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SUMMARY OF REINJECTION TESTS WITH UNTREATED GEOTHERMAL BRINE
IN WELL M-9 IN THE CERRO PRIETO GEOTHERMAL FIELD

INTRODUCTION

The reinjection of brine in a water-dominated geothermal field is of most importance and its basic objectives are to recharge the reservoir with water and control any waste that the water may contain.

In the Cerro Prieto Geothermal Field, the reservoir is a mixture of water, steam and gases in approximately the following proportions by weight:

- water 60 to 70%
- steam 30 to 40%
- gases 0.6 to 1%

Reinjection tests with separated water under working conditions were initiated in August 1979 and wells M-9 and M-29 were selected for the experiment, which included the following main objectives:

- 1.- Determine the feasibility of reinjecting water separated from wells integrated into the geothermal electric plant system under separation conditions and without prior treatment.
- 2.- Observe the behavior of the hydromechanical system as a function of time.
- 3.- Develop technology for reinjecting separated water under working
- 4.- Observe whether the reservoir shows hydraulic recharge or not.

In order to conduct this experiment, mechanical arrangements were made to transfer the water separated from well M-29 and inject it into well M-9 and initial data when the tests began were:

- a.- Reinjection pressure - 130 psig.
- b.- Flow temperature - 355°F.
- c.- Average reinjection flow rate - 40 tons/hr.

A summary of the results of this experiment were prepared on October 15, 1979 and the main conclusions are described below:

- 1.- Observations indicate that it is feasible to reinject separated water under the working conditions of the well system and the geothermal electric plant.
- 2.- A reduction of approximately 39% in the reinjection flow rate was observed.
- 3.- Surrounding wells near well M-9 have shown no variations in their production or in their operational conditions.
- 4.- The development of technology to manage the flow of wells for reinjection has been initiated
- 5.- The mechanical system has operated satisfactorily.

The experiment continues satisfactorily,

but with some variations in the operational parameters, which are indicated in the reinjection graphs (Fig. 5).

The second summary was prepared in February, 1981 and was presented at the Third Symposium on the Cerro Prieto Geothermal Field. In this summary, it was state that:

- a.- Brine reinjection under separation conditions is feasible.
- b.- The system continues operating normally.
- c.- Reduction in reinjection flow is not significant (Fig. 6).
- d.- Experience is being gained in the management of the system.

This third summary was prepared between February, 1981 and May, 1982 to supplement the previous two summaries and its results are listed below:

- a.- Mechanically, the system continues to operate normally.
- b.- The reduction in the reinjection flow rate is significant (Fig. 7).
- c.- The operational parameters have varied in accordance with the operational needs of the system.

Operational data are as follows:

- a.- Reinjection pressure - 115 psig.
- b.- Reinjection temperature - 347°F.
- c.- Average reinjection flow rate - 10 tons/hr.

CONCLUSIONS

The objectives established at the beginning of this experiment in Cerro Prieto have been achieved, since the technique developed provides the bases for implementation on a larger scale. It would be advisable to conduct tests in other areas of the field in order to ratify the results obtained to date through this experiment.

DESCRIPTION OF GRAPHS

- Fig. 1.- Area of the geothermal field where the reinjection wells are located.
- Fig. 2.- Hydromechanical diagram of surface installations.
- Fig. 3.- Diagram of the completion of well M-9 during reinjection.
- Fig. 4.- Table of volumes reinjected.
- Fig. 5.- Graph of 1980 reinjection data.
- Fig. 6.- Graph of 1981 reinjection data.
- Fig. 7.- Graph of 1982 reinjection data.

