

BOB SEILER, PRESIDENT  
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MARK WHITSON, TREASURER  
MICHAEL T. DEALY, MANAGER  
THOMAS A. ADRIAN, ATTORNEY



DIRECTORS:  
JERRY BLAIN  
CLARKE DIXON  
EUGENE GRUENBACHER  
KIRK LARSON  
NADINE STANNARD

## EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2

313 SPRUCE • HALSTEAD, KANSAS 67056-1925 • equusbed@ink.org • VOICE (316) 835-2224 • FAX (316) 830-2210  
August 12, 2004

David L. Pope, Chief Engineer  
Division of Water Resources  
Kansas Department of Agriculture  
109 S.W. 9th Street, Second Floor  
Topeka, Kansas 66612-1283

Re: Application No. 45567 – City of Wichita

Dear Mr. Pope:

The referenced application was reviewed by the Equus Beds Groundwater Management District pursuant to K.A.R. 5-22-12. The application was reviewed using the District's Revised Management Program (effective May 1, 1995), and Rules and Regulations K.A.R. 5-22-1 through 5-22-12. Copies of the District's Application Review Information report and the independent consultant's project report are enclosed for your information.

Additionally, a draft copy of the proposed Memorandum of Understanding (MOU) between the District and the applicant has been enclosed. The District Board of Directors and the City of Wichita have conditionally agreed to the terms of the MOU, and a copy of the signed agreement shall be submitted to the Division by September 15, 2004.

Based upon the review findings, the provisions of the proposed MOU, and comments from the Board of Directors, the applicant and the public, the District recommends the application for approval subject to conditions that:

- 1) the City will provide GMD2 the actual distance from the proposed point of diversion to the nearest nondomestic water wells, substantiating that the proposed point of diversion complies with Well Spacing Regulation K.A.R. 5-22-2. The distances shall be either surveyed by a state-licensed surveyor or engineer, or scaled from an aerial photograph by qualified Harvey County Farm Service Agency staff;
- 2) the basin storage area shall be defined in compliance with K.A.R. 5-1-1(k) specifying the portion of the aquifer's unsaturated zone used for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- 3) monitoring of the basing storage area shall include water levels, water quality, water use, water storage, water recovery, precipitation, basic data access and operational reports;
- 4) a monitoring well network is established using Kansas Geological Survey methodology to determine index water levels in each water budget accounting unit, and monitoring water levels for water balance calculations and determination of recharge credits;
- 5) as determined by Kansas Geological Survey methodology the basin storage area is divided into 38 water budget accounting units and each unit is assigned an index identification number as shown on figure 3;
- 6) the index water levels are established in compliance with K.A.R. 5-1-1(oo), to designate water level elevations spatially throughout the basin storage area, to be used to represent the maximum volume of a basin storage area, and storage available for recovery based upon accounting methodology, and conditions of the permit;

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APPLICATION REVIEW INFORMATION

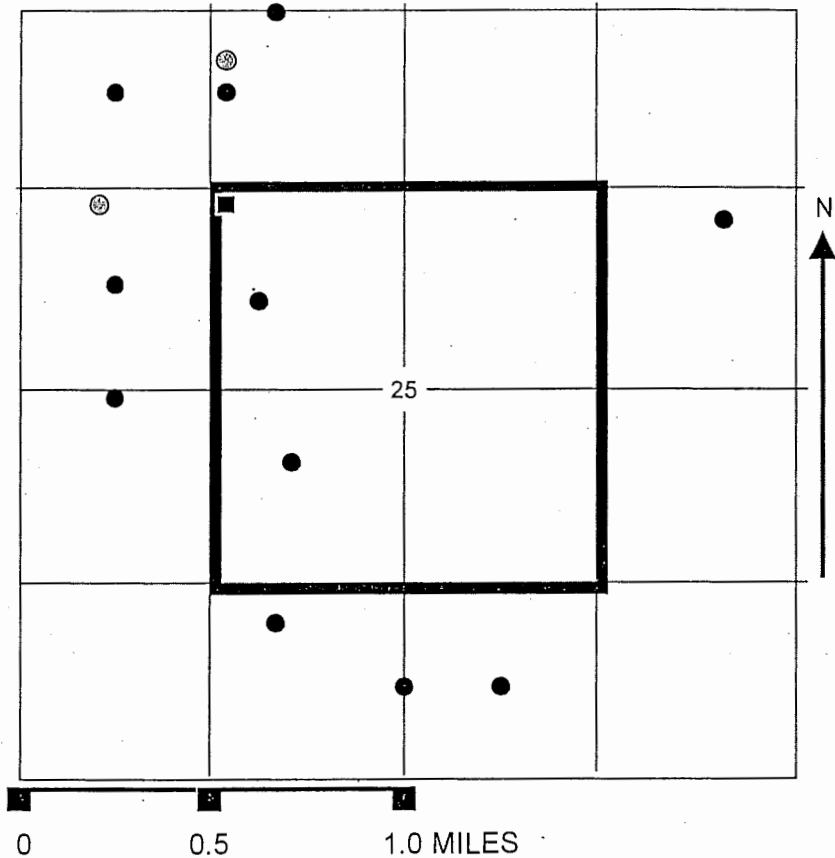
NAME CITY OF WICHITA APPLICATION NO. 45567  
 ADDRESS 455 N. MAIN STREET APPL. NEW  
WICHITA, KS 67202 COUNTY HARVEY TRACT NW-NW-NW  
 WELL LOCATION S 25 T 23 R 3 W  
 QUANT 1000 AF RATE 1200 GPM  
 WELL SPACING D=1600', ND=1200'

- Proposed Well
- Non-Domestic Well
- ⊙ Domestic Well

**ISSUE:** The application was filed for an aquifer storage and recovery well for the City of Wichita's Aquifer Storage and Recovery system. The applicant proposes to recharge water to the Equus Beds aquifer through the well for aquifer storage and recovery. The recharged water shall be diverted from the same well to be utilized for municipal use at a later time.

**BACKGROUND INFORMATION:**

JUL 3, 2003 - The applicant filed application no. 45567 for permit to withdraw water for municipal use as part of the Aquifer Storage and Recovery system. The application proposes the diversion of 1,000 AF/Y at a maximum diversion rate of 1,200 GPM, from a



proposed aquifer storage and recovery well located in the Northwest quarter of the Northwest quarter of the Northwest quarter of Section 25, Township 23 South, Range 3 West, Harvey County. The proposed well location is more specifically described as being 5,124 feet north and 5,272 feet west of the southeast corner of said section (figures 1 and 2).

FEB 11, 2004 - DWR requested that the District review the application and make recommendations.

FEB 13, 2004 - The District requested an extension of time to submit recommendations on the application to allow review of the application by the Board of Directors. It was requested that

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the time to provide recommendations be extended for 120 days. Copies of the extension request were submitted to the applicant and parties of interest who submitted letters of concern.

MAY 13, 2004 – It was the consensus of the Board of Directors at the May 11, 2004, meeting, that an additional 90-day extension be requested from the Chief Engineer, DWR, to provide recommendations. The additional time would allow for application review by the Board's consultant and the scheduling of a public meeting. Copies of the May 13, 2004, extension request were submitted to the applicant and parties of interest who submitted letters of concern to DWR regarding the proposed applications.

JUN 7, 2004 – The DWR approved an extension of time until August 13, 2004, to allow additional time for application review and recommendation.

**FINDINGS:** Application no. 45567 is subject to the Aquifer Management Program and District Standards and Policies, effective May 1, 1995, and Rules and Regulations K.A.R. 5-22-1 through K.A.R. 5-22-12.

Application no. 45567 is subject to the installation of a water flowmeter in accordance with District Metering Regulation K.A.R. 5-22-4a.

The proposed use of water is for municipal use associated with the applicant's aquifer storage and recovery (ASR) project. The applicant proposes to recharge bank storage water from the Little Arkansas River into the Equus Beds aquifer through a proposed aquifer storage and recovery well.

The applicant's proposal for aquifer storage will consist of a basin storage area underlying an area approximately 92,720 acres in size (figure 3). The following Division of Water Resources regulations as defined by K.A.R. 5-1-1, shall apply to the ASR project:

- (b) Acceptable quality surface water – surface water that will not degrade the quality of the groundwater source into which it is discharged;
- (e) Aquifer storage – the act of storing water in the unsaturated portion of an aquifer by artificial recharge for subsequent diversion and beneficial use;
- (f) Aquifer storage and recovery system – the 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;
- (g) Artificial recharge – the use of source water to artificially replenish the water supply in an aquifer;
- (k) Basin storage area – the portion of the aquifer's unsaturated zone use for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- (l) Basin storage loss – that portion of artificial recharge naturally flowing or discharging from the basin storage area;
- (oo) Index water level – water level elevations established spatially throughout a basin storage area to be used to represent the maximum volume of a basin storage area, and

storage available for recovery based upon accounting methodology, and conditions of the permit;

(hhh) Recharge credit – the quantity of water that is stored in the basin storage area and that is available for subsequent appropriation for beneficial use by the operator of the aquifer storage and recovery system;

(sss) Source water – water used for artificial recharge that meets the following conditions:

- (1) Is available for appropriation for beneficial use;
- (2) Is above baseflow stage in the stream;
- (3) Is not needed to satisfy minimum desirable streamflow requirements; and
- (4) Will not degrade the ambient groundwater quality in the basin storage area;

(iiii) Water balance – the method of determining the amount of water in storage in a basin storage area by accounting for inflow to, outflow from and changes in storage in that basin storage area.

Based on Kansas Geological Survey methodology for optimum monitoring well network design, the basin storage area was sub-divided into of 38 water budget accounting units, each comprised of a four square mile area (figure 3). Each unit consists of a monitoring well site utilized to obtain index water levels, and water quality data.

The proposed ASR well is located in the NW-NW-NW of Section 25, Township 23 South, Range 3 West (figure 4), and at a point near the center of basin storage unit no. 5 (figure 5).

The proposed well is one of three aquifer storage and recovery wells centralized in water budget accounting unit nos. 2 and 5, to be implemented as part of Phase I of the ASR project. The aquifer storage and recovery wells are identified by the applicant as RRW-1 through RRW-3, and proposed under application nos. 45567, 45568 and 45576 (figures 2, 4 and 5).

The applicant's proposed aquifer storage and recovery system is an effort to meet the City of Wichita's projected long term water demands, and to impede the movement of saltwater contamination plumes from the Burrton oil field area and the Arkansas River.

It is projected that the recharge of bank storage water to the aquifer will raise water levels in the basin storage area creating a change in hydraulic head that will retard movement of saltwater contamination.

The proposed ASR well is located one mile east of the Burrton Intensive Groundwater Use Control Area Boundary (figure 6). Saltwater contamination plumes with chloride concentrations greater than 250 mg/L, are located west of the proposed well site (figure 6). The nearest saltwater plume is in the middle portion of the aquifer (depth 125 feet bls) located approximately one-mile west of the application and moving to the southeast.

The proposed quantity of 1,000 AF/Y, to be diverted at a maximum rate of 1,200 GPM, would allow the withdrawal of water for a maximum period of 188.5 days during bank storage conditions.

The District Board of Directors, by approved motion recommended to the Chief Engineer, DWR, revisions of Article 22. The proposed changes included a provision to Safe Yield regulation 5-22-7, stipulating that applications not subject to the Safe Yield Regulation shall include applications for aquifer storage and recovery wells.

Under the proposed ASR application, only the water stored in the basin storage area shall be withdrawn for beneficial use by the operator of the aquifer storage and recovery system (recharge credit). The availability of the recharge credit shall be determined based on the

index water levels and water balance of the basin storage area. As a result of utilizing the recharge credit water, the aquifer's safe yield balance would not be affected.

The application does not comply with Well Spacing Regulation K.A.R. 5-22-2. The proposed well is located 1,200 feet north-northwest from an existing irrigation well authorized by water permit no. 37898 (figure 4). The minimum required spacing distance to nondomestic water wells is 1,320 feet.

The Division of Water Resources advised that no responses were received from the well owners contacted within one-half mile of the proposed well site.

The application complies with the Reclamation and Recycling Policy 9007.6, which provides that groundwater users are encouraged to:

- a. anticipate future water demands and needs;
- b. assess options for development of new water supplies;
- c. embrace a philosophy that the groundwater user has a responsibility to maintain, manage and restore groundwater resources;
- d. endeavor to initiate cooperative water reclamation and supply projects using water which has been treated, purified and reclaimed to recharge or store to meet future water supply needs;
- e. embrace the concept of continual recycling of usable water; and
- f. cooperate with the District to investigate means to supplement groundwater resources by improving recharge, preventing its deterioration and seeking means to import water.

Hydrologic and geologic data indicate that depth to bedrock is approximately 189 feet below land surface (bls). Depth to water is approximately 30 feet bls and saturated thickness 159 feet. Regional groundwater flow direction at the proposed well site is southeast.

The lithologic log of the proposed well site indicates that the aquifer is comprised of alternating sand and clay layers (figure 7). The clay units range from 2 to 18 feet in thickness. The sand units range from 2 to 35 feet in thickness, with the 35 feet thick unit located from a depth of 116 to 151 feet below land surface.

Water level data has been recorded by the District at groundwater monitoring site IW05 located approximately 0.5 mile west of the proposed well site (figure 4). Water levels recorded at the site during the period of record from October 2001 to April 2004 (figure 8), ranged from 25.7 to 44.8 feet bls in both IW05A (total depth 65 feet), and IW05C (total depth 190 feet). The IW05C lithologic log reported that depth to bedrock was 193 feet bls.

IW05 water level data (figure 8) indicated no substantial difference in hydraulic head. The water levels in both completion zones exhibited nearly identical responses to water table fluctuations.

The application's proposed well depth is 189 feet bls to be completed in the lower portion of the aquifer. Proposed well construction specifications were not submitted with the application. An example diagram of recharge and recovery well construction was included in the applicant's demonstration project report (figure 9).

The applicant proposes to install observation wells for groundwater level and water quality monitoring at the site. The quantity and quality of source water recharged at the site will be monitored.

**STAFF RECOMMENDATIONS:**

Based on data submitted by the applicant and District findings, staff recommends that the application be approved subject to conditions that:

- 1) the City will provide GMD2 the actual distance from the proposed point of diversion to the nearest nondomestic water wells, substantiating that the proposed point of diversion complies with Well Spacing Regulation K.A.R. 5-22-2. The distances shall be either surveyed by a state-licensed surveyor or engineer, or scaled from an aerial photograph by qualified Harvey County Farm Service Agency staff;
- 2) the basin storage area shall be defined in compliance with K.A.R. 5-1-1(k) specifying the portion of the aquifer's unsaturated zone used for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- 3) monitoring of the basing storage area shall include water levels, water quality, water use, water storage, water recovery, precipitation, basic data access and operational reports;
- 4) a monitoring well network is established using Kansas Geological Survey methodology to determine index water levels in each water budget accounting unit, and monitoring water levels for water balance calculations and determination of recharge credits;
- 5) as determined by Kansas Geological Survey methodology the basin storage area is divided into 38 water budget accounting units and each unit is assigned an index identification number as shown on figure 3;
- 6) the index water levels are established in compliance with K.A.R. 5-1-1(oo), to designate water level elevations spatially throughout the basin storage area, to be used to represent the maximum volume of a basin storage area, and storage available for recovery based upon accounting methodology, and conditions of the permit;
- 7) the highest index water level shall be limited to the predevelopment water table measurement or computed gradient based on KGS Bulletin 79 data and a minimum depth of 10 feet below land surface at the point of lowest land surface elevation in water budget accounting unit index no. 5;
- 8) the lowest index water level shall be determined per K.A.R. 5-12-1(b)(2) and the highest index water level shall be 1425 feet msl (17.6 feet bls), based on the predevelopment water level for index well no. 5, as determined from Kansas Geological Survey Bulletin 79 (1949);
- 9) water level monitoring data from index well no. 5 shall be used to compute the water balance and determine recharge credits for the proposed ASR application;
- 10) the total volume of the basin storage area shall be calculated in acre-feet utilizing the established highest and lowest index well levels for each water budget accounting unit, the area of the basin storage area, and the storage coefficient of the aquifer in each accounting unit;
- 11) the water balance to determine change in the basin storage area shall be calculated, where total inflow minus total outflow equals the change in groundwater storage;
- 12) the inflow data utilized in water balance calculations shall include natural recharge, groundwater and stream inflow, artificial recharge, and any other source of water deemed inflow by the District or the Division of Water Resources, further passive recharge shall not be considered as inflow and shall be excluded from water balance calculations;

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- 13) the outflow data utilized in water balance calculations shall include evapotranspiration; baseflow, groundwater and stream outflow, non-domestic well use, and any other source of water deemed outflow by the District or the Division of Water Resources;
- 14) the proposed recovery of water artificially recharged by the operator of the aquifer storage and recovery system shall only occur when recharge credits are determined to be available;
- 15) determination of recharge credits for the proposed ASR application shall be computed through water balance methodology utilizing index data from water budget accounting unit nos. 1, 2, 3, 4, 5, 6, 8, 9 and 10, and credit for passive recharge shall be prohibited;
- 16) a monitoring well network is installed at the applicant's expense to monitor the aquifer storage and recovery site as shown on Attachment 45567-A(r), and shall include existing monitoring well site IW05;
- 17) the monitoring wells are drilled and completed at depths correlating to the recharge and recovery zone of the aquifer for water sample collection, water level measurements and testing purposes;
- 18) the monitoring well sites are completed at spacing distances of 330 feet and 660 feet from the recharge and recovery well;
- 19) water level monitoring at the recharge and recovery site shall be automated with a frequency not to exceed six hours;
- 20) before installation of the proposed ASR well, the applicant shall submit a water level and water quality monitoring plan to GMD2 for review and comment and to the Chief Engineer, DWR for approval;
- 21) the water quality monitoring plan shall provide all necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, and temperature;
- 22) the proposed ASR well is equipped with water meters to separately and accurately record the total flow of water injected and diverted from the ASR well;
- 23) the water meter installations shall comply with K.A.R. 5-22-4;
- 24) the use of the proposed ASR well is authorized by the Kansas Department of Health and Environment as a Class V UIC well and minimum water quality standards for effluent are approved by the Department for organic and inorganic compounds, pesticides and bacteria; the water recharged to the aquifer through the ASR well shall comply with the source water regulation K.A.R. 5-1-1(sss);
- 25) the water recharged to the aquifer shall either comply with EPA and KDHE safe drinking water standards, or meet the ambient water quality at the recharge sites, whichever is better, as determined by the Secretary of the Kansas Department of Health and Environment;
- 26) the quality of recharge water injected into the aquifer through the proposed well shall not degrade the ambient groundwater quality in the basin storage area;
- 27) to establish baseline ambient groundwater quality prior to bank storage withdrawal, water quality analyses shall be completed at the applicant's expense for samples collected from:
  - a) domestic wells located within one-quarter mile of the proposed bank storage well, b) the proposed withdrawal well, and 3) all monitoring wells located at the bank storage diversion site;

- 28) the recharge system is constructed, operated and monitored to prevent groundwater contamination;
- 29) the applicant shall provide to the District a final report containing a description and scaled map of the as-built aquifer storage and recovery system;
- 30) the diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year; and
- 31) the operation of the proposed ASR well shall not impair existing water rights nor prejudicially affect the public interest.

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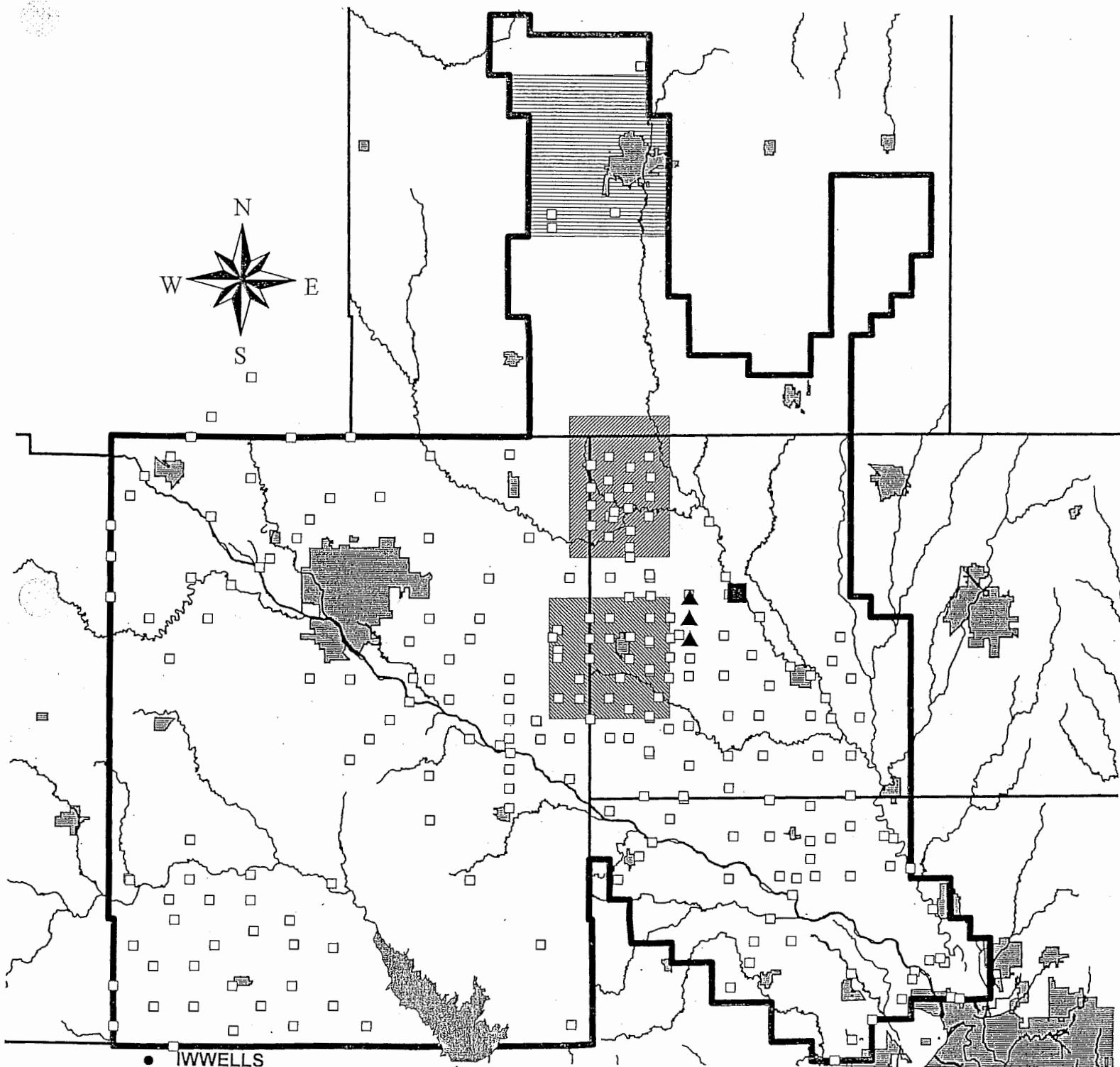
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Figure 1. - Equus Beds Groundwater Management District No. 2  
 Aquifer Storage and Recovery Project Map  
 July 13, 2004

