3. WATER ANALYSIS AT THE SAMSEN WATER TREATMENT PLANT.

3.1 Introduction During the early period of operation of the Water Treatment Plant, there were not many consumers. Because the population of Bangkok has increased very rapidly, since The Second World War, it has become necessary to expand the Water Treatment Plant to produce adequate water to meet the increased needs of consumers. Modern and advanced techniques are used in the newly expanded plant. There are many scientific institutes, who are interested in the quality of the water supply and have opened up a water analysis laboratory in their institutes.

In 1919 The Department of Science, Ministry of Industry, provided a water analysis laboratory to analyse the physical and chemical properties both of surface and ground water samples from different parts of Thailand. In the early stages of the operation of the Water Treatment Plant at Samsen which had no laboratory of their own the water samples of the Water Treatment Plant were regularly sent to the laboratory of the Department of Science.

In 1952 The Department of Medical Science, Ministry of Public Health provided a water analysis laboratory to analyse the physical, chemical, and bacteriological properties of surface and ground water. To this laboratory, samples were sent from differents parts of Thailand, which used to be sent to the laboratory of the Department of Science.

In 1959 The Rural Water Supply Division of the Department of Public and Municipal Works provided a water analysis laboratory. The purpose was to analyse water samples sent from the Water Treatment Plants in various provinces and to control the quality of the water to meet drinking water Standards. Initially the laboratory could do the tests for only physical and chemical properties. For the bacteriological property it was not yet propetly equipped.

In 1959 The Bangkok Water Works Division of the Department of Public and Municipal Works with the cooperation of USOM esta--blished a water analysis laboratory, composed of a building, equipement, glassware, and reagents, which could perform tests for physical, chemical, and bacteriological properties.

3.2 Water Analysis Laboratory of the Bangkok Water Treatment Plant. There are two methods of examination:

For the Physical and Chemical properties;

For the Bacteriological property.

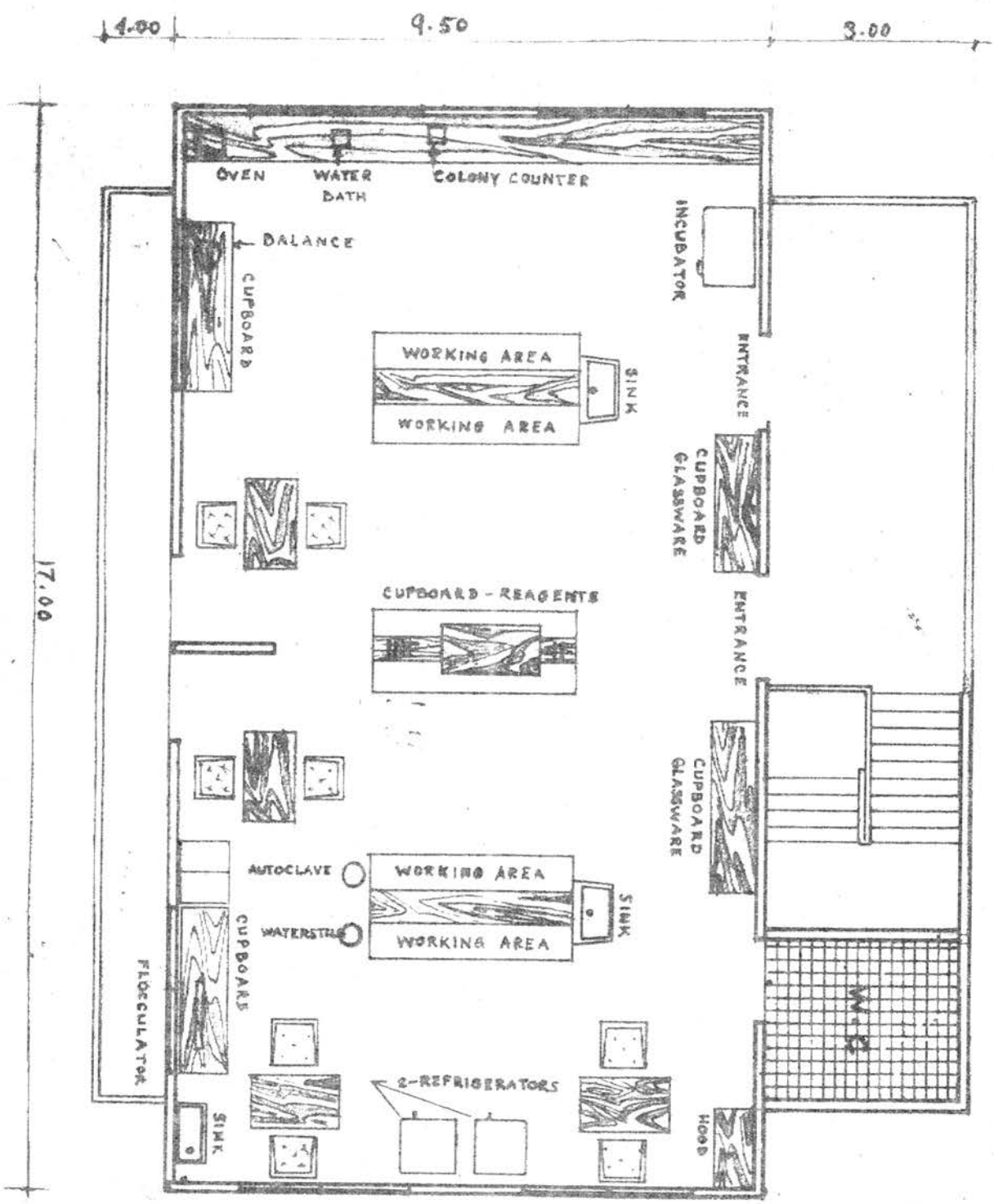
Physical and Chemical Properties.

Daily test: To examine water samples at various stages from the Water Treatment Plant. The samples include:

a) One sample of raw water taken from the canal at the inlet chamber.

b) Ten samples taken from sedimentation tanks while the water is in the process being clarified.

c) Five samples of treated water taken from the five pumping houses.



WATER ANALYSIS LABORATORY

The total samples to be tested are 16 samples per day. The samples are to be examined for pH value, alkalinity, turbidity, and carbon dioxide.

For raw water, the flocculation test(Jar test) is run daily to determine the minimum amount of chemicals required for floc forming with the raw water. The chemicals commonly used are aluminum sulfate and lime. The flocculation test is done daily at 9.00 - 10.00 o'clock. When it is found that a different chemical dosing is required from that of the previous day, the report of the analysis is sent to the chief of the Plant who will then order the change in chemical dosing before 12.00 o'clock of the same day.

