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A Note on the Water Levels and Quality
of Groundwater from the Observation Well
at Hill Run, St. Catherine Plains

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by

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INTRODUCTION

The Crop Diversification and Irrigation Project (CDI) started functioning officially from October 1985, to reinforce the institutional capacity of Agro-21 Corporation Limited to promote and develop private commercial agricultural investment in Jamaica. One of the activities of the CDI project was to rehabilitate and construct irrigation infrastructure such as wells, canals, pumping stations, fencing and storage facilities. On the reorganization of the activities of the Agro-21 Corporation Limited, with effect from April 1, 1989, the CDI project was merged with the National Irrigation Commission. The area of activity is a part of the St. Catherine Plains mostly on the western outskirts of Kingston where it is divided into five (5) sub-areas which are designated as Project - A, Project - B, Project - C (Horticulture), Project-C (small farmers' area) and Project-E. Other areas of small farmer activity include Hill-Run, and Bushy Park. The Hydrogeologist working with the project executed the programme of rehabilitating the old wells and constructing the new ones and also carried out other hydrogeological activities all of which are indicated below:

- a) Three old wells in Project-A were rehabilitated in late 1985.
- b) Fourteen (14) wells were constructed in Projects - A, B, C (Horticulture) and E during the period September, 1985 to February, 1988.
- c) Six (6) old wells in Project-E and two (2) old wells in Project-C (small farmers' area) were tested for their yield and quality of water during the period April, 1987 to February, 1988.
- d) Four (4) observation wells were constructed in coastal area to the east, south-east and south of the project areas and one in the Hill-Run area to monitor the quality of groundwater.
- e) Two (2) exploratory wells were drilled in the Hill-Run area tapping the limestone aquifer.
- f) Water levels and quality of groundwater in the general area were monitored.

As specified in the project document, environmental monitoring of the project activities will be the responsibility of the Underground Water Authority which will include monitoring of:

- a) Water quality with respect to both salinity and contamination by pesticides and other pollutants.
- b) Groundwater extraction.

Monitoring of groundwater levels is necessary to relate any changes in the quality of groundwater with extraction. Monitoring of water levels and the quality of groundwater and preparation of respective project reports were done in collaboration with Underground Water Authority.

Major hydrological work carried out has been described in the following reports:

1. Ramanamurty, D.V. December, 1988. A report on the groundwater resources of horticulture Project-C, Caymanas area, St. Catherine Plains. Land Utilization Department, Agro-21 Corporation Limited, Kingston.

Contains reports on the construction, development and testing of two wells viz. Watson Grove #3 and Riversdale #1 and the recommended rates of extraction of groundwater from these wells. Describes the chemical characteristics of water required for use in horticulture and the suitability of groundwater in the area for this purpose.

2. Ramanamurty, D.V., and B. Fernandez. March, 1989. A report on the salinity of and groundwater in the alluvial aquifer in parts of Bernard Lodge and Caymanas Areas and the adjoining coastal area, St. Catherine Plains. Land Utilization Department, Agro-21 Corporation Limited, Kingston.

Contains chemical analyses data of groundwater from 38 wells in the area; historical data from 1963 to 1982 and recent data from 1985 to 1988; shows areas of groundwater contamination with sea water and other pollutants.

3. Ramanamurty, D.V. May, 1989. A report on the groundwater resources of Project-A, Bernard Lodge area, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains reports on testing of one old well, Half Way Tree #6, reconstruction, development and testing of three old wells, Half Way Tree #4, #5 and Cookson #3 and construction, development and testing of five new wells, Half Way Tree #2, Cookson #4, Newlands #2, #2A and #3, recommended rates of groundwater extraction from the wells, chemical characteristics of water required for irrigation and the suitability of groundwater for this purpose.

4. Ramanamurty, D.V. July, 1989. A report on the groundwater resources of Project-B, Caymanas area, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains reports on the construction development and testing of wells, Cowpark-A, North Syndicate #2, South Syndicate #2, Naggo Head and Guinep Pen and testing of old well, Cedar Grove #2, recommended rates of groundwater extraction from the wells, chemical characteristics of water for irrigation and suitability of groundwater in the area for this purpose.

