

**Investigation And Abatement Of  
Saltwater Seepage Into The Upper  
Colorado River From the West  
O'Daniel Seep In An Area Of Oil and  
Gas Exploration And Production  
Activities, Howard County, Texas**



**Bill Renfro, P.G. and Dan O'Donnell, P.E.**

**Site Remediation**

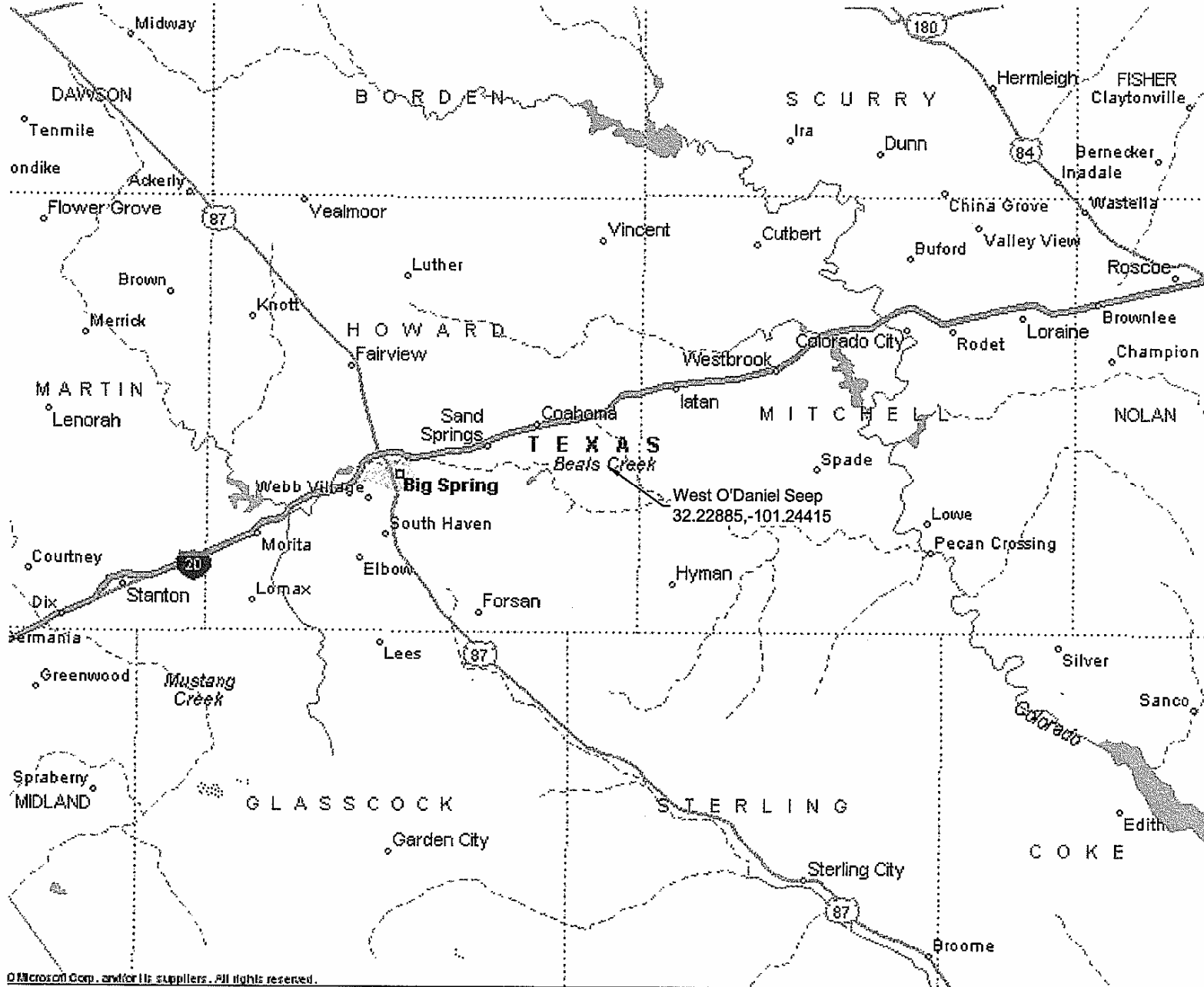
**Oil and Gas Division**

**Railroad Commission of Texas**

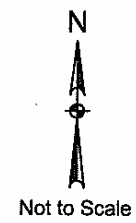
**16<sup>th</sup> International Petroleum Environmental Conference**

