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ROCK CREEK CARBON DIOXIDE PILOT PROJECT

Annual Report, July 1980–June 1981

Work Performed for the Department of Energy
Under Contract No. DE-AC21-76MC05301

Date Published—September 1982

Pennzoil Exploration and Production Company
Vienna, West Virginia

FOSSIL ENERGY

U. S. DEPARTMENT OF ENERGY

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ROCK CREEK CARBON DIOXIDE PILOT PROJECT

Annual Report, July 1980–June 1981

Paul E. King, Jr., *Principal Investigator*
Pennzoil Exploration and Production Company
Vienna, West Virginia 26105

Royal J. Watts, *Technical Project Officer*
Morgantown Energy Technology Center
P.O. Box 880
Morgantown, West Virginia 26505

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UNITED STATES DEPARTMENT OF ENERGY

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INTRODUCTION

This report is the eighty-first report on the progress of the Rock Creek carbon dioxide project in Roane County, West Virginia.

Designed, developed and operated by Pennzoil Exploration and Production Company, this project will demonstrate the feasibility of miscible carbon dioxide oil recovery in the Rock Creek Big Injun Field. A successful demonstration of this process will lead to a field wide commercial development. Also, the technical success of this project would be utilized in the development of other miscible carbon dioxide oil recovery projects in numerous fields within the Appalachian area.

A detailed description of the reservoir lithology, laboratory tests, process design and project design was presented in the first annual report for this project and published in Volume No. 1 of the 1977 ERDA Symposium Proceedings entitled "Development of a Pilot Carbon Dioxide Flood in the Rock Creek Big Injun Field, Roane County, West Virginia."

PILOT SUMMARY

The Rock Creek CO_2 Project was initiated in 1976 under an ERDA-Pennzoil cost sharing contract. Wells were drilled to develop the 19.65 acre dual 5-spot pilot shown in Figure 1. Then water was injected into the Big Injun formation to pressurize the reservoir and to observe the waterflood response, which was a sharp production kick as shown in Figure 2. Recovery during this time was 11,084 BO or 564 BO/Ac.

Carbon dioxide injection began at the Rock Creek Project in February, 1979. By June, 1980, 23,842 tons had been injected and DOE funds were expired. The Project was then certified under the DOE Tertiary Incentive Program. A 1.55 acre 4-spot mini-pilot was developed and an additional 12,000 tons of carbon dioxide were purchased. The mini-pilot is diagramed in Figure 1.

To date, an effective carbon dioxide volume equivalent to 10% of the total pore volume has been injected into the original pilot injection wells (PI-1 through PI-6). Currently, wells PI-1 through PI-5 are on water injection and the mini-pilot injection wells, PI-6 through PI-8, are injecting carbon dioxide. Wells PI-6 through PI-8 will continue CO_2 injection until an effective volume of carbon dioxide equivalent to approximately 25% of the total mini-pilot pore volume has been injected. All of the PI wells will then remain on water injection until the miscible carbon dioxide displacement mechanism has been fully evaluated.

The producing wells began to respond to carbon dioxide injection within six months of the initial injection. This production response is shown in Figure 2. Oil recovery due to carbon dioxide injection from the 19.65 pilot area was 9,866 BO or 502 BO/Ac. as of July 1, 1981. Since July, 1980, mini-pilot producing well Shaffer OB-1 has produced 1,203 BO or 776 BO/Ac. as a result of carbon dioxide injection.

The high carbon dioxide produced to oil produced ratio at Shaffer No. 1 is a result of two factors. Soon after the initial carbon dioxide injection in February, 1979, this well began producing carbon dioxide. It was determined that this production was a result of communication from one or more injection wells through the Big Lime thief zone. To date, the total estimated volume of carbon dioxide produced through the Big Lime at Shaffer No. 1 is 696 tons. More recently, an additional increase in carbon dioxide production was observed at this well. Through various tests, it was determined that this additional gas production is a result of communication, possibly a fracture, through the Big Injun reservoir from injection well PI-8. The volume of carbon dioxide produced at Shaffer No. 1 as a result of this communication has not been determined at this time.

In June, 1981, a well was drilled 75' from PI-2 to pressure core the Big Injun reservoir. The location of this well, drilled with 100% DOE funding, is shown in Figure 1. The purpose of this

well was to determine the fluid saturations in a portion of the reservoir that has been invaded by carbon dioxide. Although the results of this core well have not been fully evaluated, a preliminary study has indicated that the majority of carbon dioxide injected into PI-2 is flooding the upper 11 feet of the Big Injun reservoir.

The progress of the project and the corresponding cash outlay are depicted pictorially in Figure No. 3. The budgeted costs in Figure No. 3 includes anticipated expenses for proposed additional work.

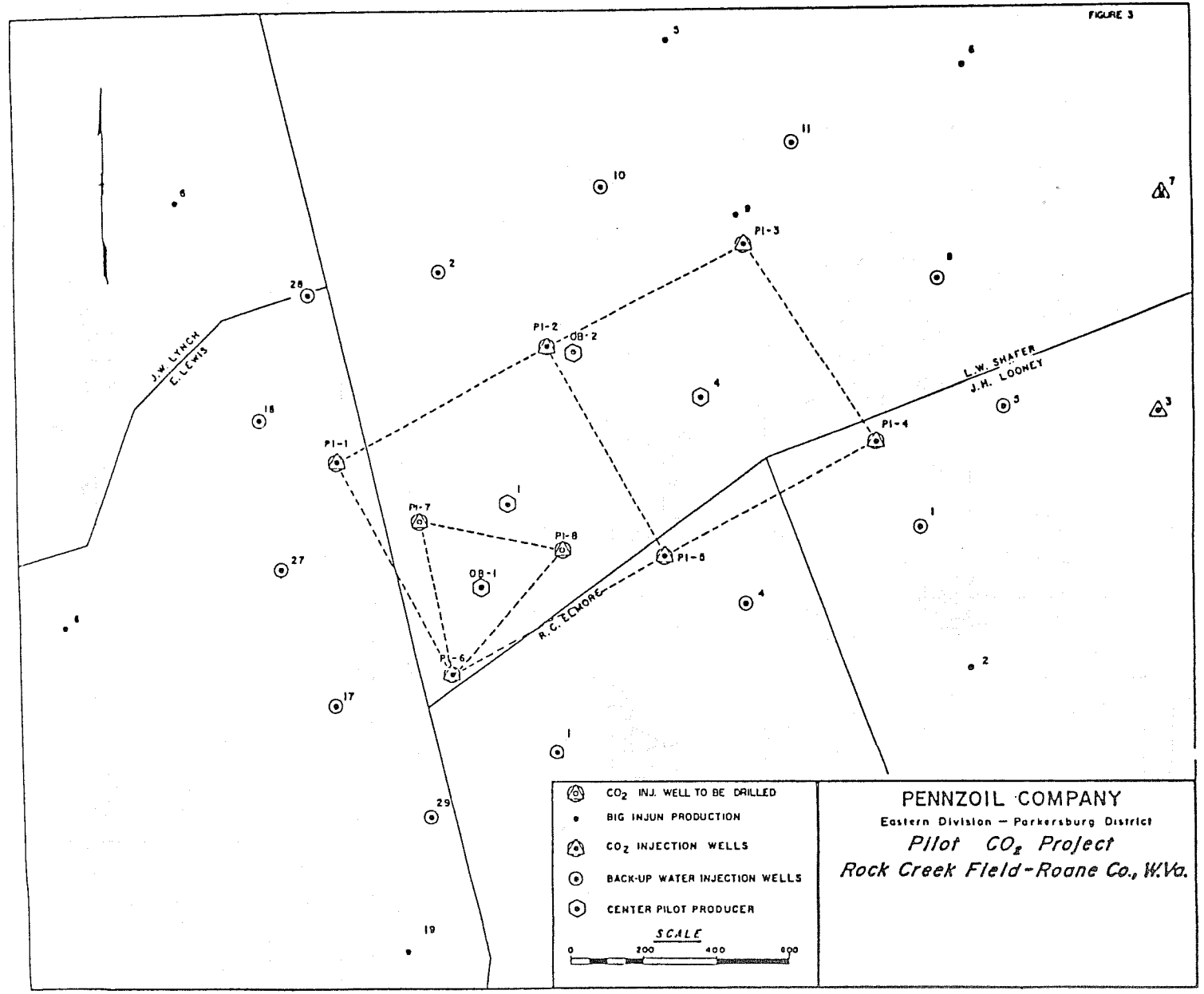
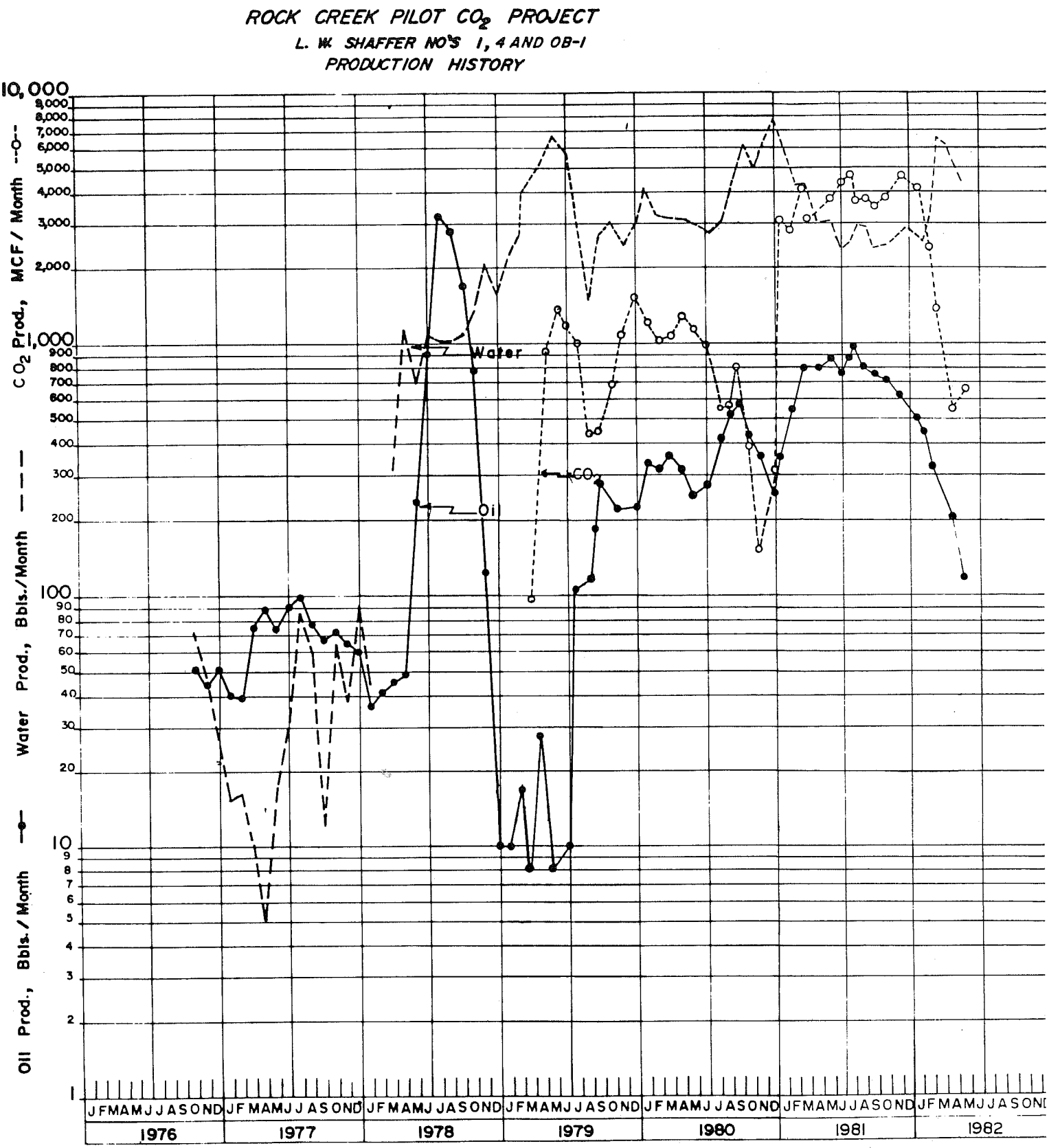


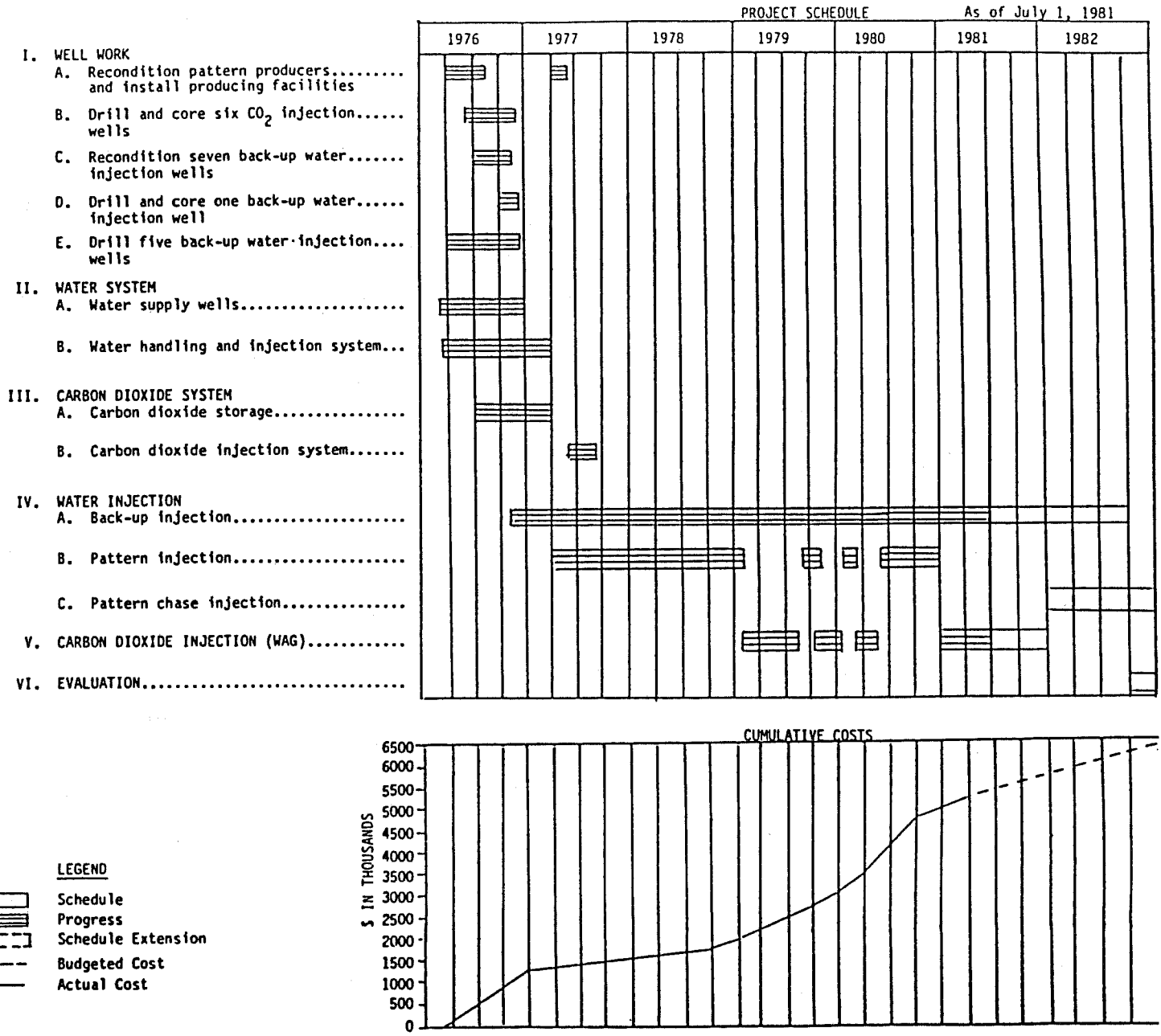
FIGURE 3
J.W. LYNCH
C. LEWIS
L.W. SHAFER
J.H. LOONEY
R.C. ECMORE
PI-1
PI-2
PI-3
PI-4
PI-5
PI-6
PI-7
PI-8
OB-1
OB-2
CO2 INJ. WELL TO BE DRILLED
BIG INJUN PRODUCTION
CO2 INJECTION WELLS
BACK-UP WATER INJECTION WELLS
CENTER PILOT PRODUCER
SCALE
0
200
400
600
PENNZOIL COMPANY
Eastern Division — Parkersburg District
Pilot CO2 Project
Rock Creek Field-Roane Co., W.Va.

6-10-80 JW

FIGURE NO. 2


ROCK CREEK PILOT CO_2 PROJECT
L. W. SHAFFER NO'S 1, 4 AND OB-1
PRODUCTION HISTORY
CO_2 Prod., MCF / Month --o--
Water Prod., Bbls./Month ----
Oil Prod., Bbls. / Month —•—
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
Water
Oil
CO_2
J F M A M J J A S O N D
1976
1977
1978
1979
1980
1981
1982

OIL RECOVERY BY CARBON DIOXIDE INJECTION
ROCK CREEK FIELD, ROANE COUNTY, WEST VIRGINIA



CONCLUSION

Although this pilot has yet to prove that an expanded carbon dioxide flood in the Rock Creek Big Injun reservoir would be economically feasible, the pilot has been technically successful in several aspects. First of all, the mechanical operation of the project has proceeded smoothly in comparison to similar projects in the industry. Through this work, much experience has been gained (both mechanically and in reservoir engineering) that may be helpful in future projects of this nature. Also, from the production response to carbon dioxide injection and the Shaffer OB-2 core analysis, the miscible carbon dioxide injection displacement mechanism is moving oil. the amount of oil to be recovered, the time required, and the amount and cost of carbon dioxide injection required to produced this oil will all have a very significant effect on the economics of this project.

PRODUCING WELLS

The waterflood response of the two center producing wells peaked in July, 1978, and was depleted by December, 1978. Recovery due to water injection was 11,084 BO or 564 BO/Ac.

Oil production related to carbon dioxide injection began in July, 1979. This early response indicates a fingering of carbon dioxide in the reservoir rather than a bank-type movement of oil. As of July 1, 1981, the production as a result of carbon dioxide injection has been 9,866 BO or 502 BO/Ac. for the project. The mini-pilot has produced 1,203 BO or 776 BO/Ac. related to carbon dioxide. The average daily production during June, 1981, was 11.9 BO and 35 BW from L. W. Shaffer No. 1, 8.4 BO and 42 BW from L. W. Shaffer No. 4 and 5.9 BO and 8 BW from L. W. Shaffer OB-1, which was acidized and coverted to a producing well on July 18, 1980. The low fluid production from L. W. Shaffer OB-1 indicates formation damage and this well is scheduled for an acid treatment in July, 1981.

Communication through the Big Lime thief zone was confirmed by carbon dioxide production at L. W. Shaffer No. 1 in March, 1979, less than one month after carbon dioxide injection began. L. W. Shaffer No. 4 and OB-1 began producing increased volumes of carbon dioxide in May, 1979, and January, 1981, respectively. It is believed that the carbon dioxide production from L. W. Shaffer No. 4 and OB-1 is through the Big Injun reservoir. As of July 1, 1981,

cumulative carbon dioxide production from L. W. Shaffer No. 1 was 1154.3 tons through the Big Injun reservoir and 695.6 tons through the Big Lime thief zone. The average daily carbon dioxide production from this well in June, 1981, was 6.7 tons per day. It is believed that this increased carbon dioxide production at L. W. Shaffer No. 1 is a result of communication, possibly a fracture, through the Big Injun reservoir from injection well PI-8. L. W. Shaffer No. 4 has produced a total of 454.9 tons of carbon dioxide, averaging 1.49 tons per day in June, 1981. Cumulative carbon dioxide production is 78.6 tons from L. W. Shaffer OB-1, which averaged 0.7 tons per day in June, 1981.

The production history of these three wells is tabulated in Appendix A and presented graphically in Appendix B.

INJECTION WELLS

Carbon Dioxide Injection Wells

Pilot injection wells PI-1 through PI-6 were on water injection from June 16, 1980, until December 26, 1980. Wells PI-7 and PI-8 were drilled to develop the 1.55 acre mini-pilot previously mentioned. These wells began water injection on December 8, 1980. On December 26, 1980, wells PI-2 through PI-8 began carbon dioxide injection. Well PI-1, which now serves as a back-up injection well for the mini-pilot, continued to inject water throughout the year.

Within two days of the initial carbon dioxide injection into PI-8, producing well L. W. Shaffer No. 1 began producing an increased volume of carbon dioxide. PI-8 was returned to water injection on January 24, 1981, and the carbon dioxide production from L. W. Shaffer No. 1 decreased. Additional tests confirmed that PI-8 was the source of the increased carbon dioxide produced from L. W. Shaffer No. 1. An attempt to squeeze cement PI-8 indicated that this communication is through the Big Injun reservoir, rather than the Big Lime thief zone.

Cumulative carbon dioxide injection for the project as of July 1, 1981, totaled 31,649 tons. After accounting for the carbon dioxide produced through the Big Lime thief zone, the net carbon dioxide injection to date has been 30,954 tons. This net volume equates to 219,773 reservoir barrels. As of July 1, 1981, total production from

the producing wells since the start of carbon dioxide injection was 139,563 reservoir barrels, including carbon dioxide production from the Big Injun reservoir. Therefore, by material balance, it is estimated that 38.4% of the carbon dioxide and water injected during this time has entered the pattern area. As expected, the effective injection has increased since OB-1 was converted to a production well.

Since December 16, 1980, 28,325 reservoir barrels of carbon dioxide and 8,914 barrels of water have been injected into the mini-pilot. During this time, total fluid production from L. W. Shaffer OB-1 has been 8,058 reservoir barrels. Therefore, by material balance, the effective injection into the mini-pilot has been 21.6%.

The injection history for these wells is listed in Appendix C and presented graphically in Appendix D.

Back-up Water Injection Wells

Injection into the thirteen back-up wells totaled 1,978,875 barrels of water as of July 1, 1981. The average injection rate for these wells during June, 1981, was 50 BWPD per well at a wellhead pressure of 1063 psig. In comparison, the average rate in June, 1980, was 70 BWPD per well at 955 psig wellhead.

The injection history for these wells is tabulated in Appendix E and presented graphically in Appendix F.

OBSERVATION WELLS

The pressure monitoring program was continued through July 17 at L. W. Shaffer OB-1. The well maintained an average surface pressure of 326 psig, ranging from 300 to 350 psig.

On July 18, the 4-1/2" fiberglass casing was perforated from 2022' to 2036' with 28 holes. Then 12 barrels of 15% HCl acid was spotted through the tubing at 1980' and pumped away at 3.5 BPM with 1600 psi. The well was shut-in overnight and flowed back the following day. After production equipment was installed, the well began producing on July 28.

Observation well L. W. Shaffer OB-2 was spudded on April 27, 1981, at the location shown in Figure No. 1. In this well, the Big Injun formation was pressure cored. Of the 43 feet drilled with the coring tools, 27 feet of core was recovered at reservoir pressure and frozen. The core has been shipped to Core Labs in Midland, Texas, for analysis. Results should be available by mid-July.

Dual induction, compensated density, compensated neutron, gamma ray, caliper and sonic velocity logs were run in this well. Copies of these logs over the Big Injun formation are shown in Appendix G. In combination with the results of the core analyses, these logs should enable a fair evaluation of the carbon dioxide displacement mechanism in the Big Injun reservoir.

In order to enable future logging programs, fiberglass casing was set over the Big Injun formation. This well, which is currently shut-in, will be completed after all of the results have been evaluated.

APPENDIX A

History of Production

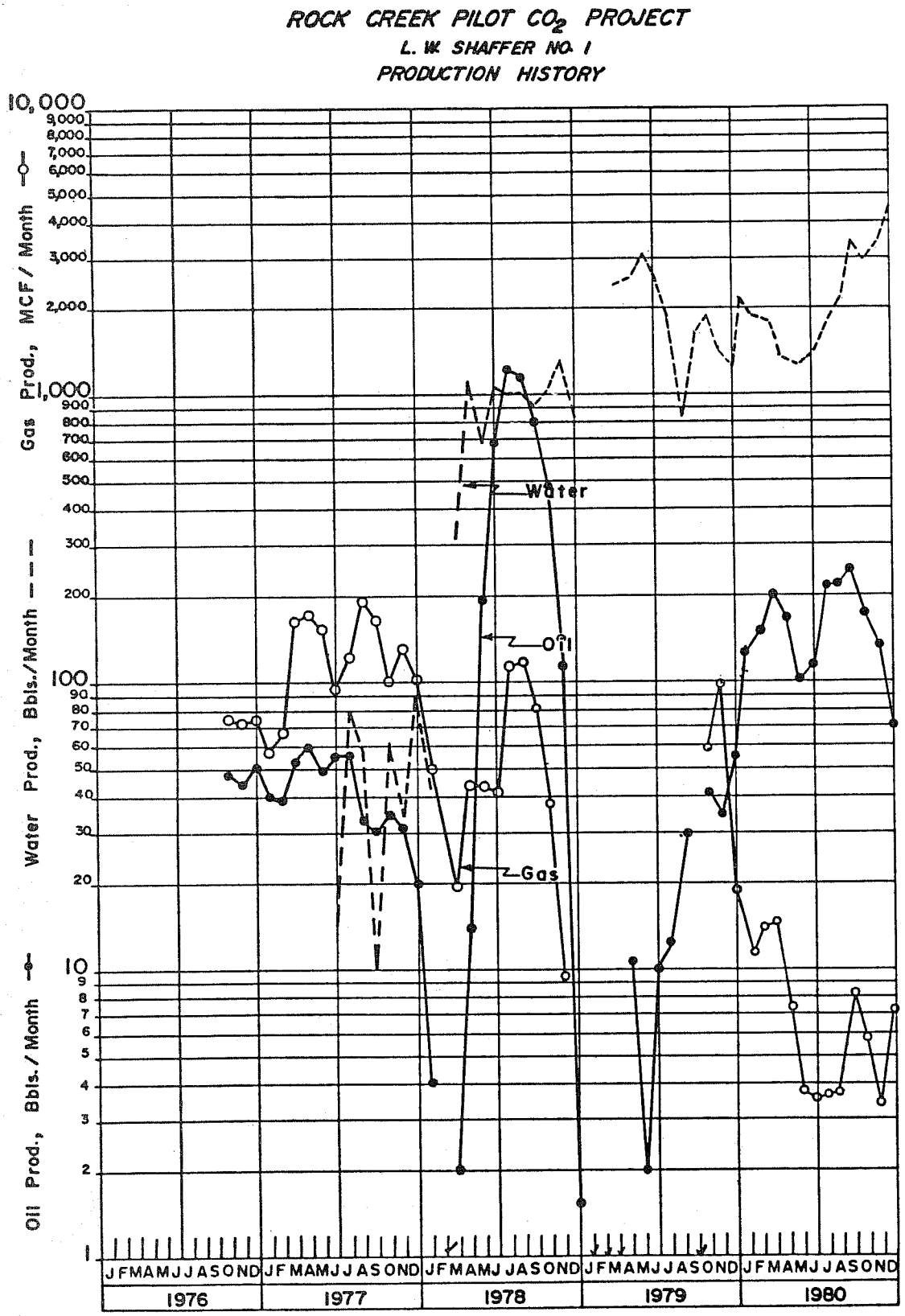
ROCK CREEK PILOT CARBON DIOXIDE PROJECT
HISTORY OF PRODUCTION

	L. W. Shaffer No. 1				L. W. Shaffer No. 4				L. W. Shaffer OB-1			
	Oil Bbls.	Water Bbls.	Gas MMCF	Hrs.	Oil Bbls.	Water Bbls.	Gas MMCF	Hrs.	Oil Bbls.	Water Bbls.	Gas MMCF	Hrs.
1976												
October	48	0	0.0744	47	3	69	0.0620	48				
November	44	0	0.0720	59	0	47	0.0600	60				
December	51	0	0.0744	64	0	26	0.0620	64				
1977												
January	40	0	0.0576	37	0	15	0.0420	34				
February	39	0	0.0672	46	0	16	0.0560	38				
March	53	0	0.1635	62	22	10	0.1268	62				
April	60	0	0.1723	66	28	5	0.1168	60				
May	49	0	0.1527	58	24	17	0.1744	54				
June	56	12	0.0950	65	34	19	0.1949	60				
July	56	78	0.1224	88	43	7	0.2083	70				
August	33	56	0.1929	93	43	3	0.2239	62				
September	30	10	0.1650	93	36	2	0.2100	62				
October	35	62	0.1009	100	37	2	0.1653	67				
November	31	34	0.1305	87	34	4	0.1204	66				
December	20	86	0.1023	80	39	5	0.1178	66				
1978												
January	4	43	0.0495	33	32	1	0.0570	57				
February	0	0	0	0	41	0	0.1104	70				
March	2	313	0.0194	147	43	3	0.1178	67				
April	14	1,116	0.0435	404	34	11	0.1133	64				
May	195	681	0.0434	254	40	8	0.1178	60				
June	688	1,082	0.0420	616	235	4	0.1532	162				
July	1,246	1,036	0.1170	694	2,029	15	0.2022	690				
August	1,174	1,016	0.1190	726	1,662	22	0.1686					
September	804	932	0.0810	720	919	167	0.0917	720				
October	474	1,031	0.0373	744	314	350	0.0262	646				
November	109	1,315	0.0094	720	17	783	0.0010	605				
December	1	857	0.0008	424	9	768	0.0208	503				
1979												
January	0	0	0	Workover	10	2,258	0.0110	685				
February	0	0	0	Workover	17	2,777	0.0149	654				
March	0	2,446	0.0962*	458	8	2,377	0.0036	568				
April	11	2,451	0.9147*	669	17	3,473	0.0151	705				
May	2	3,118	1.4950*	484	6	3,571	0.0057	672				
June	10	2,646	1.2818*	607	0	3,088	0.0012	604				
July	13	1,912	1.0468*	478	94	1,810	0.1358	200				
August	30	839	0.4487*	118	104	817	0.0915	132				
September	0	1,689	0.4095*	191	187	1,008	0.1456*	196				
October	42	1,864	0.6024*	244	242	1,159	0.2355*	246				
November	35	1,579	0.8449*	464	188	994	0.4422*	440				
December	56	1,393	1.1749*	646	170	1,599	0.7742*	577				
1980												
January	131	2,263	1.0166*	672	212	1,817	0.3686*	744				
February	160	1,947	0.8114*	696	172	1,407	0.2737*	696				
March	206	1,866	0.9138*	707	164	1,455	0.2876*	707				
April	178	1,514	1.1591*	719	145	1,576	0.2699*	719				
May	107	1,444	0.9815*	702	160	1,534	0.3056*	734				
June	121	1,503	0.6665*	419	164	1,294	0.3249*	419				
July	219	1,800	0.1798*	372	206	1,205	0.3866*	393	24	438		104
August	221	2,238	0.1438*	350	212	985	0.6138*	304	76	788		175
September	253	3,401	0.1189*	362	267	2,063	0.5914*	502	63	760		178
October	183	2,950	0.2591*	369	184	1,597	0.1318*	361	27	513		54
November	150	3,402	0.6790*	416	189	1,921	0.9380*	389½	10	660		179
December	70	4,525	0.2759*	530	197	2,396	0.3600*	482	0	808		203
1981												
January	240	1,593	2.9367*	352	119	2,031	0.1708*	423	10	1,381	0.0183*	506
February	361	1,047	2.6004*	328	121	1,935	0.1879*	349	62	1,479	0.0702*	469
March	397	1,316	3.4437*	319	192	2,003	0.5738*	400	211	1,162	0.2179*	187
April	345	1,223	2.0063*	252	213	1,133	0.8252*	377	245	688	0.3009*	480
May	355	1,304	2.6820*	305	233	1,387	0.8534*	402	297	510	0.3764*	379
June	358	1,039	3.4577*	295½	243	1,213	0.7690*	349	178	244	0.3720*	305¼
Cumulative Production	9,610	66,072			10,154	56,262			1,203	9,431		

