



Baca / Thoreau Water System Well Project

Navajo Nation, McKinley County, NM

November 2017



Hydrogeologic Investigation Report

Prepared for:
Navajo Nation Water Management Branch
PO Box 678
Fort Defiance, AZ 86504





November 17, 2017

#6922883

Mr. Jason John
Navajo Nation
Water Management Branch
PO Box 678
Fort Defiance, AZ 86504

Subject: Hydrogeologic Investigation Report, Baca-Prewitt & Thoreau Navajo Chapter, McKinley County, New Mexico

Dear Mr. John:

Souder, Miller, & Associates (SMA) is pleased to submit this Hydrogeologic Investigation Report for the Baca-Thoreau Water System Well Project. The report summarizes the hydrology in the project area and provides recommendations for the location of a future water supply well.

SMA appreciates the opportunity to provide Engineering Services to the Navajo Nation. If you have any questions or comments concerning the report, please feel free to call me at 505.299.0942 or to email me at matthew.earthman@soudermiller.com.

Sincerely,

SOUDER, MILLER & ASSOCIATES

Matthew A. Earthman, P.G.
Project Geoscientist

Enclosure: Hydrogeologic Investigation Report

Cc w/ Enclosures:

Ms. Helena Shannon, District Engineer, Indian Health Services, Gallup, NM
Mr. David Shoultz, Principal Engineer, Navajo Tribal Utility Authority
Ms. Sharon Francisco, Baca/Prewitt Navajo Chapter
Mr. Lester Emerson, Thoreau Navajo Chapter

TABLE OF CONTENTS

1.0	INTRODUCTION AND BACKGROUND	1
1.1	Baca-Thoreau Water System Overview	1
1.2	Statement of Problem	1
2.0	PROJECT APPROACH	2
3.0	GEOLOGY AND SITE SETTING	2
3.1	Regional Geology.....	2
3.2	Site Setting	3
3.3	Local Geology	3
3.3.1	Cenozoic Units	4
3.3.2	Mesozoic Units.....	4
3.3.3	Paleozoic Units	5
3.4	Geological Structure.....	6
4.0	HYDROLOGY	6
4.1	Upper Chinle Formation Aquifer	7
4.2	Sonsela Sandstone Member Aquifer	7
4.2.1	Aquifer Characteristics.....	7
4.2.2	Existing Wells & Infrastructure	7
4.2.3	Water Quality.....	7
4.3	San Andres & Glorieta Formation Aquifer	8
4.3.1	Aquifer Characteristics.....	8
4.3.2	Existing Wells & Infrastructure	8
4.3.3	Water Quality.....	9
5.0	NEW WELL LOCATION EVALUATION.....	9
5.1	Well Interference Assessment	10
5.2	Potential Contaminant Source Inventory	11
6.0	CONCLUSIONS & RECOMMENDATIONS	12
7.0	REFERENCES	13

LIST OF FIGURES

- Figure 1.** Vicinity Map of Baca-Thoreau Project Area
- Figure 2.** Aerial Photo of Thoreau Area with Existing Water Supply Wells
- Figure 3.** Geologic Map of Project Area
- Figure 3a.** Geologic Unit Descriptions & A-A' Geologic Cross Section of Project Area
- Figure 4.** Stratigraphic Section of Bedrock Units near Thoreau
- Figure 5.** Structural Contour Map of Sonsela Sandstone Formation
- Figure 6.** Structural Contour Map of San Andres/Glorieta Formation
- Figure 7.** Proposed Well Installation Areas near Thoreau
- Figure 8.** Proposed Well Site No. 3 Contaminant Inventory Map

LIST OF TABLES

- Table 1.** Summary of Municipal Supply Wells near Thoreau
- Table 2.** Summary of Well Data from NMOSE & USGS Database
- Table 3.** Summary of Water Quality Data from USGS Database
- Table 4.** Summary of Potential Contaminant Sources near Proposed Well Site 1

APPENDICES

- Appendix A.** Conceptual Well Design Diagram
- Appendix B.** Theis Equation Calculations
- Appendix C.** Tribal Well Information & As-Built Diagrams
- Appendix D.** NMOSE Well Logs & Information

HYDROGEOLOGIC INVESTIGATION REPORT

Baca-Thoreau Water System Well Project
Navajo Nation, McKinley County, New Mexico

November, 2017

1.0 INTRODUCTION AND BACKGROUND

Souder, Miller & Associates (SMA) has prepared this hydrogeologic investigation for the Water Management Branch and Baca-Prewitt Chapter of the Navajo Nation in order to address the findings of the Baca-Thoreau Preliminary Engineering Report (PER) prepared by SMA in April, 2016. This report was prepared to determine potential groundwater sources for the water system supplying the Thoreau and Baca-Prewitt Navajo Chapters (herein referred to as the Baca-Thoreau Water System) located approximately 35 miles southeast of Gallup within McKinley County, New Mexico. This system serves approximately 1,700 people (470 homes), and the community is projected to grow to a population of 2,500 people (700 homes) by 2035 (SMA, 2016). The project location map is illustrated on the vicinity map and aerial photo maps included as Figures 1 and 2, respectively. The 2015 water demand for the Baca-Thoreau system was approximately 103,000 gallons per day, and is expected to increase to 153,000 gallons per day by 2035.

1.1 Baca-Thoreau Water System Overview

The Baca-Thoreau water distribution system is approximately 40-years old and utilizes two supply wells within the Thoreau Chapter which were built in the 1970's and 1980's. Currently, the wells are pumped for extended periods of time (more than the IHS maximum pumping standard of 12 hours/day) to meet the demands of the Baca-Thoreau Water System.

Water from the two wells is pumped through 4-inch and 6-inch diameter Polyvinyl Chloride (PVC) distribution lines and supplied to seven storage tanks within the service area. Six of the storage tanks are located proximal to the Thoreau Chapter, with a total storage capacity of approximately 237,000 gallons. One storage tank is located near the Baca Chapter with a storage capacity of 100,000 gallons.

1.2 Statement of Problem

The main concern of the Baca/Prewitt Chapter, Thoreau Chapter, the Navajo Tribal Utility Authority (NTUA), and the Navajo Nation is the lack of an adequate water supply in the community. The Baca/Prewitt Chapter is currently being supplied through a regional interconnection with the adjacent Chapter of Thoreau water system. However, the regional

water system currently does not have adequate water supply from the two active wells in the Thoreau Chapter to supply the current demand of the combined Baca-Prewitt and Thoreau service areas. If one or both wells were to fail, it would result in an emergency shortage of water in the service area, and would pose a threat to the health, sanitation, and security of the residents of the service area. This would be particularly dangerous if the West Thoreau well, which supplies most of the water in the service area, failed.

A new water supply in the service area would reduce the risk of a water shortage emergency in the communities if either current well fails, and would provide a much-needed redundant source for the system.

2.0 PROJECT APPROACH

SMA initiated the project by reviewing available literature and documents from existing wells and hydrologic investigations near the project area. Information that was compiled and reviewed included geologic maps and data, NTUA as-builts and well records, New Mexico Office of the State Engineer (NMOSE) well records data, personnel interviews, and New Mexico Bureau of Geology and United States Geological Survey (USGS) publications. Local water well drillers were also contacted to gain first-hand information on aquifer characteristics, water well production, depth, and locations. This information is summarized below with recommendations for the location and design of the proposed supply well.

3.0 GEOLOGY AND SITE SETTING

3.1 Regional Geology

The Baca-Thoreau Water System project area is located approximately 35 miles southeast of Gallup, New Mexico near the Interstate 40 corridor. The location of the project area is indicated on the topographic vicinity map included as Figure 1.

The project area is located within the southeast portion of the Colorado Plateau, a large geologic feature spanning portions of Arizona, Utah, New Mexico, and Colorado characterized by relatively continuous sedimentary rocks of Mesozoic age. These sedimentary rocks, composing the exposed, high cliffs in the areas around Gallup are typically continuous over large areas and in many cases, act as regional aquifers.

Although the project is in an area of relative stability, a major structural feature is located southwest of the project area. The Baca/Prewitt Chapter is located on the northwest boundary of the Zuni Uplift, a geologic feature resulting from the indentation of a dense portion of crust

approximately 10 miles in diameter into the Colorado Plateau cratonic block (Chamberlin and Anderson, 1989). The collision of the denser material resulted in the deformation and uplift of the area spanning from just east of Gallup to south of Grants, known as the Zuni Uplift. The Zuni Uplift was thought to have occurred during the Eocene Epoch (55 to 35 million years ago), resulting in the deformation of Paleozoic and Mesozoic rock units. Several large-scale fold structures, with a general easterly dip, have resulted in a locally irregular geology.

3.2 Site Setting

The Baca/Prewitt and Thoreau Chapters are located within the Semiarid Tablelands of the Arizona/New Mexico Plateau Ecoregion (Griffith et al., 2006) at an elevation ranging from 7,100 to 7,400 feet above sea level. This ecoregion is characterized by the presence of mesas, plateaus, and canyons formed from gently dipping, often exposed, sedimentary rock units. Vegetation in this ecoregion generally consists of Dropseed and Grama grasses, saltbush, and Piñon and Juniper woodlands (Griffith et al., 2006).

Data from the Western Regional Climate Center (WRCC, 2017) indicates that during the period from 1929 to 1992, the Thoreau, New Mexico Co-Op station received an average of 10.7 inches of precipitation per year, with the wettest months occurring during the southwest monsoon season from July to October. Evaporation from the region, as indicated by the National Oceanic and Atmospheric Administration Evaporation Atlas (NOAA, 1982) for surface water (shallow lakes) is approximately 47 inches per year. The average daily high temperature in the area is 65°F, and the average daily low temperature is 36°F (WRCC, 2017).

3.3 Local Geology

In the Thoreau and Baca/Prewitt area, geology is dominated by Mesozoic and Paleozoic-aged units. The local surface geology of the area was mapped at a 1:24,000 scale by Jacques F. Robertson in 1990 (USGS publication GQ-1675). A portion of the Thoreau, New Mexico quadrangle geologic map as prepared by Robertson, as well as portions of the Thoreau NE Geologic Map (Green & Pierson, 1971), and the Continental Divide Geologic Map (Green, 1976) are included as Figure 3. Geologic unit descriptions and a north-south geologic cross section of the area adapted from Robertson (1990) are included as Figure 3A.

A summary of the predominant geological formations found near the project area is included below. The descriptions are organized by the age of the units (youngest to oldest), and are summarized graphically by the stratigraphic column included as Figure 4. The thickness indicated in the section is estimated and reflects approximate depths of each unit as indicated in several borings advanced in the area.

3.3.1 Cenozoic Units

The Thoreau and Baca/Prewitt area is locally underlain by relatively young Quaternary alluvium, colluvium, and eolian sediments. The Quaternary alluvium and colluvium consist of unconsolidated clay, silt, and sand that was derived from bedrock in surrounding topographic highs and transported to the lower elevation predominately by surface water flow. The Quaternary eolian deposits, located primarily east of Thoreau, consist of well sorted sand transported by wind processes. The Quaternary sediments in the area are usually less than 100 feet thick.

3.3.2 Mesozoic Units

Mesozoic Units dominate the project area, and are present as outcrop exposures to the north of the Thoreau Chapter extending to depths in excess of 1,000 feet.

Mancos Shale

The youngest Mesozoic-aged formation near the project area is the Cretaceous Mancos Shale, which is composed of three primary members, including the Pescado Tongue, consisting of dark-gray shale and limestone, the Rio Salado Tongue, consisting of gray shale and lighter siltstones, and the Whitewater Arroyo Tongue, a yellowish-gray silty shale. The Mancos Shale is not present in the project area, and only occurs as outcrop at high elevations above 8,200 feet above mean sea level (amsl) approximately one mile north of Thoreau, as indicated on the geologic map included as Figure 3. The formation has a thickness of approximately 300 feet north of the project area.

Dakota Sandstone

The Mancos Shale is underlain by the Dakota Sandstone, a middle Cretaceous unit with an age of approximately 145-100 Ma. The Dakota Formation forms the “cap” of the bluffs to the north of Thoreau, present only at elevations above 8,000 feet amsl in the project area. The Dakota was emplaced as part of a marine transgression, and represents shallow marine and fluvial depositional environments (Anderson, 1983). The Dakota Sandstone consists of two members: the Twowells Tongue, consisting of light gray to yellow-gray cross-bedded sandstone; and the Main Body, consisting of brown to light gray sandstone. The Main Body Member also includes interbedded conglomerate and shale facies deposited by fluvial systems. The Dakota Sandstone has a total thickness of approximately 150 feet north of Thoreau.

Morrison Formation

The Dakota Formation is underlain by the Jurassic Morrison Formation, which is divided into the Brushy Basin, Westwater Canyon, and Recapture Members (Robertson, 1990), and composed primarily of fluvial sandstones, siltstone, and shale. The Brushy Basin Member is characterized by a distinct green-gray color, is composed primarily of a kaolinite-rich siltstone, and has a

thickness of approximately 100 feet north of Thoreau. The Westwater Canyon is composed of pink-orange-red arkosic, coarse-grained sandstone and gravel, and has a thickness of approximately 200 feet north of Thoreau. The Westwater Canyon is considered a good, regional aquifer north of the project area near Crownpoint, and was commonly mined for uranium ore in the region. The Recapture Member is a red-brown fine-grained sandstone with a thickness of approximately 300 feet north of Thoreau.

Cowsprings & Summerville Formations (Zuni Sandstone)

Underlying the Morrison Formation is the Jurassic Cow Springs and Summerville Formations, formerly referred to as the Zuni Sandstone (Anderson, 1993). These formations are red-gray-brown, fine-grained sandstone and siltstones, and are often difficult to distinguish from each other when utilizing drilling cuttings. The Summerville and Cow Springs Formations have a combined thickness of approximately 550 feet in the project area.

Todilto Limestone

The Summerville is underlain by the Todilto Limestone, which acts as a common subsurface marker bed in the region. The Todilto is a gray-white, competent limestone with abundant gypsum, and forms an abrupt contact with the overlying Summerville formation. The Todilto Limestone has a thickness of approximately 40 feet in the area.

Entrada Sandstone

The Jurassic Entrada Sandstone is present below the Todilto Limestone, and consists of a tan-brown-red fine-grained eolian sandstone. The Entrada has a thickness of approximately 200 feet in the region, and acts as an aquifer in areas to the north of Thoreau near Smith Lake.

Chinle Formation

The Entrada Sandstone is underlain by the Triassic Chinle Formation, which consists of a red-brown-purple shale that is present through much of western New Mexico and Arizona. The Chinle is present near the surface to a depth of approximately 1,100 feet in the Thoreau area, and is divided into three generalized members– the Upper Chinle, the Sonsela Sandstone, and the Lower Chinle. The upper and lower Chinle Members consist of shale with minor siltstone interbeds, and each have thicknesses of approximately 400-600 feet. The Sonsela Sandstone Member is a relatively thin (50-100 feet) unit which is present between the upper and lower members, and consists of a coarse-grained sandstone and basal conglomerate. The Sonsela acts as an aquifer in the area, and is utilized by many livestock and domestic wells in the area; additional information on the aquifer characteristics are detailed in Section 4.2.

3.3.3 Paleozoic Units

Underlying the Triassic-aged Chinle Formation are the Permian San Andres Limestone and Glorieta Sandstone. The San Andres consists of a gray to light gray limestone with significant

fracturing and karstification, and has a thickness of approximately 100 feet in the region. The Glorieta Sandstone underlies the San Andres and is composed of well-sorted pink fluvial sandstones, and has a local thickness of approximately 150 feet. These two formations were deposited during a period of ocean transgression, and form a single aquifer in the area. The San Andres/Glorieta Formations are located at depths ranging from 1,000 feet below ground surface in the southern portion of the project area to approximately 2,700 feet north of Thoreau near Smith Lake.

3.4 Geological Structure

As discussed in Section 3.1, the project area is located within a relatively stable section of the Colorado Plateau, with most of the sedimentary formations being relatively continuous with a slight dip (2-4°) to the north. However, a very large structural feature, the Bluewater Fault Zone, is present approximately four miles east of Thoreau. The fault zone generally runs north-south, and trends along New Mexico State Highway 371, as indicated on Figure 3. The Bluewater Fault Zone displaces geologic units by up to 400 feet and can affect regional groundwater flow. Units on the east side of the fault are generally down-dropped (deeper) relative to the western side of the fault (Robertson, 1990).

4.0 HYDROLOGY

SMA conducted an extensive review of published literature for the Baca/Prewitt-Thoreau area, and obtained information on existing water well construction, location, and water quality from the Navajo Tribal Utility Authority (see Appendix C), New Mexico Office of the State Engineer (NMOSE) WATERS online database (NMOSE, 2017, see Appendix D) and the United States Geological Survey (USGS) well database (USGS, 2017, see Table 3). As described previously, drillers in the Grants-Milan area were interviewed as well. Aerial photos showing the project site location and surrounding wells on file with the NMOSE, USGS, and NTUA (labeled with index number & keyed to Tables 2 and 3) are included on Figure 2.

The project area (outside of the Navajo Nation) is located within the NMOSE Bluewater Underground Management Basin. Several areas near the project, including the Tri-State Power Station approximately seven miles east of Thoreau and the Transwestern Pipeline Facility located approximately 1.5 miles northwest of Thoreau, have been pump tested and documented in hydrogeologic studies (Shomaker, 1981).

The NMOSE Waters and USGS databases were utilized to obtain information on existing wells and potential aquifers in and near the project area. Information from nearby wells, including depth to water, total depth, and each well's target aquifers is summarized in Table 3. Potential

and primary aquifers near the project area are described below.

4.1 Upper Chinle Formation Aquifer

Several shallow wells (typically less than 300 feet) near the Thoreau area are completed within the shallow alluvial sediment or the Upper Chinle Formation. These shallower wells are almost exclusively used for livestock and do not appear to yield significant water. NMOSE records indicated one livestock well in the area east of Thoreau (NMOSE File Number B-0900-X, Index No. 17, Figure 2) is completed within isolated sand lenses and fractures within the upper Chinle at a depth of 300 feet below ground surface and produces upwards of 15 gpm. Water quality information was not available for review in literature. The magenta well markers in Figure 2 illustrate the location of wells completed in the upper portions of the aquifer.

4.2 Sonsela Sandstone Member Aquifer

4.2.1 Aquifer Characteristics

The Sonsela Sandstone is present at depths ranging from as shallow as 150 feet south of Interstate-40 to over 700 feet north of Thoreau. The formation acts as a primary aquifer for several domestic wells and older municipal wells in the Thoreau and Baca/Prewitt area. Figure 5 is a structural contour map illustrating the elevation of the top of the Sonsela formation as documented in well logs available for the area.

The aquifer acts as a semi-confined unit in the Thoreau area, with water typically pressurized to 300-400 feet above the top of the formation. Groundwater flow in the Sonsela near Thoreau and Baca/Prewitt is generally to the southeast (Cooper & John, 1968). Limited information is available regarding regional draw-down in the aquifer.

4.2.2 Existing Wells & Infrastructure

The Sonsela Sandstone is utilized by many wells within the Thoreau area. As mentioned in Section 4.2.1., many domestic wells within Thoreau proper, the Transwestern Pipeline well (Index No. 18, Figure 2), and several tribal wells, including 16T-349 and 16T-676, are completed within the Sonsela Sandstone. Wells within the Sonsela report production up to 30 gallons per minute (NMOSE well logs), although most wells yield between 5-20 gpm (Cooper & John, 1968). The blue well markers in Figure 2 illustrate the location of wells completed in the Sonsela Sandstone aquifer.

4.2.3 Water Quality

Water quality from the Sonsela is generally good. Water quality results from the former Thoreau well (16T-349) collected in 1966 indicated very good water quality, with low total dissolved solids (TDS), metals, and sulfate content. This agrees with measurements compiled from several other wells in the area by Cooper & John (1968), who report generally good

quality, with TDS concentrations typically less than 1,000 mg/L. However, as few wells completed within the aquifer are currently utilized for municipal supply, limited information is available regarding the majority of EPA Primary Water quality standards; as such, there is potential that water within the Sonsela may have elevated radiogenic or metal concentrations that have not been reported in literature.

4.3 San Andres & Glorieta Formation Aquifer

4.3.1 Aquifer Characteristics

The San Andres Limestone and Glorieta Sandstone act as a reliable aquifer throughout much of New Mexico. In the Thoreau area, these units are located at depths of approximately 1,100 to 1,500 feet below surface. Figure 6 is a structural contour map with the approximate elevation of the top of the San Andres/Glorieta aquifer in the project area.

Groundwater flow in the San Andres/Glorieta aquifer is typically transmitted through fractures, dissolution channels, and karst structures (Baldwin & Anderholm, 1992). The aquifer is confined, with water typically pressurized to 800-900 feet above the top of the formation. In the Thoreau area, depth to water is reported as shallow as 170 feet to 350 feet below ground surface. The groundwater flow direction within the San Andres Limestone in the Thoreau area is thought to be to the northeast (Baldwin & Anderholm, 1992).

4.3.2 Existing Wells & Infrastructure

The San Andres/Glorieta aquifer is currently utilized by the West Thoreau (16T-614), JW Camp (16T-594), Town of Thoreau (NMOSE File No. B-0386) and Thoreau High School Well (Index No. 31, Figure 2) supply wells. The inactive Navajo tribal well 16K-334 also utilizes this aquifer. As summarized in Tables 1 and 3, these wells have a range of production from 30 gpm upwards of 100 gpm. The regional aquifer transmissivity near the Thoreau area is estimated to be approximately 140 ft²/day (Baldwin & Anderholm, 1992); this agrees with pump test information from the 16T-614 Navajo tribal well and the Transwestern Pipeline supply well (Index No. 18, Figure 2), which indicated transmissivities of 118 ft²/day and 100 ft²/day, respectively (Well Records & Shomaker, 1981). These values are significantly greater than the 64 ft²/day transmissivity calculated from pump testing conducted in Tribal well 16T-529, suggesting a significant amount of variability within the San Andres/Glorieta aquifer. Specific capacities of wells completed in the formation are also variable; the 16T-529 well reports a specific capacity of approximately 0.14 gallons per minute per foot (gpm/ft) at a pumping rate of 21 gpm (NTUA/HIS 16T-529 Well Records, Appendix C). However, the specific capacity in 16T-614 was calculated to be much higher at 0.2 gpm/ft at a pumping rate of 100 gpm (NTUA/IHS 16T-614 Well Records (1982), Appendix C). The Thoreau High School well reports a specific capacity of 0.3 gpm/ft, which is similar the 16T-614 West Thoreau well (NMED Drinking

Water Watch, 2017). The red well markers in Figure 2 illustrate the location of wells completed in the San Andres/Glorieta.

Several Navajo Chapters in addition to the Baca/Prewitt-Thoreau system utilize the San Andres/Glorieta Aquifer for their water supply. The Ramah Chapter, located approximately 30 miles south of Thoreau, utilizes the San Andres Formation for their Jacobs Supply Well, which produces up to 150 gpm (Yazzi, 2013). Information obtained from pump tests south of Zuni Pueblo (Crouch, 1991) indicates production upwards of 200 to 300 gpm, suggesting production from the unit increases south of the Thoreau-Baca/Prewitt area.

4.3.3 Water Quality

Groundwater quality from the San Andres/Glorieta Aquifer is highly variable, and can range from very good to highly mineralized (White & Kelly, 1989). The Thoreau Tribal wells have relatively good water quality, with no frequent exceedances of Primary or Secondary Safe Drinking Water Act maximum contaminant levels (MCLs). However, the JW Camp well (15T-529) has documented one sampling event in which a concentration of total radium (sum of radium-226 + radium-228) was detected in excess of the Primary MCL (Table 3). The Town of Thoreau well also reports occasional exceedances of total radium from their water treatment plant (NMED Drinking Water Watch, 2017), and are reported to contain elevated secondary contaminants. It is unclear if these exceedances are occurring predominantly from one well or are resulting from both active wells. Measurements from Thoreau-area wells report TDS concentrations between 250-600 mg/L, which is low or comparable to other carbonate-hosted aquifers in New Mexico.

5.0 NEW WELL LOCATION EVALUATION

After reviewing the information summarized above regarding the local hydrogeology and water quality in the area, SMA has delineated an area for installation of a supply well. The area is located primarily to the north and west of the Town of Thoreau, as illustrated in Figure 7. This area was delineated based upon the land surface elevation, depth to target aquifers (San Andres/Glorieta Aquifer, with potential to also screen Sonsela Aquifer) and existing infrastructure. Following delineation of the area for installation of a supply well, SMA selected three proposed well installation locations based upon land status, the availability of electrical power, and the proximity of existing water transmission infrastructure. The three proposed well installation locations are illustrated on Figure 7.

Anthropogenic factors have the potential to influence the efficient operation and water quality of wells. SMA assessed the proposed Well Location 3 for well interference from nearby existing

wells, and also evaluated potential sources of contamination in the surrounding area.

5.1 Well Interference Assessment

Two tribal wells (16T-529 and 16T-614), two Town of Thoreau municipal supply wells, and several domestic and livestock wells utilizing the San Andres/Glorieta aquifer are operating within two miles of the proposed well locations. To evaluate potential interference from the pumping wells on the proposed well locations, SMA completed Theis calculations for all three proposed well installation sites utilizing the location of tribal and NMOSE-registered wells in the area. As aquifer characteristics for the Sonsela Aquifer are not available, SMA only evaluated effects in the San Andres/Glorieta Aquifer.

For the calculation, SMA assumed an aquifer transmissivity of 140 ft²/day (Baldwin & Anderholm, 1992), and an aquifer storativity of 4×10^{-4} (Frenzel, 1992) for the San Andres/Glorieta Aquifer. The calculation was performed for a 20-year pumping period, and assumes that the newly installed well will be pumped at a rate of 120 gpm for 12 hours per day, resulting in an annual diversion of 100 acre-feet. The Theis calculation was completed for each proposed well location, assuming a single well will be installed (not a well at each proposed location).

The results of the Theis calculation, included in Appendix B, shows potential drawdown induced by a new supply well for each proposed location over a 20-year pumping period. The effects of pumping from each proposed well location on 16T-529, 16T-614, and the nearby Thoreau High School well are summarized below:

Drawdown Potential in Existing Wells over a 20 Year Pumping Period (feet)

Proposed Well Site	16T-529	16T-614	Thoreau H.S. Well
Well Site No. 1	84	73	58
Well Site No. 2	74	59	44
Well Site No. 3	56	64	98

The calculations indicate the most favorable location, resulting in the least interference in existing wells, would be Well Location 2, which would only induce a maximum of 74 feet of drawdown in the nearest existing well. However, this location is distal from existing three-phase electrical service, and would require approximately two miles of three-phase power lines to be installed to provide service the well. Well Location 1 is closer to existing power infrastructure (0.9 miles away), but its proximity to the 16T-529 & 16T-614 wells will induce slightly more drawdown (up to 84 feet). Well Location 3 falls in the middle, with a maximum

drawdown potential of 64 feet in existing, active Tribal supply wells, but the potential to greatly influence a nearby supply well for Thoreau High School. Electrical service is also much closer to this location, being present only 1,600 feet away. However, the siting of Well Location 3 may negatively affect the existing NTUA water system hydraulics. Preliminary hydraulic evaluation revealed that construction of the well and tie-in to the existing system at Location 3 would increase maximum pressures in the existing water distribution line to near the rated pipe pressure rating, which could potentially damage the pipeline.

Although the potential for interference from Well Location 1 is greater than the other locations, the difference is relatively minor, with predicted drawdowns only 15% greater than what was calculated for Well Location 2. Well Location 1 will allow for the best balance of cost savings to connect with existing tribal infrastructure while still being in a hydrogeologically favorable location. This location requires less than half the distance of power lines to be constructed/upgraded than Well Location 2, and the elevation of the well site and proximity to the water storage tank will require less hydraulic pressure to pump water to the storage tank than Well Location 3, which will reduce electrical consumption and O&M costs over the long-term. As such, SMA recommends the installation of a well at this location.

5.2 Potential Contaminant Source Inventory

After determining that the proposed Well Location 1 will not result in significant pumping interference with existing wells, SMA conducted a potential contaminant source inventory around the proposed well site. As outlined by the Navajo Nation Environmental Protection Agency (NNEPA) Source Water Assessment & Protection (SWAP), SMA investigated potential contamination sources within a 1/2-mile radius of the proposed well installation site. Potential risks were evaluated using several online database sources including the EPA Enviromapper database, NMED eGIS Mapper, NMOSE Water Rights Reporting System, aerial photos, FEMA flood maps, and observations made during site visits by SMA personnel. The findings of the assessment were compared to the potential contaminant sources listed in the NNEPA SWAP *Susceptibility Assessment "Update" Form*, and utilized to prepare a contaminant source inventory diagram, included as Figure 8 and summarized in Table 4.

The results of the assessment indicate that several relatively minor potential contamination sources are present in proximity to the proposed well location, consisting of a gas transmission pipeline, animal range land, and several single-family residential septic systems. The animal rangeland is located throughout the well installation area; horses and cattle can graze and roam freely through much of the Thoreau area. The transmission pipeline is located approximately 1,000 feet to the north, and the single-residence septic systems are located over 750 feet from the proposed well site. SMA believes the risk from the animal rangeland, gas pipeline, and residential septic systems is relatively minor, and can be further minimized by constructing the

well with proper well seals which will prevent any shallow, contaminated water from entering the well casing.

6.0 CONCLUSIONS & RECOMMENDATIONS

SMA recommends the installation of a groundwater supply well utilizing the San Andres/Glorieta Aquifer and potentially the Sonsela Aquifer as the primary production aquifers. The San Andres/Glorieta Aquifer is documented to be capable of producing upwards of 80 gallons per minute in existing tribal wells in the area, and water quality within the area is relatively good, with only occasional exceedances of total radium reported in area supply wells. The Sonsela Aquifer is capable of production between 20-30 gallons per minute with good water quality; a well utilizing both aquifers may be capable of sustained production of over 100 gallons per minute.

SMA recommends the installation of a pilot exploratory well at the proposed Well Location 1 (Figures 7 & 8) to collect discreet interval water samples from both the Sonsela and San Andres/Glorieta Aquifers. A pilot well installed to a depth of 1,500 feet below ground surface should fully penetrate the Sonsela Aquifer (anticipated to be located from 750 to 850 feet bgs) and the San Andres/Glorieta Aquifer (anticipated to be located from 1,300 to 1,500 feet bgs). Following an analysis of water quality samples and water production estimates, a production well can then be designed and completed to intercept one or both aquifers. A conceptual well design diagram, assuming both the Sonsela and San Andres Aquifer will be screened, is included as Appendix A.

The primary well installation location is adequately distal from existing NTUA and NMOSE-managed supply wells, and should not result in excessive pumping interference or cause detrimental effects to well production. The location is also adequately distal from any significant sources of contamination, and is located proximal to existing water distribution infrastructure and three-phase electrical power, which will minimize costs to bring the well into operation.

7.0 REFERENCES

- Anderson, O.J. (1993). *Zuni Sandstone and Acoma Tongue Defined*. New Mexico Geology, v. 15, no. 2. May, 1993. pp. 38-39
- Anderson, O.J. (1983). *Geology and Coal Resources of the Atarque Lake Quadrangle, Cibola County, New Mexico*. New Mexico Bureau of Mines and Mineral Resources Open File Report 167 (June, 1982, revised 1983)
- Baldwin, J.A. & Anderholm, S.K. (1992). Hydrogeology and groundwater chemistry of the San Andres-Glorieta Aquifer in the Acoma Embayment and Eastern Zuni Uplift, West-Central New Mexico. USGS Water Resources Investigations Report 91-4033.
- Chamberlin, R.M. and Anderson, O.J. (1989). *The Laramide Zuni uplift, Southeastern Colorado Plateau: a microcosm of Eurasian-style indentation-extrusion tectonics?*. New Mexico Geological Society Guidebook, Fortieth Field Conference Guidebook – Southeastern Colorado Plateau. pp. 81-90
- Cooper, J.B. & John, E.C. (1968). Geology and Ground-Water Occurrence in Southeastern McKinley County, New Mexico. New Mexico Office of the State Engineer Technical Report 35: Santa Fe, NM.
- Crouch, T.M. (1991). Evaluation of the Bidahochi and San Andres-Glorieta aquifers on parts of the Zuni Indian Reservation, McKinley and Cibola Counties, New Mexico. United States Geological Survey Water-Resources Investigations Report 89-4192.
- Federal Emergency Management Administration. (2017). FEMA Flood Map Service Center – Interactive Map and Database. webpage: < <https://msc.fema.gov/portal/search>> Accessed October 2, 2017.
- Freeze, Allan R. and Cherry, John A. (1979). Groundwater. Prentice-Hall: Englewood Cliffs.
- Frenzel, P.F. (1992). Simulation of Groundwater Flow in the San Andres-Glorieta Aquifer in the Acoma Embayment and Eastern Zuni Uplift, West-Central New Mexico. USGS Water Resources Investigations Report 91-4099.
- Google, Inc. (2016). Aerial photo of Thoreau High School Area, Google Earth Pro. Accessed September 25, 2017.
- Google, Inc. (2016). Aerial photo of Thoreau & Baca Area, Google Earth Pro. Accessed August 2, 2017.
- Green, M.W. (1976). *Geologic Map of the Continental Divide USGS Quadrangle, McKinley County, New Mexico*. USGS Publication GQ-1338.

- Green, M.W. & Pierson, C.T. (1971). *Geologic Map of the Thoreau NE USGS Quadrangle, McKinley County, New Mexico*. USGS Publication GQ-954.
- Griffith, G.E., Omernik, J.M., McGraw, M.M., Jacobi, G.Z., Canavan, C.M., Schrader, T.S., Mercer, D., Hill, R., and Moran, B.C. (2006). Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).
- New Mexico Environment Department (NMED). (2017). Online Environmental GIS (eGIS) Mapper Tool. webpage: < <https://gis.web.env.nm.gov/EGIS/>> Accessed October 2, 2017
- New Mexico Office of the State Engineer (NMOSE). (2017). Online Water Rights Reporting System (NMWRRS) Database. <webpage: <http://www.ose.state.nm.us/WRAB/index.php>>
- Pine, Robert (2017). Personal Communication between Mr. Robert Pine, NMOSE Hydrology Bureau and Matthew Earthman, SMA on July 31, 2017.
- Robertson, J.F. (1990). *Geologic Map of the Thoreau USGS Quadrangle, McKinley County, New Mexico*. USGS Publication GQ-1675. (map scale: 1:24,000)
- Shomaker, J.W. (1981). Report on Aquifer Test, Transwestern Pipeline Company, Thoreau, NM.. Dated June, 1981.
- Smith, C.T. (1959). *Jurassic Rocks of the Zuni Mountains*. New Mexico Geological Society Guidebook, Tenth Field Conference Guidebook.
- Souder, Miller & Associates (SMA). (2016). Baca/Thoreau Water System Improvements Project Preliminary Engineering Report. Dated April, 2016
- Stewart Brothers Drilling Co. (2017). Personal Communication between Mr. Randy Stewart, Stewart Brothers Drilling, and Matthew Earthman, SMA on March 15, 2017.
- United States Environmental Protection Agency (EPA). (2017). Online EPA Enviromapper Database and Interactive Map. webpage: < <https://www.epa.gov/emefdata/em4ef.home>> Accessed October 2, 2017.
- United States Geological Survey (USGS) (2017). USGS New Mexico Water Science Center Interactive Well Map & Database. <<https://maps.waterdata.usgs.gov/mapper/index.html?state=nm>>. Accessed August 3, 2017
- USGS (1995). Continental Divide 7.5 Minute Quadrangle. (map scale: 1:24,000)
- USGS (1995). Cottonwood Canyon 7.5 Minute Quadrangle. (map scale: 1:24,000)
- USGS (1995). Pine Canyon 7.5 Minute Quadrangle. (map scale: 1:24,000)

USGS (1995). Prewitt 7.5 Minute Quadrangle. (map scale: 1:24,000)

USGS (1980). Bluewater 7.5 Minute Quadrangle. (map scale: 1:24,000)

USGS (1980). Goat Mountain 7.5 Minute Quadrangle. (map scale: 1:24,000)

USGS (1963). Casamero Lake 7.5 Minute Quadrangle. (map scale: 1:24,000)

USGS (1963). Hosta Butte 7.5 Minute Quadrangle. (map scale: 1:24,000)

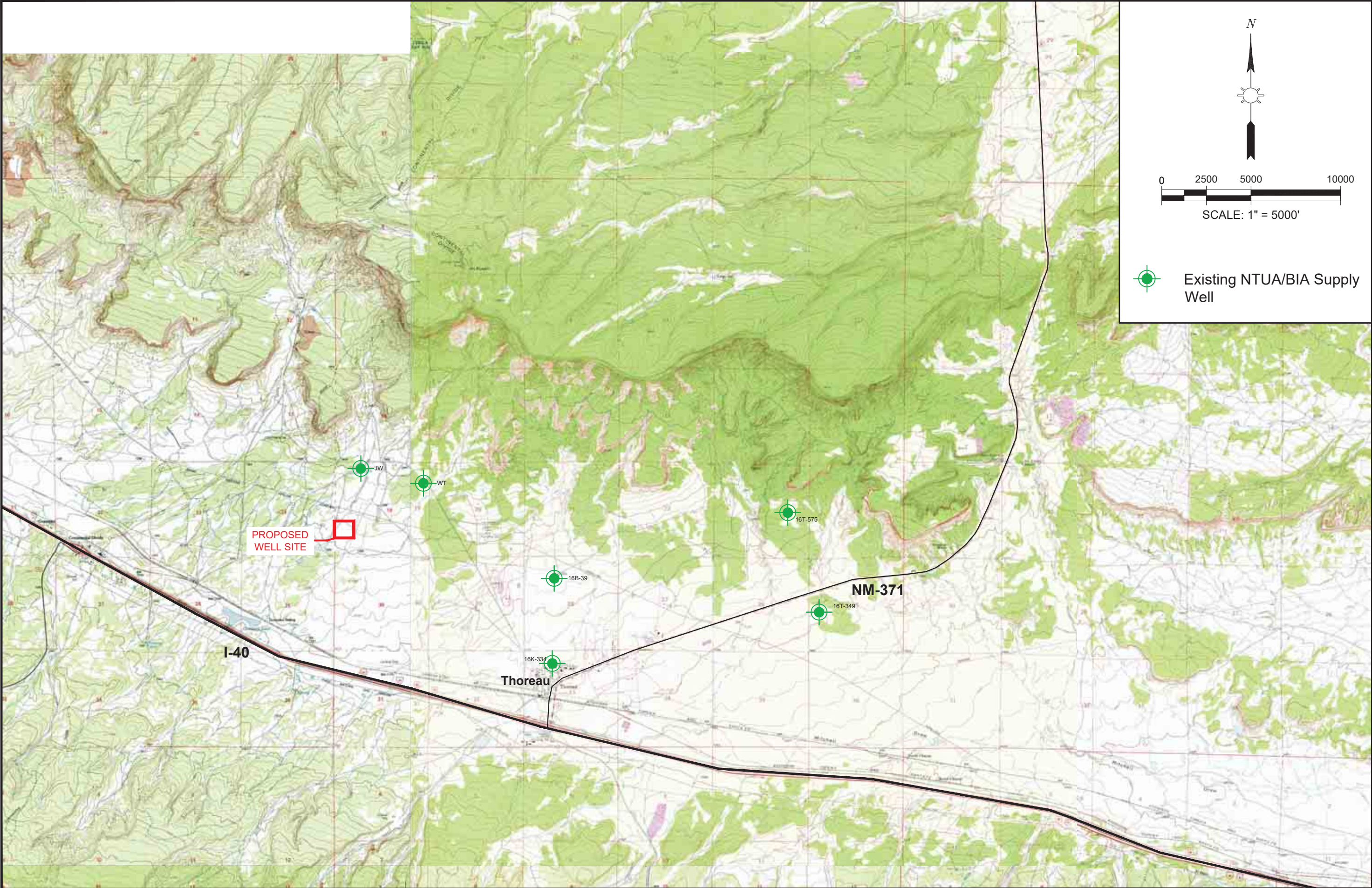
USGS (1963). Thoreau 7.5 Minute Quadrangle. (map scale: 1:24,000)

USGS (1963). Thoreau NE 7.5 Minute Quadrangle. (map scale: 1:24,000)

Western Regional Climate Center (2017). Thoreau, NM Station Historical weather information, webpage: <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm2785>

White, W.D. and Kelly, T.E. (1989). *The San Andres-Glorieta Aquifer in West-Central New Mexico*. New Mexico Geological Society Guidebook, Fortieth Field Conference Guidebook – Southeastern Colorado Plateau. pp. 331-335

FIGURES



Existing NTUA/BIA Supply Well

PROJECT VICINITY MAP WITH EXISTING TRIBAL WELLS
BACA-THOREAU HYDROGEOLOGICAL REPORT
NAVAJO NATION, MCKINLEY COUNTY, NEW MEXICO

SOUDER, MILLER & ASSOCIATES
5454 VENICE AVE NE, SUITE D
ALBUQUERQUE, NM 87113
Phone (505) 299-0942 Fax (505) 293-3430
www.soudermiller.com
Serving the Southwest & Rocky Mountains
Albuquerque, Farmington, Las Cruces, Roswell, Santa Fe, NM - El Paso, TX
Cortez, Grand Junction - Montrose, CO - Salt Lake City, UT



Designed MAE	Drawn MAE	Checked RMB
-----------------	--------------	----------------

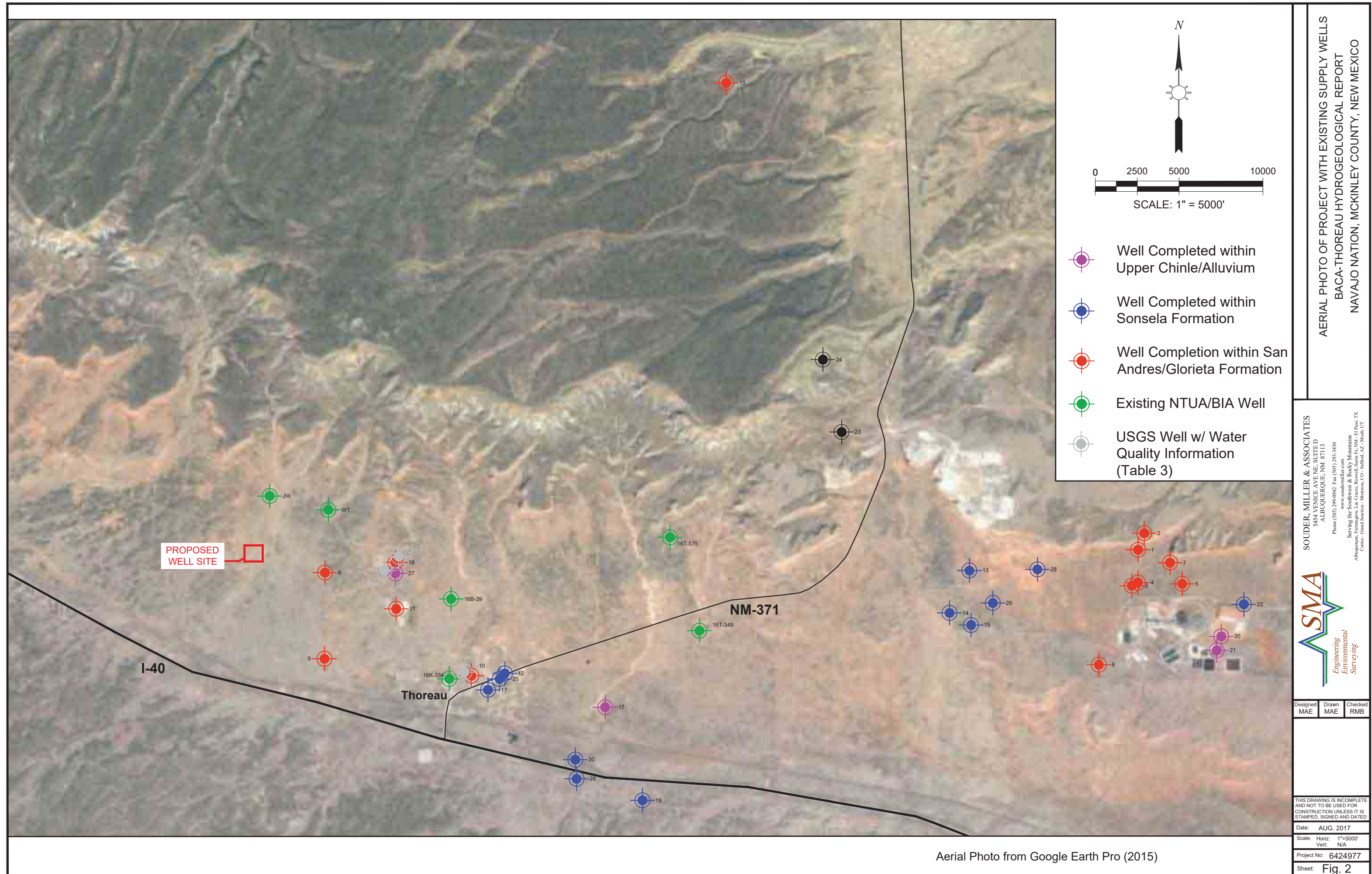
THIS DRAWING IS INCOMPLETE
AND NOT TO BE USED FOR
CONSTRUCTION UNLESS IT IS
STAMPED, SIGNED AND DATED

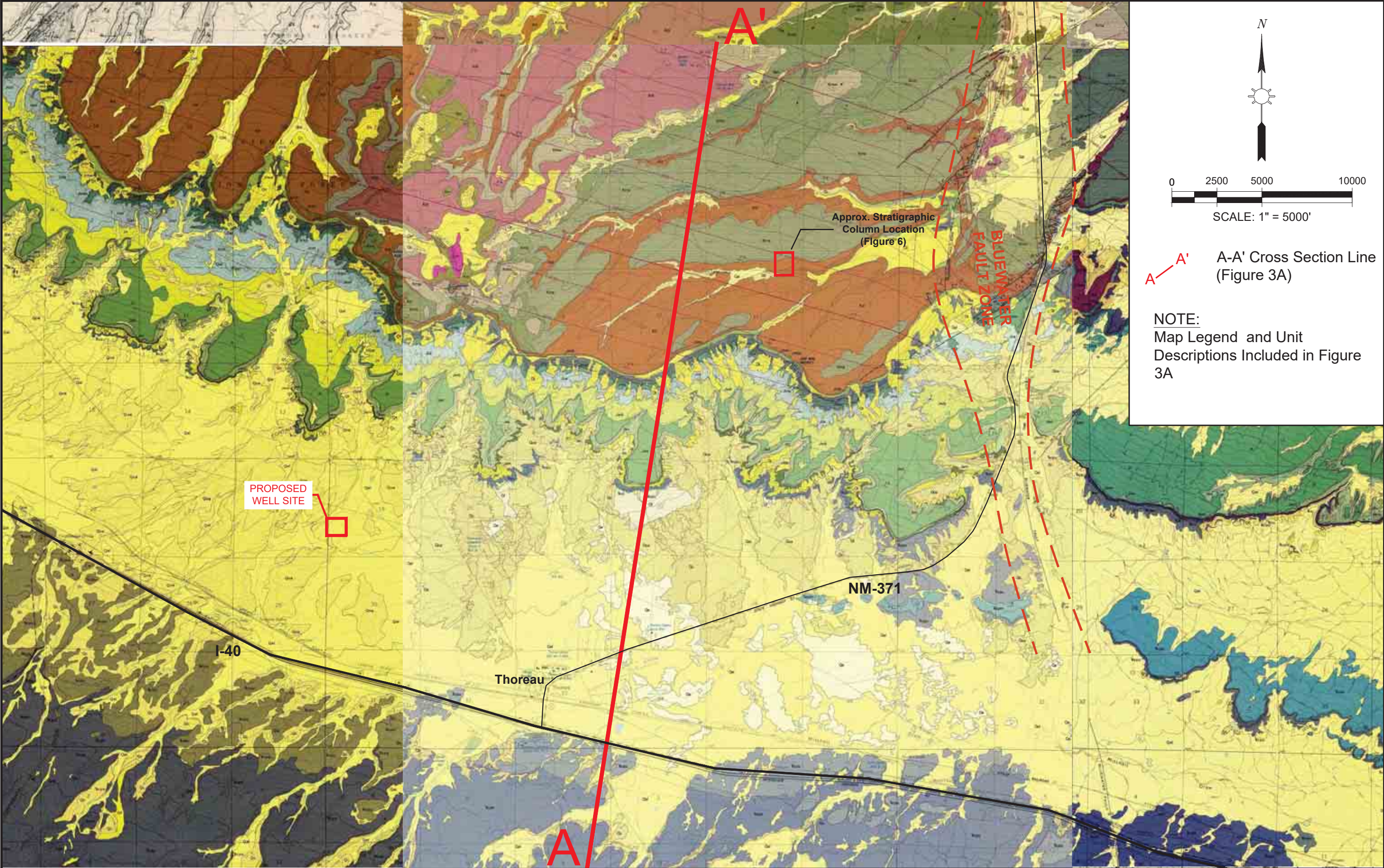
Date: AUG. 2017

Scale: Horiz: 1"=5000'
Vert: N/A

Project No: 6922883

Sheet: Fig. 1





N

0 2500 5000 10000

SCALE: 1" = 5000'

A-A' Cross Section Line (Figure 3A)

NOTE:
Map Legend and Unit
Descriptions Included in Figure
3A

GEOLOGIC MAP OF PROJECT AREA

BACA-THOREAU WATER SYSTEM IMPROVEMENTS PROJECT

NAVAJO NATION, MCKINLEY COUNTY, NEW MEXICO

SOUDEY, MILLER & ASSOCIATES
5454 VENICE AVE NE, SUITE D
ALBUQUERQUE, NM 87113
Phone: (505) 299-0942 Fax: (505) 293-3430
www.soudermiller.com
Serving the Southwest & Rocky Mountains
Albuquerque, Farmington, Las Cruces, Roswell, Santa Fe, NM - El Paso, TX
Cortez, Grand Junction - Montrose, CO - Safford, AZ - Moab, UT

SMA
Engineering
Environmental
Surveying

Designed MAE	Drawn MAE	Checked SAM
-----------------	--------------	----------------

THIS DRAWING IS INCOMPLETE
AND NOT TO BE USED FOR
CONSTRUCTION UNLESS IT IS
STAMPED, SIGNED AND DATED

Date: AUG. 2017

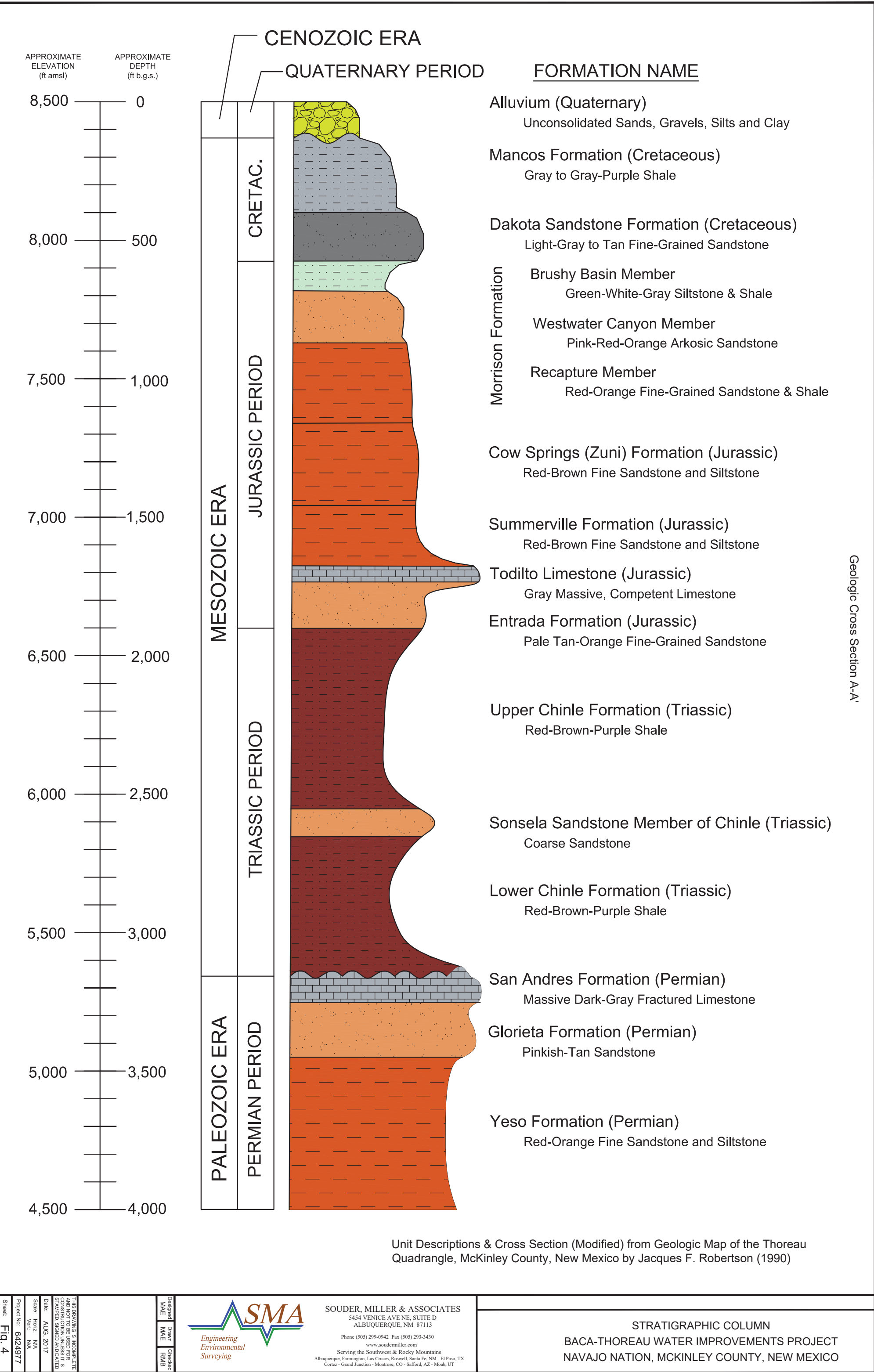
Scale: Horiz: 1"=5000'
Vert: N/A

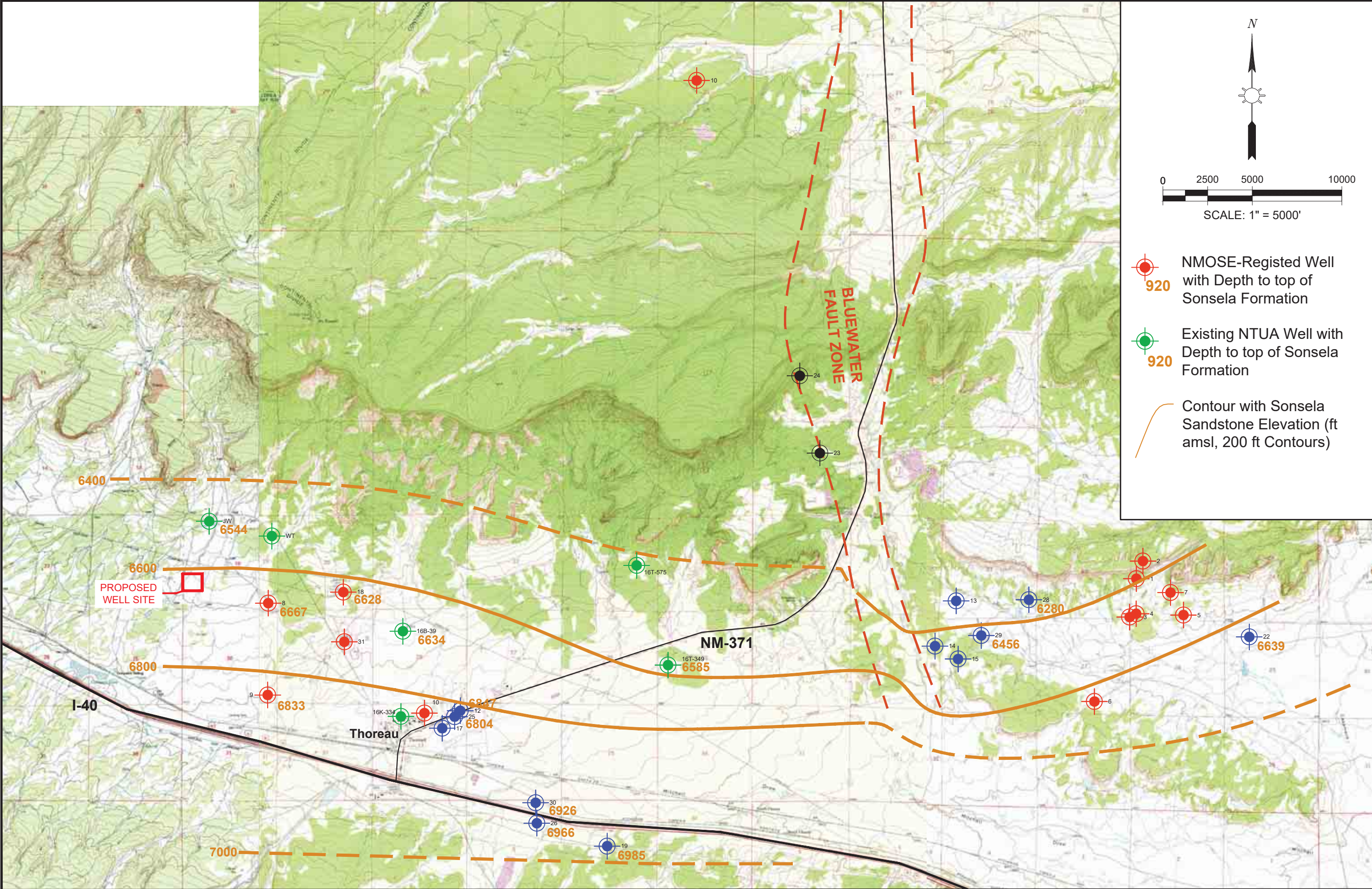
Project No: 6424977




Sheet: Fig. 3

© Copyright 2017 Souder, Miller & Associates - All Rights Reserved

P:\6-BACA-THOREAU\6424977\Hydrogeological\ACAD\017-08 Hydrogeological Drawing.dwg, MAE, 1/18/2017 10:14 AM





-  **920** NMOSE-Registered Well with Depth to top of Sonsela Formation
-  **920** Existing NTUA Well with Depth to top of Sonsela Formation
-  Contour with Sonsela Sandstone Elevation (ft amsl, 200 ft Contours)

SONSELA SANDSTONE STRUCTURAL CONTOUR MAP
BACA-THOREAU HYDROGEOLOGICAL REPORT
NAVAJO NATION, MCKINLEY COUNTY, NEW MEXICO

SMA
Engineering
Environmental
Surveying

SOUDER, MILLER & ASSOCIATES
5454 VENICE AVE NE, SUITE D
ALBUQUERQUE, NM 87113
Phone (505) 299-0942 Fax (505) 293-3430
www.soudermiller.com
Serving the Southwest & Rocky Mountains
Albuquerque, Farmington, Las Cruces, Roswell, Santa Fe, NM - El Paso, TX
Cortez, Grand Junction - Montrose, CO - Silver, AZ - Moab, UT

Designed MAE	Drawn MAE	Checked RMB
-----------------	--------------	----------------

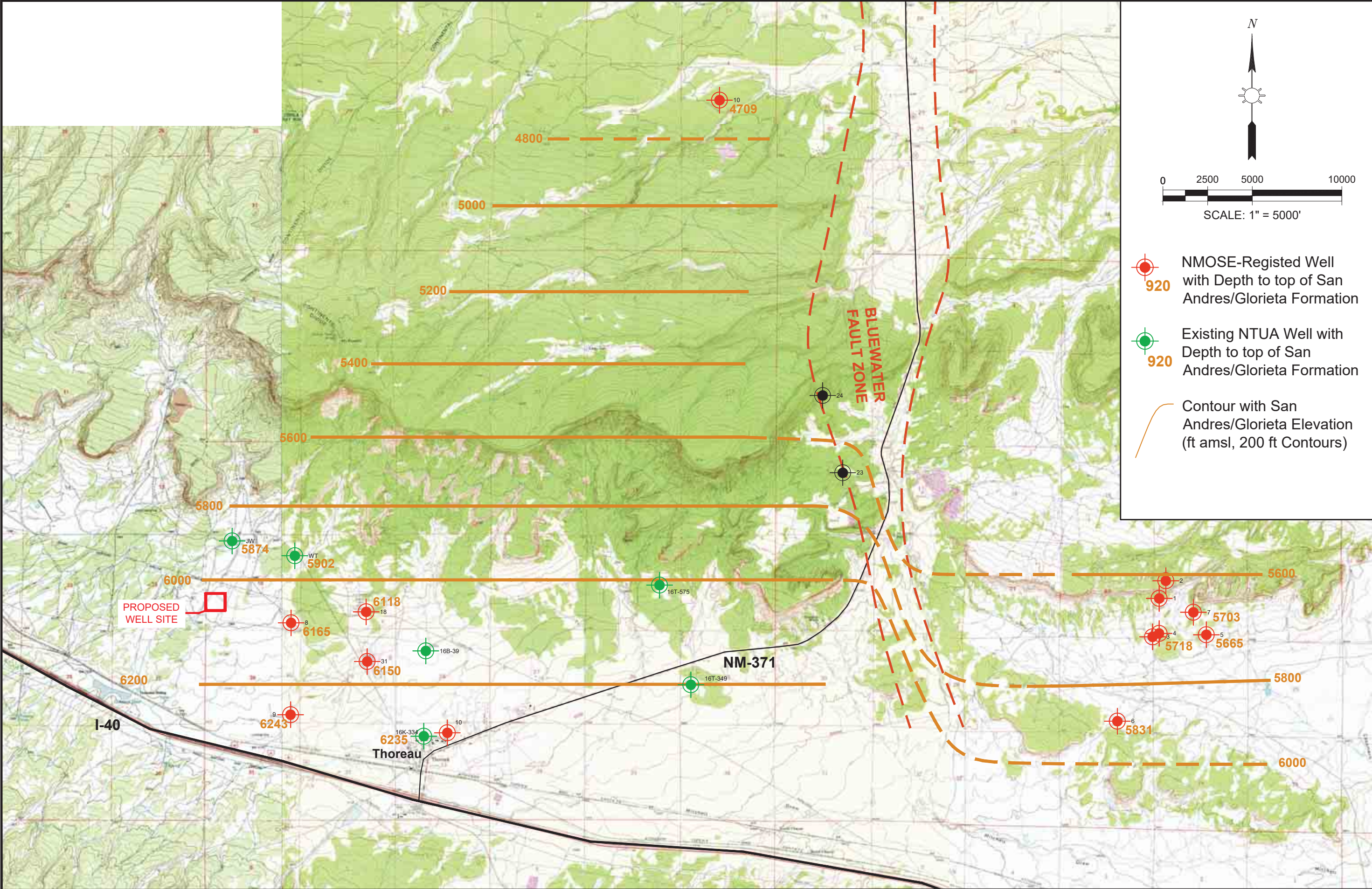
THIS DRAWING IS INCOMPLETE
AND NOT TO BE USED FOR
CONSTRUCTION UNLESS IT IS
STAMPED, SIGNED AND DATED

Date: AUG. 2017

Scale: Horiz: 1"=5000'
Vert: N/A

Project No: 6922883

Sheet: Fig. 5



N

0 2500 5000 10000

SCALE: 1" = 5000'

920 NMOSE-Registered Well with Depth to top of San Andres/Glorieta Formation

920 Existing NTUA Well with Depth to top of San Andres/Glorieta Formation

Contour with San Andres/Glorieta Elevation (ft amsl, 200 ft Contours)

SAN ANDRES/GLORIETA AQUIFER STRUCTURAL CONTOUR MAP
BACA-THOREAU HYDROGEOLOGICAL REPORT
NAVAJO NATION, MCKINLEY COUNTY, NEW MEXICO

SOUDEY, MILLER & ASSOCIATES
5454 VENICE AVE NE, SUITE D
ALBUQUERQUE, NM 87113
Phone (505) 299-0942 Fax (505) 293-3430
www.soudermiller.com
Serving the Southwest & Rocky Mountains
Albuquerque, Farmington, Las Cruces, Roswell, Santa Fe, NM - El Paso, TX
Cortez, Grand Junction - Montrose, CO - Silver, AZ - Moab, UT

SMA
Engineering
Environmental
Surveying

Designed	Drawn	Checked
MAE	MAE	RMB

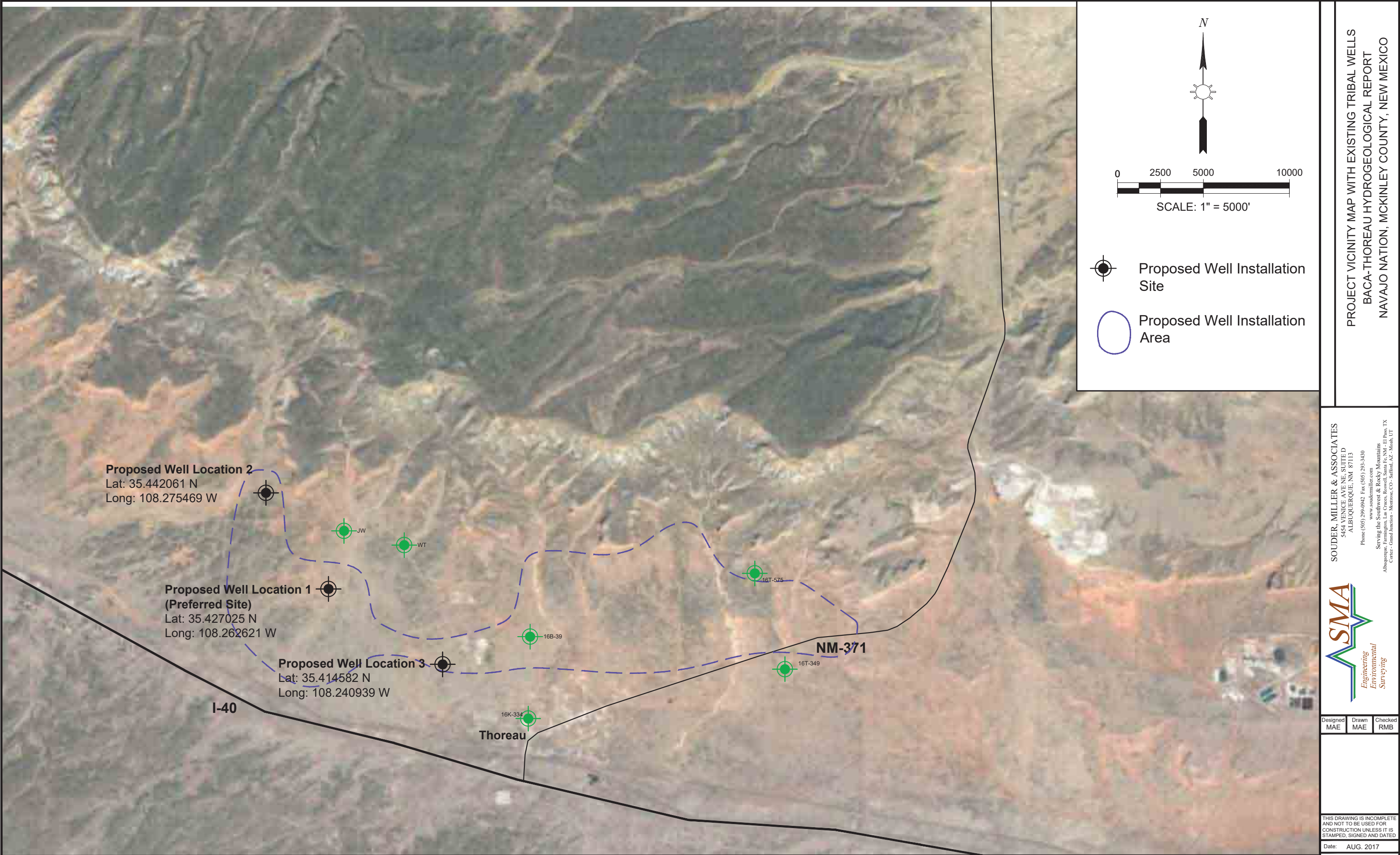
THIS DRAWING IS INCOMPLETE AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS STAMPED, SIGNED AND DATED