**November 3-5, 2009**

Figure 1-1. Site Location Map



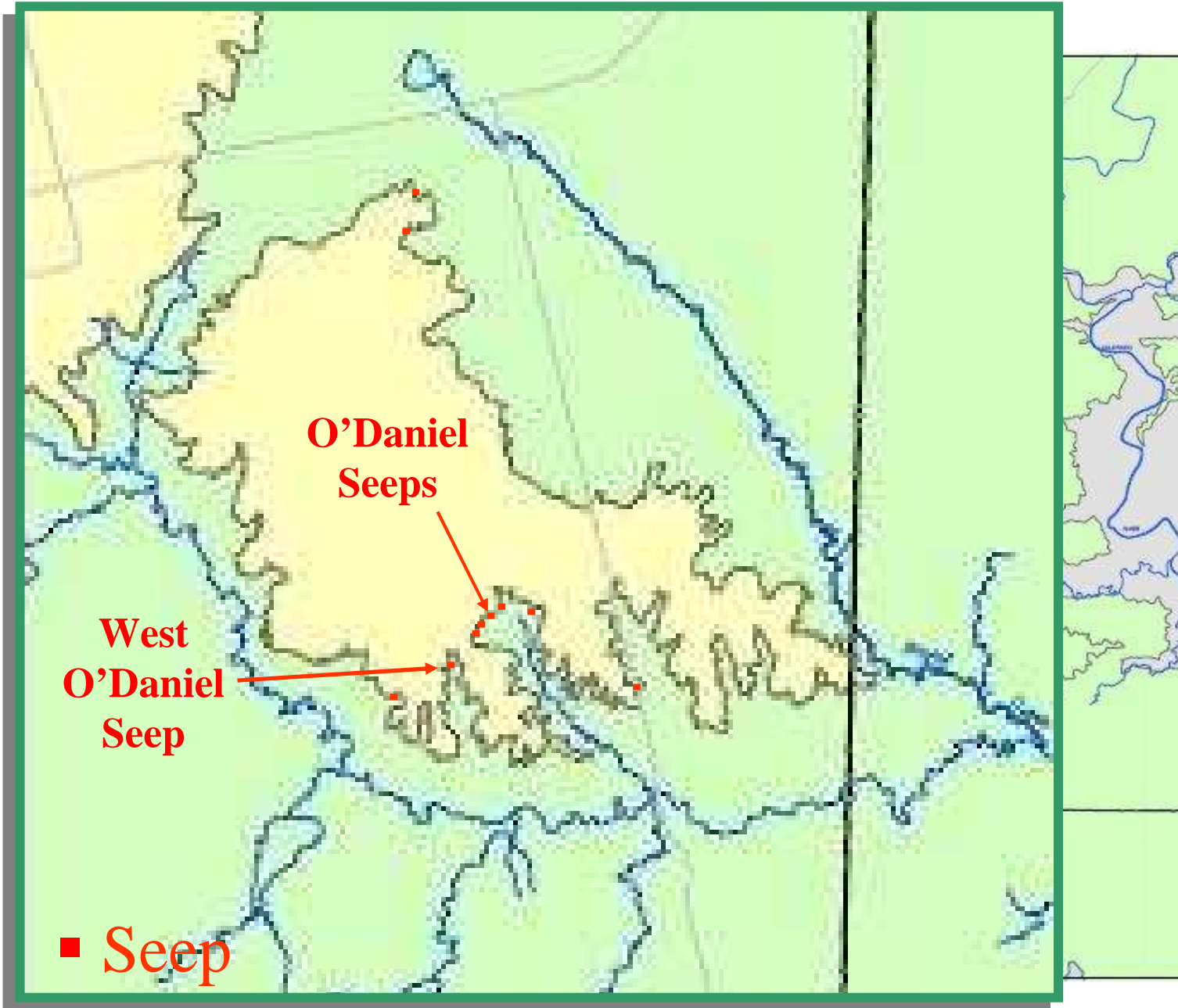
© Microsoft Corp. and/or its suppliers. All rights reserved.

