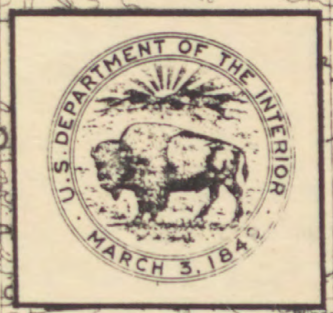
WATER-RESOURCES INVESTIGATIONS 81-36

RESULTS OF HYDROLOGIC TESTS AND WATER-CHEMISTRY ANALYSES, WELLS H-4A, H-4B, AND H-4C AT THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO



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Data were collected during hydrologic testing at wells H-4A, H-4B, and H-4C in the southern part of the proposed Waste Isolation Pilot Plant site in southeastern New Mexico. The three water-bearing zones tested, the Magenta and Culebra Dolomite Members of the Rustler Formation and the Rustler-Salado Formation contact, yield water to wells at rates less than 0.9 gallon per minute. Throughout the testing, water-pressure response in the tested zone was monitored by a pressure-transducer system. Shut-in and slug tests were conducted to acquire the data from which the following values were derived. Calculated transmissivities for the Magenta Dolomite, Culebra Dolomite, and the Rustler-Salado contact at wells H-4A, H-4B, and H-4C were 0.06, 0.9, and 0.0006 foot squared per day, respectively. Estimates of storage coefficient were 10^{-6}, 10^{-9}, and 10^{-4}.

Water samples from the Magenta and Culebra had dissolved-solids concentrations of 22,300 and 18,100 milligrams per liter, respectively. The major chemical constituents of ground-water samples from these two zones were sodium, chloride, and sulfate. Water samples from the Rustler-Salado Formation contact had a dissolved-solids concentration of 322,000 milligrams per liter, and magnesium, sodium, and chloride were the major constituents. Radium-226, a naturally occurring radioactive element, was present in samples from all three zones.

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UNITED STATES DEPARTMENT OF THE INTERIOR

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CONVERSION FACTORS

In this report, values for measurements except chemical measurements are given in inch-pound units only. The following table contains factors for converting to metric units.

Multiply inch-pound units	By	To obtain metric units
foot	0.3048	meter
foot squared per day	0.0929	meter squared per day
cubic foot per day	0.02832	cubic meter per day
gallon per minute	3.785	liter per minute
mile	1.609	kilometer

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level of nets of both the United States and Canada, formerly called "Mean Sea Level." NGVD of 1929 is referred to as sea level in this report.

SYMBOLS USED IN THE REPORT

Symbol	Description
Ci	Curie: Unit of radioactivity, the amount of any nuclide that undergoes exactly 3.7×10^{10} radioactive disintegrations per second.
Es	Bulk modulus of elasticity of solid skeleton of an aquifer.
H	Hydraulic head in the well above the initial static hydraulic head at time $t > 0$, in feet.
H_o	Maximum hydraulic head in the well above initial static hydraulic head at time $t > 0$, in feet.
Q	Average discharge or recharge of water from or to the test zone, in cubic feet per day.
S	Storage coefficient: volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head (dimensionless unit).
T	Transmissivity: The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient, in feet squared per day.
V	Volume
h	Head or height, in feet.
h'	Hydraulic head at time $t > 0$, in feet.
h_i	Static hydraulic head, in feet.
h_o	Hydraulic head at time $t = 0$, in feet.
Δp	Change in hydraulic head over one log cycle of time.
r	Radial distance.
r_c	Radius of tubing in the interval over which water levels fluctuate, in feet.
r_s	Radius of open hole.

Symbol	Description
t	Time since initial stress of test zone.
t'	Time since shut-in began.
α	$\frac{r_s^2}{r_c^2} S$
ρ	Density of fluid.
μ	Micro (10^{-6}).
P	Pico (10^{-12}).

RESULTS OF HYDROLOGIC TESTS AND WATER-CHEMISTRY ANALYSES, WELLS H-4A, H-4B, AND H-4C AT THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO

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ABSTRACT

Data were collected during hydrologic testing at wells H-4A, H-4B, and H-4C in the southern part of the proposed Waste Isolation Pilot Plant site in southeastern New Mexico. The three water-bearing zones tested, the Magenta and Culebra Dolomite Members of the Rustler Formation and the Rustler Formation-Salado Formation contact, yield water to wells at rates less than 0.9 gallon per minute. Throughout the testing, water-pressure response in the tested zone was monitored by a pressure-tranducer system. Shut-in and slug tests were conducted to acquire the data from which the following values were derived.

Well	Test zone	Calculated transmissivity (foot squared per day)	Estimated storage coefficient
H-4A	Magenta Dolomite Member of the Rustler Formation	0.06	10^{-6}
H-4B	Culebra Dolomite Member of the Rustler Formation	0.9	10^{-9}
H-4C	Rustler Formation-Salado Formation contact	0.0006	10^{-4}

Water samples from the Magenta and Culebra had dissolved-solids concentrations of 22,300 and 18,100 milligrams per liter, respectively. The major chemical constituents of water samples from these two zones were sodium, chloride, and sulfate. Water samples from the Rustler-Salado contact had a dissolved-solids concentration of 322,000 milligrams per liter and magnesium, sodium, and chloride were the major constituents. Radium-226, a naturally occurring radioactive element, was present in samples from all three zones.

INTRODUCTION

Purpose

The U.S. Geological Survey, at the request of the U.S. Department of Energy, is investigating the geohydrology of the proposed Waste Isolation Pilot Plant (WIPP) site near Carlsbad, New Mexico (fig. 1). The investigation is designed to supplement the work conducted by Sandia National Laboratories, which is responsible for the technical development of the site. The proposed facility would be constructed in bedded salts of the Permian age Salado Formation.

The purpose of this publication is to report values of transmissivity, estimates of the storage coefficient, and information on water chemistry for several water-bearing zones above the salt section. The data presented were obtained from wells H-4A, H-4B, and H-4C, located in sec. 5, T. 23 S., R. 31 E., near the southwestern boundary of the site.

Scope

The values given in this report pertain only to the specific location of the H-4 wells. However, in conjunction with measured aquifer characteristics at other locations, onsite as well as offsite, it should be possible to acquire a comprehensive regional representation of the area's hydrology. In turn, a regional knowledge of aquifer characteristics would aid in the prediction for transport of radionuclides to the biosphere via ground-water movement, in the event the storage facility is breached.

At the WIPP site, water movement in the water-bearing zones above and below the salt section could potentially move radionuclides offsite. A previous study (Mercer and Orr, 1979) indicates that the water-bearing zones in the Permian Rustler Formation require the most detailed investigation. The three geologic zones tested are the Magenta Dolomite and Culebra Dolomite Members of the Rustler Formation and the Rustler Formation-Salado Formation contact (fig. 2).

The zones of interest, mentioned above, yield water to wells at rates less than 0.9 gallon per minute. For this reason, shut-in tests and slug tests were used in the determination of transmissivities and estimates of the storage coefficients. Special testing procedures were developed to perform these tests. Throughout the testing sequence, water-pressure response in the tested zones was monitored by a pressure-transducer system. The testing procedures, methods of analyses, test results, and results of water-chemistry analyses are described in this report.

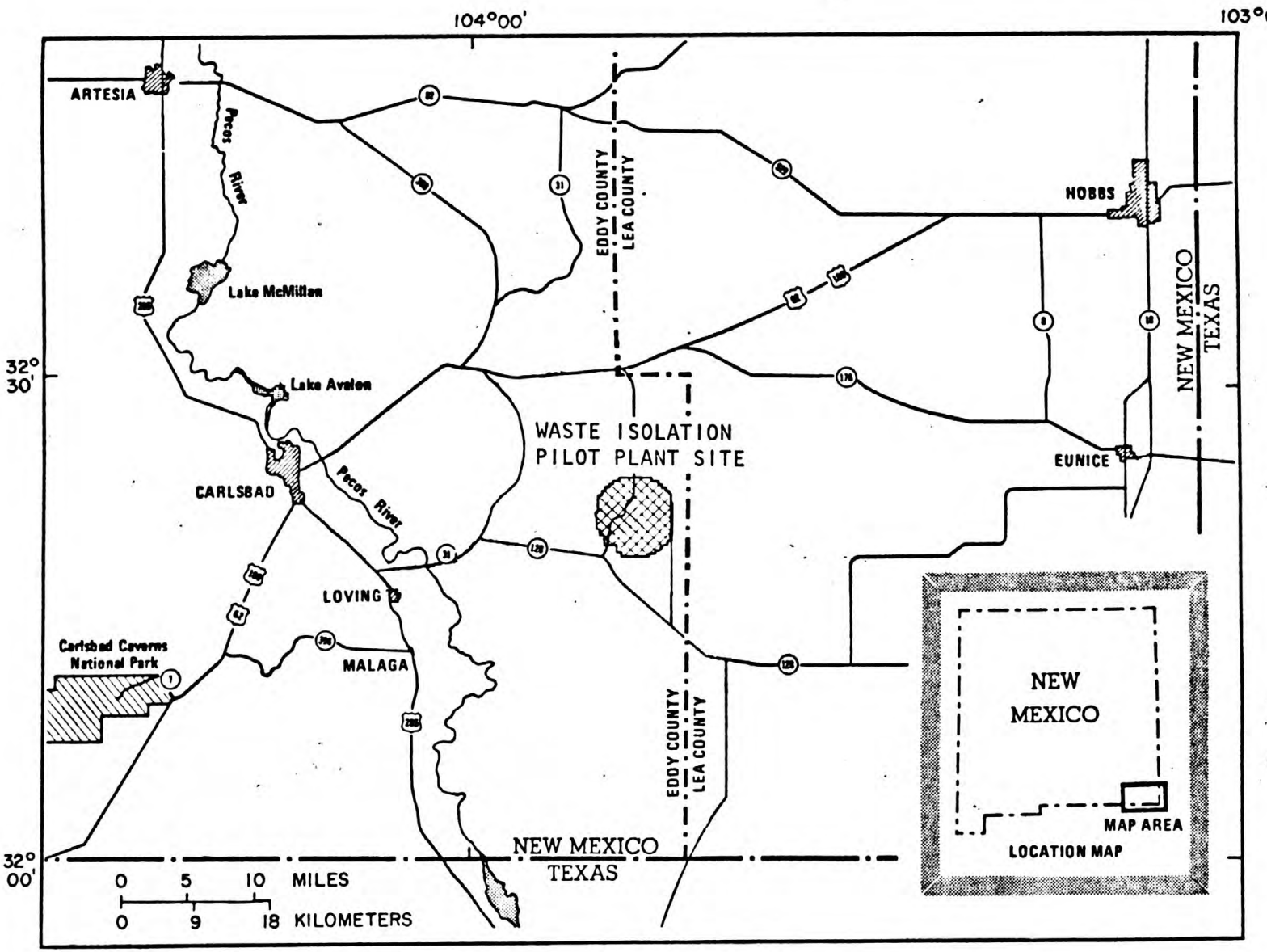


Figure 1. General location of the proposed Waste Isolation Pilot Plant site.

Age		Rock unit	Depth interval (feet)	Thickness (feet)	Graphic log	Description
QUATERNARY	Holocene	Surficial deposits	0-13	13		Dune sand, reddish-brown, fine, unconsolidated; some caliche rubble.
						----------UNCONFORMITY----------
	Pleistocene	Gatuna Formation	13-29	16		Sandstone, medium-grained, poorly sorted, dark-reddish-brown, soft to medium hard.
						--------UNCONFORMITY----------
LATE PERMIAN	Ochoan	Dewey Lake Red Beds	29-315	286		Predominantly interbedded siltstone and sandstone, very fine to fine-grained, dark-reddish-brown with greenish-gray reduction spots and bands of selenite, hard to medium hard; some mudstone.
						--------UNCONFORMITY----------
			315-377	62		Anhydrite, pale-yellowish-brown, soft to hard; some gypsum, selenite, and minor siltstone.
		Magenta Dolomite Member	377-403	26		Dolomite, light-brownish-gray, with selenite vugs and veined gypsum, trace siltsone.
		Rustler Formation	403-490	87		Anhydrite, pale-yellowish-brown to light-olive-gray, very fine crystalline; siltstone, moderate-reddish-brown, with mud, light-blueish-gray; and some gypsum, very fine crystalline.
		Culebra Dolomite Member	490-516	26		Dolomite, light-olive-gray, very fine-grained, pitted, argillaceous and brecciated in part.
			516-626	110		Anhydrite, light-olive-gray; siltstone, dark-reddish-brown; and mudstone, medium-dark-gray, with some clay.
		Salado Formation (upper part)	626-661 Total depth 661	-		Dissolution residue; including clay, mudstone, and gypsum.

EXPLANATION

SAND or SANDSTONE

ANHYDRITE (or GYPSUM)

DISSOLUTION RESIDUE CLAY or MUD with or without GYPSUM FRAGMENTS

SILTSTONE or MUDSTONE

DOLOMITE

Figure 2. General stratigraphic sequence at site of wells H-4A, H-4B, and H-4C.

Acknowledgments

Appreciation is expressed to Bob Statler of Sandia National Laboratories, who was responsible for field operations, and Earl Cunningham, Cotton Bradley, Wayne Laney, and Matt Wilson of Fenix and Scisson for scheduling and direction of support operations during drilling and testing.

A special thanks goes to Jim Basler, U.S. Geological Survey, Albuquerque, who was responsible for test-instrumentation development, and R. K. Dewees, U.S. Geological Survey, Carlsbad, who collected data during formation testing.

HYDROLOGIC TESTING

Shut-in tests and slug tests were used to determine transmissivities and estimates of storage coefficients of the zones in which wells H-4A, H-4B, and H-4C are completed. The location of the wells are shown in figure 3. These tests were chosen because the test zones generally yield only small quantities of water to the wells (less than 0.9 gallon per minute). Both methods primarily are restricted to wells that are fully developed and fully penetrate a confined aquifer. In addition, the slug test is restricted to wells completed in aquifers of low transmissivity. In order to perform these tests and obtain optimum results, special testing procedures were devised.

Test procedures

Pretest activities

Special care was taken in the drilling program used to complete each test well. Air, air foam, and brine were used at one time or another as drilling and coring fluids (table 1). By making this effort not to contaminate or plug the test zone, optimum test results could be achieved.

In order to test the different zones above the repository level, three wells were drilled. Each well was completed in a different test zone: Well H-4A in the Magenta Dolomite Member of the Rustler Formation, well H-4B in the Culebra Dolomite Member of the Rustler Formation, and well H-4C in the Rustler Formation-Salado Formation contact zone. Each well was drilled to a point above the test zone, cased, and cemented up to the land surface. The test zone was then cored.

Upon completion of a well, brine was used to flush the well and then compressed air was used to remove the brine from the well. This action would develop the cored interval as well as guard against any plugging or contamination that might occur. Water levels were monitored until hydrologic testing began to assure that equilibrium had been reached.

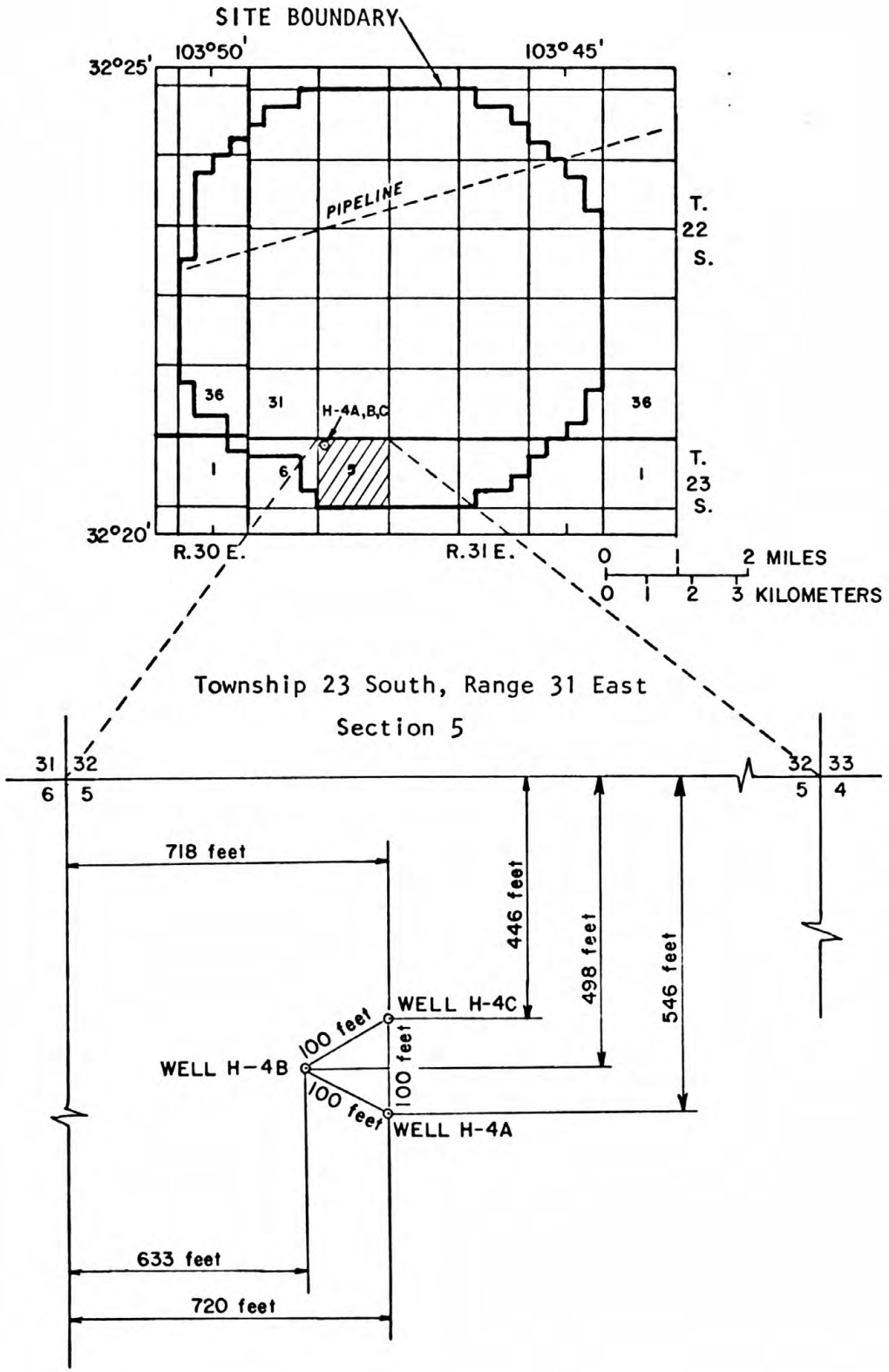


Figure 3. Location of wells H-4A, H-4B, and H-4C within the proposed site boundary.

Table 1. Construction and testing chronologies of wells H-4A, H-4B, and H-4C

[All measurements adjusted to ground level in altitude above National Geodetic Vertical Datum of 1929, H-4A, 3332.9 feet; H-4B, 3332.8 feet; H-4C, 3333.5 feet.]

Well H-4A -- 546 feet from north line, 720 feet from west line

04-29-78 to 04-30-78	Set surface pipe.
05-16-78 to 05-20-78	Spudded and rotary drilled hole with air and air foam to 365 feet. Cleaned hole and set casing at 364 feet. Cemented casing. Drilled out cement and plug, cleaned out to 365 feet. Ran core bit in hole.
05-22-78	Cut core from 365 feet to a total depth of 415 feet using air foam and water. Flushed hole with brine and removed brine using compressed air.
05-23-78 to 11-30-78	Monitored water levels.
12-01-78 to 12-04-78	Ran shut-in tests and slug tests.
12-05-78 to present (1981)	Monitored water levels.

Well H-4B -- 498 feet from north line, 633 feet from west line

04-29-78 to 04-30-78	Set surface pipe.
05-09-78 to 05-11-78	Spudded and rotary drilled hole with air and air foam to 477 feet. Cleaned hole and set casing to 476 feet. Cemented casing.
05-15-78	Drilled out cement and plug, cleaned out to 477 feet. Cut core from 477 feet to a total depth of 529 feet using air foam. Flushed hole with brine and removed brine using compressed air.
05-17-78 to 12-04-78	Monitored water levels.
12-05-78 to 12-07-78	Ran shut-in tests and slug tests.
12-08-78 to present (1981)	Monitored water levels.

Table 1. Construction and testing chronologies of wells H-4A, H-4B, and H-4C - Concluded

Well H-4C — 446 feet from north line, 718 feet from west line

04-20-78 to 04-30-78	Set surface pipe.
05-03-78 to 05-05-78	Spudded and rotary drilled hole with air and air foam to 610 feet.
05-05-78 to 05-06-78	Ran U.S. Geological Survey logs and Dresser Atlas logs. Cleaned hole and set casing to 609.5 feet. Cemented casing.
05-08-78	Drilled out cement and plug, cleaned out to 611 feet. Cut core from 611 feet to a total depth of 661 feet using air foam. Flushed hole with brine and removed brine using compressed air.
05-10-78 to 02-28-79	Monitored water levels.
03-01-79 to 03-16-79	Ran slug tests and shut-in tests.
03-17-79 to present (1981)	Monitored water levels.

Pressure monitoring system

A downhole pressure transducer was connected to a digital-readout data logger at the surface in order to monitor the response of the tested zone during shut-in tests and slug tests. This pressure-transducer system has the capability to continuously monitor downhole conditions prior to and thoughout the test period, which insures proper initiation and completion of the test.