Date: AUG. 2017

Scale: Horiz: 1"=5000'
Vert: N/A

Project No: 6922883

Sheet: Fig. 6



SOUDEY, MILLER & ASSOCIATES
5454 VENICE AVE NE, SUITE D
ALBUQUERQUE, NM 87113
Phone (505) 299-0942 Fax (505) 293-3430
www.soudermiller.com
Serving the Southwest & Rocky Mountains
Albuquerque, Farmington, Las Cruces, Roswell, Santa Fe, NM - El Paso, TX
Cortez, Grand Junction - Montrose, CO - Salt Lake City, UT



Designed MAE	Drawn MAE	Checked RMB
-----------------	--------------	----------------

THIS DRAWING IS INCOMPLETE
AND NOT TO BE USED FOR
CONSTRUCTION UNLESS IT IS
STAMPED, SIGNED AND DATED

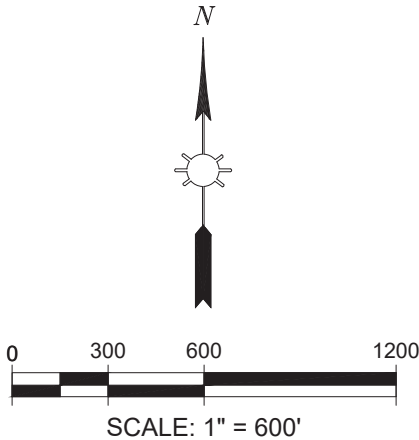
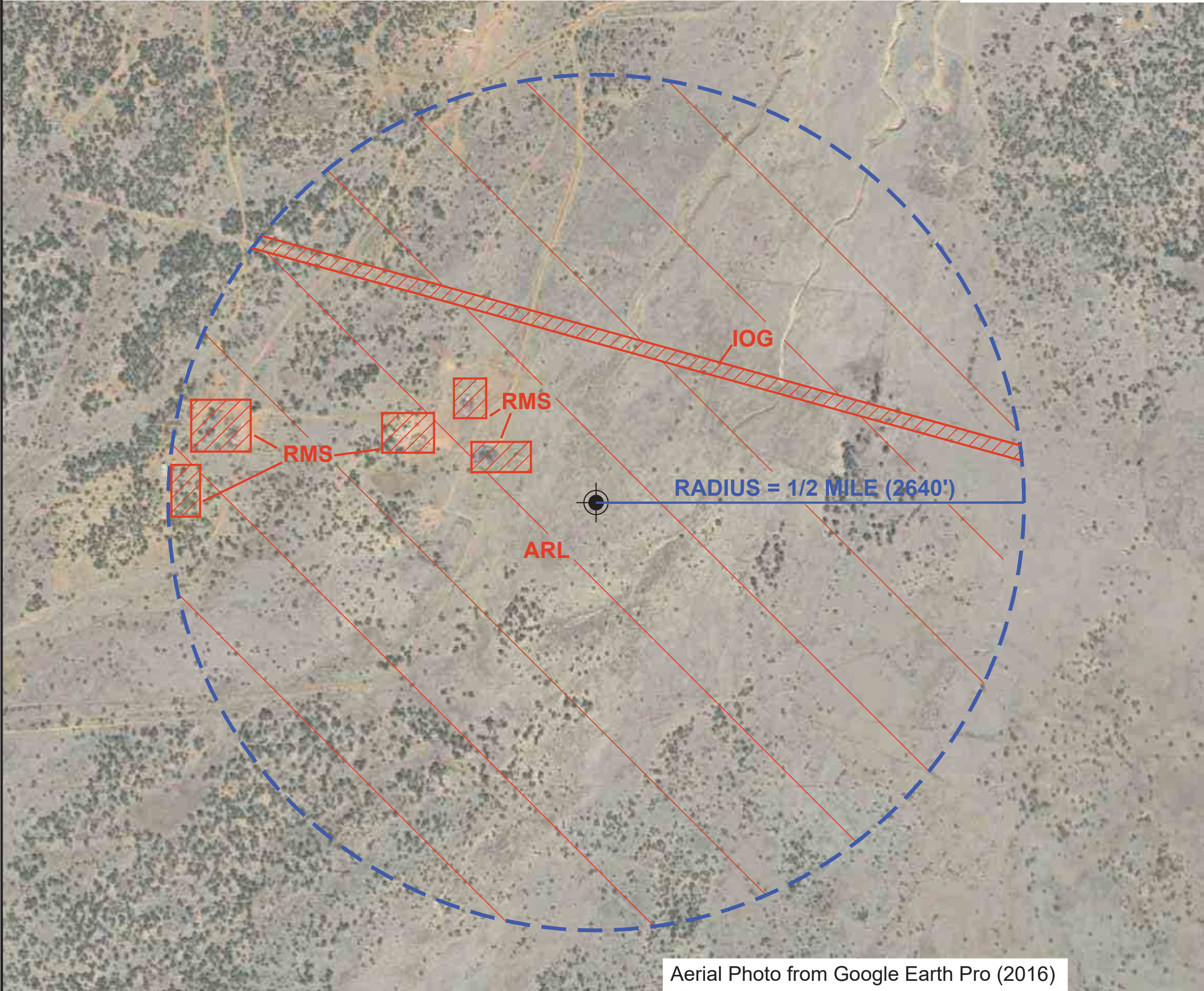
Date: AUG. 2017

Scale: Horiz: 1"=5000'
Vert: N/A

Project No: 6922883

Sheet: Fig. 7

Basemap from Thoreau, Thoreau NE, Prewitt, Cottonwood Canyon, Continental Divide, & Pine Canyon, NM USGS 7.5 Minute Quadrangles)



LEGEND

- Proposed Well 1 Location (Approximate)
- Potential Contaminant Source W/ NNEPA Code (Appendix F, NNEPA-PWSSP Susceptibility Update Form)



Map Codes:
RMS - Unsewered Single Family Residence
ARL - Animal Range Land
IOG - Oil/Gas Transmission Pipeline

WELL LOC. 1 - POTENTIAL CONTAMINANTS WITHIN 1/2 MILE

BACA-THOREAU HYDROGEOLOGIC REPORT

NAVAJO NATION, MCKINLEY COUNTY, NEW MEXICO

SOUDER, MILLER & ASSOCIATES

5454 VENICE AVE NE, SUITE D

ALBUQUERQUE, NM 87113

Phone: (505) 299-0942 Fax: (505) 293-3430

www.soudermiller.com

Serving the Southwest & Rocky Mountains

Albuquerque, Farmington, Las Cruces, Roswell, Santa Fe, NM - El Paso, TX

Cortez, Grand Junction - Montrose, CO - Salt Lake City, UT

SMA

Engineering

Environmental

Surveying

Designed MAE	Drawn MAE	Checked RMB
-----------------	--------------	----------------

THIS DRAWING IS INCOMPLETE AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS STAMPED, SIGNED AND DATED

Date: SEPT. 2017

Scale: Horiz: 1" = 300'
Vert: N/A

Project No: 6425674

Sheet: Fig. 8A

TABLES

Table 1. Summary of Existing Supply Wells near Baca-Thoreau System
Baca-Thoreau Water Systems Improvements Project
Navajo Nation, McKinley County, New Mexico

Well Name	Location		Well Elevation (ft amsl)	Well Depth (ft bgs)	Static Water Level		Casing Diameter (inches)	Screened Interval (ft bgs)	Production Rate (gpm)	Test Specific Capacity (gpm/ft)	Aquifer Name
	Latitude	Longitude			Depth (ft bgs)	Elevation (ft amsl)					
JW Camp Well (16T-529)	35.436038	-108.2602	7404	1708	228 (1964)	7176 (1964)	6"	1522-1708	25	0.14	San Andres / Glorieta
					260 (1979)	7144 (1979)					
West Thoreau Well (16T-614)	35.433814	-108.2484	7377	1760	286 (1982)	7091 (1982)	8"	1510-1640	80	0.2	San Andres / Glorieta
					292 (1984)	7085 (1984)		1660-1690			
Tribal Well 16T-349	35.413585	-108.1734	7120	677	180	6940	8"	525-600	20	0.36	Sonsela Sandstone
								600-677			
Thoreau High School Well	35.41737	-108.2343	7250	1242	123 (1966)	7127 (1966)	8"	980-1040	75 (pump limited to 47)	0.3 (Approx.)	San Andres / Glorieta
					263 (2010s)	6987 (2010s)		1080-1142			

Well Locations & Construction Information from Well Records provided by NTUA, HIS, and Gallup-McKinley County Schools District
Specific Capacity calculated from drawdown and test pumping rate records



Table 2. Wells Registered with NMOSE Near Thoreau, New Mexico

Baca-Thoreau Water Supply Project, Navajo Nation, New Mexico

Index Number*	Name/NMOSE No.	NMOSE POD No.	Use	Diversion (afy)	Owner	Easting (NM-SP W)	Northing (NM-SP W)	Elevation (ft amsl)	Depth of Well (ft)	Depth to Water (ft)	Production (gpm)
1	B 00087	B 00087 B-S-6	IND	15.03	TRI STATE GENERATION	2647706	1611088	7033	990	451	130
2	B 00087	B 00087 B-S-2	IND	15.03	TRI STATE GENERATION	2648074	1612073	7311	1555	182	120
3	B 00087	B 00087 POD10	IND	15.03	TRI STATE GENERATION	2647334	1608942	6938	1550	272	175
4	B 00087	B 00087 B-S-5	IND	15.03	TRI STATE GENERATION	2647699	1609130	6961	1445	189	100
5	B 00087	B 00087 B-S-4	IND	15.03	TRI STATE GENERATION	2650339	1609058	6930	1724	233	120
6	B 00087 B	B 00087 B-S-7	MON	577.5	TRI-STATE ASSOC., INC.	2645367	1604228	6953	1376	216	20
7	B 00087 B	B 00087 POD9	MON	577.5	TRI-STATE ASSOC., INC.	2649614	1610313	6983	1500	324	125
8	B 00386	B 00386 Exp	MUN	200.5	THOREAU WATER & SANITATION	2599229	1609722	7292	1380	--	50
9	B 00386	B 00386-5	MUN	200.5	THOREAU WATER & SANITATION	2608649	1603723	7163	1120	150	85
10	B 00386	B 00386 S	MUN	200.5	THOREAU WATER & SANITATION	2607951	1603581	7150	1150	75	80
11	B 00417	B 00417	SAN	3	THE NAVAJO TRIBE, DWR	2623152	1638919	7492	3102	550	25
12	B 00826	B 00826	MUL	3	R. P. WALDIE	2609971	1603715	7147	343	120	30
13	B 00853	B 00853 0-1	MON	0	CONOCO, INC.	2637665	1609849	7045	946	--	--
14	B 00853	B 00853 0-2	MON	0	CONOCO, INC.	2636481	1607319	7024	897	--	--
15	B 00853	B 00853 EXPL. 4	MON	0	CONOCO, INC.	2637771	1606601	7026	740	187	--
16	B 00899	B 00899	DOM	3	JIM M. RENEAU	2608966	1602735	7140	220	95	--
17	B 00900	B 00900 X	DOM	3	TIETJEN RANCH	2615959	1601699	7075	401	160	--
18	B 00954	B 00954	IND	66	TRANSWESTERN PIPELINE CO.	2603422	1610335	7308	1350	320	40
19	B 00986	B 00986	STK	3	CARVER LAND & CATTLE CO.	2618175	1596150	7100	170	90	15
20	B 01019	B 01019 POD13	MON	0	PLAINS ELECTRIC GENERATION	2652688	1605927	6848	37	--	--
21	B 01019	B 01019 POD11	MON	0	PLAINS ELECTRIC GENERATION	2652414	1605089	6854	106	6	--
22	B 01019	B 01019 POD14	MON	0	TRI STATE GENERATION	2654031	1607835	6859	270	31	--
23	B 01034	B 01034	DOM	3	B. A. MARSH	2630054	1618106	7284	485	150	30
24	B 01102	B 01102	DOM	3	MARY ANN O'NEAL	2628933	1622423	7559	510	180	15
25	B 01173	B 01173	DOM	3	REX EBY	2609656	1603381	7144	375	127	--
26	B 01178	B 01178	STK	3	ERLINE L BEGAY	2614248	1597432	7100	350	113	10
27	B 01244	B 01244	MON	0	DANIEL B. STEPHENS & ASSOC.	2603441	1609680	7290	72	25	2
28	B 01301	B 01301	EXP	0	NW NM REG. SOLID WASTE	2641727	1609913	7000	946	190	20
29	B 01302	B 01302	EXP	0	NW NM REG. SOLID WASTE	2639069	1607911	6996	740	190	20
30	B 01620	B 01620	DOM	3	DAVID C. MILLER	2614179	1598571	7086	305	90	10
31	Thoreau H.S.	Well No. 1	MUN		THOREAU HIGH SCHOOL	2603453	1607561	7250	1242	178	75
31	16T-614 (WT)	West Thoreau	MUN	--	NTUA	2599433	1613468	7377	1760	396	80
32	16T-529 (JW)	JW Camp	MUN	--	NTUA	2595933	1614293	7404	1708	300	20
33	16T-575	--	STK	--	NTUA	2619803	1611828	7280	1150	320	15
34	16T-349	--	MUN	--	NTUA	1606263	2621554	7120	677	180	20
35	16B-39	--	MUN	--	NTUA	2606748	1608152	7234	730	280	9
36	16K-334	Thoreau S.C.	MUN	--	BIA	2606638	1603393	7160	1201	131	38

Well Water Use Codes

MUN - Municipal

SAN - Sanitary

STK - Livestock Well

IND - Industrial Well

DOM - Domestic

MUL - Multiple Household

EXP - Exploratory Well

MON - Monitoring Well

* Index Number Correlates to Figure 2 which Indicates the Location of Wells

Index No. Color Key:

Red San Andres/Glorieta Well
Blue Sonsela Well
Green Existing Tribal Well
Black Alluvial/Unknown



Table 3. Water Quality Data from Select Wells Near Thoreau, New Mexico

Baca-Thoreau Water Supply Project, Navajo Nation, New Mexico

Map Index No.	U-1	U-2	U-3	16K-334	16T-349	16T-529	16T-614
USGS Well No.	352532108140001	352532108140601	352418108131501	352418108131502	--	--	--
Well Name	Transwestern Pipeline	Transwestern Pipeline	BIA School Well (Old)	BIA School Well	16T-349	JW Camp Well	West Thoreau Well
Depth Well	--	--	505	1201	677	1708	1760
Aquifer	San Andres/Glorieta	San Andres/Glorieta	Sonsela Sandstone	San Andres/Glorieta	Sonsela Sandstone	San Andres/Glorieta	San Andres/Glorieta
Sample Date	March, 1975	March, 1975	September, 1964	June, 1952	September, 1971	Various	Various
Specific Conductance	480	661	879	836	580	687	401
Acid Neutralizing Capacity	218	267	221	213	--	--	--
Bicarbonate	266	326	270	260	240	217	244
Nitrate Plus Nitrite	0.02	0.41	0.02	0	0.12	1.4	<0.3
Orthophosphate	0.03	0.18	--	--	0.04	--	--
Hardness	130	4	400	460	5	180	171
Noncarbonate Hardness	0	0	180	240	147	--	--
Calcium	44	1.6	120	140	2	94.8	33
Magnesium	5.1	0.1	22	29	<0.01	85	22
Sodium	43	150	39	10	138	20.8	18.7
Sodium Adsorption Ratio (SAR)	1.6	31	0.8	--	26.8	--	--
Sodium Fraction Of Cations	41	98	13	--	6.11	--	--
Potassium	2.5	2	2	--	<0.1	--	--
Chloride	3.8	15	28	5	19.5	44	
Sulfate	40	58	220	240	30.3	72	31
Fluoride	0.3	0.2	0.2	0.4	0.54	1.4	0.24
Silica	9.5	9	12	11	--	--	--
Iron	0.01	0.05	0.01	--	0.15	0.46	0.57
Manganese	0.02	--	--	--	--	0.005	<0.05
Total Dissolved Solids	279	399	574	568	337	286	--
Ph (ph Units)	--	--	7.3	--	9	7.1	7.8
Uranium	--	--	--	--	--	0.0034	0.004
Adjusted Gross Alpha	--	--	--	--	--	7.4 +/- 1.3	5.4 +/- 1.2
Total Radium (226/228)	--	--	--	--	--	5.82	3.5 +/- 0.4

Note: All results in mg/L unless otherwise noted

Results in **Red** indicate EPA Drinking Water Primary Standard ExceedanceResults in **Blue** indicate EPA Drinking Water Secondary Standard Exceedance

Tribal Well Analytical Data from NTUA and IHS Well Records & Documents

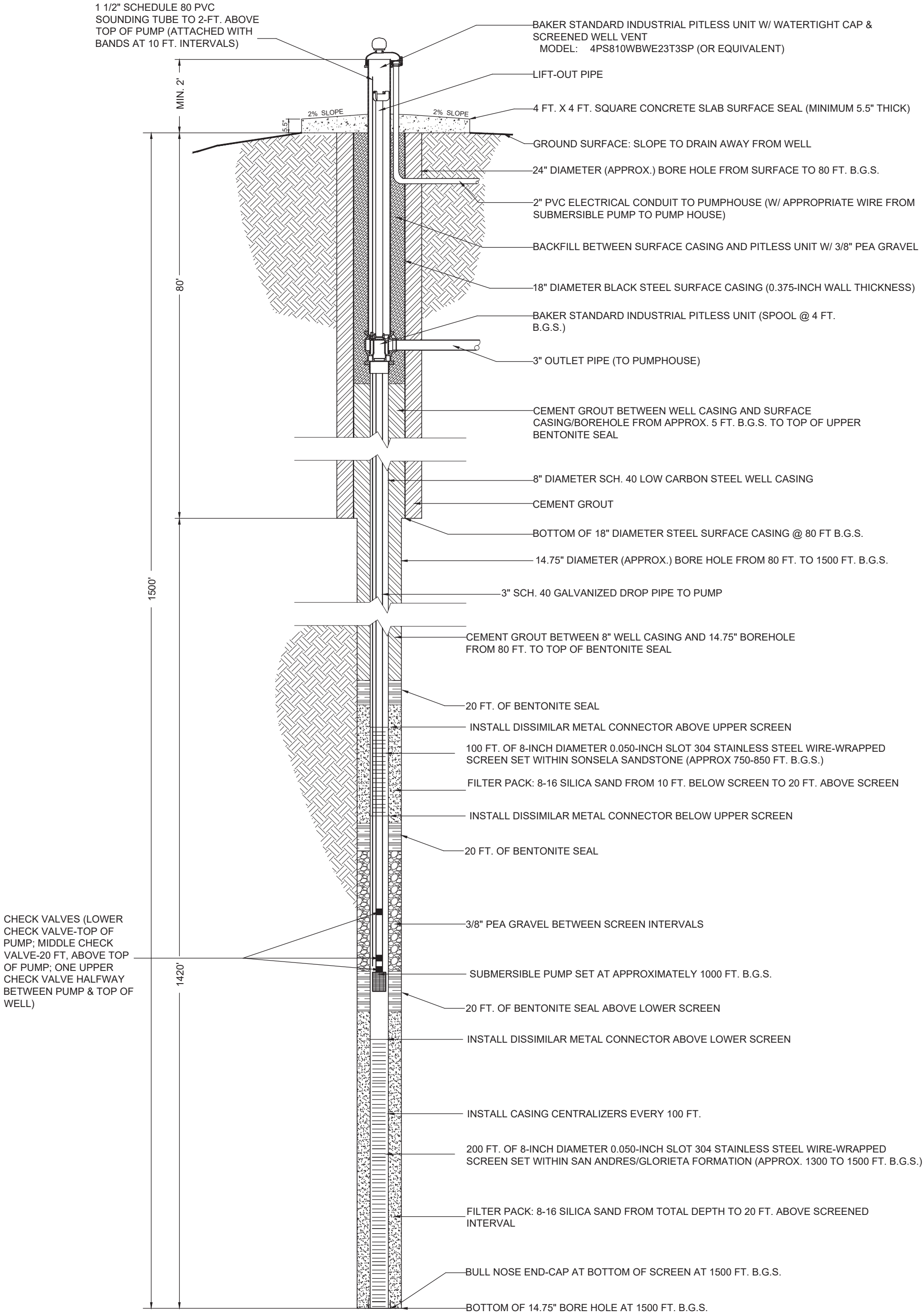
USGS-Registered Well Analytical Data from USGS Water Quality Database (accessed October, 2017)



**Table 4. Potential Contaminant Sources within 1/2 Mile of Proposed Well Location
Baca-Thoreau Water System Improvements Project, Navajo Nation, McKinley County, New Mexico**

Contaminant Source Number	NNEPA Contaminant Source Code	Contaminant Source Type	Actual or Potential Contaminant?	Contaminants of Concern	Distance from Proposed Well (ft)
1	ARL	Animal Range Land	Potential	Nitrate, Phosphate, Chloride, Pesticides, Pathogens	0-2640
2	IOG	Transwestern Pipeline Oil/Gas Transmission Line	Potential	Oils, Gasoline, Volatile Organic Compounds, Natural Gas, Propane	1000
3	RMS	Unsewered Single Family Residences - Three Potential Septic Tanks/Leachfields	Potential	Septage, Septic Effluent, Pathogens, Nitrate, Ammonia, Chloride, Household Chemicals	450-2640

APPENDIX A
Conceptual Well Design Diagram



NOTES: DIAGRAM NOT TO SCALE

APPENDIX B
Theis Equation Calculation Spreadsheet

Appendix B, Exhibit 1 - Theis Equation Drawdown Calculations for Proposed Thoreau Well Location 1 - Anticipated Use of 100 afy
Baca-Thoreau Hydrogeologic Investigation

User Inputs - Proposed Wells

Proposed Pump Time (% of Day)	50%	(140 ft2/day)
Assumed Transmissivity (gpd/ft)	1048	
Assumed Aquifer Storativity (unitless)	0.0004	
Well Specific Capacity (gpm/ft)	0.1	
Pumping Time (years)	20	

User Inputs - Existing Wells

Assumed Pump Time (% of day)	100%
Assumed Well Efficiency (%)	80%

Cell Color Coding Legend

	Input Value from User
	Calculated Value
	Drawdown Result
	Expected Drawdown at Radial Distance from Well (Radius of Influence)

Proposed Well List

Name (NMOSE File Record #)	Northing (State Plane)	Easting (State Plane)	Diversion Amount (ac-ft/y)	Average Calcuated Proposed Pump Rate (gpm) from Annual Diversion
Well Site 1	1610948	2595059	100	124

Total Proposed Diversion	100	acre-ft/year
--------------------------	-----	--------------

Existing Well & Distances List

Name (NMOSE File Record #)	Diversion Amount (ac-ft/y)	Northing (State Plane)	Easting (State Plane)	Total Well Depth (ft bgs)	Depth to Water (ft)	Distance from Proposed Well (miles)	Water Column Thickness (ft)	Assumed Pump Rate (gpm)	Predicted Pump Drawdown (ft)	Predicted Drawdown from Proposed Wells (ft)	Well Loss due to Inefficiency (ft)	Total Drawdown	Percent of Water Column Drawdown due to Proposed Wells
Thoreau H.S.	50	1607561	2603453	1242	178	1.7	1064	31	310.0	58	77	445	5%
16T-614 (WT)	80	1613468	2599433	1760	396	1.0	1364	50	496.0	73	124	693	5%
16T-529 (JW)	30	1614293	2595933	1708	300	0.7	1408	19	186.0	84	46	316	6%
16T-575	15	1611828	2619803	1150	320	4.7	830	9	93.0	31	23	147	4%
16T-349	20	1606263	2621554	677	180	5.1	497	12	124.0	29	31	184	6%
16B-39	9	1608152	2606748	730	280	2.28	450	6	55.8	50	14	120	11%
16K-334	25	1603393	2606638	1201	131	2.6	1070	15	155.0	46	39	240	4%
B 00386	201	1609722	2599229	1380	200	0.8	1180	124	1243.0	78	311	1631	7%
B 00386	201	1603723	2608649	1120	150	2.9	970	124	1243.0	44	311	1597	4%
B 00386	201	1603581	2607951	1150	75	2.8	1075	124	1243.0	44	311	1598	4%
B 00417	3	1638919	2623152	3102	550	7.5	2552	2	18.6	20	5	43	1%
B 00087	15	1611088	2647706	990	451	10.0	539	9	93.2	13	23	130	2%
B 00087	15	1612073	2648074	1555	182	10.0	1373	9	93.2	13	23	130	1%
B 00087	15	1608942	2647334	1550	272	9.9	1278	9	93.2	13	23	130	1%
B 00087	15	1609130	2647699	1445	189	10.0	1256	9	93.2	13	23	130	1%
B 00087	15	1609058	2650339	1724	233	10.5	1491	9	93.2	12	23	129	1%
B 00087 B	578	1604228	2645367	1376	216	9.6	1160	358	3580.3	14	895	4489	1%
B 00087 B	578	1610313	2649614	1500	324	10.3	1176	358	3580.3	13	895	4488	1%
Quarter Mile	0	1610948	2596379							109.8			
Half Mile	0	1610948	2597699							91.0			
3/4 Mile	0	1610948	2599019							80.1			
One Mile	0	1610948	2600339							72.3			
Two Miles	0	1610948	2605619							53.6			



Appendix B, Exhibit 2 - Theis Equation Drawdown Calculations for Proposed Thoreau Well Location 2 - Anticipated Use of 100 afy
Baca-Thoreau Hydrogeologic Investigation

User Inputs - Proposed Wells

Proposed Pump Time (% of Day)	50%	(140 ft2/day)
Assumed Transmissivity (gpd/ft)	1048	
Assumed Aquifer Storativity (unitless)	0.0004	
Well Specific Capacity (gpm/ft)	0.1	
Pumping Time (years)	20	

User Inputs - Existing Wells

Assumed Pump Time (% of day)	100%
Assumed Well Efficiency (%)	80%

Cell Color Coding Legend

	Input Value from User
	Calculated Value
	Drawdown Result
	Expected Drawdown at Radial Distance from Well (Radius of Influence)

Proposed Well List

Name (NMOSE File Record #)	Northing (State Plane)	Easting (State Plane)	Diversion Amount (ac-ft/y)	Average Calcuated Proposed Pump Rate (gpm) from Annual Diversion
Well Site 2	1616505	2591398	100	124

Total Proposed Diversion	100	acre-ft/year
--------------------------	-----	--------------

Existing Well & Distances List

Name (NMOSE File Record #)	Diversion Amount (ac-ft/y)	Northing (State Plane)	Easting (State Plane)	Total Well Depth (ft bgs)	Depth to Water (ft)	Distance from Proposed Well (miles)	Water Column Thickness (ft)	Assumed Pump Rate (gpm)	Predicted Pump Drawdown (ft)	Predicted Drawdown from Proposed Wells (ft)	Well Loss due to Inefficiency (ft)	Total Drawdown	Percent of Water Column Drawdown due to Proposed Wells
Thoreau H.S.	50	1607561	2603453	1242	178	2.8	1064	31	310.0	44	77	432	4%
16T-614 (WT)	80	1613468	2599433	1760	396	1.6	1364	50	496.0	59	124	679	4%
16T-529 (JW)	30	1614293	2595933	1708	300	1.0	1408	19	186.0	74	46	306	5%
16T-575	15	1611828	2619803	1150	320	5.5	830	9	93.0	27	23	144	3%
16T-349	20	1606263	2621554	677	180	6.0	497	12	124.0	25	31	180	5%
16B-39	9	1608152	2606748	730	280	3.31	450	6	55.8	40	14	110	9%
16K-334	25	1603393	2606638	1201	131	3.8	1070	15	155.0	37	39	230	3%
B 00386	201	1609722	2599229	1380	200	2.0	1180	124	1243.0	54	311	1608	5%
B 00386	201	1603723	2608649	1120	150	4.1	970	124	1243.0	35	311	1589	4%
B 00386	201	1603581	2607951	1150	75	4.0	1075	124	1243.0	35	311	1589	3%
B 00417	3	1638919	2623152	3102	550	7.4	2552	2	18.6	20	5	43	1%
B 00087	15	1611088	2647706	990	451	10.7	539	9	93.2	12	23	128	2%
B 00087	15	1612073	2648074	1555	182	10.8	1373	9	93.2	12	23	128	1%
B 00087	15	1608942	2647334	1550	272	10.7	1278	9	93.2	12	23	128	1%
B 00087	15	1609130	2647699	1445	189	10.8	1256	9	93.2	12	23	128	1%
B 00087	15	1609058	2650339	1724	233	11.3	1491	9	93.2	11	23	127	1%
B 00087 B	578	1604228	2645367	1376	216	10.5	1160	358	3580.3	12	895	4488	1%
B 00087 B	578	1610313	2649614	1500	324	11.1	1176	358	3580.3	11	895	4487	1%
Quarter Mile	0	1616505	2592718							109.8			
Half Mile	0	1616505	2594038							91.0			
3/4 Mile	0	1616505	2595358							80.1			
One Mile	0	1616505	2596678							72.3			
Two Miles	0	1616505	2601958							53.6			



Appendix B, Exhibit 3 - Theis Equation Drawdown Calculations for Proposed Thoreau Well Location 3 - Anticipated Use of 100 afy

Baca-Thoreau Hydrogeologic Investigation

User Inputs - Proposed Wells

Proposed Pump Time (% of Day)	50%	(140 ft2/day)
Assumed Transmissivity (gpd/ft)	1048	
Assumed Aquifer Storativity (unitless)	0.0004	
Well Specific Capacity (gpm/ft)	0.1	
Pumping Time (years)	20	

User Inputs - Existing Wells

Assumed Pump Time (% of day)	100%
Assumed Well Efficiency (%)	80%

Cell Color Coding Legend

	Input Value from User
	Calculated Value
	Drawdown Result
	Expected Drawdown at Radial Distance from Well (Radius of Influence)

Proposed Well List

Name (NMOSE File Record #)	Northing (State Plane)	Easting (State Plane)	Diversion Amount (ac-ft/y)	Average Calcuated Proposed Pump Rate (gpm) from Annual Diversion
Well Site 3	1606542	2601665	100	124

Total Proposed Diversion	100	acre-ft/year
--------------------------	-----	--------------

Existing Well & Distances List

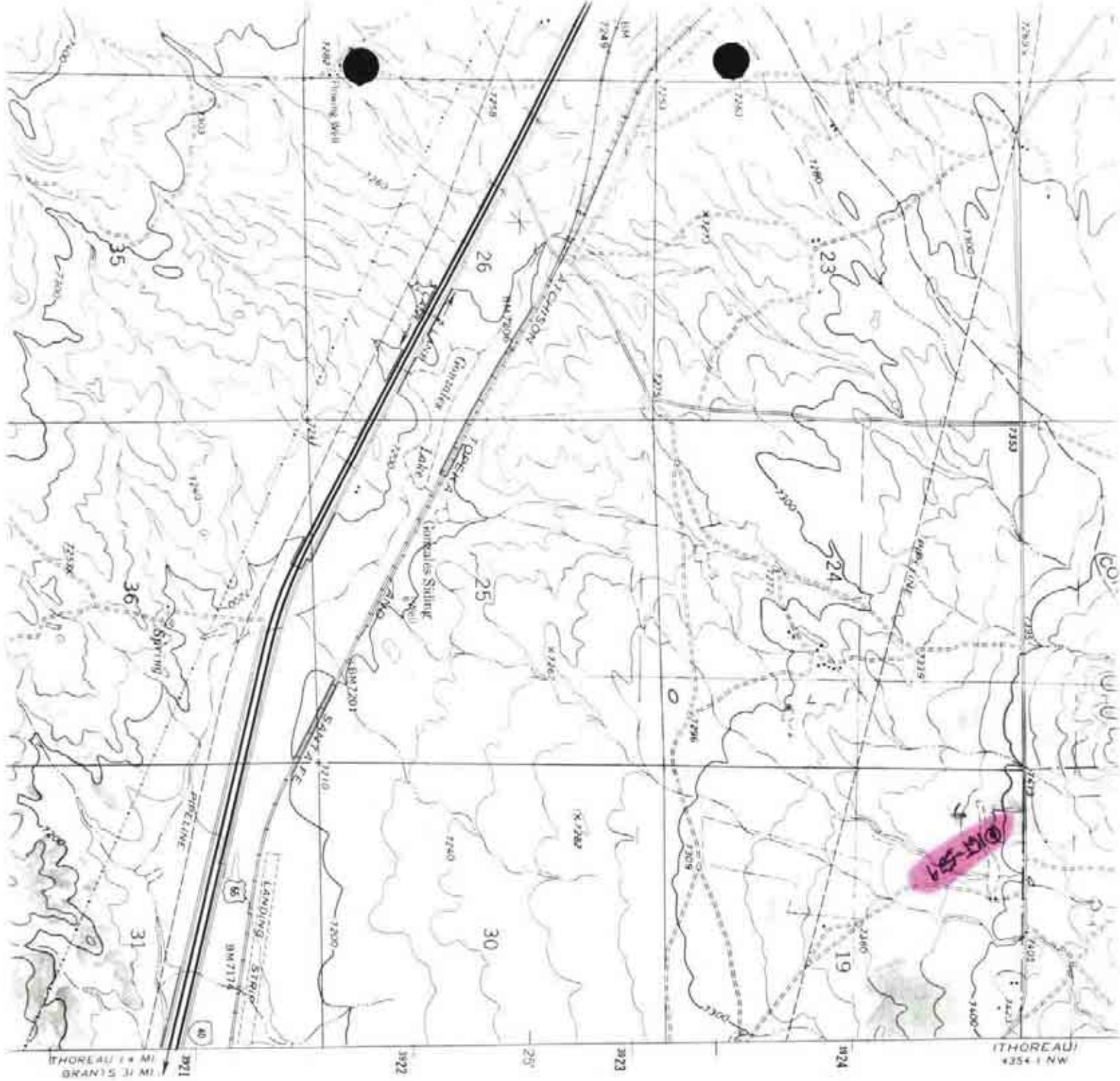
Name (NMOSE File Record #)	Diversion Amount (ac-ft/y)	Northing (State Plane)	Easting (State Plane)	Total Well Depth (ft bgs)	Depth to Water (ft)	Distance from Proposed Well (miles)	Water Column Thickness (ft)	Assumed Pump Rate (gpm)	Predicted Pump Drawdown (ft)	Predicted Drawdown from Proposed Wells (ft)	Well Loss due to Inefficiency (ft)	Total Drawdown	Percent of Water Column Drawdown due to Proposed Wells
Thoreau H.S.	50	1607561	2603453	1242	178	0.4	1064	31	310.0	98	77	485	9%
16T-614 (WT)	80	1613468	2599433	1760	396	1.4	1364	50	496.0	64	124	684	5%
16T-529 (JW)	30	1614293	2595933	1708	300	1.8	1408	19	186.0	56	46	289	4%
16T-575	15	1611828	2619803	1150	320	3.6	830	9	93.0	38	23	154	5%
16T-349	20	1606263	2621554	677	180	3.8	497	12	124.0	37	31	192	7%
16B-39	9	1608152	2606748	730	280	1.01	450	6	55.8	72	14	142	16%
16K-334	25	1603393	2606638	1201	131	1.1	1070	15	155.0	69	39	263	6%
B 00386	201	1609722	2599229	1380	200	0.8	1180	124	1243.0	80	311	1634	7%
B 00386	201	1603723	2608649	1120	150	1.4	970	124	1243.0	63	311	1616	6%
B 00386	201	1603581	2607951	1150	75	1.3	1075	124	1243.0	65	311	1619	6%
B 00417	3	1638919	2623152	3102	550	7.4	2552	2	18.6	20	5	43	1%
B 00087	15	1611088	2647706	990	451	8.8	539	9	93.2	16	23	133	3%
B 00087	15	1612073	2648074	1555	182	8.9	1373	9	93.2	16	23	132	1%
B 00087	15	1608942	2647334	1550	272	8.7	1278	9	93.2	16	23	133	1%
B 00087	15	1609130	2647699	1445	189	8.7	1256	9	93.2	16	23	133	1%
B 00087	15	1609058	2650339	1724	233	9.2	1491	9	93.2	15	23	131	1%
B 00087 B	578	1604228	2645367	1376	216	8.3	1160	358	3580.3	17	895	4493	1%
B 00087 B	578	1610313	2649614	1500	324	9.1	1176	358	3580.3	15	895	4491	1%
Quarter Mile	0	1606542	2602985							109.8			
Half Mile	0	1606542	2604305							91.0			
3/4 Mile	0	1606542	2605625							80.1			
One Mile	0	1606542	2606945							72.3			
Two Miles	0	1606542	2612225							53.6			



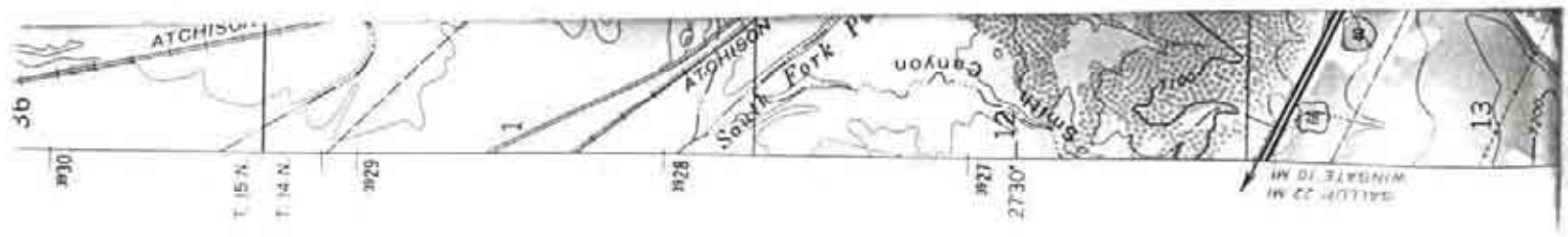
APPENDIX C

Tribal Well As-Builts & Well Information

(Wells 16T-529, 16T-614, 16T-349, 16K-334, 16B-39, & 16T-575)



047-38,45





NTUA WELL - J. W. CAMP
TRIBAL # 16T-529

6/8/93



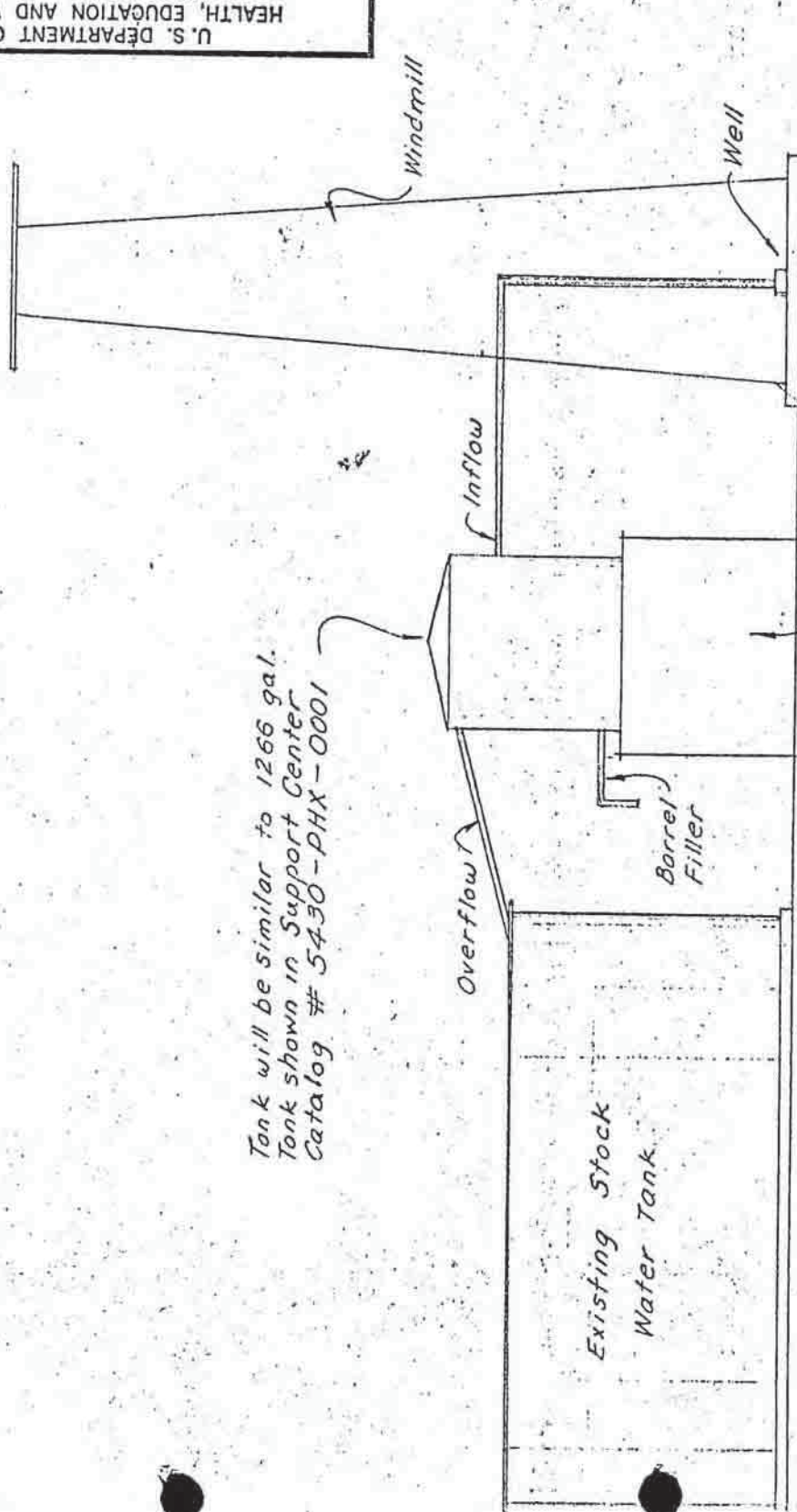
J. W. CAMP
16T-529

6/8/93

167529

U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE PUBLIC HEALTH SERVICE DIVISION OF INDIAN HEALTH		SHEET NO.		OF		TOTAL SHEETS	
DRAWN BY:		DATE:		OFFICE OF ENVIRONMENTAL HEALTH NAVAJO INDIAN HEALTH AREA OFFICE WINDOW ROCK, ARIZONA			
DRAWING NO.							

STORAGE TANK AND
WATERING POINT



Well Logs /Diagrams

WSW NO. 16 T- 529

SURFACE

DEPTH AND SIZE OF SURFACE CASING
UNKNOWN

2" TUBING

COMPLETED: 3/20/64

ELEVATION: +7380'

LOCATION: 1200+ FNL, 1700+ FNL,

SEC. 19, T.14N., R.13W.,

MCKINLEY COUNTY, NEW MEXICO

PUMP @ 638'

PUMP TEST: 4/19/79, SWL 260',

60 GPM, 183' DRAWDOWN

1120' ± TOP OF SAN ANDRES L.S.

6 5/8" UNKNOWN WEIGHT, BUT PROBABLY
6" ID. THEY SAY "T+C" SO IT MAY BE
A BETTER THAN NORMAL GRADE CASING.

1506' TOP GLORIETA S.S.

1522'

PERFORATIONS — PROBABLY 1/8" x 2 1/2"
MACHINE CUT SLOTS. SOME BLANK
INTERVALS MAY ALSO BE PRESENT.

1708'

SCALE: NONE

DATE: 8/20/87 AND 4/30/90

BY: H.F.P.

WINDMILL MAINTENANCE RECORD

WELL No. 16T-529

DATE REPAIRED	WORK DONE AND MATERIALS USED
9/16/69	Pulled 19 joints of sucker rods and replaced leather cups.
1/12/70	Repaired pump rods, standpipe, stop & waste valve and valve handle.
1/19/70	Pulled rods, releathered plunger and foot valve.
7/23/73	Repaired 1½" stop and waste valve.
10-29-74	Made earthpit and refilled around the tank and trough
11/25/74	Changed oil, okay
2/12/75	Replaced valve - 1½ valve.
12-01-75	<i>Welded storage tank</i>

16T-529. Well equipped with 16' Aermotor windmill, 27,900 gallon storage tank, two (2) steel trough, 27,900 gallon tank needs a tank cover put on.

Well # _____ Data _____

Project #6591 _____

1. Source of Power 16' Aermotor Windmill
2. A. Date of Construction 2/12/64 B. Tribal Well No. 16T-529
C. Contractor Navajo Tribe D. Surface Elevation _____
3. A. Depth 1708' B. Size of Bore Hole 8-3/4"
4. Casing: A. Size 66-5/8" B. Type T&C
C. Location 186' Perforated on Bottom
5. Screen: A. Length _____ B. Location _____
C. Type _____ D. Slot Size _____
6. Gradation of Gravel Pack _____
7. Depth of Grout Envelope _____
8. A. Static Water Level 302 Drawdown = 365'
B. Date of Measurement 9/28, 29/77
9. Pump: A. Make _____ B. Model _____
C. Horsepower _____ D. Voltage _____
E. Phasing _____ F. Full Load Amperage _____
G. Rated Capacity _____ H. Depth of Setting _____
I. Elevation of Probes _____ J. Pumping Depth _____
10. Water Level Indicator: A. Depth of Setting _____
B. Type _____
11. A. Size of Drop Pipe 1-1/4"
B. Size of Submersible Cable _____
12. Location of Check Valves _____

106 CHS-1000 10-10-77
#106-1000 2000

Well Records / Schedules

TRIBAL WELL RECORD
LOCATION FILE

UPDATED JAN 07 94

TRIBAL WELL NO 16T-529

PWSID Nm3560303

WELL NAME/OTHER NO JOHN WILLCIE CAMP

WELL TYPE
(MARK ONLY ONE)

WELL STATUS
(MARK ONLY ONE)

WELL USE
(MARK ONLY ONE)

- ☒ WW WATER WELL
☐ WA ARTESIAN WELL
☐ WS SPRING
☐ NS NATURAL SPRING
☐ OW OBSERVATION WELL
☐ GS GAS WELL
☐ OP OIL PRODUCTION
☐ MW MINERAL WELL
☐ XX UNKNOWN

- ☒ ACT ACTIVE
☐ INA INACTIVE
☐ ABA ABANDONED
☐ UNK UNKNOWN

- ☐ DOM DOMESTIC
☐ AGR AGRICULTURE
☐ LIV LIVESTOCK
☐ IND INDUSTRIAL MINING
☐ REC RECREATION
☒ MUN MUNICIPAL
☐ OTH OTHER
☐ UNK UNKNOWN

QUAD NO 5463

MILES WEST

MILES SOUTH

NE SE SW NW / NE SE SW NW / NE SE SW NW
10 ACRE 40 ACRE 160 ACRE

SECT.

T TOWNSHIP

R RANGE

APPROXIMATE LOCATION 1.50 mi W of RADIO TOWER

LATITUDE

LONGITUDE

UTM COORDINATES: X(EAST) 748780

Y(NORTH) 3924630

ZONE 12

OPERATOR NTUA

USGS WATERSHED CODE 13020207000

STATE: ☐ AZ ARIZONA

☒ NM NEW MEXICO

☐ UT UTAH

☐ CO COLORADO

COUNTY: ☐ AP APACHE

☒ MK MCKINLEY

☐ SJ SAN JUAN

☐ MT MONTEZUMA

☐ NA NAVAJO

☐ VL VALENCIA

☐ KA KANE

☐ LP LA PLATA

☐ CO COCONINO

☐ BL BERNALLILLO

☐ SD SANDOVAL

☐ SO SOCORRO

☐ RA RIO ARRIBA

☐ SA SAN JUAN

GRAZING DISTRICT 16

CHAPTER NAME: THOREAU

CHAPTER CODE THOR

LOCATION DATA SOURCE: FIELD CHECKED

LOCATION FILE COMPLETED BY: L. NOTAH

DATE 91/1/93

FIELD CHECKED BY: L. NOTAH

DATE 6/1/93
/dbase/wells/doc/Loc-Form.wp

revised 07 April 93

TRIBAL WELL RECORD STRUCTURE FILE

update

TRIBAL WELL NO 167-529 STARTED 2/2/1964 COMPLETED 3/20/1964
ELEVATION 7404 FT DEPTH 1708 DEPTH MEASURED 3/20/1964

DEPTH IS ☒ MEASURED ☐ ESTIMATED ☐ REPORTED WELL DIA. 8.75 IN

1 CASING DIA <u>6.62</u>	FROM <u>1</u>	FT	TO <u>1708</u>	FT	MATL <u>STL</u>
2 CASING DIA <u> </u>	FROM <u> </u>	FT	TO <u> </u>	FT	MATL <u> </u>
3 CASING DIA <u> </u>	FROM <u> </u>	FT	TO <u> </u>	FT	MATL <u> </u>
4 CASING DIA <u> </u>	FROM <u> </u>	FT	TO <u> </u>	FT	MATL <u> </u>

CASING MATL CODES: brs=brass cop=copper evd=everdur irn=iron mon=monel
pls=plastic stl=steel sst=stainless steel

1 CASING PERFORATED FROM <u>1522</u>	FT	TO <u>1708</u>	FT	OPENING TYPE <u>P</u>
2 CASING PERFORATED FROM <u> </u>	FT	TO <u> </u>	FT	OPENING TYPE <u> </u>
3 CASING PERFORATED FROM <u> </u>	FT	TO <u> </u>	FT	OPENING TYPE <u> </u>
4 CASING PERFORATED FROM <u> </u>	FT	TO <u> </u>	FT	OPENING TYPE <u> </u>
5 CASING PERFORATED FROM <u> </u>	FT	TO <u> </u>	FT	OPENING TYPE <u> </u>

OPENING CODES: f=fractured rock l=louvered/shutter-type screen m=mesh screen
p=perforated/porous/slotted casing r=wire-wound screen
s=screen/type unknown t=sand point w=walled/shored x=open hole
z=other

DATE WELL TURNED OVER TO TRIBE: / /

FUNDED BY:

CONTRACTOR: NAVAJO TRIBE

SITE IMPROVEMENTS

- ☐ WM WINDMILL
- ☒ WP WATERING POINT
- ☒ TA TANK
- ☒ WL WATER LINE
- ☐ TR TROUGH
- ☐ CS CISTERN
- ☐ HP HAND PUMP
- ☐ NO NONE

TYPE OF LIFT

- ☐ AL AIRLIFT
- ☐ PS PISTON
- ☐ TU TURBINE
- ☐ MT MULTIPLE TURBINE
- ☐ CN CENTRIFUGAL
- ☐ MC MULTIPLE CENTRIFUGAL
- ☐ BU BUCKET
- ☒ SU SUBMERSIBLE

ENERGY SOURCE

- ☒ EM ELECTRIC MOTOR
- ☐ DE DIESEL ENGINE
- ☐ HA HAND
- ☐ GS GAS ENGINE
- ☐ LP LP GAS ENGINE
- ☐ NG NATURAL GAS ENGINE
- ☐ WM WINDMILL
- ☐ SO SOLAR

PUMP HP 5

ON SITE STORAGE CAPACITY 14000 GAL

STRUCTURE DATA SOURCE: WELL FILE/NTUA FILE/LNOTAH

STRUCTURE FILE COMPLETED BY: L. NOTAH
revised 08 April 93

DATE 9/1/93
/dbase/wells/doc/Str-Form.vp

UPDATED JAN 12 94

TRIBAL WELL RECORD HYDROLOGY FILE

update

TRIBAL WELL NO 167-529

USGS AQUIFER CODE 310GLRT

THICKNESS FT NOMINAL YIELD 25 GPM YIELD MEASURED 6/22/1992

☒ BAILER ☐ PUMP TEST @ 15 GPM FOR 8.0 HOURS DATE 3/20/1964

DRAWDOWN 365 FT OBSERVATION WELL DATA AVAILABLE ☐ YES ☒ NO

HORIZ CONDUCTIVITY FT/DAY SPECIFIC CAPACITY GPM/FT

VERT. CONDUCTIVITY FT/DAY STORAGE COEF

COEF OF TRANSMISSIVITY FT²/DAY

INDICATE ADDITIONAL PUMPING TEST DATA AVAILABLE AS HARD COPY:

☐ YES ☐ NO MULTIPLE RATE DRAWDOWN PUMPING TEST

☒ YES ☐ NO SINGLE RATE DRAWDOWN PUMPING TEST

☐ YES ☐ NO MULTIPLE RATE DRAWDOWN/RECOVERY TEST

☒ YES ☐ NO RECOVERY TEST

LOG AVAILABLE: ☒ DL DRILLER'S ☐ EL ELECTRIC LOG

HYDROLOGY DATA SOURCE: WELL FILE/NTUA FILE/LNOTAH

HYDROLOGY FILE COMPLETED BY: L. NOTAH DATE 9/1/93

ENTERED JAN 13 1994
ENTERED JAN 13 1994

STATIC WATER LEVEL FILE

<p><i>add</i> ✓ DEPTH TO SWL <u>302</u> FT DATE <u>9/28/1977</u></p> <p>✓ DEPTH TO SWL <u>260</u> FT DATE <u>4/19/1979</u></p> <p>✓ DEPTH TO SWL <u>302</u> FT DATE <u>9/30/1981</u></p> <p>✓ DEPTH TO SWL <u>592</u> FT DATE <u>6/22/1992</u></p> <p>✓ DEPTH TO SWL <u>435</u> FT DATE <u>8/6/1992</u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p>	<p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p> <p>DEPTH TO SWL <u> </u> FT DATE <u> </u> / <u> </u> / <u> </u></p>
--	---

revised 08 April 93

/dbase/wells/doc/Byd-Form.wp

ENTERED JAN 13 1994

TRIBAL WELL RECORD
GEOHYDROLOGIC UNITS

new enter

TRIBAL WELL NO 167-529

SEQ-NO 001
DEPTH TO TOP

0

DEPTH TO BOTTOM

90

GEOHYDRO-UNIT

110ALVM

LITH.

ALVM

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE N

SEQ-NO 002
DEPTH TO TOP

90

DEPTH TO BOTTOM

860

GEOHYDRO-UNIT

231PFDF

LITH.

SHLE

LITHOLOGIC MODIFIER

RED WITH MINOR SNDS, LMSN LENS

CONTRIBUTING UNIT CODE N

SEQ-NO 003
DEPTH TO TOP

860

DEPTH TO BOTTOM

910

GEOHYDRO-UNIT

231SNSL

LITH.

SDSL

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE N

~~SEQ-NO 004~~
~~DEPTH TO TOP~~

~~910~~

~~DEPTH TO BOTTOM~~

~~952~~

~~GEOHYDRO-UNIT~~

~~LITH.~~

~~SHLE~~

~~LITHOLOGIC MODIFIER~~

~~CONTRIBUTING UNIT CODE N~~

~~SEQ-NO 005~~
~~DEPTH TO TOP~~

~~DEPTH TO BOTTOM~~

~~GEOHYDRO-UNIT~~

~~LITH.~~

~~LITHOLOGIC MODIFIER~~

~~CONTRIBUTING UNIT CODE N~~

INTERVAL FILE COMPLETED BY: M.P. JOHNSON
revised 08 April 93

ENTERED JUN 13 1994

DATE 09/08/93
/dbase/wells/doc/Int-Form.wp

TRIBAL WELL RECORD

GEOHYDROLOGIC UNITS

TRIBAL WELL NO 167-529

SEQ-NO 004
DEPTH TO TOP

910

DEPTH TO BOTTOM

1430

GEOHYDRO-UNIT

231CHNL

LITH.

SDSL

LITHOLOGIC MODIFIER

INCS. L. PET FOR 1/2 MON BUTTE

CONTRIBUTING UNIT CODE N

SEQ-NO 005
DEPTH TO TOP

1430

DEPTH TO BOTTOM

1442

GEOHYDRO-UNIT

231SRMP

LITH.

SNDS

LITHOLOGIC MODIFIER

HARD

CONTRIBUTING UNIT CODE N

SEQ-NO 006
DEPTH TO TOP

1442

DEPTH TO BOTTOM

1532

GEOHYDRO-UNIT

230MNKP

LITH.

SHLE

LITHOLOGIC MODIFIER

SOME CONGLOMERATE

CONTRIBUTING UNIT CODE N

SEQ-NO 007
DEPTH TO TOP

1532

DEPTH TO BOTTOM

1570

GEOHYDRO-UNIT

313SADR

LITH.

LM SN

LITHOLOGIC MODIFIER

SOME SHALE

CONTRIBUTING UNIT CODE U

SEQ-NO 008
DEPTH TO TOP

1570

DEPTH TO BOTTOM

1708

GEOHYDRO-UNIT

310GLRT

LITH.

SNDS

LITHOLOGIC MODIFIER

HARD, RED/GRAY/WHITE

CONTRIBUTING UNIT CODE P

INTERVAL FILE COMPLETED BY: M.S. JOHNSON
revised 08 April 93

DATE 09/08/93
/dbase/wells/doc/Int-Form.wp

ENTERED JAN 13 1994

TRIBAL WELL RECORD
COMMENTS FILE

add

TRIBAL WELL NO 167-529

PERTINENT
COMMENTS:

GEOHYDROLOGIC DATA SOURCE: WELL FILE (DRILLER'S LOG,
USGS WELL SCHEDULE). GEOHYDROLOGIC UNIT BOUNDARIES
ARE APPROXIMATE.

THIS WELL MAY ALSO PRODUCE FROM THE SAN ANDRES LIMESTONE (3135ADR).

- ☒ LOCATION COORDINATES MEASURED WITH GPS DEVICE ☒ SATELLITES VISIBLE
- ☐ LOCATION COORDINATES PICKED OFF TOPO MAP -SCALE=
- ☐ ELEVATION PRINTED ON TOPO MAP -SCALE=
- ☐ ELEVATION MEASURED WITH GPS UNIT -4 SATELLITES VISIBLE
- ☒ ELEVATION INTERPOLATED FROM 1:24000 TOPO

THE IMPROVEMENTS AT THIS SITE ARE:

- | | |
|---|---|
| <input checked="" type="checkbox"/> IN GOOD CONDITION | <input type="checkbox"/> NEED SOME MAINTENANCE |
| <input type="checkbox"/> IN FAIR CONDITION | <input type="checkbox"/> NEED MAJOR MAINTENANCE |
| <input type="checkbox"/> IN POOR CONDITION | |

STORAGE TANK IS ☒ COVERED ☐ UNCOVERED

COMMENTS BY: C NOTAH / M.S. JOHNSON
revised 07 April 93

DATE 9 / 1 / 93
/cbase/wells/doc/Com-Form.wp

UPDATED JAN 13 *ql*

updated
SEP 27 1990
Jeyus

TRIBAL WELL RECORD
LOCATION FILE

TRIBAL WELL NO [116]T-1529 [] [] []

PWSID WM01000303

WELL NAME/OTHER NO [1] 1W 114 11E 10AMP INTUA INTUA 1W 114 [] []

WELL TYPE
(MARK ONE ONLY)

WELL STATUS
(MARK ONE ONLY)

WELL USE
(MARK ONE ONLY)

(☒) WW WATER WELL
() WA ARTESIAN WELL
() WS SPRING
() OW OBSERVATION WELL
() GS GAS WELL
() OP OIL PRODUCTION
() MW MINERAL WELL
() ~~XX~~ UNKNOWN

(☒) ACT ACTIVE
() INA INACTIVE
() ABA ABANDONED
() UNK UNKNOWN

(☒) DOM DOMESTIC
() AGR AGRICULT.
() LV LIVESTOCK
() IND INDUSTRIAL
MINING
() REC RECREATION
(☒) MUN MUNICIPAL
() OTH OTHER
() UNK

QUAD NO [112] []

MILES WEST [] [] .55

MILES SOUTH [] [] .55

NE SE SW NW/NE SE SW NW [119] [T] 14 .W [R] 13 .W
10 acre 40 acre 160 acre SECT. TOWNSHIP RANGE

APPROXIMATE LOCATION [6] 11 NE 10P INTUA INTUA [] [] [] [] [] []

[] [] [] [] [] [] [] [] LATITUDE [] [] [] [] [] [] LONGITUDE [] [] [] [] [] []

UTM COORDINATES: X(east) [7487100] Y(north) [3924630] ZONE [112]

OPERATOR INTUA [] [] [] [] USGS WATERSHED CODE [113020207101010]

STATE: () AZ ARIZONA (☒) NM NEW MEXICO () UT UTAH () CO COLORADO

COUNTY: () AP APACHE (☒) MK MCKINLEY () SJ SAN JUAN () MT MONTEZUMA
() NA NAVAJO () VL VALENCIA () KA KANE () LP LA PLATA
() CO COCINO () BL BERNALLILLO

() SD SANDOVAL
() SO SOCORRO
() RA RIO ARRIBA
() SA SAN JUAN

GRAZING DISTRICT [116]

CHAPTER NAME THOR

CHAPTER CODE [] [] []

LOCATION DATA SOURCE: WELL FILES/18 1810MEI 1811-16 []

LOCATION FILE COMPLETED BY: JB DATE 5/28/87

FIELD CHECKED BY: [J] [B] [E] [K] [1] [S] [5] [18] [7] [] [] DATE 5/28/87

SEP 27 1990
B

STRUCTURE FILE COMPLETED BY: _____ DATE ____/____/____
rev:840426 form: well record str

TRIBAL WELL RECORD
HYDROLOGY FILE

WELL NO USGS AQUIFER CODE

THICKNESS FT NOMINAL YIELD GPM YIELD MEASURED / /

() BAILER () PUMP TEST @ GPM FOR HOURS DATE / /

DRAWDOWN FT OBSERVATION WELL DATA AVAILABLE () YES () NO

HORIZ CONDUCTIVITY FT/DAY SPECIFIC CAPACITY GPM/FT

VERT. CONDUCTIVITY FT/DAY STORAGE COEF

COEF OF TRANSMISSIVITY FT²/DAY

INDICATE ADDITIONAL PUMPING TEST DATA AVAILABLE AS HARD COPY:

()Y ()N MULTIPLE RATE DRAWDOWN PUMPING TEST

()Y ()N SINGLE RATE DRAWDOWN PUMPING TEST

()Y ()N MULTIPLE RATE DRAWDOWN/RECOVERY TEST

()Y ()N RECOVERY TEST

LOGS AVAILABLE: ()DL DRILLER'S LOG ()EL ELECTRIC LOG

[illegible]

HYDROLOGY FILE COMPLETED BY: _____ DATE ____ / ____ / ____

STATIC WATER LEVEL FILE

[illegible]

TRIBAL WELL RECORD
COMMENTS FILE

TRIBAL WELL NO [] [] [] [] [] [] [] [] [] [] [] []

PERTINENT
COMMENTS:

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

T R I B A L W E L L R E C O R D
L O C A T I O N F I L E

entered 11/12/86 JHE

TRIBAL WELL NO [1][6][7]-[5][2][9] [] [] [] [] PWSID [N][M][0][0][0][3][0][3]

WELL NAME/OTHER NO [J][O][H][N] [W][I][L][L][I][E] [C][A][M][P] [M][T][U][A] [W][E][L][L]

W E L L T Y P E (MARK ONE ONLY)	W E L L S T A T U S (MARK ONE ONLY)	W E L L U S E (MARK ONE ONLY)
<input checked="" type="checkbox"/> WW WATER WELL	<input checked="" type="checkbox"/> ACT ACTIVE	<input type="checkbox"/> DOM DOMESTIC
<input type="checkbox"/> WA ARTESIAN WELL	<input type="checkbox"/> INA INACTIVE	<input type="checkbox"/> AGR AGRICULT.
<input type="checkbox"/> WS SPRING	<input type="checkbox"/> ABA ABANDONED	<input checked="" type="checkbox"/> LIV LIVESTOCK
<input type="checkbox"/> OW OBSERVATION WELL		<input type="checkbox"/> IND INDUSTRIAL
<input type="checkbox"/> GS GAS WELL		<input type="checkbox"/> MIN MINING
<input type="checkbox"/> OP OIL PRODUCTION		<input type="checkbox"/> REC RECREATION
<input type="checkbox"/> MW MINERAL WELL		<input checked="" type="checkbox"/> MUN MUNICIPAL
		<input type="checkbox"/> OTH OTHER

QUAD NO [1][2][1] MILES WEST [10].[5][5] MILES SOUTH [4].[5][5]
☒ NE SE SW NW/NE SE SW ☒ NW/NE SE SW ☒ NW [1][9] [T][14].[0][N] [R][13].[0][W]
 10 acre 40 acre 160 acre SECT. TOWNSHIP RANGE

APPROXIMATE LOCATION [6] [M][I][L][E] [N][W] [0][F] [T][H][O][R][E][A][U] [] [] [] []
[] LATITUDE [] [] [] [] [] [] LONGITUDE [] [] [] [] [] []

UTM COORDINATES: X(east) [7][4][8][7][3][5] Y(north) [3][9][2][4][6][6][0] ZONE [1][2]

OPERATOR [N][T][U][A] [] [] [] [] [] USGS WATERSHED CODE [] [] [] [] [] [] [] [] [] [] [] [] [] [] [] []

STATE: ☐ AZ ARIZONA ☒ NM NEW MEXICO ☐ UT UTAH ☐ CO COLORADO
 COUNTY: ☐ AP APACHE ☒ MK MCKINLEY ☐ SJ SAN JUAN ☐ MT MONTEZUMA
☐ NA NAVAJO ☐ VL VALENCIA ☐ KA KANE ☐ LP LA PLATA
☐ CO COCHINO ☐ BL BERNALLILLO
☐ SD SANDOVAL
☐ SO SOCORRO GRAZING DISTRICT [1][6]
☐ RA RIO ARRIBA
☐ SA SAN JUAN

CHAPTER NAME THOREAU CHAPTER CODE [T][H][O][R]

LOCATION DATA SOURCE: [T][R][1][B][E] [B].[S][T][O][W][E] [R][T].[6] [1][H][S] [] []

LOCATION FILE COMPLETED BY: Masud u. Zaman DATE 11/06/1986

FIELD CHECKED BY: [] [] [] [] [] [] [] [] [] [] [] [] [] [] [] [] DATE / /

entered 11/12/86
SIL

STRUCTURE FILE COMPLETED BY: M. Z. DATE 11/06/86
rev: 840426 form: well record str

entered 4/12/86
SUC

310 SADR
[3][1][0] [G][L][R][T]

(~~✓~~) BAILER (X) PUMP TEST @ [] [] 1/5 GPM FOR [] [] 8.0 HOURS DATE 3/20/1964

VERT. CONDUCTIVITY[] [] [] . [] [] [] FT/DAY STORAGE COEF [.] [] [] [] [] []

```
( )Y ( )N MULTIPLE RATE DRAWDOWN PUMPING TEST
( )Y ( )N SINGLE RATE DRAWDOWN PUMPING TEST
( )Y ( )N MULTIPLE RATE DRAWDOWN/RECOVERY TEST
( )Y ( )N RECOVERY TEST
```

[illegible]

HYDROLOGY FILE COMPLETED BY: M. Z. DATE 11/06/1986

DEPTH TO SWL ²²⁸ FT DATE 3/20/1964 DEPTH TO SWL FT DATE / /

DEPTH TO SWL		FT DATE / /	DEPTH TO SWL		FT DATE / /
--------------	--	-------------	--------------	--	-------------

DEPTH TO SWL	FT DATE / /	DEPTH TO SWL	FT DATE / /
--------------	-------------	--------------	-------------

DEPTH TO SWL	FT DATE / /	DEPTH TO SWL	FT DATE / /
--------------	-------------	--------------	-------------

DEPTH TO SWL	FT	DATE	DEPTH TO SWL	FT	DATE
		/ /			/ /

DEPTH TO SWL	FT	DATE	DEPTH TO SWL	FT	DATE
		/ /			/ /

TRIBAL WELL RECORD
COMMENTS FILE

TRIBAL WELL NO [1]6[T]-[5]2[9] [] [] [] []

PERTINENT

COMMENTS: *Originally from 1964 to 1977 well was equipped with a windmill, stock tank, troughs etc and was used mainly for stock watering, and partially for domestic water use.