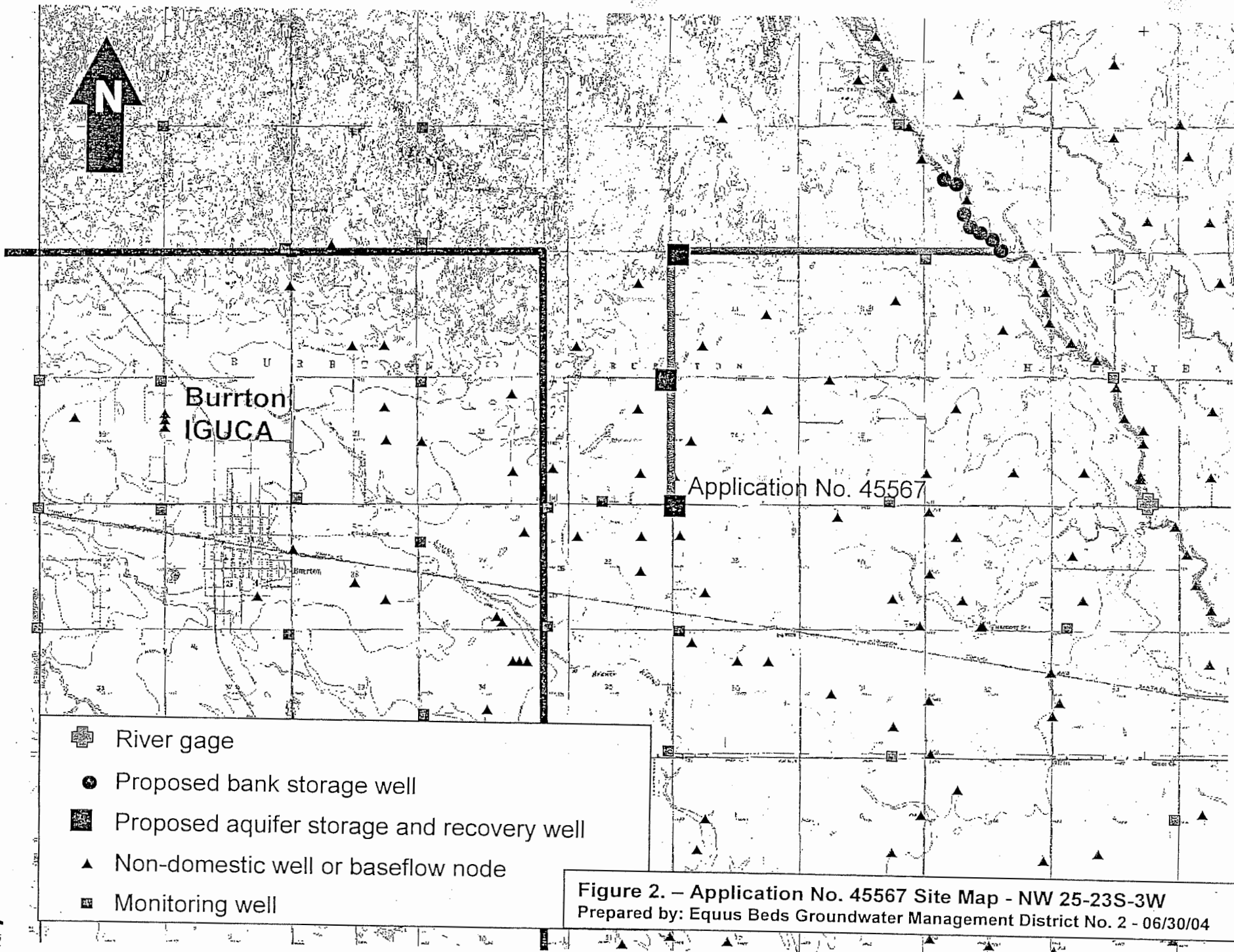


- IWWELLS
- Monitoring Wells
- ▨ Cheney Reservoir
- ▭ Counties
- ▭ District Boundary
- Streams
- ▧ Major Stream
- ▨ Cities
- Special Use Areas
- ▨ BURRTON IGUCA
- ▨ MCPHERSON IGUCA
- ▨ SWQA
- ▲ Application for Proposed Aquifer Recharge and Recovery Well
- Applications for 7 Proposed Bank Storage Withdrawal Wells

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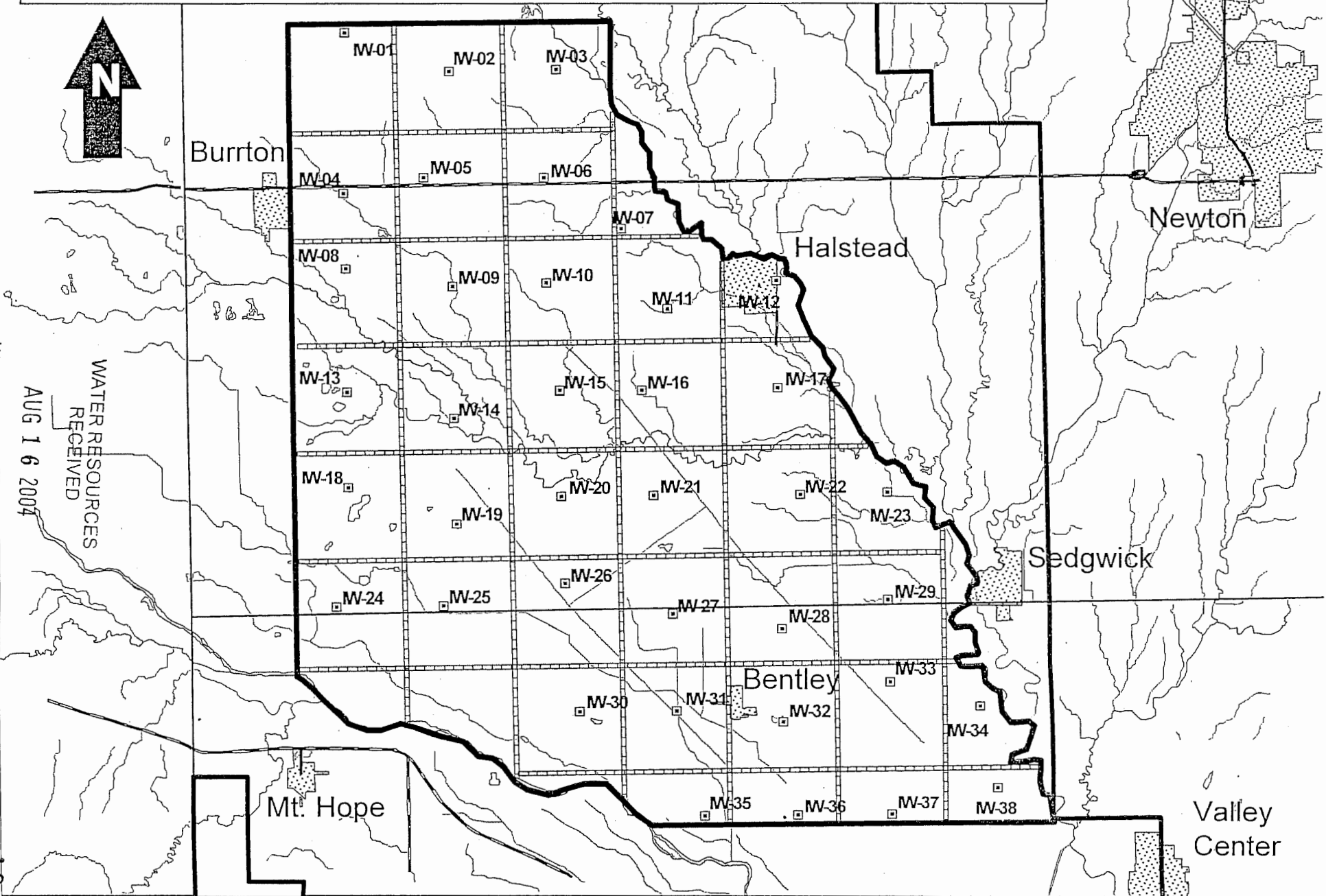
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**Figure 2. – Application No. 45567 Site Map - NW 25-23S-3W**  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04

Figure 3. – Basin Storage Area Map - Application No. 45567 Site Map - NW 25-23S-3W

Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04



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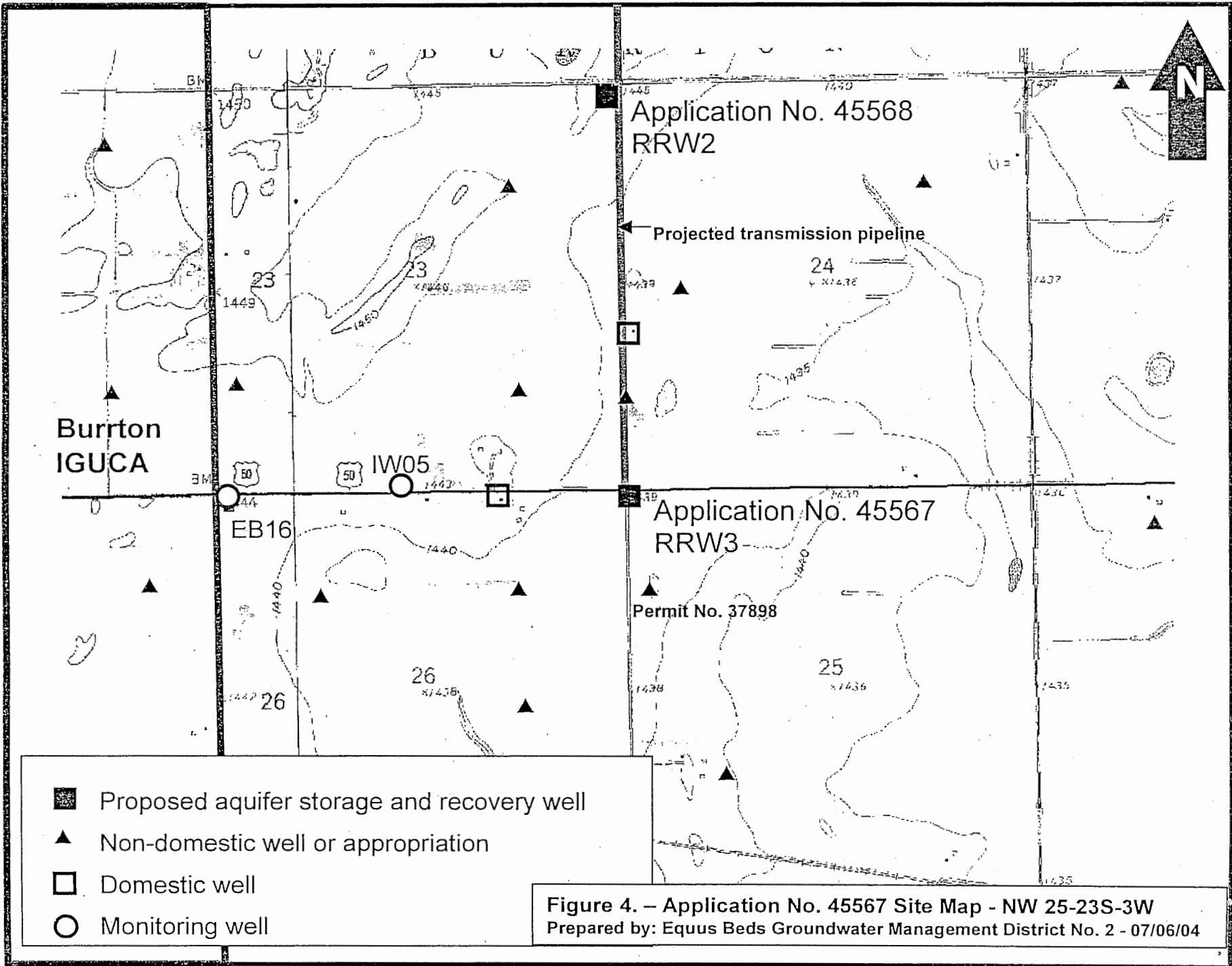
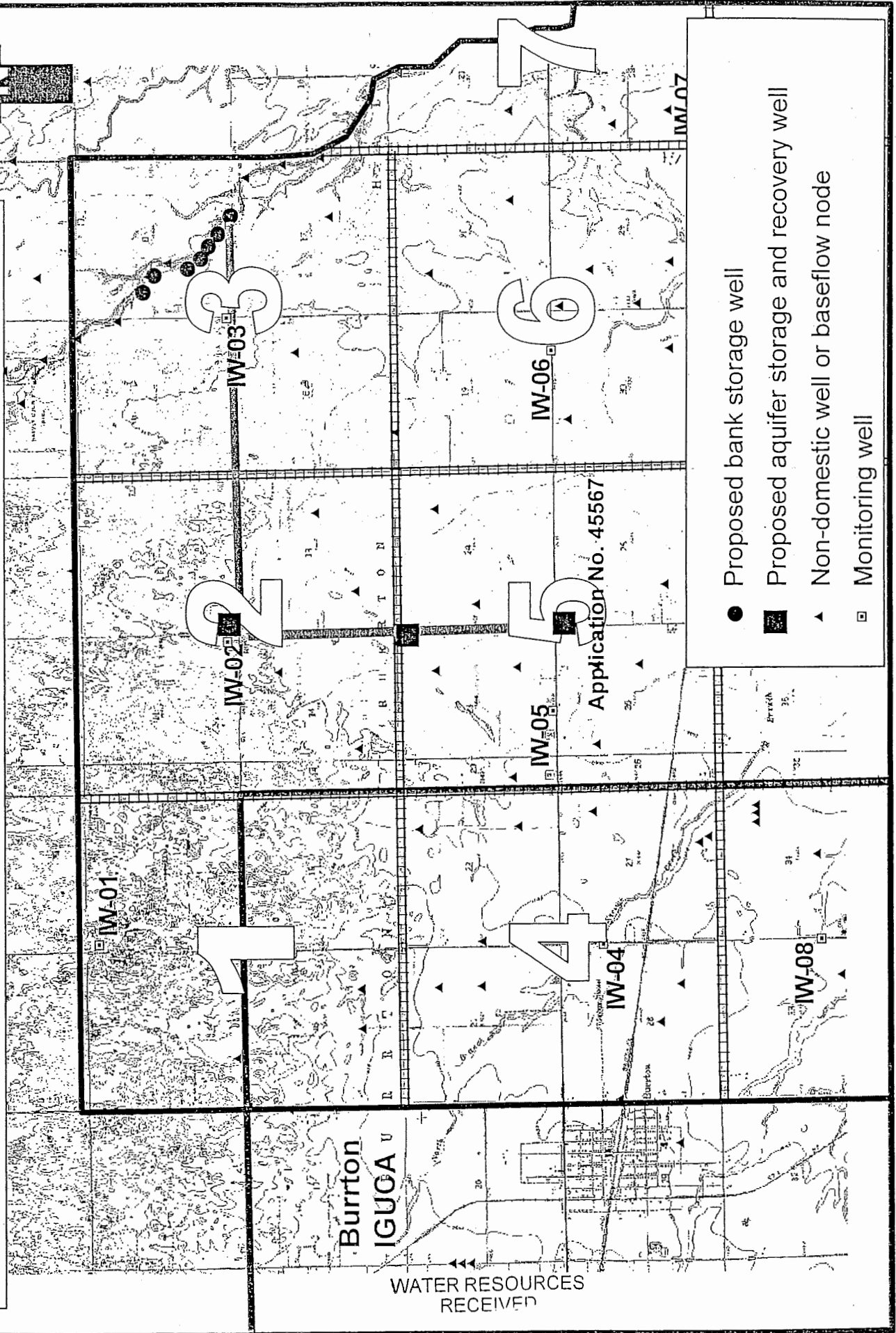
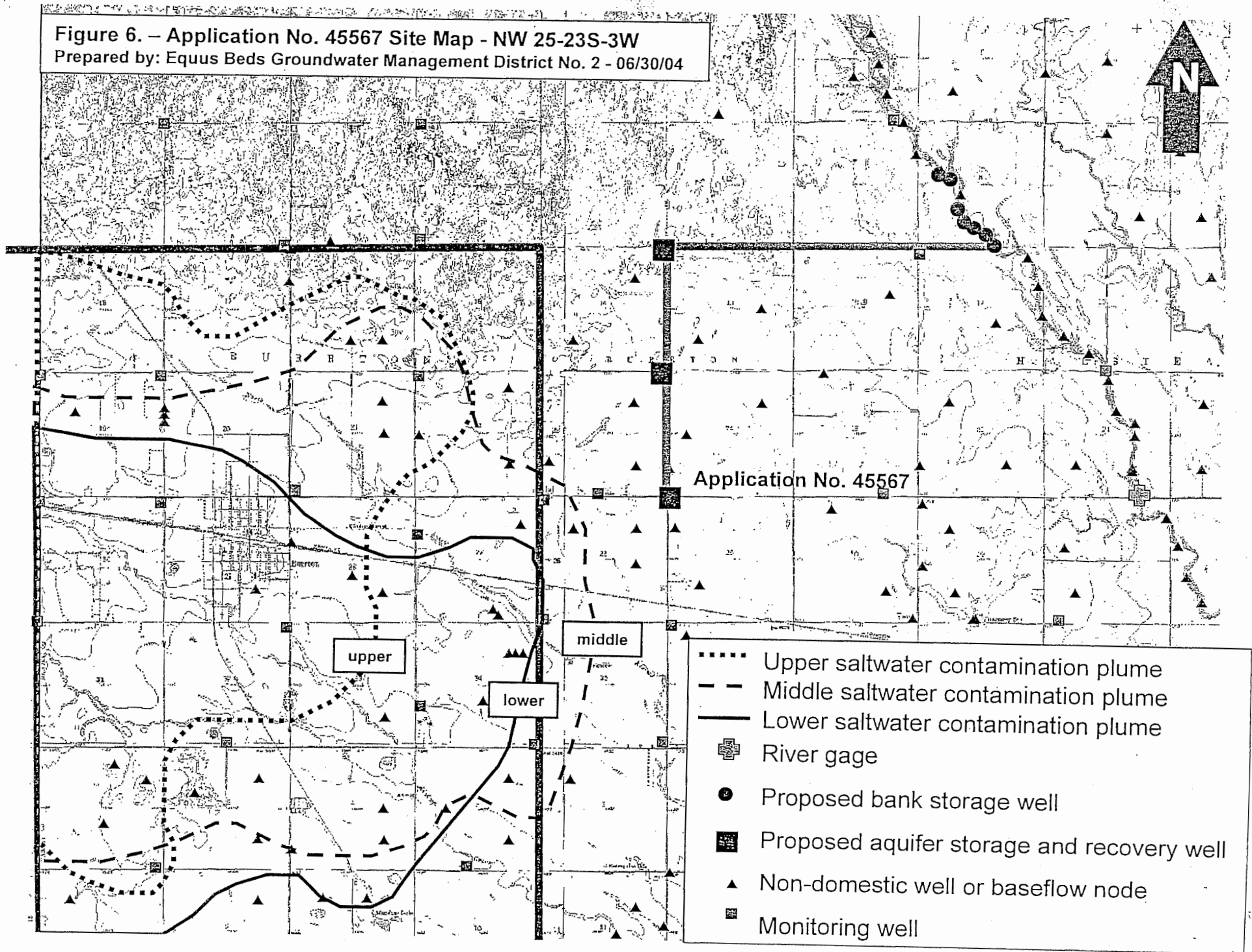


Figure 5. – Basin Storage Area Accounting Unit Map- Application No. 45567 Site Map - NW 25-23S-3W  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04



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**Figure 6. – Application No. 45567 Site Map - NW 25-23S-3W**  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04



- ..... Upper saltwater contamination plume
- - - Middle saltwater contamination plume
- Lower saltwater contamination plume
- ⊕ River gage
- Proposed bank storage well
- Proposed aquifer storage and recovery well
- ▲ Non-domestic well or baseflow node
- Monitoring well

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256 5925 WATER WELL RECORD Form WAW-5 KSA 82a-1212 ID No. RW-3

1 LOCATION OF WATER WELL: Fraction NW NW NW NW Section Number 25 Township Number T 23 Range Number R 3 E 4

County: Harvey Distance and direction from nearest town or city street address of well if located within city? Approximately 3 miles east of Burton

2 WATER WELL OWNER: City of Wichita Board of Agriculture, Division of Water Resources  
 RRA, SL Address, Box # 455 N. Main Application Number:  
 City, State, ZIP Code Wichita, KS 67202

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

X		
NW		NE
SW		SE

DEPTH OF COMPLETED WELL 181 ft. ELEVATION: Unknown

Depth(s) Groundwater Encountered 1 ft. 2 ft. 3 ft.

WELL'S STATIC WATER LEVEL 30.15 ft. below land surface measured on mo/day/yr 11-12-02

Pump test data: Well water was Not checked, ft. after hours pumping gpm

Est. Yield UNKNOWN gpm: Well water was ft. after hours pumping gpm

Bore Hole Diameter 6 in. to 200 ft. end in. to ft.

WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well  
 1 Domestic 3 Foodst 6 Oil field water supply 9 Dewatering 12 Other (specify below)  
 2 Irrigation 4 Industrial 7 Domestic (lawn & garden) 10 Monitoring well

Was a chemical/bacteriological sample submitted to Department? Yes No  If yes, mo/day/yr sample was submitted Water Well Disinfected? Yes No

4 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below) CASING JOINTS: Glued  Clamped Wroded Threaded

Blank casing diameter 2 in. to 159 ft. Dia in. to ft. Dia in. to ft. Dia in. to ft.

Casing height above land surface 24 in. weight 95 lbs./ft. Wall thickness or gauge No. 214

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Layered slotted 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)

SCREEN PERFORATED INTERVALS: From 189 ft. to 189 ft. From ft. to ft. From ft. to ft. From ft. to ft.

GRAVEL PACK INTERVALS: From 164 ft. to 200 ft. From ft. to ft. From ft. to ft. From ft. to ft.

5 GROUT MATERIAL: 1 Neel cement 2 Cement grout 3 Bentonite 4 Other Bentonite Holes

Grout intervals: From ft. to ft. From ft. to ft. From ft. to ft. From ft. to ft.

What is the nearest source of possible contamination:  
 1 Septic tank 2 Sewer lines 3 Water/tight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Foodyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below) None known

Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	6	Topsoil	168	189	Sand, very fine to coarse with gravel, fine and clay streaks
6	13	Clay, light gray			
13	22	Sand, medium to fine with gravel, medium to fine	189	200	Shale, black
22	33	Clay, brown			
33	47	Sand, very fine to medium, gravel, medium to fine			
47	59	Clay, gray, green			
59	61	Sand, fine to medium, gravel, fine to medium			
61	73	Clay, green			
73	83	Sand, very fine to medium with gravel, fine to medium			
83	101	Clay, gray, green			
101	114	Sand, coarse to very fine with gravel, medium to fine			
114	116	Clay, green			
116	151	Sand, coarse to very fine with gravel, fine to medium			
151	168	Clay, green			

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION This water well was (1) constructed (2) reconstructed or (3) plugged under my jurisdiction and was completed on (mo/day/yr) 11-12-02 and this record is true to the best of my knowledge and belief, Kansas Water Well Contractor's License No. 135 This Water Well Record was completed on (mo/day/yr) 11-22-02 by (signature) [Signature]

under the business name of Clarke Well & Equipment, Inc.

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRINT FULLY AND PRINT clearly. Please fill in blanks, underline or circle the correct answer. Send by three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone 785-296-5624. Send one to WATER WELL OWNER and retain one for your records. Fee of \$3.00 for each constructed well.

