrumental part of the permit conditions, so much so that the operations plan needs to be reviewed and approved at the same time as the permit applications. Additionally, certain aspects of the operational plan may be best identified as permit conditions.

15. That surface water intake quantities and direct municipal supply quantities shall be reported by the City to the Chief Engineer and GMD 2 as follows:

- Each month for the first year of operation;
- Each calendar quarter for the second year of operation;
- By March 1 each year thereafter; or
- Other intervals as may be required by the Chief Engineer to properly evaluate the project.

GMD2 Comment: Consider monthly reports for a longer period of time or even the life of the project. The City already submits monthly injection reports to KDHE and GMD2, so it would be preferable to add this data to the monthly report.

## Attachment A

16. That if water quality in a nearby existing domestic well meets the current drinking water standards and the water quality is subsequently changed by the ASR project such that the water no longer meets the current drinking water standards, the City will provide and install a home water treatment system to bring the water back to drinking water standards or provide other appropriate remedies to replace the domestic water supply with water that meets the drinking water standard without additional cost to the resident.

GMD2 Comment: Is this only for domestic wells within 660 feet of an ASR well, or is it for all domestic wells in the Basin Storage Area? If not for all the domestic wells, should it be?

17. That if a domestic water well, existing before the filing of these applications for permit, and within 660 feet of an existing or new ASR well, is adversely impacted by drawdown from such well, the City will re-drill or take other appropriate, affirmative action to restore productivity of such domestic well to the same rate and quality as existed before.

GMD2 Comment: What about domestic wells farther than 660 feet from an ASR well? Because it is being proposed to lower the aquifer levels at which ASR credits can be pumped, this amounts to an overall lowering of the water table in the Basin Storage Area during an extended drought. Therefore, not only is direct well to well impairment of domestic wells a concern, but so is the overall lowering of the water level.

### Miscellaneous from the Chief Engineer's March 22, 2018 letter:

The following is stated in the letter: "In drafting our proposed approval documents, we note that it appears that the City's proposal does not fully address necessary reporting when taking recharge credits - how and with what frequency the City will report on the source of diverted water: native, PRCs, and/or AMCs."

GMD2 Comment: Also, the sequencing of water pumped from the aquifer needs to be defined. Native water rights should be pumped first, then physical recharge credits, and then AMCs last.

Additional GMD2 Comment: What about "Ensuring other area native rights are protected from impairment by requiring the City to use pumping rotation and timing if conflicts occur" as stated in the Chief Engineer's previous PowerPoint Presentations? There appears to be no proposed condition(s) that represent this concept in the draft F & O. There is language in the existing ASR recovery water permits that state:

"That if the Chief Engineer determines that impairment of an existing prior water right is caused by operation of the aquifer storage and recovery well, the City shall either regulate the aquifer storage and recovery well's diversion to secure water to satisfy all prior rights, or comply with any other requirement as specified by the Chief Engineer to prevent or protect the public interest."

## Attachment B

**GMD2 review and comments regarding the draft Proposed Replacement Findings & Order for ASR phase II. Draft original text in black, GMD2 comments in red. Please note that only select findings and order paragraphs are noted, as many of the conditions discussed in Attachment A cover many of the items in the draft Findings & Order.**

### FINDINGS:

17. That the City has conducted extensive modeling and data analysis to indicate that during a prolong drought, groundwater elevations would drop below the current minimum index levels (in some Index Cells). This would prevent the City from withdrawing (most) recharge credits when they are most needed.

**GMD2 Comment: Suggested revisions noted above in red. Water Levels in 17 of the 38 Index Cells drop below the 1993 levels during an extended drought according to the City's model. 10 of the 15 Index Cells in the Central Well field Study Area drop below the 1993 levels.**

20. That the City is proposing an alternative procedure for establishing recharge credits during the periods when physical recharge of the aquifer is not feasible. Surface water from the existing Little Arkansas River ASR diversion works would be (GMD2 Comment: Add "treated at the ASR Phase II water treatment plant and") sent directly to the City's Main Water Treatment Plant and used for municipal supply. This water would offset diversions from the Equus Beds Wellfield, and allow the aquifer to remain at high levels.

