

Agenda Item 2a
Bank Storage Withdrawal &
Aquifer Storage and
Recovery
Water Appropriation
Applications

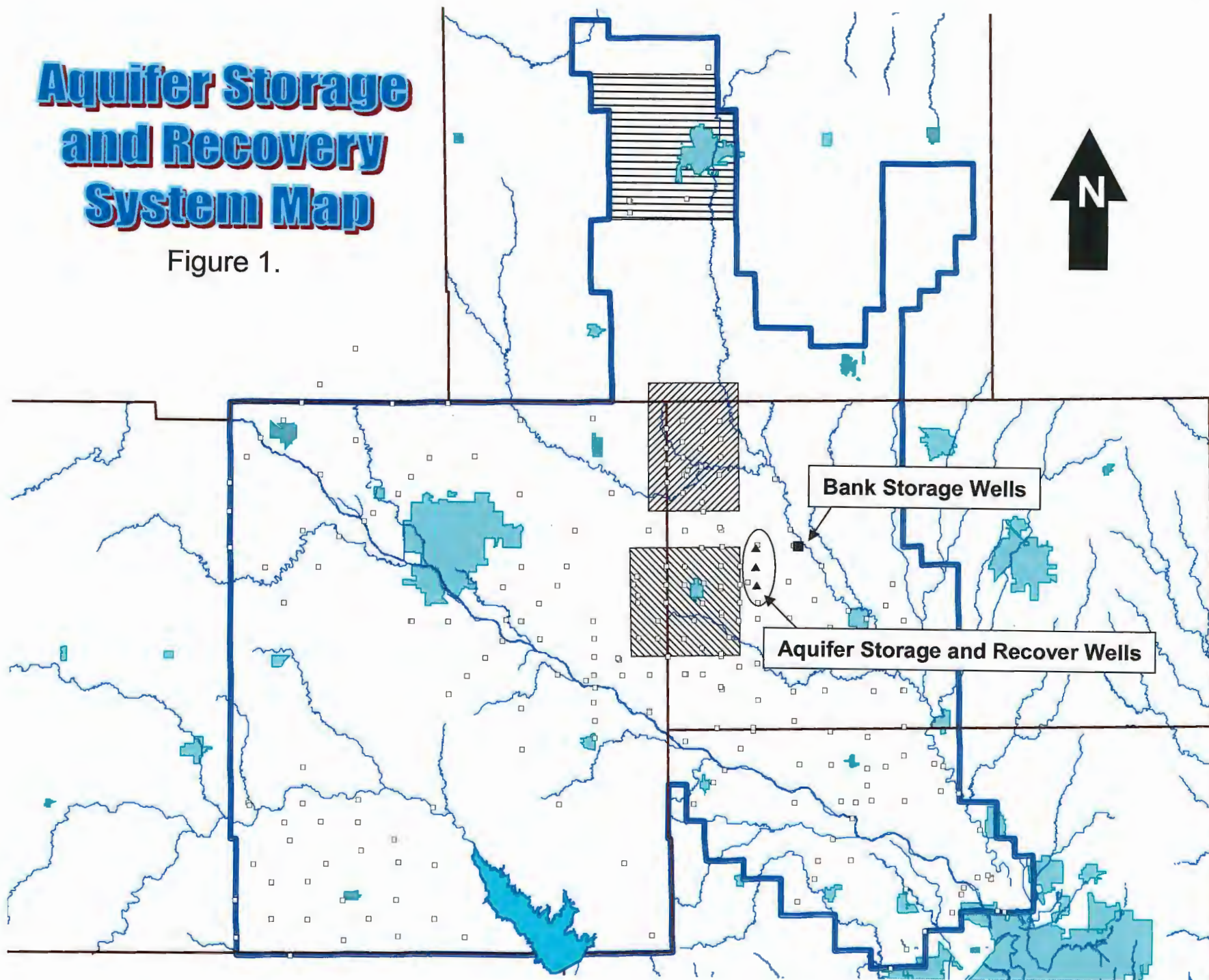


Bank Storage Withdrawal Well Applications 45569 through 45575

The applications were filed for bank storage wells 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.

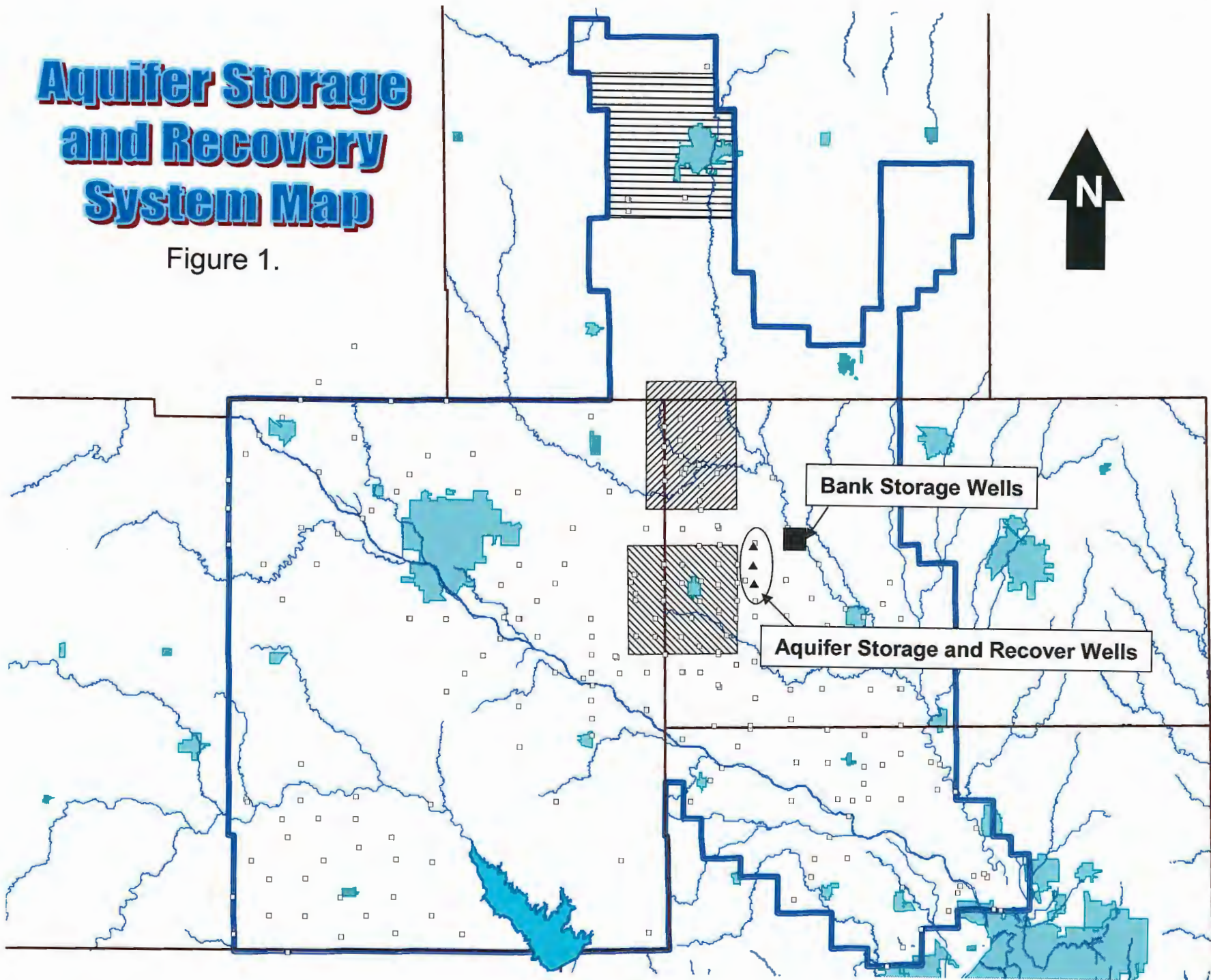
Aquifer Storage and Recovery System Map

Figure 1.



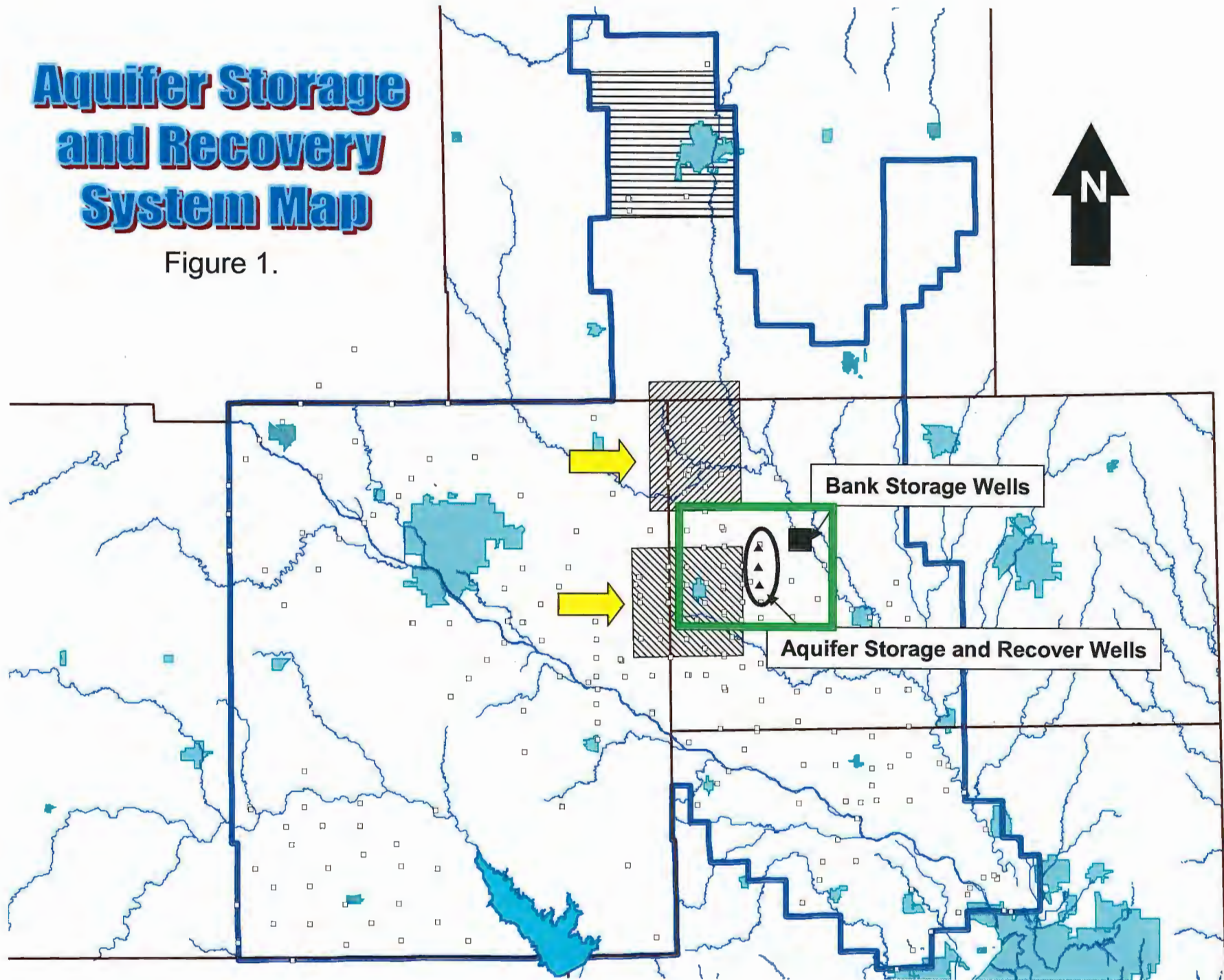
Aquifer Storage and Recovery System Map

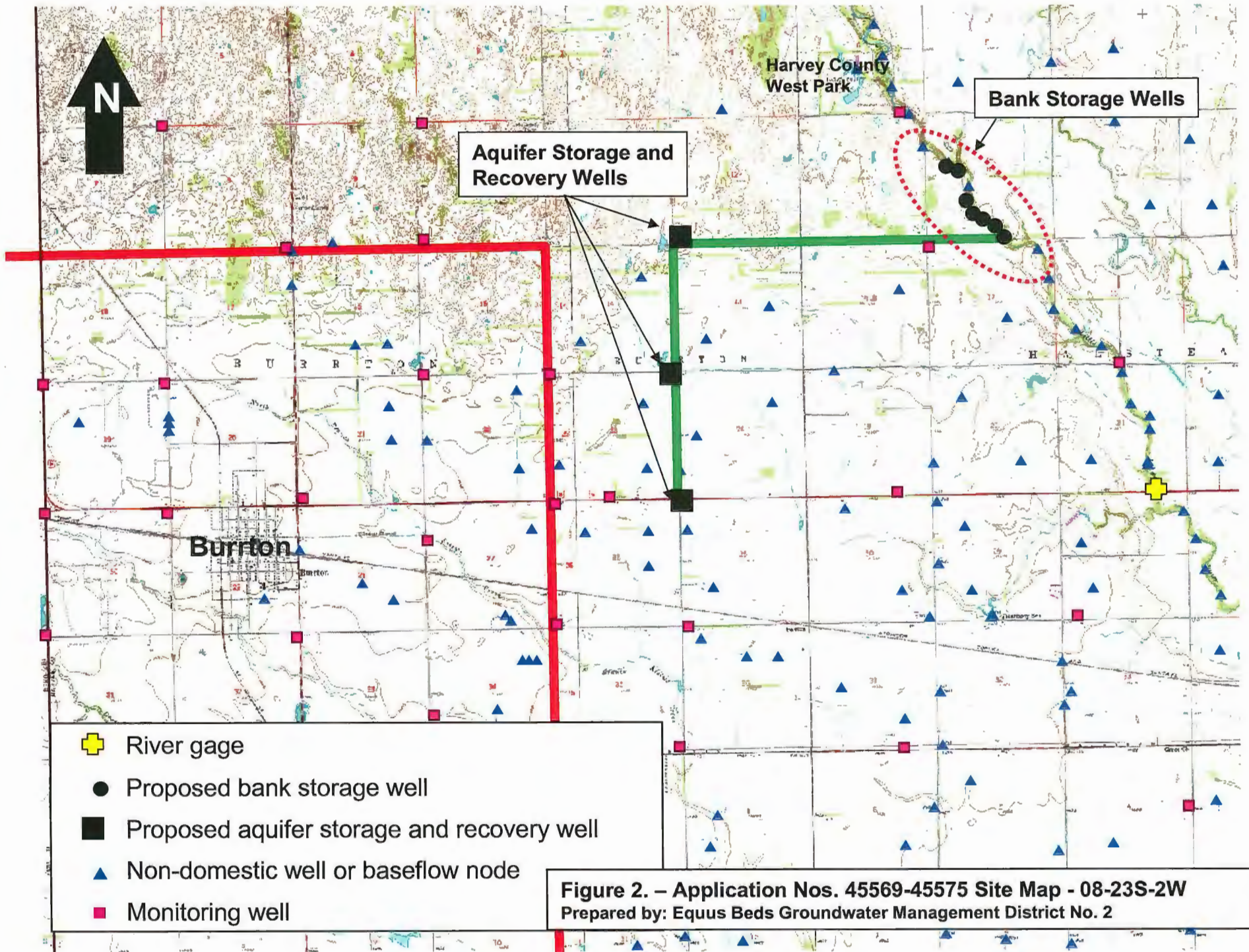
Figure 1.

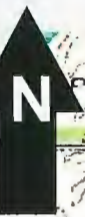
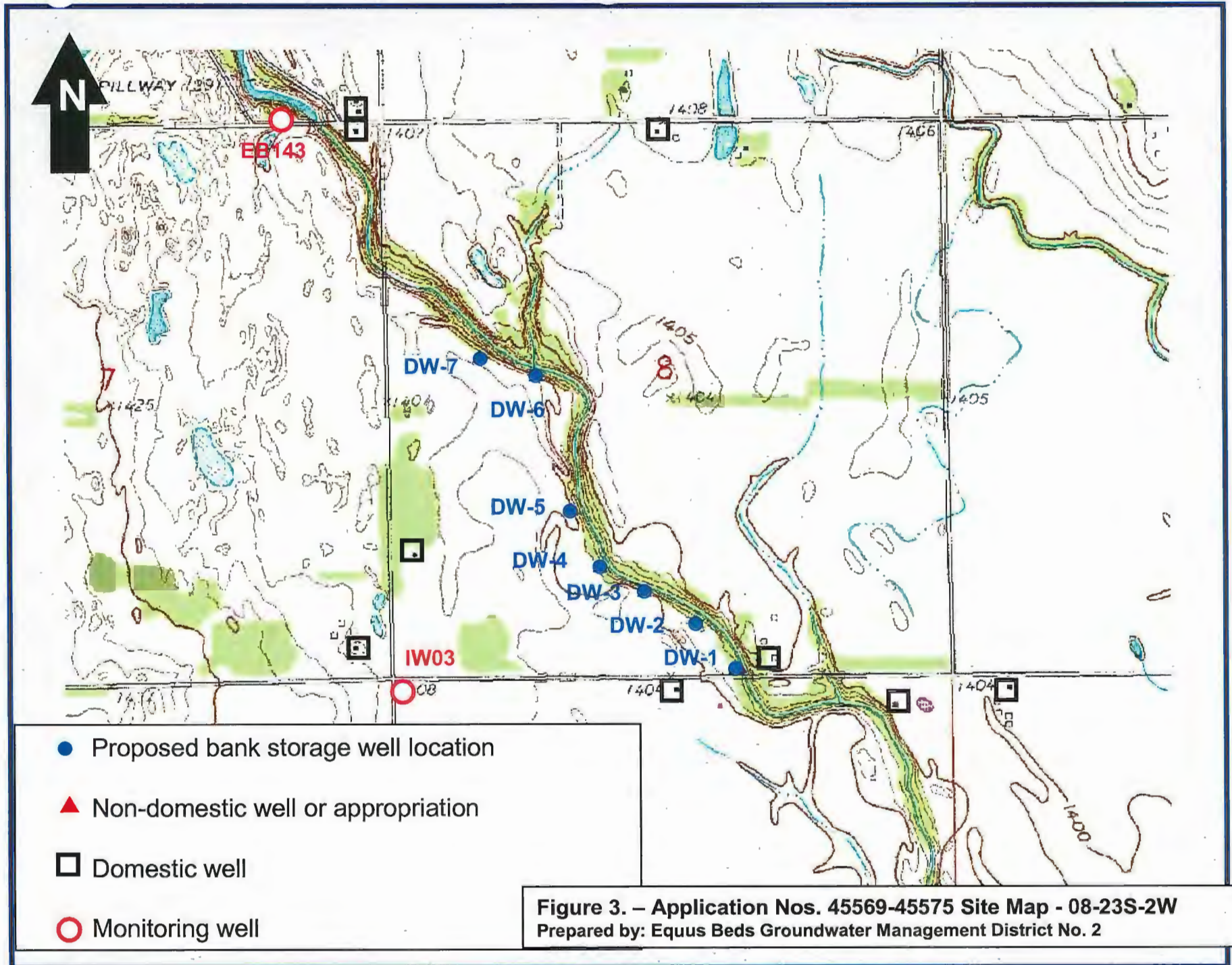


Aquifer Storage and Recovery System Map

Figure 1.