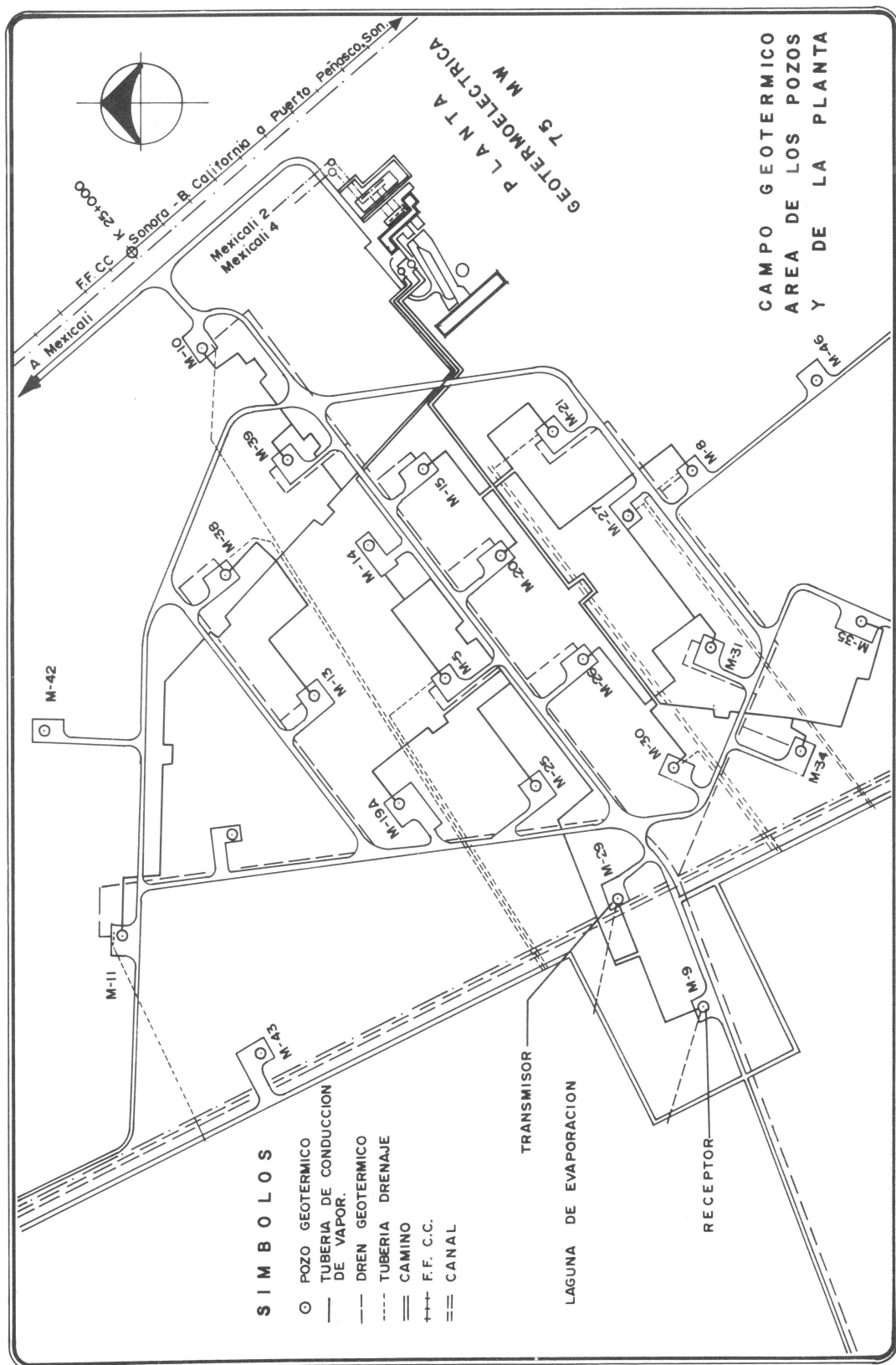


Fig. 1: LOCALIZACION DENTRO DEL CAMPO GEOTERMICO DE CERRO PRIETO, DE LOS POZOS M-9 y M-29, EMPLEADOS PARA EL EXPERIMENTO.

