

The Commonwealth of Massachusetts

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REPORT

OF THE

DEPARTMENT OF PUBLIC HEALTH

ON THE

SANITARY CONDITION OF CERTAIN RIVERS  
OF THE COMMONWEALTH

UNDER CHAPTER 49 OF THE RESOLVES OF 1936 AND CHAPTER 66 OF  
THE RESOLVES OF 1937

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FEBRUARY 1, 1938

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## The Commonwealth of Massachusetts

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### SPECIAL REPORT OF THE DEPARTMENT OF PUBLIC HEALTH RELATIVE TO THE SANITARY CONDITION OF CERTAIN RIVERS WITHIN THE COMMONWEALTH.

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FEBRUARY 1, 1938.

*To the General Court of Massachusetts.*

Herewith is submitted a report relative to the investigations made by the Department of Public Health in co-operation with the Federal Works Progress Administration, as authorized and directed under the provisions of chapter 66 of the Resolves of 1937, relative to the sanitary condition of certain rivers in the Commonwealth. Chapter 66 of the Resolves of 1937 reads as follows:

*Resolved,* The department of public health is hereby authorized and directed to continue the investigation provided by chapter forty-nine of the resolves of nineteen hundred and thirty-six, in co-operation with the Federal Works Progress Administration, and also to investigate, in co-operation therewith, the sanitary condition of the Ten Mile river in the vicinity of Attleboro, of the French and Quinebaug rivers in the vicinity of Webster and Dudley, of the Millers river in the vicinity of Northampton, of the Concord and Assabet rivers of the Nashua river in the vicinity of Fitchburg and Clinton, of the Merrimack river, of the Blackstone river, of the Charles river in the vicinity of Boston, of the Mystic river, of the Neponset river in the vicinity of Dedham, Hyde Park and Mattapan, and of such other rivers within the commonwealth as said department may determine. Said department shall also, in co-operation with said administration, assemble data pertaining to the pollution of the Connecticut river. For the said purposes said department may expend for services, other than personal services, and for traveling expenses, supplies, materials and equipment, such sums, not exceeding, in the aggregate, three thousand dollars, as may hereafter be appropriated therefor, in addition to the unexpended balance of the

amount appropriated by item 586b of chapter four hundred and thirty-two of the acts of nineteen hundred and thirty-six. Said department shall report its recommendations, if any, together with drafts of legislation necessary to carry such recommendations into effect, by filing the same with the clerk of the house of representatives on or before the first Wednesday of December in the current year.

*Approved May 28, 1937.*

Under date of November 6, 1937, a communication was sent to the Clerk of the House of Representatives, in which it was stated that the investigation was delayed because funds were not made available until August 13, 1937, for the portion of the work to be carried on by the Federal Works Progress Administration, and the following draft of resolve was filed with the Clerk of the House of Representatives:

*Resolved*, That the time within which the department of public health shall report to the general court upon the investigation in co-operation with the Federal Works Progress Administration of the sanitary condition of certain rivers and streams within the commonwealth as required by chapter sixty-six of the resolves of nineteen hundred and thirty-seven is hereby extended to the first day of February, nineteen hundred and thirty-eight. The department may expend for the purposes of this resolve the unexpended balance of the amount appropriated by item thirty-six of chapter four hundred and forty-five of the acts of nineteen hundred and thirty-seven.

Under the provisions of chapter 49 of the Resolves of 1936, the Department of Public Health reported on the sanitary condition of the Blackstone, Hoosick, Housatonic and Nashua rivers in Senate Document No. 50 of 1937. The investigation under the provisions of chapter 66 of the Resolves of 1937 has been limited to the sanitary condition of the Assabet and Concord, Blackstone, Charles, Connecticut, French and Quinebaug, Merrimack, Mystic, Nashua, Neponset and Ten Mile rivers, but mention also is made in this report of the Hoosick, Housatonic, Taunton and Danvers rivers.

The pollution of the inland waters of the Commonwealth of Massachusetts was a problem as early as 1884, when the Legislature established a commission known as the Massa-

chusetts Drainage Commission and directed that commission to investigate the drainage conditions in the valleys of the Mystic, Blackstone, Neponset and Charles rivers. Up to that time there was no state agency which had the oversight of inland waters, and when public water supplies were first introduced it was common practice to dispose of sewage by discharging it into the nearest stream or tidal estuary, regardless of the effect upon the health and comfort of those residing in the vicinity or of those using the waters for industrial or other purposes.

As a result of the investigations of 1884 and 1885 by the Massachusetts Drainage Commission, legislation was enacted in 1886 (chapter 274 of the Acts of 1886) which was amended in 1888 (chapter 375 of the Acts of 1888), giving the then State Board of Health the general oversight of inland waters, with instructions to consult with and advise the officials of municipalities and firms or individuals relative to their proposed systems of water supply, drainage and sewerage as to the most appropriate source of water supply, the best method of assuring its purity, and as to the best method of disposing of drainage and sewage. This legislation went farther and made it mandatory to consult with and advise persons or corporations engaged or intending to engage in manufacturing or other business whose drainage or sewage might tend to pollute any inland waters, and authorized the Board to conduct experiments to determine the best methods of purification and disposal of such drainage and sewage. This legislation is now incorporated in chapter 111 of the Tercentenary Edition of the General Laws, as amended by chapter 340 of the Acts of 1937.

As a result of this early legislation an Engineering Division was established in the State Board of Health, a laboratory was provided for water and sewage analyses, and an experiment station was established in the city of Lawrence for experimental work in the disposal of sewage and industrial wastes and the purification of water. The work of this experiment station has served as a basis for many of the present adopted methods of sewage and industrial waste disposal and the purification of water, not only in this State,

but throughout this country and the world, and as a result of the work carried on at this station the Department of Public Health has been able to advise cities, towns, industries and others relative to the disposal of their wastes as required under the provisions of the General Laws.

#### EARLIER LEGISLATION ON STREAM POLLUTION.

The only mandatory power which the Department of Public Health has in the matter of stream pollution other than to order improvements in sewage treatment works and to promulgate rules and regulations to protect sources of water supply is relative to the pollution of the Neponset River, Horn Pond Brook, the Aberjona River, Assabet River and Alewife Brook as provided in the following legislation:

Neponset River (chapter 541 of the Acts of 1902, as amended particularly by chapter 360 of the Acts of 1906, and chapter 180 of the Acts of 1916).

Horn Pond Brook in Woburn and Winchester (chapter 235 of the Acts of 1907).

Aberjona River (chapter 291 of the Acts of 1911).

Assabet River (chapter 655 of the Acts of 1914).

Alewife Brook (Arlington, Belmont, Cambridge and Somerville) (chapter 88 of the Acts of 1918).

The Assabet River act, as an example of this type of legislation, is as follows:

SECTION 1. The state board of health is hereby authorized and directed to prohibit the entrance or discharge of sewage into any part of the Assabet river or its tributaries, and to prohibit the entrance or discharge therein of every other substance which may be injurious to public health or may tend to create a public nuisance.

SECTION 2. The board shall consult and advise with the owner of any factory or other establishment, or any municipality discharging any substance into the Assabet river, at his or its request, or of its own motion, as to the best practicable and reasonably available means of rendering the waste or refuse therefrom harmless, and any order or finding by the board shall be prima facie evidence of compliance or non-compliance with the provisions of section one of this act.

SECTION 3. The supreme judicial court or any justice thereof, and the superior court or any justice thereof, shall have jurisdiction in equity to

enforce the provisions of this act and of any order made by the state board of health in conformity therewith, and to enjoin the entrance or discharge into any part of the Assabet river or its tributaries of sewage or of any other substance which is, or which said board shall have determined may be, injurious to public health or tending to create a public nuisance. Proceedings to enforce any such order or to obtain such an injunction shall be instituted and prosecuted by the attorney-general at the relation of the state board of health.

SECTION 4. Whoever, contrary to any order of the state board of health, permits the entrance or discharge into any part of the Assabet river or its tributaries of sewage or of any other substance injurious to public health or tending to create a public nuisance, shall be punished by a fine not exceeding five hundred dollars for each offence.

*Approved June 10, 1914.*

A somewhat less drastic act relative to the Charles River appears as section 175 of chapter 111 of the General Laws.

The Department, under the provisions of chapter 433 of the Acts of 1909, and chapter 350 of the Acts of 1919, incorporated in section 7 of chapter 83 of the Tercentenary Edition of the General Laws, has the power to order improvements in sewage treatment, purification and disposal works.

