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DEPARTMENT OF THE AIR FORCE

Construction, Completion, and Testing of Replacement Monitoring Wells MW 3–2, MW 6–2, MW 7–2, and MW 11–2, Mountain Home Air Force Base, Idaho, February Through April 2000

Open-File Report 00–515

U.S. Department of the Interior
U.S. Geological Survey

Construction, Completion, and Testing of Replacement Monitoring Wells MW 3–2, MW 6–2, MW 7–2, and MW 11–2, Mountain Home Air Force Base, Idaho, February Through April 2000

By D.J. Parliman

Open-File Report 00–515

Prepared in cooperation with
Department of the Air Force

Boise, Idaho
2001

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Charles G. Groat, Director

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Boise, ID 83702-4520
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Copies of this report can be purchased from:

U.S. Geological Survey
Information Services
Box 25286
Federal Center
Denver, CO 80225
e-mail: infoservices@usgs.gov

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FIGURES

TABLE

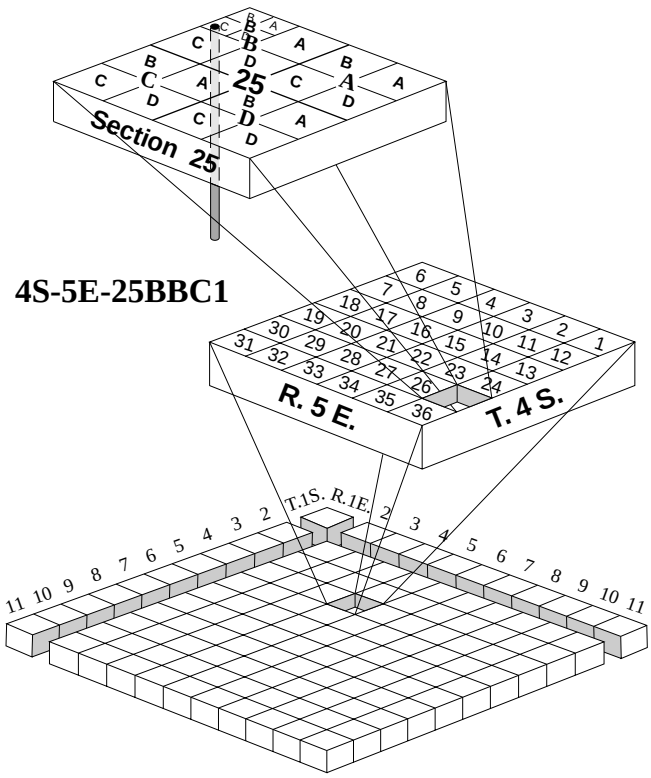
CONVERSION FACTORS AND OTHER ABBREVIATED UNITS

Multiply	By	To obtain
acre	4,047	square meter
foot (ft)	0.3048	meter
cubic foot per minute (ft^3/min)	0.02832	cubic meter per minute
gallon per minute (gal/min)	0.06309	liter per second
horsepower (hp)	746	watt
inch (in.)	25.4	millimeter
mile (mi)	1.609	kilometer
pound per square inch (lb/in^2)	6.895	kilopascal
square mile (mi^2)	2.590	square kilometer

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8)\,(°C)+32$$

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



WELL-NUMBERING SYSTEM

The well-numbering system used by the U.S. Geological Survey in Idaho indicates the location of wells within the official rectangular subdivisions of the public lands, with reference to the Boise base line and Meridian. The first segment of a well number indicates the township, the second the range, and the third the section in which the well is situated. The letters following the section number indicate the well location within the section: The first letter denotes the 160-acre tract; the second, the 40-acre tract; and the third, the 10-acre tract. The letters are assigned in a counterclockwise direction, beginning in the northeast quarter. The last numeral is a serial number assigned when the well is inventoried. Thus, well 4S-5E-25BBC1 is in the SW $^1/_4$ NW $^1/_4$ NW $^1/_4$ sec. 25, T. 4 S., R. 5 E., and was the first well inventoried in that tract.

Construction, Completion, and Testing of Replacement Monitoring Wells MW 3–2, MW 6–2, MW 7–2, and MW 11–2, Mountain Home Air Force Base, Idaho, February Through April 2000

By D.J. Parliman

Abstract

In February and March 2000, the U.S. Geological Survey Western Regional Research Drilling Operation constructed replacement monitoring wells MW 3–2, MW 6–2, MW 7–2, and MW 11–2 as part of a regional ground-water monitoring network for the Mountain Home Air Force Base, Elmore County, Idaho. Total well depths ranged from 435.5 to 456.5 feet, and initial depth-to-water measurements ranged from about 350 to 375 feet below land surface. After completion, wells were pumped and onsite measurements were made of water temperature, specific conductance, pH, and dissolved oxygen. At each well, natural gamma, spontaneous potential, resistivity, caliper, and temperature logs were obtained from instruments placed in open boreholes. A three-dimensional borehole flow analysis was completed for MW 3–2 and MW 11–2, and a video log was obtained for MW 11–2 to annotate lithology and note wet zones in the borehole above saturated rock.

USGS personnel and drilling at monitoring well 3–2, February 2000.

INTRODUCTION

Mountain Home Air Force Base (MHAFB) covers about 9 mi^2 in southwestern Elmore County, Idaho (fig. 1). Geology of MHAFB includes varying depths of soil and unconsolidated sediments overlying a thick sequence of fractured basalt flows with interbeds of cinders or sediments at irregular intervals (Young, 1977, p. 8). Depth to water in the regional ground-water system, sole source of public water supply for MHAFB, currently is about 350 to 375 ft below land surface, and ground-water movement generally is southwestward (Young and others, 1992, sheet 1). Seasonal change in water levels can exceed 10 ft per year in some wells; water levels are highest in about February and lowest in about October.

Water levels in the regional system have been declining for more than 30 years, and by 1999, levels

