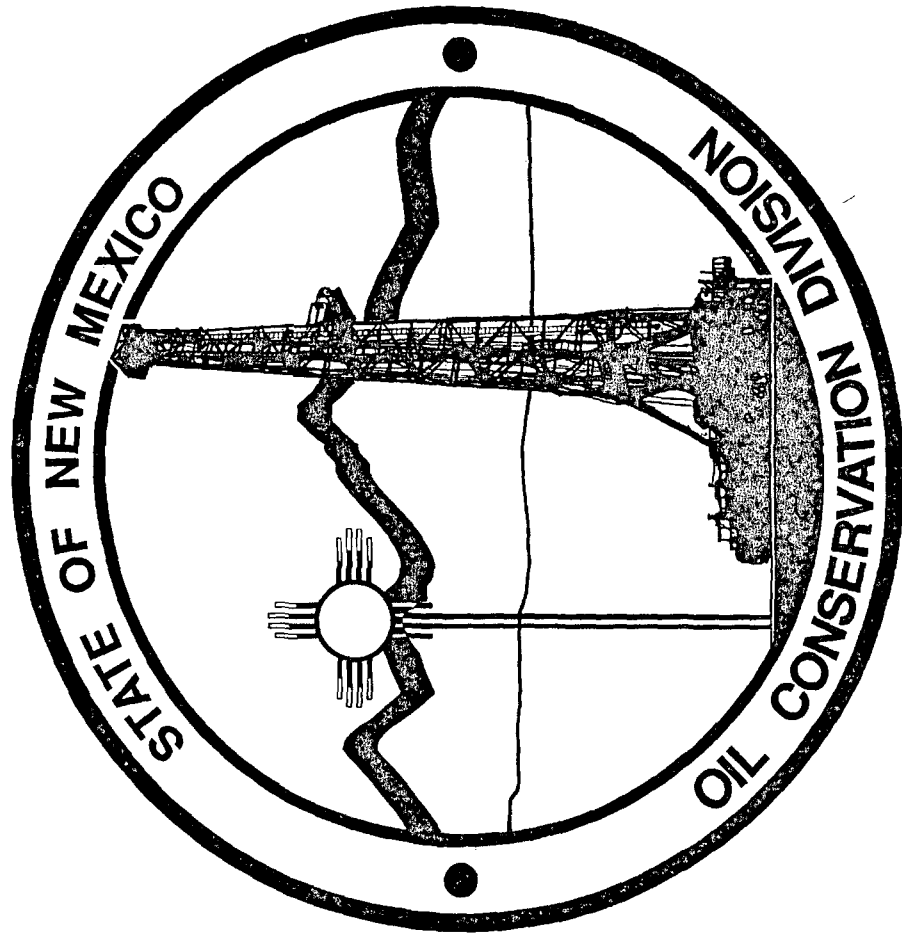


CASE NO. 14015
OCD EXHIBIT 12



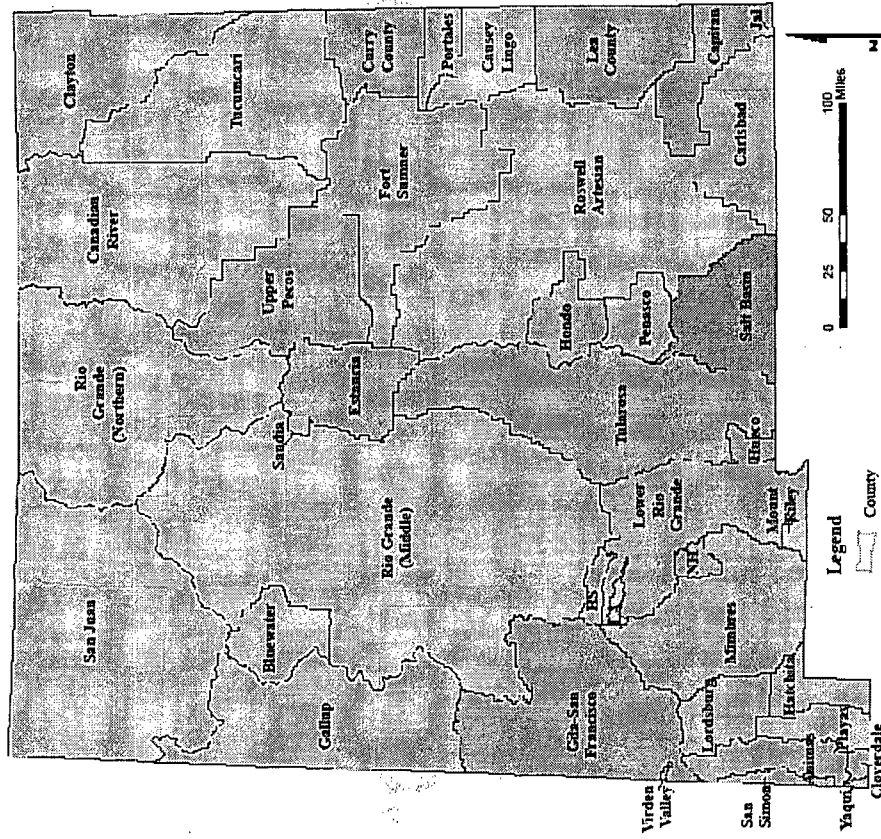
HYDROGEOLOGY OF SAN JUAN BASIN

“VULNERABLE AREA”

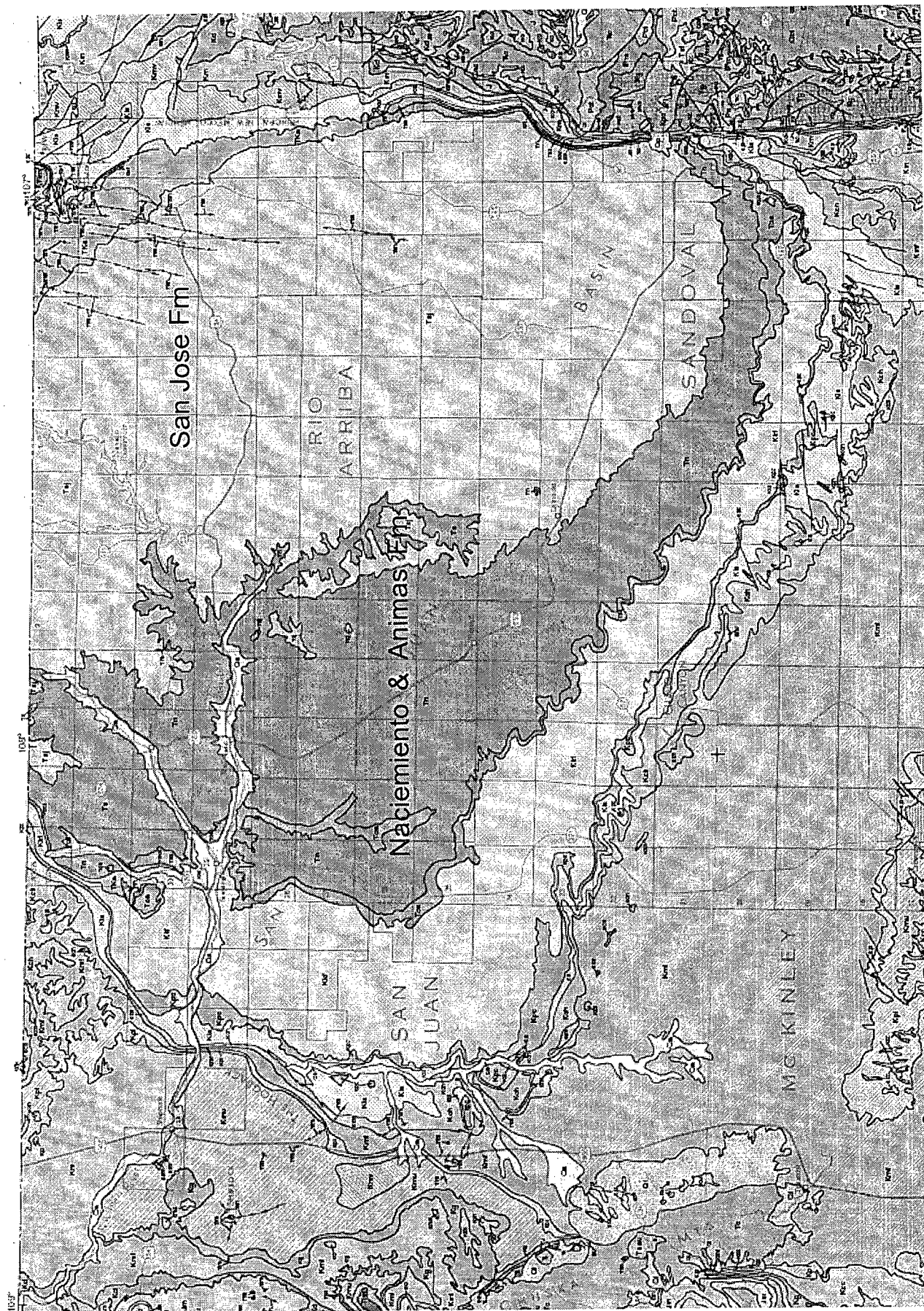
vs.

“NON-VULNERABLE AREA”

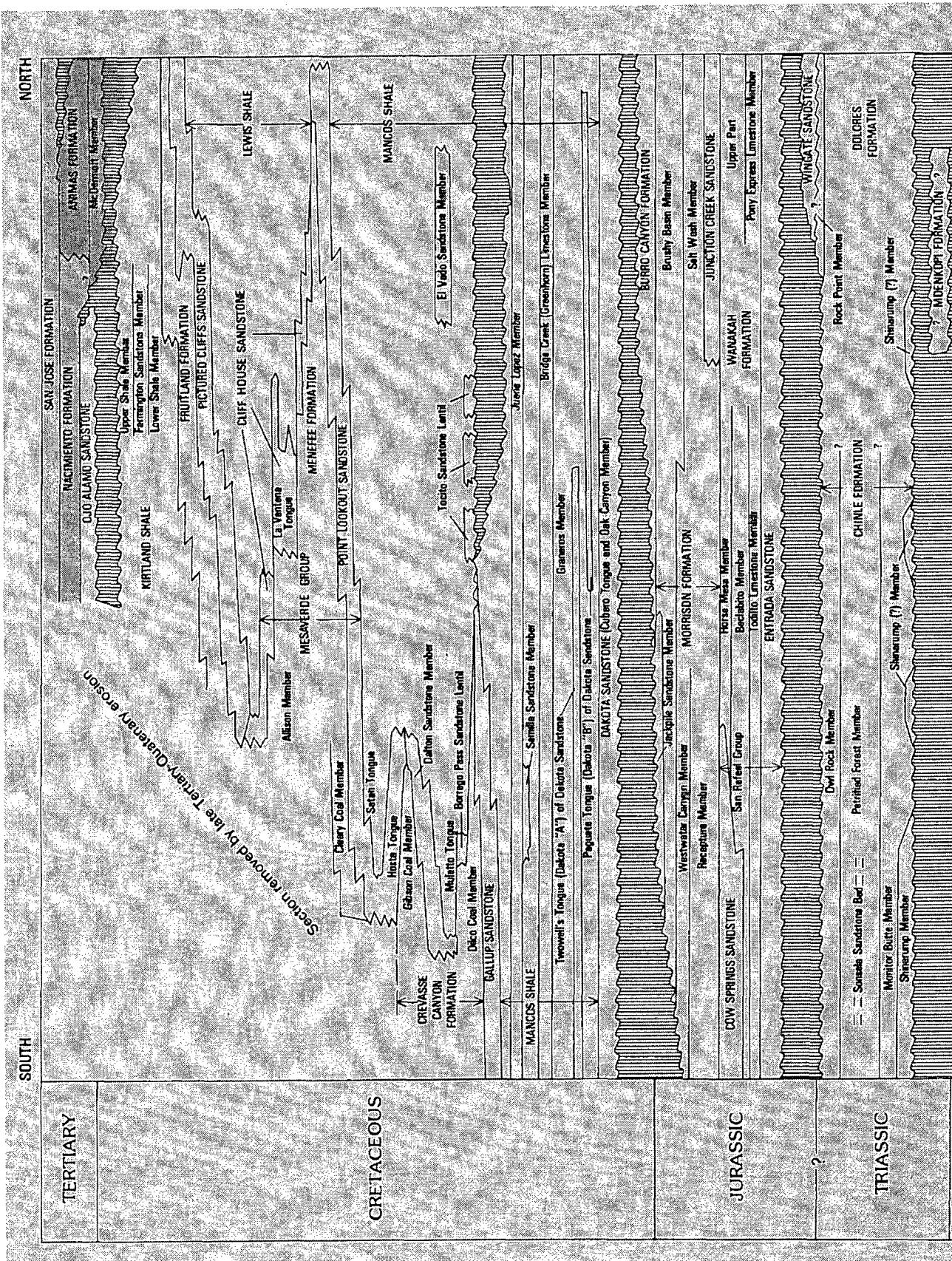
New Mexico Office of the State Engineer Underground Water Basins in New Mexico