In order to more adequately protect our inland and tidal waters from pollution the special commission, established under the provisions of chapter 11 of the Resolves of 1935, and chapter 32 of the Resolves of 1936, for investigating the public health laws and policies of the Commonwealth, recommended the passage of three bills on stream and coastal pollution as shown in House, No. 1200 of 1937, viz.: Appendices XXI and XXII, and sections 72A, 72B, 72C, 72D and 72E of Appendix XXXIV.

Appendix XXI would give this Department authority, after a public hearing, to —

order any city or town to install, maintain and operate, or to provide for the installation, maintenance and operation of, filter beds or other works for the treatment, purification and disposal of the sewage of such city or town. . . .

Appendix XXII would authorize the Department, after a hearing, to —

prescribe and establish rules and regulations for the purpose of preventing pollution or contamination of any or all lakes, ponds, streams, tidal waters and flats or the tributaries of such tidal waters and flats. . . .

A precedent for this legislation is in section 175 of chapter 111 of the General Laws relative to the Charles River.

Appendix XXXIV would amend chapter 130 of the General Laws so as to provide that —

*Section 72A.* The department of public health may prohibit the entrance or discharge into or on any of the tidal waters and flats in the commonwealth which have been approved by the said department in accordance with the provisions of this chapter, or the tributaries of such waters, of sewage or any other substance which might be injurious to the public health or might tend to contaminate or pollute any of said tidal waters or flats from which shellfish are taken.

*Section 72B.* The supreme judicial court or any justice thereof, and the superior court or any justice thereof, shall have jurisdiction in equity to enforce the provisions of sections seventy-two A to seventy-two E, inclusive, and any order made by the department of public health in conformity therewith. Proceedings to enforce any such order shall be instituted and prosecuted by the attorney general upon the request of the said department.

*Section 72C.* Whoever permits the entrance or discharge into or on any part of said waters or flats which have been approved by the department of public health in accordance with the provisions of this chapter, or the tributaries of such waters, of sewage or any other substance injurious to the public health or tending to contaminate any area from which shellfish are taken, shall be punished by a fine of not more than five hundred dollars.

*Section 72D.* In carrying out the provisions of sections seventy-two A to seventy-two E, inclusive, the department of public health shall not interfere with any prescriptive right of drainage or sewerage existing on January one, nineteen hundred and thirty-seven, nor shall said department prohibit the use of any sewer or drain or any outlet thereof existing on said date unless authorized by law so to do.

*Section 72E.* The department of public health shall, of its own motion or at the request of the officials of any town in or near which said waters or flats are situated or of any factory or other establishment situated on or near said waters and flats, consult and advise with said officials as to the best practicable and reasonably available means of rendering harmless the sewage, waste or refuse from such town or establishment. In any case wherein the said department determines that the best practicable and reasonably available means of disposing of such sewage, waste or refuse is to discharge the same into tidal waters from which

shellfish are taken for use as bait only, the provisions of sections seventy-two A to seventy-two E, inclusive, shall not apply.

This would enlarge the scope of chapter 312 of the Acts of 1929 which now relates only to the tidal waters of Barnstable, Dukes and Nantucket counties.

The Department of Public Health, in its report submitted to the Legislature in accordance with chapter 49 of the Resolves of 1936, relative to the sanitary condition of the Blackstone, Hoosick, Housatonic and Nashua rivers, recommended in Senate Document No. 50 of 1937 the passage of an act similar to Appendix XXII of House, No. 1200 of 1937, as quoted above. This proposed legislation was not adopted.

Reports in considerable detail are being prepared by the Federal Works Progress Administration, State Planning Projects, under the sponsorship of this Department, for several rivers in the State as required under the provisions of chapter 66 of the Resolves of 1937, and copies of some of those reports are already available for distribution.

#### DISCUSSION OF BIOCHEMICAL OXYGEN DEMAND DETERMINATIONS.

In connection with the following descriptions of the various streams, reference is made in several places to the analytical term "biochemical oxygen demand." This determination, recognized as one of the more important in sewage treatment and stream pollution work, is a measure of the oxygen required to oxidize in a given time, usually five days, the organic matter in a sample of water, or sewage in the presence of oxygen, bacteria and other microscopic life. The sample is incubated during this period of the test at 68° F. The difference between the initial oxygen and the oxygen after incubation is the oxygen used up by the biochemical processes.

The samples of water collected from the various rivers by engineers of the Works Progress Administration were, in general, collected in the dry six months of the year, June to November, inclusive, most of them being collected in

August, September and October. The samples collected by the Works Progress Administration engineers of the Concord and Assabet rivers, however, were collected in the months of March and April, 1937. The samples were generally collected during periods of twelve to twenty-four hours in composite parts made up of individual samples taken every fifteen to thirty minutes. Catch samples were also collected for the dissolved oxygen determinations. The samples collected by representatives of the Department were, in general, catch samples, and all of the Department's analyses referred to in the following pages are of samples collected during the dry six months, June to November, inclusive.

In order that certain pertinent data relative to those investigations may be made readily available to the Legislature, reports on the following rivers are submitted herewith in summary form:

#### CONCORD AND ASSABET RIVERS.

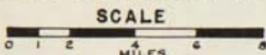
The Concord River above its outlet into the Merrimack River drains an area of about 405 square miles, including the watersheds of the Assabet and Sudbury rivers which join to form the Concord River in the town of Concord.

For the most part, the drainage basin of the Concord River is very flat and contains much swamp and meadow land. In the lower part of its course, between North Billerica and the mouth of the river, there is a considerable fall, particularly in the last  $1\frac{1}{4}$  miles, where there is a fall of about 47 feet at the Wamesit Dam in Lowell.

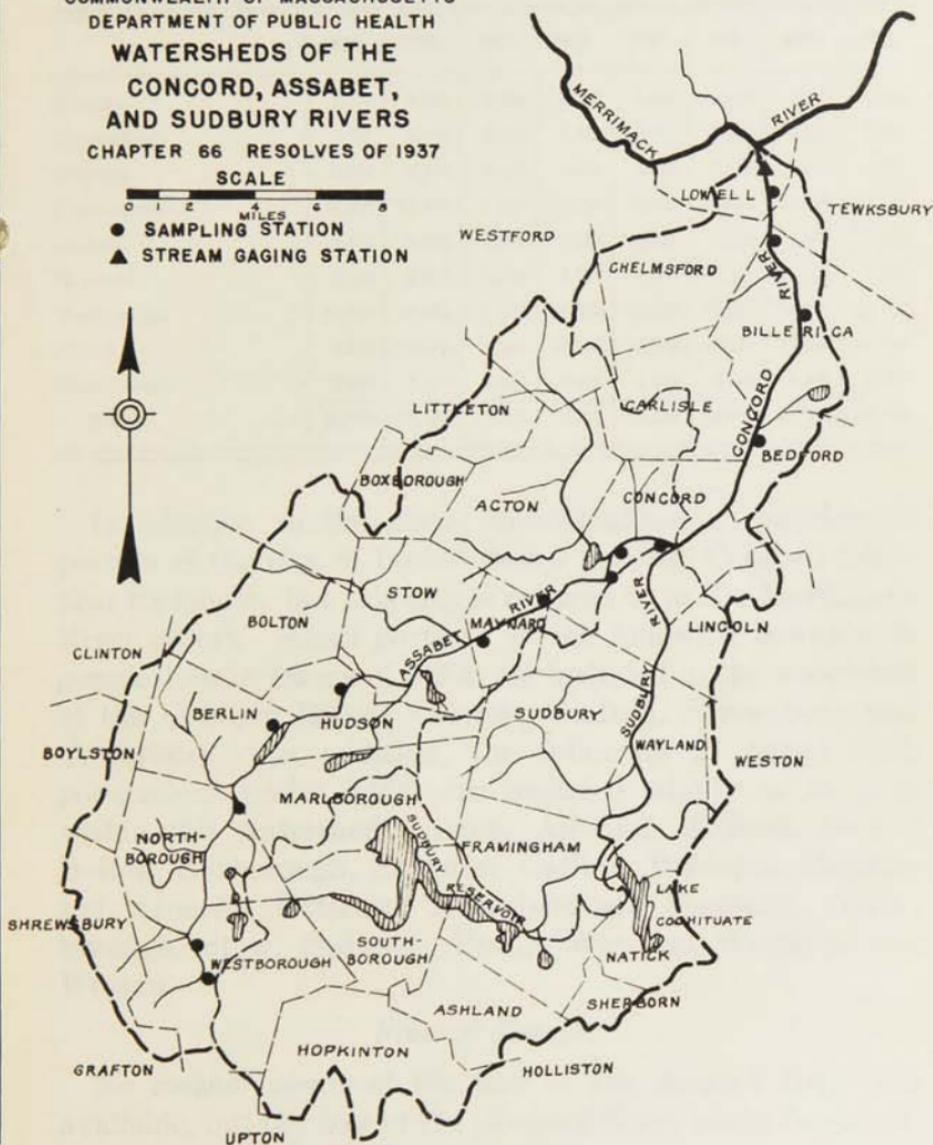
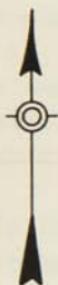
The Sudbury River has a drainage area at its junction with the Assabet River of 166.6 square miles, of which 92.8 square miles, tributary to the Sudbury reservoirs and Lake Cochituate, have been diverted for water supply purposes for the Metropolitan Water District. No sanitary survey of the Sudbury River watershed has been made in connection with this investigation.

