ZUNI RIVER BASIN ADJUDICATION
HYDROGRAPHIC SURVEY REPORT
FOR SUB AREAS 4 AND 8

United States of America
v.
State of New Mexico, ex. rel State Engineer, A& R Productions, et al.
Case Number 01cv00072 BDB

Prepared Under the Direction of the

UNITED STATES DEPARTMENT OF INTERIOR

In Cooperation with the

State of New Mexico
Office of the State Engineer
Hydrographic Survey Bureau

By

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1 INTRODUCTION

The *United States v. State of New Mexico ex rel State Engineer, A&R Productions, et al.* case (Case number 01cv00072 BDB) is currently pending in the United States District Court for the District of New Mexico. This hydrographic survey report serves the Zuni River Basin water rights adjudication process of this case. The Zuni River Basin was divided into 10 sub-areas to facilitate the orderly survey of water uses over multiple years (see Figure 1-1). During 2003, sub-areas 4 and 8 of the Zuni River Basin area were surveyed for water uses. The major water uses in these sub-areas are domestic and stock watering, with little commercial, industrial, and agricultural irrigation uses. The findings of the hydrographic survey are presented in this report. Maps showing the location of water uses are included with this report.

1.1 Description of the Area

The Zuni River Basin, depicted in Figure 1-1, covers approximately 1,930 square miles of land in Cibola and McKinley counties in the western central part of New Mexico. The Basin is bounded on the northwest and northeast by the Upper Puerco Basin and the Rio San Jose Basin, respectively, and on the southwest and southeast by the Carrizo Wash Basin and the North Plains Closed Basin, respectively. Sub-areas 4 and 8 of the Zuni River Basin lie within Cibola County, and cover the eastern part of the Basin from Range 12W to Range 14W (see Figure 1-1). Sub-area 4, lying in townships 10 and 11, covers 79.4 square miles (50,808 acres), while Sub-area 8, lying in townships 7, 8, and 9, covers an area of 167.6 square miles (107,256 acres) (see Figure 1-2). The climate of the area is characterized as a semi-arid. The annual average minimum temperature is in the range of 30 to 34ºF, and the annual average maximum temperature is in the range of 64 to 67ºF. More variations in temperature are observed, with highs up to the 90's in the summer and lows down to the teens in the winter. The average annual precipitation is in the range of 12 to 14 inches, while average annual snowfall is in the range of 17 to 44 inches, depending on location and elevation.