Underground Water Basins Map is based on the
New Mexico Geological Survey (NMGS) data
Copyright 1998 by the New Mexico Geological Survey
Correlation Data Base (CDB) coordinates data (format: lat-long)
Map is provided in UTM, NAD83, Zone 13, datum.
Checked on October 24, 2008 by Christine Matthews
GIS Water Resources Assessment Program
File: GDB-Underground_WaterBasinsMap.mxd



USGS, 1990. Hydrologic Atlas
720-A, Hydrogeology of the San
Jose, Nacimientto, and Animas
Formations in the San Juan
structural basin, New Mexico,
Colorado, Arizona and Utah.



EXPLANATION

Outcrop of San Jose Formation—From Dane and Bachman, 1965, and Tweto, 1979

Outcrop of Nachimmo Formation—From Dane and Bachman, 1965, Fassett, 1974, and Tweto, 1979

Outcrop of Animas Formation—From Dane and Bachman, 1965, Fassett, 1974, and Tweto, 1979

Boundary of study area

Oil- or gas-test hole—Data from Petroleum Information Corporation

Water well—Data from National Water Information System

EXPLANATION

Outcrop of San Jose Formation—From Dane and Bachman, 1965, and Tweto, 1979

Outcrop of Nacimiento Formation—From Dane and Bachman, 1965, Fassett, 1974, and Tweto, 1979

Outcrop of Animas Formation—From Dane and Bachman, 1965, Fassett, 1974, and Tweto, 1979

Boundary of study area

Water well—Upper number is altitude of potentiometric surface, in feet above sea level; Lower number is year water level was measured or reported. — indicates no value

Spring—Upper number is altitude of land surface at spring, in feet above sea level; Lower number is year spring was visited. — indicates no value

8,000 1970

8,000 1970

8,000 1970

8,000 1970

8,000 1970

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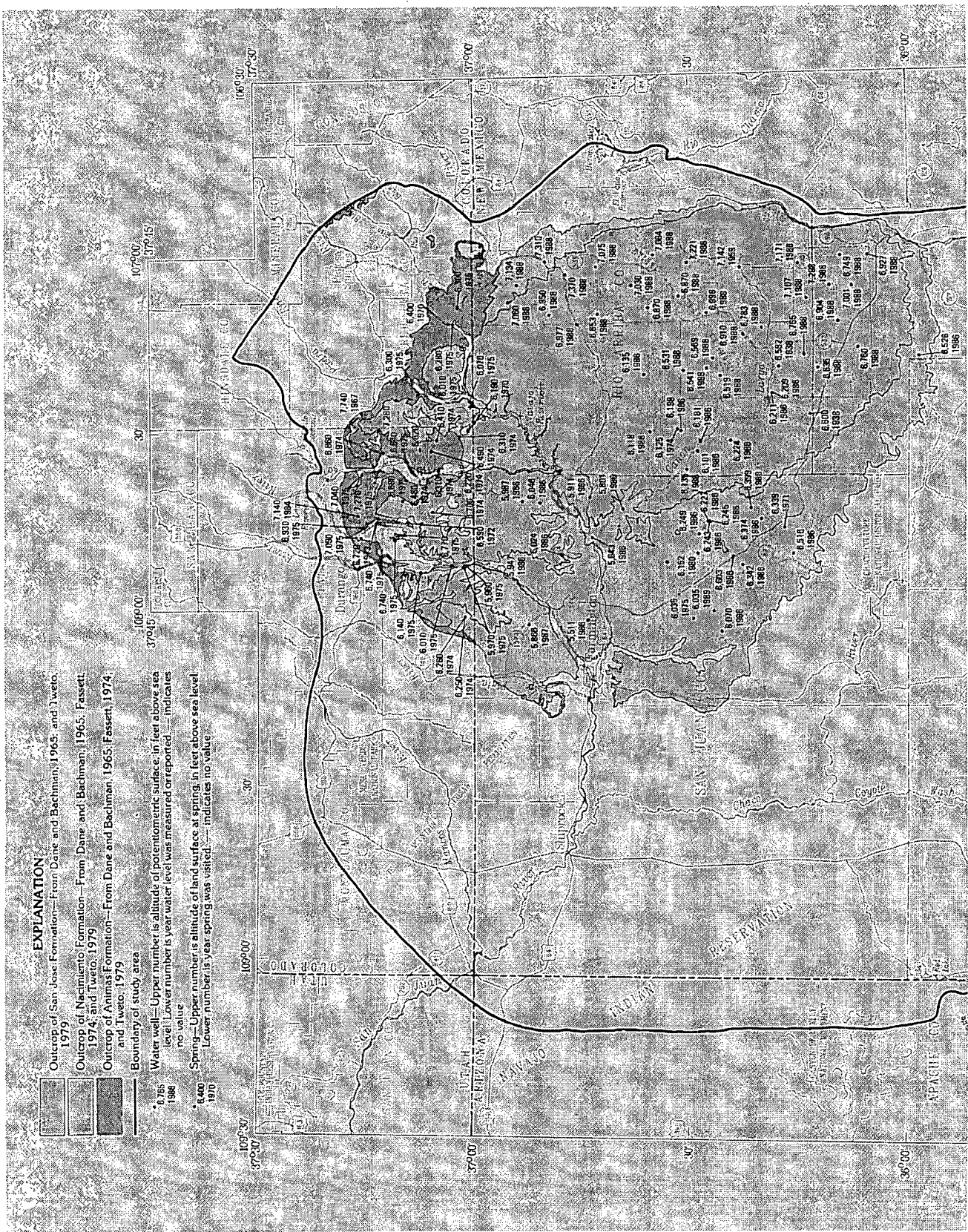
8,000 1970

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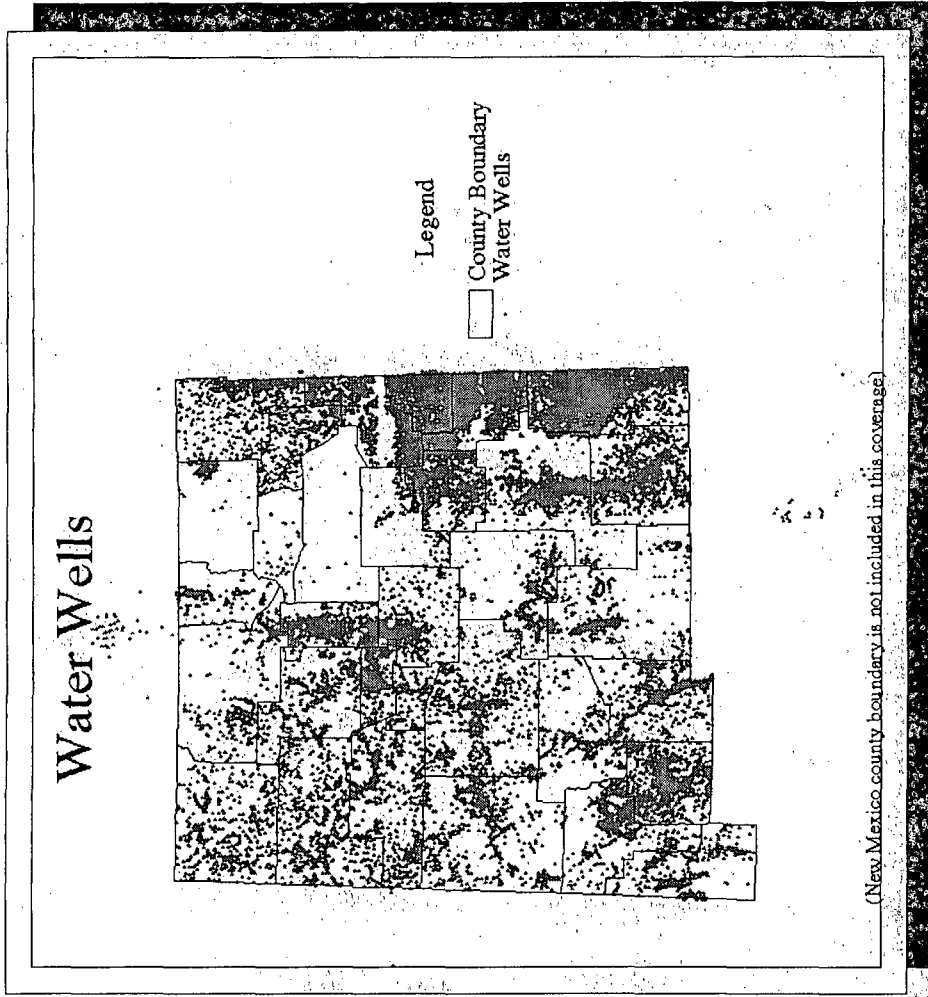
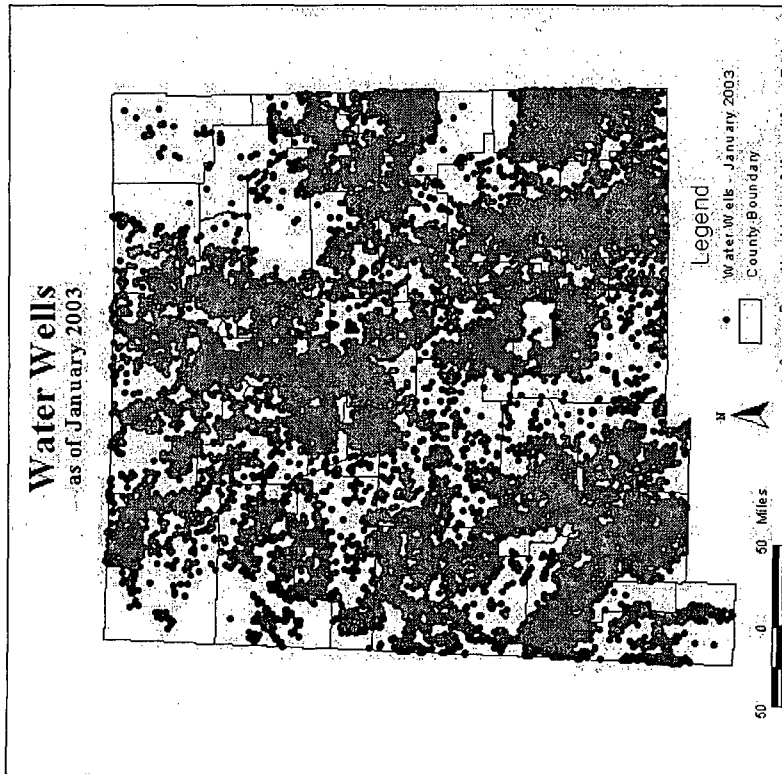
8,000 1970