With five samples of treated water the residual chlorine test is made using the Orthotolidine method. The results of the test were residual chlorine between 0.4 - 0.6 ppm. If it is found to be lower than 0.4 ppm., the chlorine dosing should be increased immediately. The residual chlorine test is carried out three times a day at 9.00, 13.00, and 16.00 o'clock.

With ten samples of clarified water the test is made to check the chemical dosing equipment. If it is in good condition and the dosing rate controller is correct, all of the ten samples of clarified water will show the results to be almost the same. If it is found that some of the samples are very much different from the other, the operator will look for the source of discre-
-pancies and corrective measures will be taken immediately.

For example, if the result of the test of clarified water from sedimentation tank No.8 shows the pH value and alkalinity to be lower than the others, the operator will quess at once that the alum dosing machine of tank No.8 probably gives too much alum solution to the water, readjust of the dosing machine.

Weekly tests: Three raw water samples of the intake canal are sent weekly from the Maintenance and Protection Division. The samples which are collected from the canal at Samlae in Patumtani will be tested for physical and chemical properties.

Monthly tests: 2 samples, one taken from the canal and the other from a tap at the Samsen Water Treatment Plant, will be tested for physical, chemical and bacteriological properties.

Other tests: When some consumers wish to know the quality of the water in their premises , the laboratory will render the necessary test service for them.

The Bacteriological Property: The water analysis laboratory collects the samples and runs the test daily for the bacteriological property.

The samples are:- raw water from the intake canal at the Samsen Water Treatment Plant, treated water pumped into the distribution system at every pumping house, and also treated water in the distribution system that is very remote from the source.

Four samples are treated daily and about 100 samples monthly. The test consists of plate count to determine the number of bacteria in 1 ml. of water; presumptive test and confirm test to determine whether there is coliform bacteria present in the

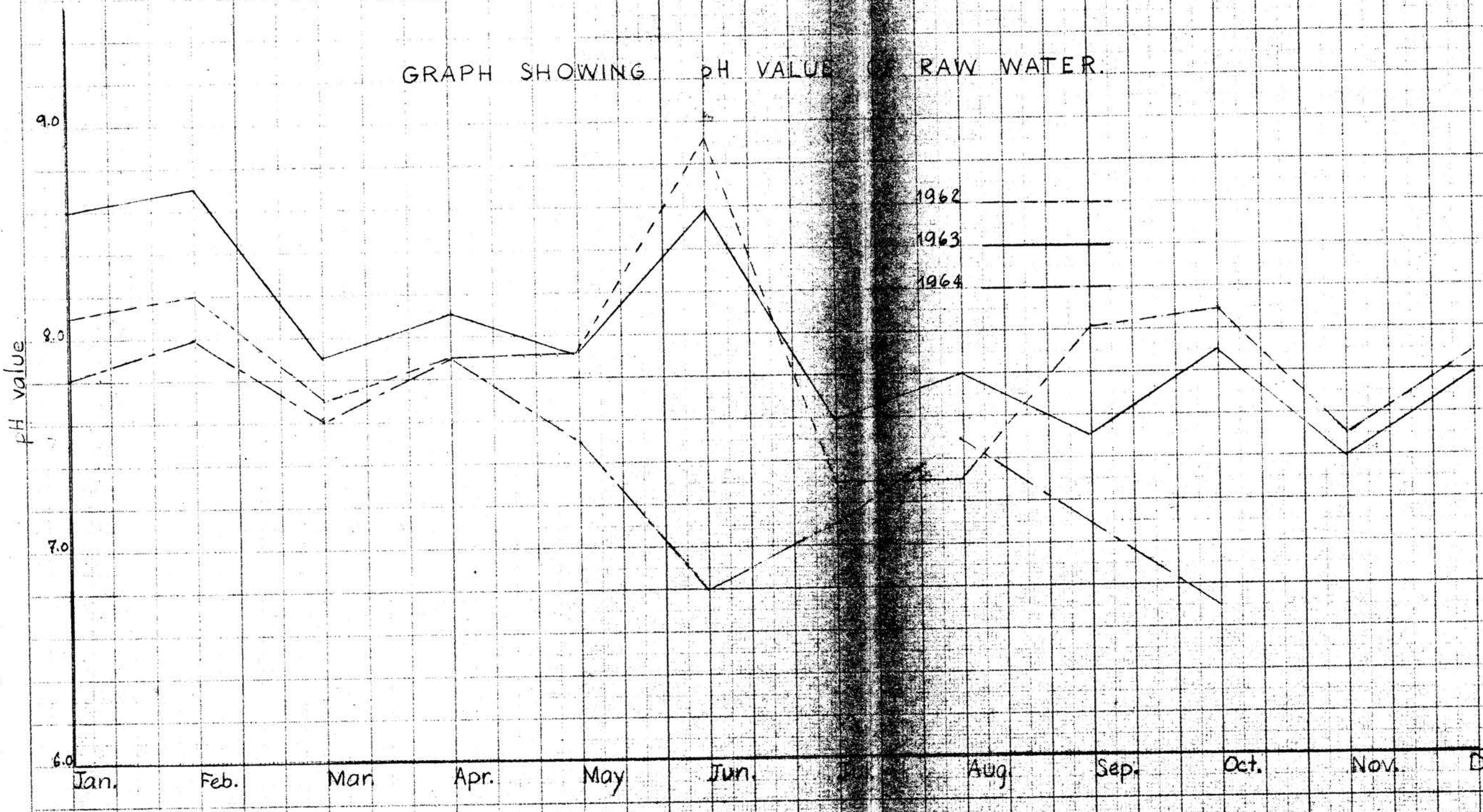
water or not. If the test is positive in the confirm test, it means that there is coliform bacteria present in the sample. A method of expressing results has been developed. It is known as the most probable number(M.P.N.) of coliform organisms. According to the bactoriological standard for drinking water, the M.P.N. is not supposed to exceed the 2.2

