



WATER-RIGHT DOCKET

Ozark National Scenic Riverways

Docket No: 7

BIG SPRING WELL.

Supporting Hydro Data

01-20-1971: letter to nps western service center from geological survey water resources division regarding reports of the wells drill



UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 340
Rolla, Missouri 65401

January 20, 1971

Mr. Don Barrett
U.S. Department of Interior
National Park Service
Western Service Center
450 Golden Gate Ave., Box 36035
San Francisco, California 94102

Dear Mr. Barrett:

Enclosed are reports of the wells drilled at Round Spring, Alley Spring and Big Spring. Each report consists of:

1. Location map of well with respect to the 50-year flood.
2. Description of the drilling and completion of the well.
3. Insoluble residue log by Missouri Geological Survey.
4. Driller's log.
5. Pump test data and drawdown curves.
6. Water analysis by Missouri Geological Survey.
7. Copy of strip chart from observation well at Round Spring only.

In addition we are furnishing a summary of the data obtained from the ~~six~~^{four} wells drilled to date and their relationships to the knobs area in the vicinity of Eminence and Two Rivers and to the specific capacity map of the southern part of Missouri taken from Mineral and Water Resources of Missouri.

Time spent on the well drilling activities at the three sites consisting of well location, drilling, pump testing and report writing is summarized below:

Walter Oakes	34 days well location, drilling & pump testing.
Gerald Feder	2 days pump testing.
Leo Emmett	4 days pump testing & data analysis.
E. J. Harvey	6 days, drilling, pump testing & report writing.

It has been a pleasure to work with you on the drilling activities. If you have any questions regarding these reports or the data gathered please do not hesitate to write us.

Sincerely,

A handwritten signature in dark ink, appearing to read "E. J. Harvey". The signature is written in a cursive style with a prominent initial "E".

E. J. Harvey
Assistant District Chief

Enclosures

BIG SPRING WELL

The Big Spring well was started Nov. 11, 1970 and the pump test was completed Dec. 17, 1970. The section was considerably more open from the surface to the total depth of 520 feet than the section at the Alley Spring site. The well started in the Eminence Dolomite and was finished in the lower part of the Potosi Dolomite. Numerous openings of 1 to 1 1/2 feet were encountered so that the original projected casing depth of 250 feet had to be revised to 370 feet. Crevices containing mud were encountered between 250 and 370 feet and it was believed that the water would be clear with casing set at 370 feet even though crevices occurred below that depth. The pump test corroborated this as the water cleared considerably during the step test and was very clear 6 hours after start of the long pump test.

The casing was grouted by the Halliburton method with 100 sacks of cement. Because of the numerous cavities cement did not circulate to the surface, but a seal around the lower part of the casing was formed. The cement set 72 hours, the pump test was run, 2 cubic yards of washed gravel were added outside the casing, and 150 additional sacks of cement were added on top of the gravel. This is normal procedure in cavernous limestone where cement may run into cavernous zones. The cement was added in three 50-sack batches allowing some time to set before adding more cement. The cement level after 50 sacks was found at 88 feet but dropped. After adding the two additional batches of 50 sacks each the cement level was found at 65 feet but dropped to 95 feet. It was decided that a cavity at 95 feet was taking cement and additional washed gravel should be added to fill most of the annular space remaining and cap this with 15 to 20 feet of cement to the surface.

The capacity and pump tests were started Dec. 16, 1970 and completed Dec. 17th. The data for the capacity test are summarized below:

Step	Duration of step, minutes	Total drawdown (feet)	Yield (gpm)	Specific capacity
1	0-16	.82	29	35
2	17-60	6.0	100	16.7
3	61-181	19.0	225	11.8
4	182-310	25.0	280	11.2

The pump was shut down at 310 minutes and the well recovered in 195 minutes. The long test was started at 6:30 p.m. on Dec. 16th and the well was pumped continuously for 840 minutes at a steady rate of 230 gpm causing a drawdown of approximately 20 feet. The specific capacity was 11 gpm per foot of drawdown. The water level totally recovered in about 2 hours.

An observation well 240 feet deep about 1,000 feet from the new well was equipped with a continuous recorder. No interference occurred in the well and apparently no appreciable hydraulic connection exists.

The yield of the new well was by far the best obtained of the six wells drilled to date.

Drillers' Log of Big Spring Well

<u>No Log to 30 feet</u>	<u>Depth (feet)</u>	
Lime, white, hard	30-45	
Lime, white, opening	45-46	
Lime, white, opening	64-65	
Lime, white	65-100	Wayne Clark, driller ↑ ↓
Lime, white, medium	100-105	
Lime, white, soft	105-108	
Lime, white, medium	108-140	
Lime, white, soft	140-143	
Lime, white, medium	143-147	
Mud & boulders, soft	147-150	
Lime, white, medium	150-160	
Lime & flint	160-193	
Mud & boulders, soft	193-195	
Lime & flint, light, hard	195-240	
Lime & chert, white & brown, hard	240-305	
Lime & chert, white & brown, hard	305-315	
Open	315-316	
Lime & flint, white & brown	316-334	
Open, mud	334-335 1/2	
Open, mud	353-354	
Open, mud	357-358 1/2	
Open, mud	361-363	
Open, mud	366-367	
Bad crack	380	
Lime & flint, white, hard	380-400	
Lime & flint, white, hard	400-415	
Good, hard	400-515	
Bad crack	515-517	
Total Depth	520 feet	