The Assabet River has a drainage area at its confluence with the Sudbury River in Concord of 176.4 miles. The following table shows the towns wholly or in part within the drainage area, together with the estimated population:

COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC HEALTH  
WATERSHEDS OF THE  
CONCORD, ASSABET,  
AND SUDBURY RIVERS  
CHAPTER 66 RESOLVES OF 1937



- SAMPLING STATION
- ▲ STREAM GAGING STATION





*Population of Municipalities in Excess of 5,000 Wholly or in Large Part within the Limits of the Concord River Watershed in Massachusetts.*

	1900.	1905.	1910.	1915.	1920.	1925.	1930.	1935.
Billerica . . . . .	2,775	2,843	2,789	3,246	3,646	4,913	5,880	6,650
Chelmsford . . . . .	3,984	4,254	5,010	5,182	5,682	6,573	7,022	7,595
Concord . . . . .	5,652	5,421	6,421	6,681	6,461	7,056	7,477	7,723
Framingham . . . . .	11,302	11,548	12,948	15,860	17,033	21,078	22,210	22,651
Hudson . . . . .	5,454	6,217	6,743	6,758	7,607	8,130	8,469	8,495
Maynard . . . . .	3,142	5,811	6,390	6,770	7,086	7,857	7,156	7,107
Marlborough . . . . .	13,609	14,073	14,579	15,250	15,028	16,236	15,587	15,781
Natick . . . . .	9,488	9,609	9,866	11,119	10,907	12,871	13,589	14,394
Westborough . . . . .	5,400	5,378	5,446	5,925	5,789	6,348	6,409	6,073
Totals . . . . .	60,806	65,154	70,192	76,791	79,239	91,062	93,799	96,469

In addition to the above municipalities a considerable portion of the city of Lowell drains into the Concord River near its mouth, but this city is referred to in the Merrimack River report. Small portions of the following towns with populations in excess of 5,000 are included in the watershed of the Concord River: Clinton, Grafton, Shrewsbury and Tewksbury. In addition, the following 21 towns with populations under 5,000 are included wholly or in part within this watershed: Acton, Ashland, Bedford, Berlin, Bolton, Boxborough, Boylston, Carlisle, Holliston, Hopkinton, Lincoln, Littleton, Northborough, Sherborn, Southborough, Stow, Sudbury, Upton, Wayland, Westford and Weston.

*Flow of Stream.*

No measurements of the flow of the Assabet River are available, but the flow of the Concord River at the Lawrence Street bridge in the city of Lowell has been computed for a number of years, and for the period 1901 through September 30, 1915, the results are published by the United States Geological Survey, Water Resources Branch. The gage and records are maintained by the Locks and Canals Company of Lowell.

Since December 16, 1936, the flow of this stream has been measured by the United States Geological Survey at a new first order station located 300 feet below the Rogers Street bridge.

### *Water Supplies.*

The towns of Acton, Bedford, Billerica, Grafton, Littleton, Shrewsbury and part of Upton and Westford are supplied with water from ground sources, while the towns of Clinton, Concord, Hudson, Marlborough, Maynard, Northborough and Westborough are supplied from surface water sources.

In the town of Chelmsford there are three districts supplied with water, the North Chelmsford Fire District, the Chelmsford Water District and the East Chelmsford Water District. The first two districts are supplied from tubular wells, while the last named obtains its water from the municipal supply of the city of Lowell. The towns of Berlin, Bolton, Boxborough, Boylston, Carlisle and Stow have no public water supplies.

None of the ground water supplies in this area are treated except that of Billerica, which is aerated and chlorinated. The surface water supplies of Marlborough, Clinton and Maynard are treated by chlorination, and that of the town of Northborough is treated by modified slow sand filtration for the removal of sediment, color and microscopic organisms. The supply of Westborough, which originates in a pond, filters through a dam which separates the pond from a filter basin, so called, from which water enters the distribution system, and it may be considered that this supply consists largely of filtered surface water.

Although a considerable portion of the populated section of the city of Lowell is within the watershed of the Concord River, the main source of water supply for this city is located on the north side of the Merrimack River outside of this watershed. An auxiliary source of water supply, however, is taken from tubular wells near River Meadow or Hales Brook, a tributary of the Concord River.

*Condition of Rivers.*

Samples have been collected for analyses, both by the Works Progress Administration and the Department of Public Health, from the Concord River, and by the Department of Public Health from its tributaries throughout much of their courses. The results of the analyses show that the condition of the Assabet River has changed but little during recent years. At none of the points examined in 1937 was the oxygen content of the water reduced sufficiently to cause a nuisance, but below Maynard the amount of dissolved oxygen as determined by the Department's chemists was only 25 per cent of saturation in the month of August. The average for the year for the dry months, June to November, inclusive, however, was 58.7 per cent of saturation. The biochemical oxygen demand of the water of this stream increases somewhat as the river passes Hudson and Maynard, the maximum average determination being 4.1 parts per million below Hudson. The river improves materially in passing to Maynard, and during the past year, while there was evidence of pollution, it is due to industrial wastes, the effect of which disappears before this stream reaches its mouth. The analyses of the samples of the Concord River show that except at its mouth in Lowell it is in reasonably satisfactory condition.

*Sewerage and Sewage Disposal.*

The sewage of Westborough and Hudson is treated by intermittent sand filtration, while the sewage from the town of Maynard is discharged to works consisting of Imhoff tanks and trickling filters. The sewage from West Concord is removed in the Concord sewerage system to sand filtration works draining into the Concord River.

The sewage from a portion of the Grafton State Hospital formerly discharged into the Assabet River, but in 1930 was diverted out of the watershed. The sewage from the Lyman School in Westborough is discharged into the Westborough sewerage system, while that from the Westborough State Hospital and the Massachusetts Reformatory at Concord is

treated by intermittent sand filtration works at each of these institutions. The industrial wastes produced at the Massachusetts Reformatory which were formerly discharged into the Assabet River were removed to the filter beds at this institution in 1930. It is probable that there is some overflow of sewage from the sewers of the town of Hudson at times of high ground water.

The town of Concord has a sewerage system which discharges on to sand filters located on low ground east of the Concord River about three quarters of a mile below the confluence of the Assabet and Sudbury rivers.

The only section of the town of Billerica having a sewerage system is the village of North Billerica, where the sewage is conveyed to a filtration area situated near the west bank of the river. This system has in the past been controlled by the Talbot Mills, but will probably be taken over by the town in the near future.

A considerable proportion of the sewage of the city of Lowell is discharged directly into the Concord River as it passes through that municipality. The matter of sewerage and sewage disposal in the valley of the Concord River was investigated by the Department of Public Health under the provisions of chapter 269 of the Acts of 1924, and a report was submitted as Senate Bill No. 123 of 1925. This report recommended the construction of a main sewer along the easterly side of the Concord River to an outlet into the Merrimack River.

#### *Sources of Pollution.*

There was considerable interest in improving the condition of the Assabet River in 1914, particularly on the part of certain residents in Concord, and, as a result of a petition, chapter 655 of the Acts of 1914 was adopted, which act was based on the Neponset River act referred to elsewhere in this report.

