


11-1961

Recreation in the Pool (1961)

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ANDROSCOGGIN RIVER AND POOL STUDIES

Comparisons of Analytical Data
and
Probable Reaeration in the Pool

1961

Lewiston, Maine
November, 1961

Androscoggin River and Pool Studies

Introduction.

This section of the Annual Report contains the results of comparisons of analytical and test data obtained from water sampled at various locations in the Androscoggin river and Pool.

Five day Biochemical Oxygen Demands, Oxygen Deficiencies, Methylene Blue Stabilities and Oxygen consumed from Permanganate test results are described. Hydrogen sulphide tests were negative through the season. A period of nine weeks was chosen for comparison of the test data obtained from North Turner and Turner Center Bridges and Gulf Island Dam.

Biochemical Oxygen Demands. Five Day.

This season, in addition to the usual Thursday B.O.D. determinations, daily tests were made with river water sampled at North Turner Bridge, Turner Center Bridge and Gulf Island Dam. These additional tests are described in the next section of this report, however, these data were used in the reaeration calculations. The Thursday B.O.D. results are listed in Table B.O.D. #1. Daily B.O.D. results are listed in Table B.O.D. #2 (next section).

B.O.D. measurements on North Turner water indicate a more uniform discharge of pollution this year as compared to previous periods. The demands are low and reflect the reductions in pollution load made last June.

Table O.D. #1

B.O.D. and Oxygen Deficit 1961
Weekly Averages*

Date Week Ending	B.O.D. ppm	D.O. ppm	Oxygen (ppm) Deficit or Surplus
North Turner Bridge			
July 6	3.58	3.55	-0.03
13	2.67	3.91	+1.24
20	2.98	3.81	+0.83
27	3.49	3.26	-0.23
Aug. 3	3.51	3.22	-0.29
10	3.85	2.35	-1.50
17	3.30	2.72	-0.58
24	3.19	3.18	-0.01
31	2.89	2.86	-0.03
Nine week averages	3.27	3.21	-0.06
Turner Center Bridge			
July 6	3.35	1.94	-1.41
13	2.86	2.88	+0.02
20	2.49	2.79	+0.30
27	3.18	2.83	-0.35
Aug. 3	3.01	2.22	-0.79
10	3.51	1.16	-2.35
17	3.07	1.30	-1.77
24	2.89	2.13	-0.76
31	2.78	2.02	-0.76
Nine week averages	3.02	2.14	-0.88
Gulf Island Dam			
July 13 x	2.45	0.05	-2.40
20	1.35	0.35	-1.00
27	1.72	0.90	-0.82
Aug. 3	2.48	0.92	-1.56
10	2.54	1.07	-1.47
17	2.46	0.49	-1.97
24	3.15	0.09	-3.06
31	1.93	0.13	-1.80
Sept. 7	1.56	0.53	-1.03
Nine week averages	2.18	0.50	-1.68