5. Ramanamurty, D.V. July, 1989. A report on the groundwater resources of Project-E, Bernard Lodge area, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains reports on the construction, development and testing of three new wells Goshen #3A, Clifton #B, and Clifton #5 and testing of 6 old wells, Limetree #1, Government Park, Clifton #3 Congrieve Park #4, Salt Pond #7, and Reidspen #1, recommended rates of groundwater extraction from the wells, chemical characteristics of water required for irrigation and suitability of groundwater in the area for this purpose.

6. Ramanamurty, D.V. July, 1989. A report on the groundwater resources of Project-C (small farmers area), Caymanas area, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains reports on testing of two old wells, Phoenix Park #1 and #3 and drilling of five coreholes, Lawrencefield, Riversdale #2 and #3 Cowpark B and C.

7. Ramanamurty, D.V., K. Mulchansingh and B. Fernandez. July, 1989. A report on the ground water levels in parts of Bernard Lodge and Caymanas areas and adjoining coastal area, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains water level data and hydrographs for 27 wells and descriptions on the fluctuations in water levels.

8. Ramanamurty, D.V., and B. Fernandez. July, 1989. A note on the salinity of and groundwater from Riversdale #1 well, Caymanas area, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains chemical analyses results of water samples collected from Riversdale #1 well from August, 1986 to March 1989 and description on the changes in the quality of groundwater with pumping time. Attempts to explain the unusually high concentrations of sodium and chloride in water just at the beginning of pumping.

9. Ramanamurty D.V. and B. Fernandez. July, 1989. A note on the water levels and quality of groundwater from the observation well at Hill-Run, St. Catherine Plains. National Irrigation Commission, Kingston.

Contains water level data, hydrographs and chemical analyses results of water samples from the Hill-run observation well.

Reports on the construction of five (5) observation wells along the coast and in the Hill-Run area, and on the drilling of two (2) exploratory wells tapping the limestone Aquifer in the Hill-Run area and on the organic contamination of groundwater in parts of Bernard Lodge area have been issued by the Underground Water Authority under the titles listed below:

1. Fernandez, B. January, 1988. The drilling of monitoring wells, South St. Catherine. Underground Water Authority, Kingston.

The Crop Diversification Project on the South St. Catherine alluvial plains, required high quality groundwater, necessitating the replacement of older sand pumping wells. The quality of groundwater must remain high and the monitoring well network is one early warning system put in place to detect any changes in groundwater quality. The five monitoring wells are aligned in a crescent between the well field and the sea. Multi-level (piezometers) and single level completion using 3" O pvc have been constructed.

2. Fernandez, B. July, 1988. Well completion report, Hill-Run Drive #1, exploratory Well, South St. Catherine. Underground Water Authority, Kingston.

Contains drilling, and testing information. The hole was drilled down to 200 ft. Groundwater from the well was highly saline in the deep zone and moderately saline in the top zone. The well was abandoned.

3. Fernandez, B. August 1988. Well completion report, Pepper Pot Drive exploratory well #2, Hill Run area, St. Catherine. Underground Water Authority, Kingston.

Contains drilling and testing information. The hole was drilled down to 80 ft. Testing could not be completed due to caving of the hole and it was abandoned.

4. Fernandez, B. and D.V. Ramanamurty. July 1989. Ground-water monitoring for organic contamination. Bernard Lodge, St. Catherine Plains. Underground Water Authority, Kingston.

Six water samples one each from six wells in and around the project areas were analysed. Concentration of organophosphorous pesticides in the groundwater were below the detectable limit. Concentration of organochlorine pesticides were also less than the detectable limit except in one sample.

Facilities extended by Agro-21 Corporation Limited, Underground Water Authority and National Irrigation Commission Limited, in furtherance of the work and in the preparation of the reports are gratefully acknowledged.

A note on the water levels and quality of Groundwater from the Observation well at Hill Run, St. Catherine Plains.