Figure 7. – Application No. 45567 Lithologic Log for Test Well at Proposed ASR Well Site

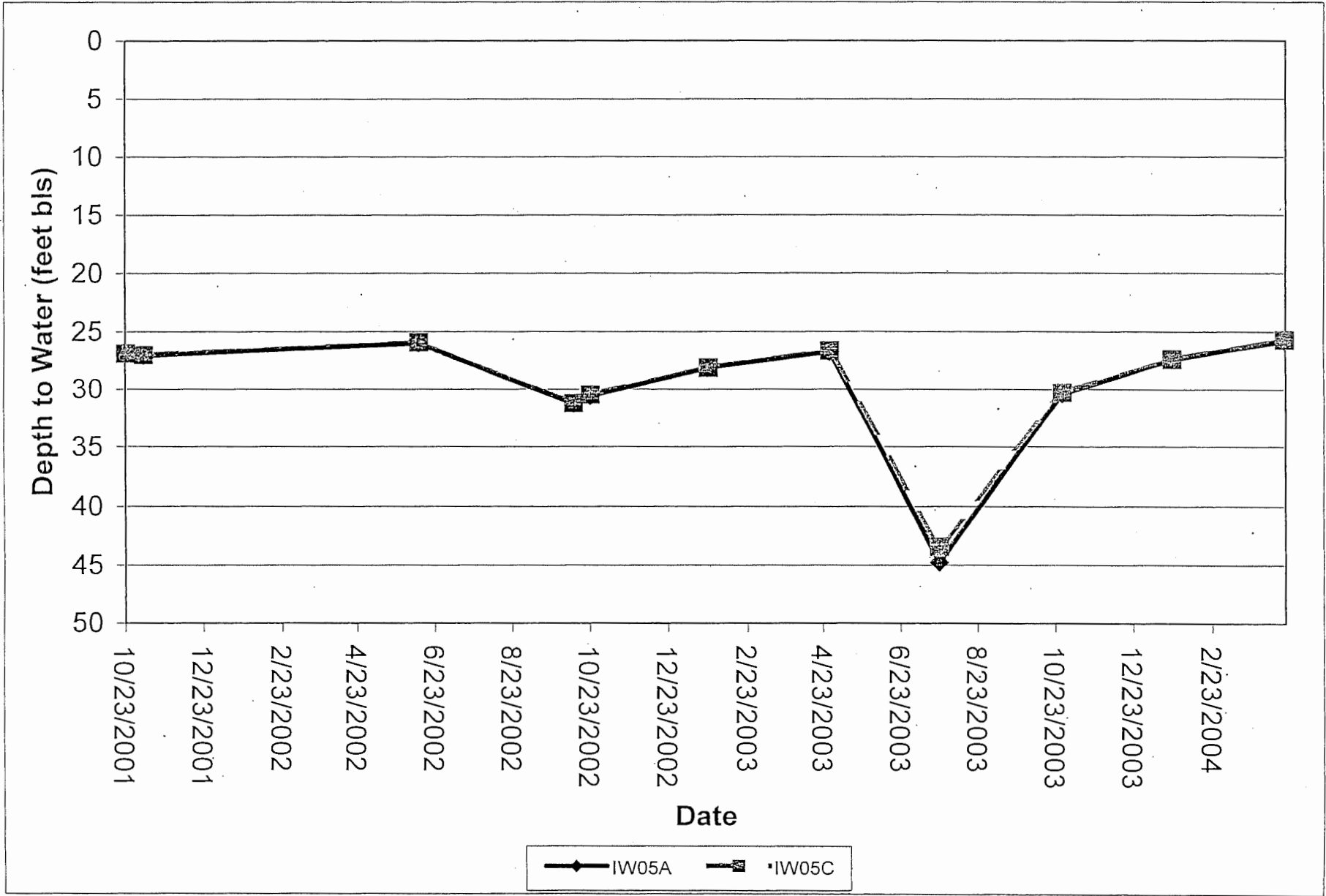
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Groundwater Monitoring Site IW05  
SE-SW-SE Sec. 23, T23S, R3W



IW05A Depth = 65 feet  
IW05C Depth = 190 feet

Figure 8 .



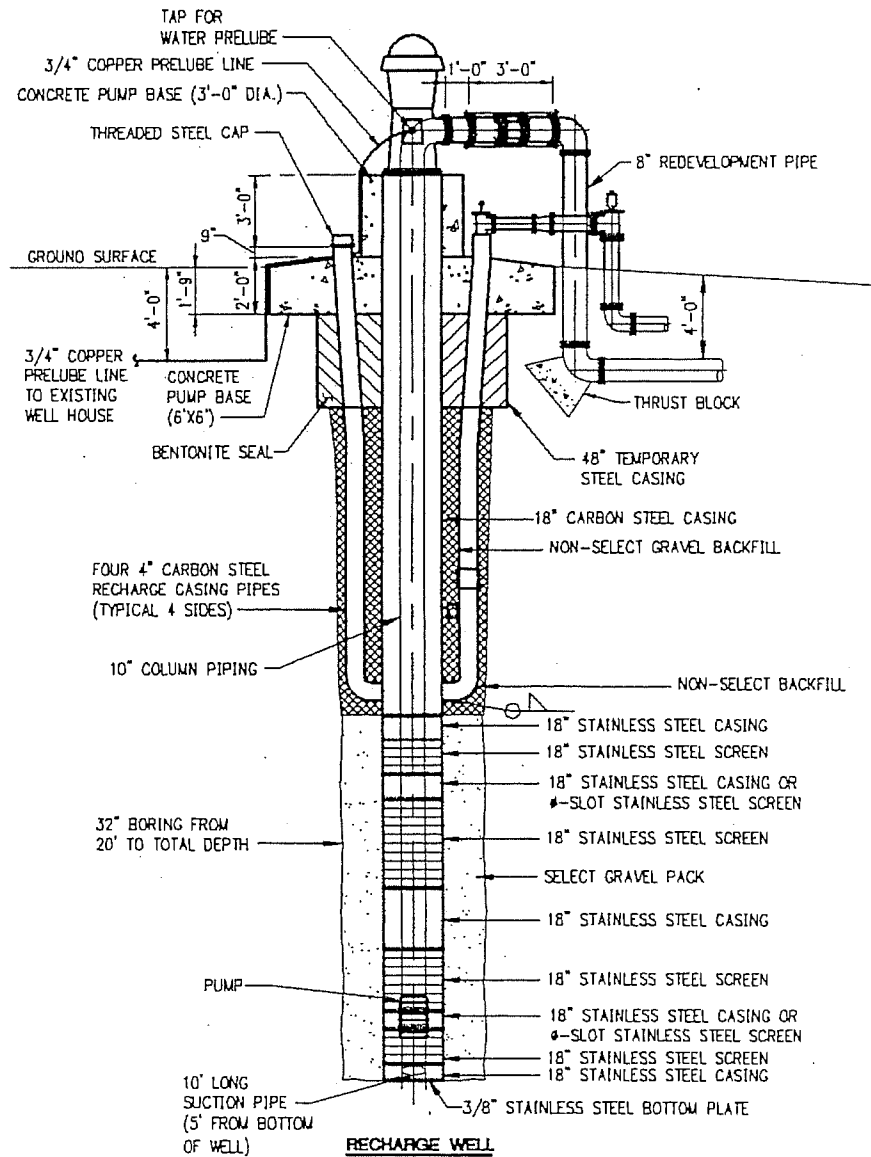


Figure 9. –  
Application  
No. 45567  
Example of  
Construction  
Design for  
Recharge and  
Recovery Well

Attachment 45567-A(r).

Application No. 45568  
RRW2

Projected transmission pipeline

Application No. 45567  
RRW3

Permit No. 37898

- Proposed aquifer storage and recovery well
- ▲ Non-domestic well or appropriation
- Domestic well
- Existing monitoring well
- Proposed monitoring well

Attachment 45567-A(r). – Application No. 45567 Site Map - NW 25-23S-3W  
Prepared by: Equus Beds Groundwater Management District No. 2

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## EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2

313 SPRUCE • HALSTEAD, KANSAS 67056-1925 • equusbed@ink.org • VOICE (316) 835-2224 • FAX (316) 830-2210  
August 12, 2004

David L. Pope, Chief Engineer  
Division of Water Resources  
Kansas Department of Agriculture  
109 S.W. 9th Street, Second Floor  
Topeka, Kansas 66612-1283

Re: Application No. 45568 – City of Wichita

Dear Mr. Pope:

The referenced application was reviewed by the Equus Beds Groundwater Management District pursuant to K.A.R. 5-22-12. The application was reviewed using the District's Revised Management Program (effective May 1, 1995), and Rules and Regulations K.A.R. 5-22-1 through 5-22-12. Copies of the District's Application Review Information report and the independent consultant's project report are enclosed for your information.

Additionally, a draft copy of the proposed Memorandum of Understanding (MOU) between the District and the applicant has been enclosed. The District Board of Directors and the City of Wichita have conditionally agreed to the terms of the MOU, and a copy of the signed agreement shall be submitted to the Division by September 15, 2004.

Based upon the review findings, the provisions of the proposed MOU, and comments from the Board of Directors, the applicant and the public, the District recommends the application for approval subject to conditions that:

- moa*
- 1) the basin storage area shall be defined in compliance with K.A.R. 5-1-1(k) specifying the portion of the aquifer's unsaturated zone used for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
  - 2) monitoring of the basing storage area shall include water levels, water quality, water use, water storage, water recovery, precipitation, basic data access and operational reports;
  - 3) a monitoring well network is established using Kansas Geological Survey methodology to determine index water levels in each water budget accounting unit, and monitoring water levels for water balance calculations and determination of recharge credits;
  - 4) as determined by Kansas Geological Survey methodology the basin storage area is divided into 38 water budget accounting units and each unit is assigned an index identification number as shown on figure 3;

*moa*

  - 5) the index water levels are established in compliance with K.A.R. 5-1-1(oo), to designate water level elevations spatially throughout the basin storage area, to be used to represent the maximum volume of a basin storage area, and storage available for recovery based upon accounting methodology, and conditions of the permit;
  - 6) the highest index water level shall be limited to the predevelopment water table measurement or computed gradient based on KGS Bulletin 79 data and a minimum depth of 10 feet below land surface at the point of lowest land surface elevation in water budget accounting unit index no. 5;
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- mon*
- 7) the lowest index water level shall be determined per K.A.R. 5-12-1(b)(2) and the highest index water level shall be 1425 feet msl (17.6 feet bls), based on the predevelopment water level for index well no. 5, as determined from Kansas Geological Survey Bulletin 79 (1949);
  - 8) water level monitoring data from index well no. 5 shall be used to compute the water balance and determine recharge credits for the proposed ASR application;
  - 9) the total volume of the basin storage area shall be calculated in acre-feet utilizing the established highest and lowest index well levels for each water budget accounting unit, the area of the basin storage area, and the storage coefficient of the aquifer in each accounting unit;
  - 10) the water balance to determine change in the basin storage area shall be calculated, where total inflow minus total outflow equals the change in groundwater storage;
  - 11) the inflow data utilized in water balance calculations shall include natural recharge, groundwater and stream inflow, artificial recharge, and any other source of water deemed inflow by the District or the Division of Water Resources, further passive recharge shall not be considered as inflow and shall be excluded from water balance calculations;
  - 12) the outflow data utilized in water balance calculations shall include evapotranspiration, baseflow, groundwater and stream outflow, non-domestic well use, and any other source of water deemed outflow by the District or the Division of Water Resources;
  - 13) the proposed recovery of water artificially recharged by the operator of the aquifer storage and recovery system shall only occur when recharge credits are determined to be available;
  - 14) determination of recharge credits for the proposed ASR application shall be computed through water balance methodology utilizing index data from water budget accounting unit nos. 1, 2, 3, 4, 5, 6, 8, 9 and 10, and credit for passive recharge shall be prohibited;

*mon*

  - 15) a monitoring well network is installed at the applicant's expense to monitor the aquifer storage and recovery site as shown on Attachment 45568-A(r), and shall include existing monitoring well site IW05;
  - 16) the monitoring wells are drilled and completed at depths correlating to the upper and lower zones of the aquifer for water sample collection, water level measurements and testing purposes;
  - 17) the monitoring well sites are completed at spacing distances within 660 feet from the recharge and recovery well;
  - 18) water level monitoring at the recharge and recovery site shall be automated with a frequency not to exceed six hours;

*mon*

  - 19) before installation of the proposed ASR well, the applicant shall submit a water level and water quality monitoring plan to GMD2 for review and comment and to the Chief Engineer, DWR for approval;
  - 20) the water quality monitoring plan shall provide all necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, and temperature;
  - 21) the proposed ASR well is equipped with water meters to separately and accurately record the total flow of water injected and diverted from the ASR well;
  - 22) the water meter installations shall comply with K.A.R. 5-22-4;

*mon*

  - 23) the use of the proposed ASR well is authorized by the Kansas Department of Health and Environment as a Class V UIC well and minimum water quality standards for effluent are approved by the Department for organic and inorganic compounds, pesticides and bacteria, the

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David L. Pope  
August 12, 2004  
Page 3 -

water recharged to the aquifer through the ASR well shall comply with the source water regulation K.A.R. 5-1-1(sss);

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- 24) the water recharged to the aquifer shall either comply with EPA and KDHE safe drinking water standards, or meet the ambient water quality at the recharge sites, whichever is better, as determined by the Secretary of the Kansas Department of Health and Environment;
- 25) the quality of recharge water injected into the aquifer through the proposed well shall not degrade the ambient groundwater quality in the basin storage area;
- 26) to establish baseline ambient groundwater quality prior to bank storage withdrawal, water quality analyses shall be completed at the applicant's expense for samples collected from: a) domestic wells located within one-quarter mile of the proposed aquifer storage and recovery well, b) the proposed ASR well, and 3) all monitoring wells located at the ASR site;
- 27) the recharge system is constructed, operated and monitored to prevent groundwater contamination;
- 28) the applicant shall provide to the District a final report containing a description and scaled map of the as-built aquifer storage and recovery system;
- 29) the diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year; and
- 30) the operation of the proposed ASR well shall not impair existing water rights nor prejudicially affect the public interest.

Please contact me should there be any question regarding the District's findings or recommendation.

A District decision may be appealed to the District Board of Directors by submitting a written petition to the District office within 30 days from date of this notification, pursuant to K.A.R. 5-22-12.

Sincerely,  
EQUUS BEDS GROUNDWATER  
MANAGEMENT DISTRICT NO. 2

Michael T. Dealy, L. G.  
Manager



MTD/DRK/rk  
Enclosures

pc: David Warren, City of Wichita  
John F. and Ileen L. Weber  
Edward J. Weber  
Equus Beds Groundwater Management District Board of Directors

Ronald and Sharon Neuway  
Edward W. Combs  
Dick Van Wye

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**APPLICATION REVIEW INFORMATION**

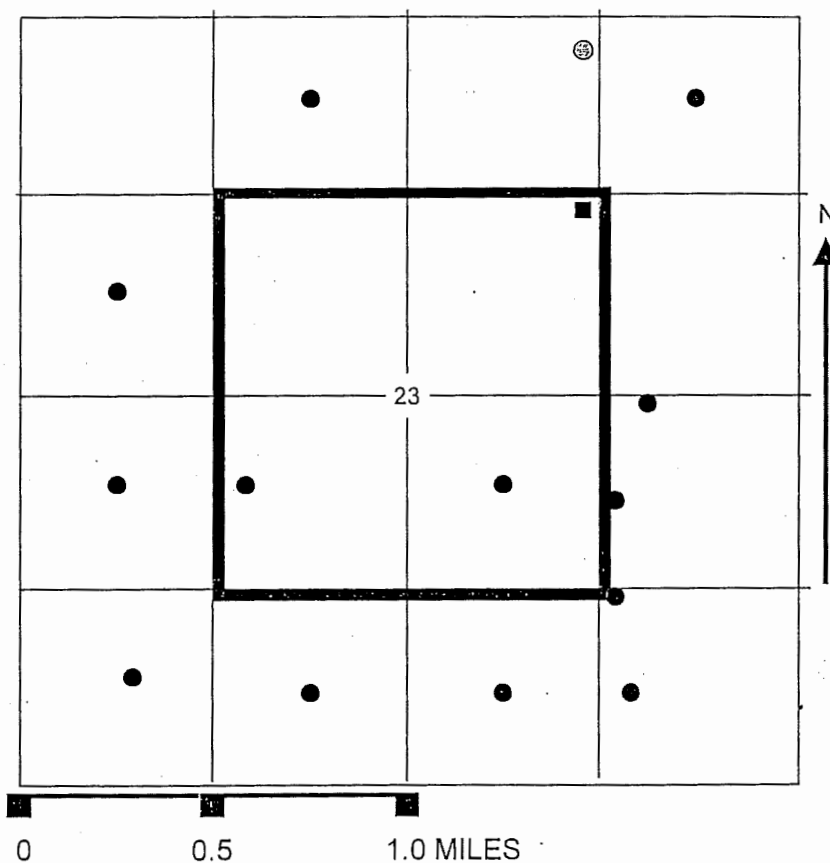
NAME	<u>CITY OF WICHITA</u>	APPLICATION NO.	<u>45568</u>
ADDRESS	<u>455 N. MAIN STREET</u>	APPL.	<u>NEW</u>
	<u>WICHITA, KS 67202</u>	COUNTY	<u>HARVEY TRACT NE-NE-NE</u>
		WELL LOCATION	<u>S 23 T 23 R 3 W</u>
		QUANT	<u>1000 AF</u> RATE <u>1000 GPM</u>
		WELL SPACING	<u>D=2085', ND=1750'</u>

- Proposed Well
- Non-Domestic Well
- ⊙ Domestic Well

**ISSUE:** The application was filed for an aquifer storage and recovery well for the City of Wichita's Aquifer Storage and Recovery system. The applicant proposes to recharge water to the Equus Beds aquifer through the well for aquifer storage and recovery. The recharged water shall be diverted from the same well to be utilized for municipal use at a later time.

**BACKGROUND INFORMATION:**

JUL 3, 2003 - The applicant filed application no. 45568 for permit to withdraw water for municipal use as part of the Aquifer Storage and Recovery system. The application proposes the diversion of 1,000 AF/Y at a maximum diversion rate of 1,000 GPM, from a proposed aquifer storage and recovery well located in the Northeast quarter of the Northeast quarter of the Northeast quarter of Section 23, Township 23 South, Range 3 West, Harvey County. The proposed well location is more specifically described as being 5,232 feet north and 159 feet west of the southeast corner of said section (figures 1 and 2).



FEB 11, 2004 - DWR requested that the District review the application and make recommendations.

FEB 13, 2004 - The District requested an extension of time to submit recommendations on the application to allow review of the application by the Board of Directors. It was requested that

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the time to provide recommendations be extended for 120 days. Copies of the extension request were submitted to the applicant and parties of interest who submitted letters of concern.

MAY 13, 2004 – It was the consensus of the Board of Directors at the May 11, 2004, meeting, that an additional 90-day extension be requested from the Chief Engineer, DWR, to provide recommendations. The additional time would allow for application review by the Board's consultant and the scheduling of a public meeting. Copies of the May 13, 2004, extension request were submitted to the applicant and parties of interest who submitted letters of concern to DWR regarding the proposed applications.

JUN 7, 2004 – The DWR approved an extension of time until August 13, 2004, to allow additional time for application review and recommendation.

**FINDINGS:** Application no. 45568 is subject to the Aquifer Management Program and District Standards and Policies, effective May 1, 1995, and Rules and Regulations K.A.R. 5-22-1 through K.A.R. 5-22-12.

Application no. 45568 is subject to the installation of a water flowmeter in accordance with District Metering Regulation K.A.R. 5-22-4a.

The proposed use of water is for municipal use associated with the applicant's aquifer storage and recovery (ASR) project. The applicant proposes to recharge bank storage water from the Little Arkansas River into the Equus Beds aquifer through a proposed aquifer storage and recovery well.

The applicant's proposal for aquifer storage will consist of a basin storage area underlying an area approximately 92,720 acres in size (figure 3). The following Division of Water Resources regulations as defined by K.A.R. 5-5-1, shall apply to the ASR project:

- (b) Acceptable quality surface water – surface water that will not degrade the quality of the groundwater source into which it is discharged;
- (e) Aquifer storage – the act of storing water in the unsaturated portion of an aquifer by artificial recharge for subsequent diversion and beneficial use;
- (f) Aquifer storage and recovery system – the 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;
- (g) Artificial recharge – the use of source water to artificially replenish the water supply in an aquifer;
- (k) Basin storage area – the portion of the aquifer's unsaturated zone use for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- (l) Basin storage loss – that portion of artificial recharge naturally flowing or discharging from the basin storage area;
- (oo) Index water level – water level elevations established spatially throughout a basin storage area to be used to represent the maximum volume of a basin storage area, and

storage available for recovery based upon accounting methodology, and conditions of the permit;

(hhh) Recharge credit – the quantity of water that is stored in the basin storage area and that is available for subsequent appropriation for beneficial use by the operator of the aquifer storage and recovery system;

(sss) Source water – water used for artificial recharge that meets the following conditions:

- (1) Is available for appropriation for beneficial use;
- (2) Is above baseflow stage in the stream;
- (3) Is not needed to satisfy minimum desirable streamflow requirements; and
- (4) Will not degrade the ambient groundwater quality in the basin storage area;

(iiii) Water balance – the method of determining the amount of water in storage in a basin storage area by accounting for inflow to, outflow from and changes in storage in that basin storage area.

Based on Kansas Geological Survey methodology for optimum monitoring well network design, the basin storage area was sub-divided into of 38 water budget accounting units, each comprised of a four square mile area (figure 3). Each unit consists of a monitoring well site utilized to obtain index water levels, and water quality data.

The proposed ASR well is located in the NE-NE-NE of Section 23, Township 23 South, Range 3 West (figure 4), and at a point near the center of the boundary between basin storage unit nos. 2 and 5 (figure 5).

The proposed well is one of three aquifer storage and recovery wells centralized in basin storage unit nos. 2 and 5, to be implemented as part of Phase I of the ASR project. The aquifer storage and recovery wells are identified by the applicant as RRW-1 through RRW-3, and proposed under application nos. 45567, 45568 and 45576 (figures 2, 4 and 5).

The applicant's proposed aquifer storage and recovery system is an effort to meet the City of Wichita's projected long term water demands, and to impede the movement of saltwater contamination plumes from the Burrton oil field area and the Arkansas River.

It is projected that the recharge of bank storage water to the aquifer will raise water levels in the basin storage area creating a change in hydraulic head that will retard movement of saltwater contamination.

The proposed ASR well is located one mile east of the Burrton Intensive Groundwater Use Control Area Boundary (figure 6). Saltwater contamination plumes with chloride concentrations greater than 250 mg/L, are located west of the proposed well site (figure 6). The nearest saltwater plumes are in the upper (depth 66 feet bls) and middle (depth 152 feet bls) portions of the aquifer located approximately one-half mile west of the application and moving to the southeast.

The proposed quantity of 1,000 AF/Y, to be diverted at a maximum rate of 1,000 GPM, would allow the withdrawal of water for a maximum period of 226 days, when aquifer storage and recovery conditions are met.

The District Board of Directors, by approved motion recommended to the Chief Engineer, DWR, revisions of Article 22. The proposed changes included a provision to Safe Yield regulation 5-22-7, stipulating that applications not subject to the Safe Yield Regulation shall include applications for aquifer storage and recovery wells.



Under the proposed application only the water stored in the basin storage area shall be withdrawn for beneficial use by the operator of the aquifer storage and recovery system (recharge credit). The availability of the recharge credit shall be determined based on the index water levels and water balance of the basin storage area. As a result of utilizing the recharge credit water, the aquifer's safe yield balance would not be affected.

The application complies with Well Spacing Regulation K.A.R. 5-22-2. The Division of Water Resources advised that one response was received from the well owners contacted within one-half mile of the proposed well site (exhibit A).

The application complies with the Reclamation and Recycling Policy 9007.6, which provides that groundwater users are encouraged to:

- a. anticipate future water demands and needs;
- b. assess options for development of new water supplies;
- c. embrace a philosophy that the groundwater user has a responsibility to maintain, manage and restore groundwater resources;
- d. endeavor to initiate cooperative water reclamation and supply projects using water which has been treated, purified and reclaimed to recharge or store to meet future water supply needs;
- e. embrace the concept of continual recycling of usable water; and
- f. cooperate with the District to investigate means to supplement groundwater resources by improving recharge, preventing its deterioration and seeking means to import water.

Hydrologic and geologic data indicate that depth to bedrock is approximately 257 feet below land surface (bls). Depth to water is approximately 35 feet bls and saturated thickness 222 feet. Regional groundwater flow direction at the proposed well site is southeast.

The lithologic log of the proposed well site indicates that the aquifer is comprised of alternating sand and clay layers (figure 7). The clay units range from 3 to 43 feet in thickness. The sand units range from 3 to 21 feet in thickness, with the 21 feet thick unit located from a depth of 232 to 253 feet below land surface.

Water level data has been recorded by the District at groundwater monitoring site IW05 located approximately 1.1 miles southwest of the proposed well site (figure 4). Water levels recorded at the site during the period of record from October 2001 to April 2004 (figure 8), ranged from 25.7 to 44.8 feet bls in both IW05A (total depth 65 feet), and IW05C (total depth 190 feet). The IW05C lithologic log reported that depth to bedrock was 193 feet bls.

IW05 water level data (figure 8) indicated no substantial difference in hydraulic head. The water levels in both completion zones exhibited nearly identical responses to water table fluctuations.

Water level data has been recorded by the District at groundwater monitoring site IW02 located approximately 1 mile north of the proposed well site (figure 4). Water levels recorded at the site during the period of record from October 2001 to April 2004 (figure 9), indicated that a perched water table existed at a depth of 26 feet bls. Water levels ranged from 4.07 to 10.07 feet in IW02A (total depth 26 feet). Water level data for IW02C ranged from 33.68 to 53.27 feet (total depth 95 feet) during the period of record. The IW02C lithologic log reported that depth to bedrock was 149 feet bls, with the lowest sand unit from 75 to 115 feet bls.