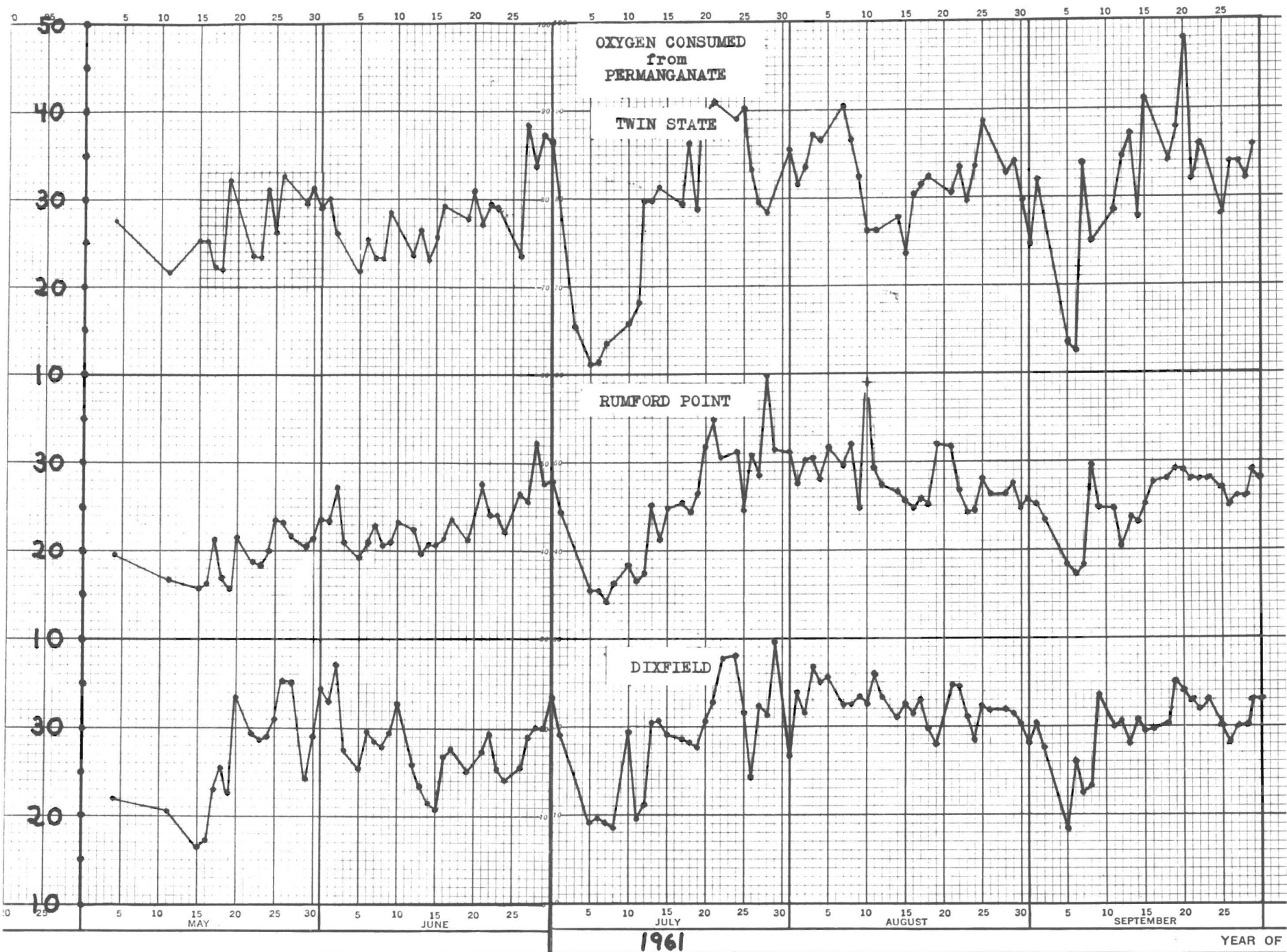
x not included
in the averages

The average daily deficit of dissolved oxygen (B.O.D. minus D.O.) in the water at North Turner Bridge during the nine week period was so small that for all practical purposes there was sufficient oxygen to completely satisfy the five day B.O.D. However, there was an oxygen deficit at Turner Center Bridge and a larger one at Gulf Island Dam. For more details see the next section of this report.

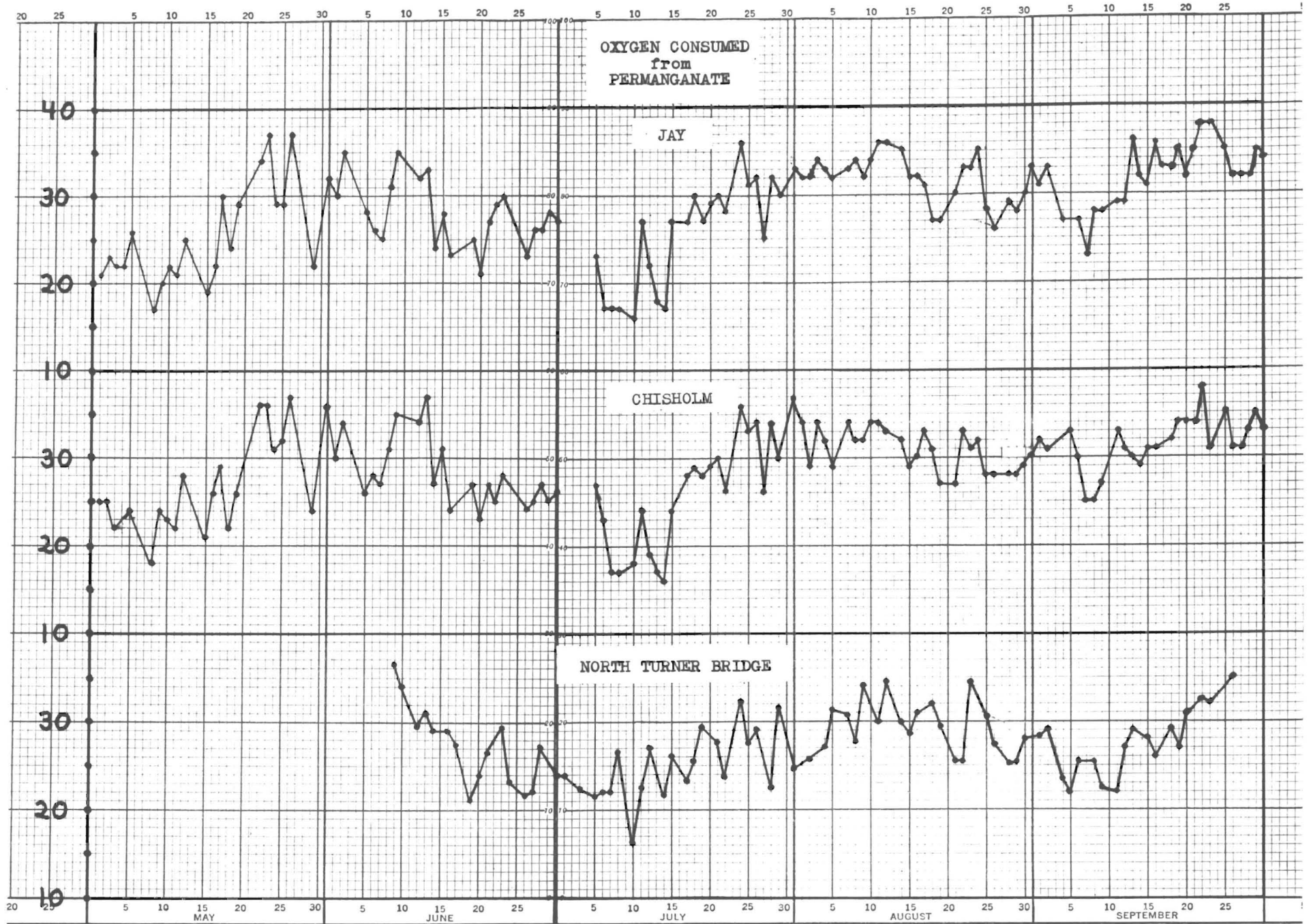
Oxygen Consumed
From Permanganate.

O.C.P. analyses were made five days each week on samples of river water taken at Gorham (Twin State), North Turner Bridge, Turner Center Bridge, several locations in the Pool, Gulf Island Dam, Deer Rips Dam and the Lewiston Canal. Similar tests were made every week day at Rumford Point Bridge, Dixfield, Jay and Chisholm. The accompanying plots indicate the extent of the daily variations in the chemical demand during this season.

One of the effects of the reduced sulphite waste liquor discharge is shown in the reduction of the O.C.P. demands. At North Turner Bridge the average daily O.C.P. was 42.9 ppm in 1960, and 27.1 ppm in 1961; a difference of 15.8 ppm. The figures for the same periods at Gulf Island Dam were 35.0 ppm and 22.6 ppm; a 12.4 ppm reduction.