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A Note on the Water Levels and Quality
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1. Introduction

An observation well in Hill Run area was constructed in October 1987, tapping the alluvial aquifer to monitor the water levels and quality of water. Drilling of a pilot hole showed the occurrence of three aquifers between 20 feet and 40 feet, 55 feet and 65 feet and 86 feet and 95 feet. Piezometer tubes were installed in the wells one tapping the aquifer between 20 feet and 40 feet and the other tapping the two lower aquifers so as to monitor the aquifers separately. The shallow piezometer is 40 feet deep and the deep piezometer is 100 feet deep.

2. Water Level Data

Water level data was collected from the piezometers from January 1988 to September 1988 and again in April and May 1989. Data could not be collected during the later part of 1988 and early part of 1989 as the site was unapproachable due to water logging and sometimes as the water was stagnant in the casing over the pipes.

During 1988 the water levels in both the piezometers behave in the same way. They fluctuated slightly around 26 feet till early August. Heavy rains in mid September increased the levels by about a foot in both the piezometers. The levels in April - May 1989 were just a little less than 26 feet.

Water level data is given in Table 1 and the hydrographs quality of water are given as Figs. 1 to 4.

Chemical analyses results for water samples collected from both the piezometers are given in Tables 2 and 3. Graphs showing the concentrations of major anions and cations are given in Fig. 5 and 6. The water belongs to sodium chloride type with the concentration of chloride around 10 equivalents per million and sodium varying around 9 - 11 equivalents per million. Fluctuations in sodium content are more in the water from the shallow aquifer than in that from the deeper one.

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TABLE 1

ST. CATHERINE PLAINSWATER LEVEL DATA

LOCATION: HILL Run PIEZOMETER

ELEVATION OF R.P. 2686 ft

REF. POINT FOR MEASUREMENT TOP OF TALL PVC PIPE

DEEP

SHALLOW

Date	Water Level below R.P.	Elevation of Water Level	Well Discharge (1GPM)	Date	Water Level below R.P.	Elevation of Water Level	Well Discharge (1GPM)
	ft.	ft.			ft.	ft.	
21 1/88	0.86	26.00		21 1/88	0.90	25.96	
10 2/88	0.90	25.96		10 2/88	0.93	25.93	
11 2/88	0.95	25.91		11 2/88	0.97	25.89	
23 2/88	1.30	25.56		23 2/88	0.90	25.96	
9 3/88	0.50	26.36		9 3/88	0.45	26.41	
8 4/88	0.50	26.36		8 4/88	0.48	26.38	
5 5/88	0.60	26.26		5 5/88	0.65	26.21	
12 5/88	0.55	26.31		12 5/88	0.60	26.26	
10 6/88	1.00	25.86		10 6/88	1.00	25.86	
13 6/88	1.01	25.85		13 6/88	1.15	25.71	
6 7/88	1.15	25.71		6 7/88	1.15	25.71	
8 7/88	1.13	25.73		8 7/88	1.18	25.68	
21 7/88	0.43	26.43		21 7/88	0.47	26.39	
5 8/88	0.74	26.12		5 8/88	0.72	26.14	
19 8/88	0.59	26.27		19 8/88	0.63	26.23	
2 9/88	0.35 ABOVE PIPE	27.21		2 9/88	0.20 ABOVE PIPE	27.06	
29 9/88	0.29 ABOVE PIPE	27.15		29 9/88	0.14 ABOVE PIPE	27.00	
4 4/89	0.0	26.86		4 4/89	0.0	26.86	
1 5/89	0.07	26.79		1 5/89	0.11	26.75	

Chemical Analyses of Water Samples

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Location: HILL RUN

a) Deep
b) Shallow

OBS WELL

Area:

SL NO.	DATE	pH	e Sp. Conductance	TDS	Ca	Mg	Na	K	Fe	Cl mg/l	SO ₄	B	F	PO ₄	NO ₃	* Alkalinity			Total * Hardness	SAR
																HCO ₃	CO ₃	Total		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 a	22 <u>10</u> 87	7.9	1730	1157.2	92.9	43.3	188	1.70	0.06	377.1	59.8	0.56	-	-	-	198.8	21.6	220.4	409.8	
b	23 <u>10</u> 87	7.9	2320	1362.6	94.6	39.9	314.0	1.22	0.04	472.2	55.9	0.56	-	-	-	311.3	33.5	344.8	400.0	
2 a	11/87	7.7	1810	1070.6	110.6	44.2	244.5	1.60	0.20	371.7	115.7	0.19	-	-	-	246.4	56.1	302.5	460.0	
b		7.8	1800	1067.2	106.6	52.3	234.5	1.60	0.83	382.5	135.3	0.11	-	-	-	246.4	46.4	292.8	484	
3 a	23 <u>2</u> 88	8.0	1740	-	-	-	250	-	-	370.7	-	-	-	-	-	246.6	0.0	246.6	-	-
b		8.2	1880	-	-	-	290	-	-	402.3	-	-	-	-	-	249.0	19.2	268.2	-	-
4 a	13 <u>6</u> 88	7.5	1670	1100.8	94.2	46.8	186.5	14	35.4	357.9	17.7	-	-	-	-	265.1	0.0	265.1	416.0	
5 a	5.7.88	7.8	1710	-	-	-	219.5	-	-	362.6	-	-	-	-	-	235.9	-	235.9	-	-
b		7.7	1830	-	-	-	255	-	-	373.9	-	-	-	-	-	240.7	-	240.7	-	-
6 a	21 <u>7</u> 88	7.1	1640	-	-	-	211.0	-	-	350.3	-	-	-	-	-	283.1	-	283.1	-	-
b		7.2	1810	-	-	-	234.5	-	-	374.0	-	-	-	-	-	325.3	-	325.3	-	-
7 a	5.8.88	7.5	1770	-	-	-	220.0	-	-	386.3	-	-	-	-	-	308.1	-	308.1	-	-
b		7.5	1860	-	-	-	230.0	-	-	363.6	-	-	-	-	-	318.1	-	318.1	-	-

e/μmhos/cm at 25°C * as CaCO₃

(Analysis by Jamaica Bauxite Institute, Kingston)

St. Catherine Plains

Table 3.

Chemical Analyses of Water Samples

Location: HILL RUN

a) Deep

OBS WELL

Area:

b) Shallow

SL NO.	DATE	pH	e Sp. Conductance	TDS	Ca	Mg	Na	K	Fe	Cl mg/l	SO ₄	B	F	PO ₄	NO ₃	* Alkalinity			Total * Hardness	SAR
																HCO ₃	CO ₃	Total		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
8a	17 ¹ / ₅₃	7.1	1720	—	—	—	200	—	—	348.8	—	—	—	—	—	318.1	—	318.1	—	—
b		7.1	1850	—	—	—	200	—	—	371.5	—	—	—	—	—	338.0	—	338.0	—	—
9a	29 ⁹ / ₂₃	7.4	1760	—	—	40.8	225	21.5	—	335.9	—	—	—	—	—	267.1	26.0	315.1	—	—
b		7.0	1920	—	—	35.8	250	18.0	—	376.3	—	—	—	—	—	351.6	0.0	351.6	—	—

e/p/mhos/cm at 25°C * as CaCO₃

(Analysis by Jamaica Bauxite Institute, Kingston)

St. Catherine Plains
Well Hydrograph

Fig. 1

Location: HILL RUN PIEZOMETER (DEEP)