PILLWAY 7.39

EB143

DW-7

DW-6

DW-5

DW-4

DW-3

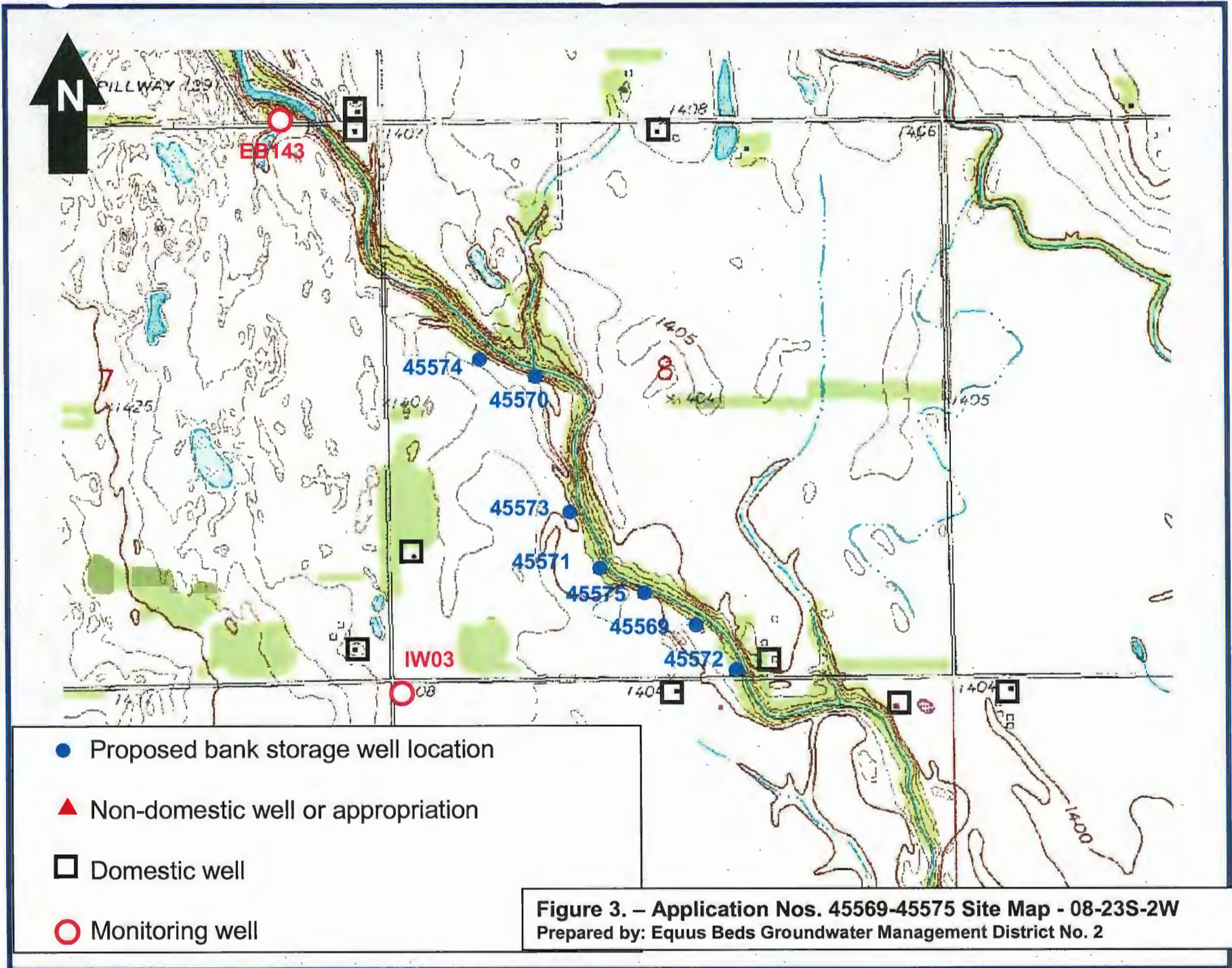
DW-2

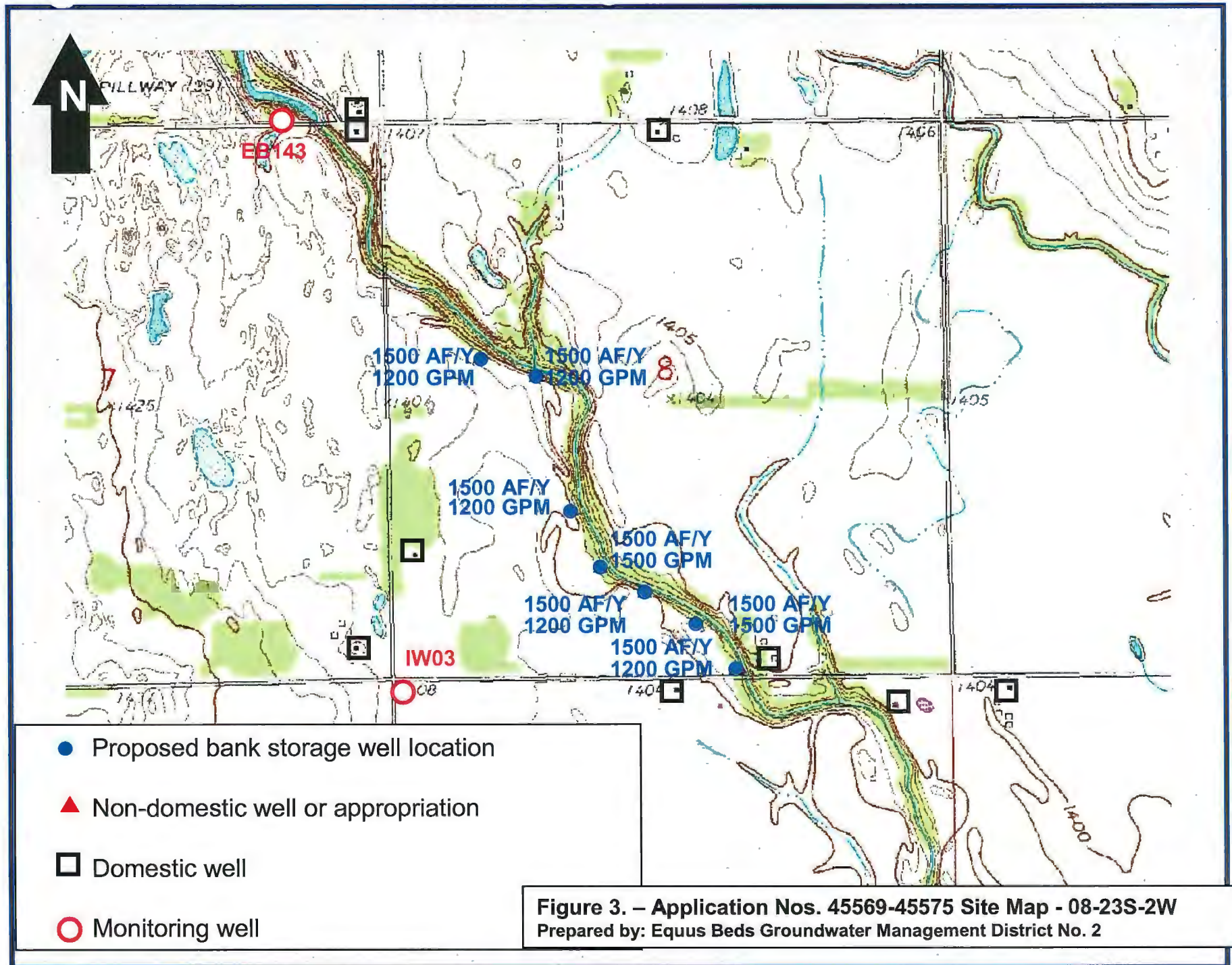
DW-1

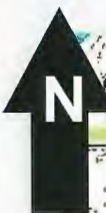
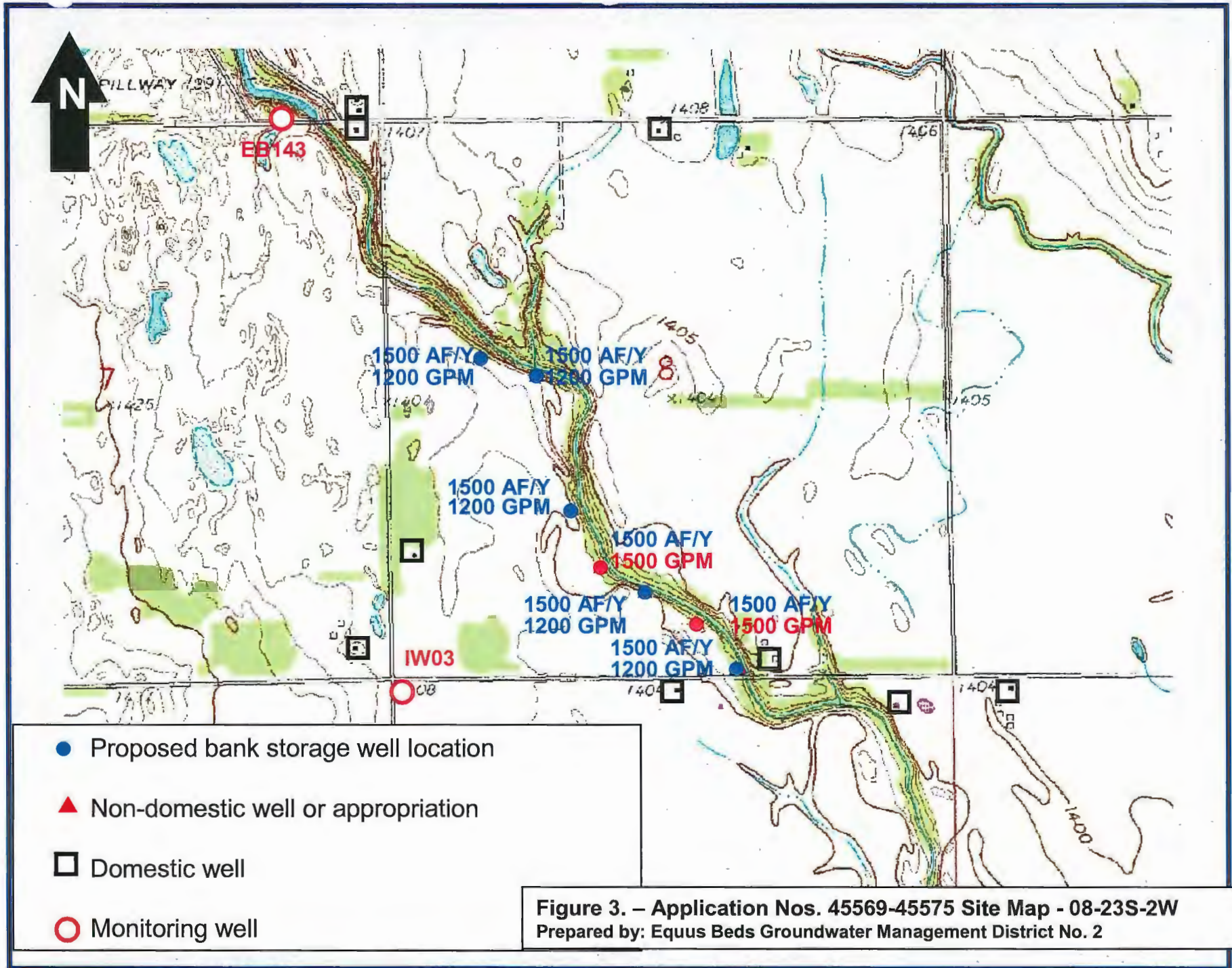
IW03

- Proposed bank storage well location
- ▲ Non-domestic well or appropriation
- Domestic well
- Monitoring well

Figure 3. - Application Nos. 45569-45575 Site Map - 08-23S-2W
 Prepared by: Equus Beds Groundwater Management District No. 2







PILLWAY 1399

EB143

1500 AF/Y
1200 GPM

1500 AF/Y
1200 GPM

1500 AF/Y
1200 GPM

1500 AF/Y
1500 GPM

1500 AF/Y
1200 GPM

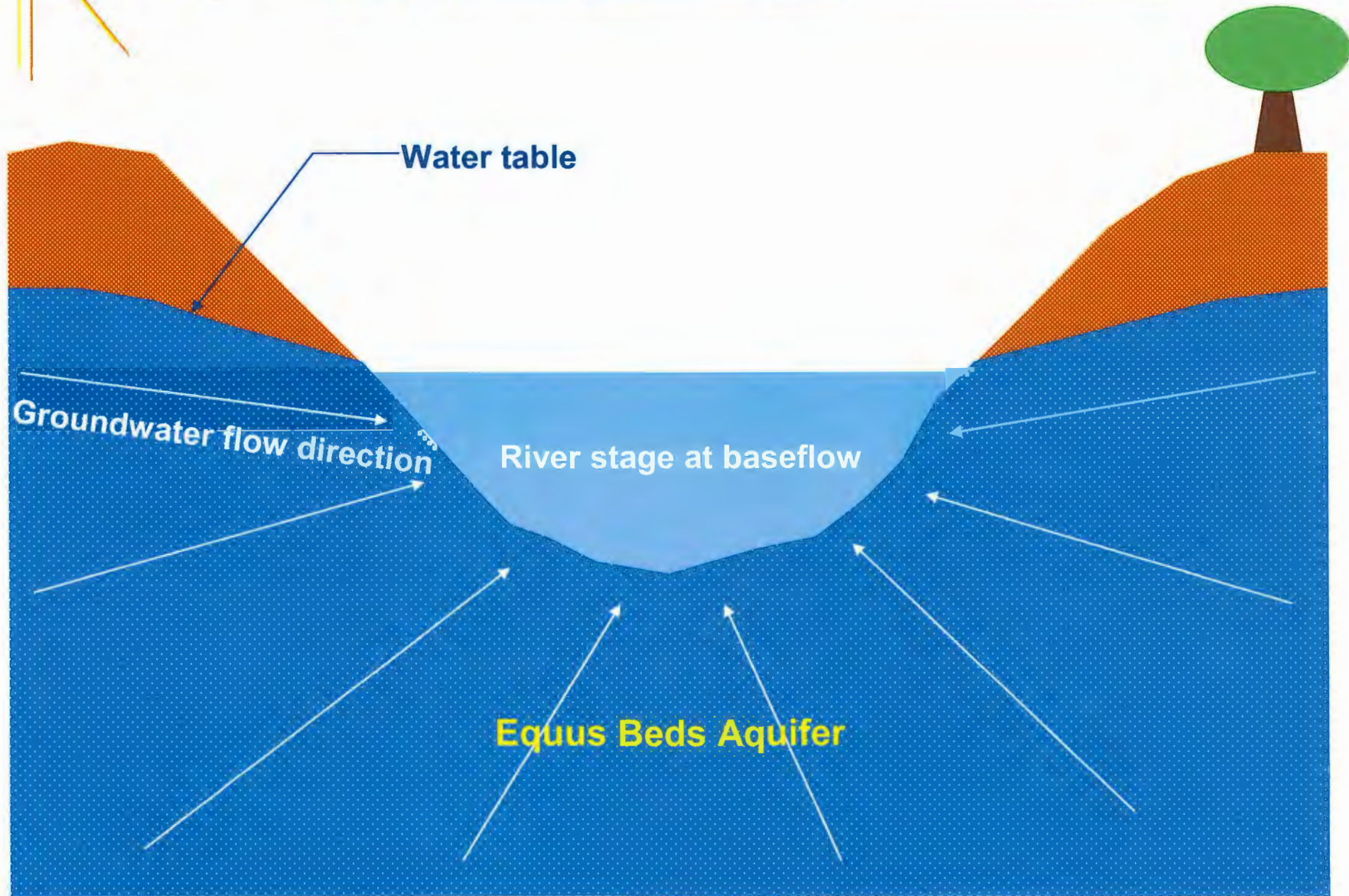
1500 AF/Y
1500 GPM

1500 AF/Y
1200 GPM

IW03

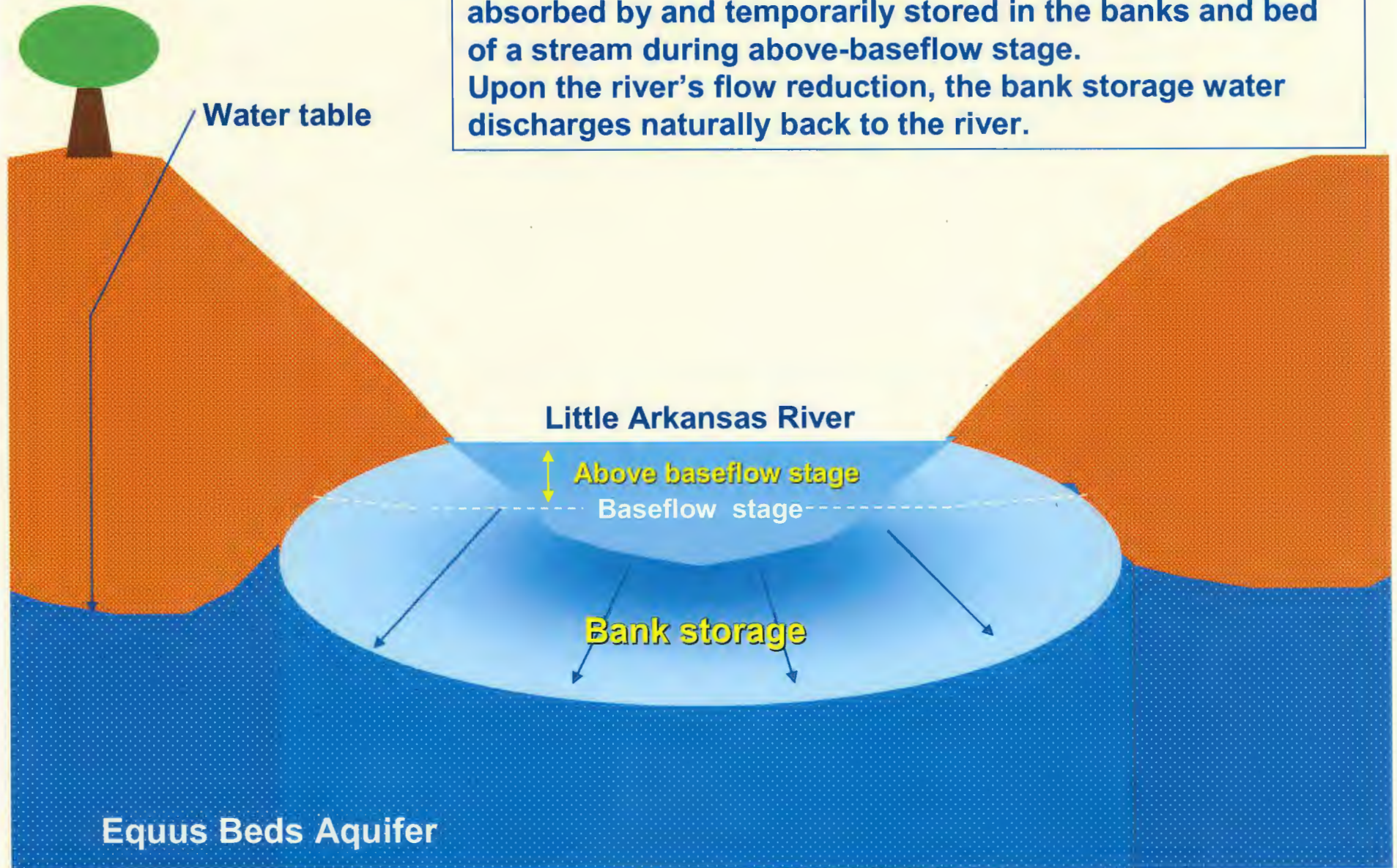
Figure 3. – Application Nos. 45569-45575 Site Map - 08-23S-2W
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Generalized cross section of the Equus Beds aquifer discharging (baseflow) to the rivers. Annual baseflow is approximately 6.5 billion gallons.

