



Department of Public Works & Utilities

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11/15/2016

Tim Boese
District Manager
Groundwater Management District No. 2
313 Spruce Street
Halstead, KS 67056

Re: ASR Permit Modifications - GMD2 Data Review and Coordination

Dear Mr. Boese:

The existing permit conditions for the City of Wichita's (City) ASR project define the lowest vertical extent of the basin storage area, and currently restrict recharge credit recovery to periods when water levels are above a specific lower index water level. The lowest index water levels for the basin storage area are currently established by the lowest historic water levels within the Equus Beds Wellfield (EBWF), which were recorded January of 1993. The State of Kansas Division of Water Resources (DWR) recently modified K.A.R 5-12-1 in acknowledgement that additional flexibility was needed in both existing and future ASR projects with respect to the defined bottom of the basin storage area.

The City has now identified that ASR recharge credits would not be available, especially under high aquifer demand scenarios where the City and other users would have to utilize consecutive years of full base water rights in the EBWF to meet demands. This finding inherently requires the City to evaluate a reasonable alternative lower vertical extent for the existing ASR basin storage area that ensures recharge credits are available throughout periods of high aquifer demand.

The City and GMD2 have been working collaboratively to examine and project the impacts to groundwater levels in the EBWF and ASR basin storage area during consecutive years of drought and high aquifer demand and how, based on the current lowest index water levels permitted for the project, the decreased groundwater levels will affect the City's ability to access recharge credits when they are needed most.

The aquifer model presented in USGS Scientific Investigations Report 2013-5042 has been utilized to represent the response of the Equus Beds aquifer during an eight-year drought. The aquifer has been assumed to start the modeled drought relatively full, emulating its condition in January 2011. Environmental parameters and reported water use from the drought conditions of 2011 and 2012 were utilized to represent stresses on the aquifer. Pumping from the aquifer by City of Wichita wells was modeled in three ways: full use of our vested water right, use of ASR recharge credits above the 1993 water levels only, and use of ASR recharge credits later in the drought. Model inputs are presented in Attachment A.

Several demonstrative figures have been prepared, and have been attached for your review. These present a comparison between the modeled results and the aquifer conditions that existed in early 1993. Attachments B & C represent the extent and magnitude to which the modeled post-drought conditions indicate the depth to water in the Basin Storage Area

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will be below the USGS-interpolated 1993 water level. Model results for use of ASR recharge credits under current regulations (Attachment B) indicate a significant depletion of the aquifer below the 1993 levels. Model results allowing use of ASR credits only when needed to satisfy City demand later in the drought (Attachment C) indicate a reduction in the magnitude and extent of aquifer depletion. A direct comparison of the model runs for existing and modified ASR regulations (Attachment D) illustrates the positive impact to the aquifer under modified regulations by facilitating judicious and flexible ASR credit use. The potential simulated water level increases between existing and modified ASR regulations are further illustrated by comparing the resultant modeled water level elevations at the geographic location for each index well (Attachment E).

In order to maintain progress in establishing and describing the requisites for modification to the City's existing ASR permits, the City of Wichita is providing the results of recent groundwater modeling efforts that reproduce and provide further refinement of previously presented information and assertions. These include the following hard copy and electronic file resources:

1. Input Files for the following runs of the USGS Equus Beds MODFLOW model (Electronic File Submission)
 - a. Run 1 - Base Line Scenario, utilizing 40,000 Acre-Feet throughout drought
 - b. Run 2 - ASR Current Regulation Credit Utilization and Availability scenario
 - c. Run 3 - ASR Modified Regulation Credit Utilization and Availability scenario
2. Model Input Table illustrating pumping and hydrologic stress components (Attachment A)
3. Spreadsheets providing summaries of pumping data including annual City Water Rights, ASR Credits, Agricultural use, and Industrial use by type, year, and quantity breakdown according to DWR provided data (Electronic File Submission)
4. Output files for the following runs of the USGS Equus Beds MODFLOW model (Electronic File Submission)
 - a. Run 1 - Base Line Scenario, utilizing 40,000 Acre-Feet throughout drought
 - b. Run 2 - ASR Current Regulation Credit Utilization and Availability scenario
 - c. Run 3 - ASR Modified Regulation Credit Utilization and Availability scenario
5. Spreadsheets and tables illustrating ASR credit unavailability during progressive years of drought and various aquifer demands for each model run (Electronic File Submission)
6. Post Processing Figures
 - a. Comparison of Model Run 2 ASR Current Regulation Credit Utilization and Availability results to original USGS interpolated 1993 water level raster (Attachment B)
 - b. Comparison of Model Run 3 Modified Current Regulation Credit Utilization and Availability results to original USGS interpolated 1993 water level raster (Attachment C)
 - c. Comparison of Model Run 3 to Model Run 2 results illustrating improvement in water levels from added ASR credit availability and utilization flexibility (Attachment D)
 - d. Comparison of index well water levels between existing and modified ASR regulations (Attachment E)