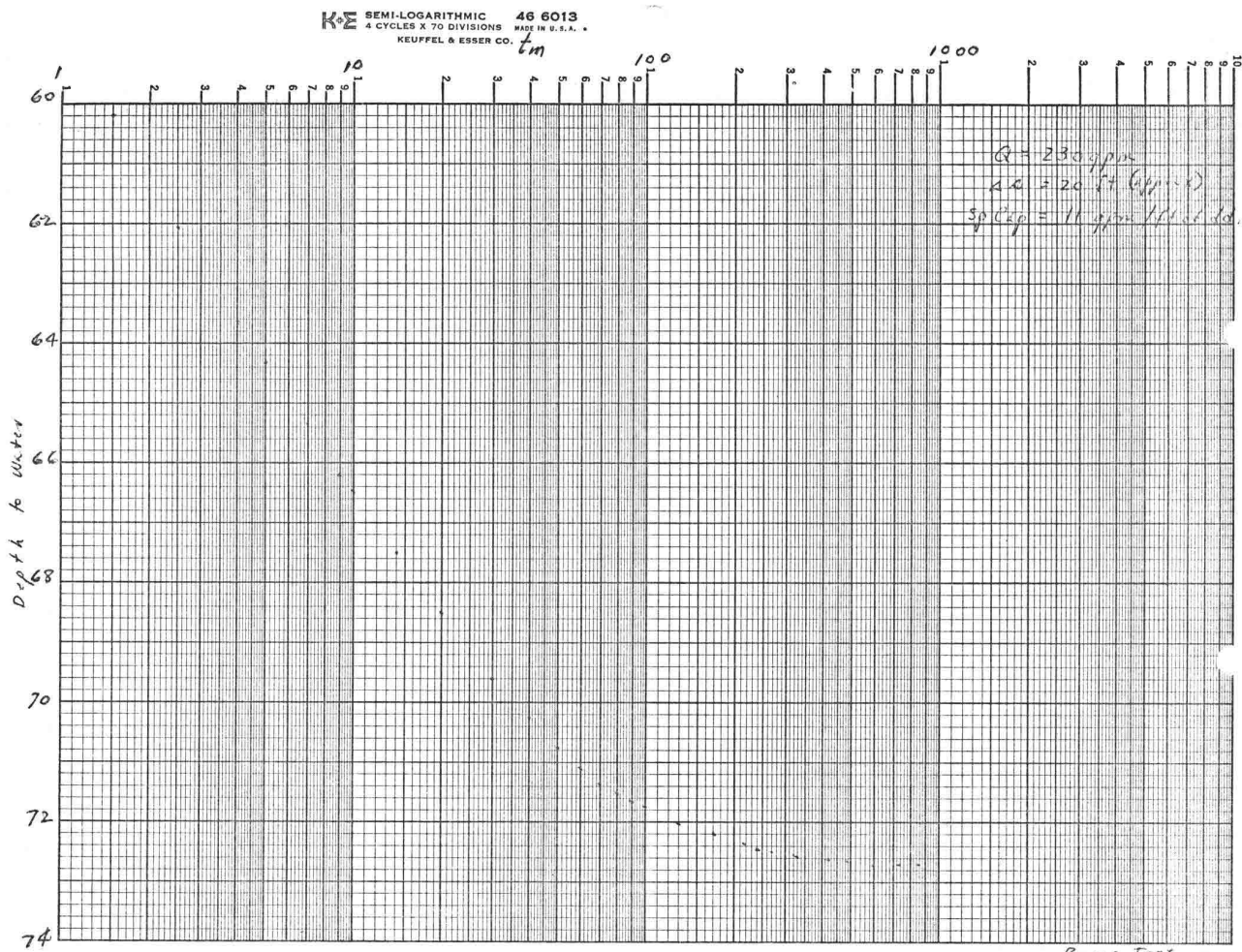
BIG SPRING WELL PUMP TEST					
Dec. 16-17, 1970					
Date	Hour	Time, minutes	Depth to water, feet	Yield	Remarks
12/16/70	0845		53.0	0	
	0915		52.95	0	
	0955		52.93	0	
		Pump on @ 10:00			
		3	54.7	36	
		5	55.0	29	
		8	54.51	29	
		10	54.51	29	
		16	53.82	29	Sp. Cap. 35 gpm/ft.
		17	Increased discharge		
		18	55.32	100	
		21	57.68	100	
		25	57.90	100	Cond. 490 @ 15°C
		35	58.50	100	
		52	59.05	100	Sp. Cap.=16.7 gpm/ft.
		60	59.05	100	Cond. 420 @ 15°C
		61	Increased discharge		
		62	61.85	220	
		70	67.72	225	Cond. 460 @ 15°C
		83	69.48	230	Cond. 480 @ 14.5°C
		90	70.00	230	
		100	70.50	220	
		110	70.95	225	
12/16/70	12:30	150	71.62	230	
		170	71.82		Cond. 490 @ 14.5°C
		180	71.92	225	Sp.Cap.=11.8 gpm/ft.
	13:02	192	Pump wide open		
	13:05	185	75.22	280	
		190	75.90		Cond. 500 @ 14.5°C
		240	77.32	280	
	14:40	280	77.62	280	Cond. 490 @ 14.5°C
	15:08	308	77.97		Sp.Cap.=11.2 gpm/ft.
		Pump off @ 15:10			
	15:12	2	64.70	0	
		10	58.90		
		30	55.49		
		45	54.60		
		60	54.09		
		185	52.60		
		195	52.72		
12/16/70	18:30	Pump on for long test @ 230 gpm.			
		1.5	60.20		
		4	63.65		
		10	66.49		
		20	68.50		
	19:00	30	69.59		Cond. 490 @ 14.5°C
		45	70.47		
		60	71.08		
		90	71.62		

Big Spring Well Pump Test--continued

Date	Hour	Time, minutes	Depth to water, feet	Yield	Remarks
		130	72.03	230	
		155	72.15		
		190	72.30		
		240	72.43		
		320	72.55		
12/17/70	0030	360	72.59	230	Cond 490 @ 14.5°C
		420	72.61		
		480	72.63		
		540	72.65		
		600	72.68		
		660	72.70		
		720	72.70	230	Cond. 490
		810	72.68		
		840	72.67		
	0838	Pump off - Recovery			
		2	63.45	0	
		4	61.16		
		6	59.77		
		8	58.85		
		10	58.16		
		16	56.82		
		20	56.24		
		30	55.22		
		35	54.95		
		42	54.57		
		50	54.28		
12/17/70	0938	60	53.92		
		90	53.28		
		110	53.02		
		352	53.02		
	1610	452	52.90		
12/18/70	0730		51.50		

END OF MEASUREMENTS

Big Spring Well - Step Test Dec. 16, 1970



Big Spring well Pump Test
Dec. 16, 1970

WELL DRILLER'S REPORT

NATIONAL PARK SERVICE - LWSSC

Permit No. _____

1 WELL OWNER PARK DZARK NSR
 Name National Park Service, WDC
 Address San Francisco, Calif Owners Well No. _____
 Local Site Name _____

2 LOCATION OF WELL STATE Missouri
 County Carter Ground Water Basin _____
 N/S _____ Ft., E/W _____ Ft. From _____ Corner
 of Sec. 6, T. 26 N/S, R. 1 E/W, SW 4 M
 Distance from cities, roads, railroads etc. 4 miles

3 TYPE OF WORK (check) New Well ☒
 Replacement Well ☐ Deepening ☐ Repair ☐
 Destroying ☐ If destroying, describe material &
 procedure _____

4 NATURE OF USE (check) Testwell ☒
 Domestic ☐ Industrial ☐ Municipal ☐
 Stockwater ☐ Irrigation ☐ Mining ☐
 Others ☐

5 DRILLING METHOD (check)
 Rotary ☐ Cable Tool ☒ Other ☐

6 BORE DIAMETER & DEPTHS
10 in. from 0 ft. to 370 ft.
6 " " 370 " " 520 "
 " " " " " " " "
 " " " " " " " "

7 CASING SCHEDULE None ☐
 Steel ☐ Welded ☐ Threaded ☒
 Other ☐ New ☒ Used ☐
6 in. I.D. from 0 ft. to 370 ft. Gage _____
 " " " " " " " "
 " " " " " " " "
 " " " " " " " "
 Casing extends above ground level 2 ft.