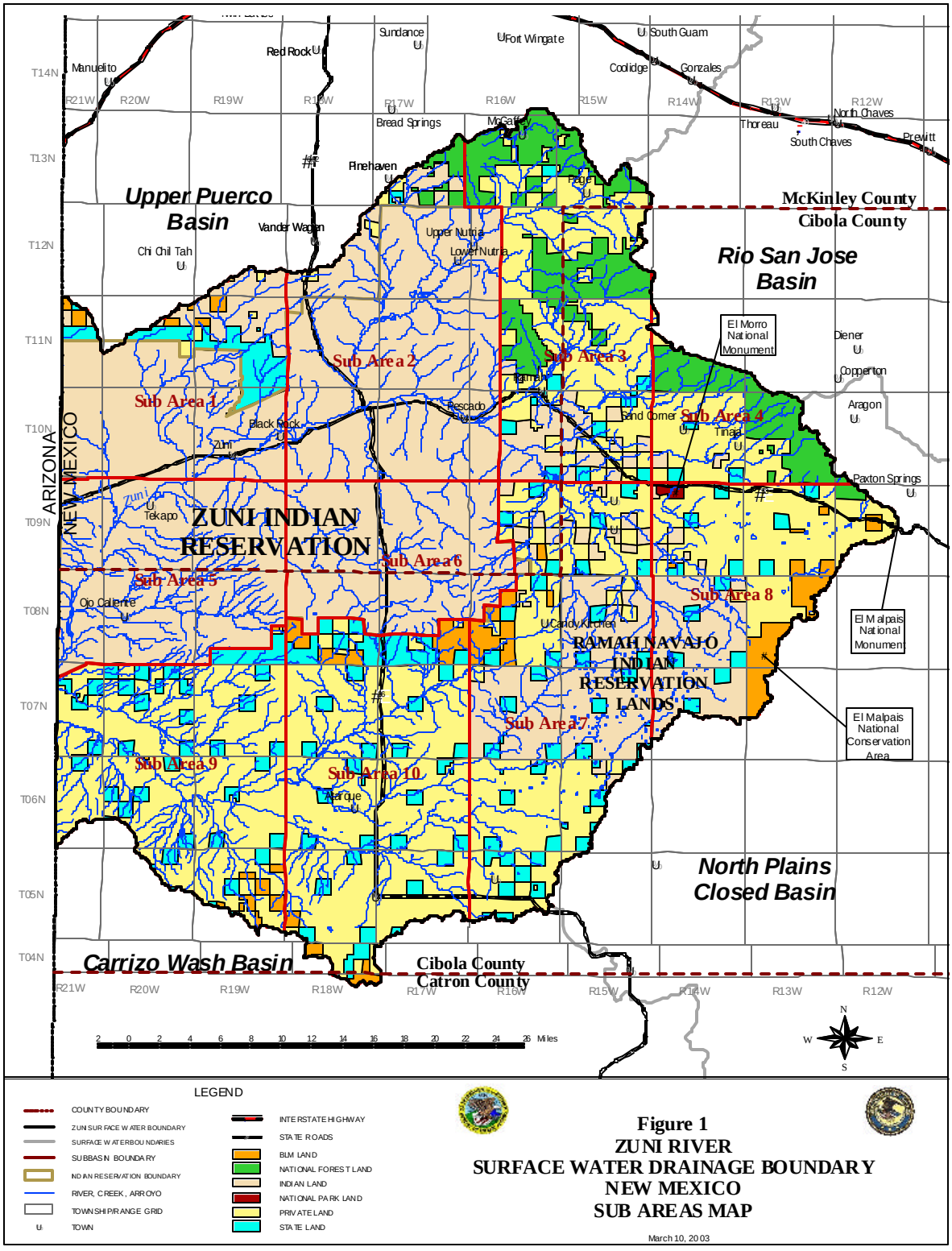

Figure 1-1: Zuni River Basin and Sub-areas.