Practically all serious pollution of the river from domestic sewage has been prevented, and the only objectionable sources of pollution of this stream at the present time are the industrial wastes entering it from industries in the towns

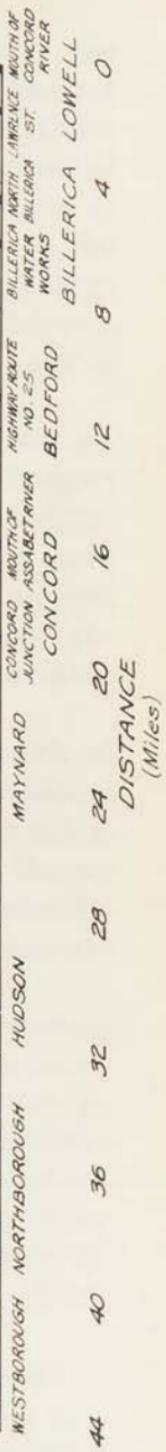
**CONCORD & ASSABET RIVERS**  
**BIOCHEMICAL OXYGEN DEMAND**  
 — Average of W.P.A. Composite Samples 1937  
 - - - Average of Dept. of Public Health Catch Samples,  
 (June - November 1937)

PARTS PER MILLION

CONCORD RIVER

ASSABET RIVER

JUNCTION OF ASSABET AND CONCORD RIVERS





of Hudson, Stow, Maynard and Acton, particularly the highly colored industrial wastes from Maynard. It has not appeared to be advisable to attempt to use the provisions of chapter 655 of the Acts of 1914 to prevent these industrial wastes from entering the stream, because of the opinion of the Attorney General of July 26, 1923, which was to the effect that discoloration of the water and an unpleasant appearance of its surface do not in themselves constitute a violation of an act similar to that relating to the Assabet River.

As the engineers of the Works Progress Administration have not completed their detailed surveys of the Assabet River, it has not been practicable to prepare a table showing the quantities of industrial wastes, but judging from the available information no further legislation to prevent pollution of this stream appears to be required unless objections are raised to the appearance of the stream because of industrial waste pollution.

The Concord River within the confines of the town of Concord receives little pollution other than the occasional overflow of sewage from the sewage pumping station. Within the limits of the town of Chelmsford, Beaver Brook, a tributary of River Meadow Brook, is polluted by sewage from buildings in the vicinity of Massachusetts Highway Route 4.

Large quantities of domestic sewage and industrial wastes are discharged into the Concord River and its tributary, Hales Brook, in the city of Lowell, including sewage with industrial wastes entering the stream from numerous outlets of the city sewers. These discharges create objectionable conditions in most of that portion of the river below Lawrence Street in Lowell. The sewer outlets in the Concord River in Lowell are referred to in the Merrimack River section of this report.

While the Concord River within the limits of the city of Lowell is in an objectionable condition, the remaining portion of the stream is not objectionable, and no legislation appears to be necessary so far as the Concord River is concerned other than that relating to the Merrimack River, referred to elsewhere in this report.

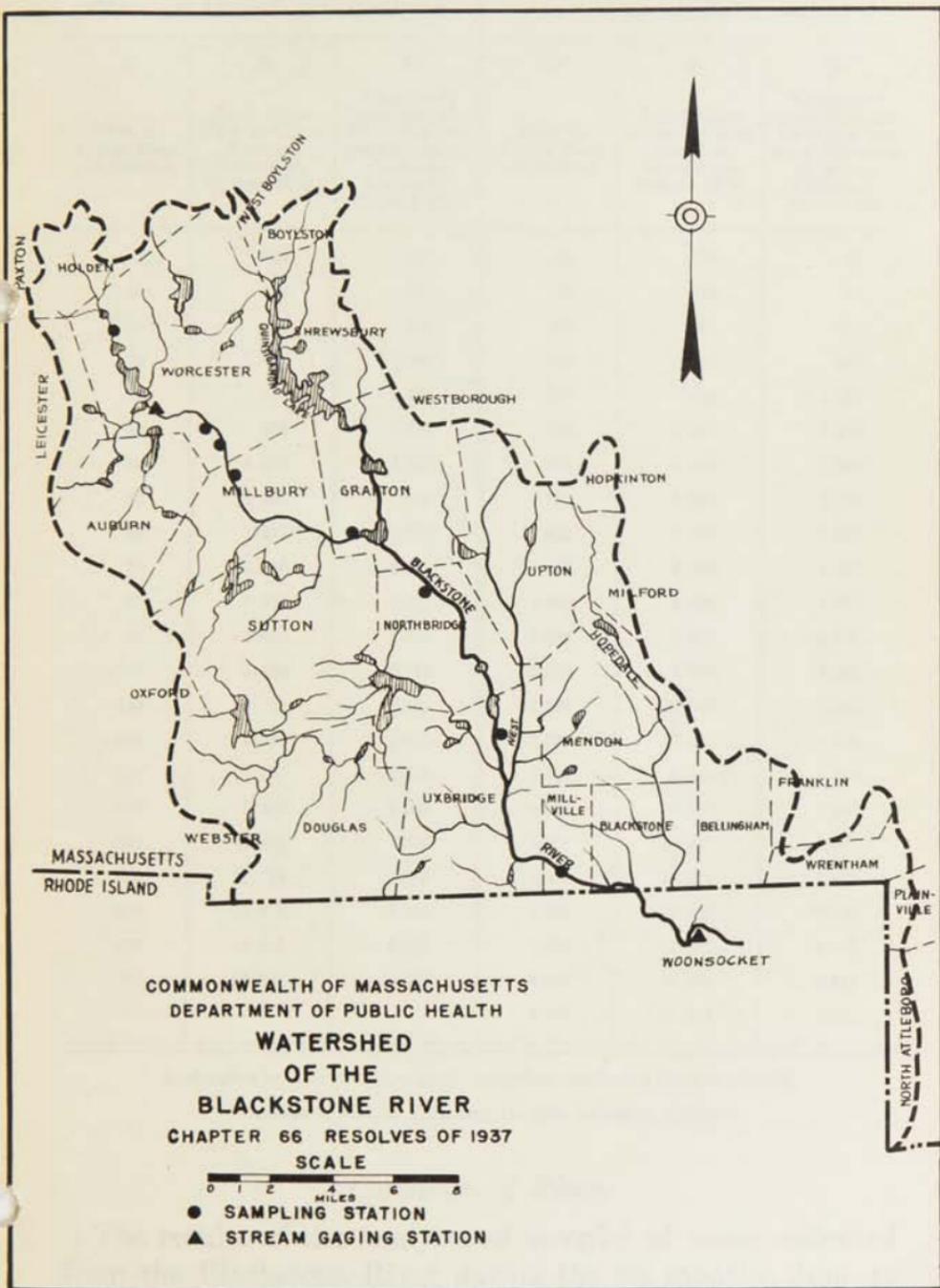
## BLACKSTONE RIVER.

A discussion of the Blackstone River was included in the report of the Department of Public Health to the Legislature of 1937 in Senate Document No. 50 of that year, and, as the engineers of the Works Progress Administration have since made no further examination of this stream, no considerable information relative to this situation is contained herein. The report of the engineers of the Works Progress Administration on this matter was published in September, 1936.

The Department has made the usual examinations of the river, but no estimates in addition to those presented in Senate, No. 50 as to the quantity of industrial wastes have been made.

*Flow of Stream.*

Gaging stations are maintained on the Blackstone River at Worcester and at Woonsocket, Rhode Island, by the United States Geological Survey. The former station was established in 1923 and the latter in 1929. An examination of the records of these stations shows that 50 per cent of the time from October 1, 1928, to September 30, 1935, the flow of the river at Worcester has been less than 25.5 cubic feet per second, and from October 1, 1929, to September 30, 1935, at Woonsocket, Rhode Island, less than 430 cubic feet per second. The following table shows the number of days that the flow was less than the specified amounts, also equivalent flows in cubic feet per second per square mile of drainage area:



COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC HEALTH  
**WATERSHED**  
**OF THE**  
**BLACKSTONE RIVER**  
 CHAPTER 66 RESOLVES OF 1937  
 SCALE

- 0 1 2 4 6 8  
 MILES
- SAMPLING STATION
  - ▲ STREAM GAGING STATION



AT WORCESTER. (DRAINAGE AREA = 31.3 SQUARE MILES.)			AT WOONSOCKET, R. I. <sup>1</sup> (DRAINAGE AREA = 416 SQUARE MILES.)		
(1)	(2)	(3)	(4)	(5)	(6)
Flow in Cubic Feet per Second.	Equivalent Flow in Cubic Feet per Second per Square Mile.	Number of Days that the Flow was less than Amounts shown in Columns (1) and (2).	Flow in Cubic Feet per Second.	Equivalent Flow in Cubic Feet per Second per Square Mile.	Number of Days that the Flow was less than Amounts shown in Columns (4) and (5).
5	.160	114	50	.120	14
10	.319	520	100	.240	92
15	.479	843	200	.481	515
20	.639	1,089	300	.721	880
25	.799	1,269	400	.962	1,150
30	.958	1,476	500	1.202	1,328
40	1.278	1,753	600	1.442	1,546
50	1.597	1,934	700	1.683	1,732
60	1.917	2,071	800	1.923	1,841
70	2.236	2,161	900	2.163	1,907
80	2.556	2,217	1,000	2.404	1,988
90	2.875	2,271	1,500	3.606	2,182
100	3.195	2,318	2,000	4.808	2,292
150	4.792	2,451	2,500	6.010	2,346
200	6.390	2,503	3,000	7.212	2,375
250	7.987	2,525	3,500	8.413	2,384
300	9.584	2,539	4,000	9.615	2,397
350	11.182	2,545	4,500	10.817	2,404
400	12.779	2,550	5,000	12.019	2,405
500	15.974	2,552	6,000	14.423	2,409
600	19.169	2,554	7,000	16.827	2,411
700	22.364	2,556	8,000	19.231	2,411
			9,000	21.635	2,412

Last figure in Columns (3) and (6) indicates number of days in records.