8 PERFORATIONS Perforated? Yes ☐ No ☒
 Type of perforator used _____
 Size of perforations _____ in. by _____ in.
 Perforation per row _____ Rows per ft. _____
 _____ perforations from _____ ft. to _____ ft.
 " " " " " " " "
 " " " " " " " "
 " " " " " " " "

9 SCREENS Well screen installed? Yes ☐ No ☒
 Mfr's name _____ Model No. _____
 Type _____
 Diam.(in.) Slot size(in.x in.) Placed from (ft.) To (ft.)
 _____ x _____ to _____
 _____ x _____ to _____
 _____ x _____ to _____

10 CONSTRUCTION Gravel Packed? Yes ☐ No ☒
 Washed gravel? Yes ☒ No ☐ Gravel Size _____ in.
 Gravel placed from 240 ft. To 290 ft.
 " " " " " " " "
 Surface seal provided? Yes ☒ No ☐ Casing Seal? Yes ☒ No ☐
 To what depth? 370 ft. Size or Diam. 10 inch
 Seal material neal cement
 Did any strata contain unpotable water? Yes ☐ No ☒
 Type of contam. _____ Strata depth _____
 Sealing method Pressure Grout - Halliburton method
 From 240 ft. To 290 ft.
 " " " " " " " "

11 WATER LEVELS (feet below ground surface)
 Depth water first found 51.6 ft. date 12/10/70
 Static water level 52.9 " " 12/16/70
 " " " " " " " "
 " " " " " " " "
 " " " " " " " "

12 FLOWING WELL (check) No control ☒
 Controlled by? Valve ☐ Cap ☐ Plug ☐
 Does well leak around casing? Yes ☐ No ☒
 Artesian pressure _____ ft. above ground surface,
 Artesian flow _____ g.p.m., date _____

13 WELL TESTS Dd - Drawdown is the distance in
 feet the water level is lowered be-
 Developed? Yes ☐ No ☒ low the static level
 Bailed _____ hrs., rate _____ gpm
 ✓ Pumped 5 " " 280 "
 Surged _____ hrs. method _____ rate _____
 Pump test? Yes ☒ No ☐ By whom? Clark & Clark
 Pump type Submersible H.P. 30 Outlet size 3"
 Depth pumped from 356 ft., date 12/14/70
 ✓ Yield 230 gpm w/ 19.95 ft. Dd., after 14 hrs
 " " " " " " " "
 " " " " " " " "
 " " " " " " " "
 Bailer test _____
 Recovery 19 ft. in 10 1:50 (Time)
 Electric log? Yes ☐ No ☒ Chemical analysis? Yes ☒ No ☐
 Water temp. 56 °F Quality Good

14 PUMP Installed? Yes ☐ No ☒
 Mfr's name _____ Cap. _____
 Type _____ H.P. _____ Model No. _____
 Outlet size _____ in. Driven by _____
 Depth to pump or bowels _____ ft. date _____

15 WELL DRILLER'S STATEMENT
 Date started 12/10/70 Date completed 12/17/70
 State log filed? Yes ☒ No ☐

This well was drilled under my supervision and this report is
 true to the best of my knowledge and belief.
 Co. Name CLARK & CLARK DRILLING CO.
 Name Clark
 Address P.O. Box 2, Kenton, Mo.
 License No. _____ Date 12/17/70

MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES

Box 250

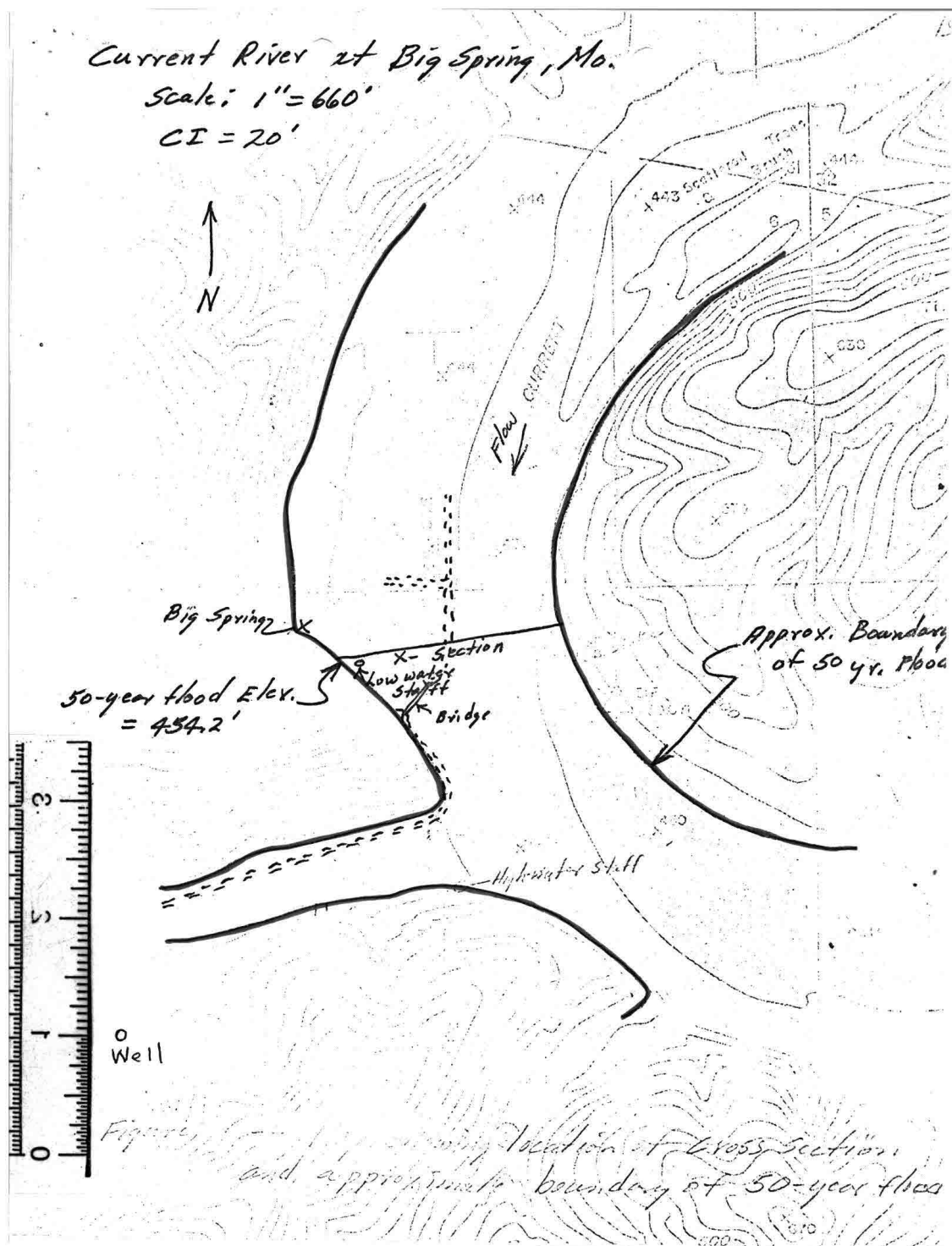
Rolla, Missouri 65401

County: Carter Well: T.D. 520' Temp. 14°C. Clear, Cond. 490. Drilled 12-70
 Owner: National Park Service, Van Buren, Mo. (Washington, D.C.) Potosi formation. Yield 230 gpm.
 Location: S.W. 1/4 Sec. 6, T26N, R1E at Big Spring near Van Buren, Mo. Water level pumping 70' below surface
 Analysis No.: 6817 Analyst: M.E. Phillips, E. Lyng Collected at well after 14 hrs. pumping
 Collector: W. Dokes & L. Emmett Date Collected: 12-18-70 Date Analyzed: 1-19-71

CONSTITUENTS	IN PARTS PER MILLION
Turbidity	<u>Slight light-colored suspended matter</u>
Odor	<u>None</u>
pH	<u>—</u>
Alkalinity (CaCO ₃)	<u>258.5</u>
Phenolphthalein	<u>8.0</u>
Methyl Orange	<u>250.5</u>
Carbonate (CO ₃)	<u>4.8</u>
Bicarbonate (HCO ₃)	<u>305.6</u>
Silica (SiO ₂)	<u>9.1</u>
Aluminum (Al)	<u>—</u>
Calcium (Ca)	<u>56.7</u>
Magnesium (Mg)	<u>28.0</u>
Sodium (Na)	<u>1.2</u>
Potassium (K)	<u>0.6</u>
Total Manganese (Mn)	<u>0.01</u>
Total Iron (Fe)	<u>0.06</u>
Sulfate (SO ₄)	<u>1.0</u>
Chloride (Cl)	<u>3.2</u>
Nitrate (NO ₃)	<u>0.0</u>
Fluoride (F)	<u>0.0</u>
Total Dissolved Solids	<u>257.1</u>
Total Hardness	<u>256.8</u>
Carbonate Hardness	<u>256.8</u>
Non-carbonate Hardness	<u>0.0</u>

Remarks:

Copies To:



188 3-23-71
Mab
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LS4 (WSC)LWW
OZAR/USGS

8 JAN 1971

Memorandum

To: Director, Western Service Center
Through: Chief, Office of Land Acquisition and Water Resources
Chief, Water Resources Section

From: Hydraulic Engineer, WSC-LWW

Subject: Trip report to Big Springs Ozark - December 15-18, 1970

1. Purpose of trip: To meet with the USGS regarding the hydraulics of the test well at Big Springs in the Ozark National Scenic Riverways and discuss other technical matters involving the testing of the well, and to observe and evaluate the pumping test of the Big Spring well in accordance with the contract specifications.

2. Itinerary: Departed San Francisco on December 15 for Big Springs, Ozark NSR in Missouri and arrived at the Geological Survey's office in Rolla, Missouri for a meeting with the USGS representatives on the pump test and completion of the Big Springs well, then proceeded to Big Springs from the USGS office. On duty at Big Springs from December 16 through December 17 and returned on December 18.

3. Companions: None

4. Accomplishments:

a. Before proceeding to the well at Big Spring, I met with District Chief Anthony Homyk and Chief Hydrologist Ned Harvey of the U.S. Geological Survey in Rolla, Missouri.

(1) We discussed general items of information concerning the construction of the wells and submittal of the USGS report on the well drilling operations.

- (2) A lengthy discussion was held with Chief Hydrologist Harvey regarding the pump testing, the equipment on hand at the site for making water level measurements and the methods of controlling and measuring the discharge. Mr. Harvey informed me that everything was ready for the test and that no problems were expected with the pumping test.
- (3) Mr. Harvey advised me that their men were on the site and according to a recent telephone conversation, pump testing of the well would begin at 8 o'clock on the morning of December 16.
- b. Arrived at the Big Springs well site at about 7:30 am on December 16 and met with USGS Hydrologist L. Emmett and Hydraulic Engineering Technician W. Oaks who were on hand to supervise the pump test and record the water level measurements and flow from the well. The USGS equipment, the contractor's equipment and the test procedures were inspected for compliance with the contract plans and specifications.
- c. Met with the contractor's representative, Mr. Wayne Clark, Clark & Clark Drilling Company of Fenton, Missouri, who explained the layout and capabilities of the drilling and pump test equipment.
- d. With USGS representatives, Messrs. Emmett and Oaks, visited the observation well and noted the trend of existing readings recorded by well measuring device.
- e. Upon completion of the installation of the test pump at approximately 356 feet and installation of testing equipment, the pump test began about 10 am, December 16, and continued till 10:28 am, December 17.