In October, 1977 well was requested by IHS to be used as a water source for John LaBelle Camp water system. Currently this system became a part of regional Thoreau System being completed by IHS.

② well was test pumped by IHS. Data on IHS file.
water quality analyses on file entered SLL. 11/12/86.

TRIBAL WELL NO >16T-529

PWSID >NM 0000303
STATE NUMBER

WELL NAME/OTHER NO >J. WILLIE CAMP NTUA WELL

WELL TYPE >WW

WELL STATUS ACT

WELL USE >MUN

QUAD NO >121 MILES WEST > 0.55 MILES SOUTH > 4.55

10 ACRE >NE 40 ACRE >NW 160 ACRE >NW SECT >19 TWSHP >T14.0N RANGE >R13.0W

APPROXIMATE LOCATION *1.50 mi. WEST OF RADIO TOWER*
~~>6 M W OF THOREAU CHPT. HSE.~~UTM COORD: X(EAST) ⁷⁴⁸⁷⁸⁰>748700 Y(NORTH) >3924630 ZONE >12 OPERATOR >NTUA

WATERSHED CODE > 13,020,207 STATE >NM COUNTY >MK CHAPTER CODE >THOR

GRAZING DISTRICT >16 LOCATION DATA SOURCE >WELL FILES/B.STONE RT-6

FIELD CHECKED BY >J.BEKIS 05/87

WELLNO 16T-529 STARTED 2/12/1964 COMPLETED 3/20/1964

ELEVATION ^{7,404.0}~~7,380.0~~ FT DEPTH 1,708.0 FT DEPTH MEASURED 3/20/1964

DEPTH IS M

WELL DIA 8.75 IN

1 CASING DIA 6.62 IN	FROM	⁻¹ 0.0 FT TO 1,708.0 FT	MATL STL
2 CASING DIA 0.00 IN	FROM	0.0 FT TO 0.0 FT	MATL
3 CASING DIA 0.00 IN	FROM	0.0 FT TO 0.0 FT	MATL
4 CASING DIA 0.00 IN	FROM	0.0 FT TO 0.0 FT	MATL

WELL NO= 16T-529

1 CASING PERFORATED FROM 1,522.0 FT	TO 1,708.0 FT	OPENING TYPE P
2 CASING PERFORATED FROM 0.0 FT	TO 0.0 FT	OPENING TYPE
3 CASING PERFORATED FROM 0.0 FT	TO 0.0 FT	OPENING TYPE
4 CASING PERFORATED FROM 0.0 FT	TO 0.0 FT	OPENING TYPE
5 CASING PERFORATED FROM 0.0 FT	TO 0.0 FT	OPENING TYPE

DATE WELL TURNED OVER TO TRIBE 0/ 0/ 0

FUNDED BY

CONTRACTOR

SITE IMPROVEMENTS WM-TA-WL-WP

TYPE OF LIFT SU

ENERGY SOURCE EM

PUMP HP *50* ON SITE STORAGE CAPACITY *14000*
STRUCTURE DATA SOURCE WELL FILES/IHS

TRIBAL WELL NO >16T-529 < USGS AQUIFER CODE >310GLRT <

THICKNESS >186.0< NOMINAL YIELD >*25* ~~0.0~~< DATE YIELD MEASURED > *6/22/1992*
~~07-07-0~~

ENTER BT OR PT >BT< GPM > 15.0< HOURS > 8.0< TEST DATE > 3/20/1964

DRAWDOWN > 365.0< OBSERVATION WELL DATA AVAILABLE (ENTER Y OR N) >*N*<

HORIZONTAL CONDUCTIVITY > 0.000< SPECIFIC CAPACITY >0.00<

VERTICAL CONDUCTIVITY > 0.000< STORAGE COEFFICIENT >.0000000

COEFFICIENT OF TRANSMISSIVITY > 0.0<

* AVAILABILITY OF TEST DATA *

>N< MULTIPLE RATE DRAWDOWN TEST

y >~~N~~< SINGLE RATE DRAWDOWN TEST

>N< MULTIPLE RATE/RECOVERY TEST

y >~~N~~< RECOVERY TEST

* LOGS AVAILABLE * (ENTER DL OR EL)

>DL< DRILLERS LOG > < ELECTRIC LOG

DATA SOURCE >

<

\$RECNO WELLNO SWL DATE
15087 16T-529 228.0 3/20/1964

...no geologic interval data available

...no field water quality data available

ORIGINALLY FROM 1964 TO 1967 WELL WAS EQUIPPED WITH A
WINDMILL/STOCK TANK/TROUGHS/ETC AND WAS USED MAINLY FOR
STOCK WATERING AND PARTIALLY FOR DOMESTIC USE/ IN OCT 1977
WELL WAS REQUESTED BY IHS TO BE USED AS A WATER SOURCE
FOR J.WILLIE CAMP WATER SYSTEM. CURRENTLY THIS SYSTEM
BECAME A PART OF REGIONAL THOREAU SYSTEM BEING COMPLETED
BY IHS/ WELL WAS TEST PUMPED BY IHS/DATA ON IHS FILE
WATER QUALITY ANALYSES ON FILEMZ
UTMS COORDS PICKED ACCORDING TO RTS DATA....JCR
RIO SAN JOSE HSR ID NW-015--LAND STATUS=TNT
WELL CONFIRMED-UPDATED PER * O&M SURVEY OF FALL 91 *

updated 9-7-93 C. NOTAH

50

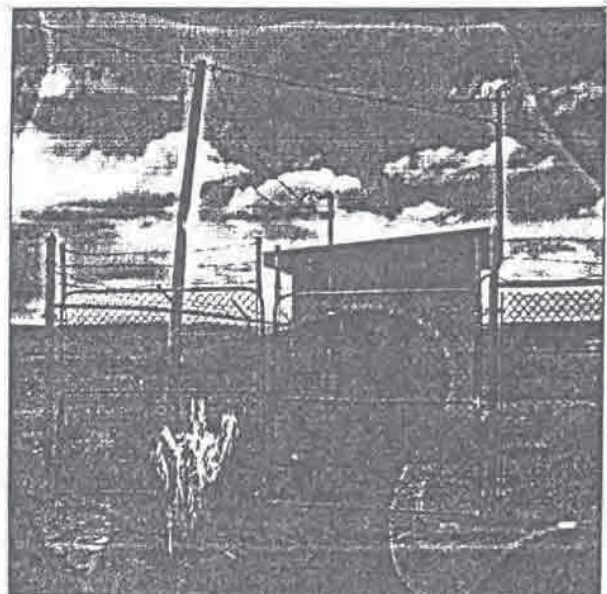
WELLNO =16T-529
 EAST =748735 748700
 NORTH =3924660 3924630
 ZONE =12
 ACRE/10 =NE
 ACRE/40 =NW
 ACRE/160 =NW
 SECTION =19
 TOWNSHIP =T14. ON
 RANGE =R13. OW
 QUADNO =121
 MILESW =00.55
 MILESS =04.55
 APPROX-LOCAT =6 MILE NE OF THOREAU
 WATERSHED = 13020207
 COUNTY =MK
 GD =16
 CHAPTER =THOR
 CHECKED-BY =B
 CHECKED-DATE = 5/28/87
 OPERATOR =NTUA
 DRILLED-BY =NECA
 COMPLETED = 3/20/64
 ELEVATION = 7380.0
 DEPTH = 1708.0
 AQUIFER =310GLRT
 SWL = 228.0
 DATE = 3/20/64
 CASING-DIA-1 = 6.62
 YIELD = 0.0
 YIELD-DATE = 1/ 1/1801
 IMPROVEMENTS =WM-TA-WL-WP
 LIFT =SU
 ENERGY =EM
 PUMP-HP =0000
 STORAGE =000000 27900 * 2
 PWSID =NM0000303
 NO-HOMES = 85
 POP = 465
 CATTLE =000
 HORSES =000
 SHEEP/GOATS =000
 CORN =000
 ALFALFA =000
 GRAIN =000
 GARDEN =000
 ORCHARD =000
 WELLTYPE =WW
 WELLUSE =MUN DOM
 WELLSTATUS =ACT
 WELLNAME =J. WILLIE CAMP NTUA WELL
 DATA-SOURCE =WELL FILES/B. STONE RT-6/FIELD CHECKED
 ANNUAL-USE = 255.0
 STATUS =TNT
 USGSQ =5463
 QUADNAME =CONTINENTAL DIVIDE

NO PHOTO

encl
 SEP 28 1990
 HSR ID and
 LAND STAT.
 J. Beggs

Well Schedule

1. Water Inventory I.D. or R.G. Number 16 T 529 Date Inspected 5-28-87
2. Owners Name NAVAJO TRIBE
3. Address NAVAJO NATION, WINDOW ROCK
- A. Priority Date _____
- B. Location N 4, NW 4, NW 1/4 Section; 17 Township 14 North, Range 13 West
Projected, Being within the _____ Grant.
U.S.G.S. Quad Name CONTINENTAL DIVIDE S.E.O. Quad I.D. # _____
Being within MCKINLEY County, New Mexico N. Mex.
- C. Source of water; Shallow Ground U C Artesian _____
Tributary to Rio Grande Stream System.
- D. Driller NECA Topography Flat Elev. 7380
Well used for; DOMESTIC
Casing Size 5 5/8 Equipment: Pump Subm pump
Power ELECTRIC Discharge Measurement _____ G.P.M.
Comments: ACTIVE Emergency Check

2709 + STORAGE Location Map
for LIVESTOCK2 NEW TANK for Domestic
Well PhotoEMERGENCY — 5/28/87
CHECK

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Q. 121

0.5 X 4.55

WELL SCHEDULE

Date July 16, 1964 Field No. 16T-529
Record by WIREY Office No. _____
Source of data Obs & Driller

1. Location: State NEW MEXICO County Mc KINLEY
Map 3 NW of THOREAU

_____ $\frac{1}{4}$ _____ $\frac{1}{4}$ sec. _____ T _____ N _____ S _____ R _____ E _____ W _____

2. Owner: NAVAJO TRIBE Address _____
Tenant _____ Address _____
Driller TRIBE Address _____

3. Topography Gentle slope.

4. Elevation _____ ft. above _____ below _____

5. Type: Dug, drilled driven, bored, jetted 3 1964

6. Depth: Rept. 1708 ft. Meas. _____ ft.

7. Casing: Diam. 6 $\frac{5}{8}$ in., to _____ in., Type _____
Depth 1708 ft., Finish PERT-1522-1708

8. Chief Aquifer GLORIETA From _____ ft. to _____ ft.
Others _____

9. Water level 228 ft. rept. 3/20 1964 above L.S.
below _____ which is _____ ft. above _____ below surface

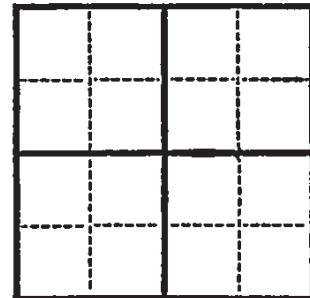
10. Pump: Type _____ Capacity _____ G. M.
Power: Kind _____ Horsepower _____

11. Yield: Flow _____ G. M., Pump _____ G. M., Meas., Rept. Est. _____
Drawdown _____ ft. after 8 hours bail pumping 15 G. M.

12. Use: Dom. Stock PS., RR., Ind., Irr., Obs. _____
Adequacy, permanence _____

13. Quality Good S.C. 687 Temp 62 °F.
Taste, odor, color _____ Sample Yes
No _____
Unfit for _____

14. Remarks: (Log, Analyses, etc.) Partial contacts on back;
too much casing for good log



Partial contacts - ETH 126

0-90 Alluvium

90-860 Chinle (U. Pet. Forest)?

860-910 ~~Chinle~~ Chinle (Sonsela)?

910-1570 Chinle - Moenkopi - San Andres

1570-1708 Glorieta?

WELL RECORD

Water Well Development
Navajo Tribe
Window Rock, Arizona

Project No. 6591
WELL NO. 16T-529

Quad. No. 121 Miles west 2.6 Miles south 2.35

6 Miles NW Thoreau, New Mexico

Location

Began well 2/12/64 Finished well 3/20/64

Diameter of well 8-3/4" Depth of well 1708 ft.

Static water level 228 ft. Drawdown 365 ft. Recovery _____

Quantity of water on test run: bailer: pump: 15 G. P. M. Tested for 8 hours

Kind of casing: 6-5/8" T&C Sizes and length 6-5/8"x1708', 186' Perforated on bottom.

Screen kind _____ Length _____ Mesh _____

Contractor The Navajo Tribe Address Failing Rig: D. Ryan, B. Yazzie & Panther, Drillers, Window Rock, Arizona

DEPTH

LOG

From	To	Formation	Acquifer	Remarks
0	37			Surface
37	112			Red Stone
112	197			Red Brown Sandstone
197	380			Redish Shale
380	400			Red, Brown, Shale
400	440			Red Shale with little Limestone
440	623			Red Shale
623	645			Red Shale
645	665			Red Shale W/Streak Sand
665	840			Red Shale W/Streaks Blue Shale & Sand.
840	850			Red Black Shale W/Gray Lime Strk.
850	865			Sand & Shale
865	880			Sand
880	905			Shale & Sand
905	952			Red, Brown, Blue & White Shale
952	1020			Hard Clear Sand
1020	1090			Glomerate Shale Variable
1090	1172			Glomerate Shale Variable

Remarks:

S.P. 1100 62°

Teta Salts	Calcium Ca.	Magnesium Mg.	Sodium Na.	Chlorides Cl.	Sulfates SO ₄	Carbonates HCO ₃	P.H.	CO ₃

Excellent Good Fair XXXX Poor Doubtful Not suitable for domestic, livestock use

CONTINUED ON PAGE "TWO".

Cylinder size: _____

Tubing, cylinder and suction
pipe length in feet: _____

Kind of pump rod: _____

Size of box and pin: _____

Liner, if any: _____

Windmill: (make) _____

Size: _____

Storage: (kind) _____

Capacity: _____

Troughs: (kind) No. _____

Comments: _____

Total Depth

WELL RECORD

Water Well Development
Navajo Tribe
Window Rock, Arizona

PAGE 2
Continuation.

Project No. 6591

WELL NO. 16T-529

Quad. No. _____ Miles west _____ Miles south _____

Location _____

Began well _____ Finished well _____

Diameter of well _____ Depth of well _____

Static water level _____ Drawdown _____ Recovery _____

Quantity of water on test run: bailer: pump: _____ G. P. M. Tested for _____ hours

Kind of casing: _____ Sizes and length _____

Screen kind _____ Length _____ Mesh _____

Contractor _____ Address _____

DEPTH

LOG

From	To	Formation	Acquifer	Remarks
1172	1190			Glomerate Shale Variable
1190	1200			Redish & Gray Shale
1200	1250			Red, Blue & Gray Shale
1250	1280			Red, Blue Shale & White Clay
1280	1330			Red Blue Shale & Limestreaks
1330	1394			Blue, Gray Lime W/Gray Shale
1394	1430			Blue, Gray Lime W/Shale
1430	1442			Sand Streak Hard
1442	1448			Conglomerate Shale
1448	1532			Conglomerate Colored Shale Lime lenses.
1532	1560			Lime W/Shale
1560	1570			Broken Lime W/Shale
1570	1637			Sand Glorieta Hard
1637	1654			Brown Shale W/little Sandstone
1654	1697			Red Gray W/White Lime
1697	1708			White Sandstone Hard

Remarks:

S.P.

Teta Salts	Calcium Ca.	Magnesium Mg.	Sodium Na.	Chlorides CL	Sulfates SO 4	Carbonates HCO 3	P.H.	CO 3

Excellent Good Fair Poor Doubtful Not suitable for domestic, livestock use

cc: U.S. Geological Survey H (2)
Well 16T-529 Folder
Mr. Holmes-Engineer
Chrono
Gen. Foreman

Cylinder size: _____

Tubing, cylinder and suction
pipe length in feet: _____

Kind of pump rod: _____

Size of box and pin: _____

Liner, if any: _____

Windmill: (make) _____

Size: _____

Storage: (kind) _____

Capacity: _____

Troughs: (kind) No. _____

Comments: _____

Total Depth

DISTRICT: CROWNPOINT

		BEFORE	AFTER
LOCATION: J. W. Camp	INTUA WELL NO. 1	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Tribal Well No.	16T-529	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Well Elevation	7404 ft.	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Motor	RedJacket 5hp 230v 1phase Serial EB640		Franklin 10hp 230v 1phase Serial #210-0011
Pump Cable Size	4/3 740 ft.		0/3 810 ft.
Pump	RedJacket N28GC		Pleuger NE612-18-M6 Serial #312-0003
Total Depth	1708 ft.		1500 ft.
Casing	6 5/8in. 0-1708 ft.		6 in.
Pump Setting	638 ft.		803 ft.
Pumping Level	569 ft.		
Drop Pipe Size	2in. x 21ft. 630ft. 30jts.		2in. x 21ft. 38jts. 798ft.
Probe Pipe Size	none	1/2in.x 21ft. 504ft. 24jts.	none
Lower Probes (RED)	620 ft.		Transducer 1 ft. above pump
Higher Probes (BLACK)	620 ft.		850 ft.
Static Water Level	302 ft.		
Gallons Per Minute	21 gpm		25 gpm
Total Dynamic Head-TDH	719 ft. or 330psi		
DATE INSTALLED:	September 30, 1981	January 17, 1990	June 22, 1992

NOTE: Probe pipe installed January 17, 1990.

COMMENTS:

Storage Tank - Gallons	14,000	Starter: Size 1 Delta Fuse: NON 60	
	Diameter-14ft.x Height 12ft.		
Base Elevation	7540 ft.		
Overflow Elevation	7554 ft.		

Test / Production Information

DISTRICT: CROWFOUNT

WATER PRODUCTION SUMMARY
1984 TO 1995
WELL PURPOSE: XI 000 GALLONS

SYSTEM LOCATION	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
1. CROWFOUNT 1 158-1 ✓	8486.8	15708.2	9758.9	11324.5	5263.0	14581.4	0.0	0.0	0.0	0.0	0.0	0.0	67220.8
2. CROWFOUNT 2 158-2 ✓	30130.3	27429.0	31590.7	32228.7	30593.5	43565.6	0.0	0.0	0.0	0.0	0.0	0.0	203337.8
3. LITTLEWATER 1 157-54.7 ✓	0.0	0.0	0.0	12794.6	18798.2	11419.4	0.0	0.0	0.0	0.0	0.0	0.0	43912.2
	34617.1	43137.2	41147.6	57257.8	62844.7	67566.4	0.0	0.0	0.0	0.0	0.0	0.0	310370.8
4. THREE MILE PT. 1 151-518 ✓	2403.9	2365.2	2234.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7063.7
5. W. HOREAU NC 1 161-574 ✓	2676.2	2253.9	957.2	1226.5	1864.0	4795.1	0.0	0.0	0.0	0.0	0.0	0.0	13744.9
6. W. HOREAU 3 161-614 ✓	0.0	2659.0	4853.6	4979.5	9164.0	7560.3	0.0	0.0	0.0	0.0	0.0	0.0	28376.4
	5082.1	7278.1	7245.4	6184.0	11648.0	12265.4	0.0	0.0	0.0	0.0	0.0	0.0	49105.0
7. CHURCH ROCK 1-A 167-538A ✓	8088.4	10111.2	9636.2	8434.9	5958.7	8473.4	0.0	0.0	0.0	0.0	0.0	0.0	48052.8
8. CHURCH ROCK 1-B 167-538B ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9. CHURCH ROCK 1-E 167-538E ✓	7953.1	11044.1	9681.6	9441.9	11763.0	11471.1	0.0	0.0	0.0	0.0	0.0	0.0	61394.8
10. CHURCH ROCK 1-F 167-538F ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11. CHURCH ROCK 1-G 167-538G ✓	2060.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2061.0
12. CHURCH ROCK 1-H 167-538H ✓	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
	18102.4	21175.8	18717.9	17896.8	17721.7	17894.5	0.0	0.0	0.0	0.0	0.0	0.0	111569.1
13. PACA 1 167-616 ✓	2179.3	2452.9	2387.7	2521.9	3399.7	3173.7	0.0	0.0	0.0	0.0	0.0	0.0	16117.2
14. PACA 2 167-616A ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2179.3	2452.9	2387.7	2521.9	3399.7	3173.7	0.0	0.0	0.0	0.0	0.0	0.0	16117.2
15. CASARETO CUP 1 167-539 ✓	340.9	617.0	412.3	582.7	1243.2	1453.9	0.0	0.0	0.0	0.0	0.0	0.0	4650.0
	340.9	617.0	412.3	582.7	1243.2	1453.9	0.0	0.0	0.0	0.0	0.0	0.0	4650.0
16. REAS SPRINGS 1 167-538 ✓	1499.7	3768.7	0.0	2152.0	2616.6	2370.6	0.0	0.0	0.0	0.0	0.0	0.0	12396.6
	1499.7	3768.7	0.0	2152.0	2616.6	2370.6	0.0	0.0	0.0	0.0	0.0	0.0	12396.6

WELL: 16-T-529

LOCATION: THOREAU CHAPTER (WATER SOURCE FOR JOHN WILLIE CAMP)

FIND DRAWDOWN AT 50 gpm FOR 1200 MIN.

TEST PUMP $Q = 21 \text{ gpm}$ t - s curve has 3 slopes, Δ_1 , Δ_2 , AND Δ_3 .

$$\Delta_1 = 36 \text{ psi/log cycle}$$

$$\Delta_2 = 12 \text{ psi/log cycle}$$

$$\Delta_3 = 5 \text{ psi/log cycle}$$

FROM THE t - s CURVE, the SLOPES CHANGE AT t_1, t_2, t_3, t_4

$$\text{WHERE } t_1 = 1, t_2 = 22, t_3 = 150, t_4 = 1200$$

$$\Delta'_1 = \frac{Q_2}{Q_1} \Delta_1, \Delta'_2 = \frac{Q_2}{Q_1} \Delta_2, \Delta'_3 = \frac{Q_2}{Q_1} \Delta_3$$

 S = THEORETICAL DRAWDOWN

$$\begin{aligned} S &= (\log t_2 - \log t_1) \Delta'_1 + (\log t_3 - \log t_2) \Delta'_2 + (\log t_4 - \log t_3) \Delta'_3 \\ &= (\log 22 - \log 1) \Delta'_1 + (\log 150 - \log 22) \Delta'_2 + (\log 1200 - \log 150) \Delta'_3 \\ &= 1.342 \Delta'_1 + 0.834 \Delta'_2 + 0.903 \Delta'_3 \end{aligned}$$

$$\text{NOW AT } Q_2 = 50 \text{ GPM}, \Delta'_1 = 90, \Delta'_2 = 30, \Delta'_3 = 12.5$$

$$S = 157 \text{ psi}$$

PUMPING LOSSES WILL BE TAKEN AS 10%

$$S_{\text{ACTUAL}} = 157 + 15.7 = 173 \text{ psi}$$

$$\begin{aligned} \text{PUMPING LEVEL} &= \text{STATIC WATER LEVEL} + S \\ &= 260 \text{ FT} + 173 (2.32) \\ &= 661 \text{ FT TOC} \end{aligned}$$

TRANSMISSIVITY WILL BE CALCULATED FOR EACH SLOPE

$$T_1, T_2, T_3 \quad \text{WHERE } T = \frac{264Q}{\Delta s}$$

$$T_1 = \frac{264(21)}{36(2.32)} = 66.4 \text{ gpd/ft}$$

$$T_2 = \frac{264(21)}{12(2.32)} = 199.1 \text{ gpd/ft}$$

$$T_3 = \frac{264(21)}{5(2.32)} = 478 \text{ gpd/ft}$$

WELL 16-T-529

THOREAU CHAPTER - WATER SOURCE FOR JOHN WILLIE CAMP.

$$w(u) = \frac{T_s}{114.6Q}$$

$$w(u)_1 = \frac{66.4 \times 36(2.32)}{114.6 \times 21} = 2.3044, u = 5.9 \times 10^{-2}$$

$$w(u)_2 = \frac{199.1 \times 12(2.32)}{114.6 \times 21} = 2.3032, u = 5.9 \times 10^{-2}$$

$$w(u)_3 = \frac{478 \times 5(2.32)}{114.6 \times 21} = 2.3040, u = 5.9 \times 10^{-2}$$

S = COEFFICIENT OF STORAGE

$$S = \frac{u T t}{1.87 r^2}$$

$$u = 5.9 \times 10^{-2}, T = 478, t = 6.9 \times 10^{-4} = 0.83, r = 0.25'$$

$$T = 199$$

$$T = 66$$

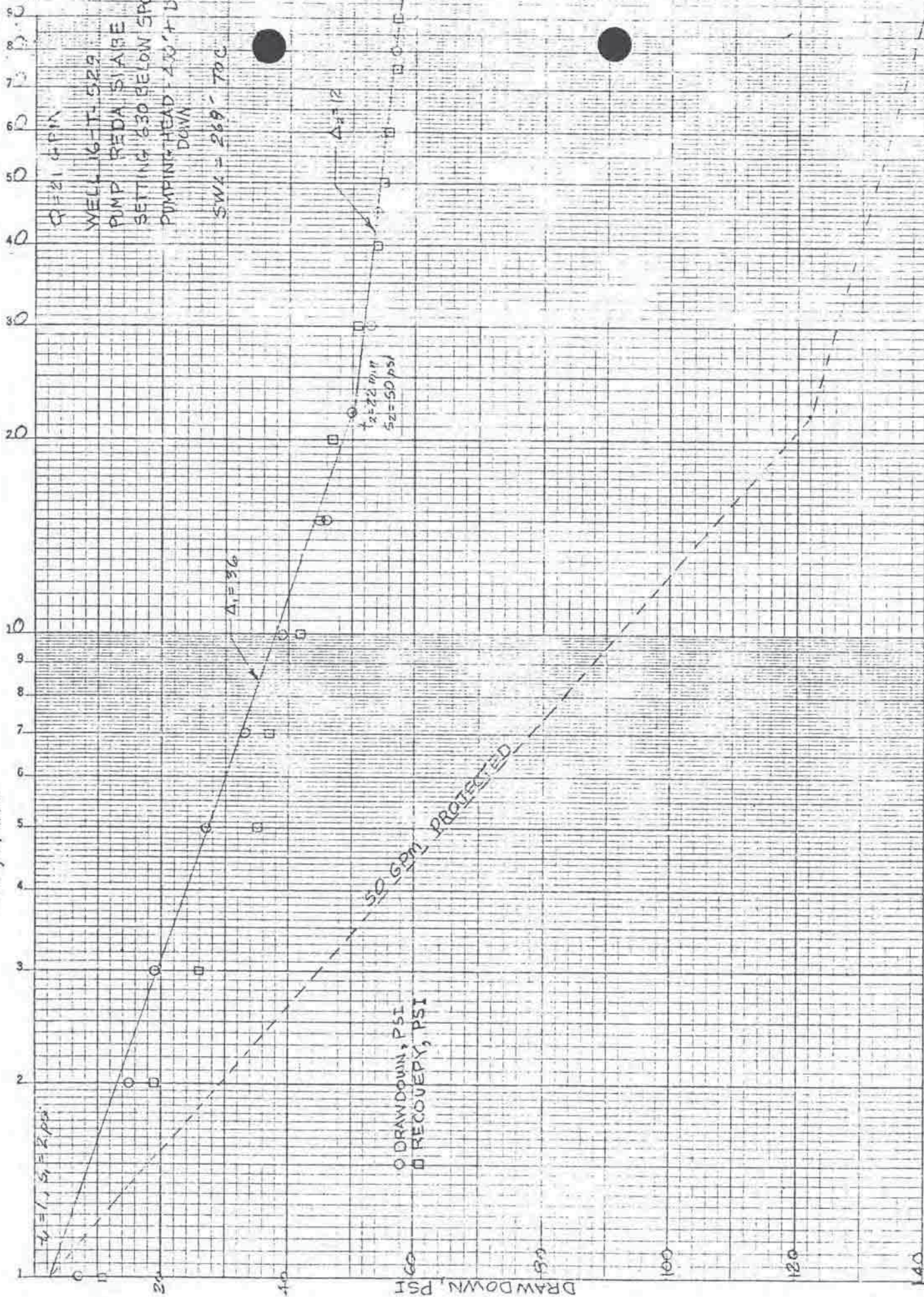
$$S = \frac{5.9 \times 10^{-2} \times 478 \times 6.9 \times 10^{-4}}{1.87 \times 0.25^2} = 1.66 \times 10^{-1}$$

DRAWING PAPER NO. 1371-11
 TRACING PAPER NO. 1230-11
 SEMI-LOG. 2 CY. BY 10 DIV./IN.

AQUABEE

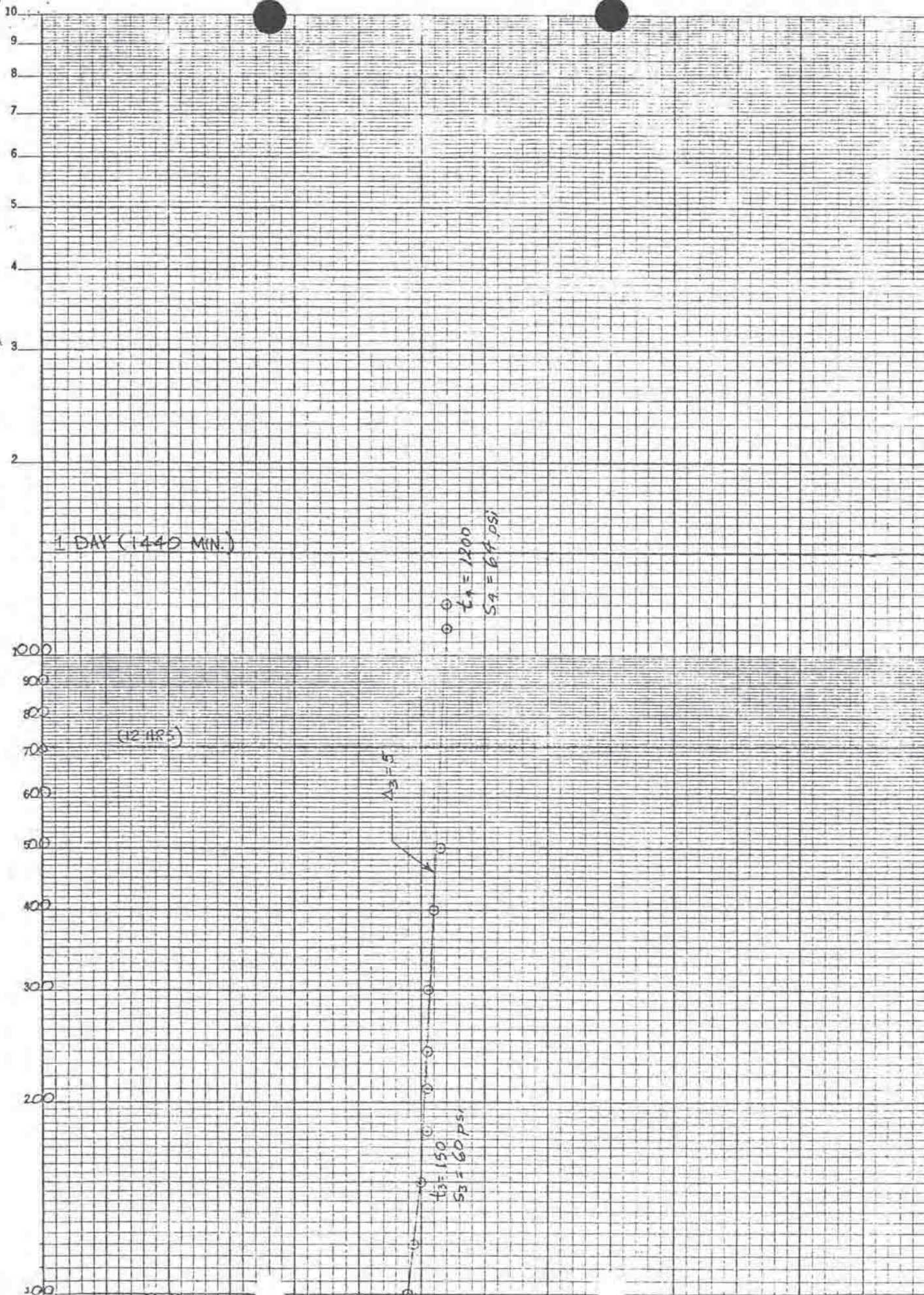
MADE IN USA

TIME, t , MIN.



AQUABEE
MADE IN USA

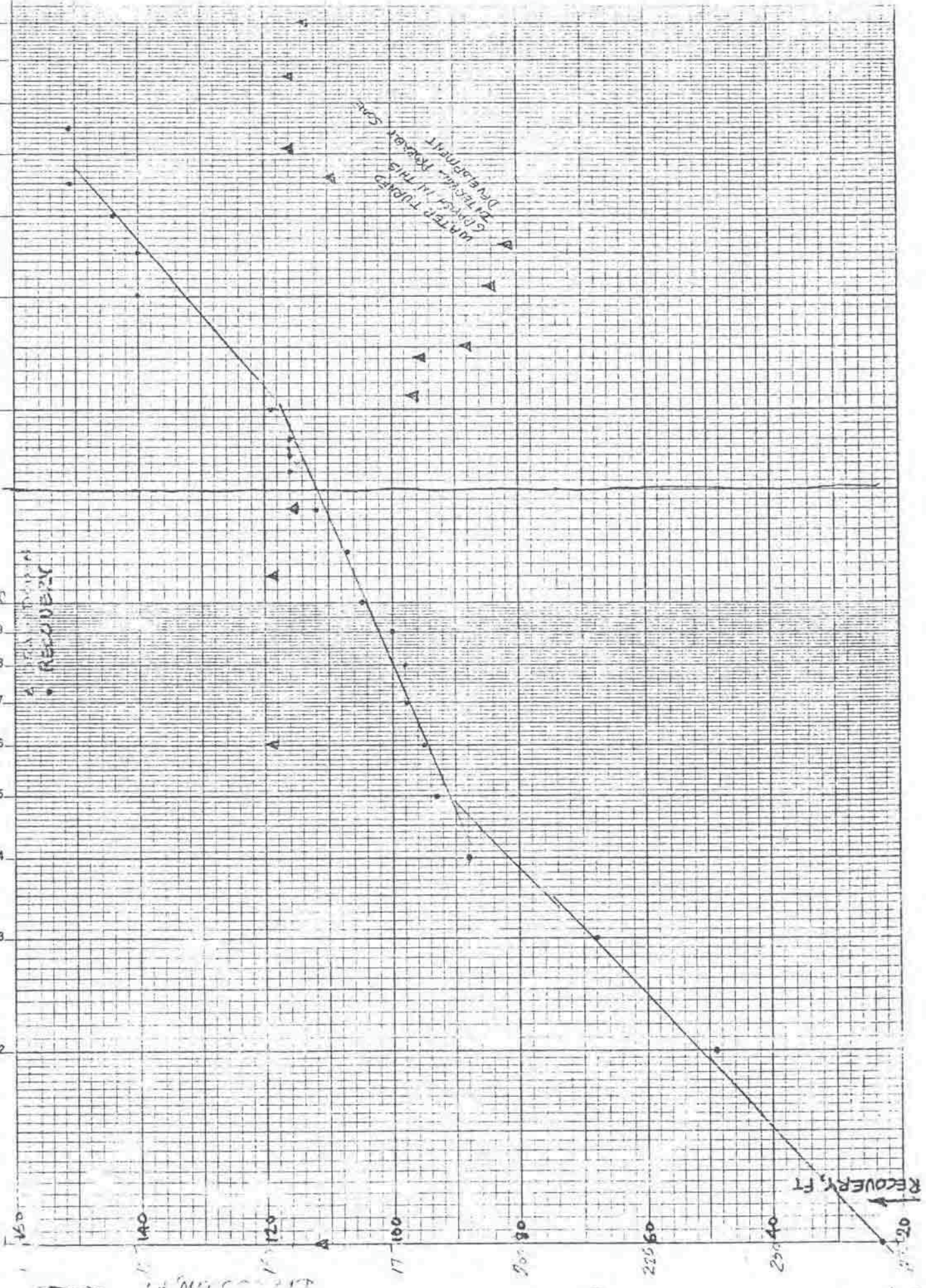
DRAWING PAPER NO. 1371-11
TRACING PAPER NO. 1230-11
SEMI-LOG. 2 CY. BY 10 DIV./IN.



DRAWING PAPER NO. 1371-11
 TRACING PAPER NO. 1230-11
 SEMI-LOG. 2 CY, BY 10 DIV./IN.

TIME IN HOURS
 T14N R13W S19
 MADE IN 1977
 SEPT 28, 1977 BY EMERSON ARVISO

TIME, MINUTES



150 140 130 120 110 100 90 80 70 60 50 40 30 20 10

DRAWING PAPER NO. 1371-11
TRACING PAPER NO. 1230-11
SEMI-LOG. 2 CY. BY 10 DIV./IN.

AQUABEE
MADE IN USA

PUMPING RATE = 21 GPM
PUMP SET ON 36 JOINTS X 21' = 756'
PUMP = 20 HP BERRY
DRAW DOWN MEASURED BY AIRLINE
SILE = 302' 9-28-77

A

A

A

A

A

A

A

A

A

A

A

A

A

A

John Willie Camp

72-914th

Water Source

EST PUMP - WELL NO. 16T-529

Sept 28, 1977

Location: Approximately ^{2 1/2} miles west of
Thoreau High School - Thoreau, New Mexico.

WELL RECORD

Depth of well: 1,708 ft.

36 JOINTS = 756 feet down

Static water level: 228 ft.

Raindown: 365 ft.

Test ran w/ bailer: 15 gpm Tested f/ 8 hours.

Inside of casing: 6 5/8" T & C

Size and length of casing: 6 5/8" x 1,708 ft., 186 ft. is
excavated on the bottom.

Time of day Airline reading Meter reading GPM Comment

Time of day	Airline reading	Meter reading	GPM	Comment
4:00 PM	0	195	0	
4:02	0	125	162	water - black
4:25	15	126	160	10 Water meter bad
4:30	5	130	151	9 Water meter disconnecter
4:35	17	130	151	10
4:38	14	128	156	15
4:43		119	179	20 4:43 flow = 20 gpm
4:49	24	117	181	20 water - light brown
4:50	26	113	191	20
4:55	36	111	195	20 gpm
5:00	36	110	198	20 gpm water turbid
5:10	46	125	163	20 gpm 5 gallons / 15 sec.
5:15	51	128	155	20 greyish brown
5:30	63	128	155	20 5 gallons in 15 sec. water turned really green due to cycles

EST PHALP - WELL NO. 16T-529 CONTINUES

Time of day	Pressure	Water level	Water reading	GPM	Comment
5:35	121	water 158	very brown (chocolate milk)	20	
6:10	126	water 135	clearing, still turbid	20	5 gallons in 14.5 seconds
7:15	171	water 124	is slightly turbid	20	5 gallons in 14.4 seconds
7:45 P.M.	201	133 PSI	water is very light brown	20	5 gal. in 15 seconds
8:45 P.M.	261	130 PSI	H ₂ O is still very light brown	20	5 gal. in 14.5 seconds
9:15 P.M.	321	124 PSI	H ₂ O is the same as above	20	5 gal. in 15.1 seconds
10:45 P.M.	381	130 PSI	" " " "	20	5 gal. in 14.5 seconds
11:45 P.M.	441	80 PSI	H ₂ O is clearing up a little	20	5 gal. 14.3 seconds
12:45 A.M.	501	80 PSI	H ₂ O is clearing up	20	5 gal. 14.3 seconds
1:45 A.M.	561	80 PSI	H ₂ O same as above	20	5 gal. 14.5 seconds
2:45 A.M.	621	80 PSI	" filled diesel tank	20	5 gal. 14.5 seconds
3:45 A.M.	681	80 PSI	H ₂ O almost all clear up	20	5 gal. in 14.4 seconds
4:45 A.M.	741	80 PSI	"	20	5 gal. in 14.6 seconds
5:45 A.M.	801	80 PSI	"	20	5 gal. in 15 seconds
6:45 A.M.	861	80 PSI	H ₂ O 52 mm clear up	20	5 gal. in 14.7 seconds
7:45 A.M.	921	80 PSI	H ₂ O clear up	20	5 gal. in 14.5 seconds
8:45 A.M.	981	80 PSI	H ₂ O is real clear	20	5 gal. in 14.8 seconds
9:45 A.M.		80 PSI	H ₂ O is clear	20	5 gal. in 14.8 seconds
10:45 A.M.		Added 5 gallons of diesel			
11:45 A.M.		80 PSI	H ₂ O is clear about 70°	20	5 gal. in 15.0 seconds
12:45 P.M.		80 PSI	H ₂ O is clear	20	5 gal. in 14.7 seconds
1:45 P.M.	1341	80 PSI		20	5 gal. in 14.6 seconds

Recovery test Well No. 11-T-529

3:45 P.M. ELAPSED TIME 80 PSI

PSI RECOVERED

FT. OF RECOVERED

			0	0
46	1	90	10	23
47	2	101	21	49
48	3	110	30	68
49	4	118	38	88
50	5	120	40	93
51	6	121	41	95
52	7	122	42	98
53	8	122	42	98
54	9	123	43	100
55	10	125	45	105
2:57 P.M.	12	126	46	107
59	14	128	48	112
4:01 P.M.	16	130	50	116
03	18	130	50	116
05	20	131	51	119
15	30	140	60	140
4:20 P.M.	35	140	60	140
25	40	142	62	144
30	45	145	65	151
4:40 P.M.	55	145	65	151
4:50		147		

09-30-77 Took air line pressure for static H₂O level
For 45 minutes, and the air line pressure reading
was 144 PSI.

16 T-529

RECEIVED
MAY 05 1978

A-2

Khan

April 17, 1978

Field Engineer
Crownpoint Service Unit

Pump Testing Results for Navajo Tribal Wells

Jerry Butler, Chief, SPCB, NAHHS

The results of test pumping three Tribal wells and one PHS well are summarized below.

1. Tribal well 16-T-539 is located in 53, R12W, T15N approximately 2½ miles northeast of Smith Lake Chapter House, McKinley County, New Mexico.

Depth of well	=	1,470'	TOC
Pump Setting	=	672'	TOC
Air Line Setting	=	672'	
SWL	=	533' (from airline)	
Pumping Rate	=	40 gpm	
Drawdown	=	86'	
Duration	=	24 hours	

Date: September 26-27, 1977

Comments: Plot of data is scattered. Probable reason is that operator stopped the pump once during test for twenty minutes

The raw data from the test is enclosed.

2. Tribal well 16-T-529 is located about 5 miles NW of Thoreau, McKinley County, New Mexico in S12, R13W, T14N, NMPM.

Depth of well	=	1,708'	TOC
Pump Setting	=	756'	TOC
Airline Setting	=	756'	
SWL	=	302' (measured w/airline)	
Pumping rate	=	21 gpm	
Drawdown	=	267'	
Duration	=	23 hours	

Date: September 28-29, 1977

Comments: Plot of data is scattered, and may be the result of development during test pumping. The well stabilized for the pumping rate indicated at 267' of drawdown after seven hours of pumping. Recovery readings were taken and the raw data is enclosed.

3. Tribal well A-5 is located on the Alamo Reservation in S32, R6W, T2N, NMPM and is currently being used as a water source on PL 86-121 project NA-75-129.

Depth of well	=	100'	TOC
Pump setting	=	87'	TOC
Airline setting	=	87'	
SWL	=	58.5'	
Pumping Rate	=	44 gpm	
Drawdown	=	21.5'	
Duration	=	20 hours	

Date: July 7-8, 1977

Comment: Plot of data is uniform. The raw and plotted data are enclosed.

4. PHS well Mansell #3 is located on the Alamo Reservation in S5, R6W, T2N and currently being used as a water source for PL 86-121 project NA-75-129.

Depth of well	=	205'	TOC
Pump Setting	=	189'	TOC
Airline Setting	=	189'	
SWL	=	155' (measured w/airline)	
Pumping rate	=	67 gpm	
Drawdown	=	3.0 feet	
Duration	=	21 hours	

Date: July 6-7, 1977

Comments: The sensitivity of the airline gauge was not great enough to make a plot of the drawdown meaningful. The raw data is enclosed.

5. PHS well Mansell #4 is located on the Alamo Reservation in S5, R6W, T2N and currently being used as a water source for PL 86-121 project NA-75-129.

	Depth of well	=	162'	TOC
	Pump setting	=	147'	TOC
	Airline setting	=	147'	
S	SWL	=	112'	
	Pumping rate	=	19.4 gpm	
	drawdown	=	35'	
	Duration	=	56 minutes	
	Date: March 16, 1978			

Comment: Plotted data is enclosed.

s/ Dale Cartmel
Dale Cartmel
Field Engineer

DG:ejb

cc: File
Navajo Tribe Division of Sanitation ✓

Enclosure: Pump Test data

WELL: A-5

LOCATION: ALAMO CHAPTER

DRAWDOWN

RECOVERY 2

TIME ELEMENT	TIME AFTER START	AIR LINE PRESSURE	GUAGE READING	SAME WATER LEVEL	Recovery DRAW DOWN	METER READING	PUMP RATE	COM- MENTS
00:00:30	00:00:00		80	80	0			
00:01:30	00:00:30		72	72	8			
00:02:30	00:01:00		70.5	70.5	9.5			
00:03:30	00:01:30		70.25	70.25	9.75			
00:04:30	00:02:00		70	70	10			
00:05:00	00:03:00		71	71	9			
00:06:00	00:04:00		71	71	9			
00:07:00	00:05:00		71	71	9			
00:08:00	00:06:00		70	70	10			
00:09:00	00:08:00		70	70	10			
00:10:00	00:10:00		70	70	10			
00:11:00	00:14:00		69	69	11			
00:12:00	00:18:00		68.5	68.5	11.5			
00:13:00	00:22:00		68.5	68.5	11.5			
00:14:00	00:26:00		68.5	68.5	11.5			
00:15:00	00:30:00		68.5	68.5	11.5			
00:16:00	00:40:00		68.0	68.0	12.0			
00:17:00	50:00		67.5	67.5	12.5			
00:18:00	01:00:00		67.0	67.0	13.0			
00:19:00	01:20:00		66.0	66.0	14.0			
00:20:00	01:40:00		66.0	66.0	14.0			
00:21:00	02:00:00							
00:22:00								

Recovery test Well No. 16F-529

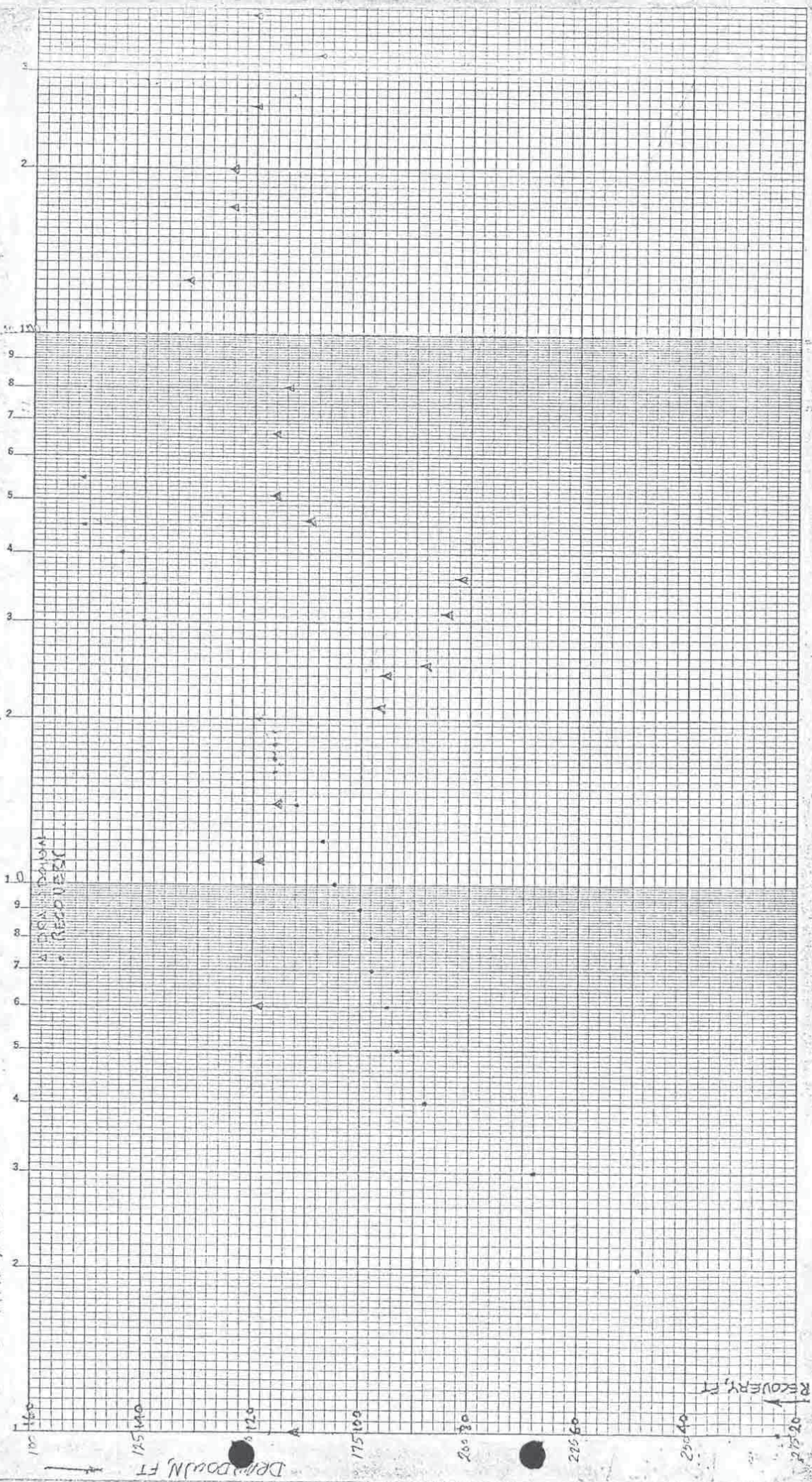
3:45 P.M. ELAPSED TIME 80 PSI			6 PSI RECOVERY	IFT. OF RECOVERY
			0	0
46	1	90	10	23
47	2	101	21	49
48	3	110	30	68
49	4	118	38	88
50	5	120	40	93
51	6	121	41	95
52	7	122	42	98
53	8	122	42	98
54	9	123	43	100
55	10	125	45	105
3:57 P.M.	12	126	46	107
59	14	128	48	112
4:01 P.M.	16	130	50	116
03	18	130	50	116
05	20	131	51	119
15	30	140	60	140
4:20 P.M.	35	140	60	140
25	40	142	62	144
30	45	145	65	151
4:40 P.M.	55	145	65	151
4:50		147		

09-30-77 Took air line pressure for static H₂O level
 For 45 minutes, and the air line pressure reading
 was 144 PSI.

DRAWING PAPER NO. 1371-11
TRACING PAPER NO. 1230-11
SEMI-LOG. 2 CY. BY 10 DIV., IN.

TIME, MINUTES

WELL 10-1 001
TIAN R3W S19
SEPT 28, 1977 BK EMERSON ARISO



Water Quality

Today is: 05/17/94

PWS NAVAJO INDIAN COMPLIANCE TRACKING SYSTEM
---Inventory Information---

PWS Name: J.WILLIE CAMP/W THOREAU

Street: BOX 170

City : FT DEFIANCE

State : AZ Zip: 86504

County : APACHE

Source : Ground Water

Population : 500

Connections: 189

Consecutive: No

Storage : 219000

Owner Char.: NTUA

Serv. Area : Residential

Adm. Region: NAVAJO AREA OFFICE

Adm. Dist. : CROWNPOINT S.U.

Activity : Active

Reg. Agent : Federal

PWS ID : 3500303

Type : Community

Owner : NTUA

Phone :

Phone :

Contact : FRIEDA WHITE

Phone : (602)729-5721

Phone : EXT. 269

Bact Samp Req: 1

Comp. Cycle : Monthly

Laboratory : NTUA

Reservation : Navajo

Last Survey : 05/27/92

Surveyor : HILL, ONDELACY/IHS

Name of Source : WELL #16T-529

Type : Ground Water

Capacity, gpm: 21

Availability : Permanent

Depth of Well: 1708

No. of wells : 1

Treatment : Disinfection
Other

Process : Gas Chlorination
Fluoridation

Name of Source : WELL #16T-614

Type : Ground Water

Capacity, gpm: 56

Availability : Permanent

Depth of Well: 1690

No. of wells : 1

Treatment : Disinfection
Other

Process : Gas Chlorination
Fluoridation

Name of Source : WELL #16T-350

Type : Ground Water

Capacity, gpm: 56

Availability : Permanent

Depth of Well: 1500

No. of wells : 1

Treatment : Disinfection
Other

Process : Gas Chlorination
Fluoridation

CHEMICAL
ANALYSISNAVAJO TRIBAL UTILITY AUTHORITY
LABORATORYFile
Thoreau

SAMPLE NUMBER 184 PWSID NUMBER NM 0303 *
 SAMPLE LOCATION J. H. Camp DATE COLLECTED 9-25-90
 DATE RECEIVED 9-25-90 COLLECTED BY P. Sandoval
 DATE OUT 1-7-91 ADDRESS NTUA
 TECHNICIAN Thoreau

TEST	PARAMETER	METHOD	RESULTS	MCL
✓	ARSENIC	ATOMIC ABSORPTION	4.001	0.05
✓	BARIUM	ATOMIC ABSORPTION	.287	1.0
✓	CADMIUM	ATOMIC ABSORPTION	4.001	0.01
✓	CHROMIUM	ATOMIC ABSORPTION	4.001	0.05
✓	IRON	ATOMIC ABSORPTION	4461	N/A
✓	LEAD	ATOMIC ABSORPTION	4.001	0.05
✓	MANGANESE	ATOMIC ABSORPTION	.005	N/A
✓	MERCURY	FLAMELESS ATOMIC ABSORPTION	5.001	0.002
✓	SELENIUM	ATOMIC ABSORPTION	4.001	0.01
✓	SILVER	ATOMIC ABSORPTION	4.001	0.05
✓	NITRATE (AsN) <u>Copper</u>	CADMIUM REDUCTION <u>AA</u>	.002	10.0 1.3
✓	FLUORIDE	ELECTRODE		1.4

FORM NO. 5460 (2)

REV 5-83

WATER CHEMICAL ANALYSIS

NAVAJO TRIBAL UTILITY AUTHORITY



SAMPLE NO. 184
 SAMPLE LOCATION JW CAMP DATE COLLECTED 25 SEP 90
 DATE RECEIVED 25 SEP 90 COLLECTED BY SANDOVAL
 DATE OF FINAL ANALYSIS 15 OCT 90 ADDRESS NTUA
 TECHNICIAN ABECENT / J. FRANCIS

TEST	PARAMETER	METHOD	RESULTS	mg/l
	ALKALINITY	TITRAMETRIC <u>as CaCO₃</u>	175.7 mg/L	
	CALCIUM	TITRAMETRIC OR AA " "	94.8 "	75-200
	CHLORIDE	TITRAMETRIC <u>IC</u>	10.9 "	250
	TOTAL HARDNESS	TITRAMETRIC <u>as CaCO₃</u>	180.0 "	500
	MAGNESIUM	CALCULATED OR AA " "	85.0 "	
	MANGANESE <u>NITRATE-NITROGEN</u>	SPECTROPHOTOMETRIC OR AA <u>IC</u>	ND = NONE DETECTED	0.05-
	IRON <u>NITRITE-NITROGEN</u>	SPECTROPHOTOMETRIC OR AA <u>IC</u>	ND	0.3-
	pH	ELECTRODE	7.10236	6.5-8.5
	PHOSPHATE	SPECTROPHOTOMETRIC <u>IC</u>	ND	
	POTASSIUM	FLAME PHOTOMETER		1000-2000
	SODIUM	FLAME PHOTOMETER <u>CALC.</u>	15.0 mg/L	
	SULFATE	TITRAMETRIC <u>IC</u>	20.8 "	250
	TOTAL DISSOLVED SOLIDS	ELECTRODE <u>GRAVIMETRIC</u>	285.6 "	500
	TURBIDITY	NEPHELOMETER	0.2 NTU	
	FLUORIDE	ELECTRODE <u>IC</u>	1.27 mg/L	1.4

REMARKS
FORM NO. 5459

WATER CHEMICAL ANALYSIS

Bureau of Indian Affairs
Soil, Water & Materials Testing Laboratory
P. O. Box 1060, Gallup, New Mexico 87301

16T-529

Lab. No. 76-PHS-CP-109 Field No. CP-75-35 Analyzed By N. R.
Date Received by Lab. 6-24-75 Transcribed By M. J. L. L. L.
Date Collected 6-20-75 Checked By Andrew M. L. L.
Location Thoreau Date Analysis Completed
Source of Water Well #16-T-528-529 Reported By Sammy S. Charlie
Collector's Name Sammie S. Charlie Date Reported 9-4-75
Authorized By B. Chelikowsky
END REPORT TO: Bruce Chelikowsky ADDRESS: Department: USPHS
Environmental Health & Sanitation Agency: Crownpoint
Crownpoint Indian Hospital Branch: OEH
Crownpoint, New Mexico 87313

(X) Test Requested	Meq/l	Mg/l	Recommended Standards
Boron (B)		0.54	1.0
Iron (Fe)	Trace	Trace	0.3
Calcium (Ca)	2.00	40.08	75 - 200
Magnesium (Mg)	1.30	15.81	50 - 150
Sodium (Na)	2.80	64.37	115 **
Potassium (K)	0.03	1.17	1000 to 20
CATIONS			
	6.13		
Phosphorus (P)		Trace	50.0 **
Bicarbonate (HCO ₃)	3.26	198.93	150
Carbonate (CO ₃)	0.52	15.61	
Sulfate (SO ₄)	0.90	43.23	250
Chloride (Cl)	1.66	58.96	250
Fluoride (F)	0.01	0.26	50 ⁰ to 58.3 ⁰ 1.8 58.7 ⁰ to 70.6 ⁰ 1.5 70.7 ⁰ to 90.5 ⁰ 1.2
Nitrate (NO ₃)	0.002	0.12	45
ANIONS			
	6.35		
Total Solids	Mg/l	321	500
Dissolved Solids	Mg/l	308	
	Tons Per Acre Foot	0.42	
Hardness as Mg/l	Calcium, Magnesium	165	500
Ca CO ₃	Non Carbonate		
Alkalinity as Mg/l	Phenolphthalein	26	N.A.
Ca CO ₃	Total Alkalinity (Methyl Orange)	163	
Soluble Sodium Percentage (SSP)	48		
Sodium Absorption Ratio (SAR)	2.18		
Specific Conductance (Microhm/cm at 25°C)	570		
Residual Sodium Carbonate (RSC)	0.48		
PH	8.4		4 to 10
Glass for Irrigation Water	2.51		
Arsenic (As)			0.05 *
Barium (Ba)			1.0 *
Cadmium (Cd)			0.01 *
Copper (Cu)			1.0
Cyanide (Cn)			0.2
Chromium (Cr.)			0.05 *
Iron (Fe)			0.05 *
Lead (Pb)			0.05
Manganese (Mn)			0.005 **
Mercury			0.01 *
Selenium (Se)			
Silica (SiO ₂)			0.05
Silver (Ag)			5.0
Zinc (Zn)			0.5
Alkyl Benzene Sulfonates (ABS)			0.001
Phenols			

*Cause for Rejection of the Supply
**Unofficial Standards

WATER CHEMICAL ANALYSIS
 Bureau of Indian Affairs
 Soil, Water & Materials Testing Laboratory
 P. O. Box 1060, Gallup, New Mexico 87301

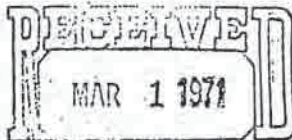
16T-529

Lab. No. 74-PHS-FD-319 Field No. _____ Analyzed By N. P. [Signature]
 Date Received by Lab. 12-17-73 Transcribed By [Signature]
 Date Collected 12-17-73 Checked By [Signature]
 Location 9 mi. W of Thoreau Chapter Date Analysis Completed _____
 Source of Water WM-16E529 Reported By [Signature]
 Collector's Name A. Smiley Date Reported DEC 28 1973
 Authorized By W. Conway
 ADDRESS: Department: USPHS SEND REPORT TO: Ward Conway
 Agency: Gallup P. O. Box 1337
 Branch: OEh Gallup, NM

(X) Test Requested		Meq/l	Mg/l	Recommended Standards
Boron (B)			0.20	1.0
Iron (Fe)		0.003	0.06	0.3
Calcium (Ca)		2.60	52.40	75 - 200
Magnesium (Mg)		1.40	19.40	50 - 150
Sodium (Na)		21.60	496.58	115 **
Potassium (K)		0.06	2.35	1000 to 2000
CATIONS		25.86		
Phosphorus (P)			0.10	50.0 **
Bicarbonate (HCO ₃)		3.14	197.82	150
Carbonate (CO ₃)		0.21	6.21	
Sulfate (SO ₄)		4.35	208.93	250
Chloride (Cl)		17.28	612.75	250
Fluoride (F)		0.03	0.62	50 ⁰ to-58.3 ⁰ -1.58.7 ⁰ to79.6 ⁰ 1.70.7 ⁰ to90.5 ⁰ 1.
Nitrate (NO ₃)		0.07	9.34	45
ANIONS		25.10		
Total Solids	Mg/l		1515	500
Dissolved Solids	Mg/l		1464	
	Tons Per Acre Foot	1.99		
Hardness as Mg/l	Calcium, Magnesium		210	500
Ca CO ₃	Non Carbonate		52	
Alkalinity as Mg/l	Phenolphthalein		11	N.A.
Ca CO ₃	Total Alkalinity (Methyl Orange)		158	
Soluble Sodium Percentage (SSP)	84			
Sodium Absorption Ratio (SAR)	14.91			
Specific Conductance (Micromhos at 25°C)	2730			
Residual Sodium Carbonate (RSC)				
pH	8.4			4 to 10
Class for Irrigation Water	6454			
Arsenic (As)				0.01 *
Barium (Ba)				1.0 *
Cadmium (Cd)				0.01 *
Copper (Cu)				1.0
Cyanide (Cn)				0.2
Hexavalent Chromium (Hex. Cr.)				0.05 *
Lead (Pb)				0.05 *
Manganese (Mn)				0.05
Mercury (Hg)				0.005 **
Selenium (Se)				0.01 *
Zinc (Zn)				5.0
Alkyl Benzene Sulfonates (ABS)				0.5
Phenols				0.001

Cause for Rejection of the Supply _____
 *Unofficial Standard

Total Iron — 2.20 ppm



BUREAU OF INDIAN AFFAIRS
SOILS LABORATORY
GALLUP, NEW MEXICO
LABORATORY DATA SHEET FOR WATER SAMPLES

OFF OF ENV HLTH

LAB NO. 71-PHS-76 FIELD NO. _____ ANALYZED BY Am
COLLECTOR Phillip E. Pollard TRANSCRIBED BY Am
LOCATION Thoreau Chapter CHECKED BY Am
DATE RECEIVED BY LABORATORY 8-3-70 REPORTED BY Det Cooke
DATE ANALYSIS COMPLETED 8-25-70 AUTHORIZED BY Phillip E. Pollard
DATE COLLECTED 7-14-70 SOURCE OF WATER 16T-529
DEPARTMENT H.E.W. AGENCY Crownpoint BRANCH U.S.PHS

		Mg/l	Mg/l
Temperature (°F)			
Silica (SiO ₂)			
Boron (B)			0.30
Iron (Fe)		trace	trace
Calcium (Ca)		1.50	30.06
Magnesium (Mg)		1.15	13.98
Sodium (Na)		7.28	167.37
Potassium (K)		trace	trace
Cations		9.93	
Phosphorus (P)			0.07
Bicarbonate (HCO ₃)		3.55	216.62
Carbonate (CO ₃)		0.25	7.50
Sulphate (SO ₄)		1.49	71.56
Chloride (Cl)		4.33	153.54
Fluoride (F)		0.02	0.29
Nitrate (NO ₃)		0.02	1.24
Anions		9.66	
Total Solids	Mg/l		577
Dissolved Solids	Mg/l		467
	Tons Per Acre Foot	0.64	
Hardness as Mg/l	Calcium, Magnesium		133
Ca CO ₃	Non Carbonate		
Alkalinity as Mg/l	Phenolphthalein		13
Ca CO ₃	Total Alkalinity (Metnyl Orange)		178
Soluble Sodium Percentage (SSP)		73	
Sodium Absorption Ratio (SAR)		6.32	
Specific Conductance (Micromhos at 25°C)		1000	
Residual Sodium Carbonate (RSC)		1.15	
PH		8.5	
Class for Irrigation Water		C3-5.2	

Remarks: Total Iron - 0.02 ppm

RECEIVED

MAR 22 1971

WATER DEVELOPMENT
NEW MEXICO

USGS-WKD
Form 01

529 16T-529
16T-3

ANALYTICAL STATEMENT

COUNTY McKinley

Ariz. 6.16

54189 0.121

Location 3 NW of Thoreau

Date of collection Mar. 20, 1964

Source (type of well) Drilled
Owner Navajo Tribe

Date driled Mar. 1964 Cased to ft

Depth 1708' Diam

WSP Glorieta

Water level 228 ft

Sampled after pumping hrs

Yield GPM (meas or est)

Ft of coll Well

Appearance Sediment

Temp (°F) 62 Use Dom., Stock

Collector Tribe

Chemist RLI

Date completed May 14, 1964

Checked by LJA

Ignition Loss Color

Dissolved Solids:

Residue at 180°C

Calculated (Sum) 419

Tons per Acre Foot 0.57

Hardness as CaCO₃ 35

Non-carbonate Hardness 0

T Na 90, SAs 11, pH 8.2

Specific Conductance

(microhos at 25°C) 687

	apm	ppm
SiO ₂		7.1
Fe		
Ca	0.50	10
Mg	0.20	2.4
Na		
K		
Na+K	6.37	147
HCO ₃	3.87	236
CO ₃	0.00	0
SO ₄	1.92	92
Cl	1.24	44
F	0.04	0.8
NO ₃	0.00	0.00
	7.07	

NAVAJO NATION - DIVISION OF NATURAL RESOURCES
WATER RESOURCE MANAGEMENT
P.O. Drawer 140, Ft. Defiance, AZ 86504
(602) 729-5282, 5283

WUP NO. 94-2-3

VALID FROM JAN 01 1994 to DEC 31 1994

WATER USE PERMIT

NOTE: This Permit is valid only upon signature of the Division of Natural Resources Executive Director. Please read Water Use Permit information sheet before completing this form.