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The City requests that GMD2 provide a documented response detailing the District's concurrence in regards to the provided groundwater modeling results by no later than December 15th of 2016.

Sincerely,

Alan King
Director of Public Works & Utilities

Enclosure **Groundwater Modeling Files & Results**

cc: David Barfield, P.E., Chief Engineer
Lane LeTourneau, P.G., Water Appropriation Program Manager
Joseph T. Pajor, Deputy Director, Public Works & Utilities
Don Henry, Assistant Director, Public Works & Utilities
Daniel Clement, Burns & McDonnell
Brian Meier, Burns & McDonnell
Scott Macey, Assistant Division Manager, Public Works & Utilities

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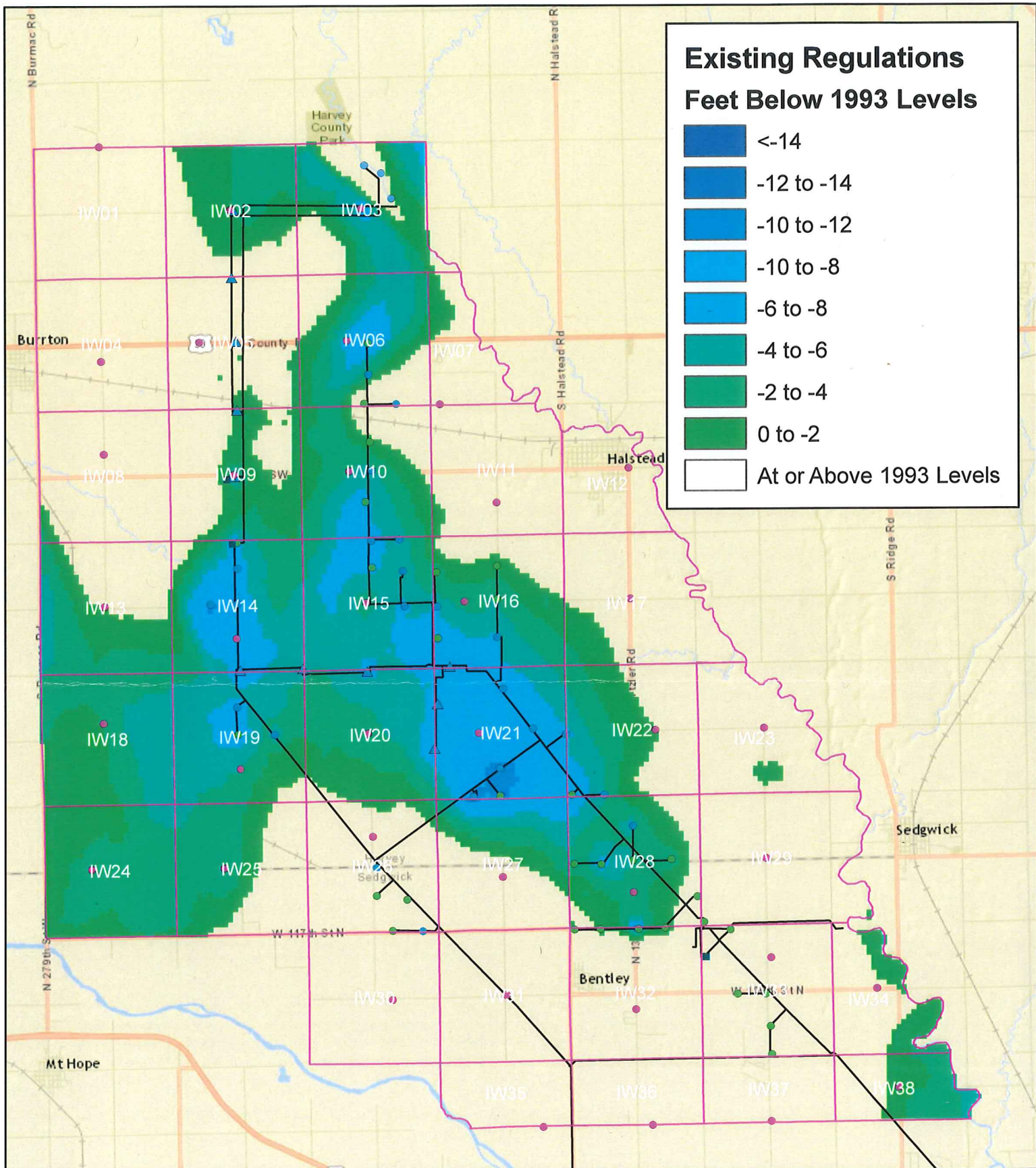
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Base Line Scenario - EQUUS BEDS USGS MODFLOW Model Run No. 1									
Initial Aquifer Conditions	Modeled Jan 2011	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Drought Year		20941	20745	40000	40000	40000	40000	40000	40000
City Demand Equus Base		20941	20745	40000	40000	40000	40000	40000	40000
ASR Credits Used		0	0	0	0	0	0	0	0
Total Equus		20941	20745	40000	40000	40000	40000	40000	40000
City Demand Cheney		52688	51339	23823	32225	23823	23823	32084	29943
City Demand Total		73629	72084	63823	72225	63823	63823	72084	69943
Irrigation Demand	2011 Reported Use	2012 Reported Use	2011 Reported Use	2011 Reported Use	2011 Reported Use	2012 Reported Use	2011 Reported Use	2011 Reported Use	2012 Reported Use
Climate Data	2011	2012	2011	2011	2012	2011	2012	2011	2012
River Data	2011	2012	2011	2011	2012	2011	2012	2011	2012