<sup>1</sup> October 1, 1928, to February 21, 1929, inclusive, omitted.

### *Condition of River.*

The results of the analyses of samples of water collected from the Blackstone River during the six months, June to November, inclusive, in 1937, still show evidence of serious pollution in that branch known as Kettle Brook, below Cherry Valley in Leicester and Worcester, where, judging

from the analyses, a considerable quantity of industrial waste and some sewage are discharged into the stream. The river above the sewage treatment works of the city of Worcester has shown a slight improvement over the conditions found in 1936, and samples taken from a point below the Worcester sewage treatment works also show an improvement over the last two years, though this stream still contains an excessive amount of iron which makes it offensive in appearance. The biochemical oxygen demand tests show a slight increase in pollution as the stream passes through Millbury. At Northbridge and Uxbridge a further improvement over the conditions found in 1936 was shown by the analyses, while at its mouth in Millville a marked improvement in the condition of the river was shown. The sewage treatment works at Worcester have been in normal operation during the year, and the final effluent has been generally of satisfactory quality.

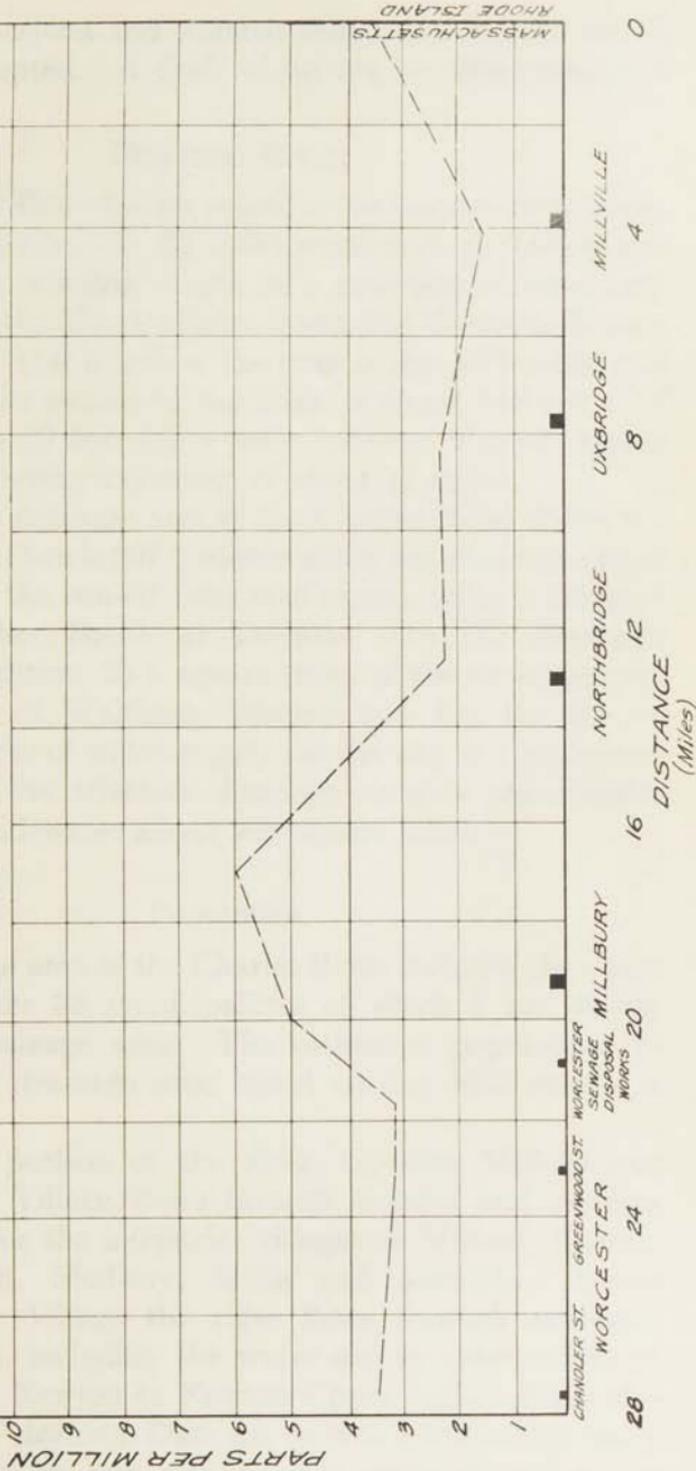
The Blackstone River continues to be one of the most seriously polluted streams in the State, due very largely to the discharge of certain industrial wastes and to domestic sewage, particularly from the towns of Millbury and Uxbridge.

In 1919, through the efforts of citizens and members of the Legislature from the towns in the lower portion of the course of this stream in Massachusetts, a special act was passed directing the city of Worcester to spend a considerable amount of money during a specified time in the construction of sewage treatment works. The city completed the construction of these works in accordance with this act, and placed these works in operation in 1925. While this drastic legislation has been successful in reducing the pollution of this stream by the sewage of the city of Worcester, complaint is made from time to time with particular reference to the pollution by industrial wastes from the Cherry Valley section of Leicester and Worcester, and there is interest in the further relief of the pollution, particularly by wastes containing large quantities of iron which are discharged into the stream in Worcester. If this stream is to be improved, legislation similar to that relative to the

# BLACKSTONE RIVER

## BIOCHEMICAL OXYGEN DEMAND

--- Average of Dept. of Public Health  
Catch Samples (June - November 1937)





Neponset, Aberjona and Assabet rivers and Alewife Brook should be adopted. A draft of an act for this purpose is appended.

#### CHARLES RIVER.

The Charles River has its source in the town of Hopkinton, which is approximately 25 miles southwest of Boston and follows a very winding course in a generally northeasterly direction into the Charles River Basin and thence to Boston Harbor. The total length of the river is about 72 miles, and the fall from its source to the basin is about 346 feet. Of this fall, some 76 feet takes place between Newton Upper Falls and the basin, a distance of about 11 miles.

The natural drainage area of the Charles River above the Charles River Dam is 297.9 square miles, but about one third of the flow or the run-off from 66.2 square miles is diverted through Mother Brook at Dedham into the Neponset River. In addition, 23.6 square miles of the drainage area in the towns of Waltham, Weston and Lincoln are set aside as a source of water supply for the city of Cambridge, thus making the effective drainage area of the Charles River above tidewater about 208 square miles.

#### *Population.*

The drainage area of the Charles River includes the whole or part of some 33 municipalities of which 8 are wholly within the drainage area. The estimated population included in the drainage area based on the 1935 census is 451,314.

The upper portion of the river, between Milford and Charles River Village, flows through wooded and meadow lands except for the industrial villages in Milford, Bellingham, Franklin, Medway, Millis and Medfield. Below Charles River Village the river flows through extensive meadow lands, including the water supply reservations of Brookline and Newton to Newton Upper Falls. From this point to the Watertown Dam the river is bordered by many industrial concerns and consists of a series of mill ponds formed by some ten dams. The Charles River Basin extends

from the Watertown Dam to the Charles River Dam at Boston, and has been extensively developed for recreational purposes.