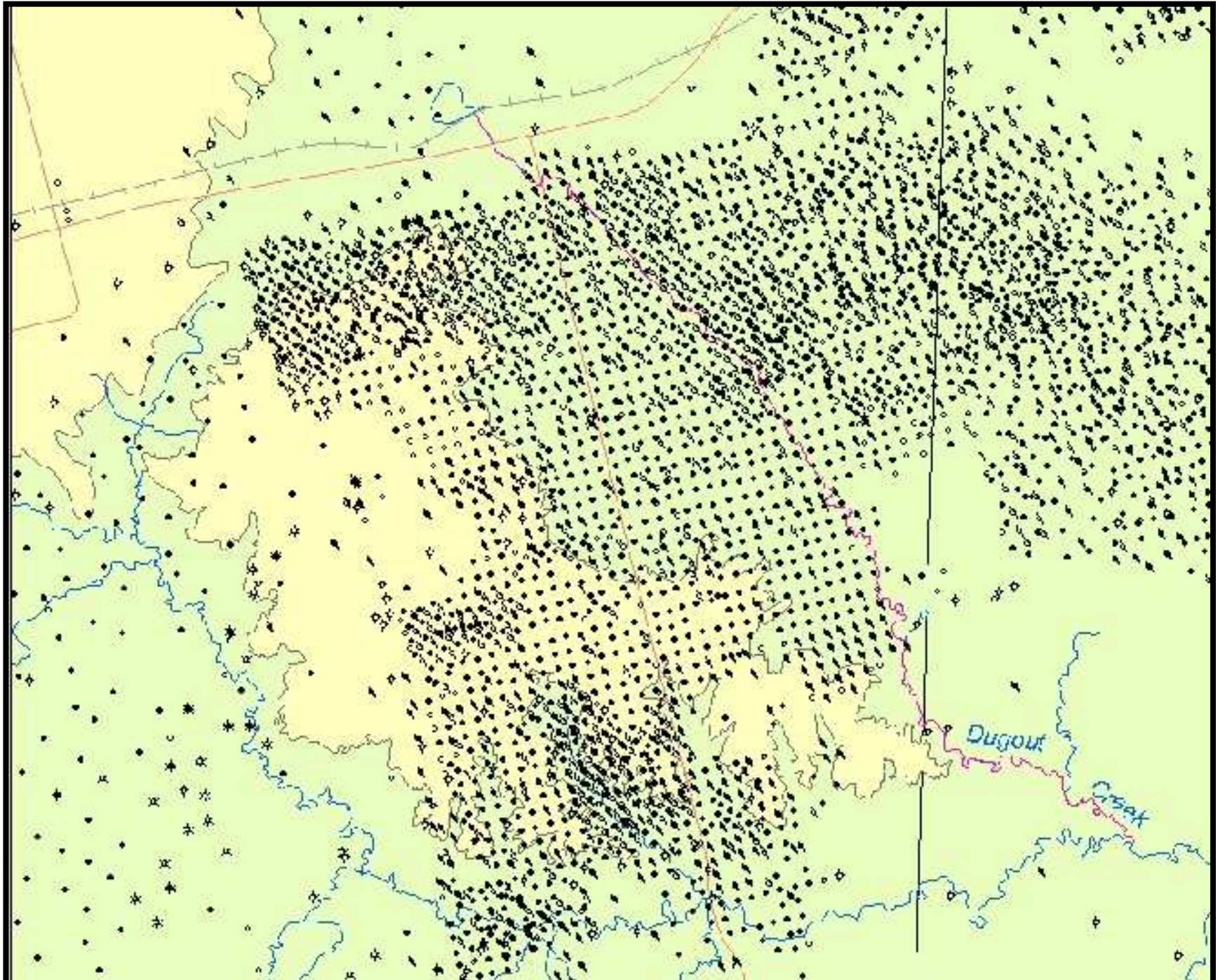


# Upper Colorado River Watershed Upstream of Spence Reservoir

- **An Outlier of the Ogallala Aquifer (Major) in Howard County lies Unconformably on the Triassic Dockum Group.**
- **Seeps Emanating from the Base of the Outlier Perimeters at the Ogallala/Dockum Group Contact are Impacting Beals Creek which flows into the Colorado River upstream of Spence Reservoir.**







# *The O'Daniel Seeps*

**Investigated in 1998-1999 by:**

- **The Railroad Commission of Texas (RRC)  
contracted with  
The Bureau of Economic Geology (BEG)  
for the investigation**
- **A Fluorescein Dye study by the RRC**