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OXYGEN CONSUMED
from
PERMANGANATE

JAY

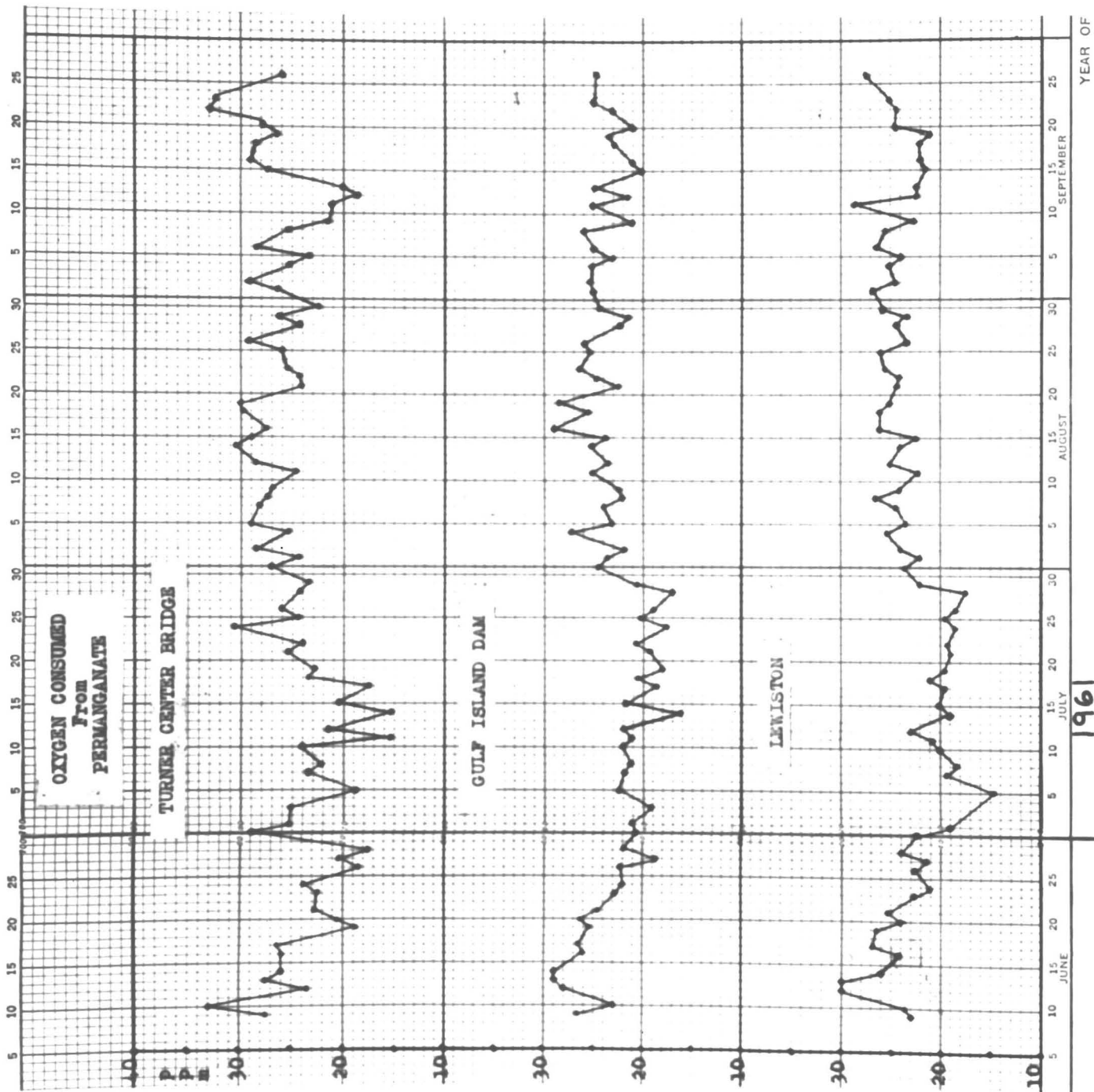
CHISHOLM

NORTH TURNER BRIDGE

1961

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The O.C.P. averages for each week of the nine week period, at three Pool locations were,

Average Weekly O.C.P. (ppm)				
Date	Wk. End.	N.T.B.	T.C.B.	G.I.D.
July	6	23.1	24.5	--
	13	22.9	21.3	21.7
	20	25.2	20.0	17.6
	27	27.7	26.2	19.5
Aug.	3	26.2	25.5	21.5
	10	30.2	24.8	23.7
	17	31.7	23.9	25.3
	24	29.4	26.7	25.6
	31	27.3	25.8	24.0
Sept.	7	--	--	24.7
1961				
Nine week averages		27.1	24.3	22.6
1960				
Nine week averages		42.9	37.2	35.0

As in previous years the decrease in O.C.P. was always larger in the two day passage between the Turner Bridges than in the eight day passage to Gulf Island Dam.

This season the average daily decrease in O.C.P. as the water passed through the Pool was 4.5 ppm; considerably lower than last year. The thirteen average is 5.9 ppm.

Average Daily Loss Total O.C.P. ppm			
1961	4.5 ppm	1954	6.6 ppm
1960	7.9	1953	3.7
1959	5.9	1952	5.4
1958	4.6	1951	7.0
1957	5.0	1950	7.5
1956	7.5	1949	5.7
1955	5.4		