3.3 The Results of Examinations of Water.

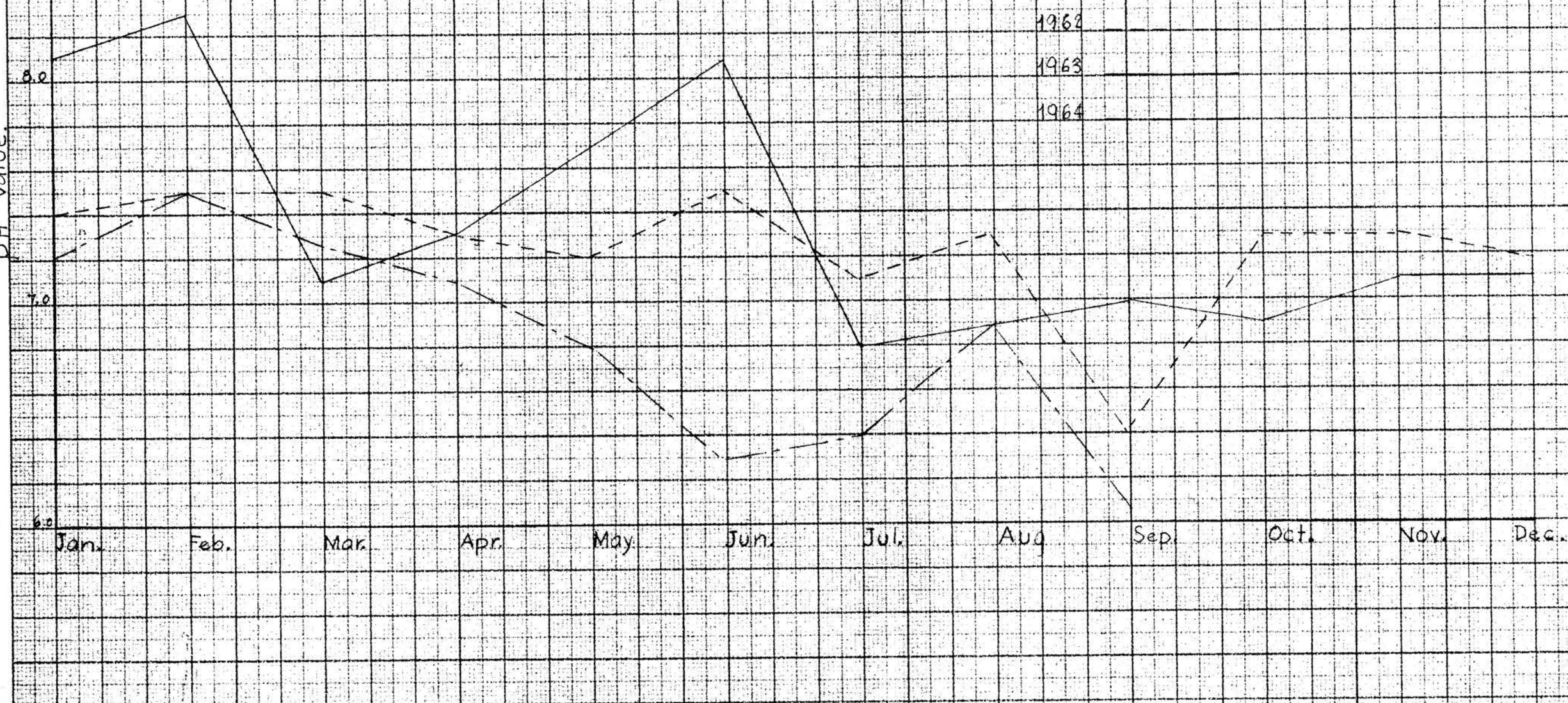
The results of the examinations of raw water and treated water since 1962 have been plotted in graphs showing monthly differences of water quality and the comparison from year to year.

****

GRAPH SHOWING pH VALUE OF RAW WATER.



GRAPH SHOWING pH VALUES OF FILTERED WATER.



GRAPH SHOWING TURBIDITY OF [illegible] WATER

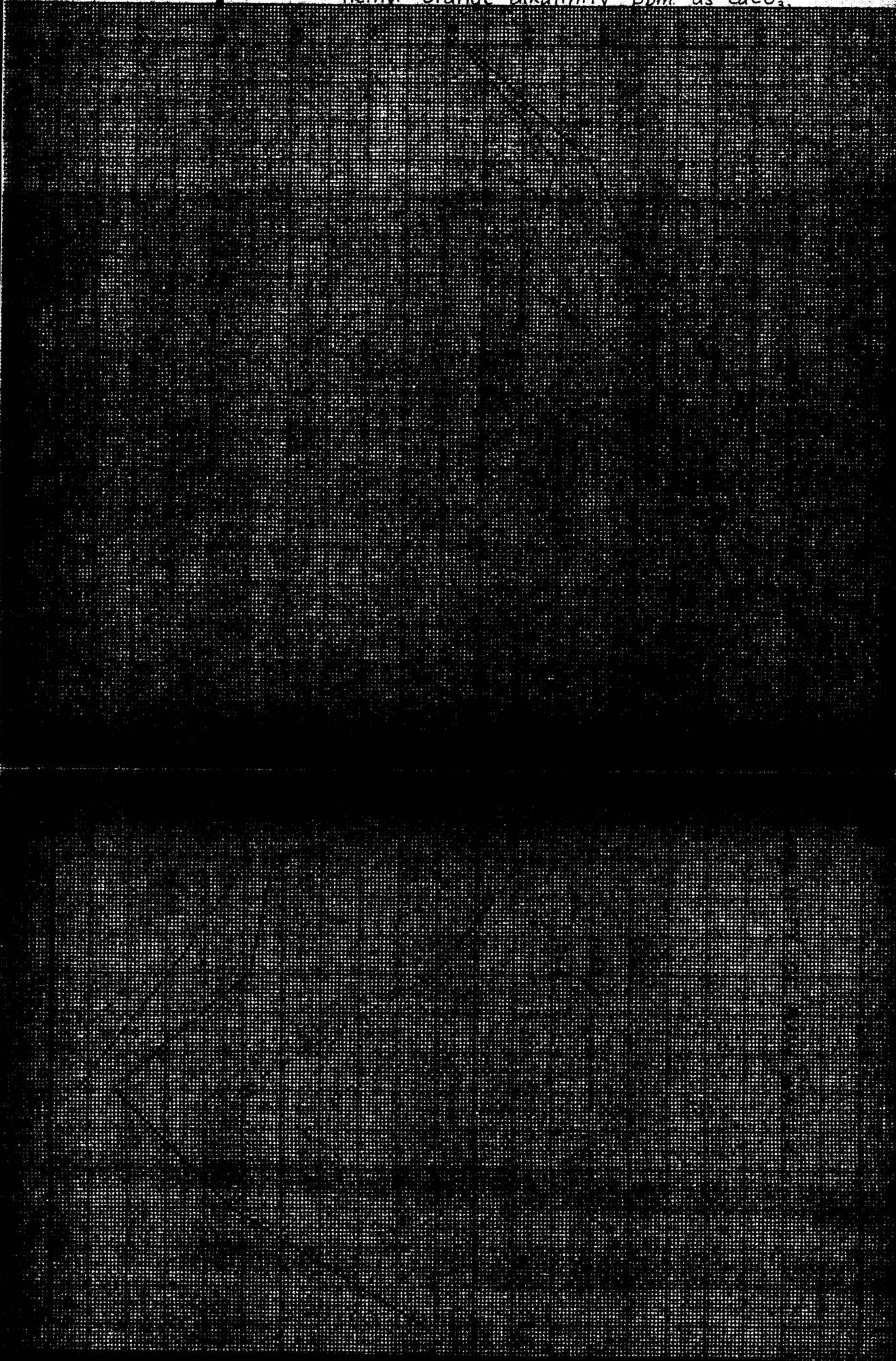
Turbidity - silica scale.