Water pressures recorded at the land surface reflect the pressure head above the measuring point (fig. 4). Pressure head plus the elevation head is equal to the hydraulic head. By defining the measuring point to be the datum for the elevation head, the pressure head measured is equivalent to the hydraulic head. Therefore, the terms pressure head and hydraulic head are interchangeable in this report.

First shut-in test

The first step in the test sequence was to bail water from the hole in order to stress the water-bearing zone and provide formation water for the forthcoming slug test. The water level was lowered to a point just above the test zone. Next, a pressure transmitter was lowered on a logging cable into the well to monitor water-level recovery in the open hole. The rise in water level was monitored in order to obtain an estimate for the average discharge of water from the test zone. After a discharge value was obtained, the transmitter was removed from the hole.

A special inflatable packer was then lowered into the well on drill stem tubing to a point just above the test zone. Modifications made to the inflatable packer allowed for continuous monitoring of downhole conditions at the surface. These modifications (fig. 4) consisted of strapping a transducer housing to the tubing directly above the rubber packer element. Inside the housing, a pressure transducer was installed. A length of steel tubing connected to the housing was inserted beneath the packer element and extended to the bottom of the element, where it was exposed to the test zone. This feed-through line allowed the transducer to sense pressures at the test zone after packer inflation. To inflate the packer, the tubing was filled with water obtained during bailing. Packer inflation effectively sealed off the test zone. The pressure-recovery rate increased significantly because the zone no longer had to supply water to the well bore. The test zone remained in this configuration until a static pressure was reached. A graphical representation of the water pressure in the test zone during the shut-in test is shown in figure 5.

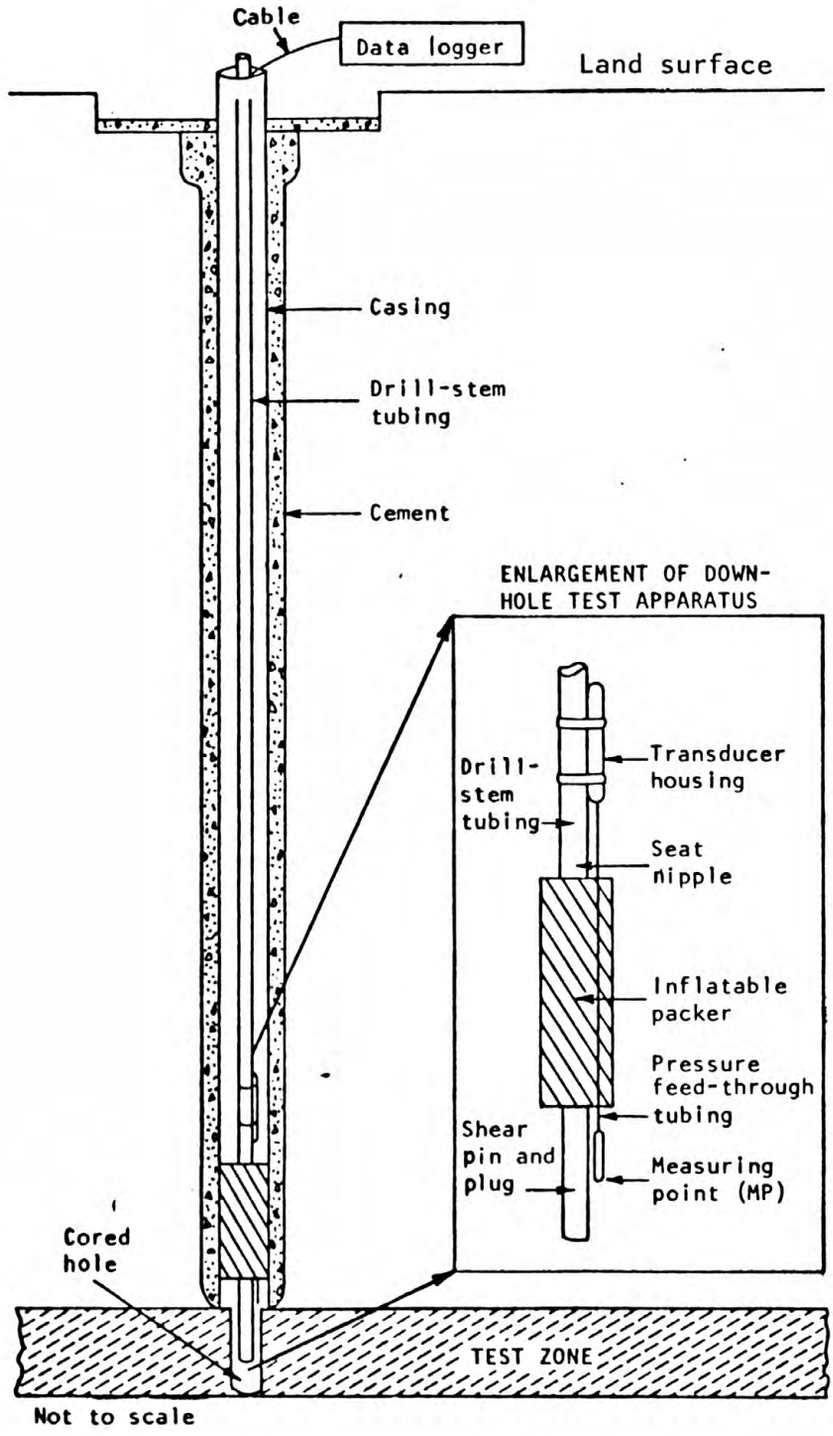


Figure 4. Typical well-testing configuration.

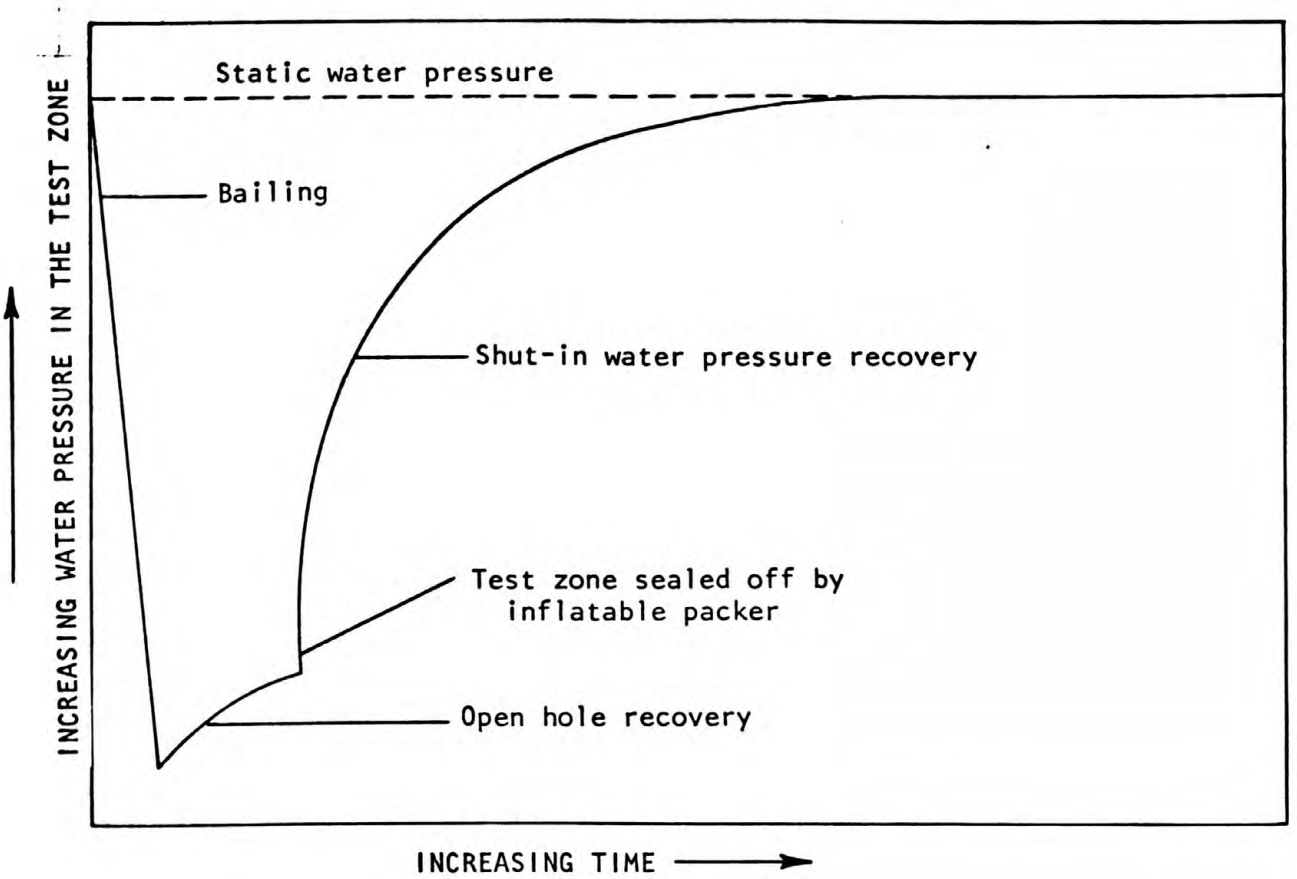


Figure 5. First shut-in test.

Slug test

The second type of test performed on each test zone was the slug test (Cooper and others, 1967). A slug test is performed by suddenly injecting or removing a known volume or slug of water from a well. At the end of the shut-in test, the test zone was in the proper configuration for an injection-type slug test. The tubing above the packer was filled with formation water to just above land surface while the pressure transducer system was monitoring the formation pressure. The plug in the lower part of the packer (fig. 4) was knocked out, causing an instantaneous increase in pressure (slug) to the test zone. The decrease in pressure or hydraulic head was then monitored.

Modifications to testing procedures at wells H-4A and H-4B

When sufficient information had been obtained to analyze the slug test at well H-4A, a second shut-in test was performed. This test was accomplished by running a standing valve in the tubing and into a seat nipple on the top of the packer (fig. 4). The test zone was then effectively sealed off from the remaining part of the slug of water in the tubing (fig. 6). Because H-4A was the first well to be tested using the specially designed inflatable packer and monitoring system, a second slug test was performed to demonstrate the repeatability of results.

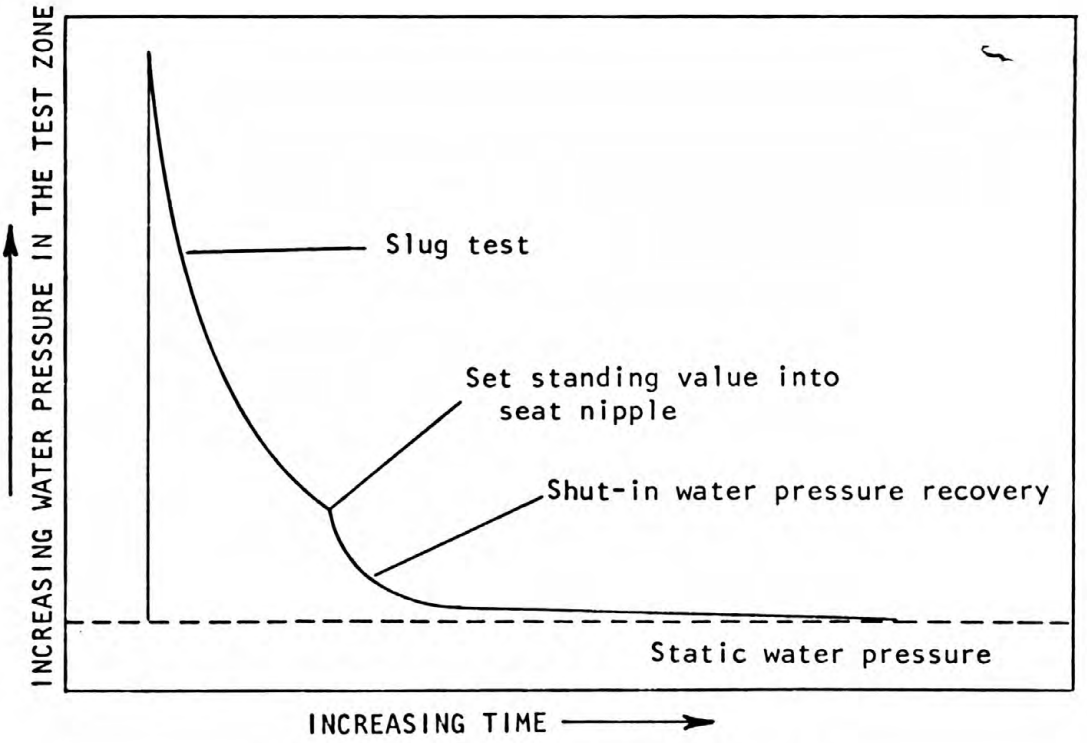


Figure 6. Shut-in after slug test.

An insufficient amount of water was bailed from well H-4B prior to the first shut-in test. Therefore, by the time the inflatable packer was lowered into the hole and inflated, the test zone had returned to near static pressure and the subsequent shut-in did not show enough pressure recovery to analyze. Another attempt was made to perform a shut-in test after the slug test procedure was completed. Water was swabbed from the tubing in order to stress the test zone. After the water level was allowed to recover for some time, a standing valve was lowered into the tubing and set in the seat nipple (fig. 4). As in the shut-in after bailing, water no longer was moving in the test zone or the well (in this case the tubing); therefore, the rate of water-pressure recovery increased (fig. 7).

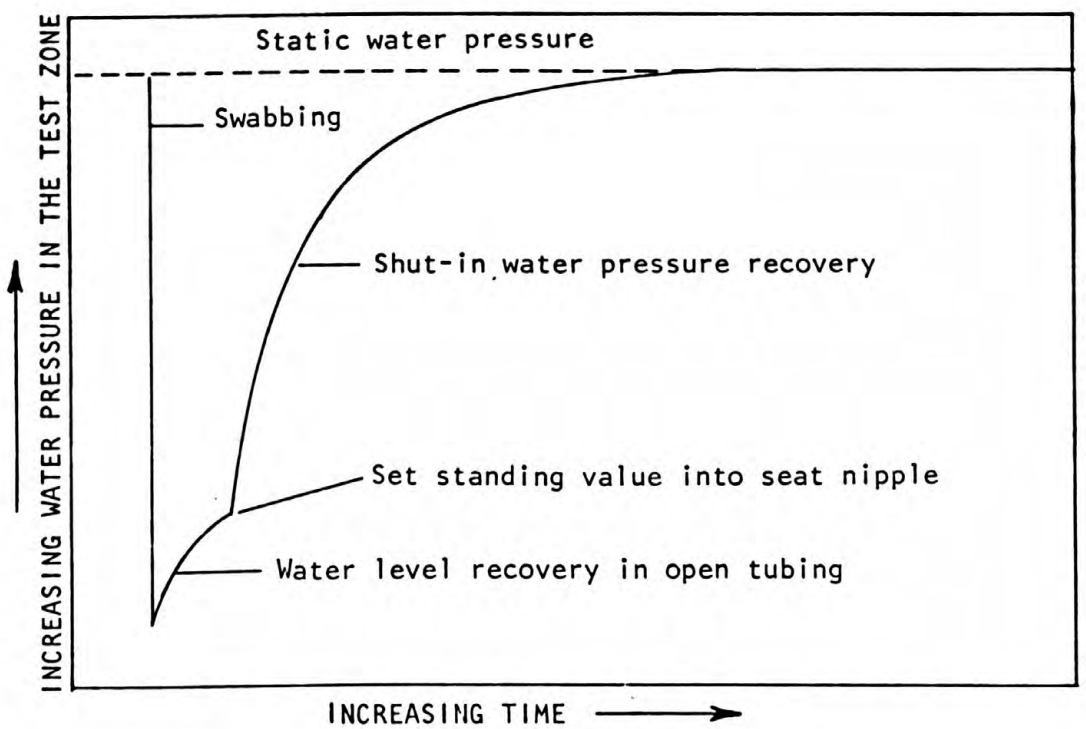


Figure 7. Shut-in after swabbing.

Test analyses

Shut-in tests

The method used in analyzing the shut-in test was adapted from the Theis recovery method (Theis, 1935). The following paragraphs describe the use of the method as applied to shut-in tests.

The time (t) since the initial stress of the test zone is divided by the time (t') since the shut-in test began. The quotient of these two time increments is then plotted on the logarithmic scale of semilogarithmic paper against the hydraulic head in the test zone plotted on a linear scale. A transmissivity is calculated using the following equation:

$$T = \frac{2.30Q}{4\pi\Delta p} \qquad (1)$$

where

T = transmissivity, in feet squared per day;

Q = average discharge/recharge of water from/to the test zone, in cubic feet per day; and

Δp = change in hydraulic head over 1 log cycle of time, in feet.

In the above equation, Q may be calculated in several different ways depending on how the test zone was stressed prior to the shut-in. When the hole was bailed before the test zone was shut-in, Q was calculated from the water-level recovery in the open well for the elapsed time between the end of bailing and the beginning of the shut-in. For the shut-in test after a slug test, Q was calculated from the water decline that occurred during the slug test. Swabbing was used to stress the test zone at well H-4B. In that case, Q was calculated from the water-level rise in the tubing that occurred for the time between the end of swabbing and the beginning of the shut-in.

Slug tests

Slug tests were analyzed using standard techniques as presented by Cooper and others (1967). The method of analysis is given in the following paragraphs.

The ratio of heads, H/H_o, can be calculated by the following equation:

$$H/H_o = \frac{h' - h_i}{h_o - h_i} \qquad (2)$$

where

H = hydraulic head in the well above the initial static hydraulic head at time $t > 0$, in feet;

H_o = maximum hydraulic head in the well above initial static hydraulic head at time $t > 0$, in feet;

h' = hydraulic head at time $t > 0$, in feet;

h_i = static hydraulic head, in feet; and

h_o = hydraulic head at time $t = 0$, in feet.

From measured values of h', values of H/H_o are computed and are plotted on the linear scale of semilogarithmic paper against the time measurement t, in seconds, on the logarithmic scale. The data curve is then superposed on given type curves by standard curve-matching procedures (Papadopulos and others, 1973). The match curve is used to select a value of t. The transmissivity is then determined by the equation:

$$T = \frac{86{,}400\ r_c^2}{t} \qquad (3)$$

where

T = transmissivity, in feet squared per day;

r_c = the radius of the tubing in the interval over which the water level fluctuates, in feet; and

t = time in seconds, at the match line.

Storage coefficient is then determined by the equation:

$$S = \frac{r_c^2}{r_s^2} \alpha \qquad (4)$$

where

S = storage coefficient, dimensionless;

r_s = radius of open hole, in feet;

r_c = radius of tubing in interval over which water levels fluctuate, in feet; and

$\alpha = \frac{r_s^2}{r_c^2} S$, dimensionless.

TEST RESULTS

The specially modified hydrologic testing procedures, along with the established methods of analyses discussed in the preceding section, produced comparable results for transmissivities (T) and estimates for the coefficients of storage (S) in the test zones of wells H-4A, H-4B, and H-4C. All data obtained during onsite operations such as construction detail of wells (fig. 20) and test data used for calculations (table 5) are included in the Supplemental Information section at the end of this report.

Well H-4A

A transmissivity value of 0.06 foot squared per day was calculated from the first slug test for the Magenta Dolomite Member of the Rustler Formation at well H-4A. This value is consistent with the results of the shut-in tests and the second slug test at well H-4A (table 2). Data plots of the shut-in tests and slug tests are presented in figures 8, 9, 10, and 11. The complete history of the hydraulic head during testing of well H-4A is shown in figure 12.

Well H-4B

A transmissivity value of 0.9 foot squared per day was calculated from the slug test for the Culebra Dolomite Member of the Rustler Formation at well H-4B (fig. 13). Difficulties were encountered in performing shut-in tests 1 and 2, making the transmissivity value obtained from the slug test the only usable result (table 2).

Due to insufficient bailing prior to shut-in test 1, the test zone was not stressed enough to prepare it for the shut-in test. As a result, the water pressure of the tested zone at the time of shut-in was very near static water pressure. A transmissivity value could not be calculated because the pressure recovery was insignificant. A second shut-in test (fig. 14) was conducted to verify the transmissivity value acquired from the previous slug test. An attempt was made to stress the test zone by swabbing the tubing, but swabbing was unable to remove all the water from the tubing. Therefore, only a short flow time could be allowed if a shut-in recovery was to be performed. Shut-in test 2 was conducted and a transmissivity calculated (table 2). This value is believed to be questionable due to the short length of the flow time. A complete history of hydraulic head during testing of well H-4B is shown in figure 15.