ASR Current Regulations - Equus Beds USGS MODFLOW Model Run No. 2									
Initial Aquifer Conditions	Modeled Jan 2011	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Drought Year		20941	20745	40000	40000	40000	40000	40000	40000
City Demand Equus Base		20941	20745	40000	40000	40000	40000	40000	40000
ASR Credits Used		0	0	18500	17500	10500	8500	5000	5000
Total Equus		20941	20745	58500	57500	50500	48500	45000	45000
City Demand Cheney		52688	51339	5323	14725	13323	15323	27084	24943
City Demand Total		73629	72084	63823	72225	63823	63823	72084	69943
Irrigation Demand	2011 Reported Use	2012 Reported Use	2011 Reported Use	2011 Reported Use	2011 Reported Use	2012 Reported Use	2011 Reported Use	2011 Reported Use	2012 Reported Use
Climate Data	2011	2012	2011	2011	2012	2011	2012	2011	2012
River Data	2011	2012	2011	2011	2012	2011	2012	2011	2012

ASR Modified Regulations - Equus Beds USGS MODFLOW Model Run No. 3									
Initial Aquifer Conditions	Modeled Jan 2011	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Drought Year		20941	20745	40000	40000	40000	40000	40000	40000
City Demand Equus Base		20941	20745	40000	40000	40000	40000	40000	40000
ASR Credits Used		0	0	0	0	0	0	0	4351
Total Equus		20941	20745	40000	40000	40000	40000	40000	44351
City Demand Cheney		52688	51339	23823	32225	23823	23823	32084	25592
City Demand Total		73629	72084	63823	72225	63823	63823	72084	69943
Irrigation Demand	2011 Reported Use	2012 Reported Use	2011 Reported Use	2011 Reported Use	2011 Reported Use	2012 Reported Use	2011 Reported Use	2011 Reported Use	2012 Reported Use
Climate Data	2011	2012	2011	2011	2012	2011	2012	2011	2012
River Data	2011	2012	2011	2011	2012	2011	2012	2011	2012