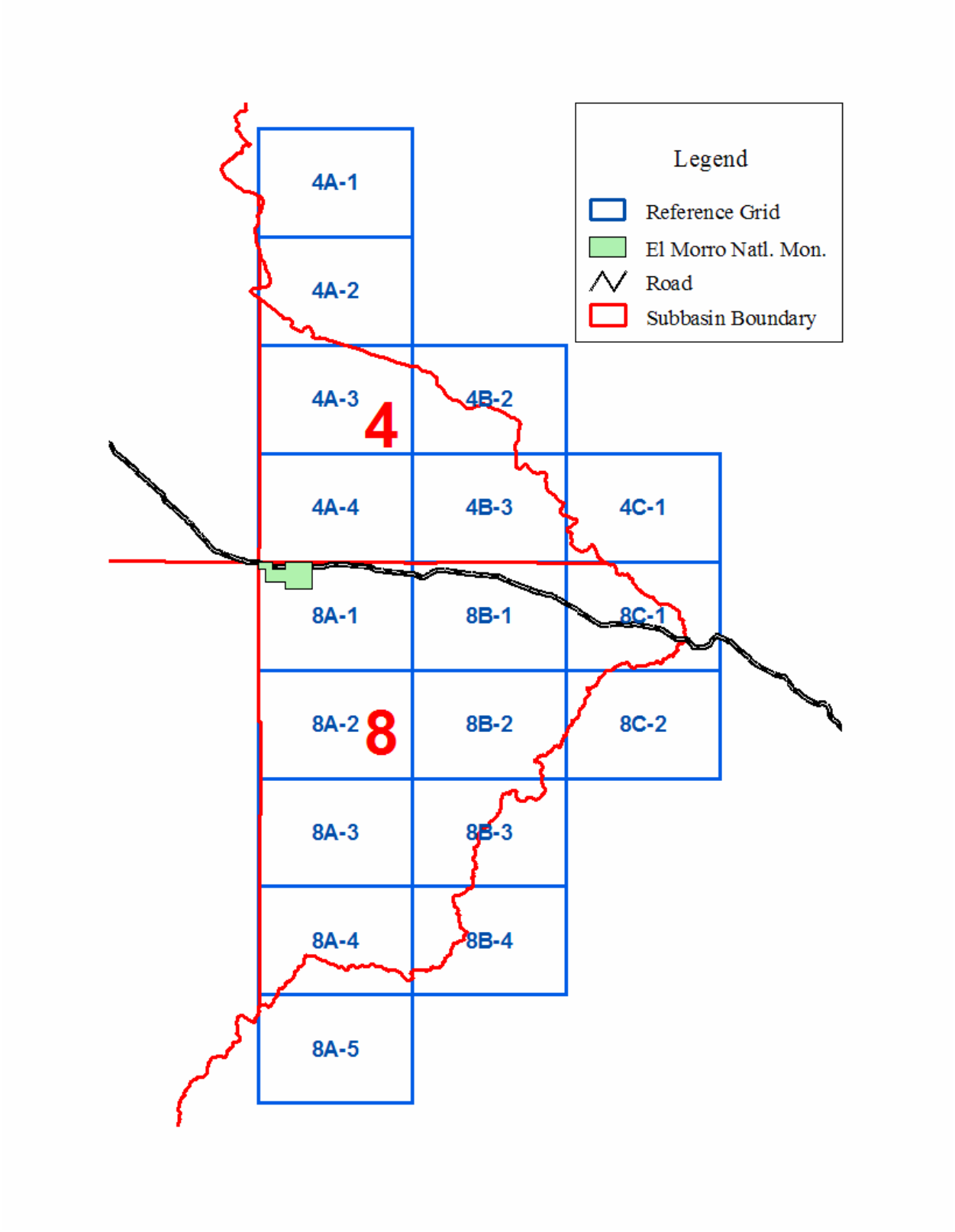

Figure 1-2: Map Index for Sub-areas 4 and 8 of the Zuni River Basin.

1.2 Technical Specification for Hydrographic Survey

The technical specifications for the hydrographic survey follow those prepared by the State of New Mexico, Office of the State Engineer, Hydrographic Survey Bureau (Hydrographic Survey Specifications) dated April 15, 2003. The United States and the State of New Mexico prepared a document entitled 'Joint Technical Progress Report, Zuni River Hydrographic Survey' (February 2002), which describes the procedure, variances, and schedule for the hydrographic survey. The United States and the State of New Mexico Hydrographic Survey Bureau consulted during the hydrographic survey field work and report preparation.

The Zuni River Basin is in the Gallup Underground Administrative Basin which was declared in March 14, 1994. Therefore, many of the domestic and stock wells in the Zuni River Basin were drilled without requiring a permit. For this reason, a process was established requesting that water users update their water rights to include wells constructed prior to 1994. This process included mailing packets of information to land owners, holding a public meeting, and establishing field offices staffed by Office of the State Engineer personnel to help water users update and complete their water rights records. Additionally, whenever possible, the land owners were consulted concerning wells and ponds on their property at the time of the field assessments. The field assessment identified many wells without permits. The water rights identified during the abstracting process were linked to the information obtained in the field during the hydrographic survey.

1.3 Aerial Photography

Aerial photography and topographic maps were used as a basis for mapping the areas of interest. For Sub-areas 4 and 8, United States Geological Survey (USGS) digital orthophoto quarter quadrangles (DOQQs) produced using aerial photography acquired in June and October of 1997 were plotted on a scale of 1:12,000 (1"=1000'). DOQQs are adequate for mapping of domestic and stock water uses based on the State of New Mexico Hydrographic Survey Technical Specifications dated April 15, 2003.

2 GEOGRAPHIC INFORMATION SYSTEM

All the geospatial components of the hydrographic survey water uses that were field inspected are stored in a Geographic Information System (GIS). The system used is in Windows-based ArcGIS software. The data and information stored consists of:

- Digital image data acquired for survey.
- Data (hard copy and electronic) obtained from state agencies including landowners, addresses, and ownership maps.
- Data and information acquired from the hydrographic survey field work.

As stated previously, USGS DOQQs were used for mapping purposes. The images were transferred into the New Mexico State Plane Coordinate System, West Zone, using the 1983 North American Datum.

Property ownership data was obtained from the Cibola County Assessor's Office in Grants, New Mexico. Property ownership maps were obtained from the same office. Not all of the areas in the sub-basin have owner names.

All data gathered was compiled in a Microsoft Access database. The database includes owner name and address; sub-file number; map label; Office of State Engineer file number; water uses, sources, and types; locations (PLS); coordinates; aerial photograph and field visit dates; description of facilities; and photograph identifications of the water features.

2.1 Global Positioning System

All the water use locations were mapped using a Global Positioning System (GPS). Field crews used a Trimble GeoXT (hand-held 12 channel) GPS receiver. The integrated Wide Area Augmentation System (WAAS) differential GPS data service was used to achieve location data while in the field.

2.1.1 Field Data Logging Procedures

All GPS observations were made at an approximate antenna height of four feet. GPS data was logged at one position per second at maximum position dilution of precision 8.0 and a minimum

signal noise ratio of 3.0. The elevation mask used was 12 degrees. GPS data was collected using the internal antenna of the receiver.