APPLICANT: NAVAJO TRIBAL UTILITY AUTHORITY
Last Name, First; or/Company Name

MAILING ADDRESS: P. O. Box 170

CITY: Fort Defiance STATE: Arizona ZIP CODE: 86504

TELEPHONE NUMBER: (602) 729-5721 CONTACT PERSON: Ken Craig

Date Received MAY 12 1994 Date Completed FEB 22 1995

\$25.00 Filing Fee Received JUN 01 1994 Initial WK

WATER SOURCE

() Spring No. _____ () Steam Name _____

() Stockpond Name/No. _____ () Lake/Reservoir Name _____

(X) Well No. 16T-350/16T-614 () Injection Well No. _____

() Other Descript./Name West Thoreau #2 Grazing District: 16

CHAPTER: Thoreau Chapter Code: THOR

State: () AZ/Arizona (X) NM/New Mexico () UT/Utah () CO/Colorado

COUNTY: () AP/Apache (X) MK/McKinley () SJ/San Juan () MT/Montezuma
() NA/Navajo () VL/Valencia () KA/Kane () LP/La Plata
() CO/Coconino () BL/Bernalillo
() SD/Sandoval
() SO/Socorro
() RA/Rio Arriba
() SA/San Juan

Quad No. 5563

UTM COORDINATES: X(East) 749900 Y(North) 3924380 ZONE 12

NE SE SW NM / NE SE SW NM / NE SE SW NW
10 Acre 40 Acre 160 Acre SECTION T TOWNSHIP R RANGE

LAND STATUS

(X) TRUST () FEE () LEASE () ALLOTMENT () OTHER

WATERSHED NAME: Rio Grande Basin Little Colorado USGS WATERSHED CODE NO. 13020207

WATER USE

Primary: () Domestic () Recreational
 (X) Municipal () Industrial
 () Livestock () Mining
 () Irrigation Agriculture () Commercial
 () Wildlife & Fish () Other

Number of People: _____ Number of Home: 193 Commercial: 0

TYPE OF LIVESTOCK: () Horses No. _____ () Goats No. _____
n/a () Cattle No. _____ () Sheep No. _____

TYPE OF CROPS: n/a () Row (i.e. corn) Acres _____
 () Forage-Hay-Pasture Acres _____
 () Small Grains Acres _____
 () Horticulture (i.e. fruits & vegetables) Acres _____

TYPE OF WILDLIFE: () Fish No. _____ () Small Game No. _____
n/a () Large Game No. _____ () Birds No. _____

IF WATER IS USED FOR INDUSTRIAL OR MINING PURPOSES, ATTACHED WATER SUPPLY PLAN DESCRIBING SOURCE AND METHODS OF DIVERSION, CONVEYANCE AND USES.

SEASON OF MAXIMUM USE: () SPRING (X) SUMMER () FALL () WINTER

MAXIMUM RATE OF USE: 57.6 (X) GAL/MIN or () CU-FT/SECEXPECTED DATE WATER USAGE TO BEGIN: JAN 01 1994 ~~IN USE~~

EXPECTED VOLUME OF WATER TO BE USED: 42.19 AC/FT (13,746,000 Wellhead
~~30,274,560~~ GALLONS)

METHOD OF WATER DIVERSION: () Instream Pump () Gate or Gravity Flow
 (X) Other: Submersible pump

METHOD OF WATER CONVEYANCE: () Ditch () Canal (X) Pipeline () Truck
 () Other: _____

ATTACH AN 8-1/2" X 11" MAP SHOWING EXACT LOCATION OF WATER SOURCE AND SCENARIO/LOCATION OF WHERE WATER IS TO BE USED.

RETURN FLOW OR DISCHARGE

AMOUNT OF WATER: n/a METHOD: () Director
 () GAL/MIN () CU/FT/SEC () GPD () Indirect
 () Injection

IS DISCHARGE TREATED? () YES () NO
 IS QUALITY AFFECTED? () YES () NO IS TEMPERATURE AFFECTED? () YES () NO

FEDERAL/UIC PERMIT: n/a NPDES PERMIT NUMBER: n/a

90 2 3

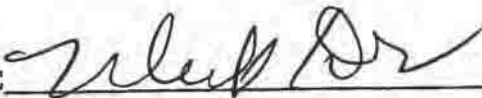
CONDITIONS

1. The Navajo Tribal Utility Authority, hereinafter the Permittee, agrees to comply with the terms and conditions of this Water Use Permit, the Navajo Nation Water Code, and all applicable tribal and federal laws. Permittee understands and agrees that failure to comply may result in revocation of this permit, pursuant to 22 N.T.C. §1404 (1984).
2. This permit is valid only for the term specified and shall expire at the end of that term.
3. If the purpose for water withdrawal authorized by this permit requires more than ~~30,274,566~~ ^{13,746,000} gallons, the Permittee shall be authorized to exceed the specified amount by five percent, or 14,433,300 gallons, provided that any exceedance of the permitted amount must be reported to the Department. If actual use exceeds or is projected to exceed the specified amount plus five percent, the Permittee shall apply to the Director for a modification of this permit. Such request shall be reviewed by the Director, and the Permittee shall be notified of the Director's decision no later than 10 business days following receipt of the request for modification.
4. The Navajo Tribal Utility Authority shall make its best efforts to work with the Department of Water Resources Management to develop an economical method of billing Navajo Tribal Utility Authority customers covered by the Navajo Nation Water Code.
5. Permittee agrees to submit to the Water Code Section quarterly reports indicating the quantity of water withdrawn pursuant to this permit. Such reports shall consist of meter readings or other evidence showing the amount of water withdrawn monthly pursuant to the permit. Other evidence may include estimates or calculations of withdrawals during unmetered periods, provided such estimates or calculations are clearly indicated as such and explained on the quarterly reports.
6. Permittee agrees to hold harmless and indemnify the Navajo Nation against any and all losses, costs, damages, claims, expenses or other liability, arising from or connected with Permittee's acts or omissions undertaken pursuant to this permit, including but not limited to, any accident or injury to person or property.
7. The courts of the Navajo Nation shall have exclusive jurisdiction over any and all disputes arising under this permit, following the exhaustion of administrative remedies. Nothing herein shall be construed as a waiver of the sovereign immunity of the Navajo Nation, pursuant to 1 N.T.C. §351 et

seq.

8. Permittee agrees to maintain its facilities for water withdrawal and diversion under this permit in a safe and sanitary manner, free of unnecessary debris, pursuant to applicable tribal and federal law.
9. This permit applies only to the stated use of water from the specified point of withdrawal or diversion. (Ref. page 2 of use permit)
10. This permit constitutes nothing more than tribal permission to use water under specific conditions pursuant to the Water Code. Permittee is required to comply with all other applicable tribal and federal laws prior to beginning the proposed project where the water will be used.
11. Permittee must notify the Department of Water Resources Management, Water Code Section, in writing if sub-contractors are hired to haul water covered by this permit.
12. This permit may be revoked or modified by the Director pursuant to 22 N.T.C. §1404 (1984) for failure to comply with the permit terms, for noncompliance with applicable tribal or federal law, to protect water or other tribal resources, or for any other just cause. The Director shall notify the Permittee in writing not less than 15 business days prior to the effective date of revocation or modification. The notice shall state the ground(s) for revocation or modification. If the Permittee negates the ground(s) prior to the effective date, the permit will remain unaffected. Decisions of the Director shall be considered final actions within the meaning of 22 N.T.C. §2102 (1984).
13. Permittee agrees to allow reasonable entry upon their premises by employees of the Navajo Nation engaged in the administration of this permit. The Permittee shall be notified by the Department of the identity of those personnel who will require access to the Permittee's facilities, and when practicable of the date and time that access to a particular facility will be required; provided that the Permittee understands that in times of emergency such prior notification by the Department may not be possible. It shall be the responsibility of the Permittee to insure that those Navajo Nation personnel specified by the Department as requiring access are adequately trained to safely enter the Permittee's premises, so as to conduct activities necessary in the administration of this permit.

PERMITTEE'S SIGNATURE



DATE MAY 10 1984

RECOMMENDATION: YES (X) NO ()

Don Harley
WATER CODE ADMINISTRATOR

May 24 1994

YES (X) NO ()

John M. Phons
DIRECTOR/WATER RESOURCES MGMT.

2-14-95

YES (✓) NO ()

Leg Logan
DEPARTMENT OF JUSTICE

2-16-95

APPROVED/DISAPPROVED:

William Bantel
EXEC. DIRECTOR/DIV. OF NATURAL RESOURCES

2/17/95

Revised : 4/94



THE NAVAJO NATION

WINDOW ROCK, NAVAJO NATION (ARIZONA) 86515

PETER MACDONALD
CHAIRMAN, NAVAJO TRIBAL COUNCIL

FRANK E. PAUL
VICE CHAIRMAN, NAVAJO TRIBAL COUNCIL

03 August 1982

Mr. Masud Zaman, Hydrogeologist, SFCB
Office of Environmental Health & Engineering
Navajo Area Indian Health Service
Post Office Box "G"
Window Rock, Arizona 86515

RE: Permission to drill a replacement
well at John Willie Camp, West
Thoreau, New Mexico

Dear Mr. Zaman,

Your application and permit to drill a deep well at John Willie Camp, West Thoreau, New Mexico, and attached letter have been reviewed by our department. Drilling permit is issued with the following conditions:

1. Complete well record, such as drilling log, electric logs, pump test data, etc. will be furnished to .
2. All information related to the well record will be made available to the Navajo Water Commission through us.
3. In case that the water sources are depleted in any of the ^{existing} wells in the area due to pumping of the new well, Indian Health Service will replace these sources for domestic and livestock use.

If you have any questions, please do not hesitate to contact us.

Sincerely yours,

THE NAVAJO TRIBE

Anson C. Damon Jr.
Anson C. Damon Jr., Director
Water & Sanitation Department

CONCURRENCE:

Glenn C. George
Glenn C. George, Director
Navajo Water Commission

ATTACHMENT;



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Health Services Administration

Office of Environmental Health
and Engineering

July 23, 1982

Navajo Area
Indian Health Service
P. O. Box G
Window Rock, Arizona 86515

Our Ref: NA-79-225

16T-614

Mr. Anson Damon, Jr., Manger
Water and Sanitation Department
P.O. Box #678
Ft. Defiance, Arizona 86504

RE: Permission to drill a
replacement well at John
Willie Camp, West Thoreau, New
Mexico

Dear Mr. Damon:

The failure to remove an unknown solid obstruction at 950 feet depth and the presence of high radionuclide concentration in the water of existing West Thoreau Well #16T-350, the Indian Health Service, Office of Environmental Health and Engineering, Window Rock, Arizona has decided to drill a replacement well in the area.

Since, the long range plans are that the existing John Willie Camp System (NTUA), the Thoreau Chapter "Iron" System (Water and Sanitation) and the newly constructed West Thoreau System should eventually be consolidated into one large system, it was decided to drill the proposed replacement well in the area where access to three-phase power and main water line is easily available. The John Willie Camp area has been chosen as the most suitable location for the new well.

The replacement well will be located on a Tribal Trust land in the SE/4, NE/4, NE/4 of Section 19, T14N, R13W about 2.75 miles northwest of Thoreau. The new well will be approximately 1,750 feet deep, penetrating the total thickness of the San Andres-Glorieta aquifer (see attached well feasibility report for full detail).

The additional information on the the request are as follows:

1. Availability - Source Location: There are two existing wells in the close vicinity of proposed well site. The nearest well #16T-529, located about 0.6 mile west of the proposed well site, is 1,708 feet deep, static water level 260 feet (1979) and produces about 20 gallons per minute of good quality water from the San Andres-Glorieta aquifer. This well, presently, provide water to a small, existing John Willie Camp system, which is maintained and operated by the NTUA. This system will finally be merged into planned larger West Thoreau system and the Well #16T-529 then be used as a standby water source.

The second existing Well #14.13.20432, known as Transwestern Pumping Station well, is located about one mile south-southeast of proposed well site. This well is approximately 1,300 feet deep, static water level 200 feet and produces also from the San Andres-Glorieta aquifer. The yield and the chemical quality of the water is unknown. This well is located up the dip from the proposed well (see attached location map).

There are several other existing deep wells in the area which are owned and operated by different parties. The parties are, the McKinley County School District, the BIA School District, the City of Thoreau, the El Paso pumping station, the Navajo Tribe and others. All these wells are located up the dip towards the recharge area in the south, farther away and out of the influence zone of the proposed well (for locations, see attached map).

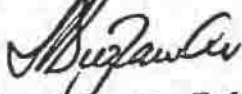
2. Quantity of Water Requested: Approximately 150 gallons per minute production will be needed from the proposed replacement well.
3. Point of Use and Purpose: The new well will be the major water source for the consolidated West Thoreau System.
4. Prior Use and Rights Protection: As discussed in point one, all existing wells, except John Willie Camp Well #16T-529, in the area are at a safe distance and their production will not be influenced by the operation of the new well. The Well #16T-529, being located at a short distance (0.6 mile) from the proposed well, may have some effect, but the effect will be tolerable due to the standby status of this well. Moreover, both wells will be maintained and operated by the same utility agency (NTUA).

The Well #16T-529 will also be used as an observation well during the pump test of the new well and later as a water level monitoring well in the area.

5. Three copies of the drilling application duly signed by the area councilman, the members of the grazing committee, a copy of USGS location map, and a copy of the well drilling feasibility report is attached for your information and record, we shall appreciate the processing this application in the earliest convenience.

If you have any question regarding this request, please do not hesitate to call me.

Sincerely yours,



Masud Laman, Hydrogeologist

Enclosures

xc: Steve Weaver, Field Engineer, OEH, Crownpoint Service Unit
 Gerald Babigian, District Engineer, OEH, Gallup Service Unit
 Project File, NA-79-225

NAVAJO TRIBAL COUNCIL
WATER DEVELOPMENT DEPARTMENT

APPLICATION AND PERMIT TO DRILL ☒ , REDRILL ☐ ,

RECASE ☐ , OR DEEPEN ☐ , A WATER WELL

THIS WELL WILL BECOME THE PROPERTY OF THE NAVAJO
TRIBAL COUNCIL AT THE END OF PERMITTEE'S TENURE

District 16 Name/Number of Well _____

Name of Driller NECA Phone No. (505) 368-5151

Address P.O. Box 969, Shiprock, N.M. 87420

Well Driller's License No. _____ Date start of work July, 1982

Permittee's Name DHEW-Public Health Service, Division of Indian Health

Navajo Area Indian Health Service, Office of Environmental
Address Health, Window Rock, AZ 86515

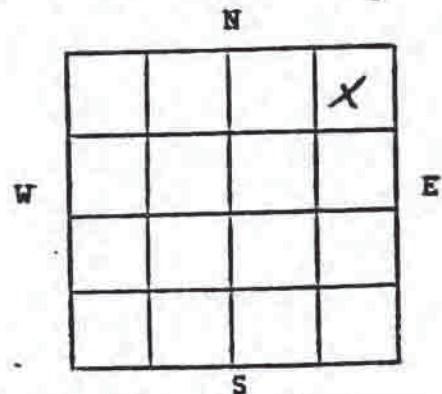
Estimated Depth of Well 1750 Ft. Location of Well Near county rd. #27

Diameter of well 12 1/4 In. Section No. 19 County McKinley

Diameter of Casing 8 5/8 In. Twp 14N Range 13W P.M. _____

Weight of Casing 24 lbs./ft. Please mark well location to nearest
40 acre (small square) below

Type of Well: Domestic ☐
Irrigation ☐
Municipal ☐
Stock ☐
Other ☐



Method to be used in drilling rotary

If above location is unknown, complete
the following:

Estimated Depth of Bottom & Top of Shutoff

Type of Shutoff _____

Grazing Committee Signature on back.

Copies: Permittee
Driller
Water Development Dept.

County _____

State _____

[Signature]
Permittee's Signature

[Signature]
N.T. Water Development

[Signature]
District Councilman's Signature

FEASIBILITY REPORT

Well Drilling
West Thoreau Water System
McKinley County, New Mexico

Masud Zaman
Hydrogeologist
Indian Health Service
Window Rock, Arizona

Open File Report
July 1982

CONSOLIDATED WEST THOREAU SYSTEM

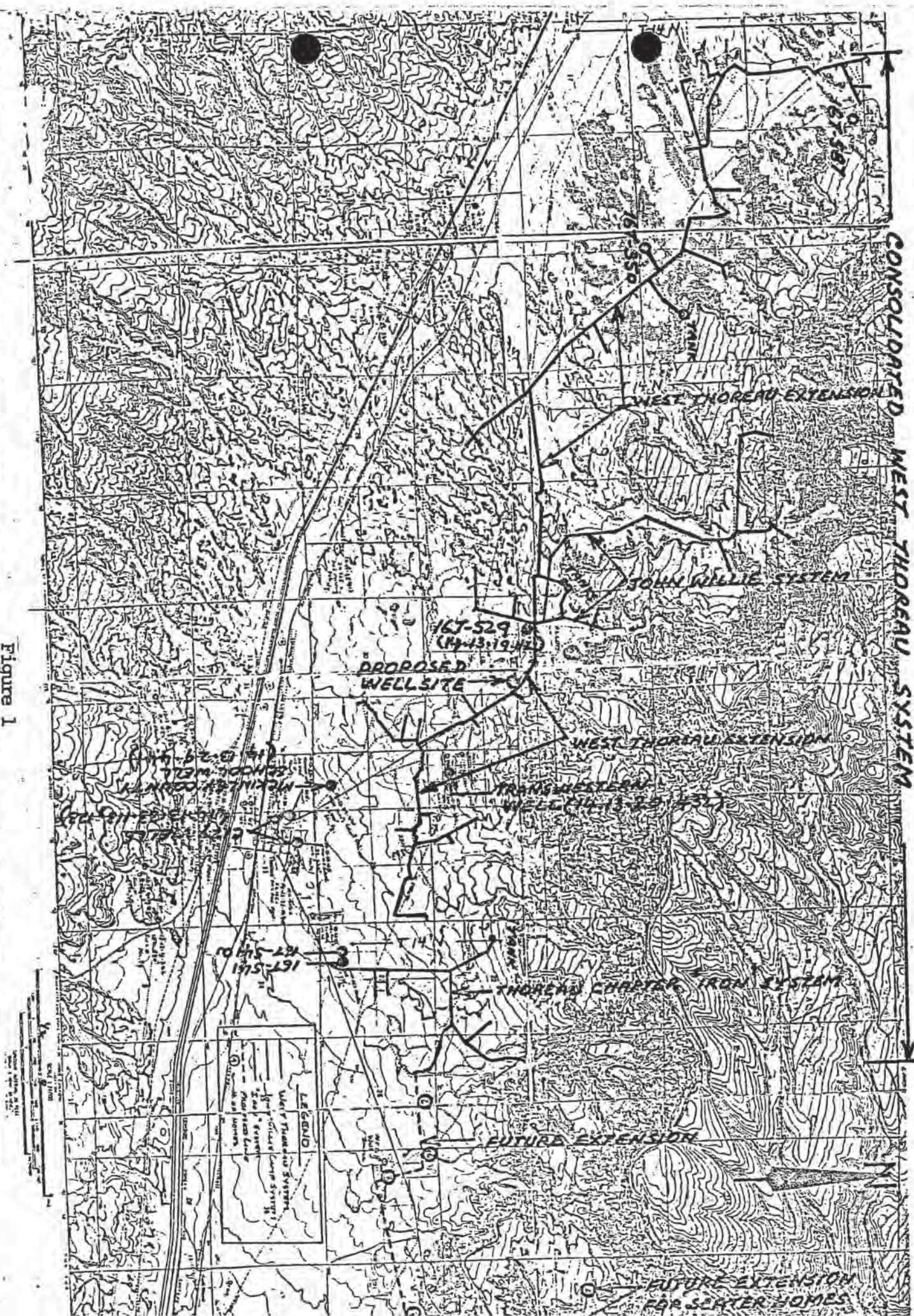


Figure 1

FEASIBILITY REPORT

Well Drilling for West Thoreau Water System

INTRODUCTION

The existing West Thoreau Well #16T-350, located approximately 6.5 miles west of Thoreau, New Mexico, was drilled in May 1958. The Navajo Tribe's record indicates that the well was completed in Glorieta Sandstone at 1,730 feet depth, the first 1,500 feet was lined with 8 5/8-inch casing and 230 feet of open hole was left at the bottom. The record does not show any other construction details or hydrologic information about the well.

Between May 1958 through May 1979, the Navajo people in the area used the well for stock watering and seldom hauled water for domestic use. In 1979, when the construction of the West Thoreau water system (NA-79-225) was planned, as an extension of the John Willie Camp System, Crownpoint OEH was authorized to use Well #16T-350 as a domestic water source to feed the proposed system. At that time, Dale Cartmel of Crownpoint OEH, checked the well depth and found a blockage at 950 feet. A 6.5 hour, 50 gallon per minute pump test was also conducted. The pump was set at 729 feet, the static water level was 19 feet and the level stabilized at 450 feet below the ground surface after pumping.

In July 1981, Steve Weaver of Crownpoint OEH ran a second pump test at the rate of 55 GPM for 24 hours. The pump was set at 760 feet, static water level 22 feet, and the total drawdown after 24 hours pumping at a constant rate of 55 GPM, was 320 feet. The radionuclide results showed that the water contained Gross Alpha 29 pCi/L, Uranium 7.6 pCi/L, Radium 226 of 3 pCi/L.

In January 1982, plans were made to rehabilitate the well by redrilling to the total depth and sealing off the radioactive zones in the well. The NTUA cable tool rig was hired for the job. The attempt to clean the well proved unsuccessful because of a solid obstruction at 950 feet depth. And the operation was called off after seven days.

After analysing all the options and to avoid other unforeseen problems in rehabilitating the West Thoreau Well #16T-350, the decision was made to drill a replacement well either near the existing Well #16T-350 or at a suitable location along the water system. After discussion, the John Willie Camp area was chosen as the proposed replacement well site.

Current long range plans are that the existing John Willie Camp System, Thoreau Chapter ("Iron") System and the newly constructed West Thoreau System will eventually be consolidated into one large system. Besides providing water to the John Willie Camp and West Thoreau systems, the new well will also replace the poor quality water of the Thoreau Chapter ("Iron") System. Plans are also being made to extend Thoreau Chapter System further east and northeast to provide domestic

water to several existing Navajo homes located in that area. The proposed well will be the major water source for the entire system and the existing Well #16T-529, now serving the John Willie Camp System, will be used as a standby source.

LOCATION

The proposed replacement well will be located on Tribal Trust Land (14.13.19.224) in the John Willie Camp area, which lies approximately 2.75 miles northwest of the junction of I-40 and NM #56 and about four miles east southeast of the existing West Thoreau Well #16T-350. The proposed well site will be approximately 0.6 mile east of the existing John Willie Camp Well #16T-529 (see attached location map, Figure 1).

PHYSICAL FEATURES

The study area that lies on the north flank of the Zuni uplift is a broad valley. This valley is approximately three miles wide and delineated on the south by rocks that dip 30° - 50° off the Zuni uplift and disappear beneath the alluvium in the valley at an altitude of between 6,800 and 7,200 ft. The shear walls of orange-red sandstone, more than 200 feet in height, rise abruptly from the northern edge of the valley. These sandstone cliffs are capped by the younger sedimentary rocks which form slopes and escarpments at an altitude of over 8,200 feet. The Continental Divide crosses just west of the study area. The drainage is predominately to the east, away from the Continental Divide. The land surface slopes so gently to the east that the stream gradients are too low to accomplish any downcutting. The Interstate I-40 and the Santa Fe Railway traverse the valley longitudinally.

CLIMATE

The area has a semi-arid climate with abundant sunshine and low relative humidity. The average annual temperature is about 50°F. The maximum summer temperatures seldom exceeds 100°F and the winter low temperatures may be lower than 0°F. The average annual precipitation in the higher altitudes is about 20-inches (New Mexico State Engineer Office, 1956). The precipitation ranges from 12-16 inches along the Continental Divide, and 10-12 inches at lower elevation areas. The heaviest rainfall occurs during July, August and September (about 50 percent of the total annual precipitation). The precipitation occurs in the form of brief, intense thunderstorms. Some snow accumulates at higher elevations during winter.

EXISTING WATER SUPPLY

There are several existing water supply systems in the Thoreau area. The systems are as follows:

1. The City of Thoreau

This system obtains its water from 2 or 3 deep wells, which produce (as reported) from the San Andres-Glorieta aquifer and supply water to the City for domestic and commercial use.

2. The BIA School District

The school has its own water supply system and obtains water from several wells. The Well #16K-302A is 1,250 feet deep and produces from the San Andres-Glorieta aquifer. Other wells on the system produce from the sandstone beds of the Chinle Formation. The school system is operated and maintained by the BIA.

3. McKinley County School District

This school is located about 0.5 miles northwest of Thoreau, maintains its own water system and obtains water from a 1,284 feet deep well which produces (as reported) from the San Andres-Glorieta aquifer.

4. Transwestern Pumping Station

Located about 1.75 miles northwest of Thoreau, this system obtains its water from four wells. Three wells (735, 743, 750 feet deep) produce from the sandstone beds of the Chinle Formation and the fourth well, which is 1,300 feet deep (as reported), produces from the San Andres-Glorieta aquifer.

5. El Paso Pumping Station

Located south of the City, this system has several wells and all of these produce from the San Andres-Glorieta aquifer.

6. Thoreau Chapter "Iron" System

This system, located about one mile east of Thoreau, was constructed by IHS under Public Law 86-121 in 1966 to provide water to 20 PHA homes and about 30 existing Navajo homes located in the area (see Figure 1 for well locations and distribution system). The system was originally planned to obtain water from the existing chapter house Well #16T-541, which was about 435 feet deep and produced approximately 10 gallons per minute of good quality water from the sandstone beds of the Chinle Formation. But, because of its low yield, a new 1,220 feet deep well(#16T-541a,) was drilled adjacent to the Chapter House well. The record shows that the new well partially penetrated the San Andres-Glorieta aquifer and produced about 50 gallons per minute of marginal quality water. To improve the quality, the water from two wells is mixed before injection into the system. The consumers still complain about the quality of the water.

The system is operated and maintained by the Navajo Tribe Water and Sanitation Department field office in Crownpoint.

7. John Willie Camp System

This system, located 3.5 miles northwest of Thoreau, was completed under Public Law 86-121 in May 1978, and was transferred to the Navajo Tribal Utility Authority (NTUA) in August 1979. This system serves about 40 homes in the John Willie Camp area. The system

obtains its water from existing Tribal Well #16T-529 (14.13.19.112). This well is 1,708 feet deep, and was drilled by the Tribe in 1964. The static water level in 1979 was 260 feet below the ground surface. The well produces 21 GPM with a total drawdown of 267 feet (pump set at 620 feet). The production of this well could be increased by setting a high capacity pump at a lower depth, but the 6-inch I.D. casing may hinder the use of a high capacity pump.

The well location and distribution system is shown on the attached map. (Figure 1).

FIELD WORK

After the decision was made to drill a replacement well, a reconnaissance trip was made on June 29, 1982 to the study area. The author was accompanied by Gerald Babigian, District Engineer, Gallup OEH and Steve Weaver, Field Engineer, Crownpoint OEH. During the trip the team surveyed the West Thoreau, John Willie Camp and Iron System project areas, selected a proposed well site, collected information on existing wells in the Thoreau area, and studied the geology of the area.

ACKNOWLEDGMENTS

The author appreciates the help provided by Gerald Babigian and Steve Weaver during the field trip and later providing records on existing wells in the area to complete this feasibility study.

The author also greatly appreciates the assistance of Mr. James Crum, P.E., Chief, SFCB, and Mr. Charles Dowell, P.E., Deputy Chief, SFCB, who reviewed the draft and helped finalize this report.

GEOLOGIC CONDITIONS

The study area is located in a broad, flat valley on the north flank of the Zuni uplift and, lies within the southern limit of the San Juan structural basin. This roughly circular basin is about 25,000 square miles in area that lies mostly in the northwestern part of New Mexico but extends slightly into Colorado, Utah and Arizona. The Zuni uplift, an element of the San Juan basin, is an elongated dome whose axis strikes roughly northwest. The upwarping of the Zuni Mountain resulted in the exposure of Precambrian complex rocks which are flanked northward, toward the study area, by the younger strata. The rocks on the northeastern flank of the Zuni uplift dip uniformly to the north and northeast at an angle ranging from 3° to 5°, but the dips are much steeper on the southwestern flank. The north limb of the upwarp was subjected to severe erosion to form a series of northwest trending cuestas. The areas between cuestas are occupied by valleys, cut into the soft Triassic, Jurassic and Cretaceous shales lying between more resistant sandstones and limestones.

The area went through severe disturbances and contains several minor and major faults. The most prominent one is the Bluewater fault, which is located only a few miles east of the study area and extends

northward from near Bluewater Lake to Smith Lake. The fault is obscured by alluvium in the valley north of I-40 but is well exposed on both north and south ends. The maximum throw along the Bluewater fault zone ranges from 200 to 400 feet (Smith, 1954, page 22).

The broad, flat valley in which the study area is situated is underlain by the Triassic and Permian strata. The lowest geologic unit, which is known to be a reliable aquifer in the area, is the Glorieta Sandstone of middle Permian age, of the San Andres-Glorieta Formation. The rocks of lower Permian age (Yeso and Abo Formations) underlying the Glorieta Sandstone are known to contain poor quality water and will not be considered in this report. Overlying the San Andres-Glorieta Formations is a thick sequence of Chinle Formation of Triassic age. The geologic relationship of these units is shown in Figure 2. The approximate geologic column, estimated from Figure 2 will be as follows:

AGE	FORMATION	MEMBER	THICKNESS FT.
Triassic	Chinle Formation	Upper Shale Member	800
		Mid. Sandstone Member	200
		Lower Shale Member	360
		Shinarump (?) S.St. Mem.	40
Permian	San Andres Formation	San Andres Limestone	150
		Glorieta Sandstone	200
	Yeso Formation	San Yasidro Member	
		Meseta Blanca Member	
	Abo Formation		

NOTE: Actual thickness must be confirmed from E-log of the proposed well.

The Glorieta Sandstone is grayish-orange-pink-light brown or pale-red very fine to fine-grained, hard, massive and cross bedded quartz sandstone. The lower contact of the Glorieta Sandstone is gradational with the underlying San Yasidro member of the Yeso Formation and is very difficult to establish. The driller's log of Plains Escalante Well #1 (14.12.23.333) near Prewitt shows an abundance of gypsum at the base of the unit. The unit is about 220 feet thick.

The San Andres Limestone, that conformably overlies the Glorieta Sandstone, is grayish-pink of light brownish-gray, massive, crystalline, sandy limestone. The regional thickness of the limestone is about 150 feet but varies locally. The log of the John Willie Camp Well #12T-529 14.13.19.112) within the study area shows the presence of two limestone beds separated by a thin lens of sandstone. The Plains Escalante Well #1 on the other hand does not have any limestone at all and the Chinle Formation is lying directly over the Glorieta Sandstone. The Glorieta Sandstone and San Andre Limestone forms a single hydrologic unit and is exposed south of the study area in the Zuni Mountains.

The Chinle Formation of late Triassic Age, unconfirmably overlies the San Andres Limestone or at places directly over the Glorieta Sandstone. To simplify the nomenclature, Smith (1954) divided the formation into three parts. The lower part consists of the Shinarump member, Monitor Butte member and part of the Petrified Forest member. The middle part consists of the Sonsela Sandstone beds and the upper part consists of upper Petrified Forest member (including the intertonguing Correo (?) Sandstone member) and the Owl Rock member. The Chinle Formation crops out south of the study area in the Zuni Mountains.

HYDROLOGIC CONDITIONS

The San Andres-Glorieta Formations are hydrologically connected and act as a single aquifer. Regionally the average aquifer thickness is about 300 feet, but the thickness varies from place to place. The aquifer crops out at higher elevations on the north flank of the Zuni uplift where it receives its recharge from spring snow melts and summer thunderstorms that infiltrate the formation. The water moves north and northeastward from the recharge area. The high altitude of the recharge area and the confining effects of the overlying Chinle Formation create the artesian pressure in the San Andres-Glorieta aquifer in the direction of the flow. The water quality is good near the recharge area and deteriorates as water moves through the formation farther north and northeastward.

The depth to the top of the San Andres-Glorieta aquifer varies from about 550 feet in the south, near Bluewater Valley, in Well #13.13.16.444 to about 1,000 feet at McKinley County School Well #14.13.29.441 (Figure 2). The depth to the top of the aquifer at the proposed well location (14.13.19.224) should be approximately 1,400 feet below the ground surface.

Several existing wells, at Thoreau and its vicinity, that penetrate the San Andres-Glorieta aquifer yield from a minimum of 10 gpm to a maximum of 50 gpm. In the author's opinion the aquifer in the area is capable of producing a much higher yield than the yields in the existing wells. For instance, the Plains Escalante State well field, located a few miles west of the study area, will produce much higher yields from each of their wells than any of the existing wells in the area.

In the Grants-Bluewater area, a few miles southeast of Thoreau, the wells penetrating the aquifer yield large quantities of water for irrigation, industrial and municipal supplies. But in this area, San Andres Limestone produces more water than the underlying Glorieta Sandstone. The high production from the San Andres Limestone is because of increased secondary porosity caused by the interconnected Cavernous Zone and solution channels that result in the high transmissibilities in the aquifer. Such geologic conditions do not seem to be encountered in the study area, but it is possible that by using proper drilling methods and a careful well design the yield would increase appreciably.

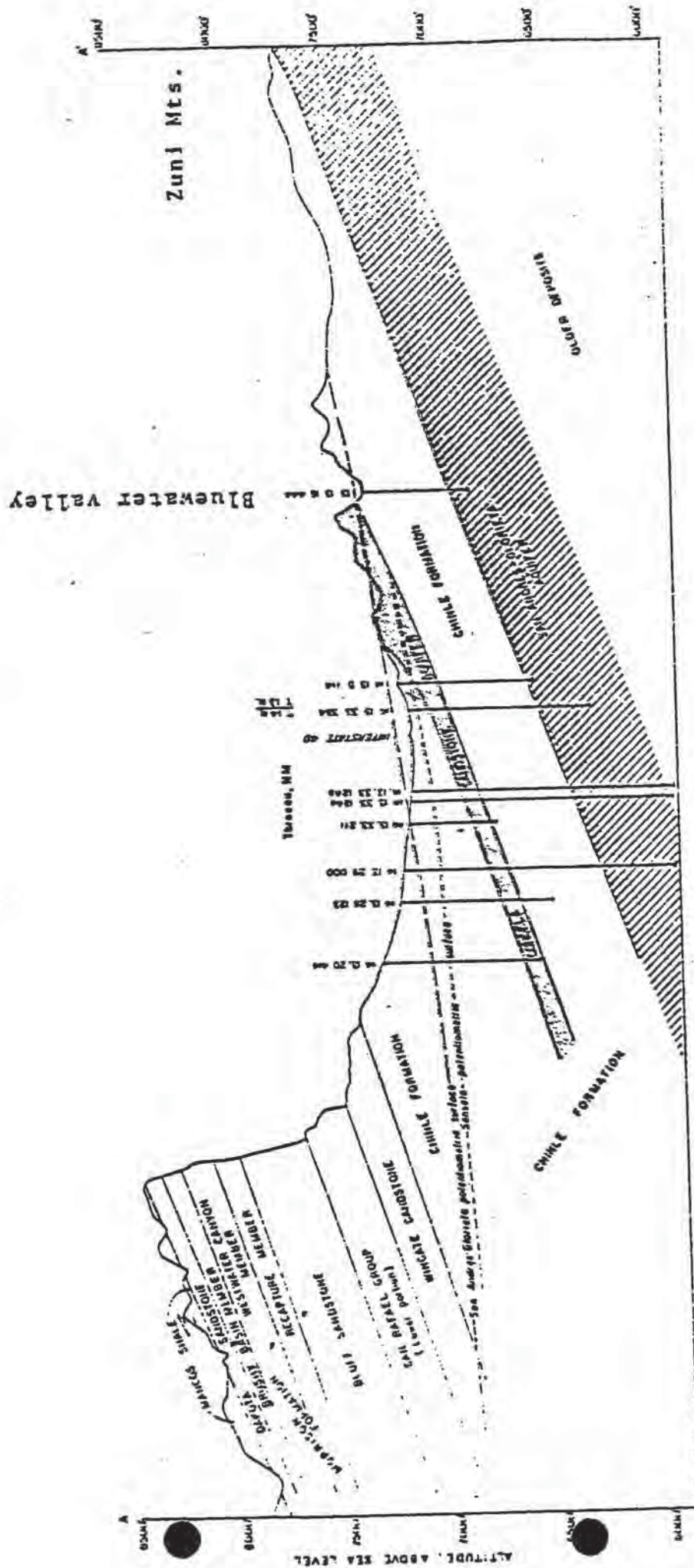


Figure 2

GEOLOGIC CROSS SECTION AT THOREAU, NEW MEXICO

(Source: Hydrologic evaluation of north flank of Zuni uplift and plan of replacement for Plains Electric Generation and Transmission, Inc., Albuquerque, New Mexico, by Tim E. Kelly, 1981.)

On a regional basis the hydraulic conductivity of the aquifer ranges between 0.05 - 150 ft./day, and the transmissivity from less than 5 to 3,740 ft.²/day. The variations may be the result of the degree of cementation in the Glorieta Sandstone. The storage coefficient ranges from 7.6×10^{-5} to 1.3×10^{-4} (source - Jobin, 1962, Cooley and others, 1969, Shomaker, 1971).

Chinle Formation: This formation unconfirmably overlies the San Andres Limestone or at places directly over the Glorieta Sandstone. The formation is composed of shale, siltstone, mudstone and sandstone sequence and acts as a confining layer. The Sonsela Sandstone in the middle part of the Chinle Formation is a persistent aquifer and yields water to several existing wells at Thoreau and in the vicinity of the study area. The water in this sandstone is under artesian pressure due to its exposure (recharge area) in the higher altitude on the north flank of the Zuni uplift. The water, under artesian pressure, does not flow to the surface but rises some distance above the top of the aquifer. A yield of up to 30 GPM is reported but 5-20 GPM is normally obtained from this aquifer. The chemical quality of water is good to fair but deteriorates away from the recharge area.

CONCLUSION

1. Approximately 150 gallons per minute production is required to maintain an adequate supply of water to serve the consolidated West Thoreau, John Willie Camp and Thoreau Chapter "Iron" systems and the future east-northeastward extension of the Thoreau Chapter "Iron" System to connect several Navajo homes in the area.
2. Because of an unknown solid obstruction at the 950 feet depth and radionuclide contamination in the water, the existing West Thoreau Well #16T-350 is not to be used for domestic water. The well will be replaced by drilling a new well approximately 1,750 feet deep at the proposed location near John Willie Camp.
3. The existing John Willie Camp Well #16T-529, that produces about 20 GPM and presently supplies water to NTUA John Willie Camp System would be used as a standby water source after the new well is drilled and hooked up to the consolidated system. The static water level in Well #16T-529 may be effected by the high production rate of the proposed well and due to short distance (0.6 mile) between the two wells (Figure 1) but the effect will be tolerable due to standby status of 16T-529. Moreover both wells will be maintained and operated by the same agency.
4. The nearest existing well that produces from the San Andres-Glorieta aquifer is the Transwestern Pumping Station Well #14.13.20.432. This well is about 1,300 feet deep and is located approximately one mile southeast of the proposed well. The Transwestern well, being located up the dip, will not be influenced from the production of the proposed well. The other existing wells (McKinley County School, BIA School, City of Thoreau and El Paso Pumping Station wells) in the area are located farther south and southeast (1.75 - over 2 miles) of the proposed well location and would be completely out of the influence zone.

5. The Plains Escalante State well field is located a few miles west of Thoreau and their second well field is located southeast of Thoreau near Prewitt. These fields penetrate the San Andres-Glorieta aquifer, from which Plains wants to withdraw approximately 7,000 acre-feet of water per year. The water will be used for the power generating station now under construction near Prewitt, and Plains has applied to the New Mexico State Engineer for the allocation of said amount. Along with the application, Plains also submitted a plan of replacement for about 50 existing wells (including Well #16T-350) expected to be effected by the withdrawal of 7,000 acre-feet of water from the Gallup basin. In the author's opinion, since Well #16T-350, due to unavoidable circumstances, is being replaced by drilling a new well in the general area, the new well, if effected by Plain's activities, must be included in their plan of replacement because this well will be the major source of ground water to maintain the aforementioned water system in the area.

RECOMMENDATIONS

1. Drill a 12.25 inch diameter hole from the surface to 1,400 feet ± 50 ft., to the bottom of the Chinle Formation, run E-logs (sp., resistivity, gamma-ray and Caliper) for the record, encase the hole with 8 5/8-inch O.D. casing and seal off the entire Chinle Formation by cement grouting the outside of the casing.
2. Drill a 7 7/8-inch diameter hole from 1,400 feet to total depth (approximately 1,750 feet) or until the total thickness of the San Andres-Glorieta aquifer is penetrated. Drilling should be suspended as soon as soft, white, gypsum fragments become abundant.
3. Run sp, resistivity, gamma-ray and neutron porosity logs for well design.
4. Case bottom portion with 6 5/8-inch O.D., perforated casing if necessary; otherwise leave the hole open.
5. Develop the well by using water jetting tools until the well is cleared from mud and drill cuttings.
6. Pump test the well and collect water samples for complete chemical and radionuclide analyses.
7. Chlorinate the well.

SELECTED REFERENCES

1. Cooper, J.B., 1968, Technical Report 35, Geology and Ground Water Occurance in Southeastern McKinley County, New Mexico.
2. Cooley, M.E., 1959, Triassic Stratigraphy in the State-line Region of West Central New Mexico and East Central Arizona, in New Mexico Geol. Soc. Guidebook, 10th field conference.

3. Gordon E.D., 1961, Geology and Ground Water Resources of the Grants-Bluewater Area, Valancia County, New Mexico: New Mexico State Engineer Tech. Report.
4. Helpenmy, L.C., and Whitcomb, H.A., 1949, Water Supply Investigation at Baca School near Prewitt, McKinley County, New Mexico: open file report: And Water Supply Investigation at Thoreau, McKinley County, New Mexico, open file report.
5. Harohbargar, M.W., Repenning, C.A., and Irwin, J.H., 1957, Stratigraphy of Uppermost Triassic and Jurassic Rocks of the Navajo County: U.S.G.S. Prof. Paper 291.
6. Hunt, C.B., 1936, Geology and Fuel Resources of the Southern Part of the San Juan Basin, New Mexico, pt. 2, The Mount Taylor Coal Field: U.S.G.S. Geol. Survey Bull. 860-B.
7. Hunt, C.B., and Dane, C.H., 1954, Map Showing Geologic Structure of the Southern Part of the San Juan Basin, including parts of San Juan, McKinley, Sandoval, Valancia, and Bernalillo Counties, New Mexico: U.S. Geol. Survey Oil and Gas investigation map OM-158.
8. Kelly, T.E., 1981, Hydrologic Evaluation of the North Flank of the Zuni Uplift, West Central New Mexico, and Plan of Replacement for Plains Electric Generation and Transmission Cooperative, Inc., Albuquerque, New Mexico.
9. Kelley, V.C., 1950, Regional Structure of the San Juan Basin, San Juan Basin, New Mexico and Colorado: New Mexico Geol. Soc. Guidebook, 1st Field Conference.
10. Smith, C.T., 1954, Geology of Thoreau Quadrangle, McKinley and Valancia Counties, New Mexico: New Mexico Inst. Min. Tech., State Bur. Mines and Mineral Resources Bull. 31.
11. Shomaker, J.W., 1971., Water Resources of Fort Wingate Army Depot and Adjacent Areas, McKinley County, New Mexico: U.S.G.S., open field report.
12. West, S.W., 1957, Interim Report on Water Wells, Gallup, New Mexico: U.S.G.S.

Maps / Photographs



NTUA WELL - WEST THOREAU
TRIBAL # 16T-614

6/8/93



NTUA - WEST THOREAU
16T-614

6/8/93



Date Photo Was Taken UNIA.

4754 15 NE
CONTINENTAL D

1924

1923

1922

4754 15 NE
CONTINENTAL D

1600 000
FEET

T. 14 N.

T. 13 N.

1919

045014
NTUA

Radio Tower
Pumping Sta

330

PIPELINE

LANDING STRIP

40

66

BM 7139

Thoreau

33

ATCHISON

TOPEKA

PIPELINE

WT

Pumping Sta

6

5

4

3

Well Logs /Diagrams

WELL 16 T-614

WEST THOREAU, N.M.

LOCATION 14.13.19.224

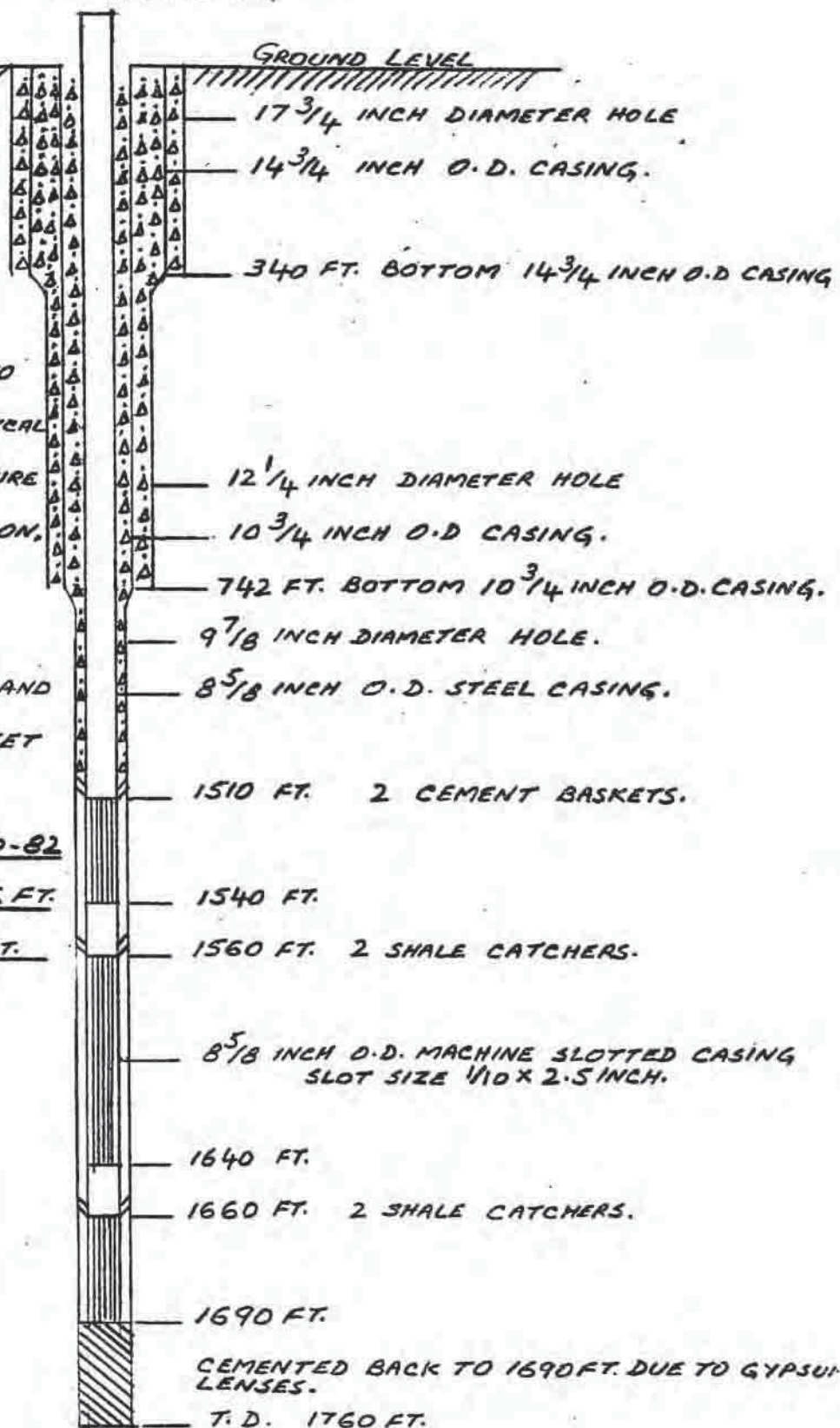
NOTE: BECAUSE OF
HEAVY SHALE CAVING A
10³/₄ INCH O.D. LINER WAS
PLACED FROM 742 FEET TO
SURFACE. THE LINER'S VERTICAL
SEAM PARTED UNDER PRESSURE
DURING GROUTING OPERATION,
HENCE DECIDED TO LINE
THE ENTIRE HOLE WITH
8⁵/₈ INCH O.D. CASING AND
CEMENT FROM 1510 FEET
TO SURFACE.

WELL COMPLETED: 10-20-82

STATIC WATER LEVEL: 286 FT.

AQUIFER: GLORIETA S.S.T.

MASUD ZAMAN



Well Records / Schedules

DISTRICT: CROWNPOINT

		BEFORE	AFTER
LOCATION: West Thoreau	INTUA WELL NO.	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Tribal Well No.	16T-614	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Well Elevation	7377 ft.	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Motor	Franklin 15hp 460v 3phase		Franklin 40hp 460v 3phase
Pump Cable Size	6/3 JAC		#4 Flat 700 ft. 150 ft. round
Pump	NN65-14		Crown S6-100 15A Stage Serial 1260
Total Depth	1690 ft.		1690 ft.
Casing	8 5/8 in.		8 5/8 in.
Pump Setting	798 ft.		798 ft.
Pumping Level			480 ft. at 28 gpm
Drop Pipe Size	3in. x 21ft. 798 ft.		3in. x 21ft. 798 ft.
Probe Pipe Size	3/4in. x 21ft. 693 ft.		3/4in. x 21ft. 588 ft.
Lower Probes (RED)	788 ft.		788 ft. (red-high probes)
Higher Probes (BLACK)	688 ft.		688 ft. (black)
Static Water Level	292 ft. (2-84)		
Gallons Per Minute	56 gpm		30 gpm
Total Dynamic Head-TDH	722 ft.		
DATE INSTALLED:	October 1982		June 22, 1992

COMMENTS:

Storage Tank - Gallons		Amps: A-29 B-28	Hour Meter:
		Volts: AB-235	Water Meter:
Diameter-			Counter Meter:
Base Elevation			Volts:
Overflow Elevation			Amps:

62

WELLNO	=16T-614
EAST	=749895 749900
NORTH	=3924670 3924380
ZONE	=12
ACRE/10	=SE
ACRE/40	=NE
ACRE/160	=NE
SECTION	=19
TOWNSHIP	=T14. ON
RANGE	=R13. OW
QUADNO	=000
MILESW	=00.00
MILESS	=00.00
APPROX-LOCAT	=0.6 MI ESE OF 16T-529 JV CAMP WELL
WATERSHED	= 13020207
COUNTY	=MK
GD	=16
CHAPTER	=THOR
CHECKED-BY	= B
CHECKED-DATE	= 5/28/87
OPERATOR	=NTUA
DRILLED-BY	=NECA
COMPLETED	=10/20/82
ELEVATION	= 7375.0
DEPTH	= 1690.0
AQUIFER	=310GLRT
SWL	= 286.0
DATE	=10/20/82
CASING-DIA-1	=14.75 8"
YIELD	= 0.0
YIELD-DATE	= 1/ 1/1801
IMPROVEMENTS	=TA-WL
LIFT	=SU
ENERGY	=EM
PUMP-HP	=0040
STORAGE	=000000
PWSID	=NM00000303
NO-HOMES	= 0
POP	= 0
CATTLE	=000
HORSES	=000
SHEEP/GOATS	=000
CORN	=000
ALFALFA	=000
GRAIN	=000
GARDEN	=000
ORCHARD	=000
WELLTYPE	=WW
WELLUSE	=MUN DOM
WELLSTATUS	=ACT
WELLNAME	=14.13.19.224 WEST THOREAU
DATA-SOURCE	=WELL FILES/7.5 USGS QUAD FIELD CHECK
ANNUAL-USE	= 0.0
STATUS	=TNT
USGSQ	=5563
QUADNAME	=THOREAU

ent'd
SEP 28 1990
HSR 10 and L/S
J. B. J.

Well Schedule

1. Water Inventory I.D. or R.G. Number 16T-614 Date Inspected 5-28-87
2. Owners Name NAVAJO TRIBE - NTUA
3. Address NAVAJO NATION
- A. Priority Date _____
- B. Location SE 1/4, NE 1/4, NE 1/4 Section; 19 Township 14 North, Range 15 West
Projected, Being within the _____ Grant.
U.S.G.S. Quad Name THOREAU S.E.O. Quad I.D. # _____
Being within MCKINLEY County, New Mexico
- C. Source of water; Shallow Ground LL Artesian _____
Triburary to Rio Grande Stream System.
- D. Driller NECA Topography Hill Elev. 7375
Well used for; Domestic
Casing Size 8" Equipment: Pump Sub
Power Electric Discharge Measurement _____ G.P.M.
Comments: Active *Emery Chagg*

Location Map



Well Photo



— EMERY CHAGG
5-28-87

TRIBAL WELL NO >16T-614

PWSID >NM 0000303
STATE NUMBER

WELL NAME/OTHER NO >14.13.19.224 WEST THOREAU

WELL TYPE >WW

WELL STATUS ACT

WELL USE >MUN

QUAD NO >000 MILES WEST > 0.00 MILES SOUTH > 0.00

10 ACRE >SE 40 ACRE >NE 160 ACRE >NE SECT >19 TOWNSHIP >T14.0N RANGE >R13.0W

APPROXIMATE LOCATION *.10 mi. N.W. of RADIO TOWER*
>~~6 MI ESE OF 16T 529 JV CAMP WELL~~

UTM COORD: X(EAST) >749900 Y(NORTH) >3924380 ZONE >12 OPERATOR >NTUA

WATERSHED CODE >13020207 STATE >NM COUNTY >MK CHAPTER CODE >THOR

GRAZING DISTRICT >16

LOCATION DATA SOURCE >WELL FILES/7.5 USGS QUAD

FIELD CHECKED BY >J.BEKIS 05/87

C. NOTAM 6/8/93

WELLNO 16T-614

STARTED 10/ 0/1982

COMPLETED 10/20/1982

ELEVATION *7,377.0*
~~7,375.0~~ FT DEPTH 1,690.0 FT DEPTH MEASURED 10/20/1982

DEPTH IS M

WELL DIA 9.87 IN

1 CASING DIA 14.75 IN	FROM	0.0 FT TO	340.0 FT	MATL STL
2 CASING DIA 10.75 IN	FROM	0.0 FT TO	742.0 FT	MATL STL
3 CASING DIA 8.62 IN	FROM	0.0 FT TO	1,690.0 FT	MATL STL
4 CASING DIA 0.00 IN	FROM	0.0 FT TO	0.0 FT	MATL

WELL NO= 16T-614

1 CASING PERFORATED FROM 1,510.0 FT	TO 1,540.0 FT	OPENING TYPE P
2 CASING PERFORATED FROM 1,560.0 FT	TO 1,640.0 FT	OPENING TYPE P
3 CASING PERFORATED FROM 1,660.0 FT	TO 1,690.0 FT	OPENING TYPE P
4 CASING PERFORATED FROM 0.0 FT	TO 0.0 FT	OPENING TYPE
5 CASING PERFORATED FROM 0.0 FT	TO 0.0 FT	OPENING TYPE

DATE WELL TURNED OVER TO TRIBE 0/ 0/ 0

FUNDED BY IHS

CONTRACTOR NECA

SITE IMPROVEMENTS TA-WL

TYPE OF LIFT SU

ENERGY SOURCE EM

PUMP HP ¹⁵~~40~~ ON SITE STORAGE CAPACITY 0
STRUCTURE DATA SOURCE WELL FILES

TRIBAL WELL NO >16T-614 < USGS AQUIFER CODE >310GLRT <

THICKNESS > 0.0< NOMINAL YIELD > 30.0< DATE YIELD MEASURED > ~~01/01/80~~ ^{6/22/93}

ENTER BT OR PT >PT< GPM > 100.0< HOURS > 22.0< TEST DATE >11/ 9/1982

DRAWDOWN > 488.0< OBSERVATION WELL DATA AVAILABLE (ENTER Y OR N) >N<

HORIZONTAL CONDUCTIVITY > 0.000< SPECIFIC CAPACITY >0.00<

VERTICAL CONDUCTIVITY > 0.000< STORAGE COEFFICIENT >.0000000

COEFFICIENT OF TRANSMISSIVITY > 118.0<

* AVAILABILITY OF TEST DATA *
>N< MULTIPLE RATE DRAWDOWN TEST
>Y< SINGLE RATE DRAWDOWN TEST
>N< MULTIPLE RATE/RECOVERY TEST
>Y< RECOVERY TEST

* LOGS AVAILABLE * (ENTER DL OR EL)
> < DRILLERS LOG >EL< ELECTRIC LOG
DATA SOURCE > <

\$RECNO	WELLNO	SWL DATE
15191	16T-614	285.0 11/ 9/1982
15192	16T-614	286.0 10/20/1982

...no geologic interval data available

...no field water quality data available

TOTAL DEPTH OF THE WELL WAS 1760 FT/SEALED BACK TO
1690 FEET DUE TO GYPSUM LENSES/WELL DIAMETER 17.75"
FROM 00 TO 340 FEET AND INSTALLED 14.75" OD SURFACE
CASING AND CEMENTED/DRILLED 12.25" HOLE 340 FEET TO 742
FEET/INSTALLED 10.75" LINER AND CEMENTED TO AVOID SHALE
CAVING.../DRILLED 9.87 DIA HOLE AND INSTALLED 8.62"
O.D. PRODUCTION CASING/COMPLETE CHEMICAL/RADIOLOGICAL
ANALYSIS OF WATER IS ON FILE.....M.Z.
RIO SAN JOSE HSR ID NW-018--LAND STATUS=TNT

UPDATED OCT 13 1986
ENTERED OCT 13 1986

PWSID [N]M]0]0]0]0]3]0]3]

WELL USE
(MARK ONE ONLY)

() DOM DOMESTIC
() AGR AGRICULT.
(X) LIV LIVESTOCK
() IND INDUSTRIAL
MINING
() REC RECREATION
(X) MUN MUNICIPAL
() OTH OTHER

form:well record loc

ENTERED OCT 13 1986

STRUCTURE FILE COMPLETED BY: m. z. DATE 9/25/1986
rev:840426 form: well record str

ENTERED OCT 13 1986

SADR

() BAILER (☒) PUMP TEST @ [1] [100] GPM FOR [2] [2] . [0] HOURS DATE 11/9/1982
Pump set at 1000.8 feet bgl.

COEF OF TRANSMISSIVITY [] [] [] [] [] [] FT2/DAY 880 GPD/FT.

(✓)Y ()N RECOVERY TEST

HYDROLOGY FILE COMPLETED BY: *m. z.* DATE *9/25/1986*

SW. DEPTH TO SWL 286 FT DATE 10/20/1982 DEPTH TO SWL _____ FT DATE ____/____/____
ENTERED OCT 13 1985

DEPTH TO SWL FT DATE / / DEPTH TO SWL FT DATE / /

form: well record hyd

8570
24
2

TRIBAL WELL RECORD
COMMENTS FILE

TRIBAL WELL NO V6V7-V6V4 11111

PERTINENT

COMMENTS: (X) Total depth of the well was 1760 feet, sealed back
to 1690 feet due to Gypsum lenses.

XX Well diameter 17.75 inch From 00 to 340 feet and installed
14.75 inch o.d. surface casing and cemented.

— Drilled 12.25 inch hole 340 feet to 742 feet, installed
10.75 inch liner and cemented to avoid shale caving.

— Drilled 9.87 inch diameter hole and installed 8.62 inch
o.d. production casing.

Complete chemical/radiological analyses of water available on file. M.Z.

ENTERED OCT 13 1986 *for.*

TRIBAL WELL RECORD
LOCATION FILE

update ✓
UPDATED MAY 09 1994

TRIBAL WELL NO 167-614

PWSID NM3500303

WELL NAME/OTHER NO WEST THOREAU

WELL TYPE
(MARK ONLY ONE)

- ☒ WW WATER WELL
☐ WA ARTESIAN WELL
☐ WS SPRING
☐ NS NATURAL SPRING
☐ OW OBSERVATION WELL
☐ GS GAS WELL
☐ OP OIL PRODUCTION
☐ MW MINERAL WELL
☐ XX UNKNOWN

WELL STATUS
(MARK ONLY ONE)

- ☒ ACT ACTIVE
☐ INA INACTIVE
☐ ABA ABANDONED
☐ UNK UNKNOWN

WELL USE
(MARK ONLY ONE)

- ☐ DOM DOMESTIC
☐ AGR AGRICULTURE
☐ LIV LIVESTOCK
☐ IND INDUSTRIAL MINING
☐ REC RECREATION
☒ MUN MUNICIPAL
☐ OTH OTHER
☐ UNK UNKNOWN

QUAD NO 5563

MILES WEST

MILES SOUTH

NE SE SW NW / NE SE SW NW / NE SE SW NW
10 ACRE 40 ACRE 160 ACRE

SECT.