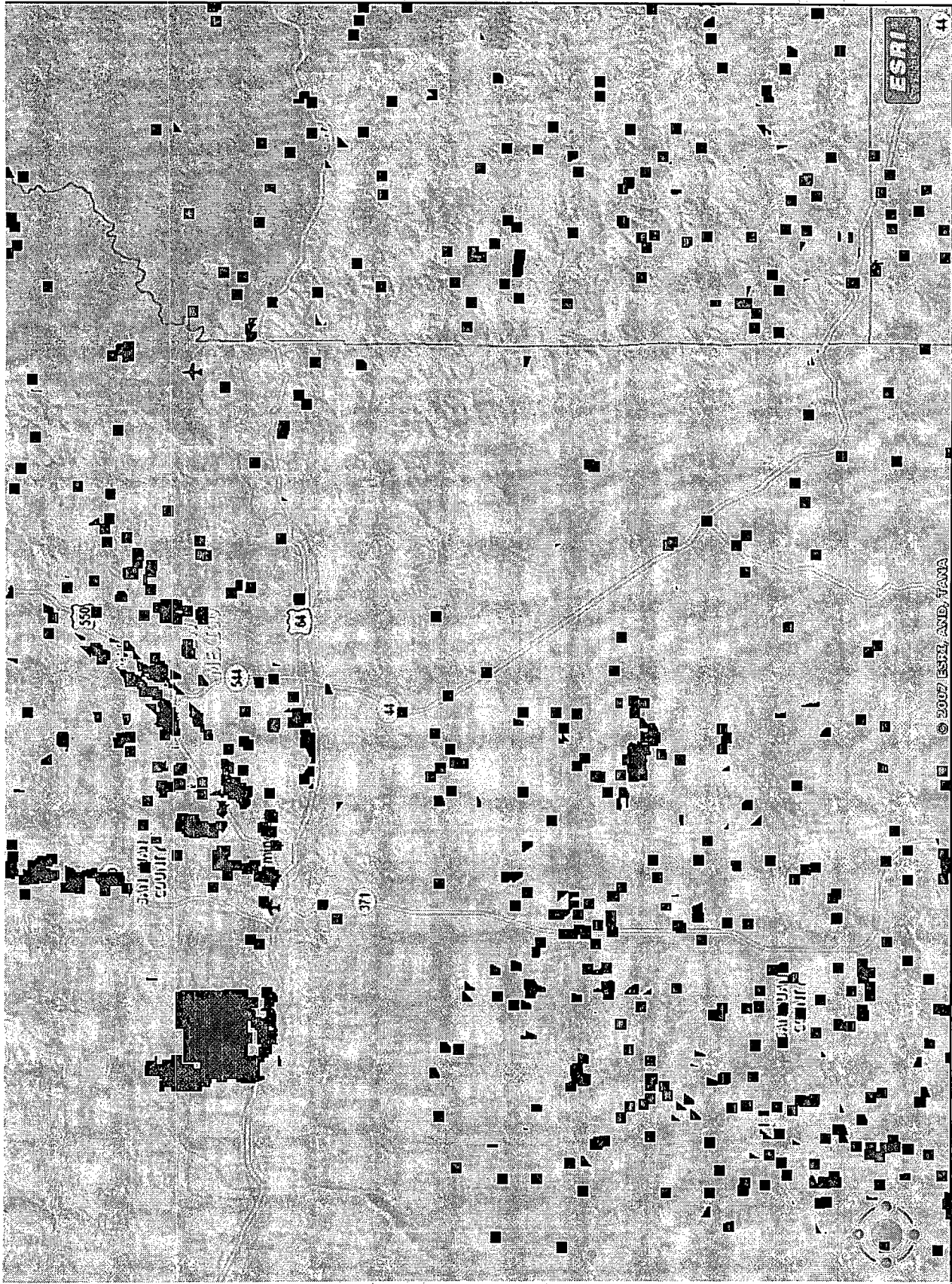


WATER WELLS IN THE SAN JUAN BASIN

- Two major databases detail the locations and designated uses of water wells permitted by the Office of the State Engineer.
 - USGS (available from USGS and RGIS)
 - OSE (available from OSE and RGIS).

WATER WELLS IN THE SAN JUAN BASIN





OFFICE OF THE STATE ENGINEER

iWATERS Database

- An unknown, but significant number of water wells are listed in the OSE iWATERS Database in the “*Vulnerable Area*,” as specified in the present Pit Rule (Subparagraph (g), Paragraph (2), Subsection C of 19.15.2.50 NMAC).

Unlined Pits Allowed

- Subparagraph (g), Paragraph (2), Subsection C of 19.15.2.50 NMAC.

(g) Unlined pits.

(iii) Unlined pits shall be allowed in the following areas provided that the operator has submitted, and the division has approved, an application for permit as provided in Section 50 of 19.15.2 NMAC, and provided that the pit site is not located in fresh water-bearing alluvium or in a wellhead protection area:

Unlined Pits Allowed

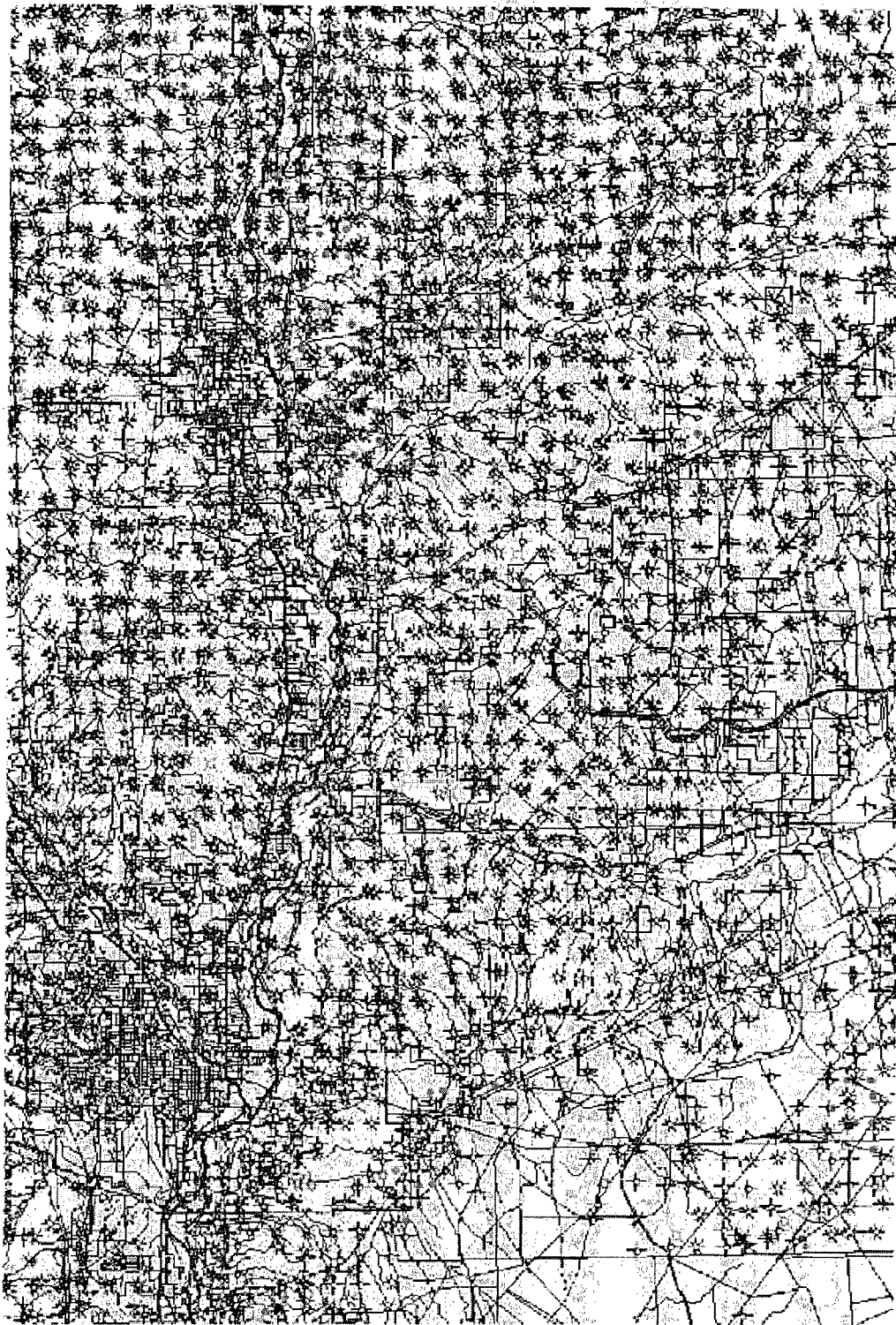
- . . . Township 23 South, Range 30 East, NMPM Sections 1 through 19; and that area within San Juan, Rio Arriba, Sandoval and McKinley counties that is outside the valleys of the San Juan, Animas, Rio Grande and La Plata rivers, which are bounded by the topographic lines on either side of the rivers that are 100 vertical feet above the river channels, measured perpendicularly to the river channels, and is outside those areas that lie within 50 vertical feet, measured perpendicularly to the drainage channel, of all perennial and ephemeral creeks, canyons, washes, arroyos and draws, and is . . .

Unlined Pits Allowed

- ... outside the areas between the above-named rivers and the Highland Park Ditch, Hillside Thomas Ditch, Cunningham Ditch, Farmers Ditch, Halford Independent Ditch, Citizens Ditch or Hammond Ditch, provided that no protectable ground water is present or if present, will not be adversely affected; or any area where the discharge into the pit meets New Mexico water quality control commission ground water standards.

Unlined Pits Allowed

- OCD drafted approximately 165 maps that depict the “Vulnerable Area.”
- The maps are on file in the Santa Fe office and are available to industry for review.
- No member of Industry has requested to review these maps for the past two years.
- The maps are not being used.
- How does industry know which areas are “vulnerable” as defined?
- They don’t!



Map No. 28

Oil Conservation Division



Drawn By

Map Date

**PERCENT OF WATER WELLS WITH
DEPTH TO WATER OF 60 FEET OR LESS**

SAN JUAN BASIN

SAN JUAN CO.

1685/1896

4908/6062

88.9%

81.0%

PERMIAN BASIN

EDDY CO.

LEA CO.

1993/2886

7635/8745

69.1%

87.3%

NORTHEAST NEW MEXICO

COLFAX CO.

