10-1966

Mill Pollution

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Bates College

Twenty-Fourth Annual Report

Part Three

Mill Pollution Loads

1966

Introduction. The objective of this portion of the annual report is, the application of Biochemical Oxygen Demand and Dissolved Oxygen data for the determination of soluble pollution loads discharged to the Androscoggin River by the three companies.

Berlin, New Hampshire Area. Three sampling stations are located in this area. Bell's Ice House, Mile 138.8, about four miles upstream from Brown Company Mill, Gorham (Public Service), Mile 130.4 and Gilead Bridge Maine, Mile 119.1. The State Line is situated at Mile 118.8. Some data obtained at Virginia Bridge is included here, but a more detailed description is included in the Rumford area section.

During the summer, river water at Bell's Ice House station had a B.O.D. below one part per million. There is little variation from year to year. The B.O.D.'s for the 1963-1966 seasons were,

1966	6,820	lbs.	per	day
1965	6,220	"	"	"
1964	7,200	"	"	"
1963	7,820	"	"	"

Water sampled at the Public Service station in Gorham,

BELL'S ICE HOUSE

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	T/d	Month Aver. T/d	B.O.D. 5 day 20°C ppm	T/d	Month Aver. T/d
May							
5	7.59	12.24	92.90		1.3	9.86	
12	5.73	12.24	70.13	93.97	1.9	10.88	12.79
19	13.42	11.32	151.90		1.8	24.15	
26	6.29	9.69	60.95		1.0	6.29	
June							
2	5.56	9.18	51.04		1.0	5.56	
9	5.76	8.36	48.15		1.0	5.76	
16	7.59	8.21	62.32	49.80	0.7	5.31	4.79
23	5.87	7.96	46.70		0.6	3.52	
30	5.40	7.55	40.77		0.7	3.78	
July							
7	5.52	7.45	41.13		0.6	3.31	
14	5.52	7.34	40.52	41.67	0.7	3.86	3.44
21	5.44	7.85	42.71		0.6	3.26	
28	5.53	7.65	42.31		0.6	3.32	
August							
4	4.94	7.96	39.32		0.5	2.47	
11	5.05	7.55	38.13	40.55	0.5	2.52	2.43
18	5.45	7.96	43.38		0.5	2.73	
25	5.01	8.26	41.38		0.4	2.01	
September							
1	5.21	8.06	41.99		0.3	1.56	
8	5.33	8.67	46.21		0.6	3.20	
15	5.18	8.36	43.31	45.68	0.4	2.07	2.96
22	5.58	9.18	51.23		0.9	5.02	
29	5.12	9.79	50.18		0.9	4.61	
June 2 - Sept 23 average				44.43			3.41

GORHAM

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW	DISSOLVED OXYGEN			B.O.D. 5 day 20°C		
	MT/d	ppm	T/d	Calc Month	ppm	T/d	Calc Month
May				Aver.			Aver.
5	7.59	12.78	97.00		4.1	31.12	
12	7.53	12.58	94.73		5.6	42.17	
16	9.60	11.85	113.76		3.4	32.64	
17	11.83	11.80	139.60		5.5	65.06	
18	12.47	11.96	149.14		3.9	48.63	
19	13.42	12.09	162.25		3.5	46.97	
20	14.63	11.70	171.18	100.08	2.9	42.42	33.20
23	9.32	11.22	104.57		3.4	31.69	
24	7.48	10.60	79.23		2.6	19.45	
25	7.48	9.73	72.78		2.8	20.94	
26	6.29	9.58	60.26		3.0	18.87	
27	5.51	9.14	50.36		3.7	20.39	
30	5.54	8.75	48.48		3.3	18.28	
31	6.70	8.64	57.89		3.9	26.13	
June							
1	6.39	8.28	52.16		2.6	16.61	
2	5.56	9.27	51.15		2.4	13.34	
3	5.50	9.32	51.26		3.1	17.05	
6	5.96	7.92	47.20		3.3	19.67	
7	6.80	7.87	53.52		3.6	24.48	
8	5.83	8.02	46.76		4.3	25.07	
9	5.76	8.07	46.48		3.9	22.46	
10	8.26	7.92	65.42		4.0	33.04	
13	7.87	9.78	76.97		2.5	19.68	
14	5.87	8.49	49.84		2.9	17.02	
15	6.56	7.76	50.91	49.79	3.6	23.62	19.76
16	7.59	7.66	58.14		2.4	18.22	
17	7.93	8.49	67.33		2.2	17.45	
20	5.92	7.51	44.46		3.0	17.76	
21	5.95	7.25	43.14		2.7	16.07	
22	5.88	7.61	44.75		2.8	16.46	
23	5.87	7.04	41.33		3.3	19.37	
24	6.17	7.25	44.73		3.4	20.98	
27	6.25	7.51	46.94		2.7	16.88	
28	5.83	7.09	41.34		3.3	19.24	
29	5.49	6.42	35.25		4.2	23.06	
30	5.40	6.73	36.34		3.2	17.28	
July							
1	5.31	6.88	36.53		2.9	15.40	
5	5.40	6.69	36.13		1.7	9.18	
6	5.59	7.04	39.35		2.4	13.42	
7	5.52	7.25	40.02		2.1	11.59	
8	5.38	7.40	39.81		3.6	19.37	
11	5.47	6.62	36.21		3.2	17.51	
12	5.51	6.31	34.77		4.2	23.14	
13	5.57	6.88	38.32		3.0	16.71	

GORHAM

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	T/d	MONTH Aver. T/d	B.O.D. 5 day 20°C ppm	T/d	MONTH Aver. T/d
July							
14	5.52	6.68	36.87		3.0	16.56	
15	5.25	6.88	36.12	37.38	3.1	16.28	18.74
18	5.40	6.68	36.07		3.9	21.06	
19	5.31	6.68	35.47		4.4	23.37	
20	5.30	6.52	34.56		4.5	23.85	
21	5.44	6.94	37.75		4.3	23.39	
22	5.38	7.14	38.41		3.1	16.68	
25	5.42	7.04	38.16		3.4	18.43	
26	5.52	6.73	37.15		3.4	18.77	
27	5.49	6.52	35.80		6.2*	34.04	
28	5.53	6.83	37.77		3.3	18.23	
29	5.75	7.35	42.26		3.1	17.83	
August							
1	5.23	7.51	39.28		3.2	16.74	
2	5.08	6.37	32.36		3.2	16.26	
3	4.93	6.62	32.64		3.9	19.23	
4	4.94	7.25	35.82		2.8	13.83	
5	4.98	6.88	34.26		3.4	16.93	
8	5.08	7.14	36.27		3.1	15.75	
9	4.93	6.83	33.67		3.0	14.79	
10	4.94	6.57	32.46		3.5	17.29	
11	5.05	6.57	33.18		3.3	16.67	
12	5.23	6.42	33.58		3.2	16.74	
15	4.93	6.47	31.90		2.9	14.30	
16	4.98	7.20	35.85	35.74	2.9	14.44	16.97
17	5.52	7.35	40.57		3.9	21.52	
18	5.45	7.51	40.93		2.1	11.45	
19	4.94	7.04	34.78		3.9	19.27	
22	5.06	7.35	37.19		3.3	16.70	
23	5.00	7.20	36.00		3.8	19.00	
24	5.07	7.20	36.50		3.8	19.27	
25	5.01	7.40	37.07		3.5	17.54	
26	5.01	7.45	37.33		3.4	17.03	
29	4.97	7.56	37.57		4.2	20.88	
30	4.86	7.40	35.96		3.7	17.98	
31	4.94	7.45	36.80		3.6	16.78	
September							
1	5.16	7.45	38.44		3.6	18.58	
2	5.14	7.14	36.70		3.1	15.93	
5	5.12	8.44	43.21		4.5	23.04	
6	5.23	8.44	44.14		1.2	6.28	
7	5.32	8.23	43.78		3.2	17.02	
8	5.33	8.33	44.40		4.0	21.32	
9	5.18	8.13	42.11		3.8	19.68	
12	5.18	7.71	39.94		5.8	30.04	
13	5.19	7.92	41.18	42.41	4.2	21.80	22.81
14	5.19	8.35	43.25		3.8	19.72	
15	5.18	7.97	41.29		4.5	23.31	
16	5.10	7.90	40.29		4.7	23.97	
19	5.13	8.07	41.40		5.3	27.19	
20	5.11	8.33	42.57		4.2	21.46	
21	5.18	8.20	42.48		6.7	34.71	
22	5.58	8.72	48.66		6.0	33.48	
23	5.46	8.64	47.17		5.5	30.30	
29	5.12	9.32	47.72		4.0	20.48	
June - September 23 average				41.33			19.57