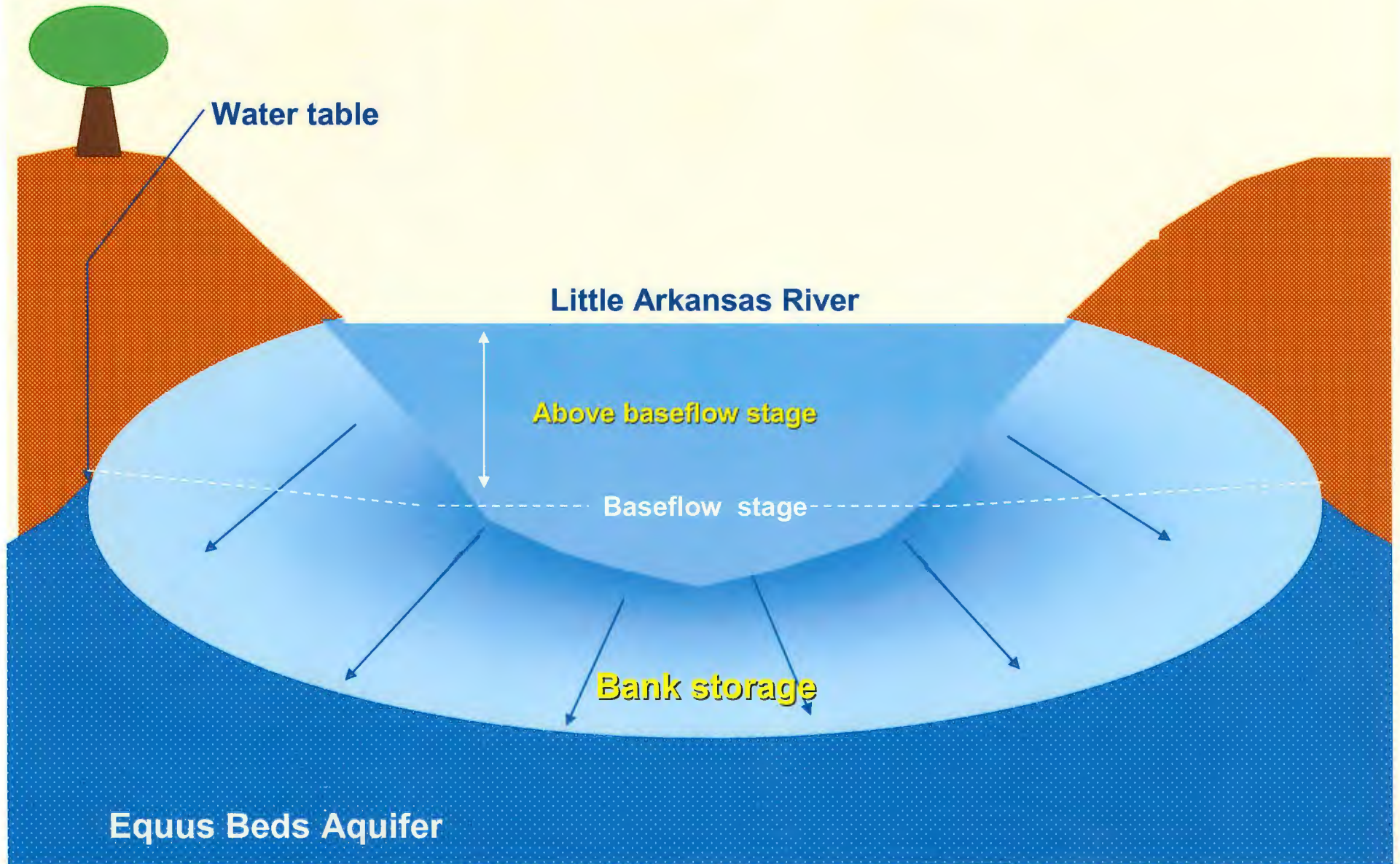


Aquifer Storage and Recovery Project - ASR

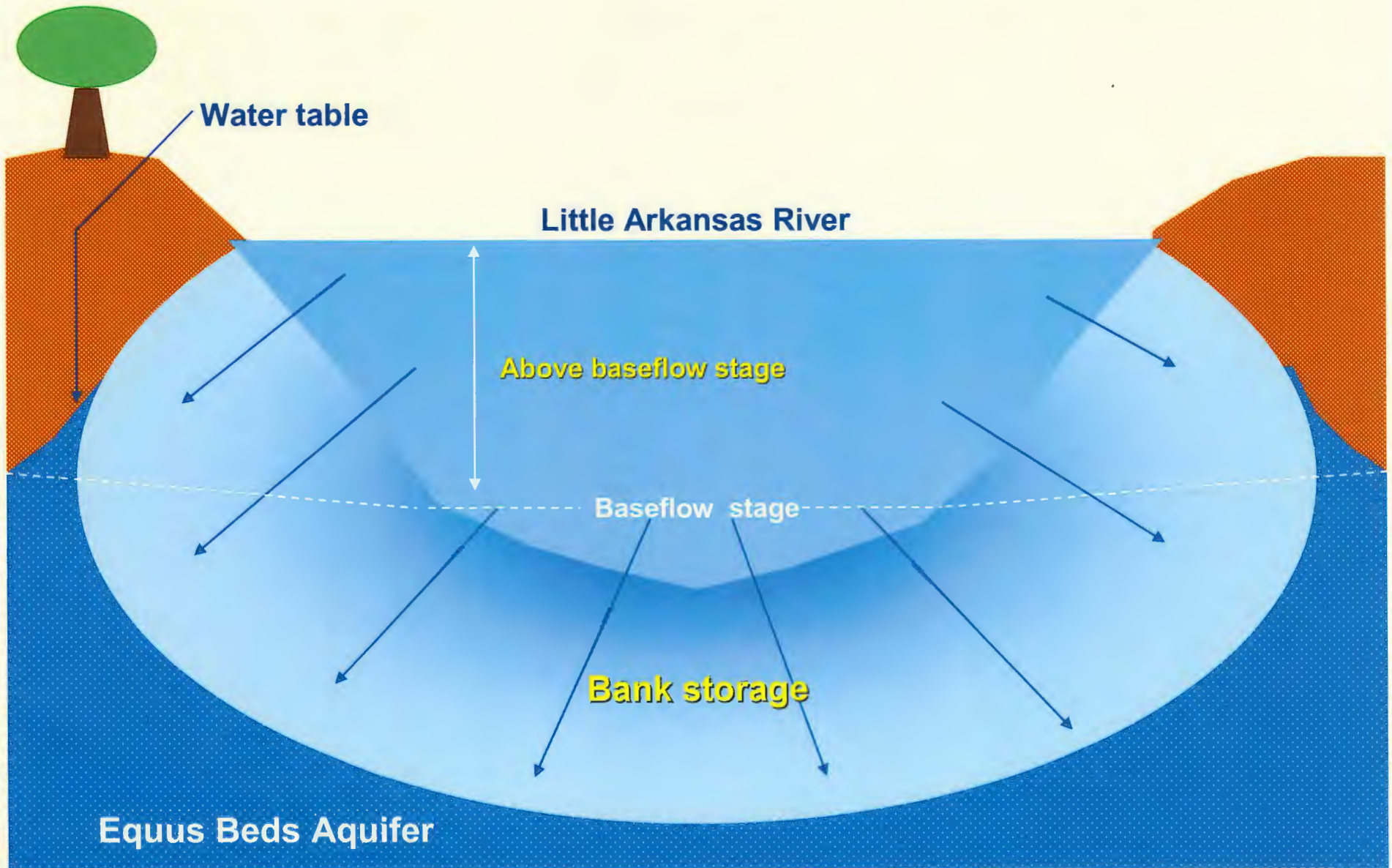
Bank storage by definition K.A.R. 5-1-1(i), means water absorbed by and temporarily stored in the banks and bed of a stream during above-baseflow stage. Upon the river's flow reduction, the bank storage water discharges naturally back to the river.



Aquifer Storage and Recovery Project - ASR

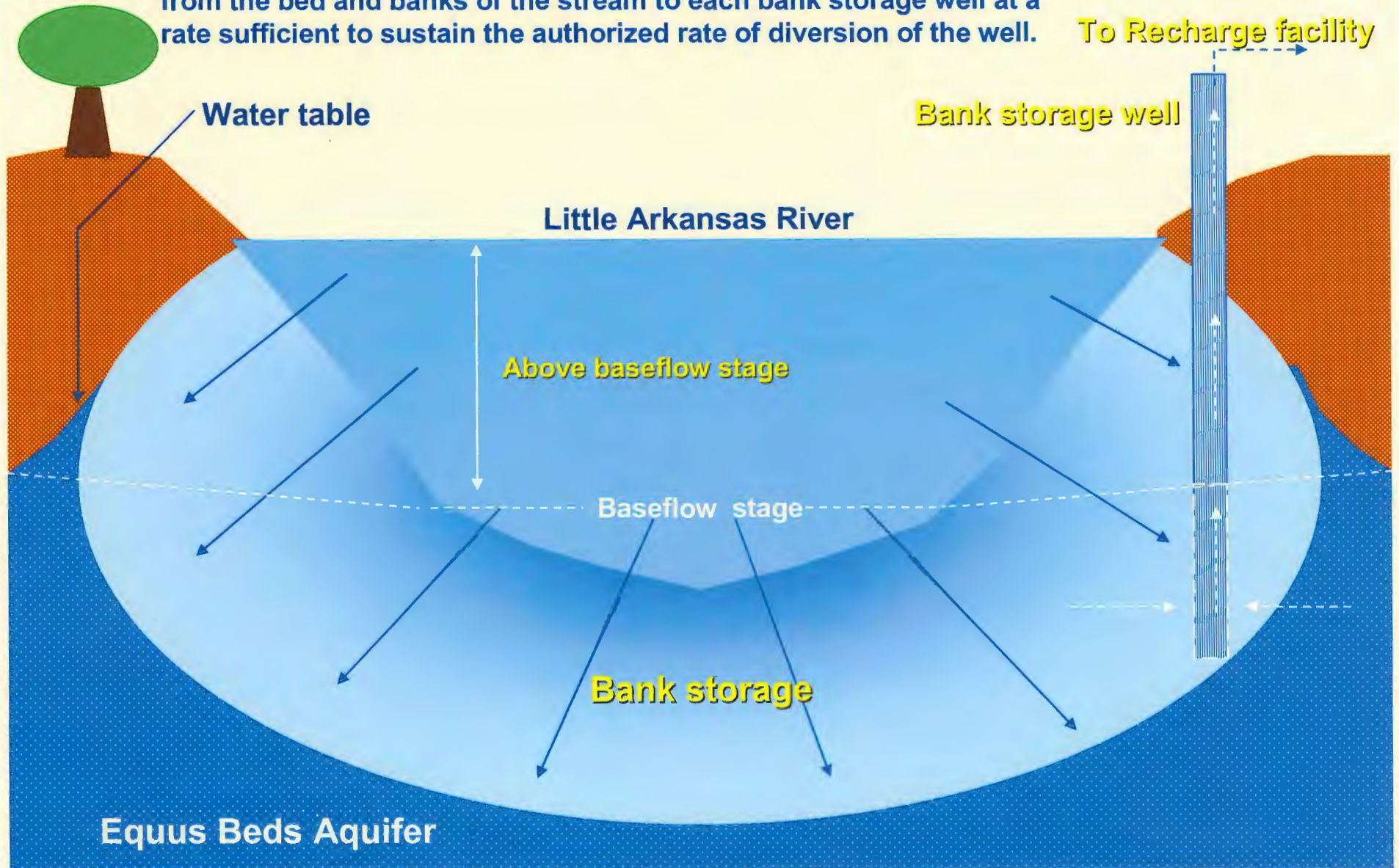


Aquifer Storage and Recovery Project - ASR



Aquifer Storage and Recovery Project - ASR

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.

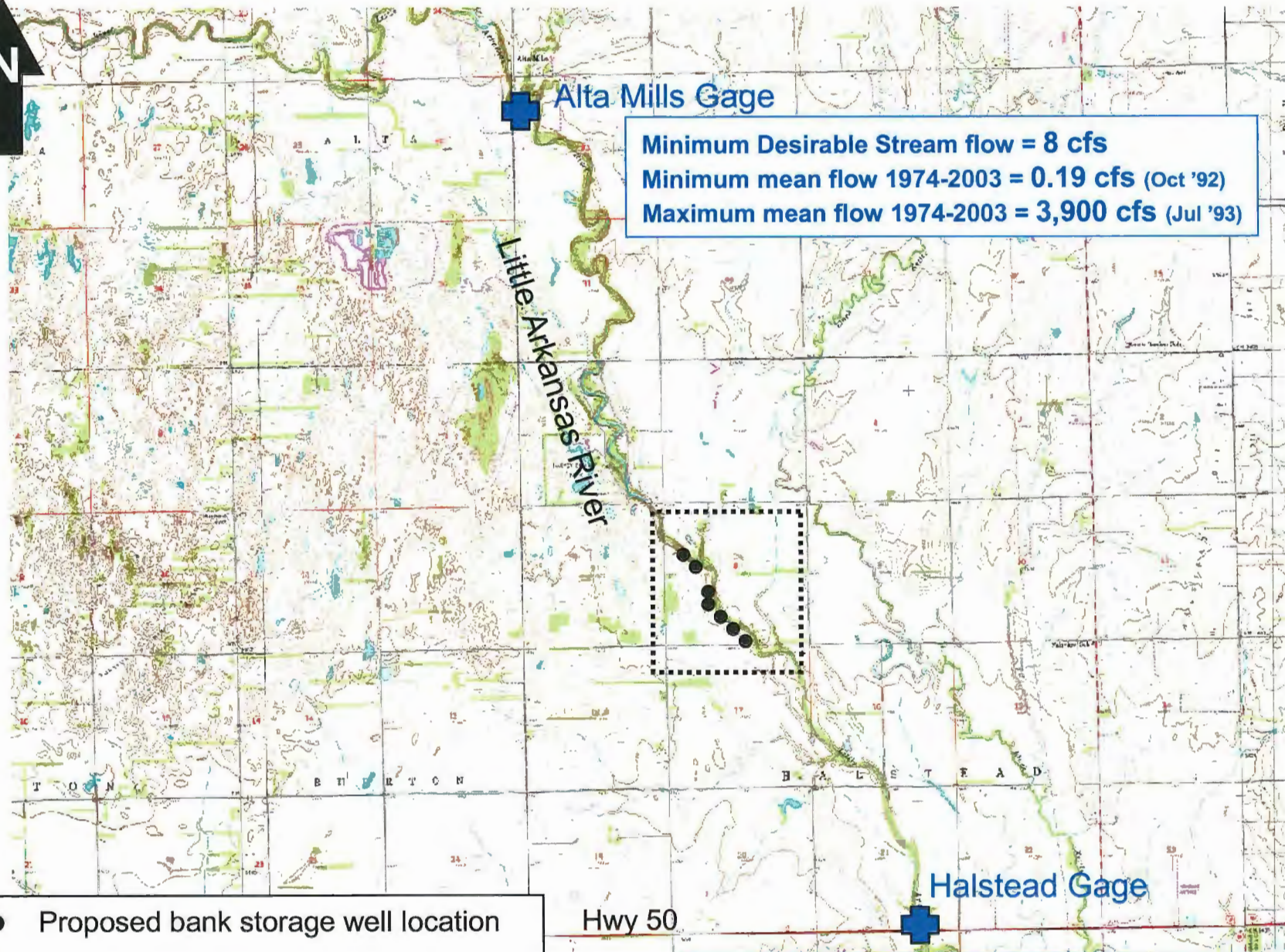


Reference No.: 959087
Date: 10/28/97
Location: withdrawal well
SE-SE-NE 34-23S-2W
Harvey County
View Direction: Northwest
Image By: D. Koci
Image Source: Equus Beds GMD2



The proposed use of water is 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.**



Alta Mills Gage

Minimum Desirable Stream flow = 8 cfs
Minimum mean flow 1974-2003 = 0.19 cfs (Oct '92)
Maximum mean flow 1974-2003 = 3,900 cfs (Jul '93)