T TOWNSHIP

R RANGE

APPROXIMATE LOCATION 180 mi NW OF RADIO TOWER

LATITUDE

LONGITUDE

UTM COORDINATES: X(EAST) 749900

Y(NORTH) 3924380

ZONE 12

OPERATOR MTUA

USGS WATERSHED CODE 13020207000

STATE: ☐ AZ ARIZONA

☒ NM NEW MEXICO

☐ UT UTAH

☐ CO COLORADO

COUNTY: ☐ AP APACHE

☒ MK MCKINLEY

☐ SJ SAN JUAN

☐ MT MONTEZUMA

☐ NA NAVAJO

☐ VL VALENCIA

☐ KA KANE

☐ LP LA PLATA

☐ CO COCONINO

☐ BL BERNALLILLO

☐ SD SANDOVAL

☐ SO SOCORRO

☐ RA RIO ARRIBA

☐ SA SAN JUAN

GRAZING DISTRICT 16

CHAPTER NAME: THOREAU

CHAPTER CODE THOR

LOCATION DATA SOURCE: FIELD CHECKED

LOCATION FILE COMPLETED BY: L. NOTAH

FIELD CHECKED BY: L. NOTAH

revised 07 April 93

DATE 9/1/93

DATE 6/1/93

/dbase/wells/doc/Loc-Form.w

TRIBAL WELL RECORD STRUCTURE FILE

update
UPDATED MAY 09 1994

TRIBAL WELL NO 16T-614

STARTED 10/1/1982 COMPLETED 10/20/1982

ELEVATION 7377

FT DEPTH 1690

DEPTH MEASURED 10/20/1982

DEPTH IS ☒ MEASURED

☐ ESTIMATED

☐ REPORTED

WELL DIA. 9.87 IN

1 CASING DIA	<u>14.75</u>	FROM	<u>0</u>	FT	TO	<u>340</u>	FT	MATL	<u>STL</u>
2 CASING DIA	<u>10.75</u>	FROM	<u>0</u>	FT	TO	<u>742</u>	FT	MATL	<u>STL</u>
3 CASING DIA	<u>8.62</u>	FROM	<u>0</u>	FT	TO	<u>1690</u>	FT	MATL	<u>STL</u>
4 CASING DIA	<u> </u>	FROM	<u> </u>	FT	TO	<u> </u>	FT	MATL	<u> </u>

CASING MATL CODES: brs=brass cop=copper evd=everdur irn=iron mon=monel
pls=plastic stl=steel sst=stainless steel

1 CASING PERFORATED FROM	<u>1510</u>	FT	TO	<u>1540</u>	FT	OPENING TYPE	<u>P</u>
2 CASING PERFORATED FROM	<u>1560</u>	FT	TO	<u>1640</u>	FT	OPENING TYPE	<u>P</u>
3 CASING PERFORATED FROM	<u>1660</u>	FT	TO	<u>1690</u>	FT	OPENING TYPE	<u>P</u>
4 CASING PERFORATED FROM	<u> </u>	FT	TO	<u> </u>	FT	OPENING TYPE	<u> </u>
5 CASING PERFORATED FROM	<u> </u>	FT	TO	<u> </u>	FT	OPENING TYPE	<u> </u>

OPENING CODES: f=fractured rock l=louvered/shutter-type screen m=mesh screen
p=perforated/porous/slotted casing r=wire-wound screen
s=screen/type unknown t=sand point w=walled/shored x=open hole
z=other

DATE WELL TURNED OVER TO TRIBE: / /

FUNDED BY: ZHS

CONTRACTOR: NECA

SITE IMPROVEMENTS

- ☐ WM WINDMILL
- ☐ WP WATERING POINT
- ☐ TA TANK
- ☒ WL WATER LINE
- ☐ TR TROUGH
- ☐ CS CISTERN
- ☐ HP HAND PUMP
- ☐ NO NONE

X PUMP HOUSE
X WELL HEAD

PUMP HP 15

TYPE OF LIFT

- ☐ AL AIRLIFT
- ☐ PS PISTON
- ☐ TU TURBINE
- ☐ MT MULTIPLE TURBINE
- ☐ CN CENTRIFUGAL
- ☐ MC MULTIPLE CENTRIFUGAL
- ☐ BU BUCKET
- ☒ SU SUBMERSIBLE

ENERGY SOURCE

- ☒ EM ELECTRIC MOTOR
- ☐ DE DIESEL ENGINE
- ☐ HA HAND
- ☐ GS GAS ENGINE
- ☐ LP LP GAS ENGINE
- ☐ NG NATURAL GAS ENGINE
- ☐ WM WINDMILL
- ☐ SO SOLAR

ON SITE STORAGE CAPACITY GAL

STRUCTURE DATA SOURCE: WELL FILE/NTUA FILE

STRUCTURE FILE COMPLETED BY: L. NOTAH
revised 08 April 93

DATE 9/1/93
/dbase/wells/doc/Str-Form.wp

TRIBAL WELL RECORD HYDROLOGY FILE

UPDATED ^{update} MAY 09 1994

TRIBAL WELL NO 167-614

USGS AQUIFER CODE 310GLRT

THICKNESS FT NOMINAL YIELD 30 GPM YIELD MEASURED 6/22/1992

☐ BAILER ☒ PUMP TEST @ 100 GPM FOR 22.0 HOURS DATE 11/9/1982

DRAWDOWN 488 FT OBSERVATION WELL DATA AVAILABLE ☐ YES ☒ NO

HORIZ CONDUCTIVITY FT/DAY SPECIFIC CAPACITY GPM/FT

VERT. CONDUCTIVITY FT/DAY STORAGE COEF

COEF OF TRANSMISSIVITY 1/18 FT²/DAY

INDICATE ADDITIONAL PUMPING TEST DATA AVAILABLE AS HARD COPY:

- ☐ YES ☐ NO MULTIPLE RATE DRAWDOWN PUMPING TEST
- ☒ YES ☐ NO SINGLE RATE DRAWDOWN PUMPING TEST
- ☐ YES ☐ NO MULTIPLE RATE DRAWDOWN/RECOVERY TEST
- ☒ YES ☐ NO RECOVERY TEST

LOG AVAILABLE: ☐ DL DRILLER'S ☒ EL ELECTRIC LOG

HYDROLOGY DATA SOURCE: WELC FILE/L. NOTAH

HYDROLOGY FILE COMPLETED BY: L. NOTAH DATE 9/15/93

ENTERED MAY 09 1994

STATIC WATER LEVEL FILE

✓ DEPTH TO SWL <u>286</u> FT DATE <u>10/20/1982</u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
✓ DEPTH TO SWL <u>285</u> FT DATE <u>11/9/1982</u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
new enter DEPTH TO SWL <u>292</u> FT DATE <u>2/1/1984</u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>
DEPTH TO SWL <u> </u> FT DATE <u> / / </u>	DEPTH TO SWL <u> </u> FT DATE <u> / / </u>

TRIBAL WELL RECORD GEOHYDROLOGIC UNITS

TRIBAL WELL NO

SEQ-NO
DEPTH TO TOP

DEPTH TO BOTTOM

GEOHYDRO-UNIT

LITH.

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE ☐

SEQ-NO
DEPTH TO TOP

DEPTH TO BOTTOM

GEOHYDRO-UNIT

LITH.

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE ☐

SEQ-NO
DEPTH TO TOP

DEPTH TO BOTTOM

GEOHYDRO-UNIT

LITH.

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE ☐

SEQ-NO
DEPTH TO TOP

DEPTH TO BOTTOM

GEOHYDRO-UNIT

LITH.

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE ☐

SEQ-NO
DEPTH TO TOP

DEPTH TO BOTTOM

GEOHYDRO-UNIT

LITH.

LITHOLOGIC MODIFIER

CONTRIBUTING UNIT CODE ☐

INTERVAL FILE COMPLETED BY: _____
revised 08 April 93

DATE ____/____/____
/dbase/wells/doc/Int-Form.wp

TRIBAL WELL RECORD
COMMENTS FILE

UPDATED MAY 09 1994

TRIBAL WELL NO 167-614

PERTINENT
COMMENTS: Pitless UNIT

- ☒ LOCATION COORDINATES MEASURED WITH GPS DEVICE ☐ 6 SATELLITES VISIBLE
☐ LOCATION COORDINATES PICKED OFF TOPO MAP -SCALE=
☐ ELEVATION PRINTED ON TOPO MAP -SCALE=
☐ ELEVATION MEASURED WITH GPS UNIT -4 SATELLITES VISIBLE
☒ ELEVATION INTERPOLATED FROM 1:24000 TOPO

THE IMPROVEMENTS AT THIS SITE ARE:

- ☒ IN GOOD CONDITION ☐ NEED SOME MAINTENANCE
☐ IN FAIR CONDITION ☐ NEED MAJOR MAINTENANCE
☐ IN POOR CONDITION
STORAGE TANK IS ☒ COVERED ☐ UNCOVERED

COMMENTS BY: L. NOTAH
revised 07 April 93

DATE 9/1/93
/dbase/wells/doc/Com-Form.w2

updated
SEP 27 1990
Jozug

TRIBAL WELL RECORD
LOCATION FILE

TRIBAL WELL NO [11671-16114] [] [] []

PWSID WIM000003013

WELL NAME/OTHER NO [114] [113] [110] 1234 W THH0100041 [] [] []

WELL TYPE
(MARK ONE ONLY)

☒ WW WATER WELL
☐ WA ARTESIAN WELL
☐ WS SPRING
☐ OW OBSERVATION WELL
☐ GS GAS WELL
☐ OP OIL PRODUCTION
☐ MW MINERAL WELL
☐ XX UNKNOWN

WELL STATUS
(MARK ONE ONLY)

☒ ACT ACTIVE
☐ INA INACTIVE
☐ ABA ABANDONED
☐ UNK UNKNOWN

WELL USE
(MARK ONE ONLY)

☒ DOM DOMESTIC
☐ AGR AGRICULT.
☐ LIV LIVESTOCK
☐ IND INDUSTRIAL
MINING
☐ REC RECREATION
☒ MUN MUNICIPAL
☐ OTH OTHER
☐ UNK

QUAD NO [] [] []

MILES WEST [] [] [] []

MILES SOUTH [] [] [] []

NE SE SW NW/NE SE SW NW/NE SE SW NW [114] [114.W] [113.W]
10 acre 40 acre 160 acre SECT. TOWNSHIP RANGE

APPROXIMATE LOCATION [6M1] [E5E] [0A] [11671-1529] [N1V] [] [] []

[CAMPI] [WEL4] LATITUDE [] [] [] [] [] LONGITUDE [] [] [] [] [] []

UTM COORDINATES: X(east) [7499900] Y(north) [39214380] ZONE [12]

OPERATOR [NTLHA] [] [] [] [] USGS WATERSHED CODE [11301201207] [] []

STATE: ☐ AZ ARIZONA ☒ NM NEW MEXICO ☐ UT UTAH ☐ CO COLORADO

COUNTY: ☐ AP APACHE ☒ MK MCKINLEY ☐ SJ SAN JUAN ☐ MT MONTEZUMA
☐ NA NAVAJO ☐ VL VALENCIA ☐ KA KANE ☐ LP LA PLATA
☐ CO COCNINO ☐ BL BERNALLILLO

☐ SD SANDOVAL
☐ SO SOCORRO
☐ RA RIO ARRIBA
☐ SA SAN JUAN

GRAZING DISTRICT [116]

CHAPTER NAME THOR CHAPTER CODE [] [] [] []

LOCATION DATA SOURCE: WELL FILES/17.5 145151 QUAD1

LOCATION FILE COMPLETED BY: JB DATE 5/28/87

FIELD CHECKED BY: [J.] [B.] [K.] [S.] [S.] [1871] [] [] DATE 5/28/87

TRIBAL WELL RECORD
STRUCTURE FILE

WELL NO [] [] [] [] [] [] [] [] [] [] [] STARTED ___ / ___ / ___ COMPLETED ___ / ___ / ___

ELEVATION 713.75 FT DEPTH FT DEPTH MEASURED / /

DEPTH IS () MEASURED () ESTIMATED () REPORTED WELL DIA. [] [] [] IN

1 CASING DIA [] [] . [] [] FROM [] [] [] [] FT TO [] [] [] [] FT MATL [] [] []

2 CASING DIA [] [] . [] [] FROM [] [] [] FT TO [] [] [] [] FT MATL [] [] []

3 CASING DIA [] [] . [] [] FROM [] [] [] [] FT TO [] [] [] [] FT MATL [] [] []

4 CASING DIA [] [] . [] [] FROM [] [] [] [] FT TO [] [] [] [] FT MATL [] [] []

casing matl codes brs=brass cop=copper evd=everdur irn=iron mon=monel
pls=plastic stl=steel sst=stainless steel

1 CASING PERFORATED FROM [] [] [] [] FT TO [] [] [] [] FT OPENING TYPE []

2 CASING PERFORATED FROM [] [] [] [] FT TO [] [] [] [] FT OPENING TYPE []

3 CASING PERFORATED FROM [] [] [] [] FT TO [] [] [] [] FT OPENING TYPE []

4 CASING PERFORATED FROM [] [] [] [] FT TO [] [] [] [] FT OPENING TYPE []

5 CASING PERFORATED FROM []]]]] FT TO []]]]] FT OPENING TYPE []

opening codes: f=fractured rock, l=louvered or shutter-type screen,
m=mesh screen, p=perforated, porous, slotted casing, r=wire-wound screen
s=screen, type unknown, t=sand point, w=walled or shored, x=open hole
z=other

DATE WELL TURNED OVER TO TRIBE: / /

FUNDED BY: [] [] [] [] [] [] [] [] CONTRACTOR: [] [] [] [] [] [] [] [] [] [] [] [] [] [] [] [] [] []

SITE IMPROVEMENTS

() WM WINDMILL
() WP WATERING POINT
(X) TA TANK
(X) WL WATER LINE
() TR TROUGH
() CS CISTERN
() HP HAND PUMP
() NO NONE

TYPE OF LIFT

() AL AIRLIFT
() PS PISTON
() TU TURBINE
() MT MULTIPLE
TURBINE
() CN CENTRIFUGAL
() MC MULTIPLE
CENTRIFUGAL
() BU BUCKET
(X) SU SUBMERSIBLE

ENERGY SOURCE

() EM ELECTRIC MOTOR
() DE DIESEL ENGINE
() HA HAND
() GS GAS ENGINE
() LP LP GAS ENGINE
() NG NATURAL GAS ENGINE
() WM WINDMILL
() SO SOLAR

PUMP HP ON SITE STORAGE CAPACITY GAL

[illegible]

STRUCTURE FILE COMPLETED BY: _____ DATE __/__/__
rev:840426 form: well record str

TRIBAL WELL RECORD
HYDROLOGY FILE

WELL NO [] [] [] [] [] [] [] [] [] [] USGS AQUIFER CODE [] [] [] [] [] [] [] []

THICKNESS [] [] FT NOMINAL YIELD [] [] [] GPM YIELD MEASURED _ / _ / _

() BAILER () PUMP TEST @ [] [] [] GPM FOR [] [] [] . [] HOURS DATE _ / _ / _

DRAWDOWN [] [] [] [] FT OBSERVATION WELL DATA AVAILABLE () YES () NO

HORIZ CONDUCTIVITY [] [] [] . [] [] [] FT/DAY SPECIFIC CAPACITY [] . [] [] GPM/FT

VERT. CONDUCTIVITY [] [] [] . [] [] [] [] FT/DAY STORAGE COEF [.] [] [] [] [] [] []

COEF OF TRANSMISSIVITY [] [] [] [] [] [] [] [] FT²/DAY

INDICATE ADDITIONAL PUMPING TEST DATA AVAILABLE AS HARD COPY:

()Y ()N MULTIPLE RATE DRAWDOWN PUMPING TEST

()Y ()N SINGLE RATE DRAWDOWN PUMPING TEST

()Y ()N MULTIPLE RATE DRAWDOWN/RECOVERY TEST

()Y ()N RECOVERY TEST

LOGS AVAILABLE: ()DL DRILLER'S LOG ()EL ELECTRIC LOG

[illegible]

HYDROLOGY FILE COMPLETED BY: _____ DATE / /

STATIC WATER LEVEL FILE

[illegible]

TRIBAL WELL RECORD
COMMENTS FILE

TRIBAL WELL NO [] [] [] [] [] [] [] [] [] []

PERTINENT
COMMENTS:

rev:840430

form: well record com

Test / Production Information

DISTRICT: CHANDPOINT

WATER PRODUCTION SUMMARY
1984 TO 1995

WELL PUMPAGE 21000 GALLONS

SYSTEM LOCATION	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
CHANDPOINT 1													
158-1 ✓	448.8	15708.2	9554.9	11324.3	5263.0	14581.4	0.0	0.0	0.0	0.0	0.0	0.0	62720.8
CHANDPOINT 2													
159-2 ✓	30130.3	27429.0	31990.7	32228.7	38293.5	43565.4	0.0	0.0	0.0	0.0	0.0	0.0	203337.8
159-3 ✓	0.0	0.0	0.0	13704.6	18788.2	11417.4	0.0	0.0	0.0	0.0	0.0	0.0	43912.2
159-4 ✓	34417.1	43117.2	41147.6	37227.8	62444.7	89544.4	0.0	0.0	0.0	0.0	0.0	0.0	310370.8
THREE MILE PT 1													
151-518 ✓	2463.9	2565.2	2234.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7963.7
THREE MILE PT 2													
151-519 ✓	2678.2	2753.9	937.2	1226.5	1884.0	4705.1	0.0	0.0	0.0	0.0	0.0	0.0	13794.9
THREE MILE PT 3													
161-616 ✓	0.0	2459.0	4953.6	4879.5	9144.0	7540.3	0.0	0.0	0.0	0.0	0.0	0.0	28396.4
CHURCH ROCK 1-A													
161-534 ✓	5082.1	7278.1	7245.4	6184.0	11048.0	12245.4	0.0	0.0	0.0	0.0	0.0	0.0	49105.0
CHURCH ROCK 1-B													
161-538 ✓	8088.4	10111.2	9036.2	8434.9	9758.7	8473.4	0.0	0.0	0.0	0.0	0.0	0.0	48052.8
CHURCH ROCK 1-C													
161-539 ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHURCH ROCK 1-D													
161-540 ✓	7953.1	11044.1	9481.6	9441.9	11763.0	11471.1	0.0	0.0	0.0	0.0	0.0	0.0	61394.8
CHURCH ROCK 1-E													
161-541 ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHURCH ROCK 1-F													
161-542 ✓	2040.9	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2041.0
CHURCH ROCK 1-G													
161-543 ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHURCH ROCK 1-H													
161-544 ✓	18102.4	21175.8	18717.9	17894.8	17721.7	17894.5	0.0	0.0	0.0	0.0	0.0	0.0	111599.1
CHURCH ROCK 1-I													
161-545 ✓	2179.3	2452.9	2389.7	2521.9	3399.7	3173.7	0.0	0.0	0.0	0.0	0.0	0.0	16117.2
CHURCH ROCK 1-J													
161-546 ✓	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHURCH ROCK 1-K													
161-547 ✓	2179.3	2452.9	2389.7	2521.9	3399.7	3173.7	0.0	0.0	0.0	0.0	0.0	0.0	16117.2
CASAPETO CUP 1													
161-539 ✓	340.9	617.0	412.3	582.7	1243.2	1453.9	0.0	0.0	0.0	0.0	0.0	0.0	4650.0
CASAPETO CUP 2													
161-539 ✓	340.9	617.0	412.3	582.7	1243.2	1453.9	0.0	0.0	0.0	0.0	0.0	0.0	4650.0
MILAD SPRINGS 1													
161-598 ✓	1490.7	3746.7	0.0	2152.0	2616.6	2370.6	0.0	0.0	0.0	0.0	0.0	0.0	12390.6
MILAD SPRINGS 2													
161-598 ✓	1490.7	3746.7	0.0	2152.0	2616.6	2370.6	0.0	0.0	0.0	0.0	0.0	0.0	12390.6

(3)

NAVAJO TRIBAL UTILITY AUTHORITY

WATER PRODUCTION REPORT

REPORTING PERIOD: January '92 - December '92

DISTRICT: Ft. Defiance - Crownpoint Sub

SYSTEM	X1000 GALLONS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
BACA NM 0331	PRODUCTION	470	589	0	301	502	487	1205	463	311	186	183	335	5032
BREAD SPRINGS NM 0292	PRODUCTION	563	943	513	1110	0	618	1009	1402	939	749	605	896	9347
CASAMERO CUP NM 3060	PRODUCTION	8	13	18	13	1	11	102	29	52	30	24	24	325
CASAMERO LAKE NM 0256	PRODUCTION	381	396	379	304	908	256	461	644	427	378	307	512	5353
CHURCHROCK NM 0260	PRODUCTION	1342	1464	1131	1911	1445	1455	1643	3254	1361	523	403	770	16702
CROWNPOINT NM 3039	PRODUCTION	5100	5016	6334	5330	9601	5913	6607	10465	6277	4426	6358	3636	75063
LAKE VALLEY NM 0269	PRODUCTION	573	551	982	539	896	484	720	732	560	830	595	1139	8601
RED ROCK NM 0335	PRODUCTION	290	720	402	677	445	502	474	768	438	457	381	618	6172
SMITH LAKE NM 0211	PRODUCTION	1757	1169	1834	2100	1589	1545	1522	2624	1686	1697	1901	2972	22476
TORREON NM 3042	PRODUCTION	2031	3305	3205	2033	2622	2360	3331	3956	3253	2670	2218	2413	33397
WEST THOREAU NM 0303	PRODUCTION	1198	1546	1751	1186	1098	1038	1506	1826	1019	1265	1064	1678	16173
GRAND TOTAL	PRODUCTION	13713	15712	16549	15584	19107	14669	18580	26163	16323	13211	14039	14991	198641

SENT TO MASUD
17 MAY 84

Test Pump

Location Thoran Pump Depth 1500.8' Weather Cond. SLICKS
Well 16-T-522-614 Airline Depth N/A Total Depth 1750
Date 9 Nov 1982 Static Water Level 285 Initials _____
Casing Size (I.D.) 8 7/8 " Perforations _____ Pump 40 hp

16T-614

Elapsed Time		Increments Time	Hour of Day		Water Level Below Top of Casing (ft)	Feet of Water Above Airline psi / ft	Drawdown	Recovery	Pump Rate (gpm)
			Drawdown	Recovery					
12:16 PM	0	0			285		0.0		2285/74
	:30	:30			300				106 gpm
1:00	1	:30	✓		310		25.0	✓	280 7
1:30		:30							110
2:00	2	:30			374		89.0	✓	370 410
2:30		:30							120
3:00	3	:30			410		125.0	✓	510
3:30		:30							120 gpm
4:00	4	:30			440		155.0	✓	630
4:30		:30							115 gpm
12:21	5:00	5	:30		467		182.0	✓	745
	6:00	6	1:00		491		206.0	✓	860 115
	7:00	7	✓ 1:00		514		229.0	✓	980 120
	8:00	8	✓ 1:00		532		247.0	✓	095 195
	9:00	9	✓ 1:00		550		265.0	✓	210
12:26	10:00	10	✓ 1:00		565		280.0	✓	320
	12:00	12	✓ 2:00		590		305.0	✓	550
	14:00	14	✓ 2:00		610		325.0	✓	875
	16:00	16	✓ 2:00		626		341.0	✓	000
	18:00	18	✓ 2:00		639		354.0	✓	230
12:36	20:00	20	✓ 2:00		649		364.0	✓	445
12:41	25:00	25	5:00		671	cloudy	386.0	guy/brown	045
12:46	30:00	30	5:00		685		400.0		1615

AMSCOPE				CO ₂ volume		water	gpr
12:51 35:00 35	5:00		694	409.0	✓	231	
12:56 40:00 40	5:00		699	414.0	✓	680	
1:01 45:00 45	5:00		704	419.0	✓	190	
1:06 50:00 50	5:00		708	423.0	✓	2290 708	103.61
1:11 55:00 55	5:00		711	426.0	✓	2297 220	102.57
1:16 1:00:00 60	5:00		714	429.0		2291 745	105.91
1:21 1:05:00 65	5:00		716.3	431.0		2292 260	103.91
1:41 1:25:00 85	20:00		723.2	438.0	✓	2294 525	103.25
2:01 1:45:00 105	20:00		727.9	443.0	✓	2296 390	103.25
2:21 2:05:00 125	20:00	No M-Scope	—	H ₂ O still cloudy		2298 450	103.0
2:41 2:25:00 145	20:00		—			2300 505	102.75
3:01 2:45:00 165	20:00		—			2302 550	102.25
3:21 3:05:00 185	20:00			H ₂ O looks clear to me		2304 590	102.0 gpr
4:01 3:45:00 225	0:40:00		743	458.0	✓	2308 660	101.75
4:41 4:25:00 265	0:40:00		746	461.0	✓	231 2725	101.62
5:21 5:05:00 305	0:40:00		748	462.0		2316 288	101.5
6:21 6:05:00 365	1:00:00		751	467.0	✓	2322 580	101.59
7:21 7:05:00 425	1:00:00		755	470.0	✓	2328 989	101.37
8:21 8:05:00 485	1:00:00		755	473.0	✓	2335 088	101.65
9:21 9:05:00 545	1:00:00		759	474.0	✓	2341 195	101.72
10:21 10:05:00 605	1:00:00		761	476.0	✓	2347 302	101.75
11:21 11:05:00 665	1:00:00		763	478.0	✓	2353 396	101.57
12:21 12:05:00 725	1:00:00	REFILLER GENERATOR!	764.7	480.0		2359 488	101.53
1:13 1:05:00 785	1:00:00		765.5	481.0	✓	2365 558	101.17
2:21 14:05:00 845	1:00:00		766.7	482.0	✓	2371 626	101.13
3:21 15:05:00 905	1:00:00		767.2	482.0	✓	2377 678	100.77
4:21 16:05:00 965	1:00:00		768.3	483.0		2383 712	100.57
5:21 17:05:00 1025	1:00:00		770.1	485.0	✓	2389 638	98.77
6:21 18:05:00 1085	1:00:00		771.0	486.0	✓	2395 535	98.25

[illegible]

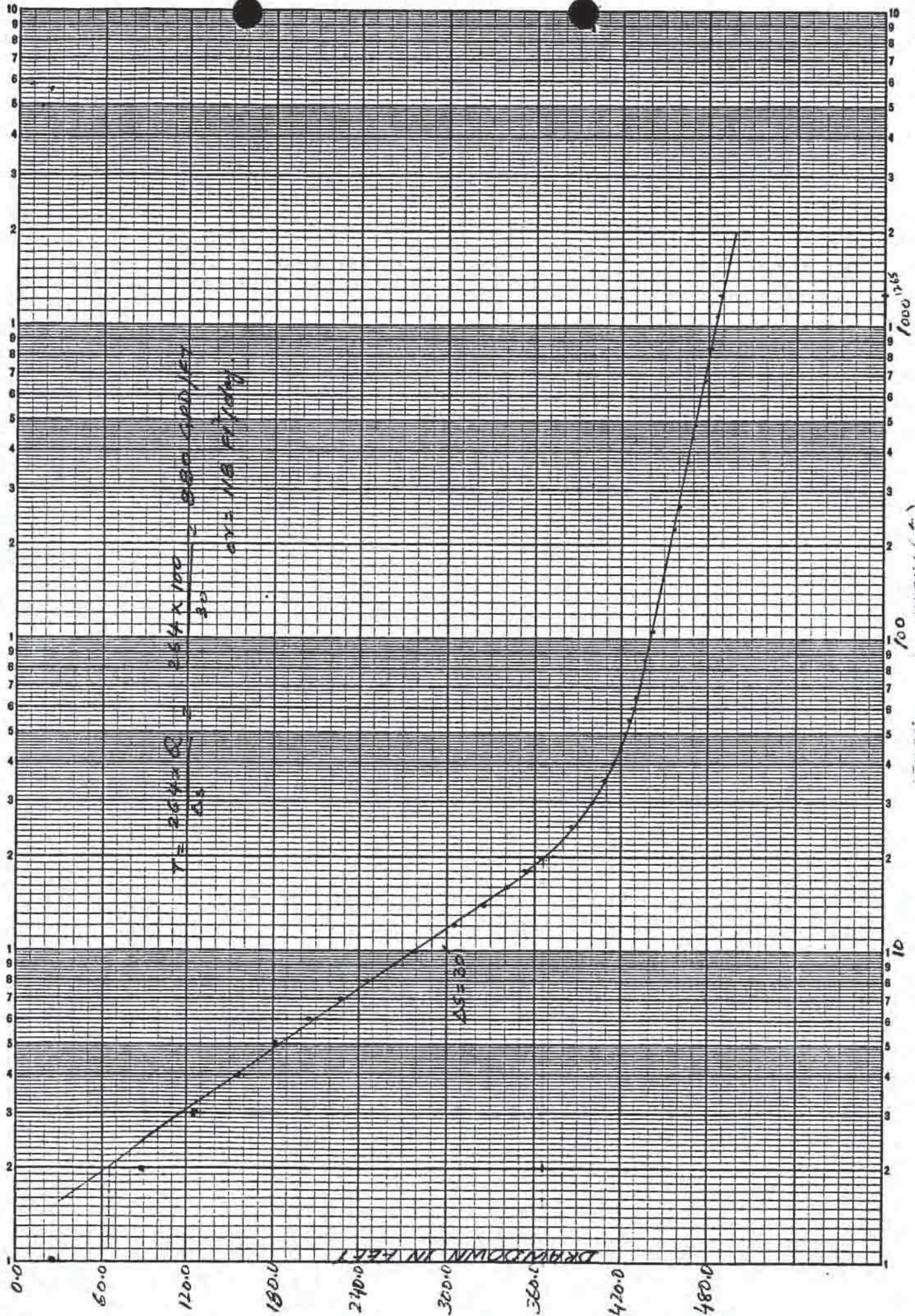
Test Pump

Location _____ Pump Depth _____ Weather Cond. _____
 Well _____ Airline Depth _____ Total Depth _____
 Date _____ Static Water Level _____ Initials _____
 Casing Size (I.D.) _____ " Perforations _____ Pump _____

Elapsed Time	Increments Time	Hour of Day		Water Level Below Top of Casing (ft)	Feet of Water Above Air-line psi / ft	Drawdown	Recovery	Pump Rate (gpm)
		Drawdown	Recovery					
2:40 0	0			747.5				2442 8:35
:30	:30			726				
1:00	:30			713				
1:30	:30			688				
2:00	:30			675				
2:30	:30			670				
3:00	:30			659				
3:30	:30			644				
4:00	:30			629				
4:30	:30			617				
5:00	:30			602				
6:00	1:00			581				
7:00	1:00			562				
8:00	1:00			544				
9:00	1:00			528				
10:00	1:00			514				
12:00	2:00			493				
14:00	2:00			478				
16:00	2:00			464				
18:00	2:00			452				
20:00	2:00			443				
25:00	5:00			425				
30:00	5:00			401				

3:20 35:00	5:00		393			
40:00	5:00		388			
45:00	5:00					
50:00	5:00		379			
55:00	5:00					
1:00:00	5:00		373			
1:05:00	20 5:00		367			
1:25:00	20:00					
1:45:00	20:00					
2:05:00	20:00					
2:25:00	20:00					
2:45:00	20:00					
3:05:00	20:00					
3:45:00	0:40:00					
4:25:00	0:40:00					
5:05:00	0:40:00					
6:05:00	1:00:00					
7:05:00	1:00:00					
8:05:00	1:00:00					
9:05:00	1:00:00					
10:05:00	1:00:00					
11:05:00	1:00:00					
12:05:00	1:00:00					
13:05:00	1:00:00					
14:05:00	1:00:00					
15:05:00	1:00:00					
16:05:00	1:00:00					
17:05:00	1:00:00					
18:05:00	1:00:00					

167-614



Water Quality

Today is: 05/17/94

PWS NAVAJO INDIAN COMPLIANCE TRACKING SYSTEM
---Inventory Information---

PWS Name: J.WILLIE CAMP/W THOREAU
Street: BOX 170
City : FT DEFIANCE
State : AZ Zip: 86504

PWS ID : 3500303
Type : Community

County : APACHE
Source : Ground Water
Population : 500
Connections: 189
Consecutive: No
Storage : 219000
Owner Char.: NTUA
Serv. Area : Residential
Adm. Region: NAVAJO AREA OFFICE
Adm. Dist. : CROWNPOINT S.U.
Activity : Active
Reg. Agent : Federal

Owner : NTUA
Phone :
Phone :
Contact : FRIEDA WHITE
Phone : (602) 729-5721
Phone : EXT. 269
Bact Samp Req: 1
Comp. Cycle : Monthly
Laboratory : NTUA
Reservation : Navajo
Last Survey : 05/27/92
Surveyor : HILL, ONDELACY/IHS

Name of Source : WELL #16T-529
Type : Ground Water
Capacity, gpm: 21
Availability : Permanent
Depth of Well: 1708
No. of wells : 1
Treatment : Disinfection
Other
Process : Gas Chlorination
Fluoridation

Name of Source : WELL #16T-614
Type : Ground Water
Capacity, gpm: 56
Availability : Permanent
Depth of Well: 1690
No. of wells : 1
Treatment : Disinfection
Other
Process : Gas Chlorination
Fluoridation

Name of Source : WELL #16T-350
Type : Ground Water
Capacity, gpm: 56
Availability : Permanent
Depth of Well: 1500
No. of wells : 1
Treatment : Disinfection
Other
Process : Gas Chlorination
Fluoridation

16 T 614



CHEMICAL and PHYSICAL ANAL. for WATER SAMPLES

Date received 11-12-82 Lab No. 4M-531 SLD user code No.

CONSULT SLD Lab Annex L for proper presentation of sample(s). TYPE or PRINT with Ball Point Pen

CHEMICAL ANALYSES: Check individual items for analysis (Mark appropriate box(es))

TYPE OF CHEMICAL ANALYSIS: ☒ Complete Secondary ☐ Organic

Water Supply System Name: West Thoreau

City or Location: West Thoreau

County: McKinley

Check one: ☐ TREATED WATER ☒ RAW WATER

Report to: Steven Weaver

Address: Crownpoint, NM 87313

Collection Date: Nov. 10, 1982

Collection Time: 2 PM

Collection Point: Well #16

Collector's remarks: This is a new well which was just drilled

Owner: U.S. Public Health Service

Source: ☐ Lake ☐ Spring ☐ Stream ☐ Pool ☐ Drain ☐ Well-Depth: 1,600 ft. LAT. LONG.

TYPE OF SYSTEM (Check one): ☐ PRIVATE ☒ PUBLIC: ☒ Community ☐ Non-community

CATIONS	mg/l	ANIONS	mg/l	PHYSICAL	HEAVY METALS	mg/l	PARAMETER	ORGANIC	mg/l
00930 Sodium (as Na)		00940 Chloride (as Cl)		70300 Total Filterable Residue	X 01000 Arsenic	0.006	Standard	39390 Endrin	
00935 Potassium (as K)		00950 Fluoride (as F)		38260 Foaming Agents (as Las)	X 01005 Barium	0.22	X	39732 Lindane	
00900 Tot. Hardness (as CaCO ₃)		00620 Nitrate (as N)		00095 Conductance Micromhos 25°C	X 01025 Cadmium	0.001		38270 Methoxychlor	
00915 Calcium (as Ca)		00430 Alkalinity (as CaCO ₃)		00400 pH	X 01030 Chromium	0.005	RADIOLOGICAL pCi/l	39400 Toxaphene	
00925 Magnesium (as Mg)		00440 Bicarbonate (as HCO ₃)		01330 Odor	X 01049 Lead	0.005	03501 Gross Beta	39730 2, 4-D	
X 01045 Iron-Total (as Fe)	0.57	00445 Carbonate (as CO ₃)		00080 Color	X 07180 Mercury	0.0005	09501 Radium-226	39740 2, 4, 5-TP (Silvex)	
X 01056 Manganese (as Mn)	0.05	00945 Sulfate (as SO ₄)		00070 Turbidity	X 01145 Selenium	0.005	11501 Radium-228		
					X 01075 Silver	0.001			

LABORATORY REMARKS:

Reviewed by: [Signature]

Date reported: 1/21/82

52000

16T-64

16T-64

STATE OF NEW YORK
HEALTH AND ENVIRONMENT DEPARTMENT
SCIENTIFIC
LABORATORY DIVISION

CHEMICAL and PHYSICAL ANALYSES
for WATER SAMPLES

Date received 11-12-82 Lab No. 1761 SLD user code No.

CONSULT SLD Lab Annex L for proper presentation of sample(s). TYPE or PRINT with Ball Point Pen.

TYPE of ANALYSIS: ☒ CHEMICAL ☐ PHYSICAL

Check individual items for analysis (Mark appropriate box(es))

INTERIM PRIMARY PARAMETER GROUP ☒ 1 ☐ 2

Water Supply System Code No. ☒ 1 ☐ 2

City or Location West Thoreau County McKinley ☐ Complete Secondary ☒ Radiological

Collector's remarks Report to Steven Weaver

Address Empire State Indian Hosp

Collection Date Nov 10 1982 Collection Time 2 PM Collection Point Well #16T674A

Owner U.S. Public Health Service

TYPE OF SYSTEM (Check one) ☒ PRIVATE ☐ PUBLIC ☐ COMMUNITY

SOURCE: ☐ Drain ☐ Spring ☐ Lake ☐ Well-Depth 1,500 ft ☐ Other (specify) ☐ LAT. ☐ LONG. ☐

Check one: ☐ TREATED WATER ☒ RAW WATER

CATIONS	mg/l	ANIONS	mg/l	PHYSICAL	mg/l	HEAVY METALS	mg/l	PARAMETER	mg/l	ORGANIC	mg/l
00930 Sodium (as Na)		00940 Chloride (as Cl)		70300 Total Filterable Residue		01000 Arsenic				39390 Endrin	
00955 Potassium (as K)		00950 Fluoride (as F)		38250 Foaming Agents (as Las)		01005 Barium				39732 Lindane	
00900 Total Hardness (as CaCO ₃)		00620 Nitrate (as N)		00095 Conductance (microhm-cm 25°C)	0.27	01025 Cadmium				38270 Methoxychlor	
00915 Calcium (as Ca)		00430 Alkalinity (as CaCO ₃)		00400 pH		01030 Chromium		RADIOLOGICAL PC/I		39400 Toxaphene	
00925 Magnesium (as Mg)		00440 Bicarbonate (as HCO ₃)		01330 Odor		01049 Lead		03501 Gross Beta		39730 2,4-D	
01045 Iron Total (as Fe)		00445 Carbonate (as CO ₃)		00080 Color		07180 Mercury		09501 Radium-226		39740 2,4,5-TP (Silver)	
01056 Manganese (as Mn)		00945 Sulfate (as SO ₄)		00070 Turbidity		01145 Selenium		11501 Radium-226			
						01075 Silver					

LABORATORY REMARKS

NOV-20

ANALYST: W. J. W. W. W.

REVIEWER: W. J. W. W. W.

DATE: 11-12-82

SLD Lab

State of New Mexico
HEALTH and ENVIRONMENT DEPARTMENT
SCIENTIFIC
LABORATORY DIVISION

CHEMICAL and PHYSICAL ANALYSES
for WATER SAMPLES

Date received 11-12-82 Lab No. 110-1760 SLD user code No.

CONSULT SLD Lab Annex L for proper presentation of sample(s). TYPE or PRINT with Ball Point Pen

CHEMICAL ANALYSES: Check individual items for analysis (Mark appropriate box(es))

INTERIM PRIMARY PARAMETER GROUP: ☒ 1 ☒ 2 ☒ 3

TYPE of CHEMICAL ANALYSIS: ☐ Organic ☒ Radiological

Water Supply System Name: *Stevenson Water* City or Location: *McKinley* County: *McKinley*

Collection Date: *Nov. 16, 1982* Collection Time: *2 PM* Collector's remarks: *Water is a very rich solution. were just drilled*

Collected By: *Stevenson Water* Owner: *U.S. Public Health Service*

TYPE of SYSTEM (Check one): ☐ PRIVATE ☒ PUBLIC: ☒ Community ☐ Non-community

SOURCE: ☐ Drain ☐ Spring ☐ Lake ☐ Well-Depth: *4.500 ft.* ☐ Other (specify): *...*

Check one: ☐ TREATED WATER ☒ RAW WATER

Report to: *Stevenson Water* Address: *Crownpoint, N.M. 87313*

LAT. *36° 0'* LONG. *106° 0'*

CATIONS	mg/l	ANIONS	mg/l	PHYSICAL	mg/l	HEAVY METALS	mg/l	PARAMETER	mg/l	ORGANIC	mg/l
00930 Sodium (as Na)	230	00940 Chloride (as Cl)	70	70300 Total Filterable Residue	221	01000 Arsenic				39300 Endrin	
00935 Potassium (as K)	149	00950 Fluoride (as F)	0.23	38200 Foaming Agents (as Las)	4.05	01005 Barium				39732 Lindane	
00900 Tot. Hardness (as CaCO ₃)	171	00620 Nitrate (as N)		00095 Conductance Micromhos 25°C	401	01025 Cadmium				38270 Methoxychlor	
00915 Calcium (as Ca)	330	00430 Alkalinity (as CaCO ₃)	200	00400 pH	7.78	01030 Chromium		RADIOLOGICAL pCi/l		39400 Toxaphene	
00925 Magnesium (as Mg)	216	00440 Bicarbonate (as HCO ₃)	243	01330 Odor	0	01049 Lead		03501 Gross Beta		39730 2,4-D	
01045 Iron-Total (as Fe)		00445 Carbonate (as CO ₃)	00	00080 Color	20	07180 Mercury		09501 Radium-226		39740 2,4,5-TP (Silvex)	
01056 Manganese (as Mn)		00945 Sulfate (as SO ₄)	310	00070 Turbidity	0.5	01145 Selenium		11501 Radium-228			
						01075 Silver					

LABORATORY REMARKS:

Reviewed by: *M. A. R. R.*
Date reported: 12/2/82

WELL RECORD

Water Well Development
Navajo Tribe
Window Rock, Arizona

WELL NO. 16T-349

Quad. No. 120 Miles west 9.85 Miles south 5.85

3 miles Northeast of Thoreau, New Mexico

Location

Began well February 13, 1958 Finished well February 24, 1958

Diameter of well 10" 0-600' 8" 600-677' Depth of well 677'

Static water level 180' Drawdown 235' Recovery 15 gpm

Quantity of water on test run: bailer: pump: 20 G. P. M. Tested for 1 hours

Kind of casing: Screw Sizes and length 8-7/8" +1 to -600'

~~Screw casing~~ Perforated Length 525-600' Mesh Torch Cut
Open hole 600-677'

Contractor Perry Bros. Drlg. Co. Address Flagstaff, Arizona
Driller: Don

DEPTH

LOG

	From	To	Formation	Acquifer	Remarks
Qd	0	7	Loose sand		
	7	45	Sandstone, purple		
	45	440	Red shale		
Trcpu	440	448	Red shale, hard		
	448	535	Red shale		
	535	570	White sandstone		
	570	580	White sandstone, w/ hard lime streaks		
Trcps	580	615	White sandstone - water		
	615	650	Gray sandstone with round gravel		
	650	675	Gray sandy siltstone		
Trcpl	675	677	Blue shale		

Remarks:

S.P. Cond. 800 Temp: 58°F

Tota Salts	Calcium Ca.	Magnesium Mg.	Sodium Na.	Chlorides Cl	Sulfates SO 4	Carbonates HCO 3	P.H.	CO 3

Excellent Good Fair Poor Doubtful Not suitable for domestic, livestock use

XX

TRIBAL WELL RECORD
LOCATION FILE

TRIBAL WELL NO 1167-349 PWSID

[illegible]

WELL TYPE
(MARK ONE ONLY)

WELL STATUS
(MARK ONE ONLY)

WELL USE
(MARK ONE ONLY)

☒ WW WATER WELL
☐ WA ARTESIAN WELL
☐ WS SPRING
☐ OW OBSERVATION WELL
☐ GS GAS WELL
☐ OP OIL PRODUCTION
☐ MW MINERAL WELL
☐ XX UNKNOWN

(☒) ACT ACTIVE
() INA INACTIVE
() ABA ABANDONED
() UIR UNKNOWN

() DOM DOMESTIC
() AGR AGRICULT.
() LIV LIVESTOCK
() IND INDUSTRIAL
MINING
() REC RECREATION
() MUN MUNICIPAL
() OTH OTHER
() UNK

QUAD NO 120 MILES WEST 9.69 MILES SOUTH 5.45

NE SE SW NW/NE SE SW NW/NE SE SW NW [25] [T] 14 [N] [R] 13 [W]
10 acre 40 acre 160 acre SECT. TOWNSHIP RANGE

APPROXIMATE LOCATION 3 MI. NE OF THURKEY

[]
 LATITUDE [] [] [] [] [] [] LONGITUDE [] [] [] [] [] []

UTM COORDINATES: X(east) 756660 Y(north) 3922580 ZONE 12

OPERATOR TE 15 K M USGS WATERSHED CODE 13020207

STATE: () AZ ARIZONA (X) NM NEW MEXICO () UT UTAH () CO COLORADO

COUNTY: () AP APACHE (☒) MC MCKINLEY () SJ SAN JUAN () MT MONTEZUMA
() NA NAVAJO () VL VALENCIA () KA KANE () LP LA PLATA
() CO COCINO () BL BERNALLILLO

()SD SANDOVAL
()SO SOCORRO
()RA RIO ARRIBA
()SA SAN JUAN

GRAZING DISTRICT 176

CHAPTER NAME HOE CHAPTER CODE

LOCATION DATA SOURCE: WELL FILES 14569 | | | | | | | | | |

LOCATION FILE COMPLETED BY: JB DATE 5/28/87

FIELD CHECKED BY: [J. B. E. K. I. S.] [5/18/87] DATE 5/28/87

updated
SEP 27 1990
Bazuy

()SU SUBMERSIBLE

STRUCTURE FILE COMPLETED BY: _____ DATE ____/____/____
rev:840426 form: well record str

TRIBAL WELL RECORD
HYDROLOGY FILE

WELL NO USGS AQUIFER CODE

THICKNESS FT NOMINAL YIELD GPM YIELD MEASURED / /

() BAILER () PUMP TEST @ GPM FOR HOURS DATE / /

DRAWDOWN FT OBSERVATION WELL DATA AVAILABLE () YES () NO

HORIZ CONDUCTIVITY FT/DAY SPECIFIC CAPACITY GPM/FT

VERT. CONDUCTIVITY FT/DAY STORAGE COEF

COEF OF TRANSMISSIVITY FT²/DAY

INDICATE ADDITIONAL PUMPING TEST DATA AVAILABLE AS HARD COPY:

```
( )Y ( )N MULTIPLE RATE DRAWDOWN PUMPING TEST
( )Y ( )N SINGLE RATE DRAWDOWN PUMPING TEST
( )Y ( )N MULTIPLE RATE DRAWDOWN/RECOVERY TEST
( )Y ( )N RECOVERY TEST
```

LOGS AVAILABLE: ()DL DRILLER'S LOG ()EL ELECTRIC LOG

[illegible]

HYDROLOGY FILE COMPLETED BY: _____ DATE ____/____/____

STATIC WATER LEVEL FILE

[illegible]

TRIBAL WELL RECORD
=====

TRIBAL WELLNO [] [] [] [] [] [] [] [] [] [] []

```
seq-no[ ] [ ] [ ]=====
      depth to top          depth to bottom    geohydro-unit      lith.
      [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
            lithologic modifier
            [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
                  contributing unit code [ ]
```

```
=====
seq-no[ ] [ ] [ ]
      depth to top          depth to bottom    geohydro-unit       lith.
      [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
                                lithologic modifier
                                [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
                                  contributing unit code [ ]
```

[illegible][illegible][illegible]

TRIBAL WELL NO [] [] [] [] [] [] [] [] [] [] [] []

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

PERRY BROTHERS

GEORGE P. — LLOYD C. — RALPH D.

WATER WELL CONTRACTORS

ANY SIZE, DEPTH OR PURPOSE

Phone Prospect 4-3841

2033 N. Navajo Dr.

FLAGSTAFF, ARIZONA

Well # 16T 351 3mi N.E. Thoreau

Total Depth 677'

Water Level 180'

1hr Bailer Test
20 BPM @ 415'

Date Commenced 2-13-58

Date Completed 2-24-58

Casing 8 5/8" - 601' Perforated bottom 75'

DATE	DEPTH	FORMATION
2-13-58	0-7'	Loose Blow Sand
	7-10	Purple Sandstone
2-14-58	10-45	Purple Sandstone
	45-130	Red Shale
2-15-58	130-185	Red Shale
2-16-58	185-200	Red Shale
2-17-58	205-250	Red Shale
2-18-58	250-370	Red Shale
2-19-58	370-440	Red Shale
	440-448	Hard Red Shale
	448-520	Red Shale
2-20-58	520-535	Red Shale
	535-550	White Sandstone (hard)
2-21-58	550-580	White Sandstone
2-22-58	580-600	White Sandstone (water)
	Rm 601'	8 5/8" Casing Perforated from 526'-601'
2-23-58	600-615	White Sandstone
	615-650	Gray Sandstone
	650-675	Gray sandy siltstone
	675-677	Blue Shale

John Perry

Lab. No. 74-PBS-PD-319 Field No. _____
 Date Received by Lab. 12-17-73
 Date Collected 12-17-73
 Location 3 mi. W of Thoreau Chapter
 Source of Water WM-16P529
 Collector's Name A. Smiley
 Authorized By W. Conway
 ADDRESS: Department: DSPHS
 Agency: Gallup
 Branch: OEH

Analyzed By A. Pinkerton
 Transcribed By _____
 Checked By _____
 Date Analysis Completed _____
 Reported By _____
 Date Reported DEC 18 1973
 SEND REPORT TO: Ward Conway
P. O. Box 1337
Gallup, NM

(X) Test Requested		Meq/l	Mg/l	Recommended Standards
Boron (B)			0.20	1.0
Iron (Fe)		0.003	0.06	0.3
Calcium (Ca)		2.60	52.10	75 - 200
Magnesium (Mg)		1.60	19.46	50 - 150
Sodium (Na)		21.60	496.58	115 **
Potassium (K)		0.06	2.35	1000 to 2000
CATIONS		25.86		
Phosphorus (P)			2.00	50.0 **
Bicarbonate (HCO ₃)		3.16	192.82	150
Carbonate (CO ₃)		0.21	6.31	
Sulfate (SO ₄)		4.35	208.93	250
Chloride (Cl)		17.28	612.75	250
Fluoride (F)		0.03	0.62	50° to 58.3° 1. 58.7° to 70.6° 1. 70.7° to 90.5° 1.
Nitrate (NO ₃)		0.07	4.24	45
ANIONS		25.10		
Total Solids	Mg/l		1515	500
Dissolved Solids	Mg/l		1464	
	Tons Per Acre Foot	1.99		
Hardness as Mg/l	Calcium, Magnesium		210	500
Ca CO ₃	Non Carbonate		52	
Alkalinity as Mg/l	Phenolphthalein		11	N.A.
Ca CO ₃	Total Alkalinity (Methyl Orange)		158	
Soluble Sodium Percentage (SSP)		84		
Sodium Absorption Ratio (SAR)		19.91		
Specific Conductance (Micromhos at 25°C)		2730		
Residual Sodium Carbonate (RSC)				
PH		8.4		4 to 10
Class for Irrigation Water		6454		
Arsenic (As)				0.01 *
Barium (Ba)				1.0 *
Cadmium (Cd)				0.01 *
Copper (Cu)				1.0
Cyanide (Cn)				0.2
Hexavalent Chromium (Hex. Cr.)				0.05 *
Lead (Pb)				0.05 *
Manganese (Mn)				0.05
Mercury (Hg)				0.005 **
Selenium (Se)				0.01 *
Zinc (Zn)				5.0
Alkyl Benzene Sulfonates (ABS)				0.5
Phenols				0.001

* Cause for Rejection of the Supply

**Unofficial Standard

Total Iron — 2.20 ppm

Lab. NO. 14-KNO-EP-201 Field NO. 11-16-73 Analyzed By [Signature]
 Date Received by Lab. 11-16-73 Date Collected 11-16-73 Checked By [Signature]
 Location Thoreau Community Water System Date Analysis Completed [Signature]
 Source of Water deep well & Domestic Reported By [Signature]
 Collector's Name Sammie S. Charlie Date Reported DEC 8 1973
 Authorized By Bruce R. Chelikowsky
 ADDRESS: Department: USPHS SEND REPORT TO: Bruce R. Chelikowsky
 Agency: Crownpoint c/o PHS Hosp.
 Branch: OEH Crownpoint, NM

(X) Test Requested		Meq/l	Mg/l	Recommended Standards
Boron (B)			<u>None</u>	1.0
Iron (Fe)		<u>None</u>	<u>None</u>	0.3
Calcium (Ca)		<u>4.20</u>	<u>84.17</u>	75 - 200
Magnesium (Mg)		<u>1.30</u>	<u>15.81</u>	50 - 150
Sodium (Na)		<u>0.42</u>	<u>9.66</u>	115 **
Potassium (K)		<u>0.01</u>	<u>2.91</u>	1000 to 2000
CATIONS		<u>5.93</u>		
Phosphorus (P)			<u>None</u>	50.0 **
Bicarbonate (HCO ₃)		<u>4.12</u>	<u>252.01</u>	150
Carbonate (CO ₃)		<u>0.41</u>	<u>12.30</u>	
Sulfate (SO ₄)		<u>1.28</u>	<u>61.48</u>	250
Chloride (Cl)		<u>0.20</u>	<u>7.09</u>	250
Fluoride (F)		<u>0.02</u>	<u>0.36</u>	50 ⁰ to 58.3 ⁰ 1.8 58.7 ⁰ to 70.6 ⁰ 1.5 70.7 ⁰ to 90.5 ⁰ 1.2
Nitrate (NO ₃)		<u>0.004</u>	<u>2.48</u>	45
ANIONS		<u>5.84</u>		
Total Solids	Mg/l		<u>36.7</u>	500
Dissolved Solids	Mg/l		<u>296</u>	
	Tons Per Acre Foot	<u>0.40</u>		
Hardness as Mg/l	Calcium, Magnesium		<u>275</u>	500
Ca CO ₃	Non Carbonate		<u>68</u>	
Alkalinity as Mg/l	Phenolphthalein		<u>21</u>	N.A.
Ca CO ₃	Total Alkalinity (Methyl Orange)		<u>207</u>	
Soluble Sodium Percentage (SSP)	<u>7</u>			
Sodium Absorption Ratio (SAR)	<u>0.25</u>			
Specific Conductance (Micromhos at 25°C)	<u>560</u>			
Residual Sodium Carbonate (RSC)				
PH	<u>8.0</u>			4 to 10
Class for Irrigation Water	<u>C7 S1</u>			
Arsenic (As)				0.01 *
Barium (Ba)				1.0 *
Cadmium (Cd)				0.01 *
Copper (Cu)				1.0
Cyanide (Cn)				0.2
Hexavalent Chromium (Hex. Cr.)				0.05 *
Lead (Pb)				0.05 *
Manganese (Mn)				0.05
Mercury (Hg)				0.005 **
Selenium (Se)				0.01 *
Zinc (Zn)				5.0
Alkyl Benzene Sulfonates (ABS)				0.5
Phenols				0.001

* Cause for Rejection of the Supply

**Unofficial Standard

Lab. No 74-PHS-TP-186 Field 10-15-73
 Date Received by Lab. 10-15-73
 Date Collected 10-15-73
 Location Thoreau water system (RL 86-121)
 Source of Water Thoreau Chapter house
 Collector's Name Tommy Horton
 Authorized By Tommy Horton
 ADDRESS: Department: USPHS
 Agency: Gallup
 Branch: OEH

Analyzed By N. J. L. B.
 Transcribed By N. J. L. B.
 Checked By P. H. M.
 Date Analysis Completed 10-14-73
 Reported By N. J. L. B.
 Date Reported OCT 16 1973

SEND REPORT TO: Tommy Horton - USPHS
P. O. Box 1337
Gallup, New Mexico 87301

(X) Test Requested		Meq/l	Mg/l	Recommended Standards
Boron (B)		0.01	0.05	1.0
Iron (Fe)		8.70	0.24	0.3
Calcium (Ca)		2.20	174.35	75 - 200
Magnesium (Mg)		0.16	26.75	50 - 150
Sodium (Na)		0.03	3.68	115 **
Potassium (K)		11.10	1.17	1000 to 2000
CATIONS				
Phosphorus (P)		5.25	8.116	50.0 **
Bicarbonate (HCO ₃)		0.66	148.22	150
Carbonate (CO ₃)		6.90	14.81	
Sulfate (SO ₄)		0.05	55.91	250
Chloride (Cl)			1.77	250
Fluoride (F)		0.02	0.37	50 ⁰ to 58.3 ⁰ 1.8
Nitrate (NO ₃)		0.04	2.48	58.7 ⁰ to 70.6 ⁰ 1.5
ANIONS				
Total Solids	Mg/l		752	500
Dissolved Solids	Mg/l		747	
	Tons Per Acre Foot	1.02		
Hardness as Mg/l	Calcium, Magnesium		545	500
Ca CO ₃	Non Carbonate		382	
Alkalinity as Mg/l	Phenolphthalein		33	N.A.
Ca CO ₃	Total Alkalinity (Methyl Orange)		163	
Soluble Sodium Percentage (SSP)		1		
Sodium Absorption Ratio (SAR)		0.07		
Specific Conductance (Micromhos at 25°C)		1000		
Residual Sodium Carbonate (RSC)				
PH		7.6		4 to 10
Class for Irrigation Water		6351		
Arsenic (As)				0.01 *
Barium (Ba)				1.0 *
Cadmium (Cd)				0.01 *
Copper (Cu)				1.0
Cyanide (Cn)				0.2
Hexavalent Chromium (Hex. Cr.)				0.05 *
Lead (Pb)				0.05 *
Manganese (Mn)				0.005 **
Mercury (Hg)				0.01 *
Selenium (Se)				5.0
Zinc (Zn)				0.5
Alkyl Benzene Sulfonates (ABS)				0.001
Phenols				

* Cause for Rejection of the Supply
 **Unofficial Standard

Total Iron — 3.00 ppm

Lab. No. 73-PHS-FD-721 Field No. _____
 Date Received by Lab. May 21, 1973
 Date Collected May 18, 1973
 Location 2 1/2 mi. NE of Thoreau
 Source of Water 16T-575
 Collector's Name Samuel Charlie
 Authorized By W. Conway
 ADDRESS: Department: DSPBS
 Agency: Gallup
 Branch: O R H

Analyzed By 4
 Transcribed By _____
 Checked By _____
 Date Analysis Completed _____
 Reported By W. Conway
 Date Reported June 18 1973

SEND REPORT TO: Ward Conway - PHS
P. O. Box 1337
Gallup, New Mexico 87301

Test Required	Meq/l	Mg/l	Recommended Standards
Boron (B)			1.0
Iron (Fe)			0.3
Calcium (Ca)			75 - 200
Magnesium (Mg)			50 - 150
Sodium (Na)			115 **
Potassium (K)			1000 to 2000
CATIONS			
Fluoride (F)			50° to 58.3° 1.8 58.7° to 70.6° 1.5 70.7° to 90.5° 1.2
Phosphorus (P)			50.0 **
Bicarbonate (HCO ₃)			150
Carbonate (CO ₃)			
Sulfate (SO ₄)			250
Chloride (Cl)			250
Nitrate (NO ₃)			45
ANIONS			
Total Solids:			500
Mg/l		267	
Dissolved Solids:			
Mg/l			
Tons Per Acre Foot			
Hardness as Mg/l; (Ca CO ₃)			500
Calcium Magnesium			
Non Carbonate			
Alkalinity as Mg/l (Ca CO ₃):			N. A.
Phenolphthalein			
Total Alkalinity (Methyl Orange)			
Soluble Sodium Percentage (SSP)			
Sodium Absorption Ratio (SAR)			
Specific Conductance (Micromhos at 25°C)			
Residual Sodium Carbonate (RSC)			
pH			4 to 10
Class for Irrigation Water			
Arsenic (As)			0.01 *
Barium (Ba)			1.0 *
Cadmium (Cd)			0.01 *
Copper (Cu)			1.0
Cyanide (Cn)			0.2
Hexavalent Chromium (Hex. Cr.)			0.05 *
Lead (Pb)			0.05 *
Manganese (Mn)			0.05
Mercury (Hg)			0.005 **
Selenium (Se)			0.01 *
Zinc (Zn)			5.0
Alkyl Benzene Sulfonates (ABS)			0.5
Phenols			0.001

* Cause for rejection of the supply.
 ** Unofficial Standard

RECEIVED
 JUN 19 1973
 OFF OF ENV HLTH

LAB NO. 72-PHS-580 FIELD NO. _____
 COLLECTOR Michael D. N.
 LOCATION Thorpeau Chapter House
 DATE RECEIVED BY LABORATORY 4-7-72
 DATE ANALYSIS COMPLETED _____
 DATE COLLECTED 4-6-72
 DEPARTMENT USPHS AGENCY _____

ANALYZED BY H. D. [Signature]
 TRANSCRIBED BY [Signature]
 CHECKED BY [Signature]
 REPORTED BY [Signature]
 AUTHORIZED BY Michael D. N.
 SOURCE OF WATER _____
 BRANCH _____

		Meq/l	Mg/l
Temperature (°F)			
Silica (SiO ₂)			
Boron (B)			0.12
Iron (Fe)		Trace	Trace
Calcium (Ca)		9.00	180.36
Magnesium (Mg)		2.30	27.97
Sodium (Na)		0.30	6.90
Potassium (K)		Trace	Trace
	Cations	11.60	
Phosphorus (P)			0.02
Bicarbonate (HCO ₃)		4.06	247.74
Carbonate (CO ₃)		Trace	Trace
Sulphate (SO ₄)		7.45	357.82
Chloride (Cl)		0.28	9.93
Fluoride (F)		0.02	0.34
Nitrate (NO ₃)		0.002	0.12
	Anions	11.81	
Total Solids	Mg/l		726
Dissolved Solids	Mg/l		724
	Tons Per Acre Foot	0.98	
Hardness as Mg/l	Calcium, Magnesium		565
Ca CO ₃	Non Carbonate		362
Alkalinity as Mg/l	Phenolphthalein		
Ca CO ₃	Total Alkalinity (Methyl Orange)		203
Soluble Sodium Percentage (SSP)		3	
Sodium Absorption Ratio (SAR)		0.13	
Specific Conductance (Micromhos at 25°C)		1030	
Residual Sodium Carbonate (RSC)			
PH		7.5	
Class for Irrigation Water		C3 S1	

Remarks:

Q120

LAB NO. 72-P'S 212 FIELD NO. _____ ANALYZED BY 4 LMD 16
 COLLECTOR Lew Fox TRANSCRIBED BY _____
 LOCATION 2 miles East of Thoreau, N. Mex. CHECKED BY John G. Gable
 DATE RECEIVED BY LABORATORY 9-30-71 REPORTED BY _____
 DATE ANALYSIS COMPLETED 10-27-71 AUTHORIZED BY Lew Fox
 DATE COLLECTED 9-30-71 SOURCE OF WATER 16-T-349
 DEPARTMENT USPHS AGENCY Gallup Unit BRANCH Field Health

		Meq/l	Mg/l
Temperature (°F)			
Silica (SiO ₂)			0.45
Boron (B)		0.01	0.15
Iron (Fe)		0.10	2.00
Calcium (Ca)		more	more
Magnesium (Mg)		6.00	137.94
Sodium (Na)		more	more
Potassium (K)		6.11	
Cations			0.04
Phosphorus (P)		3.94	240.42
Bicarbonate (HCO ₃)		1.05	31.57
Carbonate (CO ₃)		0.63	20.26
Sulphate (SO ₄)		0.55	19.50
Chloride (Cl)		0.03	0.54
Fluoride (F)		0.002	0.12
Nitrate (NO ₃)		6.20	
Anions			352
Total Solids	Mg/l		337
Dissolved Solids	Mg/l	0.46	
	Tons Per Acre Foot		5
Hardness as Mg/l Ca CO ₃	Calcium, Magnesium Non Carbonate		53
Alkalinity as Mg/l Ca CO ₃	Phenolphthalein Total Alkalinity (Methyl Orange)		147
Soluble Sodium Percentage (SSP)	98		
Sodium Absorption Ratio (SAR)	26.83		
Specific Conductance (Micromhos at 25°C)	580		
Residual Sodium Carbonate (RSC)		489	
PH	9.0		
Class for Irrigation Water	C2S4		

Remarks: Total IRON = 0.35 ppm



BUREAU OF INDIAN AFFAIRS
SOILS LABORATORY
GALLUP, NEW MEXICO
LABORATORY DATA SHEET FOR WATER SAMPLES

COPY

16T-349

LAB NO. PH-3-248 FIELD NO. _____ ANALYZED BY CL LD _____
COLLECTOR Donald Myers TRANSCRIBED BY _____
LOCATION Thorcan, New Mexico CHECKED BY _____
DATE RECEIVED BY LABORATORY 3-1-66 REPORTED BY _____
DATE ANALYSIS COMPLETED 3-5-66 AUTHORIZED BY _____
DATE COLLECTED 3-1-66 SOURCE OF WATER Well 16T-349 Navajo Tribe Windmi
DEPARTMENT US. PHS AGENCY _____ BRANCH _____

		Meq/l	Mg/l
Temperature (°F)		73°	
Silica (SiO ₂)			
Boron (B)			0.03
Total (Fe)			0.32
Iron (Fe)		0.012	0.23
Calcium (Ca)		0.15	3.01
Magnesium (Mg)		TRACE	TRACE
Sodium (Na)		6.23	143.29
Potassium (K)		TRACE	TRACE
	Cations	6.38	
Phosphorus (P)			0.092
Bicarbonate (HCO ₃)		3.50	231.84
Carbonate (CO ₃)		1.20	36.00
Sulphate (SO ₄)		0.51	24.50
Chloride (Cl)		0.73	25.89
Fluoride (F)		0.02	0.40
Nitrate (NO ₃)		0.03	1.86
	Anions	6.29	
Total Solids	Mg/l		3.36
Dissolved Solids	Mg/l		3.24
	Tons Per Acre Foot	0.45	
Hardness as Mg/l	Calcium, Magnesium		8
Ca CO ₃	Non Carbonate		
Alkalinity as Mg/l	Phenolphthalein		60
Ca CO ₃	Total Alkalinity (Methyl Orange)		190
Soluble Sodium Percentage (SST)		98	
Sodium Absorption Ratio (SAR)		22.75	
Specific Conductance (Micromhos at 25°C)		520	
Residual Sodium Carbonate (RSC)		4.85	
PH		9.0	
Class for Irrigation Water		C-25.4	

Remarks:



Navajo Nation Water Management Branch Well Log and Drilling Report

PO Box 678 Fort Defiance, Arizona * PH: 928.729.4004 * FAX: 928.729.4126

WELL NO: **16K-334** PWSID: **NM3534017**
WELL NAME/OTHER NO: **THOREAU #925/#3**
WELL TYPE: **WW** WELL STATUS: **ACT** WELL USE: **DOM**
LOCATION: **100 FT N OF BIA ELEVATED TANK**
UTM : X(EAST) **752293** Y (NORTH) **3921430** ZONE: **12** OPERATOR: **BIA**
WATERSHED CODE: **13020207000** STATE: **NM** COUNTY: **MK** CHAPTER CODE: **THOR**
GRAZING DISTRICT: **16** LOCATION DATA SOURCE: **FIELD CHECKED 4/11/95**

WELLNO: **16K-334** STARTED: **8/17/1962** COMPLETED: **10/3/1962**
ELEVATION: **7161 FT.** DEPTH: **1201 FT.** DEPTH MEASURED: **10/3/1962**
DIAMETER: **14 IN.** DEPTH IS: **M** Measured, Estimated, Reported
CASING_DIAMETER: **12.75 IN.** FROM: **0 FT.** TO: **45 FT.** MATL: **STL**
CASING_DIAMETER: **10.75 IN.** FROM: **0 FT.** TO: **130 FT.** MATL: **STL**
CASING_DIAMETER: **8.62 IN.** FROM: **-2.1 FT.** TO: **900 FT.** MATL: **STL**
CASING_DIAMETER: **6.62 IN.** FROM: **900 FT.** TO: **1201 FT.** MATL: **STL**

CASING PERFORATED FROM: **931 FT.** TO: **1191 FT.** OPENING TYPE: **P**
CASING PERFORATED FROM: **0 FT.** TO: **0 FT.** OPENING TYPE:
CASING PERFORATED FROM: **0 FT.** TO: **0 FT.** OPENING TYPE:
CASING PERFORATED FROM: **0 FT.** TO: **0 FT.** OPENING TYPE:
CASING PERFORATED FROM: **0 FT.** TO: **0 FT.** OPENING TYPE:

DATE WELL TURNED OVER TO TRIBE:

FUNDED BY: **BIA** CONTRACTOR: **LAYNE TEXAS**
SITE IMPROVEMENTS: **TA-WL** TYPE OF LIFT: **SU** ENERGY: **EM**

HORSEPOWER RATING OF PUMP: **15** ON SITE STORAGE CAPACITY: **75000 GAL.**

STRUCTURE DATA SOURCE: **BIA WELL FILES**

WELLNO: **16K-334** USGS PRINCIPLE AQUIFER CODE: **231CHNL**
THICKNESS: **0 FT.** NOMINAL YIELD: **104 GPM** DATE YEILD MEASURED: **7/2/1994**
BAILER/PUMP TEST: **PT** RATE: **39 GPM** TEST PERIOD: **24 HR.** TEST DATE: **10/18/1962**
DRAWDOWN: **419.9 FT.** OBSERVATION WELL DATA AVAILABLE: **N**
HORIZONTAL CONDUCTIVITY: **0 FT/DAY** SPECIFIC CAPACITY: **0.09 GPM/FT.**
VERTICAL CONDUCTIVITY: **0 FT/DAY** STORAGE COEFFICIENT: **0**
COEFFICIENT OF TRANSMISSIVITY: **0 FT2/DAY**
AVAILABILITY OF TEST DATA: **NYNY** DRILLERS/ELECTRIC LOGS: **DL**
HYDROLOGY DATA SOURCE: **BIA WELL FILE**



Navajo Nation Water Management Branch Well Log and Drilling Report

PO Box 678 Fort Defiance, Arizona * PH: 928.729.4004 * FAX: 928.729.4126

WELL NO: 16B-39

PWSID:

WELL NAME/OTHER NO:

WELL TYPE: WW

WELL STATUS: ACT

WELL USE: LIV

LOCATION: 1 M N OF THOREAU

UTM : X(EAST) 752220

Y (NORTH) 3922940

ZONE: 12

OPERATOR: TRIBE O&M

WATERSHED CODE: 13020207

STATE: NM

COUNTY: MK

CHAPTER CODE: THOR

GRAZING DISTRICT: 16

LOCATION DATA SOURCE: WELL FILES

WELLNO: 16B-39

STARTED:

10/30/1943

COMPLETED:

11/2/1943

ELEVATION: 7234

FT.