The District maintains a groundwater monitoring site EB17, located one-mile west of the proposed application. Water level and lithologic data at the site indicate that hydrologic conditions are similar to those at IW02.

The application's proposed well depth is 253 feet bls to be completed in the lower portion of the aquifer with hydrologic conditions similar to the C well completion zones of IW02 and IW05. Proposed well construction specifications were not submitted with the application. An example diagram of recharge and recovery well construction was included in the applicant's demonstration project report (figure 10).

The applicant proposes to install observation wells for groundwater level and water quality monitoring at the site. The quantity and quality of source water recharged at the site will be monitored.

#### STAFF RECOMMENDATIONS:

Based on data submitted by the applicant and District findings, staff recommends that the application be approved subject to conditions that:

- 1) the basin storage area shall be defined in compliance with K.A.R. 5-1-1(k) specifying the portion of the aquifer's unsaturated zone used for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- 2) monitoring of the basing storage area shall include water levels, water quality, water use, water storage, water recovery, precipitation, basic data access and operational reports;
- 3) a monitoring well network is established using Kansas Geological Survey methodology to determine index water levels in each water budget accounting unit, and monitoring water levels for water balance calculations and determination of recharge credits;
- 4) as determined by Kansas Geological Survey methodology the basin storage area is divided into 38 water budget accounting units and each unit is assigned an index identification number as shown on figure 3;
- 5) the index water levels are established in compliance with K.A.R. 5-1-1(oo), to designate water level elevations spatially throughout the basin storage area, to be used to represent the maximum volume of a basin storage area, and storage available for recovery based upon accounting methodology, and conditions of the permit;
- 6) the highest index water level shall be limited to the predevelopment water table measurement or computed gradient based on KGS Bulletin 79 data and a minimum depth of 10 feet below land surface at the point of lowest land surface elevation in water budget accounting unit index no. 5;
- 7) the lowest index water level shall be determined per K.A.R. 5-12-1(b)(2) and the highest index water level shall be 1425 feet msl (17.6 feet bls), based on the predevelopment water level for index well no. 5, as determined from Kansas Geological Survey Bulletin 79 (1949);
- 8) water level monitoring data from index well no. 5 shall be used to compute the water balance and determine recharge credits for the proposed ASR application;
- 9) the total volume of the basin storage area shall be calculated in acre-feet utilizing the established highest and lowest index well levels for each water budget accounting unit, the area of the basin storage area, and the storage coefficient of the aquifer in each accounting unit;
- 10) the water balance to determine change in the basin storage area shall be calculated, where total inflow minus total outflow equals the change in groundwater storage.

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- 11) the inflow data utilized in water balance calculations shall include natural recharge, groundwater and stream inflow, artificial recharge, and any other source of water deemed inflow by the District or the Division of Water Resources, further passive recharge shall not be considered as inflow and shall be excluded from water balance calculations;
- 12) the outflow data utilized in water balance calculations shall include evapotranspiration, baseflow, groundwater and stream outflow, non-domestic well use, and any other source of water deemed outflow by the District or the Division of Water Resources;
- 13) the proposed recovery of water artificially recharged by the operator of the aquifer storage and recovery system shall only occur when recharge credits are determined to be available;
- 14) determination of recharge credits for the proposed ASR application shall be computed through water balance methodology utilizing index data from water budget accounting unit nos. 1, 2, 3, 4, 5, 6, 8, 9 and 10, and credit for passive recharge shall be prohibited;
- 15) a monitoring well network is installed at the applicant's expense to monitor the aquifer storage and recovery site as shown on Attachment 45568-A(r), and shall include existing monitoring well site IW05;
- 16) the monitoring wells are drilled and completed at depths correlating to the upper and lower zones of the aquifer for water sample collection, water level measurements and testing purposes;
- 17) the monitoring well sites are completed at spacing distances within 660 feet from the recharge and recovery well;
- 18) water level monitoring at the recharge and recovery site shall be automated with a frequency not to exceed six hours;
- 19) before installation of the proposed ASR well, the applicant shall submit a water level and water quality monitoring plan to GMD2 for review and comment and to the Chief Engineer, DWR for approval;
- 20) the water quality monitoring plan shall provide all necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, and temperature;
- 21) the proposed ASR well is equipped with water meters to separately and accurately record the total flow of water injected and diverted from the ASR well;
- 22) the water meter installations shall comply with K.A.R. 5-22-4;
- 23) the use of the proposed ASR well is authorized by the Kansas Department of Health and Environment as a Class V UIC well and minimum water quality standards for effluent are approved by the Department for organic and inorganic compounds, pesticides and bacteria; the water recharged to the aquifer through the ASR well shall comply with the source water regulation K.A.R. 5-1-1(sss);
- 24) the water recharged to the aquifer shall either comply with EPA and KDHE safe drinking water standards, or meet the ambient water quality at the recharge sites, whichever is better, as determined by the Secretary of the Kansas Department of Health and Environment;
- 25) the quality of recharge water injected into the aquifer through the proposed well shall not degrade the ambient groundwater quality in the basin storage area;
- 26) to establish baseline ambient groundwater quality prior to bank storage withdrawal, water quality analyses shall be completed at the applicant's expense for samples collected from: a) domestic wells located within one-quarter mile of the proposed aquifer storage and recovery well, b) the proposed ASR well, and 3) all monitoring wells located at the ASR site;

- 26) to establish baseline ambient groundwater quality prior to bank storage withdrawal, water quality analyses shall be completed at the applicant's expense for samples collected from:
  - a) domestic wells located within one-quarter mile of the proposed aquifer storage and recovery well, b) the proposed ASR well, and 3) all monitoring wells located at the ASR site;
- 27) the recharge system is constructed, operated and monitored to prevent groundwater contamination;
- 28) the applicant shall provide to the District a final report containing a description and scaled map of the as-built aquifer storage and recovery system;
- 29) the diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year; and
- 30) the operation of the proposed ASR well shall not impair existing water rights nor prejudicially affect the public interest.

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BOB SEILER, PRESIDENT  
FRANK HARPER, VICE PRESIDENT  
DAVID STROBERG, SECRETARY  
MARK WHITSON, TREASURER  
MICHAEL T. DEALY, MANAGER  
THOMAS A. ADRIAN, ATTORNEY



DIRECTORS:  
JERRY BLAIN  
CLARKE DIXON  
EUGENE GRUENBACHER  
KIRK LARSON  
NADINE STANNARD

## EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2

313 SPRUCE • HALSTEAD, KANSAS 67056-1925 • equusbed@ink.org • VOICE (316) 835-2224 • FAX (316) 830-2210  
August 12, 2004

David L. Pope, Chief Engineer  
Division of Water Resources  
Kansas Department of Agriculture  
109 S.W. 9th Street, Second Floor  
Topeka, Kansas 66612-1283

Re: Application Nos. 45569 through 45575 – City of Wichita

Dear Mr. Pope:

The referenced applications were reviewed by the Equus Beds Groundwater Management District pursuant to K.A.R. 5-22-12. The applications were reviewed using the District's Revised Management Program (effective May 1, 1995), and Rules and Regulations K.A.R. 5-22-1 through 5-22-12. Copies of the District's Application Review Information reports and the independent consultant's project report are enclosed for your information.

Additionally, a draft copy of the proposed Memorandum of Understanding (MOU) between the District and the applicant has been enclosed. The District Board of Directors and the City of Wichita have conditionally agreed to the terms of the MOU, and a copy of the signed agreement shall be submitted to the Division by September 15, 2004.

Based upon the review findings, the provisions of the proposed MOU, and comments from the Board of Directors, the applicant and the public, the District recommends the applications for approval with each application subject to conditions that:

- 1) the withdrawal well is equipped with a water meter pursuant to K.A.R. 5-22-4(a);
- 2) the operation of the withdrawal wells shall not impair existing water rights nor prejudicially affect the public interest;
- 3) the proposed bank storage well is positioned at a location within 300 feet of the centerline of the Little Arkansas River channel;
- 4) The diverted bank storage water must comply with the source water regulation K.A.R. 5-1-1(sss);
- 5) the withdrawal well shall operate only during bank storage events in the Little Arkansas River, as determined by measured river flow and evidence correlating the increase of river stage to the increase of water level in the bank storage well or adjacent monitoring well;
- 6) bank storage, for the purpose of permit conditions, is limited to flows in the Little Arkansas River equal to or greater than 20 cfs during the months of October through March, and 57 cfs during the months of April through September;
- 7) streamflow data collected from the USGS gage at Highway 50 (Halstead) shall be used to determine flow conditions and bank storage well utilization and shall be based on stream flow adjusted for intervening base flow nodes and currently existing surface water rights;

*Per our discussion at meeting 3-24*

*NOT a condition on permit*

*OK*

*winding with 75 cfs @ 200' well @ 57 cfs*

*MOU*

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- 8) a monitoring well network is completed at the bank storage pump site as shown on Attachment A, and shall include existing monitoring well sites IW03, EB143 and EB144;
- 9) the monitoring wells are drilled and completed at depths correlating to the upper and lower zones of the aquifer for water sample collection, water level measurements and testing purposes;
- 10) water quality analyses shall be completed at the applicant's expense for samples collected from: a) domestic wells located within one-quarter mile of the proposed bank storage well, b) the proposed withdrawal well, and 3) all monitoring wells located at the bank storage diversion site to establish baseline ambient groundwater quality prior to bank storage withdrawal;
- 11) the quality of surface water induced into the river bank shall not degrade the ambient groundwater quality in the bank storage withdrawal area; *Not this wording.*
- 12) storage water shall meet or exceed the minimum drinking water standards specified by the Kansas Department of Health and Environment for artificial recharge;
- 13) the applicant conduct aquifer pump testing to determine the well's capture zone, the hydraulic connection between the aquifer's upper and lower zones at the well site, and submit said data and test results to the Division of Water Resources and the District within a specified time period;
- 14) no water shall be pumped from the lower unit of the aquifer, if determined by the Division of Water Resources and the District that a hydraulic connection does not exist between the aquifer's upper and lower zones;
- 15) based on the findings and conclusions of the Division of Water Resources and the District, the well is constructed to allow only withdrawal of bank storage water;
- 16) the drawdown limit in any zone, shallow or deep, will not exceed ten (10) feet at a distance 660 feet from the point of diversion on either side of the Little Arkansas River;

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wording*

- 17) within seven days after the pumping of all bank storage wells has ceased, the water level in each bank storage well, or monitoring well located within 100 feet of the bank storage well, will recover to an elevation equal to or greater than the water level elevation immediately before the bank storage well began to pump, adjusted for any regional groundwater level changes not caused by pumping of the bank storage well; *The drawdown limit is 10 feet etc*
- 18) the naturally occurring and artificially induced rate of infiltration from the bed and banks of the stream when bank storage is occurring will be sufficient to meet the following conditions: a) equal or exceed the authorized rate of diversion of all bank storage wells, b) prevent impairment caused by all bank storage wells, and c) prevent groundwater mining caused by all bank storage wells;

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wording*

- 19) *The pumping rate of each bank storage well shall not exceed a maximum of 1,000 gpm and*  
the total pumping rate of the seven bank storage wells shall not exceed a maximum of 7,000 gallons per minute;

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- 20) the well shall not be operated during baseflow conditions, and operation of the bank storage well shall be subject to measured streamflow at the Highway 50 (Halstead) gage equal to 57 cfs plus the authorized rate of the bank storage withdrawal well. Further, the operation of the well when combined with the maximum authorized rate of 7,000 gallons per minute for all seven bank storage wells is subject to measured streamflow at the Highway 50 (Halstead) gage equaling or exceeding 72.61 cfs;

*45,569  
45,575*

- 21) the applicant shall submit a water level and water quality monitoring plan for review and comment by GMD2 and approval by the Chief Engineer, DWR;

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*MISS in MOWE*  
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45,572  
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- 22) the water quality monitoring shall provide necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, and temperature;
- 23) water level monitoring at the bank storage site shall be automated with a frequency not to exceed six hours;
- 24) the applicant shall submit a well field operation, monitoring and reporting plan for review and comment by GMD2 and approval by the Chief Engineer, DWR; *45,571, 45,572, 45,573, 45,574*
- 25) the operational plan shall include utilization of monitoring wells and the stream flow monitoring gage in an automated system; and
- 26) bank storage diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year. *of A 4 year review*

Please contact me should there be any question regarding the District's findings or recommendation.

A District decision may be appealed to the District Board of Directors by submitting a written petition to the District office within 30 days from date of this notification, pursuant to K.A.R. 5-22-12.

Sincerely,  
EQUUS BEDS GROUNDWATER  
MANAGEMENT DISTRICT NO. 2

Michael T. Dealy, L. G.  
Manager

MTD/DRK/rk  
Enclosures



pc: David Warren, City of Wichita  
John F. and Ileen L. Weber  
Edward J. Weber  
Equus Beds Groundwater Management District Board of Directors

Ronald and Sharon Neuway  
Edward W. Combs  
Dick Van Wye

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APPLICATION REVIEW INFORMATION

NAME	<u>CITY OF WICHITA</u>	APPLICATION NO.	<u>45569</u>
ADDRESS	<u>455 N. MAIN STREET</u>	APPL.	<u>NEW</u>
	<u>WICHITA, KS 67202</u>	COUNTY	<u>HARVEY TRACT SW-SW-SE</u>
		WELL LOCATION	<u>S 8 T 23 R 2 W</u>
		QUANT	<u>1500 AF RATE 1500 GPM</u>
		WELL SPACING	<u>D=1000', ND&gt;2640'</u>
		BASEFLOW NODE SPACING	<u>&lt;1320'</u>

- Proposed Well
- Non-Domestic Well
- ⊙ Domestic Well
- ⊠ Baseflow Node

**ISSUE:** The application was filed for a bank storage well for the City of Wichita's Aquifer Storage and Recovery system. The applicant proposes to pump water temporarily stored in the banks and bed of the Little Arkansas River during above-baseflow stage, and recharge it into the Equus Beds aquifer.

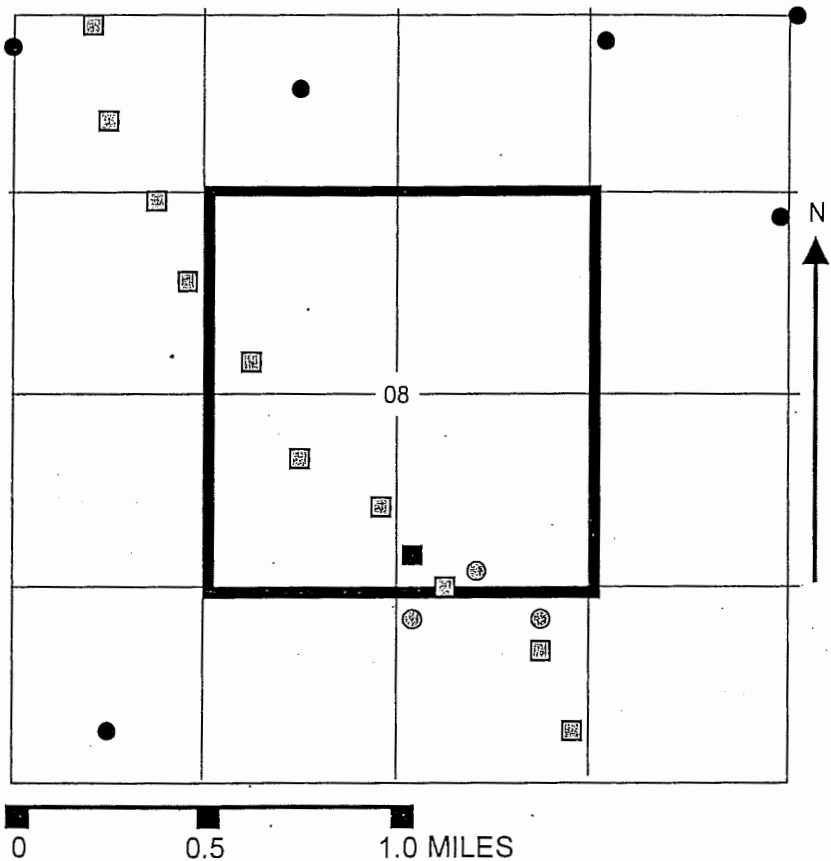
**BACKGROUND INFORMATION:**

JUL 3, 2003 - The applicant filed application no. 45569 for permit to withdraw water for artificial recharge use as part of the Aquifer Storage and Recovery system. The application proposes the diversion of 1,500 AF/Y at a maximum diversion rate of 1,500 GPM, from a proposed bank storage well located in the

Southwest quarter of the Southwest quarter of the Southeast quarter of Section 8, Township 23 South, Range 2 West, Harvey County. The proposed well location is more specifically described as being 512 feet north and 2,405 feet west of the southeast corner of said section (figures 1 and 2).

FEB 11, 2004 - DWR requested that the District review the application and make recommendations.

FEB 13, 2004 - The District requested an extension of time to submit recommendations on the application to allow review of the application by the Board of Directors. It was requested that



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the time to provide recommendations be extended for 120 days. Copies of the extension request were submitted to the applicant and parties of interest who submitted letters of concern.

MAY 13, 2004 – It was the consensus of the Board of Directors at the May 11, 2004, meeting, that an additional 90-day extension be requested from the Chief Engineer, DWR, to provide recommendations. The additional time would allow for application review by the Board's consultant and the scheduling of a public meeting. Copies of the May 13, 2004, extension request were submitted to the applicant and parties of interest who submitted letters of concern to DWR regarding the proposed applications.

JUN 7, 2004 – The DWR approved an extension of time until August 13, 2004, to allow additional time for application review and recommendation.

**FINDINGS:** Application no. 45569 for groundwater withdrawal is subject to the Aquifer Management Program and District Standards and Policies, effective May 1, 1995, and Rules and Regulations K.A.R. 5-22-1 through K.A.R. 5-22-12.

Application no. 45569 is subject to the installation of a water flowmeter in accordance with District Metering Regulation K.A.R. 5-22-4a.

The proposed use of water was for artificial recharge. Artificial recharge is defined by K.A.R. 5-1-1(g), as the use of source water to artificially replenish the water supply in an aquifer. Source water by definition K.A.R. 5-1-1(sss), must meet the following conditions:

1. Is available for appropriation for beneficial use;
2. Is above baseflow stage in the stream;
3. Is not needed to satisfy minimum desirable streamflow requirements; and
4. Will not degrade the ambient groundwater quality in the basin storage area.

The proposed source water for the applicant's artificial recharge use in the aquifer storage and recovery system, is bank storage water to be diverted from a proposed well located in the SW-SW-SE of Section 8, Township 23 South, Range 2 West (figure 2).

The proposed bank storage well is one of seven proposed bank storage wells located in Section 8. The bank storage withdrawal wells are identified by the applicant as DW-1 through DW-7, and proposed under application nos. 45569, 45570, 45571, 45572, 45573, 45574 and 45575 (figures 2 and 3).

Bank storage by definition K.A.R. 5-1-1(i), means water absorbed by and temporarily stored in the banks and bed of a stream during above-baseflow stage. Upon the river's flow reduction, the bank storage water discharges naturally back to the river. The applicant's proposed bank storage well site is located near the west bank of the Little Arkansas River (figures 2 and 3).

The proposed bank storage well shall be utilized only when river flow exceeds 42 cubic feet per second (cfs) from April through September, and 20 cfs from October through March, as measured at the United States Geological Survey (USGS) gage located at Highway 50 near Halstead (figure 1).

The 42 cfs value was derived by adding a 10.8 cfs baseflow value to the existing senior surface water appropriations downstream from the proposed site. Total maximum rate of diversion for those appropriations is approximately 31 cfs.

Twenty cfs is the Minimum Desirable Streamflow (MDS) established by the Chief Engineer (K.S.A. 82a-703c.) for Valley Center. The established MDS for the Alta Mills stream gage site is eight cfs.

The minimum flow restrictions would constitute above-baseflow conditions in response to a significant runoff event when water level elevation of the stream is greater than the elevation of the adjacent water table of the aquifer.

The proposed quantity of 1,500 AF/Y, to be diverted at a maximum rate of 1,500 GPM, would allow the withdrawal of water for a maximum period of 226 days, when bank storage conditions are met. The applicant filed applications for six other bank storage wells, five with proposed rates of 1,200 GPM and one with a proposed rate of 1,500 GPM.

The District Board of Directors, by approved motion recommended to the Chief Engineer, DWR, revisions of Article 22. The proposed changes included a provision to Safe Yield regulation 5-22-7, stipulating that applications not subject to the Safe Yield Regulation shall include applications for bank storage wells, only to the extent that the wells are withdrawing bank storage water.

Under the proposed application only bank storage water would be withdrawn. The existing groundwater at and below baseflow level would not be diminished. As a result, the aquifer's safe yield balance would not be affected.

The application complies with Well Spacing Regulation K.A.R. 5-22-2, as the types of wells not subject to the well spacing regulation under provision (e)(2) include bank storage wells. Bank storage withdrawal can only occur during periods when above baseflow conditions exist. As a result, drawdown impairment of existing wells or baseflow would not occur.

The Division of Water Resources advised that no responses were received from the well owners and landowners contacted within one-half mile of the proposed well site.

The application complies with the Reclamation and Recycling Policy 9007.6, which provides that groundwater users are encouraged to:

- a. anticipate future water demands and needs;
- b. assess options for development of new water supplies;
- c. embrace a philosophy that the groundwater user has a responsibility to maintain, manage and restore groundwater resources;
- d. endeavor to initiate cooperative water reclamation and supply projects using water which has been treated, purified and reclaimed to recharge or store to meet future water supply needs;
- e. embrace the concept of continual recycling of usable water; and
- f. cooperate with the District to investigate means to supplement groundwater resources by improving recharge, preventing its deterioration and seeking means to import water.

Hydrologic and geologic data indicate that depth to bedrock is approximately 148 feet below land surface (bls). Depth to water is approximately 5 to 10 feet bls and saturated thickness ranges from 138 to 143 feet. Regional groundwater flow direction at the proposed well site is southeast.

The lithologic log of the proposed well site indicates that the aquifer is comprised of alternating sand and clay layers (figure 4). The proposed well site lithology consists of topsoil 0 to 3 feet bls, clay 3 to 9 feet bls, sand (separated by a thin clay layer) 9 to 33 feet bls, clay 33 to 58 feet

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bls, sand 58 to 102 feet bls, clay 102 to 109 feet bls, sand 109 to 132 feet bls, clay 132 to 135 feet bls, sand 135 to 148 feet bls, and shale beginning at 148 feet bls.

The horizontal extent and continuity of the 25 feet thick clay unit from 33 to 58 feet below land surface were not determined.

Water level data has been recorded by the District at groundwater monitoring site IW03 located approximately 0.5 mile west-southwest of the proposed well site (figure 3). Water levels recorded at the site during the period of record from October 2001 to April 2004 (figure 5), ranged from 5.99 to 16.49 feet bls in IW03A (total depth 34 feet), and from 9.03 to 22.53 feet bls in IW03C (total depth 138 feet). The IW03C lithologic log reported that depth to bedrock was 166 feet bls.

IW03 water level data (figure 5) indicated that a head difference ranging from approximately 1 to 6 feet existed between the upper zone (A well) and the lower zone (C well). The water levels in both zones exhibited similar responses to water table fluctuations, indicating a hydraulic connection. The fluctuation responses indicated leakage occurrence from the upper zone to the lower zone. Pumping effects exhibited in the lower zone also affected water levels in the upper zone. The correlation between the data sets indicated that the clay unit separating the two zones is not continuous throughout the area.

The application's proposed well depth is 148 feet bls (figure 4), with a proposed screen interval from 58 to 148 feet bls. The well is proposed to be screened in the lower portion of the aquifer below the clay unit located from 33 to 58 feet bls. The applicant proposes to utilize a 24-inch diameter well casing and screen.

The hydraulic connection from the streambed and banks to each bank storage well must be sufficient to transmit bank storage water from the bed and banks of the stream to each bank storage well at a rate sufficient to sustain the authorized rate of diversion of the well.