*Spill

is contaminated with upstream natural pollution, wastes from the Brown Company's Mills and domestic pollution from Berlin and Gorham. The following calculations are based on the analytical results obtained June to September 22. The Berlin-Gorham domestic loads are the result of accepted standard calculations; 0.167 lbs. five day B.O.D. per person per day.

	B.O.D. T/d	D.O. surplus T/d
Gorham (P.S.)	19.57	21.76
Bell's	3.41	41.02
increase	16.16	
Berlin-Gorham Domestic load	1.49	
Brown Company average daily	14.67	

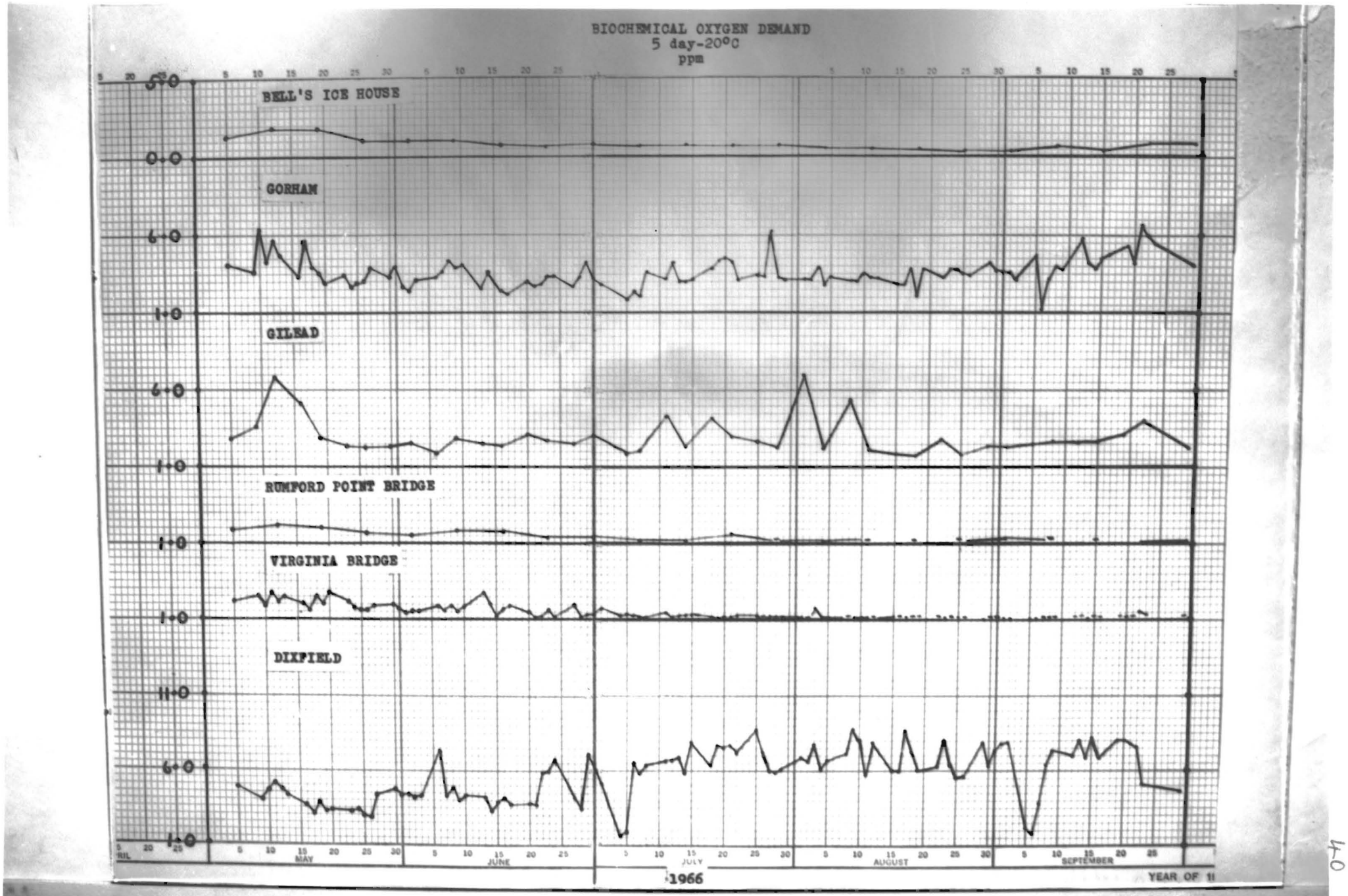
	1966	1965	1964	1963
Brown Company average daily T/d	14.67	13.52	16.35	20.76
average daily lbs/d	29,340	27,040	32,700	41,520

Bell's Ice House

1966

Period	D.O. T/d	B.O.D. T/d	D.O. Surplus T/d
May (4)*	93.97	12.79	81.18
June (5)	49.80	4.79	45.01
July (4)	41.67	3.44	38.23
Aug. (4)	40.55	2.43	38.12
Sept. (4)	45.68	2.96	42.72
June-Sept. average	44.43	3.41	41.02

*Number of tests


BIOCHEMICAL OXYGEN DEMAND
5 day-20°C
ppm
BELL'S ICE HOUSE
GORHAM
GILEAD
RUMFORD POINT BRIDGE
VIRGINIA BRIDGE
DIXFIELD
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF

Gorham (Public Service)

1966

Period	D.O. T/d	B.O.D. T/d	D.O. Surplus T/d
May (14)*	100.08	33.20	66.88
June (22)	49.79	19.76	30.03
July (20)	37.38	18.74	18.64
Aug. (23)	35.74	16.97	18.77
Sept. (17)	42.41	22.81	19.60
June-Sept. average	41.33	19.57	21.76

*Number of Tests

Gilead, Maine

1966

Period	D.O. T/d	B.O.D. 5 day T/d	Gor.-Gil. B.O.D. %loss	D.O. surplus T/d
June (9)	53.91	18.44	6.6	35.47
July (8)	33.96	16.35	14.7	17.61
Aug. (9)	30.98	16.33 (13.16)*	3.8 (22.4)*	14.65 (17.82)*
Sept. (7)	36.98	15.69	31.2	21.29
June-Sept. averae	38.96	16.70	14.6	22.26