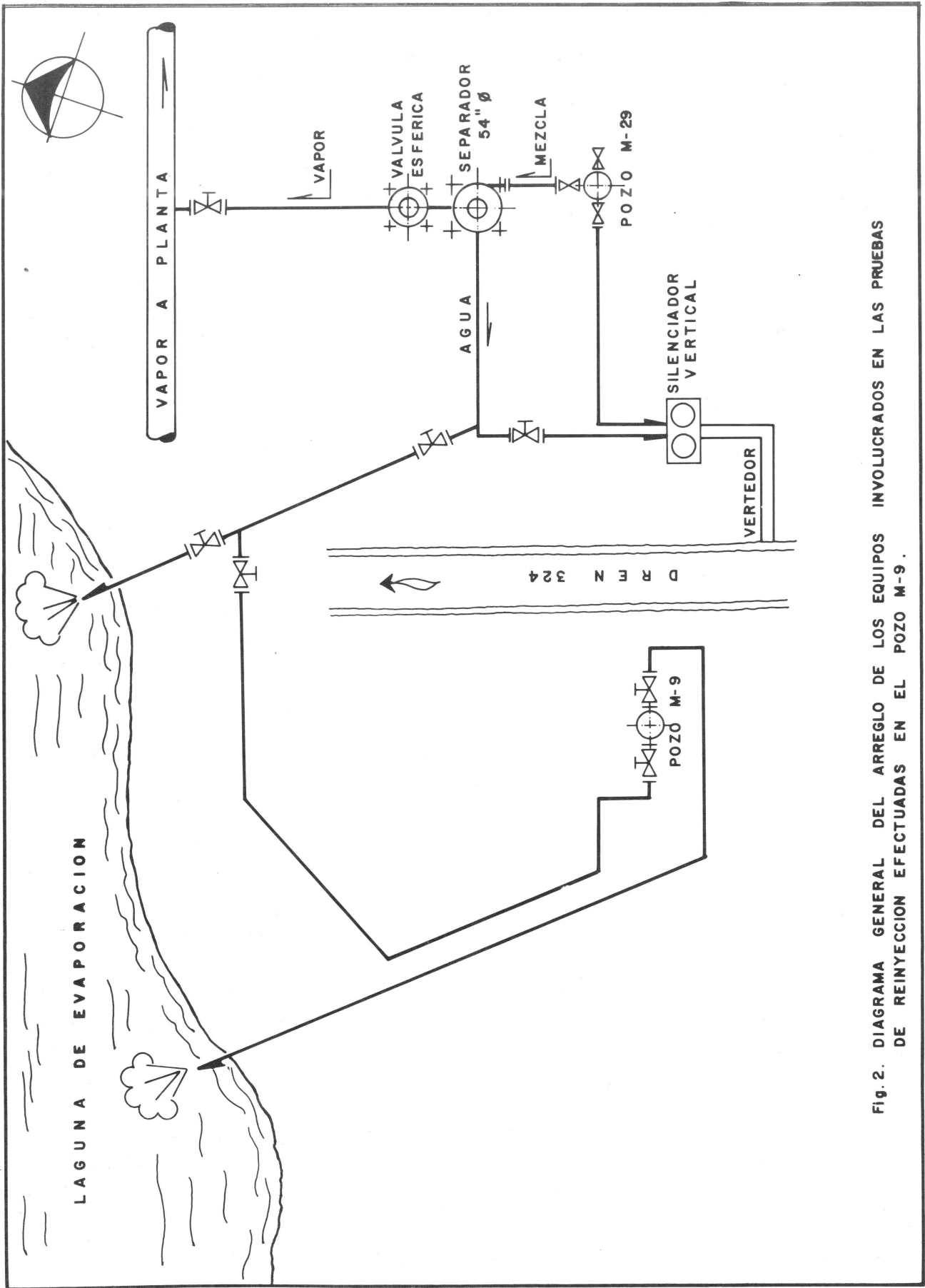
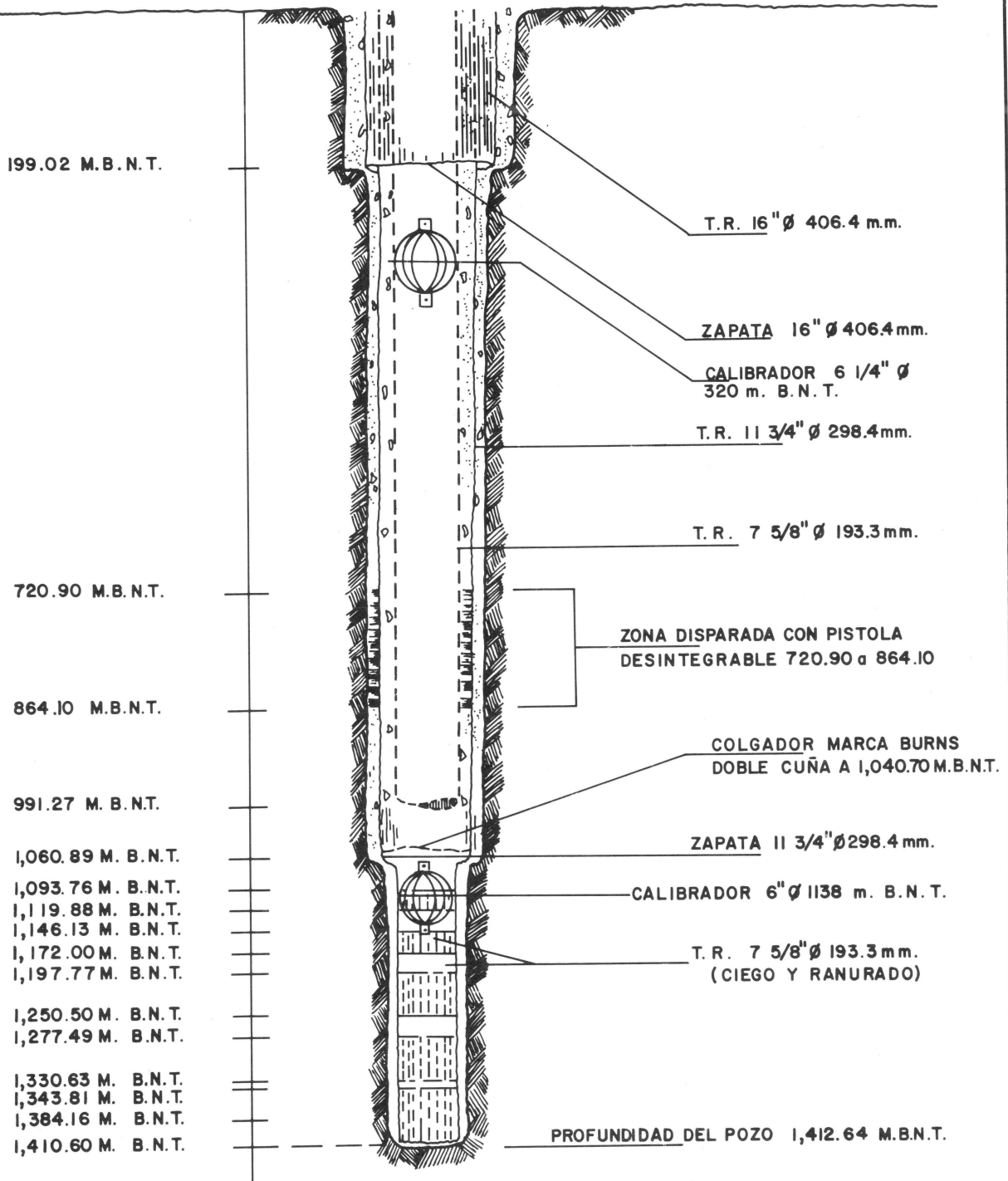