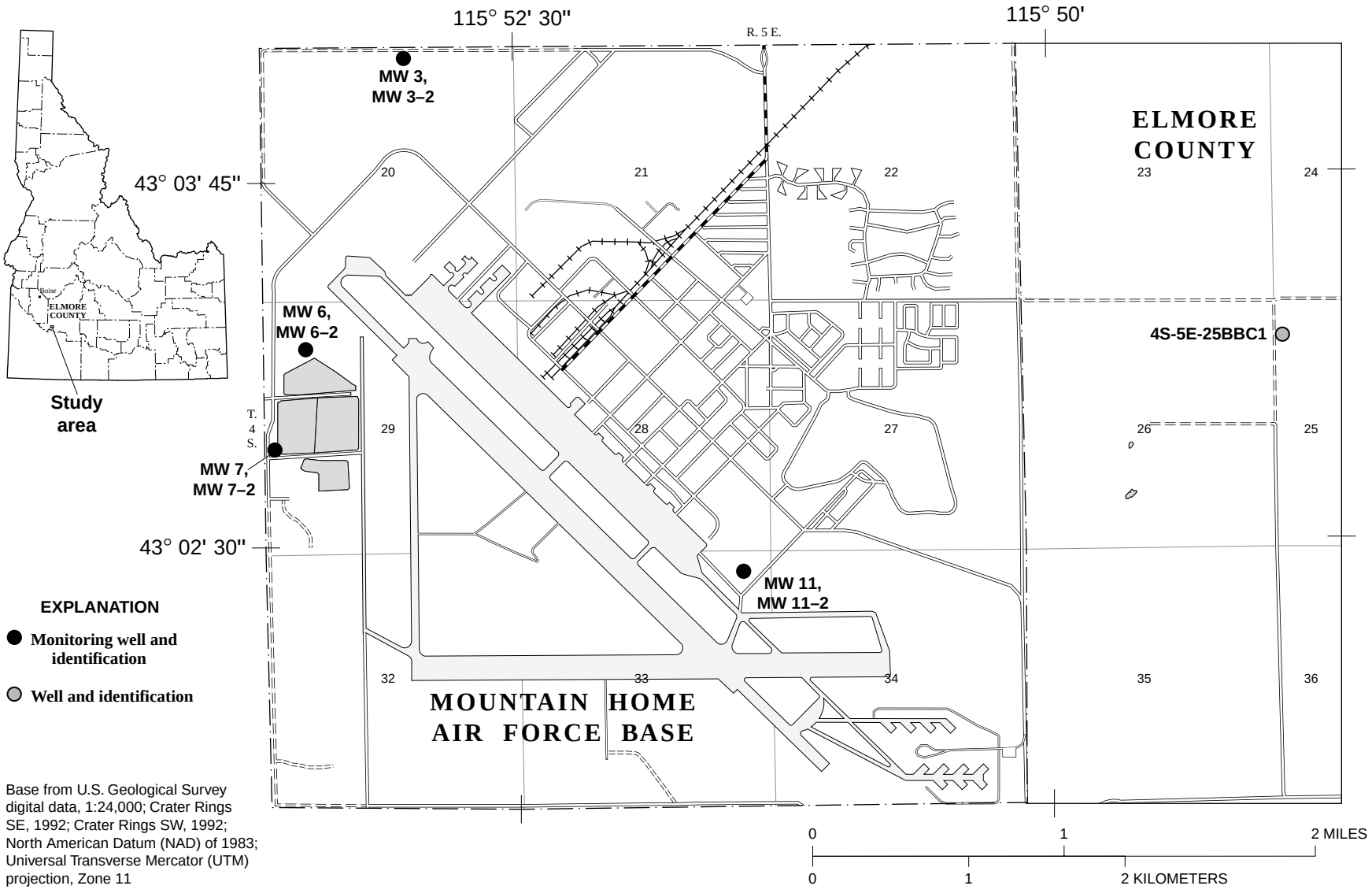


Figure 1. Locations of selected wells on and near the Mountain Home Air Force Base, Idaho.

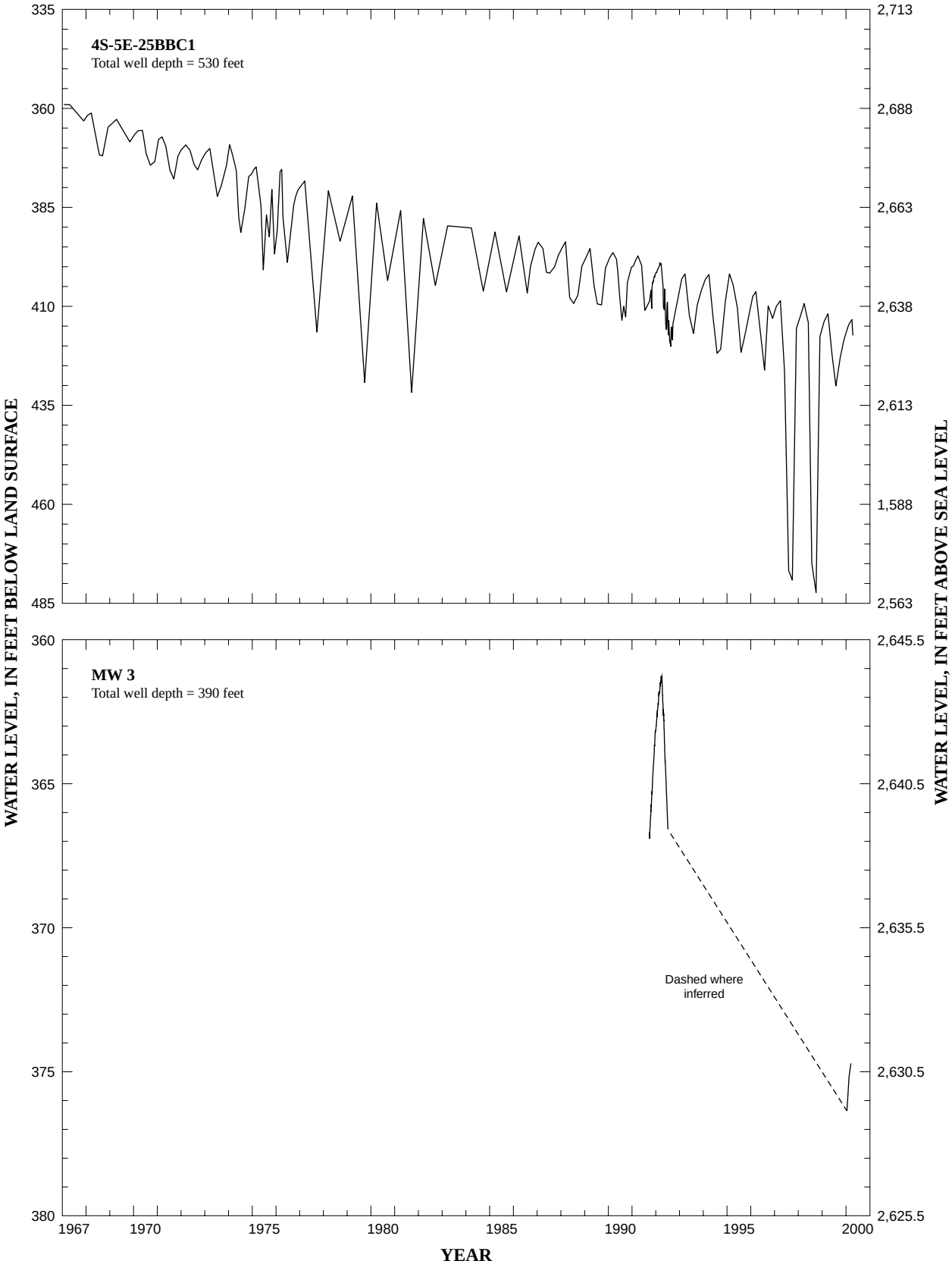


Figure 2. Hydrographs of water levels in wells 4S-5E-25BBC1 and MW 3, January 1967 to April 2000, at and near Mountain Home Air Force Base, Idaho.

in several wells at MHAFB, part of a regional groundwater monitoring network at the Base, were within a few feet of the total well depth (fig. 2). During February and March 2000, the U.S. Geological Survey (USGS) Western Regional Research Drilling Operation constructed replacement monitoring wells MW 3–2, MW 6–2, MW 7–2, and MW 11–2, located less than about 15 ft from older wells MW 3, MW 6, MW 7, and MW 11. This report summarizes the construction, completion, and testing of the four replacement wells.

LOCATION AND CONSTRUCTION OF MONITORING WELLS

Locations of the four replacement wells are shown in figure 1, and a summary of well location and construction data is presented in table 1. Order of construction was approximately from areas with potentially the least mineralized water to areas with increasingly mineralized water, based on historical water analyses from older MW 3, MW 6, MW 7, and MW 11 wells (J. Schleicher, Department of the Air Force, written commun., January 2000). An Ingersol-Rand TH75 drill rig, using high-pressure (350 lb/in^2) and large-volume (900 ft^3/min) compressed air, was used to construct boreholes for the wells. A high-pressure water sprayer was used to clean the drill rig before construction of the first well and after construction of each well.

From land surface to about 1 ft into the top of the basalt, a 14 $^1/_4$-in. button bit was used, followed by installation of 8-in. steel casing and filling of the annulus with cement grout. An 8-in. air-hammer bit completed construction of the borehole to total well depth. A foaming agent (Chemex F–603 Foamer—a nonhazardous, biodegradable anionic surfactant) was used sparingly in wells MW 3–2, MW 6–2, and MW 7–2 when the drill bit became stuck in the borehole because of poor cuttings circulation below large fractured-rock zones. After completion of these wells, air pressure was used to pump water from the boreholes and flush residual foam from the rock. No foam was used in construction of MW 11–2.

Cuttings samples from monitoring well 11–2, March 2000.

BOREHOLE CUTTINGS, WELL COMPLETION, AND ONSITE WATER ANALYSES

Samples of borehole cuttings were collected periodically as wells were being drilled. Cuttings samples were saved in zip-lock bags, and each bag was labeled with date and approximate borehole depth information. Samples later were air dried and stored at MHAFB Environmental Flight storage facilities.

