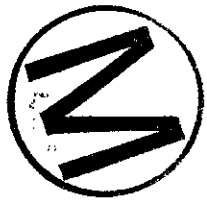
Title 40 CFR Part 191
Compliance Certification
Application
for the
Waste Isolation Pilot Plant

Appendix USDW



United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Area Office
Carlsbad, New Mexico

Underground Sources of Drinking Water

CONTENTS

FIGURES

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ACRONYMS

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
ERDA	U.S. Energy Research and Development Administration
LWA	Land Withdrawal Act
MCL	maximum contaminant level
TDS	total dissolved solids
USDW	Underground Source of Drinking Water
WIPP	Waste Isolation Pilot Plant
WQSP	Water Quality Sampling Program

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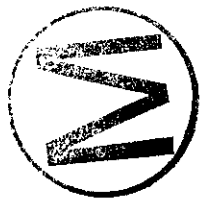


APPENDIX USDW

USDW.1 Executive Summary

The U.S. Department of Energy (DOE) must demonstrate that the Waste Isolation Pilot Plant (WIPP) may be operated and closed in compliance with the provisions and requirements of applicable U.S. Environmental Protection Agency (EPA) environmental radiation protection standards. The applicable regulations are in Title 40 Code of Federal Regulations (CFR) Part 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.* This report has been prepared to support the DOE's documentation of compliance with the requirements of 40 CFR Part 191, Subpart C, which provides environmental standards for groundwater. It focuses on the question of whether any underground source of drinking water (USDW), as defined in Subpart C of 40 CFR Part 191, is located at or near the WIPP site. A USDW, for the purposes of 40 CFR Part 191, Subpart C, is essentially an aquifer that adequately supplies water that is fit for human consumption (see Section USDW.2).

The disposal standards in 40 CFR §191.24(a)(1) require that

> Disposal systems for waste and any associated radioactive material shall be designed to provide a reasonable expectation that 10,000 years of undisturbed performance after disposal shall not cause the levels of radioactivity in any underground source of drinking water, in the accessible environment, to exceed the limits specified in 40 CFR part 141 as they exist on January 19, 1994.

The National Primary Drinking Water Standards are contained in 40 CFR Part 141.

The study area, for the purposes of this report, is defined as the 10,240 acres withdrawn for the WIPP Project under the WIPP Land Withdrawal Act (LWA) of 1992 (Pub. L. 102-579) and an area bounded by T21S through T24S, and R29E through R32E, as shown in Figure USDW-1. The study area is based on the area used for the collection of groundwater data under the WIPP Water Quality Sampling Program (WQSP). WQSP data are partially relied upon in this study to determine the potential presence of USDWs.

In addition, although any USDW located within the WIPP controlled area (the area within the WIPP site boundary as shown on Figure USDW-1) is excluded from the requirements of 40 CFR Part 191, Subpart C, WQSP data from the land withdrawal area are used in this study because the land withdrawal area has been more highly characterized during the WQSP than outlying areas. These data are considered relevant for determining groundwater characteristics of geologic units in the study area.

To assess the presence of a USDW, it is necessary for the DOE to establish mapping criteria to be applied to water quantity and quality data from wells in the study area. These DOE criteria and their bases are described in Section USDW.2. This evaluation also includes a review and summary of relevant literature pertaining to groundwater quality and quantity in the study area. The results of this review are provided in Section USDW.3.

Observation wells completed in the five water-bearing geologic units in the study area were evaluated for this study. The geologic units are

1. the Capitan Aquifer of the Guadalupian Reef Complex (hereafter referred to as the Capitan Aquifer).

2. the Culebra Dolomite Member of the Rustler Formation (hereafter referred to as the Culebra),

3. the Magenta Dolomite Member of the Rustler Formation (hereafter referred to as the Magenta),

4. the Dewey Lake Formation (hereafter referred to as the Dewey Lake), and

5. the Santa Rosa Sandstone of the Dockum Group (hereafter referred to as the Santa Rosa),

The DOE's approach for the determination of potential USDWs in the study area is based on the establishment of mapping criteria related to groundwater quantity and quality. According to the DOE's approach, USDWs subject to the requirements of 40 CFR Part 191, Subpart C are identified in the Culebra, and, because of inconclusive groundwater production data, possible USDWs are present in the Dewey Lake and the Santa Rosa. However, as reported in Chapter 8.0 of this application, even if a release from the repository were to occur, maximum contaminant levels (MCLs) would not be exceeded in any USDW.

USDW.2 Criteria for the Definition of Underground Sources of Drinking Water

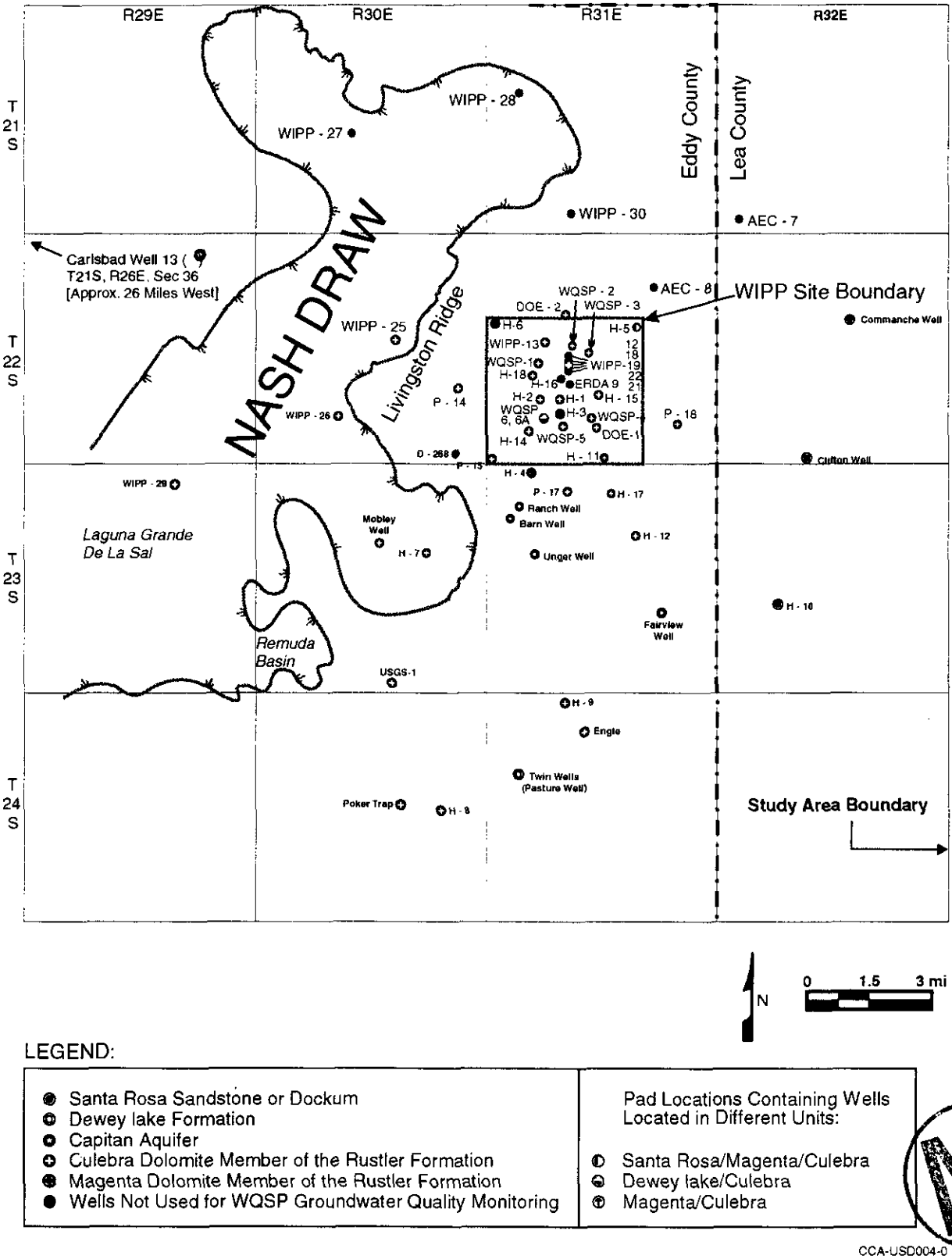
To determine if groundwater in the study area qualifies as a USDW, the DOE evaluated the available groundwater data relative to the applicable regulations. To complete this task, it is necessary for the DOE to establish mapping criteria so that available data can be directly evaluated relative to the regulation. The regulatory requirements and the DOE's mapping criteria for groundwater quantity and quality are addressed in this section.