* CO_2 Production

APPENDIX B

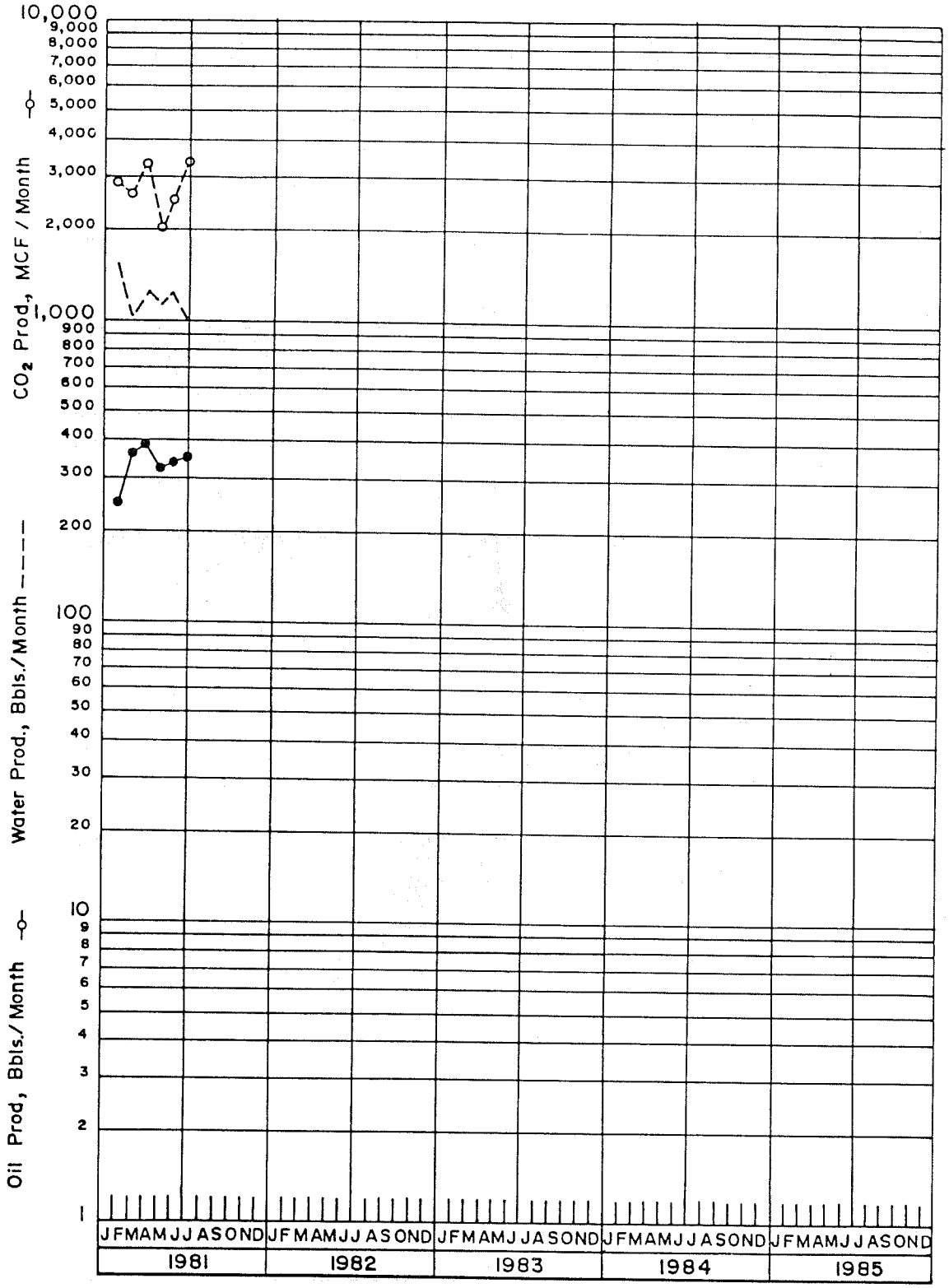
Graphical History of Production



ROCK CREEK PILOT CO_2 PROJECT

L. W. SHAFFER NO. 1

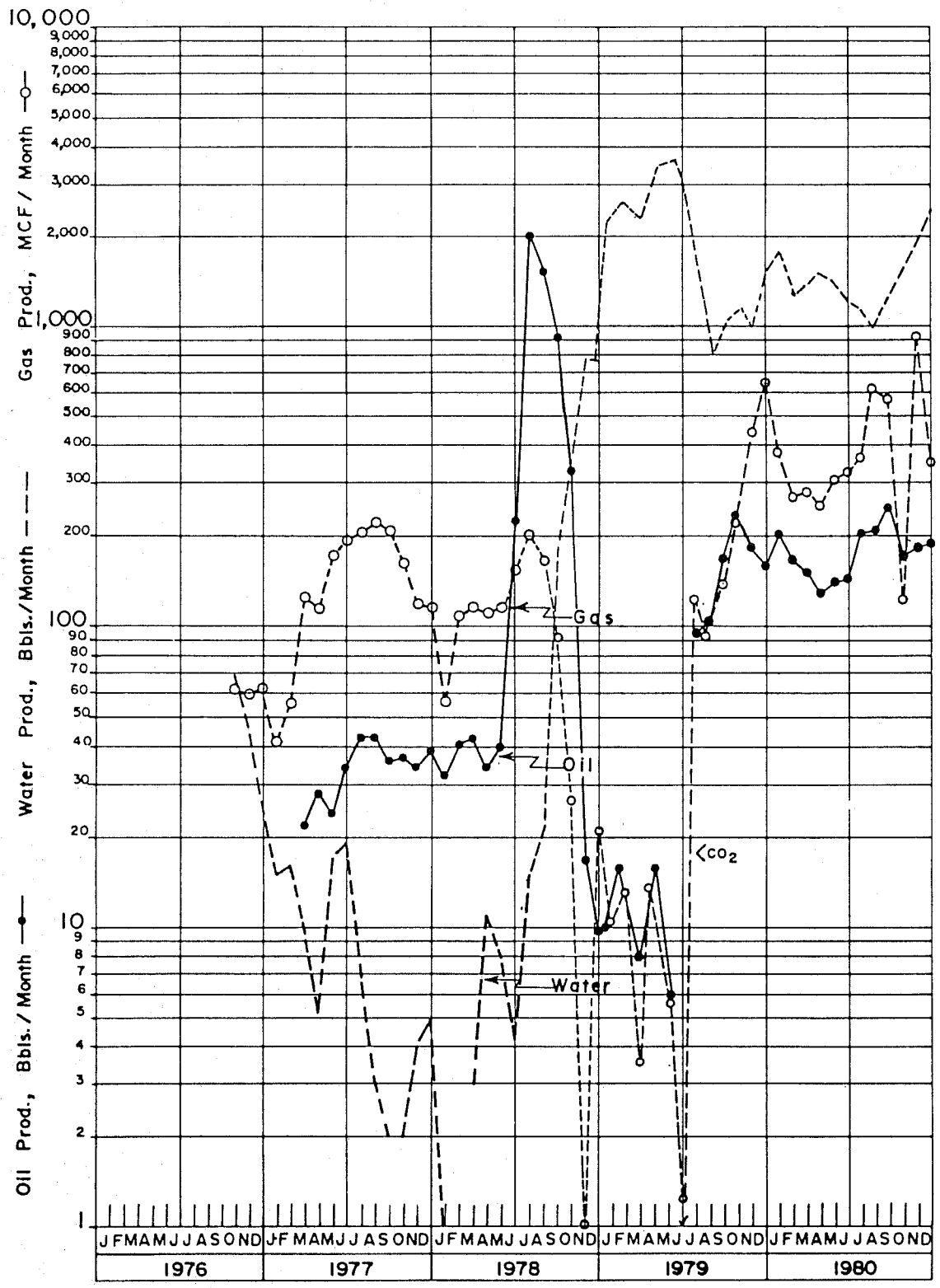
PRODUCTION HISTORY



ROCK CREEK PILOT CO_2 PROJECT

L. W. SHAFFER NO. 4

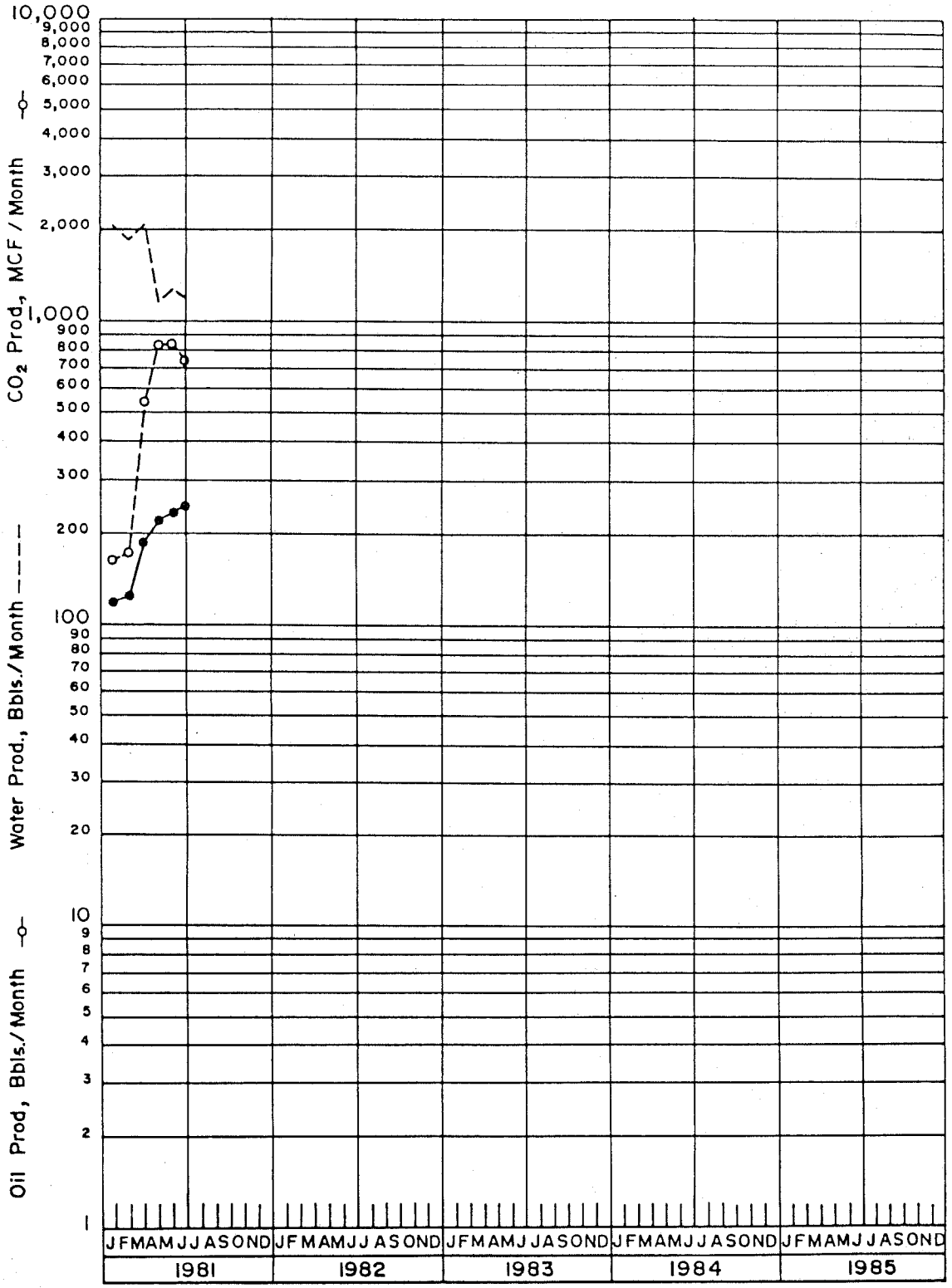
PRODUCTION HISTORY



ROCK CREEK PILOT CO_2 PROJECT

L. W. SHAFFER NO. 4

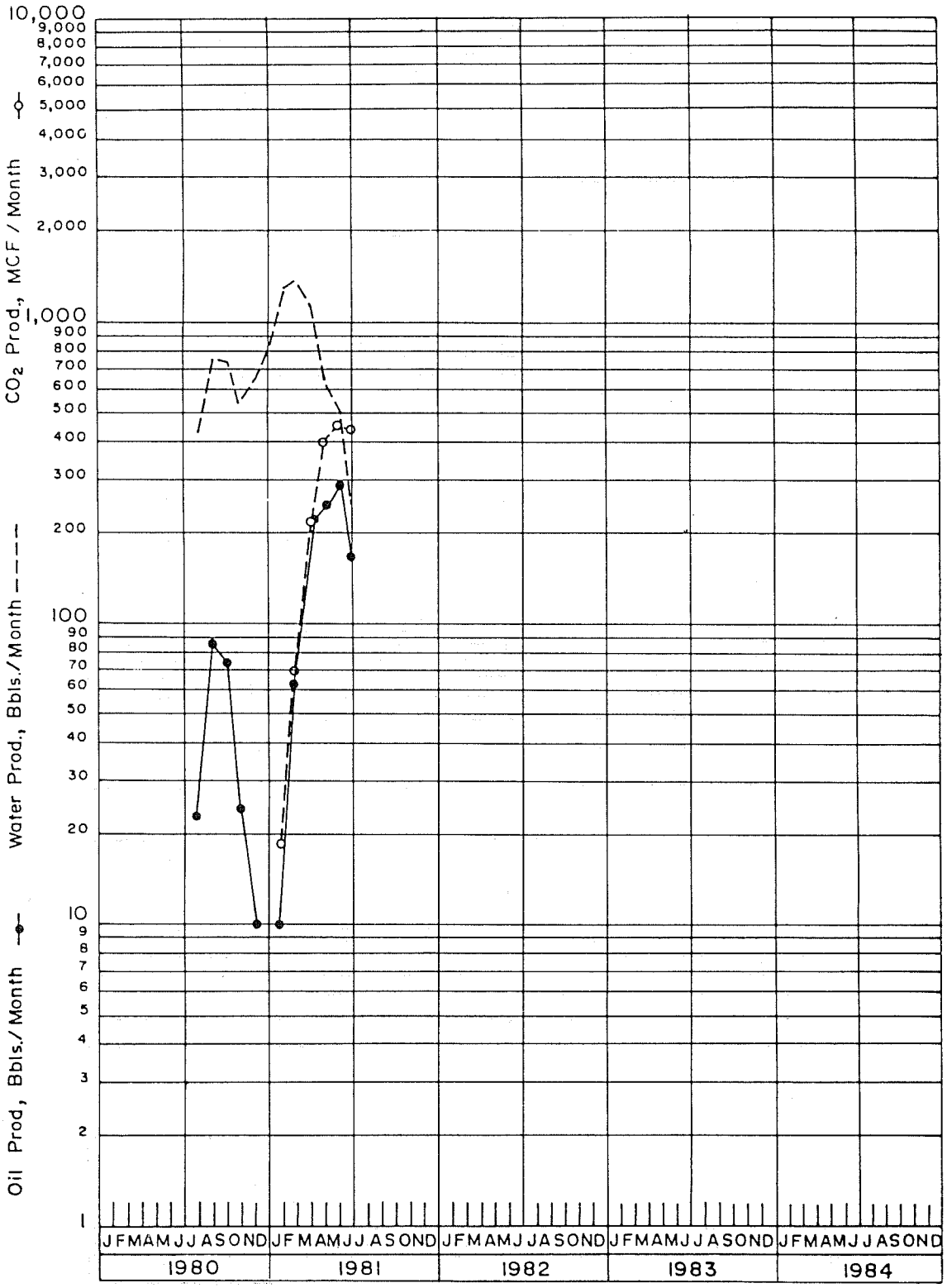
PRODUCTION HISTORY



ROCK CREEK PILOT CO_2 PROJECT

L. W. SHAFFER 08-1

PRODUCTION HISTORY



APPENDIX C

History of Carbon Dioxide Injection

ROCK CREEK PILOT CARBON DIOXIDE PROJECT
HISTORY OF CARBON DIOXIDE INJECTION

	January, 1979		February, 1979		March, 1979		April, 1979		May, 1979	
	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP
E. Lewis PI No. 1	0	-	75	850	270	725	735	880	450	780
L. W. Shaffer PI No. 2	0	-	16	755	296	840	708	1150	469	890
L. W. Shaffer PI No. 3	0	-	41	675	259	745	778	945	465	820
J. H. Looney PI No. 4	0	-	16	545	264	545	264	675	787	945
R. C. Elmore PI No. 5	0	-	98	925	336	755	773	955	470	905
L. W. Shaffer PI No. 6	0	-	89	795	224	620	481	1040	449	835
Total or Avg.	0	-	335	755	1,649	725	4,262	950	2,772	825
Cumulative Inj.	0		335		1,984		6,246		9,018	

	June, 1979		July, 1979		August, 1979		September, 1979		October, 1979	
	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP
E. Lewis PI No. 1	269	750	259	780	117	780	0	-	109	885
L. W. Shaffer PI No. 2	294	750	266	750	123	680	0	-	0	-
L. W. Shaffer PI No. 3	319	785	280	800	143	800	0	-	0	-
J. H. Looney PI No. 4	309	755	294	785	117	790	0	-	0	-
R. C. Elmore PI No. 5	308	800	257	795	105	740	0	-	0	-
L. W. Shaffer PI No. 6	303	780	263	775	92	770	0	-	105	815
Total or Avg.	1,802	770	1,619	780	697	760	0	-	214	850
Cumulative Inj.	10,820		12,439		13,136		13,136		13,350	

	November, 1979		December, 1979		January, 1980		February, 1980		March, 1980	
	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP
E. Lewis PI No. 1	368	820	555	765	126	650	0	-	177	820
L. W. Shaffer PI No. 2	319	960	563	710	128	630	0	-	212	730
L. W. Shaffer PI No. 3	224	1015	526	710	135	745	0	-	203	920
J. H. Looney PI No. 4	244	930	567	725	131	615	0	-	227	715
R. C. Elmore PI No. 5	222	1035	588	940	127	830	0	-	236	985
L. W. Shaffer PI No. 6	443	750	543	670	125	620	0	-	227	885
Total or Avg.	1,820	920	3,342	770	772	680	0	-	1,282	845
Cumulative Inj.	15,170		18,512		19,284		19,284		20,566	

	April, 1980		May, 1980		June, 1980		July, 1980		August, 1980	
	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP
E. Lewis PI No. 1	217	650	210	670	106	688	0	-	0	-
L. W. Shaffer PI No. 2	219	640	212	670	103	694	0	-	0	-
L. W. Shaffer PI No. 3	242	725	228	700	111	714	0	-	0	-
J. H. Looney PI No. 4	227	615	219	660	102	678	0	-	0	-
R. C. Elmore PI No. 5	232	810	214	710	103	708	0	-	0	-
L. W. Shaffer PI No. 6	221	690	209	675	102	683	0	-	0	-
Total or Avg.	1,358	690	1,292	680	627	694	0	-	0	-
Cumulative Inj.	21,924		23,216		23,843		23,843		23,843	

	September, 1980		October, 1980		November, 1980		December, 1980		January, 1981	
	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP
E. Lewis PI No. 1	0	-	0	-	0	-	0	-	0	-
L. W. Shaffer PI No. 2	0	-	0	-	0	-	22	883	204	965
L. W. Shaffer PI No. 3	0	-	0	-	0	-	28	808	268	931
J. H. Looney PI No. 4	0	-	0	-	0	-	12	875	361	773
R. C. Elmore PI No. 5	0	-	0	-	0	-	30	667	308	1060
L. W. Shaffer PI No. 6	0	-	0	-	0	-	22	908	193	904
L. W. Shaffer PI No. 7							51	792	292	765
L. W. Shaffer PI No. 8							85	813	232	765
Total or Avg.	0	-	0	-	0	-	250	821	1,858	880
Cumulative Inj.	23,843		23,843		23,843		24,093		25,951	

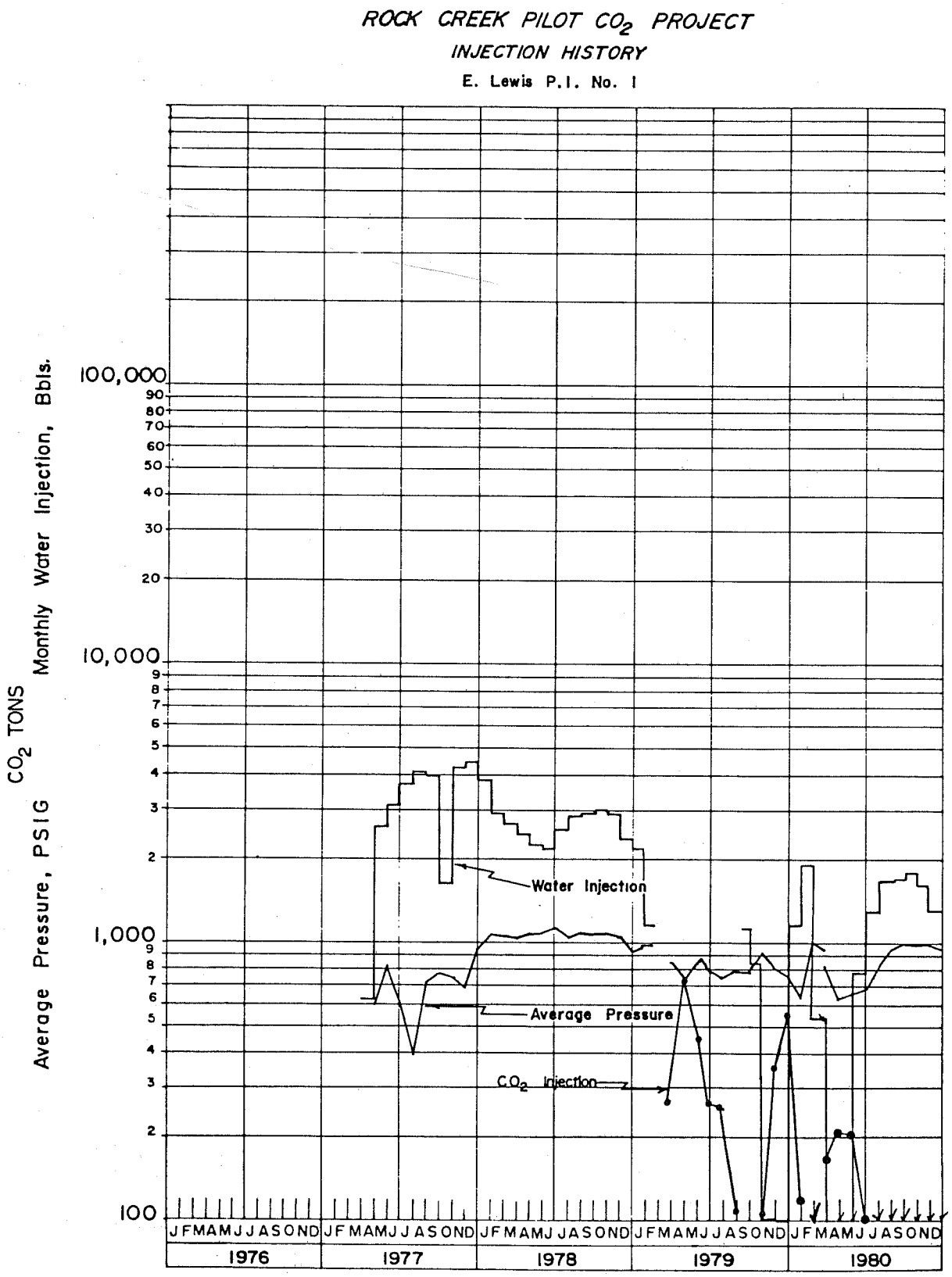
ROCK CREEK PILOT CARBON DIOXIDE PROJECT
HISTORY OF CARBON DIOXIDE INJECTION
Continued

	February, 1981		March, 1981		April, 1981		May, 1981		June, 1981	
	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP	Inj. Tons	Avg. WHP
E. Lewis PI No. 1	0	-	0	-	0	-	0	-	0	-
L. W. Shaffer PI No. 2	257	999	284	948	61	903	0	-	0	-
L. W. Shaffer PI No. 3	296	974	279	906	63	881	0	-	0	-
J. H. Looney PI No. 4	319	718	301	689	62	684	0	-	0	-
R. C. Elmore PI No. 5	290	1041	303	987	68	919	0	-	0	-
L. W. Shaffer PI No. 6	282	915	302	856	270	792	270	756	199	846
L. W. Shaffer PI No. 7	266	769	287	744	262	262	273	742	191	796
L. W. Shaffer PI No. 8	0	-	175	710	0	-	135	865	203	811
Total or Avg.	1,710	903	1,931	834	786	819	678	788	593	818
Cumulative Inj.	27,661		29,592		30,378		31,056		31,649	

	Cumulative CO_2 Injection July 1, 1981	
	Tons	RBbls.
E. Lewis PI No. 1	4,045	28,720
L. W. Shaffer PI No. 2	4,755	33,760
L. W. Shaffer PI No. 3	4,888	34,705
J. H. Looney PI No. 4	5,027	35,692
R. C. Elmore PI No. 5	5,068	35,983
L. W. Shaffer PI No. 6	5,414	38,439
L. W. Shaffer PI No. 7	1,622	11,516
L. W. Shaffer PI No. 8	830	5,893

APPENDIX D

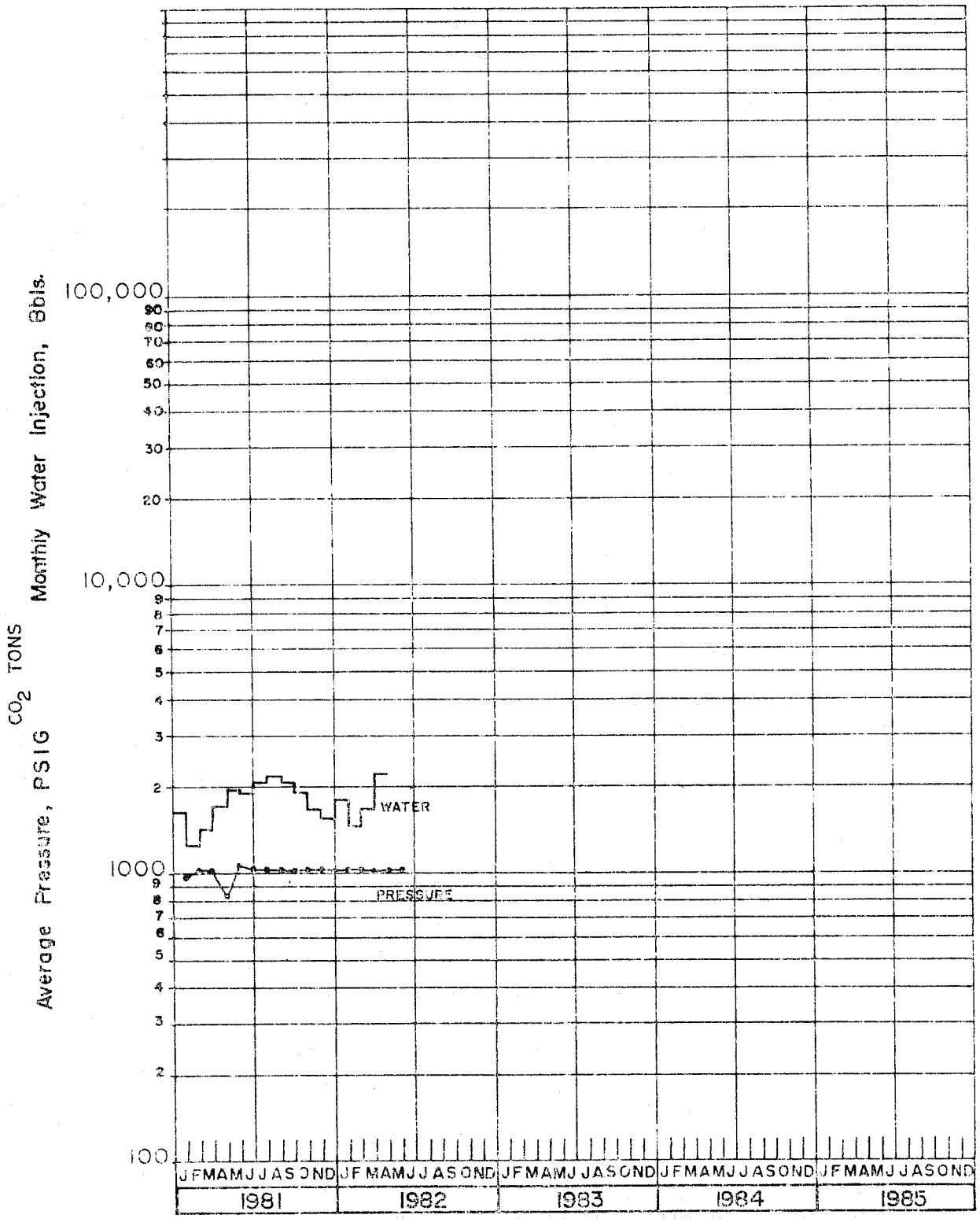
Graphical History of Carbon Dioxide Injection