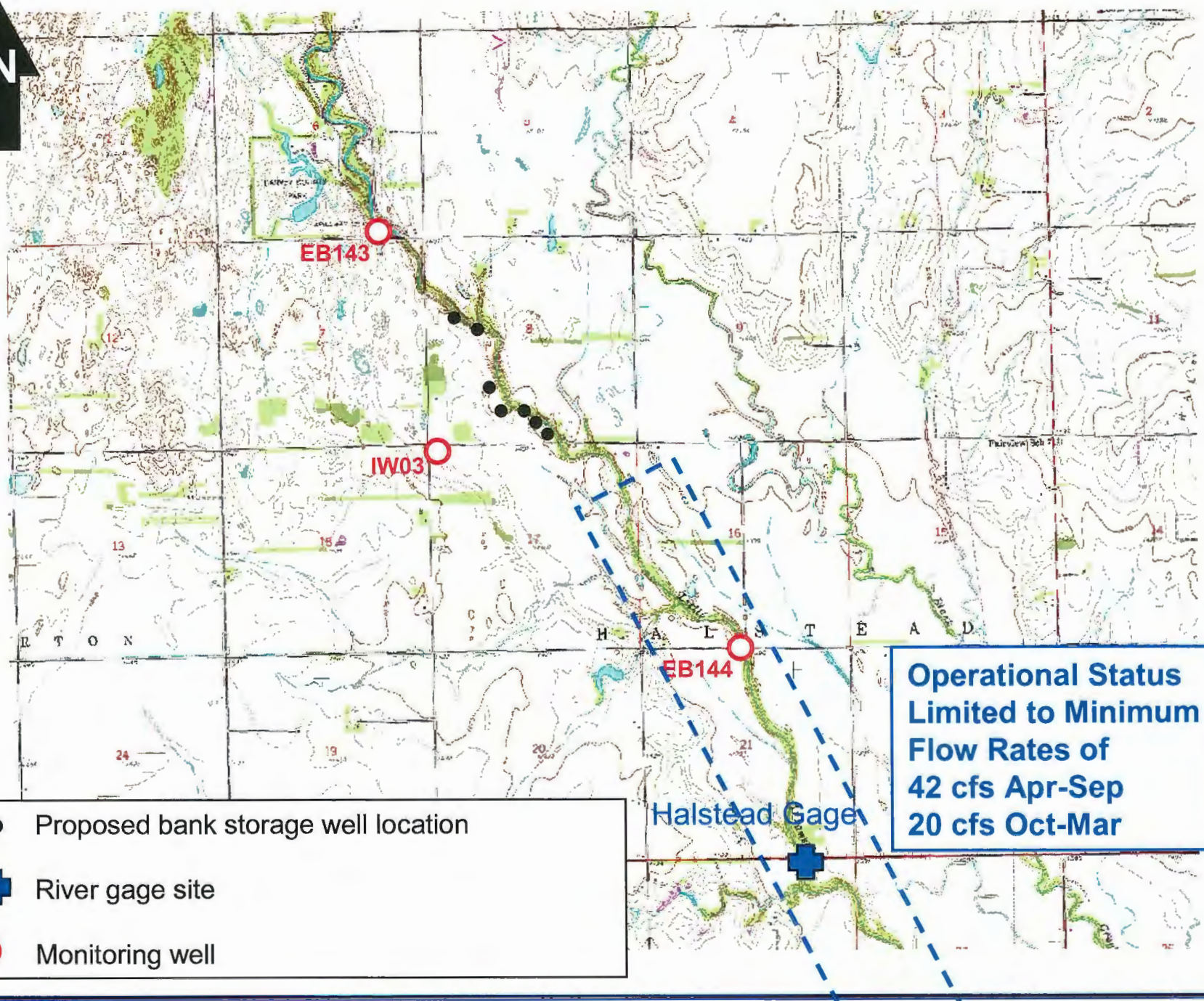
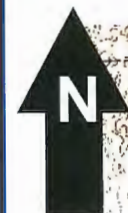
Little Arkansas River

Hwy 50

Halstead Gage

- Proposed bank storage well location
- ⊕ River gage site

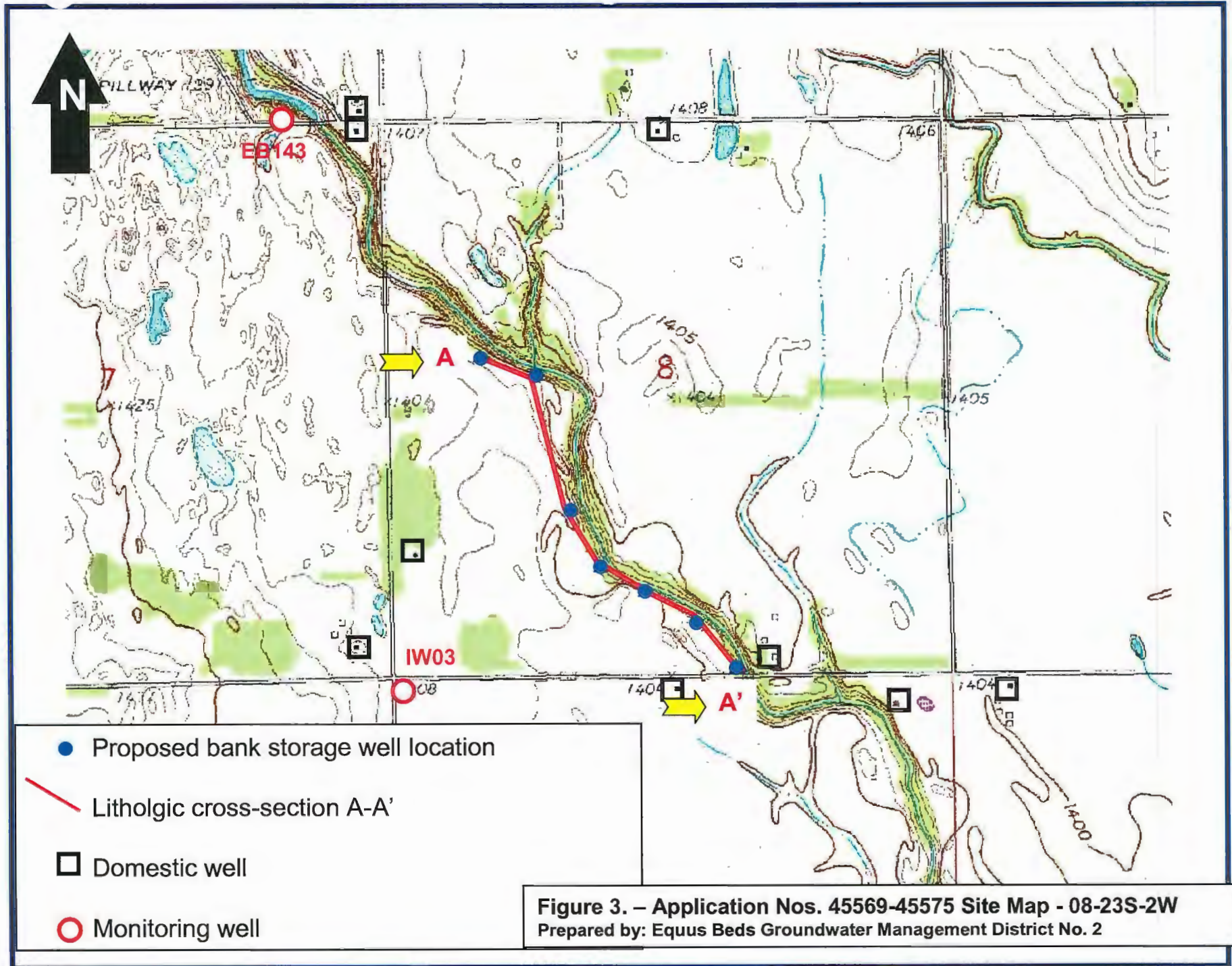
Minimum mean flow 1996-2003 = 4.78 cfs (Sep '02)
Maximum mean flow 1996-2003 = 1,818 cfs (Nov '99)



- Proposed bank storage well location
- ⊕ River gage site
- Monitoring well

**Operational Status
Limited to Minimum
Flow Rates of
42 cfs Apr-Sep
20 cfs Oct-Mar**

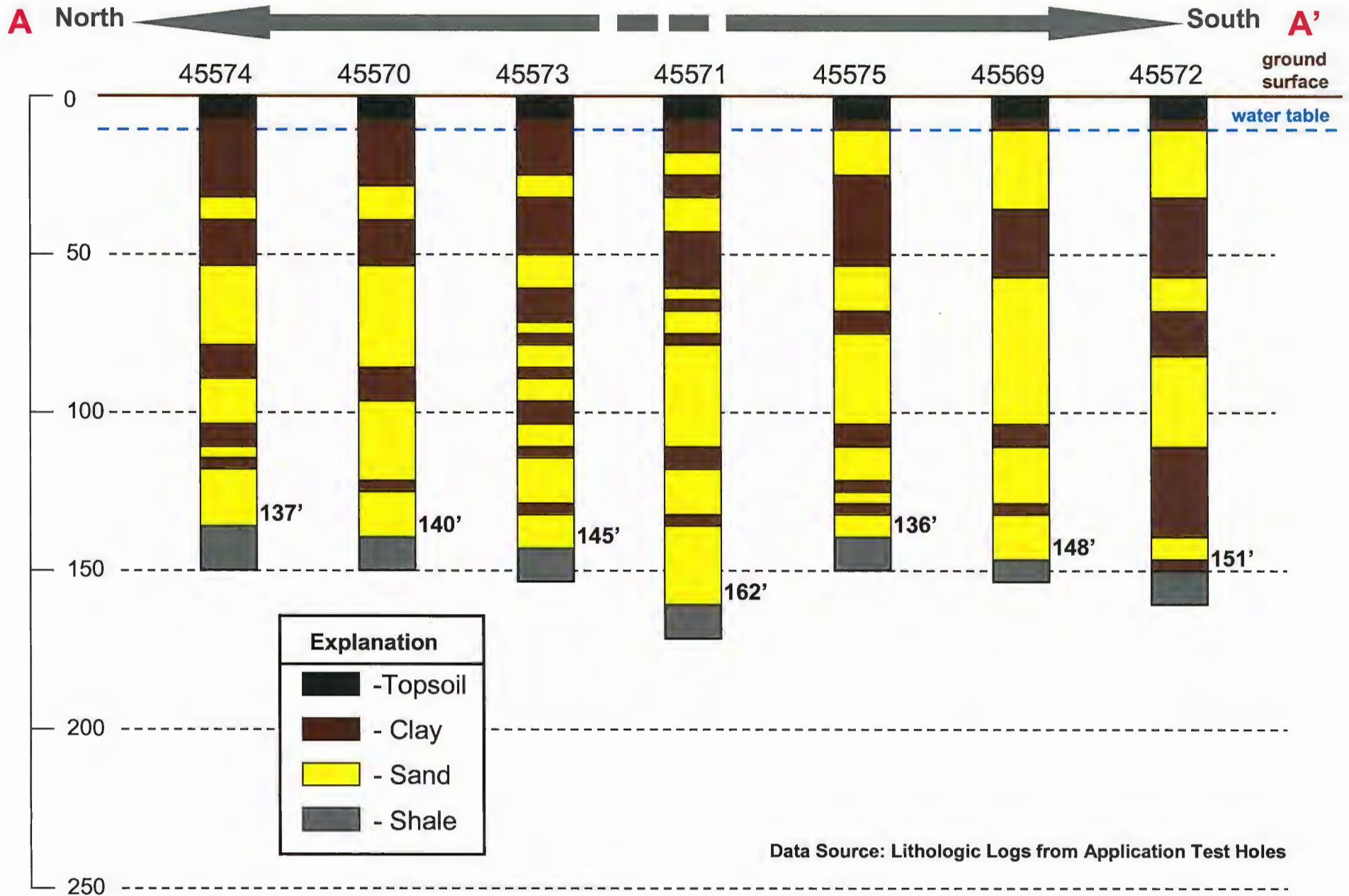
Halstead Gage



- Proposed bank storage well location
- Lithologic cross-section A-A'
- Domestic well
- Monitoring well

Figure 3. – Application Nos. 45569-45575 Site Map - 08-23S-2W
 Prepared by: Equus Beds Groundwater Management District No. 2

Generalized Lithology of Equus Beds Aquifer at Bank Storage Withdrawal Site, Sec. 8, T23S, R2W



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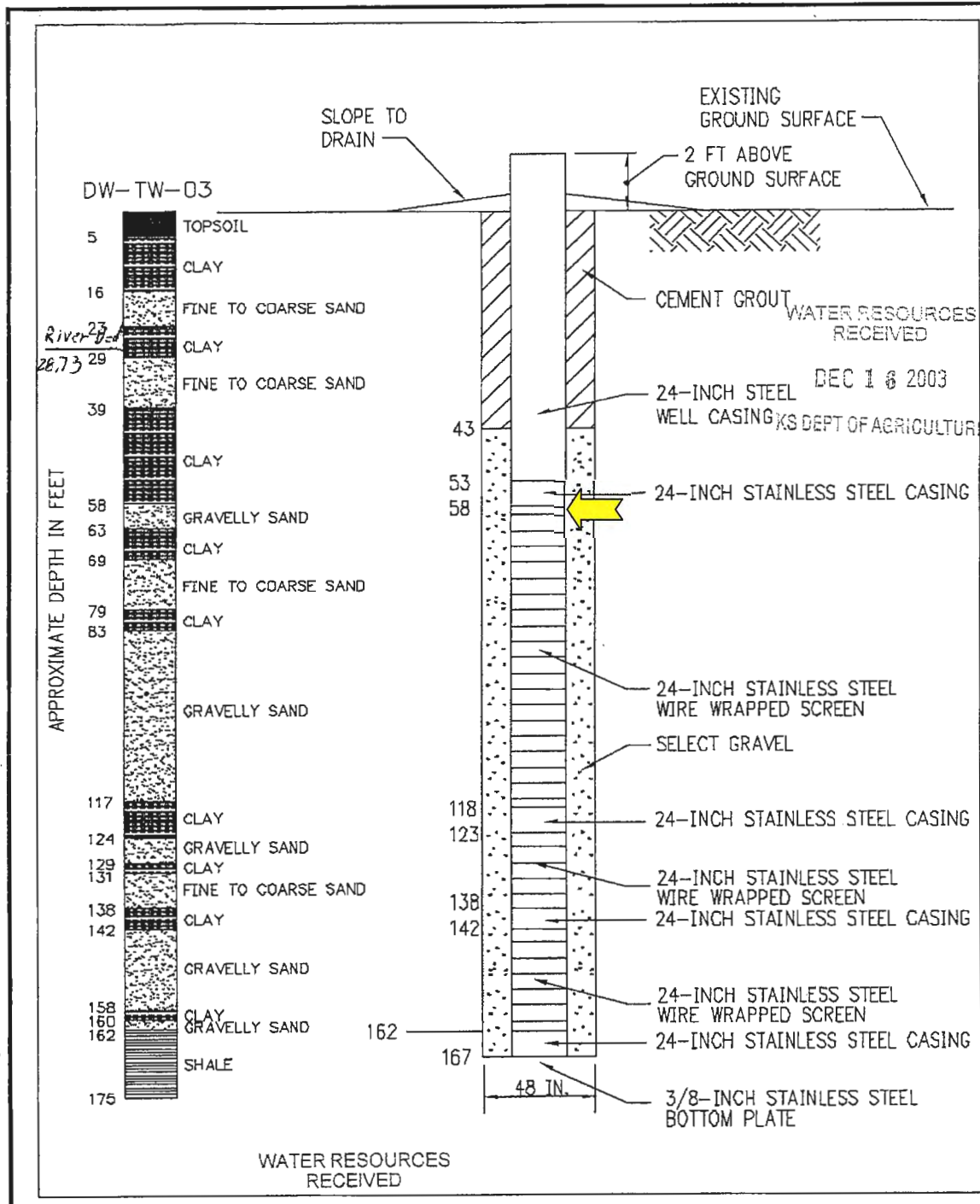
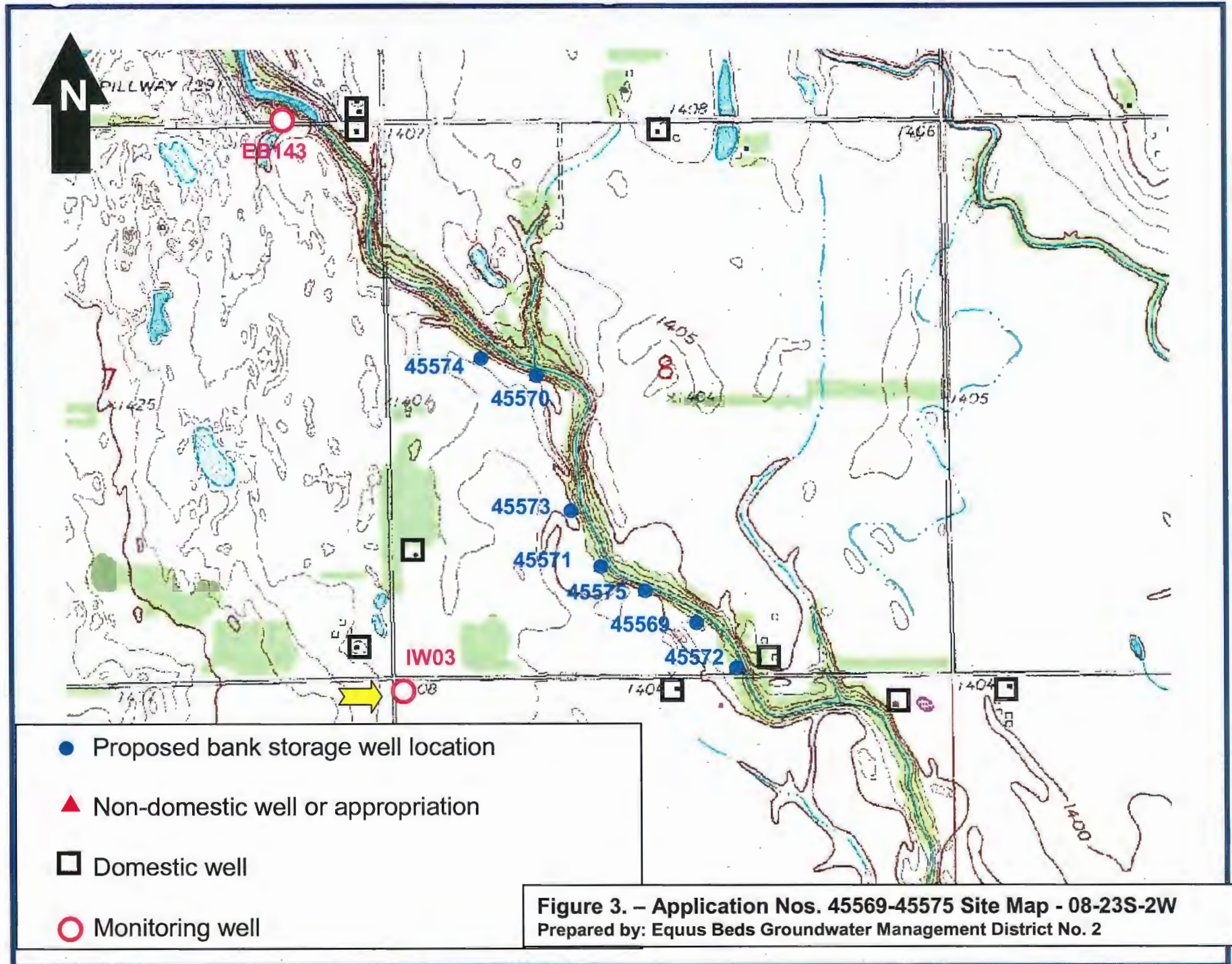
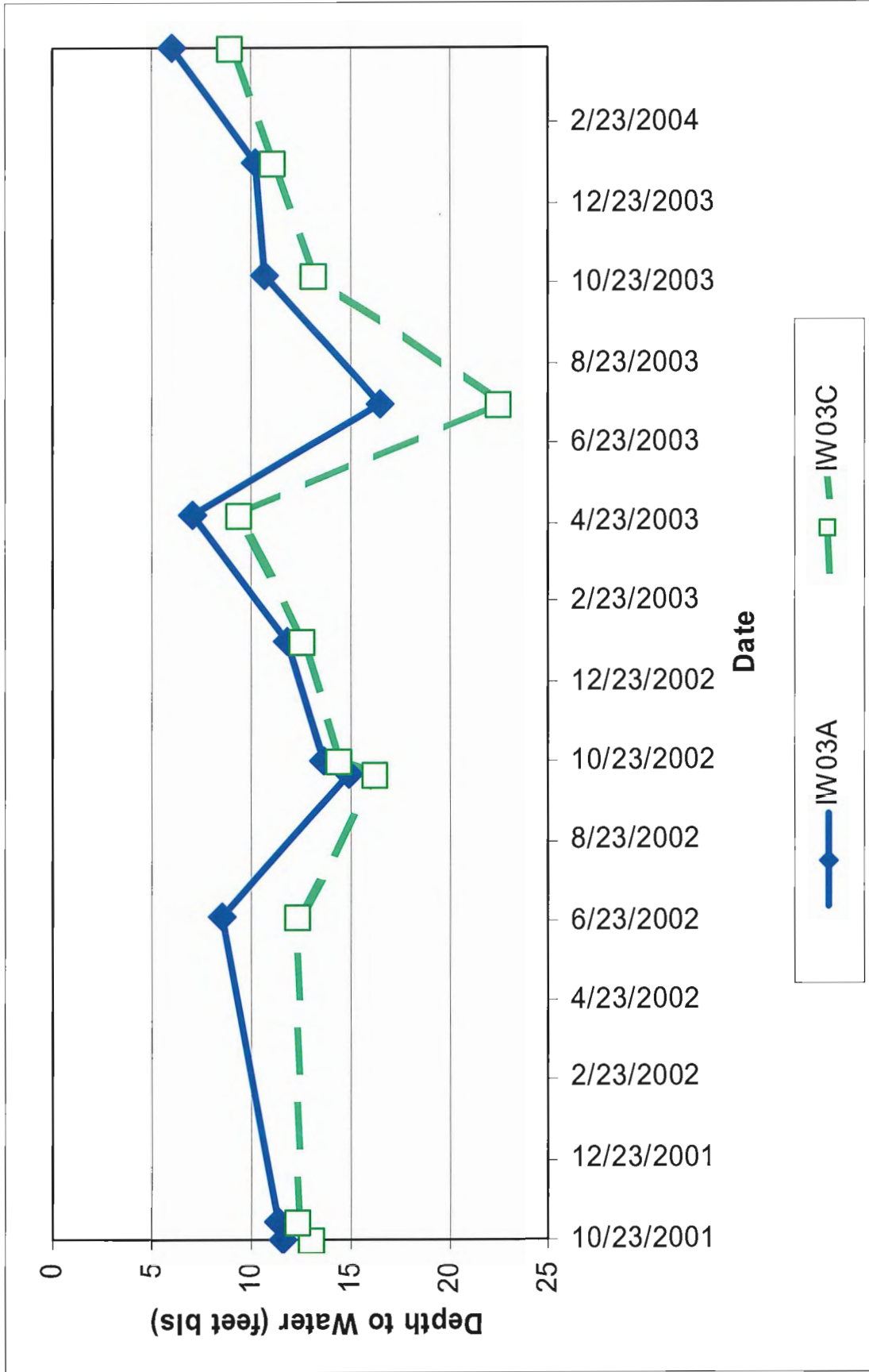