USDW.2.1 Applicable Regulations

The regulatory citations that apply to the determination of a USDW are 40 CFR § 191.22 and 40 CFR § 191.23. A USDW is defined in 40 CFR § 191.22 to mean an aquifer or its portion[1] that

(1) Supplies any public water system; or
(2) Contains a sufficient quantity of groundwater to supply a public water system; and
(i) Currently supplies drinking water for human consumption; or
(ii) Contains fewer than 10,000 milligrams of total dissolved solids per liter.

[1] All subsequent text of this report will use the term "aquifer" to denote an aquifer or its portion.



LEGEND:

Santa Rosa Sandstone or Dockum Dewey lake Formation Capitan Aquifer Culebra Dolomite Member of the Rustler Formation Magenta Dolomite Member of the Rustler Formation Wells Not Used for WQSP Groundwater Quality Monitoring	Pad Locations Containing Wells Located in Different Units: Santa Rosa/Magenta/Culebra Dewey lake/Culebra Magenta/Culebra

CCA-USD004-0

Figure USDW-1. Locations of Boreholes and Wells Used for This Study

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"Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. Such term includes:

(1) Any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and

(2) Any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

"Total dissolved solids" means the total dissolved (filterable) solids in water as determined by use of the method specified in 40 CFR Part 136.

General provisions in 40 CFR §191.23 require that

(a) Determination of compliance with this subpart shall be based upon underground sources of drinking water which have been identified on the date the implementing agency determines compliance with subpart C of this part.

USDW.2.2 DOE's USDW Mapping Criteria

Figure USDW-2 is a decision matrix showing the DOE's systematic approach for evaluating the existing data relative to 40 CFR § 191.22. To answer the questions indicated on Figure USDW-2, the DOE established mapping criteria that can be applied to the regulatory definition of a USDW. Two general mapping criteria apply: (1) groundwater quantity and (2) groundwater quality.

USDW.2.2.1 Groundwater Quantity

The term "sufficient quantity" in 40 CFR § 191.22 (2) is not strictly defined. The components that must be considered to determine sufficient quantity include groundwater production, and duration. The DOE has established two mapping sub-criteria to be applied to these components of the groundwater quantity determination:

1. an aquifer must be capable of producing water at an adequate rate, and

2. an aquifer must be capable of producing water for a sufficient duration.

USDW.2.2.1.1 Groundwater Production

The DOE uses water-consumption information to define the first sub-criterion for mapping potential USDWs. To be conservative in the definition of a USDW, the lower of the following two values is assigned to the sub-criterion:

1. The rate, over a 24-hour period, at which water would be consumed by 15 service connections.

2. The rate, over a 24-hour period, at which water would be consumed by 25 individuals.

The rate of consumption by 15 service connections is calculated using the data provided in Table USDW-1. These are U.S. Bureau of the Census data for the number of persons per household in communities in southeastern New Mexico and water-consumption data for the same communities. The water-consumption data are from a report prepared by the New Mexico State Engineer's Office (Wilson 1992).

Table USDW-1. Persons Per Household and Water Consumption

Community	Persons Per Household, 1990	Gallons Per Capita Per Day
Artesia	2.69	285
Carlsbad	2.63	307
Hobbs	2.81	267
Lovington	2.96	264
Roswell	2.66	285
Average	2.75	282

Sources: U.S. Bureau of the Census 1990; Wilson 1992.

The average water usage in these communities is 282 gallons per person per day. The 1990 census statistics for these communities show an average of 2.75 people per household. One household equals one service connection.

Therefore:

2.75 people × 282 gallons per person per day = 775.5 gallons per service connection per day
775.5 gallons per day per service connection × 15 connections =11,633 gallons per day
11,633 gallons per day/1,440 minutes per day = 8.08 gallons per minute.

The rate of consumption by 15 service connections is calculated to be 8.08 gallons per minute.

The rate over a 24-hour period at which water would be consumed by 25 individuals may be calculated using these same data. The average water usage is 282 gallons per person per day in area communities. The consumption of water by 25 people equals:

282 gallons per person per day × 25 people = 7050 gallons per day
7050 gallons per day/1,440 minutes per day = 4.89 gallons per minute

Based on these two calculations, the quantity consumed by 25 individuals (4.89 gallons per minute; nominally 5 gallons per minute) is smaller than the quantity consumed by 15 service connections (8.08 gallons per minute). To be conservative in the determination of the quantity

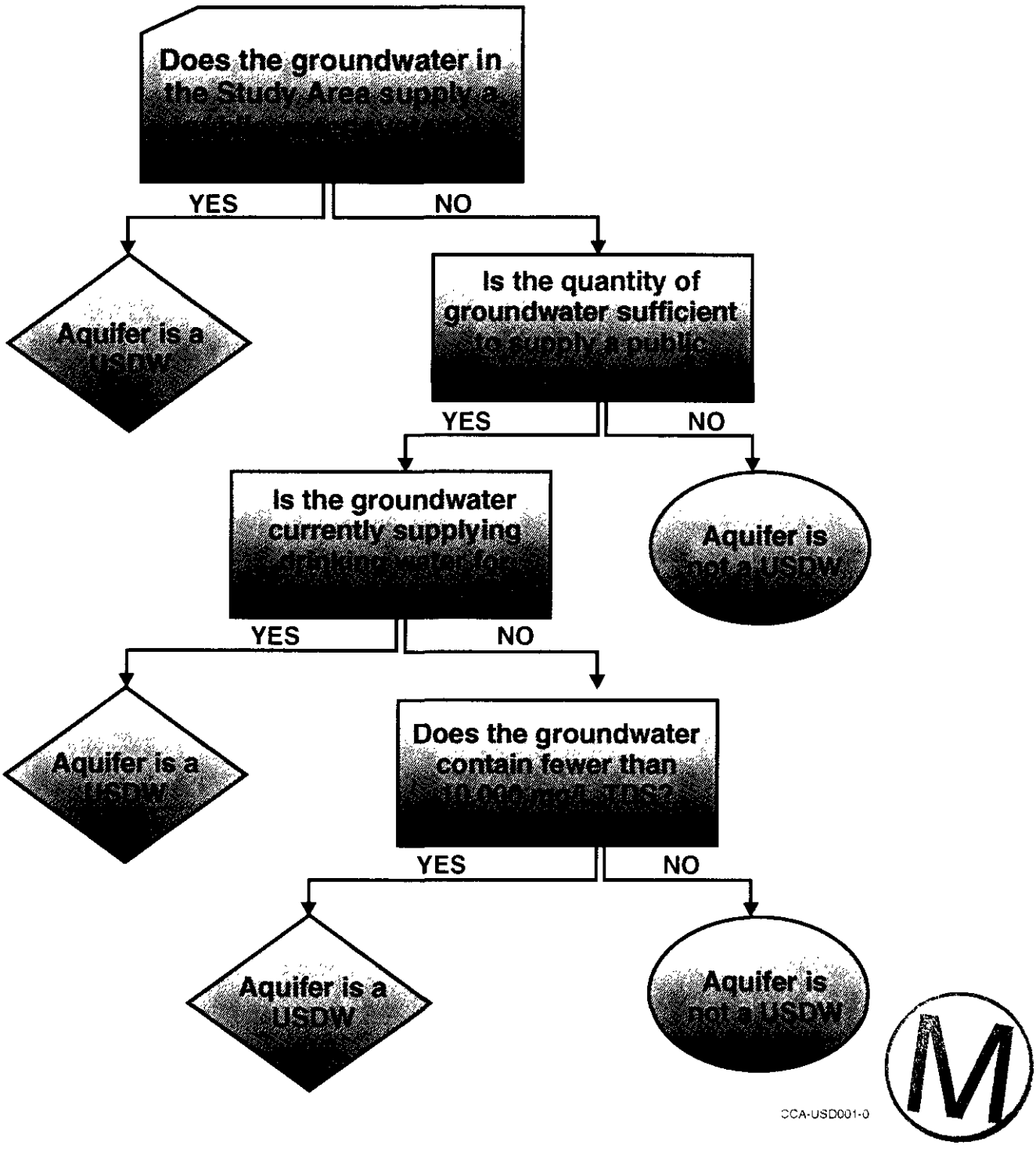

Figure USDW-2. Decision Matrix for Evaluating Existing Data Relative to 40 CFR§ 191.22 to Determine USDW

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derived from a well that meets the DOE's first quantity sub-criterion, the 5 gallons per minute value is applied.

The DOE's application of the second quantity sub-criterion (the acceptable production duration from a well) is more subjective. Because the creation of a public water supply system involves considerable capital expense, it is reasonable to assume that such a water system would not be constructed unless the water source would continue to be available for some time, at least long enough to recover the capital expense.