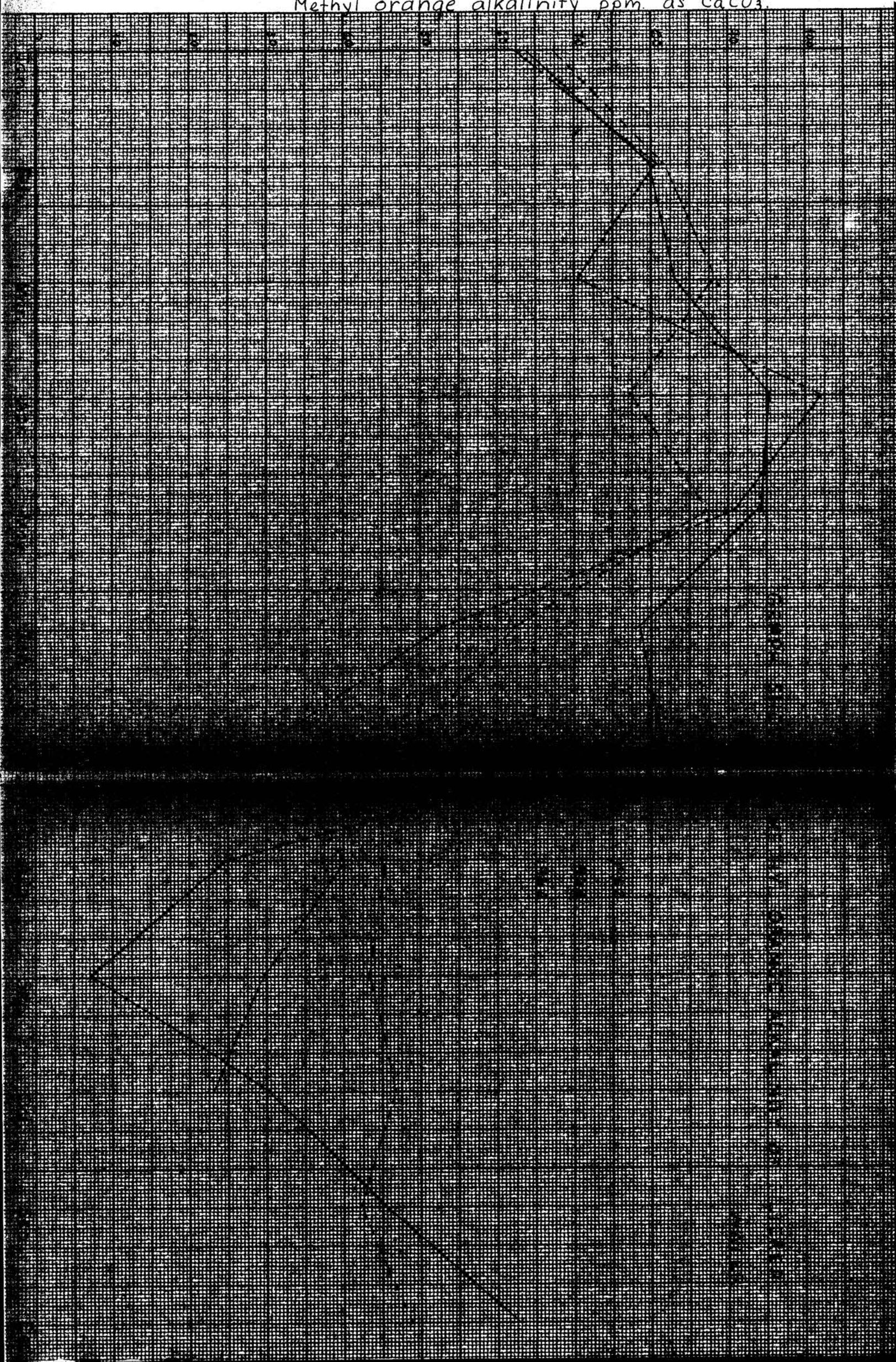
200
180
160
140
120
100
80
60
40
20
0

1962
1963
1964

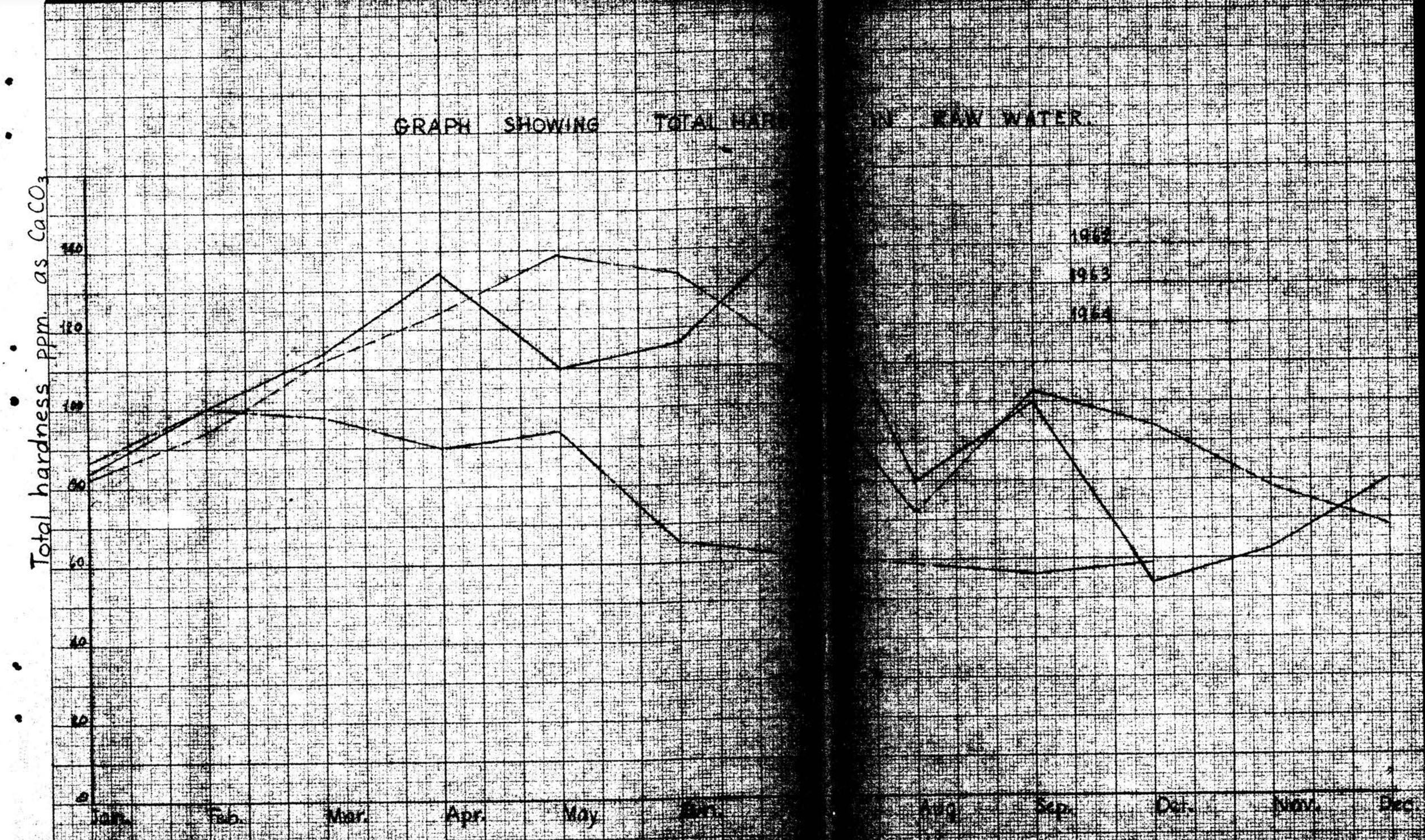
Jan. Feb. Mar. Apr. May Jun. Aug. Sept. Oct. Nov. Dec.

Methyl orange alkalinity ppm as $CaCO_3$.




Methyl orange alkalinity ppm as $CaCO_3$.