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

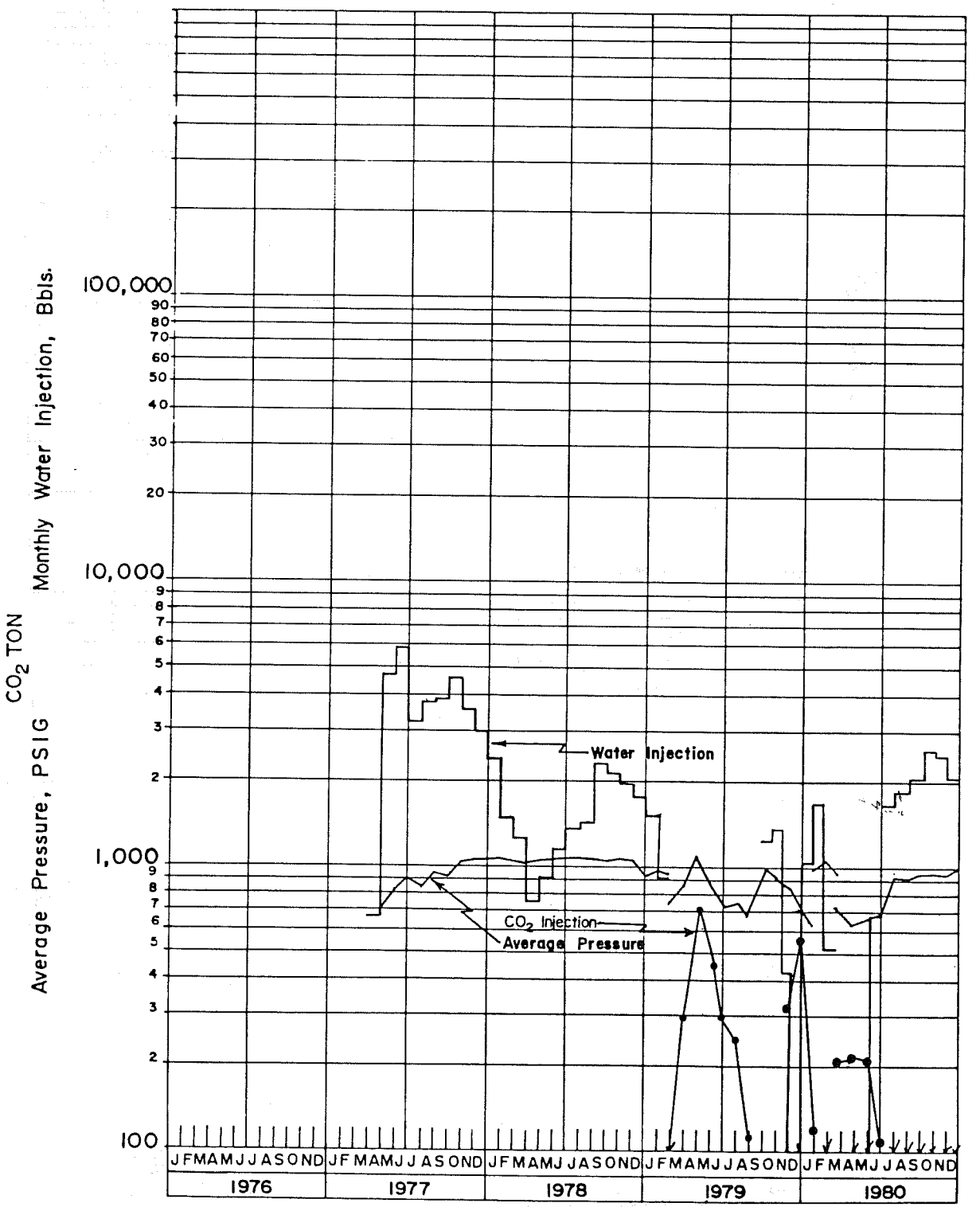
E. Lewis P.I. No. 1



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

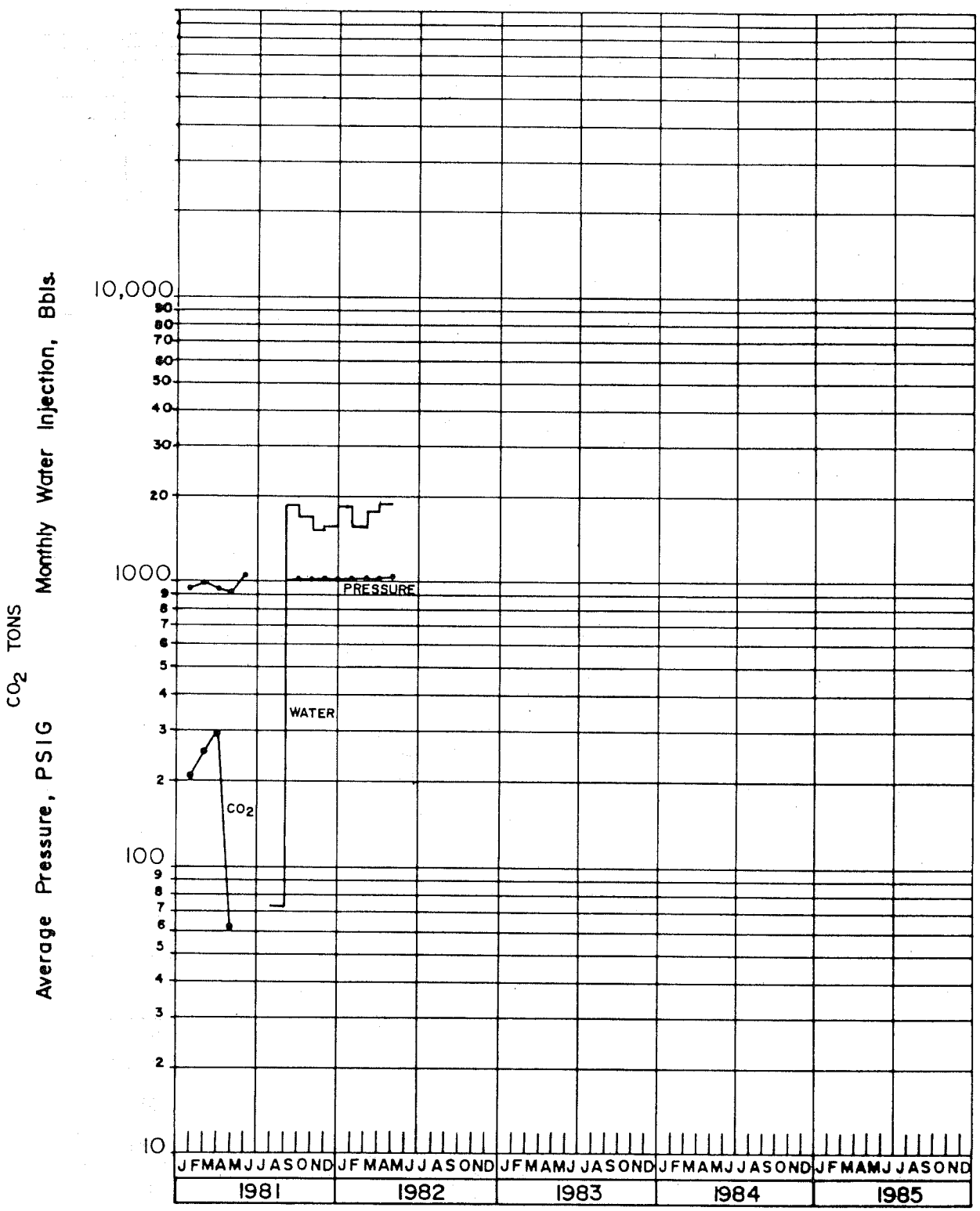
L. W. Shaffer P.I. No. 2



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

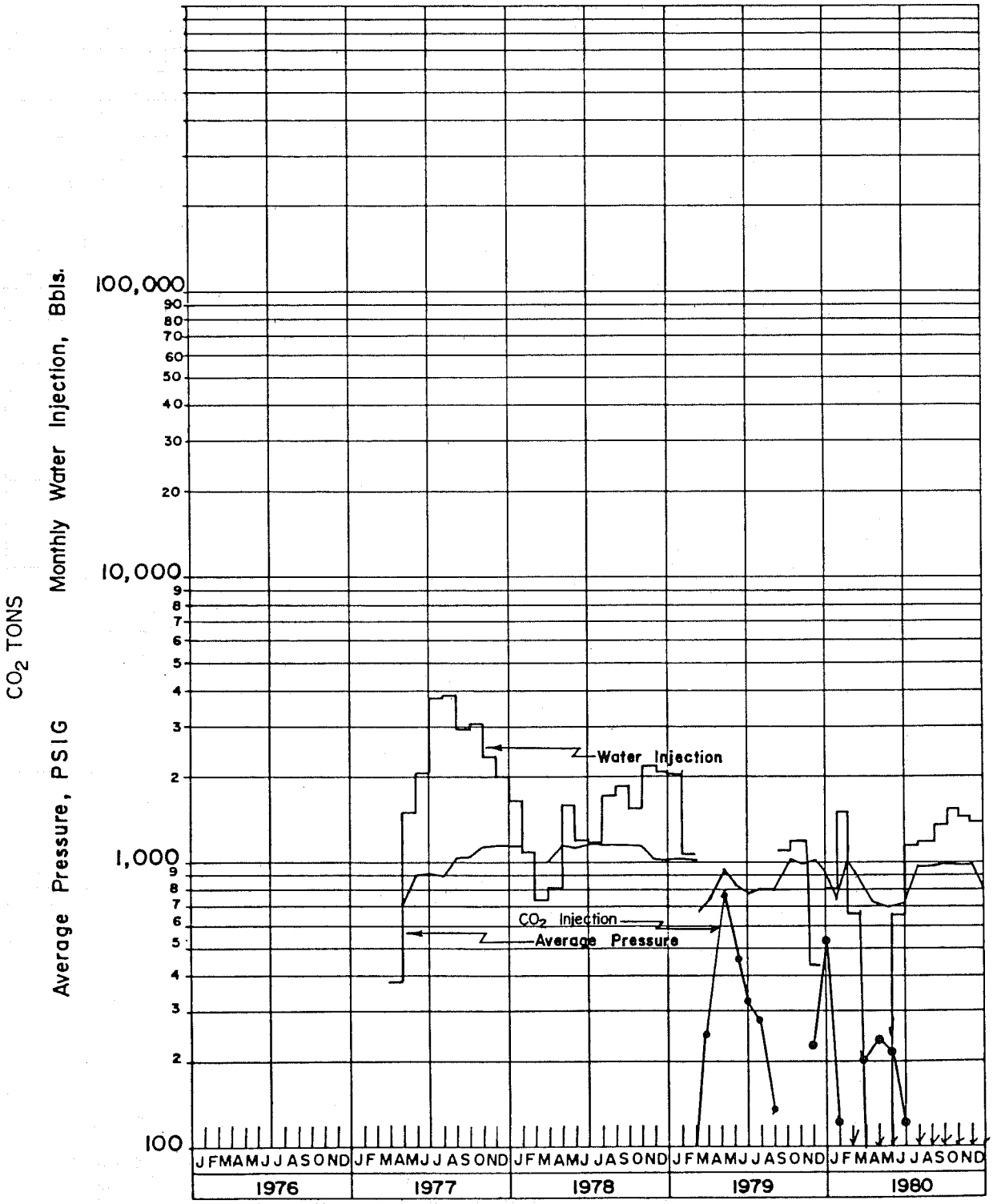
L.W. Shaffer P.I. No. 2



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

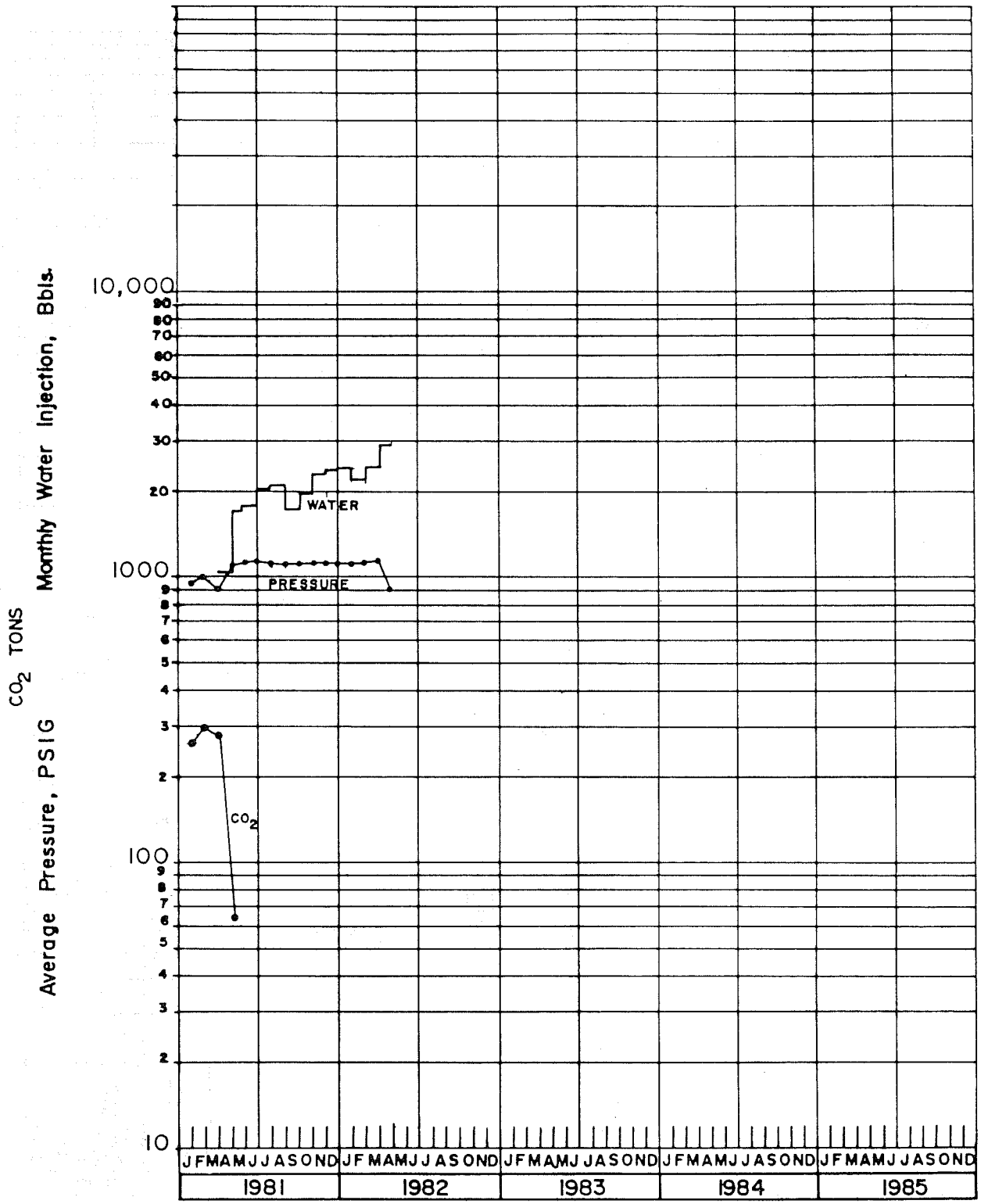
L. W. Shaffer P.I. No. 3



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

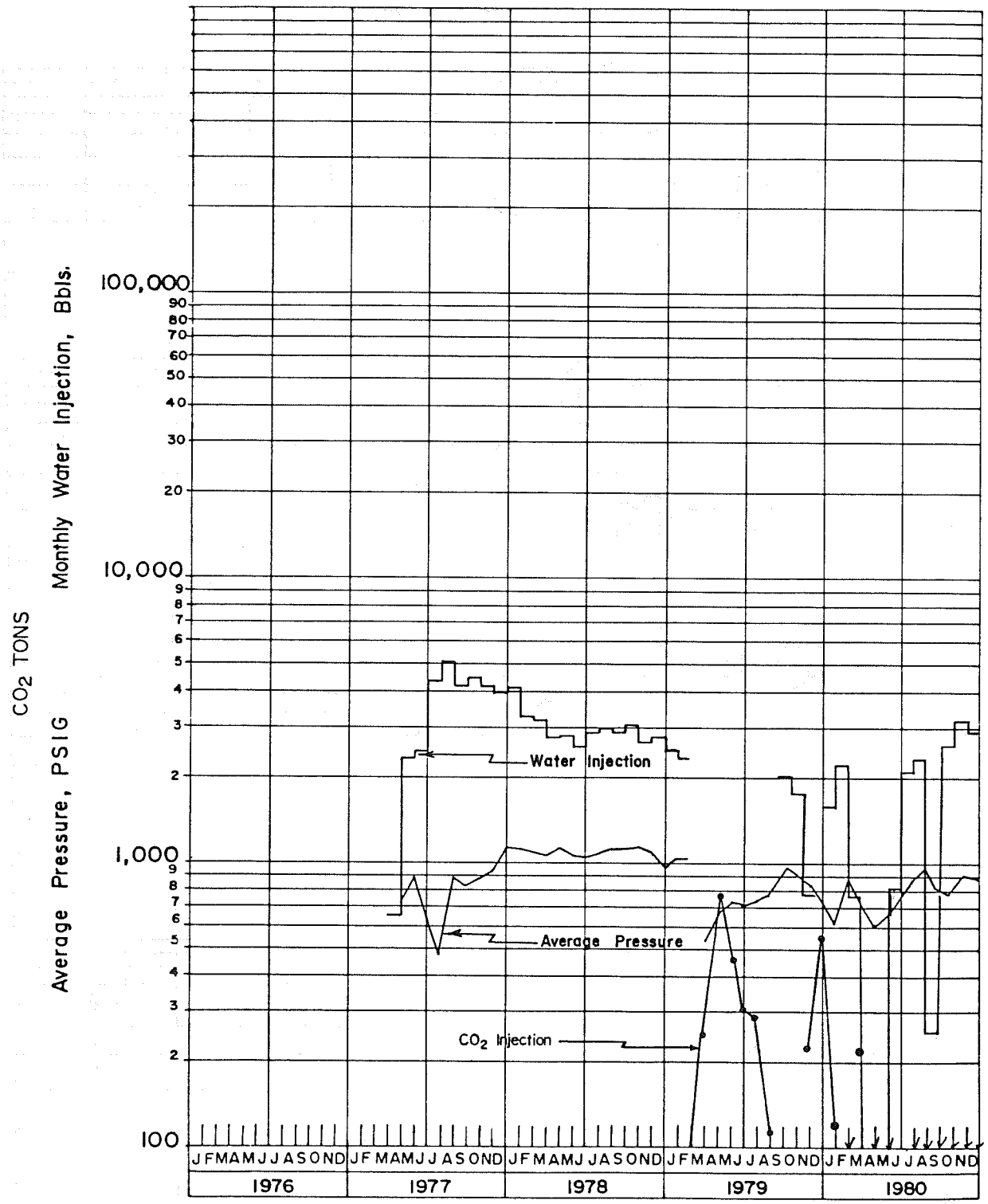
L. W. Shaffer P.I. No. 3



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

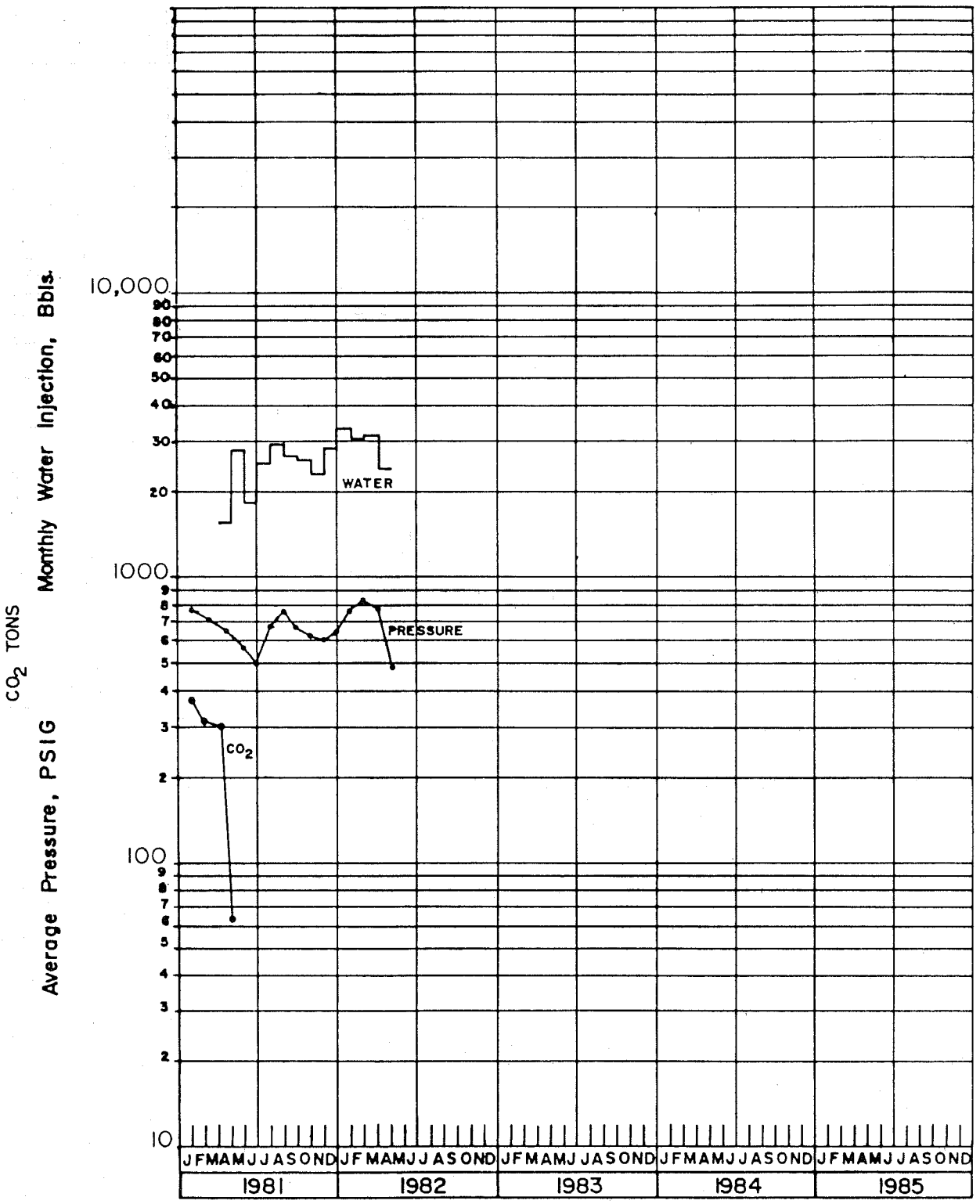
J. H. Looney P.I. No. 4



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

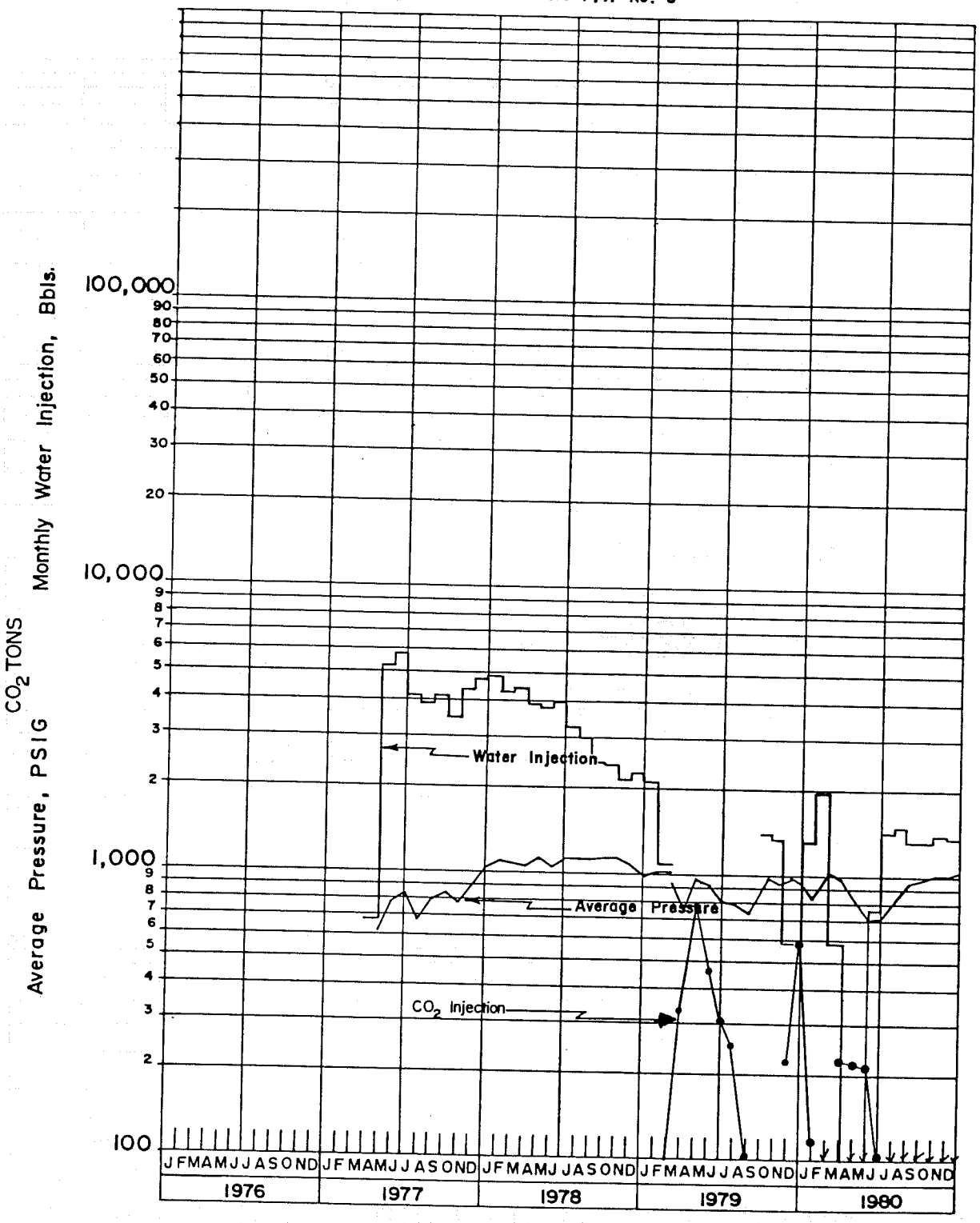
J. H. Looney P. I. No. 4



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

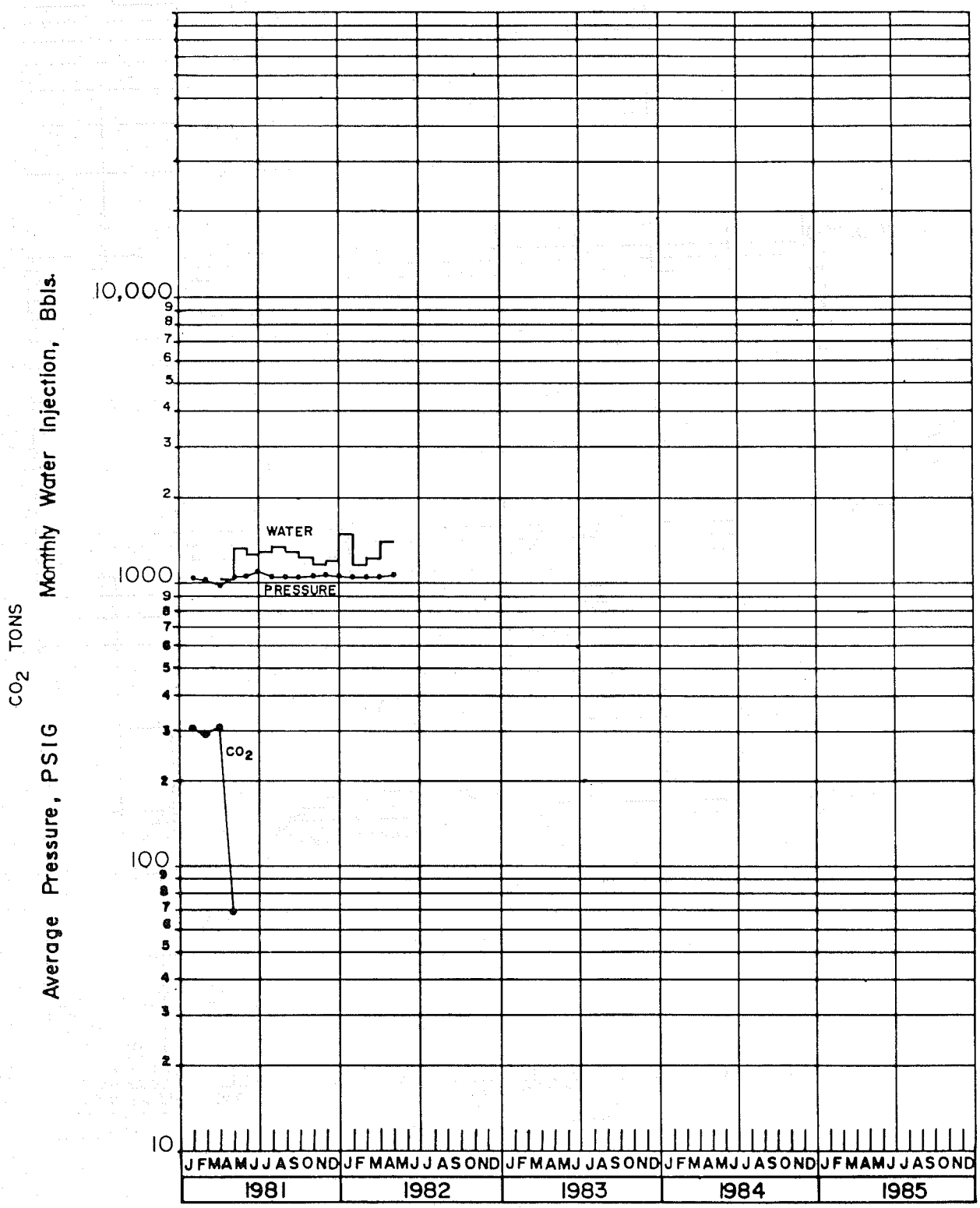
R. C. Elmore P.I. No. 5



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

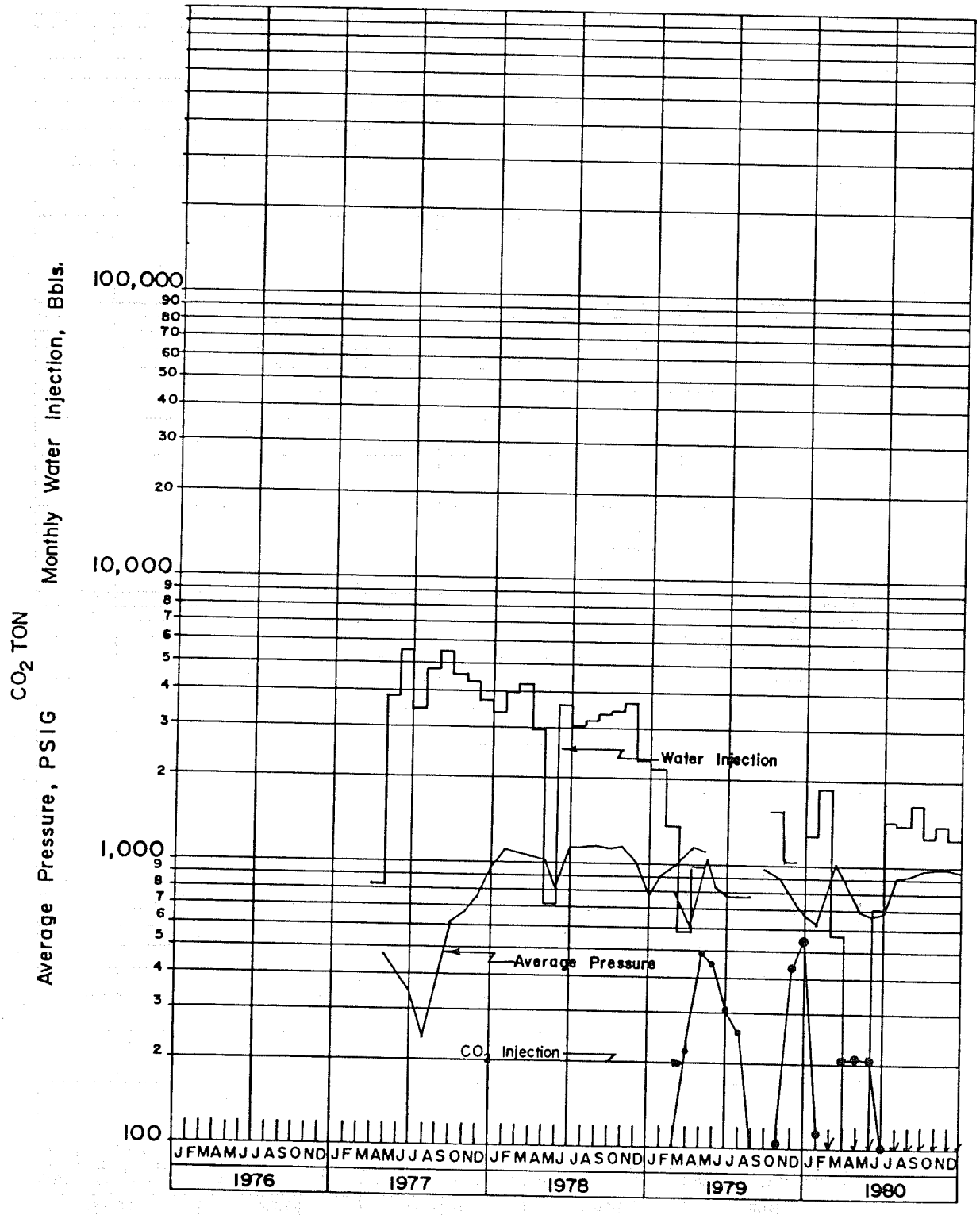
R. C. Elmore P.I. No. 5



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

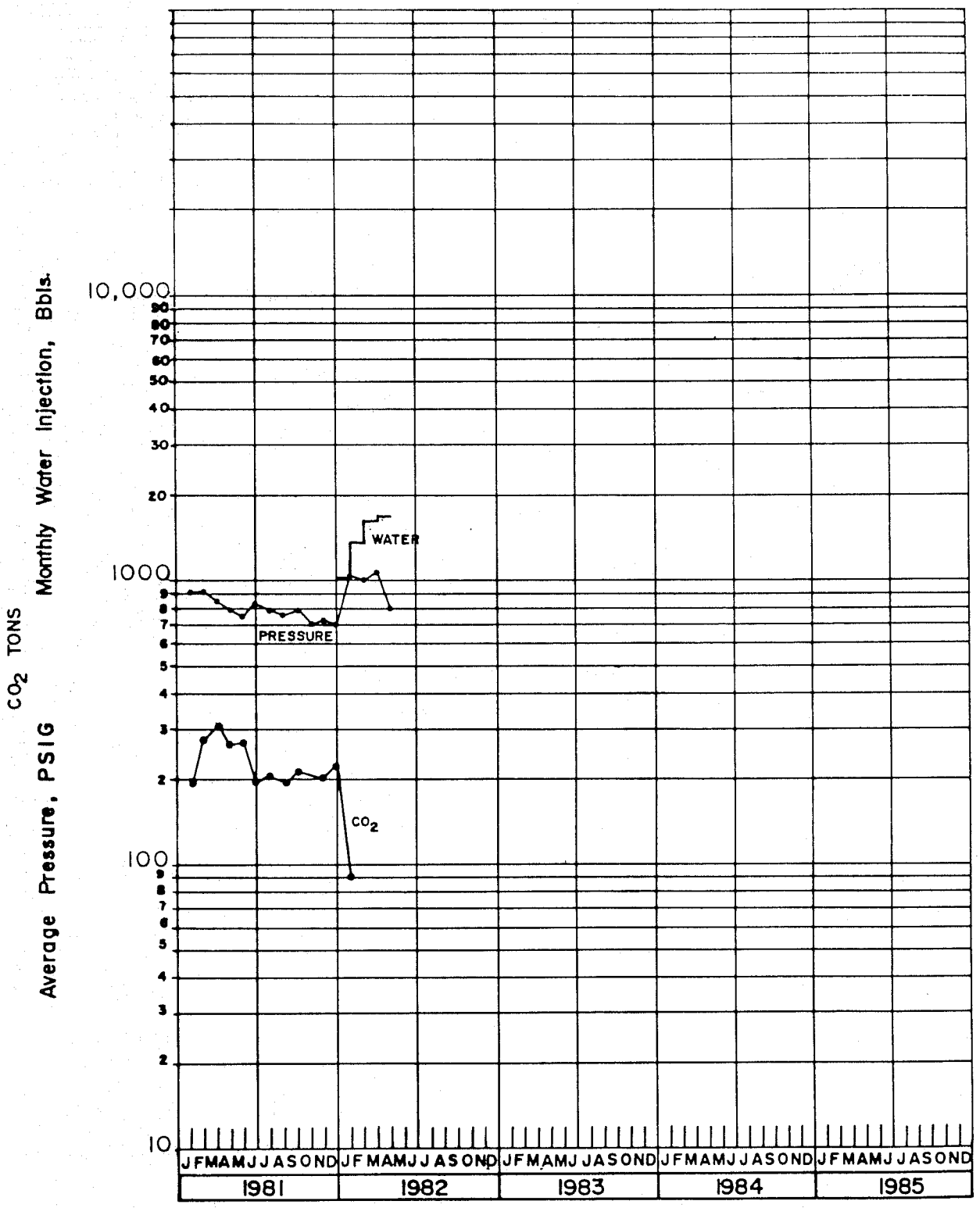
L. W. Shaffer P. I. No. 6



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

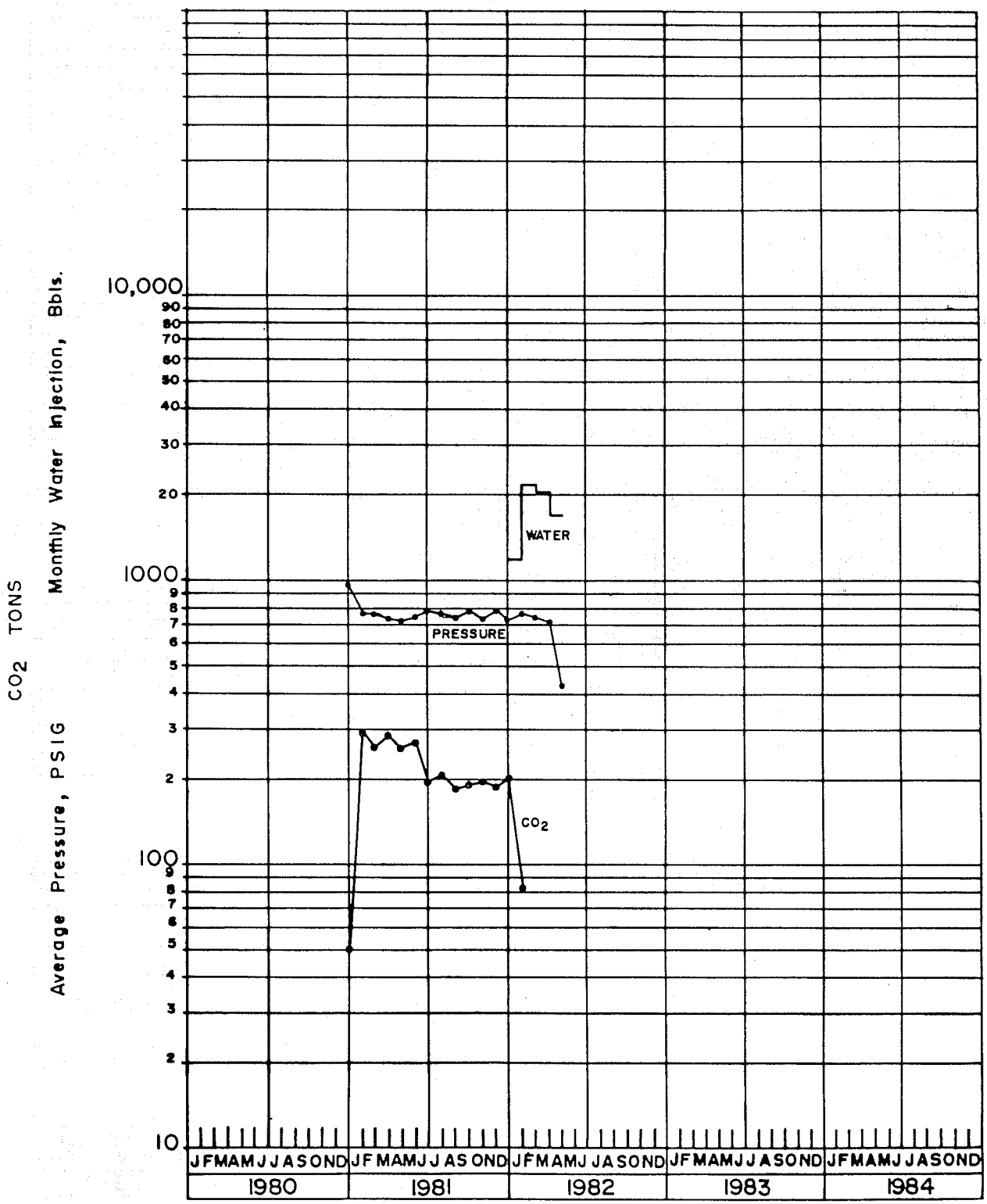
L.W. Shaffer P.I. No. 6



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

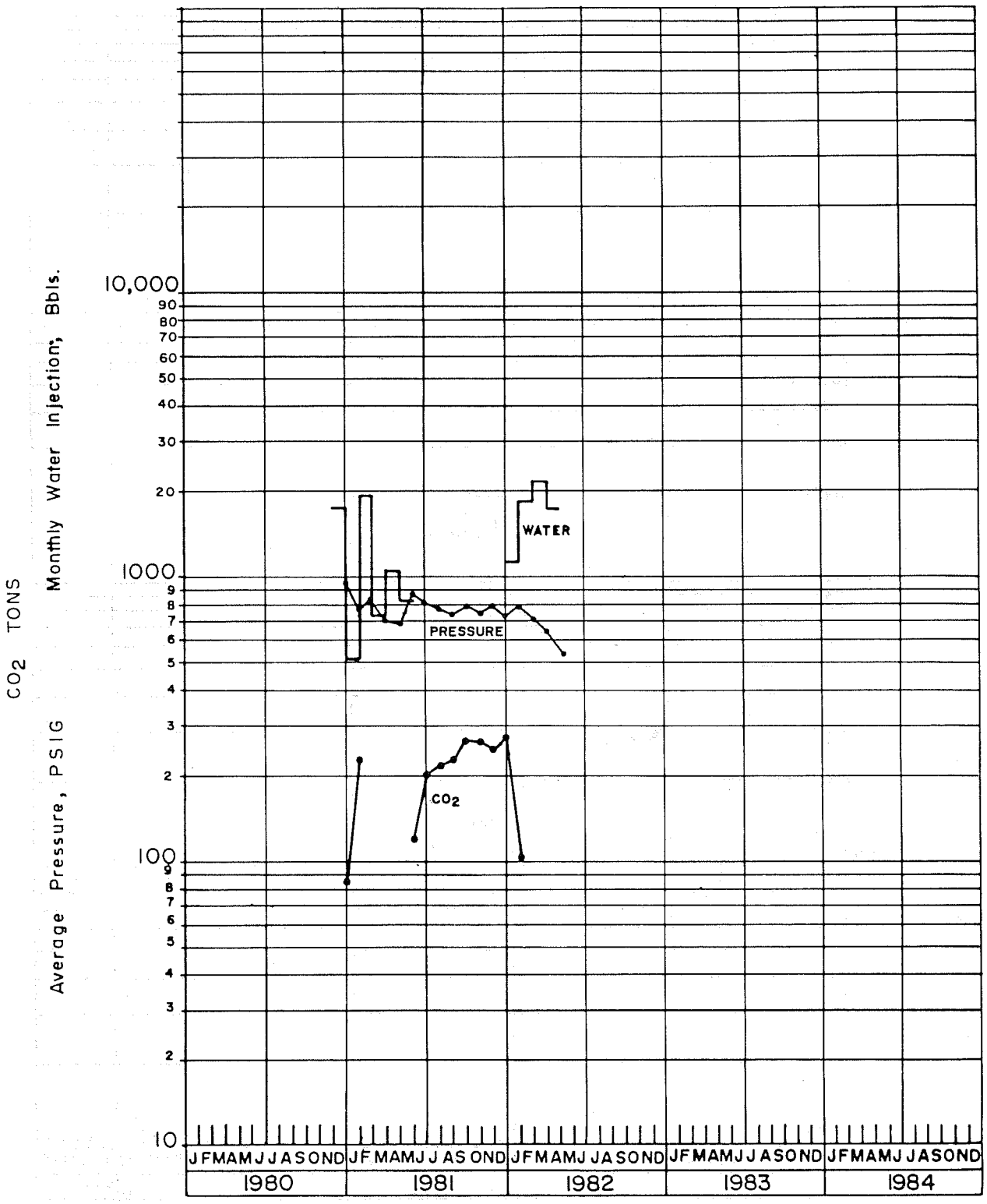
L.W. SHAFFER PI-7



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

L.W. SHAFFER PI-8



APPENDIX E

History of Water Injection

ROCK CREEK PILOT CARBON DIOXIDE PROJECT
HISTORY OF WATER INJECTION

	October, 1976		November, 1976		December, 1976		January, 1977	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	-	-	-	-	-	-	-	-
L. W. Shaffer PI No. 2	-	-	-	-	-	-	-	-
L. W. Shaffer PI No. 3	-	-	-	-	-	-	-	-
J. H. Looney PI No. 4	-	-	-	-	-	-	-	-
R. C. Elmore PI No. 5	-	-	-	-	-	-	-	-
L. W. Shaffer PI No. 6	-	-	-	-	-	-	-	-
R. C. Elmore WIW No. 1	1,785	0	2,461	0	4,479	0	4,895	0
R. C. Elmore WIW No. 4	1,244	510	2,326	825	2,263	800	2,250	805
E. Lewis WIW No. 17	1,909	730	3,288	820	3,318	800	601	800
E. Lewis WIW No. 18	1,754	750	3,196	785	2,951	800	2,990	800
E. Lewis WIW No. 27	-	-	2,878	715	3,016	800	2,696	805
E. Lewis WIW No. 28	1,990	660	1,926	705	1,342	765	1,326	765
E. Lewis WIW No. 29	-	-	967	725	1,198	815	1,081	820
J. H. Looney WIW No. 1	1,928	190	3,646	380	4,723	480	3,658	515
J. H. Looney WIW No. 5	-	-	1,768	750	1,326	800	1,344	820
L. W. Shaffer WIW No. 2	1,923	0	2,615	0	5,139	0	7,174	0
L. W. Shaffer WIW No. 8	2,046	405	3,417	350	3,156	495	3,785	575
L. W. Shaffer WIW No. 10	-	-	687	800	287	805	356	815
L. W. Shaffer WIW No. 11	-	-	452	815	327	845	484	850
Total or Avg.	14,579	405	29,627	590	33,525	630	32,640	645
Cumulative Inj.			44,206		77,731		110,371	

	February, 1977		March, 1977		April, 1977		May, 1977	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	-	-	-	-	624	595	2,603	815
L. W. Shaffer PI No. 2	-	-	-	-	662	700	4,622	820
L. W. Shaffer PI No. 3	-	-	-	-	380	715	1,501	890
J. H. Looney PI No. 4	-	-	-	-	648	715	2,304	880
R. C. Elmore PI No. 5	-	-	-	-	673	610	5,230	765
L. W. Shaffer PI No. 6	-	-	-	-	818	465	3,799	400
R. C. Elmore WIW No. 1	7,273	0	8,558	0	5,166	0	12,738	0
R. C. Elmore WIW No. 4	2,213	845	2,547	810	2,643	755	2,345	810
E. Lewis WIW No. 17	2,279	795	3,117	775	3,376	790	3,985	875
E. Lewis WIW No. 18	2,561	840	2,595	810	2,406	790	3,039	830
E. Lewis WIW No. 27	1,687	855	1,814	810	2,720	790	3,969	860
E. Lewis WIW No. 28	1,194	795	3,027	740	4,899	630	4,495	825
E. Lewis WIW No. 29	782	870	685	860	976	825	1,016	885
J. H. Looney WIW No. 1	6,259	815	6,527	800	5,905	775	6,223	845
J. H. Looney WIW No. 5	1,101	870	1,073	860	1,359	805	4,421	775
L. W. Shaffer WIW No. 2	7,637	0	9,334	0	4,418	0	6,451	0
L. W. Shaffer WIW No. 8	4,328	790	3,961	690	3,951	690	4,442	840
L. W. Shaffer WIW No. 10	191	865	178	835	253	825	2,920	865
L. W. Shaffer WIW No. 11	267	885	277	865	473	810	4,236	840
Total or Avg.	37,772	710	43,693	680	42,350	645	80,339	725
Cumulative Inj.	148,143		191,836		234,186		314,525	

	June, 1977		July, 1977		August, 1977		September, 1977	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	3,117	605	3,701	390	4,104	725	3,977	770
L. W. Shaffer PI No. 2	5,816	900	3,205	845	3,777	940	3,844	920
L. W. Shaffer PI No. 3	2,126	905	3,773	885	3,851	1030	2,967	1040
J. H. Looney PI No. 4	2,471	615	4,363	475	5,053	875	4,172	820
R. C. Elmore PI No. 5	5,700	825	4,080	660	3,883	795	4,097	835
L. W. Shaffer PI No. 6	5,506	345	3,441	235	4,746	370	5,439	605
R. C. Elmore WIW No. 1	7,422	0	7,601	0	6,415	0	10,332	40
R. C. Elmore WIW No. 4	2,694	945	2,875	950	3,068	1025	2,936	1045
E. Lewis WIW No. 17	4,612	955	4,145	970	0	-	226	325
E. Lewis WIW No. 18	3,177	940	3,329	965	3,444	1035	3,071	1020
E. Lewis WIW No. 27	4,803	945	4,987	970	5,178	1045	4,352	1030
E. Lewis WIW No. 28	5,005	915	5,274	900	5,776	985	4,381	940
E. Lewis WIW No. 29	2,537	935	2,759	925	4,524	1035	3,655	915
J. H. Looney WIW No. 1	6,450	930	6,487	930	6,494	980	5,932	1015
J. H. Looney WIW No. 5	4,791	605	5,480	695	6,169	860	5,918	755
L. W. Shaffer WIW No. 2	4,946	0	8,393	0	6,236	0	7,456	0
L. W. Shaffer WIW No. 8	4,824	920	4,918	940	5,260	1015	5,056	985
L. W. Shaffer WIW No. 10	4,843	960	5,354	960	5,204	1040	4,411	980
L. W. Shaffer WIW No. 11	4,454	955	4,601	965	5,215	1040	4,825	1020
Total or Avg.	85,294	745	88,767	720	88,397	820	87,047	790
Cumulative Inj.	399,819		488,586		576,983		664,030	

ROCK CREEK PILOT CARBON DIOXIDE PROJECT
HISTORY OF WATER INJECTION
Continued

	October, 1977		November, 1977		December, 1977		January, 1978	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,627	745	4,236	685	4,452	945	3,817	1070
L. W. Shaffer PI No. 2	4,511	1015	3,570	1040	2,987	1055	2,381	1065
L. W. Shaffer PI No. 3	3,053	1130	2,354	1155	1,979	1160	1,653	1150
J. H. Looney PI No. 4	4,438	865	4,168	930	3,957	1110	4,125	1105
R. C. Elmore PI No. 5	3,495	775	4,328	880	4,682	1035	4,826	1090
L. W. Shaffer PI No. 6	4,534	660	4,304	750	3,775	955	3,344	1100
R. C. Elmore WIW No. 1	10,589	225	9,779	315	12,393	565	4,124	725
R. C. Elmore WIW No. 4	3,060	1055	2,883	1075	2,892	1070	2,691	1065
E. Lewis WIW No. 17	3,383	870	1,854	385	3,310	820	4,203	855
E. Lewis WIW No. 18	3,299	1075	2,957	1090	3,978	1080	4,753	1065
E. Lewis WIW No. 27	4,429	1090	3,606	1095	3,177	1095	2,790	1090
E. Lewis WIW No. 28	3,590	890	2,980	965	2,491	1000	2,572	890
E. Lewis WIW No. 29	2,603	765	2,131	815	2,032	860	2,777	980
J. H. Looney WIW No. 1	5,190	895	4,717	925	5,119	990	4,588	895
J. H. Looney WIW No. 5	6,007	825	5,373	865	5,672	950	5,493	955
L. W. Shaffer WIW No. 2	10,064	90	11,448	195	10,070	245	10,866	430
L. W. Shaffer WIW No. 8	4,383	815	4,072	840	4,530	945	4,191	975
L. W. Shaffer WIW No. 10	3,949	910	3,899	1020	3,759	1085	3,099	1085
L. W. Shaffer WIW No. 11	4,825	1035	4,523	1075	4,267	1095	4,064	1085
Total or Avg.	87,029	830	83,182	845	85,522	950	76,357	985
Cumulative Inj.	751,059		834,241		919,763		996,120	