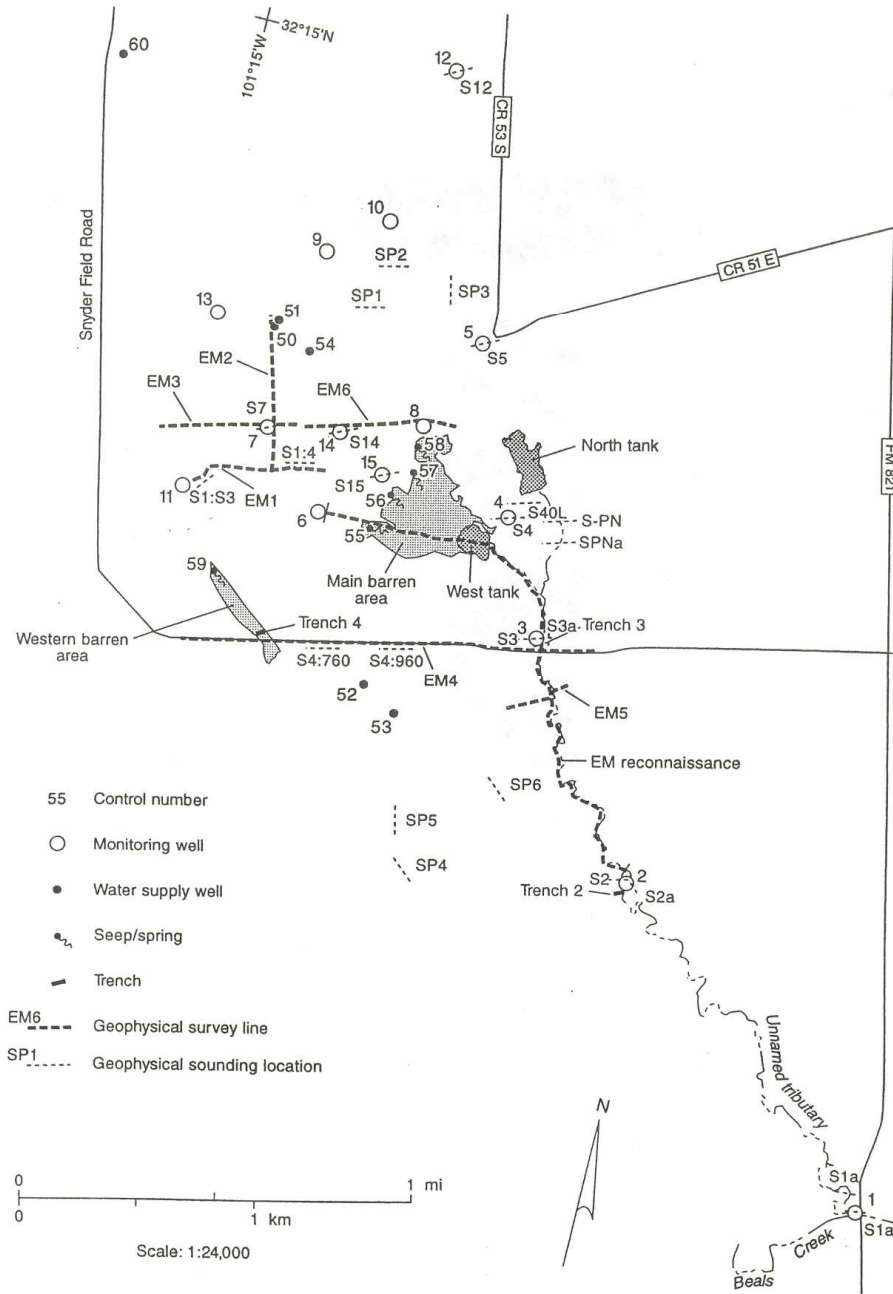


Figure I-1. Locations of EM lines and spot measurements.

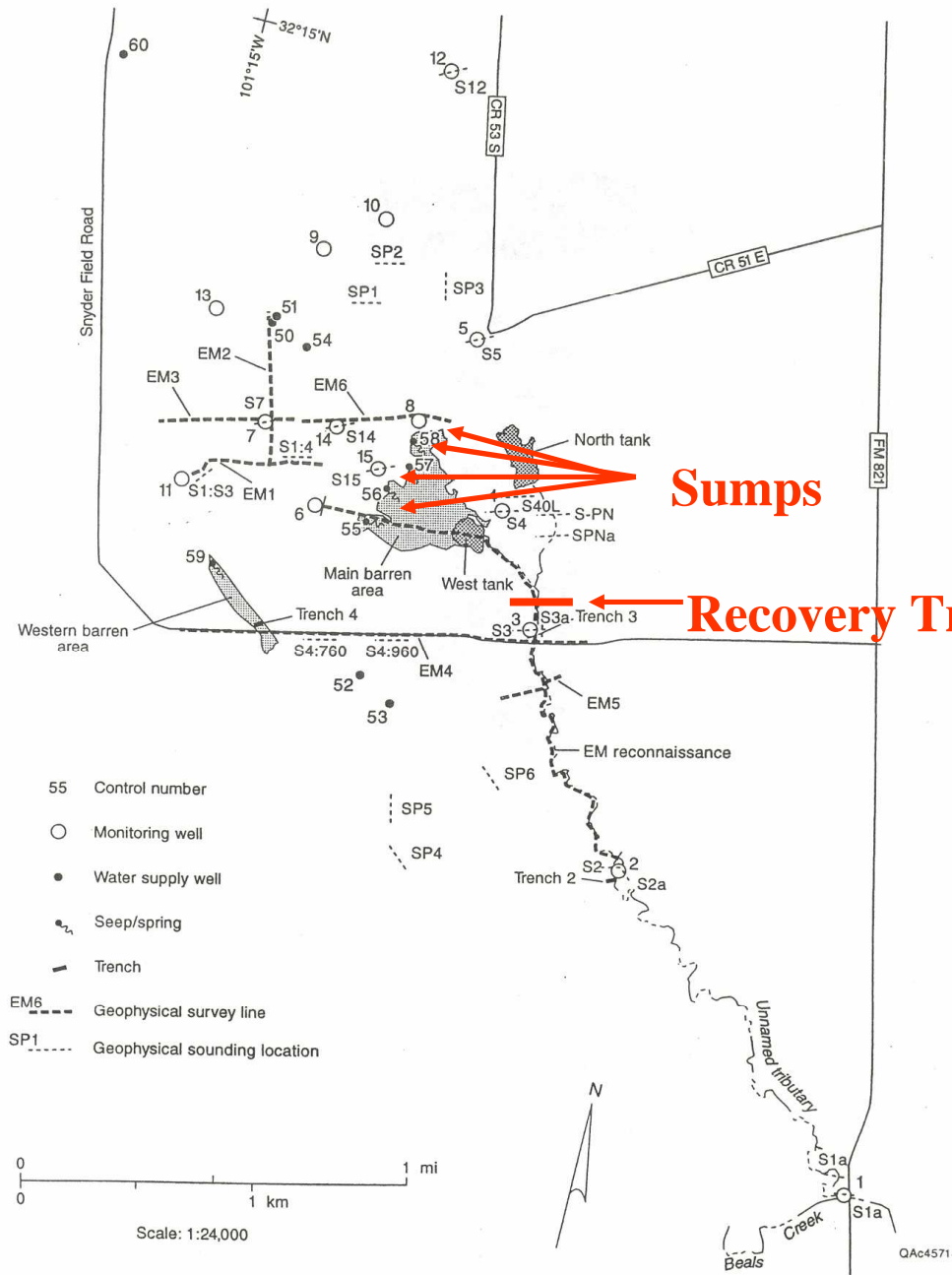
## FINDINGS:

### BEG:

- High chlorides in Ogallala and seeps
- Benzene in 3 monitor wells and a seep.

### RRC:

- Dye down Injectors
- Dye in 10 producers (present in reservoir)
- Dye in the 3 monitor wells and seep.



Operator installs a recovery sump system at seeps

**Sumps**

**Recovery Trench**

Second Operator installs recovery trench down drainage of the seeps.

Figure I-1. Locations of EM lines and spot measurements.

## COLORADO RIVER SALTWATER LOAD ABATEMENT

Abatement Facility	Avg. Chloride Concentration	Avg. Daily Recovery				Total Avg. Daily Recovery
	(mg/L)	(bbls/day)	(L/day)	(mg/day)	(lbs/day)	(lbs/day)
O'Daniel Seep Trench	30,000	23	3,589	109,710,000	237	
O'Daniel Seep Sumps	30,000	284	45,152	1,354,530,000	2,980	
<b>Total O'Daniel Seep:</b>						<b>3,217</b>

**Notes:**

**Formulae:**

$$\text{L/day} = (\text{bbls/day}) / 0.00629$$

$$\text{lbs/day} = (\text{L/day})(\text{mg/L})(2.2\text{E-}6)$$

**Conversions:**

$$1 \text{ mg} = 0.0000022 \text{ lbs}$$

$$1 \text{ L} = 0.00629 \text{ bbls}$$

bbls = Barrels (petroleum)

L = liter

mg = milligram

lbs = pounds

**Reduction of Chloride load  
Into Beals Creek and Colorado  
River approx. 3,217 lbs./day**

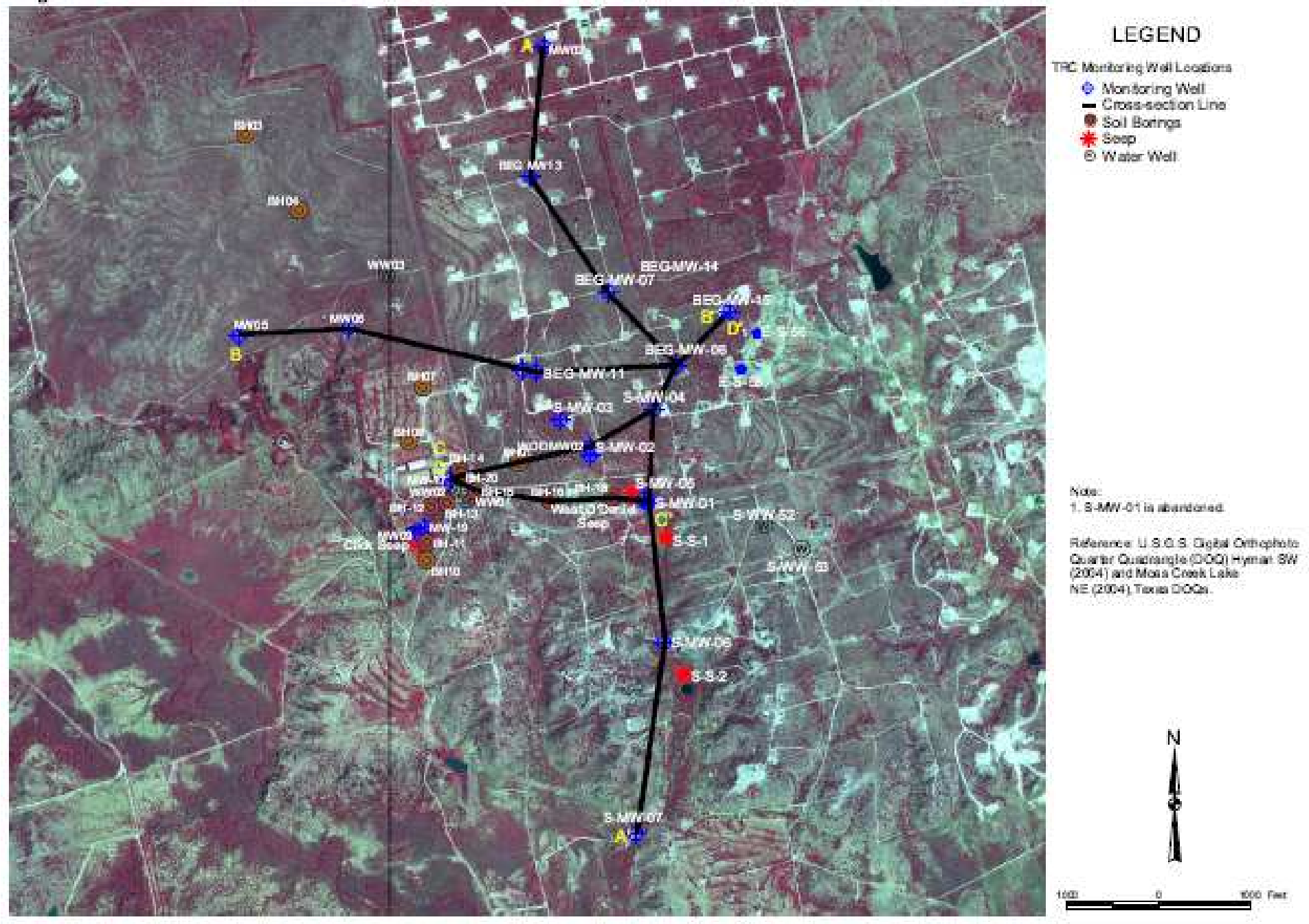
(figures on the table are rounded up to the nearest whole number)