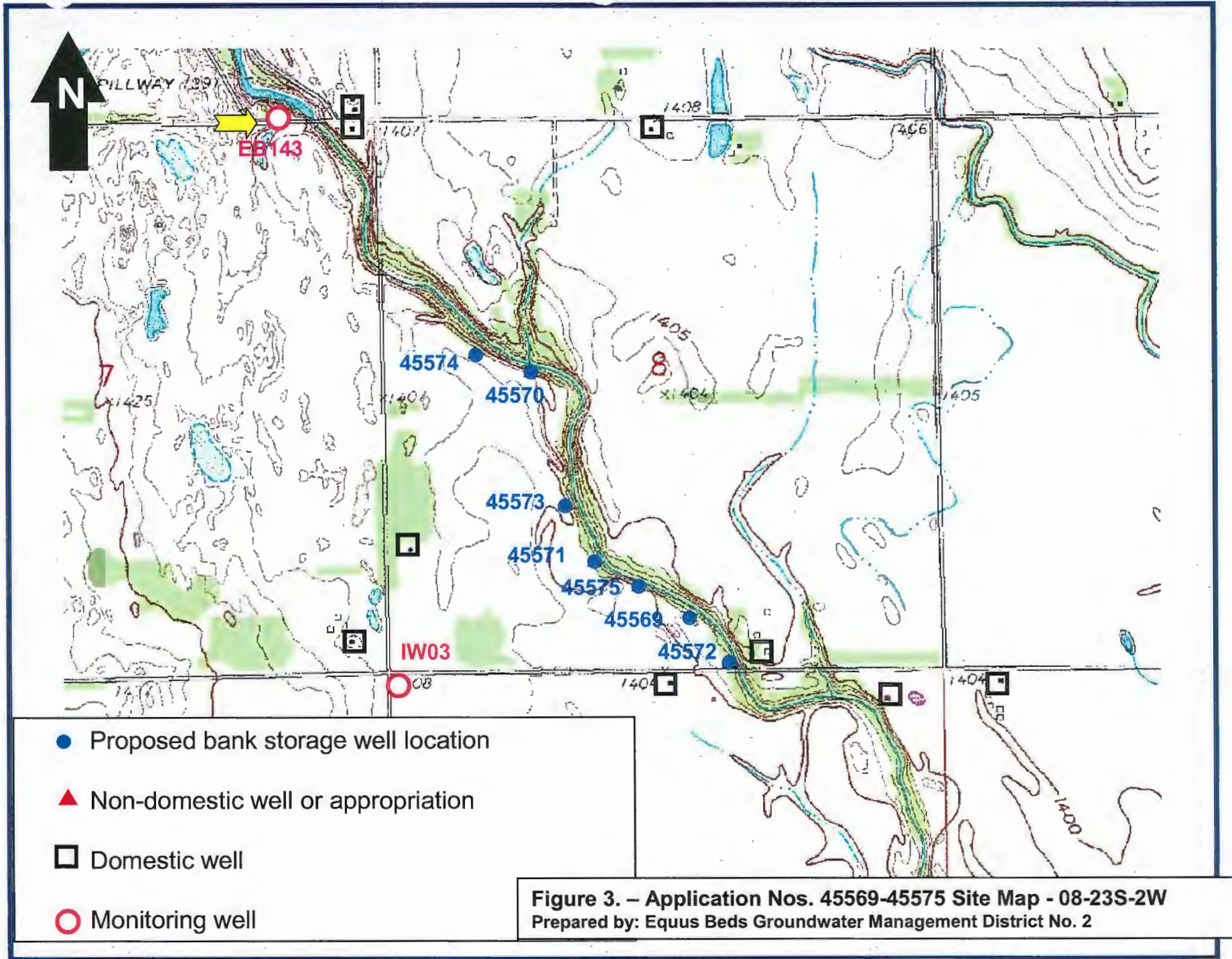
Figure 4. – Example of Lithologic Log and Construction Design for Bank Storage Well



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



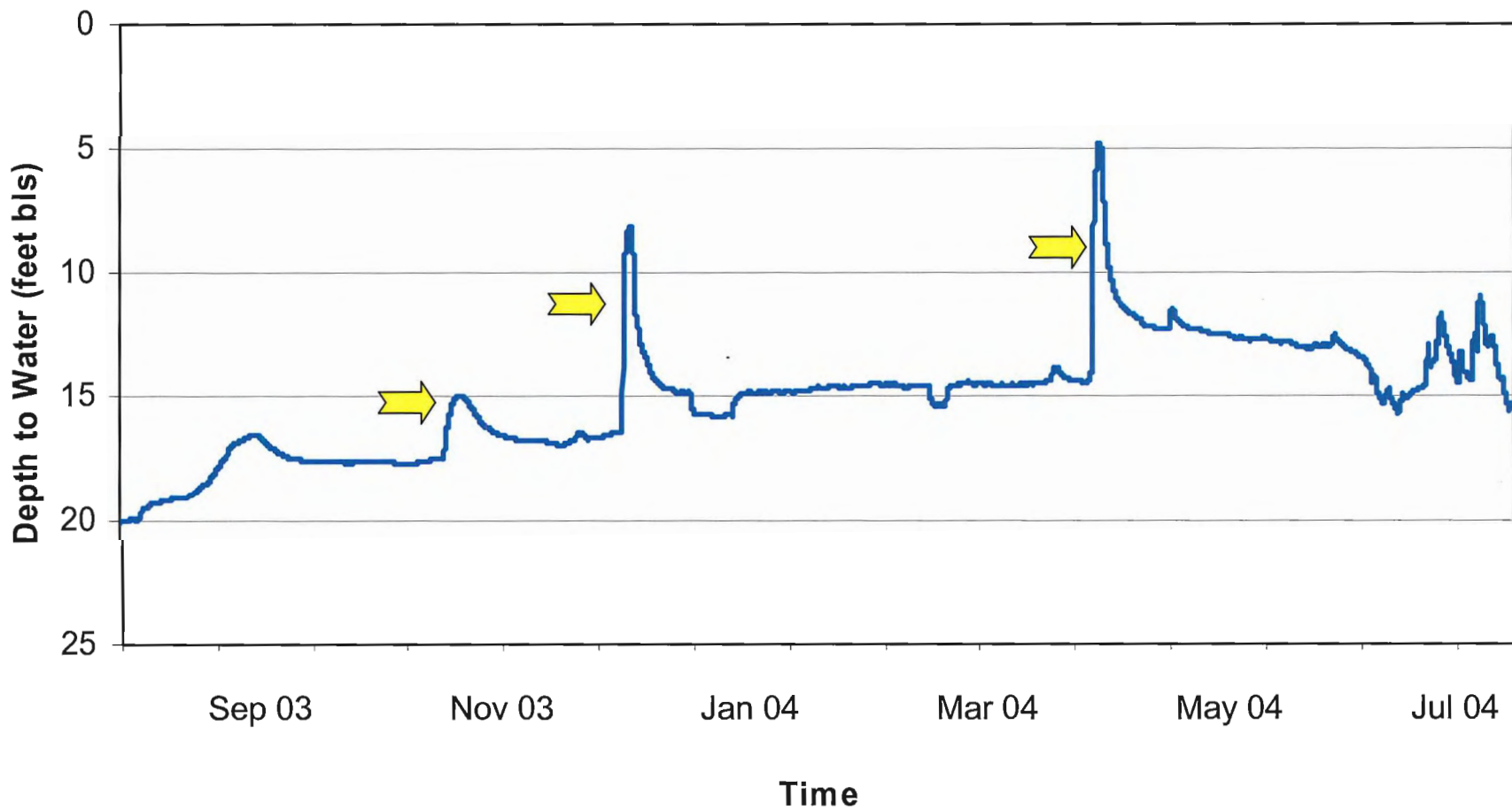
IW03A Depth – 34 feet
 IW03C Depth – 138 feet



- Proposed bank storage well location
- ▲ Non-domestic well or appropriation
- Domestic well
- Monitoring well

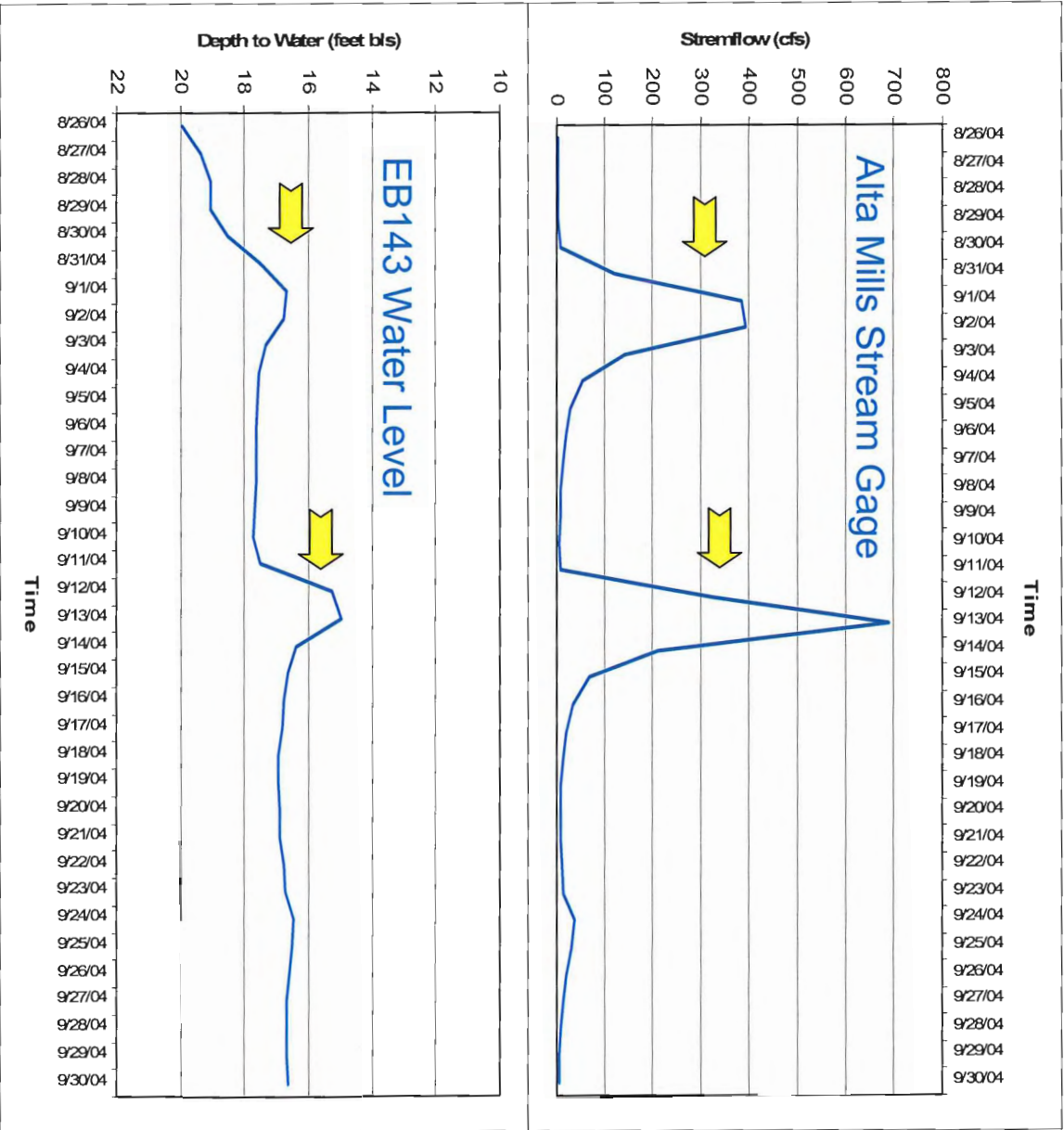
Figure 3. – Application Nos. 45569-45575 Site Map - 08-23S-2W
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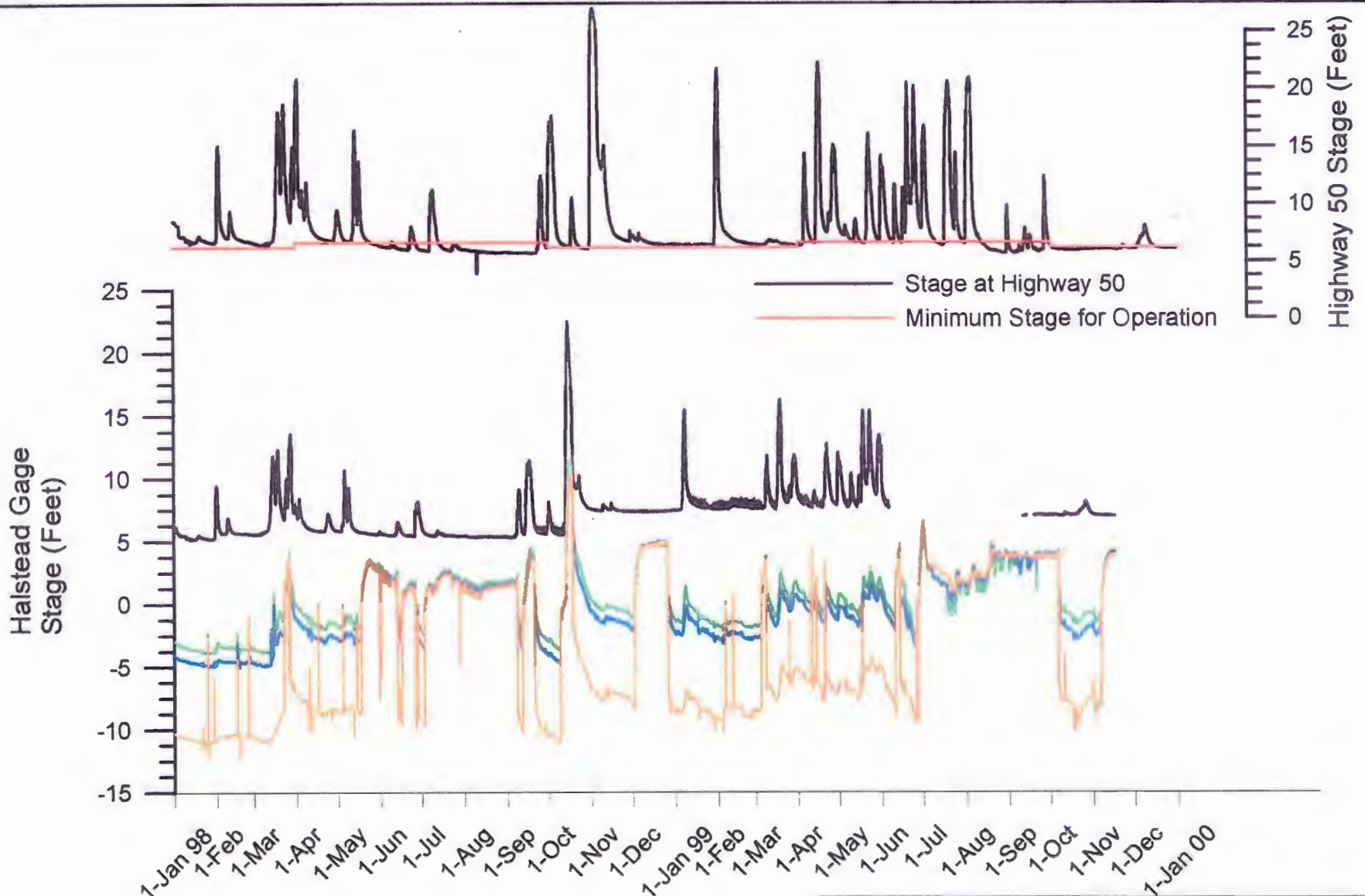
EB143 Hydrograph, August 2003-July 2004