2.1.2 Office Data Processing Procedures

Data was post-processed using a GeoXT software package that includes the Trimble Pathfinder Office version 2.90. Post-processing consisted of differential corrections of the raw receiver files using the New Mexico Institute of Mining and Technology base station at the University of New Mexico, Albuquerque. All data was analyzed in the North American Datum of 1983 and mapped in the New Mexico State Plane coordinated systems.

2.2 Field Inspections

2.2.1 Well and Spring Locations

All well and spring locations were mapped using GPS. Rough locations of wells that have permit numbers were obtained from the New Mexico Office of the State Engineer's Water Administration Technical Engineering Resources System (WATERS) database. Wells that have no permit numbers were located either using information provided by land owners or using topographic maps. Locations of these wells were verified in the field. Photographs of all springs and wells were obtained during the field visits.

2.2.2 Stock Pond Locations

Stock ponds (dirt tanks) were located using aerial photos, declarations, state records, and information from land owners and then field mapped using GPS. In many instances, new stock ponds not visible on aerial photos were identified. These stock ponds were delineated with the GPS using a polygon feature. At the time of the visit, ponds were determined to be either man-made stock ponds or natural ponds. If a natural pond was excavated or diked, then the pond was determined to be man-made. Dam heights greater than 9-feet were recorded. Photographs of the stock ponds were taken during the field visit.

2.2.3 Irrigated Land

In Sub-areas 4 and 8, there is only one parcel of irrigated land. This land was visited and inspected and the boundaries were delineated using the USGS DOQQs. The water source (a spring) was identified along with the point of diversion (a ditch). The parcel is irrigated from a seasonal spring that appears to be primarily fed from runoff and snow melt. The area of the parcel was determined after being delineated from the GIS interface. All other related data were recorded in the field.

3 DUTY OF WATER (DIVERSION)

3.1 Wells

Wells were categorized according to water use based on field visits, water right records, and information received from owners. The following categories were used:

- Domestic – The duty of water for domestic wells is historical beneficial use up to a maximum of 3 acre-feet per year (New Mexico Statues Title 19, Chapter 27, Part 1.22).
- Stock – The duty of water for stock wells is the estimated water use of livestock that could be sustained by the area served by the well or landowner area. The water use of cattle was calculated based on the information prepared by State of New Mexico. The area of land in which the well is located was determined from property ownership maps and database obtained from Cibola Assessors office. Carrying capacity is based on the number of "animal units" that can be sustained on a section of land, with one cow or five sheep equivalent to one unit. The land carrying capacity, which is the number of animals that a habitat maintains in a healthy, vigorous condition, was assumed to be 15 animal units per section. This estimate is based on information from the New Mexico Department of Agriculture. The water consumption of an animal unit is estimated at an average of 10 gallons/day (488 $feet^3$ per year or 0.0112 acre-feet per year) (Wilson and Lucero, 1997). As an illustrative example, if a stock well serves 1,280 acres (2 sections), the carrying capacity of this land is 30 animal units with a duty of 0.336 acre-feet per year. The minimum stock water amount was set at 0.1 acre-feet per year.
- Domestic and Stock - The duty of water for domestic wells is historical beneficial use up to a maximum of 3 acre-feet per year (New Mexico Statues Title 19, Chapter 27, Part 1.22).
- Commercial – The duty of commercial wells is based upon the historical use of the well. The commercial wells are for small restaurants, hotels (cabins), and stores.
- Industrial – The duty of water for the industrial wells is based upon the historical use of the well and the information provided by the owner. The industrial wells in Sub-areas 4 and 8 are for mining purposes.

- Sanitary and Commercial – The duty of water is based on the historical use of the well and information provided by the owner. The use was also specified by the owner and verified by the field survey.
- Public Water Supply – A public water supply well serves multiple homes (by water hauling) and hauled stock water. The duty of water is based on estimated water uses.
- Commercial, Domestic, and Stock – The duty of water is based on the historical beneficial use from the well with the well being used for commercial, domestic, and stock water.

3.2 Ponds

The duty of water for ponds is based on their capacities. The number of times a pond fills during a year is not estimated. The capacities of the ponds were determined using the following methodology:

Stock pond depths were estimated based on the high-water mark observed in the field. Stock pond boundaries were delineated in the office prior to the field visit. Second, the boundaries were verified /modified in the field and then they were brought into GIS for area calculations. The capacity of the stock pond was calculated by multiplying the depth times the area times a factor of 0.6 that accounts for the irregularity of the pond's geometry.