Hydrologist L. Emmett and Hydraulic Engineering Technician W. Oaks remained on the site throughout the pump test. The pump test consisted of the following two stages:

- (1) In order to develop the well, the first stage was started at 10:00 am and lasted for five hours and 10 minutes. The pumping rate was 36 gpm (calculated by using a 55 gallon drum) and in 17 minutes was increased to approximately 79 gpm (3-inch meter indicated 80 gpm). The pumping rate was then maintained until the turbidity as indicated by the specific conductance and visual observation had cleared. After one hour, the flow was increased to 225 gpm (metered) and in three hours again increased to 280 gpm the capacity of the pump. The drawdown for each pumping rate was quite rapid until the drawdown reached a stable level. The drawdowns for each rate of flow were 1.6 feet for 36 gpm, 6.2 feet for 29 gpm, 19.0 feet for 225 gpm and 25.1 feet for 280 gpm. The recovery, to 0.2 feet of static water level, lasted three hours and 15 minutes.
 - (2) The second stage of the test was started at a flow of 230 gpm (metered) and lasted for 14 hours and 8 minutes. Drawdown reached a stable level of 19.95 feet in nine hours. Specific conductance remained at 490 throughout this stage of the test. The recovery, to 0.3 foot of static water level as recorded at the start of the second stage, lasted one hour and 50 minutes.
- f. Upon completion of the recovery for the second stage of the pump test, the observation well was inspected for possible effect. No noticeable effect could be observed. During the day prior to the pump test, a moderately heavy rain fell at the site which caused some recharge of the observation well prior, during and following the period of the pump test. A straight line was observed prior to and throughout the pump test and up to three and one-half hours following the test. The observation well is located approximately 300 yards northwest of the test well.

g. The dimensions of the test well are as follows:

Total depth	520 feet
Diameter of boring	0-370 feet, 10-inch dia. 370-520 feet, 6-inch dia.
6" casing depth	0-370 feet
2" grout ring	0-240 feet (approximately) 290 feet (approximately) 370 feet
Gravel filled caverns	240 feet--290 feet

The lower 150 feet of the well is an uncased 6-inch diameter open hole in dolomite (Potosi formation).

- h. A final, more complete report will be compiled by the U. S. Geological Survey after all data has been analyzed. This test yielded a smooth curve which will aid in determining the wells usable capacity. The test pump used by the contractor was a 30 HP submersible pump. The water temperature remained 56°F. throughout the period of the test. Two one-gallon samples of water were taken prior to completion of the pumping test for chemical and bacteriological analysis. The quality of the water is considered very good from visual observation and taste.

5. Summary: From a preliminary analysis of the data available during the test, it is apparent the well has a sustained capacity in excess of the 280 gpm flow produced during first stage of the test with a maximum

drawdown of 25.1 feet. The transmissibility of the well is calculated to be 11.16 gpd/ft. The chemical quality of the water appears to be less than 500 ppm. No turbidity was noted in the second stage of the pump test and remained clear throughout that part of pumping period.

(Sgd.) D. M. AUGHENBAUGH

D. M. Aughenbaugh

Cleared for Distribution:

(Sgd.) William L. Bowen JAN 12 1971
Director, WSC (Date)

cc:

NW-WASO

Director, Midwest Region
Superintendent, Ozark

U.S. ENVIRONMENTAL PROTECTION AGENCY WATER PROGRAM OPERATIONS (WH-450) WASHINGTON, D.C. 20460		INVENTORY OF PUBLIC WATER SUPPLIES (See instructions on the reverse)		KEY IDENTIFICATION NUMBER 1 2 3 4 5 6 7 8 9 10 11 12 13 14																																							
NAME OF WATER UTILITY USNPS OZARK NATL SCENIC RIVERWAY																																											
ADDRESS PO BOX 448																																											
CITY YAM BUREN																																											
COUNTY CARTER																																											
STATE MO		ZIP 63965		TELEPHONE NUMBER 3234236																																							
127 128		129 130		131 132																																							
UTILITY OWNER (Check one) (144) ☐ MUNICIPALITY, DISTRICT, ETC. ☐ INVESTOR ☒ FEDERAL ☐ STATE ☐ OTHER (Specify in remarks)																																											
RETAIL POPULATION SERVED 2000		NUMBER SERVICES 25		NUMBER METERS 1																																							
145 153		154 160		161 167																																							
NUMBER OF WHOLESALE CUSTOMERS 0																																											
168 170																																											
PREDOMINANT CHARACTERISTIC(S) OF YOUR SERVICE AREA <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>COMMUNITY</td> <td>CAMPY TOWN</td> <td>RECREATION AREA</td> <td>MOBILE HOME PARK</td> <td>INSTITUTION</td> <td>SCHOOL OR COLLEGE</td> <td>MOTEL</td> <td>RESTAURANT</td> <td>SERVICE STATION</td> <td>CAMPGROUND</td> <td>PICNIC AREA</td> <td>LODGE</td> <td>MARINA</td> <td>SKI RESORT</td> <td>BATHING AREA</td> <td>VISITOR CENTER</td> <td>HIGHWAY SAFETY REST AREA</td> <td>AIRPORT</td> <td>OTHER (Specify in remarks)</td> </tr> <tr> <td>☒</td> <td>☒</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>☒</td> <td>☒</td> <td></td> <td>☒</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						COMMUNITY	CAMPY TOWN	RECREATION AREA	MOBILE HOME PARK	INSTITUTION	SCHOOL OR COLLEGE	MOTEL	RESTAURANT	SERVICE STATION	CAMPGROUND	PICNIC AREA	LODGE	MARINA	SKI RESORT	BATHING AREA	VISITOR CENTER	HIGHWAY SAFETY REST AREA	AIRPORT	OTHER (Specify in remarks)	☒	☒							☒	☒		☒							
COMMUNITY	CAMPY TOWN	RECREATION AREA	MOBILE HOME PARK	INSTITUTION	SCHOOL OR COLLEGE	MOTEL	RESTAURANT	SERVICE STATION	CAMPGROUND	PICNIC AREA	LODGE	MARINA	SKI RESORT	BATHING AREA	VISITOR CENTER	HIGHWAY SAFETY REST AREA	AIRPORT	OTHER (Specify in remarks)																									
☒	☒							☒	☒		☒																																
CAPACITIES																																											
PRODUCTION, NORMAL OPERATION (Gal/Day) 250000		EMERGENCY POWER ONLY (Gal/Day) 0																																									
190 199		200 209																																									
DISTRIBUTION STORAGE, GRAVITY FLOW (Gallons) 1000000																																											
210 219																																											
PRODUCTION																																											
AVERAGE DAY (Gal/Day) 30000		MAXIMUM DAY (Gal/Day) 60000																																									
220 229		230 239																																									
DATE FORM COMPLETED 7509																																											
240 243																																											
SOURCE		INTAKE LOCATION		TREATMENT																																							
LATITUDE		LONGITUDE		LAB CONTROL																																							
NO. NAME		DEG MIN SEC		SURFACE GROUND PULVERIZED AERATION PRECHLORINATION COAGULATION SEDIMENTATION FILTRATION SODIUM CONTROL SOFTENING TASTE AND ODOR CONTROL IRON REMOVAL AMMONIATION FLUORIDE ADJUSTMENT DISINFECTION CHEMICAL BACTERIAL PHYSICAL																																							
01	OWELL	36	56	45	X																																						
02	R	90	59	12	XXX																																						
03	R																																										
04	R																																										
REMARKS (Up to 50 characters) (1703 - 832)																																											
* INCLUDES AVERAGE DAILY SUMMER VISITATION																																											
BIG SPRINGS																																											