829/1282

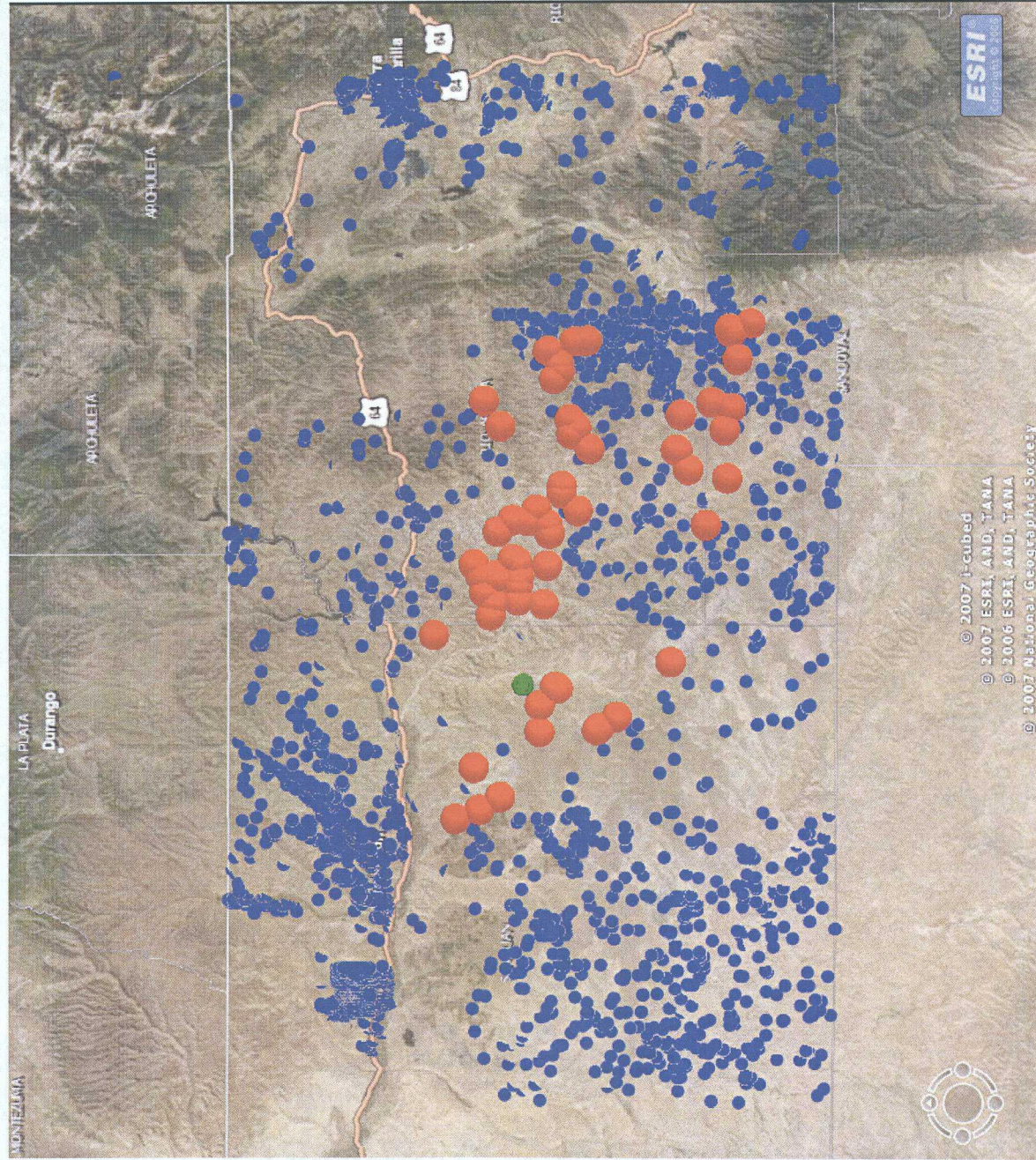
64.7%

**DATA FROM STATE ENGINEER'S OFFICE
iWATERS DATABASE**

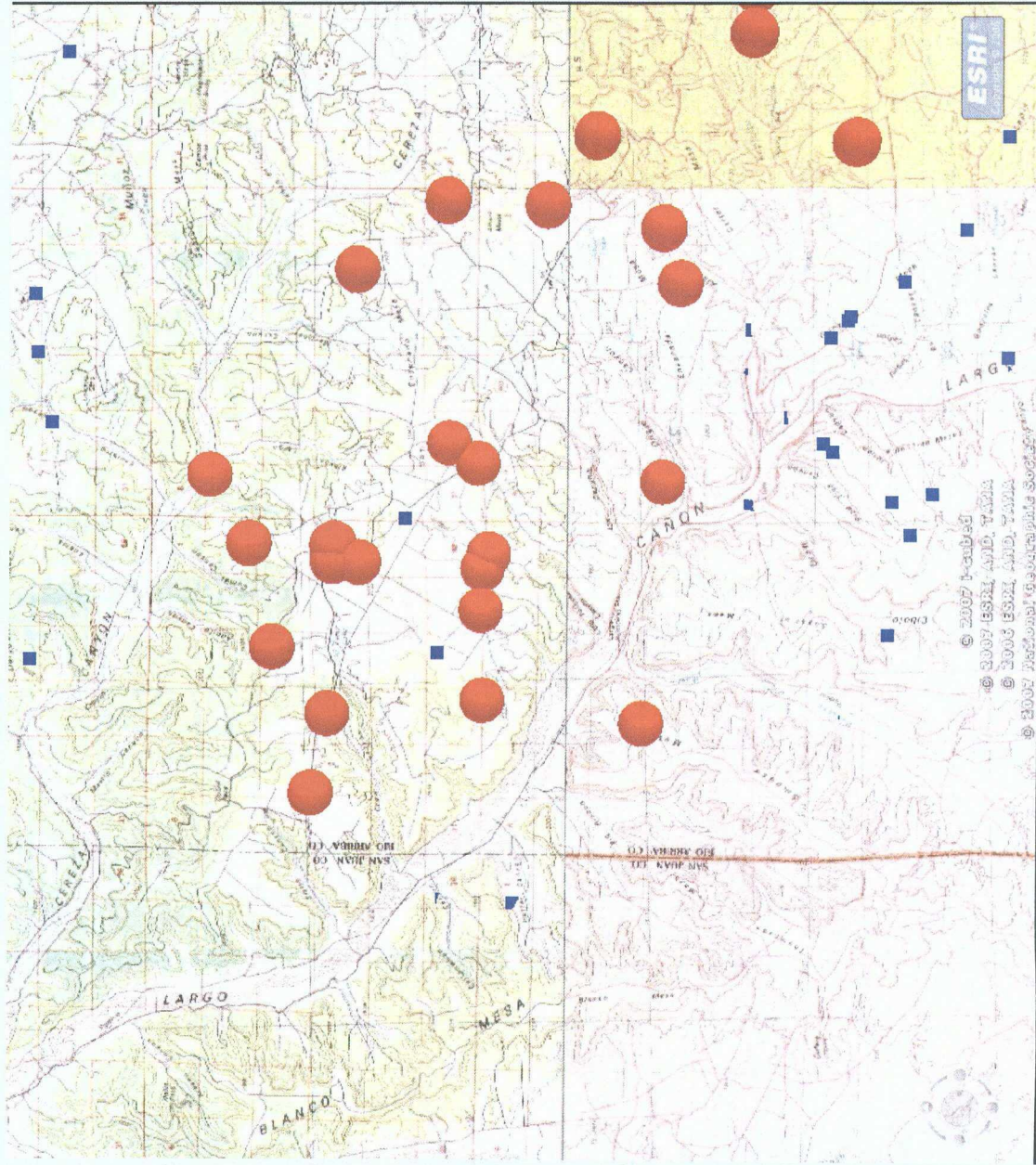
WATER WELLS LOCATED IN “NON-VULNERABLE” AREAS



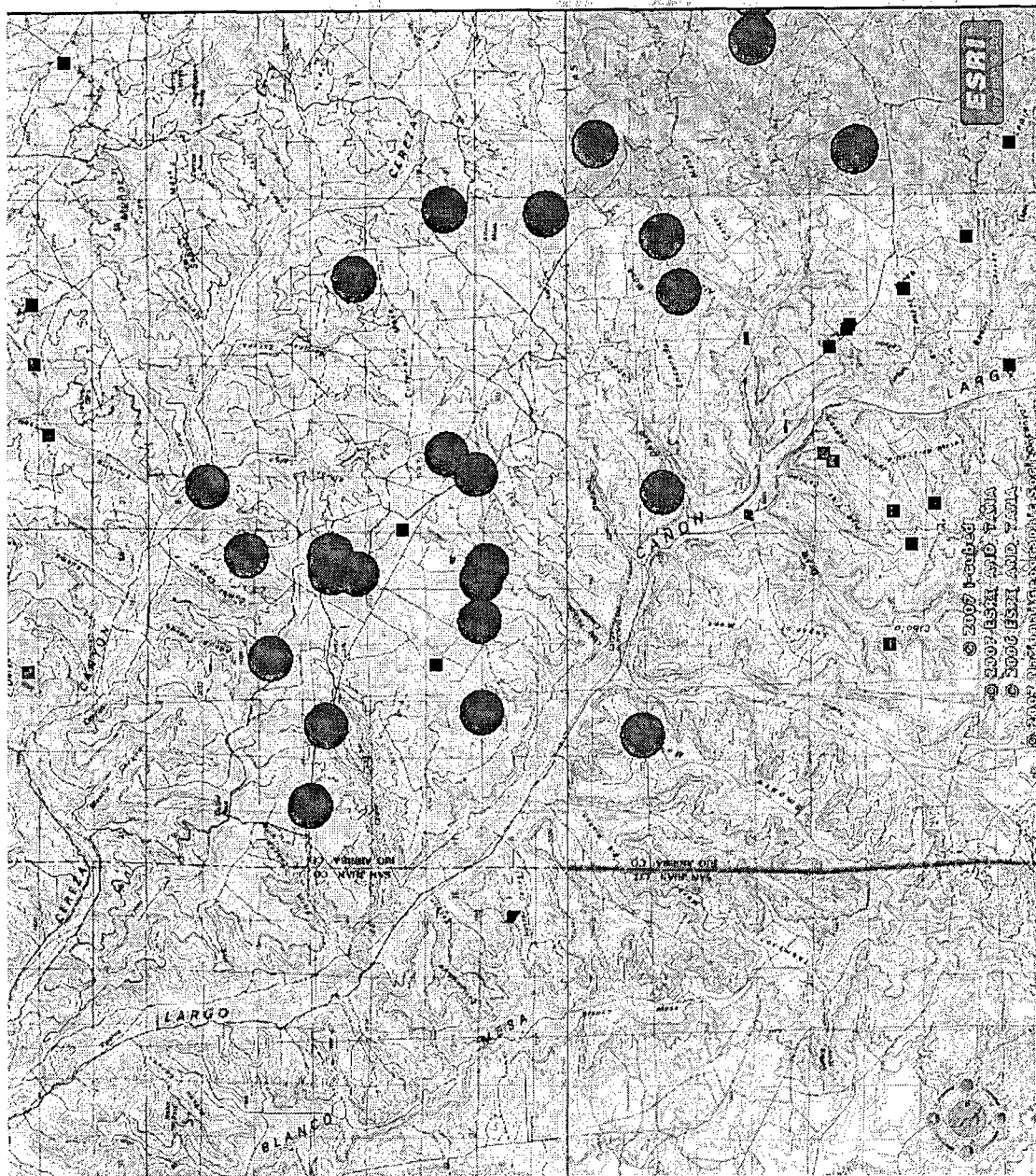
WATER WELLS LOCATED IN “NON-VULNERABLE” AREAS



WATER WELLS LOCATED IN “NON-VULNERABLE” AREAS



WATER WELLS LOCATED IN “NON-VULNERABLE” AREAS



SUMMARY OF HYDROGEOLOGY OF SAN JUAN BASIN

- The “vulnerable area” was partly based on the presence of alluvium in major rivers, etc.
- The “vulnerable area” alluvial aquifers are indeed very sensitive areas.