Four-in. and 1-in. flush-threaded polyvinyl chloride (PVC) pipes were installed into each borehole for water-quality and water-level monitoring, respectively. In general, a cap and a 5-ft section of blank 4-in. PVC pipe (cap and 10-ft section of 1-in. pipe) were installed at the bottom of each borehole, positioned about 0.5 ft above the bottom of the borehole. Factory-slotted pipe (40 ft for 4-in. pipe and 20 ft for 1-in. pipe) was added, and blank pipe was used from the slotted pipe to about 1.5 ft above land surface. Water levels were measured, and tremie pipe was used to deliver washed gravel into the borehole around each PVC pipe. Gravel was added from the bottom of the borehole to about 300 ft below land surface. A bentonite slurry was added by tremie pipe to the borehole above the gravel, followed by bentonite chips to approximately land surface.

A 1-hp Grunfos submersible pump was installed in each well; the base of the pump was positioned immediately above the top of the perforated interval. A 1-in. flush-threaded pipe was attached to the pump for water delivery. Bronze faucet and pipe “T” fittings were used at the top of the well, and no parts of the 4-in. casing or water-delivery system were glued. Completion of each well site included test pumping (to check pump operation and develop the well), placement of four steel posts around the well, pouring of a

pad about 4-in. thick around the 8-in. casing and protective posts, and construction of a steel well cap with padlock security fittings. Idaho Department of Water Resources (IDWR) well tags were welded to the outside of the 8-in. well casing, and well drillers' reports of the location, construction, and lithology were filed with the Western Region office of IDWR in Boise, Idaho. Copies of the drillers' reports are included in appendix A (back of report).

A diagram of generalized well construction and completion is shown in figure 3. Specific details of total depth, depth to top of perforated pipe, depth to top of pump, and initial water levels are described in table 1.

On March 30, wells MW 3–2, MW 6–2, and MW 7–2 were pumped (at an approximate rate of 7 to 8 gal/min) until onsite measurements of water temperature, specific conductance, pH, and dissolved oxygen stabilized. Onsite water analyses from these three wells are shown in table 1. On April 5, personnel from Foothill Engineering Consultants, Inc. (Golden, Colorado), measured the water level and collected water samples from MW 11–2, and on April 28, USGS personnel measured the water level and collected water samples from the well. Water-level data and onsite water analyses from both dates are shown for this well in table 1.

POST-CONSTRUCTION TESTING

Before PVC casings were installed in the replacement wells, natural gamma, spontaneous potential (SP), resistivity (electrical), caliper, and temperature logs were made in each borehole. Natural gamma logs were used to record changes in natural gamma radiation emitted from different types of rock. The record of gamma radiation can be used as a method for determining stratigraphic correlation and permeability, which is a measure of the ease with which water moves through rock. Spontaneous potential and resistivity logs were used to record changes in naturally occurring electrical potentials at contacts between different types of saturated rock and electrical properties of the saturated borehole rock. Caliper logs, made with a 20-in. caliper tool, were used to make borehole diameter measurements from land surface to the bottom of the borehole. Large fluctuations in caliper measurements in boreholes at MHAFB wells generally occurred at interbeds of unconsolidated rock or fracture zones in the rock. Temperature logs were used to record changes in air and water in the borehole. In saturated rock, temperature logs can be used to identify flow from various ground-water zones. Logs for each well accompany the well driller's report in appendix A.

Flowmeter tests were performed at MW 3–2 and MW 11–2. A prototype borehole Acoustic Doppler Velocimeter (ADV) was used to make direct three-dimensional measurements of in situ borehole flow in both wells. Methodology, data collection procedures, and flowmeter results are summarized in an unpublished report (Newhouse and Hansen, 2000), and a copy of this report was provided to Environmental Flight personnel at MHAFB.

A down-hole camera was used in MW 11–2 to create a depth-annotated video log of lithology and to note wet zones in the borehole above saturated rock. A small amount of water was observed flowing from a fracture in rock at about 176 ft below land surface, but no other flowing water was observed in the borehole above saturated rock. A copy of the video log also was provided to Environmental Flight personnel at MHAFB.

No attempt was made as part of this well construction project to identify rock types or specific sources of natural gamma radiation from the cuttings; interpret rock structure, lithology, or hydraulic characteristics from natural gamma, spontaneous potential, resistivity, caliper, or video logs; or estimate thermal gradients and potential multiple ground-water flow units from temperature and ADV measurements. Samples, data, flowmeter report, and video are available for further investigations.

USGS personnel and down-hole camera equipment, monitoring well 11–2, March 2000.

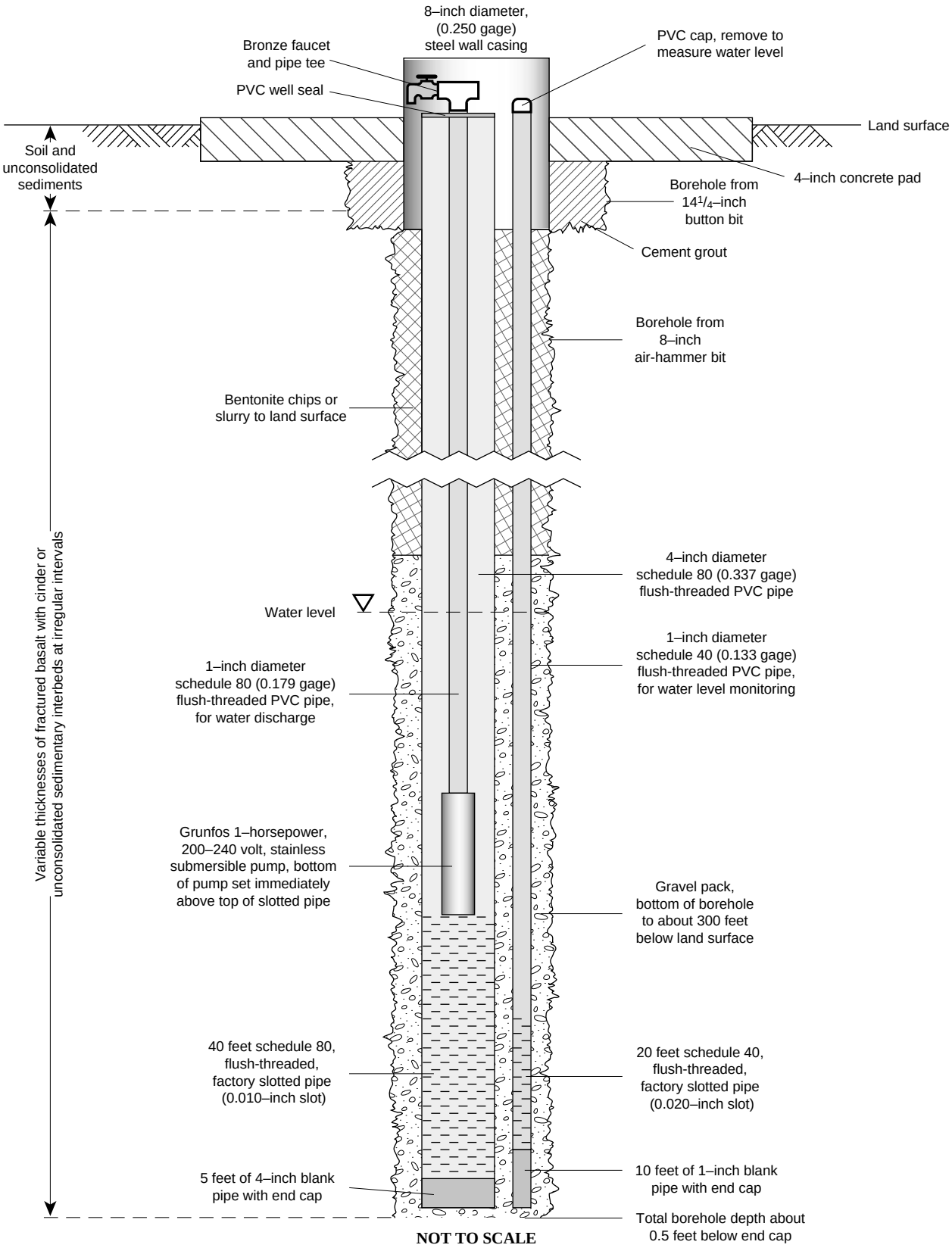


Figure 3. Diagram showing generalized monitoring well construction and description of lithology, Mountain Home Air Force Base, Idaho. (PVC, polyvinyl chloride)

Table 1. Selected location, construction, onsite water analyses, and post-construction test data for monitoring wells MW 3–2, MW 6–2, MW 7–2, and MW 11–2, Mountain Home Air Force Base, Idaho