Priority dates for man-made stock ponds were obtained from owners declarations whenever available. In the case where owners did not declare their stock pond priority dates, the date of the aerial photo was set as the priority date of the pond.

3.3 Irrigated Lands

The area of the irrigated land was determined to be 80.2 acres of pasture. The consumptive use for the area is to be determined later during the adjudication process.

4 FINDINGS OF THE HYDROGRAPHIC SURVEY

The findings of the Zuni River Basin Hydrographic survey of Sub-areas 4 and 8 are documented in this report. The findings are divided into two sections; Appendix 1 lists the water uses that have been developed by man for beneficial use (wells, constructed stock ponds, and irrigated land), and Appendix 2 lists naturally occurring water that may be beneficially used (i.e. natural ponds and springs). Documentations are presented in the form of sub-files, summaries of surveyed features, and maps. The information was prepared by or under the direction of Lee Niel Allen, a Licensed Professional Civil Engineer in the State of New Mexico.

4.1 Subfiles

Subfiles were created to identify the water right(s) of property owners within Sub-areas 4 and 8. Each owner having a water right is assigned a subfile, identified by a number. The subfile number is unique for each owner. It starts with the letters ZRB (Zuni River Basin), and then the number "1", indicating that this is the first stage of the hydrographic survey of the Basin. The subfile contains information about the surveyed water uses (stock ponds, wells, irrigated tracts, and springs). In Appendix 1, information about the features include owner name and address; water use (domestic, stock, etc.); type (well, pond, etc.); date of field visit; height of dam (if applicable); estimated depth, area, and volume (for impoundments); and place and location of use (section, township, range, and coordinates).

Naturally occurring water that is contained within owner property does not require a water right, but can be beneficially used for stock water. Information about naturally occurring water (natural ponds and springs) is contained in Appendices 2 and 3.

4.2 Map Labels

The map labels contained on the maps and in the report summaries provide information concerning the type of water use feature and the location of the feature. The first number in the label is the sub-area number and the first three characters are the map plate number on which the feature is located. Then the label has an identification of the feature type (SP for a stock-pond, W for a well, SPR for a spring, and IRR for an irrigated land). For example, 8B-1-SP23 indicates that this is a stock pond in sub-area 8 located on map plate 8B-1. The last two numbers were

assigned sequentially for every feature. Also shown on the map label is the sub file number associated with the feature for easy reference in the survey report.

4.3 Office of State Engineer File Number

When applications for water uses have been filed to the State, the Office of the State Engineer assigns a file number to the water use feature. These file numbers are obtained from the WATERS database. For wells, the Office of the State Engineer file number begins with the letter G, indicating the Gallup Underground Water Basin. OSE file numbers associated with surveyed wells are shown in the Hydrographic Survey report.

4.4 Summary of Findings of the Hydrographic Survey

The features surveyed in this report include ponds (man-made and natural), wells, irrigated areas, and springs. There is a total of six springs, one of them used for irrigation and the rest for stock watering. Tables 4-1 and 4-2 show a summary of the findings of the survey.

Table 4-1: Counts of Surveyed Wells and their Uses

Well Use	Count
Domestic	78
Stock	36
Domestic and Livestock	7
Commercial	1
Industrial	2
Sanitary & Commercial	2
Com./Dom./Stock	1
Total	**127**

Table 4-2: Counts of Surveyed Ponds

Pond	Count
Man-made	248
Natural	143
Total	**391**

4.5 Other Information

This hydrographic survey report does not include information concerning the federal water claims in Sub-areas 4 and 8. This information will be filed with the court at a later date. The hydrographic survey report does not ensure the truthfulness of all information in the declarations submitted by landowners or the land ownership information obtained from the Cibola County Assessor's Office. The United States, State of New Mexico, and Natural Resources Consulting Engineers, Inc. (consultant) reserve the right to update the information in the hydrographic survey report based new data.

5 REFERENCES

New Mexico Department of Agriculture. Online. Available http://nmdaweb.nmsu.edu/links.html.

Wilson, B. C. and Lucero, A.A. (1997). Water Use by Categories in New Mexico Counties and River Basins, and Irrigated Acreage in 1995. New Mexico State Engineer Office. Technical Report 49.

Appendix 1

Zuni Basin Hydrographic Survey
Sub-area 4 and 8

Report of Water Findings

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Appendix 2

Zuni Basin Hydrographic Survey
Sub-area 4 and 8

Report of Natural Ponds

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Appendix 3

Zuni Basin Hydrographic Survey
Sub-area 4 and 8

Report of Springs

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