Elevation of M.P- 26.46

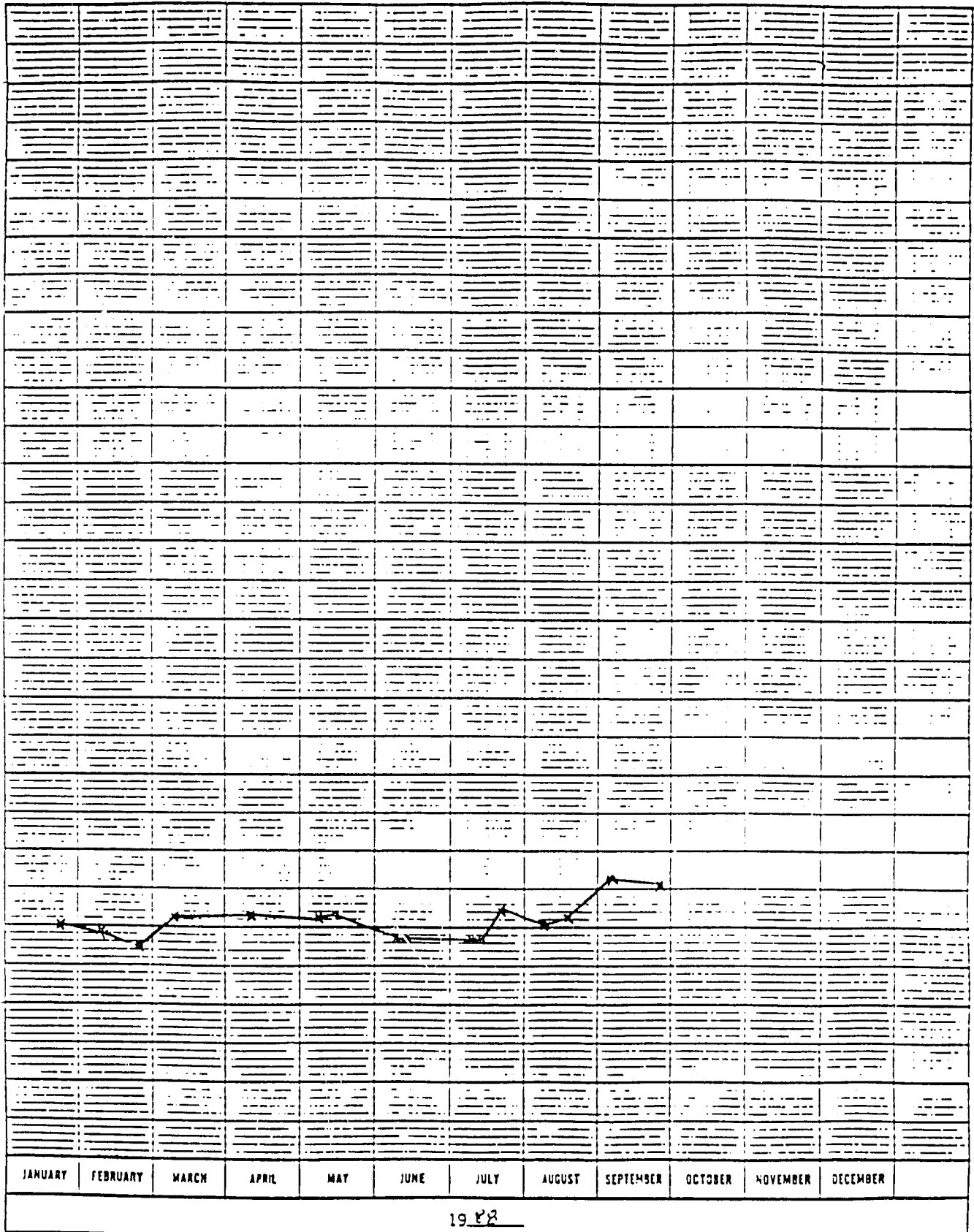
ft.

Water Level (ft) above Sea Level

30

25

20



St. Catherine Plains
Well Hydrograph

Fig-2

Location: 71 LL RUN PIEZOMETER (SHALLOW) Elevation of M.P- 26.86 ft.