GRAPH SHOWING TOTAL HAR[illegible] IN RAW WATER.



GRAPH SHOWING TOTAL HAR... IN FILTERED WATER

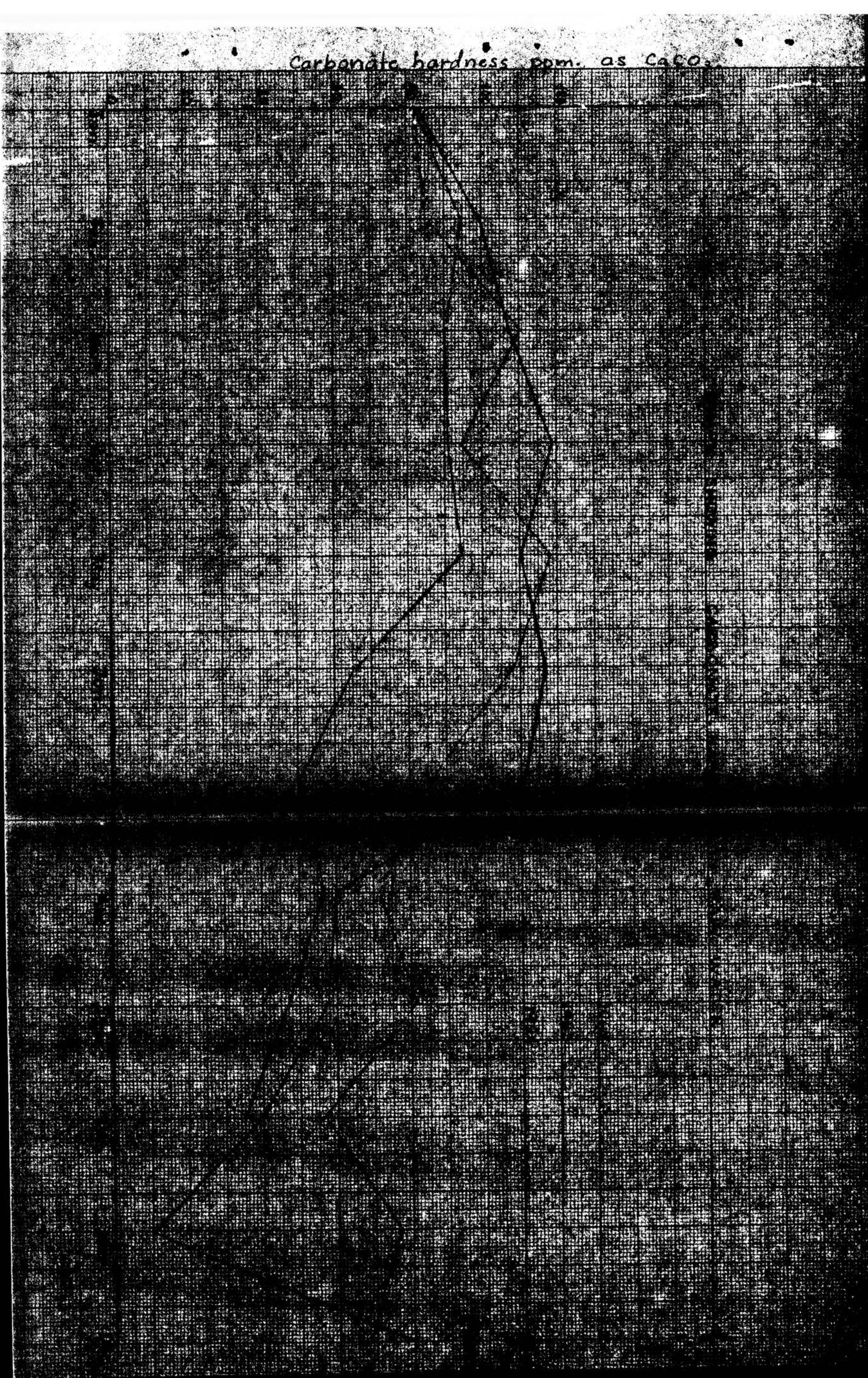
Total hardness PPM, expressed as $CaCO_3$

120
110
100
90
80
70
60
50
40
30

Jan. Feb. Mar. Apr. May June

1962
1963
1964

Aug. Sep. Oct. Nov.