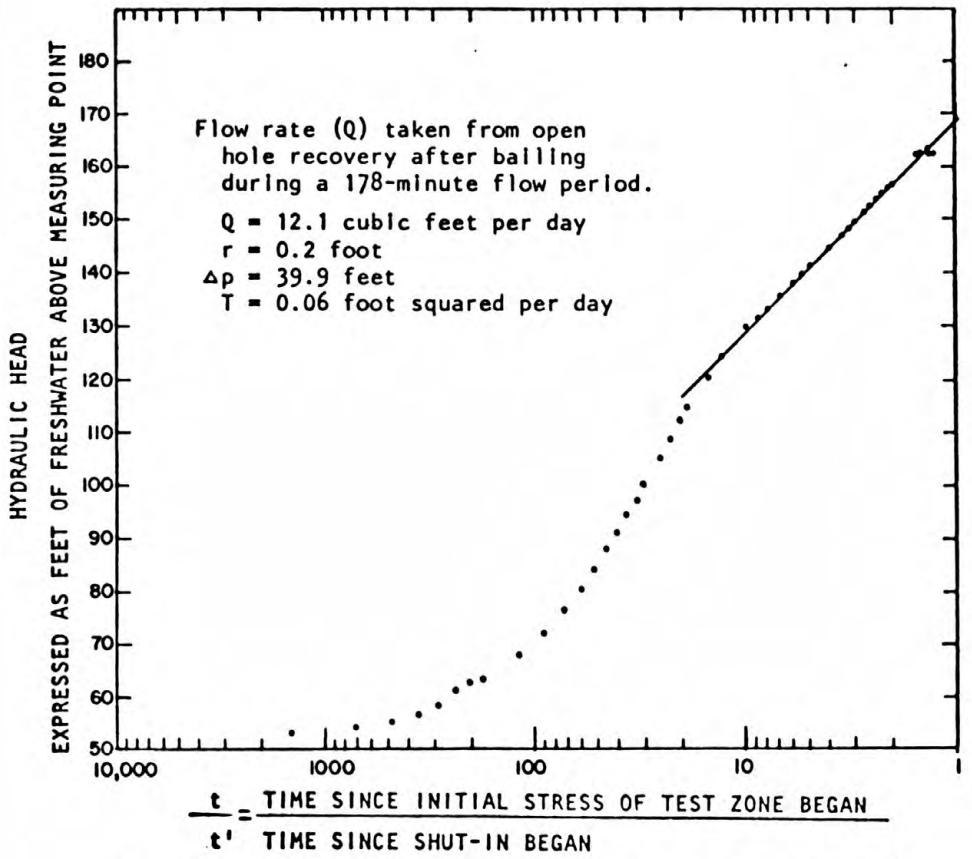


Figure 8. Results of shut-in test 1 for well H-4A.

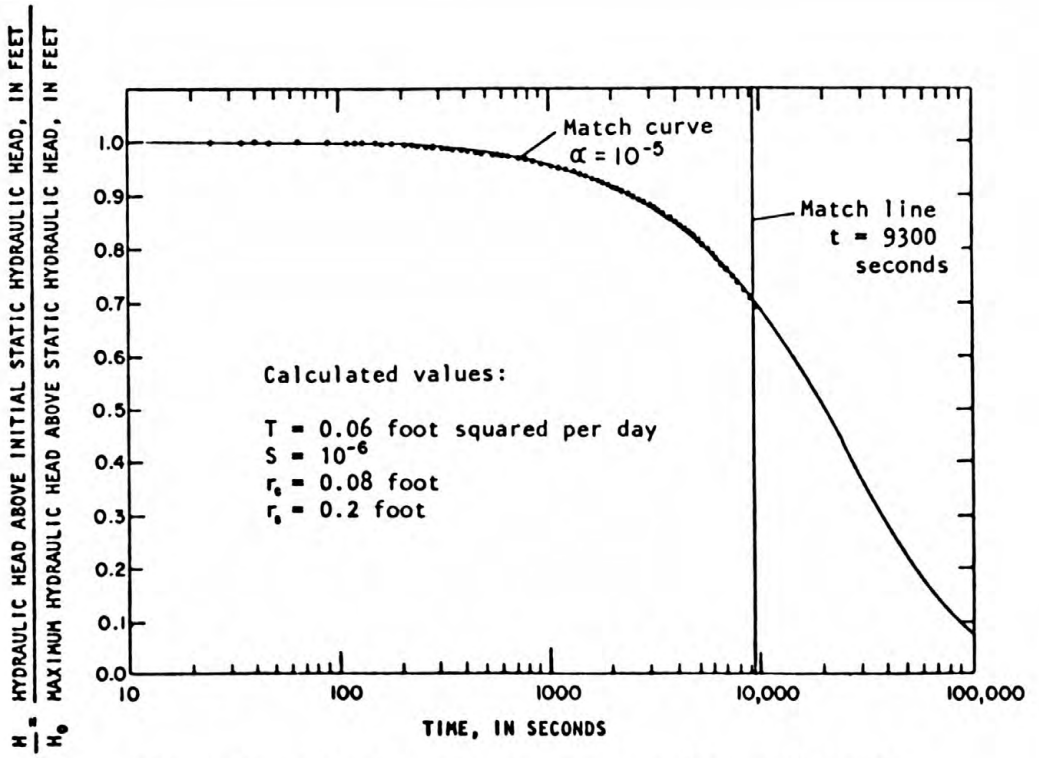


Figure 9. Results of slug test 1 for well H-4A.

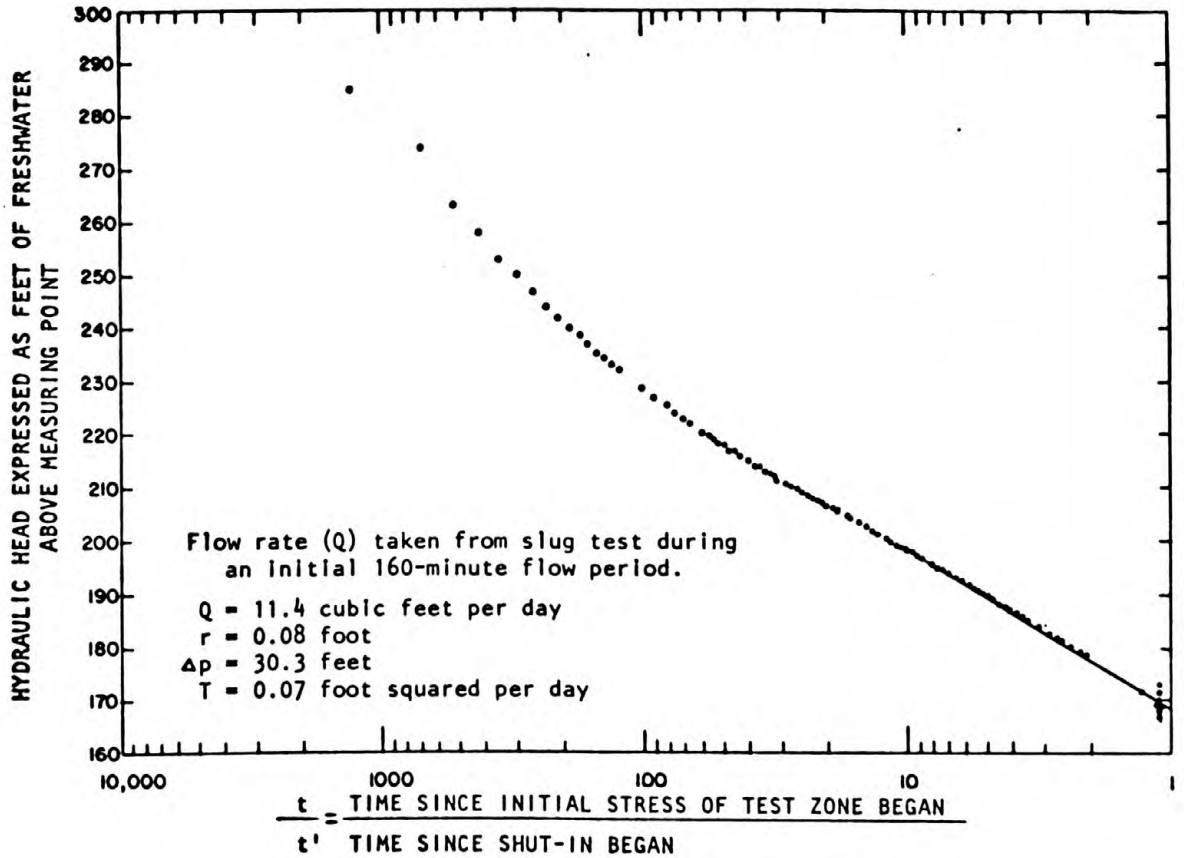


Figure 10. Results of shut-in test 2 for well H-4A.

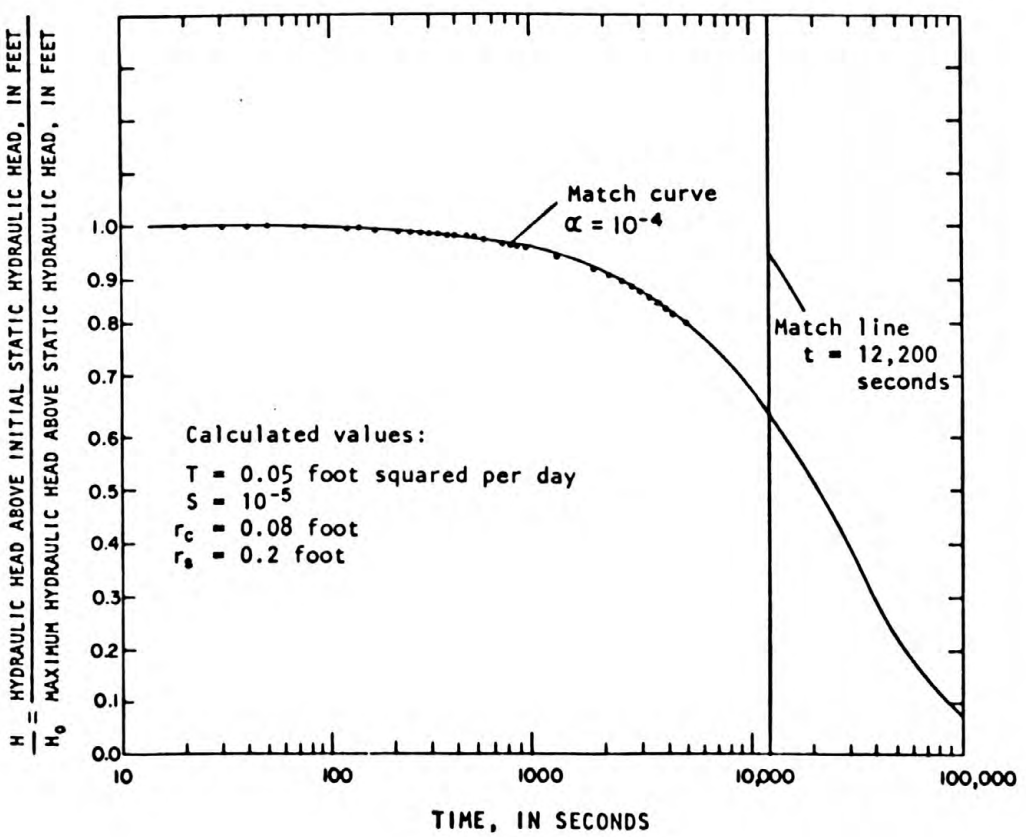


Figure 11. Results of slug test 2 for well H-4A.

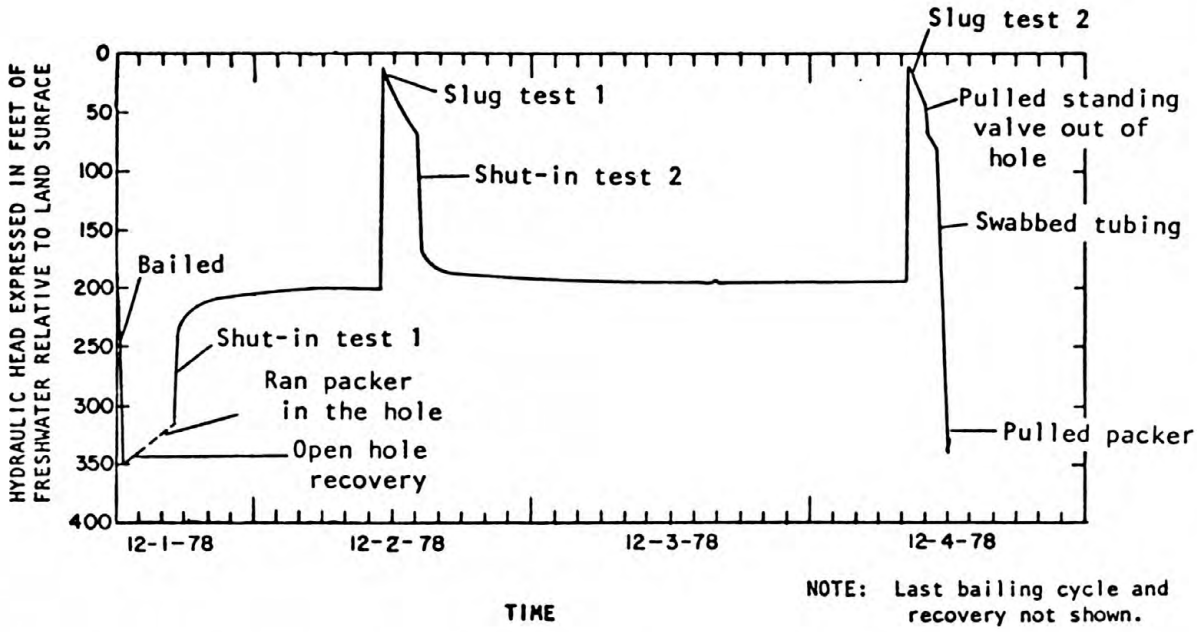


Figure 12. History of hydraulic head during testing of well H-4A.

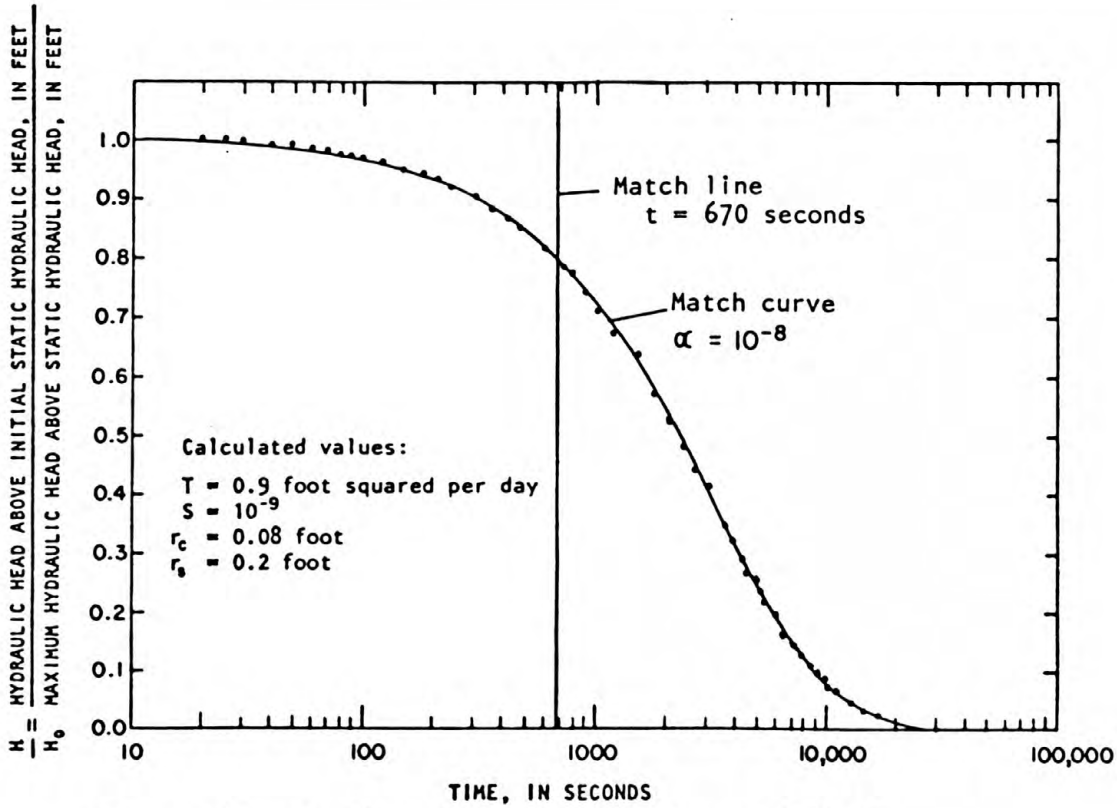


Figure 13. Results of slug test 1 for well H-4B.

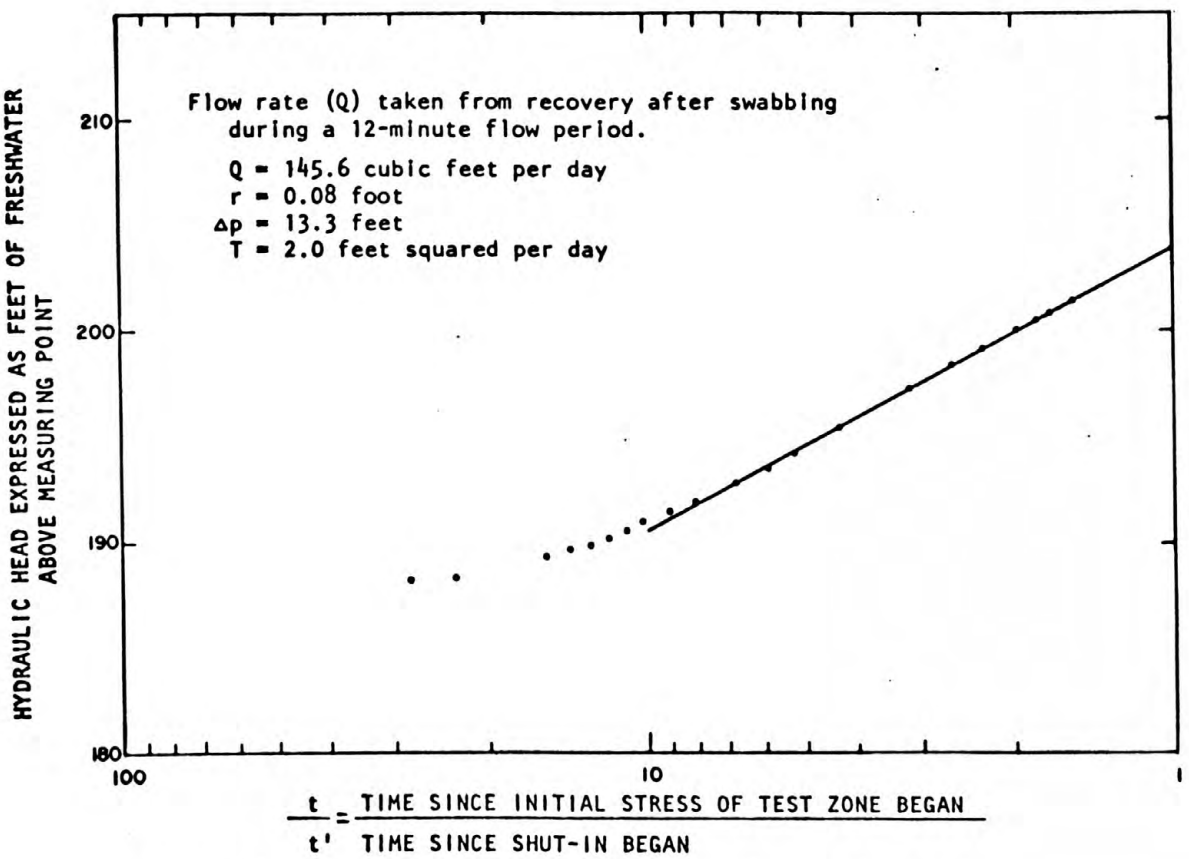


Figure 14. Results of shut-in test 2 for well H-4B.

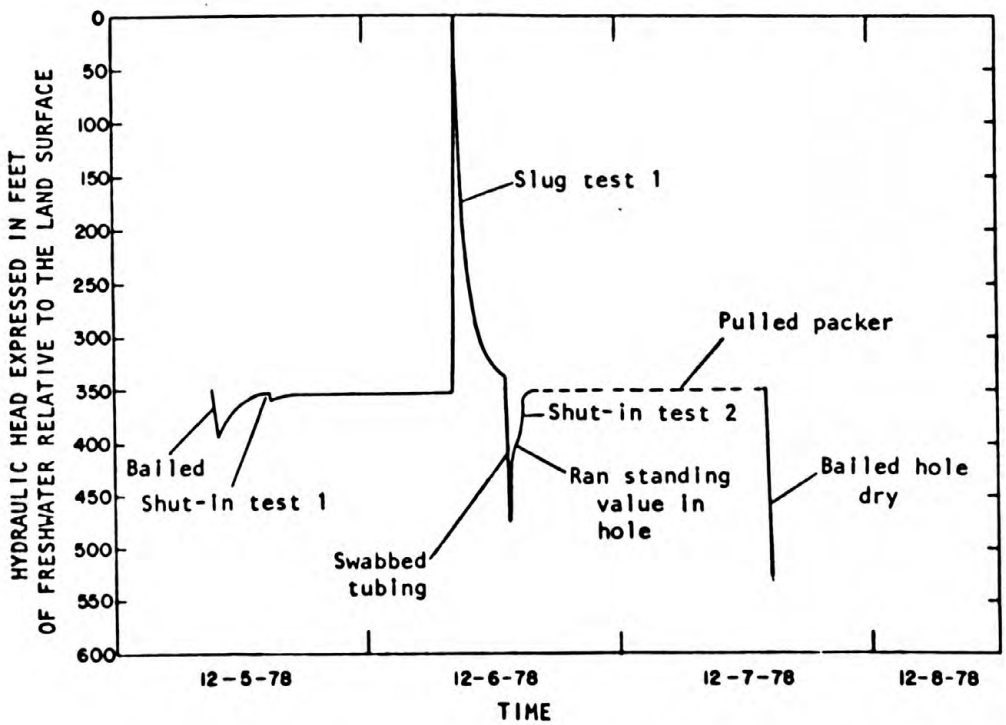


Figure 15. History of hydraulic head during testing of well H-4B.