EB143A Depth – 59 feet

Water Table/Stream Flow Comparison Graph



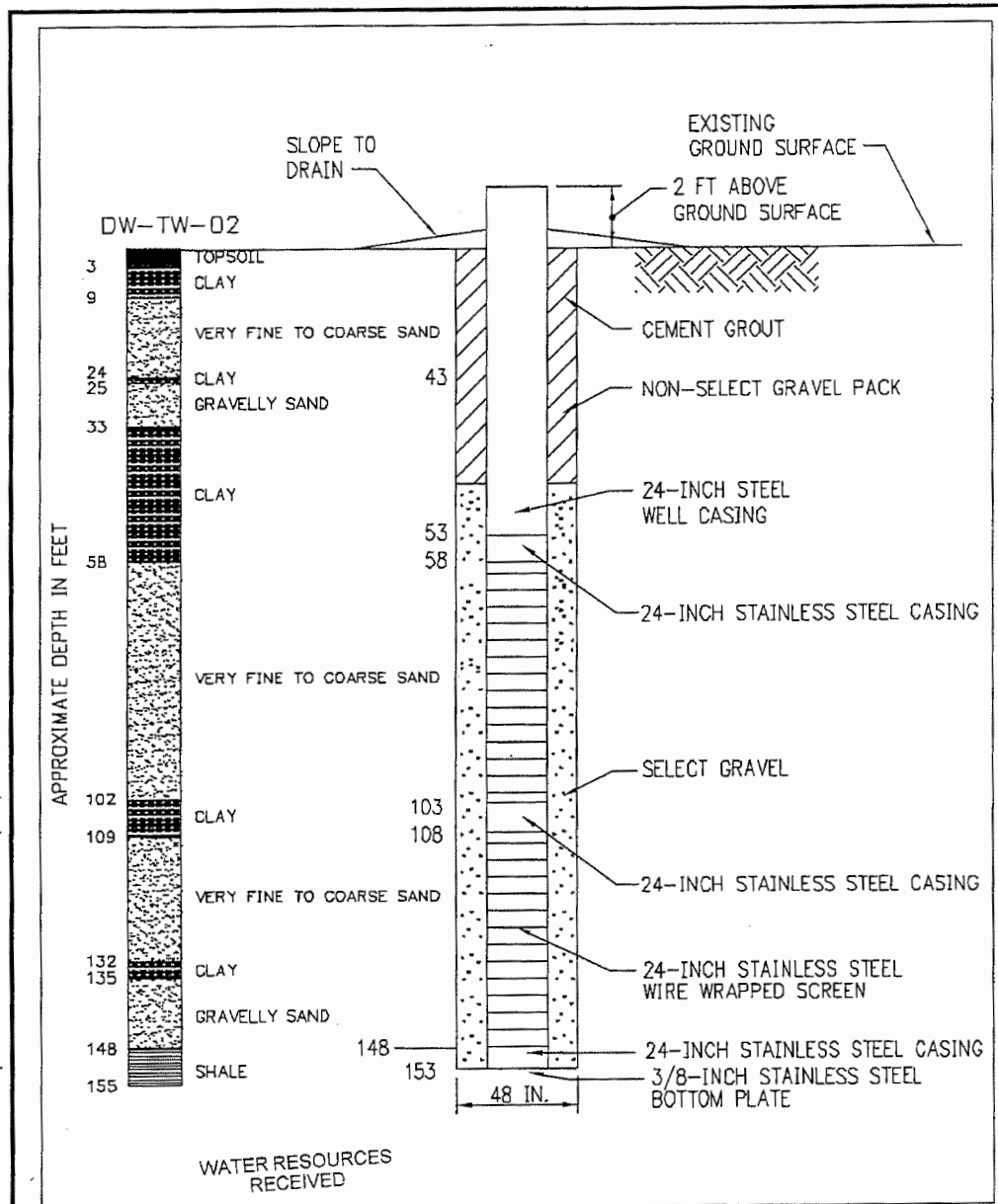


- Stage at Highway 50
- Minimum Stage for Operation
- Stage at Halstead
- Test Well 2 (Shallow)
- Test Well 3 (Shallow)
- Test Well 6 (Deep)



Figure I-36
 RIVER STAGE AND
 GROUNDWATER LEVELS AT
 DIVERSION (TEST) WELL SITE
 NEAR HALSTEAD

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JUL 03 2003

KS DEPT OF AGRICULTURE
 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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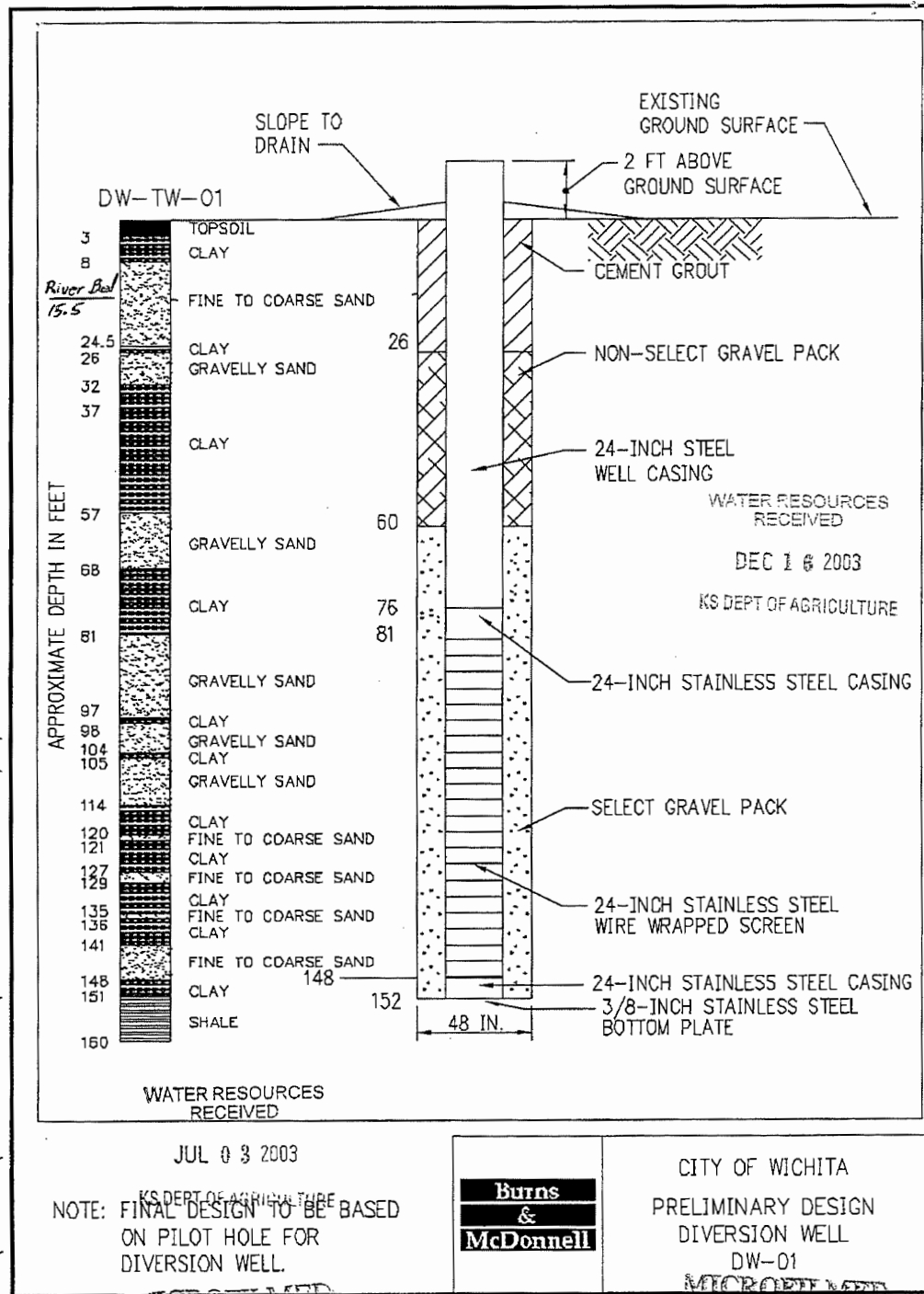
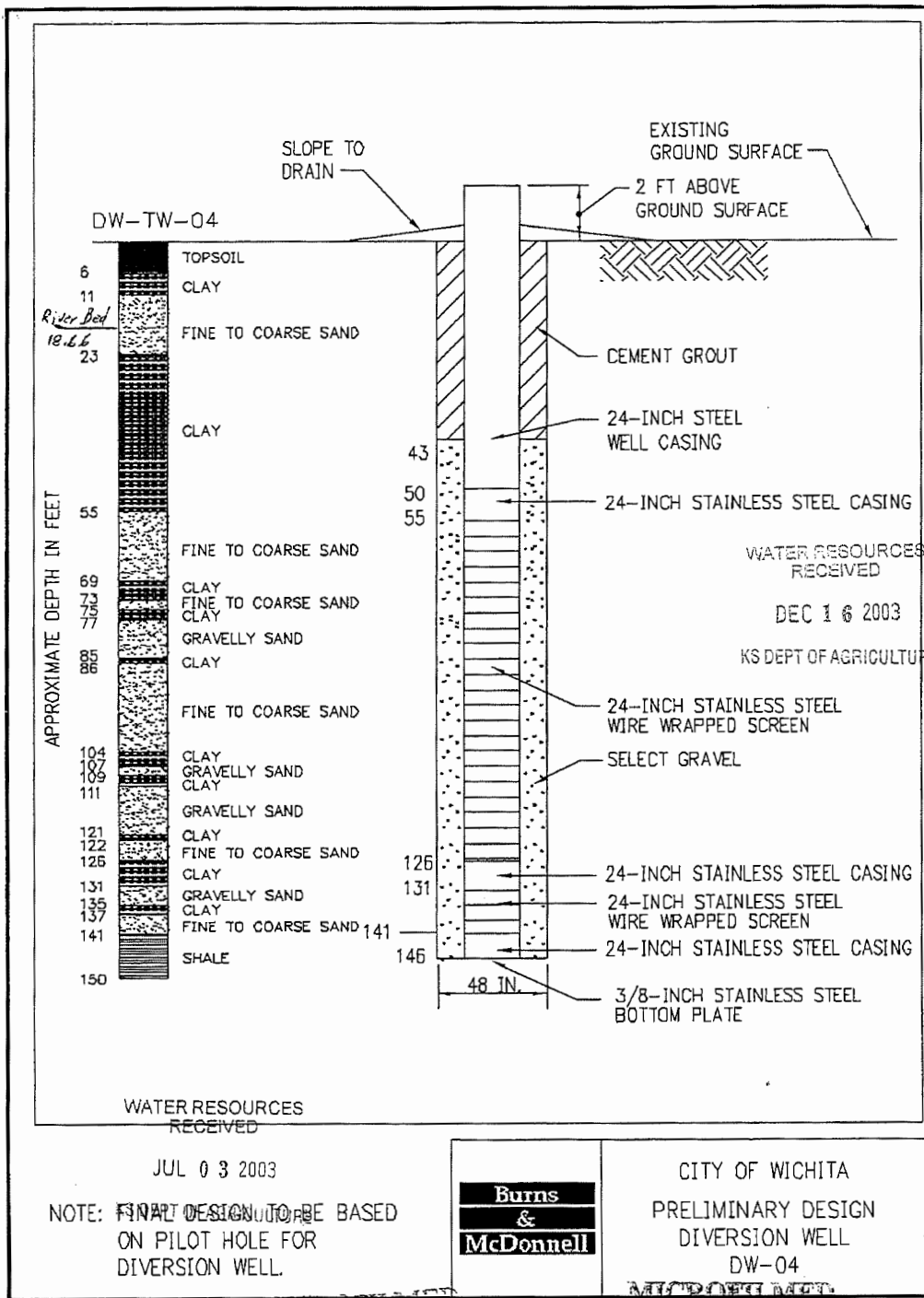


Figure 4. – Application No. 45572 Lithologic Log and Construction Design for Bank Storage Well

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MICROFILMED

MICROFILMED

STAFF RECOMMENDATIONS:

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

- 1. the withdrawal wells are equipped with water meters 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 wells are positioned at locations within 300 feet of the centerline of the Little Arkansas River;**
- 4. The diverted bank storage water must comply with the source water regulation K.A.R. 5-1-1(sss);**

STAFF RECOMMENDATIONS:

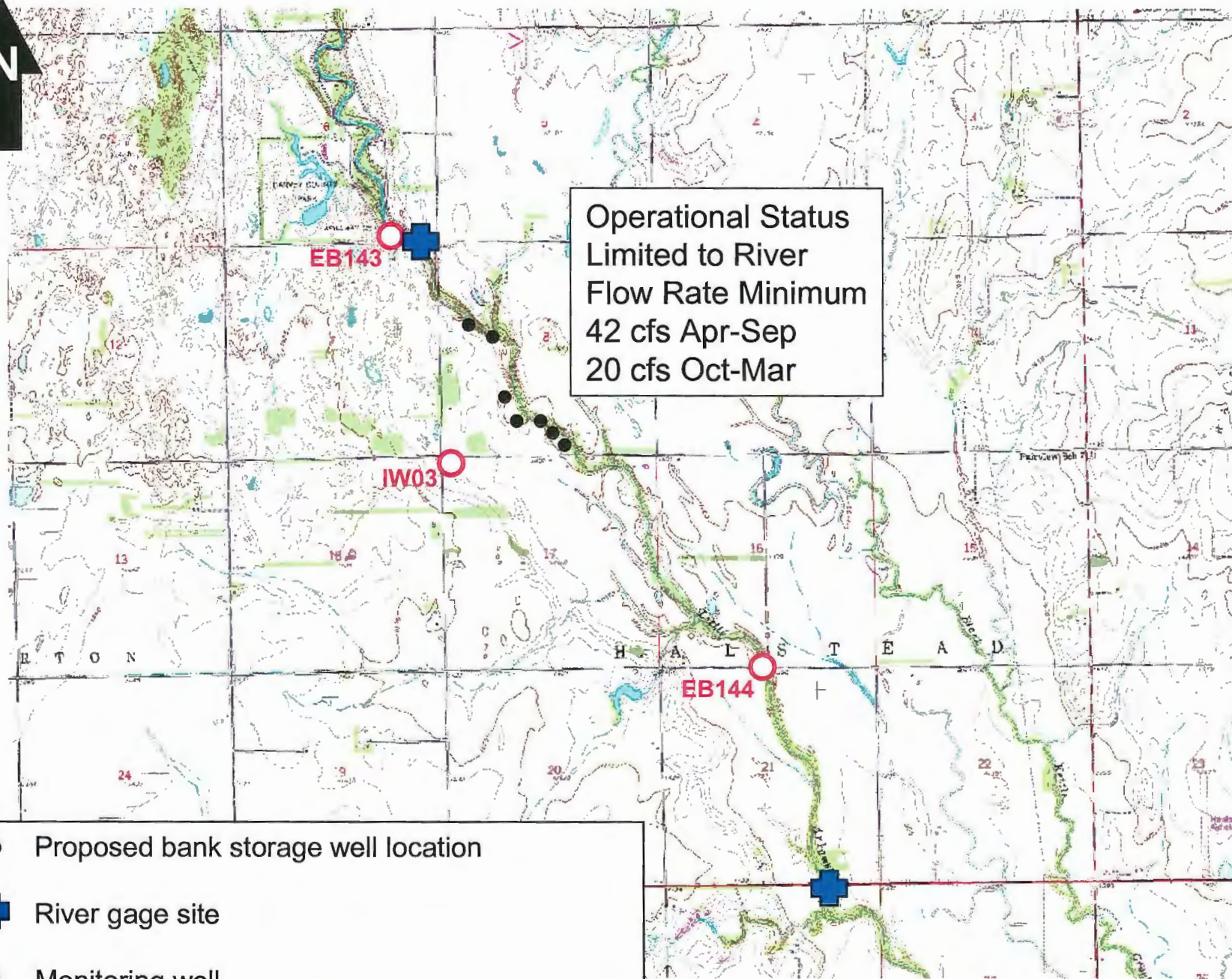
Based on data submitted by the applicant and District findings, staff recommends that the applications be approved subject to additional conditions that:

- 5. the withdrawal wells 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 wells or adjacent monitoring wells;**
- 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 42 cfs during the months of April through September;**

STAFF RECOMMENDATIONS:

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

- 7. streamflow data utilized to determine flow conditions and bank storage well utilization shall be collected from the USGS Halstead gage site located at Highway 50, and from an upstream gage site to be established under the same parameters as the Halstead gage site;**
- 8. the upstream streamflow gaging station shall be installed between one-half mile and one mile of the northernmost bank storage well (identified as DW-7);**



Operational Status
Limited to River
Flow Rate Minimum
42 cfs Apr-Sep
20 cfs Oct-Mar

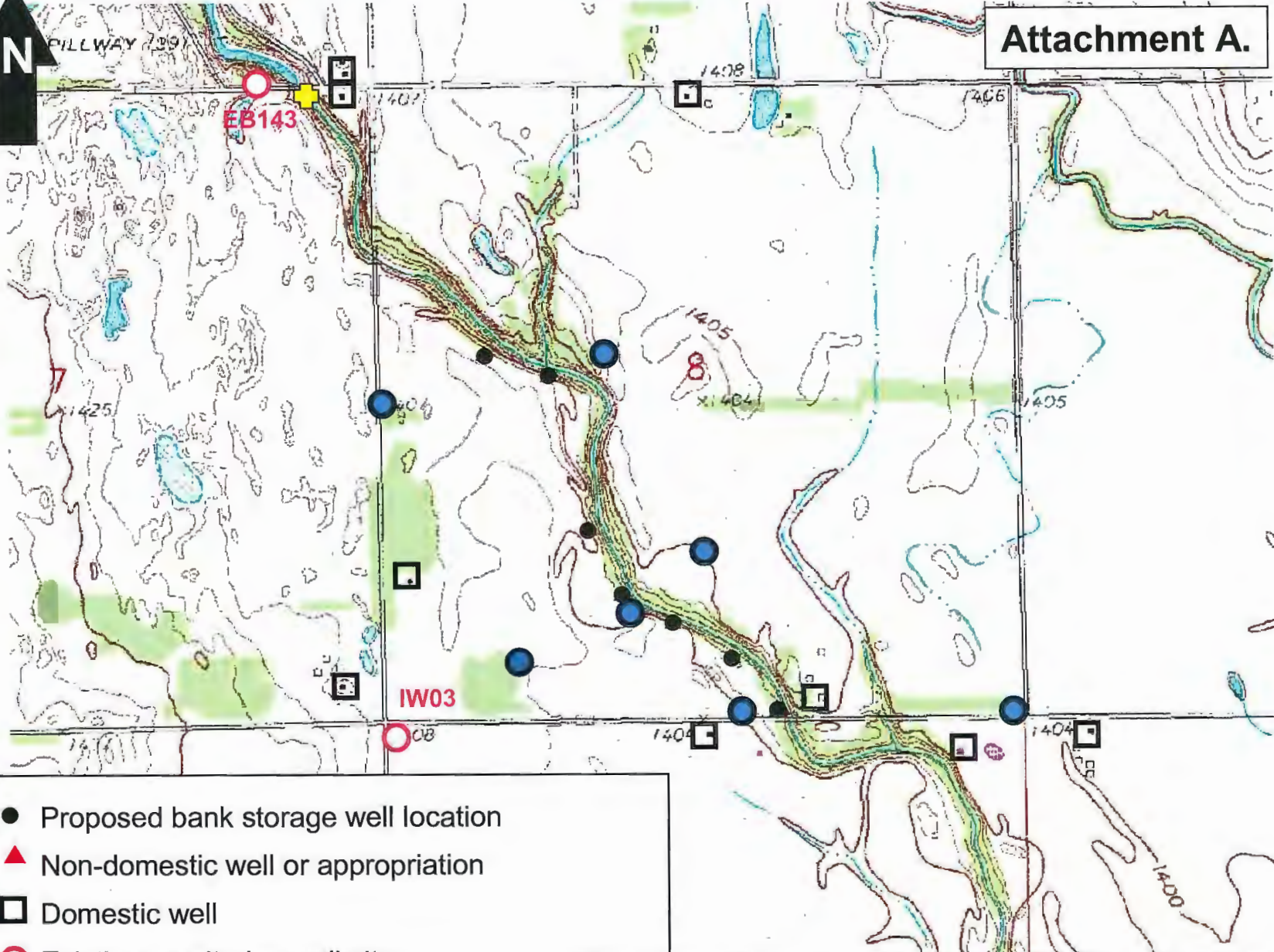
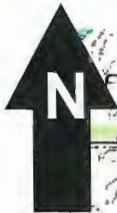
- Proposed bank storage well location
- ⊕ River gage site
- Monitoring well

STAFF RECOMMENDATIONS:

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

- 9. 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;**

Attachment A.