SUMMARY OF HYDROGEOLOGY OF SAN JUAN BASIN

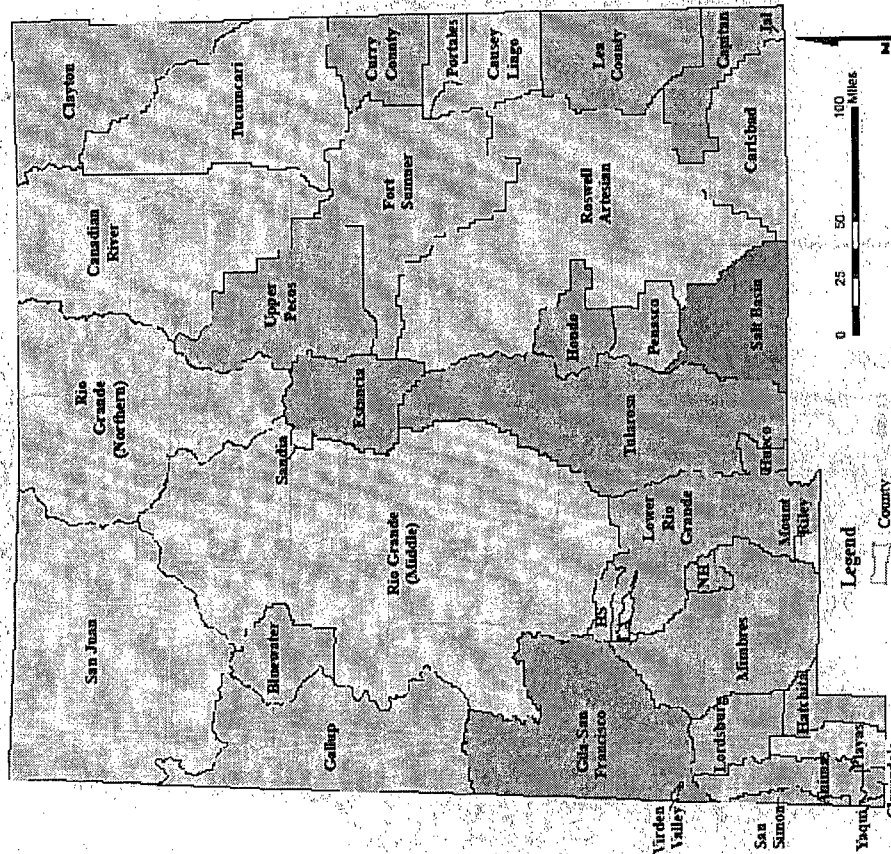
- Protectable ground water occurs in both alluvial and bedrock aquifers.
- Protectable ground water occurs in both the “vulnerable areas” and the so-called “non-vulnerable areas.”
- There is no hydrogeologic justification for the assumption that ground water will not or has not been impacted from releases from unlined pits in the “non-vulnerable areas.”

HYDROGEOLOGY OF

“EXEMPTED AREA” OF

SOUTHEAST NEW MEXICO

New Mexico Office of the State Engineer Underground Water Basins in New Mexico



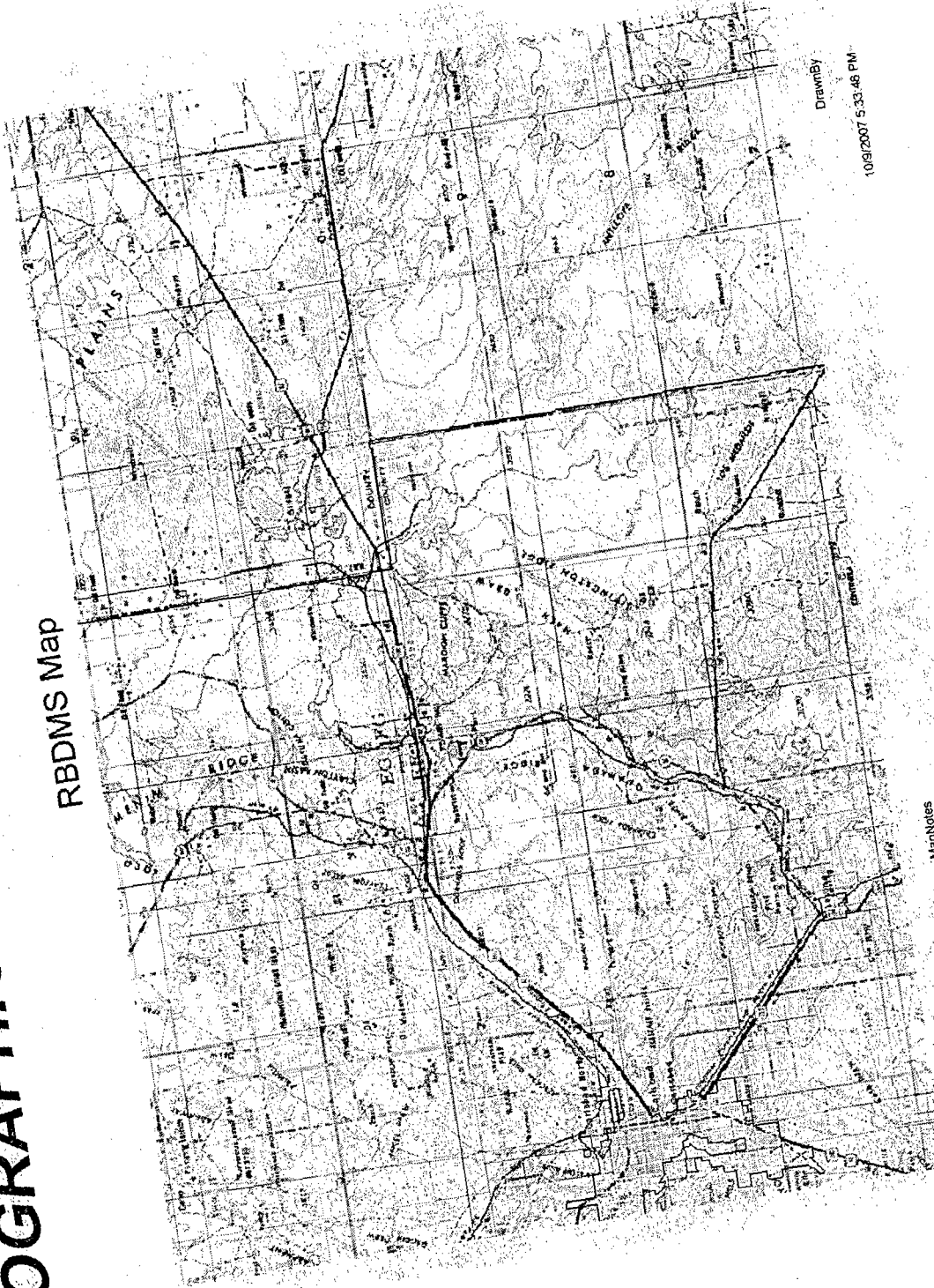
Underground Water Basins are based on the
Bureau of Land Management (BLM) National
Coordinate Data Base (NACDB) coordinates data (www.blm.gov/gis/)
Map is created in UTM, NAD83, Zone 13, North.
Created on October 24, 2009 by Christine Webster
GIS - Water Resources Assessment Program
File: \\blm\blm\basins_project\NewMexico\basins.mxd



[illegible]