Carbonate hardness ppm. as CaCO3

GRAPH SHOWING CARBONATE [illegible]SS OF FILTERED WATER

Carbonate hardness ppm: as $CaCO_3$.

90
80
70
60
50
40
30
20
10
0

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

1962
1963
1964

GRAPH SHOWING CHLORIDES IN RAW WATER

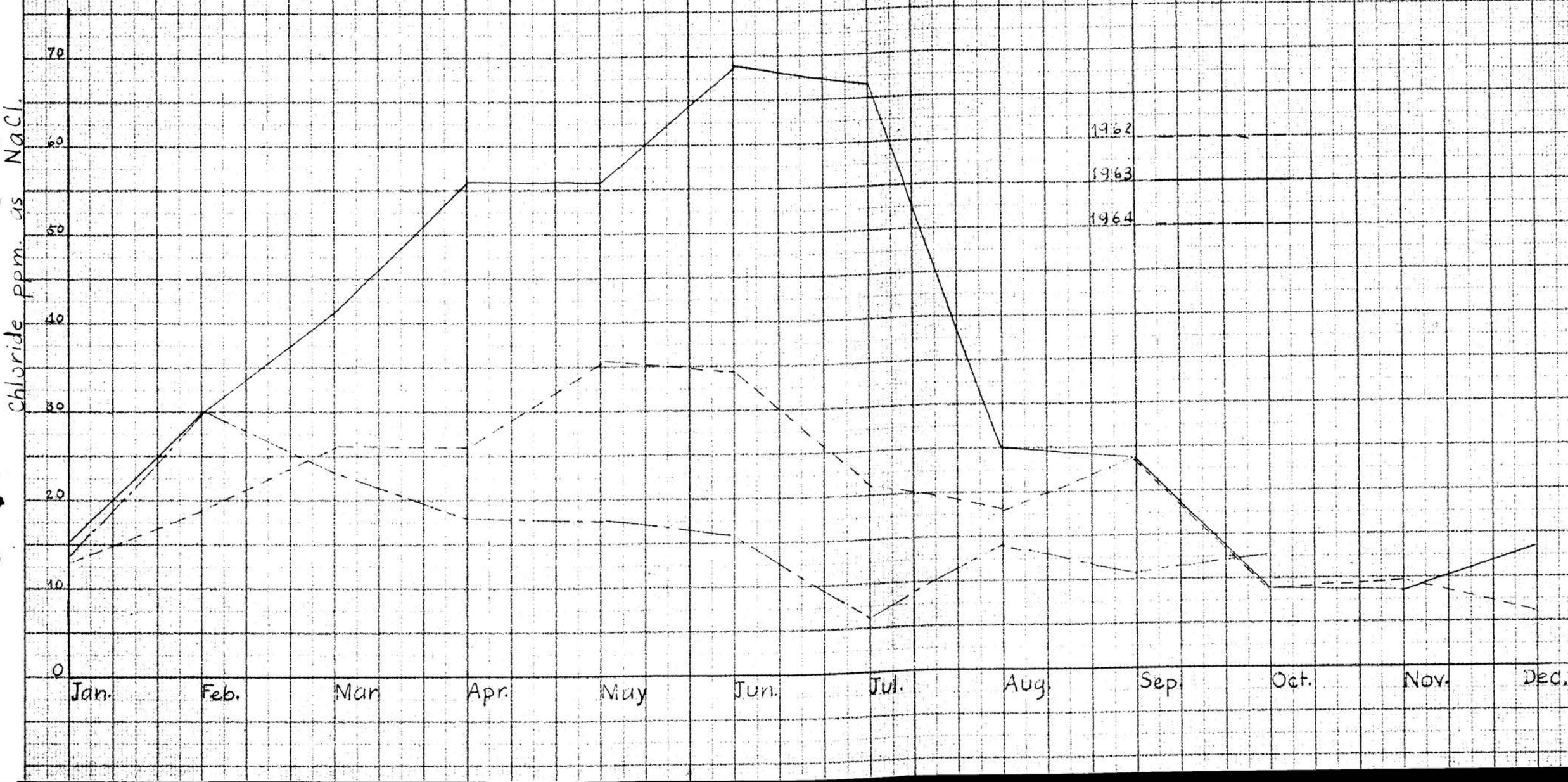
Chloride ppm expressed as NaCl.