USDW.2.2.1.2 Duration of Groundwater Production

If a USDW were available for appropriation, a determination of the duration of the supply would be necessary for planning appropriate use. According to a representative of the New Mexico State Engineer's Office, Albuquerque District, a water appropriation is generally considered permanent (Personal Communication 1996a). (Relevant information from personal communications is provided in Attachment A.) Exceptions would be the short-term appropriation of a water supply for temporary use such as for a road construction project. Therefore, a USDW appropriated for a public water supply system is generally considered to be a permanent use of the resource (Personal Communication 1996a).

According to a representative of the Rural Utility Service of the U.S. Department of Agriculture (Personal Communication 1996b), loan periods for funding new rural water supplies are generally 40 years. Appropriation and water rights issues must be resolved with the State Engineer prior to loan approval. Based on this reasoning and the State Engineer's policy of permanent appropriations, a duration of 40 years would be appropriate for a presumed permanent source. This duration is selected for the second quantity sub-criterion; however, in performing this study it was not necessary to actually apply this sub-criterion.

USDW.2.2.2 Groundwater Quality

A criterion of 10,000 milligrams per liter of total dissolved solids (TDS) is specified in the regulations. Any aquifer producing water with TDS concentrations below this level will be determined to be producing water that meets the quality criterion for a USDW. Any aquifer producing water with TDS concentrations at or above this level will be determined to be producing water that does not meet the quality criterion.

USDW.2.2.2.1 Groundwater Quality Variability

In some situations groundwater quality is variable within an aquifer, and TDS concentrations may range both above and below the criterion of 10,000 milligrams per liter of TDS. In this case, TDS concentrations in groundwater obtained from a single well in the aquifer may fluctuate because of pumping. Groundwater released from storage in response to pumping may be replaced by water consisting of a different TDS concentration derived farther from the pumping source. Therefore, the application of the criterion of 10,000 milligrams per liter of TDS is not straightforward and the effect of pumping on changes in groundwater quality in the

aquifer must be considered. Although not used in this assessment as a defining criterion, variable groundwater chemistry is discussed where relevant.

USDW.2.2.2.2 Safe Drinking Water Act Requirements

An additional groundwater quality issue is the application of MCLs under the Safe Drinking Water Act (40 CFR Part 141). All drinking water supplies must comply with the established MCLs under the Primary Drinking Water Regulations. Wells in the study area that meet the 40 CFR Part 191 USDW water-quality criterion of 10,000 milligrams per liter of TDS may not meet MCLs for other constituents under the Safe Drinking Water Act. The National Secondary Drinking Water Regulations (40 CFR Part 143), although not mandatory, deal with the aesthetics of drinking water and indicate at what levels of contamination treatment may be required to make the potential source palatable for drinking water. Because the MCLs are maximum levels at the tap after treatment, the viability and economics of treatment of the groundwater for development as a USDW must be considered. Although not used in this assessment as a defining criterion, MCLs are discussed where relevant.

USDW.2.3 General History and Limitations of Groundwater Use in the Carlsbad Basin

According to the New Mexico State Engineer, water shortages have occurred in the Pecos River drainage basin since the first major irrigation projects began in the mid-1870s (New Mexico State Engineer 1991). The Pecos River drainage basin includes the following declared groundwater basins: Carlsbad, Capitan, Roswell, Hondo, Peñasco, Fort Sumner, and Upper Pecos (Personal Communication 1996f; New Mexico State Engineer 1986). The WIPP site is located within the Carlsbad Basin (New Mexico State Engineer 1995).

By the late 1920s and early 1930s, Carlsbad irrigators began an effort to obtain additional water storage in a new reservoir (Alamogordo Reservoir). At about the same time, Roswell and Artesia farmers began to drill wells into the region's aquifers. By the late 1920s, groundwater development in the area had begun to adversely affect the volume of flow in the Pecos River. This situation caused the State Engineer to seek new legislation and adopt a groundwater code. The Roswell Artesian Basin was declared as the State's first groundwater basin shortly afterward (New Mexico State Engineer 1991).

Portions of the Carlsbad Basin and the study area were first declared by the State Engineer in 1947. The entire Carlsbad Basin and study area became declared with the addition of new areas on June 4, 1975 (New Mexico State Engineer 1995). In 1948, the Pecos River Compact was signed by New Mexico and Texas to apportion the water of the Pecos River equitably between the two states. In 1974, Texas submitted a complaint to the U.S. Supreme Court asserting that New Mexico violated the Pecos River Compact by under-delivering water at the Texas State line. In 1988, the U.S. Supreme Court adopted an amended decree that required New Mexico to make up any shortfall in annual deliveries within a six-month period.

Continued water shortages in the Carlsbad Basin and other basins associated with the Pecos River have caused the State Engineer to evaluate methods to meet the requirements of the

Pecos River Compact. If the shortfall cannot be met in the future, the State Engineer will consider taking back junior rights.

According to State Engineer records (New Mexico State Engineer 1996), no current appropriations are used for public water systems in the study area.

USDW.3 Determination of USDWs in the Study Area

Five geologic units within the study area possess groundwater that could potentially meet the definition of a USDW under Subpart C of 40 CFR Part 191: (a) the Capitan Aquifer, (b) the Culebra, (c) the Magenta, (d) the Dewey Lake, and (e) the Santa Rosa. A generalized stratigraphic cross-section of the study area shows the locations of these units with respect to the WIPP (Figure USDW-3). The Capitan Aquifer does not appear in Figure USDW-3 because it occurs approximately 10 miles north of the WIPP site boundary, outside of the cross-sectional area. The areal extent of the Capitan Aquifer is shown in Figure USDW-4.

This section describes the investigations conducted to characterize the hydrology of these formations. Important sources of relevant information are identified, and findings or conclusions related to the presence of USDWs are summarized. Relevant information from personal communications conducted during this evaluation is provided in Attachment A. The study area and the locations of boreholes and wells used in this study are shown in Figure USDW-1.

USDW.3.1 Water-Bearing Formations

The Capitan Aquifer consists of a reef margin that was deposited in a continuous, narrow, arcuate-trending belt during Permian Guadalupe time (Hiss 1976). It includes the Capitan and Goat Seep Limestones and most or all of the Carlsbad facies (Mercer 1983). The Capitan Aquifer also includes the upper part of the San Andres Limestone where it cannot be readily distinguished from the Carlsbad facies and the Goat Seep Limestone (Mercer 1983).

The two rock units of Permian Age within the Ochoan Series are the Rustler and the overlying Dewey Lake. The Rustler in the study area is characterized by a variable lithology consisting of interbedded sulfates, carbonates, clastics, and halite. Holt and Powers (1988) concluded that the Rustler was the depositional product of repeated transgressive and subsequent dessication events over low-relief salt pan and mud flat environments. The transgressive events produced lagoonal conditions favorable to the subaqueous deposition of clastics, carbonates (Culebra and Magenta), and sulfates (anhydrite beds) (Holt and Powers 1990).

The Culebra and Magenta are regionally extensive carbonate beds. Both units are generally fluid-bearing in the study area (Mercer 1983). The Culebra is an argillaceous dolomicrite containing abundant open and gypsum-filled porosity (Holt and Powers 1990). Portions of the Culebra are extensively fractured. The Culebra is generally 18- to 28-feet (5- to 9-meter) thick (Mercer 1983). The Magenta is a moderately well-indurated, arenaceous, and gypsiferous dolomite (Holt and Powers 1990). During mapping by Holt and Powers (1990),

the Magenta produced only a limited amount of fluid. The Magenta is generally 23- to 27-feet (7- to 8-meters) thick (Mercer 1983).

The Dewey Lake in the study area consists of interbedded siltstone, fine sandstone, mudstone, and claystone. Gypsum-filled fractures are abundant throughout most of the Dewey Lake. The Dewey Lake represents a transition from the marine-influenced evaporite deposition of the Rustler to fluvial deposition on a broad, low-relief, fluvial plain (Holt and Powers 1990).

The Santa Rosa is part of the Late Triassic Dockum Group. Some authors (for example, Bachman 1987) believe that there is little basis for subdividing rocks of Triassic age in southeastern New Mexico, and refer to Triassic rocks as the Dockum Group (undivided) (Holt and Powers 1990). For consistency across the study area, the term Santa Rosa is used to describe rocks of Triassic age. The Santa Rosa is present only in the eastern one-half of the WIPP site (Figure USDW-3), having been removed by erosion in the west. Where present at the WIPP site, the Santa Rosa consists of medium-to-coarse-grained, micaceous sandstone and conglomerate with interbeds of siltstone and mudstone. It overlies the Dewey Lake (Figure USDW-3) and ranges in thickness from a featheredge west of test hole U.S. Energy Research and Development Administration (ERDA)-9 to 176 feet (54 meters) in test hole H-10 (Figure USDW-1) (Mercer 1983).