Water Level (ft) above Sea Level

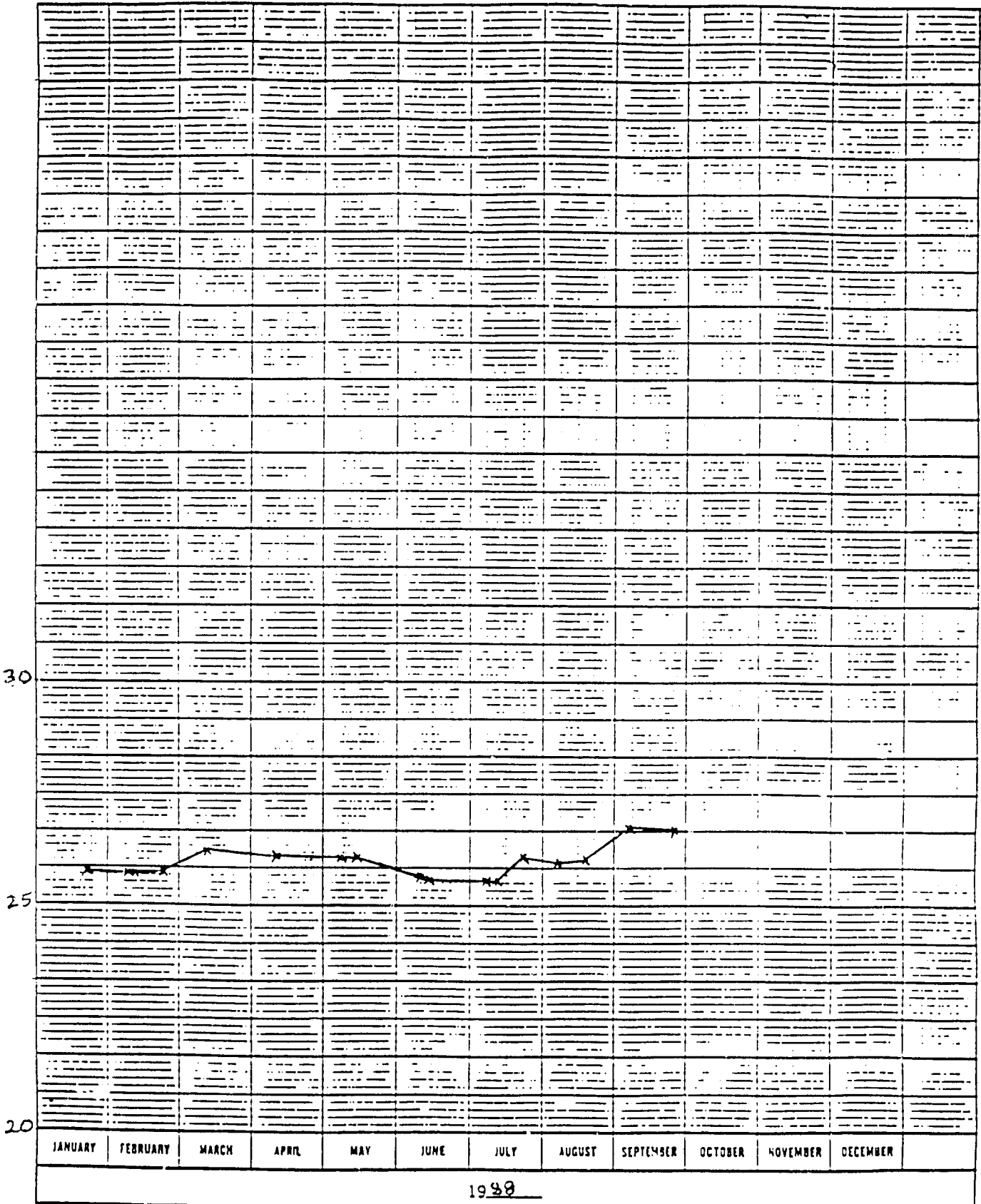


Fig-3

ft.

[illegible]

Fig. 4

ft.