INSTRUCTIONS

1. **IDENTIFICATION NUMBER** – This is a 14 digit code number that geographically identifies the location of the utility. It will be filled in by EPA personnel.
2. **NAME OF WATER UTILITY** – This is the complete, official name of the utility.
3. **ADDRESS** – This is the mailing address of the utility (*this may be but does not necessarily have to be the physical location of the treatment plant*).
4. **CITY, COUNTY, STATE** – This is the city, county and state of the mailing address of the utility.
5. **ZIP CODE** – This is the zip code of the mailing address of the utility.
6. **IS THE UTILITY OWNED BY A MUNICIPALITY, DISTRICT, INVESTOR OWNER, STATE OR OTHER** (*specify in remarks*) – Place an **X** in the box that describes the type of ownership of the utility.
7. **RETAIL POPULATION SERVED-NUMBER SERVICES, METERS** – Fill in these boxes with the most current information available. Do Not include the population served by water utilities that purchase water from you wholesale.
8. **NUMBER OF WHOLESALE CUSTOMERS** – In cases where water is sold to wholesale customers (*customers who buy water from you for resale*) fill in the boxes with the number of this type of customer.
9. **WHAT IS THE CHARACTERISTIC(S) OF YOUR SERVICE AREA?** – Place an **X** in the boxes necessary to describe the predominant characteristic(s) of your service area.
10. **CAPACITIES** – Fill in these boxes with the most current information available. Report all storage that does not have to be pumped into the system, whether it is elevated or ground storage.
11. **PRODUCTION** – Fill in these boxes with the most current information available.
12. **DATE FORM COMPLETED** – Fill in the numeric designation of the month (01 - 12) and the last two digits of the year when the form was completed.
13. **REMARKS** – Additional information can be provided (*maximum of 50 Alpha and/or Numeric characters*).
14. **SOURCE AND TREATMENT** – Write in the spaces below Name the name of the river, lake, other utility, well, field, or other source from which the supply of water is taken. Circle "R" for regular source or "A" for auxiliary source. If more than one source is used, use separate lines for each source. If more than four sources are used, then list on a second form starting with 05. Place an **X** in the block(s) for the types of treatment rendered the raw water. Mark each source separately.
15. **INTAKE LOCATION** – Latitude and Longitude of intake.
16. **LABORATORY CONTROL** – Place an **X** in the box for the type of types of laboratory analyses made at the treatment facility. Leave these blocks blank if no laboratory analyses are performed.

SUMMARY

We are including a summary of the drilling to date in the tabulation below. The wells are listed in the order of decreasing specific capacities.

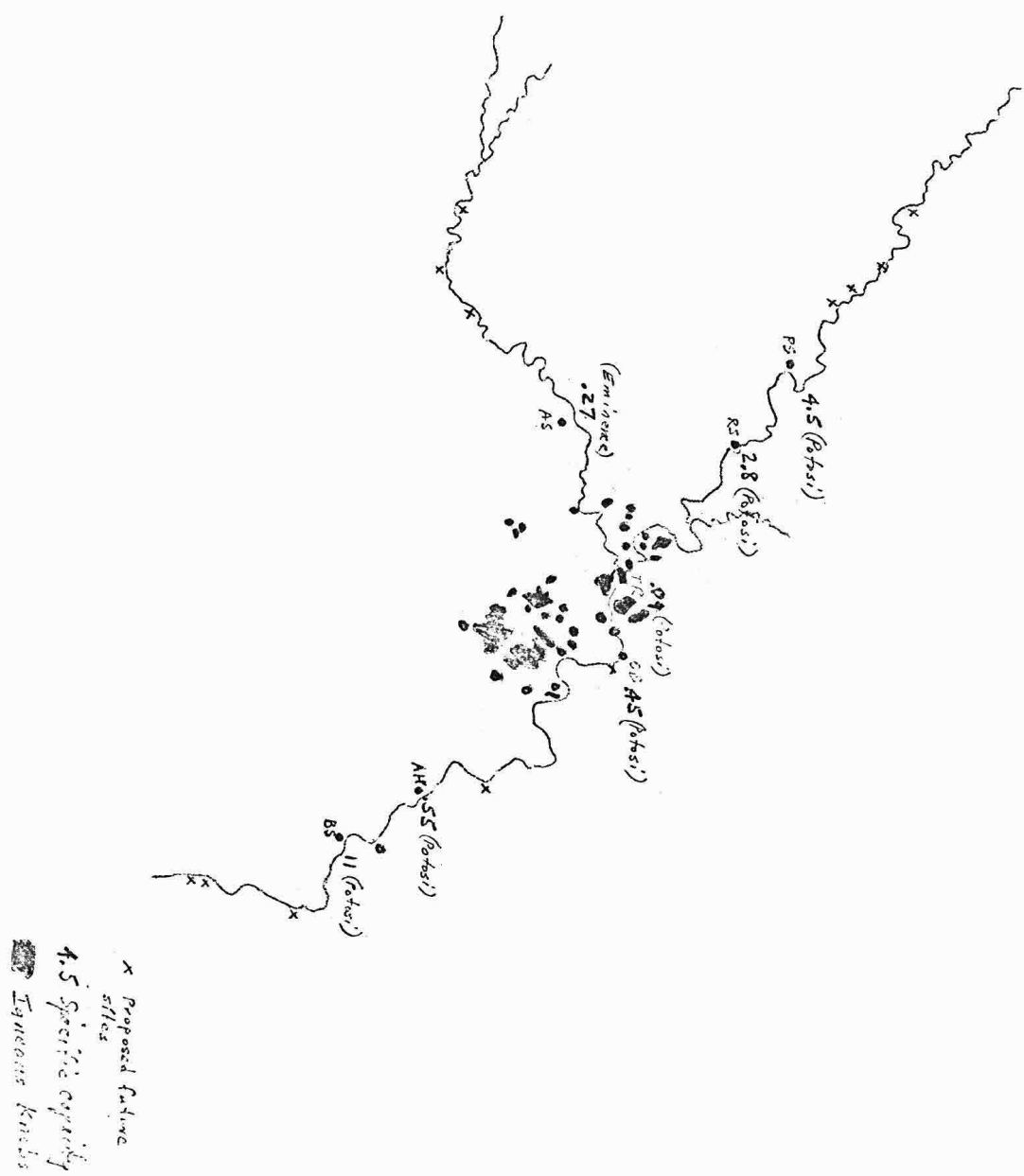
<u>Site</u>	<u>Formation penetrated</u>	<u>T.D.</u>	<u>Casing depth</u>	<u>Open Hole Dia.</u>	<u>Length</u>	<u>Yield</u>	<u>DD</u>	<u>Sp. Cap.</u>
Big Spring	Potosi 190-520	520	370	8	150	230	20	11
Pulltite Spring	Potosi 240-310	308	205	6	103	118	26	4.5
Round Spring	Potosi 180-400	400	200	8	200	120	43	2.8
Austin House	Potosi 225-250	250	200	8	50	6	11	.55 *
Owls Bend	Potosi 75±303	303	202	6	101	50	112	.45
Alley Spring	Eminence 475-650	650	300	8	350	55	214	.26
Two Rivers	Potosi 160-350	350	100	8	250	11	110	.10