*Omitting August first

GILEAD

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	DISSOLVED OXYGEN T/d	DISSOLVED OXYGEN Month Aver. T/d	B.O.D. 5 day 20°C ppm	B.O.D. 5 day 20°C T/d	B.O.D. 5 day 20°C Month Aver. T/d
May							
5	9.85	12.47	122.83		2.8	27.58	
12	8.45	11.80	99.71		6.9	58.31	
16	12.00	11.90	142.80		5.1	61.20	
19	17.39	11.96	207.98	121.76	2.9	50.43	21.21
23	12.76	11.18	142.66		2.3	29.35	
26	8.54	9.52	81.30		2.2	18.79	
30	6.52	8.44	55.03		2.3	15.00	
June							
2	6.30	8.80	55.44		2.5	15.75	
6	6.75	7.76	52.38		1.9	12.83	
9	6.56	7.61	49.92		2.8	18.37	
13	10.40	9.42	97.97		2.5	26.00	
16	8.28	7.53	62.35	53.90	2.3	19.04	18.44
20	6.45	7.09	45.73		3.1	20.00	
23	6.25	6.42	40.13		2.7	16.88	
27	6.80	7.25	49.30		2.5	17.00	
30	5.81	5.49	31.90		3.0	17.33	
July							
5	5.90	6.31	37.23		1.9	11.21	
7	5.96	6.37	37.97		2.1	12.52	
11	6.09	5.54	33.74		4.3	26.19	
14	5.83	5.90	34.40	33.96	2.4	14.00	16.35
18	5.55	5.49	30.47		4.1	22.75	
21	5.56	5.90	32.81		3.0	16.68	
25	5.45	6.11	33.30		2.7	14.72	
28	5.53	5.74	31.74		2.3	12.72	
August							
1	5.41	4.66	25.21		7.7	41.66	
4	5.17	6.26	32.36		2.3	11.89	
8	5.11	4.66	23.81		5.4	27.59	
11	5.08	5.38	27.33		2.1	10.67	
15	4.99	6.16	30.74	30.98	1.9	9.48	16.33
18	5.66	6.68	37.81		1.7	9.66	(13.16)*
22	5.12	6.06	31.03		2.9	14.85	
25	5.31	7.14	37.91		1.8	9.56	
29	5.00	6.52	32.60		2.4	12.00	
September							
1	5.11	5.64	28.82		2.4	12.26	
5	5.67	6.99	39.63		2.5	14.18	
8	5.45	7.09	38.64		2.7	14.72	
12	5.18	6.60	34.19	36.98	2.7	13.99	15.69
15	5.25	6.57	34.49		2.7	14.18	
19	5.18	6.31	32.69		3.1	16.06	
22	6.11	8.25	50.41		4.0	24.44	
29	5.32	9.32	49.58		2.3		

*Omitting August first

June 2 - September 22 average 38.96 16.70

Gilead, Maine. This station is located about 1,500 feet downstream from the State Line. Assuming the limited data are representative then, the B.O.D. load decreased 5,740 lbs. per day as the water passed 11.2 miles eastward. Although the river flows were higher than 1965 this reduction closely approximates 5,960 lbs/d that of 1965.

Gorham (total)	19.57 T/d	39,140 lbs/d
Gilead	16.70 T/d	33,400 "
Decrease	2.87	5,740 "
"	14.6%	

The average daily D.O. surplus was 22.26 T/d, or 44,520 lbs/d and the percentage B.O.D. loss was 14.6.

Virginia Bridge. This sampling station, which has become a key location in the classification discussions, is located at Mile 87.6. This season the river water traversing the 42.8 miles from Gorham, N.H. had a daily average D.O. increase of 4.68 T/d, (9,360 lbs/d), and a daily average B.O.D. reduction of 11.25 T/d, (22,500 lbs/d). Assuming no Benthal demand, the average reaeration rate between these two stations during the season was approximately 745 lbs. per mile per day. The surplus D.O. averaged 38.24 T/d (76,480 lbs/d) at the sampling location. The percentage loss of B.O.D. between Gorham, N.H. and Virginia Bridge, Maine, during the 1966 season was 64.9 and compares favorably with 67.8 during a similar period in 1965.

Rumford Area. This area includes the sampling stations located at Virginia Bridge,

VIRGINIA BRIDGE

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW	DISSOLVED OXYGEN			B.O.D. 5 day 20°C		
	MT/d	ppm	T/d	Calc Month Aver.	ppm	T/d	Calc Month Aver.
May							
5	14.37	11.02	158.36		2.15	30.89	
12	10.29	11.06	113.81		2.13	21.92	
16	16.79	10.28	172.60		1.98	33.24	
17	21.25	10.03	213.14		1.55	32.94	
18	21.87	10.12	221.32		2.50	54.68	
19	25.33	10.22	258.87		2.01	50.91	
20	30.30	10.70	324.21		2.77	83.93	
23	19.63	9.90	194.34	161.17	2.20	43.19	36.90
24	15.80	9.50	150.10		1.80	28.44	
25	14.55	8.83	128.48		1.58	22.99	
26	13.04	8.55	111.49		1.57	20.47	
27	10.71	8.35	89.43		1.90	20.35	
30	8.40	7.53	63.25		4.65	39.06	
31	7.86	7.25	56.99		4.27	33.56	
June							
1	8.40	7.98	67.03		1.41	11.84	
2	7.78	7.83	60.92		1.50	11.67	
3	7.21	8.10	58.40		1.52	10.96	
6	8.34	6.68	55.71		1.94	16.18	
7	11.88	7.10	84.35		1.57	18.65	
8	10.10	6.70	67.67		1.92	19.39	
9	8.18	6.85	56.03		1.51	12.35	
10	13.39	7.46	99.89		1.76	23.56	
13	15.31	8.34	127.68		2.79	42.72	
14	10.42	8.15	84.92		1.99	20.74	
15	8.80	7.15	62.92	64.25	1.24	10.91	14.73
16	9.66	7.12	68.78		1.59	15.36	
17	11.56	7.00	80.92		1.87	21.62	
20	7.51	7.26	54.52		1.47	11.04	
21	7.34	6.97	51.16		1.12	8.22	
22	7.16	6.58	47.11		1.16	8.31	
23	6.99	7.03	49.14		1.58	11.04	
24	6.97	6.65	46.35		1.23	8.57	
27	7.88	6.98	55.00		1.95	15.37	
28	7.51	6.98	52.42		1.14	8.56	
29	6.67	6.38	42.55		1.28	8.54	
30	6.64	6.03	40.04		1.26	8.37	
July							
1	6.21	6.15	38.19		1.65	10.25	
4	6.97	5.74	40.01		1.23	8.57	
5	6.91	5.97	41.25		1.44	9.95	
6	6.37	6.82	43.44		1.27	8.09	
7	6.86	5.85	40.13		1.05	7.20	
8	6.51	6.78	44.14		1.08	7.03	
11	6.27	6.18	38.75		1.48	9.28	
12	6.21	6.35	39.43		1.13	7.02	
13	6.37	5.80	36.95		1.16	7.39	
14	6.45	5.64	36.38		1.31	8.45	
15	6.13	6.60	40.46	38.13	1.37	8.40	7.46