[Latitude and longitude by Rockwell PLGR Global Positioning System, reported in decimal degrees and NAD27, North American Datum of 1927; altitude by level-line survey measurement to top of concrete pad at well casing and reported in feet above sea level; depth, in feet below land surface; *, water level and onsite water analyses by Foothill Engineering Consultants, Inc.; °C, degrees Celsius; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter, equivalent to parts per million; X, log completed; —, not tested]

Well data	MW 3–2	MW 6–2	MW 7–2	MW 11–2	
Location					
Township, range, and $^1/_4$-$^1/_4$-$^1/_4$-$^1/_4$ section	4S-5E-20ABBA2	4S-5E-29BBDC2	4S-5E-29CBBC2	4S-5E-33AAAC2	
Latitude	43.0702629	43.0531578	43.0472870	43.0397682	
Longitude	115.883446	115.891045	115.894516	115.857605	
Altitude (±0.5 foot)	3,005.5	2,980.7	2,981.2	2,992.0	
Well construction					
Start date	2/23/2000	2/8/2000	2/18/2000	3/3/2000	
End date	3/10/2000	3/10/2000	3/10/2000	3/10/2000	
Total borehole depth	455	436	447	457	
Total well depth	454.5	435.5	446.5	456.5	
Depth to top of perforated pipe	409.5	395.5	401.5	411.5	
Depth to top of pump	405	390	395	400	
Date of water-level measurement	3/30/2000	3/30/2000	3/30/2000	4/5/2000*	4/27/2000
Depth to water	374.62	350.07	351.73	361.30*	362.60
Water quality					
Date of water sample	3/30/2000	3/30/2000	3/30/2000	4/5/2000*	4/28/2000
Water temperature (°C)	20.2	20.0	18.5	19.4*	20.0
Specific conductance (µS/cm at 25°C)	167	178	538	1,040*	1,060
pH	8.20	8.35	7.97	7.64*	7.93
Dissolved oxygen (mg/L)	6.9	8.8	6.4	8.6*	8.1
Post-construction tests					
Natural gamma, spontaneous potential, resistivity, caliper, and temperature logs	X	X	X	X	
Three-dimensional borehole flow analysis	X	—	—	X	
Video log	—	—	—	X	

SELECTED REFERENCES

Lewis, R.E., and Stone, M.A.J., 1988, Geohydrologic data from a 4,403-foot geothermal test hole, Mountain Home Air Force Base, Elmore County, Idaho: U.S. Geological Survey Open-File Report 88–166, 30 p.

Newhouse, M.W., and Hanson, R.T., 2000, Three-dimensional flow measurements of ground water in uncased wells completed in volcanic basalts, Mountain Home Air Force Base, Idaho: U.S. Geological Survey, unpublished report, 18 p.

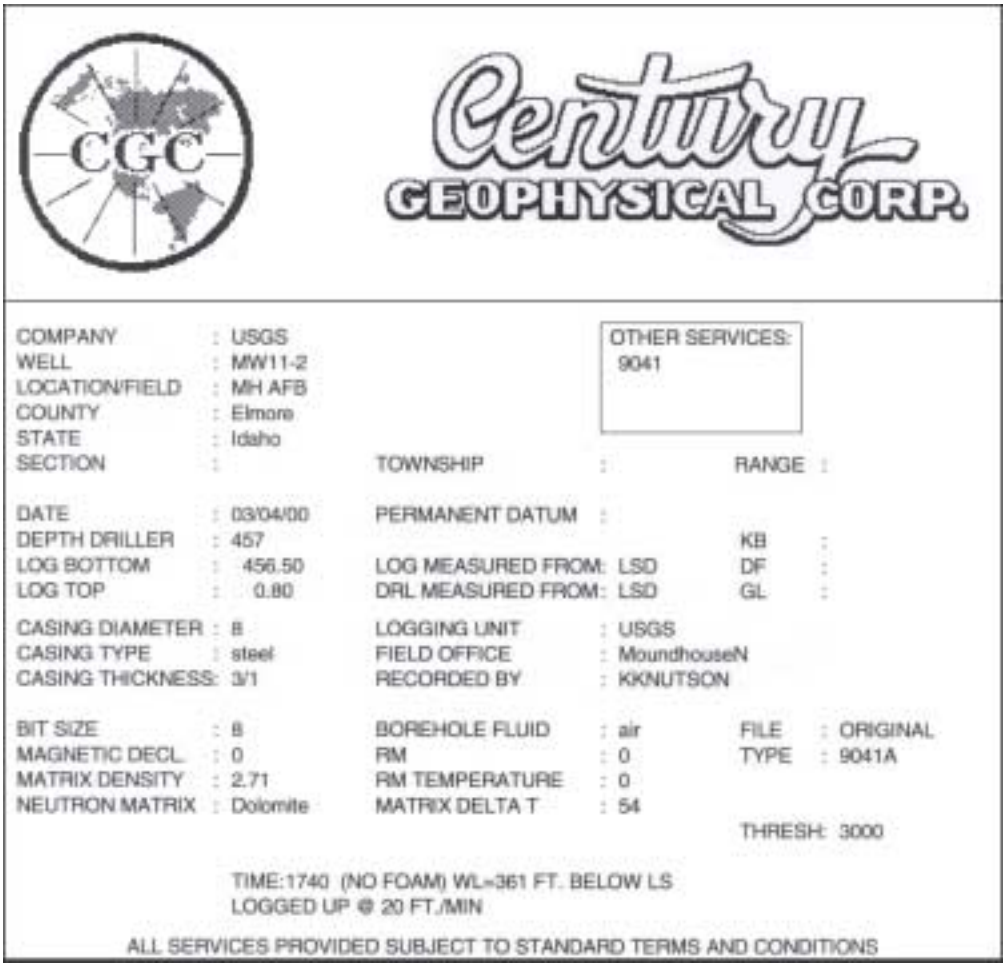
Norton, M.A., Ondrechen, W., and Baggs, J.L., 1982, Ground water investigation of the Mountain Home plateau, Idaho: Idaho Department of Water Resources Open-File Report, 62 p.

Ralston, D.R., and Chapman, S.L., 1968, Ground-water resources of the Mountain Home area, Elmore County, Idaho: Idaho Department of Reclamation, Water Information Bulletin 4, 63 p.

Young, H.W., 1977, Reconnaissance of ground-water resources in the Mountain Home plateau area, southwest Idaho: U.S. Geological Survey Water-Resources Investigations/Open-File Report 77–108, 40 p.

Young, H.W., Parliman, D.J., and Jones, M.L., 1992, Seasonal changes in ground-water quality and ground-water levels and directions of ground-water movement in southern Elmore County, southwestern Idaho, including Mountain Home Air Force Base, 1990–91: U.S. Geological Survey Water-Resources Investigations Report 92–4027, 2 pls.

Appendix A. Well drillers' reports and natural gamma, spontaneous potential, resistivity, caliper, and temperature logs for MW 3–2, MW 6–2, MW 7–2, and MW 11–2, Mountain Home Air Force Base, Idaho



Century GEOPHYSICAL CORP.

COMPANY	: USGS			OTHER SERVICES: 9041	
WELL	: MW11-2				
LOCATION/FIELD	: MH AFB				
COUNTY	: Elmore				
STATE	: Idaho				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 03/04/00	PERMANENT DATUM	:		
DEPTH DRILLER	: 457			KB	:
LOG BOTTOM	: 456.50	LOG MEASURED FROM:	LSD	DF	:
LOG TOP	: 0.80	DRL MEASURED FROM:	LSD	GL	:
CASING DIAMETER	: 8	LOGGING UNIT	: USGS		
CASING TYPE	: steel	FIELD OFFICE	: MoundhouseN		
CASING THICKNESS:	3/1	RECORDED BY	: KKNUTSON		
BIT SIZE	: 8	BOREHOLE FLUID	: air	FILE	: ORIGINAL
MAGNETIC DECL.	: 0	RM	: 0	TYPE	: 9041A
MATRIX DENSITY	: 2.71	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: Dolomite	MATRIX DELTA T	: 54		
				THRESH:	3000

TIME:1740 (NO FOAM) WL=361 FT. BELOW LS
LOGGED UP @ 20 FT./MIN

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Example of general information page for each log.