Fig. 2. DIAGRAMA GENERAL DEL ARREGLO DE LOS EQUIPOS INVOLUCRADOS EN LAS PRUEBAS DE REINYECCION EFECTUADAS EN EL POZO M-9.

ESQUEMA TERMINACION POZO M-9 DURANTE LA REINYECCION



ESCALAS:
HORIZONTAL: 1:20
VERTICAL 1:7,500

Fig. 3: ESQUEMA DE TERMINACION DE POZO M-9

**PRUEBAS REINYECCION AGUA SEPARADA
DE POZO M-29 A M-9
DEL 8 DE AGOSTO 1979 AL 25 MAYO 1982**

V O L U M E N A G U A S E P A R A D A R E I N Y E C T A D O E N M - 9 (T O N / H)	671,349.7
V O L U M E N F L U J O T O T A L A G U A S E P A R A D A D E S C A R G A D O E N M - 2 9 (T O N / H)	1'804,099.42
V O L U M E N A G U A S E P A R A D A D E S C A R G A D O E N M - 2 9 (T O N / H)	1'132,749.72
P O R C E N T A J E A G U A S E P A R A D A R E I N Y E C T A D A R E L A C I O N A D O C O N E L F L U J O T O T A L D E S C A R G A D O D E L M - 2 9	37.2
P O R C E N T A J E A G U A S E P A R A D A D E S C A R G A D O E N M - 2 9 R E L A C I O N A D O C O N E L F L U J O T O T A L D E L M - 2 9	62.8