VIRGINIA BRIDGE

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	DISSOLVED OXYGEN T/d	DISSOLVED OXYGEN Month Aver. T/d	B.O.D. 5 day 20°C ppm	B.O.D. 5 day 20°C T/d	B.O.D. 5 day 20°C Month Aver. T/d
July							
18	5.83	6.55	38.19		1.07	6.24	
19	5.83	5.55	32.36		0.97	5.66	
20	6.24	5.68	35.44		1.23	7.68	
21	5.81	6.17	35.85		1.20	6.97	
22	5.94	6.53	38.79		1.33	7.90	
25	5.51	6.55	36.09		1.27	7.06	
26	5.40	6.70	36.18		0.90	4.86	
27	5.48	6.38	34.96		1.12	6.14	
28	5.45	6.52	35.53		1.06	5.78	
29	5.94	6.45	38.31		1.15	6.83	
August							
1	5.75	6.83	39.27		1.14	6.56	
2	5.59	6.63	37.06		0.82	4.58	
3	5.78	5.72	33.06		1.82	10.52	
4	5.62	6.95	39.06		1.05	5.90	
5	5.18	7.23	37.45		1.03	5.34	
8	5.16	5.93	30.60		0.93	4.80	
9	5.27	6.80	35.84		1.05	5.53	
10	5.16	6.33	31.63		1.14	5.88	
11	5.13	6.35	32.58		1.05	5.39	
12	5.40	6.65	35.91		0.09	4.86	
15	5.10	6.40	32.64		1.23	6.27	
16	5.13	7.15	36.68	37.86	0.92	4.72	5.53
17	5.32	6.95	36.97		1.12	5.96	
18	6.08	7.20	43.77		0.73	4.44	
19	5.81	7.35	42.70		0.97	5.64	
22	5.24	6.98	36.58		0.83	4.35	
23	6.40	6.78	43.39		1.03	6.59	
24	6.51	6.83	44.46		0.73	4.75	
25	5.91	7.55	44.62		1.20	7.02	
26	5.59	7.42	41.48		0.79	4.47	
29	5.08	7.75	39.37		1.00	5.08	
30	5.05	7.72	38.99		0.82	4.14	
31	5.02	7.30	36.65		0.88	4.41	
September							
1	5.00	6.93	34.65		1.02	5.10	
2	5.24	7.30	38.25		0.97	5.08	
5	6.78	7.53	51.05		0.95	6.44	
6	6.51	8.00	52.08		1.05	6.84	
7	5.78	7.40	42.77		0.72	4.16	
8	5.70	7.88	44.82		0.80	4.56	
9	5.67	8.40	47.63		0.67	3.95	
12	5.16	7.70	39.73	46.01	0.85	4.39	5.55
13	5.16	8.22	42.42		0.92	4.75	
14	5.29	8.20	43.38		1.02	5.40	
15	5.38	7.70	41.43		0.85	4.57	
16	5.32	7.88	41.92		0.88	4.68	
19	5.49	8.60	47.21		0.83	4.56	
20	5.24	7.98	41.82		0.90	4.72	
21	5.49	8.32	45.68		0.89	4.94	
22	7.16	8.58	61.43		1.48	10.60	
23	7.75	8.50	65.88		1.25	9.69	
29	5.70	8.98	51.19				
June thru September 23 average				46.52			8.32
July thru September 23 "							6.18

Virginia Bridge

1966

Period	D.O. T/d	B.O.D. T/d	Gil.-V.B. B.O.D. % Loss	D.O. Surplus T/d
May (14)*	161.17	36.90	---	96.92
June (22)	64.25	14.73	20.1	49.52
July (21)	38.13	7.46	54.3	30.67
Aug. (23)	37.86	5.53	66.1 (57.8)**	32.33
Sept. (17)	46.01	5.55	64.6	40.46
June-Sept. Average	46.56	8.32	50.3	38.24

*Number of Tests
**Omitting Aug.1 at Gilead.

Dixfield

Period	D.O. T/d	B.O.D. 5 day T/d	Dix.-V.B. B.O.D. T/d	D.O. Surplus/ T/d Deficit-
May (14)	179.69	59.93	/23.03	/119.76
June (22)	67.51	41.49	/26.76	/ 26.02
July (21)	36.53	37.84	/30.38	- 1.31
Aug. (23)	33.75	37.90	/32.37	- 4.15
Sept. (17)	42.24	36.62	/31.07	/ 5.62
June-Sept. Average	45.00	38.46	/30.14	/ 6.54

DIXFIELD

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW	DISSOLVED OXYGEN			B.O.D. 5 day 20°C		
	MT/d	ppm	T/d	Calc Month Aver.	ppm	T/d	Calc Month Aver.
May							
5	14.37	12.14	174.45		4.76	68.40	
12	10.29	11.60	119.36		4.65	47.85	
16	16.79	11.33	190.23		3.73	62.63	
17	21.25	11.15	236.94		3.15	66.94	
18	21.87	11.58	253.26		3.93	85.95	
19	25.33	11.50	291.30		3.31	83.84	
20	30.30	12.03	364.51		3.43	103.93	
23	19.63	11.35	222.80	179.69	3.32	65.17	59.93
24	15.80	10.61	167.64		3.41	53.88	
25	14.55	9.80	142.59		3.02	43.94	
26	13.04	9.37	122.19		2.85	37.16	
27	10.71	9.28	99.39		4.36	46.70	
30	8.40	8.40	70.56		4.65	39.06	
31	7.86	7.70	60.52		4.27	33.56	
June							
1	8.40	8.20	68.88		4.38	36.79	
2	7.78	8.19	63.72		4.34	33.77	
3	7.21	8.33	60.06		4.43	31.94	
6	8.34	6.65	55.46		7.38	61.55	
7	11.88	7.58	90.05		4.33	51.44	
8	10.10	7.90	79.79		4.87	49.19	
9	8.18	7.33	59.96		3.98	32.56	
10	13.39	7.65	102.43		4.40	58.92	
13	15.31	9.75	149.27		4.30	65.83	
14	10.42	8.88	92.53		3.35	34.91	
15	8.80	7.38	64.94	67.51	3.86	33.97	41.49
16	9.66	7.10	68.59		4.10	39.61	
17	11.56	8.10	93.64		3.80	43.93	
20	7.51	7.39	55.50		3.84	28.84	
21	7.34	6.83	50.13		3.73	27.38	
22	7.16	6.43	46.04		5.93	42.46	
23	6.99	6.60	46.13		6.02	42.08	
24	6.97	6.53	45.51		6.80	47.40	
27	7.88	7.27	57.29		4.24	33.41	
28	7.51	7.10	53.32		3.50	26.29	
29	6.67	6.50	43.36		7.07	47.16	
30	6.64	5.81	38.58		6.51	43.23	
July							
1	6.21	6.00	37.26		5.12	31.80	
4	6.97	7.35	51.23		1.62	11.29	
5	6.91	7.23	49.96		1.75	12.09	
6	6.37	6.12	38.98		6.49	41.34	
7	6.86	5.83	39.99		5.84	40.06	
8	6.51	6.40	41.66		6.40	41.66	
11	6.27	5.25	32.92		6.58	41.26	
12	6.21	5.98	37.14		6.60	41.00	
13	6.37	5.43	34.59		6.76	43.06	
14	6.45	5.49	35.41		5.86	37.80	
15	6.13	6.18	37.88	36.53	7.92	48.55	37.84