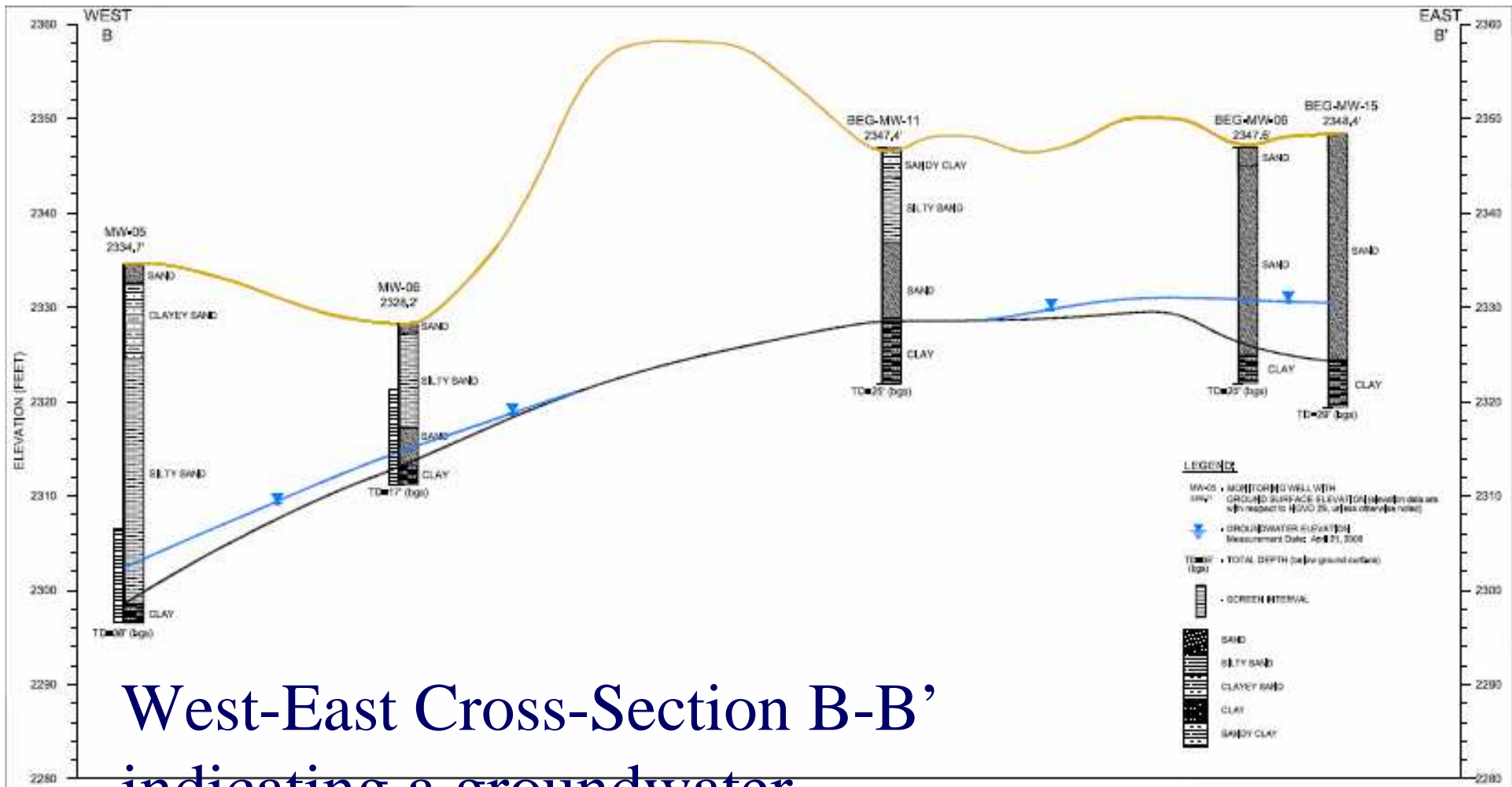
# **West O'Daniel Seep**

**Seven monitor wells installed in the area of the seep**

- **Five on the Ogallala Aquifer**
- **Two down drainage in the alluvium toward Beals Creek**