Some significance may become apparent from a comparison of the results in the tabulation, the graphs of the wells drilled, and the map showing their locations with respect to the igneous knobs in the area around Eminence. The wells at Big Spring, Pulltite Spring, Round Spring, Owls Bend and Two Rivers penetrated a substantial part of the Potosi section. The Austin House well penetrated a small part of the section. Big Spring well is located farthest from the center of the igneous knobs and had the highest specific capacity (11 gpm per foot of drawdown). Pulltite Spring well is a little closer in and has a good specific capacity (4.5 gpm per foot of drawdown). Austin House well, although it penetrated only a few feet of the Potosi, had a specific capacity that was much lower than those at Pulltite and Round Springs, but was higher than those obtained at Owls Bend and Two Rivers. Owls Bend well near the eastern flank of the knobs area had a rather low specific capacity for the thickness of Potosi penetrated but not as low as that of the Two Rivers well which probably penetrated most of the Potosi section. The Two Rivers well is essentially surrounded by igneous knobs. The well at Alley Spring did not penetrate the Potosi and for this reason is not included in the comparison.

* Rounding of numbers I had done in the past accounts for some small differences in the two tables and the figures shown on the map.

The comparison suggests that circulation of water in the Potosi is slower and retarded in the knobs area perhaps because of lack of fracture and bedding plane openings through which water might travel. Mineralization along fractures may have sealed openings to retard flow. Whatever the cause, lower yields might be expected in the knobs area and higher yields outside the knobs. Of course exceptions to this probably will be found as additional sites are developed.

Projected yields for various pumping levels				
SWL (feet)	PWL (feet)	DD (feet)	Yield (gpm)	Sp. Cap. (gpm/ft)
BIG SPRING				
53	78	25	280	11
	100	47	515	
	150	97	1,007	
	370	317	3,500	
				Bottom of casing
PULLTITE SPRING				
32	58	26	118	4.5
	100	68	306	4.5
	150	118	530	4.5
	200	168	760	4.5
				Bottom of casing
ROUND SPRING				
80	123	43	120	2.8
	150	70	196	2.8
	175	95	266	2.8
	200	120	336	
				Bottom of casing
AUSTIN HOUSE				
57	102	45	23	.51
	150	93	47	
	200	143	73	
				Bottom of casing
OWLS BEND				
45	155	110	50	.45
	200	155	70	
				Bottom of casing
ALLEY SPRING				
55	270	215	58	.27
	300	245	66	
				Bottom of casing
TWO RIVERS				
92	210	118	11	.09
				This pumping level is 110 ft. below bottom of casing.



conado Dolomite at an average depth of 500 to 600 feet. The wells that produce from this section are ideal for clubs, schools, small towns, and industries.

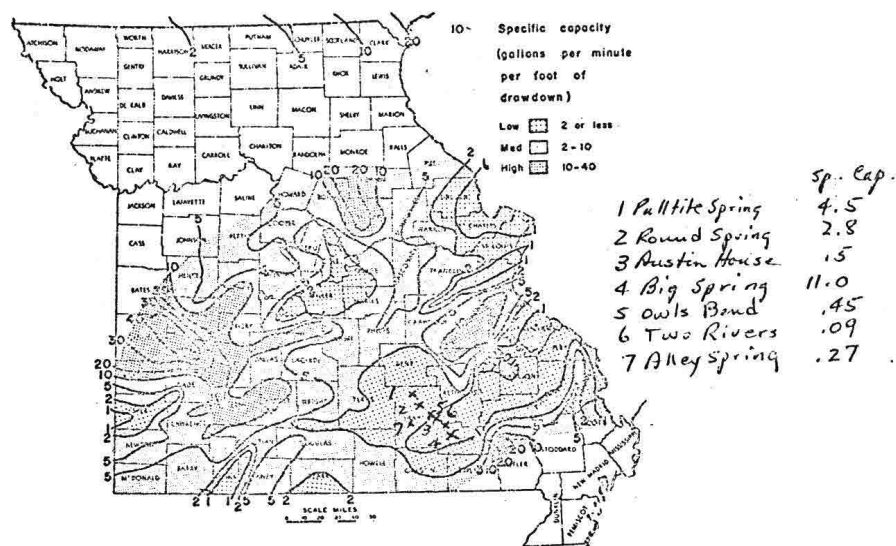


FIGURE 66.—Specific capacities of typical wells in the Ozarks.

Throughout the area numerous municipal and industrial wells yield 500 to 1,000 gallons per minute. These wells vary in depth. Wells that produce 300 to 500 gallons per minute average 1,000 to 1,500 feet in depth. Wells at Springfield in Greene County, for example, average 1,400 to 1,700 feet in depth and produce 500 to 1,000 gallons per minute. Wells at Rolla in Phelps County and Sullivan in Franklin County are 1,000 to 1,200 feet in depth and produce 400 to 600 gallons per minute.