*Flow of Stream.*

The flow of the Charles River during the summer months is greatly reduced because of the diversion through Mother Brook, the diversion for the water supplies of Brookline, Cambridge, Dedham, Needham, Newton, Waltham and Wellesley, and by infiltration into sewerage systems. An investigation by the Department of Public Health in 1931 relative to flow conditions in the Charles River shows that, during a dry year like that of 1930, the net yield of the river at Waltham was as low as 7.1 cubic feet per second, and at Watertown Dam, 9.5 cubic feet per second. Records of the flow of the Charles River at Waltham are available and published by the United States Geological Survey from October, 1931, to September, 1935. An examination of these records for the climatological years October 1, 1931, to September 30, 1935, shows that the flow at Waltham during this period was less than 175 cubic feet per second for over 50 per cent of the time. The following table shows the number of days that the flow was less than the specified amounts, also the equivalent flows in cubic feet per second per square mile of drainage area:

*Flow of the Charles River at Waltham.*

(1) Number of Days that the Flow was less than Amounts shown in Columns (2) and (3).	(2) Flow in Cubic Feet per Second.	(3) Equivalent Flow in Cubic Feet per Second per Square Mile. <sup>1</sup>
44	5	.032
74	10	.063
99	20	.126
158	30	.190
251	40	.253
336	50	.317
498	100	.632
670	150	.948
789	200	1.264
873	250	1.580
986	300	1.896
1,070	350	2.212
1,099	400	2.529
1,145	450	2.845
1,188	500	3.161
1,274	600	3.793
1,314	700	4.425
1,356	800	5.057
1,392	900	5.689
1,433	1,000	6.321
1,442	1,100	6.953
1,448	1,200	7.585
1,457	1,300	8.217
1,460	1,400	8.850
1,461 <sup>2</sup>	1,500	9.482

<sup>1</sup> On basis of effective drainage area of 158.2 square miles, made up as follows:

	Square Miles.
Natural drainage area	248.0
Less one-third of the drainage area of the Charles River above Mother Brook	66.2
Less drainage area tributary to Cambridge water supply	23.6
	<u>89.8</u>
Total effective drainage area equal	158.2

<sup>2</sup> Total number of days in record.

*Water Supplies.*

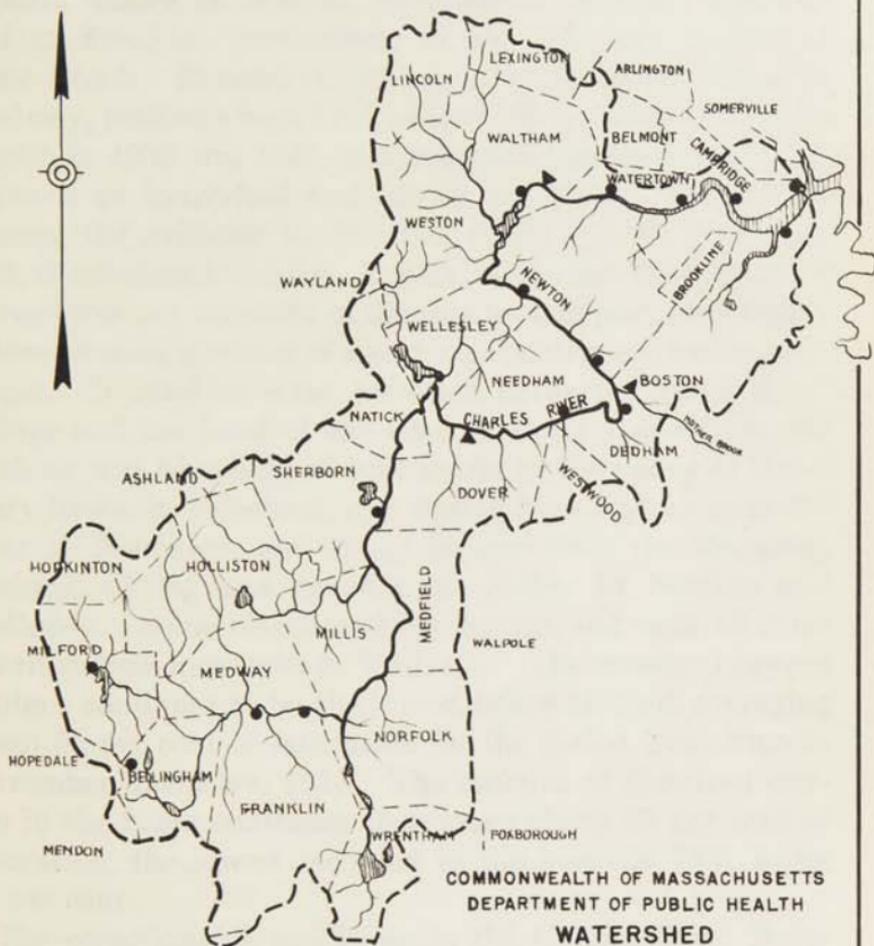
All of the municipalities included wholly or in part in the drainage area are provided with public water supplies with the exception of the towns of Mendon, Norfolk, Sherborn, Bellingham and Dover. The State Prison Colony in Norfolk and the Pondville Hospital, which contain a considerable percentage of the population of the town of Norfolk, have ground water supplies. A portion of the town of Bellingham is supplied from the waterworks of the city of Woonsocket, Rhode Island, while the town of Dover has a ground water supply which serves certain public buildings in the village. Arlington, Belmont, Boston, Lexington, Somerville and Watertown are included in the Metropolitan Water District. Cambridge, Hopedale, Milford and Lincoln are provided with surface water supplies which, with the exception of Lincoln, are subject to filtration and chlorination.

The remaining municipalities in the watershed are supplied from ground water sources. The ground water supplies of Ashland, Dedham, Hopkinton, Medfield, Millis, Natick, Walpole, Waltham, Weston, Westford and Wrentham, as well as the supply at the Wrentham State School, receive no treatment. The ground water supplies of Franklin Holliston, Medway, Needham and Newton are chlorinated, and the latter two have works for corrosive correction, as does that of the town of Wellesley. Brookline has works for the removal of iron and manganese.

Newton and Brookline and the Dedham Water Company are limited by existing legislation in the amount of water they may take from their sources of supply adjacent to the Charles River, and this has necessitated the purchasing of water from the Metropolitan Water District at times by Newton and Brookline, and the developing by the Dedham Water Company of a source in the town of Westwood.

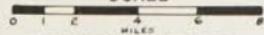
*Condition of River.*

No samples have been collected from the Charles River by the engineers of the Works Progress Administration, but



COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC HEALTH  
WATERSHED  
OF THE  
CHARLES RIVER

CHAPTER 66 RESOLVES OF 1937  
SCALE



- SAMPLING STATION
- ▲ STREAM GAGING STATION



the Department of Public Health has collected samples at various points along the course of the river for many years. The results of the analyses show that the river above the Moody Street dam in Waltham has changed but little during recent years. It is polluted by the discharge of industrial wastes at Milford, Bellingham, Norfolk, Medway and at Franklin, particularly in the tributary known as Mine Brook. Because of pollution by industrial wastes in Medway, petitions were filed with the Department of Public Health in 1936 and 1937, and litigation has been carried on between an individual and one of the mills. The master hearing the evidence in this case found for the defendant mill, this finding being due, in part, to the fact that domestic sewage was not involved in the case and, in part, that highly colored wastes were not of a particular detriment to the petitioner. It receives some pollution between Charles River Village and the head of the Charles River Basin from the washing and bleaching of knit goods in the valley of Rosemary Brook in Needham, dye wastes from a plant near the river in Needham, and waste liquors from the stripping, washing, dyeing and treating of shoddy at Newton and Wellesley. Some bleach and dye liquors and some oil enter the river from industries in Waltham. The dissolved oxygen content continues to be the lowest below Milford, averaging about 50 per cent of saturation for the period from June to November, inclusive, 1937. The amount of dissolved oxygen in the basin continues to average about 85 per cent of saturation, the lowest recorded in the basin in 1937 being 60 per cent.

The objectionable conditions in the Charles River Basin are due to sewage and storm water overflowing directly into the basin from the sewers at times of heavy run-off. In view of the extensive development of the basin for recreational purposes, it is important that the quantity of mingled sewage and storm water entering the basin be reduced.