- Proposed bank storage well location
- ▲ Non-domestic well or appropriation
- Domestic well
- Existing monitoring well site
- Proposed monitoring well site

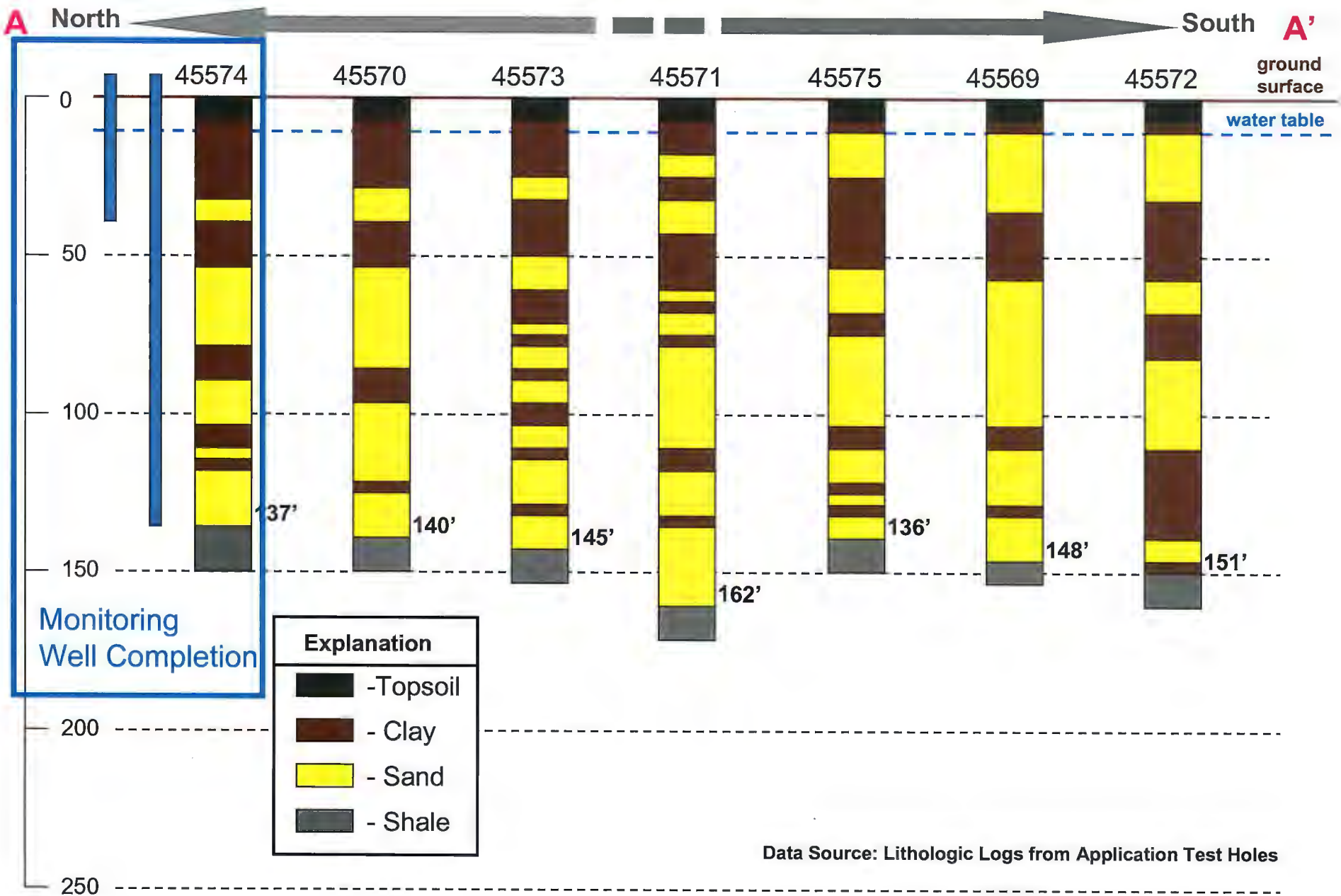
Attachment A. – Application No. 45570 Site Map - NW 08-23S-2W
Prepared by: Equus Beds Groundwater Management District No. 2 - 07/06/04

STAFF RECOMMENDATIONS:

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

- 10. 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;**

Generalized Lithology of Equus Beds Aquifer at Bank Storage Withdrawal Site, Sec. 8, T23S, R2W



STAFF RECOMMENDATIONS:

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

- 11. water quality analyses shall be completed 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;**
- 12. the quality of surface water induced into the river bank shall not degrade the ambient groundwater quality in the bank storage withdrawal area;**

STAFF RECOMMENDATIONS:

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

- 13. storage water shall meet or exceed the minimum drinking water standards specified by the Kansas Department of Health and Environment for artificial recharge;**
- 14. 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;**
- 15. 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;**

STAFF RECOMMENDATIONS:

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

- 16. 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;**
- 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;**

STAFF RECOMMENDATIONS:

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

- 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;**
- 19. the maximum pumping rate for each proposed point of diversion be limited to 1200 GPM;**

STAFF RECOMMENDATIONS:

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

20. the well shall not be operated during baseflow conditions, and operation of the bank storage wells shall be subject to the following flow conditions and plan:

River Flow (cfs)		Maximum Number of Wells Operating	Bank Storage Well Withdrawal Rate (cfs)
Apr-Sep	Oct-Mar		
44.67	22.67	1	2.67
47.35	25.35	2	5.35
50.02	28.02	3	8.02
52.70	30.70	4	10.70
55.37	33.37	5	13.37
58.04	36.04	6	16.04
60.72	38.72	7	18.72

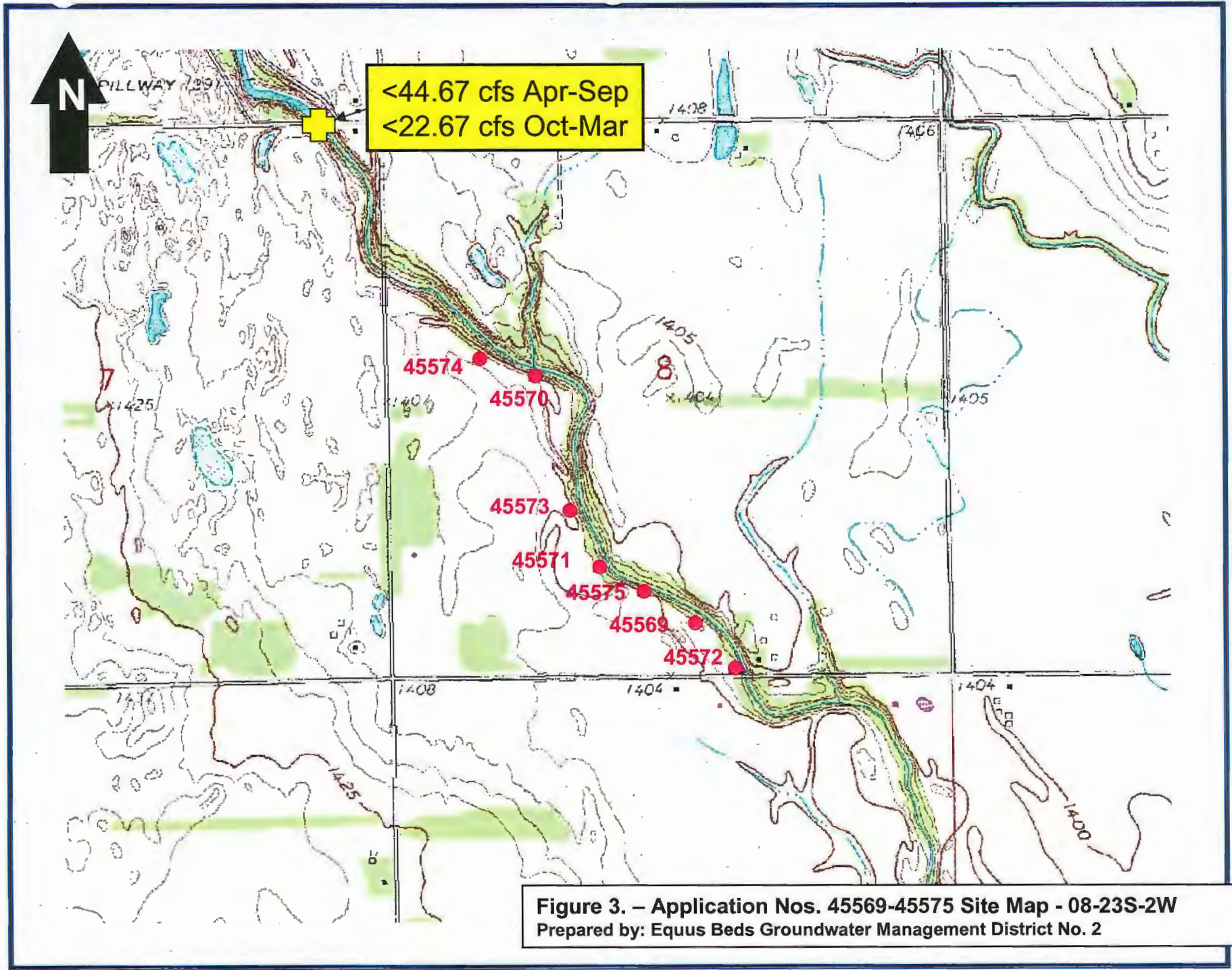
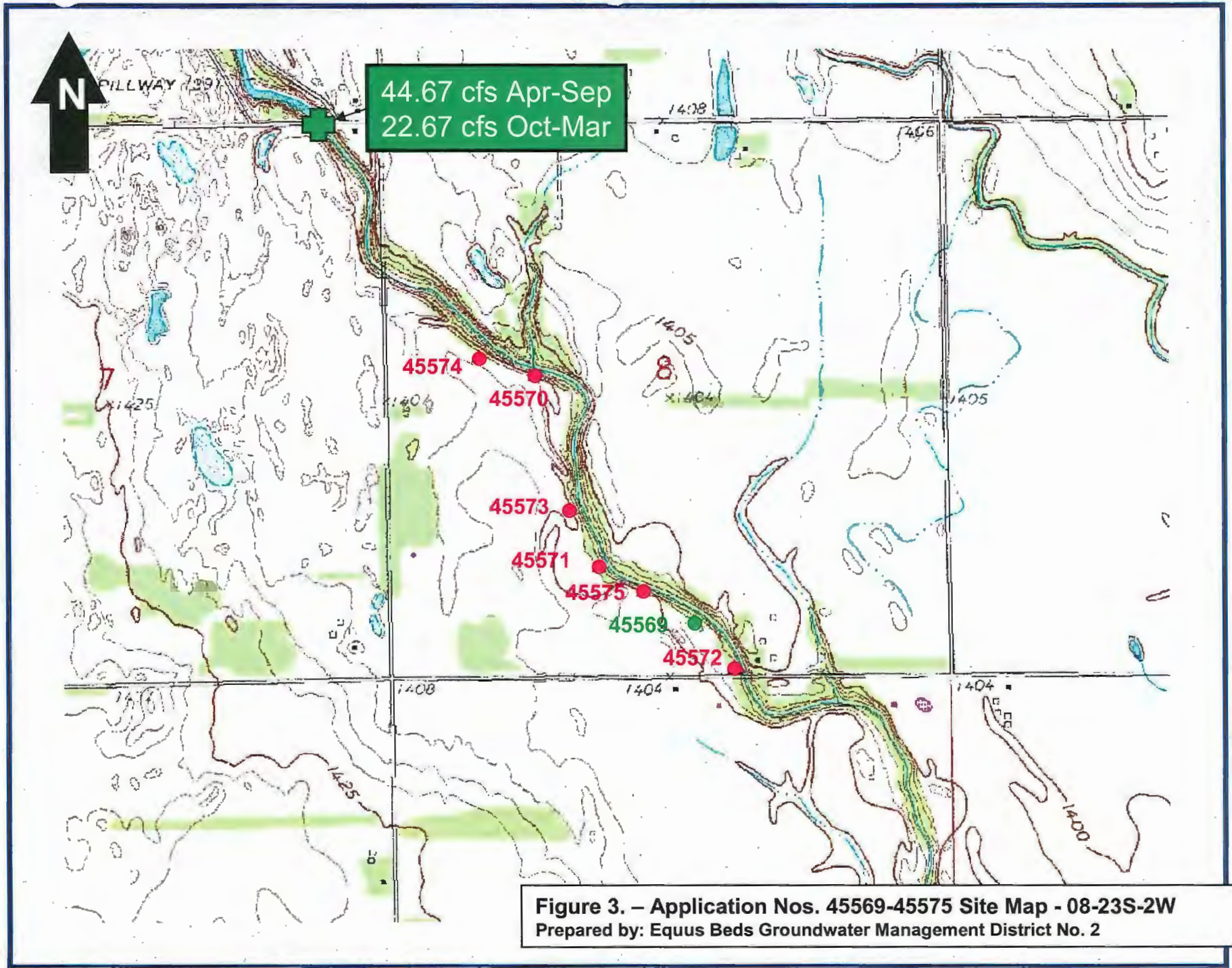


Figure 3. – Application Nos. 45569-45575 Site Map - 08-23S-2W
Prepared by: Equus Beds Groundwater Management District No. 2