	February, 1978		March, 1978		April, 1978		May, 1978	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	2,889	NR*	2,667	1025	2,432	1070	2,225	1080
L. W. Shaffer PI No. 2	1,484	NR	1,239	1020	751	1045	920	1060
L. W. Shaffer PI No. 3	1,090	NR	741	1000	814	1140	1,595	1115
J. H. Looney PI No. 4	3,282	NR	3,188	1070	2,769	1115	2,791	1065
R. C. Elmore PI No. 5	4,251	NR	4,350	1050	3,873	1115	3,789	1050
L. W. Shaffer PI No. 6	3,984	NR	4,272	1045	2,951	1020	720	810
R. C. Elmore WIW No. 1	0	-	0	-	1,371	450	4,773	765
R. C. Elmore WIW No. 4	2,319	NR	2,460	1040	2,319	1090	2,253	1035
E. Lewis WIW No. 17	4,425	NR	5,225	985	3,453	825	549	480
E. Lewis WIW No. 18	4,664	NR	5,471	1000	4,406	940	6,342	1040
E. Lewis WIW No. 27	2,282	NR	2,138	1050	1,444	1085	605	990
E. Lewis WIW No. 28	2,048	NR	1,855	990	1,639	1015	1,484	990
E. Lewis WIW No. 29	3,144	NR	3,276	1045	2,873	1080	771	1065
J. H. Looney WIW No. 1	4,199	NR	4,247	1030	4,090	1075	4,080	1035
J. H. Looney WIW No. 5	4,745	NR	4,868	1025	4,487	1070	3,775	975
L. W. Shaffer WIW No. 2	12,544	NR	15,220	945	4,703	970	13,864	975
L. W. Shaffer WIW No. 8	3,360	NR	3,292	975	3,241	1035	3,314	975
L. W. Shaffer WIW No. 10	2,064	NR	1,466	1050	1,480	820	1,696	980
L. W. Shaffer WIW No. 11	3,439	NR	3,330	1055	2,467	1090	2,703	1040
Total or Avg.	66,213	985	69,305	1020	61,563	1000	58,239	975
Cumulative Inj.	1,062,333		1,131,638		1,193,201		1,251,440	

	June, 1978		July, 1978		August, 1978		September, 1978	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	2,177	1120	2,533	1045	2,824	1085	2,907	1075
L. W. Shaffer PI No. 2	1,142	1075	1,348	1065	1,414	1065	2,300	1055
L. W. Shaffer PI No. 3	1,176	1170	1,181	1165	1,177	1160	1,698	1150
J. H. Looney PI No. 4	2,586	1055	2,876	1085	2,944	1110	2,870	1120
R. C. Elmore PI No. 5	3,883	1110	3,236	1110	2,957	1110	2,414	1120
L. W. Shaffer PI No. 6	3,574	1120	3,049	1125	3,152	1130	3,321	1120
R. C. Elmore WIW No. 1	3,696	130	9,383	625	9,267	775	7,916	740
R. C. Elmore WIW No. 4	2,128	1090	1,199	885	1,720	1100	1,556	1105
E. Lewis WIW No. 17	2,325	1100	2,625	1120	2,634	1110	2,967	1105
E. Lewis WIW No. 18	4,266	730	3,815	615	551	755	0	-
E. Lewis WIW No. 27	1,491	1090	1,627	1105	1,594	1105	1,339	1110
E. Lewis WIW No. 28	1,823	1040	2,175	1025	2,398	1020	2,636	1020
E. Lewis WIW No. 29	2,294	1030	2,243	1100	1,981	1105	1,737	1105
J. H. Looney WIW No. 1	3,815	1085	3,600	1095	3,348	1080	2,930	1055
J. H. Looney WIW No. 5	4,268	1075	4,065	1090	4,059	1085	3,841	1085
L. W. Shaffer WIW No. 2	8,001	750	3,077	700	4,529	305	499	440
L. W. Shaffer WIW No. 8	3,123	1060	3,110	1065	2,922	1065	2,630	1070
L. W. Shaffer WIW No. 10	1,907	1105	1,834	1085	2,393	1090	2,346	1115
L. W. Shaffer WIW No. 11	1,851	1145	2,064	1065	2,395	1070	2,216	1080
Total or Avg.	55,526	1005	55,040	1010	54,259	1015	48,123	1035
Cumulative Inj.	1,306,966		1,362,006		1,416,265		1,464,388	

ROCK CREEK FIELD CARBON DIOXIDE PROJECT
HISTORY OF WATER INJECTION
Continued

	October, 1978		November, 1978		December, 1978		January, 1979	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,971	1080	2,896	1045	2,343	935	2,303	975
L. W. Shaffer PI No. 2	2,122	1075	1,961	1045	1,757	935	1,654	970
L. W. Shaffer PI No. 3	1,842	1155	1,532	1125	2,174	1025	2,105	1060
J. H. Looney PI No. 4	3,043	1135	2,671	1095	2,771	995	2,639	1035
R. C. Elmore PI No. 5	2,366	1125	2,122	1080	2,229	985	2,143	1035
L. W. Shaffer PI No. 6	3,411	1135	3,640	1020	2,361	790	2,199	910
R. C. Elmore WIW No. 1	8,703	855	3,352	460	8,900	760	9,660	985
R. C. Elmore WIW No. 4	1,507	1105	1,472	1080	1,386	975	1,254	1015
E. Lewis WIW No. 17	3,166	1110	810	1095	488	1005	529	1020
E. Lewis WIW No. 18	0	-	212	1050	2,100	975	2,122	985
E. Lewis WIW No. 27	1,218	1110	1,209	1080	1,278	1015	1,193	1025
E. Lewis WIW No. 28	2,948	1030	3,064	1000	2,982	920	1,929	930
E. Lewis WIW No. 29	1,601	1100	1,788	1080	1,661	995	1,288	1010
J. H. Looney WIW No. 1	3,009	1100	2,849	1080	2,686	1005	2,689	1015
J. H. Looney WIW No. 5	3,847	1085	3,818	1065	3,737	990	3,609	1010
L. W. Shaffer WIW No. 2	2,066	885	1,666	995	2,929	955	2,853	975
L. W. Shaffer WIW No. 8	2,487	1060	2,383	1035	2,284	950	2,231	965
L. W. Shaffer WIW No. 10	2,220	1105	2,123	1085	1,742	980	1,604	1020
L. W. Shaffer WIW No. 11	2,308	1110	2,218	1085	1,800	1015	1,765	1030
Total or Avg.	50,835	1075	41,786	1030	47,608	960	45,769	1000
Cumulative Inj.	1,515,223		1,557,009		1,604,617		1,650,386	

	February, 1979		March, 1979		April, 1979		May, 1979	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,202	975	0	-	0	-	0	-
L. W. Shaffer PI No. 2	909	955	0	-	0	-	0	-
L. W. Shaffer PI No. 3	1,108	1055	0	-	0	-	0	-
J. H. Looney PI No. 4	1,503	1040	0	-	0	-	0	-
R. C. Elmore PI No. 5	1,182	1040	0	-	0	-	0	-
L. W. Shaffer PI No. 6	1,482	980	581	1120	992	1110	0	-
R. C. Elmore WIW No. 1	8,400	1020	5,604	610	6,386	540	6,068	795
R. C. Elmore WIW No. 4	1,131	1040	1,305	1085	980	955	1,011	1145
E. Lewis WIW No. 17	414	1045	411	1000	326	990	266	1000
E. Lewis WIW No. 18	1,915	1015	2,158	1015	1,226	980	1,172	1000
E. Lewis WIW No. 27	983	1050	1,342	1090	1,222	1085	1,090	1145
E. Lewis WIW No. 28	2,075	970	2,132	1000	2,136	1055	2,624	1070
E. Lewis WIW No. 29	1,058	1035	962	750	1,117	830	1,021	1160
J. H. Looney WIW No. 1	2,542	1040	3,069	1090	2,266	920	2,435	1150
J. H. Looney WIW No. 5	3,027	1035	3,722	1085	3,325	1060	3,386	1135
L. W. Shaffer WIW No. 2	2,443	995	2,836	990	1,359	1000	940	1000
L. W. Shaffer WIW No. 8	2,008	985	2,472	1020	2,189	1030	2,156	1105
L. W. Shaffer WIW No. 10	1,161	1050	1,283	1080	953	1115	918	1155
L. W. Shaffer WIW No. 11	1,501	1040	1,818	1100	1,318	1125	1,149	1155
Total or Avg.	36,044	1020	29,695	1000	25,796	985	24,236	1080
Cumulative Inj.	1,686,430		1,716,125		1,741,920		1,766,156	

	June, 1979		July, 1979		August, 1979		September, 1979	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	0	-	0	-	0	-	1,329	945
L. W. Shaffer PI No. 2	0	-	0	-	0	-	1,388	995
L. W. Shaffer PI No. 3	0	-	0	-	0	-	1,252	1030
J. H. Looney PI No. 4	0	-	0	-	0	-	2,014	970
R. C. Elmore PI No. 5	0	-	0	-	0	-	1,506	985
L. W. Shaffer PI No. 6	0	-	0	-	0	-	1,692	980
R. C. Elmore WIW No. 1	5,191	775	3,563	490	4,335	615	3,968	585
R. C. Elmore WIW No. 4	1,205	1165	1,484	1175	1,577	1175	1,467	1145
E. Lewis WIW No. 17	251	1000	282	1000	280	985	256	970
E. Lewis WIW No. 18	1,314	1000	1,473	1000	1,532	1000	1,536	975
E. Lewis WIW No. 27	1,147	1165	1,296	1170	1,424	1175	1,467	1130
E. Lewis WIW No. 28	3,627	1060	1,614	1105	1,839	1095	1,947	1070
E. Lewis WIW No. 29	1,000	1175	1,318	1175	1,445	1175	1,318	1140
J. H. Looney WIW No. 1	2,670	1170	2,925	1175	3,010	1175	2,816	1140
J. H. Looney WIW No. 5	3,301	1165	3,373	1170	3,421	1170	3,191	1140
L. W. Shaffer WIW No. 2	1,327	1000	1,684	1000	1,889	1000	1,970	970
L. W. Shaffer WIW No. 8	2,293	1120	2,405	1130	2,445	1140	2,364	1100
L. W. Shaffer WIW No. 10	1,098	1170	1,354	1175	1,420	1185	1,449	1145
L. W. Shaffer WIW No. 11	1,298	1175	1,531	1175	1,693	1185	1,656	1150
Total or Avg.	25,722	1085	24,302	1070	26,310	1080	34,586	1030
Cumulative Inj.	1,791,878		1,816,180		1,842,490		1,877,076	