Fig. 4. TABLA DE VOLUMENES REINYECCION

PRUEBAS DE REINYECCION AGUA SEPARADA DEL M-29 AL M-9 DURANTE 1980

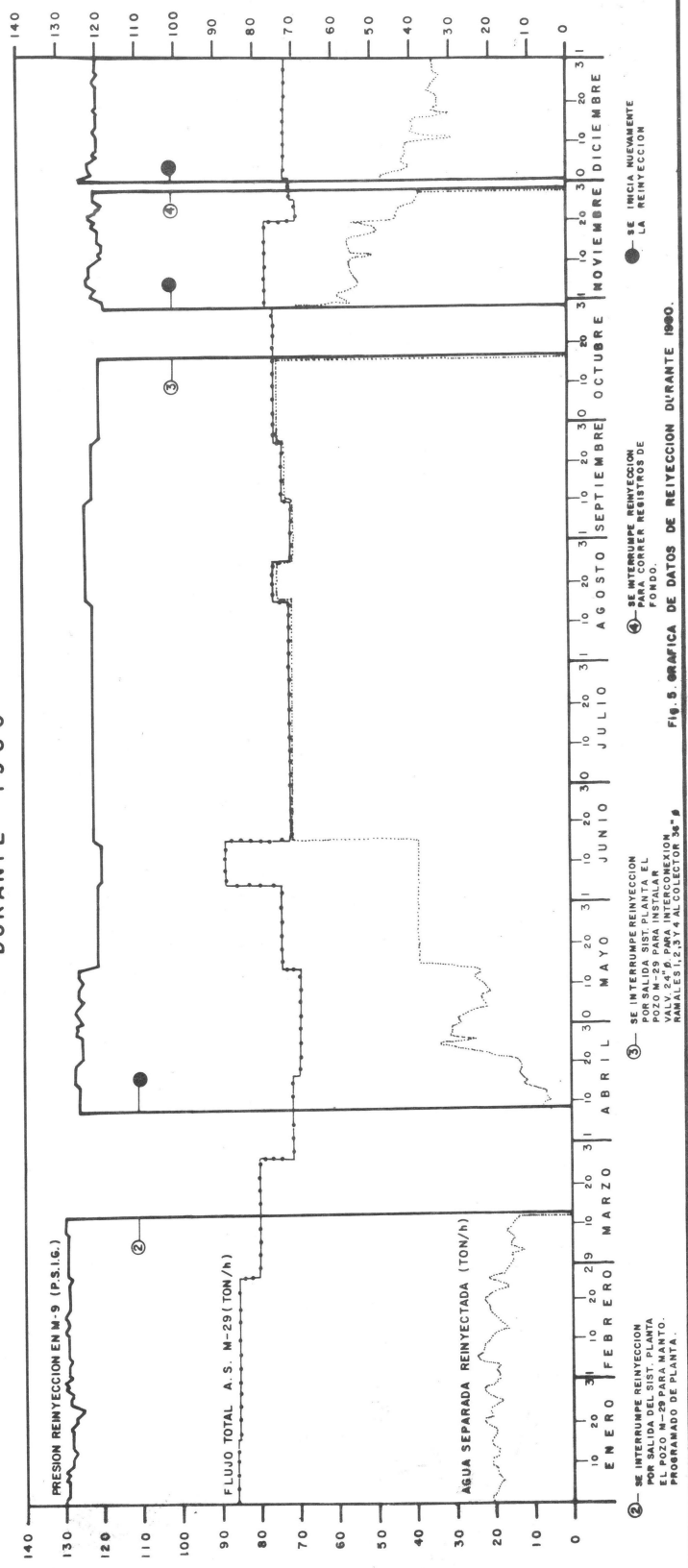


Fig. 5. GRAFICA DE DATOS DE REINYECCION DURANTE 1980.