DIXFIELD

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	DISSOLVED OXYGEN T/d	DISSOLVED OXYGEN Month Aver. T/d	B.O.D. 5 day 20°C ppm	B.O.D. 5 day 20°C T/d	B.O.D. 5 day 20°C Month Aver. T/d
July							
18	5.83	5.68	33.11		6.35	37.02	
19	5.83	5.43	31.66		7.73	45.07	
20	6.24	5.30	33.07		7.45	46.49	
21	5.81	5.60	32.54		7.70	44.74	
22	5.94	5.98	35.52		7.07	42.00	
25	5.51	5.65	31.13		8.79	48.43	
26	5.40	5.65	30.51		7.19	38.83	
27	5.48	5.80	31.78		6.00	32.88	
28	5.45	6.10	33.25		5.94	32.37	
29	5.94	6.32	37.54		6.22	36.95	
August							
1	5.75	6.07	34.90		6.86	39.45	
2	5.59	5.98	33.43		6.62	37.01	
3	5.78	5.38	31.10		7.81	45.14	
4	5.62	6.12	34.39		6.06	34.06	
5	5.18	6.58	34.08		6.73	34.86	
8	5.16	5.93	30.60		7.05	36.38	
9	5.27	5.82	30.67		8.82	46.48	
10	5.16	5.57	28.74		8.02	41.38	
11	5.13	5.33	27.34		5.73	29.40	
12	5.40	6.10	32.94		7.88	42.55	
15	5.10	6.40	32.64		5.95	30.35	
16	5.13	6.23	31.96	33.75	6.03	30.94	37.90
17	5.32	6.03	32.08		8.73	46.44	
18	6.08	6.15	37.39		7.33	44.57	
19	5.81	6.33	36.77		6.03	35.03	
22	5.24	5.75	30.13		6.34	33.22	
23	6.40	5.85	37.44		7.95	50.88	
24	6.51	6.61	43.03		6.41	41.73	
25	5.91	6.35	37.53		5.47	32.33	
26	5.59	6.80	38.01		5.60	31.30	
29	5.08	6.98	35.46		7.89	40.08	
30	5.05	6.75	34.09		6.15	31.06	
31	5.02	6.28	31.53		7.39	37.10	
September							
1	5.00	5.80	29.00		7.76	38.80	
2	5.24	6.08	31.86		7.89	41.34	
5	6.78	7.75	52.55		2.18	14.78	
6	6.51	7.95	51.75		1.65	10.74	
7	5.78	7.15	41.33		3.75	21.68	
8	5.70	7.00	39.90		6.40	36.48	
9	5.67	7.35	41.67		7.42	42.07	
12	5.16	7.03	36.28	42.24	7.00	36.12	36.62
13	5.16	6.65	33.31		7.95	41.02	
14	5.29	7.38	39.06		6.93	36.66	
15	5.38	6.77	35.32		8.22	44.22	
16	5.32	7.25	38.57		6.85	36.44	
19	5.49	7.62	41.83		8.02	44.03	
20	5.24	7.55	39.56		7.95	41.66	
21	5.49	7.68	42.16		7.79	42.76	
22	7.16	8.30	59.43		7.62	54.56	
23	7.75	8.33	64.56		5.05	39.14	
29	5.70	8.65	49.31				
June - September 23 average				45.01			38.46

Dixfield Bridge and the Riley Dam. At the two Bridge locations B.O.D. determinations were made five times each week. The seasons averages were:

Virginia Bridge	46.56	D.O.	T/d	8.32	B.O.D.	T/d
Dixfield Bridge	45.00	"	T/d	38.46	"	"
Difference	-1.56	"	T/d			
				≠ 30.14	"	"

The average daily D.O. surplus at Dixfield was small, 6.54 T/d, (13.080 lbs/d).

	B.O.D. T/d June-Sept.		
Dixfield Bridge	38.46	76,920	lbs.
Virginia Bridge	8.32	16,640	"
increase	30.14	60,280	"
area Domestic	0.70	1,400	"
Oxford Paper Co.	29.44	58,880	"

Oxford Paper Co.	1966	1965	1964*	1963
B.O.D. T/d	29.44	37.42	49.91	30.00
lbs/d	58,880	74,840	99,820	60,000

*Strike period excluded.

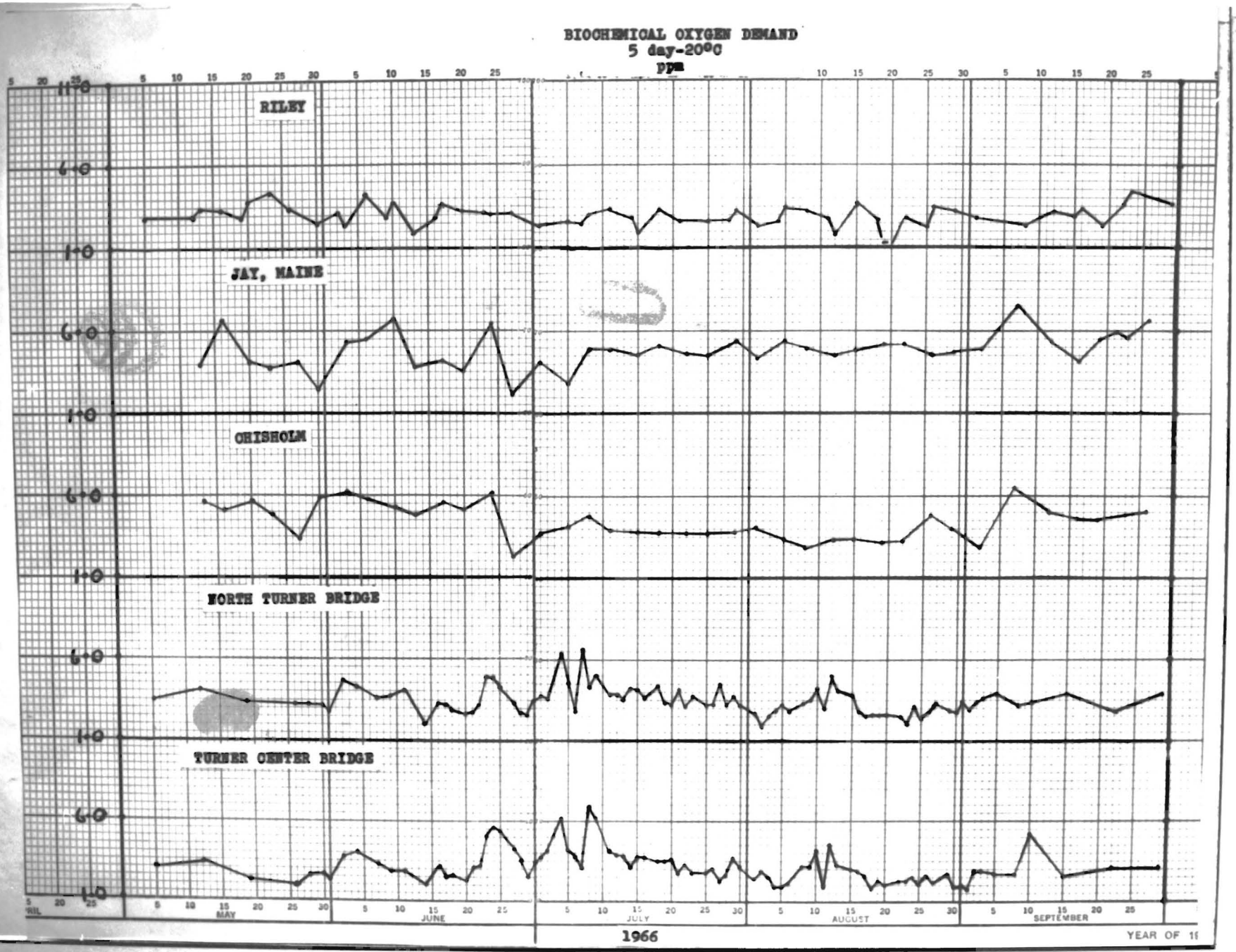
Riley Dam. This season B.O.D. determinations were made on three days each week; D.O. tests were recorded six days each week. For the calculations the D.O. test results were used only on those days when B.O.D.'s were obtained.