DEPTH:

730

FT.

DEPTH MEASURED:

11/2/1943

DIAMETER:

0

IN.

DEPTH IS:

M

Measured, Estimated, Reported

CASING_DIAMETER:

12.5 IN.

FROM:

0 FT.

TO:

95 FT.

MATL:

STL

CASING_DIAMETER:

10.5 IN.

FROM:

0 FT.

TO:

637 FT.

MATL:

STL

CASING_DIAMETER:

6 IN.

FROM:

625 FT.

TO:

730 FT.

MATL:

STL

CASING_DIAMETER:

0 IN.

FROM:

0 FT.

TO:

0 FT.

MATL:

CASING PERFORATED FROM:

605 FT.

TO:

696 FT.

OPENING TYPE: P

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

DATE WELL TURNED OVER TO TRIBE:

FUNDED BY:

BIA

CONTRACTOR:

SITE IMPROVEMENTS: WM TA

TYPE OF LIFT: PS

ENERGY: WM

HORSEPOWER RATING OF PUMP: 0

ON SITE STORAGE CAPACITY:

50000 GAL.

STRUCTURE DATA SOURCE:

WELL FILES

WELLNO: 16B-39

USGS PRINCIPLE AQUIFER CODE: 231CHNL

THICKNESS: 0 FT.

NOMINAL YIELD:

0

GPM

DATE YEILD MEASURED:

BAILER/PUMP TEST: BT

RATE:

4

GPM

TEST PERIOD: 0 HR.

TEST DATE: 11/2/1943

DRAWDOWN: 320 FT.

OBSERVATION WELL DATA AVAILABLE: N

HORIZONTAL CONDUCTIVITY:

0

FT/DAY

SPECIFIC CAPACITY:

0

GPM/FT.

VERTICAL CONDUCTIVITY:

0

FT/DAY

STORAGE COEFFICIENT:

0

COEFFICIENT OF TRANSMISSIVITY:

0

FT2/DAY

AVAILABILITY OF TEST DATA:

NNNN

DRILLERS/ELECTRIC LOGS:

DL

HYDROLOGY DATA SOURCE:

WELL FILES



Navajo Nation Water Management Branch Well Log and Drilling Report

PO Box 678 Fort Defiance, Arizona * PH: 928.729.4004 * FAX: 928.729.4126

WELL NO: 16T-575

PWSID:

WELL NAME/OTHER NO:

WELL TYPE: WW

WELL STATUS: ACT

WELL USE: LIV

LOCATION: 1.5 M NE OF THOREAU CHPTR. HSE.

UTM : X(EAST) 756290

Y (NORTH) 3924270

ZONE: 12

OPERATOR: TRIBE O&M

WATERSHED CODE: 13020207

STATE: NM

COUNTY: MK

CHAPTER CODE: THOR

GRAZING DISTRICT: 16

LOCATION DATA SOURCE: WELL FILES/B. STONE RT-6

WELLNO: 16T-575

STARTED:

11/30/1971

COMPLETED:

10/3/1972

ELEVATION: 7280

FT.

DEPTH:

1150

FT.

DEPTH MEASURED:

10/3/1972

DIAMETER:

0

IN.

DEPTH IS:

R

Measured, Estimated, Reported

CASING_DIAMETER:

6.62 IN.

FROM:

0 FT.

TO:

805 FT.

MATL:

STL

CASING_DIAMETER:

0 IN.

FROM:

805 FT.

TO:

1000 FT.

MATL:

STL

CASING_DIAMETER:

0 IN.

FROM:

0 FT.

TO:

0 FT.

MATL:

STL

CASING_DIAMETER:

0 IN.

FROM:

0 FT.

TO:

0 FT.

MATL:

STL

CASING PERFORATED FROM:

960 FT.

TO:

1000 FT.

OPENING TYPE: P

CASING PERFORATED FROM:

1000 FT.

TO:

1150 FT.

OPENING TYPE: X

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

CASING PERFORATED FROM:

0 FT.

TO:

0 FT.

OPENING TYPE:

DATE WELL TURNED OVER TO TRIBE:

10/17/1972

FUNDED BY:

BIA

CONTRACTOR:

FRONTIER DRLG

SITE IMPROVEMENTS: WM TA WL TR

TYPE OF LIFT:

ENERGY: WM

HORSEPOWER RATING OF PUMP: 0

ON SITE STORAGE CAPACITY:

27900 GAL.

STRUCTURE DATA SOURCE:

WELL FILES

WELLNO: 16T-575

USGS PRINCIPLE AQUIFER CODE: 231CHNL

THICKNESS: 0 FT.

NOMINAL YIELD:

0

GPM

DATE YEILD MEASURED:

BAILER/PUMP TEST: BT

RATE:

15

GPM

TEST PERIOD:

6

HR.

TEST DATE: 10/3/1972

DRAWDOWN: 350 FT.

OBSERVATION WELL DATA AVAILABLE: N

HORIZONTAL CONDUCTIVITY:

0

FT/DAY

SPECIFIC CAPACITY:

0

GPM/FT.

VERTICAL CONDUCTIVITY:

0

FT/DAY

STORAGE COEFFICIENT:

0

COEFFICIENT OF TRANSMISSIVITY:

0

FT2/DAY

AVAILABILITY OF TEST DATA:

NNNN

DRILLERS/ELECTRIC LOGS:

DL

HYDROLOGY DATA SOURCE:

WELL FILES

APPENDIX D
NMOSE Records Existing Well Logs

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Plains Electric Generation & Transmission Co-op, Inc. Owner's Well No. B-87-B-S-4
 Street or Post Office Address P.O. Box 6551
 City and State Albuquerque, New Mexico

Well was repaired under Permit No. B-87-B-S-4 and is located in the:

a. $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ SE of Section 23 Township 14 North Range 12 West N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Stewart Brothers Drilling Company License No. _____

Address P.O. Box 2067, Milan, New Mexico

Repair
 Drilling Began 4-7-92 Completed 4-21-92 Type tools _____ Size of hole _____ in.

Elevation of land surface or _____ at well is 6927 ft. Total depth of well 1724 ft.

Completed well is ☐ shallow ☒ artesian. Depth to water upon repair completion of well 233 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
1265	1331	66	Glorieta Sandstone	
1410	1448	38	Glorieta Sandstone	
			See section 7 on reverse side.	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 6-22-92

Quad _____ FWL _____ FSL _____

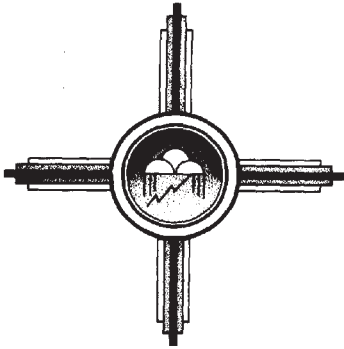
File No. B-87-B-S-4 Use _____ Location No. 14N. 12W. 23. 433

[illegible]

This well was cleaned out, the old torch^{slotted} liner removed and 438 feet of 4", 0.04 slot stainless steel screen installed and gravel packed.

Louis D. O'Dell ~~Director~~

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.



PLAINS ELECTRIC GENERATION AND TRANSMISSION COOPERATIVE, INC.

Albuquerque Headquarters
2401 Aztec Road, NE, P.O. Box 6551
Albuquerque, New Mexico 87197
Phone (505) 884-1881

Escalante Generating Station
P.O. Box 577
Prewitt, New Mexico 87045
Phone (505) 876-2271

June 17, 1992

File A.2.5

Mr. Charles A. Wohlenberg
New Mexico State Engineer's Office, District 1
3311 Candelaria, NE, Suite A
Albuquerque, New Mexico 87107

RE: Permits To Repair Well Nos. B-87-B-S-4 & B-87-B-S-5

Dear Mr. Wohlenberg:

Enclosed in triplicate are Well Logs for the wells referenced above. These well logs are filed in accordance with the condition of approval on the Permits To Repair Or Deepen Well issued October 18, 1991.

Also enclosed are pump test data and a letter dated June 16, 1983 for your convenient reference.

Please advise if there are any questions.

Sincerely,

L. D. O'Dell
Louis D. O'Dell
Water Resource Engineer

Enclosures

Copys To: Dick Toth w/ encl
Oren Key w/encl
Charlie Harding w/encl

UN22 6.8.08

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Plains Electric Generation & Transmission Co-op, Inc. Owner's Well No. B-87-B-S-5
Street or Post Office Address P.O. Box 6551
City and State Albuquerque, New Mexico

Well was repaired under Permit No. B-87-B-S-5 and is located in the:

a. $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 23 Township 14 North Range 12 West N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
the _____ Grant.

(B) Drilling Contractor Stewart Brothers Drilling Company License No. _____

Address P.O. Box 2067, Milan, New Mexico

Repair
Drilling Began 12-19-91 Completed 12-31-91 Type tools _____ Size of hole _____ in.

Elevation of land surface or _____ at well is 6934 ft. Total depth of well 1445 ft.

Completed well is ☐ shallow ☒ artesian. Depth to water upon repair completion of well 189 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
1233	1445	212	San Andres/Glorieta	100
			See section 7 on the Reverse side.	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received 6-22-92

Quad _____ FWL _____ FSL _____

File No. B-87-B-S-5 Use _____ Location No. 14N.12W.23.333

[illegible]

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

NEW MEXICO OFFICE OF THE STATE ENGINEER
WELL RECORD

1. OWNER OF WELL

Name: Tri-State Generation and TransmissionWork Phone: 505-983-4366Contact: Dennis R. Cooper

Home Phone: _____

Address: PO Box 33695City: Denver,State: COZip: 80233-0695

2. LOCATION OF WELL (A, B, C, or D required, E or F if known)

A. NW 1/4 NW 1/4 SW 1/4 Section: 23 Township: 14N Range: 12W N.M.P.M.
in _____ County.B. X = _____ feet, Y = _____ feet, N.M. Coordinate System
Zone in the _____ Grant.
U.S.G.S. Quad Map _____

C. Latitude: _____ d _____ m _____ s Longitude: _____ d _____ m _____ s

D. East _____ (m), North _____ (m), UTM Zone 13, NAD _____ (27 or 83)

E. Tract No. _____, Map No. _____, of the _____ Hydrographic Survey

F. Lot No. _____, Block No. _____ of Unit/Tract _____ of the _____
Subdivision recorded in _____ County.

G. Other: _____

H. Give State Engineer File Number if existing well: B-87-B-S-6I. On land owned by (required): Applicant

3. DRILLING CONTRACTOR

License Number: WD-225Work Phone: 505-877-1030Name: Rodgers & Co., Inc.

Home Phone: _____

Agent: Clarence RodgersMailing Address: 2615 Isleta Blvd. SWCity: Albuquerque,State: NMZip: 87105

4. DRILLING RECORD

Drilling began: 8/7/07 ; Completed: 12/31/07 ; Type tools: Rotary ;

Size of hole: _____ in.; total depth of well: _____ ft.;

Completed well is: _____ (shallow, artesian);

Depth to water upon completion of well: _____ ft.

SEE ITEM 10.

NEW MEXICO OFFICE OF THE STATE ENGINEER WELL RECORD

5. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of water-bearing formation	Estimated Yield (GPM)
<u>SEE ITEM 10.</u>				

6. RECORD OF CASING

Diameter (inches)	Pounds per ft.	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To

7. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

8. PLUGGING RECORD

Plugging Contractor: _____
 Address: _____
 Plugging Method: _____
 Date Well Plugged: _____

Plugging approved by: _____
 State Engineer Representative

No.	Top	Depth in Feet Bottom	Cubic Feet of Cement
1.			
2.			
3.			
4.			
5.			

STATE ENGINEER
BIOLOGICAL NEW YORK

2009 JAN -7 PM 2:43

Depth in Feet
From To
SEE ITEM 10.

Color and Type of Material Encountered

2008 FEB 15 PM 1:59

Trn Number: 386574

NEW MEXICO OFFICE OF THE STATE ENGINEER
WELL RECORD

10. ADDITIONAL STATEMENTS OR EXPLANATIONS:

The original well is reported to have a total depth of 1,790-ft. When workover efforts began, the static water level was measured at 451-ft., the total well depth was measured at 927-ft., and the well capacity was about 10 GPM. Fill was removed from the well from a depth of 927-ft. to 990-ft. Following redevelopment, the static water level was 252-ft. and the well capacity was about 130 GPM. We were unable to clean the well beyond 990-ft.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Moy Richardson/TQ
Driller

1-6-09
(mm/dd/year)

FOR STATE ENGINEER USE ONLY

Quad ____; FWL ____; FSL ____; Use ____; Location No. ____

File Number: _____
Form: wr-20

page 4 of 4

Trn Number: 384574

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

STATE ENGINEER
ALBUQUERQUE, NM

2008 JAN -7 PM 2:42

John R. D'Antonio, Jr. P.E.
State Engineer

District 1
121 Tijeras NE, Suite 2000
Albuquerque, NM 87102-3400

December 15, 2008

File: B-87-B (Repair and Deepen)

Rogers & Co., Inc.
2615 Isleta Blvd. SW
Albuquerque, NM 87105

Greetings:

Although this Well Record was filed last February, we just realized that the driller neglected to sign the back of the forms. Please have the driller sign the back of the enclosed Well Records and return them to our office. We apologize for bringing this to your attention after so much time has past, but we do need a signature before we can file this document.

Thank you for your cooperation in this matter. If you have any questions, please do not hesitate to call me.

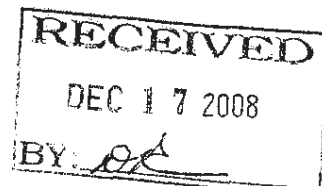
Sincerely,

Robert D. Thompson

Robert D. Thompson
Water Resource Specialist
Office of the State Engineer
(505) 764-3844

*Signed records
copies
enclosed.*

Enclosures



STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Plains Electric C & T Cooperative, Inc. Owner's Well No. B-87-B-S-7-Explore
Street or Post Office Address P.O. Box 6551
City and State Albuquerque, New Mexico 87197

Well was drilled under Permit No. B-87-B-S-7-Explore and is located in the:

- a. $\frac{1}{4}$ $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 27 Township 14 North Range 12 West N.M.P.M.
b. Tract No. _____ of Map No. _____ of the _____
c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.
d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
the _____ Grant.

(B) Drilling Contractor Stewart Brothers Drilling License No. WD-0331

Address P.O. Box 2067, Milan New Mexico 87021

Drilling Began 12-12-90 Completed 1-5-91 Type tools Rotary Size of hole 12 $\frac{1}{2}$ in.
Approx. 7 7/8 in.

Elevation of land surface or _____ at well is 6945 ft. Total depth of well 1376 ft.

Completed well is ☐ shallow ☒ artesian. Depth to water upon completion of well 216 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
1122	1376	254	Glorieta Sandstone	< 20gpm

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
8 5/8	28		14	1122	1108			
4 .04	slot SS	Screen	1122	1376	254	4 $\frac{1}{2}$ Guide	1122	1366

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
0	1122	12 $\frac{1}{4}$ "	500		

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received _____

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. _____

[illegible]

INSTRUCTIONS: This form should be completed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

2012 DEC 20 AM 11:51

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER)			OSE FILE NUMBER(S)				
	10			B-87-B				
	WELL OWNER NAME(S)			PHONE (OPTIONAL)				
	Tri-State Generation and Transmission Association Inc			303-254-3459				
	WELL OWNER MAILING ADDRESS			CITY STATE ZIP				
PO Box 33695			Denver CO 80233					
WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84				
	LATITUDE	35	25				18.51 N	
	LONGITUDE	108	05	13.77 W				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE								
Well 1R								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER		NAME OF LICENSED DRILLER		NAME OF WELL DRILLING COMPANY			
	WD225		Michael Rougier and Felipe Leon		Rodgers & Co., Inc.			
	DRILLING STARTED		DRILLING ENDED		DEPTH OF COMPLETED WELL (FT)			
	4/10/12		10/1/12		1550			
					BORE HOLE DEPTH (FT)			
					1550			
					DEPTH WATER FIRST ENCOUNTERED (FT)			
					unknown			
	COMPLETED WELL IS:		<input checked="" type="checkbox"/> ARTESIAN <input type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)		STATIC WATER LEVEL IN COMPLETED WELL (FT)			
					272			
	DRILLING FLUID:		<input checked="" type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY:					
	DRILLING METHOD:		<input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY:					
	DEPTH (feet bgl)		BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
	FROM	TO						
	0	40	30	steel surface casing	cemented in	place 15.25	3/8	
0	1226	14-3/4	API GR X65 blank	threaded	8	.277		
1226	1280	14-3/4	API GR X65 perforated	threaded	8	.277	0.25	
1280	1300	14-3/4	liner	welded	4	.247	0.125	
1300	1550	7-7/8	liner	welded	4	.247	0.125	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						
	0	40	30	cement/sand slurry	140.5	tremie		
	40	1280	14-3/4	cement by Halliburton	968.2	pressure grout		
	1280	1300	14-3/4	gravel pack	21.5	tremie		
	1300	1550	7-7/8	gravel pack	56.9	tremie		

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	B-87-B	POD NUMBER	PDD10	TRN NUMBER	472802
LOCATION					PAGE 1 OF 2

	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
	FROM	TO				
4. HYDROGEOLOGIC LOG OF WELL	0	30	30	Blow sand	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	30	1220	1190	Red bed shale and sandstone	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	
	1220	1550	330	Sandstone, grey with red shale underbeds, Glorieta SS	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input checked="" type="checkbox"/> PUMP				TOTAL ESTIMATED WELL YIELD (gpm): 175	
<input type="checkbox"/> AIR LIFT <input type="checkbox"/> BAILER <input type="checkbox"/> OTHER - SPECIFY:						
5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.				
	MISCELLANEOUS INFORMATION:					
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE: Michael Rougier and Felipe Leon					
6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> </div> <div style="width: 45%; text-align: right;"> Felipe Leon Michael Rougier </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 60%;">SIGNATURE OF DRILLER / PRINT SIGNED NAME</div> <div style="width: 35%; text-align: right;">12/18/12 DATE</div> </div>					

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

2012 DEC 20 AM 11:51

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER)				OSE FILE NUMBER(S)			
	9				B-87-B			
	WELL OWNER NAME(S)				PHONE (OPTIONAL)			
	Tri-State Generation and Transmission Association Inc				303-254-3459			
WELL OWNER MAILING ADDRESS				CITY		STATE		ZIP
PO Box 33695				Denver		CO		80233
WELL LOCATION (FROM GPS)	DEGREES		MINUTES	SECONDS	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84			
	LATITUDE	35	25	31.6 N				
	LONGITUDE	108	04	46.03 W				
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE								
Well 5R								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER		NAME OF LICENSED DRILLER			NAME OF WELL DRILLING COMPANY		
	WD225		Felipe Leon and Michael Rougier			Rodgers & Co., Inc.		
	DRILLING STARTED		DRILLING ENDED		DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)	
	7/3/12		10/3/12		1500	1500	unknown	
	COMPLETED WELL IS: <input checked="" type="checkbox"/> ARTESIAN <input type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)						STATIC WATER LEVEL IN COMPLETED WELL (FT)	
							324	
	DRILLING FLUID: <input checked="" type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY:							
	DEPTH (feet bgl)		BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
	FROM	TO						
0	30	30	steel surface casing	cemented in place	15.25	3/8		
0	1290	14-3/4	API GR X65 blank	threaded	8	.277		
1265	1290	14-3/4	liner	welded	4	.247	0.125	
1290	1500	7-7/8	liner	welded	4	.247	0.125	
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						
	0	30	30	cement/sand slurry	105.3	tremie		
	30	1290	14-3/4	cement by Halliburton	983.9	pressure grout		
	1265	1290	14-3/4	gravel pack	27	tremie		
	1290	1500	7-7/8	gravel pack	50	tremie		

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	B-87-B	POD NUMBER	B-87A009	TRN NUMBER	472718
LOCATION					PAGE 1 OF 2

	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)
	FROM	TO				
4. HYDROGEOLOGIC LOG OF WELL	0	25	25	Blow sand	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N	
	25	1280	1255	Red bed shale and sandstone	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	
	1280	1500	220	Sandstone, grey with red shale underbeds, Glorieta SS	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
					<input type="checkbox"/> Y <input type="checkbox"/> N	
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input checked="" type="checkbox"/> PUMP					TOTAL ESTIMATED WELL YIELD (gpm): 125
<input type="checkbox"/> AIR LIFT <input type="checkbox"/> BAILER <input type="checkbox"/> OTHER - SPECIFY:						
5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.				
	MISCELLANEOUS INFORMATION:					
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE: Michael Rougier and Felipe Leon					
6. SIGNATURE	<p>THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:</p> <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="width: 60%;"> <p><i>Michael Rougier / TR</i> Michael Rougier</p> <p><i>Felipe Leon / TR</i> Felipe Leon</p> <p>_____ SIGNATURE OF DRILLER / PRINT SIGNED NAME</p> </div> <div style="width: 35%; text-align: right;"> <p>12/18/12</p> <p>_____ DATE</p> </div> </div>					

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER

POD NUMBER

TRN NUMBER

LOCATION

PAGE 2 OF 2

STATE ENGINEER OFFICE

WELL RECORD

125 AUG 8 11 0 12 Section 1. GENERAL INFORMATION

(A) Owner of well Thoreau Water and Sanitation District Owner's Well No. Test hole 1
 Street or Post Office Address P.O. Box 66
 City and State Thoreau, New Mexico 87323

Well was drilled under Permit No. B-386 Explor and is located in the:

a. NE 1/4 NE 1/4 NE 1/4 NE 1/4 of Section 30 Township 14 N Range 14 W N.M.P.M.
 b. Tract No. _____ of Map No. _____ of the _____
 c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.
 d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Joe I. Salazar License No. WD 975

Address P.O. Box 916, Grants, New Mexico 87020

Drilling Began 4/22/85 Completed 4/30/85 Type tools rotary, mud _____ Size of hole 6-5/8 in.

Elevation of land surface or _____ at well is 7279 ft. Total depth of well 1380 ft.

Completed well is ☐ abandoned ☐ shallow ☐ artesian. Depth to water upon completion of well plugged ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
515	580	65	siltstone, sandstone, dirty	See remarks
625	685	60	sandstone (Sonsela)	See remarks
1127	1370	243	limestone, sandstone (Sa-Glorieta)	See remarks

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
6 5/8			0	100	100	surface pipe		
						in 8 3/4 inch hole and cemented in		

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
0	100	8 3/4		18	cemented in surface pipe, gravity
abandonment					
900	1380	6+			drilling mud, cavings
840	900				drilling mud, conditioned
690	840				cement, forced displacement
0	690				drilling mud, conditioned

Section 5. PLUGGING RECORD

Plugging Contractor Joe Salazar- Jim Pierson
 Address Grants New Mexico
 Plugging Method drill pipe - pumped displacement
 Date Well Plugged April 30, 1985
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1	690	840	40
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received June 24, 1985

Quad _____ FWL _____ FSL _____

File No. B-386-Explor Use explore Location No. 14N.13W.30.222

258568

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	65	65	Sd, fine to medium, brown and some loose gravel
65	100	35	Clay, red-brown Chinle (Upper member)
100	117	17	Clay, brown-orange
117	122	5	Clay, brown and some gravel, angular
122	385	263	Clay, brown-orange
385	435	50	Shale, brown with green reduction spots
435	480	45	Shale, purplish, hard
480	515	35	Shale, brown with green reduction spots
515	580	65	Siltstone and sandstone, brn-grn Chinle (Middle member)
580	625	45	Shale, brown
625	685	60	Sandstone, med, gray-green with pebbles (Sonsela)
685	870	185	Shale, purplish Chinle (Lower member)
870	875	5	Limestone, gray
875	1042	167	Shale, purplish, some gray green
1042	1043	1	Limestone, gray
1043	1127	84	Shale, gray-green and some other colors
1127	1141	14	Limestone, white-gray, hard San Andres (top?)
1141	1182	41	Shale, gray-green, green, purple
1182	1252	70	Sandstone, pink-white, med, hard Glorieta (top)
1252	1253	1	Shale break
1253	1370	117	Sandstone, white, soft Yeso (top?)
1370	1380	10	Shale, brown
	1380		Total depth

Section 7. REMARKS AND ADDITIONAL INFORMATION

Geophysical log run (One copy attached)

Gamma spike- in shale above top of Glorieta at 1181 feet.

Sandstone interval 515-580 produced by airlift in open hole at 400 feet. Short term yield less than 4 gpm. Non-pumping water level near 238 feet below land surface.

Sandstone interval 515-580 and also 625-685 produced by airlift in open hole from a depth of 700 feet. Yield 20-35 gpm. Apparent conductivity 900 mMHos at 60 F. Water very dirty. Water sample collected.

Yield test attempted in open hole at total depth. Produced by airlift at setting of 600 feet. Yield 30 gpm. Conductivity 650 mMHos at 68 F. Very poor test of lower part of hole. Water very dirty. Water sample collected

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

William E. Hale, Hydrologist
For Joe L. Salazar
 Driller

INSTRUCTIONS: This form should be completed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

THUNDERBIRD MUD CO.
P.O. BOX 1972 • PHONE 327-7548
FARMINGTON, NM 87499

DRILLING MUD REPORT

REPORT NO.

DATE <u>4-20</u> 19 <u>83</u>		DEPTH <u>1380</u>	
API WELL NO.	STATE	COUNTY	WELL S/T

OPERATOR <u>SALAZAR DILL CO.</u>	CONTRACTOR	RIG NO. <u>3</u>
ADDRESS <u>Rio</u>	ADDRESS	SPUD DATE <u>4-22-85</u>
REPORT FOR MR. <u>SAZAR</u>	REPORT FOR MR.	SECTION, TOWNSHIP, RANGE <u>30-14N-13W</u>

WELL NAME AND NO. <u>Theresa W.W. Test</u>		FIELD OR BLOCK NO.	COUNTY AREA <u>McKinley</u>	STATE <u>New Mex</u>
OPERATION <u>Plug</u>		CASING SURFACE IN. AT <u>100</u> FT.	MUD VOLUME (BBL) HOLE PITS	CIRCULATION DATA PUMP SIZE X IN. ANNULAR VEL. (FT./MIN.)
BIT SIZE (IN.) <u>5 7/8</u>	NO. <u>7</u>	INTERMEDIATE IN. AT	TOTAL CIRCULATING VOLUME	PUMP MAKE MODEL
DRILL PIPE SIZE <u>2 7/8</u>	TYPE	PRODUCTION OR LINER IN. AT	IN STORAGE WEIGHT	BDL./STROKE STROKE/MIN
DRILL COLLAR SIZE <u>3 1/4</u>	LENGTH	MUD TYPE <u>P1000</u>	BDL./MIN <u>2.4</u>	OPPOSITE DP OPPOSITE COLLAR CIRCULATING PRESSURE PSI BOTTOMS UP (MIN.) SYSTEM TOTAL (MIN.)

Sample from <input type="checkbox"/> Flowline <input type="checkbox"/> Pit	MUD PROPERTIES		EQUIPMENT	
Flowline Temperature <u>F</u>	SIZE	HRS/TOUR	SIZE	HRS/TOUR
Time Sample Taken	Centrifuge		Desilter	
Depth (ft.) <u>1380</u>	Densifier		Shaker	
Weight <input type="checkbox"/> (ppg) <input type="checkbox"/> (lb./cu. ft.) <u>9.0</u>	Desander		Other	
Mud Gradient (psi/ft.)	DAILY COST		CUMULATIVE COST	
Funnel Viscosity (sec./qt.) API at <u>80</u> °F	MUD PROPERTIES SPECIFICATIONS			
Plastic Viscosity cp at <u>17</u> °F	WEIGHT	VISCOSITY	FILTRATE	
Yield Point (lb./100 sq. ft.) <u>29</u>	BY AUTHORITY: <input type="checkbox"/> OPERATOR'S WRITTEN <input type="checkbox"/> DRILLING CONTRACTOR			
Gel Strength (lb./100 sq. ft.) 10 sec./10 min. <u>8/19</u> / /	<input type="checkbox"/> OPERATOR'S REPRESENTATIVE <input type="checkbox"/> OTHER			
pH <input type="checkbox"/> Strip <input type="checkbox"/> Meter <u>8.0</u>	RECOMMENDED TOUR TREATMENT			
Filtrate API (ml./30 min.) <u>5.8</u>				
API HP-HT Filtrate (ml./30 min.) <u>-</u> °F				
Cake Thickness 32nd in. API <input type="checkbox"/> HP — HT <input type="checkbox"/> <u>2</u>				
Alkalinity, Mud (Pm)				
Alkalinity, Filtrate (P _f /M _f) <u>0.25</u> / /				
Salt <input type="checkbox"/> ppm <input type="checkbox"/> Chloride <input type="checkbox"/> ppm <u>150</u>				
Calcium <input type="checkbox"/> ppm <input type="checkbox"/> Gyp (ppb) <u>60</u>				
Sand Content (% by Vol.) <u>1/2</u>				
Solids Content (% by Vol.) <u>4.9</u>				
Oil Content (% by Vol.) <u>-</u>				
Water Content (% by Vol.) <u>95.1</u>				
LCM, #/bbl				

REMARKS: <u>Bridge 640</u> <u>Glorieta 1193'</u> <u>SAN Andres 1129'</u> <u>SAN JUAN 1025'</u> <u>Worked 520' - Chilled 65'</u> <u>Surface Blsd</u> <u>Blk Hole 5 Hrs 200 Bbls W/Later</u>		HOME ADDRESS <u>Farmington</u>	TELEPHONE <u>327-7548</u>
ENGINEER <u>Bob Robertson</u>		WAREHOUSE LOCATION <u>Mobile</u>	TELEPHONE <u>325-0523</u>

G.L. 7279

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION
 Thoreau Mutual Domestic Water
 (A) Owner of well Consumers and Sewage Works Association Owner's Well No. 2
 Street or Post Office Address General Delivery
 City and State Thoreau, New Mexico 87323

Well was drilled under Permit No. B-386-S and is located in the:

a. SW $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ Ne $\frac{1}{4}$ of Section 33 Township 14 N Range 13 W N.M.P.M.
 b. Tract No. _____ of Map No. _____ of the _____
 c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.
 d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Gallup Drilling Company License No. WD 731

Address P.O. Box 969, Gallup, New Mexico 87301

Drilling Began July 6, 1977 Completed Dec. 9, 1977 Type tools Cable Tool & Rotary Size of hole 6 in. ID

Elevation of land surface or _____ at well is 7149.5 ft. Total depth of well 1150 ft.

Completed well is ☐ shallow ☒ artesian. Depth to water upon completion of well 73.3 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
270	390	77	Sand of Chinle Formation	12 GPM \times -
920	1150	230	Glorieta Sandstone & Yeso Formation.	100 GPM \times -

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
10 3/4	28.04	Welded	Ground Surface	100	102	Regular Pattern	-0-	-0-
6 5/8	18.97	Welded	Ground Surface	674	674	Regular Pattern	270	390
5 9/16	14.62	Welded	662.5	804	137.5	Regular Pattern	-0-	-0-
3 1/2	7.58	Welded	793	1150	357	Coupling	920	1150

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
0	100'	12"	Cabel Tool	175	Drop Pipe
100	441.8	10"	Cable Tool		
441.8	674	8"	Cable Tool		
674	804	6"	Cable Tool		
804	1150	4 7/8"	Rotary 100 SKS.		

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received December 28, 1977

Quad _____ FWL _____ FSL _____

File No. B-386-S Use Municipal Location No. 14N.13W.33.212
 (Valencia)

[illegible]

STATE PRINTER OFFICE
WASHINGTON, D.C.
DEC 27 1963

O. F. Hubbell
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a), Section 5 need be completed.

OWNER City of Thoreau
LOCATION Thoreau, New Mexico
CUSTOMER PHONE _____

PAUL HUBBELL
GALLUP DRILLING CO.
Gallup, New Mexico 87301

P. O. Box 969
Phone 863-3515

DATE 8/15/77 --

DEPTH	FORMATION	DEPTH	FORMATION
0-40'	Topsoil	350-360'	Gray Conglomerate Sandstone
40-50'	Quicksand (Set 52' of 12 3/4" OD Casing)	360-365'	Purple Shale
51-80'	Orange Shale w/Gravel	365-380'	Gray Shale
80-102'	Red Shale (Set 102' of 10 3/4" Cemented top to bottom)	380-390'	Tan Sandstone
102-128'	Red Sandy Shale	390-420'	Siltstone, Gray
128-130'	Sandstone, multi-colored	420-423'	Gray Sandstone, Hard
130-170'	Orange Sandy Shale	423-435'	Blue Shale
170-180'	Blue Shale	435-475'	Purple Shale (Set 441' 8" of 8 5/8 OD Casing)
180-210'	lt. Pink Shale	475-495'	Gray Sandy Shale
210-220'	lt. Gray Shale	495-535'	Gray Shale
220-222'	Purple Shale	535-570'	Purple Shale
222-245'	Gray Sandstone 1GPM Water	570-580'	Red Shale
245-265'	Purple Sandy Shale	580-623'	Purple Shale
265-270'	Gray Sandy Shale	623-628'	Gray Limestone, Hard
270-285'	Gray Sandstone 4GPM Water	628-642'	Red Shale
285-290'	Red Sandy Shale	642-647'	Gray Limestone, Hard
290-337'	White Sandstone	647-670'	Red Shale
337-350'	White Shale	670-674'	Gray Limestone, Hard (Set 674' of 8 5/8 OD Casing)

CASING SIZE TYPE T.D.

12 3/4 .280 W 52'
10 3/4 .307 W 102'
8 5/8 .188 W 441' 8"

PERFORATIONS FROM 270 TO 390'

TO _____
TO _____

PUMP SIZE MAKE T.D.

GALLUP DRILLING CO.

DRILLER

P. F. Hubbell

Page

OWNER City of Thoreau
 LOCATION Thoreau, New Mexico
 CUSTOMER PHONE _____

PAUL HUBBELL
GALLUP DRILLING CO.
 Gallup, New Mexico 87301

P. O. Box 969
 Phone 863-3515

DATE 12/9/77 --

DEPTH	FORMATION	DEPTH	FORMATION
674-744'	Gray Limestone, Hard		
744-748'	Gray Shale		
748-750'	Gray Limestone		
750-767'	Purple Shale		
767-782'	Gray Shale		
782-801'	Hard Gray Sandstone		
801-804'	Set 5 9/16 Od Liner Water Sand, Caving Bad at 804.		
804-862'	Hard Gray Sandstone		
862-890'	Red Shale		
890-1010'	White sandstone with stretches of red shale.		
1010-1150'	Buff to tan color. Glorrieta Sandstone,		

CASING	SIZE	TYPE	T.D.	PUMP	SIZE	MAKE	T.D.
	6 5/8 OD	.280 W	674'				
	5 9/16 OD	.188 W	141.5				

PERFORATIONS FROM 920 TO 1150
 TO _____
 TO _____

GALLUP DRILLING CO.
 DRILLER P. F. Hubbell

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Thoreau Water and Sanitation District Owner's Well No. 3
 Street or Post Office Address P.O. Box 66
 City and State Thoreau, New Mexico 87323

Well was drilled under Permit No. B-386-S-2 and is located in the:

a. NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 30 Township 14N Range 13W N.M.P.M.
 b. Tract No. _____ of Map No. _____ of the _____
 c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.
 d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Joe I. Salazar License No. WD 975

Address P.O. Box 916, Grants, New Mexico 87020

Drilling Began 9/8/86 Completed 9/30/86 Type tools Rotary Size of hole 12 $\frac{1}{4}$ -7/8"

Elevation of land surface or _____ at well is 7279 ft. Total depth of well _____ ft.
 drilled ----- 1370
 effective ----- 1345 \pm

Completed well is ☐ shallow ☒ artesian. Depth to water upon completion of well 220 ft.
10/10/86

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
1133	1145	12	Limestone	40 gpm
1190	1354 \pm	164	Sandstone	with drawdown
				of 605 feet

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
8 $\frac{5}{8}$			+1	1121	1122	cemented in 12 $\frac{1}{4}$ " drill hole		
6 $\frac{5}{8}$ pipe		pipe	1094	1134	44	blank		
and screen		screen	1134	1144	10	(.04 slot)		
		pipe	1144	1145	1	blank		
		pipe	1145	1186	41	blank, bottom closed		
		screen	1186	1316	130	(.04 slot)		
		pipe	1316	1354	38	blank		

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
					see section 7 for packer information

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

Date Received Jan 15, 1987

FOR USE OF STATE ENGINEER ONLY

Quad _____ FWL _____ FSL _____

File No. B-386-S-2 Use Commercial Location No. 14N.13W.2222

258541

[illegible]

6⁵/8 inch pipe and screen liner has cup packers outside the blank pipe in the following intervals near the top and base of screen sections

3 cup packer at the top of the liner and up in the 8⁵/₈-inch
liner, 1094'-1094.5' shale basket at 1133 feet
5 cup packer from 1133'-1134'
4 cup packer from 1144'-1145'
6 cup packer from 1185'-1186'

John A. Thomas
-Driller-

INSTRUCTIONS: This form should be completed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired, or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

FIELD REPORT FOR CEMENTING OF WELLS

Name of Applicant Thoreau

Name of Well _____

Driller's Name Joe SalazarDrilling Method rotaryCASING DATA:
Surface None feet of _____ inch. Grade _____

Inspected by _____ on _____

(Approved)(Rejected) _____

Water string "1140" feet of 8 5/8 inch. Grade 250 WSHInspected by JP & RLC on 11 Sep 86

(Approved)(Rejected) _____

Oil string _____ feet of _____ inch. Grade _____

Inspected by _____ on _____

(Approved)(Rejected) _____

CEMENTING PROGRAM:

Cemented by BJ Titan Supervised by Ralph Griswold

Type of shoe used _____ Float collar used _____

Bottom three joints welded _____ Cement: around shoe _____ sks.

around casing _____ sks. Additives _____

Size of hole _____ Size of casing _____ sks. of cement required _____

Plug pumped down 10:45 (a.m.) (p.m.) 12 Sep 86Cement circulated Yes No. of sacks 334 + 100

Temp. survey ran _____ (a.m.) (p.m.) Cement at _____ feet

Temp. survey ran _____ (a.m.) (p.m.) Cement at _____ feet

Checked for shut off 10:45 (a.m.) (p.m.) 750 PSI (200 over differential)

Method used _____ Supervised by _____

Checked for shut off _____ (a.m.) (p.m.)

Method used _____ Supervised by _____

REMARKS: 29 joints 8 5/8" 1220 PSI PROTUMSA8 5/8 x 250 22.36 2 yellow bands5 LB-E A252 G2 GLS-521Welded by Ellis James11 PM casing startedJob approved by [Signature]File No. B-346-S-2 Location No. 14.13.30.222

12

Centralizers

1-2

3-4

5-6

7-8

9-10

11-12

13-14

15-16

17-18

19-20

21-22

23-24



sullivan design group, incorporated

227 east palace avenue, p.o. box 283, santa fe, n.m. 87504-0283

engineering • planning • landscape architecture

June 16, 1986

Mr. Charles Wohlenberg.
State Engineer's Office
2340 Menaul, N.E.
Albuquerque, New Mexico 87107

Re: Water Well for the Thoreau Water
Sanitation District

86JUN18 P 1:34
SULLIVAN DESIGN GROUP, INCORPORATED
ALBUQUERQUE, N.M.

Dear Mr. Wohlenberg:

Enclosed for your review and comment are the drawings and contract documents for the Thoreau Water & Sanitation District Water Well.

The new well will be the same location as the proposed well for Permit No. B-386-S-2 dated August 17, 1978. The Village has stopped using Well No. B-386 which was leased and has since been separated from the water system by the new overpass.

The Thoreau Water & Sanitation District requests a variance to use welded casing pipe in place of threaded casing pipe because of costs. The proposed pipe specifications are spelled out in Division 4 of the Contract Documents.

The District is presently operating on one well which does not have adequate capacity to supply the entire system. Your prompt consideration would be appreciated.

If you have additional questions, please call.

Sincerely yours,

SULLIVAN DESIGN GROUP, INCORPORATED

Walter L. Williams, P.E.

WLW/vw

Encl. Copy of Application for Permit No. B-386-S-2

cc: Thoreau Water & Sanitation District

No. 112903

STA. ENGINEER
SANTA FE, NEW MEXICO

OFFICIAL RECEIPT

CONTROL NUMBER

DATE

Dec. 8, 1983

FILE NO.	AMT REC'D	GW	SW	TOTAL
B-386-S + -S-2	CASH			
	CHECK	X		\$10.00

BANK

First Interstate Bank of Gallup Ten Dollars Only

FOR PAYMENT AS INDICATED BELOW

Application for Extension of Time

NAME AND ADDRESS	FOR USE BY SANTA FE OFFICE ONLY					
	WATER RIGHTS					BALANCE
	DATE	EARNED		REFUND	TRANSCRIPT EXP.	
Thoreau Water & Sanitation District		GW	SW			
Box 66						
Thoreau, NM 87323						
FOR USE BY ADMINISTRATIVE DIVISION						

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

2013 APR 30 PM 1:59

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) 5				OSE FILE NUMBER(S) B-386			
	WELL OWNER NAME(S) Thoreau Water & Sanitation District				PHONE (OPTIONAL)			
	WELL OWNER MAILING ADDRESS PO Box 66				CITY Thoreau		STATE NM	ZIP 87323
	WELL LOCATION (FROM GPS)	DEGREES 35		MINUTES 24	SECONDS 34.8	N		
		LONGITUDE 108		14	51.27	W		
* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84								
DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE								
2. DRILLING & CASING INFORMATION	LICENSE NUMBER WD225		NAME OF LICENSED DRILLER Felipe Leon and Michael Rougier			NAME OF WELL DRILLING COMPANY Rodgers & Co., Inc.		
	DRILLING STARTED 9/24/12		DRILLING ENDED 11/8/12	DEPTH OF COMPLETED WELL (FT) 1120	BORE HOLE DEPTH (FT) 1210	DEPTH WATER FIRST ENCOUNTERED (FT) unknown		
	COMPLETED WELL IS: <input checked="" type="checkbox"/> ARTESIAN <input type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)					STATIC WATER LEVEL IN COMPLETED WELL (FT) 150.5		
	DRILLING FLUID: <input checked="" type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD <input type="checkbox"/> ADDITIVES – SPECIFY:							
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER – SPECIFY:							
	DEPTH (feet bgl)		BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
	FROM	TO						
	0	890	12-1/4	surface casing	threaded	8		
	880	890	7-7/8	steel casing	welded	4		
	890	1120	7-7/8	steel slotted	welded	4		1/4
0	60	17.5	14" conductor casing	welded				
3. ANNULAR MATERIAL	DEPTH (feet bgl)		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	FROM	TO						
	0	60	17.5	Cement	50.5	tremie		
	0	907	12.5	Cement	425	Halliburton		
	890	1120	7-7/8	3/8" gravel	135	tremie		
	1120	1145	7-7/8	3/8" hole plug and gravel seal	7.67	tremie		
	1145	1210	7-7/8	3/8" gravel	19.94	tremie		

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FOR OSE INTERNAL USE		WR-20 WELL RECORD & LOG (Version 06/06/2012)	
FILE NUMBER	B-386	POD NUMBER	5
LOCATION		TRN NUMBER	508378
SE 1/4 SE 1/4 SE 1/4 Section 30 T14N. R13W1		PAGE 1 OF 2	

PAGE 1 OF 2



	DEPTH (feet bgl)		THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER- BEARING ZONES (gpm)	
	FROM	TO					
4. HYDROGEOLOGIC LOG OF WELL				See attached	<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
					<input type="checkbox"/> Y <input type="checkbox"/> N		
	METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: <input checked="" type="checkbox"/> PUMP					TOTAL ESTIMATED WELL YIELD (gpm): 85	
	<input checked="" type="checkbox"/> AIR LIFT <input type="checkbox"/> BAILER <input type="checkbox"/> OTHER - SPECIFY:						
5. TEST; RIG SUPERVISION	WELL TEST	TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.					
	MISCELLANEOUS INFORMATION:						
	PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE: Michael Rougier, Felipe Leon						
6. SIGNATURE	THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING: <div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> SIGNATURE OF DRILLER / PRINT SIGNED NAME </div> <div style="width: 35%; text-align: right;"> Michael Rougier, Felipe Leon 4/26/13 DATE </div> </div>						

Borehole Logging Form

Client: Sullivan Design Group		Hole: Well 4		1 of 4
Site: Thoreau Water and Sanitation District Well 4 (B-386-POD5), Thoreau, NM			Date: 9-24-12 to 10-13-12	
Geologist: AMM, EAM		Contractor: Rodgers & Company		Map:
Drill Method: Direct Rotary		Rig: Challenger No. 280		
Notes: drilled with mud to 907 ft, drilled with air to 1,210 ft		Bit size: 17 1/2" to 60 ft, 12 1/2" to 907 ft, 7 7/8" to 1,210 ft		
Elevation, ft	Land Surface:	TOC:		
Sample Depth, ft			Description	
0-50			silty sand; sand, fine; silt, red-brown; minor angular to rounded sandstone and limestone pebbles	
50-60			silty mudstone, pink-red	
60-80			clay; pink-red and medium-brown, high plasticity	
80-110			clay; pink-red, medium-brown, and light-gray, high plasticity	
110-120			sandy clay; clay, pink-red, high plasticity; sand, fine, medium-brown	
120-140			clay; same as 80-110 ft	
140-160			silty clay; clay, pink-red and purple-brown, high plasticity	
160-170			clayey silty sand; sand, fine, medium-gray and purple-brown	
170-180			silty clay and sandstone; clay, pink-red, high plasticity, 50%; sandstone, fine, medium-gray, well-cemented, 50%	
180-190			clay; pink-red and light-gray, high plasticity; minor sandstone, fine, medium-gray, well-cemented	
190-210			clay and sandstone; pink-red and purple-brown, high plasticity, 50%; sandstone, fine, medium-gray, moderately well-cemented, 50%	
210-220			clay, sandstone, and mudstone; clay, pink-red, purple-brown, and light-gray; sandstone, fine, medium-gray, moderately well-cemented; mudstone, gray	
220-230			clay; pink-red and light-gray, high plasticity	
230-240			sandy clay; clay, red, high plasticity, 70%; sand, fine, medium-brown, 30%	
240-250			clay; same as 220-230 ft	
250-260			silty clay; clay, medium-gray and purple-brown, high plasticity	
260-280			clay; clay, medium-gray and purple-brown, high plasticity	

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2013 APR 30 PM 1:59

280-290			silty clay; same as 250-260 ft
290-300			sandstone; sandstone, fine, light-gray, moderately well-cemented; minor clay, purple-brown, high plasticity
300-310			sandstone; sandstone, fine, light-gray, moderately- to well-cemented; minor clay, purple-brown and light-gray, high plasticity
310-320			sandstone; sandstone, fine, light-gray and white, moderately- to well-cemented; minor clay, red, high plasticity; minor mudstone, red
320-330			sandstone; sandstone, fine, light-gray, moderately well-cemented, 25%; minor mudstone, red, 25%; calcareous shale, medium-gray, 25%; minor shale, dark-red, 25%
330-340			sand; sand, fine to very coarse, light-gray, angular to sub-angular, variety of lithologies
340-370			sand; sand, medium to very coarse, light-gray, angular to sub-angular, variety of lithologies
370-380			sand; sand, fine to very coarse, light-gray, angular to sub-angular, variety of lithologies; minor clay
380-400			clayey sand; sand, fine, light-gray, 80%; clay, light-gray, high plasticity, 20%
400-410			clayey sand; sand, fine, light-gray, 80%; clay, light-gray and pink-red, high plasticity, 20%
410-430			clayey sand; sand, fine, light-gray; clay, light-gray and light-purple, high plasticity
430-440			silty clay; clay, light-gray and light-purple, high plasticity; silt, light-gray and light-purple
440-450			clay; light-purple-brown and light-gray, high plasticity
450-460			silty sandy clay; clay, light-purple-brown and light-gray, high plasticity; sand, fine
460-470			sandy clay; light-purple-brown, moderate plasticity; sand, coarse, angular to sub-angular, variety of lithologies
470-480			sandy clay; light-purple-brown, moderate plasticity; sand, coarse, angular to sub-angular, variety of lithologies; minor mudstone, red
480-490			silty clay; clay, light-purple-brown and light-gray, moderate plasticity
490-500			silty sandy clay; same as 450-460 ft
500-510			sandy clay; clay, purple-red-brown, moderate plasticity; sand, coarse to very coarse, angular to sub-angular, variety of lithologies
510-530			silty sandy clay; clay, medium-red-brown, moderate plasticity; sand, fine to very coarse, angular to sub-angular, variety of lithologies
530-540			clayey sand; sand, medium-red-brown, fine to very coarse, angular to sub-angular, variety of lithologies
540-550			silty sandy clay; same as 510-530 ft
550-560			silty sandy clay; clay, pink-red, moderate plasticity; sand, fine to very coarse, angular to sub-angular, variety of lithologies
560-570			silty clay; clay, medium-red-brown, high plasticity

570-590			silty sandy clay; same as 510-530 ft
590-600			sandy clay; clay, medium-red-brown, high plasticity; sand, coarse to very coarse, angular to sub-angular, shale and mudstone lithologies
600-620			silty sandy clay; same as 510-530 ft
620-630			shale; shale, light-gray, dark-gray, and dark-red-brown; minor clay, pink-red-brown
630-640			shale, mudstone, and siltstone; light-gray, dark-gray, and dark-purple-brown, angular to sub-angular, to 5 mm
640-660			shale, mudstone, and siltstone; light-gray, dark-gray, and dark-purple-brown, angular to sub-angular, to 5 mm; minor clay, medium-red-brown, high plasticity
660-670			shale, mudstone; light-gray, dark-gray, and dark-purple-brown, angular, to 5 mm
670-700			mudstone; light-gray, dark-gray, purple-brown, angular to sub-rounded, to 5 mm, trace fossils (burrows) observed
700-710			clayey sand; sand, fine to very coarse, pink-red-brown
710-720			sandy clay; clay, medium-red-brown, high plasticity; sand, very coarse, light-gray, dark-gray, and dark-red-brown, angular to sub-angular, mudstone lithology
720-730			clayey sand; sand, medium-red-brown, very coarse, angular to sub-angular, mudstone lithology
730-740			sandy clay; clay, medium-red-brown, high plasticity; sand, very coarse, light-gray, dark-gray, dark-red-brown and pink-red, angular to sub-angular, mudstone lithology
740-770			clayey sand; sand, medium-red-brown, very coarse, angular to sub-angular, mudstone lithology
770-780			clayey sand; sand, light-gray, dark-gray, and medium-red-brown, coarse to very coarse, angular, mudstone lithology; clay, medium-red-brown
780-800			gravely sand; sand, light-gray, dark-gray, medium-red-brown, purple-brown, coarse to very coarse, angular to rounded; mudstone lithology
800-810			clayey gravel; gravel, light-gray, dark-gray, red-brown, purple-brown, angular to rounded, mudstone lithology
810-820			clayey, gravely sand; sand, light-gray, dark-gray, red-brown, purple-brown, very coarse, angular to rounded, variety of lithologies
820-830			clayey gravel; gravel, light-gray-brown, angular to sub-angular, variety of lithologies
830-840			clayey sandy gravel; gravel, light-gray-brown, angular to sub-angular, mudstone lithology with minor chert
840-850			mudstone and limestone; mudstone, red-brown, 70%; limestone, gray, 30%
850-870			mudstone; red-brown
870-890			mudstone; mudstone, red-brown and gray-white; minor gravel, variety of lithologies
890-910			mudstone and sandstone; mudstone, red-brown and dark-gray, 80%; sandstone, white, 20%
910-920			silty mudstone and sandstone; mudstone, red-brown, dark-purple-brown, and dark-gray, 60%; sandstone, light-gray, fine, 35%; minor quartz and gypsum

STATE OF NEW YORK
ALBANY
2013 APR 30 PM 1:59

920-930			silty mudstone and limestone; mudstone, red-brown, dark-purple-brown, and dark-gray, sub-angular to rounded, to 40 mm, 70%; limestone, light-gray, subangular, to 40 mm, 30%
930-950			silty mudstone, limestone, and sandstone; mudstone, red-brown, dark-purple-brown, and dark-gray, sub-angular to rounded, to 20 mm, 70%; limestone, light-gray, subangular, to 40 mm, 15%; sandstone, light-gray, fine, friable, 15%
950-960			limestone, sandstone, and shale; limestone, light-gray, sub-angular to rounded, to 20 mm, 70%; sandstone, light-gray, fine, friable, 15%; shale, pink-brown and light-gray, sub-angular to rounded, to 10 mm, 15%
960-970			sand and limestone; sand, buff-tan, fine to medium, 70%; limestone, light-gray to medium-gray, sub-angular to rounded, to 20 mm, 30%
970-990			clayey sandstone and limestone; sandstone, red-brown, dark-purple-brown, and medium-gray, sub-angular to rounded, to 20 mm, 60%; limestone, light-gray, sub-rounded, to 20 mm, 40%
990-1,000			sand, limestone, and silty shale; sand, buff-tan, fine to medium, 70%; limestone, light-gray, angular to sub-rounded, to 30 mm, 15%; shale, dark-gray, angular to sub-rounded, 15%
1,000-1,010			sand and silty shale; sand, buff-tan, fine to medium, 90%; shale, dark-gray, angular to sub-rounded, 10%
1,010-1,020			sand and limestone; sand, buff-tan, fine to medium, 70%; limestone, light-gray, angular to sub-angular, to 15 mm, 30%
1,020-1,030			sand, sandstone, and limestone; sand, buff-tan, fine to very coarse, variety of lithologies, 50%; sandstone, buff-tan, fine, to 10 mm, 25%; limestone, light-gray, angular to sub-rounded, to 10 mm, 25%
1,030-1,040			sand and limestone; sand, light-buff, fine to medium, 90%; limestone, medium-gray, angular to sub-angular, to 5 mm, 10%
1,040-1,050			sandstone and limestone; sandstone, light-buff, fine, friable, to 5 mm, 80%; limestone, medium-gray, angular to sub-angular, to 5 mm, 20%
1,050-1,060			sandstone and limestone; sandstone, light-buff, fine, friable, to 5 mm, 70%; limestone, medium-gray, angular to sub-rounded, to 15 mm, 30%
1,060-1,070			silty limestone; limestone, medium-gray, angular, to 30 mm; minor silty clay, pink; minor sandstone, light-buff, to 3 mm
1,070-1,080			calcareous shale; medium-gray, angular to sub-angular, to 5 mm
1,080-1,100			sand; sand, medium to coarse, predominantly quartz; minor limestone, medium-gray, angular, to 10 mm; minor calcareous shale, medium-gray, angular, to 10 mm
1,100-1,110			clayey sand; sand, medium-brown, fine to coarse, 70%; clay, medium-brown, high plasticity, 30%
1,110-1,120			sand, sandstone, shale, and limestone; sand, light-brown, medium to very coarse, 60%; sandstone, light-buff, fine, friable, to 5 mm, 20%; shale, dark-brown, angular, to 5 mm, 10%; limestone, medium-gray, angular, to 5 mm, 10%
1,120-1,130			silty shale, limestone, and sandstone; shale, dark-brown, angular, to 10 mm, 60%; limestone, medium-gray, to 5mm, 30%; sandstone, light-buff, fine, friable, 10%
1,130-1,140			sandstone, shale, and limestone; sandstone, light-buff and salmon-pink, fine, friable, to 5mm, 50%; shale, dark-brown, angular, to 5 mm, 25%; limestone, medium-gray, to 10 mm, 25%
1,140-1,170			silty sand; sand, dark-red-brown, very fine to coarse, 25%; minor clay, dark-red-brown; minor shale, dark-brown, angular, to 5 mm
1,170-1,180			shale and sandstone; shale, dark-brown, to 5 mm, 90%; sandstone, light-buff, fine, friable, to 5 mm, 10%
1,180-1,200			sand and sandstone; sand, dark-brown, medium, shale lithology, 90%; sandstone, light-buff, 10%
1,200-1,210			shale and sandstone; same as 1,170-1,180 ft

STATE ENGINEER OFFICE

WELL RECORD

234854

Section 1. GENERAL INFORMATION

(A) Owner of well Western Nuclear Inc. Owner's Well No. 25-1
 Street or Post Office Address P.O. Box 899
 City and State Thoreau N.M. 87323

Well was drilled under Permit No. B-417 and is located in the:

a. SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 25 Township 15 Range 13 N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Salazar Brothers Drilling _____ License No. WD-748

Address 205 Airport Road, Milan, N.M. 87021

Drilling Began 9/17/79 Completed 9/29/79 Type tools Rotary 7-7/8"-0-2800'
4-3/4"-2800-3102' Size of hole in.

Elevation of land surface or Collar at well is 7484 ft. Total depth of well 3102 ft.

Completed well is ☐ shallow ☒ artesian. Depth to water upon completion of well 550 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
2783	2900	117	San Andres Limestone	Combined yield of
2900	3102	202	Glorieta Sandstone	at least 23 gpm

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
6"	X-Line Grade 42	Welded w/ collars	0'	1240'	1240'	bell reducer	none	
5"	"	"	1240'	2800'	1560'	Lea Equipment Co. 5.5" Type 600 Guide Shoe	none	

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
2532'	2800'	7-7/8		50 sacks	pump & plug

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

File No. B-417

Quad _____ FWL _____ FSL _____

Liv. Dom/San 15N.13W.25.140

Use _____ Location No. McKinley County

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered	
From	To			
			WESTERN NUCLEAR, INC.	
Lithology:				
Depth Interval:		Thickness:	Formation:	Description:
0 - 45		45	Mancos	Dark grey shale
45 - 201		156	Dakota	Fine buff sand w/ occasional coal stringers
201 - 342		141	Morrison	Brushy Basin- green mudstone w/ poorly sorted sand lenses up to 30' thick near base
342 - 522		180	"	Westwater Canyon- poorly sorted fine to coarse grained red sands w/ widely separated thin shale stringers
522 - 1105		583	Cow Springs, Summerville	Undifferentiated maroon and green shales and siltstones w/ minor sandstones.
1105 - 1117		12	Todilto	Massive grey limestone
1117 - 1125		8	"	Chalky limestone and gypsum
1125 - 1287		162	Entrada	Well sorted very fine grained red sandstone and siltstone
1287 - 2783		1496	Chinle	Maroon and green shale and siltstones with minor sand intervals
2783 - 2811		28	Chinle(?)	Well sorted clean white med. grained sandstone
2811 - 2900		89	San Andres	Massive dark grey limestone
2900 - 2930		30	Glorieta	Clean white med. grained sandstone
2930 - 2938		8	"	Reddish siltstone and fine grained sandstone
2938 - 3081		143	"	Clean white med. to coarse grained sandstone
3081 - 3090		9	Yeso (?)	Dark red shale
3090 - 3102		12	Yeso (?)	Clean lt. pink sandstone
3102	T.D.			

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

A. L. Deeter, Resident Manager
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a), and Section 5 need be completed.

#237669

Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well R. P. Waldie Owner's Well No. 1
 Street or Post Office Address Box 746
 City and State Throusa N.M. 87373

Well was drilled under Permit No. B 826 and is located in the:

a. NE 1/4 NE 1/4 NE 1/4 of Section 33 Township 14 N Range 13 W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor SANDERS Drilling License No. WD 804

Address PO Box 3081 MILAN NM 87021

Drilling Began 2-16-80 Completed 2-19-81 Type tools Rotary Size of hole 8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 343 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 170 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
<u>296</u>	<u>335</u>	<u>39</u>	<u>white sand</u>	<u>30</u>

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
<u>5 9/16</u>	<u>190 Psi</u>		<u>0</u>	<u>343</u>	<u>343</u>	<u>—</u>	<u>296</u>	<u>338</u>

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
	<u>1 1/8</u>				
	<u>1 PH</u>				
	<u>4</u>				

Section 5. PLUGGING RECORD

Plugging Contractor 81 MAR
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
<u>1</u>			
<u>2</u>			
<u>3</u>			
<u>4</u>			

FOR USE OF STATE ENGINEER ONLY

Date Received Feb. 24, 1981

Quad _____ FWL _____ FSL _____

File No. B-826Use Domestic Location No. 14N.13W.33.224 (McKinley)

[illegible]

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

J. R. Saunders
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

234880

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well TIEJUN RANCH (FRANCES RENEAU) Owner's Well No. B-900-X
 Street or Post Office Address P.O. BOX 247
 City and State GRANTS, NM 87020

Well was drilled under Permit No. H.C. 132189 and is located in the:

a. $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 35 Township 14N Range 13W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in McKinley County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor ROTARY DRILLING License No. WD-643

Address P.O. BOX 129 GRANTS, NM 87020

Drilling Began 4/5/88 Completed 4/7/88 Type tools ROTARY Size of hole 6 $\frac{1}{2}$ in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 401.5 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 160 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
360	401.5	41.5	CRACKS IN THE CHINLEE	15

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
4	SCH 40		+ 2	401.5	403.5		380	400
7" STEEL WELDED		6	60		54	SURFACE CASING		

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
				1 SACK	POURED
					SHALE TRAP SET @ 160

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			36
2			
3			
4			

Date Received April 29, 1988 FOR USE OF STATE ENGINEER ONLY

Quad _____ FWL _____ FSL _____

File No. B-900-X Use Dam Location No. 14N-13W-35-133
(McKinley)

[illegible]

W. J. Guernsey
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

IMPORTANT — READ INSTRUCTIONS ON BACK BEFORE FILLING OUT THIS FORM.

Declaration of Owner of Underground Water Right

BLUEWATER UNDERGROUND WATER BASIN

Declaration No. B-954 BASIN NAME February 3, 1982

TWPLCo. Sta. 5 #1 Well

STATEMENT

1. Name of Declarant Transwestern Pipeline Company
 Mailing Address P.O. Box 1019, Thoreau, New Mexico 87323
 County of McKinley, State of New Mexico
2. Source of water supply Sonsella sandstone bed of Chinle Formation
 (artesian or shallow water aquifer)
3. Describe well location under one of the following subheadings:
 a. NE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Sec. 20 Twp. 14N Rge. 13W N.M.P.M., in
McKinley County.
 b. Tract No. N/A of Map No. _____ of the _____
 c. X = _____ feet, Y = _____ feet, N. M. Coordinate System _____ Zone
 in the _____ Grant.
 On land owned by Transwestern Pipeline Company
4. Description of well: date drilled 1959 driller Layne Texas depth 746 feet.
 outside diameter of casing 10 3/4 inches; original capacity _____ gal. per min.; present capacity 10
 gal. per min.; pumping lift 680' feet; static water level 397 feet (283') (below) land surface;
 make and type of pump Grundfos 5hp. Submersible set at 680'
 make, type, horsepower, etc., of power plant Electric Service
 Fractional or percentage interest claimed in well 100%
5. Quantity of water appropriated and beneficially used 16.1
 for Domestic, Industrial, and Agricultural (acre feet per acre) (acre feet per annum) purposes.
6. Acreage actually irrigated No acres, located and described as follows (describe only lands actually irrigated):

Subdivision	Sec.	Twp.	Range	Acres Irrigated

(Note: location of well and acreage actually irrigated must be shown on plat on reverse side.)

7. Water was first applied to beneficial use February 1960 and since that time
 month day year
 has been used fully and continuously on all of the above described lands or for the above described purposes except
 as follows: a complete aquifier test on this well was done by John Shomaker,
consulting geologist on May 19, 1981. Water is used continuously and only
for Transwestern's purposes, such as: engine cooling, hygienic, household
domestic, beautification and gardening except for (A)
8. Additional statements or explanations Occasional county and state maintenance projects,
and (b) ten-fifteen Indian families haul water for their household use; this
frequency depends on tribal water supplies.
See attached sheet for additional information.

I, L. Davina, Division Engineer, Transwestern Pipeline Company, being first duly sworn upon my oath,
 depose and say that the above is a full and complete statement prepared in accordance with the instructions on the re-
 verse side of this form and submitted in evidence of ownership of a valid underground water right, that I have carefully
 read each and all of the items contained therein and that the same are true to the best of my knowledge and belief.

attest Salome C. Woody
 Salome C. Woody

Transwestern Pipeline Company, doeth certify,
 by L. Davina, Division Engineer, TWP. Co.