Table 2. Hydrologic-test results

Well	Test zone	Test method	Date	Calculated transmissivities (feet squared per day)	Estimates of storage coefficient
H-4A	Magenta Dolomite Member of the Rustler Formation	Shut-in	12-01-78	0.06	-
		Slug	12-02-78	.06	10^{-6}
		Shut-in	12-02-78	.07	-
		Slug	12-04-78	.05	10^{-5}
H-4B	Culebra Dolomite Member of the Rustler Formation	Shut-in	12-05-78	-	-
		Slug	12-06-78	.9	10^{-9}
		Shut-in	12-06-78	2.0	-
H-4C	Rustler Formation -Salado Formation contact	Shut-in	03-02-79	.0004	-
		Slug	03-06-79	.0006	10^{-4}

H-4C

At well H-4C, a shut-in test (fig. 16) and a slug test (fig. 17) were performed. These two tests gave similar results (see table 2). A transmissivity value of 0.0006 foot squared per day was calculated from the slug test for the Rustler Formation-Salado Formation contact. A complete history of hydraulic head during testing of well H-4C is shown in figure 18.

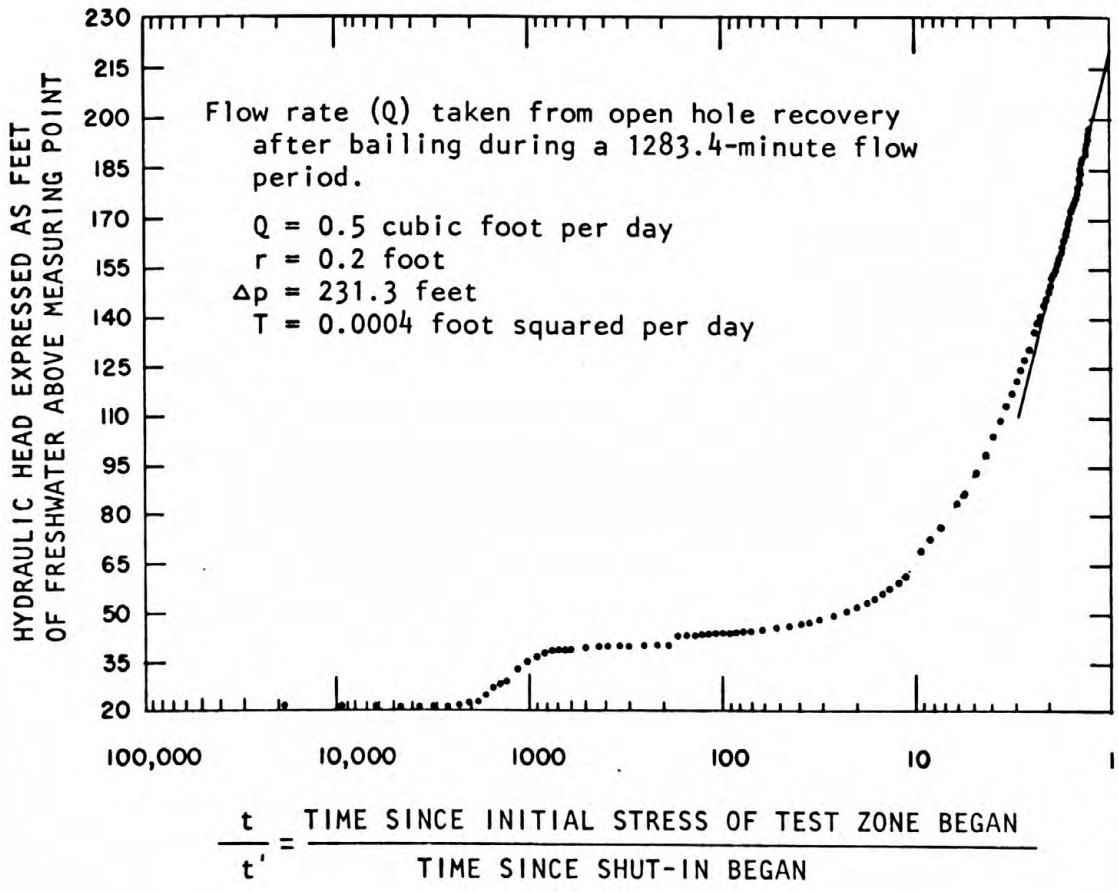


Figure 16. Results of shut-in test 1 for well H-4C.

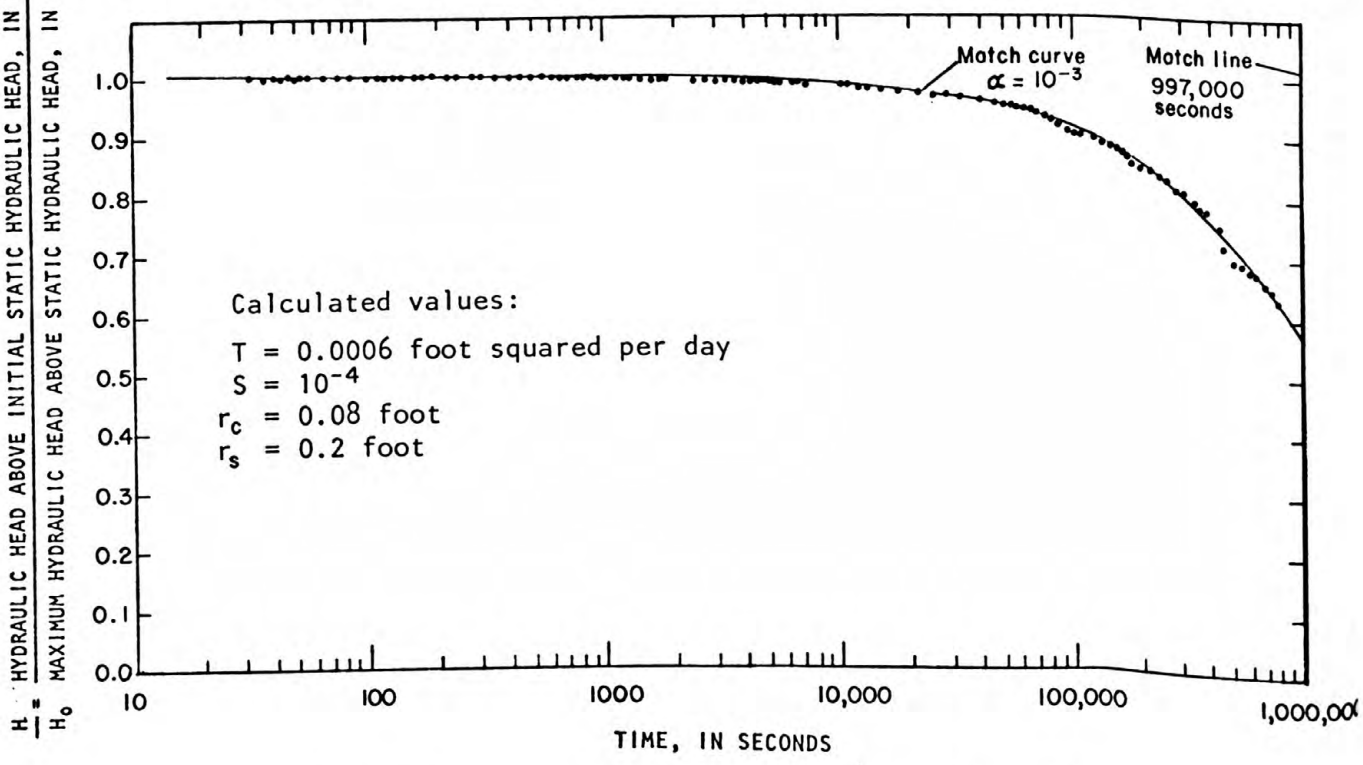


Figure 17. Results of slug test 1 for well H-4C.

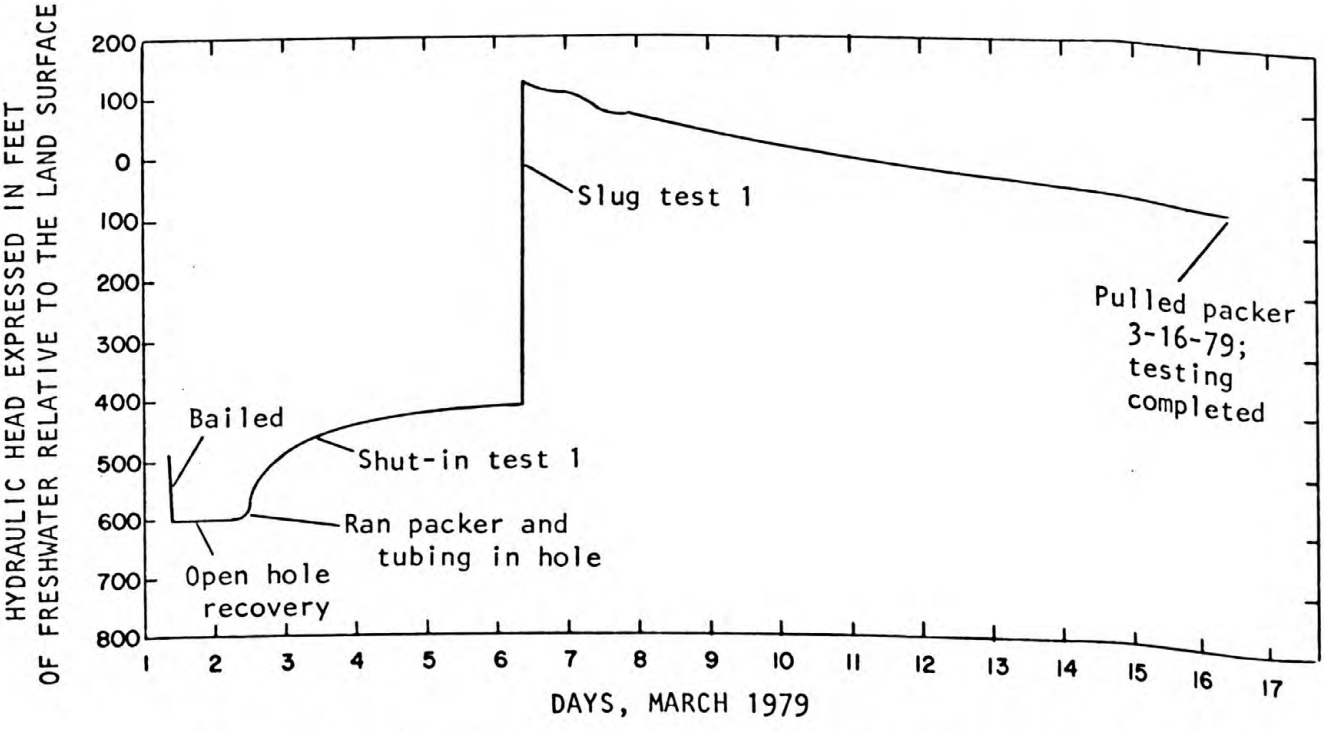


Figure 18. History of hydraulic head during testing of well H-4C.

Evaluation of test results

Slug tests may give a more accurate value for transmissivity than the shut-in tests in zones of low transmissity. In the case of the shut-in test, it is difficult to fit a straight line to the steep part of the shut-in curve in order to determine the absolute change in pressure over one log cycle (Δp). Slight inflections in the recovery curve at late times make it possible to fit several lines, each yielding a different transmissivity value, through the same curve. In slug tests, the transmissivity value is calculated using a curve-matching procedure, which is not as sensitive to the choice of the curve being matched.

In addition to this difficulty with the shut-in test, technical problems arise from the use of an average discharge of water (Q) from the test zone in calculating transmissivity. The discharge from the well is in fact continually decreasing after the zone has been stressed (bailed). Although the use of an average discharge is not unreasonable, the logistics of performing the shut-in test prevented the measurement of discharge throughout the total time from bailing until shut-in. Discharge measurements ended at the beginning of the setting of the packer. Due to the depth of the test zones below land surface, the time between the start of setting the packer and the actual shut-in was several hours. The continually decreasing discharge during this period of no measurement dictates that the calculated value would always be larger than the actual average discharge for the entire flow period.

Pressure readings taken at the beginning of the shut-in tests in zones of low transmissivity indicate that early recovery is dominated by well-bore storage effects. Generally, well-bore storage affects a recovery test in two ways: (1) A part of the water discharged from the well is water that is stored in the well bore; and (2) the recovery of hydraulic head is affected by the large storage capacity per unit volume of the well compared to the storage capacity per unit volume of the test zone. These effects apparently caused the initial part of the recovery curve to remain flat; thus, Δp was calculated using only late time recovery data.

Slug tests also can provide an estimate of the magnitude of the storage coefficient. Storage estimates were obtained by a curve-matching technique described by Cooper, Bredehoft, and Papadopulos (1967). These estimates depend upon the shapes of the type curves, which vary only slightly when alpha (α) differs by an order of magnitude; therefore, storage, which is directly proportional to alpha, is estimated only to the order of magnitude.

Although the slug test has clear advantages over the shut-in test in low transmissive zones, the transmissivity values calculated from the shut-in test data still serve as a useful check for the transmissivities calculated from the slug test; thus, the shut-in test remains an integral part of the hydrologic testing procedure.

WATER CHEMISTRY

Water in the aquifers is very mineralized, as indicated by dissolved-solids concentrations of 22,300 milligrams per liter (Magenta Dolomite Member), 18,100 milligrams per liter (Culebra Dolomite Member), and 322,000 milligrams per liter (Rustler Formation-Salado Formation contact). According to categories assigned by the U.S. Geological Survey (Hem, 1970), water in the Magenta Dolomite Member and Culebra Dolomite Member is very saline and water at the Rustler Formation-Salado Formation contact is briny.

Detailed information on the composition of water obtained from the Magenta, Culebra, and Rustler-Salado contact at wells H-4A, H-4B, and H-4C is presented in table 3. The table includes the major dissolved anions and cations, radioactive constituents, and some miscellaneous constituents.

Sampling methods

Samples for water-chemistry analyses were collected from wells H-4A, H-4B, and H-4C after completion of the hydrologic testing sequence. Stress of the formation during hydrologic testing would act to further develop the wells for water samples. Before collection of the water sample, the well was bailed to remove water standing in the casing and obtain fresh flow from the formation. A sample was then collected with either a stainless steel sampling tool or the bailing tool.

Analyses of total, suspended, and dissolved metals were made on the water samples but are not reported due to problems with the sampling technique. Bailing caused vigorous aeration of the water in the well bore, which caused precipitation of metals previously in solution. The bailing process also caused flakes of corroding metal to be cleaned from the side of the casing and suspended in the sample water.

Radiochemistry

Radioactivity is present in water from the Magenta Dolomite and Culebra Dolomite Members of the Rustler Formation and Rustler Formation-Salado Formation contact due to the natural radioactive decay of uranium, an element widely disseminated throughout the crust of the earth. In order to establish background conditions, radiochemistry for the three zones was determined. Regulatory agencies have set drinking water and health hazard standards based on radium-226, a particular radiochemical species. The concentration of radium-226, in picocuries per liter, in samples was 9.3 from the Magenta, 67 from the Culebra, and 340 from the Rustler-Salado contact (table 3).

Table 3. Chemical composition of water obtained from well H-4A, Magenta Dolomite Member, and well H-4B, Culebra Dolomite Member of the Rustler Formation; and well H-4C, Rustler Formation-Salado Formation contact

[Chemical analysis in milligrams per liter unless otherwise noted; g/mL = grams per milliliter; pci/L = picocuries per liter; ug/L = micrograms per liter; U-NAT = uranium, natural; CS-137 = cesium-137; SR/YT-90 = strontium/yttrium-90]

Well	H-4A	H-4B	H-4C
Date sampled	12-14-78	12-14-78	03-16-79
Time	1120	1210	1200
Geologic unit sampled	Magenta Dolomite Member	Culebra Dolomite Member	Rustler Formation-Salado Formation contact
Density, in g/mL at 20°C	1.017	-	1.215
Alkalinity, as calcium carbonate	52	48	1
Nitrogen, nitrite plus nitrate (NO_2+NO_3), dissolved (N)	.01	.02	.27
Phosphate, ortho, dissolved (PO_4)	.00	.00	.37
Phosphorus, ortho, dissolved (P)	.00	.00	.12
Carbon, organic total (C)	2.6	2.5	150
Carbon, organic dissolved (C)	2.5	1.4	-
Carbon, organic suspended total (C)	.5	.9	-
Hardness ($CaCO_3$)	2,200	2,200	130,000
Hardness, noncarbonate ($CaCO_3$)	2,100	2,200	130,000
Calcium, dissolved (Ca)	210	180	8,300
Magnesium, dissolved (Mg)	410	430	27,000
Sodium, dissolved (Na)	7,000	5,800	66,000
Sodium adsorption ratio	65	54	79
Sodium, percent	87	84	50
Potassium, dissolved (K)	130	180	8,600
Chloride, dissolved (Cl)	7,500	7,500	210,000

Table 3. Chemical composition of water obtained from well H-4A, Magenta Dolomite Member, and well H-4B, Culebra Dolomite Member of the Rustler Formation; and well H-4C, Rustler Formation-Salado Formation contact - Concluded

Well	H-4A	H-4B	H-4C
Sulfate, dissolved (SO_4)	7,000	4,000	1,400
Fluoride, dissolved (F)	2.5	1.9	.0
Bromide, dissolved, catalytic method (Br)	-	-	2,000
Silica, dissolved (SiO_2)	6.4	5.2	1.3
Gross alpha, dissolved (pci/L as U-NAT)	-	-	7,500
Gross alpha, suspended total (pci/L as U-NAT)	-	-	3.3
Gross beta, dissolved (pci/L as CS-137)	100	310	8,900
Gross beta, suspended total (pci/L as CS-137)	-	-	.4
Radium 226, dissolved, Radon method (pci/L)	9.3	67	340
Solids, sum of constituents, dissolved	22,300	18,100	322,000
Uranium, dissolved, extraction (ug/L)	.08	2.9	1.2
Gross alpha, dissolved (ug/L as U-NAT)	320	720	11,000
Gross alpha, suspended total (ug/L as U-NAT)	-	-	4.9
Gross beta, dissolved (pci/L as SR/YT-90)	92	290	8,100
Gross beta, suspended total (pci/L as SR/YT-90)	-	-	.4

Chemical composition

Chemical composition of water from the three zones is represented by bar graphs in figure 19. Vertical bars are used to represent total anions and total cations. The anion and cation segments are divided by horizontal lines to show the proportional concentrations of the major ions in milliequivalents per liter.

Major cations and anions of water from the three zones are shown in table 4. Dissolved anions and cations are given in milliequivalents per liter, milligrams per liter, and percentage composition.

The concentration of dissolved ionic constituents in water is greatest at the Rustler Formation-Salado Formation contact and least in the Culebra Dolomite Member. The ground water at the Rustler Formation-Salado Formation contact is very mineralized and noticeably different than that from the Culebra Dolomite Member and Magenta Dolomite Member in the percentage composition of dissolved ionic species. Dissolved ionic composition for the Rustler Formation-Salado Formation contact brine is predominately chloride, sodium, and magnesium. Calcium and potassium make up the remainder of the dissolved ions. The ionic composition of water from the Magenta appears to be very similar to that of water from the Culebra. Predominant ions in water from these two members include sodium, chloride, and sulfate. Magnesium and calcium make up the remainder of the dissolved ions. The percentage of sodium in solution decreases with depth (table 4). The percentages of chloride, magnesium, calcium, and potassium increase with depth. The percentage of sulfate decreases to very small values at the Rustler Formation-Salado Formation contact (table 4).

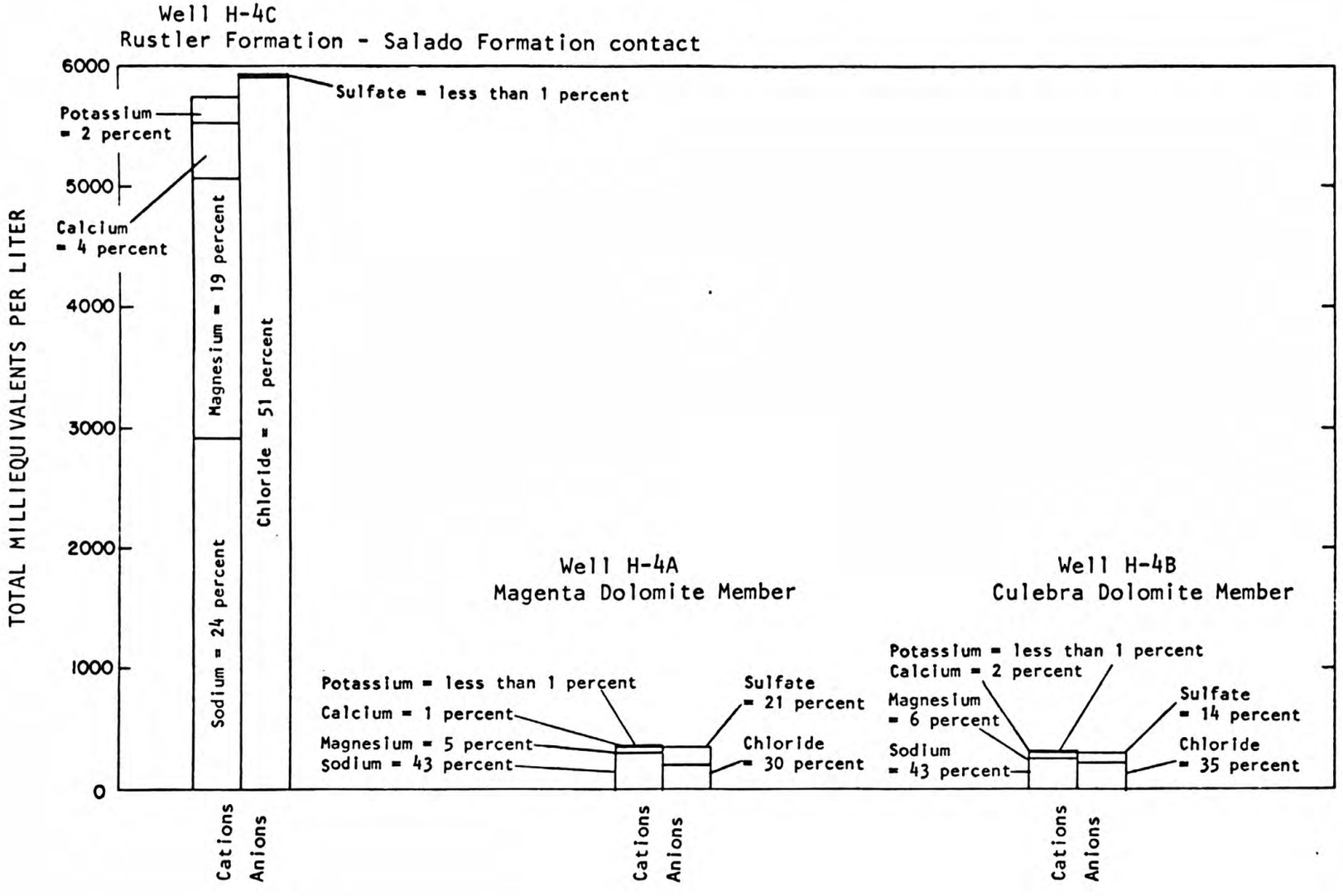


Figure 19. Percentage composition of water from the Magenta Dolomite and Culebra Dolomite Members of the Rustler Formation and Rustler Formation-Salado Formation contact.