USDW.3.2 Available Groundwater Data

Data regarding the quality and quantity of groundwater from the water bearing units in the study area were obtained from the State Engineer, numerous investigation reports, and the WIPP WQSP. The WQSP began in January 1985 to establish water quality background characterization at the site. The WQSP sampled 28 separate WIPP monitoring wells and then identified 24 of these wells for repeated sampling to establish the baseline data.

The WIPP Site Environmental Report for Calendar Year 1991 (DOE 1992) presents the results of the baseline study in which all 24 wells had been sampled at least three times. In addition to the WIPP monitor wells, the WQSP sampled 11 privately owned wells in the study area. Ten of these wells provide water for livestock and one well, the Barn Well, provides water for human consumption (DOE 1992).

Subsequent to the completion of the WIPP Site Environmental Report for Calendar Year 1991, wells have been sampled annually as part of the WQSP. In 1992 and 1993, ten well locations were sampled: eight locations in the Culebra and two privately owned wells completed in the Dewey Lake (DOE 1993, 1994). The 1994 sampling year included nine locations in the Culebra. In 1994, DOE installed six new wells in the Culebra (WQSP-1 through 6) and one well in the Dewey Lake (WQSP-6a) to assist in meeting the requirements for site characterization (DOE 1995). During 1995, sampling for groundwater quality was performed at 11 well sites, including the new WQSP locations (DOE 1996).

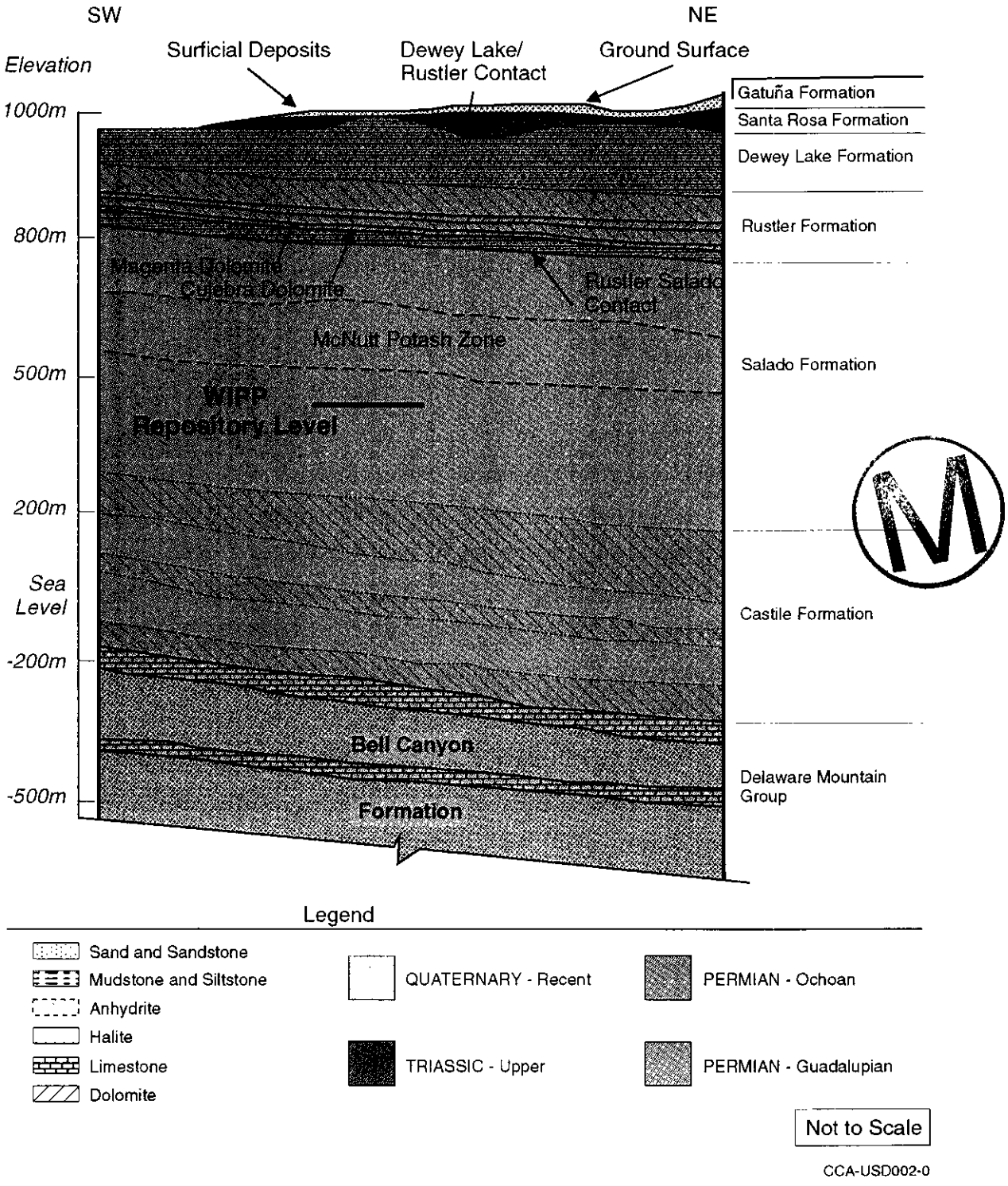

Figure USDW-3. Generalized Stratigraphic Cross-Section at the WIPP Site

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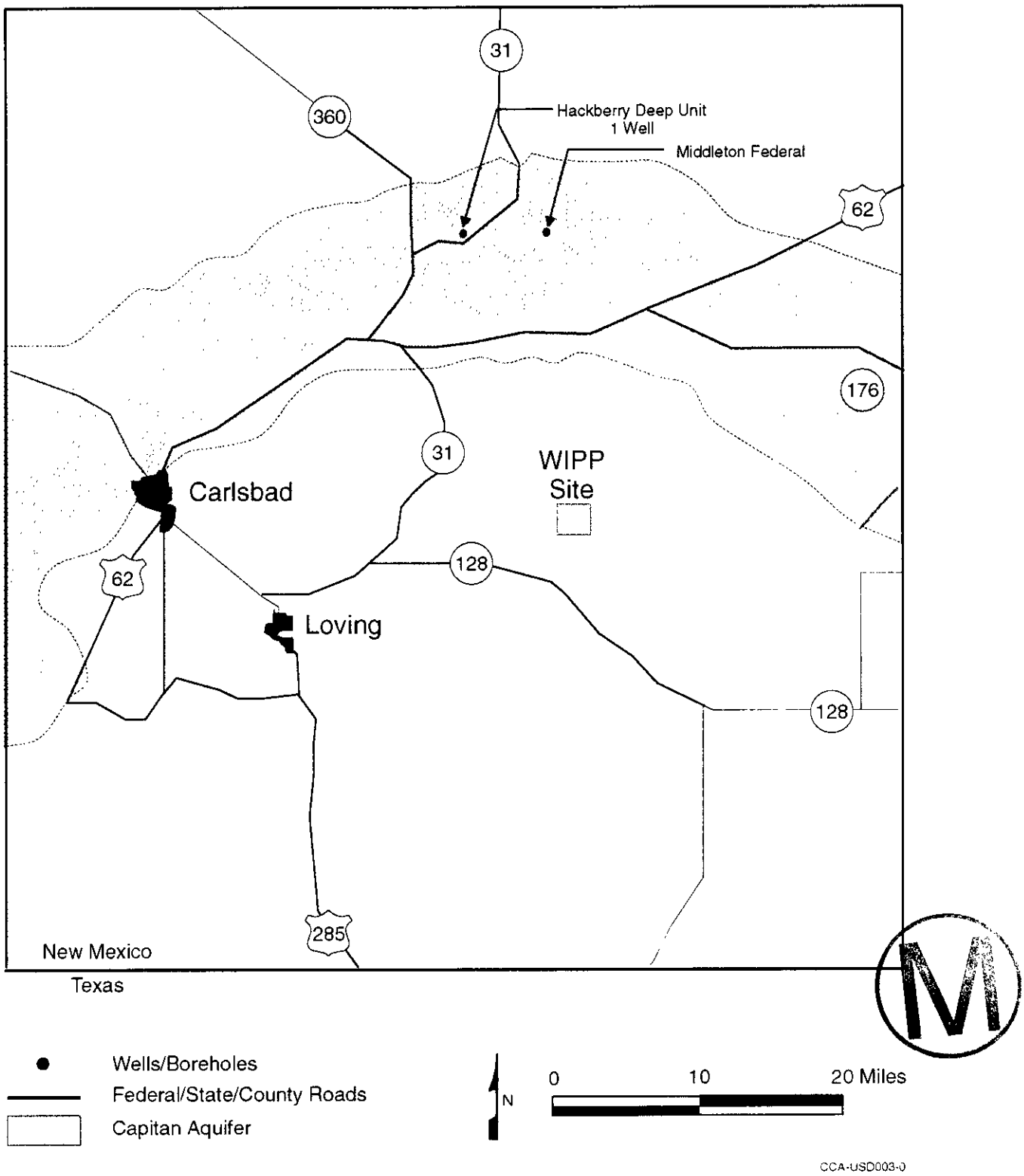

Figure USDW-4. Areal Extent of the Capitan Aquifer near Carlsbad, New Mexico

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USDW.3.3 Underground Sources of Drinking Water

This section addresses the potential for groundwater in the study area to meet the definition of a USDW. The USDW determinations are based on the available data, including some data that were developed many years ago.