33. That AMCs are not passive recharge credits because they are using existing ASR infrastructure (GMD2 Comment: AMCs would not use the entire ASR infrastructure – AMCs would only use the surface intake and treatment plant. AMCs do not use the recharge / recovery wells or basins to recharge water) and require the active diversion and treatment of surface water in order to gain credits, and are subject to the rate and quantity limitations of the permit(s).

**GMD2 Comment: This needs clarification. How can AMCs not be considered passive recharge credits when there is no definition of passive recharge credits in the DWR regulations? A clear definition of both passive recharge credits and AMCs is needed.**

### ORDER

9. That water shall only be injected into the basin storage area by means of the injection wells when the water level at any required monitoring well located within 660 feet of an injection well, (GMD2 comment: Add "recharge basin, or other recharge facility,") is 10 feet or more below the land surface elevation at those observation wells. This condition must be maintained until such time that the applicant can demonstrate that allowing recharge water to exceed this level would be in the public interest. If the applicant can document that an alternative (shallower) water level would be protective of the public interest, the applicant may petition the Chief Engineer to modify or remove this requirement. That recharge credits may be withdrawn from a cell only when recharge credits are determined to be available from the cell and the static water level at its index well is above the lowest index level; however, water may be recharged when the static water level is below the lowest index level in that well.

**GMD2 Comment: Need to add recharge basins and other recharge facilities to the restriction as stated that water can only be injected into the injection wells if the water level is 10 feet or more below land surface. This restriction needs to apply to all recharge facilities, not only to injection wells. GMD2 staff believes this condition was originally intended to apply to all recharge facilities – recharge wells, recharge basins, etc.**

## Attachment C

**AMC legal questions and comments. Factual information in black (certain words highlighted for emphasis), GMD2 comments in red.**

Fundamental question regarding the proposal: What is an Aquifer Maintenance Credit and how can an AMC be accumulated and appropriated for beneficial use under the current Water Appropriation Act and rules and regulations?

There are several definitions in the DWR and GMD2 Rules and Regulations that were established when the City's ASR Project was first being considered and permitted. The applicable definitions include:

"Aquifer storage and recovery system" as defined by GMD2 Rule and Regulation K.A.R. 5-22-1(d) and by DWR Rule and Regulation K.A.R. 5-1-1(f) "means a physical infrastructure that meets the following conditions:

(1) Is constructed and operated for **artificial recharge, storage**, and recovery of source water; and

(2) consists of apparatus for diversion, treatment, **recharge, storage**, extraction, and distribution."

"Artificial Recharge" as defined by GMD2 Rule and Regulation K.A.R. 5-22-1(f) and DWR Rule and Regulation K.A.R. 5-1-1(g) "means the use of **source** water to artificially replenish the water supply of the aquifer."

**GMD2 Comment: Is an AMC a source water? How does an AMC "artificially replenish the water supply of the aquifer"?**

"Aquifer storage" as defined by GMD2 Rule and Regulation K.A.R. 5-22-1(c) and DWR Rule and Regulation K.A.R. 5-1-1 (e) "means the act of storing water in the unsaturated portion of an aquifer by **artificial recharge** for subsequent diversion and beneficial use."

**GMD2 Comment: How is an AMC stored in the aquifer by artificial recharge? An AMC is treated source water that is not able to be physically recharged due to aquifer conditions and recharge facility infrastructure. It would also represent groundwater left in the aquifer that was not pumped under an existing water right.**

"Recharge Credit" as defined in GMD2 Rules and Regulations K.A.R. 5-22-1(ee) and DWR Rules and Regulations K.A.R. 5-1-1(mmm) "means the quantity of water that is **stored** in a basin storage area and that is available for subsequent appropriation for beneficial use by an operator of the aquifer storage and recovery system."

**GMD2 Comment: This implies that there had to be a "put" of water (water stored) for a later "take" (appropriation) of the water. Where is the "put" with an AMC? How can a new appropriation of water be established in an over-appropriated area if there is no additional water added to the system? Can water not pumped under an existing water right be appropriated again under a new water permit?**



## Attachment C

Additionally, Water Permit No. 46,627 is the surface source water permit for ASR Phase II and was approved by DWR on September 18, 2009 for 45,230 AF/Y at 41,667 GPM from a surface intake on the Little Arkansas River. The authorized beneficial use is for both **Artificial Recharge** in the Basin Storage Area and **Municipal use** by the City of Wichita, etc.