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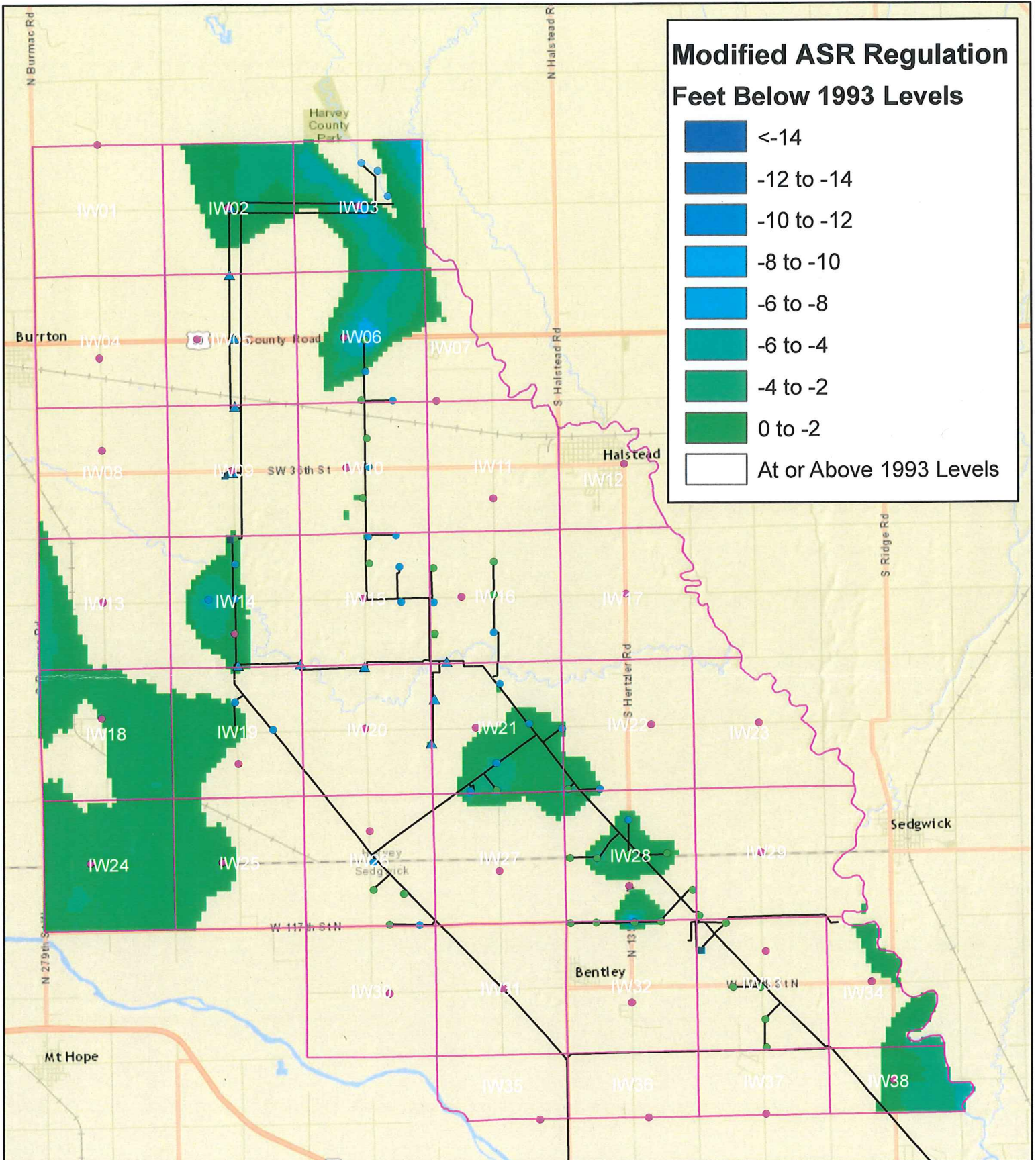
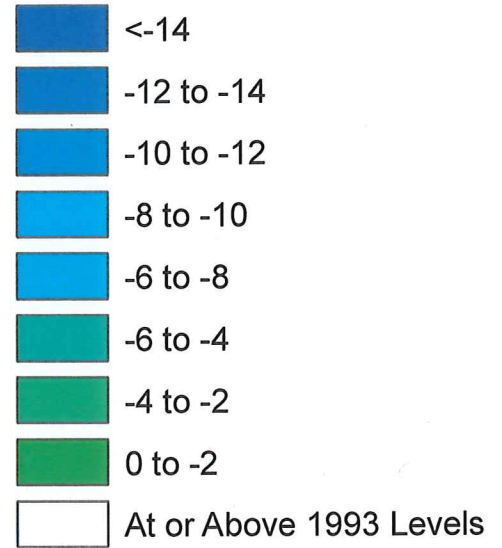