Subscribed and sworn to before me this 3rdL. Davina
day of Feb.My commission expires 9-23-83

Notary Public

OK
742550

82 FEB 9 P 1:07
 STATE ENGINEER OFFICE
 DISTRICT
 ALBUQUERQUE, N. MEX.

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Arthur L. Carver Owner's Well No. 5
 Street or Post Office Address Box 2 Rt 2
 City and State Thoreau New Mexico 87823

Well was drilled under Permit No. 13-986 and is located in the:

a. NE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 2 Township 13N Range 13W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Strang Drilling License No. WD-856

Address Guemado N.M.

Drilling Began Nov 16, 1982 Completed Nov 18, 1982 Type tools Cable Size of hole 6 1/2 in.

Elevation of land surface or 7080 at well is 7080 ft. Total depth of well 170 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 90 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
<u>150</u>	<u>155</u>	<u>5</u>	<u>Sandstone turn of coal</u>	<u>18</u>

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
<u>4</u>							<u>150</u>	<u>170</u>

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
<u>1</u>			
<u>2</u>			
<u>3</u>			
<u>4</u>			

FOR USE OF STATE ENGINEER ONLY

Date Received 11/23/82

B-986

Quad _____ FWL _____ FSL _____

S2.T13N.R13W NMPM McKinley Co.

File No. _____ Use _____ Location No. _____

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	5	5	2 ft top Soil + 3 Sandstone white
5	10	5	Sandstone white
10	15	5	" " "
15	20	5	" "
20	25	5	" "
25	30	5	Brown shale
30	35	5	Sandrock + Red stone
35	40	5	" "
40	45	5	Brown shale
45	50	5	" "
50	55	5	Brown shale + sandrock
55	60	5	" "
60	65	5	Sand rock + stone yellow and Red) Hard
65	70	5	" "
70	75	5	" "
75	80	5	" "
80	85	5	Brown shale
85	90	5	Gray shale
90	95	5	" "
95	100	5	" "
100	100	10	Brown shale
110	115	5	Gray shale
115	150	45	Sand stone trace of coal 150'
150	165	15	" " water
165	170	5	Brown shale

Section 7. REMARKS AND ADDITIONAL INFORMATION

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Wayne Strong
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

RECEIVED

OFFICE OF STATE ENGINEER
SANTA FE NEW MEXICO

DATE 4/8/16

1. GENERAL AND WELL LOCATION	OSE POD NUMBER (WELL NUMBER) POD-14 (TRCPC-15)			OSE FILE NUMBER(S) B-1019 POD 14				
	WELL OWNER NAME(S) Tri-State Generation and Transmission Association			PHONE (OPTIONAL) 303-452-6111				
	WELL OWNER MAILING ADDRESS P.O. Box 33695			CITY STATE ZIP Denver Co 80233-0695				
	WELL LOCATION (FROM GPS)	DEGREES LATITUDE 35	MINUTES 25'	SECONDS 7.81" N	* ACCURACY REQUIRED: ONE TENTH OF A SECOND * DATUM REQUIRED: WGS 84			
	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE (NW) Section 25, Township 14N, Range 12W							
2. DRILLING & CASING INFORMATION	LICENSE NUMBER 331		NAME OF LICENSED DRILLER Stewart Brothers Drilling Co./Joel H. Stewart			NAME OF WELL DRILLING COMPANY Stewart Brothers Drilling Co.		
	DRILLING STARTED 01/20/16	DRILLING ENDED 02/03/16	DEPTH OF COMPLETED WELL (FT) 260'	BORE HOLE DEPTH (FT) 270"	DEPTH WATER FIRST ENCOUNTERED (FT)			
	COMPLETED WELL IS: <input checked="" type="checkbox"/> ARTESIAN <input type="checkbox"/> DRY HOLE <input type="checkbox"/> SHALLOW (UNCONFINED)				STATIC WATER LEVEL IN COMPLETED WELL (FT) 31'			
	DRILLING FLUID: <input type="checkbox"/> AIR <input checked="" type="checkbox"/> MUD ADDITIVES - SPECIFY:							
	DRILLING METHOD: <input checked="" type="checkbox"/> ROTARY <input type="checkbox"/> HAMMER <input type="checkbox"/> CABLE TOOL <input type="checkbox"/> OTHER - SPECIFY:							
	DEPTH (feet bgl) FROM TO		BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
	0' 220'		8.75	Sch 40 PVC Blank	Threaded/Flush Joint	3.998	.25	n/a
	220' 260'		8.75	Sch 40 PVC Screen	Threaded/Flush Joint	3.998	.25	0.010
3. ANNULAR MATERIAL	DEPTH (feet bgl) FROM TO		BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT		
	0' 208.6'		8.75	Grout Well DF		Tremie		
	208.6' 213.3'		8.75	Bentonite Pellets		Tremie		
	213.3' 265'		8.75	Silica Sand		Tremie		
	265' 270"		8.75	Natural Fill "Collapsed hole"				

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 10/29/15)

FILE NUMBER B-1019	POD NUMBER 14	TRN NUMBER 581461
LOCATION NW NE SW Sec 25. T14N R12W		

PAGE 1 OF 2

DATE 4/8/16

201 0.00

PAGE 2 OF 2

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well B.A. MAISH Owner's Well No. 1
Street or Post Office Address Box 958
City and State Chowinpoint N.M. 87313

Well was drilled under Permit No. B-1034 (MC) 6/21/02 and is located in the:

a. $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 7 Township 14N Range 12W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in McKinley County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
the _____ Grant.

(B) Drilling Contractor Wayne Smith Drilling Co. License No. WD-734

Address P.O. Box 609 Chowinpoint N.M. 87313

Drilling Began 5-26 Completed 5-30 Type tools Rotary-Air Size of hole 6 3/4 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 485 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 150 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
<u>436</u>	<u>478</u>	<u>42</u>	<u>Fine white & gray sand</u>	<u>30</u>

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
<u>5 1/2</u>	<u>PVC</u>	<u>6" Bell</u>	<u>1 FT above</u>	<u>485</u>	<u>486</u>	<u>CAP</u>	<u>435</u>	<u>478</u>

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received Jan 4, 1986

Quad _____ FWL _____ FSL _____

File No. B-1034 Use Dom Location No. 14N. 12W. 7. 400

(McKinley) ✓

[illegible]

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a), and Section 5 need be completed.

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well B.A. Marsh Owner's Well No. 1
Street or Post Office Address Box 958
City and State Chowinpoint N.M. 87313

Well was drilled under Permit No. B-1034 and is located in the:

a. $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 7 Township 14N Range 12W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in McC. Rinkley County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Wayne Smith Drilling Co. License No. WD-734

Address P.O. Box 609 Chowinpoint N.M. 87313

Drilling Began 5-26 Completed 5-30 Type tools Rotary-Air Size of hole 6 3/4 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 485 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 150 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
<u>436</u>	<u>478</u>	<u>42</u>	<u>Fine white & gray sand</u>	<u>30</u>

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
<u>5 1/2</u>	<u>PVC</u>	<u>6" B&I</u>	<u>1 FT above</u>	<u>485</u>	<u>486</u>	<u>CAP</u>	<u>435</u>	<u>478</u>

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
<u>1</u>			
<u>2</u>			
<u>3</u>			
<u>4</u>			

FOR USE OF STATE ENGINEER ONLY

Date Received June 4, 1984

Quad _____ FWL _____ FSL _____

File No. B-1034 Use Don Location No. 14W.12W.7.400

(McKinley)

[illegible]

Drilled out All. + FoAm 750 CFM.

Testing while Drilling @ 440 - 30 gpm
@ 460 - 60 gpm

FINAL Test @ 485- 30.9 P.M.

RUN CASING - WATER LEVEL APPROX 150' THE NEXT DAY

Test w/ RIL @ 200' - 59pm

4 4 4 @ 240 - 109pm

Will Probly set Pump @ 300'

Hyman Z. L.
Driller

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well MARY ANN O'NEAL B-1102
Street or Post Office Address P.O. BOX 808
City and State CROWNPOINT, NM 87313

Well was drilled under Permit No. HC 127430 B-1102 and is located in the:

a. S 1/2 XX S 1/2 XX 1/4 S 1/2 XX of Section 7 Township 14 N. Range 12 W. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in McKINLEY County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
the _____ Grant.

(B) Drilling Contractor WALLIE G. FREEMAN / DBA ROTARY DRILLING License No. WD-643

Address P.O. BOX 129 GRANTS, NM 87020

Drilling Began 3/28/86 Completed 3/31/86 Type tools ROTARY Size of hole 6 1/4 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 510 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 180 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
SEEP AT 240'			RED SANDY SHALE	SEEP
475	480	5	SANDSTONE	15+

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
4" 160psi PVC			+2	200	202			
4" SCH 40 PVC			200	510	310			

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
				1 SACK POURED	
				3 SHALE TRAPS SET @ 50', 250', 450'	

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____

State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY


Date Received July 8, 1986

Quad _____ FWL _____ FSL _____

File No. B-1102 Use dom Location No. 14N.12W.7.S1/2S1/2 (McKinley)

[illegible]

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.


Driller

INSTRUCTIONS: This form should be completed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

#237554

Revised June 1972

STATE ENGINEER OFFICE WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Rex Eby Owner's Well No. B-1173
 Street or Post Office Address P.O. Box 757
 City and State Thoreau, NM 87323

Well was drilled under Permit No. B-1173 and is located in the:

a. 1/4 1/4 NE NE 1/4 of Section 33 Township 14N Range 13W N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
 Subdivision, recorded in McKinley County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
 the _____ Grant.

(B) Drilling Contractor Badger Drilling Co. License No. WD 1028
 Address 200 Western Skies Rd. # 142 Gallup N.M. 87301

Drilling Began 6/30/88 Completed 7/7/88 Type tools Air Rotary Size of hole 6 1/2 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 375 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 127 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
			Sandstone (Chinle formation)	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
7	Fiber Glass	3	+2	100	102	None		
4 1/2	PVC		15	375			160	370

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
 Address _____
 Plugging Method _____
 Date Well Plugged _____
 Plugging approved by: _____

State Engineer Representative _____

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

Date Received July 26, 1988 FOR USE OF STATE ENGINEER ONLY

File No. 61173 Use Dom Location No. 14N.13W.33.220
(McKinley)

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	11		Sand (Red)
11	13		Shale (Red sandy)
13	19		Sand (Pink)
19	24		Shale (Firm Clay)
24	26		Sand (Red)
26	32		Shale (Red sandy dry)
32	53		Shale (Very sandy damp)
53	66		Quicksand (lost circ)
66	72		Sand (Red)
72	77		Silt (Gravel)
77	165		Shale (Red)
165	195		Sandstone (Soft, shale streaks)
195	256		Shale (Purple)
256	259		Sandstone (Grey)
259	278		Shale (Purple grey streaks)
278	290		Sandstone (Brown grey streaks)
290	302		Shale (Purple)
302	313		Sandstone (Brown)
313	314		Fractured (Water)
314	319		Shale (Purple)
319	328		Sandstone (White)
328	334		Fractured (Water)
334	339		Shale (Purple)
339	375		Sandstone (White, fractured, water)

Section 7. REMARKS AND ADDITIONAL INFORMATION

Had to case out the water from 53' to 72' it had to much very fine silt.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.


Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

#237262

Revised June 1972

STATE ENGINEER OFFICE
WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well RICO MOTOR CO. A CORP. Owner's Well No. B-1178
Street or Post Office Address 501-23 WEST COAL
City and State CALLUP, NM 87301

Well was drilled under Permit No. B-1178 and is located in the:
a. NE $\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{4}$ of Section 3 Township 13N Range 13W N.M.P.M.
b. Tract No. _____ of Map No. _____ of the _____
c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in McKINLEY County.
d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in
the _____ Grant.

(B) Drilling Contractor BADGER DRILLING CO. License No. WD1028
Address 200 WESTEREN SKIES RD. #142

Drilling Began 8/18/88 Completed 9/15/88 Type tools AIR ROTARY Size of hole 6 1/2 in.
Elevation of land surface or _____ at well is _____ ft. Total depth of well 350 ft.
Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 113 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
<u>42</u>	<u>74</u>		<u>GRAVEL AND RUNNING SAND</u>	<u>1 1/2</u>
<u>134</u>	<u>350</u>		<u>SANDSTONES OF THE CHINLE</u>	<u>8</u>

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
<u>6 5/8</u>	<u>STEEL</u>		<u>+2</u>	<u>98'</u>	<u>100'</u>			
<u>4"</u>	<u>PVC</u>		<u>10'</u>	<u>350'</u>	<u>340'</u>		<u>140'</u>	<u>345'</u>

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by: _____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
<u>1</u>			
<u>2</u>			
<u>3</u>			
<u>4</u>			

FOR USE OF STATE ENGINEER ONLY

Date Received Sept 26, 1988
Quad _____ FWL _____ FSL _____
File No. B-1178 Use Perm Location No. 13N. 13W. 3. 100
(McKinley)

Section 6. LOG OF HOLE

Depth in Feet		Thickness in Feet	Color and Type of Material Encountered
From	To		
0	3		CLAY
3	7		SAND (TAN)
7	8		CLAY (BROWN)
8	40		SAND (TAN)
40	42		GRAVEL (LOST CIRCULATION)
42	56		SAND (TAN)
56	65		SANDSTONE (SOME CHERT)
65	74		SOFT SAND
74	83		SANDSTONE (TAN)
83	97		SHALE (PURPLE)
97	102		SANDSTONE (WHITE)
102	134		SHALE (PURPLE)
134	157		SANDSTONE (WHITE)
157	161		SHALE (GREEN)
161	165		SHALE (PURPLE)
165	169		SANDSTONE (GREENISH)
169	176		SANDSTONE (WHITE)
176	198		SHALE (GREEN)
198	230		SHALE (PURPLE)
230	231		SANDSTONE (LT. GREY)
231	304		SHALE (PURPLE)
304	312		SANDSTONE (GREEN)
312	315		SHALE (RED)
315	318		SANDSTONE (RED)
318	320		LIMESTONE (LT. GREY)
320	323		SANDSTONE (GREENISH)

Section 7. REMARKS AND ADDITIONAL INFORMATION

323 350 SHALE (PURPLE)

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Mike Thompson
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 9, shall be completed as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section (1a) and Section 8 need be completed.

Number of this permit B-1244-Explore-1 & 2

ACTION OF STATE ENGINEER

After notice pursuant to statute and by authority vested in me, this application is approved provided that the work shall be in accordance with the provisions of the State Engineering Law provided that all rules and regulations of the State Engineer pertaining to the drilling of shallow wells be complied with; and further subject to the following conditions: _____

1. Wells shall be drilled by a drilling contractor licensed by the State Engineer of New Mexico.
2. A complete and properly executed well(s) record on the form provided by the State Engineer shall be filed not later than ten (10) days after completion of the well. Test data shall be filed not later than ten (10) days after completion of the test(s).
3. No water shall be diverted from these wells except for testing purposes which shall not exceed 180 cumulative days, and wells shall be plugged or capped on or before March 15, 1993, unless a permit to use water from these wells is acquired from the office of the State Engineer.

Proof of completion of well shall be filed on or before _____, 19____

Proof of application of water to beneficial use shall be filed on or before _____, 19____.

Witness my hand ~~mark mark~~ this 10th day of March, A.D., 19 92

Eluid L. Martinez, State Engineer

By: [Signature]

C. A. Wohlenberg, District I

INSTRUCTIONS

This form shall be executed, preferably typewritten, in triplicate and shall be accompanied by a filing fee of \$5.00. Each of triplicate copies must be properly signed and attested.

A separate application for permit must be filed for each well used.

Secs. 1-4—Fill out all blanks fully and accurately.

Sec. 5—Irrigation use shall be stated in acre feet of water per acre per annum to be applied on the land. If for municipal or other purposes, state total quantity in acre feet to be used annually.

Sec. 6—Describe only the lands to be irrigated or where water will be used. If on unsurveyed lands describe by legal subdivision "as projected" from the nearest government survey corners, or describe by metes and bounds and tie survey to some permanent, easily located natural object.

Sec. 7—If lands are irrigated from any other source, explain in this section. Give any other data necessary to fully describe water right sought.



'93 JUN 23 AM 10 46 **STATE OF NEW MEXICO**
STATE ENGINEER OFFICE
ALBUQUERQUE

STATE ENGINEER OFFICE
SANTA FE NEW MEXICO
ELUID L. MARTINEZ
STATE ENGINEER

DISTRICT 1
3311 CANDELARIA, N.E. SUITE A
ALBUQUERQUE, NM 87107

June 22, 1993

FILE: B-1244-Explore 1 & 2

Robert H. Ward
Ward Drilling Company
P. O. Box 872
Ruidoso, NM 88345

Dear Mr. Ward:

We have been advised by Daniel B. Stephens & Associates, Inc. that you drilled a well for them on April 9, 1992. A copy of the permit is enclosed for your reference.

To date, we have not received a Well Record from you. As you know, State Engineer Rules and Regulations clearly state that a Well Record must be submitted to this office within ten (10) days after completion of the well.

Please send this Well Record in now.

Sincerely,

Susan Raffay
Susan Raffay
(505) 841-9482

sr
cc: SEO, Santa Fe



DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

93 JUN 18 P 1:10

STATE ENGINEER OFFICE
DISTRICT I
ALBUQUERQUE, N. MEX.

June 16, 1993

Ms. Susan Raffay
State Engineers Office
3311 Candelaria NE Suite A
Albuquerque, NM 87109

Dear Ms. Raffay:

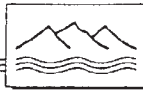
As you requested, we are submitting lithologic and well construction logs for the two wells drilled under exploratory permit number B-1244-Explore-1 & 2. As stated in the permit application, the wells were used to determine the hydraulic characteristics of the alluvial aquifer. Since completing the test in mid-December 1992, the wells have not been used. We will apply for additional permits prior to using the wells in the future.

Please let me know if you need anything else. I can be reached at 822-9400.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES

Bob Marley
Hydrogeologist



DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

3 JUN 1992 P 1. 11

STATE ENGINEER OFFICE
DISTRICT I
ALBUQUERQUE, N. MEX.

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Boring No.: 5-36E

Drilling Contractor: Ward Drilling Company
Ruidoso, New Mexico

Project No.: 2105 2.3

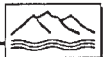
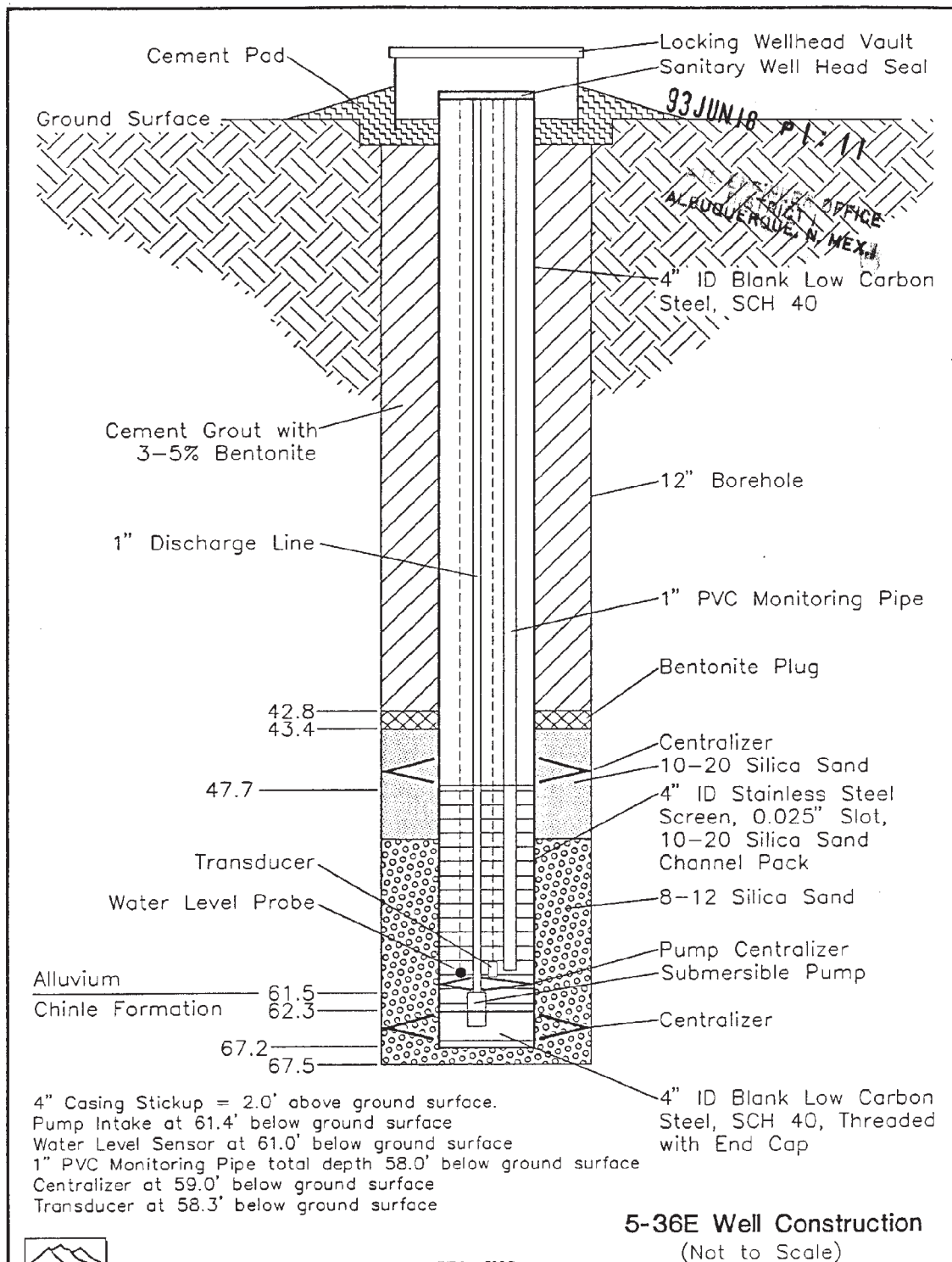
Drilling Method: Cable Tool

Date Started: 4/8/92

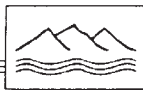
Total Depth Drilled: 67.5 ft

Date Completed: 4/9/92

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0 - 20.0	Cuttings	Silty sand	Very fine-grained, moderately sorted, trace clay, weak red (10 R 5/4, wet)
20.0 - 25.0	Cuttings	Silty sand	Very fine-grained, moderately sorted, minor clay, reddish-brown (2.5 YR 5/4, wet)
25.0 - 32.0	Cuttings	Silty sand	Fine-grained, moderately sorted, 5% coarse sand, reddish-brown (2.5 YR 5/3, wet)
32.0 - 35.7	Cuttings	Silty sand	Fine-grained, moderately sorted, 5-10% gravel (0.3 - 0.4 cm diameter), reddish-brown (2.5 YR 5/3, wet)
35.7 - 36.5	Split spoon	Sand	Medium-grained, well sorted, 10% coarse sand and gravel, reddish-brown (2.5 YR 5/3, wet)
36.5 - 49.9	Cuttings	Silty sand	Fine-grained, poorly sorted, 10-15% coarse sand and gravel, red (2.5 YR 5/6, wet)
49.9 - 51.1	Split spoon	Sand	Medium-grained, well sorted, moist to wet, minor silt, red (10 R 5/6, wet)
51.1 - 52.0	Cuttings	Sand	Medium-grained, well sorted, red (10 R 5/6, wet)
52.0 - 58.0	Cuttings	Sand	Fine-grained, moderately sorted, red (10R 5/6, wet)
58.0 - 59.0	Split spoon	Sand	Medium-grained, well sorted, 2% gravel and cobbles (1.0 - 1.5 cm diameter), red (10R 5/6, wet)
59.0 - 61.5	Cuttings	Sand	Very fine-grained, moderately sorted, 2% coarse sand, minor clay, red (2.5 YR 5/6)
61.5 - 67.5	Cuttings	Clay	Plastic, with light gray reduction spots, red (10 R 5/6, wet)



DANIEL B. STEPHENS & ASSOCIATES, INC.
6-92 JN 2105



DANIEL B. STEPHENS & ASSOCIATES, INC.

ENVIRONMENTAL SCIENTISTS AND ENGINEERS

Client: Transwestern Pipeline
Compressor Station No. 5
Thoreau, New Mexico

Boring No.: 5-371

Drilling Contractor: Ward Drilling Company
Ruidoso, New Mexico

Project No.: 2105 2.3

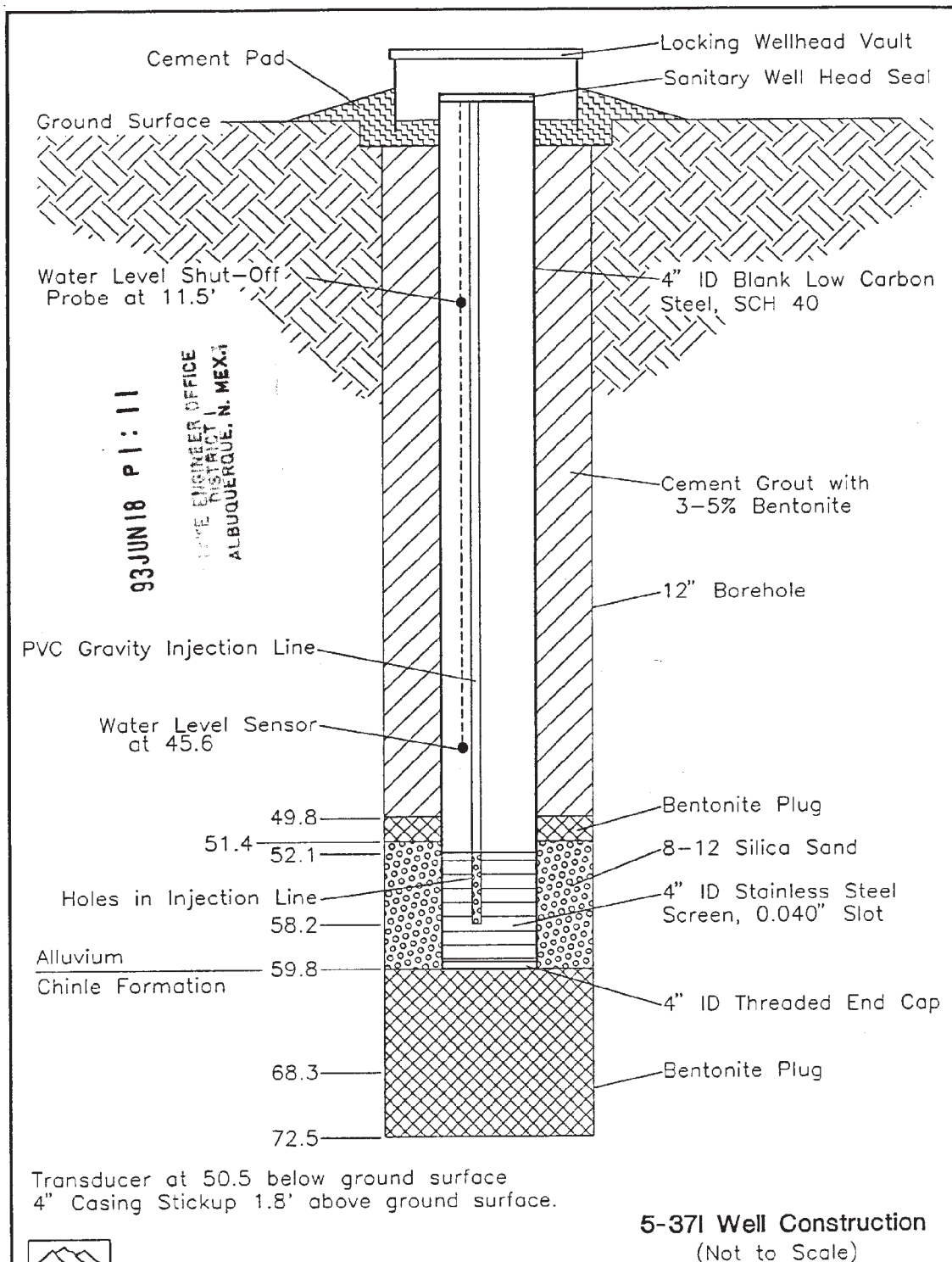
Drilling Method: Cable Tool

Date Started: 4/15/92

Total Depth Drilled: 72.5 ft

Date Completed: 4/16/92

DEPTH INTERVAL (FEET)	SAMPLE TYPE	MATERIAL TYPE	DESCRIPTION
0.0 - 37.0	Cuttings	Silty sand	Very fine to fine-grained, moderately sorted, trace clay, yellowish-red (5 YR 5/6, wet)
37.0 - 53.0	Cuttings	Silty sand	Fine-grained, poorly sorted, 15% limestone gravel and coarse sand, trace clay, yellowish-red (5 YR 5/6, wet)
53.0 - 59.0	Cuttings	Silty sand	Very fine to fine-grained, moderately sorted, trace clay, yellowish-red (5 YR 5/8, wet)
59.0 - 72.5	Cuttings	Clay	Plastic, moist to dry, trace fine sand, red (2.5 YR 4/8), partings with light gray reduction spots to 1/8" diameter. (N8)



DANIEL B. STEPHENS & ASSOCIATES, INC.
6-92 JN 2105



**STATE OF NEW MEXICO
STATE ENGINEER OFFICE
ALBUQUERQUE**

ELUID L. MARTINEZ
STATE ENGINEER

June 15, 1993

DISTRICT 1
3311 CANDELARIA, N.E. SUITE A
ALBUQUERQUE, NM 87107

FILE: B-1244-Explore-1 & 2

Daniel B. Stephens
6020 Academy, NE, Suite 100
Albuquerque, NM 87109

Greetings:

Under date of March 10, 1992, when forwarding your approved exploratory permit, numbered above, we advised you that in accordance with the conditions of approval, the well could only be tested for 10 cumulative days, and that the well was to be plugged on or before March 15, 1993, unless a permit to use the water was acquired from this office.

Please advise this office if the well was drilled and, if so, please see that the well log is submitted immediately. Since you have not applied for a permit to use the well, any well that was drilled under the above permit should now be plugged.

Very truly yours,

Susan Raffay
Susan Raffay
(505) 841-9482

sjr
cc: Santa Fe SEO

93 JUN 17 PM 2 24
STATE ENGINEER OFFICE
SANTA FE NEW MEXICO

IMPORTANT-READ INSTRUCTIONS ON BACK BEFORE FILLING OUT THIS FORM

APPLICATION FOR PERMIT

To appropriate the Underground Waters of the State of New Mexico

- Date Received January 18, 1996 File No. B-1325
- Name of applicant Northwest New Mexico Regional Solid Waste Authority
Mailing address P.O. Box 1330
City and State Thoreau, New Mexico 87323
 - Source of water supply Sonsela Aquifer, located in Bluewater Basin
(artesian or shallow water aquifer) (name of underground basin)
 - The well is to be located in the NE 1/4 SE 1/4 SE 1/4, Section 21 Township 14N
Range 12W N.M.P.M., or Tract No. _____ of Map No. _____ of the _____ District,
on land owned by Northwest New Mexico Regional Solid Waste Authority.
 - Description of well: name of driller Stewart Brothers Drilling;
Outside Diameter of casing 7 inches; Approximate depth ~~1000~~ drilled 946 feet;
 - Quantity of water to be appropriated and beneficially used 16 acre feet,
(consumptive use, diversion)
for Consumptive Use purposes.
 - ~~Acres to be used for~~ place of use Red Rocks Regional Landfill acres.

Subdivision	Section	Township	Range	Acres	Owner
South 1/2	21	14N	12W	320	NWNMRSWA
North 1/2	28	14N	12W	315	NWNMRSWA

- Additional statements or explanations:
 - This Application is for a Temporary Use Permit to appropriate 16 acre-feet of water per year from the Sonsela Aquifer for a period of 20 years. The Permit for the Red Rocks Regional Landfill is also for a 20 year period.
 - Water will be used at the Red Rocks Regional Landfill for domestic and sanitary uses, equipment maintenance, fire protection, dust control and composting.
 - This well was constructed for Conoco, Inc. in 1980 as their monitoring well MW-2. The well depth is 946 feet. Seven inch O.D. steel casing is set from 0.0 feet to 723.5 feet. Well screen consists of 6 5/8" OD #60 slot-louvered screen from 723.5 feet to 926 feet. The water level was measured at 190.5 feet on August 24, 1995.
 - The well pump tested the week of May 8, 1995 using a temporary pump at the rate of 19.5 gallons per minute for a period of 24 hours.

I, Henry Wilson, affirm that the foregoing statements are true to the best of my knowledge and belief and that development shall not commence until approval of the permit has been obtained.

NORTHWEST NEW MEXICO REGIONAL
SOLID WASTE AUTHORITY

Henry Wilson, Permittee,

By: Henry Wilson

Subscribed and sworn to before me this 12th day of January, A.D., 1996

My commission expires 11/27/99

Dandra R. Chang
Notary Public

ACTION OF STATE ENGINEER

~~After notice pursuant to statute and by authority vested in me, this application is approved provided that all~~
~~existing rights; is not contrary to conservation of water within the state and~~
~~is not detrimental to the public welfare of the state; further provided that all~~
~~Rules and Regulations of the State Engineer pertaining to the drilling of~~
~~Shallow wells be complied with; and further subject to the following conditions:~~

After notice pursuant to statute and by authority vested in me, this application
is approved provided it is not exercised to the detriment of any others having
existing rights; is not contrary to conservation of water within the state and
is not detrimental to the public welfare of the state; further provided that all
Rules and Regulations of the State Engineer pertaining to the drilling of
Shallow wells be complied with; and further subject to the following conditions:

(SEE ATTACHED CONDITIONS OF APPROVAL)

Proof of completion of well shall be filed on or before _____, 19____

Proof of application of water to beneficial use shall be filed on or before _____, 19____

Witness my hand and seal this _____ 1st _____ day of _____ February _____, A.D., XX 2002

Thomas C. Turney
~~XXXXXX~~ State Engineer

By: Andrew L. Lieuwen
Andrew L. Lieuwen
Water Resource Master

INSTRUCTIONS

This form shall be executed, preferably typewritten, in triplicate and shall be accompanied by a filing fee of \$5.00. Each of triplicate copies must be properly signed and attested.

A separate application for permit must be filed for each well used.

Secs. 1-4—Fill out all blanks fully and accurately.

Sec. 5—Irrigation use shall be stated in acre feet of water of acre per annum to be applied on the land. If for municipal or other purposes, state total quantity in acre feet to be used annually.

Sec. 6—Describe only the lands to be irrigated or where water will be used. If on unsurveyed lands describe by legal subdivision "as projected" from the nearest government survey corners, or describe by metes and bounds and tie survey to some permanent, easily located natural object.

Sec. 7—If lands are irrigated from any other source, explain in this section. Give any other data necessary to fully describe water right sought.

CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee: Northwest New Mexico Regional Solid Waste Authority

Permit Number: B-1325-T

Priority: Filing date of January 18, 1996

Source: Ground Water from the Sonsela aquifer

Point of Diversion:

Well No. B-1325 located in NE1/4 SE1/4 SE1/4 of Section 21, Township 14 North, Range 12 West, NMPM, drilled to a depth of 946 feet with 7-inch casing on land owned by the applicant, at the Red Rocks Regional Landfill, McKinley County, New Mexico.

Purpose of Use:

Domestic and sanitary uses, equipment maintenance, fire protection, and dust control.

Place of Use:

Red Rocks Regional Landfill, McKinley County, New Mexico.

Amount of Water: Consumptive use: 16.0 acre-feet per annum

2. Diversion of water under this permit shall occur only from the Sonsela aquifer (at approximate depth between 720 and 920 feet) and shall not exceed 10 acre-feet per annum over the 20-year period from February 1, 2002 to February 1, 2022.
3. This permit shall automatically expire on February 1, 2022, and any subsequent diversion of water from well B-1325 shall occur only under a separate permit from the State Engineer.
4. Well B-1325 shall be equipped with a totalizing meter, or meters, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer.
5. Records of the total amount of water diverted from Well B-1325 shall be submitted to the State Engineer on or before the 10th day of each month for the preceding calendar month.

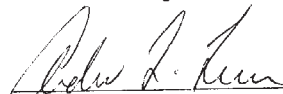
CONDITIONS OF APPROVAL (continued)

6. Well B-1325 shall be plugged in a manner acceptable to the State Engineer no later than March 1, 2022, unless a separate application to appropriate water from well B-1325 is approved by the State Engineer. A plugging record shall be filed with the State Engineer no later than ten (10) days after plugging.
7. The permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

Witness my hand and seal this 1st day of February, A.D., 2002.

Thomas C. Turney, P.E.
New Mexico State Engineer

By:



Andrew L. Lieuwen, District 1



**STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ALBUQUERQUE**

THOMAS C. TURNEY
STATE ENGINEER

July 5, 2002

DISTRICT 1
121 TIJERAS, NE, STE. 2000
ALBUQUERQUE, NM 87102-3400
(505) 841-9480

J. R. Murrietta, Executive Director
NW NM Regional Solid Waste Authority
PO Box 1330
Thoreau, NM 87323

Files: B-1324 and B-1325

Greetings:

Your meter reading has been received. In order to enter it into our database, please complete the enclosed form and submit it to our office as soon as possible. I appreciate your cooperation.

Please don't hesitate to call if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Eric Robinson".

Eric Robinson
Water Resource Specialist

ER:cr
cc: Santa Fe OSE



STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ALBUQUERQUE

THOMAS C. TURNEY
STATE ENGINEER

February 1, 2002

OFFICE OF
STATE ENGINEER
SANTA FE, NEW MEXICO
'02 FEB 4 AM 9 07

DISTRICT I
121 TIJERAS, NE, STE. 2000
ALBUQUERQUE, NM 87102-3400
(505) 841-9480

File: B-1325-T

Northwest New Mexico Regional Solid Waste Authority
P.O. Box 1330
Thoreau, NM 87323

Greetings:

Enclosed is your copy of the above-numbered Permit to Appropriate the Underground Water of the State of New Mexico, which has been approved subject to the conditions set forth on the reverse side thereof.

The permit shall automatically expire on February 1, 2022, and any subsequent diversion of water from Well B-1325 shall occur only under a separate permit from the State Engineer.

Well B-1325 shall be equipped with a totalizing meter, or meter, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer.

Records of the total amount of water diverted from Well B-1325 shall be submitted to the State Engineer on or before the 10th day of each month for the preceding calendar month.

Well B-1325 shall be plugged in a manner acceptable to the State Engineer no later than March 1, 2022, unless a separate application to appropriate water from Well B-1325 is approved by the State Engineer. A plugging record shall be filed with the State Engineer no later than ten(10) days after plugging.

The permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

Sincerely yours,

Andrew L. Lieuwen
Water Resource Master

ALL:cp
Enclosure as stated
cc: Santa Fe OSE

ADMINISTRATIVE PROCESS

Correctly prepared Proofs of Application of Water to Beneficial Use or Completions of Wells or Works, filed on or before the due date, will be accepted for processing.

Correctly prepared Proofs of Application of Water to Beneficial Use or Completions of Wells or Works, delivered after the due date, will not be accepted for filing or processing until one or more Applications for Extensions of Time are filed to bring the permit up to date.

Applications for Extensions of time which are filed on or before the due date will be processed in the order received as time and personnel are available.

If Applications for Extensions of Time are filed after the due date (LATE) but before cancellation of the permit, the file will be reviewed in the District Office and forwarded to the State Engineer with a recommendation to seek fines or other legal action through the Legal Services Division of the State Engineer Office.

If neither Proofs nor Applications for Extensions of Time are filed, the records of the permit will be reviewed and the file will be forwarded to The State Engineer with a recommendation to cancel the permit and/or to seek fines or other legal remedies through the Legal Services Division of the State Engineer Office.

MEMORANDUM

New Mexico State Engineer Office
Water Rights Division - District 1

DATE: February 1, 2002

FILE: B-1325-T

TO: Jess L. Ward *Ask for JW*

FROM: Jerry E. Carr *JEC*

SUBJECT: Application for Permit to Appropriate Ground Water of the State of New Mexico in the Bluewater Underground Water Basin -- Northwest New Mexico Regional Solid Waste Authority.

HISTORY: The subject application was filed on January 18, 1996, by Northwest New Mexico Regional Solid Waste Authority, P.O. Box 1330, Thoreau, New Mexico 87323. The notice for publication was issued on February 19, 1996. The affidavit of publication was filed on March 22, 1996, stating that the legal notice had been published on February 24, and on March 2 and 9, 1996, in The Independent. The protest period ended on March 19, 1996 and no protests were filed.

A field investigation concerning applications B-1325 and B-1325 was conducted on May 1, 1997 by District 1 personnel David Miller and Robin Hulette. The following information was recorded:

	B-1325	B-1325
Topo Map.....	38.2.2	38.2.2
Location.....	14N.12W.28.124	14N.12W.21.442
Meter Installed.....	NO	Master Meter
Serial Number.....	NA	Not Readable
Unit of Measure.....	NA	Gallons
Multiplier.....	NA	X10
Reading.....	NA	143896(0)
Previous Reading.....	NA	NONE
Date of Previous Reading.....	NA	NA
Usage in Acre-Feet.....	0	UNKNOWN
Permitted Diversion.....	10.0 AFA	16.0 AFA
Required Readings.....	NA	NA
GPS Readings, (Corrected)	NM Coordinate System, West Zone X = 415862.517 Y = 1607867.238	418954.517 1610174.404

Both wells were constructed in 1980 as Conoco, Inc. monitoring wells. Well B-1325 reportedly has no pump nor meter installed; no water meter was observed. The electric meter reading for the meter on a pole about 15 feet from the well B-1325 was all 0's. Well B-1325 was found to be in operation and reportedly providing water for the facility office which normally has 4 people working full-time. A water meter reading was recorded as shown above. The meter was found in a small "pit" adjacent to and on the north side of the concrete pad. The wooden top of the "pit" was buried under about 3 inches of dirt and cardboard. Reportedly, neither well has been used for dust control. No significant landscaping was observed around the office facility. Dust control is being accomplished using "run-off" water stored in a pond about 1/4 mile south of B-1325. The dam did not appear to be over about 6 to 8 feet in height nor cover more than about 1 [acre] of land.

CONSIDERATIONS: The applicant proposes to use an existing well B-1325 (Exhibits A and B), located in the NE1/4 SE1/4 SE1/4 of Section 21, Township 14 North, Range 12 West, NMPM, drilled to a depth of 946 feet with 7-inch casing on land owned by the applicant, at the Red Rocks Regional Landfill for domestic and sanitary uses, equipment maintenance, fire protection, dust control, and composting located in the South 1/2 of Section 21 (321 acres), and North 1/2 of Section 28 (315 acres), Township 14 North, Range 12 West, NMPM, on land owned by the applicant.

The well and lands are generally located as follows-- drive west on I-40 to the Thoreau exit and drive north on NM 371 for about 5.4 miles from the railroad overpass and turn right onto Red Mesa Bluffs Road. Drive for 1.6 miles to the office building. B-1325 is about 0.9 mile beyond the office and on the far side of the actual dump.

This application is for a Temporary Use Permit to appropriate 16 acre-feet of water per year from the Sonsela Aquifer for a period of 20 years.

Well logs by Jacobson Helgoth Consultants were obtained from the applicant on December 7, 2001, confirming that the well are in the Sonsela aquifer. In addition, this is also in agreement with the data given by Mr. Peter F. Frenzel in "Simulation of Ground-Water Flow in the San Andres-Glorieta Aquifer in the Acoma Embayment and Eastern Zuni Uplift, West-Central New Mexico": USGS Water Resources Investigations Report 91-4099, Figure 7, page 15.

EVALUATION OF WATER RIGHTS APPLICATION:

A study using the Theis Non-Equilibrium Well Formula was also conducted to estimate the drawdown on any wells of other ownership within 5,280 feet of the subject well. OSE records show that the nearest well of other ownership, B-1019, is about 1 mile from well B-1325. In addition well B-1019 is only 88 feet in depth compared to 946 feet of the pumping well which would lessen the vertical effects of pumping in this type of aquifer. Calculations were performed using the Formula with a Transmissivity of 337.0 gpd/ft and a Storage Coefficient of 0.0001. These values were given by Andy Core, Hydrology bureau, Office of the State Engineer. A pumping rate of 9.913 gallons

Memorandum to Jess L. Ward
Application B-1325
Northwest New Mexico Regional Solid Waste Authority

Page 3
February 1, 2002

per minute (16 acre feet per annum) was assumed. As Exhibit C shows, after 20 years of pumping the expected drawdown of a well at one mile the drawdown is 18.83 feet. Therefore, the additional withdrawal of 16 acre-feet per annum from well B-1325 does not appear to have a significant effect on other wells.

CONCLUSION:

There would be no impairment of existing water rights due to the granting of this permit. The operation of the regional landfill is in the public interest. Therefore, I am of the opinion that this application is not detrimental to the public welfare or contrary to the conservation of water within the State of New Mexico.

RECOMMENDATION:

Approval of this application to Appropriate Ground Water of the State of New Mexico in the Bluewater Underground Water Basin in the amount of 16.0 acre-feet per annum of consumptive use rights subject to the Rules and Regulations of the State Engineer. Suggested conditions of approval are stated as follows:

SUGGESTED CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee: Northwest New Mexico Regional Solid Waste Authority

Permit Number: B-1325-T

Priority: January 18, 1996

Source: Ground Water

Point of Diversion:

Well No. B-1325 located in NE1/4 SE1/4 SE1/4 of Section 21, Township 14 North, Range 12 West, NMPM, drilled to a depth of 946 feet with 7-inch casing on land owned by the applicant, at the Red Rocks Regional Landfill, McKinley County, New Mexico.

Purpose of Use:

Domestic, and sanitary uses, equipment maintenance, fire protection, and dust control.

Memorandum to Jess L. Ward
Application B-1325
Northwest New Mexico Regional Solid Waste Authority

Page 4
October 31, 2001

Place of Use:

Red Rocks Regional Landfill, McKinley County, New Mexico.

Amount of Water: Consumptive use: 16.0 acre-feet per annum

2. Diversion of water under this permit shall not exceed 16.0 acre-feet per annum over a 20 year period.
3. All withdrawals of water under this permit shall expire on February 1, 2022.
4. Well B-1325 shall be equipped with a totalizing meter, or meters, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer.
5. Records of the total amount of water diverted from Well B-1325 shall be submitted to the State Engineer on or before the 10th day of each month for the preceding calendar month.
6. The permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

Witness my hand and seal this 1th day of February, A.D., 2002.

Thomas C. Turney, P.E.
New Mexico State Engineer

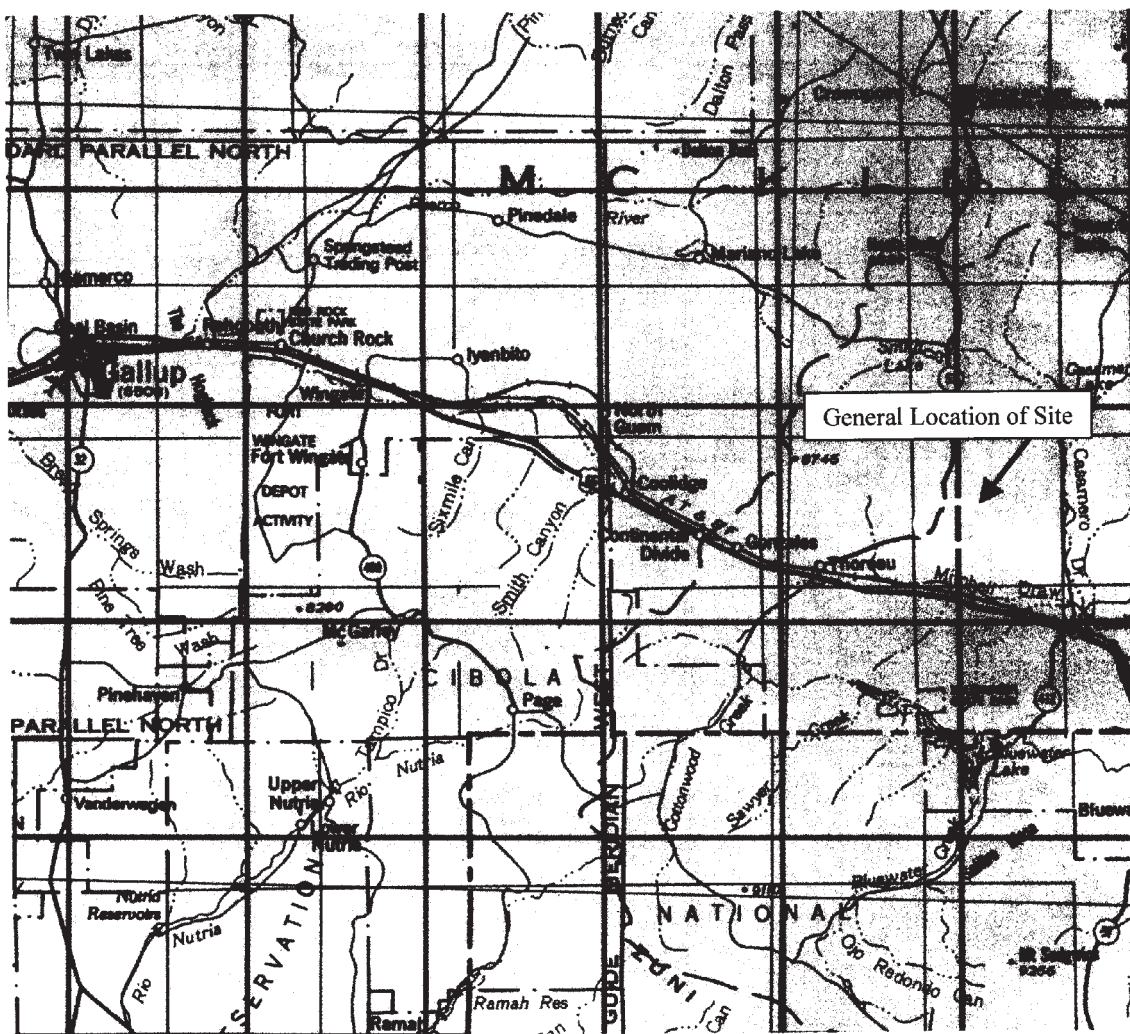
By:

Jess L. Ward, District 1

JEC:jec
cc: Santa Fe, OSE

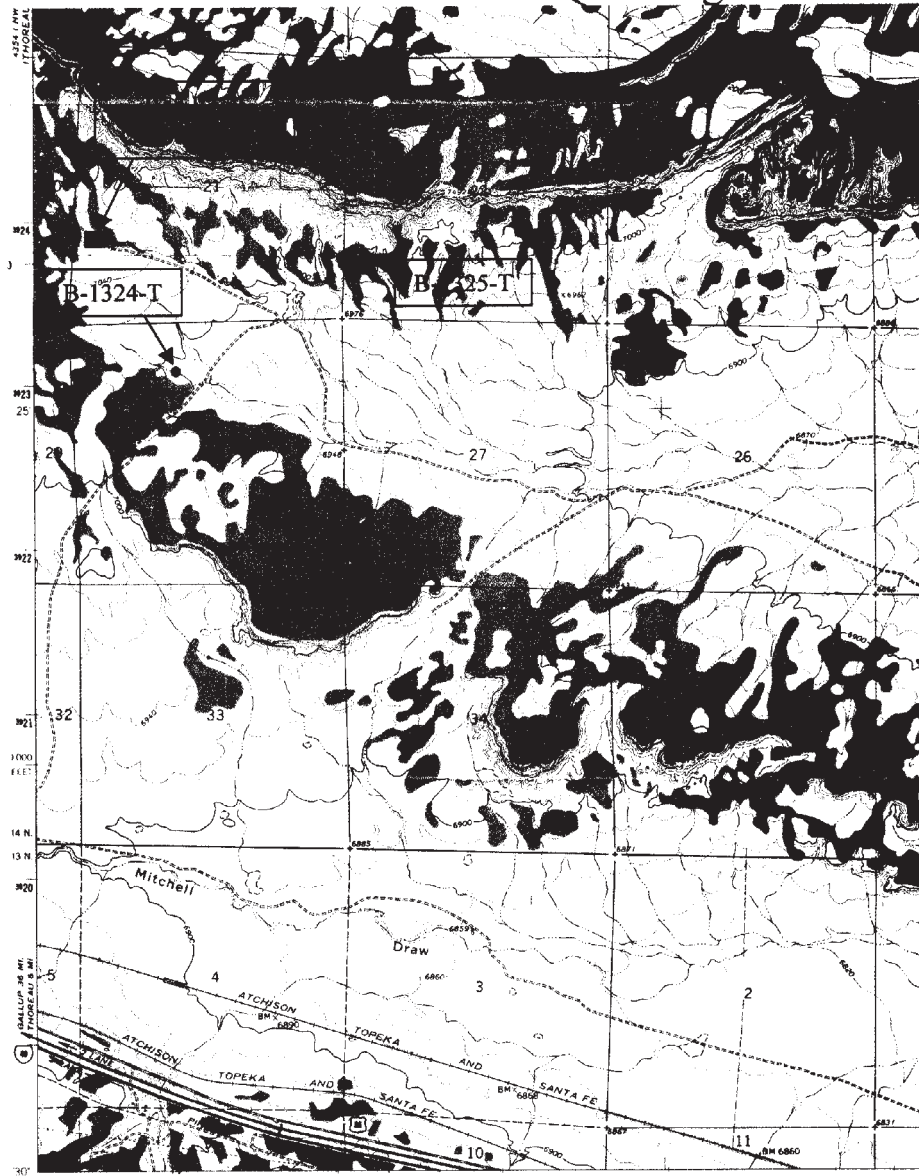
EXHIBIT A

General Location of the Site



B-1324-T
December 27, 2001

EXHIBIT B
Location of the Site
Thoreau NE 7.5 Minute Quadrangles



B-1324-T
December 27, 2001



November 27, 2001

Mr. Joe Murrietta
Executive Director
Northwest New Mexico Solid Waste Authority
P.O. Box 1330
Thoreau, New Mexico 87323

Re: Sonsela Well Information
Red Rocks Regional Landfill
JHC Project 266-05

Dear Mr. Murrietta:

Attached is the Conoco Sonsela well information that was provided to JHC by the Elkins Family to evaluate the property for the landfill permit. Note that Sonsela Well SW-3 is located near the center of the landfill property (NE NW Section 28, T14N-R12W). This well was originally called MW-3 by Conoco and this well does not currently have a pump installed. Well SW-2 (Conoco MW-2) is located on the northeast side of Landfill Cell No. 1 (NE SE Section 21, T14N-R12W). This well is the current water supply well for the Authority.

If you need any additional information, please contact me.

Sincerely yours,

JACOBSON HELGOTH CONSULTANTS, INC.

A handwritten signature in dark ink, appearing to read 'Norman C. Hogg'.

Norman C. Hogg, P.G.
Hydrogeologist

w/attachments

01 DEC -7 AM 9:10

SECTION 3.0

SONSELA WELL DETAILS

Conoco drilled and constructed three Sonsela monitoring wells on and adjacent to the Site in November and December of 1980 as part of the planning for a Uranium processing facility that was not constructed¹. The wells were designed both to establish background water quality and to evaluate the potential for the Sonsela Aquifer to provide a source of industrial water for the Uranium processing operation. Two of the three Sonsela wells are on Authority property. The third Sonsela well is currently being used by the Elkins Ranch for domestic and stock use and is similarly constructed. The Conoco well, formally known as MW-2, has been renamed SW-2 and MW-3 is now known as SW-3. The following describes the Sonsela Sandstone lithology and construction details of the two wells.

3.1 Lithologic Details

Well SW-2 was drilled in November of 1980. A 12 and three-eighths inch diameter hole was drilled to 766 feet. From 766 feet to 946 feet the well was drilled with a 10-inch diameter hole. Well SW-2 encountered 200 feet of Sonsela Sandstone between 720 and 920 feet. The sandstone was described as grayish-white with variable cement and shale interbeds every 40 or 50 feet.

Well SW-3 was drilled in December of 1980. A 12 and three-eighths inch diameter hole was drilled to 740 feet. The Sonsela Sandstone is 170 feet thick in SW-3 (540 to 710 feet). The samples were described as a grayish-white, well-cemented sandstone. The sandstone is poorly cemented where carbonate is present. The presence of shale interbeds were noted but not their specific location. The Conoco sample logs are included in Attachment 2 of this Technical Memorandum.

01 DEC - 7 1995

3.2 Construction Details

For well SW-2, the casing consists of seven-inch outside diameter steel casing between the depths of zero and 692.5 feet. Another section of seven-inch casing is located between 698 and 723.5 feet. The interval between 692.5 and 698 feet is a drilled out cement plug. The screen is constructed of six and five-eighths inch outside diameter steel #60 slot-louvered screen from 723.5 feet to 926 feet. A 20-foot long blank six and five-eighths inch screen was placed at the bottom of the louvered screen. There is some question as to how uniform the three-eighths diameter pea gravel is in the interval from 766 to 946 feet. The top of the pea gravel is estimated to be at 710 feet. The interval between the well casing and the borehole from 7 to 710 feet was pressure emplaced using cement with two percent gel.

The available well construction information is incomplete for well SW-3. Apparently the well is constructed of seven-inch O.D. steel casing from zero to 558 feet. Six and five-eighths inch O.D. #60 slot-louvered screen is placed from 558 feet to 720 feet. A 20-foot section of blank screen is placed at the bottom of the screen. Three-eighths inch diameter pea gravel was used as a filter pack media. The exact height of the pea gravel is unknown, but from the volumes used, the top should be at least ten feet above the top of the Sonsela Sandstone. The interval from 4.0 to 558 was cemented using cement with two percent gel. The best available copies of the construction diagrams are included in Attachment 3 of this Technical Memorandum. Development information is unavailable for both wells.

01 DEC -7 AM 9:11

BORING LOCATION NE 1/4 OF SW 1/4 OF SW 1/4 SECTION 21, T14N, R12W										GROUND EL. 6980 (TOP)	
DEPTH/ELEV. WATER 1870 (-10.80)				DRILL CONTRACTOR STEWART BROTHERS				TOTAL DEPTH 944.0			
DRILL RIG FAIRBANK 2500				BORING DIA. 12 3/8" - 10.0"				DATE DRILLED 11/22-26/00			
LOGGED BY MPW											
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS				
	0.0 - 3.0 SANDY CLAY; brown, damp	0					0.0 - 600.0 Drilled with polymer-bentonite fluid.				
	3.0 - 720.0 UPPER MEMBER - CHINLE FORMATION	10					0.0 - 755.0 Drilled with 12 1/4" tri-cone rock bit.				
	3.0 - 230.0 MUDSTONE; black, slightly weathered, poorly indurated; friable, less than 5% gravel.	20									
		30									
TRUE BORING LOCATION											
SECTION 21, T14N, R12W											
		70									
		80									
		90									
		100									
Wahler Associates		CROWNPOINT RED BLUFF PROJECT				EXPLORATION BORING LOG			BORING NO. MW-2		
						PROJECT NO. CNC 101A			SHEET NO. 9 OF 10		


01 DEC - 7 AM 9:10

BORING LOCATION NE 1/4 OF SW 1/4 & SE 1/4 SECTION 21 T14N R12W										GROUND EL. 1,920 (TOS)	
DEPTH/ELEV. WATER 1870 (11-20)				DRILL CONTRACTOR STEWART BROTHERS				TOTAL DEPTH 946.0			
DRILL RIG FAIRBANKS 2500				BORING DIA. 12 3/8" - 10.0"				DATE DRILLED 11-22-2018		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS				
	3.0 - 230.0 MUDSTONE (Cont'd)	100									
		110									
		120									
		130									
		140									
		150									
		160									
		170									
		180									
		190					11-22-20 am				
		200					11-22-20 pm				
Wahler Associates		CROWNPOINT RED BLUFF PROJECT				EXPLORATION BORING LOG			BORING NO. MW-2		
						PROJECT NO. CNE 101A			SHEET NO. 2 OF 10		

BORING LOCATION NE 1/4 OF SW 1/4 OF SW 1/4, SECTION 21, T14N, R12W						GROUND EL. 698.0 (TOP)	
DEPTH/ELEV. WATER 180.0 (10-80)		DRILL CONTRACTOR STEWAR BROTHERS				TOTAL DEPTH 946.0	
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-26/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	3.0 - 230.0 MUDSTONE (Continued)	200					
		210					
		220					
	230.0 - 250.0 CORRED SANDSTONE: grey, slightly weathered; well indurated; medium to fine grain.	230					
		240					
		250					
	250.0 - 720.0 MUDSTONE: black/red with light green laminations; slightly weathered; moderately indurated; friable; less than 5% gravel.	260					
		270					
		280					
		290					
		300					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO.
		PROJECT NO. CNL 101A			SHEET NO. 3 OF 10		MW-2

BORING LOCATION NE 1/4 OF SW 1/4 OF SW 1/4 SECTION 21, T14, R12W						GROUND EL. 698.0 (TOP)	
DEPTH/ELEV. WATER 187.0 (1 5-80)			DRILL CONTRACTOR STEWART BROTHERS			TOTAL DEPTH 946.0	
DRILL RIG FAIRING 3500			BORING DIA. 12 3/8" - 10.0"			DATE DRILLED 11/22-26/80	
LOGGED BY MPW							


SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Continued)	300					
		310					
		320					
		330					
		340					
		350					
		360					
		370					
		380					
		390					
		400					

	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. MW-2
		PROJECT NO. CNC 1814	SHEET NO. 24 FEB 10	

LOCATION NE 1/4 of SW 1/4 of FSW 1/4 SECTION 21, T14N, R12W							GROUND EL. 6980 (TORO)
DEPTH/ELEV. WATER 187.0' -10-80)		DRILL CONTRACTOR STEWAR BROTHERS			TOTAL DEPTH 946.0		
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-2010		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Cont'd)	400					
		410					
		420					
		430					
		440					
		450					11-22-80 pm 11-23-80 am
		460					
		470					
		480					
		490					
		500					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO.
					PROJECT NO. CNC 101A		SHEET NO. 5 of 10
							MW-2


BORING LOCATION NE 1/4 OF SW 1/4 OF SW 1/4 SECTION 21, T14N, 21W		GROUND EL. 6980 (TOP)
DEPTH/ELEV. WATER 187.0 (10-26)	DRILL CONTRACTOR STEWART BROTHERS	TOTAL DEPTH 946.0
DRILL RIG FAIRING 2500	BORING DIA. 12 3/8" - 10.0"	DATE DRILLED 11/22-26/80
		LOGGED BY MPW

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Cont'd)	500					
		510					
		520					
		530					
		540					
		550					
		560					
		570					
		580					
		590					
		600					

	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. NW-2
		PROJECT NO. CNC 101A	SHEET NO. 6 OF 10	

BORING LOCATION NE 1/4, SW 1/4, SECTION 21 T14N, R12						GROUND EL. 6920 (TOD)	
DEPTH/ELEV. WATER 182.0 (-10.20)			DRILL CONTRACTOR STEWART BROTHERS			TOTAL DEPTH 946.0	
DRILL RIG FAIRING 2500			BORING DIA. 12 3/8" - 10.0"			DATE DRILLED 11-22-20/20	
LOGGED BY MPW							

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Continued)	600					600.0 - 946.0 Drilled with Biodegradable synthetic drilling fluid.
		610					
		620					
		630					
		640					
		650					11-23-20 am 11-23-20 pm
		660					
		670					
		680					
		690					
		700					

 Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. MW-2
		PROJECT NO.	SHEET NO.	
		CNC 10/18	7 OF 10	

BORING LOCATION NE 1/4, SW 1/4 SECTION 21, T14N, R12W							GROUND EL. 698.0 (TOP)
DEPTH/ELEV. WATER 182.0 (10-20)		DRILL CONTRACTOR STEWART BROTHERS			TOTAL DEPTH 946.0		
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"			DATE DRILLED 11/22-26/80		LOGGED BY MPW
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Continued)	700					
		710					11-23-80 pm 11-24-80 am
	720.0 - 920.0 MIDDLE MEMBER - CHANCE FORMATION: SANDSTONE; grayish white, well cemented, poorly cemented when carbonate is present; shale interbeds every 40 feet or so.	720					
		730					
		740					
		750					
		760					755.0 - 946.0 Drilled with 9 7/8" tricone rock bit.
		770					755.0 Probable bridging of gravel pack.
		780					
		790					
		800					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO. MW-248
		PROJECT NO. CNE 10A			SHEET NO. 8 OF 10		

BORING LOCATION NE 1/4, SW 1/4, SW 1/4, SECTION 21, T14N, R12W										GROUND EL. (ASO (TOM))	
DEPTH/ELEV. WATER 1890 (1 0-80)			DRILL CONTRACTOR STEWART BROTHERS					TOTAL DEPTH 946.0			
DRILL RIG FAIRING 2500			BORING DIA. 12 3/8" - 10.0"			DATE DRILLED 11/22-26/80			LOGGED BY MPW		
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS				
	720.0 - 920.0 SANDSTONE (cont'd)	800									
		810									
		820									
		830									
		840									
		850									
		860									
		870									
		880									
		890									
		900									
							874.0 Run c-log plates.				
							11-24-80 am 11-24-80 pm 874.0 - 940.0 Drilled after running c-logs.				

Wahler Associates

CROWNPOINT RED BLUFF PROJECT

EXPLORATION BORING LOG

PROJECT NO. CNC 101A	SHEET NO. 9 OF 10
-------------------------	----------------------

BORING NO.
MW-2

BORING LOCATION NE 1/4 FSW 1/4 FSW 1/4 SECTION 21 T14N R11W							GROUND EL. 698.0
DEPTH/ELEV. WATER 187.0 (-10-80)		DRILL CONTRACTOR STEWART BROTHERS				TOTAL DEPTH 946.0	
DRILL RIG FAIRBANKS 2500		BORING DIA. 12 3/8" - 10"		DATE DRILLED 11-22-26/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	720.0 - 920.0 SANDSTONE (Continued)	900					
		910					
	920.0 - 946.0 LOWER MEMBER - CHINLE FORMATION - MUDSTONE: black red; unweathered; indurated; friable; less than 50% gravel.	920					
		930					
		940					
	946.0 TOTAL DEPTH	950					11-24-80 PM
		960					
		970					
		980					
		990					
		1000					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO.
		PROJECT NO. CUC 10A			SHEET NO. 10 OF 10		MW-2

DATA ON THIS LOG ARE AN APPROXIMATION OF THE GEOLOGIC AND SUBSURFACE CONDITIONS BECAUSE THE INFORMATION WAS OBTAINED FROM INDIRECT, DISCONTINUOUS, AND POSSIBLY DISTURBED SAMPLING NECESSITATED BY THE USE OF SMALL DIAMETER HOLES. HOLES AND WALLS, BORING HOLES HAVE PORTABLE COMPLICATIONS IN THEIR REGARD BECAUSE OF THE NEED TO USE DRILLING FLUID ACTION CAUSING IS ADVANCING HOLES.