160
140
120
100
80
60
40
20
0

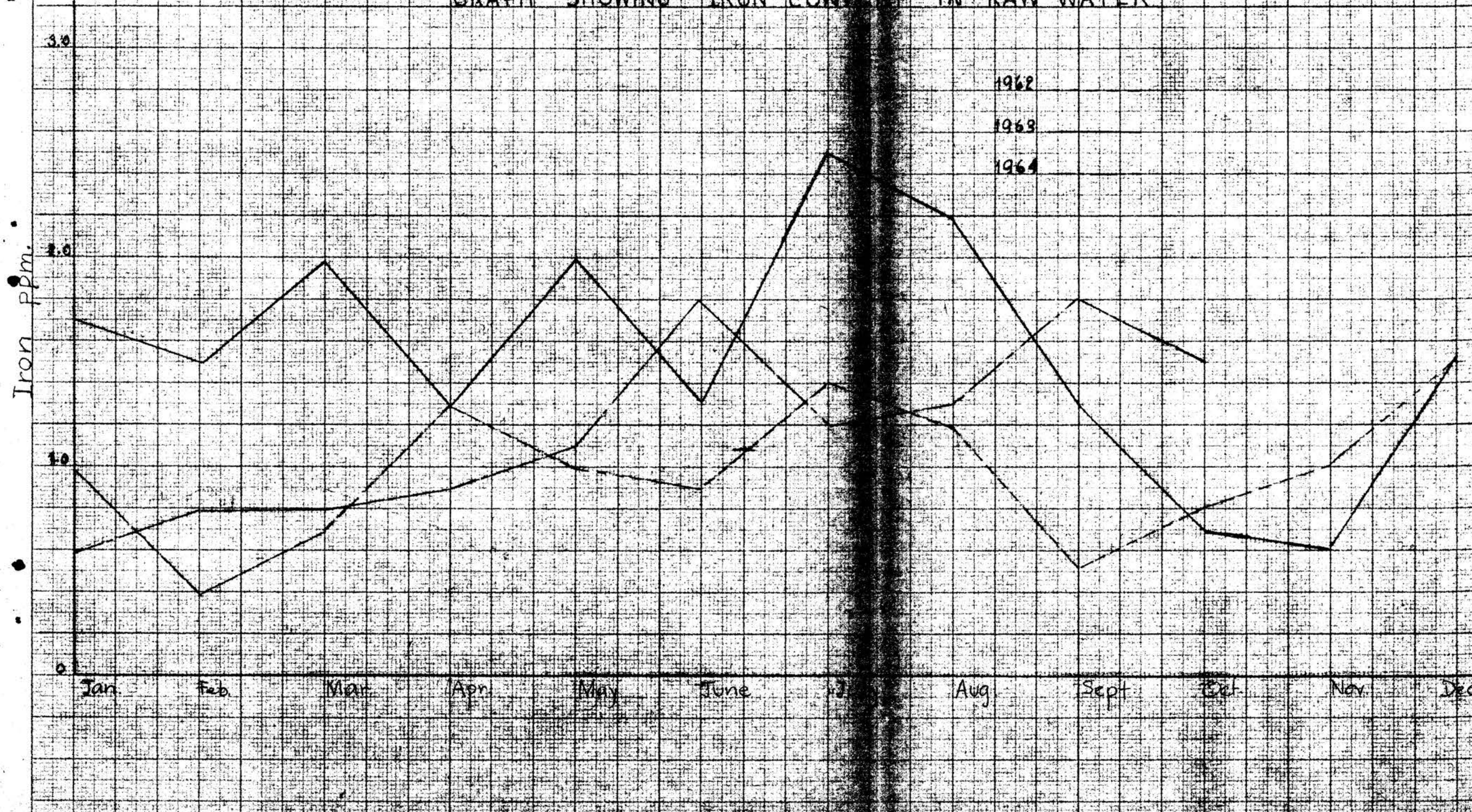
Jan. Feb. Mar Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec.

1962
1963
1964

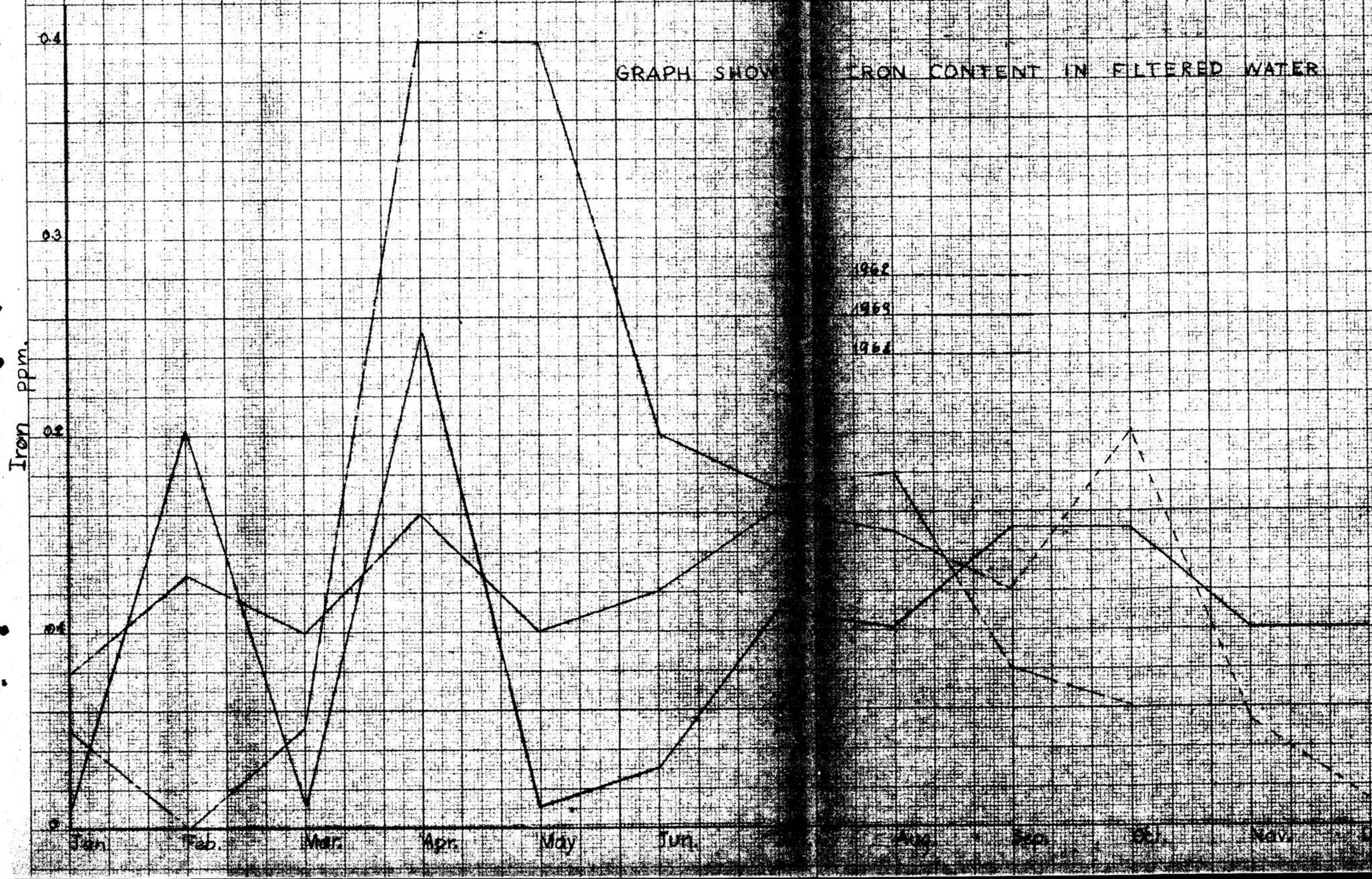
GRAPH SHOWING CHLORIDES IN FILTERED WATER