ABBREVIATIONS USED IN LOGS

CALIPER = 20-in. caliper tool
CPS = cycles per second
DEG F = degrees Fahrenheit
DEL TEMP = delta temperature (change in temperature)
FT = feet
GAM(NAT) = natural gamma
LS = land surface
LSD = land surface datum
MIN = minute
MV = millivolts
OHM-M = ohms per meter
RES(FL) = resistivity (fluid)
RES(16N) = resistivity (probes separated by 16 inches)
RES(64N) = resistivity (probes separated by 64 inches)
RM = remote
SP = spontaneous potential
TEMP = air/water temperature
WL = water level

Form 238-7
11/97

MW 3-2

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Inspected by _____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0012739
DRILLING PERMIT NO. ____-____-__-_____-_____
Other IDWR No. _____

2. OWNER:
Name Mountain Home Air Force Base
Address 366 CES/CEVQ, Bldg. 1297, 1100 Liberator St.
City Mountain Home State ID Zip 83648

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.

MW 3-2

lat/long by Rockwell PLGR(NAD27)

Twp. 04 North ☐ or South ☒
Rge. 05 East ☒ or West ☐
Sec. 20 , NW 1/4 (10 acres) NW 1/4 (40 acres) NE 1/4 (160 acres)
Gov't Lot ____ County Elmore
Lat: 43 : 04 : 13 Long: 115 : 53 : 00
Address of Well Site B Street Landfill
(Give at least name of road + Distance to Road or Landmark)
City Mountain Home Air Force Base
Lt. _____ Blk. _____ Sub. Name _____

4. USE:
☐ Domestic ☐ Municipal ☒ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)
☐ New Well ☐ Modify ☐ Abandonment ☒ Other replacemnt

6. DRILL METHOD
☐ Rotary ☐ Cable ☐ Mud Rotary ☒ Other Air Hammer

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
~~cement grout~~	0	18	25	poured
~~bent. chips~~	0	297	175	trommie pipe
~~gravel~~	297	455	100	trommie pipe

Was drive shoe used? ☐Y ☒N Shoe Depth(s) _____
Was drive shoe seal tested? ☐ Y ☐ N How? _____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
8	+1.5	18	.250	steel	☐X	☐	☐	☐
4	+1.5	454.5	.337 SH80	PVC	☒	☐	☐	☒
					☐	☐	☐	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS
Perforations Method _____
Screens Screen Type factory slotted

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
409.5	449.5	.010	440/ ft	4	PVC	☒	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
375 ft. below ground Artesian pressure ____ lb.
Depth flow encountered _____ ft. Describe access port or control devices: 1-inch PVC pipe

11. WELL TESTS:
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
7	0	375	1

Water Temp. 20.2°C (68°F) Bottom hole temp. _____
Water Quality test or comments: _____
Depth first Water Encounter _____

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
14	0	7	sand and soil		X
14	7	9	grey sand		
14	9	18	fractured basalt		
8	18	38	fractured basalt		
8	38	39	grey sand or cinders		
8	39	118	fractured basalt		
8	118	120	grey cinders		
8	120	138	fractured basalt		
8	138	140	grey cinders		
8	140	150	fractured basalt		
8	150	156	red cinders		
8	156	158	fractured basalt		
8	158	160	grey cinders		
8	160	198	fractured basalt		
8	198	200	grey cinders and basalt		
8	200	202	red cinders		
8	202	218	fractured basalt		
8	218	220	grey cinders		
8	220	455	lost circulation- no returns (large voids)	X	

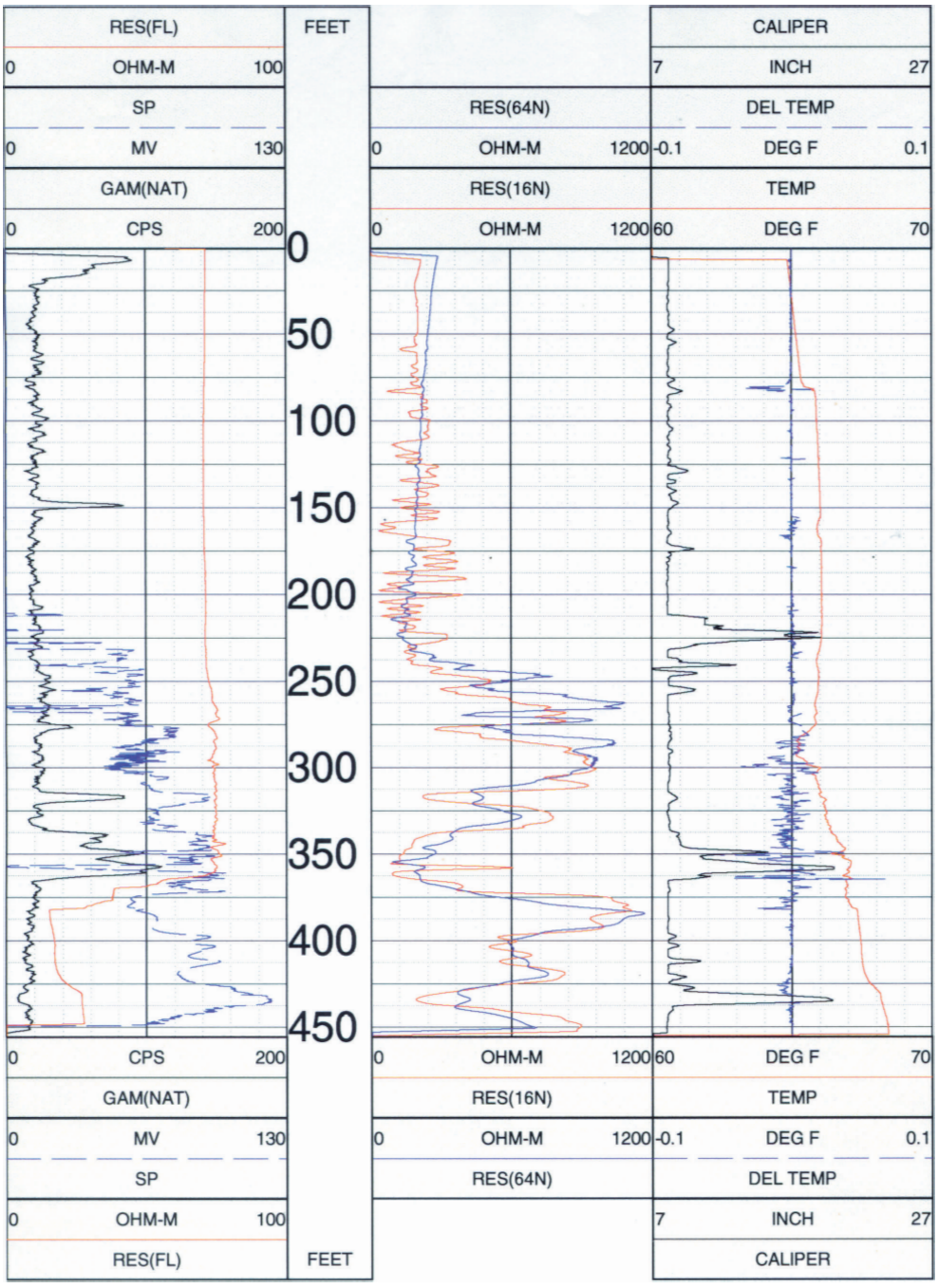
Completed Depth 454.5 (Measurable)
Date: Started 2-23-00 Completed 3-10-00

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

USGS Western Regional Research Drilling Operation
Company Name _____ Firm No. _____

Firm Official _____ Date _____
and
Driller or Operator _____ Date _____
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES


RES(FL)
0 OHM-M 100
SP
0 MV 130
GAM(NAT)
0 CPS 200
FEET
0
50
100
150
200
250
300
350
400
450
RES(64N)
0 OHM-M 1200
RES(16N)
0 OHM-M 1200
CALIPER
7 INCH 27
DEL TEMP
-0.1 DEG F 0.1
TEMP
60 DEG F 70
0 CPS 200
GAM(NAT)
0 MV 130
SP
0 OHM-M 100
RES(FL)
FEET
0 OHM-M 1200
RES(16N)
0 OHM-M 1200
RES(64N)
60 DEG F 70
TEMP
-0.1 DEG F 0.1
DEL TEMP
7 INCH 27
CALIPER