HISTORY OF WATER INJECTION
Continued

	October, 1979		November, 1979		December, 1979		January, 1980	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	854	960	91	795	0	-	1,298	990
L. W. Shaffer PI No. 2	1,550	940	424	860	0	-	1,034	980
L. W. Shaffer PI No. 3	1,354	990	442	1000	0	-	804	925
J. H. Looney PI No. 4	1,772	905	774	835	0	-	1,631	875
R. C. Elmore PI No. 5	1,489	950	597	925	0	-	1,415	1020
L. W. Shaffer PI No. 6	1,048	900	0	-	0	-	1,329	1000
R. C. Elmore WIW No. 1	2,431	645	1,845	540	2,791	820	3,686	470
R. C. Elmore WIW No. 4	1,325	1125	1,112	1055	1,049	1010	1,141	1015
E. Lewis WIW No. 17	261	1000	251	960	272	960	289	1000
E. Lewis WIW No. 18	1,501	1035	1,425	1000	1,567	960	1,664	1000
E. Lewis WIW No. 27	1,414	895	1,038	1060	1,143	1000	1,230	1010
E. Lewis WIW No. 28	1,644	1030	1,399	995	1,322	930	1,498	945
E. Lewis WIW No. 29	1,316	1135	1,102	1075	1,080	1015	1,084	1015
J. H. Looney WIW No. 1	2,507	1140	2,167	1065	2,334	1010	2,619	1010
J. H. Looney WIW No. 5	2,867	1130	2,315	1060	2,491	1000	2,734	1010
L. W. Shaffer WIW No. 2	1,885	1000	1,700	1000	1,580	965	1,876	995
L. W. Shaffer WIW No. 8	2,181	1100	1,954	1030	2,108	975	2,178	985
L. W. Shaffer WIW No. 10	1,288	1135	1,106	1065	1,051	1015	1,234	1020
L. W. Shaffer WIW No. 11	1,530	1145	1,372	1070	1,422	1020	1,547	1020
Total or Avg.	30,217	1010	21,114	970	20,210	975	30,291	960
Cumulative Inj.	1,907,293		1,928,407		1,948,617		1,978,908	

	February, 1980		March, 1980		April, 1980		May, 1980	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,903	1000	536	980	0	-	0	-
L. W. Shaffer PI No. 2	1,776	1040	513	965	0	-	0	-
L. W. Shaffer PI No. 3	1,616	1050	664	1045	0	-	0	-
J. H. Looney PI No. 4	2,198	860	769	930	0	-	0	-
R. C. Elmore PI No. 5	1,979	1025	575	1010	0	-	0	-
L. W. Shaffer PI No. 6	1,903	1010	574	970	0	-	0	-
R. C. Elmore WIW No. 1	2,962	580	2,812	580	2,560	475	2,594	500
R. C. Elmore WIW No. 4	1,203	1020	1,390	1015	1,296	1015	1,411	1030
E. Lewis WIW No. 17	287	1005	287	1005	267	1005	138	1025
E. Lewis WIW No. 18	1,622	1000	1,740	995	1,641	1000	1,657	1000
E. Lewis WIW No. 27	1,721	1010	2,542	1005	2,117	1010	2,114	1025
E. Lewis WIW No. 28	1,813	930	2,263	915	1,914	935	2,023	960
E. Lewis WIW No. 29	1,620	1015	2,998	1005	2,706	1010	3,073	1040
J. H. Looney WIW No. 1	1,445	1015	2,603	1010	2,478	1020	2,639	1035
J. H. Looney WIW No. 5	2,639	1005	2,711	1005	2,506	1005	2,504	1030
L. W. Shaffer WIW No. 2	1,987	1000	1,907	960	1,739	995	1,823	1005
L. W. Shaffer WIW No. 8	2,070	990	2,160	975	2,008	985	2,077	1000
L. W. Shaffer WIW No. 10	1,332	1020	1,371	980	1,222	1020	1,320	1030
L. W. Shaffer WIW No. 11	1,822	1015	2,448	1010	2,201	1015	2,239	1030
Total or Avg.	34,898	980	30,863	960	24,715	960	25,612	975
Cumulative Inj.	2,013,806		2,044,669		2,069,384		2,094,996	

	June, 1980		July, 1980		August, 1980		September, 1980	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	632	790	1,369	817	1,733	944	1,734	996
L. W. Shaffer PI No. 2	699	947	1,732	923	1,892	912	2,091	953
L. W. Shaffer PI No. 3	652	1002	1,251	967	1,268	968	1,413	995
J. H. Looney PI No. 4	816	710	2,190	862	2,339	949	259	813
R. C. Elmore PI No. 5	751	899	1,485	826	1,559	969	1,420	991
L. W. Shaffer PI No. 6	702	869	1,578	911	1,539	944	1,719	974
R. C. Elmore WIW No. 1	2,478	295	2,860	387	3,478	612	4,157	774
R. C. Elmore WIW No. 4	1,461	1015	1,552	1019	1,410	1041	1,270	1018
E. Lewis WIW No. 17	448	997	1,072	986	2,940	1000	2,899	822
E. Lewis WIW No. 18	1,627	1000	1,609	983	1,537	1000	1,501	983
E. Lewis WIW No. 27	1,794	1033	2,626	1006	2,429	1032	2,199	1015
E. Lewis WIW No. 28	2,132	943	2,270	946	2,203	967	2,045	951
E. Lewis WIW No. 29	3,224	1016	3,247	1021	2,986	1042	2,609	1032
J. H. Looney WIW No. 1	2,665	1041	2,700	1019	2,512	1043	2,644	1025
J. H. Looney WIW No. 5	2,477	1042	2,550	1015	2,448	1044	2,336	1025
L. W. Shaffer WIW No. 2	1,832	1003	1,844	980	1,751	1001	1,520	980
L. W. Shaffer WIW No. 8	2,039	1007	2,121	978	2,027	1006	2,064	989
L. W. Shaffer WIW No. 10	1,352	1013	1,439	1011	1,420	1047	1,305	1026
L. W. Shaffer WIW No. 11	2,473	1014	2,420	1018	2,345	1049	2,224	1037
Total or Avg.	31,254	928	37,915	930	39,816	977	37,409	968
Cumulative Inj.	2,126,250		2,164,165		2,203,981		2,241,390	

HISTORY OF WATER INJECTION
Continued

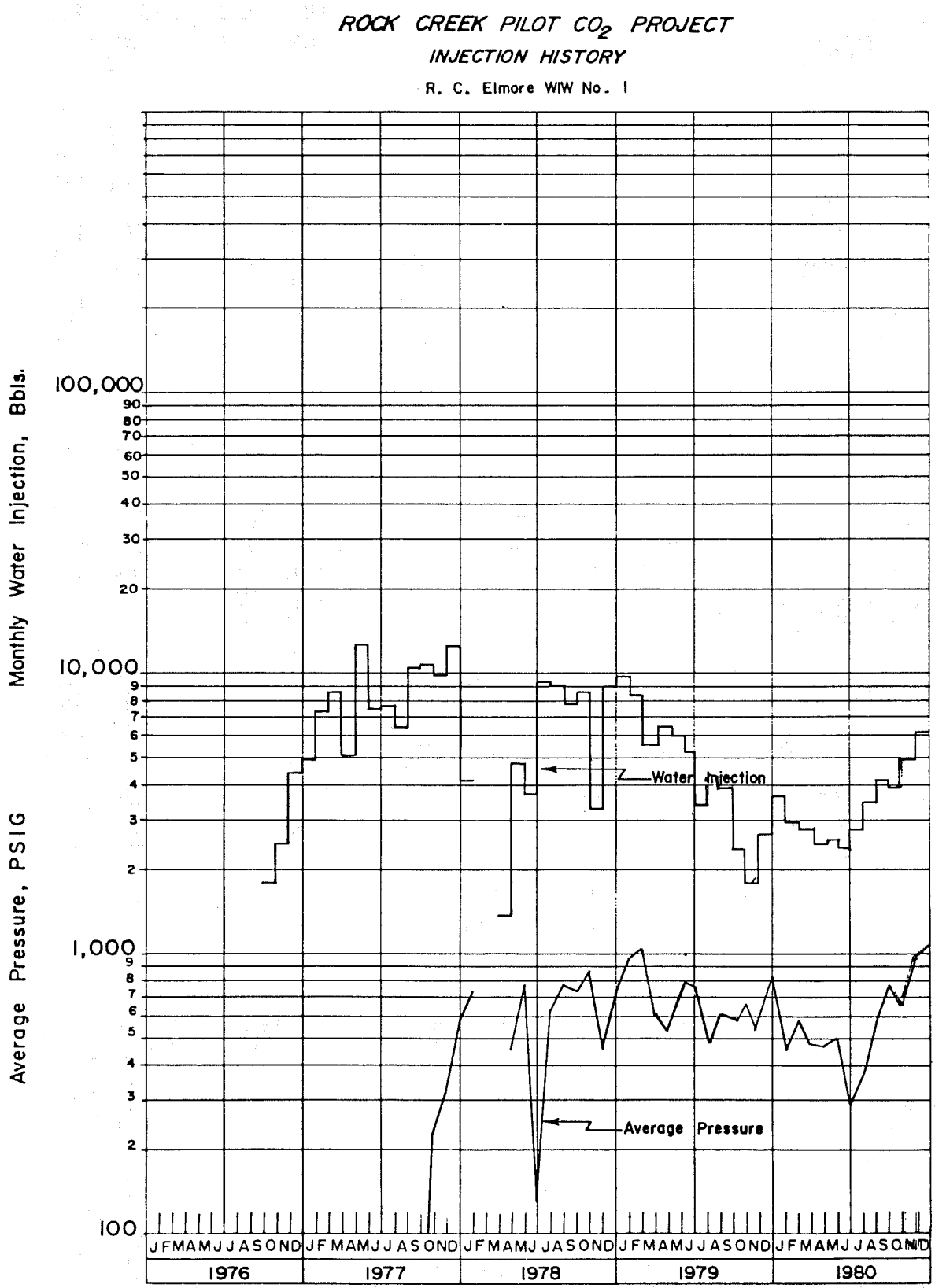
	October, 1980		November, 1980		December, 1980		January, 1981	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,828	988	1,677	996	1,369	937	1,617	973
L. W. Shaffer PI No. 2	2,683	933	2,653	991	2,099	992	0	-
L. W. Shaffer PI No. 3	1,650	985	1,603	986	1,569	995	0	-
J. H. Looney PI No. 4	2,779	784	3,182	901	2,984	878	0	-
R. C. Elmore PI No. 5	1,420	1007	1,467	1009	1,448	1032	0	-
L. W. Shaffer PI No. 6	1,389	981	1,522	989	1,378	962	0	-
L. W. Shaffer PI No. 7					533	982	0	-
L. W. Shaffer PI No. 8					1,774	973	525	838
R. C. Elmore WIW No. 1	3,943	659	4,967	969	6,135	1073	4,040	1036
R. C. Elmore WIW No. 4	1,292	1034	1,213	1037	1,175	1041	1,175	1070
E. Lewis WIW No. 17	677	258	2,066	645	1,866	638	0	297
E. Lewis WIW No. 18	1,607	983	1,547	1003	1,556	997	1,500	1018
E. Lewis WIW No. 27	2,184	1026	1,966	1031	1,855	1037	1,790	1067
E. Lewis WIW No. 28	2,090	966	1,965	983	1,906	984	1,723	1004
E. Lewis WIW No. 29	2,587	1030	2,405	1032	2,145	1041	2,214	1078
J. H. Looney WIW No. 1	2,738	1039	2,403	1050	2,411	1055	2,427	1088
J. H. Looney WIW No. 5	2,493	1031	2,210	1044	2,172	1050	2,047	1082
L. W. Shaffer WIW No. 2	1,515	1000	1,401	1008	1,369	999	1,263	1029
L. W. Shaffer WIW No. 8	2,226	998	2,096	1040	2,096	1005	2,067	1020
L. W. Shaffer WIW No. 10	1,320	1047	1,190	1042	1,165	1046	1,079	1080
L. W. Shaffer WIW No. 11	2,250	1051	2,073	1048	2,045	1051	1,932	1092
Total or Avg.	38,671	937	39,606	988	41,050	989	25,399	985
Cumulative Inj.	2,280,061		2,319,667		2,360,717		2,386,116	

	February, 1981		March, 1981		April, 1981		May, 1981	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,290	1004	1,492	1013	1,672	836	1,975	1099
L. W. Shaffer PI No. 2	0	-	0	-	9	1085	99	1100
L. W. Shaffer PI No. 3	0	-	0	-	1,074	1155	1,727	1176
J. H. Looney PI No. 4	0	-	0	-	1,649	637	2,894	575
R. C. Elmore PI No. 5	0	-	0	-	1,037	1122	1,441	1114
L. W. Shaffer PI No. 6	0	-	0	-	0	-	0	-
L. W. Shaffer PI No. 7	0	-	0	-	0	-	0	-
L. W. Shaffer PI No. 8	1,940	834	732	742	1,171	691	816	873
R. C. Elmore WIW No. 1	3,874	991	3,697	888	3,057	784	2,687	601
R. C. Elmore WIW No. 4	1,064	1144	1,216	1146	1,233	1140	1,319	1152
E. Lewis WIW No. 17	368	603	787	574	773	560	687	556
E. Lewis WIW No. 18	1,318	1079	1,403	1120	1,342	560	1,354	1104
E. Lewis WIW No. 27	1,416	1139	1,481	1149	1,293	1139	1,345	1149
E. Lewis WIW No. 28	1,258	1033	1,234	1071	1,123	1080	1,267	1091
E. Lewis WIW No. 29	1,695	1142	1,711	1156	1,368	1144	1,429	1155
J. H. Looney WIW No. 1	2,198	1154	2,533	1159	2,542	1145	2,682	1152
J. H. Looney WIW No. 5	1,608	1141	1,739	1156	1,349	1141	1,656	1151
L. W. Shaffer WIW No. 2	818	1073	778	1116	754	1102	921	1097
L. W. Shaffer WIW No. 8	1,793	1052	1,942	1075	1,881	1091	1,949	1097
L. W. Shaffer WIW No. 10	744	1147	808	1157	811	1144	1,013	1151
L. W. Shaffer WIW No. 11	1,413	1159	1,503	1165	1,368	1153	1,408	1157
Total or Avg.	22,797	1046	23,056	1046	25,506	985	28,669	1029
Cumulative Inj.	2,408,913		2,431,969		2,457,475		2,486,144	

	June, 1981		July, 1981		August, 1981		September, 1981	
	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP	Inj. Bbls.	Avg. WHP
E. Lewis PI No. 1	1,953	1019	2,130	1092	2,233	1074	2,057	1087
L. W. Shaffer PI No. 2	0	-	0	-	72	1050	1,889	1060
L. W. Shaffer PI No. 3	1,792	1196	2,010	1177	2,125	1149	1,714	1174
J. H. Looney PI No. 4	1,780	496	2,576	680	2,988	759	2,782	683
R. C. Elmore PI No. 5	1,395	1193	1,437	1161	1,475	1140	1,454	1142
L. W. Shaffer PI No. 6	45	925	0	-	0	-	0	-
L. W. Shaffer PI No. 7	0	-	0	-	0	-	0	-
L. W. Shaffer PI No. 8	0	-	0	-	0	-	0	-
R. C. Elmore WIW No. 1	1,944	466	2,095	466	2,421	496	2,499	693
R. C. Elmore WIW No. 4	1,278	1178	1,340	1155	1,297	1127	1,220	1128
E. Lewis WIW No. 17	852	585	1,001	590	1,127	525	1,053	526
E. Lewis WIW No. 18	1,329	1135	1,457	1103	1,457	1081	1,347	1088
E. Lewis WIW No. 27	1,376	1177	1,481	1107	1,481	1124	1,318	1130
E. Lewis WIW No. 28	1,344	1104	1,475	1071	1,478	1043	1,285	1045
E. Lewis WIW No. 29	1,480	1184	1,580	1142	1,591	1126	1,351	1133
J. H. Looney WIW No. 1	2,606	1185	2,718	1139	2,649	1123	2,545	1129
J. H. Looney WIW No. 5	1,861	1176	2,084	1136	1,994	1124	1,838	1128
L. W. Shaffer WIW No. 2	1,058	1128	1,168	1112	1,284	1079	1,045	1081
L. W. Shaffer WIW No. 8	1,853	1131	1,987	1093	1,955	1082	1,874	1085
L. W. Shaffer WIW No. 10	1,061	1177	1,135	1161	1,141	1127	1,002	1133
L. W. Shaffer WIW No. 11	1,451	1187	1,526	1151	1,504	1132	1,362	1139
Total or Avg.	26,458	1036	29,200	1032	30,272	1025	29,635	1032
Cumulative Inj.	2,512,602		2,541,802		2,572,074		2,601,709	