TOPOGRAPHIC BASE OF EXEMPTED AREA

RBDMS Map



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10/9/2007 5:33:46 PM

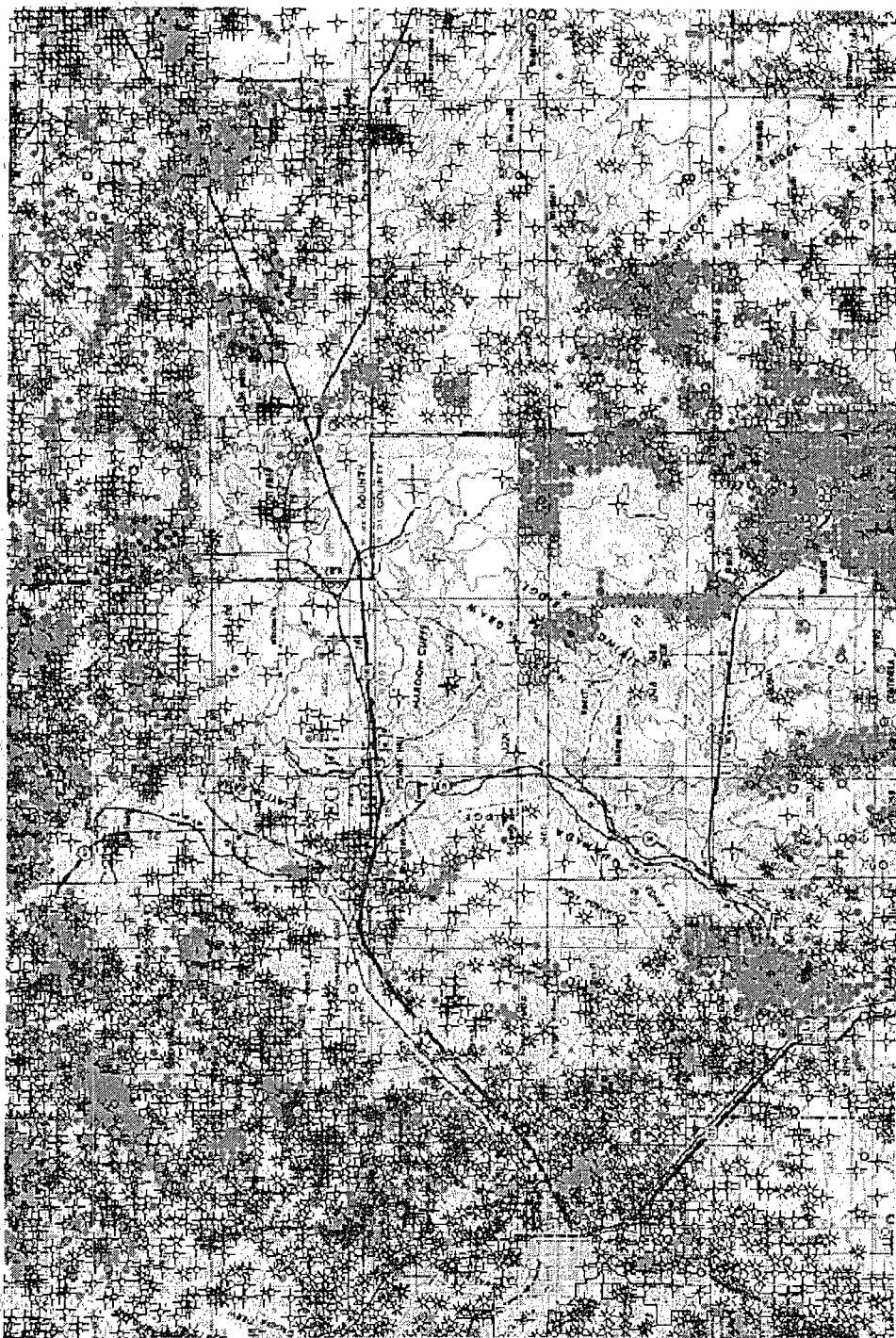
MapNotes

Oil Conservation Division



O&G WELLS IN EXEMPTED AREA

RBDMS Map



MapNotes

Oil Conservation Division

DrawnBy

10/9/2007 5:37:15 PM

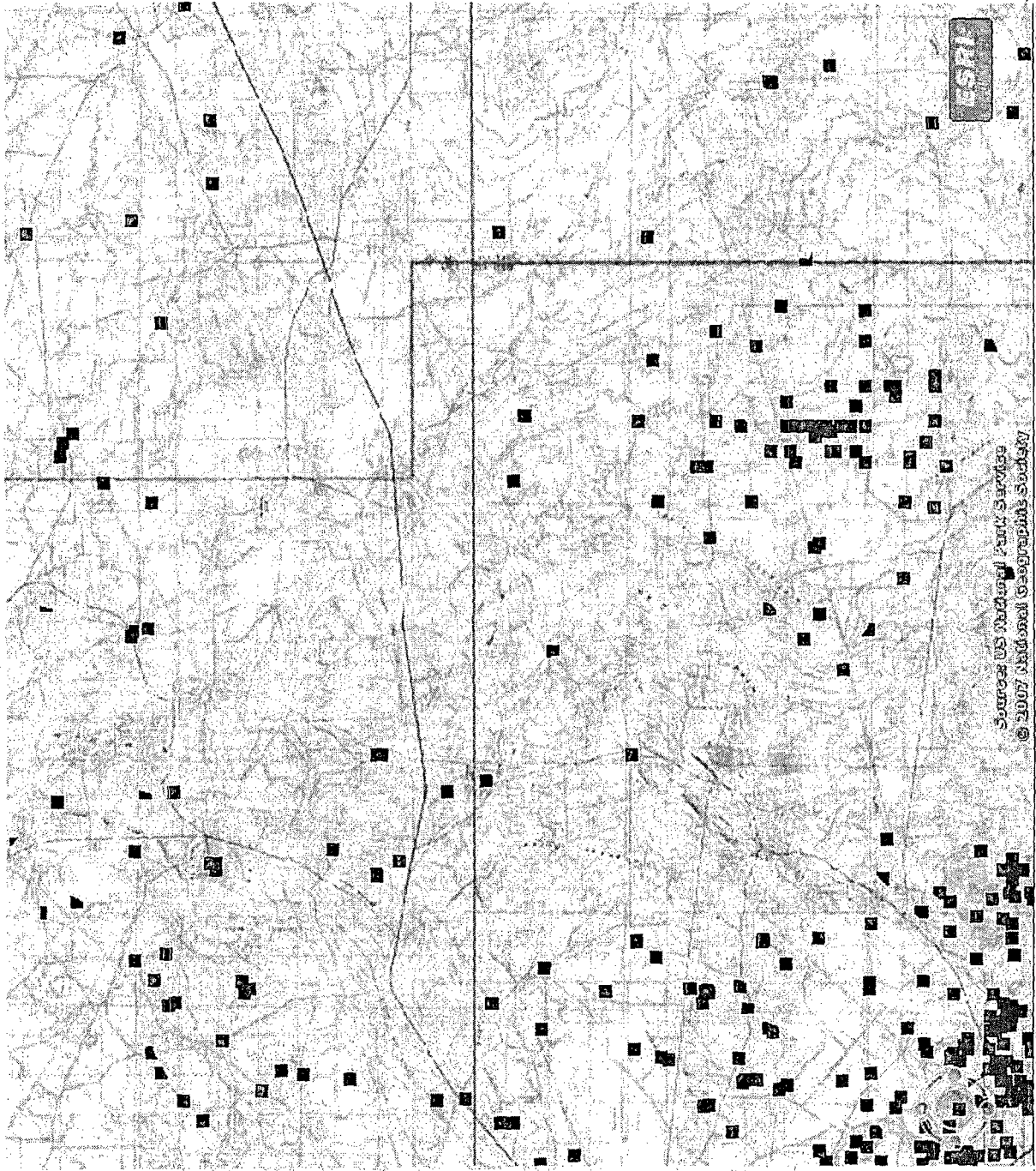
OFFICE OF THE STATE ENGINEER

iWATERS Database

➤ A total of 64 water wells are listed in the OSE iWATERS Database in the "Exempted Area," as specified in Subparagraph (g), Paragraph (2), Subsection C of 19.15.2.50 NMAC.

- 3 DOM (72-12-1 Domestic One Household)
- 5 EXP (Exploration)
- 5 IND (Industrial)
- 2 MIN (Mining Or Milling Or Oil)
- 22 MON (Monitoring Well)
- 15 PRO (72-12-1 Prospecting Or Development Of Natural Resource)
- 11 STK (72-12-1 Livestock Watering)
- 1 NS (Use Not Specified)

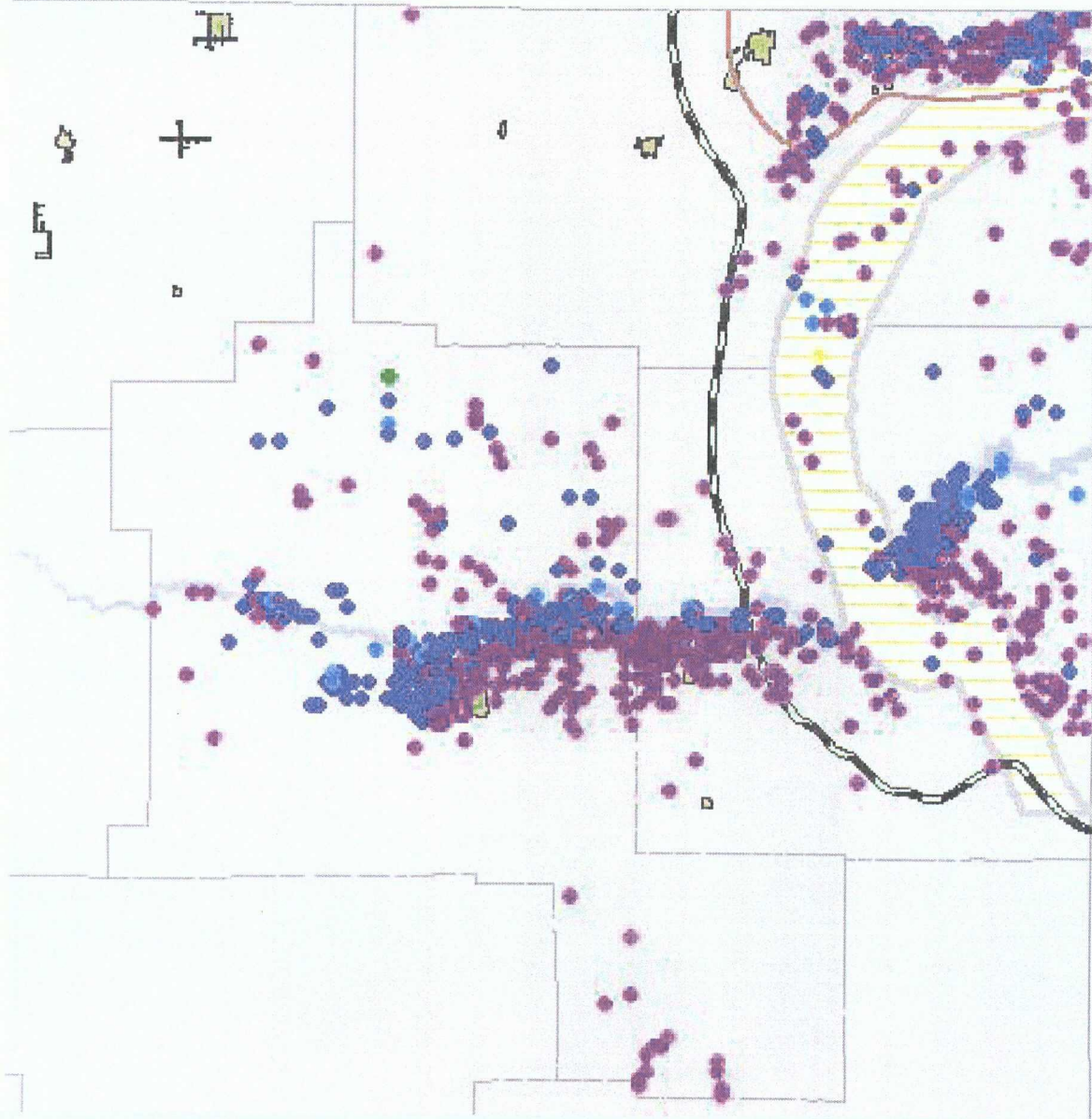
WATER WELLS IN EXEMPTED AREA



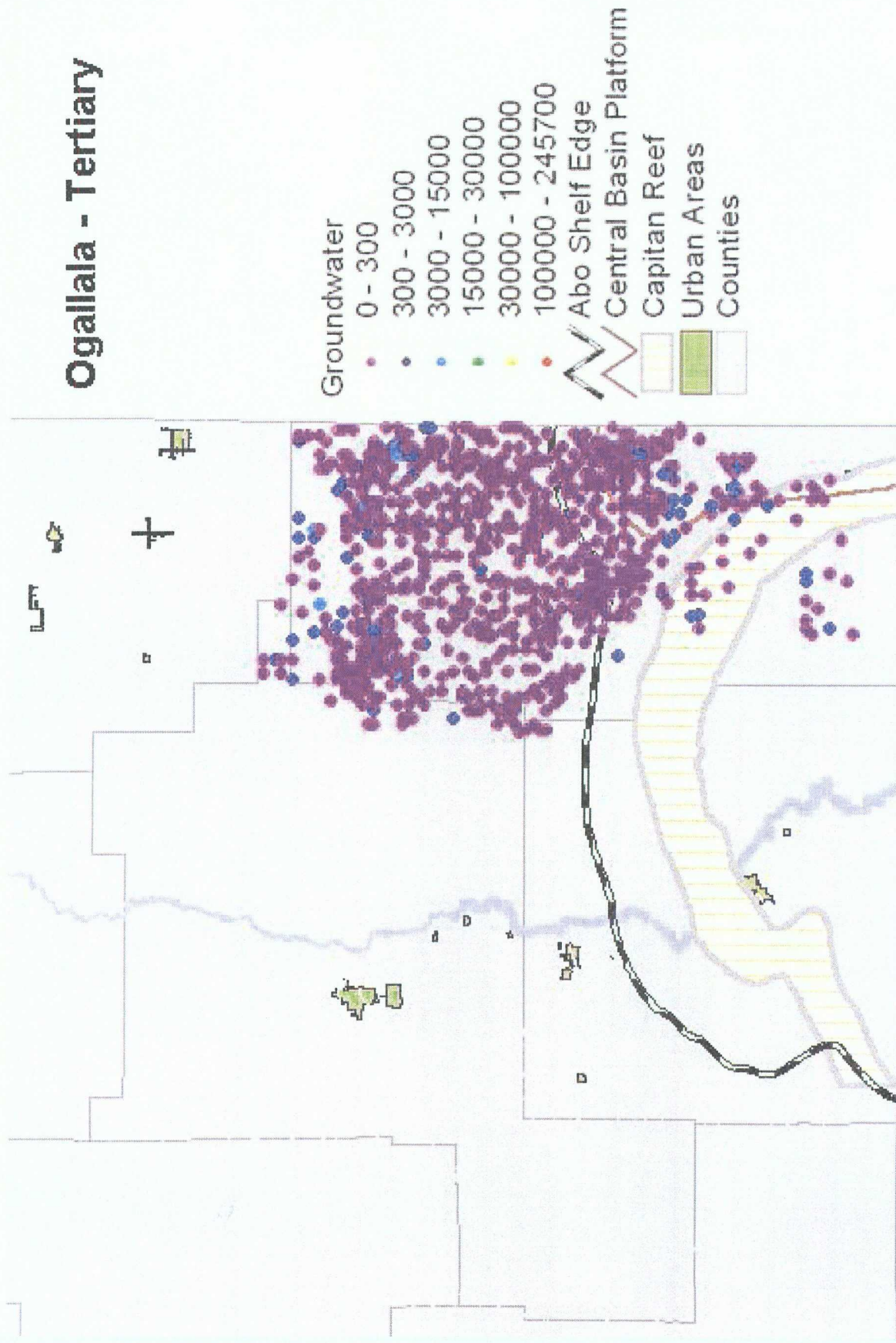
WATER QUALITY OF THE EXEMPTED AREA

Data from the New Mexico Water and
Infrastructure Data System
(NM WAIDS)