RILEY

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	DISSOLVED OXYGEN T/d	DISSOLVED OXYGEN Month Aver. T/d	B.O.D. 5 day 20°C ppm	B.O.D. 5 day 20°C T/d	B.O.D. 5 day 20°C Month Aver. T/d
May							
5*	17.29	11.05	191.05		2.75	47.55	
12	13.24	11.15	147.63		3.03	40.12	
16	19.62	9.0	176.58		3.30	64.75	
19*	29.27	10.63	311.14		2.92	85.47	
20	33.51	9.8	328.40	195.70	3.8	127.34	66.73
23	21.80	10.4	226.72		4.4	95.20	
26*	14.65	8.21	120.28		3.28	48.05	
27	12.57	6.70	84.32		Lost		
30	10.14	6.3	63.88		2.5	25.35	
June							
2*	10.02	7.22	72.34		4.05	30.56	
3	9.05	6.6	59.73		2.4	21.72	
6	8.45	5.6	47.32		4.2	35.49	
9*	11.50	6.50	74.75		2.80	32.20	
10	10.80	6.8	73.44		3.7	39.96	
13	21.30	9.3	198.09		1.9	40.47	
16*	10.85	5.96	64.67	69.62	2.82	30.60	31.50**
17	11.53	6.0	69.18		3.7	42.66	
20	9.67	5.9	57.05		3.3	31.91	
23*	8.02	5.1	40.90		3.23	25.91	
24	7.83	5.3	41.50		3.0	23.49	
27	10.75	7.0	75.25		3.1	33.33	
30*	7.51	4.1	30.79		2.82	21.18	
July							
1	7.13	3.8	27.09		2.4	17.11	
5	6.89	4.6	31.69		2.7	16.33	
7*	6.67	3.84	25.61		2.49	21.78	
8	7.26	4.9	35.57		3.0	21.78	
11	6.40	4.3	27.52		3.4	21.76	
14*	6.53	3.27	21.35		2.85	18.61	
15	6.43	3.8	24.43	25.17	1.9?	12.22?	18.03
18	5.64	4.6	25.94		3.4	19.18	
21*	6.94	3.38	23.46		2.61	18.11	
22	5.94	3.70	21.98		3.2	19.01	
25	5.33	2.9	15.46		2.6	14.26	
28*	5.64	3.80	21.43		2.68	15.12	
29	5.72	4.5	25.74		3.33	19.05	

*Oxford Paper Co. analysis; all others I.P.Co.


BIOCHEMICAL OXYGEN DEMAND
5 day-20°C
ppm
RILEY
JAY, MAINE
CHISHOLM
NORTH TURNER BRIDGE
TURNER CENTER BRIDGE
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF

RILEY

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	T/d	Month Aver. T/d	B.O.D. 5 day 20°C ppm	T/d	Month Aver. T/d
August							
1	6.05	4.0	24.20		2.3	13.92	
4*	5.70	3.45	19.67		2.62	14.94	
5	5.70	4.1	23.37		3.5	19.95	
8	5.45	3.6	19.62		3.2	17.44	
11*	5.45	2.80	15.26		2.65	14.47	
12	5.37	3.1	16.45**		1.7?	9.19?	
15	5.78	4.2	24.28	22.38	3.7	21.39	16.90
18*	5.56	3.00	16.68		2.64	14.68	
19	6.35	3.9	24.77**		0.9?	5.72**	
22	5.16	3.7	19.09		2.8	14.45	
25*	6.78	4.28	29.02		2.27	15.39	
26	6.08	4.2	25.54		3.5	21.28	
29	5.45	5.4	29.43		2.3	17.99	
September							
1*	5.24	3.24	16.98		2.84	14.88	
2	5.08	3.1	15.75		2.4	12.19	
7	6.56	7.0	45.92		6.1	40.02	
8*	5.19	5.05	26.21		2.25	11.68	
12	5.16	3.8	19.61	30.02	3.6	18.58	20.53
15*	5.43	4.33	24.60		3.41	18.52	
16	5.48	4.5	24.66		3.8	20.82	
19	5.45	6.5	35.43		2.3	12.54	
22*	6.16	6.4	39.42		3.59	22.11	
23	7.94	6.5	51.61		4.3	33.94	
29	5.78	7.05					
June-September 23 average				36.80		21.74	

**Omitting August 12 and 19
*Oxford Paper Co. analysis; all others I.P.Co.

Riley Dam

1966

Period	D.O. T/d	B.O.D. T/d	Dix.-R.D. B.O.D. %Loss	D.O. Surplus
May (9)	195.70	66.73	--	128.97
June (13)	69.62	31.55	24.0	38.07
July (13)	25.17	18.03	52.6	7.14
Aug. (11)	22.38	16.90	55.4	5.48
Sept. (10)	30.02	20.53	43.9	9.49
June-Sept. Average	36.80	21.75	43.9	15.05

Assuming no Benthal demand the decrease in D.O. and B.O.D. indicates an average reaeration of about 1100 lbs. D.O. per mile per day.

	D.O.	B.O.D.
Dixfield Bridge	45.00 T/d	38.46 T/d
Riley Dam	36.80 T/d	21.75 T/d
Decrease	8.20 T/d	16.71 T/d

16.71 - 8.20 = 8.51 T/d for the 15.4 mile stretch.

Jay Area. The Jay area includes the Riley Dam, Jay Bridge (old) and Chisholm (Otis) sampling stations. This year the river water was allowed to continuously flow over the Dam and the average daily reaeration from this and to the Jay station was 22,110 lbs. per day, cf Part Two of this report. For calculations relating to the International Paper Company's pollution load the D.O. loads were used only on those days when B.o.D. determinations were made. Interpretation of the

seasons B.O.D. results for June, when the discharge of wastes to the river was erratic and for September, when the Jay Mill was down nearly all of the test period, is unreliable. For these reasons, the July and August data are used for determining the probable pollution load at the Jay Mill.

Jay Bridge (old)	B.O.D.	27.86	T/d	55,720
Riley Dam (above)	B.O.D.	17.47	T/d	34,940
Increase		10.39		20,780

The B.O.D. decrease between the Dam and the entrance to the Jay Mill is unknown; the distance is small but with vigorous reaeration at the Dam the B.O.D. loss might be significant. As an approximation, it may be recorded that the Jay Mill pollution load during July and August was somewhat higher than the reaeration gain (19,580 lbs/d) during these months. During these two months the primary treatment plant was not always operating at maximum efficiency.

Jay, Maine

1966

Period	D.O. T/d	B.O.D. T/d	D.O. Surplus T/d
May (6)	174.83	80.66	94.17
June (8)*	89.00	46.27	42.73
July (9)	33.02	28.33	4.69
Aug. (9)	33.28	27.39	5.89
Sept. (6)**	41.98	36.14	5.84
July-Aug. average	33.15	27.86	5.29
June-Aug. average	51.77	34.00	17.77

**Omitted Pulp Mill down Sept 4-23 except for ten hours Sept. 8

* Production erratic at Jay Mill.