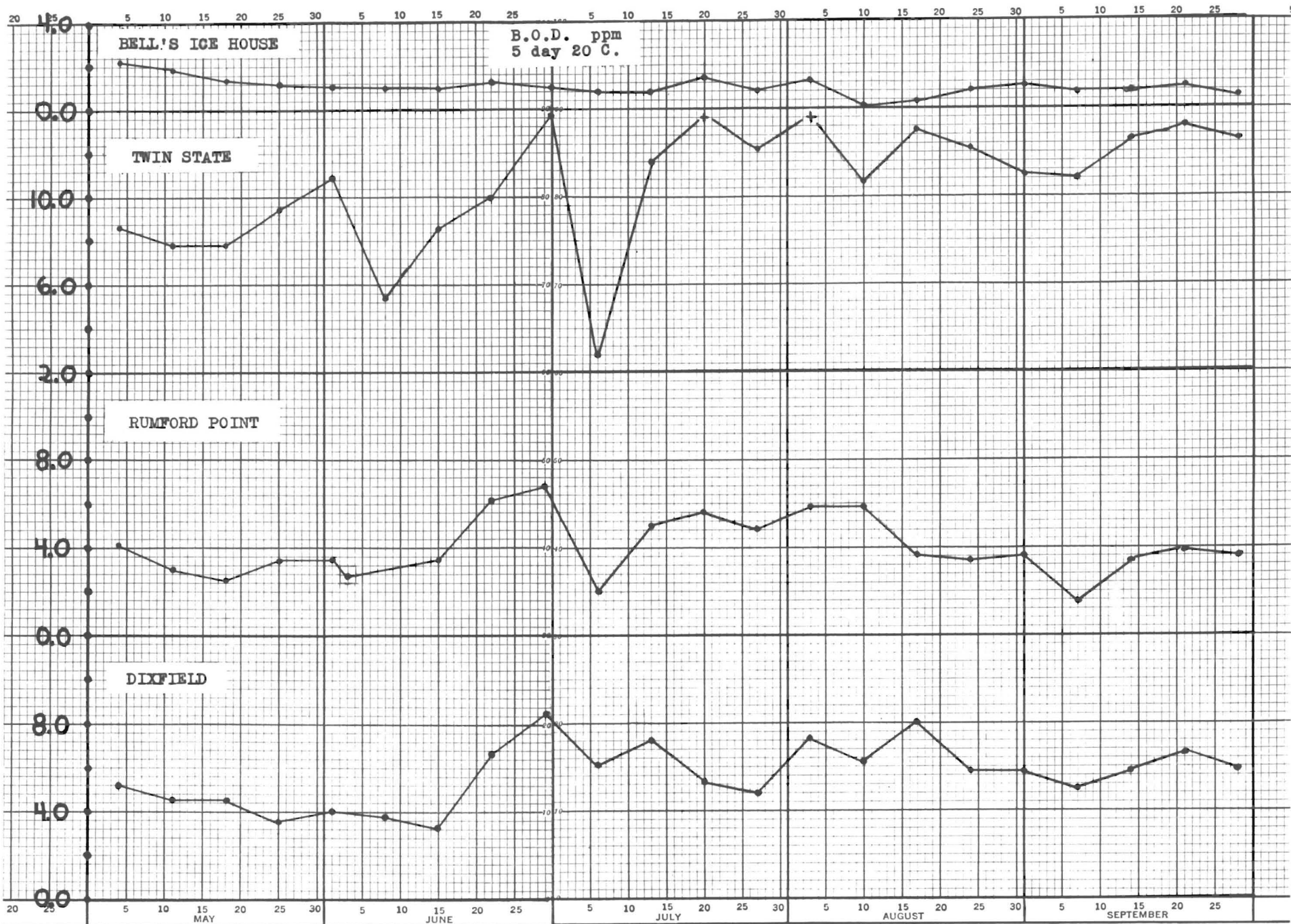
Thirteen year average 5.9 ppm

Table B.O.D. #1

Biochemical Oxygen Demand*
ppm Five Day 20°C

Date	North Turner Bridge	Turner Center Bridge	Gulf Island Dam	Lewiston
May 4	4.63	4.65	3.40	3.70
11	4.37	4.05	2.62	3.25
18	3.20	2.93	1.80	1.85
25	3.40	3.10	2.33	2.45
June 1	3.23	2.95	2.45	2.45
8	3.43	2.70	2.00	2.20
15	3.80	3.47	2.25	2.45
22	5.51	5.49	2.23	2.62
29	6.00**	4.21**	2.07**	2.15**
July 6	3.78	3.34	3.18	2.35
13	3.25	3.09	2.03	1.95
20	4.91	4.26	1.21	1.78
27	4.59	3.81	1.10	1.74
Aug. 3	4.24	3.97	2.68	1.86
10	3.98	3.29	1.84	1.55
17	3.44	2.82	2.45	1.65
24	3.85	3.19	2.92	1.38
31	3.06	2.73	1.07	1.12
Sept. 7	2.30	1.95	1.03	1.36
14	3.17	2.22	0.83	1.00
21	4.34	2.41	0.80	1.10
28	3.67	2.96	1.50	1.20

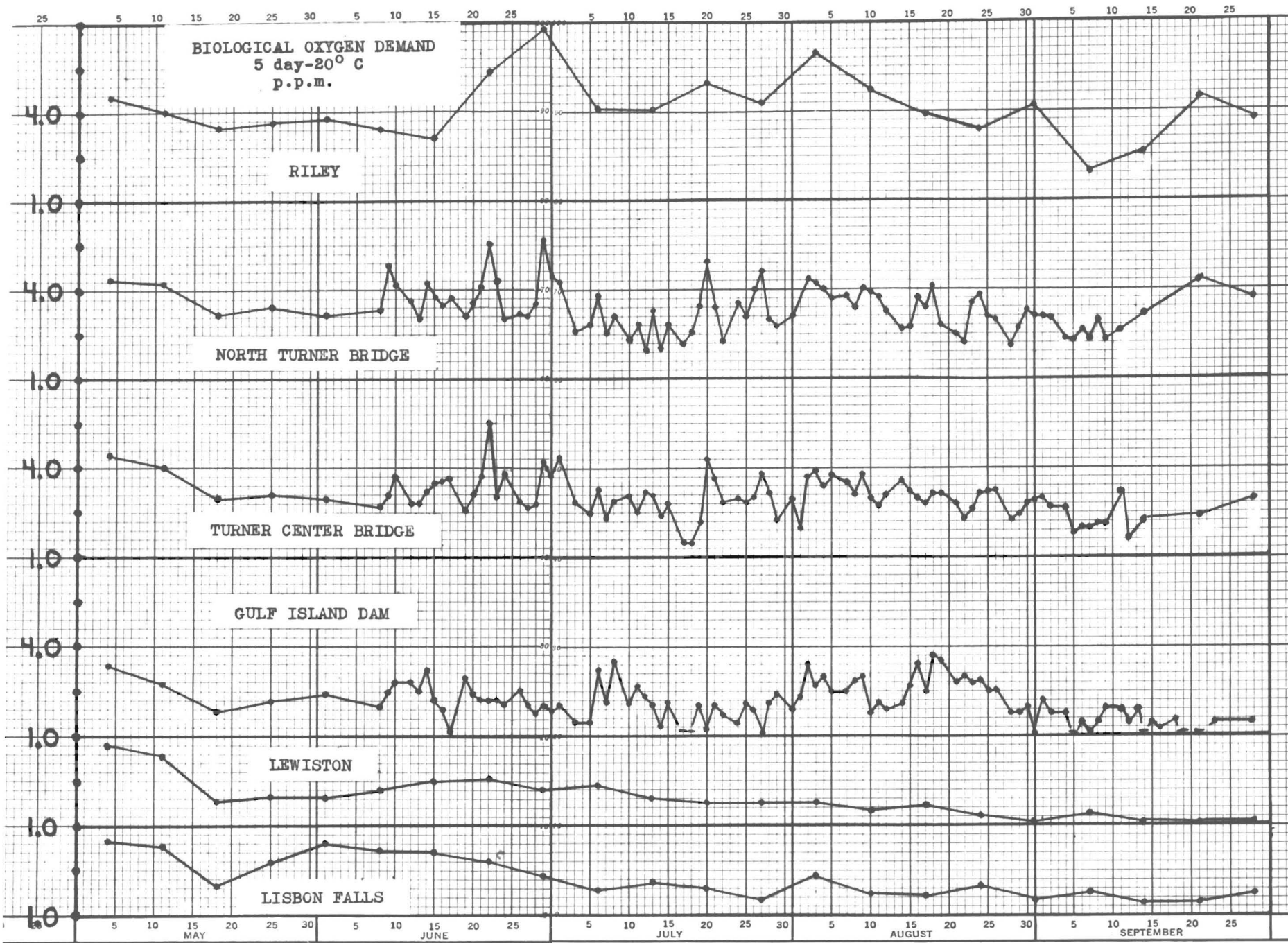
*Oxford Paper Company Data
**six day B.O.D.