GRAPH SHOWING IRON CONTENT IN RAW WATER



GRAPH SHOWING IRON CONTENT IN FILTERED WATER



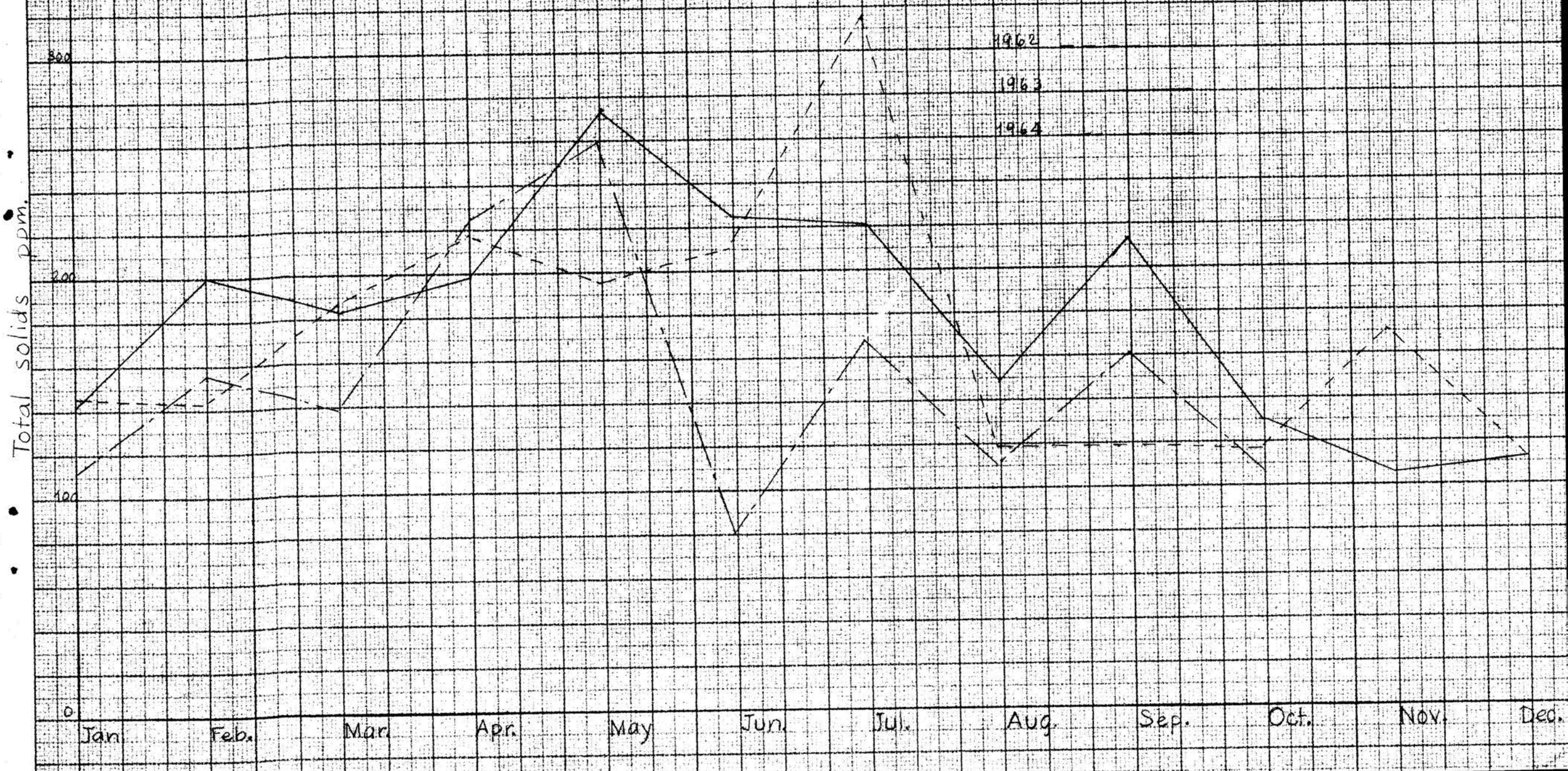
GRAPH SHOWING TOTAL SOLIDS OF RAW WATER

Total solids PPM.

1962
1963
1964

Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sept. Oct. Nov. Dec.

GRAPH SHOWING TOTAL SOLIDS OF FILTERED WATER.



Standrard for Drinking Water

The standard for drinking water, used in the water analysis laboratory of the Bangkok Water Works, follows the standard of the American Water Works Association, as follows:

pH value		6.8 - 7.2	
Total residue	not exceed	1000	ppm.
Hardness expressed as $CaCo_3$	"	300	"
Chlorides " " Cl	"	250	"
Nitrite " " N_2	"	None	"
Nitrate " " N_2	"	2 - 4	"
Ammonia " " NH_3	"	0.05	"
Albuminoid ammonia " NH_3		0.10	"
Copper	"	0.5	"
Iron	"	0.3	"
Magnesium	"	125	"
Sulfate	"	250	"
Lead	"	0.1	"
Zinc	"	15	"
Coliform bacteria M.P.N./100 ml.	"	2.2	-

Applications 1 and 2 given below shall govern when ten milliliter (10 ml) portions are used and applications 3 and 4 shall govern when one hundred milliliter (100 ml) portions are used.

1. Of all the standard ten milliliter (10 ml) portions examined per month in accordance with the specified procedure, not more than ten (10) per cent shall show the presence of organisms of the coliform group.

2. Occasionally three (3) or more of the five (5) equal ten milliliter (10 ml) portions constituting a single standard sample may show the presence of organisms of the coliform group, provided that this shall not be allowable if it occurs in consecutive samples or in more than:

(a) Five (5) per cent of the standard samples when twenty (20) or more samples have been examined per month.

(b) One (1) standard sample when less than twenty (20) samples have been examined per month.

Provided further that when three or more of the five equal ten milliliter (10 ml) portions constituting a single standard sample show the presence of organisms of the coliform group, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.

3. Of all the standard one hundred milliliter (100 ml) portions examined per month in accordance with the specified procedure, not more than sixty (60) per cent shall show the presence of organisms of the coliform group.

4. Occasionally all of the five (5) equal one hundred milliliter (100 ml) portions constituting a single standard sample may show the presence oforganisms of the coliform group, provided that this shall not be allowable if it occurs in consecutive samples for in more than:

(a) Twenty (20) per cent of the standard samples when five (5) or more samples have been examined per month.

(b) One (1) standard sample when less than five (5) samples have been examined per month.

Provided further that when all five of the standard one hundred milliliter (100 ml) portions constituting a single standard sample show the presence of organisms of the coliform group, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.(5)