Table 4. Major cations and anions of water from the Magenta Dolomite and Culebra Dolomite Members of the Rustler Formation and Rustler Formation-Salado Formation contact.

[mg/L, milligrams per liter; meq/L, milliequivalent per liter]

Well	Test zone (depth below land surface)	Chemical composition	meq/L	mg/L	Percentage composition
H-4A	Magenta Dolomite Member (375-400 feet)	**Cations**			
		Calcium	10.5	210	1
		Magnesium	33.7	410	5
		Sodium	304	7,000	43
		Potassium	3.3	130	<1
		Anions			
		Chloride	212	7,500	30
		Sulfate	146	7,000	21
H-4B	Culebra Dolomite Member (490-516 feet)	**Cations**			
		Calcium	8.98	180	2
		Magnesium	35.4	430	6
		Sodium	252	5,800	42
		Potassium	4.60	180	<1
		Anions			
		Chloride	212	7,500	35
		Sulfate	83.3	4,000	14
H-4C	Rustler Formation-Salado Formation contact (626 feet)	**Cations**			
		Calcium	414	8,300	4
		Magnesium	2,220	27,000	19
		Sodium	2,870	66,000	24
		Potassium	220	8,600	2
		Anions			
		Chloride	5,920	210,000	51
		Sulfate	29.1	1,400	<1

SUMMARY

Wells H-4A, H-4B, and H-4C are located at the Waste Isolation Pilot Plant site near Carlsbad, New Mexico. Drilling of these wells began during April 1978 and was completed during May 1978. Hydrologic testing and water-chemistry investigations were completed by March 1979.

The test zones under investigation at the proposed repository site yield water to wells at rates less than 0.9 gallon per minute. For this reason, shut-in tests and slug tests were used to calculate transmissivities and estimates for the coefficients of storage. Special testing procedures were developed to perform these tests. A distinct component of the procedure included a pressure-transducer system used throughout the testing sequence to monitor the water-pressure response in the tested zone.

Hydrologic testing results are as follows:

Well	Test zone	Calculated transmissivity (foot squared per day)	Estimated storage coefficient
H-4A	Magenta Dolomite Member of the Rustler Formation	0.06	10^{-6}
H-4B	Culebra Dolomite Member of the Rustler Formation	.9	10^{-9}
H-4C	Rustler Formation-Salado Formation contact	.0006	10^{-4}

The slug test may give a more accurate value for transmissivity than the shut-in test for the following reasons:

1. Subjectivity in determining the straight line part of the shut-in curve to be used in acquiring the change in the hydraulic head throughout one log cycle of time (p);

2. Difficulty met in obtaining a sufficient flow time preceding the shut-in to determine an actual average discharge of water (Q) from the test zone; and

3. Early time readings taken during the shut-in tests were apparently dominated by well-bore storage effects.

In addition, the slug test provides an estimate of the magnitude of the storage coefficient.

Although the slug test has these advantages over the shut-in test in low transmissive zones, the transmissivity values calculated from the shut-in test still serve as a useful check for the transmissivities calculated from the slug test; thus, the shut-in test remains an integral part of the hydrologic testing procedure.

Chemical analyses of water obtained from the Magenta Dolomite and Culebra Dolomite Members indicated these waters to be very saline, based on dissolved-solids concentrations of 22,300 and 18,100 milligrams per liter, respectively. The predominate ions in the water from the Magenta and Culebra were sodium, chloride, and sulfate. Radium-226, a naturally occurring radioactive element, was present in these waters.

Chemical analyses of water obtained from the Rustler Formation-Salado Formation contact indicated this water to be briny based on a dissolved-solids concentration of 322,000 milligrams per liter. The predominate ions in the water from the Rustler Formation-Salado Formation contact were magnesium, sodium, and chloride. Radium-226 was present in the brine.

REFERENCES CITED

Cooper, H. H., Jr., Bredehoeft, J. D., and Papadopulos, S. S., 1967, Response of a finite-diameter well to an instantaneous charge of water: Water Resources Research, v. 3, no. 1, p. 263-269.

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water; second edition, U.S. Geological Survey Water-Supply Paper 1473, 363 p.

Mercer, J. W. and Orr, B. R., 1979, Interim data report on the geohydrology of the proposed waste isolation pilot plant site, southeast New Mexico: U.S. Geological Survey Water-Resources Investigations 79-98, 178 p.

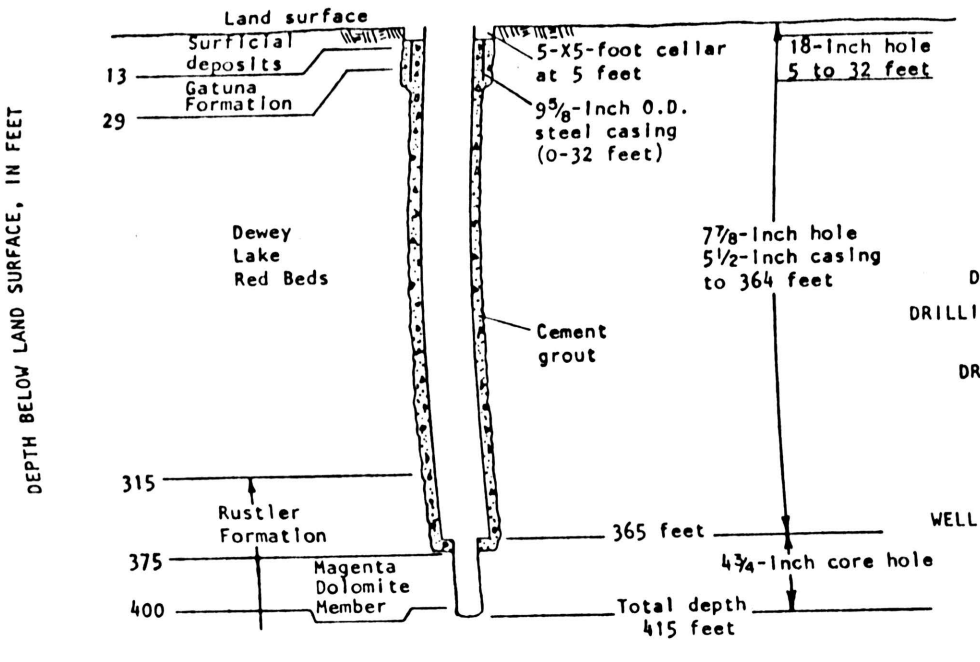
Papadopulos, S. S., Bredehoeft, J. D., and Cooper, H. H., Jr., 1973, On the analysis of "slug test" data: Water Resources Research, v. 9, no. 4, p. 1087-1089.

Theis, C. V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: American Geophysical Union Transactions, v. 16, p. 519-524.

SUPPLEMENTAL INFORMATION

This section consists of data collected during onsite operations, including construction detail of wells (fig. 20) and test data (table 5) used for the calculations that appear earlier in the text.

WELL H-4A



LOCATION: 546 feet from north line, 720 feet from west line, section 5, Township 23 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3332.9 feet (land surface)

DEPTH DRILLED: 415 feet

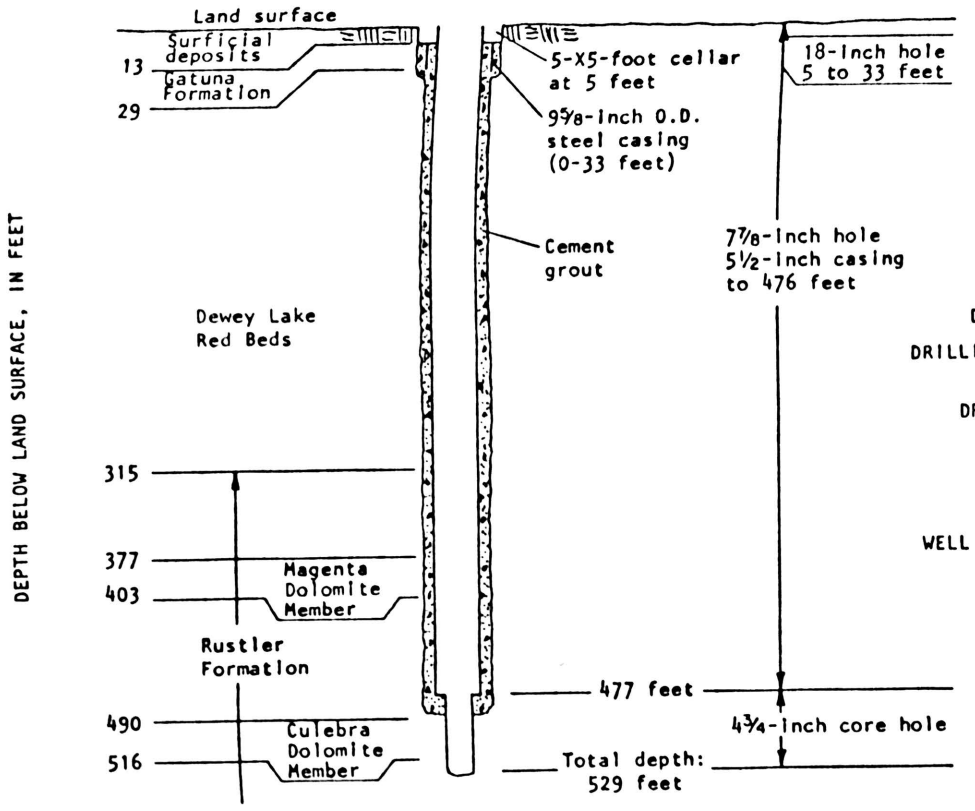
DATE COMPLETED: May 22, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-32 feet). Rotary 7⅞-inch hole with air and air foam (32-365 feet), changed to air foam at 176 feet. Cut 4¾-inch core using air foam and water (365-415 feet)

WELL CASING RECORD: 9⅝-inch outside-diameter steel casing (0-32 feet), 5½-inch outside-diameter steel casing (0-364 feet)

WELL H-4B



LOCATION: 498 feet from north line, 633 feet from west line, section 5, Township 23 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3332.8 feet (land surface)

DEPTH DRILLED: 529 feet

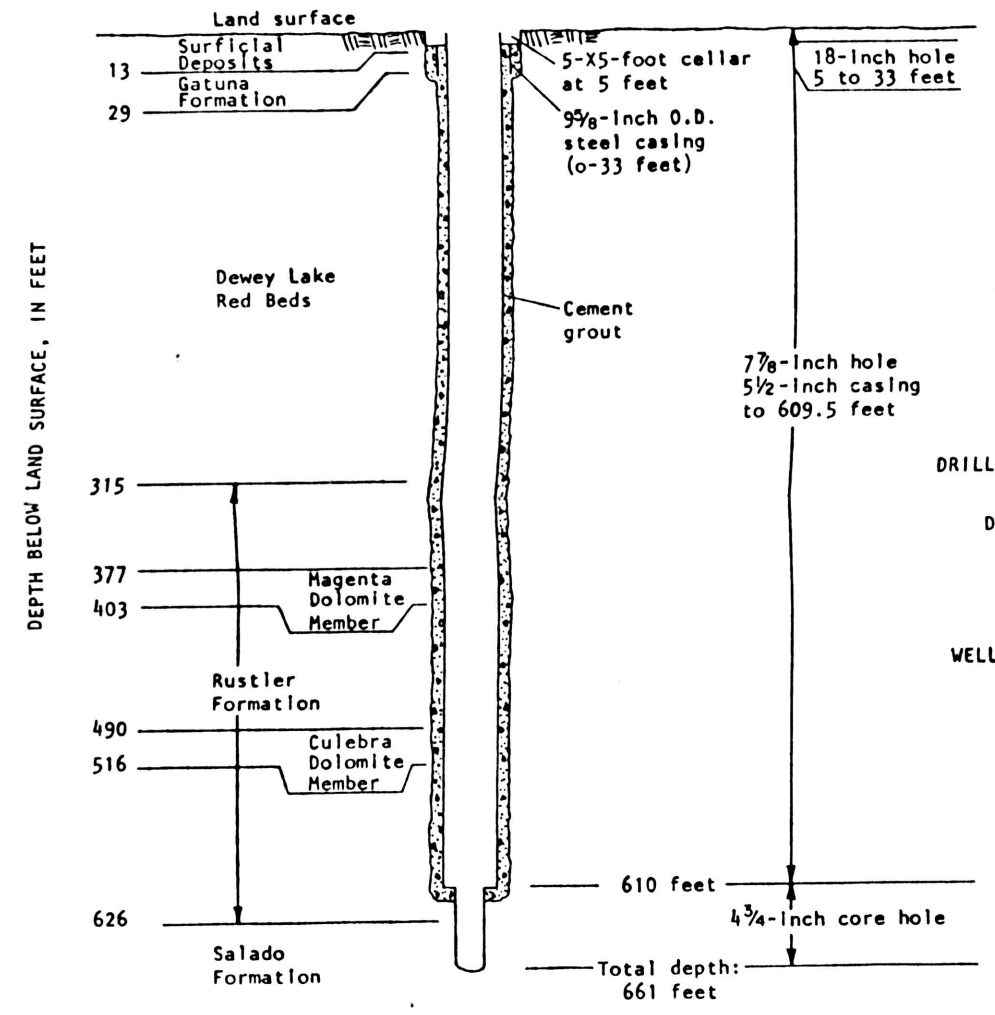
DATE COMPLETED: May 15, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-33 feet). Rotary 7⅞-inch hole with air and air foam (33-477 feet), changed to air foam at 168 feet. Cut 4¾-inch core using air foam (477-529 feet)

WELL CASING RECORD: 9⅝-inch outside-diameter steel casing (0-33 feet), 5½-inch outside-diameter steel casing (0-476 feet)

WELL H-4C



LOCATION: 446 feet from north line, 718 feet from west line, section 5, Township 23 South, Range 31 East, Eddy County, New Mexico

ALTITUDE: 3333.5 feet (land surface)

DEPTH DRILLED: 661 feet

DATE COMPLETED: May 8, 1978

DRILLING CONTRACTOR: Pennsylvania Drilling Company, Carlsbad, New Mexico

DRILLING METHOD: Drilled 18-inch hole using auger (5-33 feet). Rotary 7⅞-inch hole with air and air foam (33-610 feet), changed to air foam at 190 feet. Cut 4¾-inch core using air foam (610-661 feet)

WELL CASING RECORD: 9⅝-inch outside-diameter steel casing (0-33 feet), 5½-inch outside-diameter steel casing (0-609.5 feet)

Figure 20. Construction detail of wells H-4A, H-4B, and H-4C.

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C

H-4A - Bailing Test 1

Starting date: 12-01-78
Hole depth: 415 feet
Cased interval: 0-364 feet
Tested interval: 364-415 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation

Water levels were measured with a pressure transducer.
Measuring point (MP) for the recovery from bailing was the pressure transducer, which was 352.0 feet below land surface.
Static water level is 186.3 feet below land surface.

Type of bailer: Dart valve
Length: 19.5 feet
Diameter: 3.5 inches
Capacity: 9.75 gallons
A circular stock tank was used to hold the water which was removed during bailing.
Diameter of the stock tank: 7 feet.

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)
Date: 12-01-78					
1158	1	-	-	-	-
1200	2	-	-	-	-
1202	3	-	-	-	-
1203	4	-	-	-	-
1204	5	-	-	-	-
1205	6	-	-	-	-
1206	7	-	-	-	-
1208	8	-	-	-	-
1210	9	0.30	86.4	-	-
1211	10	-	-	-	-
1213	11	-	-	-	-
1214	12	-	-	-	-
1216	13	-	-	-	-
1218	14	-	-	-	-
1220	15	-	-	-	-
1221	16	-	-	-	-
1222	17	-	-	-	-
1223	18	.57	164.1	-	0:00
-	-	-	-	0.0	12:00
-	-	-	-	.1	13:00
-	-	-	-	.2	14:00
-	-	-	-	.3	14:45

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Bailing Test 1 - Continued

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)
Date: 12-01-78					
-	-	-	-	0.4	15:30
-	-	-	-	.5	16:15
-	-	-	-	.6	17:05
-	-	-	-	.8	18:45
-	-	-	-	.9	19:30
-	-	-	-	1.0	20:30
-	-	-	-	1.1	21:25
-	-	-	-	1.2	22:15
-	-	-	-	1.3	23:10
-	-	-	-	1.5	25:13
-	-	-	-	1.6	26:11
-	-	-	-	1.7	27:09
-	-	-	-	1.8	28:21
-	-	-	-	1.9	29:19
-	-	-	-	2.0	30:30
-	-	-	-	2.1	31:27
-	-	-	-	2.3	33:45
-	-	-	-	2.4	35:10
-	-	-	-	2.5	36:07
-	-	-	-	2.6	37:23
-	-	-	-	2.7	38:35
-	-	-	-	2.9	41:15
-	-	-	-	3.0	42:45
-	-	-	-	3.2	45:20
-	-	-	-	3.5	49:25
-	-	-	-	3.6	50:50
-	-	-	-	3.7	52:17
-	-	-	-	4.0	56:58
-	-	-	-	4.3	61:25
-	-	-	-	4.5	64:45
-	-	-	-	5.0	72:20
-	-	-	-	5.5	81:00
-	-	-	-	6.0	89:00
-	-	-	-	6.5	97:50

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Bailing Test 1 - Concluded

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)
Date: 12-01-78					
-	-	-	-	7.0	106:20
-	-	-	-	7.5	115:05
-	-	-	-	8.0	124:00
-	-	-	-	8.5	132:15
-	-	-	-	9.0	142:00
-	-	-	-	9.5	151:17
-	-	-	-	10.0	160:18
-	-	-	-	10.5	170:29
-	-	-	-	11.0	180:27
-	-	-	-	11.5	189:59

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test I

Starting date: 12-01-78
Shut in after: Bailing

Hole depth: 415 feet
Cased interval: 0-364 feet
Tested interval: 364-415 feet

Diameter of tested interval: 4.75 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation
Packer type: Lynes PIP **
Diameter: 4.5 inches

Packer set at 359.9 feet below land surface.
Measuring point (MP) was transducer tubing below the packer, which was 363.5 feet below land surface.
Static water level was 186.3 feet below land surface as measured at 0900 on 12-01-78.

REMARKS: t = time since bailing began (minutes)
t' = time since shut in (minutes)

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-01-78					
1751	-	38.1	-	0	Pretest reading.
1754:	0:0	38.3	-	0	Packer set.
	0:15	53.2	1425.0	0	-
	:30	54.2	713.0	0	-
	:45	55.5	475.7	0	-
	1:00	56.7	357.0	0	-
	1:15	58.6	285.8	0	-
	1:30	61.7	238.3	0	-
	1:45	62.7	204.4	0	-
	2:00	63.7	179.0	0	-
	3:00	68.0	119.7	0	-
	4:00	72.4	90.0	0	-
	5:00	76.7	72.2	0	-
	6:00	80.7	60.3	0	-
	7:00	84.6	51.9	0	-
	8:00	88.3	45.5	0	-
	9:00	91.6	40.6	0	-
	10:00	94.8	36.6	0	-
	11:00	97.7	33.4	0	-
	12:00	100.4	30.7	0	-
	14:00	105.4	26.4	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-01-78					
-	16:00	109.1	23.3	0	-
-	18:00	112.4	20.8	0	-
-	20:00	115.2	18.8	0	-
-	25:00	120.6	15.2	0	-
-	30:00	124.3	12.9	0	-
-	40:00	130.0	9.9	0	-
-	45:00	131.6	8.9	0	-
-	50:00	133.3	8.1	0	-
-	60:00	136.0	6.9	0	-
-	72:00	138.5	5.9	-0.01	-
-	81:00	140.1	5.4	- .01	-
-	90:00	141.5	5.0	- .01	-
-	110:00	144.1	4.2	- .01	-
-	120:00	145.2	4.0	- .02	-
-	140:00	147.1	3.5	- .03	-
-	160:00	148.5	3.2	- .02	-
-	180:00	150.0	3.0	- .01	-
-	200:00	151.2	2.8	- .01	-
-	220:00	152.3	2.6	- .01	-
-	240:00	153.3	2.5	- .01	-
-	264:00	154.3	2.3	- .02	-
-	280:00	155.0	2.3	- .02	-
-	300:00	155.6	2.19	- .03	-
-	320:00	156.2	2.11	- .03	-
-	340:00	156.6	2.05	- .04	-
-	350:00	156.8	2.02	- .05	-
2354	360:00	157.0	1.99	- .05	-
Date: 12-02-78					
0531	-	162.8	1.51	- .11	-
0602	-	162.9	1.49	- .10	-
0630	-	163.2	1.47	- .09	-
0754	-	163.9	1.42	- .10	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-in Test 1 - Concluded

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
0921	-	164.0	1.38	-0.10	-
0957	-	163.9	1.37	- .10	-
1044	-	163.2	1.35	- .07	-
1112	-	163.2	1.34	- .07	Prepared to knock the plug out of the packer for slug test 1.