1961

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Table O.D. #2
 B.O.D. and Oxygen Deficit
 Nine Week Averages

Year	B.O.D. ppm	D.O. ppm	O.D. ppm
North Turner Bridge			
1961**	3.27	3.21	0.06
1960**	4.88	3.70	1.18
1959	4.29	3.65	0.64
1958	5.66	3.62	2.04
1957	6.20	1.94	4.26
1956*	5.66	2.52	3.14
Turner Center Bridge			
1961**	3.02	2.14	0.88
1960	3.67	3.05	0.62
1959	3.03	2.37	0.66
1958	3.52	2.87	0.65
1957	5.38	0.51	4.87
1956*	5.02	1.37	3.65
Gulf Island Dam			
1961**	2.18	0.50	1.68
1960**	2.55	0.48	2.07
1959	2.82	0.92	1.90
1958	3.56	0.33	3.23
1957	3.90	0.22	3.68
1956*	4.44	0.23	4.21

*Eight Week Average

**Six days per week; all others Thursday only.

Probable Reaeration
Androscoggin Pool.

Reaeration of the river water occurs as it enters the Pool and passes over the rips just south of North Turner Bridge. A small and variable amount of additional oxygen is contributed by the Nezinscot River water. This river, however, does carry some domestic wastes. Due to so many variables the calculations of the natural reaeration in the Pool are almost impossible to determine. This O.C.P., D.O. method of determination is an inadequate one but with the limitations recognized the figures indicate an order of magnitude. The fourteen year average for the nine week summer period is nineteen tons of oxygen per day.

Probable Reaeration in Androscoggin Pool

Nine Week Period 1961

1. Average daily loss of dissolved oxygen	2.71 ppm
2. Nitrate oxygen added	0
3. Total available oxygen	<u>2.71</u> ppm
4. Average O.C.P. decrease per day	4.5 ppm
5. Average oxygen available per day	<u>2.7</u> ppm
6. Average oxygen by reaeration per day	1.8 ppm
7. Average river flow during period, c.f.s. 2809	7.6 MT/D
8. Indicated oxygen gain	14 T/D

The fourteen year reaeration averages obtained by this method are,

1961	14 tons oxygen	1954	22 tons oxygen
1960	36 per day	1953	8 per day
1959	25	1952	14
1958	6	1951	23
1957	16	1950	18
1956	35	1949	12
1955	21	1948	16

Fourteen year average 19 tons/day

Dissolved Oxygen.

The results of the dissolved oxygen determinations made on Androscoggin River water sampled at the important stations may be summarized as:

1. Twin State - Gorham. During the period from May 4 to October 5 there were no D.O. analyses reported below FIVE ppm. The majority of tests were above six ppm.

2. Rumford Point Bridge. The dissolved oxygen content of the river water was above four ppm until July 20 when a considerable decrease occurred. The low oxygen content was reported with very few exceptions until September 30. The data for the past four years are,

1961	55 days below	four	ppm
1960	15 "	"	"
1959	29 "	"	"
1958	24 "	"	"