APPENDIX F

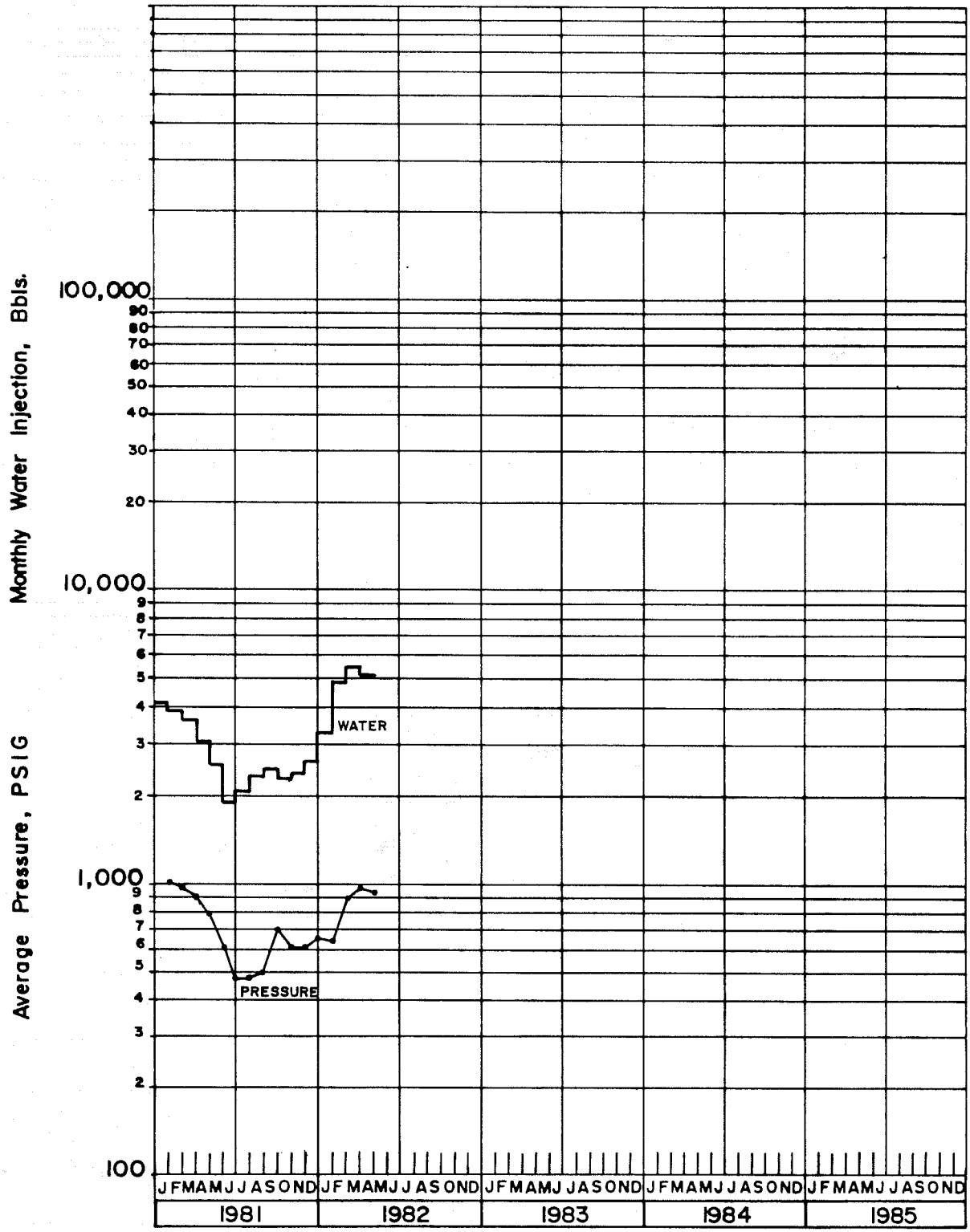
Graphical History of Water Injection



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

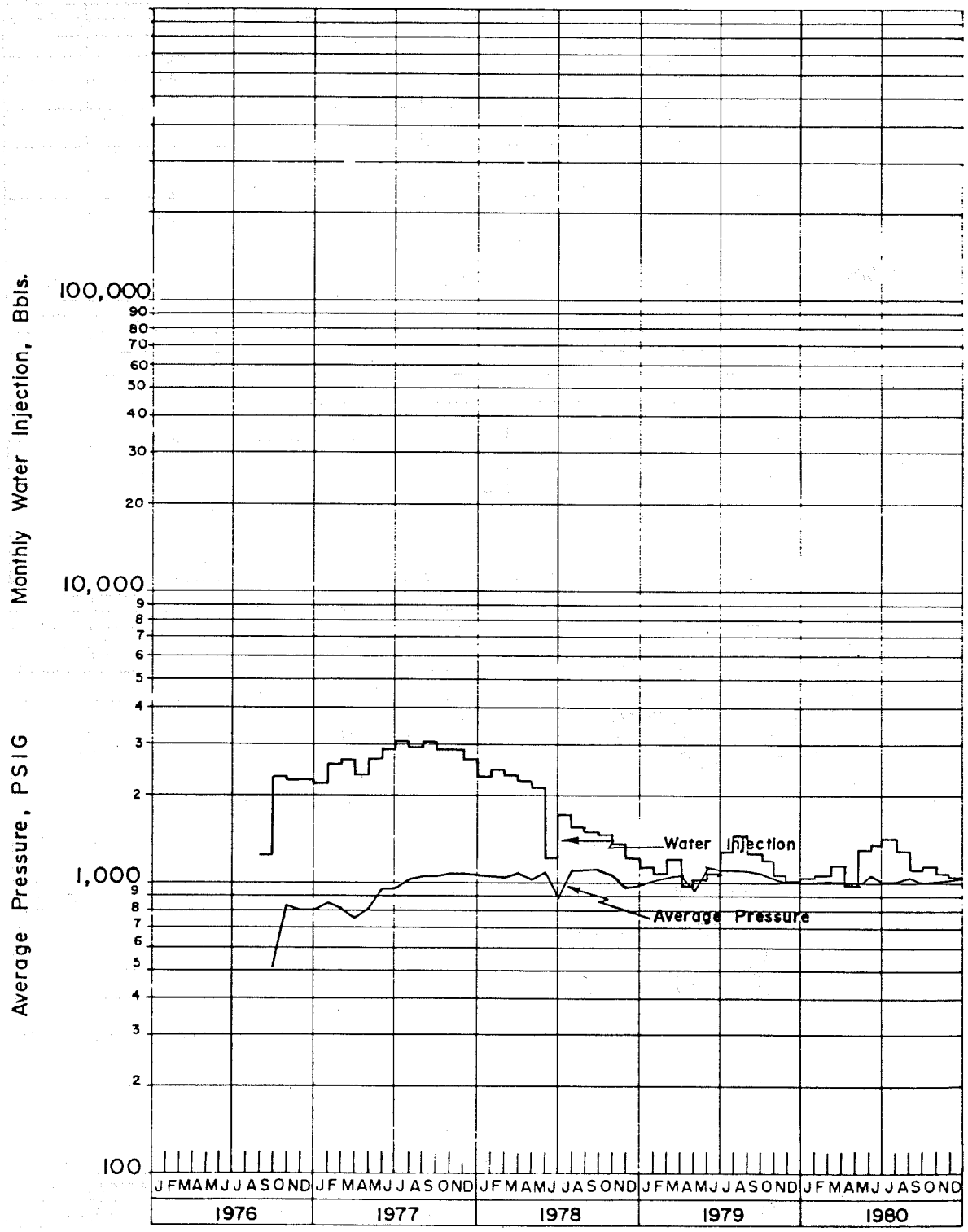
R. C. Elmore WIW No. 1



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

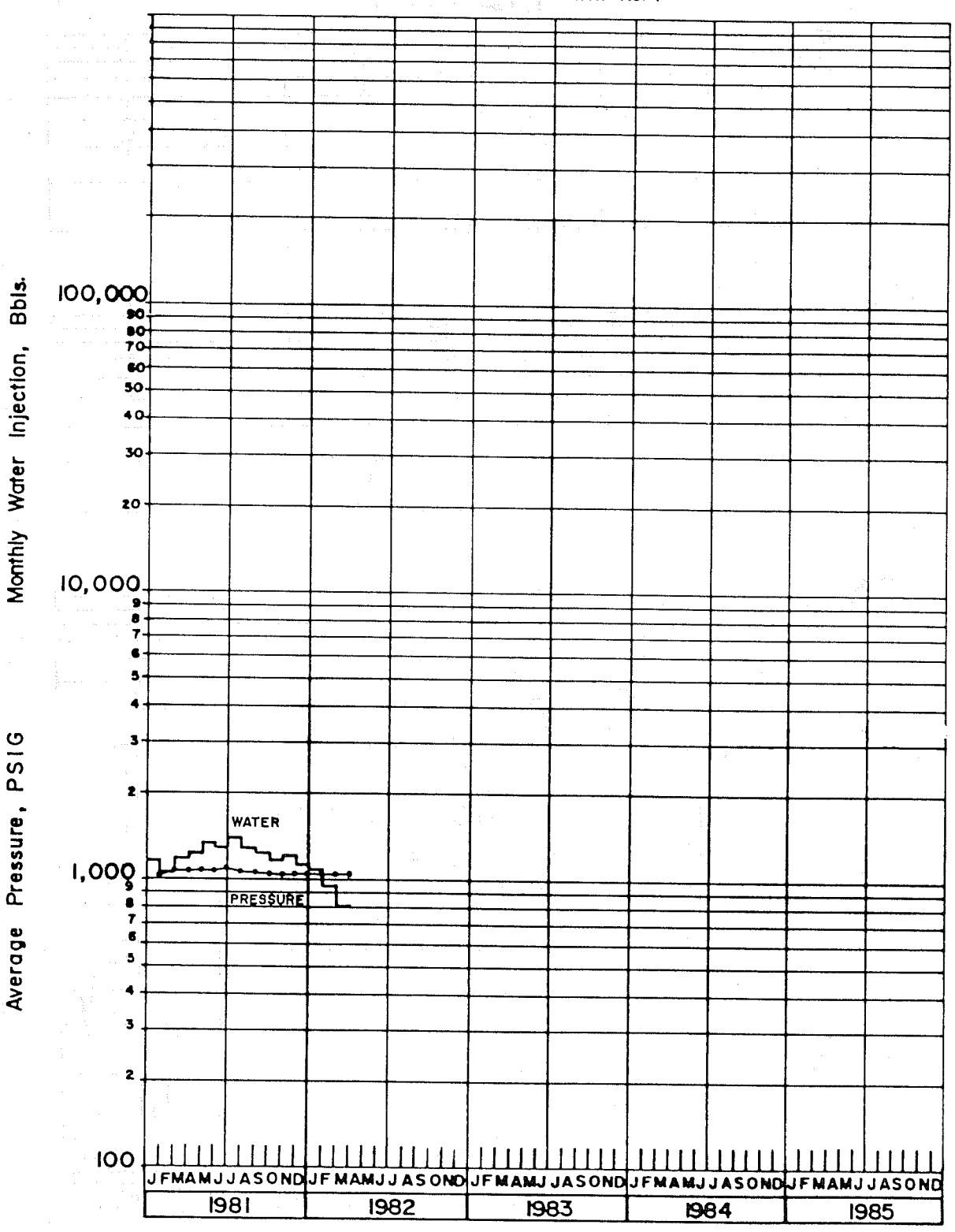
R. C. Elmore WIW No. 4



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

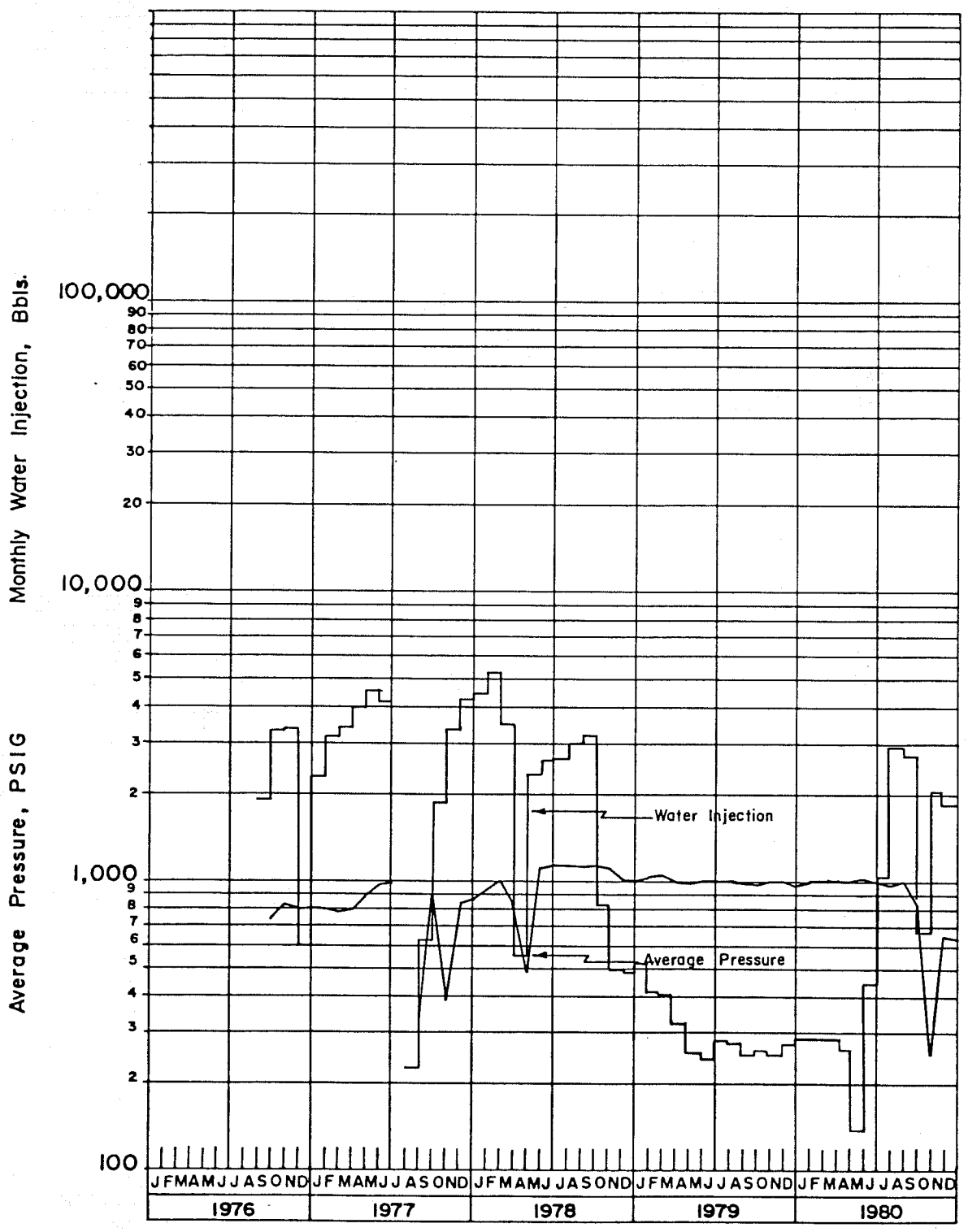
R. C. Elmore WIW No. 4



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

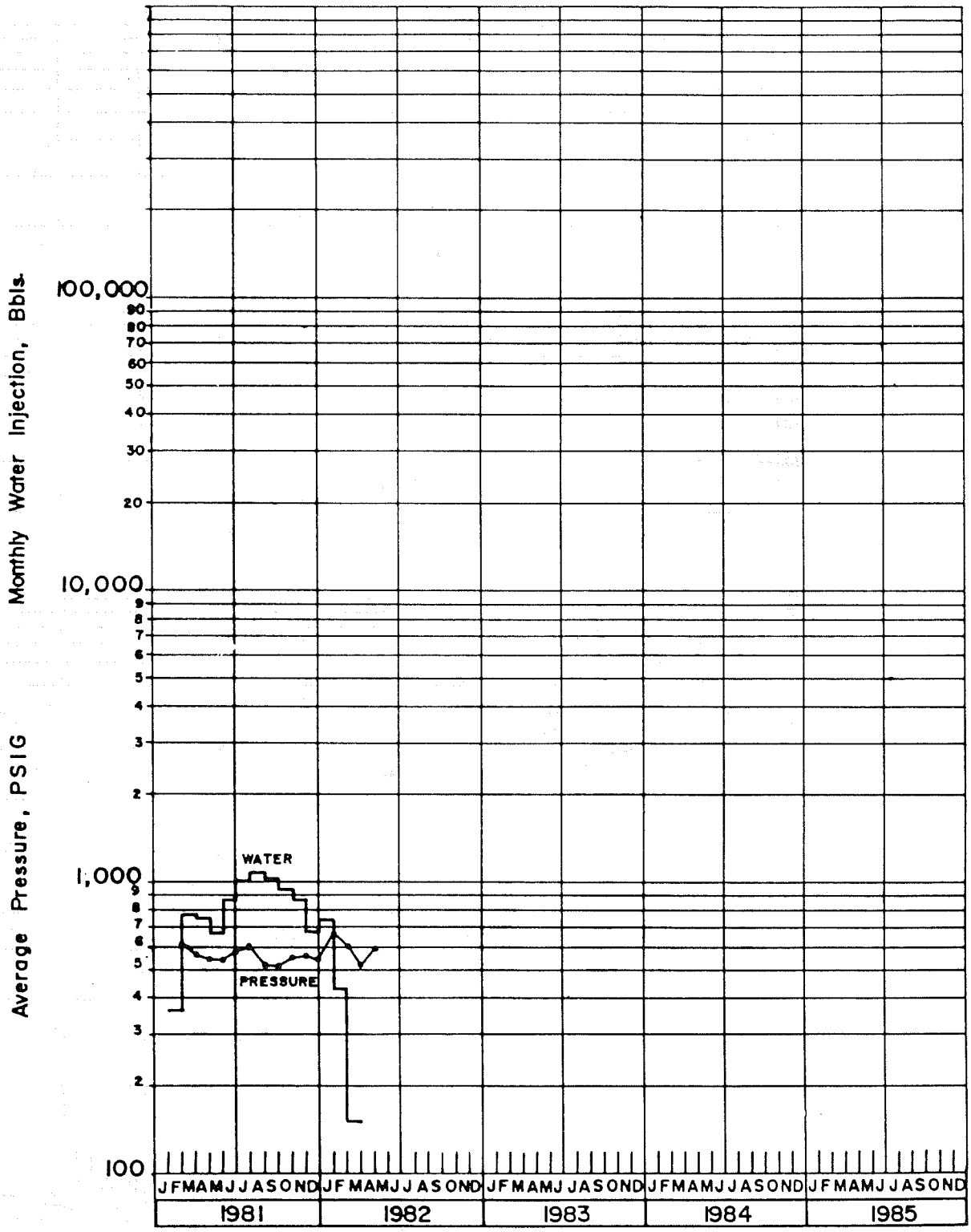
E. Lewis WIW No. 17



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

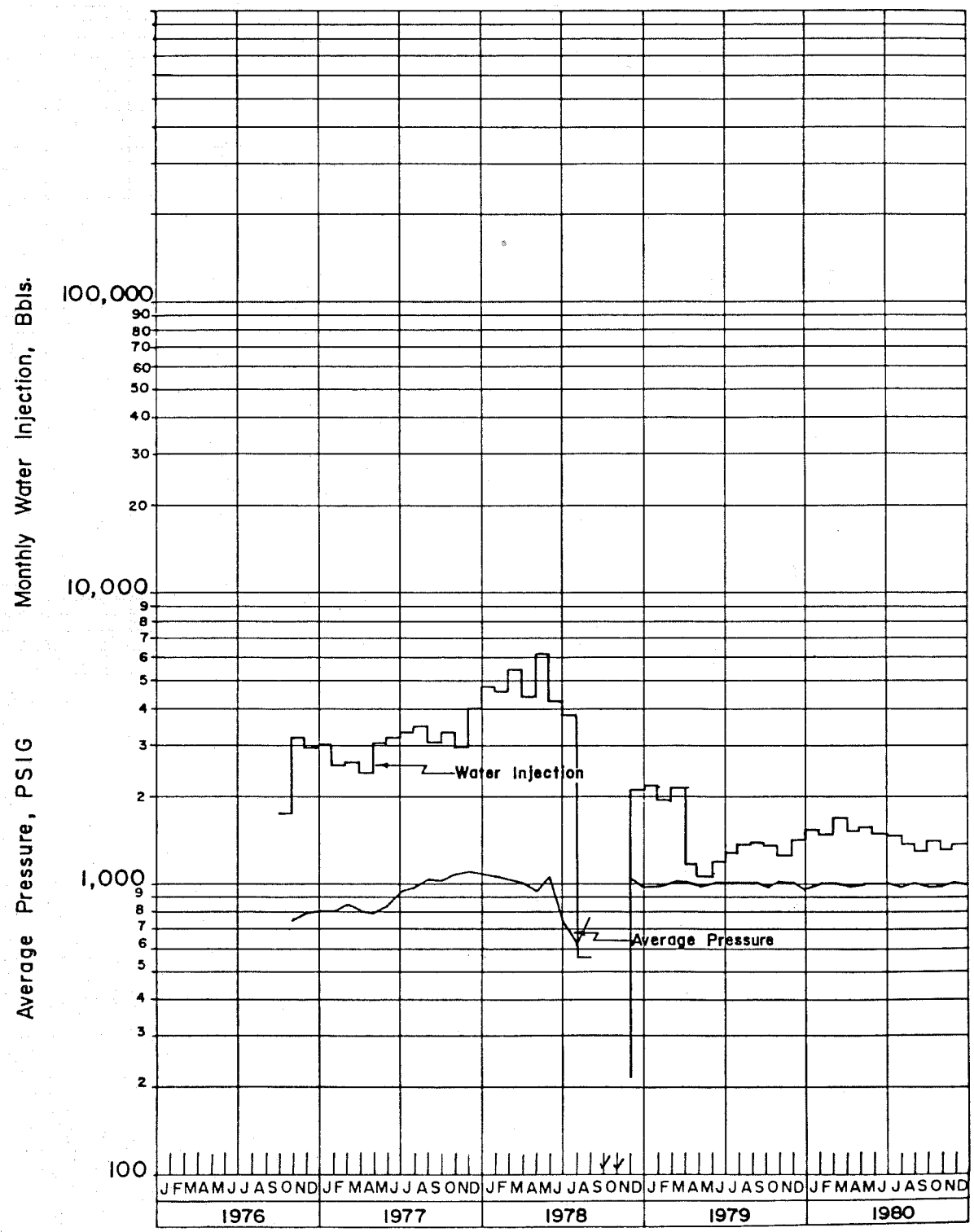
E. Lewis WIW No. 17



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

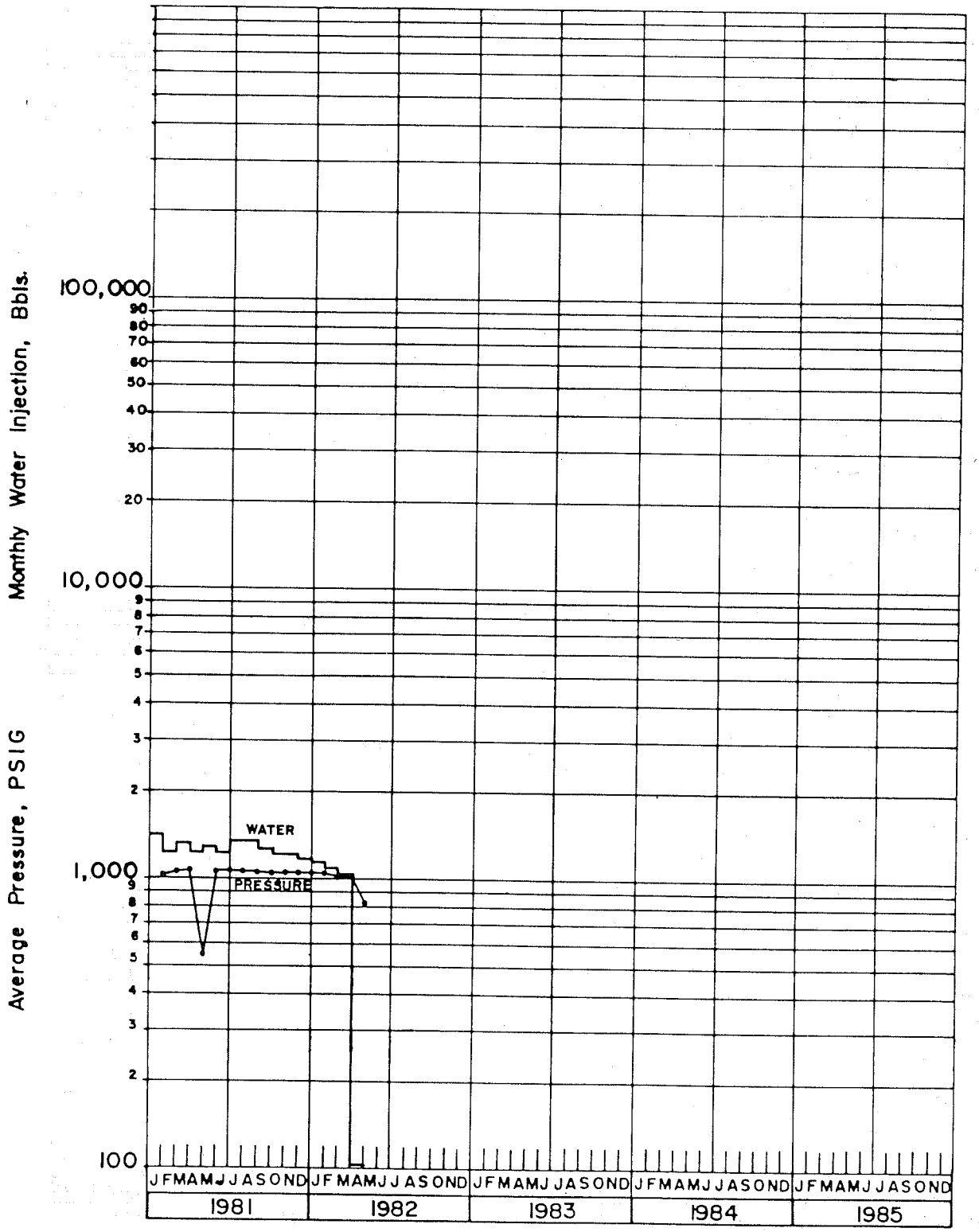
E. Lewis WIW No. 18



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

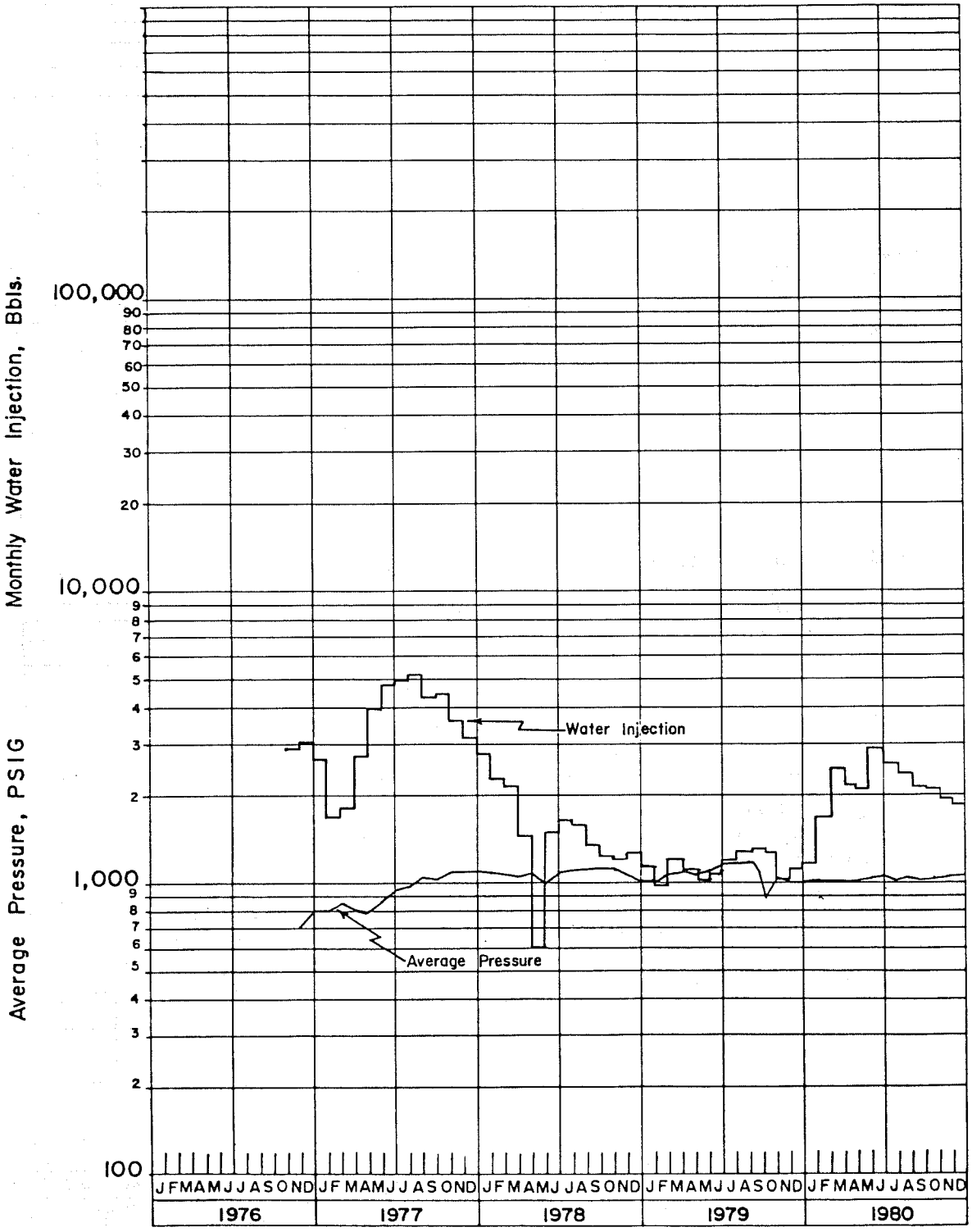
E. Lewis WIW No. 18



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

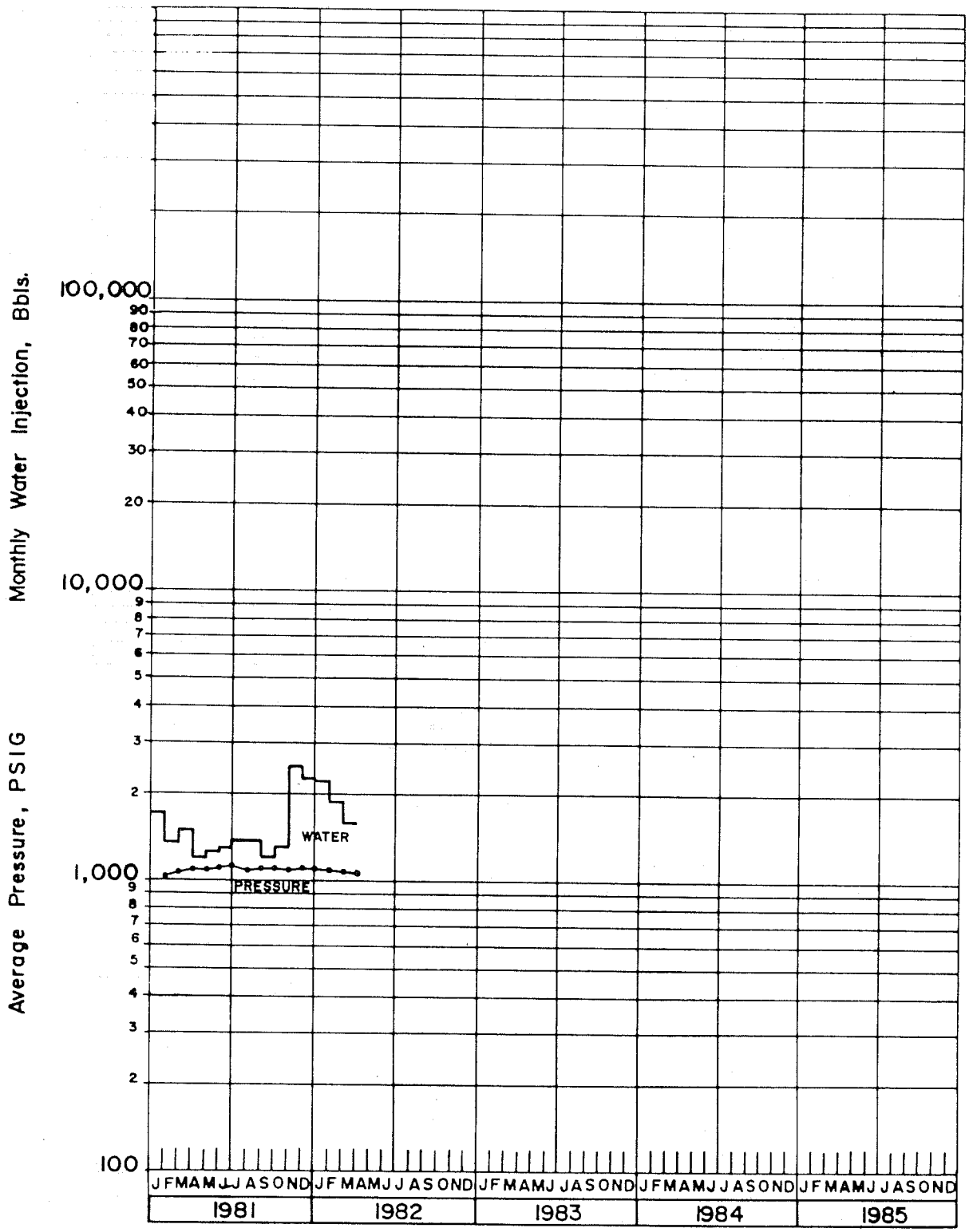
E. Lewis WIW No. 27



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

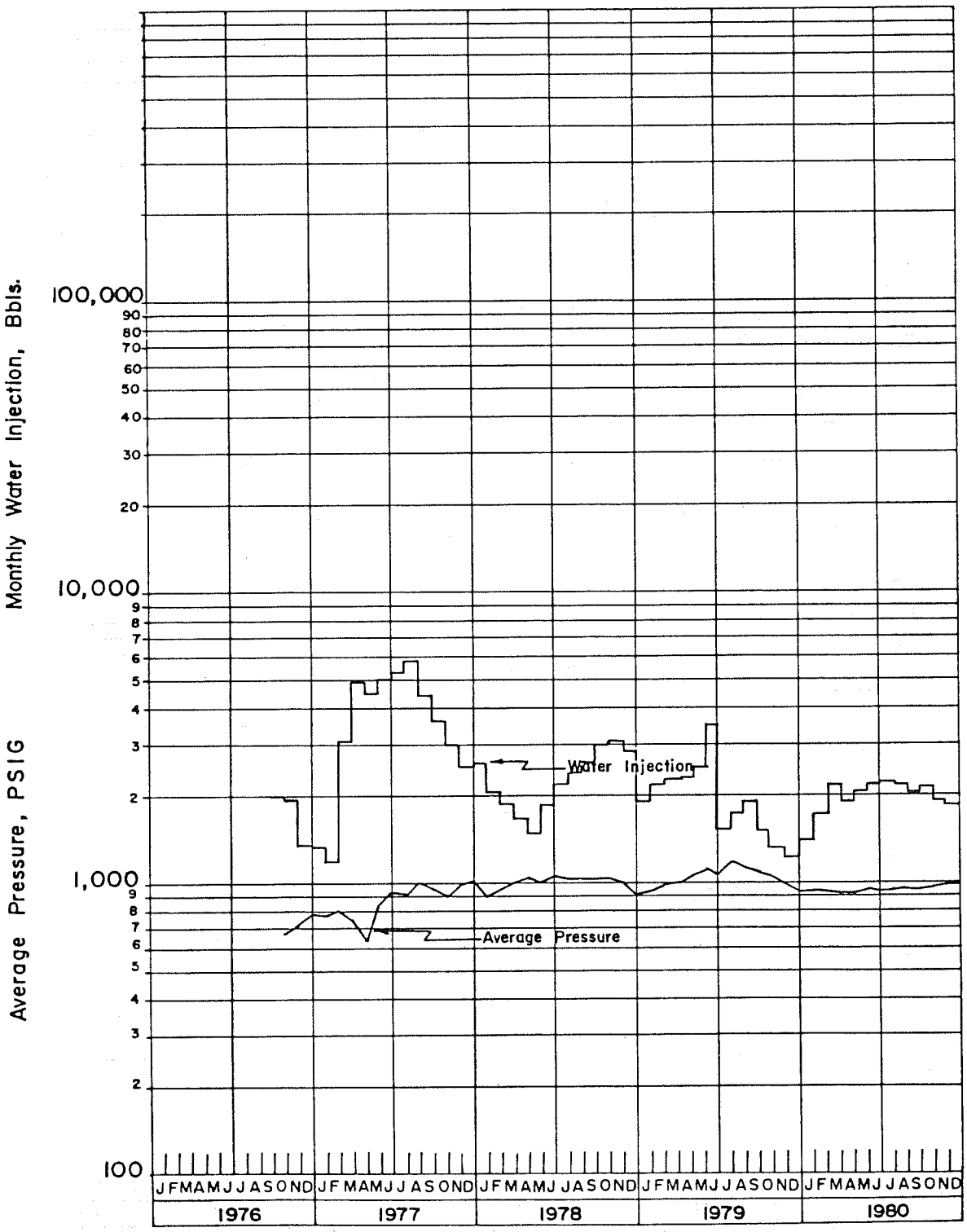