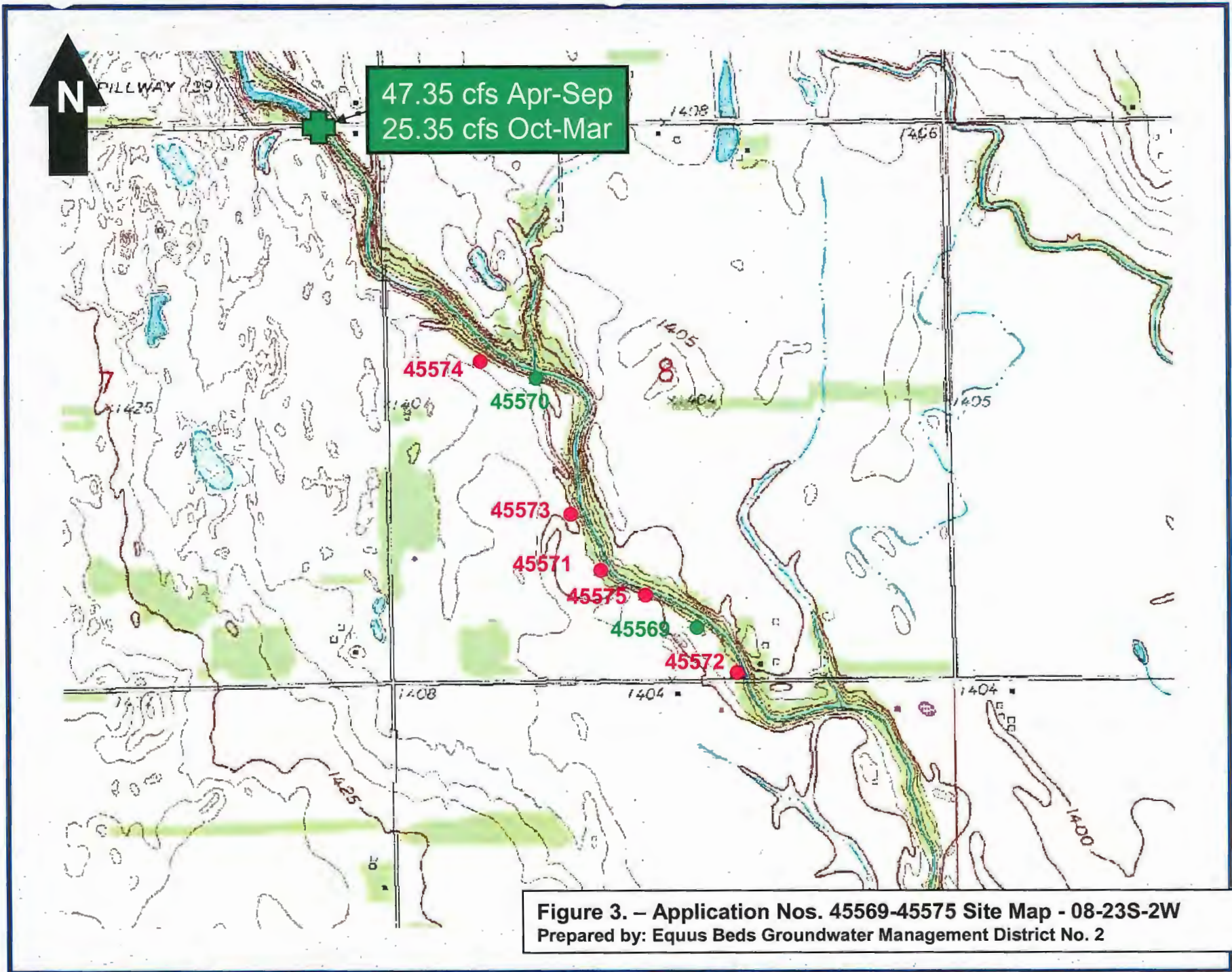


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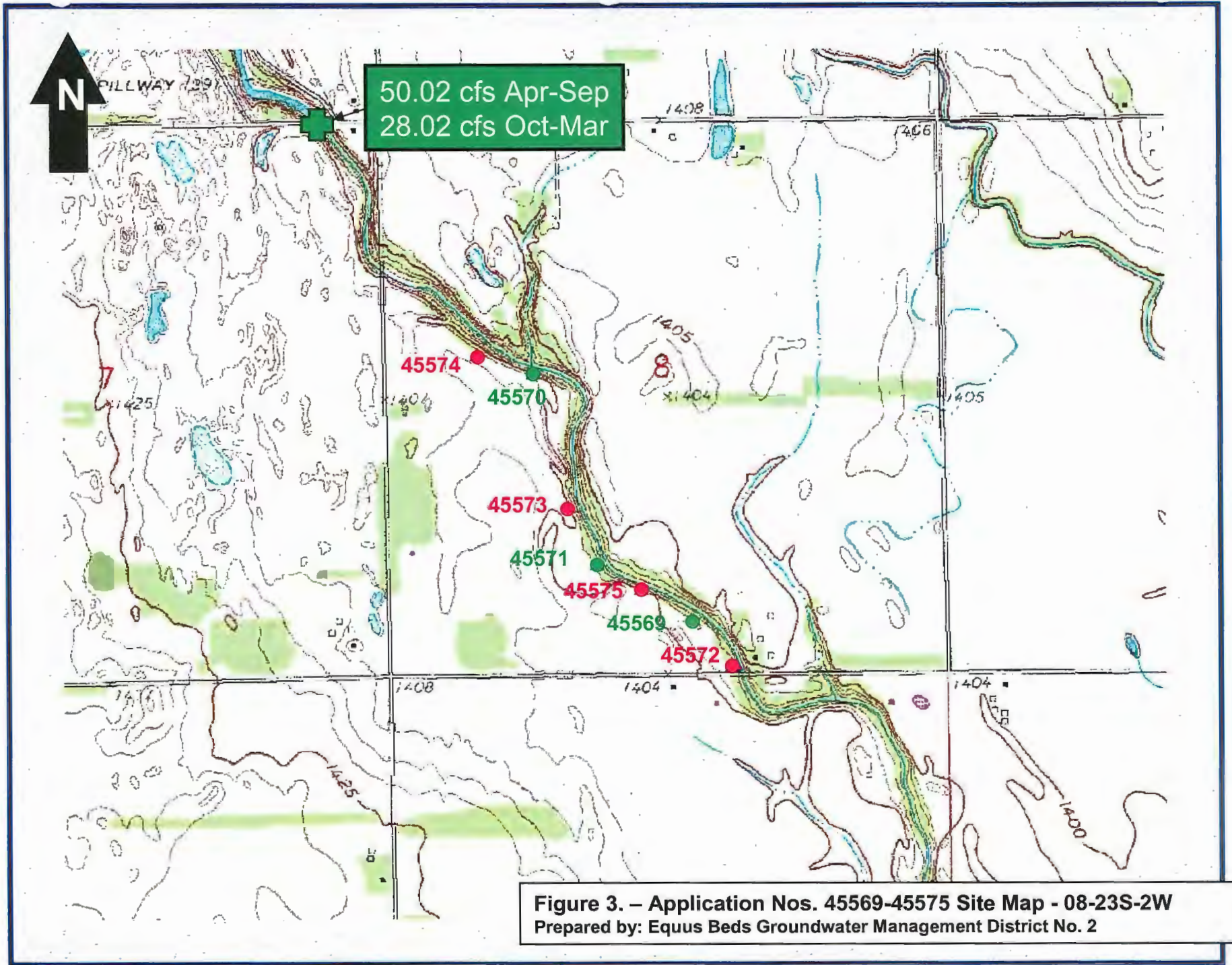


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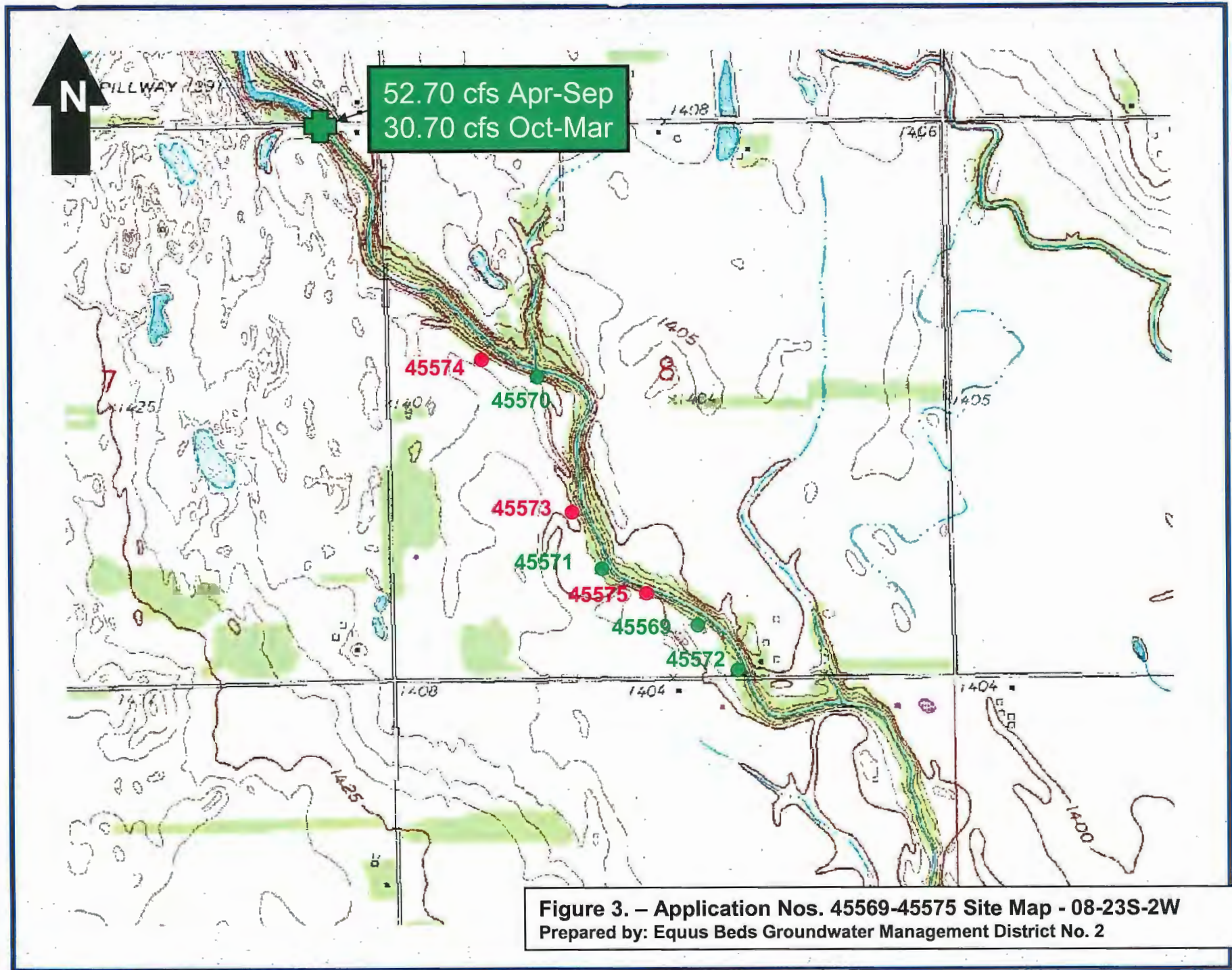


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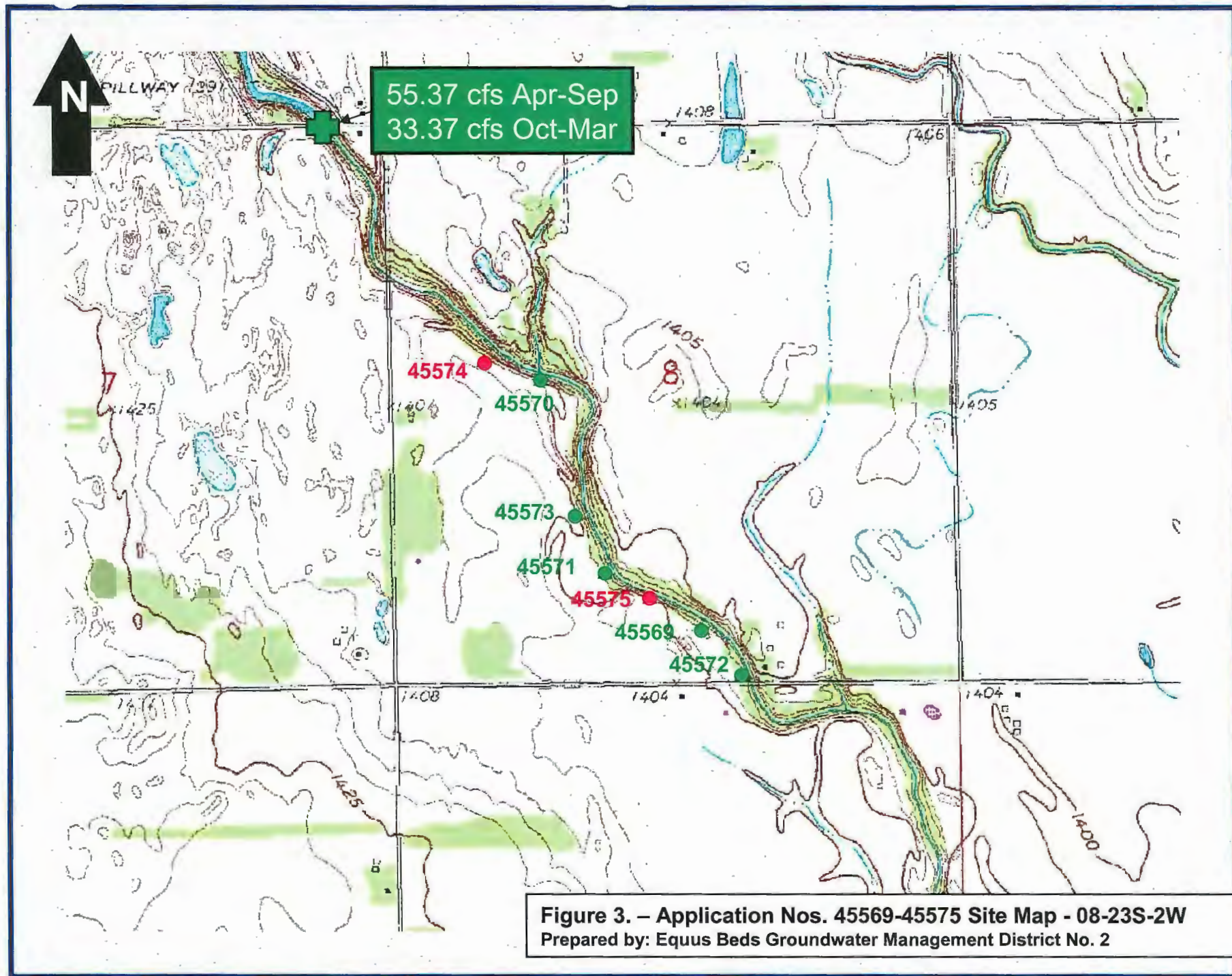


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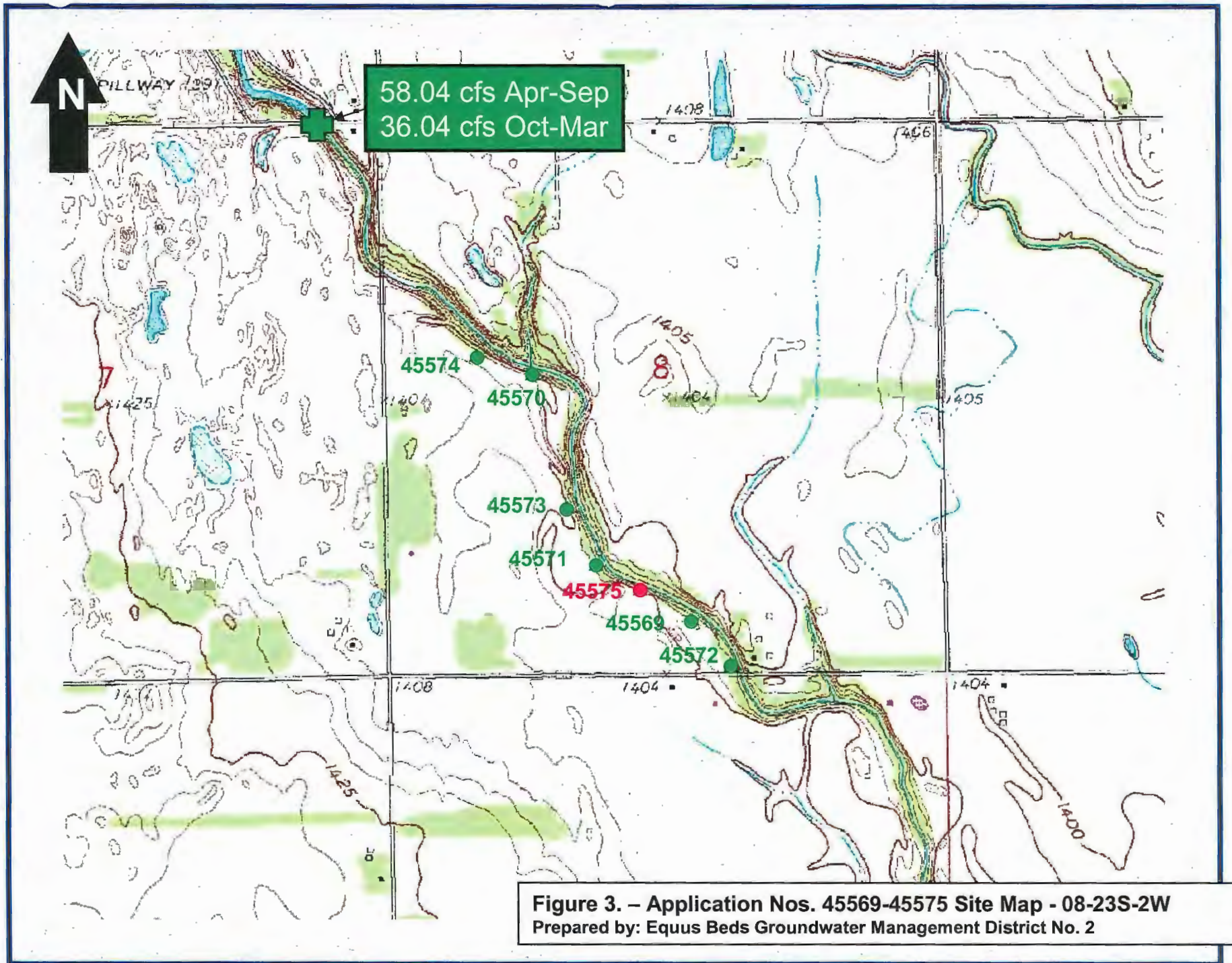


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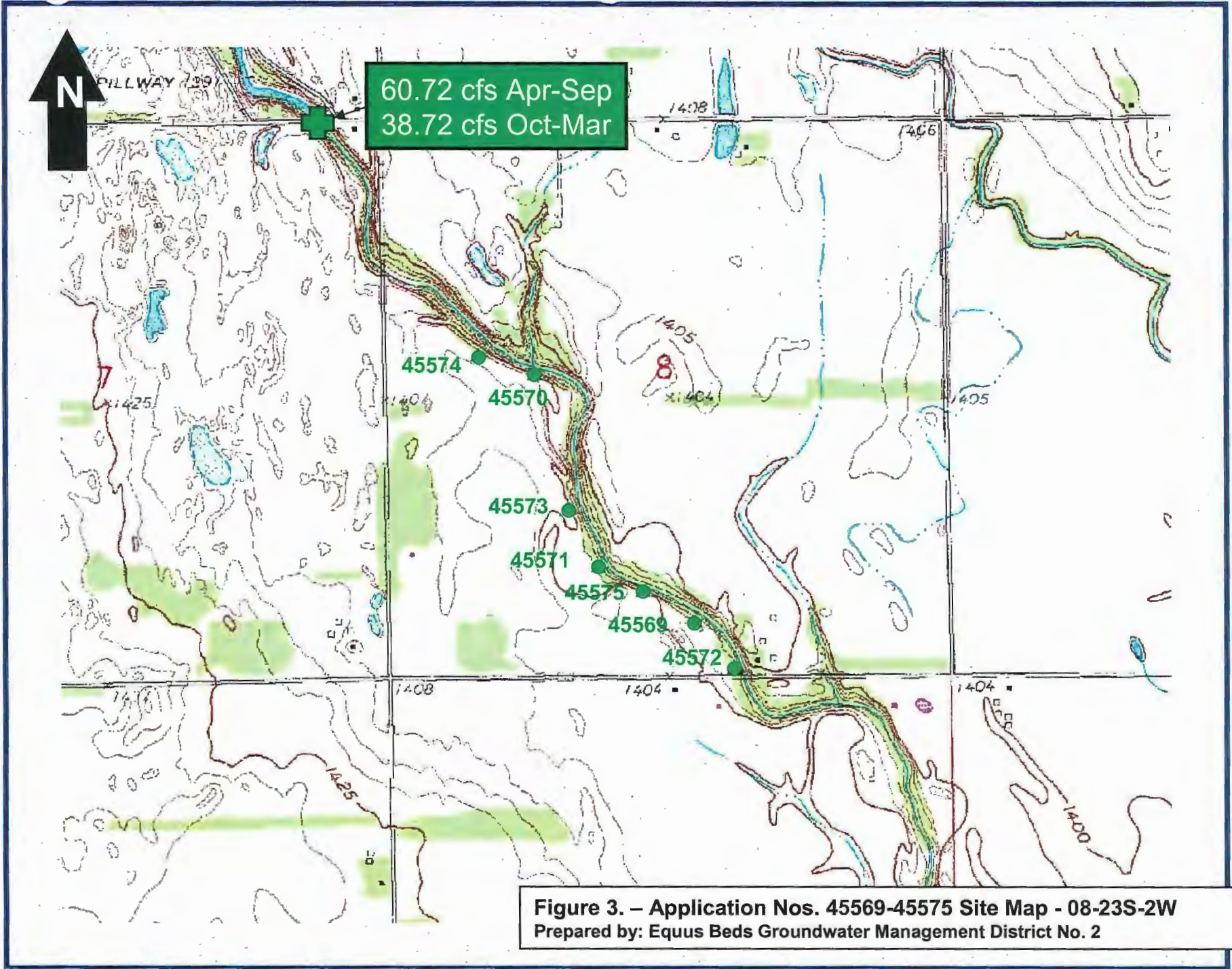


Figure 3. – Application Nos. 45569-45575 Site Map - 08-23S-2W
Prepared by: Equus Beds Groundwater Management District No. 2

STAFF RECOMMENDATIONS:

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

- 21. the applicant shall submit a water level and water quality monitoring plan to be approved by the District Board of Directors and 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;**

STAFF RECOMMENDATIONS:

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

- 24. the applicant shall submit a well field operation monitoring and reporting plan to be approved by the District Board of Directors and the Chief Engineer, DWR;**
- 25. the operational plan shall include utilization of monitoring wells and the proposed upstream river 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 1st year of operation, each calendar quarter for the 2nd year of operation, and annually thereafter by March 1, of each year.**