The naturally occurring and artificially induced rate of infiltration from the bed and banks of the stream when bank storage is occurring must be sufficient to meet the following conditions: a) equal or exceed the authorized rate of diversion of all bank storage wells, b) prevent impairment caused by all bank storage wells, and c) prevent groundwater mining caused by all bank storage wells.

The applicant proposes to install observation wells for groundwater level and water quality monitoring at the site. The quantity and quality of source water diverted at the site will be monitored.

#### **STAFF RECOMMENDATIONS:**

Based on data submitted by the applicant and District findings, staff recommends that the application be approved subject to additional conditions that:

- 1) the withdrawal well is equipped with a water meter pursuant to K.A.R. 5-22-4(a);
- 2) the operation of the withdrawal wells shall not impair existing water rights nor prejudicially affect the public interest;
- 3) the proposed bank storage well is positioned at a location within 300 feet of the centerline of the Little Arkansas River channel;
- 4) The diverted bank storage water must comply with the source water regulation K.A.R. 5-1-1(sss);

- 5) the withdrawal well shall operate only during bank storage events in the Little Arkansas River, as determined by measured river flow and evidence correlating the increase of river stage to the increase of water level in the bank storage well or adjacent monitoring well;
- 6) bank storage, for the purpose of permit conditions, is limited to flows in the Little Arkansas River equal to or greater than 20 cfs during the months of October through March, and 57 cfs during the months of April through September;
- 7) streamflow data collected from the USGS gage at Highway 50 (Halstead) shall be used to determine flow conditions and bank storage well utilization and shall be based on stream flow adjusted for intervening base flow nodes and currently existing surface water rights;
- 8) a monitoring well network is completed at the bank storage pump site as shown on Attachment A, and shall include existing monitoring well sites IW03, EB143 and EB144;
- 9) the monitoring wells are drilled and completed at depths correlating to the upper and lower zones of the aquifer for water sample collection, water level measurements and testing purposes;
- 10) water quality analyses shall be completed at the applicant's expense for samples collected from: a) domestic wells located within one-quarter mile of the proposed bank storage well, b) the proposed withdrawal well, and 3) all monitoring wells located at the bank storage diversion site to establish baseline ambient groundwater quality prior to bank storage withdrawal;
- 11) the quality of surface water induced into the river bank shall not degrade the ambient groundwater quality in the bank storage withdrawal area;
- 12) storage water shall meet or exceed the minimum drinking water standards specified by the Kansas Department of Health and Environment for artificial recharge;
- 13) the applicant conduct aquifer pump testing to determine the well's capture zone, the hydraulic connection between the aquifer's upper and lower zones at the well site, and submit said data and test results to the Division of Water Resources and the District within a specified time period;
- 14) no water shall be pumped from the lower unit of the aquifer, if determined by the Division of Water Resources and the District that a hydraulic connection does not exist between the aquifer's upper and lower zones;
- 15) based on the findings and conclusions of the Division of Water Resources and the District, the well is constructed to allow only withdrawal of bank storage water;
- 16) the drawdown limit in any zone, shallow or deep, will not exceed ten (10) feet at a distance 660 feet from the point of diversion on either side of the Little Arkansas River;
- 17) within seven days after the pumping of all bank storage wells has ceased, the water level in each bank storage well, or monitoring well located within 100 feet of the bank storage well, will recover to an elevation equal to or greater than the water level elevation immediately before the bank storage well began to pump, adjusted for any regional groundwater level changes not caused by pumping of the bank storage well;
- 18) the naturally occurring and artificially induced rate of infiltration from the bed and banks of the stream when bank storage is occurring will be sufficient to meet the following conditions: a) equal or exceed the authorized rate of diversion of all bank storage wells, b) prevent impairment caused by all bank storage wells, and c) prevent groundwater mining caused by all bank storage wells;

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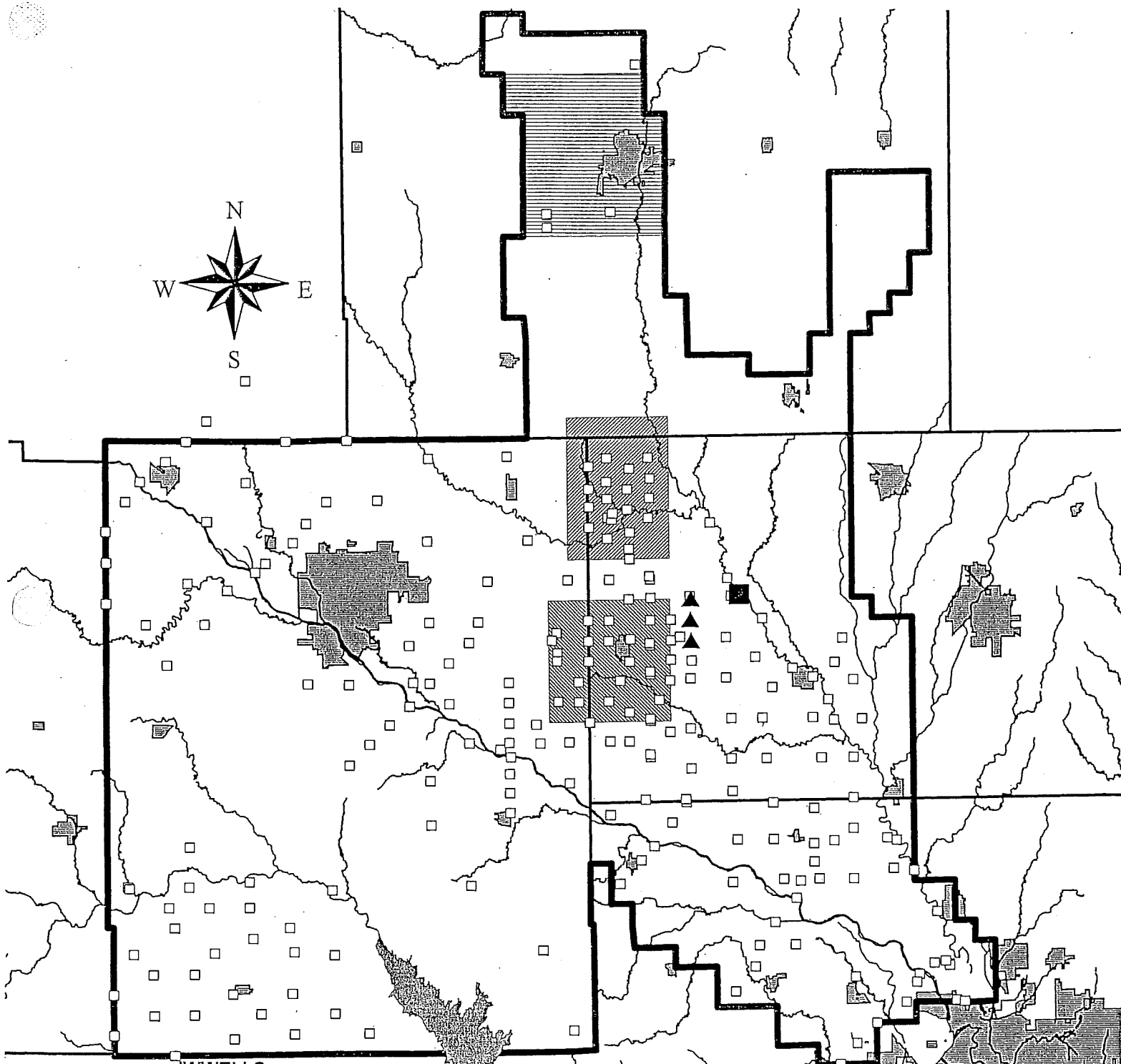
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- 19) the total pumping rate of the seven bank storage wells shall not exceed a maximum of 7,000 gallons per minute;
- 20) the well shall not be operated during baseflow conditions, and operation of the bank storage well shall be subject to measured streamflow at the Highway 50 (Halstead) gage equal to 57 cfs plus the authorized rate of the bank storage withdrawal well. Further, the operation of the well when combined with the maximum authorized rate of 7,000 gallons per minute for all seven bank storage wells is subject to measured streamflow at the Highway 50 (Halstead) gage equaling or exceeding 72.61 cfs;
- 21) the applicant shall submit a water level and water quality monitoring plan for review and comment by GMD2 and approval by the Chief Engineer, DWR;
- 22) the water quality monitoring shall provide necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, temperature;
- 23) water level monitoring at the bank storage site shall be automated with a frequency not to exceed six hours;
- 24) the applicant shall submit a well field operation, monitoring and reporting plan for review and comment by GMD2 and approval by the Chief Engineer, DWR;
- 25) the operational plan shall include utilization of monitoring wells and the stream flow monitoring gage in an automated system; and
- 26) bank storage diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year.

Figure 1. - Equus Beds Groundwater Management District No. 2  
 Aquifer Storage and Recovery Project Map  
 July 13, 2004

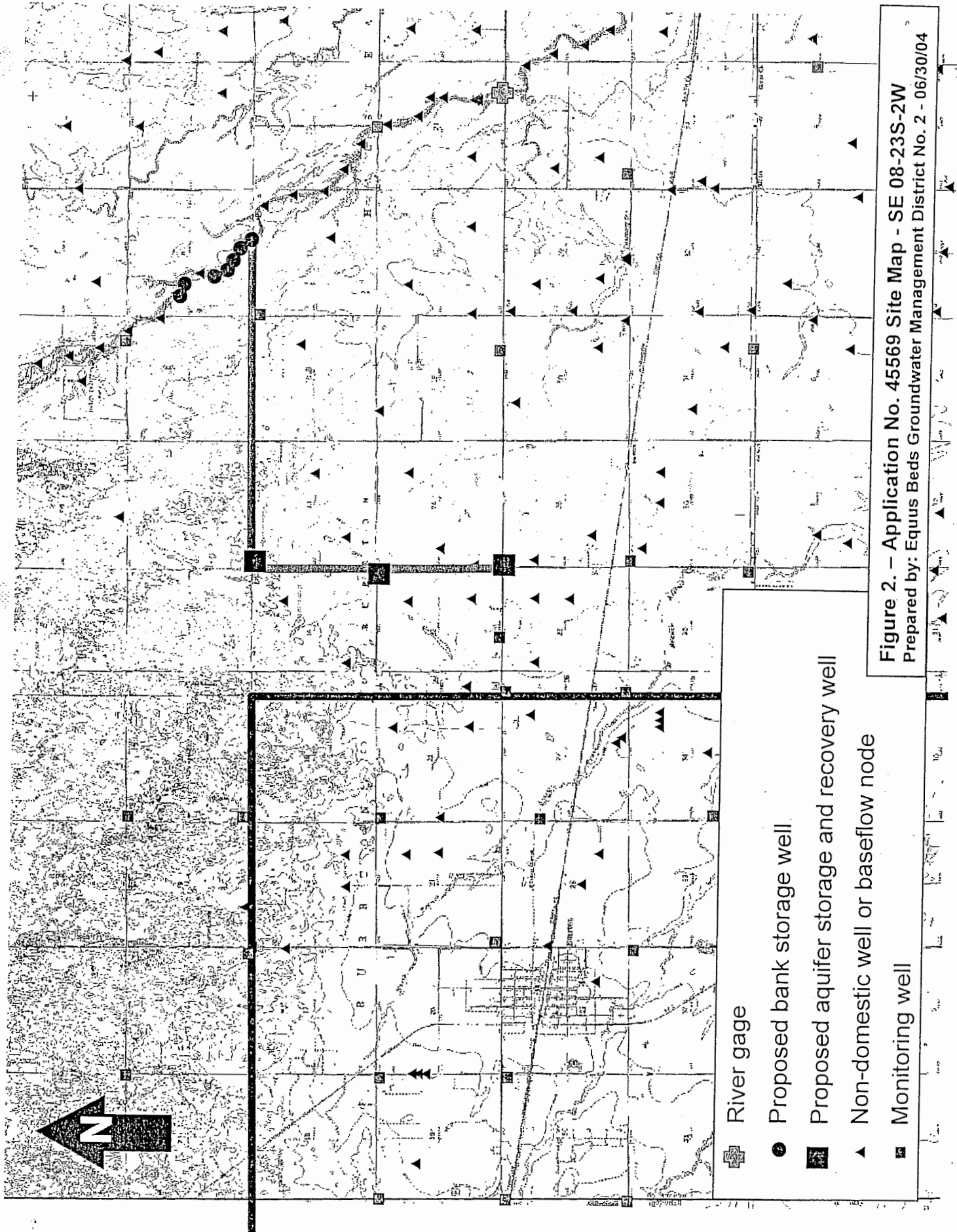


- IWELLS
- Monitoring Wells
- ▨ Cheney Reservoir
- ▭ Counties
- ▭ District Boundary
- Streams
- ▭ Major Stream
- ▭ Cities
- Special Use Areas
- ▨ BURRTON IGUA
- ▨ MCPHERSON IGUA
- ▨ SWQUA
- ▲ Application for Proposed Aquifer Recharge and Recovery Well
- ▣ Applications for 7 Proposed Bank Storage Withdrawal Wells

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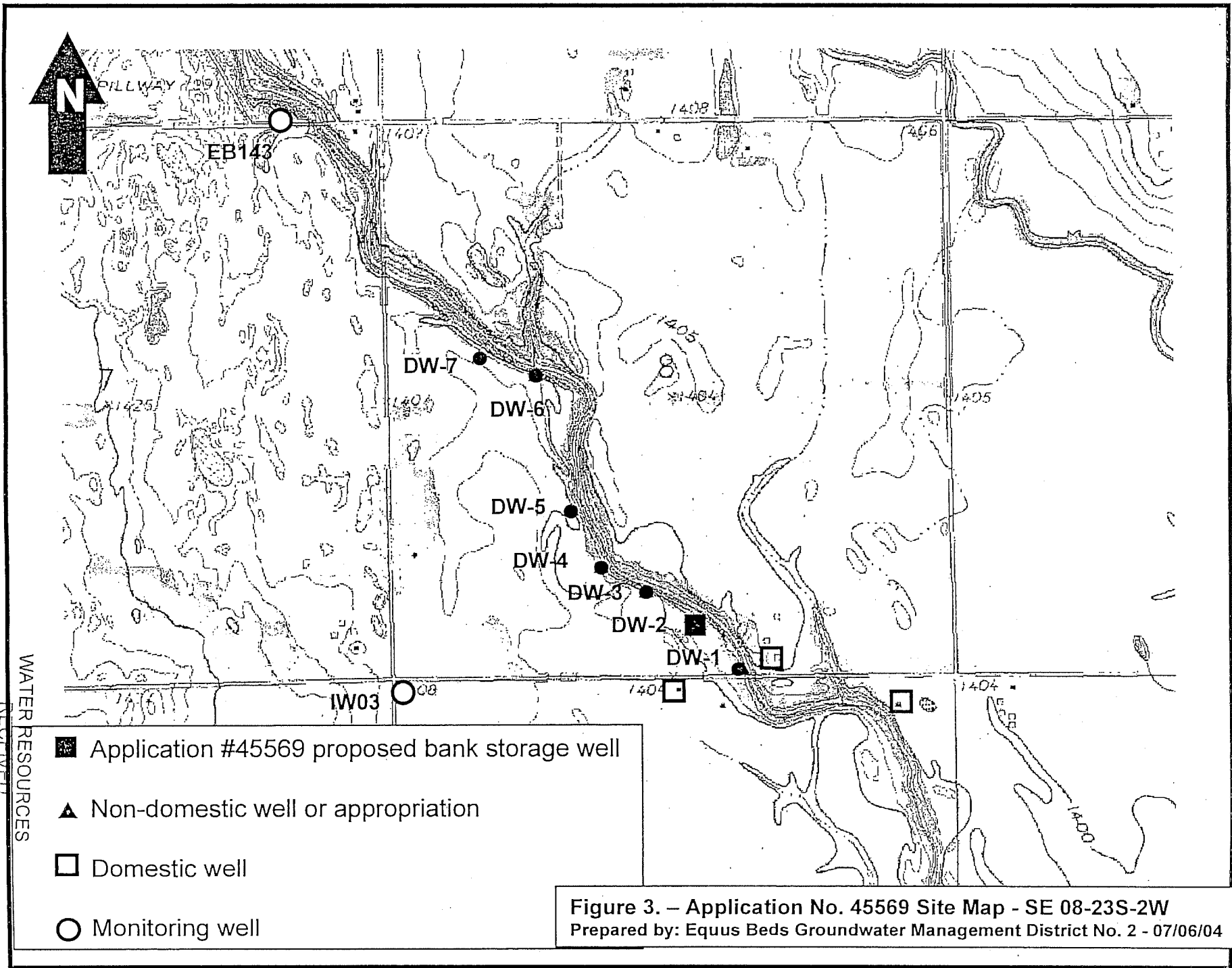
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-  River gage
-  Proposed bank storage well
-  Proposed aquifer storage and recovery well
-  Non-domestic well or baseflow node
-  Monitoring well

Figure 2. – Application No. 45569 Site Map - SE 08-23S-2W  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04



- Application #45569 proposed bank storage well
- ▲ Non-domestic well or appropriation
- Domestic well
- Monitoring well

**Figure 3. – Application No. 45569 Site Map - SE 08-23S-2W**  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 07/06/04

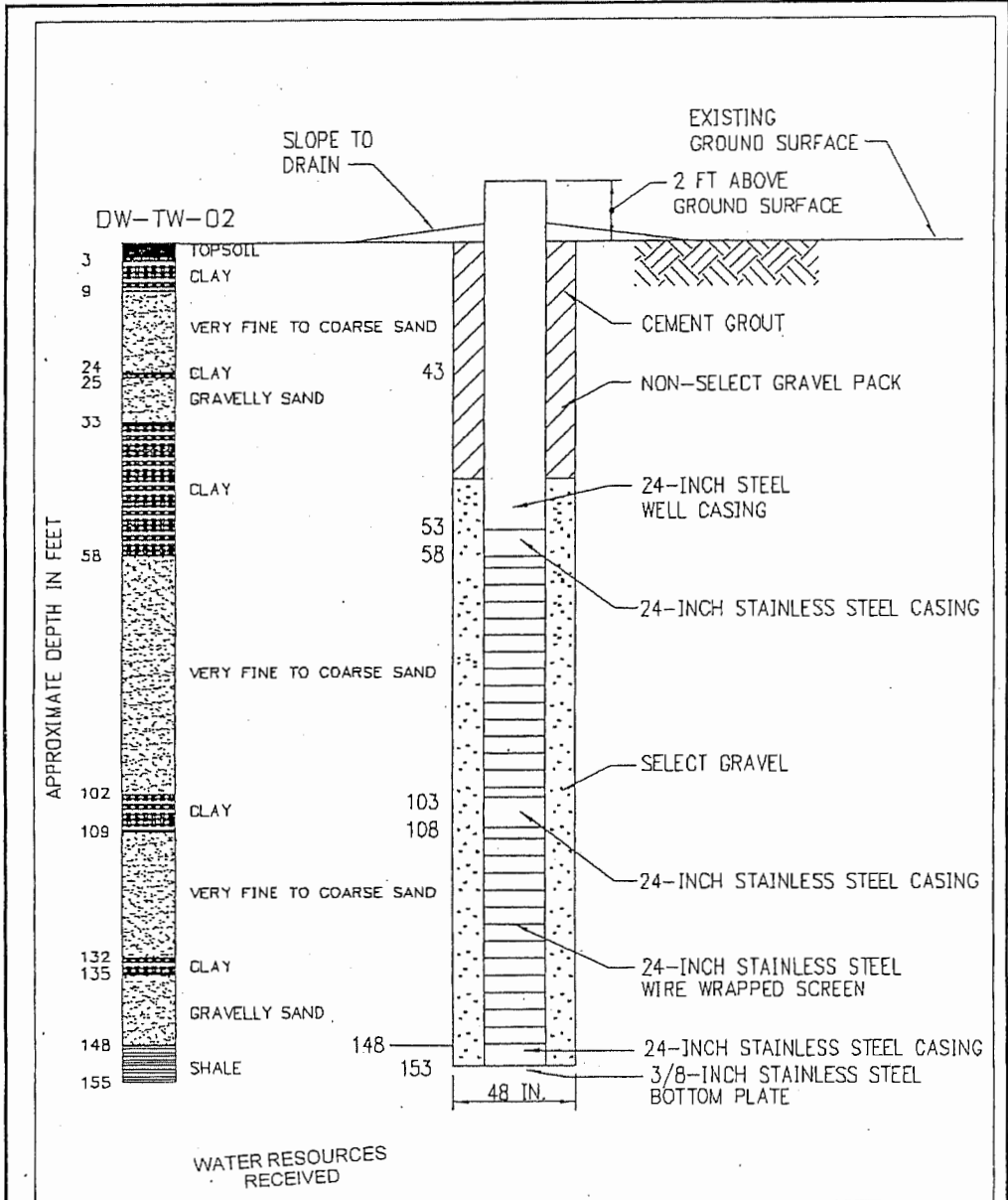
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NOTE: FINAL DESIGN TO BE BASED  
ON PILOT HOLE FOR  
DIVERSION WELL.