MW 3–2

Form 238-7
11/97

MW 6-2

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Inspected by _____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0012740
DRILLING PERMIT NO. ____-____-__-_____-_____
Other IDWR No. _____

2. OWNER:
Name Mountain Home Air Force Base
Address 366 CES/CEVQ, Bldg 1297, 1100 Liberator St.
City Mountain Home State ID Zip 83648

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.
MW6-2 N — lat/long by Rockwell PLGR(NAD27)

W E S

Twp. 04 North ☐ or South ☒
Rge. 05 East ☒ or West ☐
Sec. 29, SE 1/4 (10 acres) NW 1/4 (40 acres) NW 1/4 (160 acres)
Gov't Lot ____ County Elmore
Lat: 43 :03 11 Long: 115 :53 28
Address of Well Site near Water Treatment Plant
(Give at least name of road + Distance to Road or Landmark)
City Mountain Home Air Force Base
Lt. _____ Blk. _____ Sub. Name _____

4. USE:
☐ Domestic ☐ Municipal ☒ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)
☐ New Well ☐ Modify ☐ Abandonment ☒ Other replacemnt

6. DRILL METHOD
☐ Rotary ☐ Cable ☐ Mud Rotary ☒ Other ~~Air Hammer~~

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
~~cement grout~~	0	19.5	25	poured
~~bent. chips~~	~~18.5~~	~~295~~	175	tremmie pipe
~~gravel~~	~~295~~	~~436~~	~~100~~	~~tremmie pipe~~

Was drive shoe used? ☐Y ☒ N Shoe Depth(s) _____
Was drive shoe seal tested? ☐ Y ☐ N How? _____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
8	+1.5	18.5	.250	steel	☒	☐	☐	☐
~~4~~	~~+1.5~~	~~435.5~~	~~.317~~ SH80	PVC	☒	☐	☐	☒
					☐	☐	☐	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS
Perforations Method _____
Screens Screen Type factory slotted

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
95.5	435.5	.010	440	4	PVC	☒	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
350 ft. below ground Artesian pressure _____ lb.
Depth flow encountered _____ ft. Describe access port or control devices: 1-inch PVC pipe

11. WELL TESTS:
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
7	.85	351	2 1/4

Water Temp. 20C (68°F) Bottom hole temp. _____
Water Quality test or comments: _____
Depth first Water Encounter _____

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
14	0	14	soil and sand		X
~~14~~	~~14~~	~~18.5~~	~~fractured basalt~~		
~~8~~	~~18.5~~	~~40~~	~~fractured basalt~~		
~~8~~	~~40~~	~~42~~	~~basalt and red cinders~~		
~~8~~	~~42~~	~~54~~	~~fractured basalt~~		
~~8~~	~~54~~	~~56~~	~~grey cinders~~		
~~8~~	~~56~~	~~174~~	~~fractured basalt~~		
~~8~~	~~174~~	~~176~~	~~grey cinders~~		
~~8~~	~~176~~	~~194~~	~~fractured basalt~~		
~~8~~	~~194~~	~~196~~	~~fractured basalt and cinders~~		
~~8~~	~~196~~	~~284~~	~~fractured basalt~~		
~~8~~	~~284~~	~~285~~	~~red cinders~~		
~~8~~	~~285~~	~~314~~	~~fractured basalt~~		
~~8~~	~~314~~	~~316~~	~~brown sand and cinders~~		
~~8~~	~~316~~	~~396~~	~~lost circulation-no returns~~		
~~8~~	~~396~~	~~436~~	~~fractured basalt~~	X	

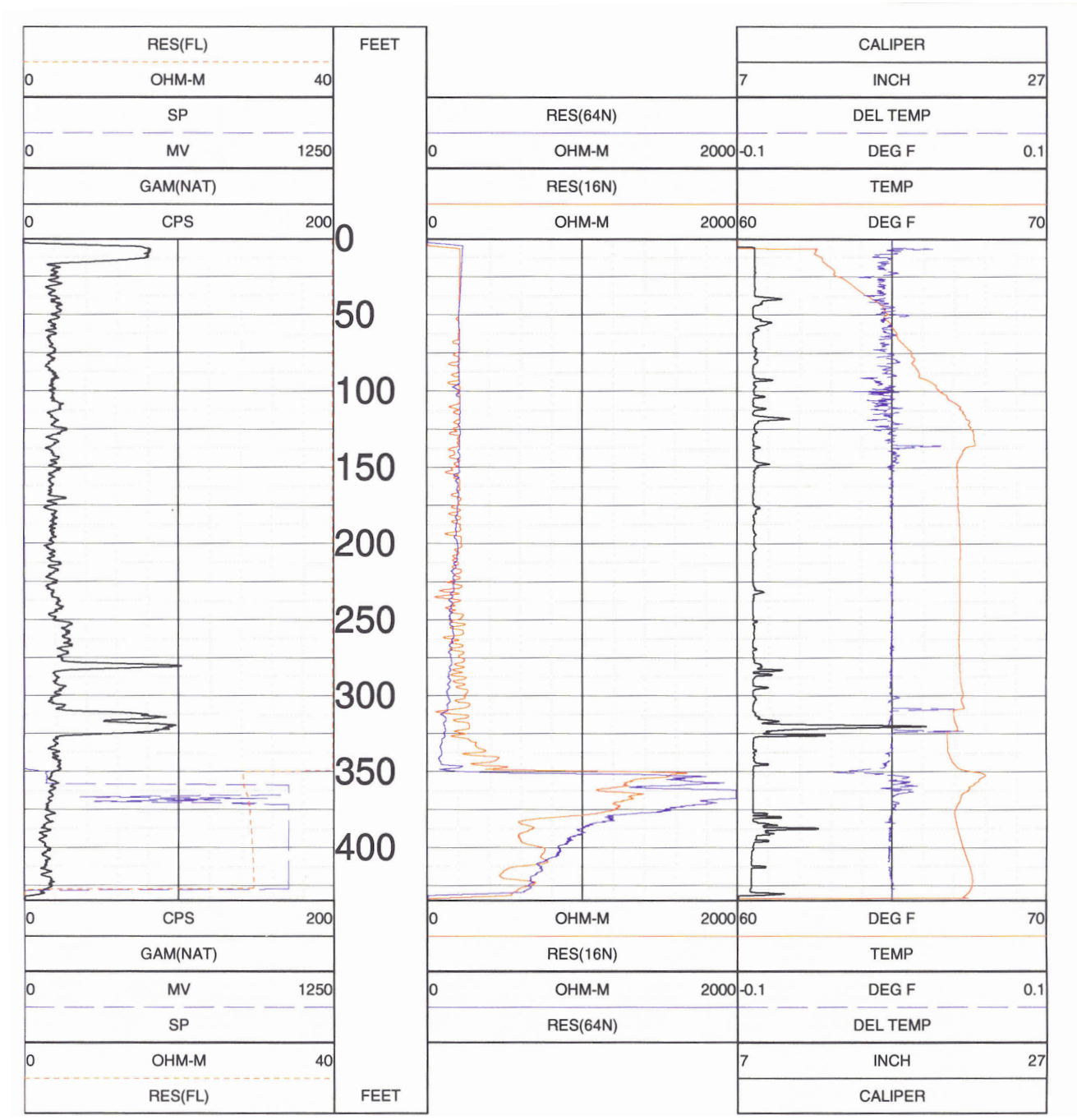
Completed Depth ~~435.5~~ (Measurable)
Date: Started 2-8-00 Completed 3-10-00

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

USGS Western Regional Research Drilling Operatio
Company Name _____ Firm No. _____

Firm Official _____ Date _____
and
Driller or Operator _____ Date _____
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES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300
350
400
RES(64N)
0 OHM-M 2000
RES(16N)
0 OHM-M 2000
CALIPER
7 INCH 27
DEL TEMP
-0.1 DEG F 0.1
TEMP
60 DEG F 70

MW 6–2

Form 238-7
11/97 MW 7-2

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Inspected by _____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0012741
DRILLING PERMIT NO. ____-____-__-_____-_____
Other IDWR No. _____

2. OWNER:
Name Mountain Home Air Force Base
Address 366CES/CEVQ, Blg.1297, 1100 Liberator St.
City Mountain Home State ID Zip 83648

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.