USDW.3.3.1 Determination of Potential USDWs in the Capitan Aquifer

The Capitan Aquifer occurs in a long, narrow arcuate belt that ranges from 10 miles (16 kilometers) to more than 14 miles (23 kilometers) wide. The unit is reported to be more than 1,500 feet thick in many locations in New Mexico. The Capitan Aquifer is not present at the WIPP site, but is located within the study area approximately ten miles north of the WIPP (Figure USDW-4) (Mercer 1983). The determination of potential USDWs in the Capitan Aquifer is described below.

Where present, the Capitan Aquifer is capable of producing a significant quantity of water. The Capitan Aquifer is a USDW in the City of Carlsbad where it supplies water for most of the city, irrigation, potash refining, and livestock. Water in the Capitan Aquifer is under water-table conditions southwest of the Pecos River at Carlsbad. North and east of Carlsbad, the aquifer is under artesian conditions (Mercer 1983).

Motts (1968) reports that yields from developed wells are from 1,000 to 4,000 gallons per minute. Records from City of Carlsbad wells indicate rated capacities ranging from 700 to 3,000 gallons per minute (Hendrickson and Jones 1952). These data indicate that the Capitan Aquifer meets the sub-criteria for rate of production of 5 gallons per minute.

Hiss (1973) reports the chemical quality of water in 12 observation wells located along the areal extent of the Capitan aquifer. TDS concentrations ranged from 603 milligrams per liter (City of Carlsbad Well 13; T21S, R26E, Sec.36) to 191,024 milligrams per liter (Hackberry Deep Unit 1; T19S, R31E, Sec.31).

Of the 12 observation wells tested, TDS concentrations in the City of Carlsbad Well 13 were the only analyses that met the 40 CFR Part 191 TDS criterion (Hiss 1973). Well 13 is approximately 26 miles west of the WIPP site. Wells outside the study area, approximately 16 miles north of the WIPP (Figure USDW-4), had TDS concentrations ranging from 25,800 to 28,740 milligrams per liter (Middleton Federal B 1; T19S, R32E, Sec. 31) and 184,227 to 191,024 milligrams per liter (Hackberry Deep Unit 1; T19S, R31E, Sec.31). Therefore, the closest Capitan Aquifer wells have TDS concentrations above the USDW water-quality criterion of 10,000 milligrams per liter and water in the Capitan Aquifer at those locations does not meet the definition of a USDW.

USDW.3.3.2 Determination of Potential USDWs in the Culebra

The DOE has applied the available groundwater data for the Culebra to the decision matrix in Figure USDW-2 to determine the potential presence of a USDW in the Culebra in the study area. The results of the analysis are described below.

Groundwater data from the WQSP and private wells in the study area are used to determine the potential for USDWs to occur in the Culebra (Table USDW-2). Applying the decision matrix requires evaluating groundwater production and quality data. Because the groundwater quality criterion is in the final position in the decision matrix, it can be readily used to screen data that must meet both the groundwater quality criterion and the DOE's sub-criteria for groundwater quantity.

Determining whether the groundwater is being used for human consumption is the decision matrix question linking the groundwater quantity and quality questions (Figure USDW-2). Because WIPP wells in the study area are used for environmental monitoring, no one is currently drinking from these wells. Groundwater from the private wells—Engle, Poker Trap, Mobley Well, and USGS-1—is used for livestock. Therefore, because the answer to the matrix question regarding current use for human consumption is no, a direct analysis for the matrix questions for quality and quantity can be applied. The wells that have TDS values less than 10,000 milligrams per liter are identified and then the data from this subset of wells are evaluated to determine whether these wells can produce a sufficient quantity of water.

Using this approach, eight wells in the Culebra produce water meeting the groundwater quality criterion of less than 10,000 milligrams per liter of TDS: H-02b, H-07b1, H-08b, H-09b, Engle, Poker Trap, Mobley Well, and USGS-1. Groundwater samples from these locations have yielded TDS values ranging from 2,100 milligrams per liter to 8,890 milligrams per liter. The application of the DOE's sub-criterion for groundwater quantity in these wells is discussed below.

Hydraulic testing of well H-02b was conducted in 1977 by bailing liquid from the cored interval in the well (Mercer and Orr 1979). The hole was bailed nearly dry during two tests and took several days to recover, indicating that the production rate and duration of production of this well would be very low. Based on this information, the well would not meet the USDW quantity criterion of 5 gallons per minute.

The pumping rate for well H-07b1 was reported to range between 5 and 6 gallons per minute when it was purged for sampling (DOE 1988). Pumping rates during purging may be greater than long-term pumping rates. In addition, the mean sulfate concentration in the well (1,960 milligrams per liter) is nearly eight times the MCL (250 milligrams per liter). Two other wells in the Culebra have sustained pumping rates greater than the USDW quantity sub-criterion of 5 gallons per minute. The pumping rates for wells H-08b and H-09b were reported to be 6 gallons per minute, and 9.6 to 10.5 gallons per minute, respectively. Groundwater in H-07b1, H-08b, and H-09b meets both the quality criterion and the groundwater production sub-criterion. Therefore, groundwater in the Culebra at the locations of these wells is considered to be a USDW. The cost of treating water from well H-07b1 and whether it could ever be used as a USDW was not addressed but could be, if further analyses are warranted.

Table USDW-2. Groundwater Data from the WQSP and Private Wells in the Study Area Used for Determining Potential USDWs in the Culebra

Well	TDS (milligrams per liter)	Sample Date	Controlled Area[1]	USDW Subject to 40 CFR Part 191, Subpart C
DOE-1	130,000	4/25/85	Yes	No
	130,000	7/3/86		
	130,000	7/28/87		
DOE-2	58,000	3/12/85	No	No
	54,000	8/27/86		
	57,500	5/19/88		
H-01[a]	97,300	3/17/77	Yes	No
H-02a	13,000	4/21/86	Yes	No
	11,000	8/12/87		
	10,400	1/19/89		
H-02b[a]	8,890	2/22/77	Yes	No
H-02c[a]	12,500	3/15/77	Yes	No
H-03b3	55,000	2/4/85	Yes	No
	54,000	5/5/86		
	54,000	8/24/87		
	53,400	3/2/89		
	55,000	8/15/90		
H-04b	20,000	7/20/85	No	No
	23,000	11/13/86		
	16,000	9/25/87		
	20,700	4/6/89		
	21,000	9/11/90		
H-05b	144,000	8/27/85	Yes	No
	150,000	5/21/86		
	153,000	2/24/88		
	154,000	8/23/89		
	160,000	5/2/90		
H-06b	58,000	9/15/85	Yes	No
	59,000	7/28/86		
	60,300	11/16/87		
	59,600	7/24/89		
	66,000	2/12/90		

Table USDW-2. Groundwater Data from the WQSP and Private Wells in the Study Area Used for Determining Potential USDWs in the Culebra (Continued)

Well	TDS (milligrams per liter)	Sample Date	Controlled Area[1]	USDW Subject to 40 CFR Part 191, Subpart C
H-07b1	3,400	3/27/86	No	Yes[2]
	3,500	2/25/87		
	3,400	4/25/88		
	3,500	5/19/89		
	3,500	11/9/90		
H-08b	3,100	1/22/86	No	Yes[2]
	3,100	2/11/87		
	2,900	6/8/88		
H-9b	3,300	11/14/85	No	Yes[2]
	3,300	1/28/87		
	3,100	6/21/88		
	3,300	1/19/90		
H-11b3	122,000	6/4/85	Yes	No
	121,000	6/4/86		
	120,000	9/15/87		
	116,000	10/25/89		
	113,000	10/17/90		
H-12	143,000	8/9/85	No	No
	140,000	1/16/87		
	130,000	12/14/88		
H-14	18,000	5/26/87	Yes	No
	17,200	1/27/88		
	16,500	4/21/89		
H-15	230,000	5/11/87	Yes	No
	230,00	1/13/88		
	246,000	11/7/88		
H-17[b]	151,000	10/27/87	No	No
H-18	24,000	11/10/87	Yes	No
	27,900	4/7/88		
	31,000	4/10/90		
P-14	26,000	2/27/86	No	No
	29,000	6/18/87		
	29,400	3/16/88		
P-15[a]	23,700	5/10/77	Yes	No