Quaternary Alluvium - Qal



Ogallala - Tertiary



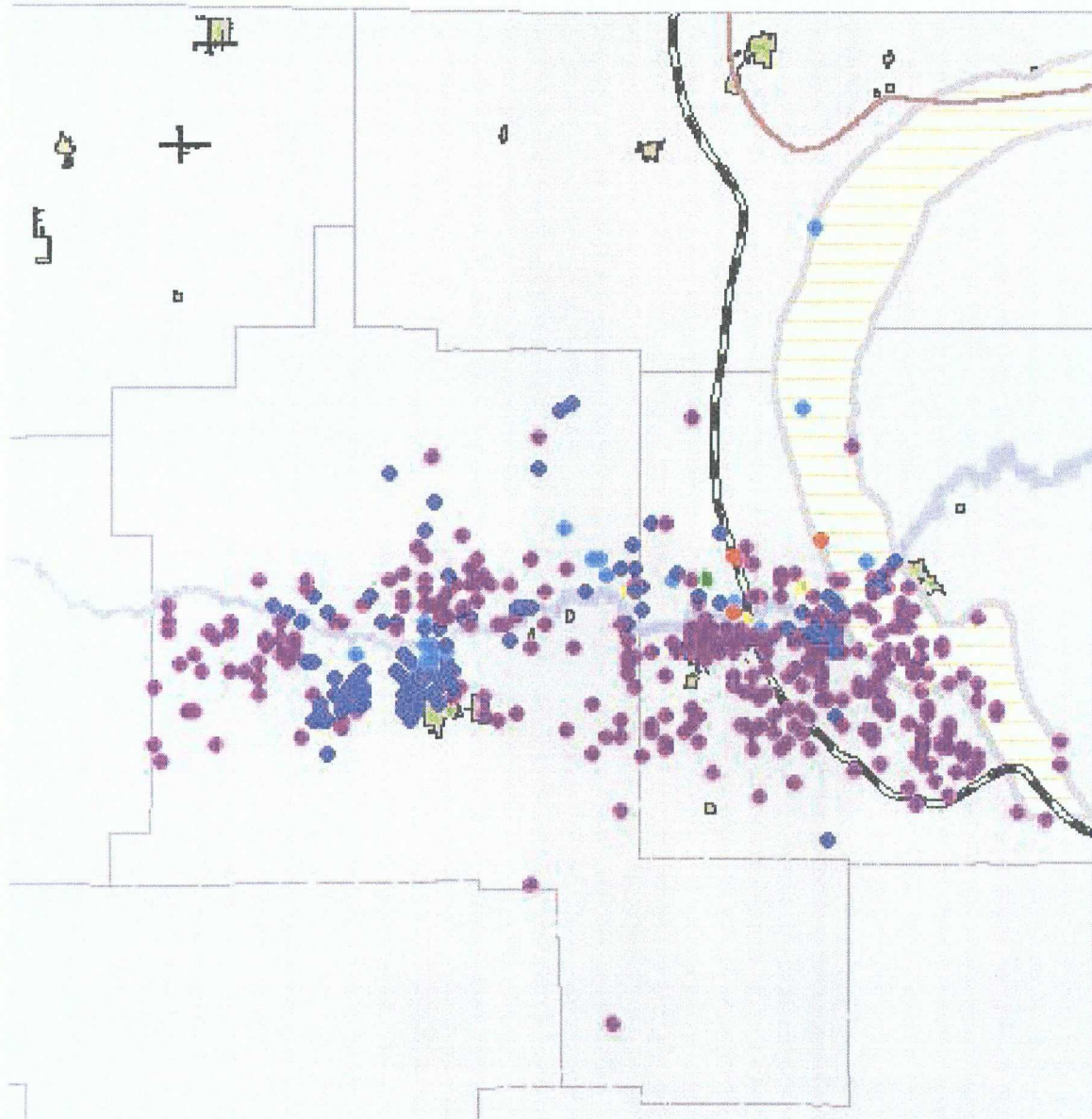
Triassic



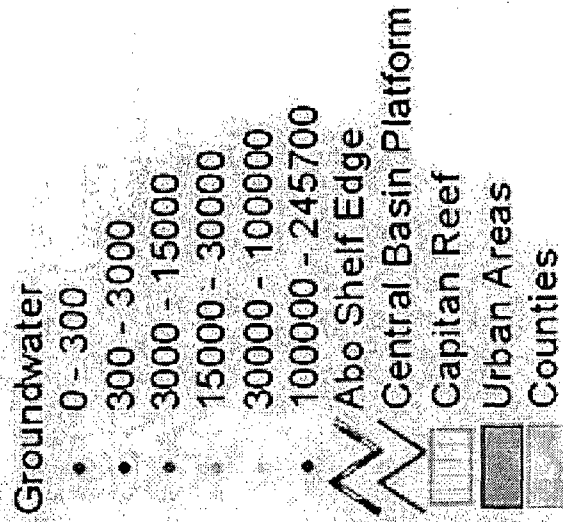
Ochoan - Permian (P4)



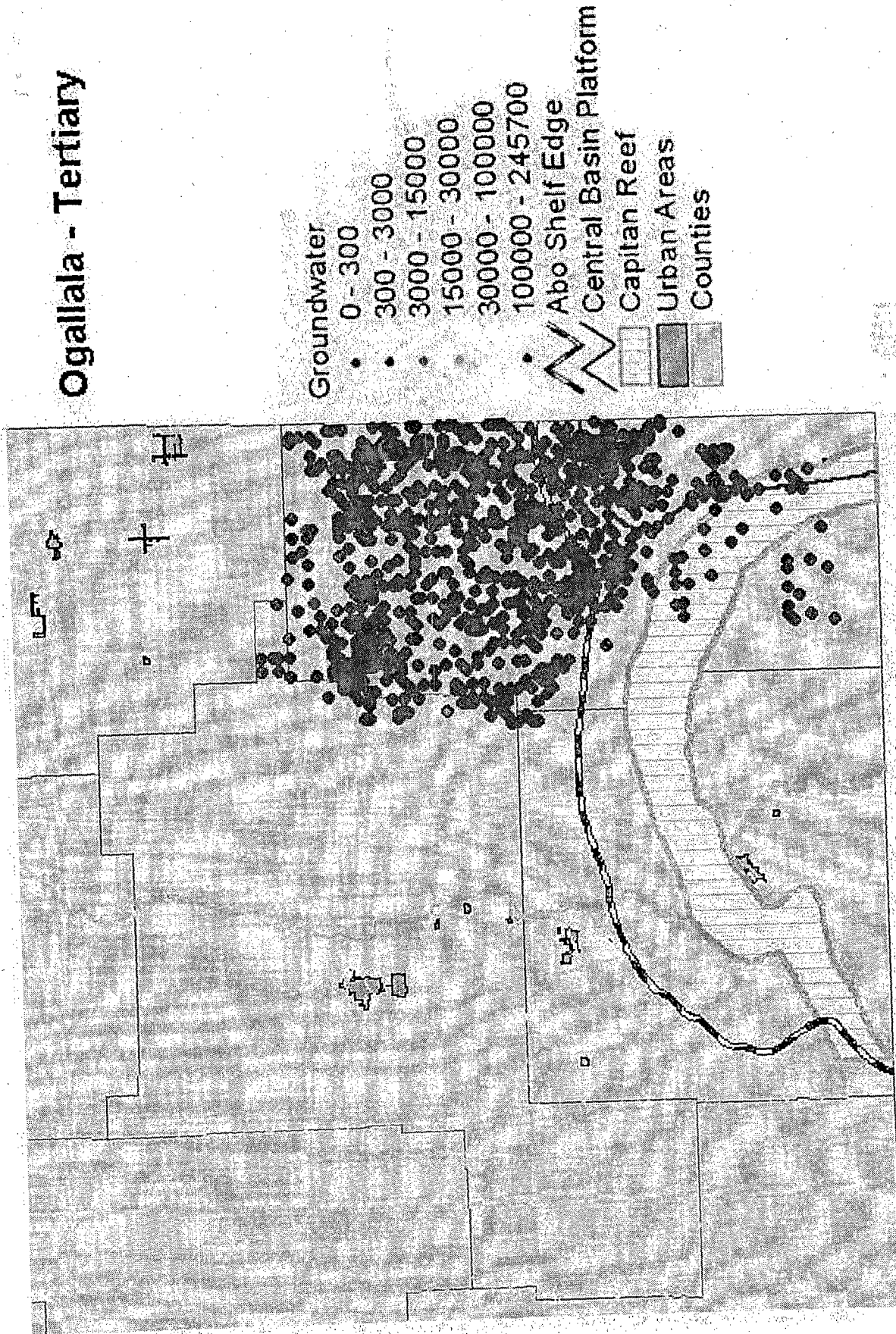
Artesia Group - Permian (P3)



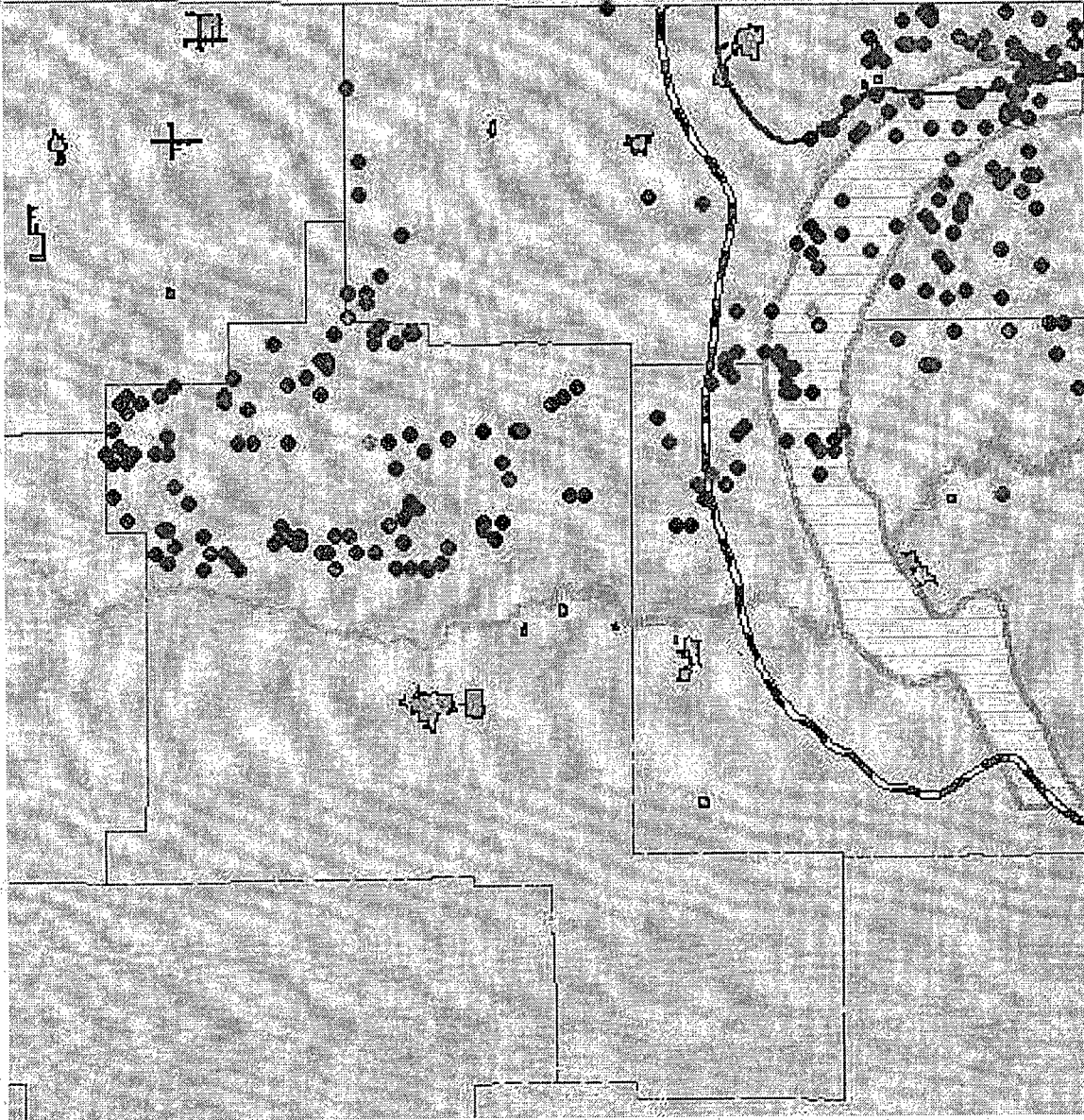
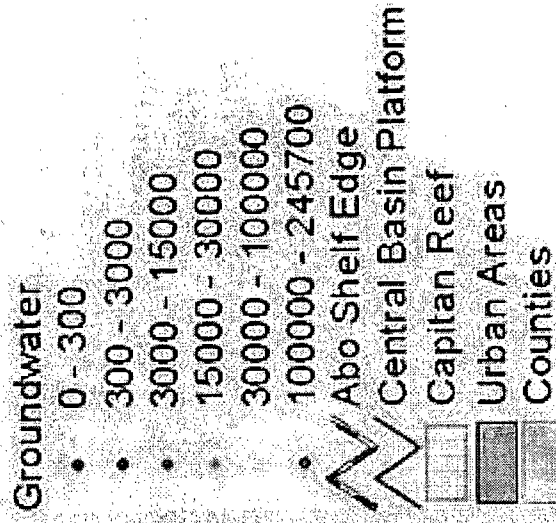
Quaternary Alluvium - Qal