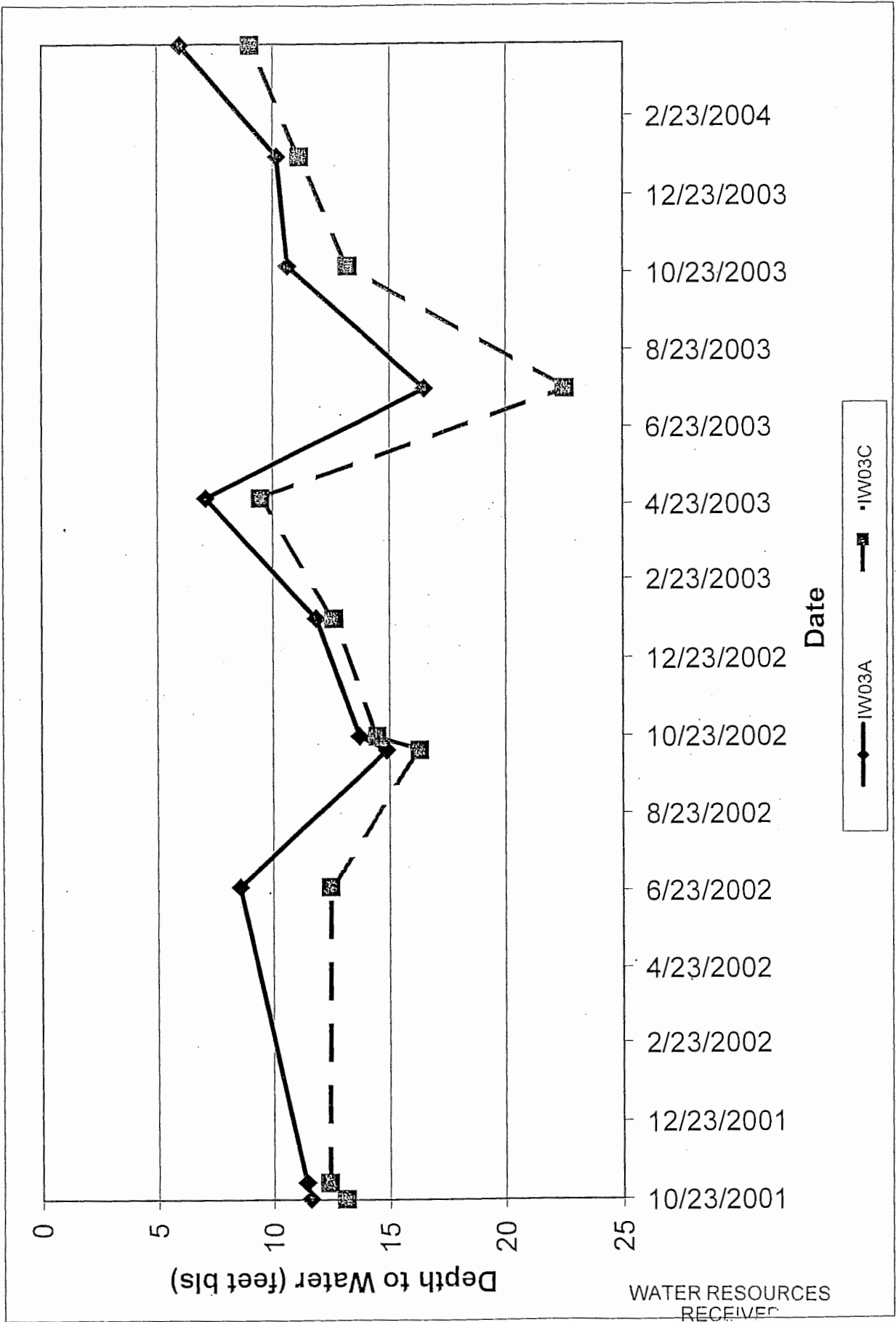


CITY OF WICHITA  
PRELIMINARY DESIGN  
DIVERSION WELL  
DW-02

Figure 4. –  
Application  
No. 45569  
Lithologic Log  
and Construction  
Design for  
Bank Storage  
Well

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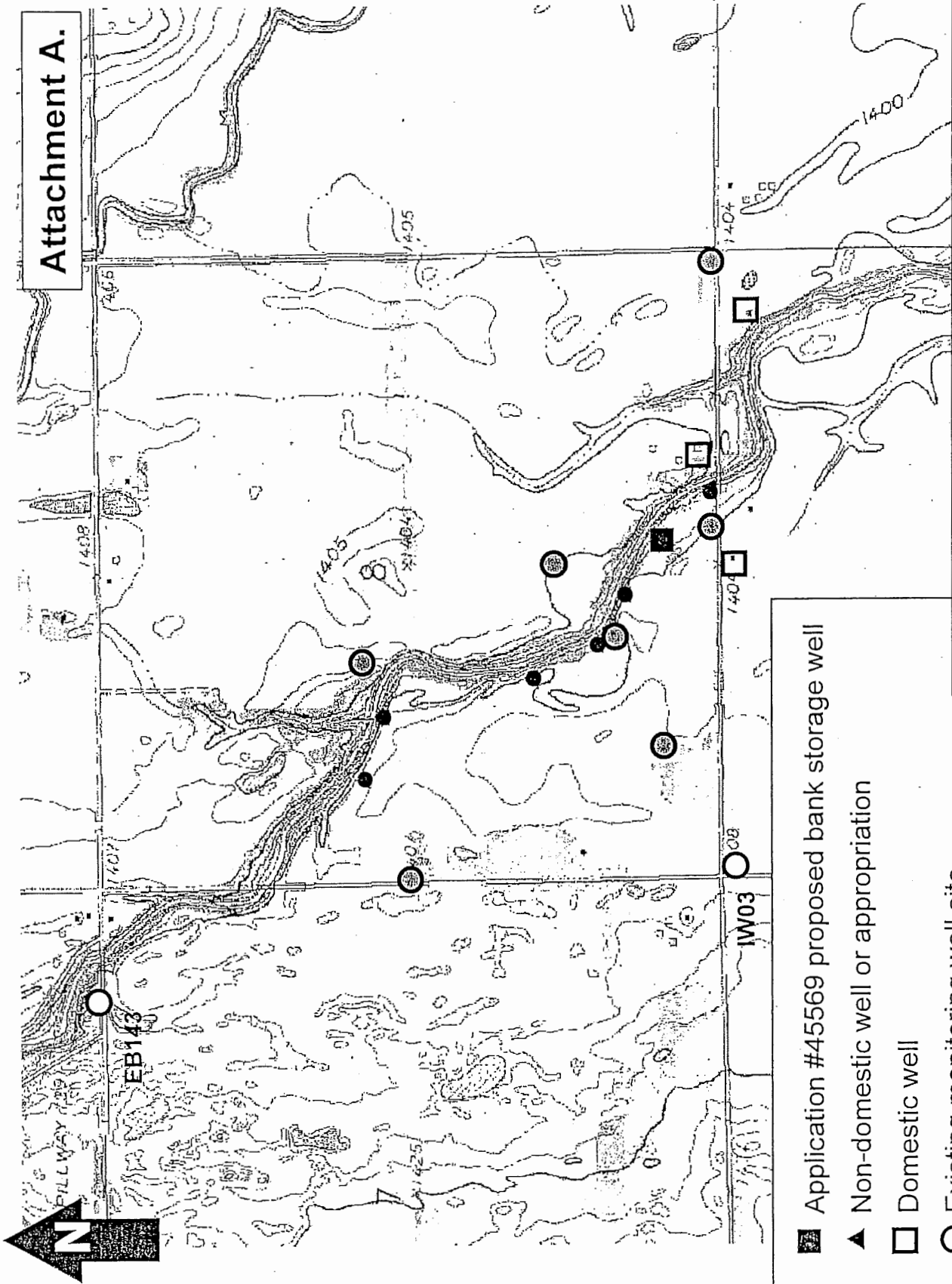
Groundwater Monitoring Site IW03  
 NW-NW-NW Sec. 17, T23S, R2W



IW03A Depth = 34 feet  
 IW03C Depth = 138 feet

Figure 5.

# Attachment A.



- Application #445569 proposed bank storage well
- ▲ Non-domestic well or appropriation
- Domestic well
- Existing monitoring well site
- Proposed monitoring well site

Attachment A. – Application No. 45569 Site Map - SE 08-23S-2W  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 07/06/04

**SEE EXHIBIT R**

**DRAFT MOU  
GMD LETTER TO CHIEF ENGINEER  
AUGUST 12, 2004**

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**SEE EXHIBIT S**

**INDEPENDENT CONSULTANT'S REPORT  
GMD LETTER TO CHIEF ENGINEER  
AUGUST 12, 2004**

**[DO NOT BATE-STAMP]**

BOB SEILER, PRESIDENT  
FRANK HARPER, VICE PRESIDENT  
DAVID STROBERG, SECRETARY  
MARK WHITSON, TREASURER  
MICHAEL T. DEALY, MANAGER  
THOMAS A. ADRIAN, ATTORNEY



DIRECTORS:  
JERRY BLAIN  
CLARKE DIXON  
EUGENE GRUENBACHER  
KIRK LARSON  
NADINE STANNARD

## EQUUS BEDS GROUNDWATER MANAGEMENT DISTRICT NO. 2

313 SPRUCE • HALSTEAD, KANSAS 67056-1925 • equusbed@ink.org • VOICE (316) 835-2224 • FAX (316) 830-2210  
August 12, 2004

David L. Pope, Chief Engineer  
Division of Water Resources  
Kansas Department of Agriculture  
109 S.W. 9th Street, Second Floor  
Topeka, Kansas 66612-1283

Re: Application No. 45576 – City of Wichita

Dear Mr. Pope:

The referenced application was reviewed by the Equus Beds Groundwater Management District pursuant to K.A.R. 5-22-12. The application was reviewed using the District's Revised Management Program (effective May 1, 1995), and Rules and Regulations K.A.R. 5-22-1 through 5-22-12. Copies of the District's Application Review Information report and the independent consultant's project report are enclosed for your information.

Additionally, a draft copy of the proposed Memorandum of Understanding (MOU) between the District and the applicant has been enclosed. The District Board of Directors and the City of Wichita have conditionally agreed to the terms of the MOU, and a copy of the signed agreement shall be submitted to the Division by September 15, 2004.

Based upon the review findings, the provisions of the proposed MOU, and comments from the Board of Directors, the applicant and the public, the District recommends the application for approval subject to conditions that:

- MOU*
- 1) the basin storage area shall be defined in compliance with K.A.R. 5-1-1(k) specifying the portion of the aquifer's unsaturated zone used for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
  - 2) monitoring of the basing storage area shall include water levels, water quality, water use, water storage, water recovery, precipitation, basic data access and operational reports;
  - 3) a monitoring well network is established using Kansas Geological Survey methodology to determine index water levels in each water budget accounting unit, and monitoring water levels for water balance calculations and determination of recharge credits;
  - 4) as determined by Kansas Geological Survey methodology the basin storage area is divided into 38 water budget accounting units and each unit is assigned an index identification number as shown on figure 3;

*MOU*

  - 5) the index water levels are established in compliance with K.A.R. 5-1-1(oo), to designate water level elevations spatially throughout the basin storage area, to be used to represent the maximum volume of a basin storage area, and storage available for recovery based upon accounting methodology, and conditions of the permit;
  - 6) the highest index water level shall be limited to the predevelopment water table measurement or computed gradient based on KGS Bulletin 79 data and a minimum depth of 10 feet below land surface at the point of lowest land surface elevation in water budget accounting unit index no. 2;

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- 7) the lowest index water level shall be determined per K.A.R. 5-12-1(b)(2) and the highest index water level shall be 1427.5 feet msl (22 feet bls), based on the predevelopment water level for accounting unit index no. 2, as determined from Kansas Geological Survey Bulletin 79 (1949);
  - 8) water level monitoring data from index well no. 2 shall be used to compute the water balance and determine recharge credits for the proposed ASR application;
  - 9) the total volume of the basin storage area shall be calculated in acre-feet utilizing the established highest and lowest index well levels for each water budget accounting unit, the area of the basin storage area, and the storage coefficient of the aquifer in each accounting unit;
  - 10) the water balance to determine change in the basin storage area shall be calculated, where total inflow minus total outflow equals the change in groundwater storage;
  - 11) the inflow data utilized in water balance calculations shall include natural recharge, groundwater and stream inflow, artificial recharge, and any other source of water deemed inflow by the District or the Division of Water Resources, further passive recharge shall not be considered as inflow and shall be excluded from water balance calculations;
  - 12) the outflow data utilized in water balance calculations shall include evapotranspiration, baseflow, groundwater and stream outflow, non-domestic well use, and any other source of water deemed outflow by the District or the Division of Water Resources;
  - 13) the proposed recovery of water artificially recharged by the operator of the aquifer storage and recovery system shall only occur when recharge credits are determined to be available;
  - 14) determination of recharge credits for the proposed ASR application shall be computed through water balance methodology utilizing index data from water budget accounting unit nos. 1, 2, 3, 4, 5 and 6, and credit for passive recharge shall be prohibited;

*mon*

  - 15) a monitoring well network is installed at the applicant's expense to monitor the aquifer storage and recovery site as shown on Attachment 45576-A(r), and shall include existing monitoring well site IW02;
  - 16) the monitoring wells are drilled and completed at depths correlating to the upper and lower zones of the aquifer for water sample collection, water level measurements and testing purposes;
  - 17) the monitoring well sites are completed at spacing distances within 660 feet from the recharge and recovery well;
  - 18) water level monitoring at the recharge and recovery site shall be automated with a frequency not to exceed six hours;

*mon*

  - 19) before installation of the proposed ASR well, the applicant shall submit a water level and water quality monitoring plan to GMD2 for review and comment and to the Chief Engineer, DWR for approval;
  - 20) the water quality monitoring plan shall provide all necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, and temperature;
  - 21) the proposed ASR well is equipped with water meters to separately and accurately record the total flow of water injected and diverted from the ASR well;
  - 22) the water meter installations shall comply with K.A.R. 5-22-4;

*mon*  
*Delete*

  - 23) the use of the proposed ASR well is authorized by the Kansas Department of Health and Environment as a Class V UIC well and minimum water quality standards for effluent are approved by the Department for organic and inorganic compounds, pesticides and bacteria.

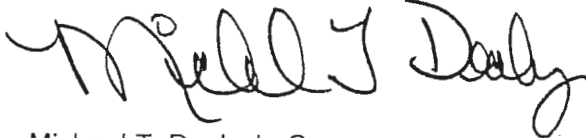
water recharged to the aquifer through the ASR well shall comply with the source water regulation K.A.R. 5-1-1(sss);

- more Delete*
- 24) the water recharged to the aquifer shall either comply with EPA and KDHE safe drinking water standards, or meet the ambient water quality at the recharge sites, whichever is better, as determined by the Secretary of the Kansas Department of Health and Environment;
- more Delete*
- 25) the quality of recharge water injected into the aquifer through the proposed well shall not degrade the ambient groundwater quality in the basin storage area;
- 26) to establish baseline ambient groundwater quality prior to bank storage withdrawal, water quality analyses shall be completed at the applicant's expense for samples collected from: a) domestic wells located within one-quarter mile of the proposed aquifer storage and recovery well, b) the proposed ASR well, and 3) all monitoring wells located at the ASR site;
- 27) the recharge system is constructed, operated and monitored to prevent groundwater contamination;
- 28) the applicant shall provide to the District a final report containing a description and scaled map of the as-built aquifer storage and recovery system;
- 29) the diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year; and
- 30) the operation of the proposed ASR well shall not impair existing water rights nor prejudicially affect the public interest.

Please contact me should there be any question regarding the District's findings or recommendation.

A District decision may be appealed to the District Board of Directors by submitting a written petition to the District office within 30 days from date of this notification, pursuant to K.A.R. 5-22-12.

Sincerely,  
EQUUS BEDS GROUNDWATER  
MANAGEMENT DISTRICT NO. 2



Michael T. Dealy, L. G.  
Manager

MTD/DRK/rk  
Enclosures

pc: David Warren, City of Wichita  
John F. and Ileen L. Weber  
Edward J. Weber  
Equus Beds Groundwater Management District Board of Directors

Ronald and Sharon Neuway  
Edward W. Combs  
Dick Van Wye



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**APPLICATION REVIEW INFORMATION**

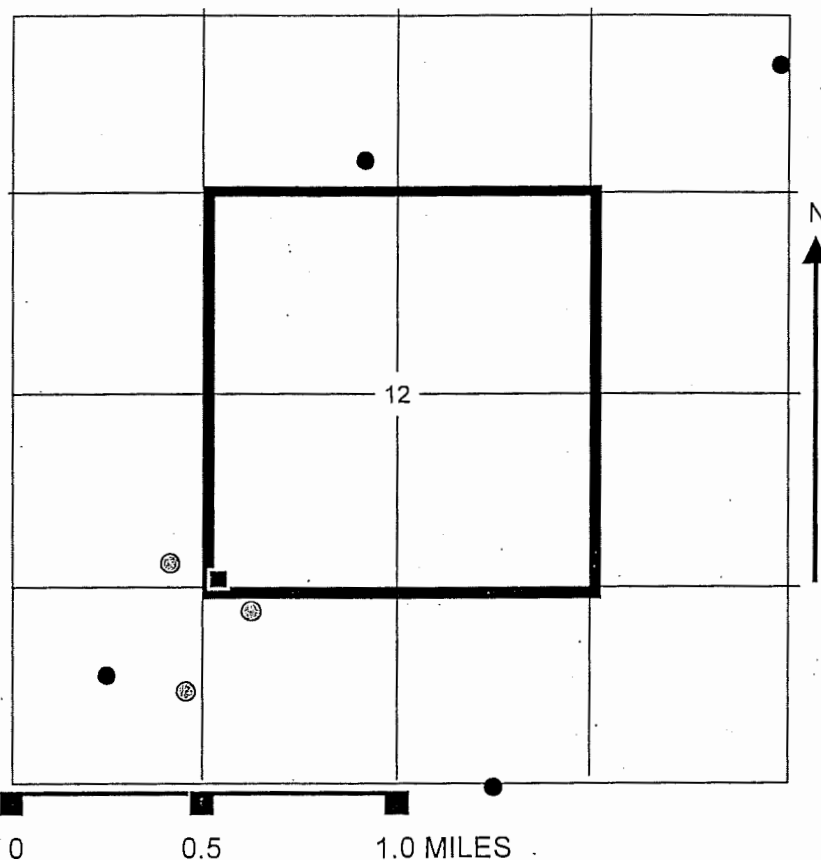
NAME	<u>CITY OF WICHITA</u>	APPLICATION NO.	<u>45576</u>
ADDRESS	<u>455 N. MAIN STREET</u>	APPL.	<u>NEW</u>
	<u>WICHITA, KS 67202</u>	COUNTY	<u>HARVEY TRACT SW-SW-SW</u>
		WELL LOCATION	<u>S 12 T 23 R 3 W</u>
		QUANT	<u>1000 AF</u> RATE <u>1000 GPM</u>
		WELL SPACING	<u>D=680', ND=2044'</u>

- Proposed Well
- Non-Domestic Well
- ⊕ Domestic Well

**ISSUE:** The application was filed for an aquifer storage and recovery well for the City of Wichita's Aquifer Storage and Recovery system. The applicant proposes to recharge water to the Equus Beds aquifer through the well for aquifer storage and recovery. The recharged water shall be diverted from the same well to be utilized for municipal use at a later time.

**BACKGROUND INFORMATION:**

JUL 3, 2003 - The applicant filed application no. 45576 for permit to withdraw water for municipal use as part of the Aquifer Storage and Recovery system. The application proposes the diversion of 1,000 AF/Y at a maximum diversion rate of 1,000 GPM, from a



proposed aquifer storage and recovery well located in the Southwest quarter of the Southwest quarter of the Southwest quarter of Section 12, Township 23 South, Range 3 West, Harvey County. The proposed well location is more specifically described as being 69 feet north and 5,212 feet west of the southeast corner of said section (figures 1 and 2).

FEB 11, 2004 - DWR requested that the District review the application and make recommendations.

FEB 13, 2004 - The District requested an extension of time to submit recommendations on the application to allow review of the application by the Board of Directors. It was requested that

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the time to provide recommendations be extended for 120 days. Copies of the extension request were submitted to the applicant and parties of interest who submitted letters of concern.

MAY 13, 2004 – It was the consensus of the Board of Directors at the May 11, 2004, meeting, that an additional 90-day extension be requested from the Chief Engineer, DWR, to provide recommendations. The additional time would allow for application review by the Board's consultant and the scheduling of a public meeting. Copies of the May 13, 2004, extension request were submitted to the applicant and parties of interest who submitted letters of concern to DWR regarding the proposed applications.

JUN 7, 2004 – The DWR approved an extension of time until August 13, 2004, to allow additional time for application review and recommendation.

**FINDINGS:** Application no. 45576 is subject to the Aquifer Management Program and District Standards and Policies, effective May 1, 1995, and Rules and Regulations K.A.R. 5-22-1 through K.A.R. 5-22-12.

Application no. 45576 is subject to the installation of a water flowmeter in accordance with District Metering Regulation K.A.R. 5-22-4a.

The proposed use of water is for municipal use associated with the applicant's aquifer storage and recovery (ASR) project. The applicant proposes to recharge bank storage water from the Little Arkansas River into the Equus Beds aquifer through a proposed aquifer storage and recovery well.

The applicant's proposal for aquifer storage will consist of a basin storage area underlying an area approximately 92,720 acres in size (figure 3). The following Division of Water Resources regulations as defined by K.A.R. 5-5-1, shall apply to the ASR project:

- (b) Acceptable quality surface water – surface water that will not degrade the quality of the groundwater source into which it is discharged;
- (e) Aquifer storage – the act of storing water in the unsaturated portion of an aquifer by artificial recharge for subsequent diversion and beneficial use;
- (f) Aquifer storage and recovery system – the 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;
- (g) Artificial recharge – the use of source water to artificially replenish the water supply in an aquifer;
- (k) Basin storage area – the portion of the aquifer's unsaturated zone use for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- (l) Basin storage loss – that portion of artificial recharge naturally flowing or discharging from the basin storage area;
- (oo) Index water level – water level elevations established spatially throughout a basin storage area to be used to represent the maximum volume of a basin storage area, and

storage available for recovery based upon accounting methodology, and conditions of the permit;

(hhh) Recharge credit – the quantity of water that is stored in the basin storage area and that is available for subsequent appropriation for beneficial use by the operator of the aquifer storage and recovery system;

(sss) Source water – water used for artificial recharge that meets the following conditions:

- (1) Is available for appropriation for beneficial use;
- (2) Is above baseflow stage in the stream;
- (3) Is not needed to satisfy minimum desirable streamflow requirements; and
- (4) Will not degrade the ambient groundwater quality in the basin storage area;

(iiii) Water balance – the method of determining the amount of water in storage in a basin storage area by accounting for inflow to, outflow from and changes in storage in that basin storage area.

Based on Kansas Geological Survey methodology for optimum monitoring well network design, the basin storage area was sub-divided into of 38 water budget accounting units, each comprised of a four square mile area (figure 3). Each unit consists of a monitoring well site utilized to obtain index water levels, and water quality data.

The proposed ASR well is located in the SW-SW-SW of Section 12, Township 23 South, Range 3 West (figure 4), and at a point near the center of basin storage unit no. 2 (figure 5).

The proposed well is one of three aquifer storage and recovery wells centralized in basin storage unit nos. 2 and 5, to be implemented as part of Phase I of the ASR project. The aquifer storage and recovery wells are identified by the applicant as RRW-1 through RRW-3, and proposed under application nos. 45567, 45568 and 45576 (figures 2, 4 and 5).

The applicant's proposed aquifer storage and recovery system is an effort to meet the City of Wichita's projected long term water demands, and to impede the movement of saltwater contamination plumes from the Burrton oil field area and the Arkansas River.

It is projected that the recharge of bank storage water to the aquifer will raise water levels in the basin storage area creating a change in hydraulic head that will retard movement of saltwater contamination.

The proposed ASR well is located one mile east of the Burrton Intensive Groundwater Use Control Area Boundary (figure 6). Saltwater contamination plumes with chloride concentrations greater than 250 mg/L, are located southwest of the proposed well site (figure 6). The nearest saltwater plumes are in the upper (depth 66 feet bls) and middle (depth 152 feet bls) portions of the aquifer located approximately 1.8 miles southwest of the application and moving to the southeast.

The proposed quantity of 1,000 AF/Y, to be diverted at a maximum rate of 1,000 GPM, would allow the withdrawal of water for a maximum period of 226 days, when aquifer storage and recovery conditions are met.

The District Board of Directors, by approved motion recommended to the Chief Engineer, DWR, revisions of Article 22. The proposed changes included a provision to Safe Yield regulation 5-22-7, stipulating that applications not subject to the Safe Yield Regulation shall include applications for aquifer storage and recovery wells.

Under the proposed application only the water stored in the basin storage area shall be withdrawn for beneficial use by the operator of the aquifer storage and recovery system

WATER RESOURCES

(recharge credit). The availability of the recharge credit shall be determined based on the index water levels and water balance of the basin storage area. As a result of utilizing the recharge credit water, the aquifer's safe yield balance would not be affected.

The application complies with Well Spacing Regulation K.A.R. 5-22-2. The Division of Water Resources advised that two responses were received from the well owners contacted within one-half mile of the proposed well site (exhibits A and B).

The application complies with the Reclamation and Recycling Policy 9007.6, which provides that groundwater users are encouraged to:

- a. anticipate future water demands and needs;
- b. assess options for development of new water supplies;
- c. embrace a philosophy that the groundwater user has a responsibility to maintain, manage and restore groundwater resources;
- d. endeavor to initiate cooperative water reclamation and supply projects using water which has been treated, purified and reclaimed to recharge or store to meet future water supply needs;
- e. embrace the concept of continual recycling of usable water; and
- f. cooperate with the District to investigate means to supplement groundwater resources by improving recharge, preventing its deterioration and seeking means to import water.

Hydrologic and geologic data indicate that depth to bedrock is approximately 129 feet below land surface (bls). Depth to water is approximately 35 feet bls and saturated thickness 94 feet. Regional groundwater flow direction at the proposed well site is southeast.

The lithologic log of the proposed well site indicates that the aquifer is comprised of alternating sand and clay layers (figure 7). The clay units range from 1 to 31 feet in thickness. The sand units range from 4 to 15 feet in thickness, with the 15 feet thick unit located from a depth of 109 to 124 feet below land surface.

Water level data has been recorded by the District at groundwater monitoring site IW02 located within 100 feet of the proposed ASR well site (figure 4). Water levels recorded at the site during the period of record from October 2001 to April 2004 (figure 8), indicated that a perched water table existed at a depth of 26 feet bls. Water levels ranged from 4.07 to 10.07 feet in IW02A (total depth 26 feet). Water level data for IW02C ranged from 33.68 to 53.27 feet (total depth 95 feet) during the period of record. The IW02C lithologic log reported that depth to bedrock was 149 feet bls, with the lowest sand unit from 75 to 115 feet bls.

The application's proposed well depth is 124 feet bls to be completed in the lower portion of the aquifer. Proposed well construction specifications were not submitted with the application. An example diagram of recharge and recovery well construction was included in the applicant's demonstration project report (figure 9).

The applicant proposes to install observation wells for groundwater level and water quality monitoring at the site. The quantity and quality of source water recharged at the site will be monitored.