MW7-2

lat/long by Rockwell PLGR(NAD27)

Twp. 04 North ☐ or South ☒
Rge. 05 East ☒ or West ☐
Sec. 29, NW (10 acres) 1/4 NW (40 acres) 1/4 SW (160 acres) 1/4
Gov't Lot ____ County Elmore
Lat: 43 02 50 Long: 115 : 53 : 40
Address of Well Site corner of base perimeter and tower roads
(Give at least name of road + Distance to Road or Landmark)
City Mountain Home Air Force Base
Lt. _____ Blk. _____ Sub. Name _____

4. USE:
☐ Domestic ☐ Municipal ☒ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)
☐ New Well ☐ Modify ☐ Abandonment ☒ Other replacemnt

6. DRILL METHOD
☐ Air Rotary ☐ Cable ☐ Mud Rotary ☒ Other ~~Air Hammer~~

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
cement grout	0	28	25	poured
bent. chips	0	304	175	tremmie pipe
~~gravel~~	304	447	100	tremmie pipe

Was drive shoe used? ☐Y ☒ N Shoe Depth(s) _____
Was drive shoe seal tested? ☐ Y☐ N How? _____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
8	+2	28	.250	steel	☒	☐	☒	☐
4	+2	446.5	.337 SH80	PVC	☒	☐	☐	☒
					☐	☐	☐	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS
Perforations Method _____
Screens Screen Type factory slotted

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
401.5	441.5	.010	440 ~~ft~~	4	PVC	☒	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
352 ft. below ground Artesian pressure _____ lb.
Depth flow encountered _____ ft. Describe access port or control devices: 1-inch PVC pipe

11. WELL TESTS:
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
7	0	352	25 min.

Water Temp. 18.5°C (65°F) Bottom hole temp. _____
Water Quality test or comments: _____
Depth first Water Encounter _____

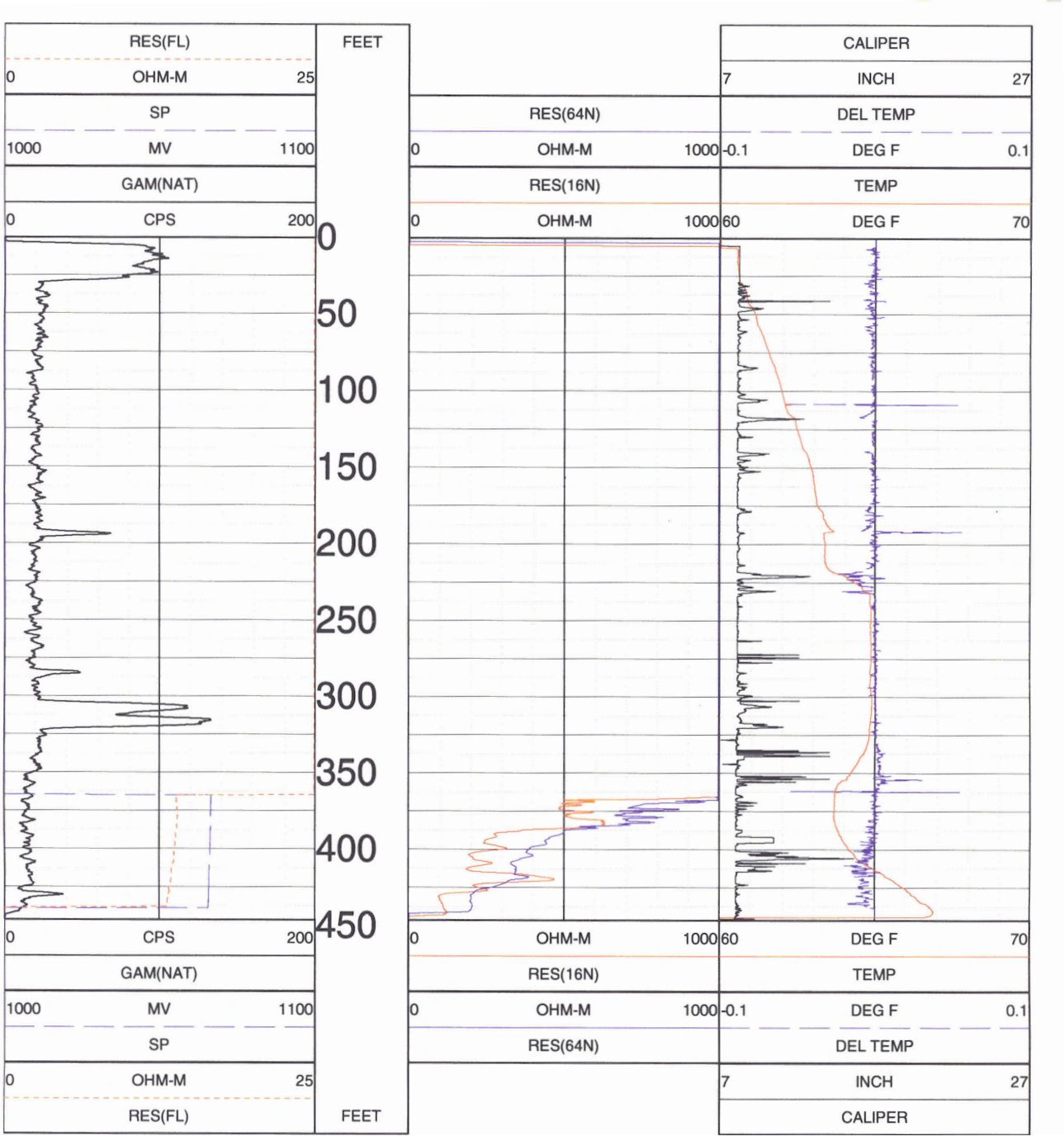
12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
14	0	27.5	sand		X
14	27.5	28	fractured basalt		
8	28	34	fractured basalt		
8	34	56	grey to red cinders		
8	56	114	fractured basalt		
8	114	116	grey cinders		
8	116	120	lost circulation-noreturns		
8	120	124	brown to grey basalt		
8	124	174	fractured basalt		
8	174	176	grey cinders		
8	176	194	fractured basalt		
8	194	216	brown sand or cinders		
8	216	234	fractured basalt		
8	234	236	grey cinders		
8	236	280	fractured basalt		
8	280	285	red cinders		
8	285	296	fractured basalt		
8	296	374	lost circulation-no returns	X	
8	374	447	fractured basalt	X	

Completed Depth 446.5 (Measurable)
Date: Started 2-18-00 Completed 3-10-00

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
USGS Western Regional Research Drilling Operatio
Company Name _____ Firm No. _____
Firm Official _____ Date _____
and
Driller or Operator _____ Date _____
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES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SP
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GAM(NAT)
0 CPS 200
FEET
0
50
100
150
200
250
300
350
400
450
RES(64N)
0 OHM-M 1000
RES(16N)
0 OHM-M 1000
CALIPER
7 INCH 27
DEL TEMP
-0.1 DEG F 0.1
TEMP
60 DEG F 70

MW 7–2

Form 238-7
11/97

MW 11-2

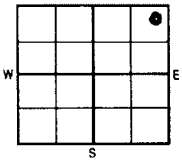
IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only
Inspected by _____
Twp ____ Rge ____ Sec ____
____ 1/4 ____ 1/4 ____ 1/4
Lat: : : Long: : :

1. WELL TAG NO. D 0012742
DRILLING PERMIT NO. ____-____-____-_____-_____
Other IDWR No. _____

2. OWNER:
Name Mountain Home Air Force Base
Address 366 CES/CEVQ,Bldg 1297,1100 Liberator St.
City Mountain Home State ID Zip 83648

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.



lat/long by Rockwell PLGR-NAD27

Twp. 04 North ☐ or South ☒
Rge. 05 East ☒ or West ☐
Sec. 29 . SE 1/4 NW 1/4 NW 1/4
Gov't Lot ____ County Elmore
Lat: 43 : 02 : 23 Long: 115 : 51 : 27
Address of Well Site Fire Training Area
City Mountain Home Air Force Base
(Give at least name of road + Distance to Road or Landmark)
Lt. _____ Blk. _____ Sub. Name _____