Table USDW-2. Groundwater Data from the WQSP and Private Wells in the Study Area Used for Determining Potential USDWs in the Culebra (Continued)

Well	TDS (milligrams per liter)	Sample Date	Controlled Area[1]	USDW Subject to 40 CFR Part 191, Subpart C
P-17	88,000	3/17/86	No	No
	90,000	12/18/86		
	84,000	10/21/87		
P-18[a]	118,000	5/10/77	No	No
WIPP-13[b]	67,000	2/16/87	Yes	No
WIPP-19	110,000	7/14/87	Yes	No
	85,400	2/12/88		
	79,000	8/29/88		
	80,000	11/3/89		
	77,200	6/13/90		
WIPP-25	14,000	2/12/86	No	No
	14,000	4/15/87		
	14,800	3/28/88		
	14,500	6/27/89		
WIPP-29[b]	290,000	3/11/87	No	No
WQSP-1	77,400	8/17/95	Yes	No
	66,300	4/11/96		
WQSP-2	67,600	8/31/95	Yes	No
	70,400	4/25/96		
WQSP-3	218,000	9/19/95	Yes	No
	214,000	5/9/96		
WQSP-4	108,000	9/28/95	Yes	No
	106,000	5/23/96		
WQSP-5	43,800	11/20/95	Yes	No
	33,300	3/12/96		
WQSP-6	21,600	10/16/95	Yes	No
	16,500	3/12/96		
WIPP-26	18,000	11/25/85	No	No
	13,000	4/1/87		
	12,800	4/14/88		

Table USDW-2. Groundwater Data from the WQSP and Private Wells in the Study Area Used for Determining Potential USDWs in the Culebra (Continued)

Well	TDS (milligrams per liter)	Sample Date	Controlled Area[1]	USDW Subject to 40 CFR Part 191, Subpart C
Private Wells				
Engle	3,450 4,000 3,600	3/4/85 12/8/87 1/31/90	No	Possible[3]
Poker Trap[c]	2,200	7/7/88	No	Possible[3]
Mobley Well[c]	3,800	4/14/88	No	Possible[3]
USGS-1[c]	2,100 4,000	4/12/88 7/7/88	No	Possible[3]
James Brothers[d]	3,940	4/30/50	No	Possible[3]

Sources: [a] Mercer and Orr 1979, [b] DOE 1988, [c] DOE 1989, [d] Hendrickson, G.E. and R.S. Jones 1952, all others DOE 1992.

Notes: [1] USDWs located within the controlled area are not subject to the requirements of Subpart C of 40 CFR Part 191.

[2] Groundwater meets both the quantity (>5 gallons per minute) and quality (<10,000 milligrams per liter, TDS) criteria. Production rates for these wells: H-07b (5 and 6 gallons per minute), H-08b (6 gallons per minute), and H-9b (9.6 to 10.5 gallons per minute).

[3] Groundwater meets the quality criterion (<10,000 milligrams per liter, TDS), but groundwater quantity data are not available; therefore, these are possible USDWs.

Long-term pump tests are not routinely performed on private wells. Therefore, production rates for the private wells are not available. Because groundwater production rates from the private wells may or may not exceed the DOE quantity sub-criterion of 5 gallons per minute, the sources for Engle, Poker Trap, Mobley Well and USGS-1 are determined to be possible USDWs.

Hendrickson and Jones (1952) report TDS concentrations for an additional well in the study area. The well belongs to the James Brothers and is located southwest of the WIPP in T23S, R30E, Sec 2. Reported TDS concentrations are 3,940 milligrams per liter. No pumping information is provided. According to State Engineer records, a well located in T23S, R30E, Sec. 2, is listed under the name Brothers Jamen, but is not a permitted or declared well (the spelling of this listing appears to represent a typographical error in the record). Because water from this well meets the quality criterion and may or may not meet the groundwater production sub-criterion, the Culebra at this location is also considered a possible USDW.

USDW.3.3.3 Determination of Potential USDWs in the Magenta

The DOE has applied the available groundwater data for the Magenta to the decision matrix in Figure USDW-2 to determine the potential presence of a USDW in the Magenta in the study area. The results of the analysis are described below.

Groundwater data from the WQSP wells in the study area are used for determining potential USDWs in the Magenta. The data evaluation for the Magenta is applied consistently using the method described in Section USDW.2.2. This approach requires an evaluation of groundwater production and quality data. Three wells have produced water with TDS concentrations below 10,000 milligrams per liter: H-03b1, H-05c, and H-06c. Table USDW-3 presents the water quality data and pumping rates for wells completed in the Magenta in the study area.

Well H-03b1 was completed in the Magenta. Water collected from this well had TDS values ranging from 8,100 to 9,300 milligrams per liter. When water was collected for analysis, the well discharge rate was approximately 0.5 gallons per minute.

Well H-04c was also completed as a Magenta water quality monitoring well. The DOE (1992) indicates that the TDS concentrations varied from 22,000 to 24,600 milligrams per liter. It is concluded that the Magenta, at this location, does not meet the water quality criterion of less than 10,000 milligrams per liter.

Water collected from Well H-05c had a TDS concentration ranging from 6,800 to 7,200 milligrams per liter. The pumping rate for purging was low. The pump test rate was maintained at approximately 0.23 gallons per minute (Sandia National Laboratories 1985).

Well H-06c was originally completed in the Culebra and was recompleted by plugging the well to the Magenta as a water quality monitoring well. Water collected from this well had TDS values ranging from 4,600 to 4,800 milligrams per liter. The purging rate for this well was 27 gallons per hour or 0.45 gallons per minute. Because sustained production rates are long term, hydrogeologic experience has shown that they would generally be lower than the short-term measured purge rates; pressures tend to drop as the well is left open for longer periods.

Most of the Magenta wells yield fluids that meet the water quality definition in the study area. However, the Magenta does not meet the sustained pumping rate of 5 gallons per minute, and consequently is not a USDW in the study area.

USDW.3.3.4 Determination of Potential USDWs in the Dewey Lake

The DOE has applied the available groundwater data for the Dewey Lake to the decision matrix in Figure USDW-2. The results of the analysis to determine the potential presence of a USDW in the Dewey Lake in the study area are described below.

Table USDW-3. Groundwater Data from the WQSP Wells in the Study Area Used for Determining Potential USDWs in the Magenta

Well	TDS (milligrams per liter)	Sample Date	Pumping Rate (gallons per minute)[1]	Controlled Area	USDW Subject to 40 CFR Part 191, Subpart C
H-03b1	8,800	7/1/85	0.25	Yes	No
	8,500	9/16/86			
	8,100	9/2/87			
	8,800	3/16/89			
	9,300	8/28/90			
H-04c	22,000	11/4/86	0.09	No	No
	24,000	10/5/87			
	23,500	7/19/88			
	24,400	4/21/89			
	24,600	10/2/90			
H-05c	6,800	10/24/86	0.23	Yes	No
	6,900	3/3/88			
	7,000	8/18/88			
	7,100	9/14/89			
	7,200	5/16/90			
H-06c	4,600	10/1/86	0.45	Yes	No
	4,800	11/4/87			
	4,800	7/26/88			
	4,800	8/4/89			
	4,800	3/15/90			

Sources: DOE 1992, DOE 1991.

[1]Note: None of the Magenta wells meets the quantity criterion of 5 gallons per minute.

Groundwater data from the WQSP and private wells in the study area are used for determining potential USDWs in the Dewey Lake. The data evaluation for the Dewey Lake is applied consistent with the method described in Section USDW.2.2. Six wells have produced water with TDS concentrations below 10,000 milligrams per liter: WQSP-6a, Barn Well, Ranch Well, Twin Wells, Fairview Well and Unger Well. Table USDW-4 presents the water quality data and pumping rates for wells completed in the Dewey Lake in the study area.

Several authors indicate the low potential for the Dewey Lake to contain significant amounts of groundwater. In general, the formation appears to have low permeabilities that would not be expected to sustain pumping for long durations. The description of the Dewey Lake as containing mostly low-permeability sediments has been noted by Brokaw et al. (1972), Cooper and Glanzman (1971), Griswold (1977), Mercer and Orr (1977, 1979), Mercer (1983), and Sandia National Laboratories and U.S. Geological Survey (1979a, b, 1980, 1981, 1982, 1983).