Figure 2-2. Location of Cross Sections





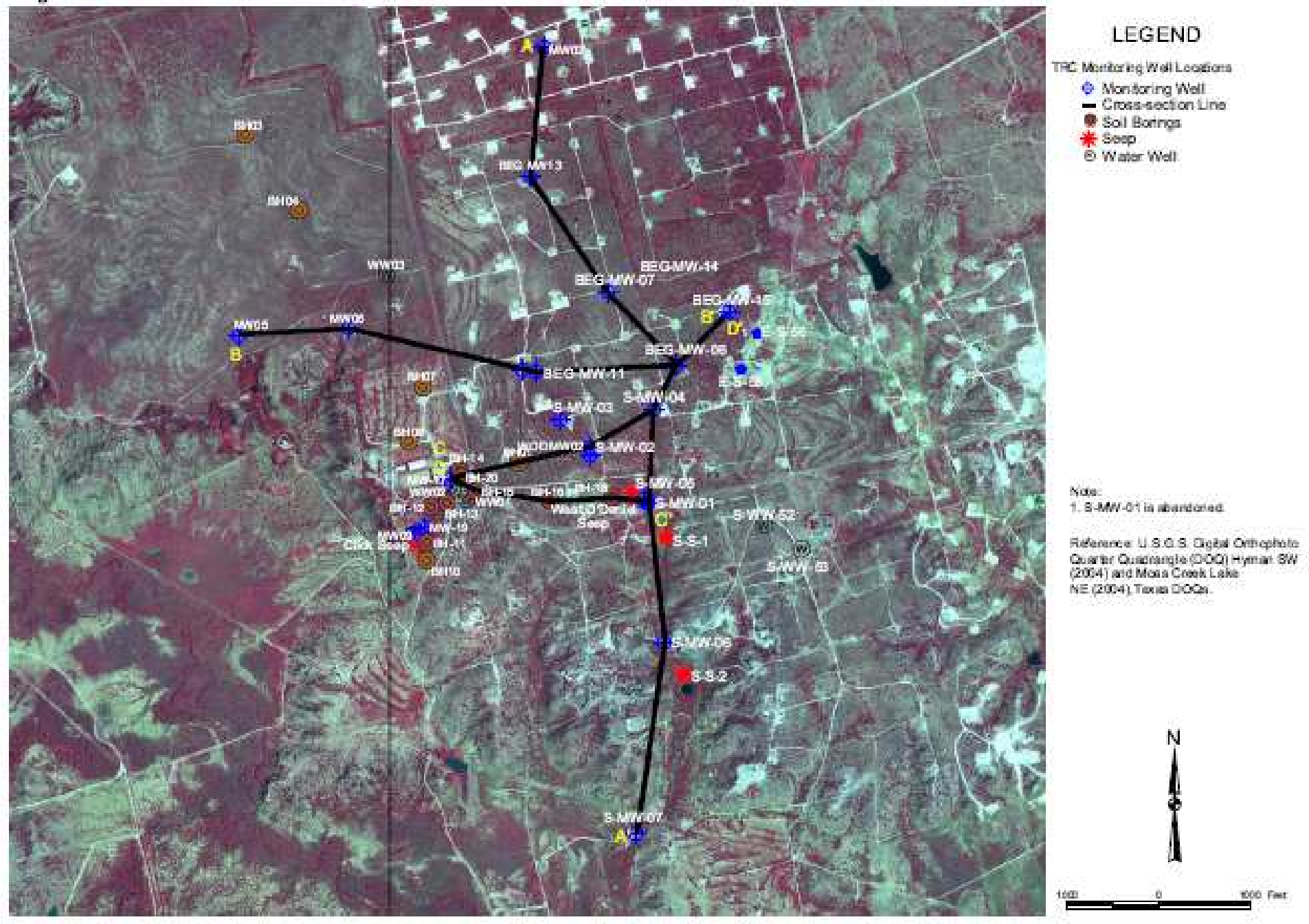
West-East Cross-Section B-B'  
 indicating a groundwater  
 divide with gradient in  
 opposite directions