**GMD2 Comment: Water Permit No. 46,627 does not authorize AMCs as a beneficial use, as AMCs are not Artificial Recharge or Municipal use.**

The City's existing groundwater permits that authorize recovery of the City's recharge credits state the source of water is "groundwater recharge credits accumulated in the Equus Beds Aquifer, that may be recovered pursuant to the operation of the approved aquifer storage and recovery project" and that "the applicant shall not be deemed to have acquired a water appropriation for groundwater from the Equus Beds Aquifer, **except for recovery of water recharged** pursuant to the approved aquifer storage and recovery project, and any subsequent modifications,..."

**GMD2 Comment: What water is being recharged to establish AMCs that can be appropriated under this water permit language?**

The Chief Engineer's September 18, 2017 letter to the City states that "DWR believes no changes to statute or rules are necessary to consider and implement the City's...request". The letter further states that the rules do not prevent two types of **recharge credits** and separate means of accounting.

**GMD2 Comment: An Aquifer Maintenance Credit is not consistent with the definition of "Recharge Credit", as there is no physical recharge and storage. AMCs can be best compared to "in lieu" of credits found in the Central Arizona Project, whereas surface water is bought and used in lieu of groundwater. The customer receives long-term groundwater storage credits that can later be recovered. This water "exchange" was authorized under Arizona State law. Kansas water law does not currently have a provision for this.**

In current Kansas water law, Water Banking is the only similar concept that allows unused water to be allocated in an over-appropriated area. Multi-Year Flex Accounts (MYFAs) is another less similar tool. Both water banking and MYFAs were authorized by State law and use **term permits**, not water appropriation permits and water rights.

## Attachment D

### Possible AMC accumulation and use policy considerations

GMD2 Comment: The main concern with AMCs is insuring that the accumulation and use of AMCs is aquifer neutral. It is essential that AMCs represent actual “wet” water (as do physical recharge credits) that would not have normally been in storage in the Basin Storage Area. AMCs cannot be just additional groundwater pumping credits established and pumped without a “wet” water source. Notwithstanding the potential legal issues of appropriation of groundwater by using AMCs, following are two possible concepts to insure aquifer neutrality:

#### Accumulation of AMCs

As proposed, AMCs can only be accumulated when aquifer water-levels are too high to allow for physical recharge. The source water from the Little Arkansas River would be treated and sent to the City in lieu of pumping groundwater from the aquifer.

It is important that for AMCs to be accumulated there has to be an equal reduction in groundwater pumping that would have *normally* occurred to meet the City's daily demand. This has to be groundwater that would have been pumped for the City's daily use, not groundwater that would have been pumped for the purpose of creating storage room in the aquifer for physical recharge, and not water that would have been pumped from Cheney Reservoir. The treated Little Arkansas River surface water sent to the City instead of being recharged has to be a direct replacement of groundwater the City normally would have pumped. The City's proposal is close to this, but it is not real clear in the proposal and there is some language in the City's proposal (page 3-5) that states the treated water sent to the City “...directly offsets groundwater that would have been pumped to meet daily demand **and** to create physical ASR recharge capacity”. Additionally, a commitment from the City to use as much surface water from Cheney Reservoir, when available, would be helpful. Also, either a permit condition is needed or a commitment from the City that groundwater will not be pumped for the purpose of creating physical recharge storage space.

#### Replacement of AMC water pumped following a drought

Following a 1% drought, there should be adequate storage room in the aquifer for physical recharge for an extended period of time. Any AMC water pumped during the drought would have to be replaced by physical recharge and the City could not begin accumulating additional AMCs until the previously pumped AMC water was replaced with physical recharge. This prevents a proliferation of AMCs compared to physical recharge credits.

To achieve aquifer neutrality, there would also need to be a constraint on the accumulation of physical recharge credits until the AMC pumped water is replaced. There are several options on how this could be achieved/conditioned, including:

- The first water physically recharged after the drought would not be counted as physical recharge credits until the AMC pumped water was replaced, or
- A percentage of the physical recharge occurring after the drought would be counted as physical recharge credits, and a percentage would not be counted and go towards replacing AMC water pumped, or
- After a predetermined quantity of physical recharge credits are accumulated, thereafter physical recharge would go towards replacing the AMC water pumped until any additional physical recharge credits could be accumulated.