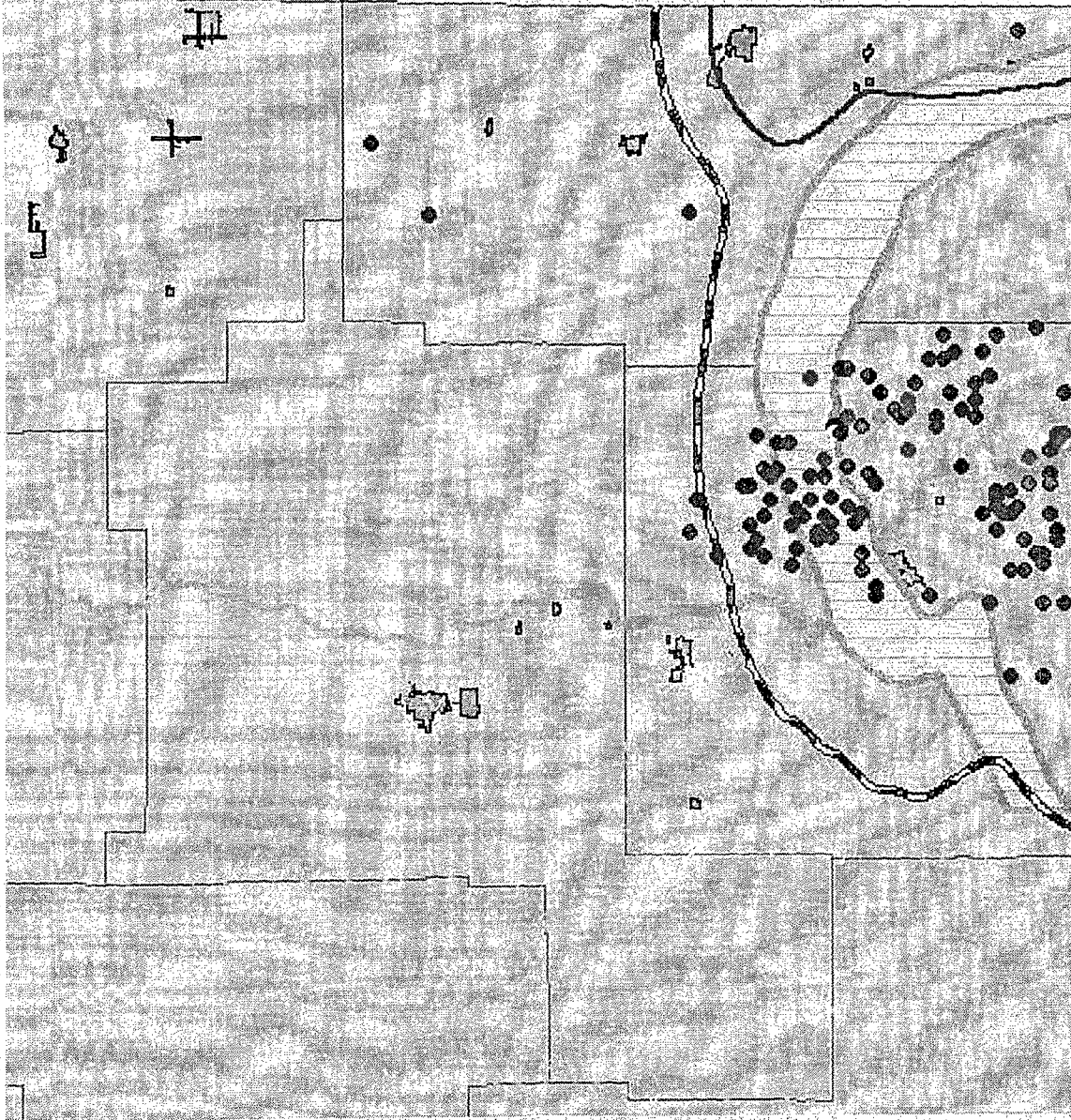
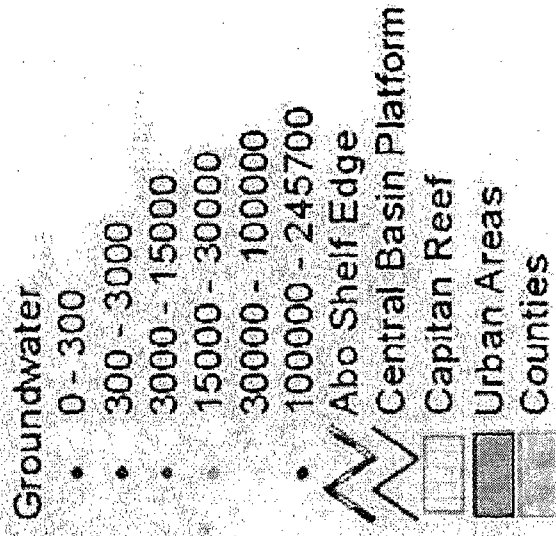
Ogallala - Tertiary



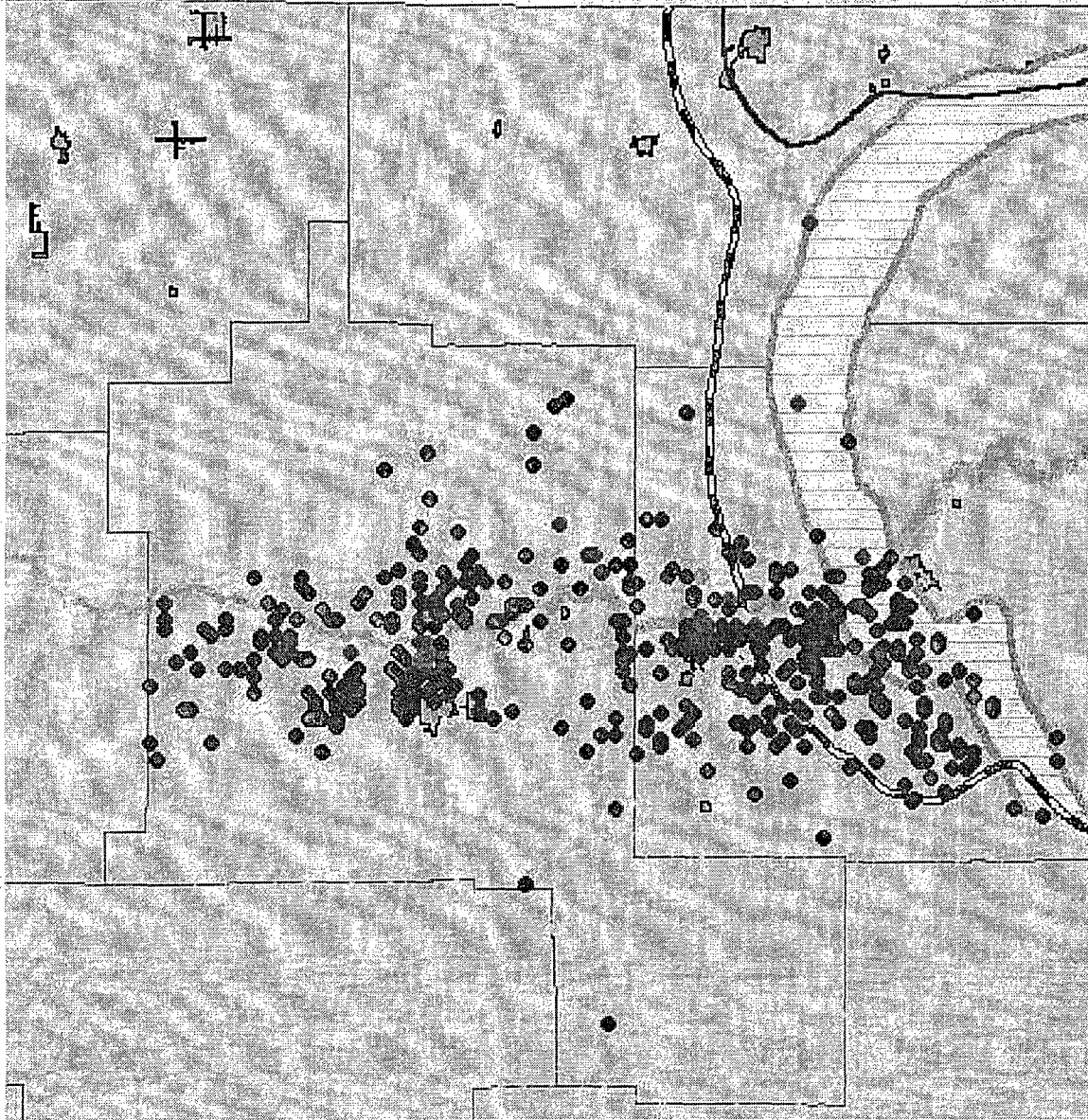
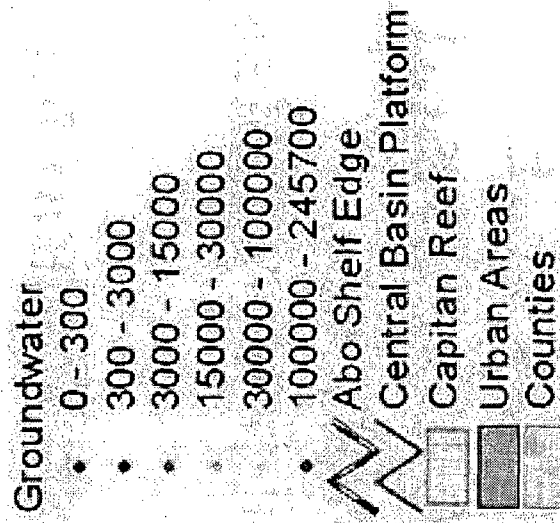
Triassic



Ochoan - Permian (P4)



Artesia Group - Permian (P3)



SUMMARY OF HYDROGEOLOGY OF EXEMPTED AREA OF SOUTHEAST NEW MEXICO

- The "exempted area" contains 64 OSE permitted water wells that are being used for "beneficial use" and that may be impacted by the release of oil field wastes from unlined pits.
- There is no hydrogeologic justification for the assumption that ground water will not or has not been impacted from releases from unlined pits in the "exempted areas."

DRILLING PIT GROUND WATER CONTAMINATION CASES

1R0474	Samson - State BD No. 4
1R0485	Chesapeake - Williams 14 Fed 1
AP056	Chevron U.S.A. - Mark Owen No. 9
AP061	Chesapeake - Herradura No. 3
AP062	Samson - Livestock 30
AP068	Apache - NEDU 527
AP070	Arrington - Mallon Drake 16 State No. 1
New Case	Bass Enterprises - Big Eddy Unit 151
New Case	Cimarex - Crawford No. 26-2
New Case	Marbob - Scratch State Com 1