JAY

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	DISSOLVED OXYGEN T/d	DISSOLVED OXYGEN Month Aver. T/d	B.O.D. 5 day 20°C ppm	B.O.D. 5 day 20°C T/d	B.O.D. 5 day 20°C Month Aver. T/d
May							
12	13.66	10.5	143.43		4.0	54.64	
16	17.74	9.5	168.53		6.7	118.86	
20	29.65	9.5	281.68	174.83	4.1	121.57	80.66
23	26.27	9.2	241.68		3.8	99.83	
27	14.80	8.6	127.28		4.1	60.68	
30	11.37	7.6	86.41		2.5	28.43	
June							
3	9.05	8.5	76.93		5.3	47.97	
6	8.45	7.6	64.22		5.5	46.48	
10	10.80	7.0	75.60		6.8	73.44	
17	11.53	7.2	83.02	89.00	4.2	48.43	46.27
20	9.66	6.7	64.72		3.5	33.81	
24	7.83	6.6	51.68		6.4	50.11	
27	10.75	8.5	91.38		2.2	23.65	
July							
1	7.13	4.7	33.51		4.1	29.23	
5	6.89	5.0	34.45		2.8	19.29	
8	7.26	5.1	37.03		4.8	34.85	
11	6.40	6.2	39.68		4.9	31.36	
15	6.43	5.4	34.72	33.02	4.5	28.94	28.33
18	5.64	5.4	30.46		5.1	28.76	
22	5.94	5.0	29.70		4.6	27.32	
25	5.33	4.7	25.05		4.5	24.89	
29	5.72	5.7	32.60		5.3	30.32	
August							
1	6.05	6.0	36.30		4.3	26.02	
5	5.70	5.9	33.63		5.4	30.78	
8	5.45	5.6	30.52		4.9	26.71	
12	5.37	5.0	26.85		4.5	24.16	
15	5.78	6.3	36.41	33.28	4.8	26.01	27.39
19	6.35	5.7	36.20		5.2	33.02	
22	5.16	5.7	29.41		5.2	26.83	
26	6.08	5.9	35.87		4.5	27.36	
29	5.45	6.3	34.34		4.7	25.62	
September							
2	5.08	5.3	26.92		4.9	24.89	
7	6.56	7.8	51.16		7.5	49.20	
12	5.16	5.6	28.90	41.98	5.4	27.86	36.14
16	5.48	6.1	33.43		4.1	22.47	
19	5.45	8.8	47.96		5.5	29.98	
23	7.94	8.0	63.52		5.6	44.46	

Note: Pulp Mill at Jay down from September 4 to 23 except for ten hours September 8.

Chisholm (Otis)

1966

Period	D.O.	B.O.D. T/d	D.O. Surplus T/d
May (6)	199.56	96.78	102.78
June (8)*	91.97	55.98	35.99
July (9)	29.81	24.81	5.00
Aug. (9)	23.46	20.90	2.56
Sept. (6)**	35.42	28.42	7.00
July-Aug. aver.	26.64	22.86	3.48
June Aug. aver.	48.41	33.90	14.51

*Production erratic at Jay Mill
**Omitted Pulp Mill down Sept. 4-23.

Chisholm (Otis). Dissolved oxygen analyses were made on each week day but owing to laboratory limitations B.O.D. determinations were obtained twice weekly. The sampling station is located just below the mill and it is probable that the Otis soluble pollution load is uniform dispersed. There is no sampling station just above the mill, hence there is no convenient base to judge the pollution discharge to the river from Otis.

The July and August analyses indicate an average daily loss of 10,040 lbs. B.O.D. This decrease between Jay and Otis must have been larger than this figure indicates, as the B.O.D. at Otis includes the contribution of this mill. During the Jay Mill shut-down in September 4 to 23, the Otis B.O.D. analyses have much higher demands than when the Jay Mill was operating!!

CHISHOLM (OTIS)

Dissolved Oxygen - Biochemical Oxygen Demand

Date	FLOW MT/d	DISSOLVED OXYGEN ppm	DISSOLVED OXYGEN T/d	DISSOLVED OXYGEN Month Aver. T/d	B.O.D. 5 day 20°C ppm	B.O.D. 5 day 20°C T/d	B.O.D. 5 day 20°C Month Aver. T/d
May							
13	13.66	11.7	159.82		5.7	77.86	
16	17.74	10.4	184.50		5.1	90.47	
20	29.65	11.5	340.98		5.7	169.00	
23	26.25	10.6	278.25	199.56	4.8	126.00	96.78
27	14.80	9.5	140.60		3.4	50.32	
30	11.37	8.2	93.23		5.9	67.08	
June							
3	9.05	8.5	76.93		6.2	56.11	
6	8.45	7.0	59.15		5.7	48.17	
10	10.80	7.8	84.24		5.2	56.16	
17	11.53	8.3	95.70	74.98	5.5	63.42	49.39
20	9.66	8.2	79.21		5.1	49.27	
24	7.83	6.4	50.11		6.1	47.76	
27	10.75	7.4	79.55		2.3	24.73	
July							
1	7.13	4.2	29.94		3.8	27.09	
5	6.89	5.2	35.83		4.1	28.25	
8	7.26	6.1	44.29		4.7	34.12	
11	6.40	4.8	30.72		3.9	24.96	
15	6.43	4.8	30.86	29.81	3.7	23.79	24.81
18	5.64	3.8	21.43		3.7	20.87	
22	5.94	4.2	24.95		3.7	21.98	
25	5.33	4.6	24.52		3.6	19.91	
29	5.72	4.5	25.74		3.9	22.30	
August							
1	6.05	4.5	27.23		4.1	27.23	
5	5.70	4.2	23.94		3.4	19.38	
8	5.45	3.4	18.53		2.8	15.26	
12	5.37	3.8	20.41		3.4	18.26	
15	5.78	3.9	22.54	23.46	3.4	19.65	20.90
19	6.35	3.9	24.77		3.2	20.32	
22	5.16	4.0	20.64		3.3	17.03	
26	6.08	4.6	27.97		4.8	29.18	
29	5.45	4.6	25.07		4.0	21.80	
September							
2	5.08	3.1	15.75		2.9	14.73	
7	6.56	6.7	44.95		6.5	42.64	
12	5.16	5.1	26.32	35.42	4.9	25.28	28.42
16	5.48	5.5	30.14		4.6	25.21	
19	5.45	6.5	35.43		4.5	24.53	
23	7.94	7.5	59.95		4.8	38.11	

Note: Pulp Mill at Jay down September 4 to 23 except for ten hours September 8

Comparisons of the B.O.D. results are listed in the Table below.