## STAFF RECOMMENDATIONS:

Based on data submitted by the applicant and District findings, staff recommends that the application be approved subject to conditions that:

- 1) the basin storage area shall be defined in compliance with K.A.R. 5-1-1(k) specifying the portion of the aquifer's unsaturated zone used for aquifer storage that has defined horizontal boundaries and is delimited by the highest and lowest index water level elevations;
- 2) monitoring of the basing storage area shall include water levels, water quality, water use, water storage, water recovery, precipitation, basic data access and operational reports;
- 3) a monitoring well network is established using Kansas Geological Survey methodology to determine index water levels in each water budget accounting unit, and monitoring water levels for water balance calculations and determination of recharge credits;
- 4) as determined by Kansas Geological Survey methodology the basin storage area is divided into 38 water budget accounting units and each unit is assigned an index identification number as shown on figure 3;
- 5) the index water levels are established in compliance with K.A.R. 5-1-1(oo), to designate water level elevations spatially throughout the basin storage area, to be used to represent the maximum volume of a basin storage area, and storage available for recovery based upon accounting methodology, and conditions of the permit;
- 6) the highest index water level shall be limited to the predevelopment water table measurement or computed gradient based on KGS Bulletin 79 data and a minimum depth of 10 feet below land surface at the point of lowest land surface elevation in water budget accounting unit index no. 2;
- 7) the lowest index water level shall be determined per K.A.R. 5-12-1(b)(2) and the highest index water level shall be 1427.5 feet msl (22 feet bls), based on the predevelopment water level for accounting unit index no. 2, as determined from Kansas Geological Survey Bulletin 79 (1949);
- 8) water level monitoring data from index well no. 2 shall be used to compute the water balance and determine recharge credits for the proposed ASR application;
- 9) the total volume of the basin storage area shall be calculated in acre-feet utilizing the established highest and lowest index well levels for each water budget accounting unit, the area of the basin storage area, and the storage coefficient of the aquifer in each accounting unit;
- 10) the water balance to determine change in the basin storage area shall be calculated, where total inflow minus total outflow equals the change in groundwater storage;
- 11) the inflow data utilized in water balance calculations shall include natural recharge, groundwater and stream inflow, artificial recharge, and any other source of water deemed inflow by the District or the Division of Water Resources, further passive recharge shall not be considered as inflow and shall be excluded from water balance calculations;
- 12) the outflow data utilized in water balance calculations shall include evapotranspiration, baseflow, groundwater and stream outflow, non-domestic well use, and any other source of water deemed outflow by the District or the Division of Water Resources;

- 13) the proposed recovery of water artificially recharged by the operator of the aquifer storage and recovery system shall only occur when recharge credits are determined to be available;
- 14) determination of recharge credits for the proposed ASR application shall be computed through water balance methodology utilizing index data from water budget accounting unit nos. 1, 2, 3, 4, 5 and 6, and credit for passive recharge shall be prohibited;
- 15) a monitoring well network is installed at the applicant's expense to monitor the aquifer storage and recovery site as shown on Attachment 45576-A(r), and shall include existing monitoring well site IW02;
- 16) the monitoring wells are drilled and completed at depths correlating to the upper and lower zones of the aquifer for water sample collection, water level measurements and testing purposes;
- 17) the monitoring well sites are completed at spacing distances within 660 feet from the recharge and recovery well;
- 18) water level monitoring at the recharge and recovery site shall be automated with a frequency not to exceed six hours;
- 19) before installation of the proposed ASR well, the applicant shall submit a water level and water quality monitoring plan to GMD2 for review and comment and to the Chief Engineer, DWR for approval;
- 20) the water quality monitoring plan shall provide all necessary chemical, physical, radiological and biological data, and include but not be limited to continuous monitoring of specific conductance, PH, turbidity, dissolved oxygen, and temperature;
- 21) the proposed ASR well is equipped with water meters to separately and accurately record the total flow of water injected and diverted from the ASR well;
- 22) the water meter installations shall comply with K.A.R. 5-22-4;
- 23) the use of the proposed ASR well is authorized by the Kansas Department of Health and Environment as a Class V UIC well and minimum water quality standards for effluent are approved by the Department for organic and inorganic compounds, pesticides and bacteria; the water recharged to the aquifer through the ASR well shall comply with the source water regulation K.A.R. 5-1-1(sss);
- 24) the water recharged to the aquifer shall either comply with EPA and KDHE safe drinking water standards, or meet the ambient water quality at the recharge sites, whichever is better, as determined by the Secretary of the Kansas Department of Health and Environment;
- 25) the quality of recharge water injected into the aquifer through the proposed well shall not degrade the ambient groundwater quality in the basin storage area;
- 26) to establish baseline ambient groundwater quality prior to bank storage withdrawal, water quality analyses shall be completed at the applicant's expense for samples collected from:
  - a) domestic wells located within one-quarter mile of the proposed aquifer storage and recovery well,
  - b) the proposed ASR well, and
  - 3) all monitoring wells located at the ASR site;
- 27) the recharge system is constructed, operated and monitored to prevent groundwater contamination;
- 28) the applicant shall provide to the District a final report containing a description and scaled map of the as-built aquifer storage and recovery system;

- 29) the diversion quantities, aquifer injection quantities, water level data and water quality analyses are reported to the Division of Water Resources and the District each month for the 1<sup>st</sup> year of operation, each calendar quarter for the 2<sup>nd</sup> year of operation, and annually thereafter by March 1, of each year; and
- 30) the operation of the proposed ASR well shall not impair existing water rights nor prejudicially affect the public interest.

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David L. Pope, Chief Eng.  
109 SW 9th ST  
2nd floor  
Topeka KS 66612-1283

August 23, 2003

Re. Application  
File no. 45,576

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AUG 27 2003

Dear Mr. Pope:

KS DEPT OF AGRICULTURE

It is very difficult to express to you our feelings in a letter. We would much prefer to sit and talk to you as we would any other friend.

We ask please that the application for the permit that Wichita has filed for be denied. We know that all of the studies for this project have been biased in favor of Wichita. Wichita has said that we (the area farmers) are all insignificant. By making this statement they have shown a selfish total disregard for an entire class of people. We know that they fully intend to keep moving forward on this until the entire aquifer is under their exclusive control. This whole process has been done in a ~~secretive~~ and underhanded way so as to ~~keep~~ all the farmers completely uninformed.

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August 22, 2003

MARK D JENNINGS, L.G.  
 ENVIRONMENTAL SCIENTIST  
 WATER APPROPRIATION PROGRAM

RE: Application File No 45576

Dear Sir:

Reference your letter of August 12 on  
 Subject Application. I have three (3) wells  
 that could be impacted by the well on subject application.  
 I have been to several meetings on this water shed.  
 The land owners and water users (approximately 900) are  
 quite concerned with Nichita's effort to control the  
 water in this area.

We have had no appreciation in land value in this area  
 in several years, water is one of our most valuable  
 assets.

I would oppose such well, unless the following  
 criteria are met:

1. Quality of recharge water to be "As-good-or-better  
 than existing water quality"
2. Well not be more than 60' deep.
3. Results of recharge water does not degrade  
 our existing water standard
4. What will be effect on SALT PLUME which is  
 moving south?

Sincerely

Edward W Combs, phone 620 463 3362  
 18116 NW 12 TH.  
 River town, KS 67020

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Wichita's plan for pumping into the Aquifer will not work as they have said it would. This plan is just an excuse to pump the aquifer dry if they so choose. Wichita has no intention of being a responsible party in this matter. They will be policing themselves on how much water is coming out of the aquifer and the quality of water going into it. If they want to bank water for the future why don't they pump the river water into Cheney? Or another idea: they could just process the water they need directly out of the river. But no! They are not about to do that. Wichita intends to rape the district's farmers, use and abuse us and then dump us without any water (or hopelessly polluted water), all of this without any compensation for our grief and ruined lives.

A year or two ago we called our district water manager to find out what all of the drilling around us was for. He said he (Mr Mike Dealy) had no idea (370)

Would drive out to see if there was some drilling going on and he would get back to us. When Mr. Dealy called us back he said they were just doing some testing.

We would like to see a special referendum vote by all of those qualified to vote in our water district. After all this involved many more than just Wichita. We should be allowed a vote on this tremendous change in our lives. We do not have the power, influence and money that Wichita has but we are very concerned about the immediate future and all the generations to come.

Thank you for  
Considering our  
Concerns.

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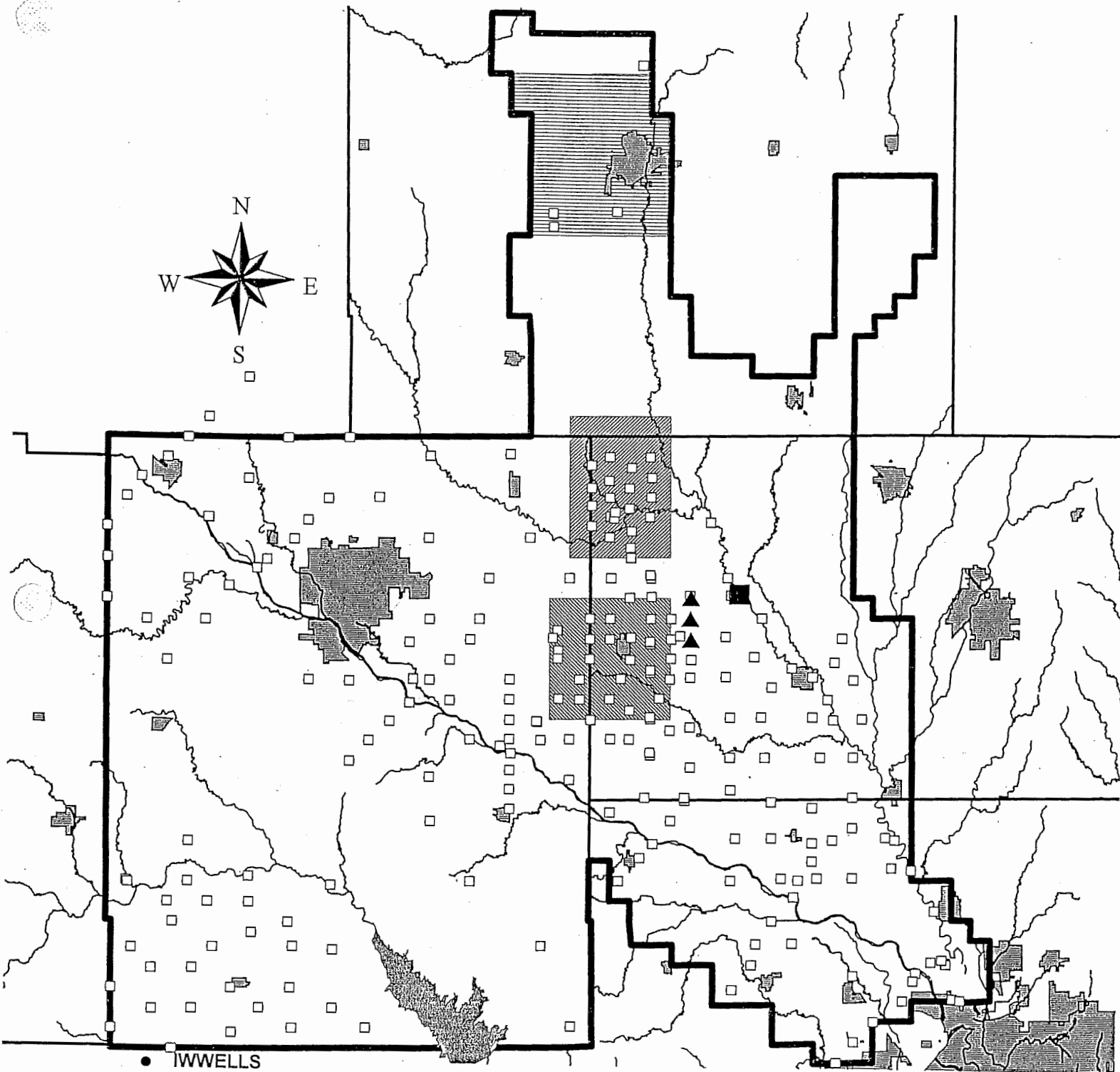
KS DEPT. OF AGRICULTURE

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Respectfully,  
Ronald B. Newmyer  
Sharon K. Newmyer

cc: Mark D. Jennings cc: Kathleen Sebelius  
Adrian J. Polansky Todd Tiaht 371

Figure 1. - Equus Beds Groundwater Management District No. 2  
 Aquifer Storage and Recovery Project Map  
 July 13, 2004



- IWELLS
- Monitoring Wells
- Cheney Reservoir
- Counties
- ▭ District Boundary
- Streams
- ∨ Major Stream
- Cities
- Special Use Areas
- ▨ BURRTON IGUCA
- ▨ MCPHERSON IGUCA
- ▨ SWQUA

- ▲ Application for Proposed Aquifer Recharge and Recovery Well
- Applications for 7 Proposed Bank Storage Withdrawal Wells

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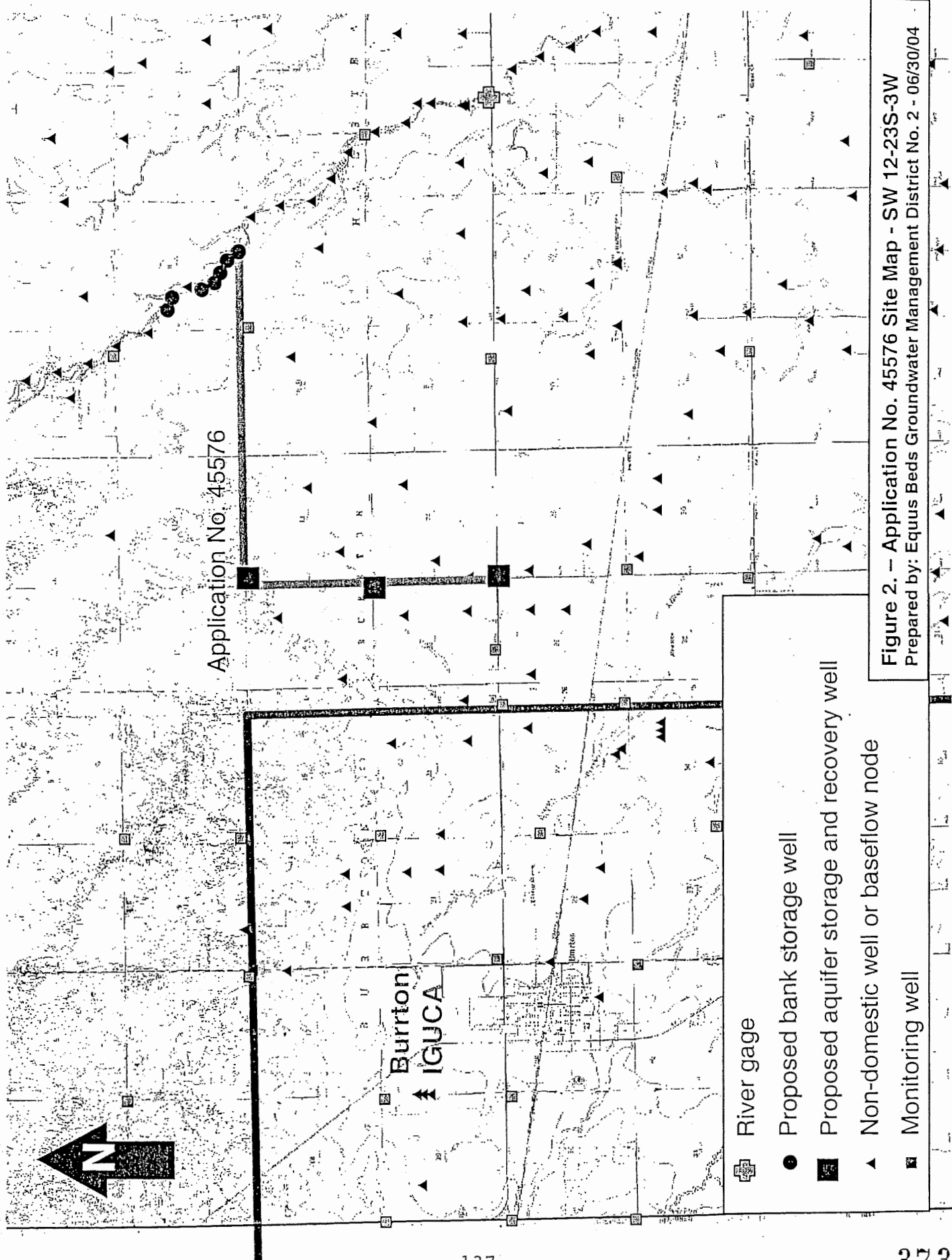
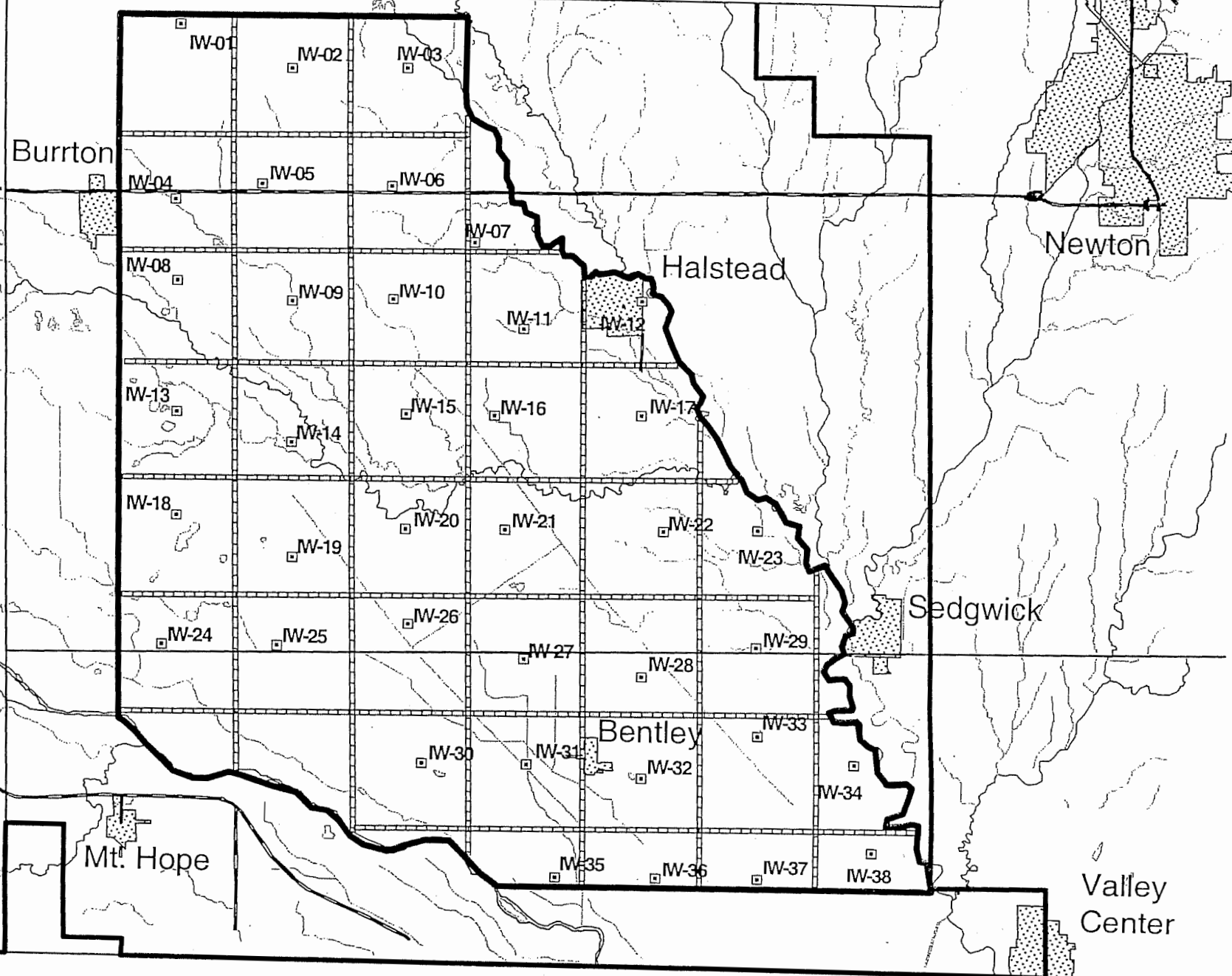


Figure 2. – Application No. 45576 Site Map - SW 12-23S-3W  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04

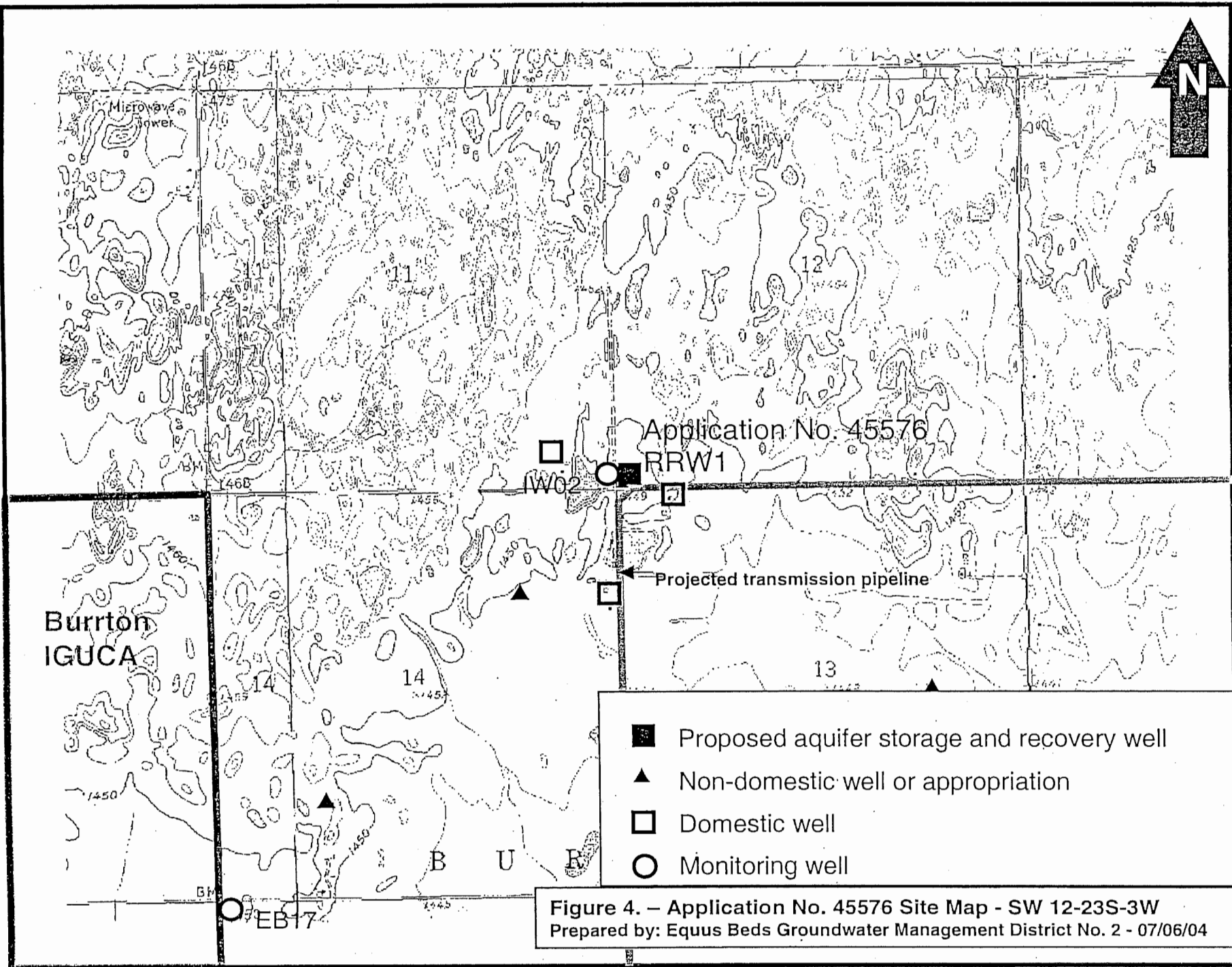
Figure 3. – Basin Storage Area Map - Application No. 45576 Site Map - SW 12-23S-3W  
Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04