Table USDW-4. Groundwater Data from the WQSP and Private Wells in the Study Area Used for Determining Potential USDWs in the Dewey Lake

Well	TDS (milligrams per liter)	Sample Date	Pumping Rate (gallons per minute)	Controlled Area[1]	USDW Subject to 40 CFR Part 191, Subpart C
H-04c	Not Tested	-	12-15	No	Possible
WQSP-6a	4,238[a] 3,920	7/13/95 3/28/96	12[b]	Yes	No
Private Wells					
Barn Well[c]	670 720 630 650	11/4/87 4/20/88 7/27/89 6/21/90	Not Tested	No	Possible[2]
Ranch Well[c]	3,300 3,200 2,900 2,800 3,000	6/18/86 12/20/87 4/20/88 7/27/89 6/20/90	Not Tested	No	Possible[2]
Twin Wells-(Pasture Well[c])	400 390 400 410	1/30/86 8/3/88 10/20/89 5/30/90	Not Tested	No	Possible[2]
Fairview Well[c,d,e]	3,400 3,300	11/16/87 7/6/88	Not Tested	No	Possible[2]
Unger Well[c,d,e]	3,300 3,200	11/18/87 7/6/88	Not Tested	No	Possible[2]

Sources: [a] Personal Communication 1996e, [b] Personal Communication 1996f, [c] DOE 1992, [d] DOE 1988, [e] DOE 1989.

Notes: [1] USDWs located within the controlled area are not subject to the requirements of Subpart C of 40 CFR Part 191.

[2] Groundwater meets quality criterion (<10,000 milligrams per liter, TDS), but groundwater quantity data are not available, therefore, the wells are possible USDWs.

Beauheim (1986) summarizes the results of an 11-zone hydraulic test performed in well DOE-2 that indicated the low permeability of the Dewey Lake. The Dewey Lake zone testing was conducted on September 13 and 14, 1985. The test method was a constant-head, borehole-infiltration test. The initial test idea was to inject water at a rate of 0.25 gallons per minute, which was near the lower threshold of the flow meter used, consistent with the low

permeability of the Dewey Lake sediments. After observing that the interval would not take the fluids, the test was converted to a constant-head test. This test was ended for two reasons:

> (1) at an apparent inflow rate of approximately 1 ml/min, even a very small leak somewhere in the system could introduce a very large error in the flow measurement; and (2) because of the low infiltration rate observed, continuing the test until reaching steady state conditions was deemed impractical, especially considering that an unknown volume of rock had to be saturated, and the infiltration would decrease further as saturation was approached (Beauheim 1986, 33).

Mercer and Orr (1979) summarize data collection in ten wells at the WIPP site. These wells are H-01, H-03, H-03 complex (H-03a, H-03b, and H-03c), P-14, P-15, P-17, P-18, and AEC-8. The data include geology, construction details, geophysical data, and hydrologic testing data. The general discussion on important shallow geologic units suggests that "the siltstones and mudstone of the Dewey Lake Formation limit liquid transmission capability" (Mercer and Orr 1979, 11). The zones noted in the drilling program were tested with the result that "no appreciable liquid flows were found" (Mercer and Orr 1979, 11).

The Dewey Lake was encountered during the drilling of H-04c, a WQSP well completed in the Magenta. According to a borehole data sheet (Fenix & Scisson, Inc. 1978), the borehole produced water at 190 feet (58 meters) at 12 to 15 gallons per minute. Groundwater quality data for the Dewey Lake were not obtained from the well. The well meets the groundwater quantity production criterion of 5 gallons per minute, but may or may not meet the quality criterion. Therefore, the Dewey Lake at this location is considered a possible USDW.

Well WQSP-6a was completed in the Dewey Lake and first sampled on July 13, 1995 (Personal Communication 1996c). The TDS concentration was reported by the laboratory at 11,000 milligrams per liter. However, based on the sum of the detected anions and cations in the sample, these data indicate a TDS value of approximately 4,238 milligrams per liter (Personal Communication 1996e). This value is consistent with the sampling results from March 28, 1996, that indicate a TDS concentration of 3,920 milligrams per liter.

WQSP-6a had a pumping rate of 12 gallons per minute during pump testing. Initial results of the pump test indicate that the well can sustain up to 30 gallons per minute (Personal Communication 1996f). Based on initial information, it appears that the Dewey Lake, at this location, meets the water quality criterion of less than 10,000 milligrams per liter and the quantity sub-criterion of 5 gallons per minute. These conditons indicate that the Dewey Lake meets the USDW definition at this location but, because the location is within the WIPP controlled area, this portion of the Dewey Lake is not subject to the requirements of 40 CFR Part 191, Subpart C.

Long-term pump tests are not routinely performed on private wells. Therefore, production rates for the private wells are not available. Because groundwater production rates from the private wells may or may not exceed the DOE quantity sub-criterion of 5 gallons per minute, the sources of Barn Well, Ranch Well, Twin Wells, Fairview Well, and Unger Well are determined to be possible USDWs. The Barn Well is the only private well identified in the study area that is used to supply drinking water to a single residence. The well is

approximately 3.4 miles (5.5 kilometers) southwest of the WIPP. It does not currently supply 25 individuals or 15 service connections.

Hendrickson and Jones (1952) report TDS concentrations for an additional well in the study area. The James Headquarters Well (T23S, R31E, Sec. 7) southwest of the WIPP site had a TDS concentration of 3,330 milligrams per liter and an estimated yield of 10 gallons per minute. Hendrickson and Jones (1952) indicate that this well is 180 feet (55 meters) deep, screened in the Dockum Redbeds. State Engineer records indicate that a well located in T23S, R31E, Sec. 7, is listed under the name James Brothers, but that the well is not permitted or declared. The State Engineer database designates that the well is located in the Triassic (Chinle) Formation Aquifer. According to Holt and Powers (1990), the Dewey Lake is the geologic unit present at a depth of 180 feet (55 meters) in this area. Therefore, it is assumed that this well is screened in the Dewey Lake, not the Triassic units. Because this well may meet both the quality criterion and the groundwater production sub-criterion, the Dewey Lake at this location is also considered a possible USDW.

USDW.3.3.5 Determination of Potential USDWs in the Santa Rosa

The DOE has applied the available groundwater data for the Santa Rosa to the decision matrix in Figure USDW-2 to determine the potential presence of a USDW in the Santa Rosa in the study area. The results of the analysis are described below.

Groundwater data from the WQSP and private wells in the study area are used for determining potential USDWs in the Santa Rosa. The data evaluation for the Santa Rosa is applied consistent with the method described in Section USDW.2.2. Three wells have been shown to produce water with TDS concentrations below 10,000 milligrams per liter: H-05c, Comanche Well, and Clifton Well. Table USDW-5 presents the water quality data and pumping rates for wells completed in the Santa Rosa in the study area.

Several wells east of the WIPP have been reported to be obtaining water from the Santa Rosa, but yields are reported to be small (Mercer 1983). Groundwater was present only in the lower part of the Santa Rosa in test hole H-05c. The water was under water-table conditions and was present in a sandstone immediately overlying the Dewey Lake. The TDS concentration in water from H-05c was reported at 1,200 milligrams per liter, which meets the 40 CFR Part 191 USDW water-quality criterion of 10,000 milligrams per liter. Mercer (1983) indicates that other hydraulic tests were not successful, implying that lack of water in the formation at H-05c prohibited testing.

The Comanche Well is approximately nine miles east of the WIPP site and is used to supply water to livestock. Groundwater from the Comanche Well has been analyzed on two occasions (DOE 1988, 1989). TDS concentrations were reported to be 340 milligrams per liter during both sampling periods.

The Clifton Well is approximately 7.7 miles (12.4 kilometers) east of the WIPP site and is used to supply water to livestock. Groundwater from the Clifton Well has also been analyzed

Table USDW-5. Groundwater Data from the WQSP and Private Wells in the Study Area Used for Determining Potential USDWs in the Santa Rosa

Well	TDS (milligrams per liter)	Sample Date	Pumping Rate (gallons per minute)	Controlled Area[1]	USDW Subject to 40 CFR Part 191, Subpart C
H-05c[a]	1,200	5/24/78	Unable to test	Yes	No
Private Wells					
Comanche	340	10/26/87	Not	No	Possible[2]
Well[b,c]	340	6/28/88	Tested		
Clifton	780	10/28/87	Not	No	Possible[2]
Well[b,c]	780	6/29/88	Tested		

Sources: [a] Mercer 1983, [b]DOE 1988, [c]DOE 1989.

Notes: [1] USDWs located within the controlled area are not subject to the requirements of Subpart C of 40 CFR Part 191.

[2] Groundwater meets quality criterion (<10,000 milligrams per liter, TDS), but groundwater quantity data are not available, therefore, the wells are possible USDWs.

on two occasions (*DOE 1988, 1989*). TDS concentrations were reported to be 780 milligrams per liter during both sampling periods.

Groundwater quantity data for the Comanche, Clifton, and H-05c wells are not available. Because groundwater production rates from the private wells may or may not exceed the DOE quantity sub-criterion of 5 gallons per minute, these wells are determined to be located in possible USDWs.