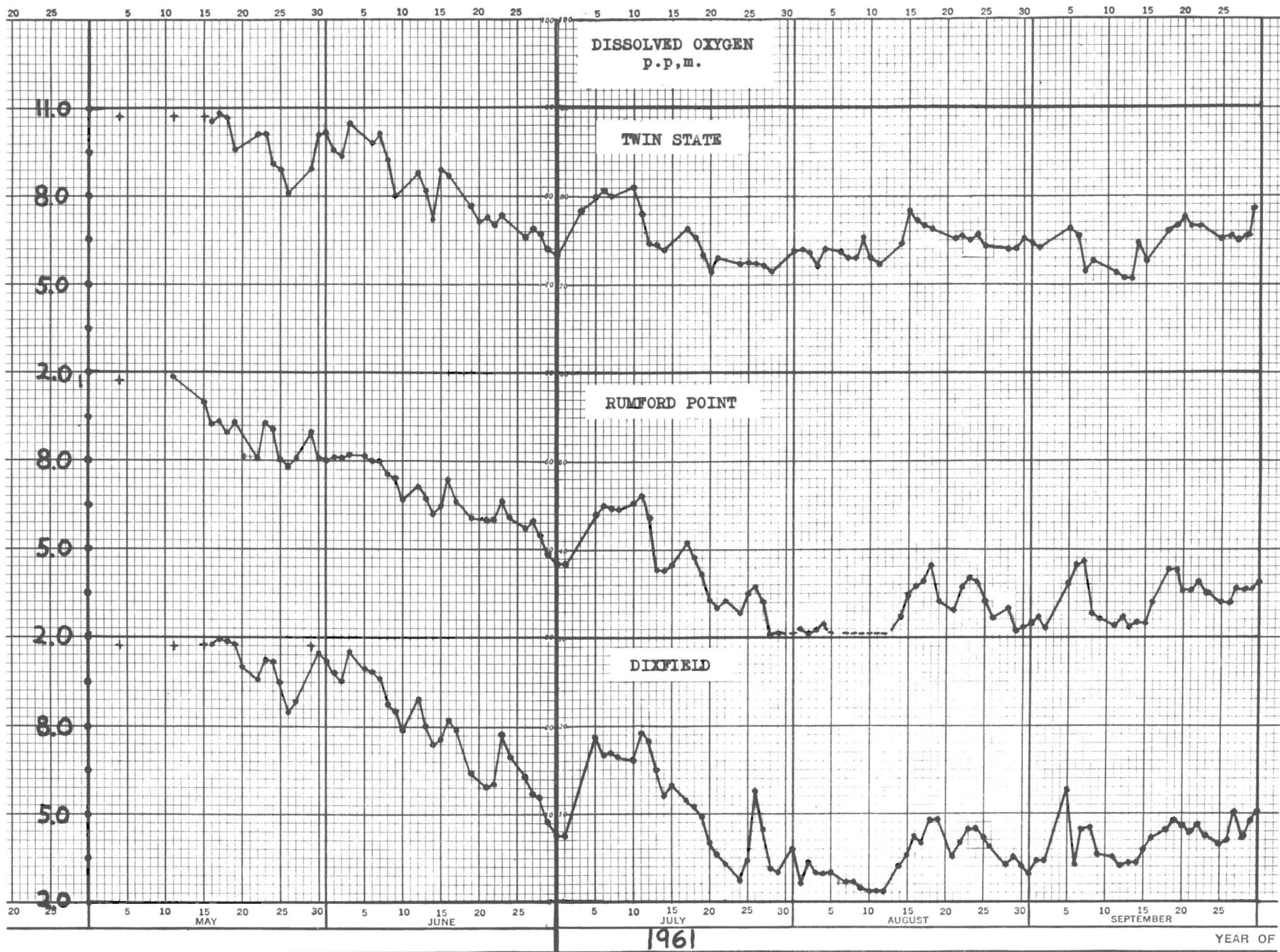
3. Dixfield. Dissolved oxygen in the water sampled at this location remained above four ppm until July 21. From this date until September 30 there were thirty-seven days reported below four ppm. The record from 1950 to date is tabulated below.

Dixfield, Maine

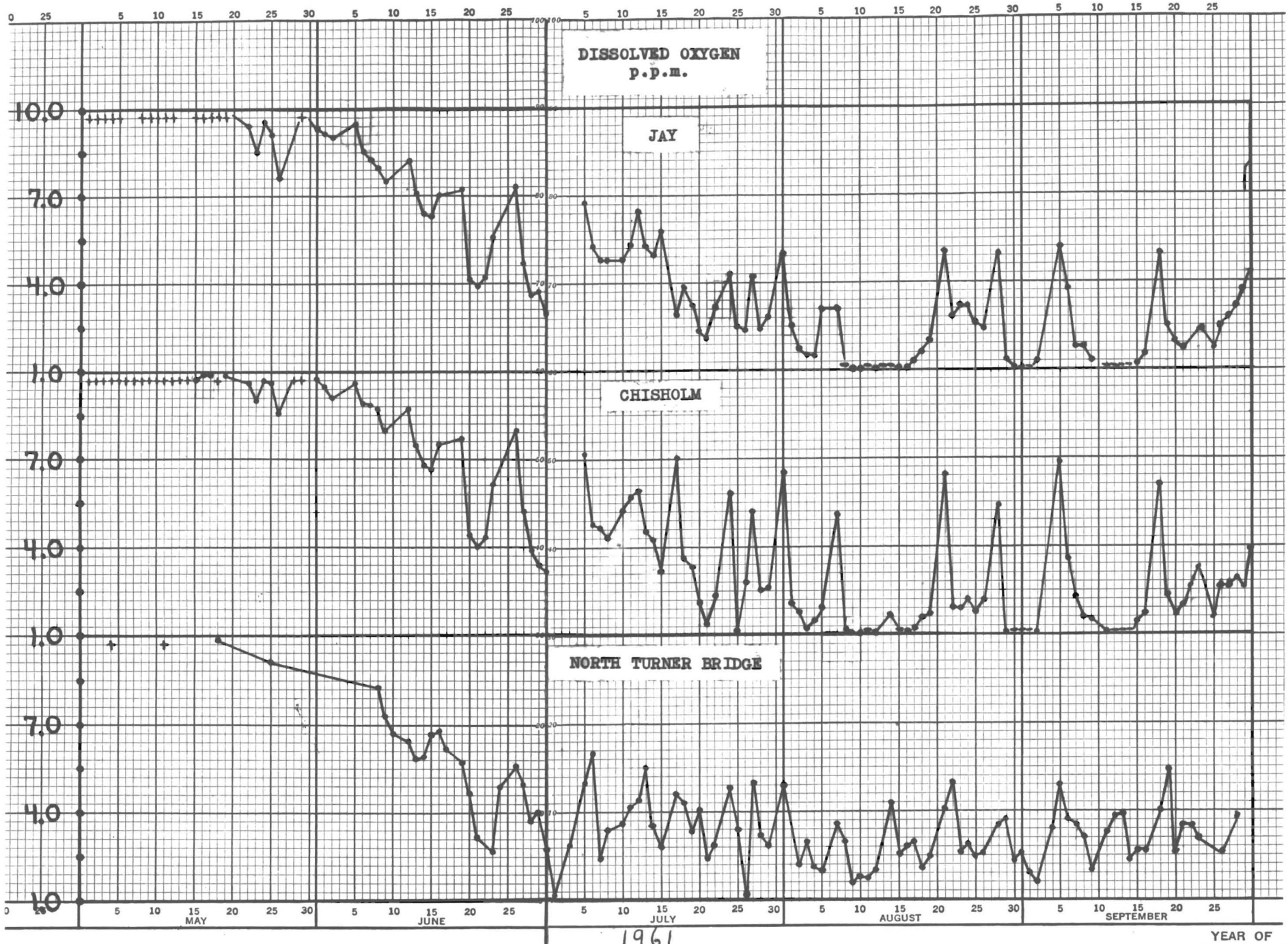
Number of Days D.O. Reported Below Four ppm