** The use of trade names in this report is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test 1

Starting date: 12-02-78
Hole depth: 415 feet
Cased interval: 0-364 feet
Packer type: Lynes PIP with feed through
Diameter of tested interval: 4.75 inches
Inside diameter(ID) of tubing: 2.0 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation
Tested interval: 364-415 feet
Diameter: 4.5 inches

Packer set at 359.9 feet below land surface.
Measuring point (MP) was transducer tubing below packer, which was 363.5 feet below land surface.
Static water level was 186.3 feet below land surface.

REMARKS:

$$H/H_o = \frac{h' - h_l}{h_o - h_l}$$

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
1113	163.2	-	-	0	Pretest reading.
1114:35	-	0	-	0	Knocked plug out of packer.
-	353.0	25	-	0	-
-	355.4	35	1.00	0	*
-	355.4	40	1.00	0	-
-	355.4	47	1.00	0	-
-	355.4	65	1.00	0	-
-	355.2	90	0.999	0	-
-	355.1	110	.998	0	-
-	355.0	120	.998	0	-
-	354.7	150	.996	0	-
-	354.4	180	.995	0	-
-	354.2	195	.994	0	-
-	354.0	210	.993	0	-
-	353.9	225	.992	0	-
-	353.7	240	.991	0	-
-	353.6	255	.991	0	-
-	353.4	270	.990	0	-
-	353.3	285	.989	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test - 1 - Continued

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	353.1	300	0.988	0	-
-	352.9	315	.987	0	-
-	352.8	330	.986	0	-
-	352.6	345	.985	0	-
-	352.5	360	.985	0	-
-	352.3	375	.984	0	-
-	352.2	390	.983	0	-
-	352.0	405	.982	0	-
-	351.8	420	.981	0	-
-	351.6	435	.980	0	-
-	351.5	450	.980	0	-
-	351.4	465	.979	0	-
-	351.3	480	.979	0	-
-	351.2	495	.978	0	-
-	351.1	510	.978	0	-
-	350.9	525	.977	0	-
-	350.8	540	.976	0	-
-	350.7	555	.976	0	-
-	350.6	570	.975	0	-
-	350.5	585	.975	0	-
-	350.3	600	.973	0	-
-	350.1	630	.972	0	-
-	349.8	660	.971	0	-
-	349.6	690	.970	0	-
-	349.3	720	.968	0	-
-	349.0	750	.967	0	-
-	348.8	780	.966	0	-
-	348.5	810	.964	0	-
-	348.3	840	.963	0	-
-	348.0	870	.962	0	-
-	347.7	900	.960	0	-
-	347.5	930	.959	0	-
-	347.3	960	.958	0	-
-	347.0	990	.956	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test - 1 - Continued

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	346.8	1020	0.955	0	-
-	346.5	1050	.954	0	-
-	346.3	1080	.953	0	-
-	346.1	1110	.952	0	-
-	345.8	1140	.950	0	-
-	345.6	1170	.949	0	-
-	345.4	1200	.948	0	-
-	345.2	1230	.947	0	-
-	344.9	1260	.945	-0.01	-
-	344.7	1290	.944	- .01	-
-	344.4	1320	.943	- .01	-
-	344.2	1350	.942	- .01	-
-	344.0	1380	.941	- .01	-
-	343.7	1410	.939	- .01	-
-	343.5	1440	.938	- .01	-
-	343.2	1470	.937	- .01	-
-	343.0	1500	.935	- .01	-
-	342.8	1530	.934	- .01	-
-	342.6	1560	.933	- .01	-
-	342.3	1590	.932	- .01	-
-	342.1	1620	.931	- .01	-
-	341.9	1650	.930	- .01	-
-	341.7	1680	.929	- .01	-
-	341.4	1710	.927	- .01	-
-	341.2	1740	.926	- .01	-
-	340.9	1770	.925	- .02	-
-	340.8	1800	.924	- .01	-
-	340.6	1830	.923	- .01	-
-	340.3	1860	.921	- .01	-
-	340.1	1890	.920	- .01	-
-	339.9	1920	.919	- .01	-
-	339.6	1950	.918	- .01	-
-	339.4	1980	.917	- .01	-
-	339.2	2010	.916	- .01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test - 1 - Continued

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	339.0	2040	0.915	-0.01	-
-	338.8	2070	.914	- .01	-
-	338.6	2100	.913	- .01	-
-	338.3	2130	.911	- .01	-
-	338.2	2160	.911	- .01	-
-	337.9	2190	.909	- .01	-
-	337.7	2220	.908	- .01	-
-	337.5	2250	.907	- .01	-
-	337.3	2280	.906	- .01	-
-	337.1	2310	.905	- .01	-
-	336.9	2340	.904	- .02	-
-	336.7	2370	.903	- .02	-
-	336.5	2400	.902	- .02	-
-	336.3	2430	.901	- .02	-
-	336.1	2460	.900	- .02	-
-	335.9	2490	.899	- .01	-
-	335.7	2520	.898	- .01	-
-	335.5	2550	.896	- .01	-
-	335.3	2580	.895	- .01	-
-	335.1	2610	.894	- .01	-
-	334.9	2640	.893	- .02	-
-	334.8	2670	.893	- .02	-
-	334.6	2700	.892	- .02	-
-	334.2	2760	.890	- .02	-
-	333.9	2820	.888	- .02	-
-	333.6	2880	.887	- .02	-
-	333.1	2940	.884	- .02	-
-	332.7	3000	.882	- .02	-
-	332.3	3060	.880	- .02	-
-	331.9	3120	.878	- .03	-
-	331.6	3180	.876	- .03	-
-	331.2	3240	.874	- .03	-
-	330.9	3300	.873	- .03	-
-	330.4	3360	.870	- .03	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test - 1 - Concluded

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	330.0	3420	0.868	-0.03	-
-	329.7	3480	.866	- .03	-
-	329.3	3540	.864	- .03	-
-	328.9	3600	.862	- .03	-
-	328.1	3720	.858	- .03	-
-	327.4	3840	.854	- .03	-
-	325.9	4080	.847	- .03	-
-	325.2	4200	.843	- .03	-
-	324.6	4320	.840	- .03	-
-	323.8	4440	.836	- .03	-
-	323.2	4560	.833	- .03	-
-	322.3	4680	.828	- .03	-
-	321.6	4800	.824	- .03	-
-	320.9	4920	.821	- .04	-
-	320.3	5040	.818	- .04	-
-	319.6	5160	.814	- .04	-
-	318.9	5280	.810	- .04	-
-	318.3	5400	.807	- .04	-
-	317.6	5520	.803	- .05	-
-	317.0	5640	.800	- .05	-
-	316.3	5760	.797	- .05	-
-	315.7	5880	.793	- .05	-
-	315.0	6000	.790	- .05	-
-	313.0	6300	.779	- .05	-
-	311.7	6600	.773	- .06	-
-	310.1	6900	.764	- .05	-
-	308.6	7200	.757	- .05	-
-	307.1	7500	.749	- .05	-
-	305.7	7800	.741	- .05	-
-	302.8	8400	.726	- .05	-
-	299.9	9000	.711	- .05	-
-	297.2	9600	.697	- .05	-
1400	-	-	-	-	Prepared to run shut-in 2

* $H/H_o = \frac{h' - 163.2 \text{ feet}}{355.4 - 163.2 \text{ feet}}$

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test 2

Starting date: 12-02-78
Shut in after: Slug test
Hole depth: 415 feet
Packer type: Lynes PIP
Diameter: 4.5 inches

Diameter of tested interval: 4.75 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation
Cased interval: 0-364 feet
Tested interval: 364-415 feet

Packer set at 359.9 feet below land surface.
Measuring point (MP) was transducer tubing below the packer, which was 363.5 feet below land surface.
Static water level was 186.3 feet below land surface or as measured at 0900 on 12-01-78.

REMARKS: t = time since slug test began (minutes)
t' = time since shut in (minutes)

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
1400:30	-	295.4	-	0	Pretest reading.
1402:10	-	269.5	-	0	Sinker bar pulled out of tubing.
1411:25	-	279.0	-	0	Standing valve lowered into tubing.
-	0	279.0	-	0	Standing valve set but did not seat.
	RESET				
-	0	-	-	0	Reset standing valve.
-	0:08	285.4	1327.3	0	-
-	:15	274.0	708.3	0	-
-	:20	263.2	531.5	0	-
-	:25	258.0	425.4	0	-
-	:30	253.3	354.7	0	-
-	:35	250.0	304.1	0	-
-	:40	247.1	266.3	0	-
-	:45	244.2	236.8	0	-
-	:50	242.1	213.2	0	-
-	:55	240.3	193.9	0	-
-	1:00	238.7	177.8	0	-
-	1:05	237.0	164.2	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut In Test 2 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	1:10	235.6	152.6	0	-
-	1:15	234.4	142.5	0	-
-	1:20	233.2	133.6	0	-
-	1:25	232.1	125.8	0	-
-	1:45	228.5	102.1	0	-
-	1:55	227.0	93.3	0	-
-	2:10	225.3	82.6	0	-
-	2:20	224.0	76.8	0	-
-	2:30	223.0	71.7	0	-
-	2:40	222.1	67.3	0	-
-	2:50	221.7	63.4	0	-
-	3:00	220.4	59.9	0	-
-	3:10	219.7	56.8	0	-
-	3:20	219.0	54.1	0	-
-	3:30	218.3	51.5	0	-
-	3:40	217.8	49.2	0	-
-	3:50	217.2	47.1	0	-
-	4:00	216.7	45.2	0	-
-	4:10	216.1	43.4	0	-
-	4:20	215.6	41.8	0	-
-	4:30	215.2	40.3	0	-
-	4:40	214.6	38.9	0	-
-	4:50	214.2	37.6	0	-
-	5:00	213.9	36.4	0	-
-	5:10	213.4	35.2	0	-
-	5:20	213.0	34.2	0	-
-	5:30	212.6	33.2	0	-
-	5:40	212.3	32.2	0	-
-	5:50	211.8	31.3	0	-
-	6:00	211.7	30.5	0	-
-	6:10	211.2	29.7	0	-
-	6:20	210.9	28.9	0	-
-	6:30	210.5	28.2	0	-
-	6:40	210.3	27.5	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test 2 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	6:50	210.1	26.9	0	-
-	7:00	209.8	26.3	0	-
-	7:10	209.4	25.7	0	-
-	7:20	209.2	25.1	0	-
-	7:30	209.0	24.6	0	-
-	7:40	208.7	24.1	0	-
-	7:50	208.5	23.6	0	-
-	8:00	208.2	23.1	0	-
-	8:10	208.0	22.7	0	-
-	8:20	207.8	22.2	0	-
-	8:30	207.6	21.8	0	-
-	8:40	207.3	21.4	0	-
-	8:50	207.1	21.0	0	-
-	9:10	206.7	20.3	0	-
-	9:20	206.5	19.9	0	-
-	9:30	206.3	19.6	0	-
-	9:40	206.1	19.3	0	-
-	9:50	205.9	19.0	0	-
-	10:00	205.7	18.7	0	-
-	10:10	205.5	18.4	0	-
-	10:20	205.4	18.1	0	-
-	10:30	205.2	17.8	0	-
-	10:40	205.0	17.6	0	-
-	10:50	204.8	17.3	0	-
-	11:00	204.7	17.1	0	-
-	11:10	204.5	16.8	0	-
-	11:20	204.3	16.6	0	-
-	11:30	204.2	16.4	0	-
-	11:40	204.0	16.2	0	-
-	11:50	203.8	15.9	0	-
-	12:00	203.7	15.7	0	-
-	12:10	203.5	15.5	0	-
-	12:20	203.4	15.3	0	-
-	12:30	203.2	15.1	0	-
-	12:40	203.0	15.0	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-in Test 2 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	12:50	202.9	14.8	0	-
-	13:00	202.8	14.6	0	-
-	13:10	202.7	14.4	0	-
-	13:35	202.3	14.0	0	-
-	13:40	202.2	13.9	0	-
-	13:50	202.1	13.8	0	-
-	14:00	202.0	13.6	0	-
-	14:10	201.8	13.5	0	-
-	14:20	201.7	13.3	0	-
-	14:30	201.6	13.2	0	-
-	14:40	201.4	13.1	0	-
-	14:50	201.3	12.9	0	-
-	15:00	201.2	12.8	0	-
-	15.10	201.1	12.7	0	-
-	15.30	200.8	12.4	0	-
-	15:40	200.7	12.3	0	-
-	15:50	200.6	12.2	0	-
-	16:00	200.5	12.1	0	-
-	16.10	200.3	11.9	0	-
-	16:20	200.2	11.8	0	-
-	16:30	200.1	11.7	0	-
-	16:40	200.0	11.6	0	-
-	16:50	199.9	11.5	0	-
-	17:00	199.8	11.4	0	-
-	17:10	199.7	11.3	0	-
-	17:20	199.6	11.2	0	-
-	17:30	199.5	11.1	0	-
-	17:40	199.3	11.01	0	-
-	17:50	199.2	10.92	0	-
-	18:00	199.1	10.82	0	-
-	18:10	199.1	10.73	0	-
-	18:20	199.0	10.65	0	-
-	18:30	199.0	10.56	0	-
-	18:40	198.7	10.47	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test 2 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	18:50	198.7	10.39	0	-
-	19:00	198.6	10.31	0	-
-	19:10	198.5	10.23	0	-
-	19:20	198.4	10.15	0	-
-	19:30	198.3	10.07	0	-
-	19:40	198.2	9.99	0	-
-	19:50	198.1	9.92	0	-
-	20:00	198.0	9.84	0	-
-	20:10	197.9	9.77	0	-
-	20:20	197.8	9.70	0	-
-	20:30	197.7	9.63	0	-
-	20:40	197.6	9.56	0	-
-	20:50	197.6	9.49	0	-
-	21:00	197.5	9.42	0	-
-	21:10	197.4	9.35	0	-
-	21:20	197.3	9.29	0	-
-	21:30	197.2	9.22	0	-
-	21:40	197.1	9.16	0	-
-	21.50	197.0	9.10	0	-
-	22:00	197.0	9.04	0	-
-	22:15	196.9	8.95	0	-
-	22:30	196.7	8.86	0	-
-	22:45	196.6	8.77	0	-
-	23:00	196.5	8.69	0	-
-	23:15	196.4	8.61	0	-
-	23:30	196.2	8.52	0	-
-	23:45	196.1	8.45	0	-
-	24:00	196.0	8.37	0	-
-	24:15	195.9	8.29	0	-
-	24:30	195.8	8.22	0	-
-	24:45	195.7	8.14	0	-
-	25:00	195.6	8.07	0	-
-	25:15	195.5	8.00	0	-
-	25:30	195.4	7.93	0	-
-	25:45	195.3	7.87	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-in Test 2 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	26:00	195.2	7.80	0	-
-	26:30	195.0	7.67	0	-
-	26:45	194.9	7.61	0	-
-	27:00	194.8	7.55	0	-
-	27:15	194.7	7.49	0	-
-	27:30	194.6	7.43	0	-
-	27:45	194.5	7.37	0	-
-	28:00	194.4	7.32	0	-
-	28:15	194.3	7.26	0	-
-	28:30	194.2	7.20	0	-
-	28:45	194.1	7.15	0	-
-	29:00	194.1	7.10	0	-
-	29:30	193.9	6.99	0	-
-	30:00	193.7	6.89	0	-
-	30:30	193.6	6.80	0	-
-	31:00	193.4	6.70	0	-
-	31:30	193.2	6.61	0	-
-	32:00	193.1	6.53	0	-
-	32.30	192.9	6.44	0	-
-	33:00	192.7	6.36	0	-
-	33:30	192.6	6.28	0	-
-	34:00	192.4	6.20	0	-
-	34:30	192.3	6.13	0	-
-	35:00	192.1	6.05	0	-
-	36:00	191.8	5.91	0	-
-	37:00	191.5	5.78	0	-
-	38:00	191.3	5.65	0	-
-	39:00	191.0	5.53	0	-
-	40:00	190.8	5.42	0	-
-	42:00	190.3	5.21	0	-
-	44:00	189.8	5.02	0	-
-	46:00	189.4	4.84	0	-
-	48:00	188.9	4.68	0	-
-	50:00	188.5	4.54	0	-
-	52:00	188.1	4.40	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test 2 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-02-78					
-	54:00	187.8	4.27	0	-
-	56:00	187.4	4.16	0	-
-	58:00	187.2	4.05	0.01	-
-	60:00	186.8	3.95	0	-
-	65:00	186.0	3.72	.01	-
-	70:00	185.4	3.53	.01	-
-	80:00	184.1	3.21	.02	-
-	90:00	183.1	2.96	.02	-
-	100:00	182.4	2.77	.02	-
-	110:00	181.7	2.61	.02	-
-	120:00	181.1	2.47	.03	-
-	130:00	180.5	2.36	.03	-
-	140:00	179.9	2.26	.04	-
-	150:00	179.4	2.18	.04	-
-	160:00	179.0	2.11	.05	-
-	170:00	178.6	2.04	.05	-
-	180:00	178.2	1.98	.06	-
-	181:30	177.4	1.97	.06	-
Date: 12-03-78					
0023	-	172.1	1.289	.24	-
0028	-	171.9	1.287	.24	-
0808	-	171.2	1.164	.41	-
0905	-	171.0	1.156	.42	-
1007	-	171.1	1.148	.41	-
1120	-	170.4	1.139	.38	-
1150	-	170.1	1.136	.37	-
1200	-	169.4	1.135	.37	-
1455	-	168.8	1.119	.33	-
1511	-	168.3	1.1179	.33	-
1516	-	168.3	1.1175	.33	-
1522	-	170.8	1.1171	.33	-
1523	-	173.4	1.1170	.33	-
1525:45	-	170.8	1.1168	.33	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Shut-In Test 2 - Concluded

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-03-78					
1527	-	169.1	1.1167	0.33	-
1528:30	-	168.4	1.1166	.33	-
1530:30	-	168.4	1.1164	.33	-
1535	-	168.5	1.1161	.33	-
1545	-	168.5	1.1153	.33	-
1600	-	170.1	1.1142	.33	-
1604	-	167.0	1.1139	.33	-
1607	-	168.4	1.1137	.33	-
1611	-	169.0	1.1134	.33	-
1615	-	168.3	1.1131	.35	-
1621	-	168.2	1.124	.33	-
1627	-	168.7	1.122	.36	-
1630	-	168.7	1.120	.36	-
Date: 12-04-78					
0755	-	169.8	1.0706	.46	-

Table 5. Hydrologic test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test 2

Starting date: 12-04-78
Hole depth: 415 feet
Cased interval: 0-364 feet
Packer type: Lynes PIP with feed through
Diameter: 4.5 inches

Inside diameter(ID) of tubing: 2.0 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation
Tested interval: 364-415 feet
Diameter of tested interval: 4.75 inches

Packer set at 359.9 feet below land surface.
Measuring point (MP) was transducer tubing below packer, which was 363.5 feet below land surface.
Static water level was 186.3 feet below land surface.

REMARKS:

$$H/H_o = \frac{h' - h_i}{h_o - h_i}$$

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-04-78					
0838:45	169.2	-	-	0	Pretest reading.
0843:50	-	0	-	0	-
	354.9	10	-	0	-
-	358.1	20	1.00	0	*
-	357.9	30	0.999	0	-
-	357.8	40	.998	0	-
-	357.7	50	.998	0	-
-	357.5	60	.997	0	-
-	357.4	75	.996	0	-
-	357.2	90	.995	0	-
-	357.1	105	.995	0	-
-	356.9	120	.994	0	-
-	356.7	135	.993	0	-
-	356.6	150	.992	0	-
-	356.4	165	.991	0	-
-	356.3	180	.991	0	-
-	356.0	195	.989	0	-
-	355.9	210	.988	0	-
-	355.7	225	.987	0	-
-	355.5	240	.986	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Slug Test 2 - Concluded

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-04-78					
-	355.5	255	0.986	0	-
-	355.3	270	.985	0	-
-	355.1	285	.984	0	-
-	355.0	300	.984	0	-
-	354.7	330	.982	0	-
-	354.4	360	.980	0	-
-	354.2	390	.979	0	-
-	353.9	420	.978	0	-
-	353.6	450	.976	0	-
-	353.4	480	.975	0	-
-	353.1	510	.974	0	-
-	352.8	540	.972	0	-
-	352.5	570	.970	0	-
-	352.2	600	.969	0	-
-	351.7	660	.966	0	-
-	351.2	720	.963	0	-
-	350.7	780	.961	0	-
-	350.2	840	.958	0	-
-	349.7	900	.956	0	-
-	347.3	1200	.943	0	-
-	345.0	1500	.931	0	-
-	342.8	1800	.919	0	-
-	340.6	2100	.907	0	-
-	338.4	2400	.896	0	-
-	336.5	2700	.886	0	-
-	334.7	3000	.876	0	-
-	332.6	3300	.865	0	-
-	330.7	3600	.855	0	-
-	329.1	3900	.846	0	-
-	327.1	4200	.836	0	-
-	325.5	4500	.827	0	-
-	323.9	4800	.819	0	-

* $$H/H_o = \frac{h' - 169.2 \text{ feet}}{358.1 - 169.2 \text{ feet}}$$

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Swabbing Test I

Starting date: 12-04-78
Hole depth: 415 feet
Cased interval: 0-364 feet

Tested interval : 364-415 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation

Measuring point (MP) for the recovery from swabbing was the pressure transducer tubing below the packer, which was 363.5 feet below land surface.
Static water level was 186.3 feet below land surface.