4. USE:
☐ Domestic ☐ Municipal XX Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)
☐ New Well ☐ Modify ☐ Abandonment XX Other replacemnt

6. DRILL METHOD
☒ Air Rotary ☐ Cable ☐ Mud Rotary XX Other Air Hammer

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
cement grout	0	28	25	poured
bent.chips	0	246	175	tremmie pipe
~~gravel~~	~~246~~	~~457~~	~~100~~	~~tremmie pipe~~

Was drive shoe used? ☐Y ☒ XX N Shoe Depth(s) _____
Was drive shoe seal tested? ☐ Y ☐ N How? _____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
~~8~~	~~+1.5~~	~~28~~	~~.250~~	~~steel~~	XX	☐	XX	☐
~~4~~	~~+1.5~~	~~456.5~~	~~.337~~ SH80	~~PVC~~	XX	☐	☐	XX

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS
Perforations Method _____
Screens Screen Type ~~factory slotted~~

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
~~411.5~~	~~451.5~~	~~.010~~	~~440/~~ ~~ft.~~	~~4~~	~~PVC~~	XX	☐
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
361 ft. below ground Artesian pressure _____ lb.
Depth flow encountered _____ ft. Describe access port or control devices: ~~1-inch PVC pipe~~

11. WELL TESTS:
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time

Water Temp. _____ Bottom hole temp. _____
Water Quality test or comments: _____
Depth first Water Encounter _____

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

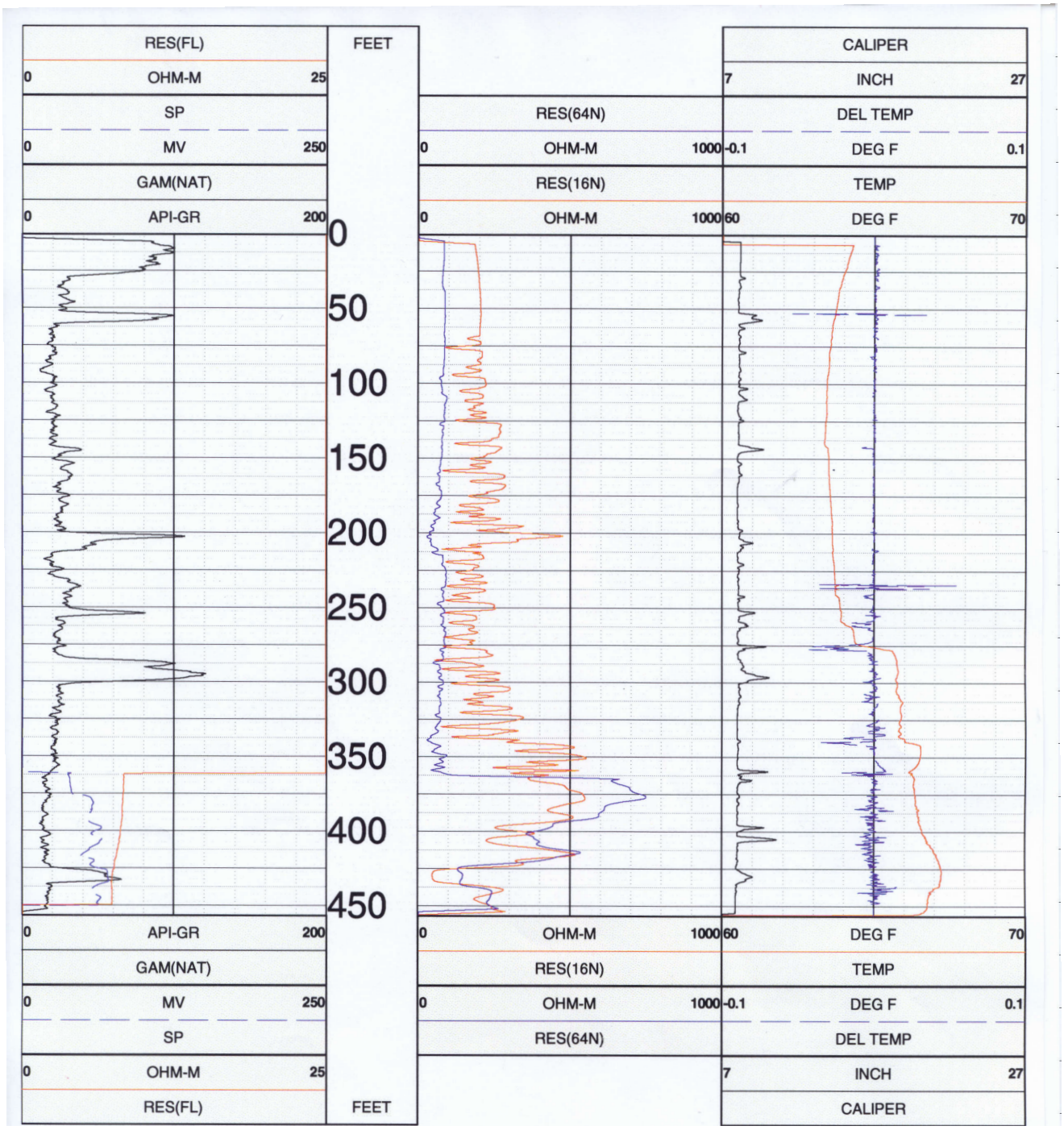
Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
14	0	27	soil and sand		X
14	27	28	fractured basalt		
8	28	54	fractured basalt		
8	54	56	brown sand		
~~8~~	~~56~~	~~74~~	~~fractured basalt~~		
8	74	76	grey cinders		
8	76	94	fractured basalt		
~~8~~	~~94~~	~~96~~	~~grey sand or cinders~~		
~~8~~	~~96~~	~~114~~	~~fractured basalt~~		
8	114	116	grey sand		
~~8~~	~~116~~	~~140~~	~~fractured basalt~~		
~~8~~	~~140~~	~~146~~	~~basalt and brown cinders~~		
8	146	174	fractured basalt		
8	174	176	grey basalt and cinders	X	
~~8~~	~~176~~	~~200~~	~~fractured basalt~~		X
8	200	206	red cinders		
8	206	214	fractured basalt		
~~8~~	~~214~~	~~216~~	~~grey cinders~~		
~~8~~	~~216~~	~~251~~	~~fractured basalt~~		
~~8~~	~~251~~	~~253~~	~~brown cinders~~		
~~8~~	~~253~~	~~282~~	~~fractured basalt~~		
~~8~~	~~282~~	~~285~~	~~brown cinders~~		
~~8~~	~~285~~	~~294~~	~~fractured basalt~~		
~~8~~	~~294~~	~~296~~	~~brown cinders~~		
~~8~~	~~296~~	~~416~~	~~fractured basalt~~	X	
~~8~~	~~416~~	~~424~~	~~basalt and gravel~~		
~~8~~	~~424~~	~~434~~	~~lost circulation no returns~~		
~~8~~	~~434~~	~~457~~	~~fractured basalt~~		

Completed Depth ~~456.5~~ (Measurable)
Date: Started ~~March 3, 2000~~ Completed ~~March 10, 2000~~

13. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
USGS Western Regional Research Drilling Operation
Company Name _____ Firm No. _____

Firm Official _____ Date _____
and
Driller or Operator _____ Date _____
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES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0 OHM-M 25
SP
0 MV 250
GAM(NAT)
0 API-GR 200
FEET
0
50
100
150
200
250
300
350
400
450
RES(64N)
0 OHM-M 1000
RES(16N)
0 OHM-M 1000
CALIPER
7 INCH 27
DEL TEMP
-0.1 DEG F 0.1
TEMP
60 DEG F 70
0 API-GR 200
GAM(NAT)
0 MV 250
SP
0 OHM-M 25
RES(FL)
FEET
0 OHM-M 1000
RES(16N)
0 OHM-M 1000
RES(64N)
60 DEG F 70
TEMP
-0.1 DEG F 0.1
DEL TEMP
7 INCH 27
CALIPER

MW 11–2

Parliman, D.J. / Construction, Completion, and Testing of Replacement Monitoring Wells, Mountain Home Air Force Base, Idaho, February Through April 2000 / OFR 00–515