1961	37 days	1955	37 days
1960	15	1954	0
1959	36	1953	30
1958	23	1952	18
1957	70	1951	21
1956	49	1950	9

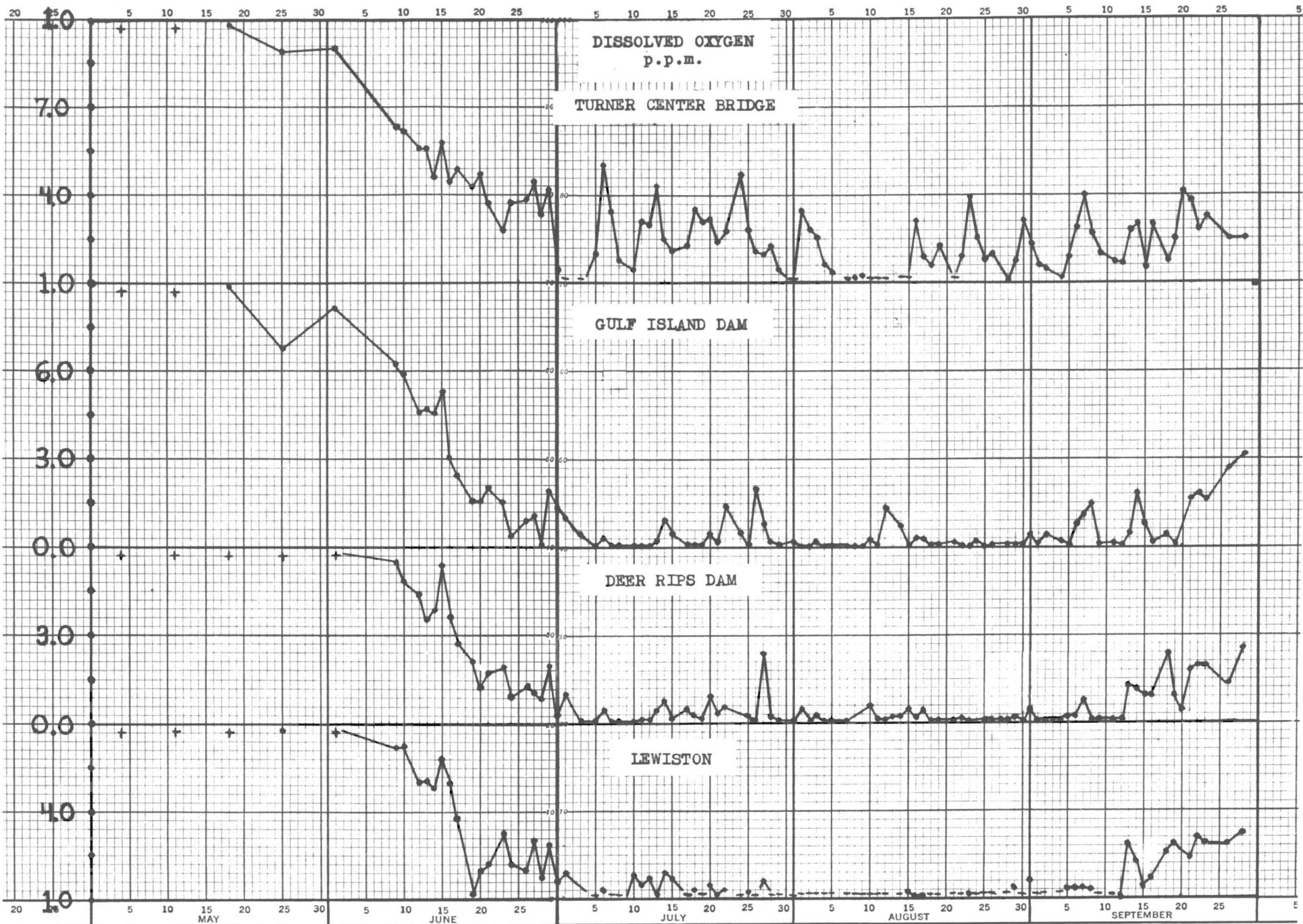
With the exception of 1957, this years "below four ppm" is equal to or larger than any since 1950.



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3213



DISSOLVED OXYGEN
p.p.m.

TURNER CENTER BRIDGE

GULF ISLAND DAM

DEER RIPS DAM

LEWISTON

1961

YEAR OF 19

32c

4. Jay and Ghisholm. Conditions at these two stations generally were not as good as last year, due to the lower quality of the water upstream.

Below Four ppm		Below One ppm	
1961	61 days	1961	9 days
1960	53 "	1960	7 "

5. North Turner Bridge. There were sixty-one days when the dissolved oxygen was reported below four ppm. This year the average ppm for eighty-one days was 3.42. The averages since 1949 are listed below. The shut down of the last sulphite pulp mill at Rumford did not produce any apparent improvement in the dissolved oxygen content of the water.

North Turner Bridge

Dissolved Oxygen		Daily Averages	
1961	3.42 ppm	1954	5.84 ppm
1960	4.13	1953	1.75
1959	3.80	1952	1.49
1958	3.62	1951	2.84
1957	1.95	1950	3.43
1956	2.43	1949	2.00
1955	1.94		

6. Turner Center Bridge. The much lower Pollution Factor did not produce any reduction in the 'low oxygen days' at this location. The past four year's record is,

Year	Days Below TWO ppm	Days Below ONE ppm	P.F. aver.
1961	32	10	0.12
1960	16	0	0.49
1959	44	29	0.60
1958	29	7	0.81

7. Gulf Island Dam. The analytical tests on water sampled at this Dam were somewhat more erratic this year due to the number one turbine and generator being down for repairs most of the summer. (The sampling equipment is near the number one intake.)