Packer set at 359.9 feet below land surface
Swabbing from 350 feet below land surface
A circular stock tank was used to hold the water that was removed during swabbing.
Diameter of the stock tank: 7 feet.

Clock time	Swab number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Remarks
Date: 12-04-78					
-	-	0.07	20.2	-	Amount of water in the tank prior to swabbing.
1121	1	.15	43.2	-	-
1128	2	.15	43.2	-	No fluid obtained.
1132	3	.17	48.9	-	-
1135	4	.17	48.9	-	No fluid obtained.
1148	5	.20	57.6	-	-
1150	6	.21	60.5	-	-
1203	7	.29	83.5	-	-
1210	8	.29	83.5	25.0	No fluid obtained.
1211	-	-	-	27.6	-
1212	-	-	-	28.2	-
1213	-	-	-	28.9	-
1214	-	-	-	29.5	-
1215	-	-	-	30.1	-
1216	-	-	-	30.5	-
1217	-	-	-	30.9	-
1218	-	-	-	31.4	-
1219	-	-	-	31.8	-
1220	-	-	-	32.2	-
1221	-	-	-	32.6	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Swabbing Test 1 - Concluded

Clock time	Swab number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Remarks
Date: 12-04-78					
1222	-	-	-	33.1	-
1223	-	-	-	33.9	-
1224	-	-	-	34.3	-
1225	-	-	-	34.7	-
1226	-	-	-	35.1	-
1227	-	-	-	35.5	-
1228	-	-	-	35.9	-
1229	-	-	-	36.2	-
1230	-	-	-	36.6	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4A - Bailing Test 2

Starting date: 12-04-78
Hole depth: 415 feet
Cased interval: 0-364 feet

Tested interval : 364-415 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Magenta Dolomite Member of the Rustler Formation

Static water level was 186.3 feet below land surface.

Type of bailer: Dart valve
Diameter (ID): 3.5 inches

Length: 19.5 feet
Capacity: 9.75 gallons

A circular stock tank was used to hold the water that was removed during bailing.
Diameter of the stock tank: 7 feet.

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)	Change in barometric pressure (in. of mercury referenced to 0)	Remarks
Date: 12-04-78							
-	-	0.29	83.5	-	-	-	Initial depth of water in tank.
1335	1	-	-	-	-	-	-
1336	2	.34	97.9	-	-	-	-
1337	3	-	-	-	-	-	-
1339	4	.40	115.2	-	-	-	-
1343	5	-	-	-	-	-	-
1345	6	-	-	-	-	-	-
1348	7	.46	132.4	-	-	-	-
1351	8	.51	146.8	-	-	-	-
1353	9	.53	152.6	-	-	-	-
1356	10	.55	158.3	-	-	-	-
1358	11	.58	167.0	-	-	-	Emptied hole.

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Bailing Test 1

Starting date: 12-05-78
Hole depth: 529 feet
Cased interval: 0-476 feet

Tested interval : 476-529 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Culebra Dolomite Member of the Rustler Formation

Water levels were measured with a pressure tranducer.
Measuring point (MP) for the recovery from bailing was the pressure transducer, which was 393.5 feet below land surface.
Static water level was 348.2 feet below land surface.

Type of bailer: Dart valve
Diameter (ID): 3.5 inches

Length: 19.5 feet
Capacity: 9.75 gallons

A circular stock tank was used to hold the water that was removed during bailing.
Diameter of the stock tank: 7 feet.

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)	Change in barometric pressure (in. of mercury referenced to 0)	Remarks
Date: 12-05-78							
0934:15	1	-	-	-	-	-	-
0936:00	2	-	-	-	-	-	-
0938:30	3	0.10	28.8	-	-	-	-
0940:10	4	.12	34.5	-	-	-	-
0942:05	5	.16	46.0	-	-	-	-
0946:00	6	.19	54.7	-	-	-	-
0948:10	7	.22	63.3	-	-	-	-
0949:40	8	.25	72.0	-	-	-	-
0951:05	9	.28	80.6	-	-	-	-
0953:30	10	.32	92.1	-	-	-	-
-	-	-	-	0.2	0:30	0	-
-	-	-	-	.4	1:00	0	-
-	-	-	-	.5	1:30	0	-
-	-	-	-	.7	2:00	0	-
-	-	-	-	.8	2:30	0	-
-	-	-	-	.9	3:00	0	-
-	-	-	-	1.1	3:30	0	-
-	-	-	-	1.3	4:00	0	-
-	-	-	-	1.6	5:00	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Bailing Test 1 - Concluded

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)	Change in barometric pressure (in. of mercury referenced to 0)	Remarks
Date: 12-05-78							
-	-	-	-	1.9	6:00	0	-
-	-	-	-	2.2	7:00	0	-
-	-	-	-	2.5	8:00	0	-
-	-	-	-	2.8	9:00	0	-
-	-	-	-	3.1	10:00	0	-
-	-	-	-	4.4	14:00	0	-
-	-	-	-	5.8	19:00	-0.01	-
-	-	-	-	7.2	24:00	- .02	-
-	-	-	-	9.9	34:00	- .02	-
-	-	-	-	12.4	44:00	- .03	-
-	-	-	-	14.6	54:00	- .04	-
-	-	-	-	16.9	64:00	- .05	-
-	-	-	-	19.0	74:00	- .06	-
-	-	-	-	21.1	84:00	- .06	-
-	-	-	-	23.2	94:00	- .08	-
-	-	-	-	27.6	117:00	- .10	-
-	-	-	-	29.1	125:00	- .10	-
-	-	-	-	31.5	138:00	- .11	-
-	-	-	-	32.6	146:00	- .10	-
-	-	-	-	35.1	159:00	- .10	-
-	-	-	-	35.9	164:00	- .10	-
-	-	-	-	37.3	174:00	- .10	-
-	-	-	-	-	-	- .1	Removed transducer at about 12:00.
-	-	-	-	-	-	- .10	Prepared to set packer.

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Shut-in Test 1

Starting date: 12-05-78
Shut in after: Bailing
Hole depth: 529 feet
Packer type: Lynes PIP
Diameter: 4.5 inches

Diameter of tested interval: 4.75 inches
Geologic unit tested: Culebra Dolomite Member of the Rustler Formation
Cased interval: 0-476 feet
Tested interval: 476-529 feet

Packer set at 468.4 feet below land surface.
Measuring point (MP) was transducer tubing below the packer, which was 472.0 feet below land surface.
Static water level was 348.2 feet below land surface as measured at 0900 on 12-03-78.

REMARKS: Formation insufficiently stressed. Shut-in reached static in very short time. Unable to calculate a value for transmissivity.
t = time since bailing began (minutes)
t' = time since shut in (minutes)

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-05-78					
1454	-	108.0	-	0	Pretest.
1455:30	0:00	-	-	0	-
-	:30	121.1	644.0	0	-
-	:35	121.7	552.1	0	-
-	:40	118.7	483.3	0	-
-	:45	116.8	429.7	0	-
-	:50	115.7	386.8	0	-
-	:55	116.0	351.7	0	-
-	1:00	115.0	322.5	0	-
-	1:10	114.3	276.6	0	-
-	1:20	114.0	242.1	0	-
-	1:30	113.7	215.3	0	-
-	1:40	113.6	193.9	0	-
-	1:50	113.5	176.4	0	-
-	2:00	113.4	161.8	0	-
-	2:10	113.3	149.4	0	-
-	2:20	113.2	138.8	0	-
-	2:30	113.2	129.6	0	-
-	2:40	115.0	121.6	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Shut-In Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-05-78					
-	2:50	113.5	114.5	0	-
-	3:00	113.3	108.2	0	-
-	3:10	113.2	102.5	0	-
-	3:20	113.2	97.5	0	-
-	3:30	113.2	92.9	0	-
1459:10	3:40	113.1	88.7	0.01	-
-	3:50	113.1	84.9	.01	-
-	4:00	113.1	81.4	.01	-
-	4:10	113.1	78.2	.01	-
-	4:20	113.1	75.2	.01	-
-	4:30	113.1	72.4	.01	-
-	4:40	114.2	69.9	.01	-
-	4:50	113.3	67.5	.01	-
-	5:00	113.2	65.3	.01	-
-	5:20	113.2	61.3	.01	-
-	5:30	113.2	-	.01	-
-	5:40	113.2	-	.01	-
-	5:50	113.2	-	.01	-
-	6:00	113.1	-	.01	-
-	7:00	113.2	-	.01	-
-	7:10	113.2	-	.01	-
-	7:20	113.2	-	.01	-
-	7:30	113.2	-	.01	-
-	7:40	113.2	-	.01	-
-	7:50	113.2	-	.01	-
-	8:00	113.3	-	.01	-
-	8:10	113.3	-	.01	-
-	8:20	113.2	-	.01	-
-	8:30	113.2	-	.01	-
-	8:40	113.4	-	.01	-
-	8:50	113.3	-	.01	-
-	9:00	113.3	-	.01	-
-	9:15	113.4	-	.01	-
-	9:30	113.4	-	.01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Shut-in Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-05-78					
-	9:45	113.4	-	0.01	-
-	10:00	113.5	-	.01	-
-	10:10	113.5	-	.01	-
-	10:20	113.5	-	.01	-
-	10:30	113.6	-	.01	-
-	10:40	113.6	-	.01	-
1506:20	10:50	113.6	-	.01	-
-	11:00	113.6	-	.01	-
-	11:15	113.6	-	.01	-
-	11:30	113.6	-	.01	-
-	11:45	113.8	-	.01	-
-	12:00	113.7	-	.01	-
-	12.15	113.8	-	.01	-
-	12:30	113.8	-	.01	-
-	12:45	113.8	-	.01	-
-	13:00	113.8	-	.01	-
-	13.15	113.9	-	.01	-
-	13:30	113.8	-	.01	-
-	13:45	113.9	-	.01	-
-	14:00	113.9	-	.01	-
-	14:15	113.8	-	.01	-
-	14:30	113.9	-	.01	-
-	14:45	113.9	-	.01	-
-	15:00	114.4	-	.01	-
-	15:15	113.9	-	.01	-
-	15:30	113.9	-	.01	-
-	15:45	114.0	-	.01	-
-	16:00	114.0	-	.01	-
-	16:15	114.0	-	.01	-
-	16:30	114.0	-	.01	-
-	16:45	114.0	-	.01	-
-	17:00	114.0	-	.01	-
-	17:30	114.0	-	.01	-
-	18:00	114.0	-	.01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Shut-in Test I - Concluded

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-05-78					
-	19:00	114.1	-	0.01	-
-	20:00	114.2	-	.01	-
-	21:00	114.2	-	.01	-
-	22:00	114.3	-	.01	-
-	23:00	114.4	-	.01	-
-	24:00	114.5	-	.01	-
-	25:00	114.5	-	.01	-
1521:30	26:00	114.6	-	0	-
-	27:00	114.6	-	0	-
-	30:00	114.7	-	0	-
-	33:00	114.9	-	.01	-
-	35:00	115.0	-	.01	-
-	40:00	115.2	-	.01	-
-	50:00	115.1	-	.01	-
-	65:00	116.1	-	.02	-
1702:30	127:00	117.9	-	.03	-
Date: 12-06-78					
0740:00	-	121.1	-	.03	-
0805:00	-	121.5	-	.03	-
0825:00	-	121.8	-	.03	-
0830:00	-	0.0	-	.03	Pressure tranducer adjustment 121.8-0.0.

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Slug Test I

Starting date: 12-06-78
Hole depth: 529 feet
Cased interval: 0-476 feet
Tested interval: 476-529 feet
Packer type: Lynes PIP

Diameter of tested interval: 4.75 inches
Inside diameter (ID) of tubing: 2.0 inches
Geologic unit tested: Culebra Dolomite Member of the Rustler Formation
Diameter: 4.5 inches

Packer set at 468.4 feet below land surface.
Measuring point (MP) was transducer tubing below the packer, which was 472.0 feet below land surface.
Static water level was 348.2 feet below land surface.

REMARKS:

$$H/H_o = \frac{h' - h_l}{h_o - h_l}$$

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-06-78					
0825	121.8	-	-	0	Pretest.
0844:20	-	0	-	0.01	-
-	-	5	-	.01	-
-	-	10	-	.01	-
-	-	15	-	.01	-
-	477.0	20	1.000	.01	*
-	476.2	25	.998	.01	-
-	475.6	30	.996	.01	-
-	474.6	35	.993	.01	-
-	474.0	40	.992	.01	-
-	476.9	45	1.000	.01	-
-	472.4	50	.987	.01	-
-	471.3	55	.984	.01	-
-	470.9	60	.983	.01	-
-	469.4	70	.979	.01	-
-	468.1	80	.975	.01	-
-	466.7	90	.971	.01	-
-	465.2	100	.967	.01	-
-	462.6	120	.959	.01	-
-	458.8	150	.949	.01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Slug Test I - Continued

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-06-78					
-	455.1	180	0.938	0.01	-
-	451.7	210	.929	.01	-
-	447.9	240	.918	.01	-
-	441.4	300	.900	.01	-
-	434.7	360	.881	-	-
0851:20	428.5	420	.863	.01	-
-	422.3	480	.846	-	-
-	410.5	600	.813	-	-
-	399.5	720	.782	-	-
-	394.3	780	.767	-	-
-	384.3	900	.739	-	-
-	374.8	1020	.712	-	-
-	361.4	1200	.675	0	-
-	341.4	1500	.618	0	-
-	323.4	1800	.568	0	-
-	307.1	2100	.522	0	-
-	292.2	2400	.480	0	-
-	279.0	2700	.443	0	-
-	267.0	3000	.409	0	-
-	245.5	3600	.348	0.01	-
-	236.1	3900	.322	.01	-
-	226.9	4230	.296	0	-
-	220.0	4500	.276	0	-
-	211.6	4860	.253	-0.01	-
-	206.5	5100	.238	- .01	-
-	200.5	5400	.222	- .01	-
-	190.1	6000	.192	- .02	-
-	179.9	6690	.164	- .03	-
-	173.6	7200	.146	- .03	-
-	167.2	7800	.128	- .03	-
-	161.7	8400	.112	- .04	-
-	157.0	9000	.099	- .04	-
-	153.0	9600	.088	- .05	-
-	149.5	10200	.078	- .05	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Slug Test 1 - Concluded

Clock time	Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-06-78					
-	146.6	10800	0.070	-0.05	-
-	139.9	12600	.051	- .08	-
-	135.6	14400	.039	- .09	-
-	132.6	16200	.030	- .11	End of test

* $$H/H_o = \frac{h' - 121.8}{477.0 - 121.8}$$

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Swabbing Test 1

Starting date: 12-06-78
Hole depth: 529 feet
Cased interval: 0-476 feet
Tested interval: 476-529 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Culebra Dolomite Member of the Rustler Formation

Measuring point (MP) for the recovery from swabbing was the pressure transducer tubing below the packer, which was 472.0 feet below land surface.
Static water level was 348.2 feet below land surface.

Tubing set at 468.4 feet below land surface.
Swabbing from 467 feet below land surface.

A circular stock tank was used to hold the water that was removed during bailing.
Diameter of the stock tank: 7 feet.

Clock time	Swab number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)	Change in barometric pressure (in. of mercury referenced to 0)	Remarks
Date: 12-06-78							
1425	1	0.05	14.4	-	-	-	-
1430	2	.10	28.8	-	-	-	-
1434	3	.15	43.2	-	-	-	-
1434:10	4	.15	43.2	-	-	-	End swabbing no fluid present.
1440:10	-	-	-	-	0:00	-	-
-	-	-	-	1.8	:15	-	-
-	-	-	-	2.0	:20	-	-
-	-	-	-	2.2	:25	-	-
-	-	-	-	2.6	:30	-	-
-	-	-	-	3.6	:35	-	-
-	-	-	-	4.4	:40	-	-
-	-	-	-	5.5	:45	0	-
-	-	-	-	6.2	:50	0	-
-	-	-	-	7.1	:55	0	-
-	-	-	-	8.2	1:00	0	-
-	-	-	-	9.8	1:05	0	-
-	-	-	-	10.4	1:10	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Swabbing Test 1 - Concluded

Clock time	Swab number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)	Change in barometric pressure (in. of mercury referenced to 0)	Remarks
Date: 12-06-78							
-	-	-	-	11.6	1:15	0	-
-	-	-	-	12.4	1:20	0	-
-	-	-	-	13.2	1:25	0	-
-	-	-	-	14.4	1:30	0	-
-	-	-	-	14.8	1:35	0	-
-	-	-	-	15.7	1:40	0	-
-	-	-	-	16.2	1:45	0	-
1442	-	-	-	16.7	1:50	0	-
-	-	-	-	16.9	1:55	0	-
-	-	-	-	17.4	2:00	0	-
-	-	-	-	41.4	2:20	0	-
-	-	-	-	41.8	2:30	0	-
-	-	-	-	42.4	2:40	0	-
-	-	-	-	43.4	3:00	0	-
-	-	-	-	44.0	3:15	0	-
-	-	-	-	44.7	3:30	0	-
-	-	-	-	45.4	3:50	0	-
-	-	-	-	45.6	3:55	0	-
-	-	-	-	45.9	4:00	0	-
-	-	-	-	46.2	4:10	0	-
-	-	-	-	46.6	4:20	0	-
-	-	-	-	46.8	4:30	0	-
-	-	-	-	47.0	4:40	0	-
-	-	-	-	47.2	4:45	0	-
-	-	-	-	47.3	4:50	0	-
-	-	-	-	47.6	5:00	0	-
-	-	-	-	47.9	5:15	0	-
-	-	-	-	48.1	5:20	0	-
-	-	-	-	48.3	5:30	0	-
-	-	-	-	49.0	6:00	0	-
-	-	-	-	49.6	6:30	0	-
-	-	-	-	50.5	7:00	0	-
-	-	-	-	51.2	7:30	0	-
-	-	-	-	52.0	8:00	0	-
-	-	-	-	53.5	9:00	0	-
-	-	-	-	54.8	10:00	0	-
-	-	-	-	57.4	12:00	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Shut-In Test 2

Starting date: 12-06-78
Shut in after: Swabbing
Hole depth: 529 feet
Packer type: Lynes PIP
Diameter: 4.5 inches

Diameter of tested interval: 4.75 inches
Geologic unit tested: Culebra Dolomite Member of the Rustler Formation
Cased interval: 0-476 feet
Tested interval: 476-529 feet

Packer set at 468.4 feet below land surface.
Measuring point (MP) was transducer tubing below the packer, which was 472.0 feet below land surface.
Static water level was 348.2 feet below land surface as measured on 12-03-78.

REMARKS: t = time since swabbing began (minutes)
t' = time since shut in (minutes)

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-06-78					
1456	0:00	-	-	0	Standing valve appeared to be set, but was not.
-	:05	82.7	-	0	-
-	:10	85.1	-	0	-
-	:15	87.1	-	0	-
1456:35	:00	119.8	-	0	Standing valve set [Restart].
-	:10	115.4	-	0	-
-	:20	82.9	-	0	-
-	:25	112.0	-	0	-
-	:35	111.1	-	0	-
-	:40	110.7	-	0	-
-	:45	110.4	-	0	-
-	:55	110.2	-	0	-
-	1:10	110.1	28.1	0	Pressure readings settled and recovery trend began.
1458	1:25	110.2	23.3	0	-
-	1:55	110.8	17.5	0	-
-	2:10	111.2	15.6	0	-
-	2:25	111.5	14.1	0	-
-	2:40	111.7	12.8	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Shut-In Test 2 - Concluded

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 12-06-78					
-	2:55	112.1	11.8	0	-
-	3:10	112.4	11.0	0	-
-	3:25	112.8	10.2	0	-
-	3:55	113.3	9.1	0	-
-	4.25	113.7	8.2	0	-
1502	5:25	114.6	6.83	0	-
-	6:25	115.3	5.92	0	-
-	7:25	116.0	5.26	0	-
-	9:25	117.2	4.35	0	-
-	14:25	119.1	3.19	-0.01	-
-	19.25	120.2	2.63	- .01	-
-	24:25	121.0	2.29	- .01	-
-	29:25	121.5	2.07	0	-
-	32:25	121.8	1.97	0	-
-	39.25	122.3	1.80	0.01	-
-	44:25	122.6	1.71	.01	-
-	59:25	123.1	1.53	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4B - Bailing Test 2

Starting date: 12-07-78
Hole depth: 529 feet
Cased interval: 0-476 feet
Tested interval: 476-529 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Culebra Dolomite Member of the Rustler Formation

Static water level was 348.2 feet below land surface.

Type of bailer: Dart valve
Length: 19.5 feet
Diameter: 3.5 inches
Capacity: 9.75 gallons

A circular stock tank was used to hold the water that was removed during bailing.
Diameter of the stock tank: 7 feet.

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Remarks
Date: 12-07-78				
-	-	0.02	5.8	Water in tank prior to testing.
1352:55	1	.05	14.4	-
1354:35	2	.07	20.2	-
1356:25	3	.11	31.7	-
1358:00	4	.14	40.3	-
1400:50	5	.18	51.8	-
1402:20	6	.20	57.5	-
1403:50	7	.23	66.2	-
1406:30	8	.27	77.7	-
1408:55	9	.30	86.4	-
1410:20	10	.33	95.0	-
1412:50	11	.37	106.5	-
1413:35	12	.40	115.2	-
1415:25	13	.44	126.6	-
1417:15	14	.48	138.2	-
1418:05	15	.52	149.7	-
1421:55	16	.55	158.3	-
1423:00	17	.59	169.9	-
1425:45	18	.59	169.9	Bail hole dry.