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ATTACHMENT B

Existing ASR Regulations
Comparison to 1993 Levels
Ending Conditions of Drought

Modified ASR Regulation Feet Below 1993 Levels



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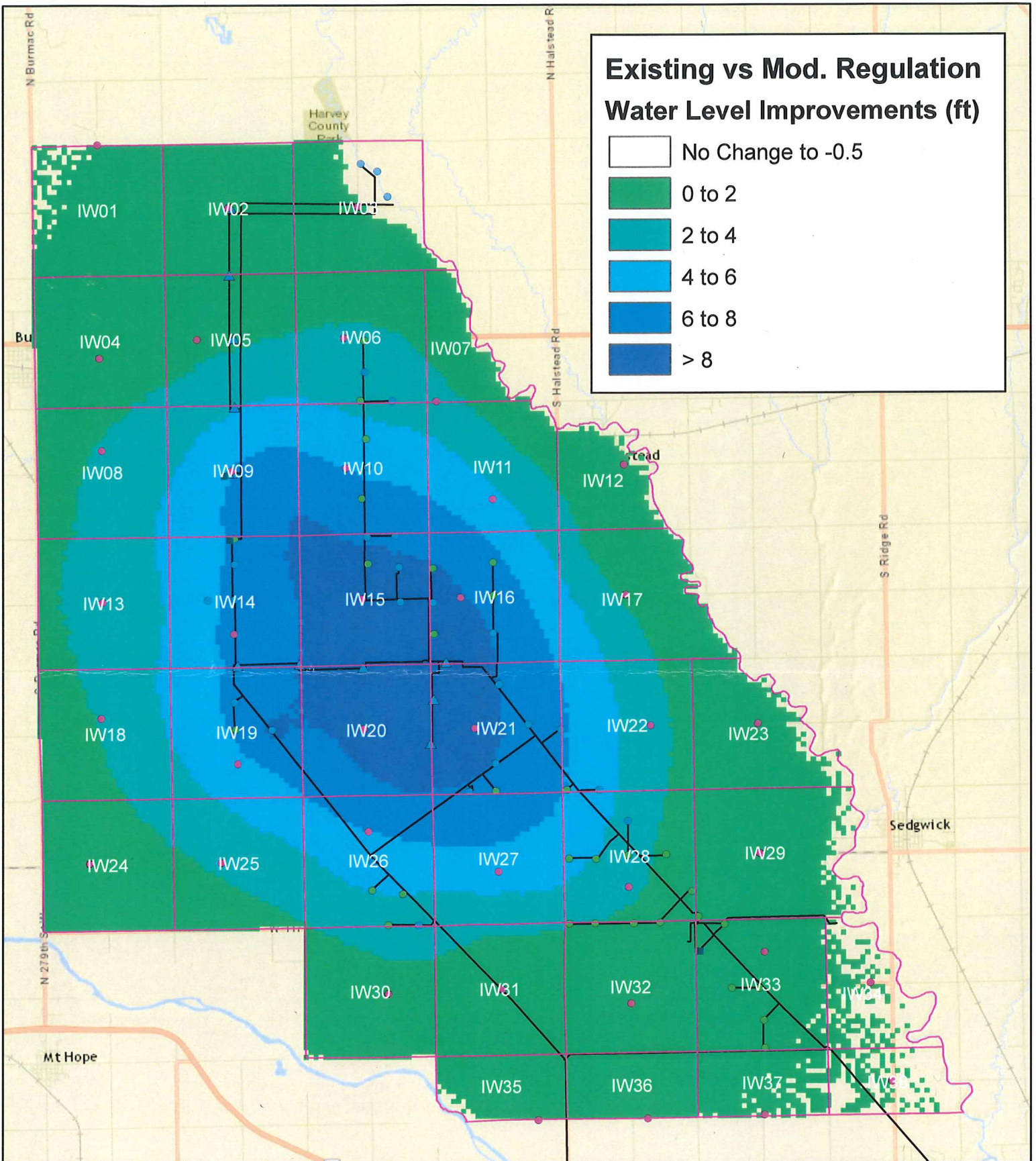
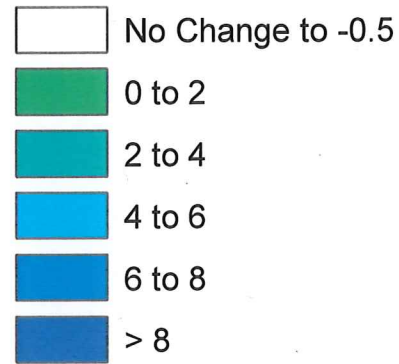