The average D.O. was lower this year, for the eighty-two sampling days, than during the preceeding two years. The seasons daily averages for the past twelve years are,

1961	0.51 ppm	1955	0.17 ppm
1960	0.73	1954	1.17
1959	1.46	1953	0.24
1958	0.32	1952	0.09
1957	0.22	1951	0.13
1956	0.24	1950	0.12

The twelve year average 0.45 ppm

8. Lewiston. The dissolved oxygen in the river water in the Lewiston Canal has always been quite small during the summer and this year was no exception. However, unlike the other sampling stations this seasons record is slightly better than that of last year.

Year	Below One ppm	Below 0.5 ppm
1961	42 days	7 days
1960	54 "	26 "

Statistically this record still appears very poor but the B.O.D.'s were so low and the Methylene Blue Stabilities so high that there was no appreciable odor present.

9. Lisbon Falls. As in previous years the dissolved oxygen content of the water at this location exceeded sixty percent saturation during the season.

Methylene Blue
Stabilities. 20°C

The Methylene Blue Stabilities indicated a considerable improvement in the quality of the river water. For the first time since test was employed the stability at North Turner exceeded ten days for most of the season.

At Gulf Island Dam wide fluctuations were present but all of the tests exceeded one day's stability. At Lewiston the water had a stability of ten days or over during all of the season

Hydrogen Sulphide.

All analytical tests were negative.

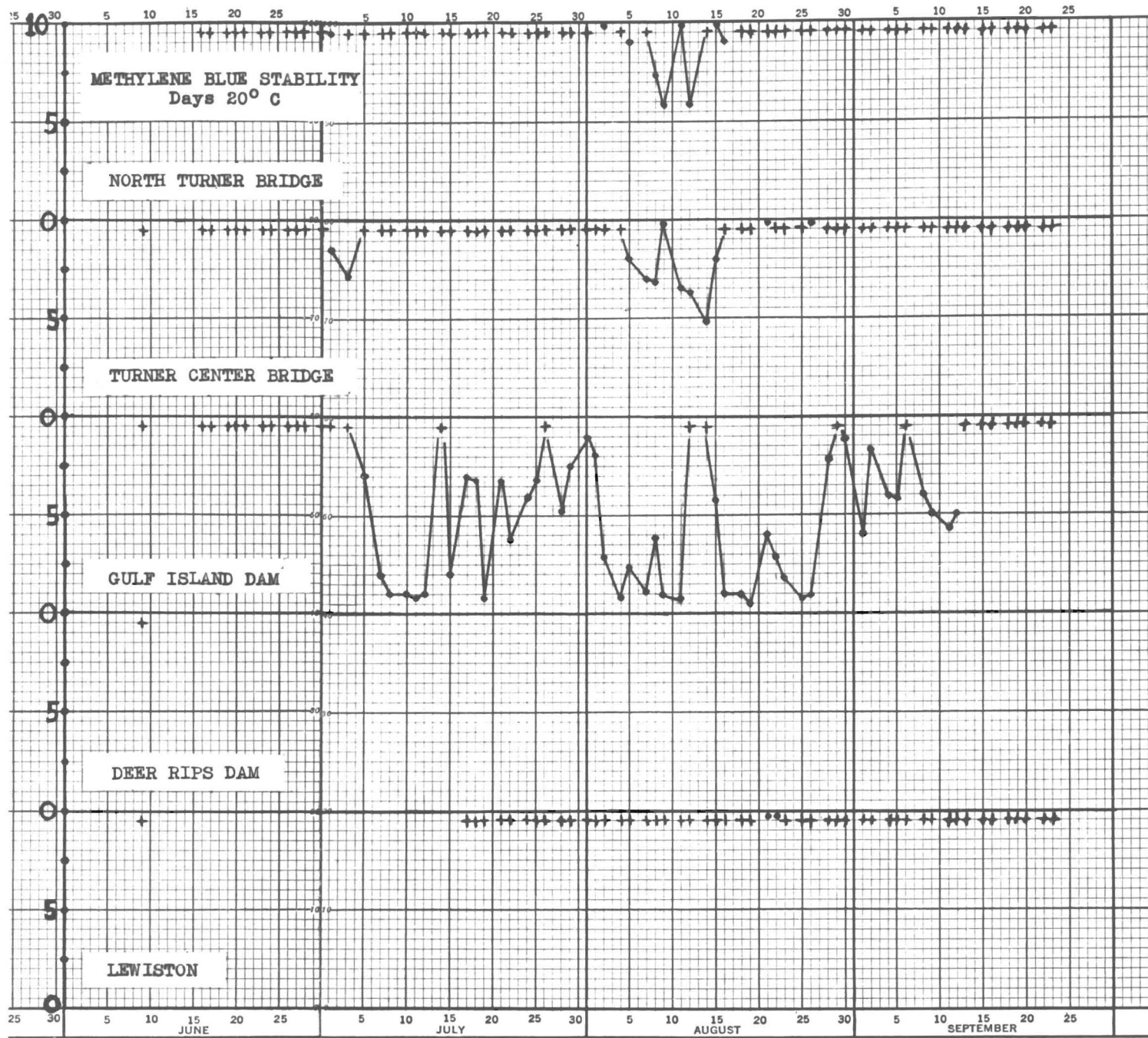
Sodium Nitrate.

For the first time since 1947 Sodium Nitrate was not added to the river water.

Storage Lagoons

The lagoon at Jay, Maine was used for the storage of strong sulphite waste liquor from June 19 to September 30. The stored liquor will be discharged to the river gradually as soon as temperature and flow conditions are favorable.

The lagoons at Berlin were seldom used during this year. The small amount of liquor stored (77 tons) was discharged over the weekend beginning October 13.



35A