USDW.4 Conclusions

Five water-bearing geologic units in the study area were evaluated for determination as USDWs under Subpart C of 40 CFR Part 191: the Capitan Aquifer, the Culebra, the Magenta, the Dewey Lake, and the Santa Rosa. The DOE's approach for determining potential USDWs in the study area is based on establishing mapping criteria related to groundwater quantity and quality. According to the DOE's approach, USDWs are identified in the Culebra and the Dewey Lake. The USDW located within the Dewey Lake is within the WIPP controlled area and is therefore not subject to the requirements of Subpart C of 40 CFR Part 191. In addition, because of inconclusive groundwater production data, possible USDWs are present outside the WIPP controlled area in the Dewey Lake and the Santa Rosa.

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Wilson, B.C. 1992, *Water Use by Categories in New Mexico Counties and River Basins, and Irrigated Acreage in 1990,* Technical Report 47, New Mexico State Engineer's Office, Santa Fe, New Mexico.

ATTACHMENT

Attachment A: Relevant Information from Personal Communications Conducted During this Study

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Title 40 CFR Part 191
Compliance Certification
Application
for the
Waste Isolation Pilot Plant

USDW Attachment A

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Attachment A

Relevant Information from Personal Communications Conducted During this Study

Reference: Personal Communication, 1996a, Wayne G. Canon, Supervisor, State Engineer, Albuquerque District, and Barbara J. Graves, John Hart and Associates, P.A., May 30, 1996.

Meeting Notes:

Barbara J. Graves, of John Hart and Associates, P.A., met with Wayne Canon, Supervisor, State Engineer, Albuquerque District, on May 30, 1996. The purpose of the meeting was to discuss the duration of appropriations for groundwater use.

Mr. Canon stated that a water appropriation is generally considered permanent. Exceptions would be the short term appropriation of a water supply for temporary use such as a road construction project.

Once a water right is obtained by a party, it is permanent unless otherwise specified. Therefore, an underground source of drinking water appropriated for a public water supply system is generally considered a permanent use of the resource.

Reference: Personal Communication, 1996b, Martha Torrez, Rural Utility Service, U.S. Department of Agriculture, and Barbara J. Graves, John Hart and Associates, P.A., June 4, 1996.

Conversation Notes:

Barbara J. Graves, of John Hart and Associates, P.A., communicated by telephone with Martha Torrez, Rural Utility Service, U.S. Department of Agriculture, on June 4, 1996. The purpose of the conversation was to discuss the funding period for development of rural water supplies.

Ms. Torrez stated that loan periods for funding of new water supplies are generally 40 years in duration. Prior to loan approval, appropriation and water rights issues must be resolved by the loan applicant with the State Engineer.

Reference: Personal Communication, 1996c, Ron G. Richardson, Westinghouse Electric Corporation, Carlsbad, New Mexico, and William A. Trippet II, John Hart and Associates, P.A., January 8, 1996.

Meeting Notes:

William A. Trippet II, of John Hart and Associates, P.A., met with Mr. Ron Richardson of the Westinghouse Waste Isolation Division at the WIPP site on January 8, 1996. The purpose of the meeting was to obtain data from the wells WQSP-6a, H-2a, H-3b1, H-5c, and H-6c. The following discussions occurred in the meeting:

- WQSP-6a was completed in the Dewey Lake Formation. It was sampled on July 13, 1995; the concentration of TDS was measured at 11,000 milligrams per liter. The well, reportedly, had a fairly good pumping rate; INTERA Inc. has recently conducted a pump test and is now in the process of reducing the data.

- Well H-2a has a TDS that is variable, but generally over 10,000 milligrams per liter. Mr. Richardson said that the pumping rate ranges between 15 and 20 gallons per hour. This is equivalent to 0.25 to 0.33 gallons per minute. If the well has a purge rate of 15 to 20 gallons per hour, the production rate to supply water over an extended period (that is, years) would be less than the purge rate

- H-3b1 was completed in the Magenta. When water was collected for analysis, the well discharge rate was approximately 0.5 gallons per minute.

- Well H-5c was completed in the Magenta. The pumping rate for purging was low. The pump test rate was maintained at approximately 0.23 gallons per minute (Sandia National Laboratories 1985). It was concluded that the Magenta Dolomite Member, at this location, does not meet the USDW quantity criterion of 5 gallons per minute over an extended period.

- Well H-6c was originally completed in the Culebra Dolomite Member and was recompleted by plugging back into a Magenta water-quality monitoring well. The well was last sampled on May 2, 1991, and the TDS value was 4,800 milligrams per liter. The substantial purging rate for this well was 27 gallons per hour or 0.45 gallons per minute. It was concluded that the Magenta Dolomite Member, at this location, does not meet the USDW quantity criterion of 5 gallons per minute over an extended period.

The H-4c well, which was completed as a Magenta water-quality monitoring well, was not discussed. Report DOE/WIPP 92-007 indicates that the TDS varied from 22,660 to 24,720 milligrams per liter at the 95% confidence level. It was concluded that the Magenta Dolomite Member, at this location, would not meet the USDW quality criterion of less than 10,000 milligrams per liter TDS.

Sandia National Laboratories, 1985, *WIPP Hydrology Program, Waste Isolation Pilot Plant, SENM, Hydrologic Data Report #1,* SAND85-7206, Sandia National Laboratories, Albuquerque, New Mexico.

DOE (U. S. Department of Energy), 1992, *Waste Isolation Pilot Plant, Site Environmental Report for Calendar Year 1991,* DOE/WIPP 92-007, U. S. Department of Energy, Carlsbad, New Mexico.

Reference: Personal Communication, 1996d, Ron G. Richardson, Westinghouse Electric Corporation, Carlsbad, New Mexico, and Barbara Graves, John Hart and Associates, P.A., June 6, 1996.

Meeting Notes:

Barbara J. Graves, of John Hart and Associates, P.A., met with Mr. Ron Richardson of the Westinghouse Waste Isolation Division at the WIPP site on June 6, 1996. The purpose of the meeting was to obtain data regarding the WQSP.

The following discussions occurred in the meeting:

According to Ron Richardson, well WQSP-6a was completed in the Dewey Lake Formation and first sampled on July 13, 1995. The TDS was reported by the laboratory at 11,000 milligrams per liter. However, Mr. Richardson found that the reported value is inaccurate, based on the sum of the detected anion and cations in the sample. These data indicate a TDS value of approximately 4,238 milligrams per liter. This is consistent with the sampling results from March 28, 1996, that indicate a TDS concentration of 3,920 milligrams per liter.

WQSP-6a reportedly had a fairly substantial pumping rate during development. INTERA Inc. recently conducted a pump test and is currently reducing the data. Based on initial information, it appears that the Dewey Lake Formation, at this location, meets the water quality criterion of less than 10,000 milligrams per liter of TDS and may meet the quantity sub-criterion of 5 gallons per minute.

Reference: Personal Communication, 1996e, Richard L. Beauheim, Sandia National Laboratories, Albuquerque, New Mexico and Barbara Graves, John Hart and Associates, P.A., July 17, 1996.

Conversation Notes:

Richard L. Beauheim provided information via telephone to a representative of WIPP who then provided Barbara J. Graves, John Hart and Associates, P.A., with written documentation of the conversation. This communication occurred during a comment resolution meeting held at Sandia National Laboratories Offices, Carlsbad, New Mexico, on July 17, 1996.

The following information was provided regarding WQSP-6a:

Transmissivity = 400 ft^2/day

Maintained pump rate - 12 gallon/minute during pump test

- 4 psi draw down, but fracture production makes interpretation difficult (12, 16, or 20 psi draw down?),

- 23 ft producing thickness (185 to 207 ft.), and

- Believes 30 gallon/minute can be sustained.

Reference: Personal Communication, 1996f, Kenneth Fresquez, Water Resource Engineering Specialist, State Engineer, Roswell District, and Barbara J. Graves, John Hart and Associates, P.A., July 31, 1996.

Conversation Notes:

Mr. Fresquez provided the information that the Capitan Basin is included in the Pecos River drainage basin. The basin also includes the following declared groundwater basins: Carlsbad, Roswell, Hondo, Penasco, Fort Sumner, and Upper Pecos (New Mexico State Engineer, 1986). The WIPP site lies within the Carlsbad Basin (New Mexico State Engineer 1995).

New Mexico State Engineer, 1986, *Pecos River Water Rights Adjudication,* Public Information Paper, New Mexico State Engineer, Roswell, New Mexico.

New Mexico State Engineer, 1995, *Rules and Regulations Governing Drilling of Wells and Appropriation and Use of Groundwater in New Mexico*, New Mexico State Engineer, Santa Fe, New Mexico.

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