E. Lewis WIW No. 27



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

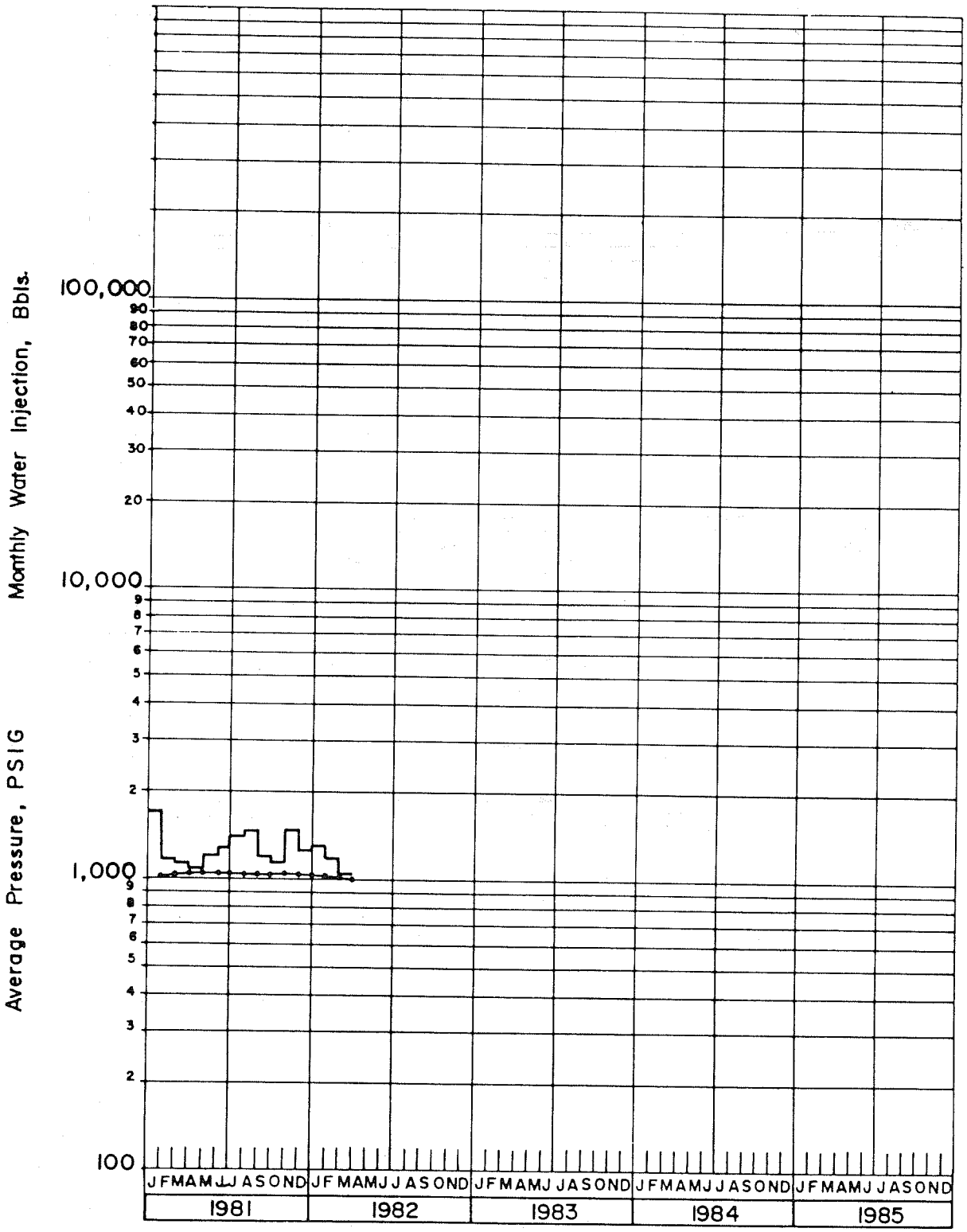
E. Lewis WIW No. 28



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

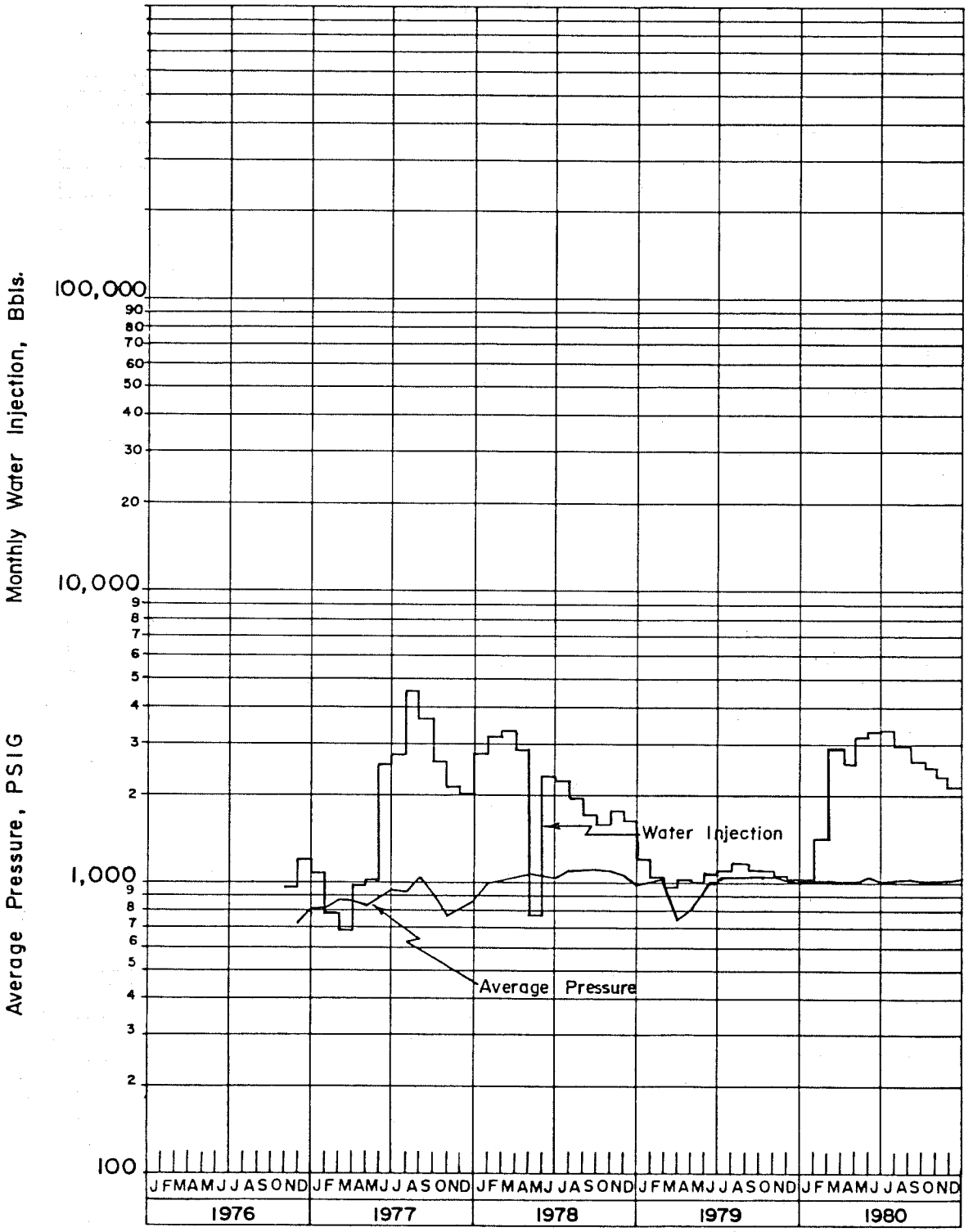
E. Lewis WIW No. 28



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

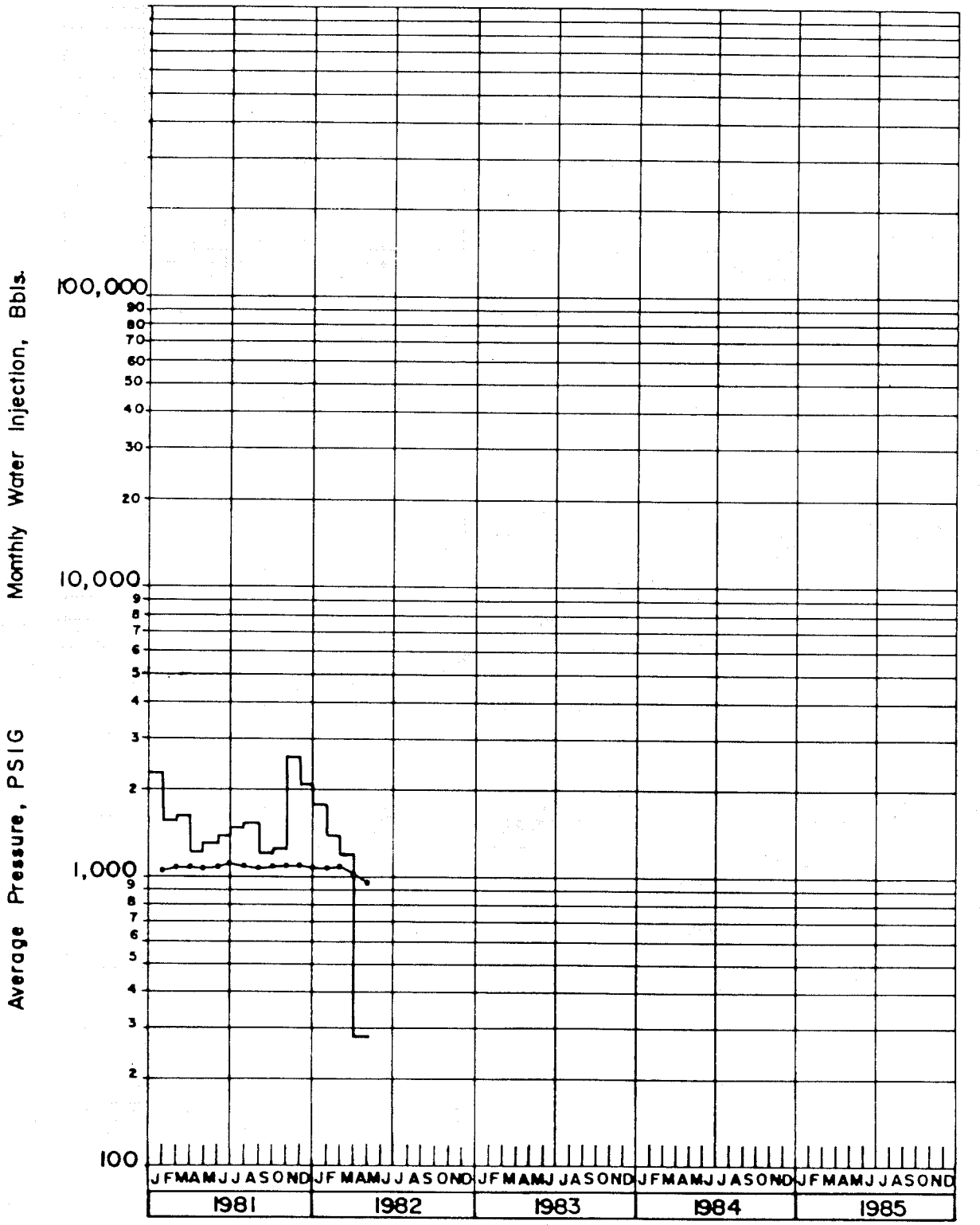
E. Lewis WIW No. 29



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

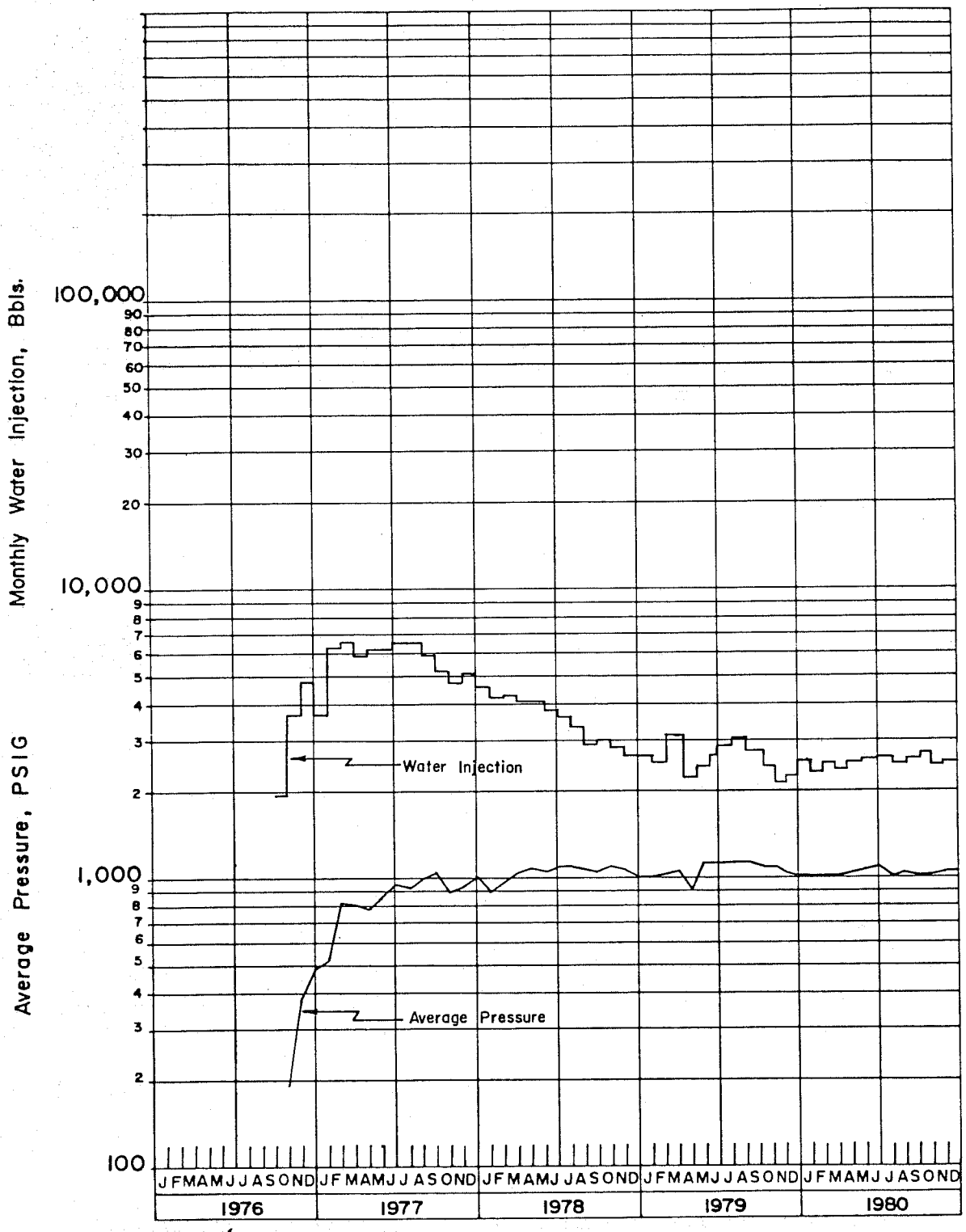
E. Lewis WIW No. 29



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

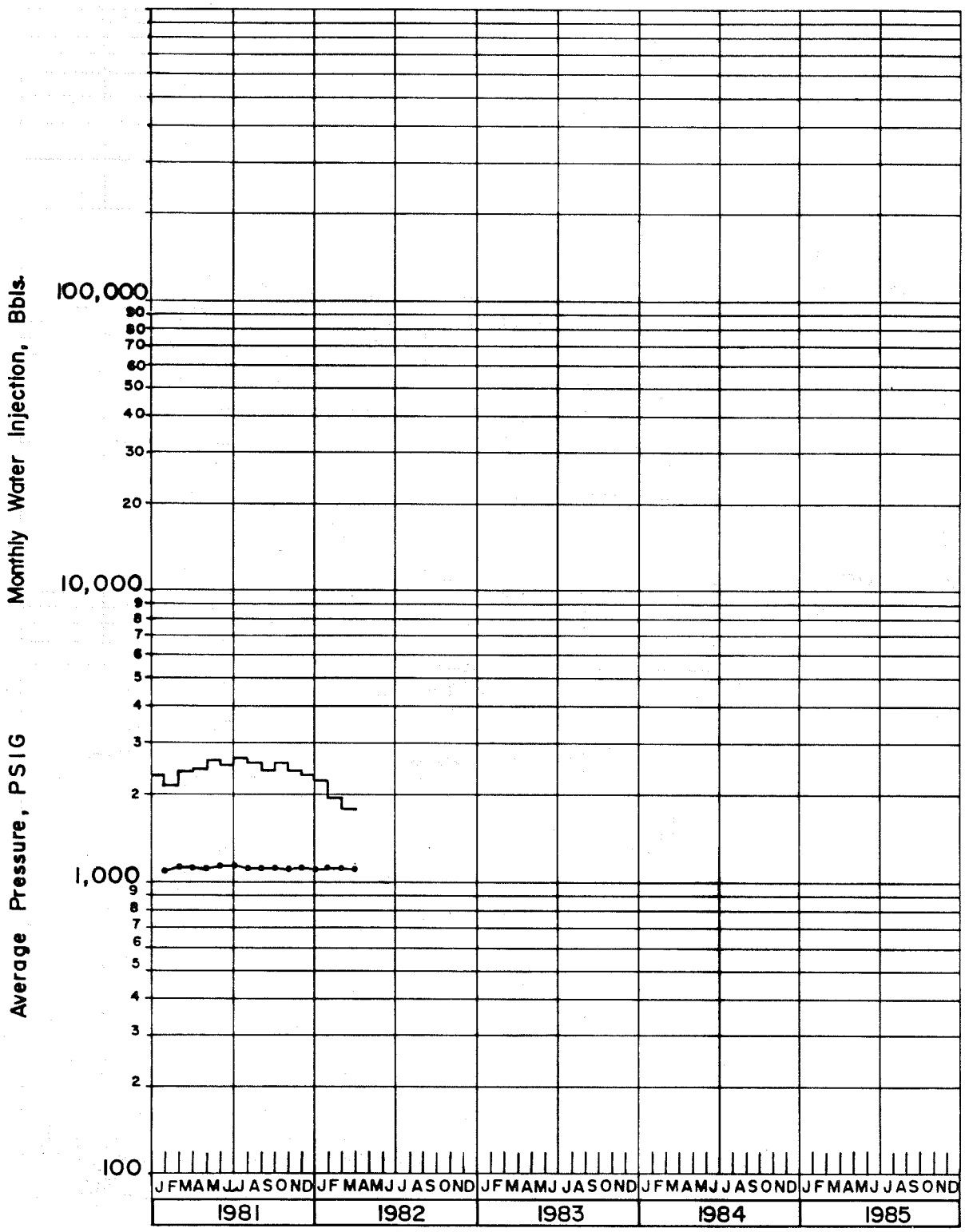
J. H. Looney WIW No. 1



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

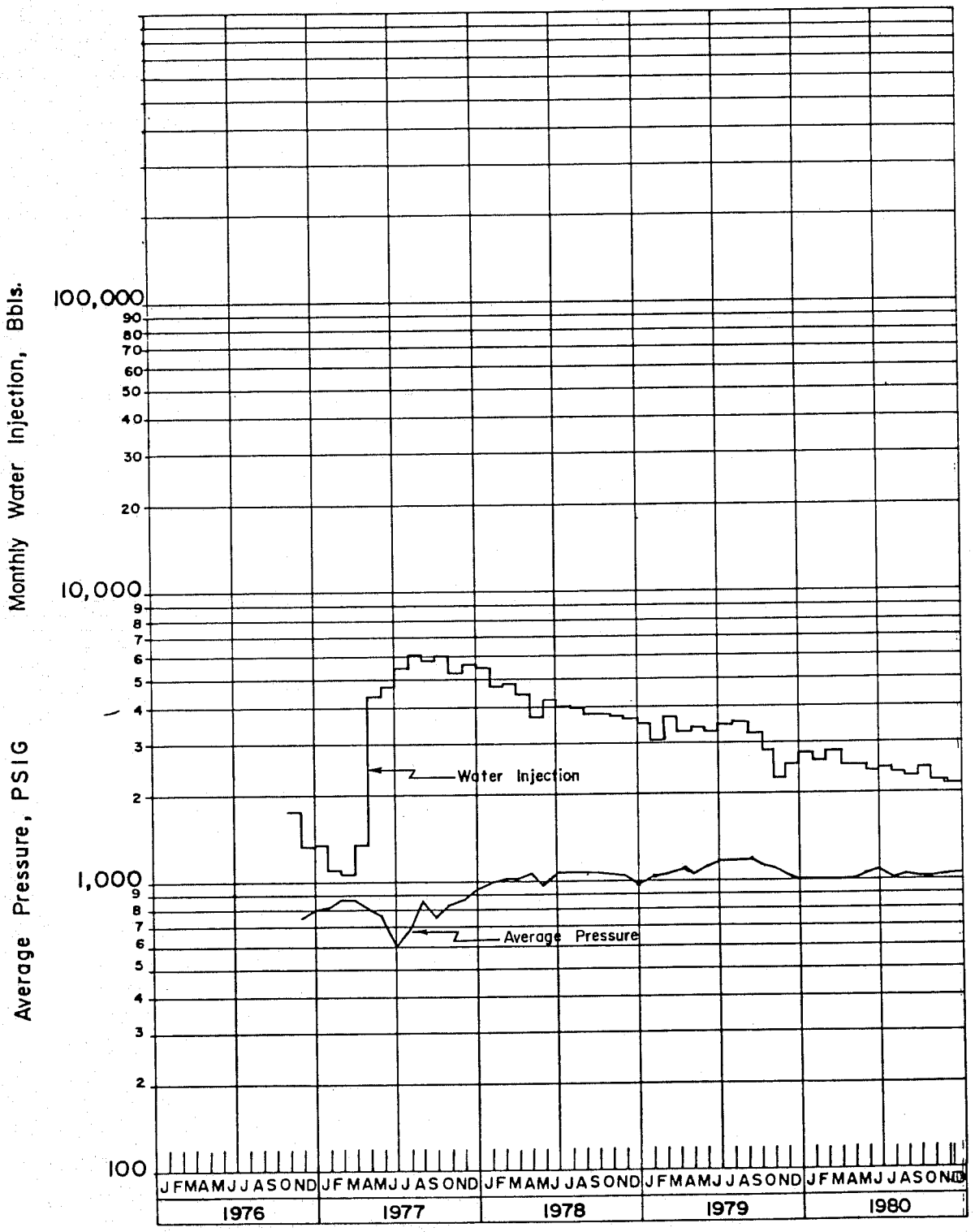
J. H. Looney WIW No. 1



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

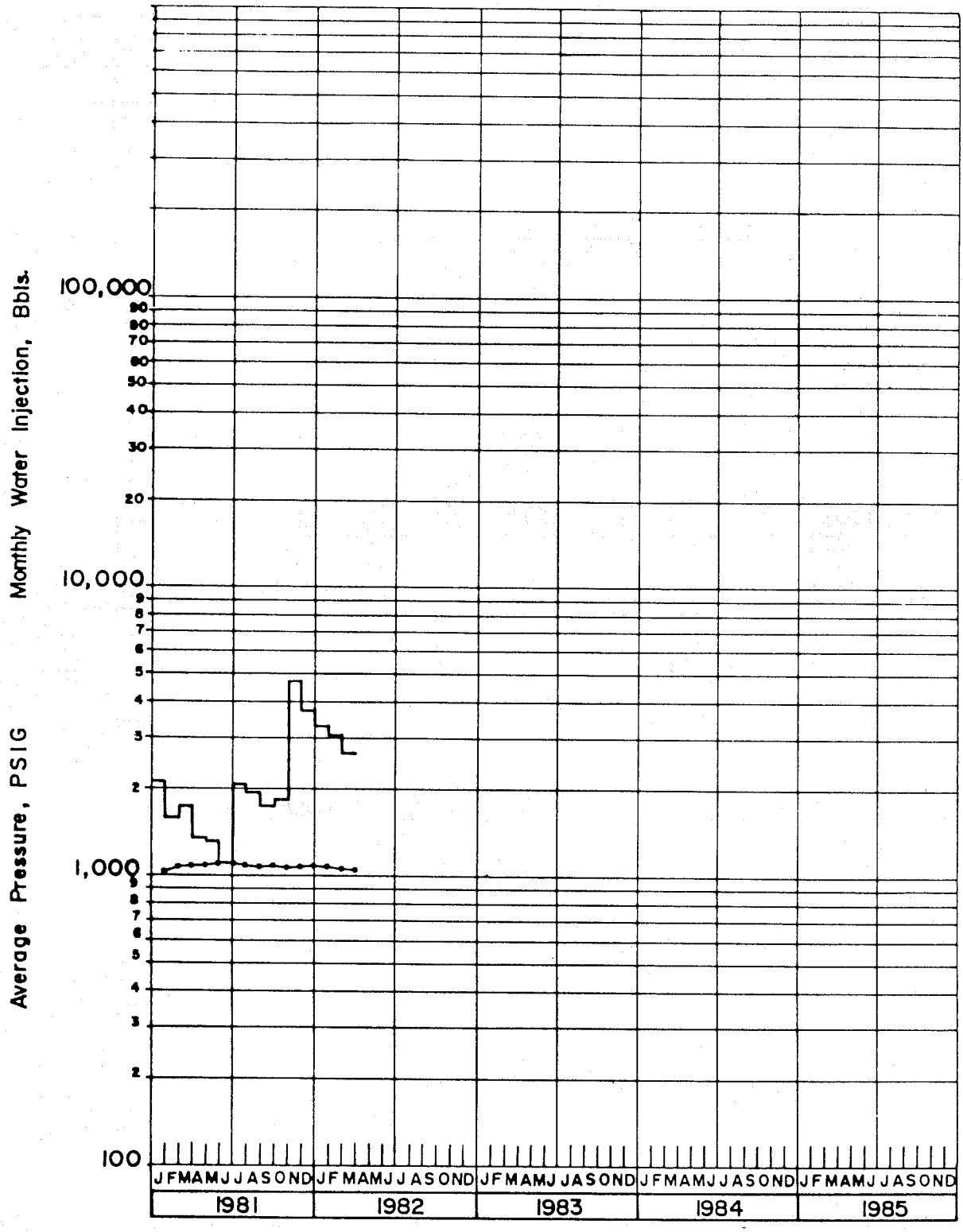
J. H. Looney WIW No. 5



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

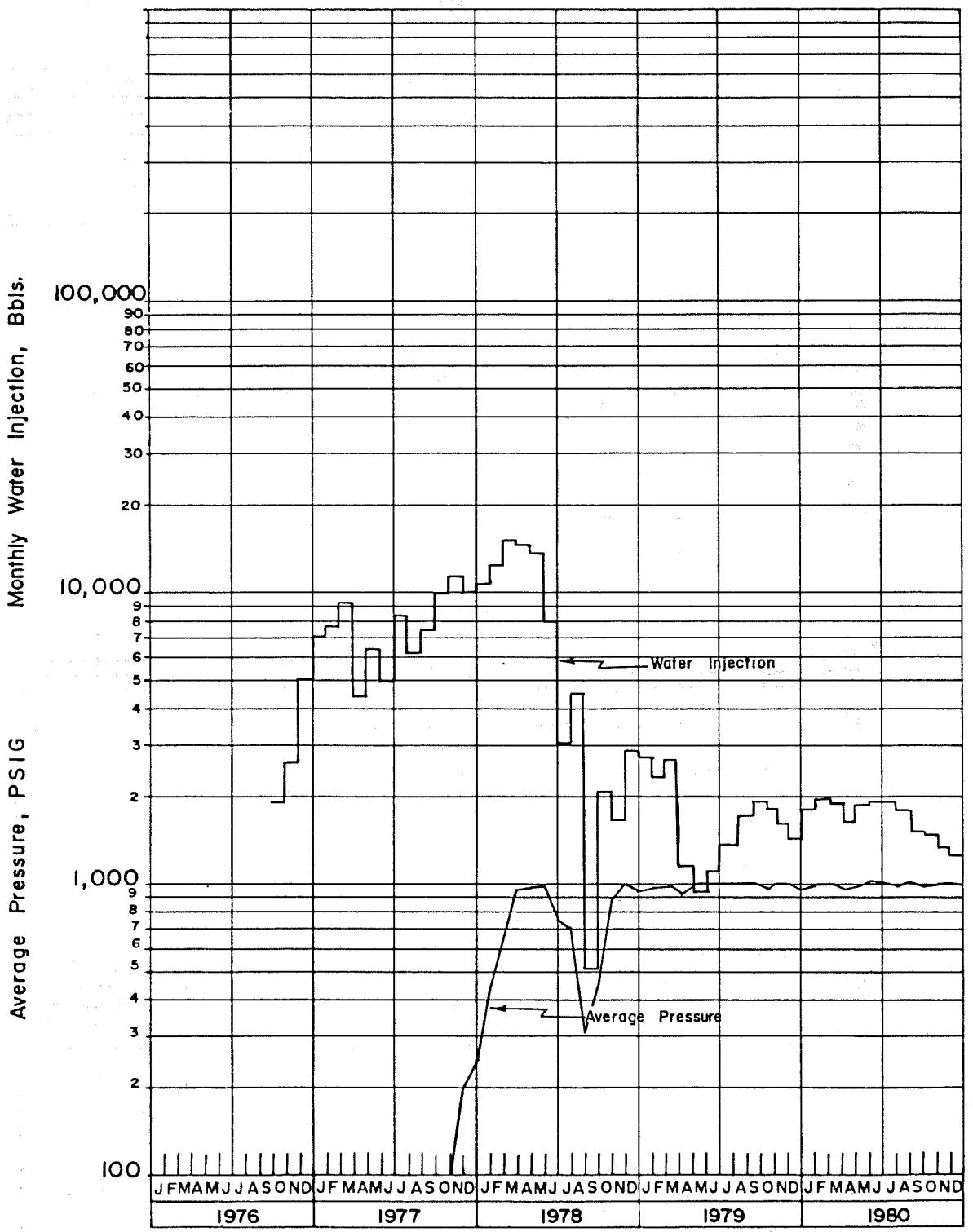
J. H. Looney WIW No. 5



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

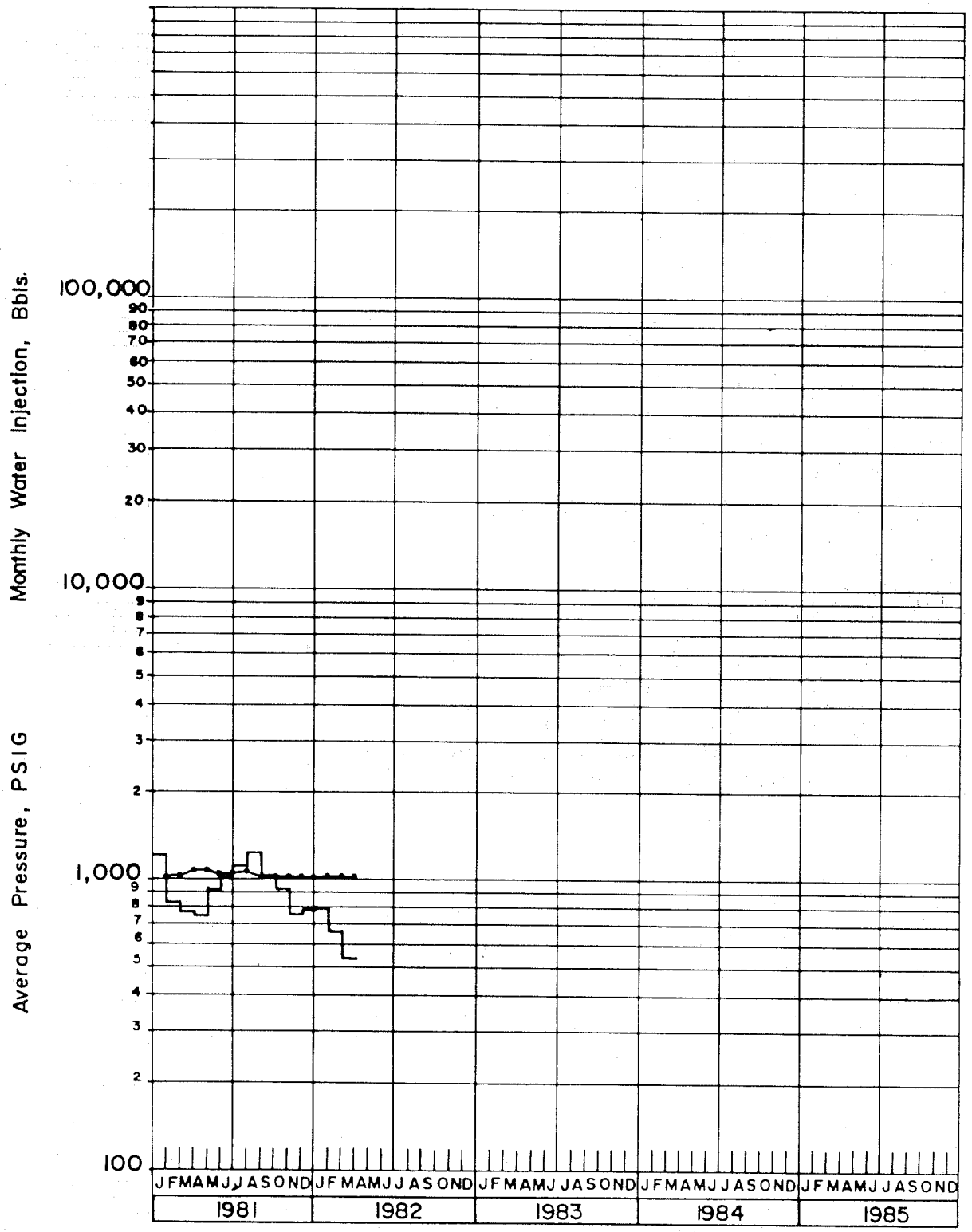
L. W. Shaffer WIW No. 2



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