GRAFICA DE REINYECCION A. S. DE POZO M-29 A M-9

AÑO 1981

- ① SE DEJO DE REINYECTAR A LAS 16:45 DEL DIA 10 DE FEB. P/REP. LINEA DE 8" A LAS 14:00 HRS. Y REINYECTAR A LAS 14:00 HRS. DEL DIA 11.
- ② SE DEJA DE REINYECTAR EL 9 DE MARZO A LAS 16:00 HRS. P/INSTALAR EQUIPO DE REINYECCION Y REINYECTAR NUEVAMENTE EL 12 DE MARZO A LAS 13:00HRS.
- ③ DEL 11 DE ABRIL AL 19 DE MAYO A LAS 11:00HRS. NO SE REINYECTO YA QUE SE EFECTUARON INTENTOS P/RECUPERACION DEL INSTRUMENTO EL 11 DE ABRIL SE EFECTUO REE. CALIBRACION.
- ④ SE DEJO DE REINYECTAR P/ARRIBAR DE CONEXION LINEA DE A.S. HACIA MODULO DE PLANEO.
- ⑤ SE EFECTUA MANIOBRA P/REINYECTAR FLUJO A M-9 SOLO DURANTE 17 HRS. SE VUELVE A MANDAR EXCEDENTE HACIA S. V.
- ⑥ SE DEJA DE REINYECTAR P/MANTO INSTALACIONES SUPERFICIALES.