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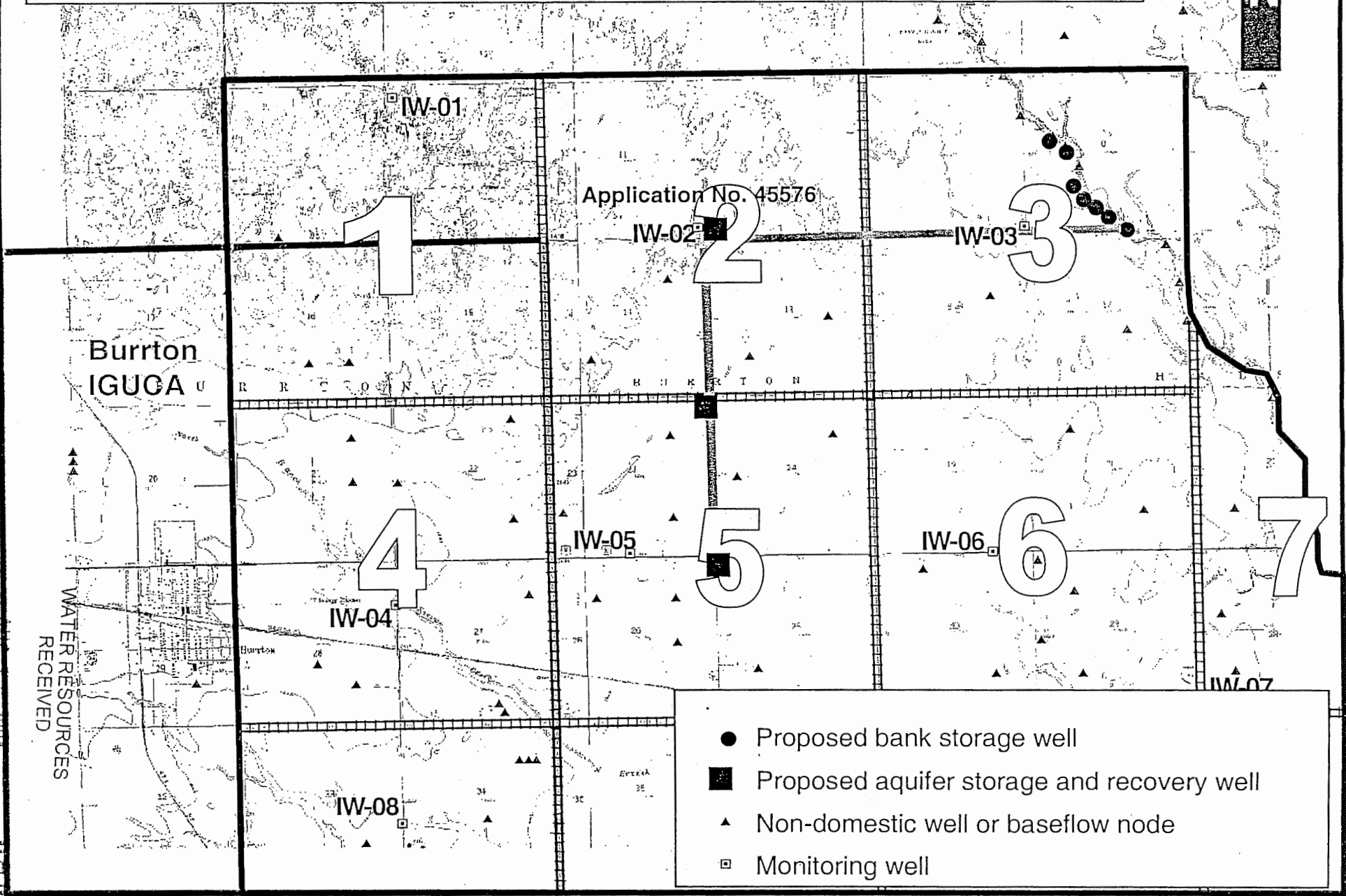
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**Figure 4. – Application No. 45576 Site Map - SW 12-23S-3W**  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 07/06/04

Figure 5. – Basin Storage Area Accounting Unit Map- Application No. 45576 Site Map - SW 12-23S-3W  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04



- Proposed bank storage well
- Proposed aquifer storage and recovery well
- ▲ Non-domestic well or baseflow node
- Monitoring well

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Figure 6. – Application No. 45576 Site Map - SW 12-23S-3W  
 Prepared by: Equus Beds Groundwater Management District No. 2 - 06/30/04

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Application No. 45576

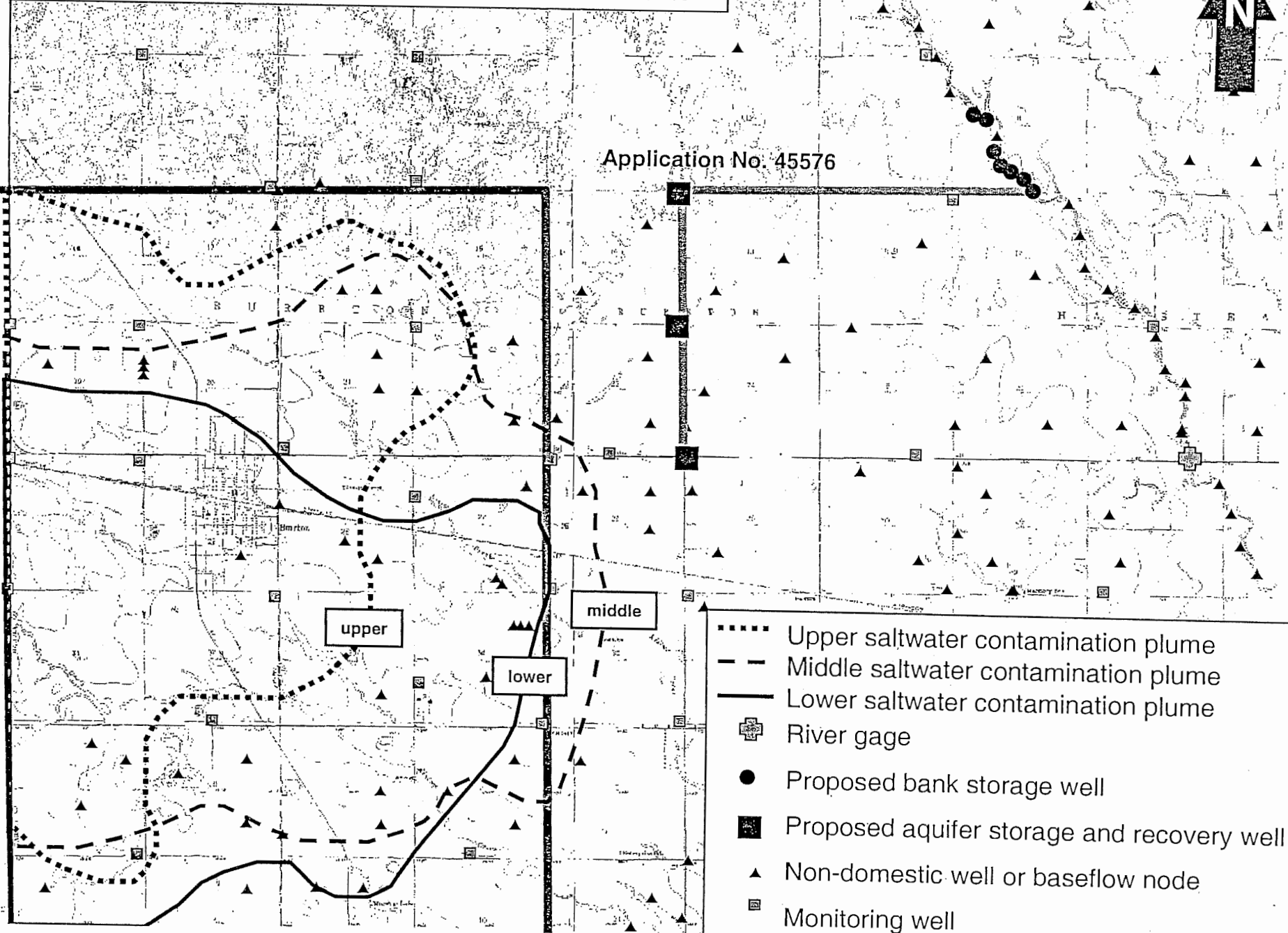


- ..... Upper saltwater contamination plume
- - - Middle saltwater contamination plume
- Lower saltwater contamination plume
- ⊕ River gage
- Proposed bank storage well
- Proposed aquifer storage and recovery well
- ▲ Non-domestic well or baseflow node
- Monitoring well

upper

middle

lower



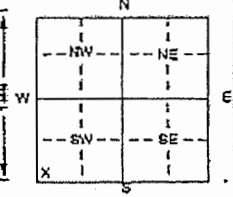


263 5925 WATER WELL RECORD Form WWC-5 KSA 82a-1212 ID No. RRW-1

1 LOCATION OF WATER WELL: Fraction Section Number Township Number Range Number  
 County: Harvey SW SW SW 12 T 23 S R 3 E W

Distance and direction from nearest town or city street address of well if located within city?  
 Approximately 3 1/2 miles east and 2 miles north of Burden

2 WATER WELL OWNER: City of Wichita Board of Agriculture, Division of Water Resources  
 RR#, SL Address, Box #: 455 N. Main Application Number:  
 City, State, ZIP Code: Wichita, KS 67202

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:  DEPTH OF COMPLETED WELL: 126 ft. ELEVATION: unknown

Depth(s) Groundwater Encountered 1 ft. 2 ft. 3 ft.  
 WELL'S STATIC WATER LEVEL not checked ft. below land surface measured on mo/day/yr  
 Pump test data: Well water was not checked ft. after hours pumping  
 Est. Yield UNKNOWN gpm; Well water was not checked ft. after hours pumping  
 Bore Hole Diameter: 5 in. to 140 ft. and in. to ft.  
 WELL WATER TO BE USED AS:  
 1 Domestic 2 Irrigation 3 Foodst 4 Industrial 5 Public water supply 6 Oil field water supply 7 Domestic (lawn & garden) 8 Air conditioning 9 Dewatering 10 Working well 11 Injection well 12 Other (specify below)

Was a chemical/bacteriological sample submitted to Department? Yes No  If yes, mo/day/yr sample was submitted Water Well Disinfected? Yes No

4 TYPE OF BLANK CASING USED:  
 1 Steel 2 PVC 3 RWP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)  
 Casing joints: Glued Clamped Welded Threaded

Blank casing diameter: 2 in. to 84 ft. Dia. in. to ft. Dia. in. to ft.  
 Casing height above land surface: 24 in. weight: 70 lbs./ft. Wall thickness or gauge No. 154

TYPE OF SCREEN OR PERFORATION MATERIAL:  
 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Concrete tile 6 Fiberglass 7 PVC 8 RWP (SR) 9 Asbestos-cement 10 Other (specify) 11 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE:  
 1 Continuous slot 2 Louvered shutter 3 Mesh slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)

SCREEN-PERFORATED INTERVALS: From 84 ft. to 124 ft. From ft. to ft.  
 GRAVEL PACK INTERVALS: From 55 ft. to 140 ft. From ft. to ft.

5 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other Bentonite Holeplug  
 Grout intervals: From ft. to ft. From ft. to ft. From 0 ft. to 55 ft.  
 What is the nearest source of possible contamination:  
 1 Septic tank 2 Sewer lines 3 Wastewater lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Field yard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below) 17 None known

Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	3	Topsoil	103	109	Clay, green, hard
3	13	Clay, brown, sandy, soft	109	124	Sand, coarse to very fine with gravel, fine
13	17	Clay, reddish brown, sandy, soft	124	129	Clay, dark gray
17	27	Sand, coarse to very fine, loose	129	140	Shale, black, hard
27	53	Clay, tan, hard			
53	62	Sand, coarse to very fine, loose			
62	64	Clay, green, hard			
64	78	Sand, coarse to very fine, loose, clean			
78	77	Clay, green, hard			
77	82	Sand, coarse to very fine with gravel, fine, loose, clean			
82	91	Clay, green, hard, sand streak at 87'			
91	103	Sand, coarse to very fine with gravel, fine, loose, clean			

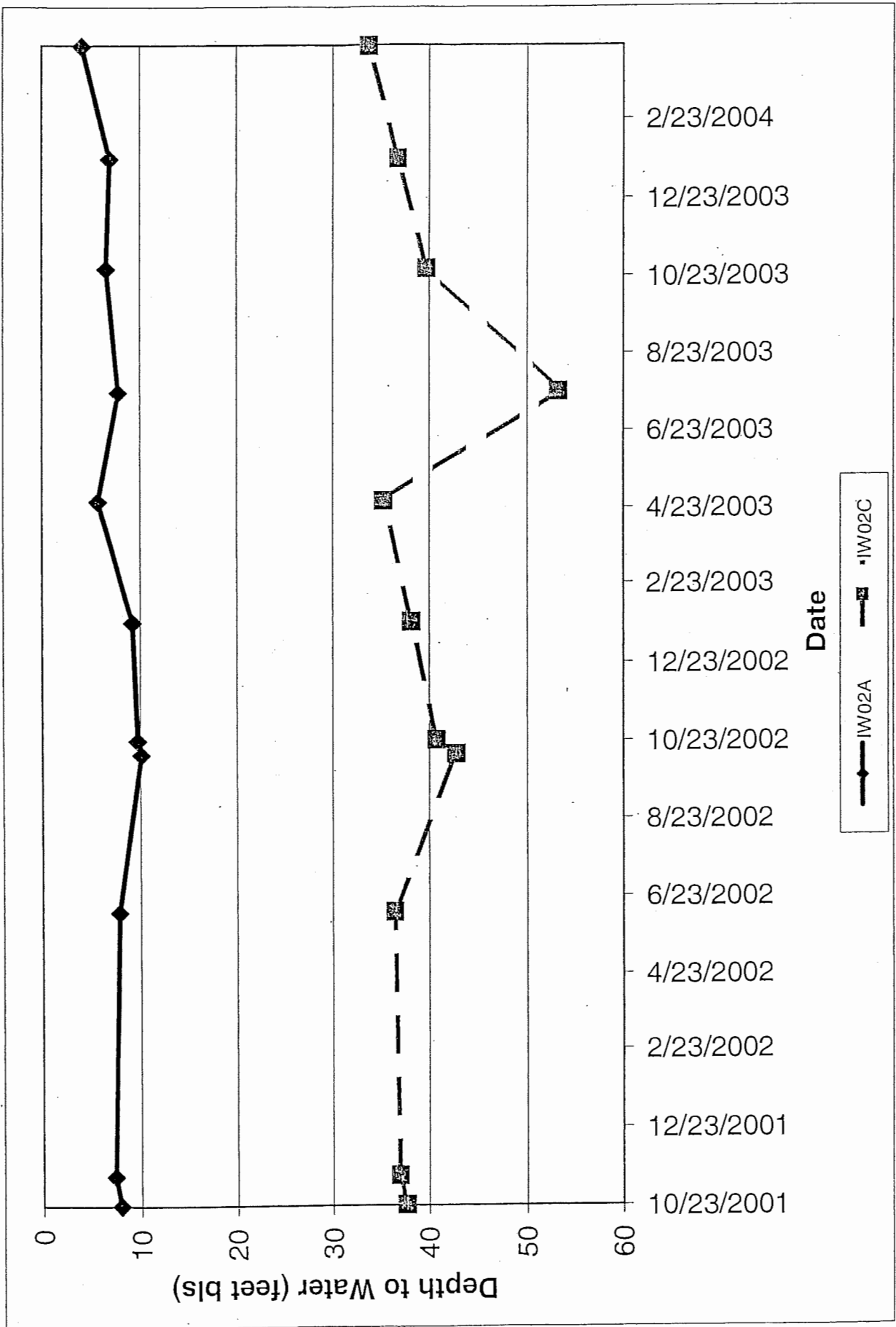
6 CONTRACTORS OR LANDOWNERS CERTIFICATION: This water well was (1) constructed (2) reconstructed or (3) plugged under my jurisdiction and was completed on (mo/day/yr) 12-10-02 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 185 This Water Well Record was completed on (mo/day/yr) 12-25-02 under the business name of Clarke Well & Equipment, Inc. by (Signature) [Signature]

INSTRUCTIONS: Use typewriter or ballpoint pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send log three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66604-0001. Telephone 785-296-5224. Send one to WATER WELL OWNER and retain one for your records. Fee of \$1.00 for each completed well.

Figure 7. – Application No. 45576. Lithologic Log for Test Well at Proposed ASR Well Site

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Groundwater Monitoring Site IW02  
 SW-SW-SW Sec. 12, T23S, R3W



IW02A Depth = 26 feet  
 IW02C Depth = 95 feet

Figure 8.

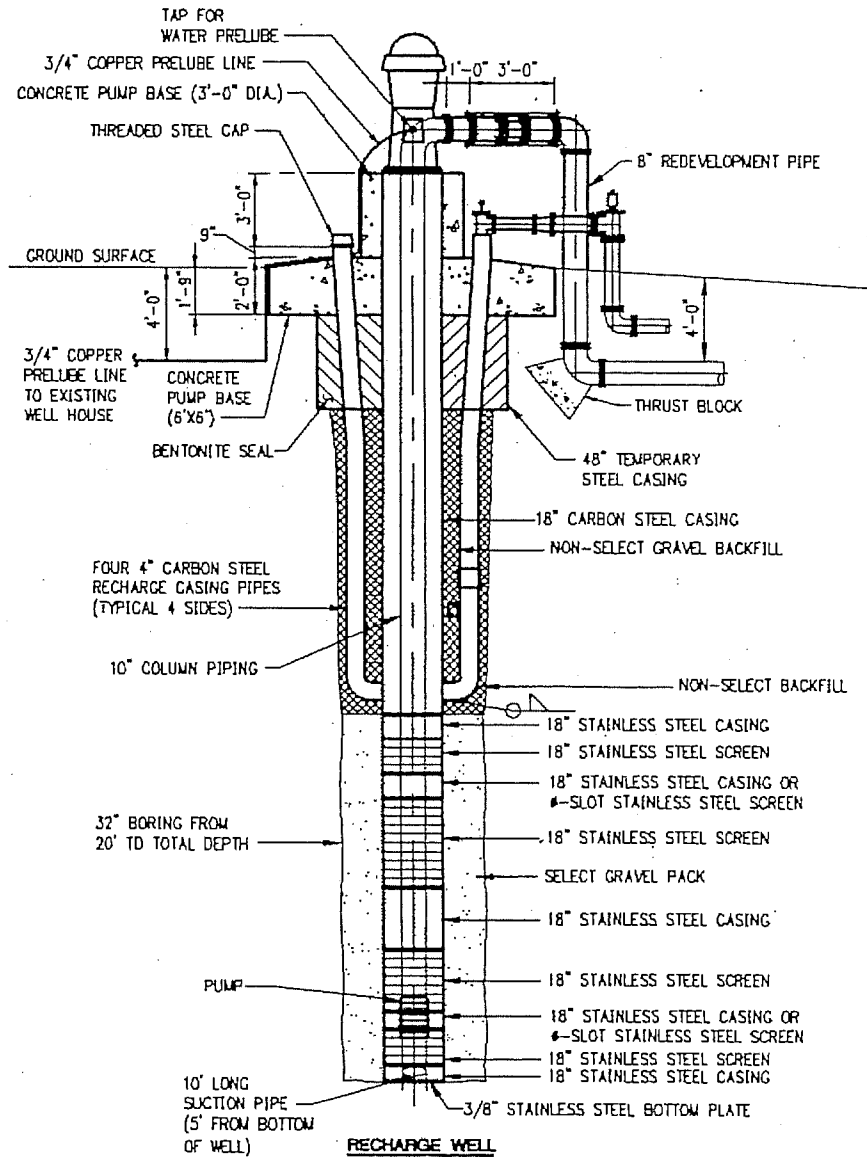
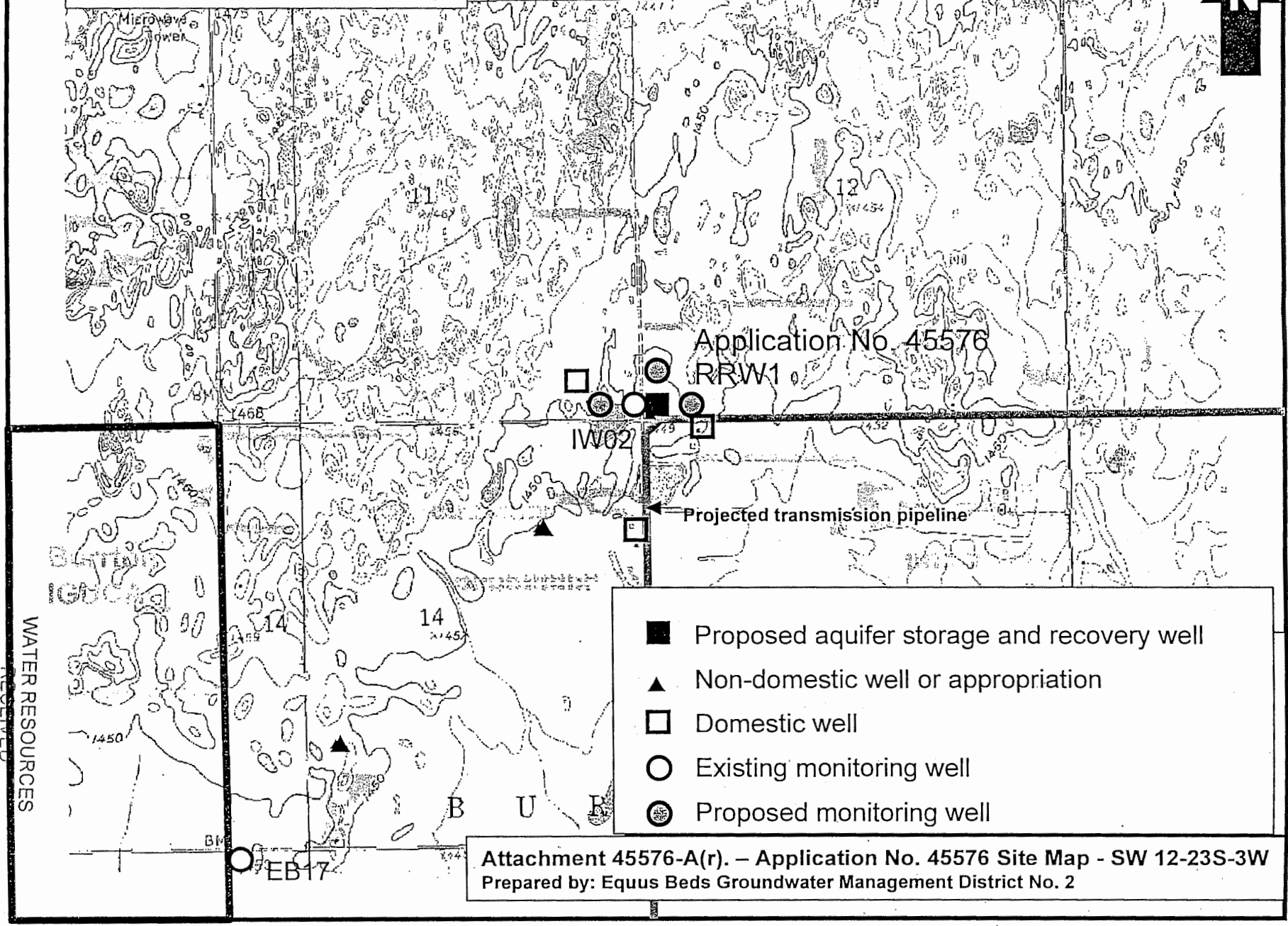


Figure 9. –  
Application  
No. 45576  
Example of  
Construction  
Design for  
Recharge and  
Recovery Well

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Attachment 45576-A(r).



- Proposed aquifer storage and recovery well
- ▲ Non-domestic well or appropriation
- Domestic well
- Existing monitoring well
- Proposed monitoring well

Attachment 45576-A(r). – Application No. 45576 Site Map - SW 12-23S-3W  
Prepared by: Equus Beds Groundwater Management District No. 2

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