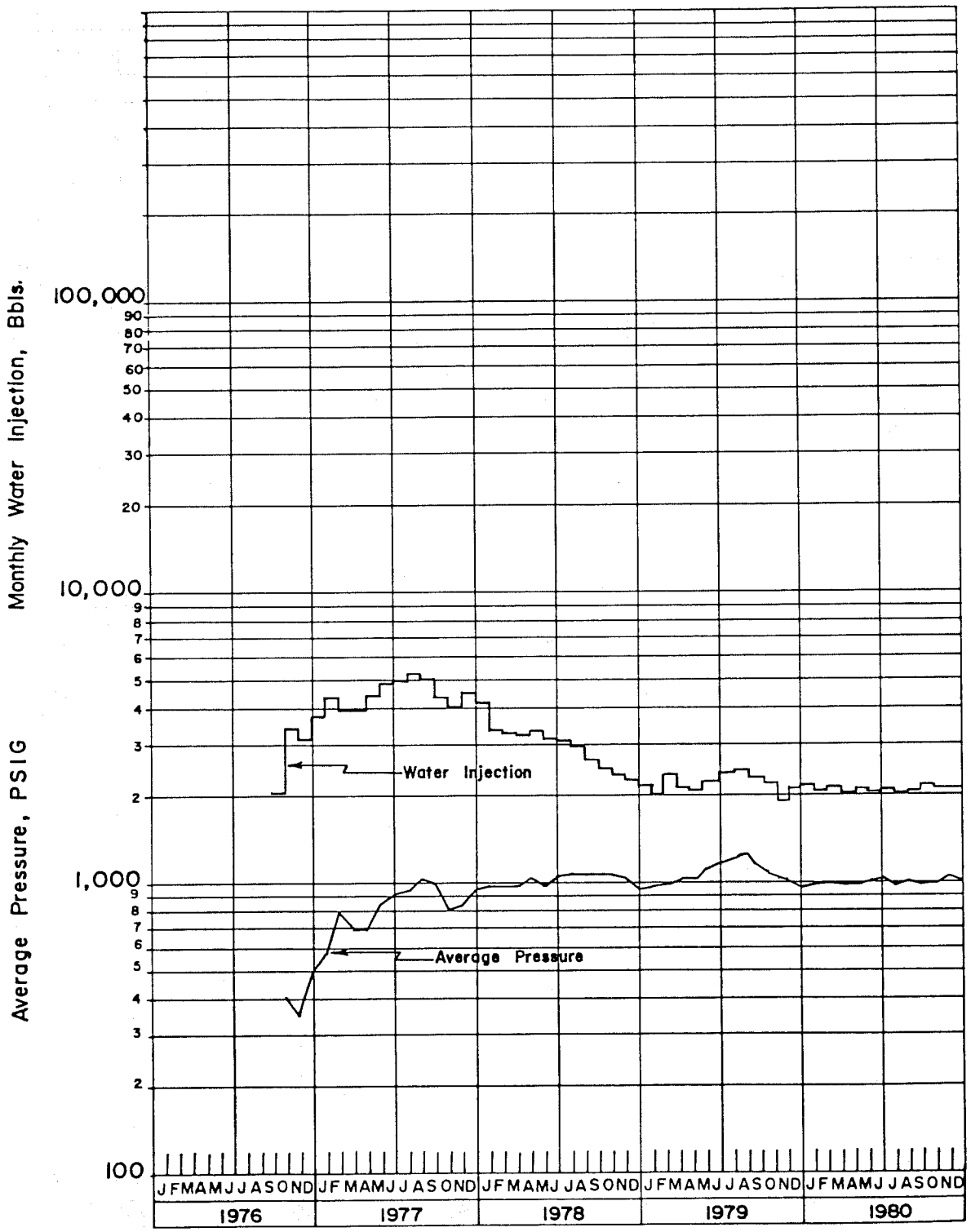
L. W. Shaffer WIW No.2



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

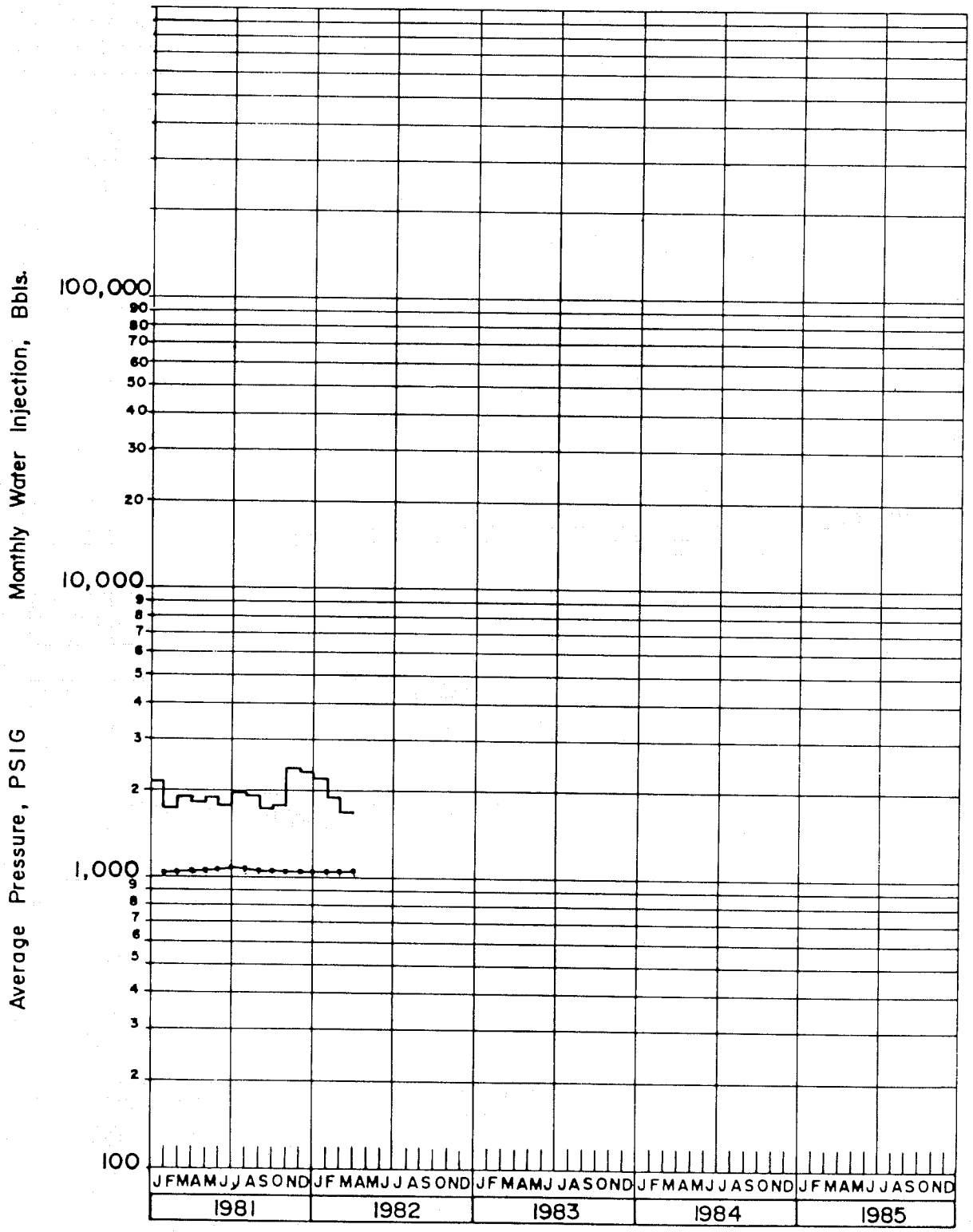
L. W. Shaffer WIW No. 8



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

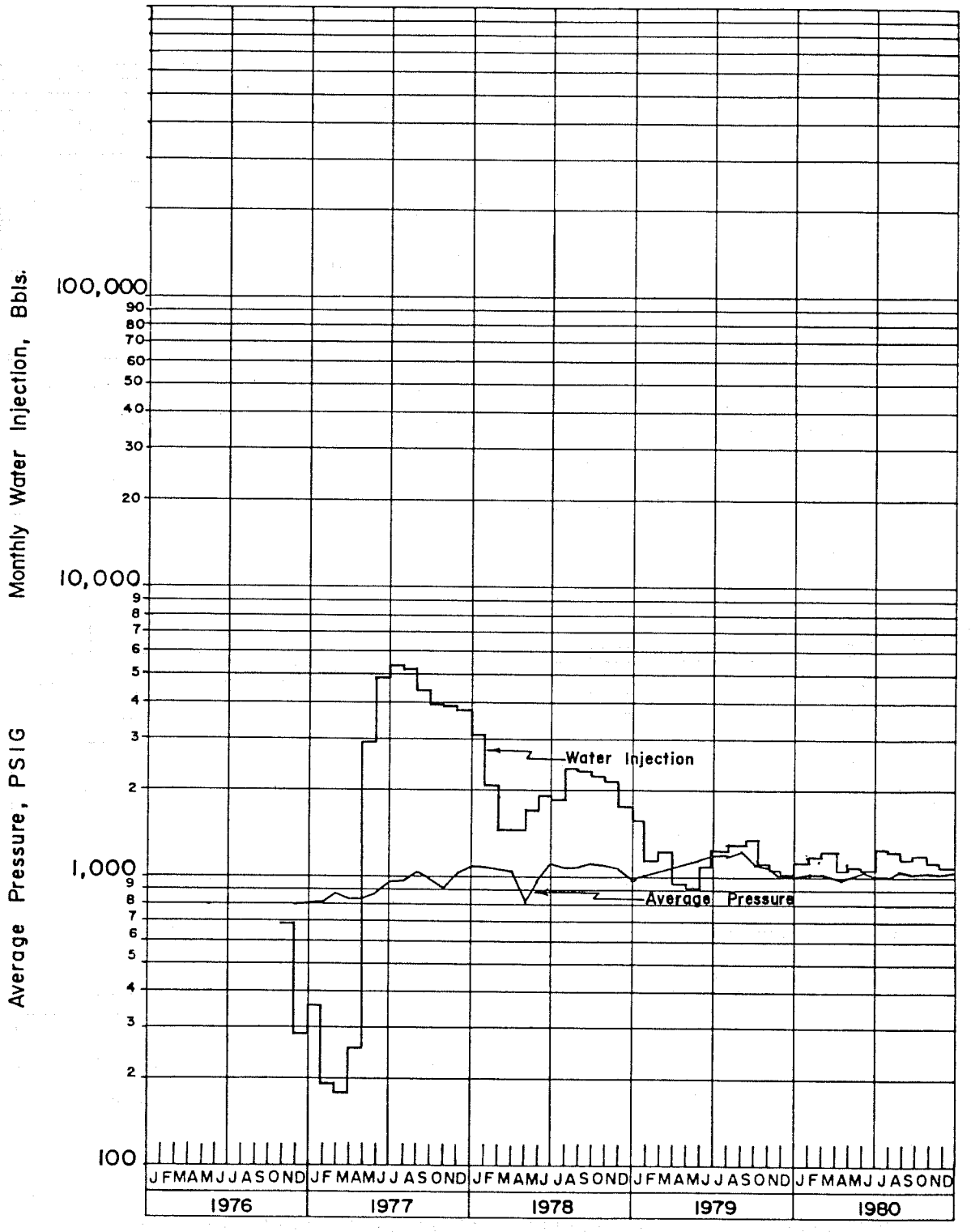
L. W. Shaffer WIW No. 8



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

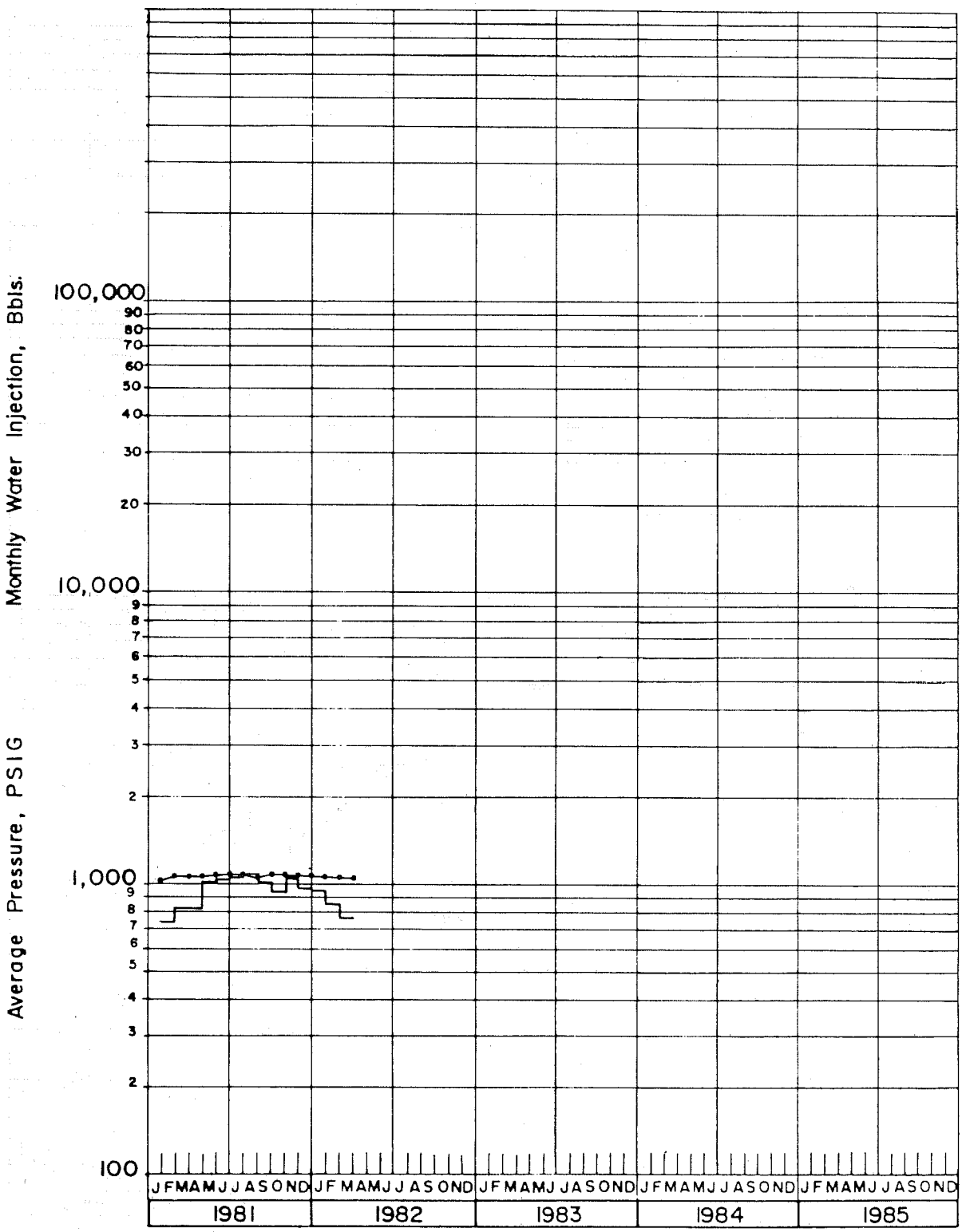
L. W. Shaffer WIW No. 10



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

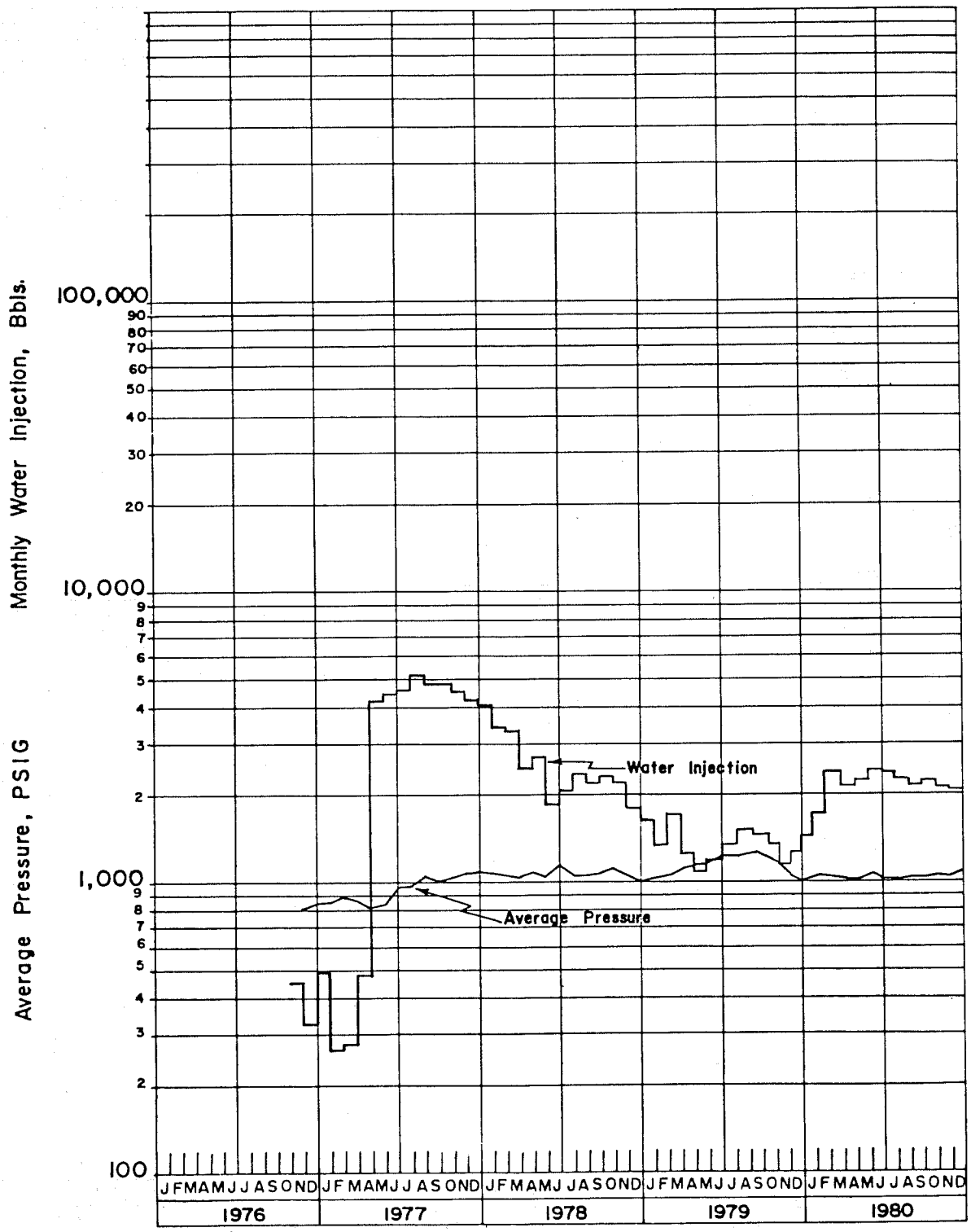
L. W. Shaffer WIW No. 10



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

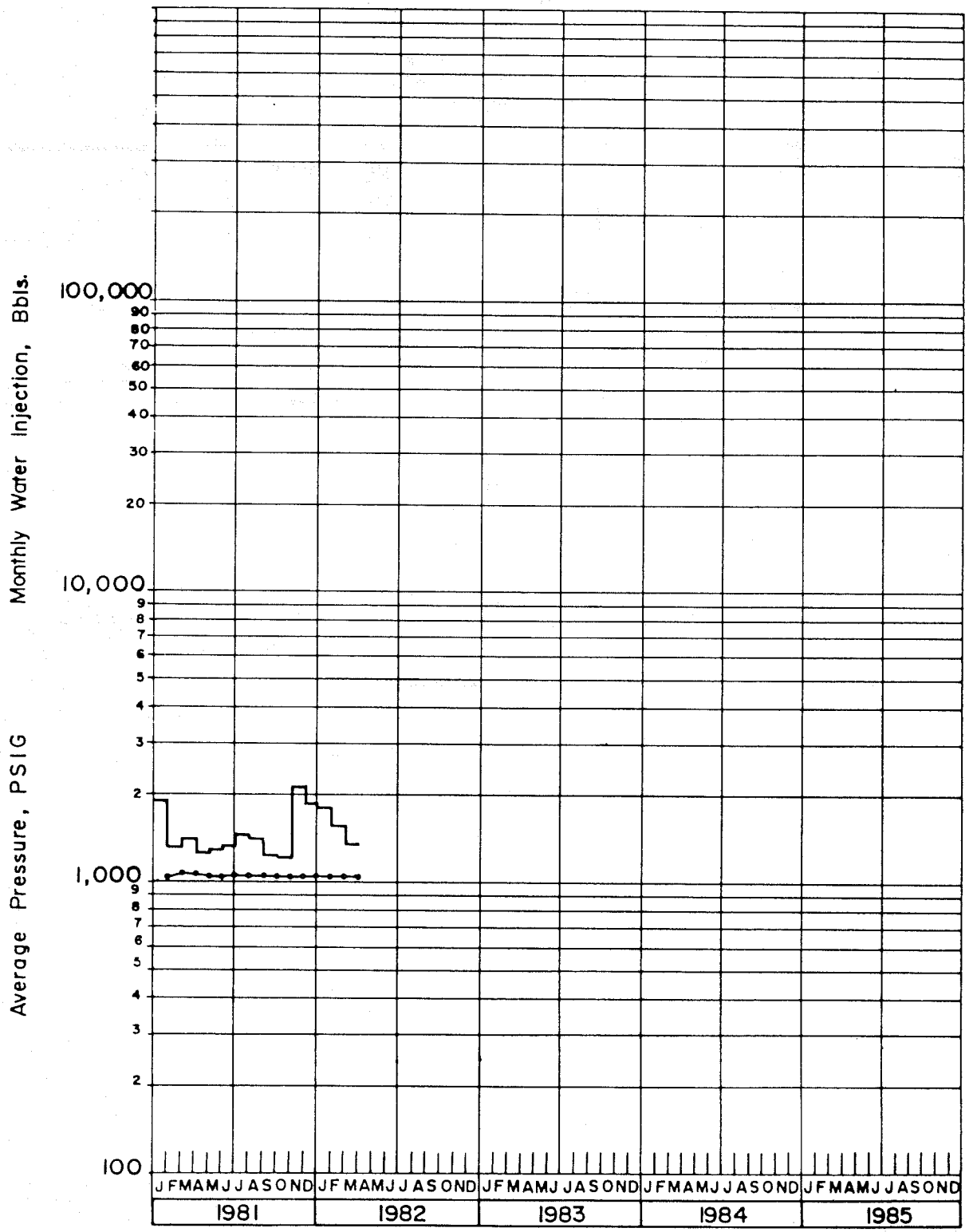
L. W. Shaffer WIW No. 11



ROCK CREEK PILOT CO_2 PROJECT

INJECTION HISTORY

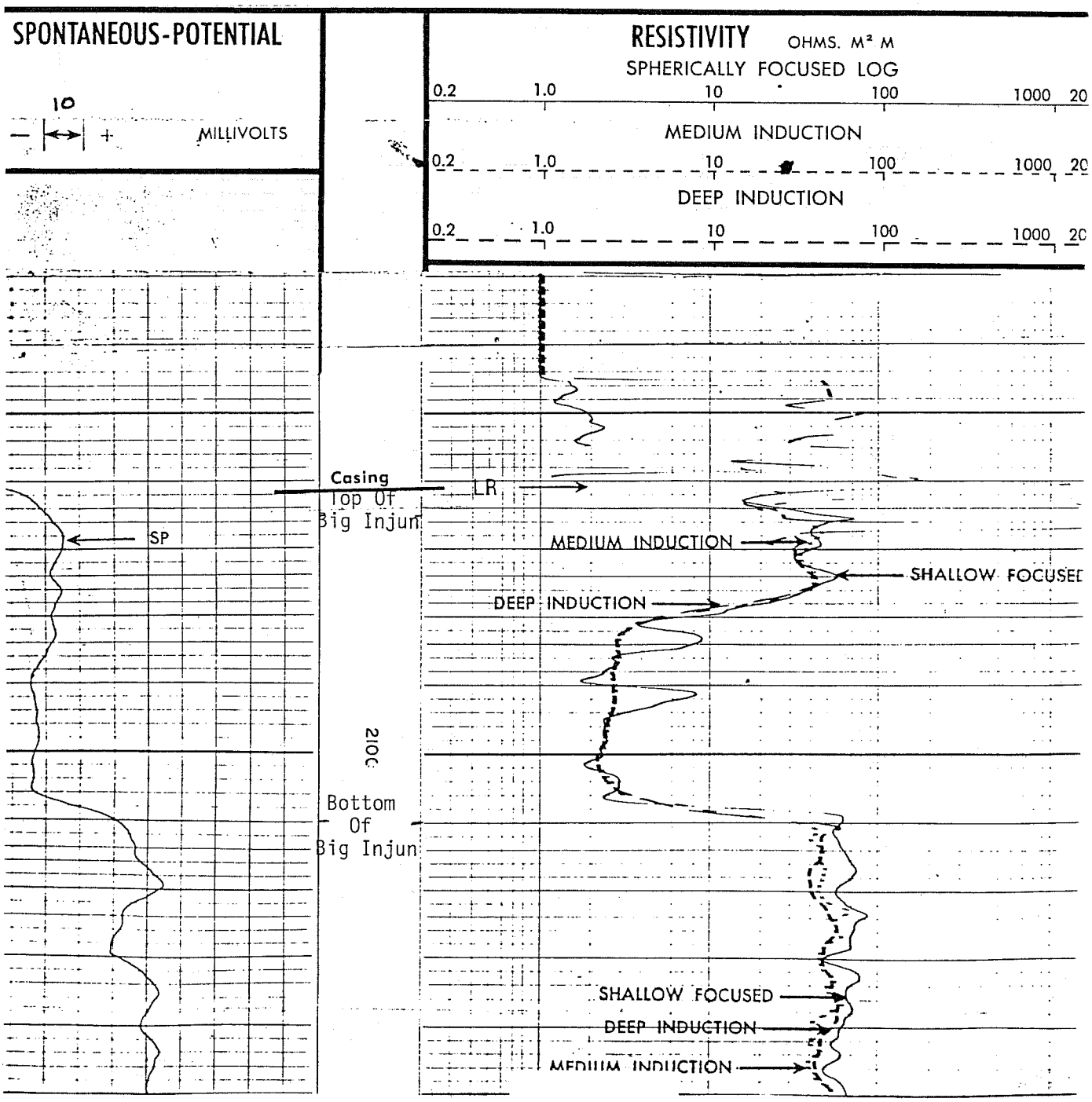
L. W. Shaffer WIW No.11



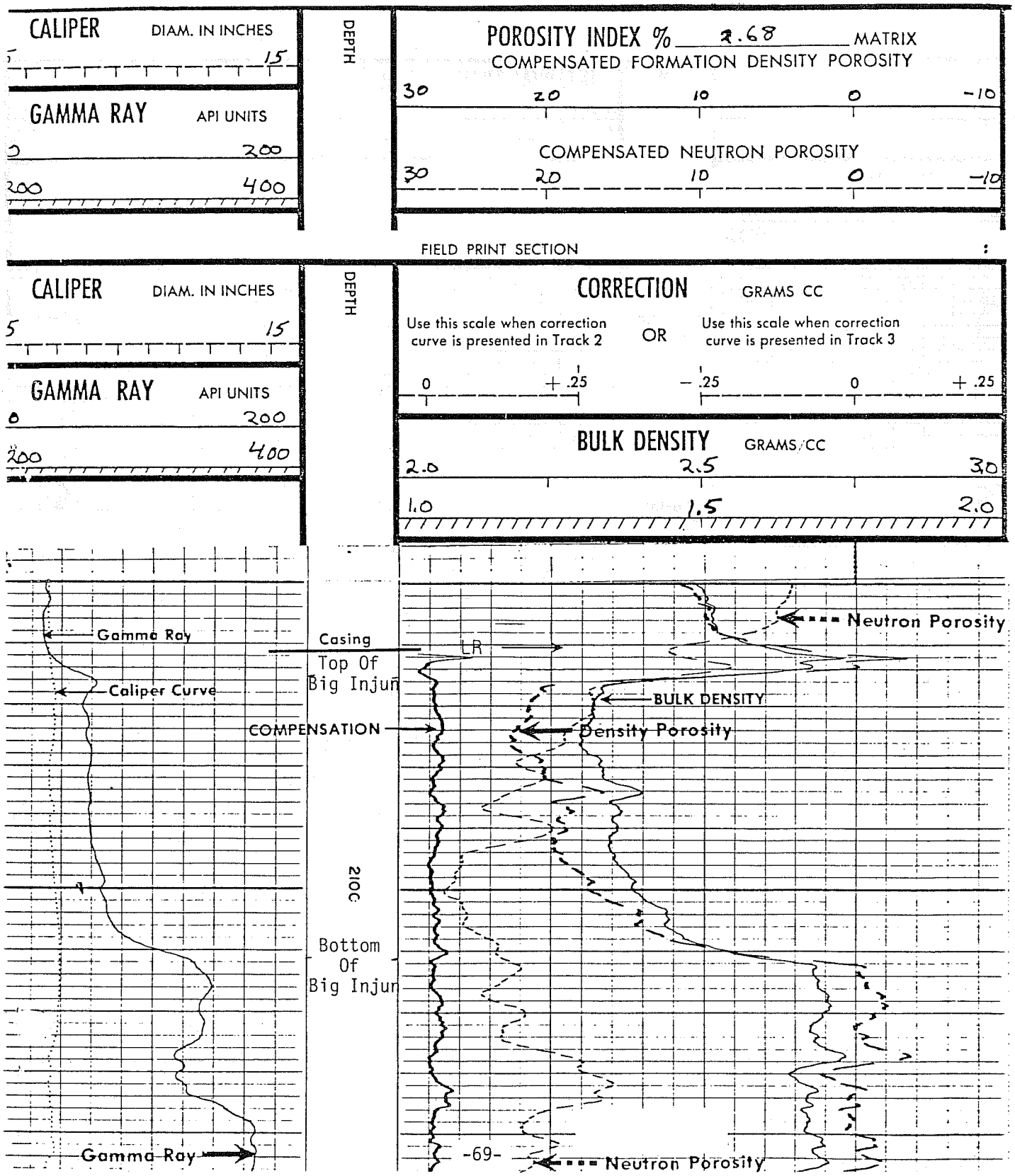
APPENDIX G

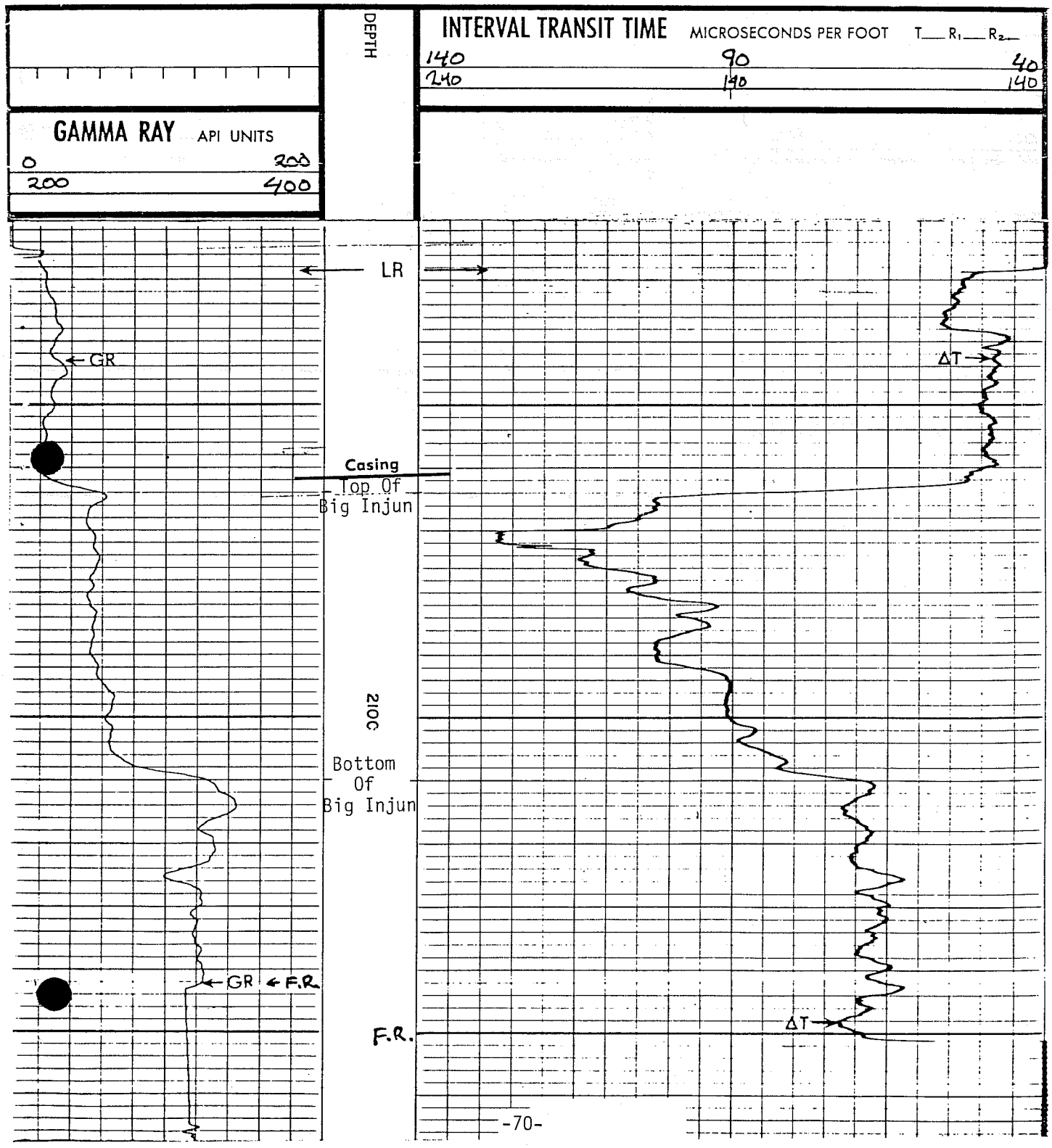
L. W. Shaffer OB-2
Open Hole Logs

L. W. SHAFFER OB-2
ROCK CREEK CO_2 PROJECT
DUAL INDUCTION LOG



L. W. SHAFFER OB-2
ROCK CREEK CO_2 PROJECT
DENSITY LOGS



U.S.G.P.O. 569-028/53

L. W. SHAFFER OB-2
ROCK CREEK CO_2 PROJECT
SONIC VELOCITY LOG