THIS LOG INDICATES CONDITIONS IN THIS HOLE ONLY ON THE DATE INDICATED AND MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND OF OTHER DATA. ALL WATER LEVELS SHOWN ARE SUBJECT TO VARIATION.

THIS HOLE WAS LOGGED IN SUCH A WAY AS TO PROVIDE DATA PRIMARILY FOR DESIGN PURPOSES AND NOT NECESSARILY FOR THE PURPOSES OF SPECIFIC CONTRACTORS.


THE STRATIFICATION LEVELS OR DEPTH INTERVALS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES, AND THE TRANSITIONS MAY BE MINOR.

SOIL CLASSIFICATION SHOWN ON LOGS ARE FIELD CLASSIFICATIONS BASED ON THE WHEELER SOIL CLASSIFICATION SYSTEM.

BORING LOCATION 1/4 SW 1/4 NW 1/4 SECTION 28 T4N R12W						GROUND EL. (AS7 (TAR))	
DEPTH/ELEV. WATER 180.0 (12' - 80')						DRILL CONTRACTOR STEWART BROTHERS	
DRILL RIG FAIRING 2500						TOTAL DEPTH 740.0	
BORING DIA. 12 3/8"						DATE DRILLED 12/5-10/80	
LOGGED BY MPW							

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
CL	ALLUVIUM 0.0 - 35.0 SANDY CLAY: brownish red; damp; 25% medium to fine sand; 75% moderately plastic fines.	0					0.0 - 740.0 Drilled with 12 1/4" tricone rockbit.
		10					0.0 - 740.0 Drilled with bentonite and polymer mix.
		20					Descriptions based on drill cuttings.
		30					
		40					
	35.0 - 54.0 UPPER MEMBER - CHINLE FORMATION	40					
	55.0 - 105.0 CORROD SANDSTONE: gray; slightly weathered; well indurated; medium to fine grain.	50					
		60					
		70					
		80					
		90					
		100					

Wahler Associates	CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG		BORING NO. MW-3
	PROJECT NO. CNC 1014		SHEET NO. 1 OF 3		

BORING LOCATION NE 1/4 SW 1/4, NW 1/4, SECTION 28 T14N, R17W						GROUND EL. 6957/TOP	
DEPTH/ELEV. WATER 180.0 (12-81)		DRILL CONTRACTOR STEWA. BROTHERS				TOTAL DEPTH 740.0	
DRILL RIG FAIRING 3500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	35.0 - 105.0 CORRED SANDSTONE (cont'd)	100					
	105.0 - 540.0 MUDSTONE: bedded with light green laminations, slightly weathered, moderately indurated, friable, less than 5% gravel.	110					
		120					
		130					
		140					
		150					
		160					
		170					
		180					
		190					
		200					
		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO.
		PROJECT NO. CNC 1018			SHEET NO. 2 of 3		MW-3

BORING LOCATION NE 1/4 SW 1/4 NW 1/4 SECTION 28 T14N R12W		GROUND EL. 6987 (TOP)
DEPTH/ELEV. WATER 180.0	DRILL CONTRACTOR STEWART BROTHERS	TOTAL DEPTH 7400
DRILL RIG FAIRING 2500	BORING DIA. 12 3/8"	DATE DRILLED 12/5-10/80
SOIL CLASS.	DESCRIPTION	LOGGED BY MPW

DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
200					
210					
220					
230					
240					
250					
260					
270					
280					
290					
300					

Wahler Associates

CROWNPOINT RED BLUFF PROJECT

EXPLORATION BORING LOG

BORING NO.

PROJECT NO.

SHEET NO.


CNC 1014

3 OF 3

MW-3

BORING LOCATION <u>NE 1/4 SW 1/4 SECTION 28 T14N, R12W</u>		GROUND EL. <u>6987 (TOP)</u>	
DEPTH/ELEV. WATER <u>1803 (12' - 80')</u>		DRILL CONTRACTOR <u>STEWART BROTHERS</u>	
DRILL RIG <u>FAIRING 3500</u>		BORING DIA. <u>12 3/8"</u>	
DATE DRILLED <u>12/5-10/82</u>		TOTAL DEPTH <u>740.0</u>	
LOGGED BY <u>MPW</u>			

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	105.0 - 540.0 MUDSTONE (cont'd)	300					
		310					
		320					
		330					
		340					
		350					
		360					
		370					
		380					
		390					
		400					

 Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. <u>MW-3</u>
		PROJECT NO. <u>CH101A</u>	SHEET NO. <u>4 of 8</u>	

NE 1/4, SW 1/4, NW 1/4 SECTION 28 T4N, R12W										GROUND EL. 6987 (TOP)	
DEPTH/ELEV. WATER 1870 (2-80)		DRILL CONTRACTOR STEWARD BROTHERS				TOTAL DEPTH 740					
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80		LOGGED BY MPW					
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS				
	105.0 - 740.0 MUDSTONE (CONTINUED)	400									
		410									
		420									
		430									
		440									
		450									
		460									
		470									
		480									
		490									
		500									
Wahler Associates		CROWNPOINT RED BLUFF PROJECT				EXPLORATION BORING LOG			BORING NO.		
						PROJECT NO.		SHEET NO.			
						010101A		5 OF 8			
								MW-3			

NE 1/4 SW 1/4, NW 1/4 SECTION 28 T14N, R12W										GROUND EL. 697 (TOP)	
DEPTH/ELEV. WATER 1800 (12-80)		DRILL CONTRACTOR STEWART-ROTHERS				TOTAL DEPTH 740.0					
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80		LOGGED BY MPW					
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS				
	505.0 - 540.0 MUDSTONE (Continued)	500									
		510									
		520									
		530									
		540									
	540.0 - 710.0 MIDDLE MEMBER - CHINLE FORMATION. SANDSTONE: grayish white, well cemented, poorly cemented when carbonate is present; shale interbeds.	550									
		560									
		570									
		580									
		590									
		600									

Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. M11-3
		PROJECT NO. CMC 101A	SHEET NO. 6 of 8	

BORING LOCATION NEW SW 1/4 NW 1/4 SECTION 28 T14N R12E							GROUND EL. 6987 (TBM)
DEPTH/ELEV. WATER 182.0 (12-80)		DRILL CONTRACTOR STEWART BOOTHES			TOTAL DEPTH 740.0		
DRILL RIG FAIRBANKS 2500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-1980		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	540 - 710.0 SANDSTONE (Continued)	600					
		610					
		620					
		630					
		640					
		650					
		660					
		670					
		680					
		690					
		700					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO.
					PROJECT NO.	SHEET NO.	
					CNC 101A	7 OF 7	MW-3

BORING LOCATION		NE 1/4 SW 1/4 NW 1/4 SECTION 28 T14N R 2W				GROUND EL. 6987 (TOM)	
DEPTH/ELEV. WATER		1820' (17-80)		DRILL CONTRACTOR		STEWART BROTHERS	
DRILL RIG		FAIRING 3500		BORING DIA.		12 3/8"	
				DATE DRILLED		12-5-1982	
SOIL CLASS.		DESCRIPTION		DEPTH	SAMPLE NO.	PR RQD	REC. MODE
		540.0 - 710.0 SANDSTONE (Continued)		700			
		710.0 - 740.0 LOWER MEMBER - CHINLE FORMATION - MUDSTONE: blocky, slightly weathered, moderately indurated, friable, less than 5% gravel.		710 720 730 740			
		740.0 TOTAL DEPTH		740 750 760 770 780 790 800			
<p>DATA ON THIS LOG ARE AN APPROXIMATION OF THE GEOLOGIC AND SURFACE CONDITIONS BECAUSE THE INFORMATION WAS OBTAINED FROM INDIRECT, DISCONTINUOUS, AND POSSIBLY DISTURBED SAMPLING NECESSITATED BY ROTARY AND WIRE MOUNTED HOLES. FURTHER COMPLICATIONS TO THIS RECORD BECAUSE OF THE NEED TO USE DRILLING FLUID AND/OR CAUSE TO ADVANCING HOLES.</p> <p>THIS LOG INDICATES CONDITIONS IN THIS HOLE ONLY OF THE DATE INDICATED AND MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND ON OTHER DATES. AIR WATER LEVELS SHOWN ARE SUBJECT TO VARIATION.</p> <p>THIS HOLE WAS LOGGED IN ACCORDANCE WITH THE REQUIREMENTS FOR EXPLORATION BORING LOGS AND NOT NECESSARILY FOR THE PURPOSES OF SPECIFIC CONTRACTORS.</p> <p>THE STRATIFICATION LINES OR DEPTH INTERVALS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES, AND THE TRANSITIONS MAY BE GRADUAL.</p> <p>SOIL CLASSIFICATIONS SHOWN ON LOGS ARE FIELD CLASSIFICATIONS BASED ON THE HOFER SOIL CLASSIFICATION SYSTEM.</p>							
Wahler Associates		CROWNPOINT RED BLUFF PROJECT				EXPLORATION BORING LOG	
		PROJECT NO.				SHEET NO.	
		CNC 101A				B 873	
						BORING NO.	
						MW-3	

ATTACHMENT 3

CONSTRUCTION DIAGRAMS

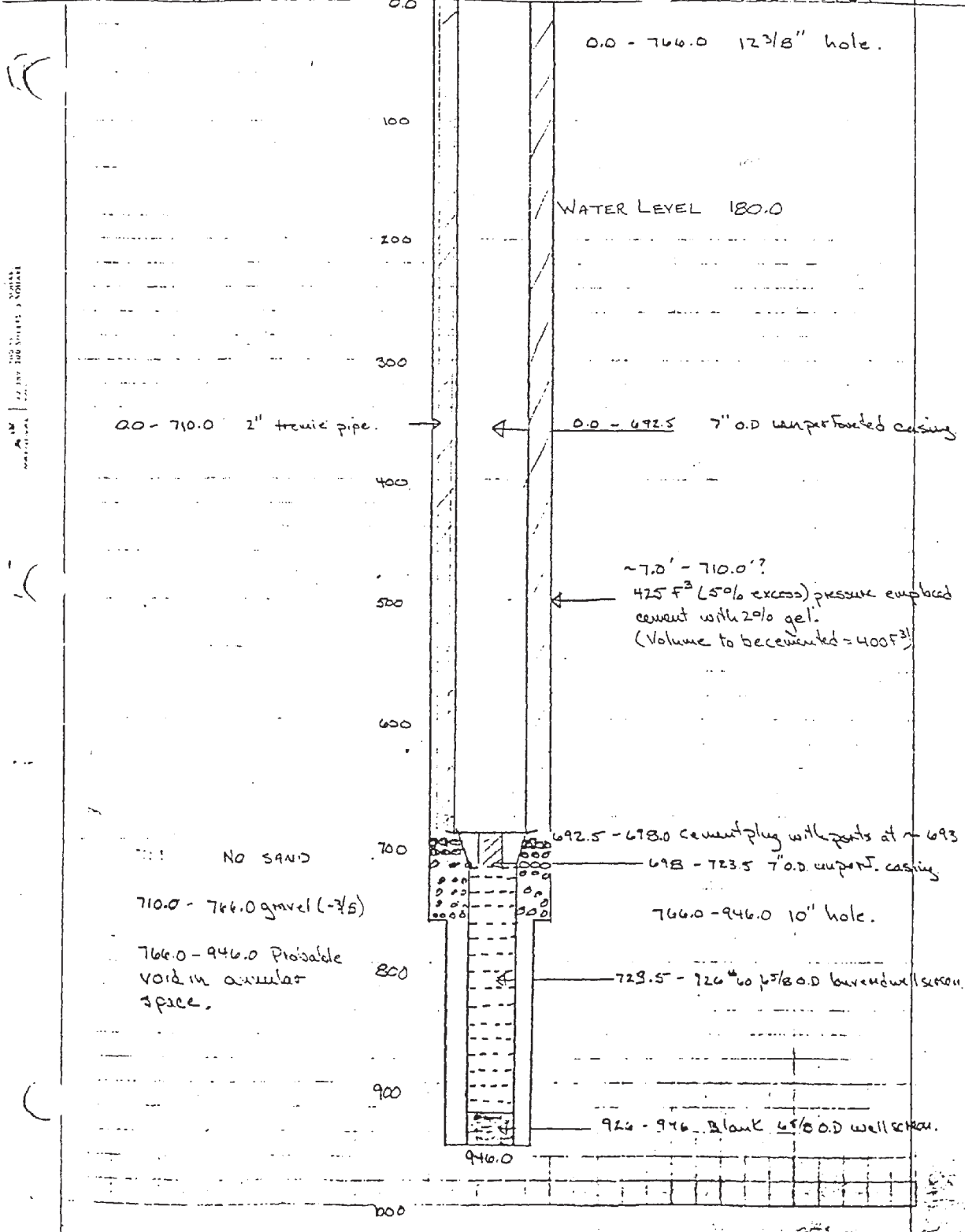
01 DEC -1 PM 9:10

01/10

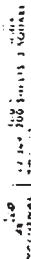
CNC 101H 11-24-80

PROJECT

MW-2 CROSS SECTION

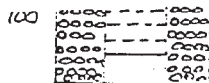


MW-3 CROSS SECTION



Well No. 4,
NW 1/4, SECTION 28,
T14N, R12W

IS FOR CEMENTING
CEMENT PLUG
AND LAYER
GRAVEL PACK ($-3/8"$)



$$\text{Volume of sand } (V_s) = .5620 \times 9' = 5.1 \text{ F}^3$$

$$\text{Volume of cement (Vc)} = 540' \times .5680 = 307 \text{ F}^3 \times 1.5 \text{ (50\% excess)} = 460 \text{ F}^3$$

HC - 1-8457 - \$50.00

IMPORTANT-READ INSTRUCTIONS ON BACK BEFORE FILLING OUT THIS FORM

APPLICATION FOR PERMIT

To Appropriate the Underground Waters of the State of New Mexico

- Date Received January 18, 1996 File No. B-1324
1. Name of applicant Northwest New Mexico Regional Solid Waste Authority
 Mailing address P.O. Box 1330
 City and State Thoreau, New Mexico 87323
2. Source of water supply Sonsela Aquifer, located in Bluewater Basin
 (artesian or shallow water aquifer) (name of underground basin)
3. The well is ~~not~~ located in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$, Section 28 Township 14N
 Range 12W N.M.P.M., or Tract No. _____ of Map No. _____ of the _____ District,
 on land owned by Northwest New Mexico Regional Solid Waste Authority.
4. Description of well: name of driller Stewart Brothers Drilling;
 Outside Diameter of casing 7 inches; Approximate depth ~~xxx~~ drilled 740 feet;
 5. Quantity of water to be appropriated and beneficially used 10 acre feet,
 (consumptive use, diversion)
 for Consumptive Use purposes.
6. Acreage to be irrigated or place of use Red Rocks Regional Landfill acres.

Subdivision	Section	Township	Range	Acres	Owner
South 1/2	21	14W	12W	320	NWNMRSWA
North 1/2	28	14W	12W	315	NWNMRSWA

7. Additional statements or explanations
1. This Application is for a Temporary Use Permit to appropriate 10 acre-feet of water per year from the Sonsela Aquifer for a period of 20 years. The Permit for the Red Rocks Regional Landfill is also for a 20 year period.
 2. Water will be used at the Red Rocks Regional Landfill for domestic and sanitary uses, equipment maintenance, fire protection, dust control and composting.
 3. This well was constructed for Conoco, Inc. in 1980 as their monitoring well MW-3. The well depth is 740 feet. Seven inch O.D. steel casing is set from 0.0 feet to 558 feet. Well screen consists of 6 5/8" OD #60 slot-louvered screen from 558 feet to 720 feet. The water level was measured at 186.4 feet on August 24, 1995.
 4. The well was pump tested the week of May 8, 1995 using a temporary pump at the rate of 19.5 gallons per minute for a period of 144 minutes.

I, Henry Wilson, affirm that the foregoing statements are true to the best of my knowledge and belief and that development shall not commence until approval of the permit has been obtained.

NORTHWEST NEW MEXICO REGIONAL
SOLID WASTE AUTHORITY

Henry Wilson, Permittee,

By: Henry Wilson

Subscribed and sworn to before me this 12th day of January, A.D. 19 96

My commission expires 4/27/99

Dandra L. Chang
Notary Public

ACTION OF STATE ENGINEER

[illegible]

After notice pursuant to statute and by authority vested in me, this application is approved provided it is not exercised to the detriment of any others having existing rights; is not contrary to conservation of water within the state and is not detrimental to the public welfare of the state; further provided that all Rules and Regulations of the State Engineer pertaining to the drilling of Shallow wells be complied with; and further subject to the following conditions:

(SEE ATTACHED CONDITIONS OF APPROVAL)

Proof of completion of well shall be filed on or before _____, 19____

Proof of application of water to beneficial use shall be filed on or before _____, 19_____.

Witness my hand and seal this 1st day of February, A.D., 19 2002.

Thomas C. Turney
~~S. E. Reynolds~~, State Engineer.

By: Andrew L. Lieuwen
Andrew L. Lieuwen
Water Resource Master

INSTRUCTIONS

This form shall be executed, preferably typewritten, in triplicate and shall be accompanied by a filing fee of \$5.00. Each of triplicate copies must be properly signed and attested.

A separate application for permit must be filed for each well used.

Secs. 1-4—Fill out all blanks fully and accurately.

Sec. 5—Irrigation use shall be stated in acre feet of water per acre per annum to be applied on the land. If for municipal or other purposes, state total quantity in acre feet to be used annually.

Sec. 6—Describe only the lands to be irrigated or where water will be used. If on unsurveyed lands describe by legal subdivision "as projected" from the nearest government survey corners, or describe by metes and bounds and tie survey to some permanent, easily located natural object.

Sec. 7.—If lands are irrigated from any other source, explain in this section. Give any other data necessary to fully describe water right sought.

CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee: Northwest New Mexico Regional Solid Waste Authority

Permit Number: B-1324-T

Priority: Filing date of January 18, 1996

Source: Ground Water from the Sonsela aquifer

Point of Diversion:

Well No. B-1324 located in SE1/4 NE1/4 NW1/4 of Section 28, Township 14 North, Range 12 West, NMPM, drilled to a depth of 740 feet with 7-inch casing on land owned by the applicant, at the Red Rocks Regional Landfill, McKinley County, New Mexico.

Purpose of Use:

Domestic and sanitary uses, equipment maintenance, fire protection, and dust control.

Place of Use:

Red Rocks Regional Landfill, McKinley County, New Mexico.

Amount of Water: Consumptive use: 10.0 acre-feet per annum

2. Diversion of water under this permit shall occur only from the Sonsela aquifer (at approximate depth between 540 and 710 feet) and shall not exceed 10 acre-feet per annum over the 20-year period from February 1, 2002 to February 1, 2022.
3. This permit shall automatically expire on February 1, 2022, and any subsequent diversion of water from well B-1324 shall occur only under a separate permit from the State Engineer.
4. Well B-1324 shall be equipped with a totalizing meter, or meters, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer.
5. Records of the total amount of water diverted from Well B-1324 shall be submitted to the State Engineer on or before the 10th day of each month for the preceding calendar month.

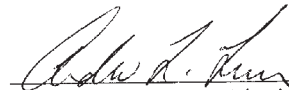
CONDITIONS OF APPROVAL (continued)

6. Well B-1324 shall be plugged in a manner acceptable to the State Engineer no later than March 1, 2022, unless a separate application to appropriate water from well B-1324 is approved by the State Engineer. A plugging record shall be filed with the State Engineer no later than ten (10) days after plugging.
7. The permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

Witness my hand and seal this 1st day of February, A.D., 2002.

Thomas C. Turney, P.E.
New Mexico State Engineer

By:



Andrew L. Lieuwen, District 1



**STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ALBUQUERQUE**

THOMAS C. TURNER
STATE ENGINEER

July 5, 2002

DISTRICT 1
121 TIJERAS, NE, STE. 2000
ALBUQUERQUE, NM 87102-3400
(505) 841-9480

J. R. Murrietta, Executive Director
NW NM Regional Solid Waste Authority
PO Box 1330
Thoreau, NM 87323

Files: B-1324 and B-1325

Greetings:

Your meter reading has been received. In order to enter it into our database, please complete the enclosed form and submit it to our office as soon as possible. I appreciate your cooperation.

Please don't hesitate to call if you have any questions.

Sincerely,

A handwritten signature in cursive script that reads "Eric Robinson".

Eric Robinson
Water Resource Specialist

ER:er
cc: Santa Fe OSE



STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ALBUQUERQUE

February 1, 2002

THOMAS C. TURNEY
STATE ENGINEER

File: B-1324-T

OFFICE OF
STATE ENGINEER
SANTA FE, NEW MEXICO

02 FEB 4 AM 9 07
DISTRICT I

121 TIJERAS, NE, STE. 2000
ALBUQUERQUE, NM 87102-3400
(505) 841-9480

Northwest New Mexico Regional Solid Waste Authority
P.O. Box 1330
Thoreau, NM 87323

Greetings:

Enclosed is your copy of the above-numbered Permit to Appropriate the Underground Water of the State of New Mexico, which has been approved subject to the conditions set forth on the reverse side thereof.

The permit shall automatically expire on February 1, 2022, and any subsequent diversion of water from Well B-1324 shall occur only under a separate permit from the State Engineer.

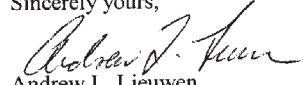
Well B-1324 shall be equipped with a totalizing meter, or meter, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer.

Records of the total amount of water diverted from Well B-1324 shall be submitted to the State Engineer on or before the 10th day of each month for the preceding calendar month.

Well B-1324 shall be plugged in a manner acceptable to the State Engineer no later than March 1, 2022, unless a separate application to appropriate water from Well B-1324 is approved by the State Engineer. A plugging record shall be filed with the State Engineer no later than ten(10) days after plugging.

The permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

Sincerely yours,


Andrew L. Lieuwen
Water Resource Master

ALL:cp

Enclosure as stated

cc: Santa Fe OSE

ADMINISTRATIVE PROCESS

Correctly prepared Proofs of Application of Water to Beneficial Use or Completions of Wells or Works, filed on or before the due date, will be accepted for processing.

Correctly prepared Proofs of Application of Water to Beneficial Use or Completions of Wells or Works, delivered after the due date, will not be accepted for filing or processing until one or more Applications for Extensions of Time are filed to bring the permit up to date.

Applications for Extensions of time which are filed on or before the due date will be processed in the order received as time and personnel are available.

If Applications for Extensions of Time are filed after the due date (LATE) but before cancellation of the permit, the file will be reviewed in the District Office and forwarded to the State Engineer with a recommendation to seek fines or other legal action through the Legal Services Division of the State Engineer Office.

If neither Proofs nor Applications for Extensions of Time are filed, the records of the permit will be reviewed and the file will be forwarded to The State Engineer with a recommendation to cancel the permit and/or to seek fines or other legal remedies through the Legal Services Division of the State Engineer Office.

MEMORANDUM

New Mexico State Engineer Office
Water Rights Division - District 1

DATE: December 27, 2001

FILE: B-1324-T

TO: Jess L. Ward *Ask for JW*

FROM: Jerry E. Carr *JEC*

SUBJECT: Application for Permit to Appropriate Ground Water of the State of New Mexico in the Bluewater Underground Water Basin -- Northwest New Mexico Regional Solid Waste Authority.

HISTORY: The subject application was filed on January 18, 1996, by Northwest New Mexico Regional Solid Waste Authority, P.O. Box 1330, Thoreau, New Mexico 87323. The notice for publication was issued on February 19, 1996. The affidavit of publication was filed on March 22, 1996, stating that the legal notice had been published on February 24, and on March 2 and 9, 1996, in The Independent. The protest period ended on March 19, 1996 and no protests were filed.

A field investigation concerning applications B-1324 and B-1325 was conducted on May 1, 1997 by District 1 personnel David Miller and Robin Hulette. The following information was recorded:

	B-1324	B-1325
Topo Map.....	38.2.2	38.2.2
Location.....	14N.12W.28.124	14N.12W.21.442
Meter Installed.....	NO	Master Meter
Serial Number.....	NA	Not Readable
Unit of Measure.....	NA	Gallons
Multiplier.....	NA	X10
Reading.....	NA	143896(0)
Previous Reading.....	NA	NONE
Date of Previous Reading.....	NA	NA
Usage in Acre-Feet.....	0	UNKNOWN
Permitted Diversion.....	10.0 AFA	16.0 AFA
Required Readings.....	NA	NA
GPS Readings, (Corrected)	NM Coordinate System, West Zone X = 415862.517 Y = 1607867.238	418954.517 1610174.404

Both wells were constructed in 1980 as Conoco, Inc. monitoring wells. Well B-1324 reportedly has no pump nor meter installed; no water meter was observed. The electric meter reading for the meter on a pole about 15 feet from the well B-1324 was all 0's. Well B-1325 was found to be in operation and reportedly providing water for the facility office which normally has 4 people working full-time. A water meter reading was recorded as shown above. The meter was found in a small "pit" adjacent to and on the north side of the concrete pad. The wooden top of the "pit" was buried under about 3 inches of dirt and cardboard. Reportedly, neither well has been used for dust control. No significant landscaping was observed around the office facility. Dust control is being accomplished using "run-off" water stored in a pond about 1/4 mile south of B-1325. The dam did not appear to be over about 6 to 8 feet in height nor cover more than about 1 [acre] of land.

CONSIDERATIONS: The applicant proposes to use existing well B-1324 (Exhibits A and B), located in the SE1/4 NE1/4 NW1/4 of Section 28, Township 14 North, Range 12 West, NMPM, drilled to a depth of 740 feet with 7-inch casing on land owned by the applicant, at the Red Rocks Regional Landfill for domestic, and sanitary uses, equipment maintenance, fire protection, dust control, and composting located in the South 1/2 of Section 21 (321 acres), and North 1/2 of Section 28 (315 acres) Township 14 North, Range 12 West, NMPM, on land owned by the applicant.

The well and lands are generally located as follows-- drive west on I-40 to the Thoreau exit and drive north on NM 371 for about 5.4 miles from the railroad overpass and turn right onto Red Mesa Bluffs Road. Drive for 1.6 miles to the office building. Well B-1324 is about 1/4 mile beyond (east) of the office and about 1/4 [mile] south of the road.

This application is for a Temporary Use Permit to appropriate 10 acre-feet of water per year from the Sonsela Aquifer for a period of 20 years.

Well logs by Jacobson Helgoth Consultants were obtained from the applicant on December 7, 2001, confirming that the well are in the Sonsela aquifer. In addition, this is also in agreement with the data given by Mr. Peter F. Frenzel in "Simulation of Ground-Water Flow in the San Andres-Glorieta Aquifer in the Acoma Embayment and Eastern Zuni Uplift, West-Central New Mexico": USGS Water Resources Investigations Report 91-4099, Figure 7, page 15.

EVALUATION OF WATER RIGHTS APPLICATION:

A study using the Their Non-Equilibrium Well Formula was also conducted to estimate the drawdown on any wells of other ownership within 5,280 feet of the subject well. OSE records show that the nearest well of other ownership, B-1019, is about 1-1/2 mile from well B-1324. In addition well B-1019 is only 88 feet in depth compared to 740 feet of the pumping well which would lessen the vertical effects of pumping in this type of aquifer. Calculations were performed using the Formula with a Transmissivity of 337.0 gpd/ft and a Storage Coefficient of 0.0001. These values were given by Andy Core, Hydrology bureau, Office of the State Engineer. A pumping rate of

Memorandum to Jess L. Ward
Application B-1324
Northwest New Mexico Regional Solid Waste Authority

Page 3
December 27, 2001

6.195 gallons per minute (10 acre feet per annum) was assumed. As Exhibit C shows, after 20 years of pumping the expected drawdown of a well at one mile the drawdown is 11.76 feet. Therefore, the additional withdrawal of 10 acre-feet per annum from well B-1324 does not appear to have a significant effect on other wells.

CONCLUSION:

There would be no impairment of existing water rights due to the granting of this permit. The operation of the regional landfill is in the public interest. Therefore, I am of the opinion that this application is not detrimental to the public welfare or contrary to the conservation of water within the State of New Mexico.

RECOMMENDATION:

Approval of this application to Appropriate Ground Water of the State of New Mexico in the Bluewater Underground Water Basin in the amount of 10.0 acre-feet per annum of consumptive use rights subject to the Rules and Regulations of the State Engineer. Suggested conditions of approval are stated as follows:

SUGGESTED CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee: Northwest New Mexico Regional Solid Waste Authority

Permit Number: B-1324-T

Priority: January 18, 1996

Source: Ground Water

Point of Diversion:

Well No. B-1324 located in SE1/4 NE1/4 NW1/4 of Section 28, Township 14 North, Range 12 West, NMPM, drilled to a depth of 740 feet with 7-inch casing on land owned by the applicant, at the Red Rocks Regional Landfill, McKinley County, New Mexico.

Purpose of Use:

Domestic, and sanitary uses, equipment maintenance, fire protection, and dust control.

Memorandum to Jess L. Ward
Application B-1324
Northwest New Mexico Regional Solid Waste Authority

Page 4
October 31, 2001

Place of Use:

Red Rocks Regional Landfill, McKinley County, New Mexico.

Amount of Water: Consumptive use: 10.0 acre-feet per annum

2. Diversion of water under this permit shall not exceed 10 acre-feet per annum over a 20 year period.
3. All withdrawals of water under this permit shall expire on December 31, 2021.
4. Well B-1324 shall be equipped with a totalizing meter, or meters, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer.
5. Records of the total amount of water diverted from Well B-1324 shall be submitted to the State Engineer on or before the 10th day of each month for the preceding calendar month.
6. The permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

Witness my hand and seal this 27th day of December, A.D., 2001.

Thomas C. Turney, P.E.
New Mexico State Engineer

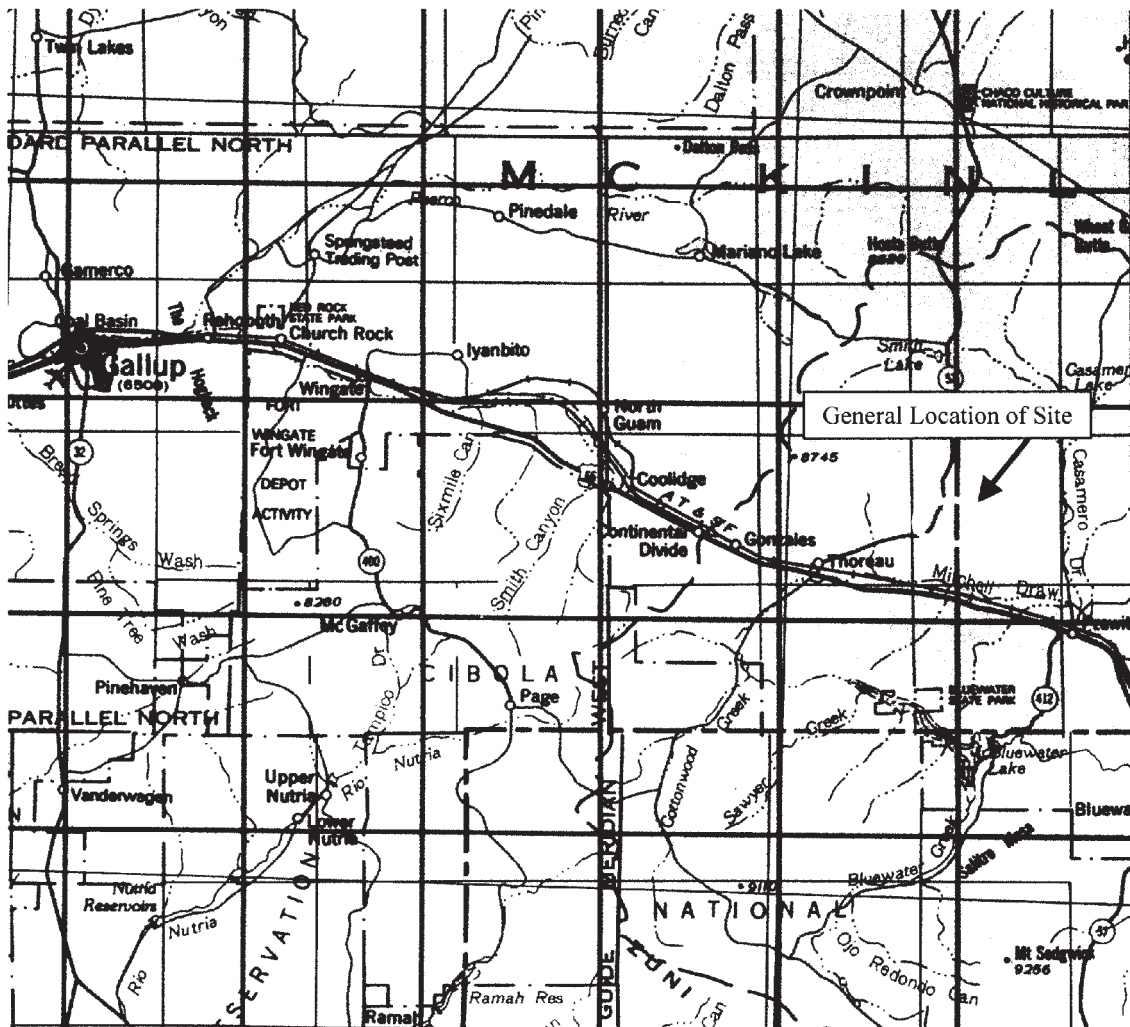
By:

Jess L. Ward, District 1

JEC:jec
cc: Santa Fe, OSE

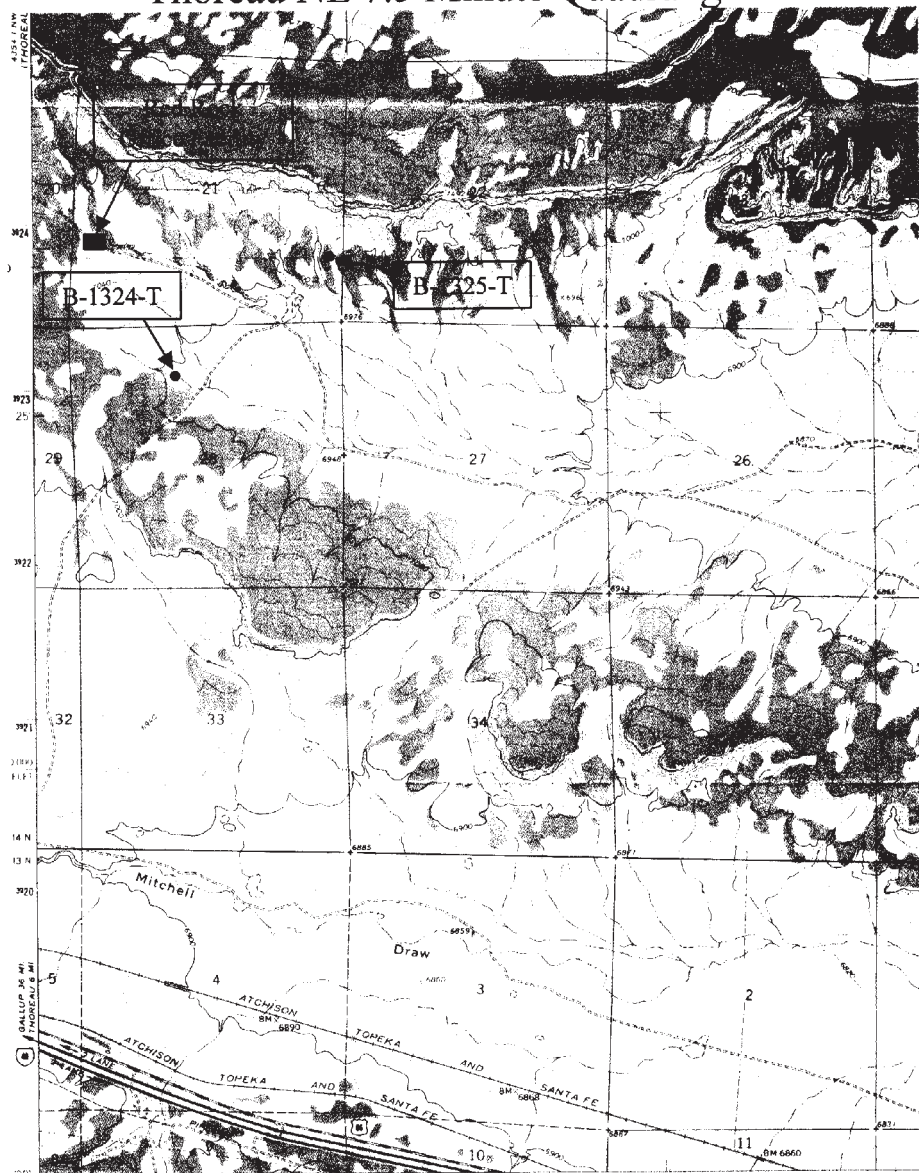
EXHIBIT A

General Location of the Site



B-1324-T
December 27, 2001

EXHIBIT B
Location of the Site
Thoreau NE 7.5 Minute Quadrangles



B-1324-T
December 27, 2001



Jacobson Helgoth
CONSULTANTS

November 27, 2001

Mr. Joe Murrietta
Executive Director
Northwest New Mexico Solid Waste Authority
P.O. Box 1330
Thoreau, New Mexico 87323

Re: Sonsela Well Information
Red Rocks Regional Landfill
JHC Project 266-05

Dear Mr. Murrietta:

Attached is the Conoco Sonsela well information that was provided to JHC by the Elkins Family to evaluate the property for the landfill permit. Note that Sonsela Well SW-3 is located near the center of the landfill property (NE NW Section 28, T14N-R12W). This well was originally called MW-3 by Conoco and this well does not currently have a pump installed. Well SW-2 (Conoco MW-2) is located on the northeast side of Landfill Cell No. 1 (NE SE Section 21, T14N-R12W). This well is the current water supply well for the Authority.

If you need any additional information, please contact me.

Sincerely yours,

JACOBSON HELGOTH CONSULTANTS, INC.

Norman C. Hogg, P.G.
Hydrogeologist

w/attachments

01 DEC -7 PM 9:10

SECTION 3.0

SONSELA WELL DETAILS

Conoco drilled and constructed three Sonsela monitoring wells on and adjacent to the Site in November and December of 1980 as part of the planning for a Uranium processing facility that was not constructed¹. The wells were designed both to establish background water quality and to evaluate the potential for the Sonsela Aquifer to provide a source of industrial water for the Uranium processing operation. Two of the three Sonsela wells are on Authority property. The third Sonsela well is currently being used by the Elkins Ranch for domestic and stock use and is similarly constructed. The Conoco well, formally known as MW-2, has been renamed SW-2 and MW-3 is now known as SW-3. The following describes the Sonsela Sandstone lithology and construction details of the two wells.

3.1 Lithologic Details

Well SW-2 was drilled in November of 1980. A 12 and three-eighths inch diameter hole was drilled to 766 feet. From 766 feet to 946 feet the well was drilled with a 10-inch diameter hole. Well SW-2 encountered 200 feet of Sonsela Sandstone between 720 and 920 feet. The sandstone was described as grayish-white with variable cement and shale interbeds every 40 or 50 feet.

Well SW-3 was drilled in December of 1980. A 12 and three-eighths inch diameter hole was drilled to 740 feet. The Sonsela Sandstone is 170 feet thick in SW-3 (540 to 710 feet). The samples were described as a grayish-white, well-cemented sandstone. The sandstone is poorly cemented where carbonate is present. The presence of shale interbeds were noted but not their specific location. The Conoco sample logs are included in Attachment 2 of this Technical Memorandum.

3.2 Construction Details

For well SW-2, the casing consists of seven-inch outside diameter steel casing between the depths of zero and 692.5 feet. Another section of seven-inch casing is located between 698 and 723.5 feet. The interval between 692.5 and 698 feet is a drilled out cement plug. The screen is constructed of six and five-eighths inch outside diameter steel #60 slot-louvered screen from 723.5 feet to 926 feet. A 20-foot long blank six and five-eighths inch screen was placed at the bottom of the louvered screen. There is some question as to how uniform the three-eighths diameter pea gravel is in the interval from 766 to 946 feet. The top of the pea gravel is estimated to be at 710 feet. The interval between the well casing and the borehole from 7 to 710 feet was pressure emplaced using cement with two percent gel.

The available well construction information is incomplete for well SW-3. Apparently the well is constructed of seven-inch O.D. steel casing from zero to 558 feet. Six and five-eighths inch O.D. #60 slot-louvered screen is placed from 558 feet to 720 feet. A 20-foot section of blank screen is placed at the bottom of the screen. Three-eighths inch diameter pea gravel was used as a filter pack media. The exact height of the pea gravel is unknown, but from the volumes used, the top should be at least ten feet above the top of the Sonsela Sandstone. The interval from 4.0 to 558 was cemented using cement with two percent gel. The best available copies of the construction diagrams are included in Attachment 3 of this Technical Memorandum. Development information is unavailable for both wells.

0100-7-0000
1150-7-0000

BORING LOCATION NE 1/4 of SW 1/4 of SW 1/4 SECTION 21, T14N, R12W							GROUND EL. 6980 (TOP)
DEPTH/ELEV. WATER 1870 (2-10-80)		DRILL CONTRACTOR STEWA. BROTHERS			TOTAL DEPTH 946.0		
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-26/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	0.0 - 3.0 SANDY ALLUVIUM CLAY; black red; damp	0					0.0 - 600.0 Drilled with polymer-bentonite fluid.
	3.0 - 720.0 UPPER MEMBER - CHINLE FORMATION	10					0.0 - 755.0 Drilled with 12 1/4" tri-cone rock bit.
	3.0 - 230.0 MUDSTONE; black red; slightly weathered; poorly indurated; friable; less than 5% gravel.	20					
		30					
		40					
		50					
		60					
		70					
		80					
		90					
		100					

TRUE BORING LOCATION

SECTION 21, T14N, R12W

01 DEC - 7 AM 9:10

Wahler Associates	CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG		BORING NO. MW-2
	PROJECT NO. CNG 101A		SHEET NO. 1 OF 10		

DEPTH/ELEV. WATER 187.0 (12-10-80)		DRILL CONTRACTOR STEWARD BROTHERS		GROUND EL. 139.0 (TOP)		
DRILL RIG FAIRBANKS 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILL. 11/22-26/80		
TOTAL DEPTH 946.0		LOGGED BY MPW				
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC. CODE	REMARKS
	3.0 - 230.0 MUDSTONE (Cont'd)	100				
		110				
		120				
		130				
		140				
		150				
		160				
		170				
		180				
		190				11-22-80 am
		200				11-22-80 pm

Wahler Associates

CROWNPOINT RED BLUFF PROJECT

EXPLORATION BORING LOG

PROJECT NO. CHC 101A	SHEET NO. 2 OF 10
-------------------------	----------------------

BORING NO.

MW-2

DEPTH/ELEV. WATER 187.0 (2-10-80)		DRILL CONTRACTOR STEWART BROTHERS		GROUND EL. 6980 (TOP)		
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-26/80		
LOGGED BY MPW		TOTAL DEPTH 946.0				
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC. MODE	REMARKS
	3.0 - 230.0 MUDSTONE (Continued)	200				
		210				
		220				
	230.0 - 250.0 CORRED SANDSTONE: grey, slightly weathered; well indurated; medium to fine grain.	230				
		240				
	250.0 - 720.0 MUDSTONE: blocky with light green burrations; slightly weathered; moderately indurated; friable; less than 5% gravel.	250				
		260				
		270				
		280				
		290				
		300				

Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. MW-2
		PROJECT NO. CNE 101A	SHEET NO. 3 OF 10	

LOCATION NE 1/4 of SW 1/4 of SW 1/4 SECTION 21 T1 R12W									
DEPTH/ELEV. WATER 1800 (10-80)		DRILL CONTRACTOR STEWART BROTHERS				GROUND EL. 698.1 (TCM)			
DRILL RIG FAIRBANK 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-26/80		TOTAL DEPTH 946.0			
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	LOGGED BY MPW		
							REMARKS		
	250.0 - 720.0 MUDSTONE (Continued)	300							
		310							
		320							
		330							
		340							
		350							
		360							
		370							
		380							
		390							
		400							

Wahler Associates

CROWNPOINT RED BLUFF PROJECT

EXPLORATION BORING LOG

PROJECT NO.

CNE 1614

SHEET NO.


24 OF 40

BORING NO.

MW-2

DEPTH/ELEV. WATER 157.0 (12-10-80)		DRILL CONTRACTOR STEW BROTHERS		GROUND EL. 698.0 (TOP)	
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-20/80	
TOTAL DEPTH 946.0		LOGGED BY MPW			

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Cont'd)	400					
		410					
		420					
		430					
		440					
		450					11-22-80 am 11-23-80 am
		460					
		470					
		480					
		490					
		500					

 Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. MW-2
		PROJECT NO. CUC 101A	SHEET NO. 5 OF 10	

LOCATION NE 1/4 of SW 1/4 of SECTION 21, T4N, R12W
 DEPTH/ELEV. WATER 187.0 2-10-21 DRILL CONTRACTOR STEWART BROTHERS GROUND EL. 698.0 (TOP)
 DRILL RIG FAIRING 2500 BORING DIA. 12 3/8" - 10.0" DATE DRILLED 11/22-26/80 TOTAL DEPTH 946.0
 SOIL CLASS. DESCRIPTION LOGGED BY MDW

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Cont'd)	500					
		510					
		520					
		530					
		540					
		550					
		560					
		570					
		580					
		590					
		600					

Wahler
Associates

CROWNPOINT RED BLUFF
PROJECT

EXPLORATION BORING LOG

BORING NO.

PROJECT NO.

SHEET NO.


CNE 101A

16 of 10

MW-2

BORING LOCATION NE 1/4 SW 1/4 SW 1/4 SECTION 21 T14N, R12W						GROUND EL. 6920 (T=20)	
DEPTH/ELEV. WATER 182.0 2-10-20			DRILL CONTRACTOR STEW. T. BROTHERS			TOTAL DEPTH 946.0	
DRILL RIG FAIRING 2500			BORING DIA. 12 3/8" - 10.0"			DATE DRILLED 11-22-2018	
LOGGED BY MPW							

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	250.0 - 720.0 MUDSTONE (Continued)	600					600.0 - 946.0 Drilled with biodegradable, synthetic drilling fluid.
		610					
		620					
		630					
		640					
		650					11-23-20 am
		660					11-23-20 pm
		670					
		680					
		690					
		700					

 Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. MW-2
		PROJECT NO.	SHEET NO.	
		CNE 101A	7 OF 10	

BORING LOCATION NE 1/4, SW 1/4, SW 1/4 SECTION 21, T14N, R12W										GROUND EL. 698.0 (TOP)	
DEPTH/ELEV. WATER 182.0			-10-80			DRILL CONTRACTOR STEWART BROTHERS			TOTAL DEPTH 946.0		
DRILL RIG FAIRING 2500			BORING DIA. 12 3/8" - 10.0"			DATE DRILLED 11/22-26/80			LOGGED BY MPW		
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS				
	250.0 - 720.0 MUDSTONE (Continued)	700									
		710					11-23-80 pm 11-24-80 am				
	720.0 - 920.0 MIDDLE MEMBER - CHINLE FORMATION: SANDSTONE; grayish white, well cemented, poorly cemented when carbonate is present; shale interbeds every 40 feet or so.	720									
		730									
		740									
		750									
		760					755.0 - 946.0 Drilled with 9 7/8" tri-cone rock bit.				
		770					755.0 Probable bridging of gravel pack.				
		780									
		790									
		800									
Wahler Associates		CROWNPOINT RED BLUFF PROJECT				EXPLORATION BORING LOG			BORING NO.		
						PROJECT NO. CMC 10A			SHEET NO. 3 of 10		
									MW-2		

LOCATION NE 1/4, SW 1/4, SECTION 21, T14N, R12W									
DEPTH/ELEV. WATER 1890 -10-80		DRILL CONTRACTOR STEW. T. BROTHERS				GROUND EL. (ABOCTOP)			
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8" - 10.0"		DATE DRILLED 11/22-26/80		TOTAL DEPTH 946.0			
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS		
	720.0 - 920.0 SANDSTONE (cont'd)	800							
		810							
		820							
		830							
		840							
		850							
		860							
		870							
		880							
		890							
		900							
									874.0 Run c-log plates.
									11-24-80 am 11-24-80 pm 874.0 - 940.0 Drilled after running c-logs.

Wahler Associates

CROWNPOINT RED BLUFF PROJECT

EXPLORATION BORING LOG

PROJECT NO. CMC 101A

SHEET NO. 9 OF 10

BORING NO. MW-2

DEPTH/ELEV. WATER 187.0 (7-10-80)		DRILL CONTRACTOR STEWART BROTHERS		GROUND EL. 198.6 (TOP)		
DRILL RIG FAIRBANKS 2500		BORING DIA. 12 3/8" - 10"		DATE DRILLED 11-22-26/80		
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC. MODE	REMARKS
	720.0 - 920.0 SANDSTONE (Continued)	900				
		910				
		920				
	920.0 - 946.0 LOWER MEMBER - CHINLE FORMATION - MUDSTONE: black red; unweathered; acid; indurated; friable; less than 50% gravel.	930				
		940				
	946.0 TOTAL DEPTH	950				11-24-80 PM
		960				
		970				
		980				
		990				
		1000				


DATA ON THIS LOG ARE AN APPRECIATION OF THE GEOLOGIC AND SUBSURFACE CONDITIONS BECAUSE THE INFORMATION WAS OBTAINED FROM INDIRECT, DISCONTINUOUS, AND POSSIBLY DISTURBED SAMPLING RECLASSIFIED BY USE OF SMALL-DIAMETER HOLES. ROTARY AND MASONRY HOLES HAVE FURTHER COMPLICATIONS IN THIS REGARD BECAUSE OF THE NEED TO USE DRILLING FLUID AND/OR CASING IN ADVANCING HOLES.

THIS LOG INDICATES CONDITIONS IN THIS HOLE ONLY ON THE DATE INDICATED AND MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND ON OTHER DATES. ANY WATER LEVELS SHOWN ARE SUBJECT TO VARIATION.

THIS HOLE WAS LOGGED IN SUCH A WAY AS TO PROVIDE DATA PRIMARILY FOR DESIGN PURPOSES AND NOT NECESSARILY FOR THE PURPOSES OF ENGINEERING CONSTRUCTION.

THE STRATIFICATION LINES OR BOUNDARIES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES, AND THE TRANSITIONS MAY BE GRADUAL.

SOIL CLASSIFICATIONS SHOWN ON LOGS ARE FIELD CLASSIFICATIONS BASED ON THE UNITED STATES CLASSIFICATION SYSTEM.

	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO. MW-2
		PROJECT NO. CWA 10A	SHEET NO. 26 OF 10	

BORING LOCATION NE 1/4 SW 1/4 NW 1/4 SECTION 28 T44N R12W							GROUND EL. 687 (TORN)
DEPTH/ELEV. WATER 180.0 (-12-80)		DRILL CONTRACTOR STEWA BROTHERS		TOTAL DEPTH 7400			
DRILL RIG FAIRBANKS 2500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
CL	ALLUVIUM 0.0 - 35.0 SANDY CLAY: brownish red; damp; 25% medium to fine sand; 75% moderately plastic fines.	0 10 20 30 40 50 60 70 80 90 100					0.0 - 7400 Drilled with 12 1/4" tri-cone rock bit. 0.0 - 740.0 Drilled with bentonite and polymer mix. Descriptions based on drill cuttings.
	35.0 - 540.0 UPPER MEMBER - CHINLE FORMATION 85.0 - 105.0 CORROD SANDSTONE; gray; slightly weathered; well indurated; medium to fine grain.						
Wahler Associates		CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG		BORING NO. MW-3	
		PROJECT NO. CNE 101A		SHEET NO. 1 OF 3			

DEPTH/ELEV. WATER 180.0 (12-17-86)		DRILL CONTRACTOR STEV I BROTHERS		GROUND EL. 1957.102	
DRILL RIG FAIRING 3500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80	
LOGGED BY MPW					
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC. MODE
					REMARKS
	35.0 - 105.0 CORRED SANDSTONE (cont'd)	100			
	105.0 - 540.0 MUDSTONE: brecciated with light green laminations; slightly weathered, moderately indurated, friable; less than 5% gravel.	110			
		120			
		130			
		140			
		150			
		160			
		170			
		180			
		190			
		200			
Wahler Associates		CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG	
				BORING NO.	
		PROJECT NO.		SHEET NO.	
		CNC 101A		22 OF 28	
				MW-3	

NE 1/4 SW 1/4 NW 1/4 SECTION 28 T14N R12W						GROUND EL. 6987 (TO)	
DEPTH/ELEV. WATER 180.0 (12-12-80)		DRILL CONTRACTOR STE RT BROTHERS				TOTAL DEPTH 740.0	
DRILL RIG FAIRING 250.0		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	1050-540.0 MUDSTONE (continued)	200					
		210					
		220					
		230					
		240					
		250					
		260					
		270					
		280					
		290					
		300					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT			EXPLORATION BORING LOG		BORING NO.
					PROJECT NO.	SHEET NO.	
					SNC 1014	3 of 3	MW-3

DEPTH/ELEV. WATER 180.3 (12-80)		DRILL CONTRACTOR STEWART BROTHERS		GROUND EL. 698.7 (680)			
DRILL RIG FAIRING 7500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80			
TOTAL DEPTH 740.0		LOGGED BY MPW					
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	105.0 - 540.0 MUDSTONE (cont'd)	300					
		310					
		320					
		330					
		340					
		350					
		360					
		370					
		380					
		390					
		400					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG		BORING NO.	
				PROJECT NO. CUL101A		SHEET NO. 4 of 8	
						MW-3	

DEPTH/ELEV. WATER 1870 (12-2-80)		SECTION 28 T14N R12W				GROUND EL. 6987 (TOP)	
DRILL RIG FAIRING 3500		BORING DIA. 12 3/8"		DRILL CONTRACTOR STEWART BROTHERS		TOTAL DEPTH 7400	
				DATE DRILLED 12/5-10/80		LOGGED BY MPW	
SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	105.0 - 740.0 MUDSTONE (continued)	400					
		410					
		420					
		430					
		440					
		450					
		460					
		470					
		480					
		490					
		500					
Wahler Associates		CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG		BORING NO.	
				PROJECT NO. 010101A		SHEET NO. 5 OF 8	
						MW-3	

DEPTH/ELEV. WATER 180.0 (12-12-80)		DRILL CONTRACTOR STEWART BROTHERS		GROUND EL. 698.7(TOP)	
DRILL RIG FAIRING 2500		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80	
TOTAL DEPTH 740.0		LOGGED BY MPW			

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	505.0 - 540.0 MUDSTONE (Continued)	500					
		510					
		520					
		530					
		540					
	540.0 - 710.0 MIDDLE MEMBER - CHINLE FORMATION. SANDSTONE: grayish white, well cemented, poorly cemented when carbonate is present; shale interbeds.	550					
		560					
		570					
		580					
		590					
		600					

Wahler Associates	CROWNPOINT RED BLUFF PROJECT		EXPLORATION BORING LOG		BORING NO. M11-3
	PROJECT NO. CNO 1018	SHEET NO. 6 of 8			


DEPTH/ELEV. WATER 182.0 (12-12-80)		DRILL CONTRACTOR STEW I BROTHERS		GROUND EL. 6987 (TOM)	
DRILL RIG FAIRBANKS 2500		BORING DIA. 12 3/8"		DATE DRILLED 12-5-80	
TOTAL DEPTH 7400		LOGGED BY MPW			

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR ROD	REC.	MODE	REMARKS
	540-710.0 SANDSTONE (Continued)	600					
		610					
		620					
		630					
		640					
		650					
		660					
		670					
		680					
		690					
		700					
		710					
		720					

 Wahler Associates	CROWNPOINT RED BLUFF PROJECT	EXPLORATION BORING LOG		BORING NO.
		PROJECT NO. CNC 101A	SHEET NO. 7 OF 8	MW-3

DEPTH/ELEV. WATER 1800 (12-12-80)		DRILL CONTRACTOR STEWART BROTHERS		GROUND EL. 6987(TOP)	
DRILL RIG FAIRING 2300		BORING DIA. 12 3/8"		DATE DRILLED 12/5-10/80	
TOTAL DEPTH 740.0		LOGGED BY MPW			

SOIL CLASS.	DESCRIPTION	DEPTH	SAMPLE NO.	PR RQD	REC.	MODE	REMARKS
	540.0 - 710.0 SANDSTONE (Continued)	700					
	710.0 - 740.0 LOWER MEMBER - CHINLE FORMATION - MUDSTONE: blocky, slightly weathered, moderately indurated, friable, less than 5% gravel.	710					
		720					
		730					
	740.0 TOTAL DEPTH	740					
		750					
		760					
		770					
		780					
		790					
		800					



CROWNPOINT RED BLUFF PROJECT

EXPLORATION BORING LOG

PROJECT NO.	SHEET NO.	BORING NO.
CNC 101A	8 OF 8	MW-3

DATA OF THIS LOG ARE AN APPROXIMATION OF THE GEOLOGIC AND SURFACE CONDITIONS BECAUSE THE INFORMATION WAS OBTAINED FROM INDIRECT, DISCONTINUOUS, AND POSSIBLY BIASED OR SMALL-DIAMETER HOLES. ROTARY AND WASH BORING HOLES HAVE FURTHER COMPLICATIONS IN THIS REGARD BECAUSE OF THE NEED TO USE DRILLING FLUID AND/OR GAS/LINE IN ADVANCING HOLES.

THIS LOG INDICATES CONDITIONS IN THIS HOLE ONLY OF THE DATE INDICATED AND MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND ON OTHER DATES. ANY WATER LEVELS SHOWN ARE SUBJECT TO VARIATION.

THIS HOLE WAS LOGGED IN ROCK & SOIL AS TO PROVIDE DATA PRIMARILY FOR REGION PURPOSES AND NOT NECESSARILY FOR THE PURPOSES OF SPECIFIC CONTRACTORS.

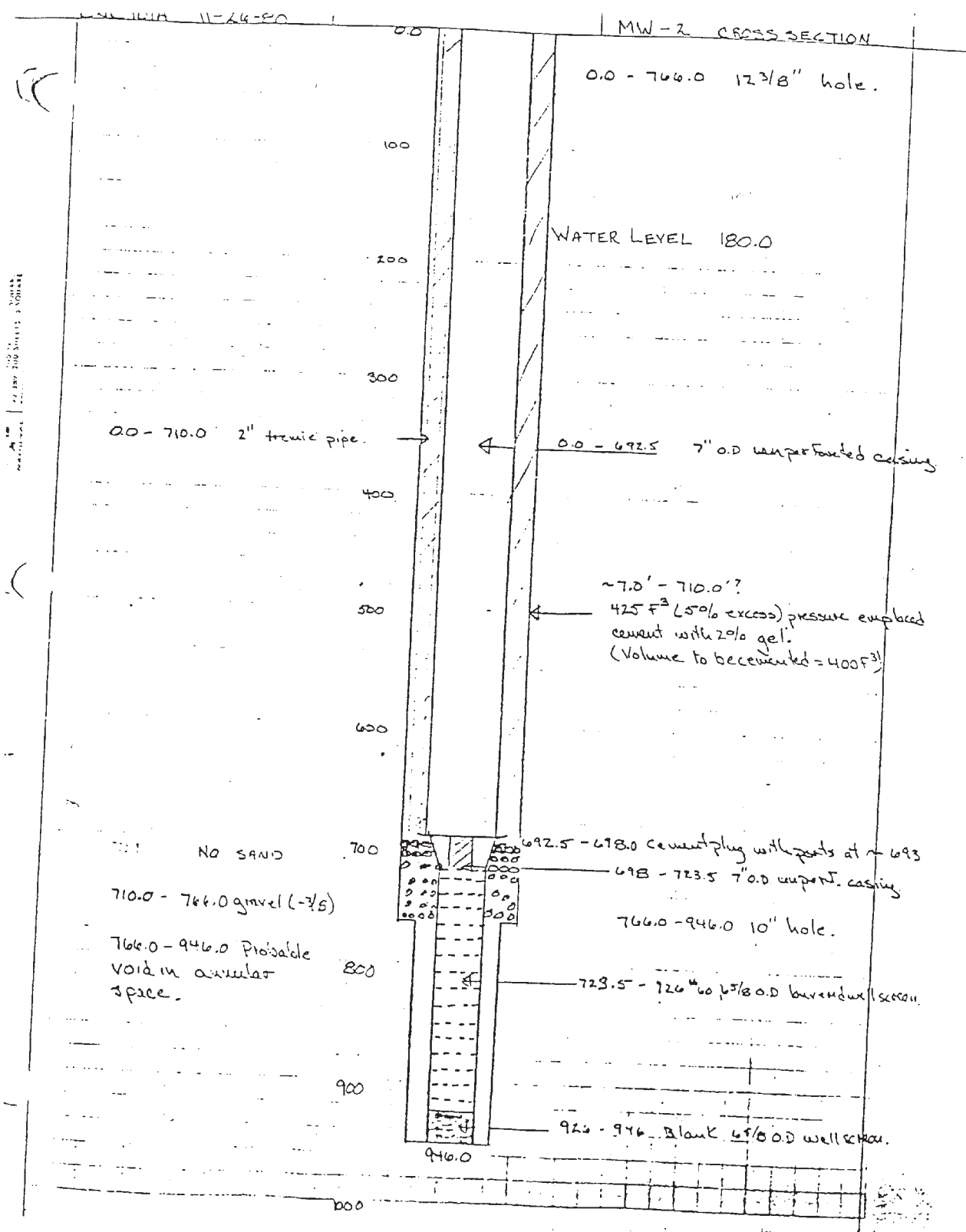
THE STRATIFICATION LINES ON DEPTH INTERVALS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES, AND THE TRANSITIONS MAY BE GRADUAL.

SOIL CLASSIFICATIONS SHOWN IN LOG ARE FIELD CLASSIFICATIONS BASED ON THE UNIFORM SOIL CLASSIFICATION SYSTEM.

ATTACHMENT 3

CONSTRUCTION DIAGRAMS

01 DEC -7 PM 9:10
000000

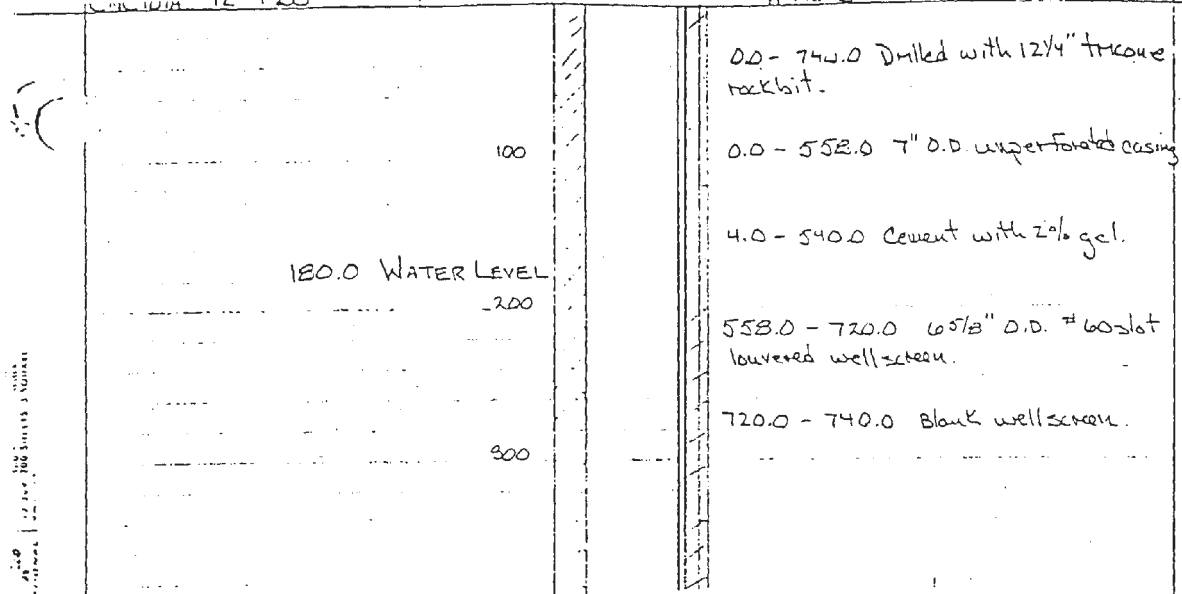


11-24-80
MW-2 CROSS SECTION
0.0 - 766.0 12 3/8" hole.
WATER LEVEL 180.0
0.0 - 710.0 2" tremie pipe.
0.0 - 692.5 7" O.D. unperforated casing
~710.0' - 710.0'?
425 F³ (50% excess) pressure employed
cement with 20% gel.
(Volume to be cemented = 400 F³)
692.5 - 698.0 Cement plug with parts at ~693
698.0 - 723.5 7" O.D. support casing
766.0 - 946.0 10" hole.
723.5 - 926.0 6 5/8" O.D. borehole section.
926.0 - 946.0 Blank 6 5/8" O.D. well section.
946.0
1000

NO SAND
710.0 - 766.0 gravel (-3/8)
766.0 - 946.0 Probable
void in annular
space.

0.0
100
200
300
400
500
600
700
800
900

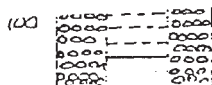
1MW-3 CROSS SECTION



TRUE BORING LOCATION

Well No. 4,
NW 1/4, SECTION 28,
T14N, R12W

treacher pipe
IS FOR CEMENTING
CEMENT PLUG
AND LAYER
GRAVEL PACK (3/8")



$$\text{Volume of gravel } (V_g) = V_{gs} + V_{gc} = (.5959 \times 120') + (.5680 \times 130') = 114.6 \text{ F}^3$$

$$\text{Volume of sand } (V_s) = .5680 \times 9' = 5.1 \text{ F}^3$$

$$\text{Volume of cement } (V_c) = 540' \times .5680 = 307 \text{ F}^3 \times 1.5 \text{ (50\% excess)} = 460 \text{ F}^3$$