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ATTACHMENT C

Modified ASR Regulations to
1993 Levels Comparison
Ending of Simulated Drought

Existing vs Mod. Regulation Water Level Improvements (ft)



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ATTACHMENT D

Existing vs Modified ASR Regulation
Aquifer Water Level Improvements
Under Modified ASR Index
Cell Lower Elevations

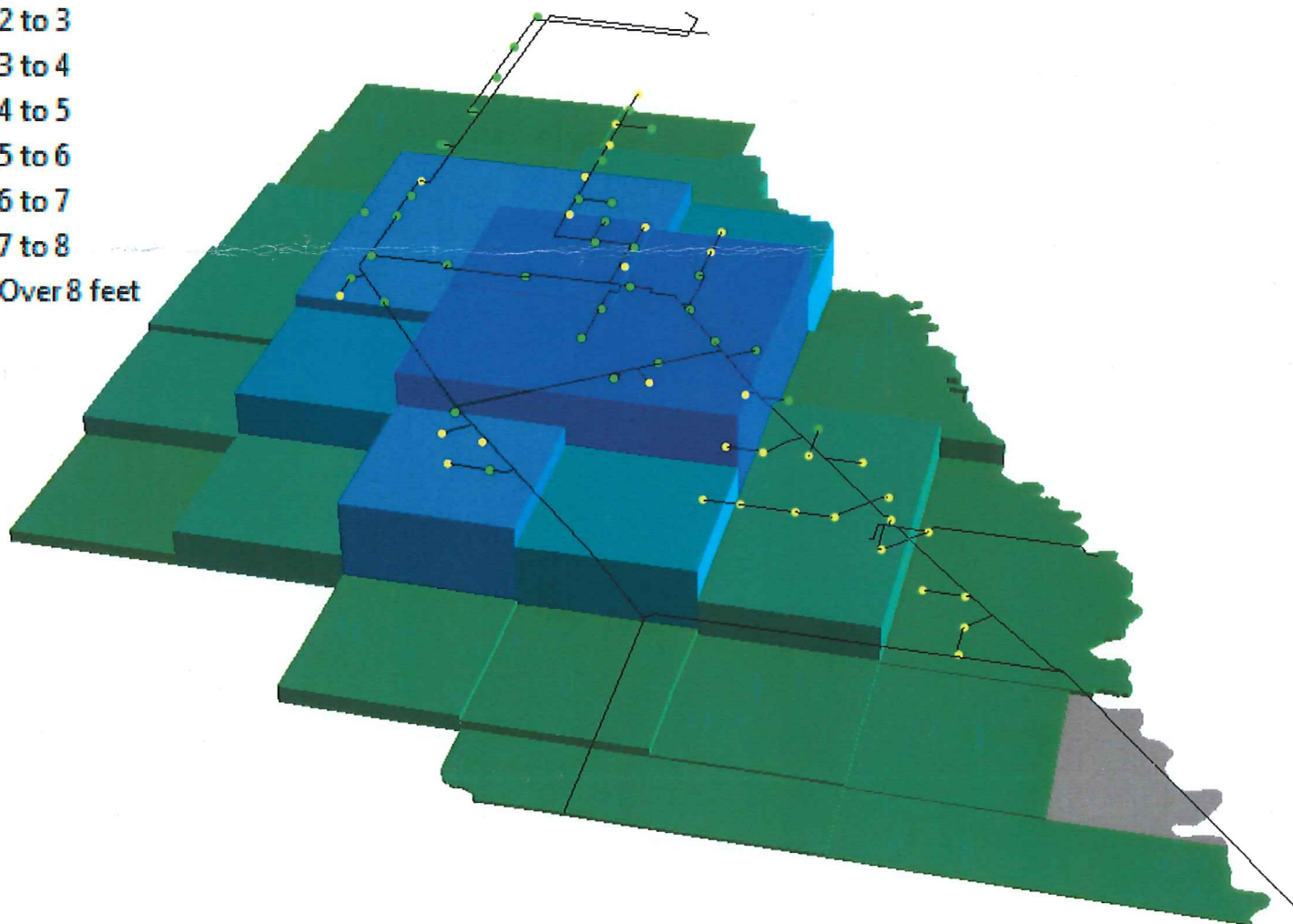
ATTACHMENT E

Water Level Improvements by Index Well

Under Modified ASR Credit Recovery Regulations

ASR Existing vs Current Regulations

Water Level Improvement (ft)



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