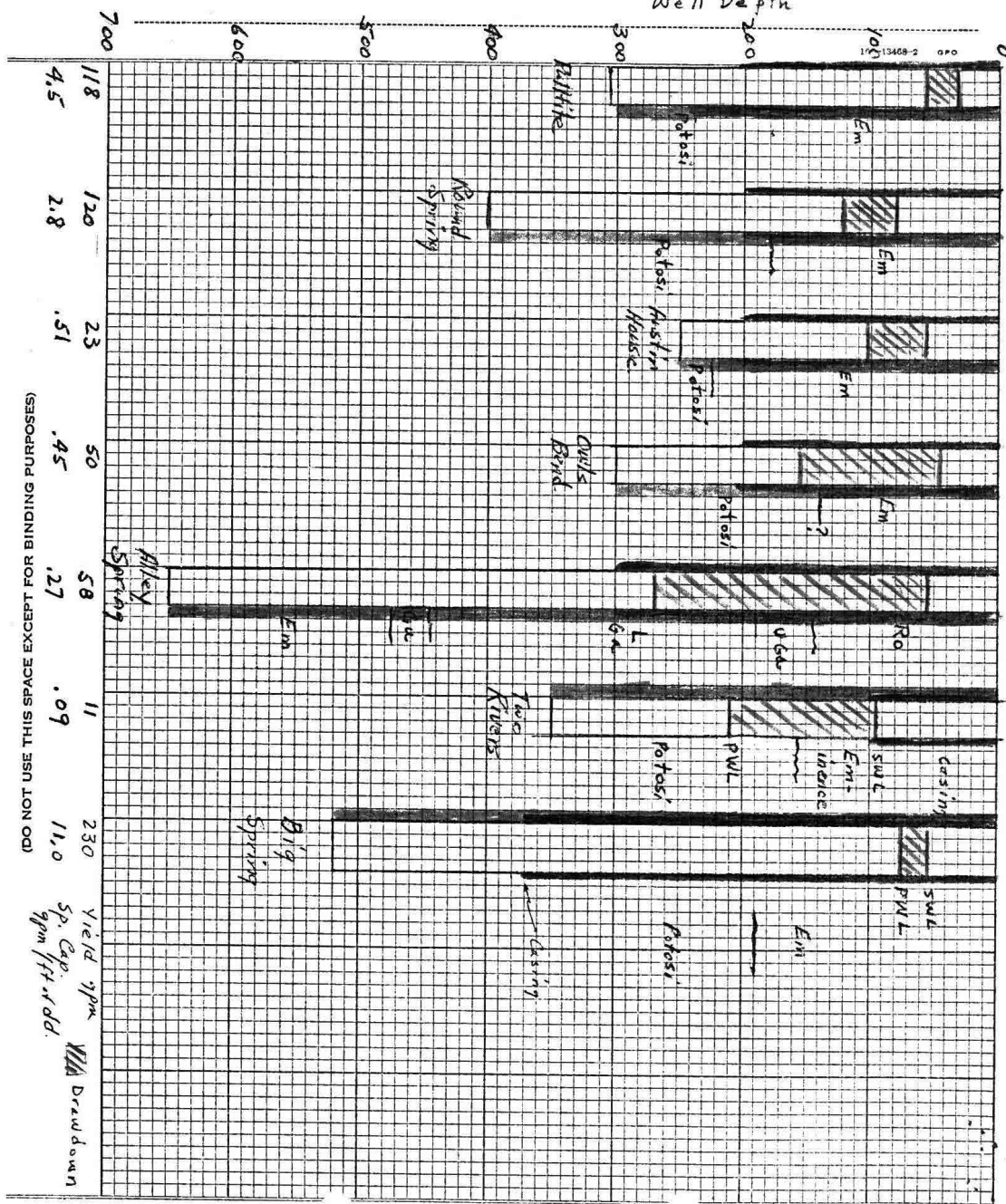
Throughout the area requirements of 15 to 25 gallons per minute can normally be met by drilling to a depth of 300 to 350 feet through the Roubidoux Formation. This is usually an ideal depth for farm wells. Private wells for farms and dwellings in the central Ozarks average 300 feet in depth, whereas in the southwest part of the State the average depth to the Roubidoux is 500 feet.

Descriptions of aquifers

Lamotte Sandstone.—The Lamotte Sandstone is geologically the oldest aquifer in the State and is the basal unit of the Cambrian Sys-

File { Washington
Number { District

Well Depth



Sheet No. _____ of _____ sheets. Prepared by _____ Date _____ Checked by _____ Date _____

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TRIP REPORT - LWSSC

Missouri - The Ozarks

By: William E. Fields
Supervisory Hydraulic Engineer

Inclusive Dates
of Travel: July 24--25, 1968

July
8/14

On July 24 and 24, I was in the Missouri area and spent most of that time in the vicinity of the Ozarks National Scenic Riverways. Garland Moore of the Water Rights Section, Washington Service Center, was with me. We made the trip as a result of a memorandum from the Director's office which transferred the administration of water resources in the States of Minnesota, Iowa, and Missouri from the Washington Service Center to ours.

Superintendent Thompson, Gary and I spent all of the 24th visiting some of the sites within the take line of the Riverway. We visited the District sites at Pulltight, Powder Mill and Two Rivers. We also visited the areas of Big Spring, Alley Spring and Blue Spring. These are presently administered by the State but will eventually come under our jurisdiction. Big Spring is a terrific example of a large limestone spring and flows 850,000,000 gallons a day during peak flow periods. It is interesting to note that this amount of water (one day's flow) would last Carlsbad Caverns at our present use for about 85 years. Our problems in this area obviously will not be a shortage of water but one of finding water of potable quality.

On our return trip to St. Louis, we stopped by the USGS offices in Rolla, Missouri and visited with District Chief Tony Homyk and his assistant, Edward Harney, so I could get acquainted with them. We also visited with the Missouri State Geologist, Robert Knight, for a short while. Gary Moore has done a fine job in coordinating and supervising the water resources studies in this area and the transition from their office to ours will be simple.

The next construction project will be at Two Rivers and the Washington Service Center has already written the specifications. They will send them to us and we will advertise according to our standard procedure.

(Sgd) William E. Fields
JEF

cc:
Chief, Branch of Water Resources, WASO

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Docket Information

Number of Documents in Docket 28
Documents Dated from 7/24/1968 to 1/20/1971
Docket Compiled: 6/7/2011