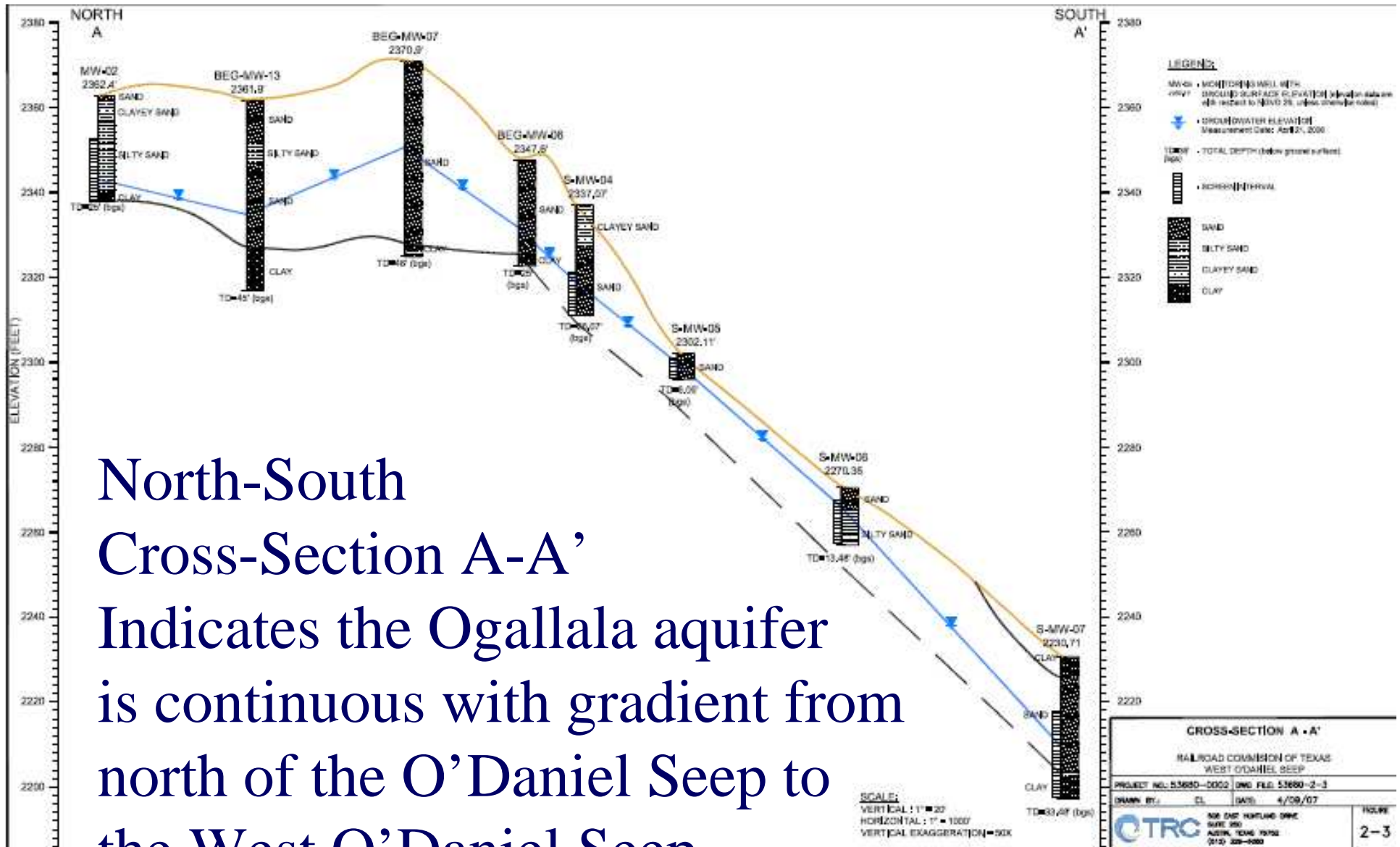
SCALE:  
 VERTICAL: 1" = 10'  
 HORIZONTAL: 1" = 500'  
 VERTICAL EXAGGERATION = 50X

<b>CROSS-SECTION B - B'</b>	
RAILROAD COMMISSION OF TEXAS WEST COASTAL SEEP	
PROJECT NO: 53680-0002	DWG FILE: 53680-2-4
DRAWN BY: K.S.	DATE: 04/08/07
505 DUT HURFINE DRIVE SUITE 200 AUSTIN, TEXAS 78702 (512) 228-8200	
PAGE 2-4	

Monitor Well BEG-MW-11 has never been dry during all previous monitoring events indicating that the aquifer is continuous from east to west with a gradient divide between the boundaries of the Ogallala outlier.

Figure 2-2. Location of Cross Sections





North-South  
Cross-Section A-A'  
Indicates the Ogallala aquifer  
is continuous with gradient from  
north of the O'Daniel Seep to  
the West O'Daniel Seep.

# Recovery Options

- **Recovery Wells**
- **Recovery Trench**  
(chosen as most cost-effective)

**Recovery through Halophytic Vegetation**