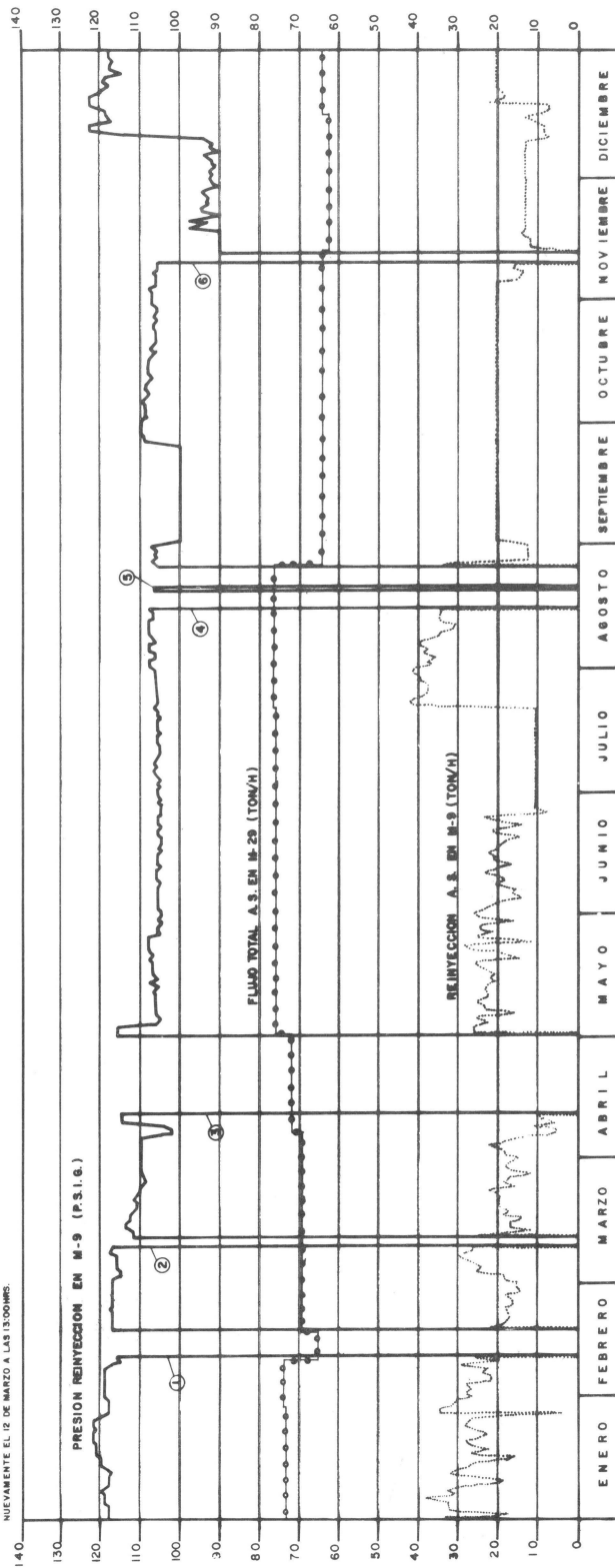


Fig. 6. GRAFICA DE DATOS DE REINYECCION DURANTE 1981

GRAFICA DE REINYECCION A.S. DE POZO M-29 A M-9

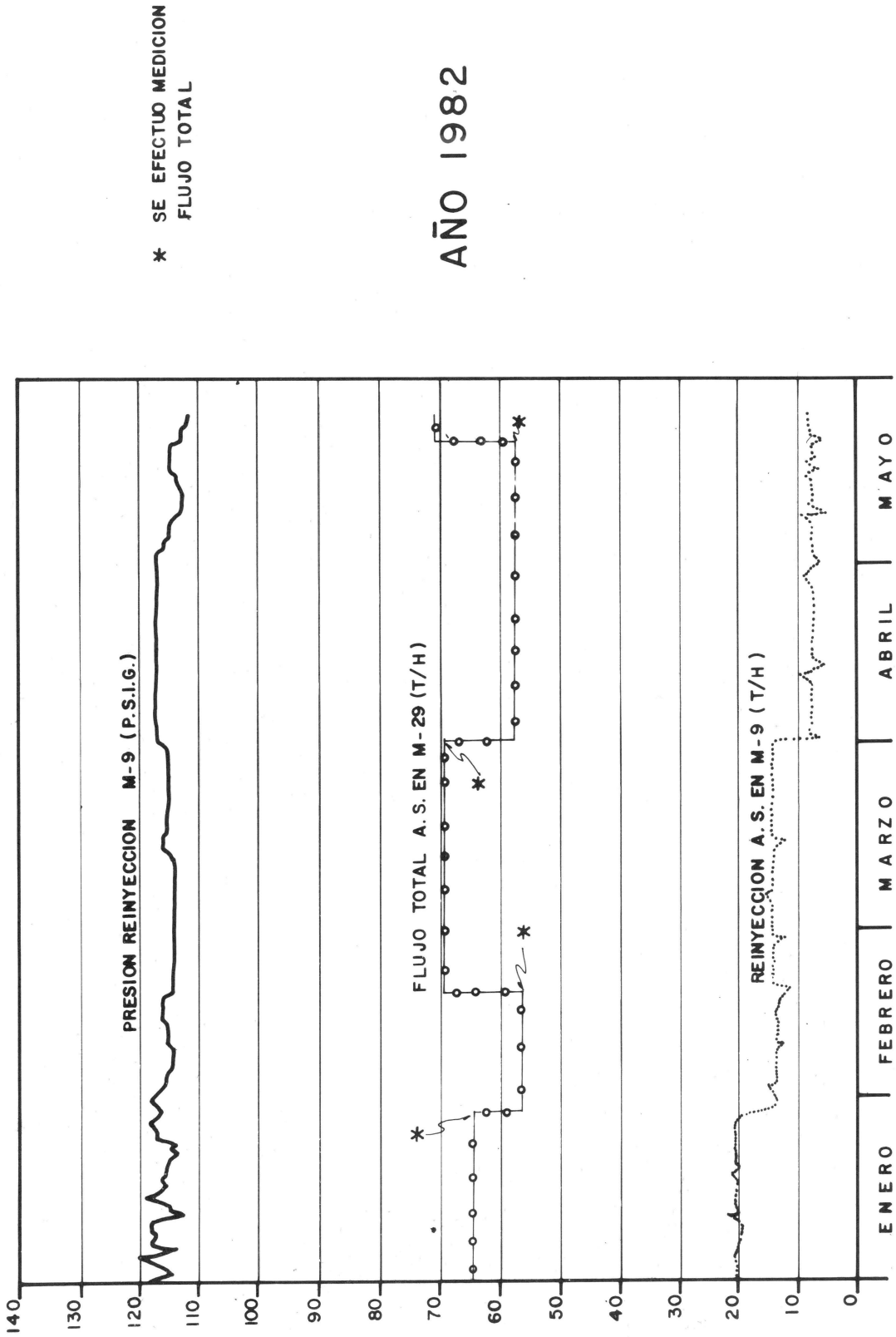


Fig. 7. GRAFICA DE DATOS DE REINYECCION DURANTE 1982