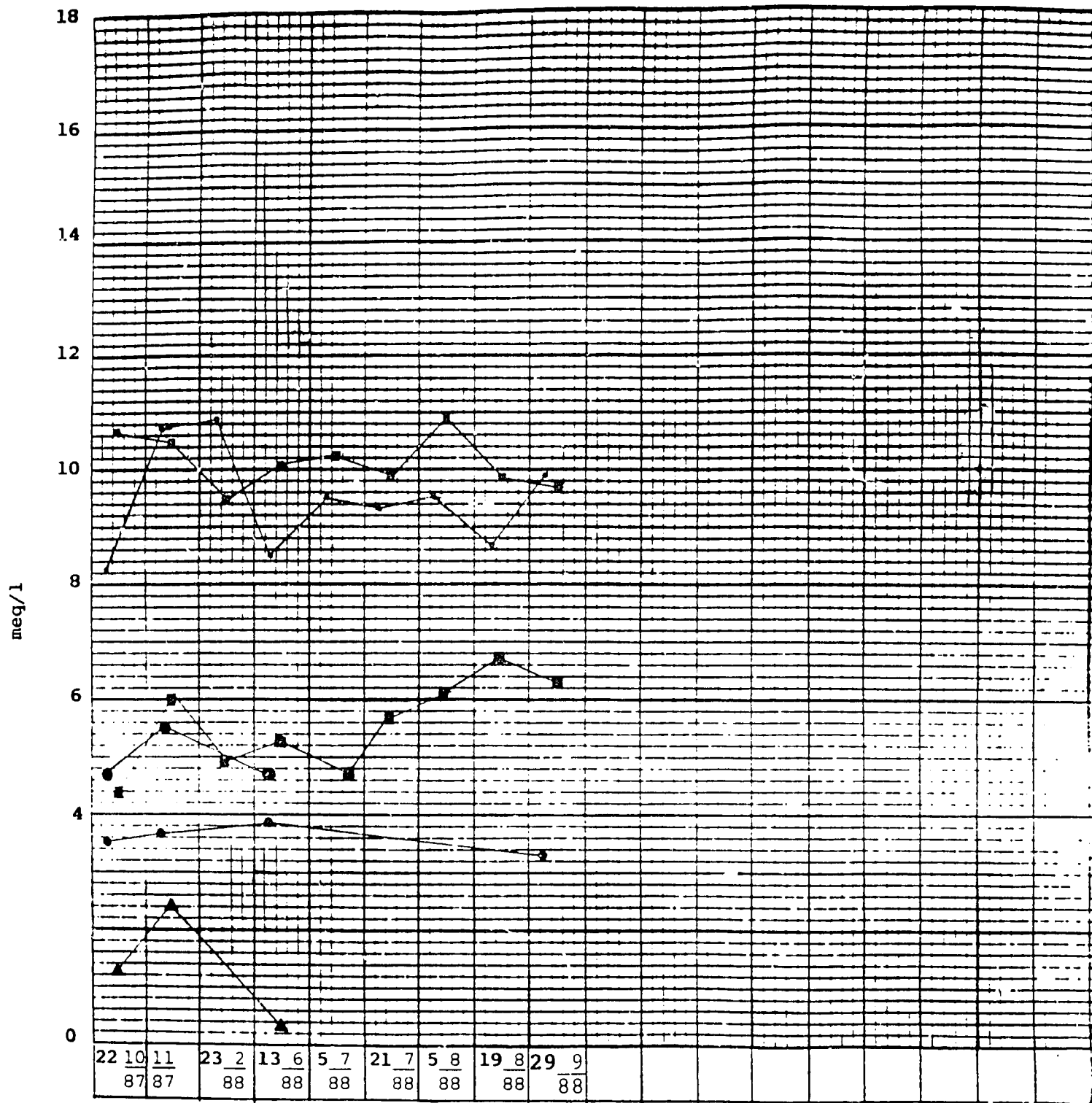
[illegible]

GRAPH SHOWING THE CONCENTRATION OF ANIONS AND
CATIONS IN WELL WATER

Fig. 5

AREA: HILL RUN

WELL NAME: HILL RUN
(DEEP OBSERVATION)