B.O.D. Tons/day
Monthly Averages

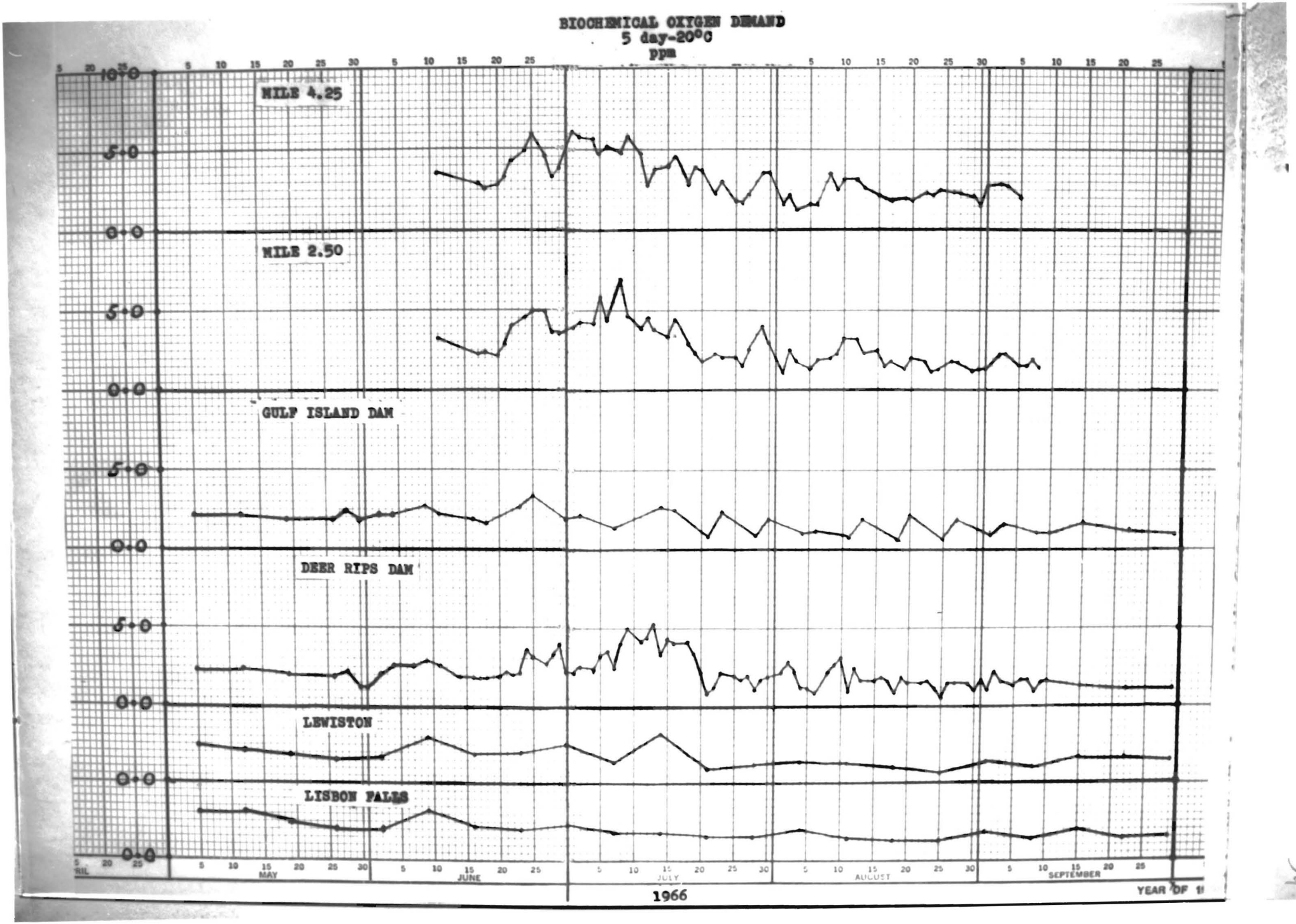
International Paper Company

Period	Riley Dam	Jay	Jay-Riley Dam	Chisholm	Chis.-Jay
May	66.73	80.66	13.93	96.78	+16.12
June	31.50	50.60	19.10	55.98	+ 5.38
(13 omit)	30.75	46.27	15.52	49.39	+ 3.12
July	18.03	28.33	10.30	24.81	- 3.52
Aug.	16.90	27.39	10.49	20.90	- 6.49
Sept.	20.53	36.14*	15.51*	28.42*	- 7.72*

*Jay Pulp Mill down Sept. 4-23!!!

North Turner Bridge. The daily average five day B.O.D. and D.O. loads arriving at this station, during the eleven week test period, were 23.91 tons and 27.91 Tons respectively although this indicates a small 4.0 tons surplus of D.O. there were six weeks when a deficit existed. Efforts were made to compare the Otis results with those of North Turner on "B.O.D. days" but there did not appear to be any consistent data on which to pass judgement. Part Four of this report contains detailed data at this and other stations in the Pool.

Turner Center Bridge. Statistics and personal observations, indicate considerable Benthal activity in the river area between the two Bridges. During the test season, an average daily B.O.D. decrease of 3,480 lbs was accompanied by a loss of 23,040 lbs. of dissolved oxygen; a ratio of 1 to 6.6. With the exception of Week #1, all of


BIOCHEMICAL OXYGEN DEMAND
5 day-20°C
ppm
MILE 4.25
MILE 2.50
GULF ISLAND DAM
DEER RIPS DAM
LEWISTON
LISBON FALLS
10·0
5·0
0·0
MAY
JUNE
JULY
AUGUST
SEPTEMBER
1966
YEAR OF 1

the remaining ten weeks of the special test period there was an oxygen deficit, ranging from 1060 lbs. to 53,000 lbs. per day.

Deer Rips Dam. This station may be considered as the southern end of the Pool. Extensive data (cf Part Four) were obtained and systematicly studied. The quality of the water was consistently poor throughout the entire season. The B.O.D. load passing this station was high and the D.O, present was very low. The average daily B.O.D. load was 14.06 tons and with only 4.17 tons of available oxygen the deficit was 9.89 tons. (19,780 lbs). Benthal activity was very noticeable until the third week of July and much of the Pool was at or near the anaerobic condition. After being approximately constant for four weeks the B.O.D. load decreased by about 50% in Week #4 and a slow decline was registered during the remaining seven weeks.

The Pool and C Classification. To maintain at least five ppm of dissolved oxygen in the water, at all times and places, would require a drastic reduction in upstream pollution loads and probably mechanical reaeration in the Pool for several years. For an example estimate, the highest oxygen deficit occurred at North Turner Bridge during the first week of July.

The oxygen deficit to satisfy the ultimate B.O.D. demand of the water entering the Pool, would be 32.19 T/d x 1.6 equal to 51.47 T/d or 102,940 lbs. D.O. per day. There were present 49,200 lbs. of D.O. thus the actual oxygen deficit

would be 53,740 lbs. Assuming the reaeration in the Pool equals the Benthal B.O.D. contribution, then to maintain five ppm with the 7.02 MT/d river flow during that week, another 7.02 x 5.0 or 35,100 lbs. of oxygen would be required. Under the conditions existing during the first week of July and if the Benthal assumption is valid(?) then the reduction in B.O.D. and an increase in D.O. would have to total about 90,000 lbs. per day to maintain a C standard.

Recapitulation

B.O.D. Load Five day; Ultimate 20°C

June-September

Location	B.O.D. T/d Five day 20°C	Company Load to River T/d	lbs/d
1. Bell's Ice House	3.41		
2. Gorham, N.H.	19.57	14.67	29,340
3. Gilead, Maine	16.70		
4. Virginia Bridge	8.32		
5. Dixfield	38.46	29.44	58,880
6. Riley	21.75		
7. Jay (July-August)	(27.86)	10.39	20,780
8. Chisholm (July-August)	(22.86)	?	
9. North Turner Bridge*	23.91		
10. Turner Center Bridge*	22.17		
11. Deer Rips Dam*	14.06		

*Eleven Week Period