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Bailing Test 1

Starting date: 03-01-79
Hole depth: 661 feet
Cased interval: 0-609.5 feet
Tested interval: 610-661 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Rustler Formation-Salado Formation contact

Water levels were measured with a pressure transducer.
Measuring point (MP) for the recovery from bailing was the pressure transducer, which was 604 feet below land surface.
Static water level was unknown prior to this testing phase.

Type of bailer: Dart valve
Length: 19.5 feet
Diameter: 3.5 inches
Capacity: 9.75 gallons

A circular stock tank was used to hold the water that was removed during bailing.
Diameter of the stock tank: 7 feet.

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)
Date: 03-01-79					
0945	1	-	-	-	-
0947	2	-	-	-	-
0950	3	-	-	-	-
0953	4	-	-	-	-
0955	5	-	-	-	-
0957	6	-	-	-	-
0959	7	-	-	-	-
1001	8	-	-	-	-
1002	9	-	-	-	-
1004	10	-	-	-	-
1006:35	11	0.48	138.2	-	0
-	-	-	-	0	6:30
-	-	-	-	0	7:00
-	-	-	-	0	7:30
-	-	-	-	0	9:00
-	-	-	-	0.1	10:00
-	-	-	-	.3	15:00
-	-	-	-	.4	16:00
-	-	-	-	.4	17:00
-	-	-	-	.5	18:00

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Bailing Test 1 - Concluded

Clock time	Bailer number	Depth of water in tank (feet)	Total volume in tank (gallons)	Water pressure (feet of freshwater above MP)	Time since bailing stopped (minutes:seconds)
Date: 03-01-79					
-	-	-	-	0.5	19:00
-	-	-	-	.6	20:00
-	-	-	-	.7	25:00
-	-	-	-	1.8	80:00
-	-	-	-	1.9	90:00
-	-	-	-	2.0	101:00
-	-	-	-	2.1	128:00
-	-	-	-	2.2	150:00
-	-	-	-	2.3	180:00
-	-	-	-	2.3	210:00
-	-	-	-	2.4	240:00
1738	-	-	-	2.7	-
1808	-	-	-	2.7	-
1830	-	-	-	2.7	-
1930	-	-	-	2.8	-
Date: 03-02-79					
0730	-	-	-	3.6	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Shut-In Test 1

Starting date: 03-02-79
Hole depth: 661 feet
Cased interval: 0-609.5 feet

Tested interval: 610-661 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Rustler Formation - Salado Formation contact

Shut in after: Bailing

Type of packer: LYNES PIP with feed through
Diameter: 4.5 inches

Packer set at 604.4 feet below land surface.
Measuring point (MP) was transducer tube below packer, which was 607.8 feet below land surface.
Static water level was unknown prior to this testing phase.

Remarks: t = time since bailing began (minutes).
t' = time since shut in (minutes)

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-02-79					
1057	-	20.2	-	0	Pretest.
1129:10	00:00	-	-	-	Packer set with weight of fluid in tube alone.
-	:05	21.4	18531.0	0	-
-	:10	21.4	9266.0	0	-
-	:15	21.4	6177.7	0	-
-	:20	21.5	4633.5	0	-
-	:25	21.5	3707.0	0	-
-	:30	21.5	3089.3	0	-
-	:35	21.5	2648.1	0	-
-	:40	22.0	2317.2	0	-
-	:45	23.0	2059.9	0	-
-	:50	23.2	1854.0	0	-
-	:55	25.4	1685.5	0	-
-	01:00	27.6	1545.2	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Shut-In Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-02-79					
-	01:05	28.6	1426.4	0	-
-	01:10	29.4	1324.6	0	-
-	01:20	33.3	1159.1	0	-
-	01:30	35.2	1030.4	0	-
-	01:40	36.9	927.5	0	-
-	01:50	38.1	843.3	0	-
-	02:00	39.0	773.1	0	-
-	02:10	39.0	713.7	0	-
-	02:20	38.9	662.8	0	-
-	02:30	39.1	618.7	0	-
-	03:00	39.7	515.7	0	-
-	03:30	40.0	442.2	0	-
-	04:00	40.3	387.0	0	-
-	04:30	40.3	344.2	0	-
-	05:00	40.3	309.8	0	-
-	06:00	40.5	258.4	-0.01	-
-	07:00	40.6	221.6	- .01	-
-	08:00	40.6	194.0	- .01	-
-	09:00	43.5	172.6	- .01	Pressure up on packer.
-	10:00	43.6	155.4	- .01	-
-	11:00	43.7	141.4	- .01	-
-	12:00	43.9	129.7	- .01	-
-	13:00	44.0	119.8	- .01	-
-	14:00	44.1	111.3	0	-
-	15:00	44.2	103.9	0	-
-	16:00	44.3	97.5	0	-
-	17:00	44.4	91.8	0	-
-	18:00	44.5	86.8	- .01	-
-	19:00	44.6	82.3	- .01	-
-	20:00	44.7	78.2	- .01	-
-	22:00	45.0	71.2	- .01	-
-	25:00	45.3	62.8	0	-
-	30:00	45.9	52.5	0	-
-	35:00	46.5	45.1	0.01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Shut-in Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-02-79					
-	40:00	47.1	39.6	0.01	-
-	45:00	47.8	35.3	.02	-
-	50:00	48.5	31.9	.01	-
-	60:00	49.7	26.7	.02	-
-	70:00	51.0	23.1	.02	-
-	90:00	53.6	18.2	.01	-
-	100:00	55.0	16.4	0	-
-	110:00	56.2	15.0	- .02	-
-	121:00	57.6	13.8	- .02	-
-	136:00	59.7	12.4	- .03	-
-	150:00	61.4	11.3	- .02	-
1429:10	180:00	69.1	9.6	- .03	-
-	210:00	73.1	8.4	- .03	-
1529:10	240:00	76.7	7.4	- .03	-
1630	-	83.7	6.1	- .04	Following data were taken from the data logger and corrected for temperature variations and power fluctuations.
1701	-	86.9	5.7	- .03	-
1802	-	93.3	4.9	0	-
1903	-	99.1	4.4	0.04	-
2004	-	104.5	4.0	.07	-
2105	-	109.3	3.7	.12	-
2206	-	113.7	3.4	.15	-
2307	-	117.8	3.2	.15	-
Date: 03-03-79					
0008	-	121.4	3.0	.15	-
0109	-	124.9	2.88	.16	-
0210	-	128.1	2.75	.15	-
0311	-	131.1	2.64	.15	-
0513	-	136.4	2.45	.19	-
0614	-	138.8	2.37	.22	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Shut-in Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-03-79					
0715	-	141.1	2.30	0.27	-
0917	-	144.4	2.18	.33	-
1018	-	146.1	2.13	.31	-
1119	-	147.7	2.08	.32	-
1220	-	149.1	2.04	.31	-
1300	-	151.9	2.01	.25	-
1400	-	153.3	1.97	.26	-
1500	-	154.4	1.94	.21	-
1600	-	155.7	1.90	.18	-
1700	-	157.2	1.87	.19	-
1800	-	158.7	1.84	.20	-
1900	-	160.1	1.82	.24	-
2000	-	161.6	1.79	.28	-
2100	-	163.0	1.77	.31	Following data are direct pressure readings.
2200	-	164.2	1.75	.31	-
2300	-	165.4	1.72	.31	-
2400	-	166.3	1.70	.32	-
Date: 03-04-79					
0100	-	167.8	1.69	.39	-
0200	-	169.2	1.67	.43	-
0300	-	170.1	1.65	.44	-
0400	-	171.2	1.64	.47	-
0500	-	172.1	1.62	.51	-
0600	-	172.9	1.61	.53	-
0700	-	173.9	1.59	.55	-
0800	-	173.9	1.58	.56	-
0900	-	174.2	1.57	.54	-
1000	-	174.5	1.55	.50	-
1100	-	174.9	1.54	.45	-
1200	-	175.5	1.53	.43	-
1300	-	176.3	1.52	.40	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Shut-in Test 1 - Continued

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-04-79					
1400	-	177.0	1.51	0.38	-
1500	-	177.7	1.50	.35	-
1600	-	178.2	1.49	.33	-
1700	-	178.9	1.48	.32	-
1800	-	179.8	1.47	.34	-
1900	-	180.8	1.464	.40	-
2000	-	181.8	1.455	.44	-
2057	-	182.6	1.448	.50	-
2154	-	183.5	1.441	.53	-
2251	-	184.2	1.434	.55	-
2348	-	184.7	1.427	.55	-
Date: 03-05-79					
0045	-	185.3	1.420	.56	-
0142	-	185.8	1.414	.56	-
0239	-	186.1	1.407	.56	-
0336	-	186.7	1.401	.56	-
0433	-	187.4	1.396	.57	-
0530	-	187.9	1.390	.60	-
0627	-	187.7	1.384	.61	-
0800	-	187.4	1.376	.59	-
1400	-	190.3	1.345	.45	-
1500	-	189.8	1.341	.38	The following data were taken from the data logger and corrected for temperature variations and power fluctuations.
1600	-	190.2	1.336	.36	-
1700	-	190.7	1.332	.35	-
1800	-	191.3	1.328	.36	-
1900	-	192.1	1.324	.40	-
2000	-	192.5	1.320	.44	-
2100	-	193.3	1.316	.47	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Shut-in Test 1 - Concluded

Clock time	Stop watch time (minutes: seconds)	Water pressure (feet of freshwater above MP)	t/t'	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-05-79					
2200	-	194.0	1.312	0.49	-
2300	-	194.6	1.308	.51	-
2400	-	195.1	1.304	.52	-
Date: 03-06-79					
0100	-	195.7	1.301	.53	-
0200	-	196.2	1.298	.54	-
0300	-	196.7	1.294	.53	-
0730	-	197.0	1.280	.52	-
0800	-	196.7	1.278	.53	-
0900	-	196.8	1.275	.52	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1

Starting date: 03-06-79
Hole depth: 661 feet
Cased interval: 0-609.5 feet
Clock time: 9:44:29
Inside diameter of tubing: 2.0 inches
Type of packer: LYNES PIP
Diameter: 4.5 inches

Tested interval: 610-661 feet
Diameter of tested interval: 4.75 inches
Geologic unit tested: Rustler Formation-Salado Formation contact

Packer set at 604.4 feet below land surface.
Measuring point (MP) was transducer tubing below packer, which was 607.8 feet below land surface.
Static water level was unknown prior to this testing phase.

Remarks: $\frac{H}{H_o} = \frac{h' - h_i}{h_o - h_i}$

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-06-79				
197.0	0	-	0	Pretest reading.
418.2	1	-	0	-
543.7	2	-	0	-
897.8	3	-	0	-
866.6	4	-	0	-
645.7	5	-	0	-
657.9	6	-	0	-
779.2	7	-	0	-
775.8	8	-	0	-
719.0	9	-	0	-
714.1	10	-	0	-
745.2	12	-	0	-
731.8	14	-	0	-
735.4	16	-	0	-
735.9	18	-	0	-
734.2	20	-	0	-
735.7	22	-	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-06-79				
734.7	24	-	0	-
735.3	26	-	0	-
734.9	28	-	0	-
735.1	30	-	0	-
735.0	32	1.00	0	$\frac{H}{H_o} = \frac{h' - 197.0}{735.0 - 197.0}$
735.0	34	1.00	0	-
735.0	36	1.00	0	-
735.0	38	1.00	0	-
735.0	40	1.00	0	-
735.0	42	1.00	0	-
735.0	44	1.00	0	-
735.0	46	1.00	0	-
735.0	48	1.00	0	-
735.0	50	1.00	0	-
735.0	52	1.00	0	-
735.0	54	1.00	0	-
734.9	56	1.00	0	-
735.0	58	1.00	0	-
734.9	65	1.00	0	-
734.9	70	1.00	0	-
734.9	75	1.00	0	-
734.9	80	1.00	0	-
734.9	85	1.00	0	-
734.9	90	1.00	0	-
734.9	95	1.00	0	-
734.9	100	1.00	0	-
734.8	105	1.00	0	-
734.9	110	1.00	0	-
734.9	115	1.00	0	-
734.9	120	1.00	0	-
734.8	125	1.00	0	-
734.8	130	1.00	0	-
734.8	135	1.00	0	-
734.8	140	1.00	0	-
734.8	145	1.00	0	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-06-79				
734.9	150	1.000	0	-
734.8	155	1.000	0	-
734.8	160	1.000	0	-
734.8	165	1.000	0	-
734.8	170	1.000	0	-
734.7	175	0.999	0	-
734.8	180	1.000	0	-
734.7	190	0.999	0	-
734.7	200	.999	0	-
734.7	210	.999	0	-
734.7	220	.999	0	-
734.6	230	.999	0	-
734.6	240	.999	0	-
734.6	250	.999	0	-
734.6	260	.999	0	-
734.5	270	.999	0	-
734.5	280	.999	-0.01	-
734.5	290	.999	0	-
734.4	300	.999	- .01	-
734.4	310	.999	- .01	-
734.4	320	.999	- .01	-
734.4	330	.999	- .01	-
734.4	340	.999	- .01	-
734.4	350	.999	- .01	-
734.4	360	.999	- .01	-
734.3	370	.999	- .01	-
734.3	380	.999	- .01	-
734.3	390	.999	- .01	-
734.2	400	.999	- .01	-
734.3	410	.999	0	-
734.2	420	.999	- .01	-
734.2	430	.999	- .01	-
734.2	440	.999	- .01	-
734.1	450	.998	- .01	-
734.1	460	.998	- .01	-
734.1	470	.998	- .01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-06-79				
734.1	480	0.998	-0.01	-
734.1	490	.998	- .01	-
734.0	500	.998	0	-
734.1	510	.998	- .01	-
734.0	520	.998	- .01	-
734.0	530	.998	- .01	-
734.0	540	.998	- .01	-
733.9	550	.998	- .01	-
734.0	560	.998	- .01	-
733.9	570	.998	- .01	-
733.8	580	.998	- .01	-
733.9	590	.998	- .01	-
733.8	600	.998	- .01	-
733.7	660	.998	- .01	-
733.6	720	.997	- .01	-
733.5	780	.997	- .01	-
733.4	840	.997	- .01	-
733.3	900	.997	- .01	-
733.2	960	.997	- .01	-
733.2	1020	.997	- .01	-
733.1	1080	.996	- .01	-
733.0	1140	.996	- .01	-
732.9	1200	.996	- .01	-
732.8	1260	.996	- .01	-
732.7	1320	.996	- .01	-
732.6	1380	.996	- .01	-
732.5	1440	.995	- .01	-
732.5	1500	.995	- .01	-
732.3	1560	.995	- .01	-
732.3	1620	.995	- .01	-
732.2	1680	.995	- .01	-
732.1	1740	.995	- .01	-
732.1	1800	.995	- .01	-
731.9	1860	.994	- .01	-
731.9	1920	.994	- .01	-
731.7	1980	.994	- .01	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-06-79				
731.7	2040	0.994	-0.01	-
731.6	2100	.994	- .01	-
731.2	2400	.993	- .02	-
730.8	2700	.992	- .02	-
730.4	3000	.991	- .03	-
730.1	3300	.991	- .03	-
729.8	3600	.990	- .03	-
729.4	3900	.990	- .03	-
729.1	4200	.989	- .04	-
728.7	4500	.988	- .04	-
728.7	4800	.988	- .02	-
728.4	5100	.988	- .03	-
728.1	5400	.987	- .02	-
727.7	5700	.986	- .02	-
727.6	6000	.986	- .03	-
727.2	6300	.986	- .03	-
727.3	6600	.986	- .02	-
727.6	6900	.986	- .02	-
726.6	7200	.984	- .03	-
724.4	10200	.980	- .05	-
724.1	10800	.980	- .06	-
723.7	11400	.979	- .06	-
723.4	12000	.978	- .07	-
722.9	12600	.978	- .06	-
722.6	13200	.977	- .08	-
722.3	13800	.976	- .07	-
722.0	14400	.976	- .07	-
721.6	15000	.975	- .08	-
721.3	15600	.975	- .09	-
721.0	16200	.974	- .09	-
720.5	16800	.973	- .09	-
720.3	17400	.973	- .11	-
719.9	18000	.972	- .09	-
718.2	21600	.969	- .13	-
716.8	25200	.966	- .12	-
715.3	28800	.963	- .14	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-06-79				
714.4	32400	0.962	-0.11	-
713.5	36000	.960	- .06	-
712.5	39600	.958	- .03	-
711.2	43200	.956	0	-
710.0	46800	.954	.03	-
708.9	50400	.951	.04	-
707.5	54000	.949	.04	-
706.1	57600	.946	.04	-
704.8	61200	.944	.05	-
703.4	64800	.941	.06	-
702.0	68400	.939	.07	-
700.8	72000	.936	.08	-
698.2	75600	.932	.09	-
Date: 03-07-79				
694.4	79200	.925	.08	-
692.1	82140	.920	.05	-
689.9	85740	.916	0	-
688.1	89340	.913	- .04	-
686.6	92940	.910	- .10	-
685.1	96540	.907	- .17	-
692.1	82140	.918	- .04	The following data were taken from the data logger and corrected for temperature variations and power fluctuations.
689.9	85717	.915	- .07	-
687.3	89294	.911	- .04	-
685.8	92871	.909	- .10	-
684.3	96448	.906	- .14	-
683.1	100025	.904	- .18	-
682.0	103602	.901	- .22	-
681.0	107179	.900	- .23	-
679.8	110756	.897	- .29	-
679.3	114333	.896	- .29	-
679.0	117910	.896	- .27	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-07-79				
678.5	121487	0.895	-0.23	-
677.8	125064	.894	- .21	-
676.9	128642	.892	- .19	-
675.9	132219	.890	- .19	-
Date 03-08-79				
674.4	135796	.887	- .18	-
674.0	139373	.887	- .19	-
673.1	142950	.885	- .20	-
672.3	146527	.883	- .20	-
671.4	150104	.882	- .19	-
670.5	153681	.880	- .20	-
669.6	157258	.878	- .19	-
667.9	160835	.875	- .18	-
664.4	164412	.869	- .29	-
662.5	168012	.865	- .24	The following data are direct pressure readings.
659.9	171612	.860	- .33	-
659.0	175212	.859	- .36	-
658.0	178812	.857	- .36	-
657.1	182412	.855	- .43	-
656.9	-	.855	-	Pulled sinker bar between 1303 and 1315 and pumped water into tubing until manometer read 656.8.
614.3	-	.776	-	-
656.8	-	.855	- .45	Stable after pumping.
656.3	186012	.854	- .47	-
655.4	189651	.852	- .54	The following data were taken from data logger and were corrected for temperature variations and power fluctuations.
654.5	193290	.850	- .58	-
653.8	196929	.849	- .59	-
653.4	200568	.848	- .58	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date 03-08-79				
653.2	204207	0.847	-0.54	-
652.6	207846	.847	- .48	-
652.0	211485	.846	- .46	-
651.5	215124	.845	- .44	-
650.9	218763	.844	- .42	-
Date: 03-09-79				
650.2	222402	.842	- .41	-
646.4	236958	.835	- .29	The following data were taken from the data logger and were corrected for temperature variations and power fluctuations.
646.0	240597	.835	- .25	-
645.4	244236	.834	- .18	-
644.4	247875	.832	- .10	-
643.0	251514	.829	- .08	-
642.6	255114	.828	- .08	Pulled data logger for H-2C pressure build up experiment.
638.2	265914	.820	- .18	Data logger on H-2C from 0900-1200.
637.1	269514	.818	- .23	The following data were taken from the data logger and were corrected for temperature and power fluctuations.
636.3	273114	.817	- .26	-
635.5	276714	.815	- .29	-
635.3	280314	.815	- .26	-
634.9	283914	.814	- .22	-
634.6	287514	.813	- .19	-
634.3	291114	.813	- .16	-
633.8	294714	.812	- .13	-
633.2	298314	.811	- .10	-
632.5	301914	.810	- .07	-
631.8	305514	.808	- .06	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Continued

H-4C - Slug Test 1 - Continued

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date 03-10-79				
631.3	309114	0.807	-0.02	-
624.2	340314	.794	.13	-
624.1	341514	.794	.15	-
619.3	360414	.785	.11	-
617.1	363114	.781	.10	-
617.9	366714	.782	.10	-
617.6	370314	.782	.10	-
617.4	373914	.781	.12	-
617.1	377514	.781	.15	-
Date: 03-11-79				
604.6	427014	.758	.14	-
603.1	433314	.755	.10	-
602.0	441702	.753	- .01	-
Date: 03-12-79				
584.7	451314	.721	- .32	-
Date: 03-13-79				
573.1	516114	.699	- .19	-
570.7	540114	.695	- .29	-
Date: 03-14-79				
564.4	595926	.683	.18	-
562.7	603726	.680	.17	-
561.1	614226	.677	.09	-
560.0	620238	.675	.03	-

Table 5. Hydrologic-test data for wells H-4A, H-4B, and H-4C - Concluded

H-4C - Slug Test 1 - Concluded

Water pressure (feet of freshwater above MP)	Time (seconds)	H/H_o	Change in barometric pressure (inches of mercury referenced to 0)	Remarks
Date: 03-15-79				
552.3	682338	0.660	0.03	-
547.5	719598	.652	.03	-
Date: 03-16-79				
539.5	777138	.637	.03	-