Date

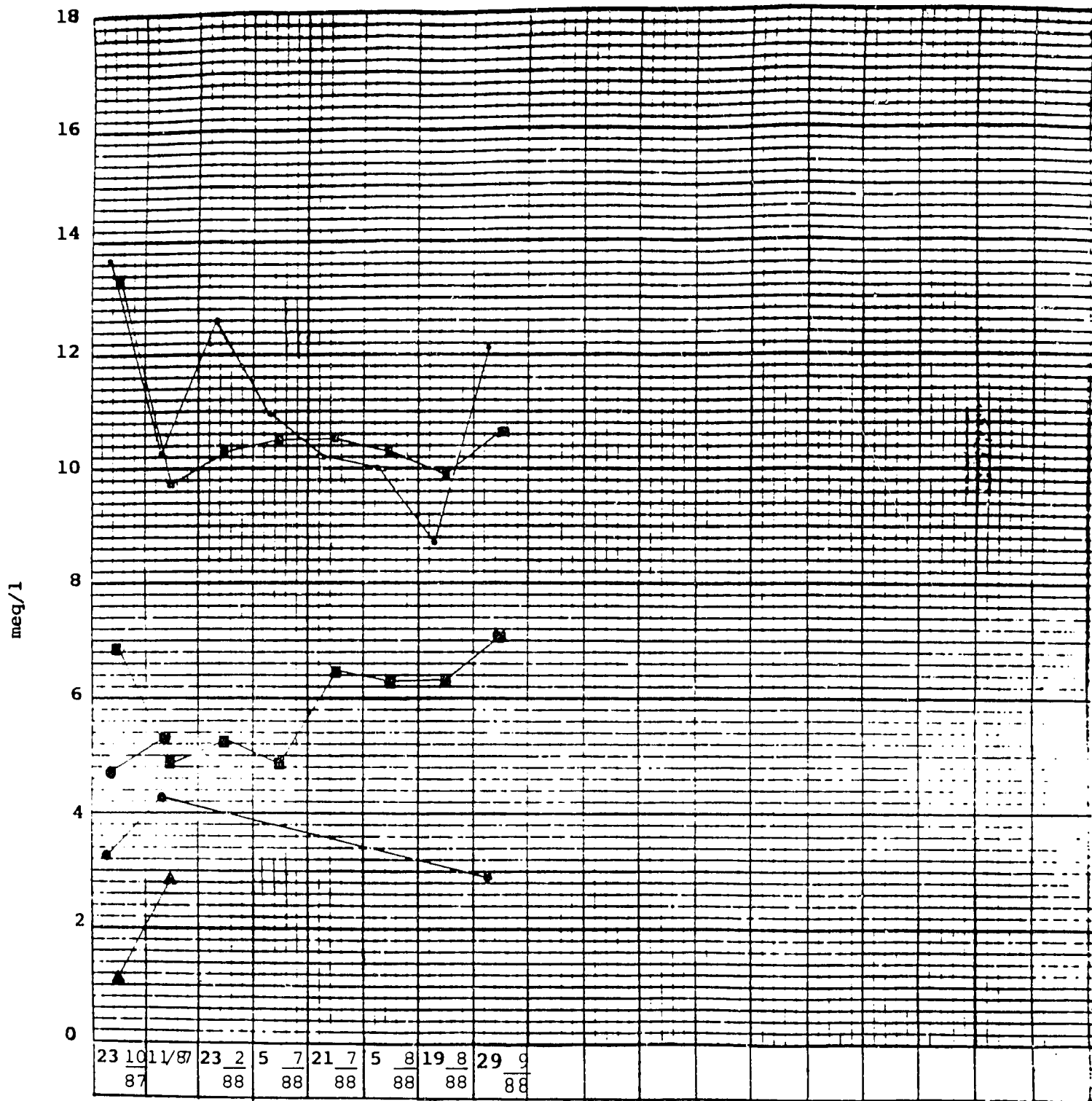
- calcium
- magnesium
- sodium
- chloride
- ▲ sulphate
- bicarbonate and carbonate

**GRAPH SHOWING THE CONCENTRATION OF ANIONS AND
CATIONS IN WELL WATER**

Fig. 6

AREA: HILL RUN.

WELL NAME: HILL RUN
(SHALLOW OBSERVATION)



Date

● calcium
■ magnesium
▲ sodium

◆ chloride
▼ sulphate
+ bicarbonate and carbonate