#### *Investigations of the River.*

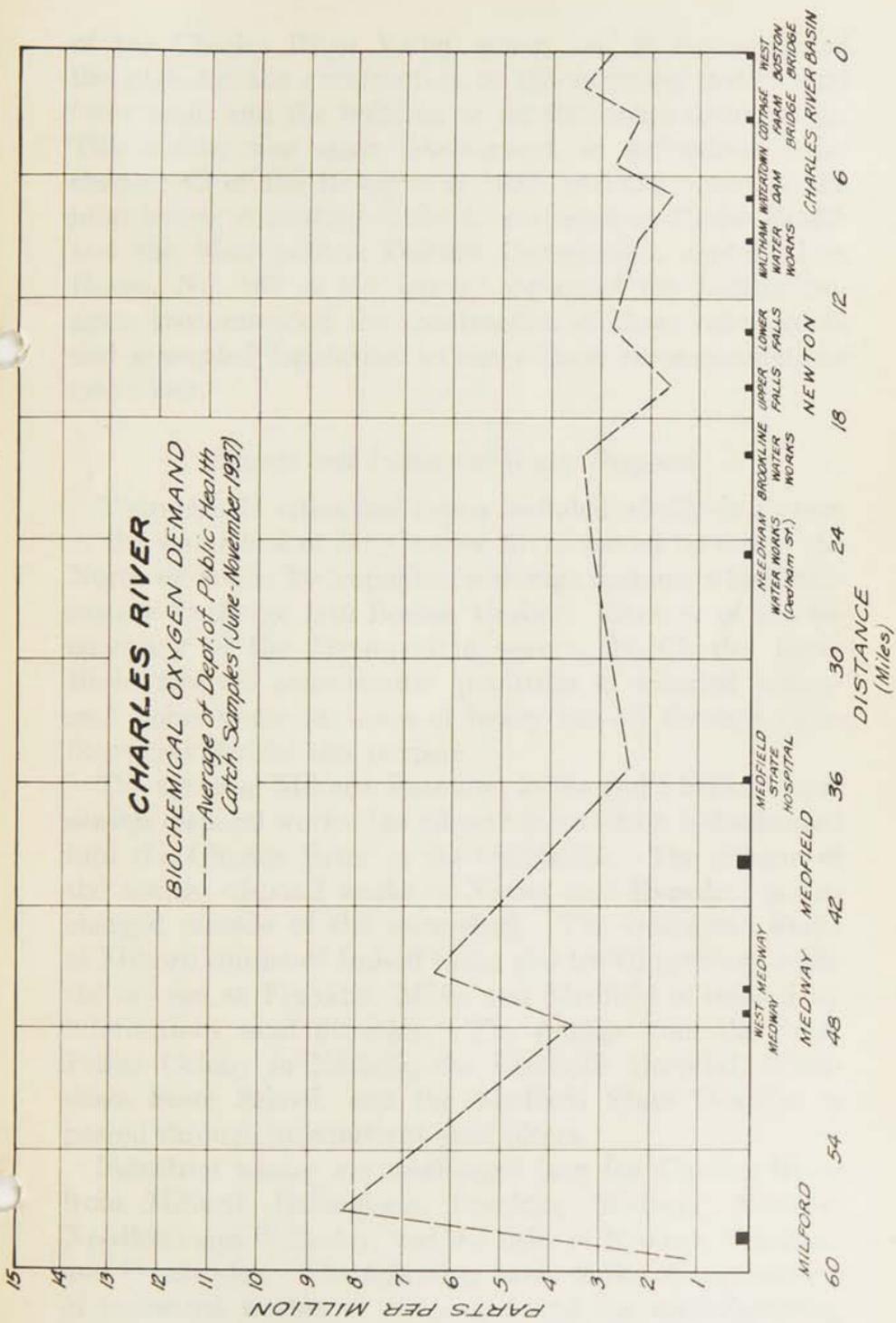
The Charles River has been the subject of various investigations by the Department of Public Health in past years.

As early as 1906, under chapter 158 of the acts of that year, the then State Board of Health was empowered to adopt rules and regulations to prevent the pollution of the Charles River within the Metropolitan Park District. In 1920 this act was repealed and the Department of Public Health was authorized, under chapter 541 of that year, to make reasonable rules to protect the Charles River from sewage and waste pollution. This act is now incorporated as section 175 of chapter 111 of the General Laws.

In 1931 the Department investigated relative to conditions caused by low flows in the Charles River between Charles River Village and the basin. The Department in its report, published as House No. 158 of 1932, recommended that the Metropolitan District Commission be given the necessary authority to purchase the water rights controlling the flow of the river at Waltham. The water rights of the Boston Manufacturing Company were acquired in 1937 by the Metropolitan District Commission, and the flow is now regulated so far as practicable.

In 1931 the Department of Public Health and the Metropolitan District Commission, acting as a joint board under the provisions of chapter 40 of the Resolves of 1931, investigated the condition of the Charles River Basin as affected by the overflow of sewage from the Charles River Valley sewer of the South Metropolitan Sewerage District. The joint board in its report to the Legislature stressed the importance of protecting the basin from pollution in view of its development and use for recreational purposes, and recommended relief for the Charles River Valley sewer by extending the high-level South Metropolitan sewer to Newton and constructing a pumping station and force main in the lower Charles River Valley for pumping sewage from the Charles River Valley sewer into the high-level Metropolitan sewer. In House Document No. 1600 of 1937, which is the report of the Board of Engineers to investigate the discharge of sewage into Boston Harbor and its tributaries, it was pointed out that the extension of the high-level South Metropolitan sewer through much of the city of Newton did not relieve conditions in the lower part

**CHARLES RIVER**  
**BIOCHEMICAL OXYGEN DEMAND**  
 --- Average of Dept. of Public Health  
 Catch Samples (June-November 1937)



MILFORD 60  
 54  
 48  
 42  
 36  
 30  
 24  
 18  
 12  
 6  
 0

WEST MEDWAY  
 MEDWAY  
 MEDFIELD  
 MEDFIELD  
 WEST MEDWAY  
 STATE HOSPITAL  
 NEEDHAM WATER WORKS (Needham St.)  
 BROOKLINE WATER WORKS  
 UPPER FALLS  
 LOWER FALLS  
 WALTHAM WATER WORKS  
 WALTHAM WATERTOWN DAM  
 CHARLES RIVER BASIN



of the Charles River Valley sewer, and it recommended the plan for the construction of the pumping station and force main and the building of an additional trunk sewer. This matter was again investigated, as authorized under chapter 42 of the Resolves of 1937, and the report of the joint board, consisting of the Department of Public Health and the Metropolitan District Commission, contained in House, No. 187 of the current session of the Legislature, again recommended the construction of these relief works and appended legislation to carry these recommendations into effect.

### *Sewage and Industrial Waste Disposal.*

There are 14 cities and towns included wholly or in part in the watershed of the Charles River served by either the North or South Metropolitan sewerage systems which ultimately discharge into Boston Harbor. Because of the inadequacy of the Metropolitan sewers, the Charles River Basin receives considerable quantities of mingled sewage and storm water at times of heavy run-off through overflows provided for this purpose.

The towns of Milford, Franklin, Millis and Medfield have sewage disposal works, the effluent from which is discharged into the Charles River or its tributaries. The effluent of the sewage disposal works of Natick and Hopedale is discharged outside of the watershed. The treatment works at Milford consist of Imhoff tanks and trickling filters, while the sewage at Franklin, Millis and Medfield is treated by intermittent sand filtration. The sewage from the State Prison Colony in Norfolk, the Pondville Hospital, Wrentham State School, and the Medfield State Hospital is passed through intermittent sand filters.

Industrial wastes are discharged into the Charles River from Milford, Bellingham, Franklin, Medway, Norfolk, Needham and Wellesley, and the cities of Newton, Waltham and Cambridge. The following table shows the quantities of industrial wastes so discharged and the manufacturing processes from which they result:

*Industrial Wastes Discharged into Charles River.*

CITY OR TOWN.	Kind of Manufactured Product or Process.	Quantity of Industrial Waste (Gallons per Day).	Remarks.
Hopkinton . . .	None in watershed . . . . .	None	- -
Milford . . .	Rubber, straw and felt hats, hat bodies, shoes, tools, elastic webbing.	398,000	- -
Hopedale . . .	None in watershed . . . . .	None	- -
Mendon . . .	None in watershed . . . . .	None	- -
Bellingham . . .	Wool shoddy . . . . .	67,000	- -
Franklin . . .	Wool scouring, yarns, woolen cloth, rubber goods, knitted goods, felt goods.	800,500	- -
Holliston . . .	Wax paper . . . . .	9,000	- -
Medway . . .	Woolen shoddy, laundry . . . . .	115,000	- -
Sherborn . . .	None in watershed . . . . .	None	- -
Millis . . .	Roofing and building materials . . . . .	Negligible	Offensive wastes to sewer.
Wrentham . . .	None in watershed . . . . .	None	- -
Norfolk . . .	Woolen shoddy . . . . .	750,000	- -
Walpole . . .	None in watershed . . . . .	None	- -
Medfield . . .	Building bricks . . . . .	10,000	- -
Dover . . .	None in watershed . . . . .	None	- -
Westwood . . .	None in watershed . . . . .	None	- -
Natick . . .	None in watershed . . . . .	None	- -
Wellesley . . .	Woolen cloth . . . . .	68,500	- -
Newton . . .	Rubber goods, paper, carbonizing, knit goods.	45,000	Offensive wastes to sewers.
Needham . . .	Rubber goods, toys, cloth finishing and dyeing, and knit goods.	60,600	- -
Boston . . .	- - - - -	None	Offensive wastes.
Brookline . . .	None in watershed . . . . .	None	- -
Lincoln . . .	None in watershed . . . . .	None	- -
Weston . . .	None in watershed . . . . .	None	- -
Lexington . . .	None in watershed . . . . .	None	- -
Waltham . . .	Paper, batteries, mica products, watches, sandpaper, bleaching and dyeing.	623,000	Offensive wastes to sewers.
Belmont . . .	None in watershed . . . . .	None	- -
Arlington . . .	None in watershed . . . . .	None	- -
Somerville . . .	None in watershed . . . . .	None	- -
Watertown . . .	Rubber goods . . . . .	26,000	Offensive wastes to sewer.
Cambridge . . .	Rubber hose . . . . .	200,000	- -

Increase in quantities from Medway and Wellesley over those published in House, No. 1600 of 1937 is due to more recent data and changes in industrial conditions. Changes in quantities from Newton and Needham are due to correction in location of a manufacturing concern.

Under section 175 of chapter 111 of the General Laws, the Department of Public Health is authorized to make reasonable orders relative to the entrance or discharge of sewage, waste, refuse or other substances into the Charles River. This act, however, is not as stringent as the mandatory powers given to the Department over some of the other streams of the Commonwealth, but no further legislation appears to be required at present other than that necessary to provide more adequate sewers in the vicinity of the Charles River Basin.

#### CONNECTICUT RIVER.

The provisions of chapter 66 of the Resolves of 1937, relative to the Connecticut River, are somewhat different than those relative to the other streams referred to in that the resolve provides that the Department shall, in co-operation with the Works Progress Administration, assemble data pertaining to the pollution of the Connecticut River, while in the case of the other streams the resolve requires that the Department investigate, in co-operation with the Works Progress Administration, the sanitary condition of certain streams.

A limited amount of work was carried on in connection with the investigation of the Connecticut River by the Works Progress Administration in 1936, and an office was established in Springfield for this purpose, but much of the work of that office related to the Millers, Deerfield, Westfield and Chicopee rivers rather than to the Connecticut River. Most of the work of the engineers in the Springfield office of the Works Progress Administration since the approval of the project on August 13, 1937, has related to the Connecticut River.

From its source in the Connecticut lakes in northern New Hampshire, the Connecticut River flows southerly along the boundary line between New Hampshire and Vermont, thence across Massachusetts and Connecticut a distance of 345 miles into Long Island Sound. Of this total length about 66 miles are in Massachusetts.

The drainage area of the Connecticut River lies, in part, in Canada, in the States of New Hampshire, Vermont,

Massachusetts and Connecticut, and has a total area at its mouth of 11,243.3 square miles, made up as follows:

	Square Miles.
Canada . . . . .	114.6
New Hampshire . . . . .	3,040.6
Vermont . . . . .	3,925.5
Massachusetts . . . . .	2,726.2
Connecticut . . . . .	1,436.4
Total . . . . .	11,243.3

The most important tributary streams entering the Connecticut River in Massachusetts are the Millers River, Deerfield River, Chicopee River, which is formed by the Quaboag, Ware and Swift rivers, and the Westfield River.

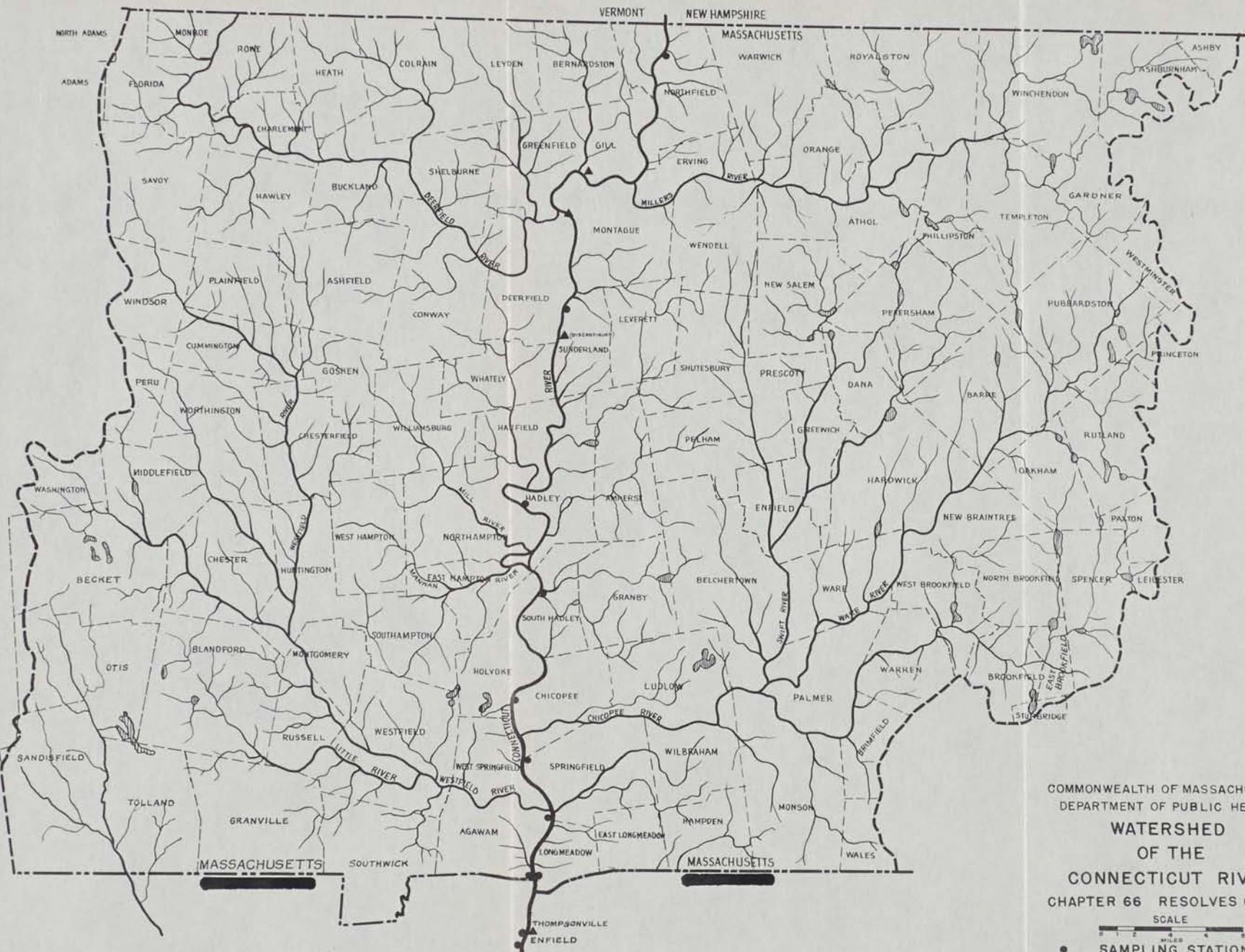
The total fall of the Connecticut River from the Connecticut lakes to Long Island is about 1,900 feet, and the fall within the limits of Massachusetts is about 176 feet.

### *Population.*

The drainage area of the Connecticut River in Massachusetts includes wholly or in part 108 municipalities, but in this report consideration is given only to those municipalities which border the stream, and to the town of Amherst, from which sewage is discharged directly into the Connecticut River. The population figures of these 20 municipalities in census years since 1900 are shown in the following table:

*Population of Municipalities Bordering Connecticut River.*

	1900.	1905.	1910.	1915.	1920.	1925.	1930.	1935.
Northfield . . . . .	1,966	2,017	1,642	1,782	1,775	1,821	1,888	1,950
Gill . . . . .	1,015	1,023	942	951	879	918	983	995
Erving . . . . .	973	1,094	1,148	1,168	1,295	1,334	1,263	1,283
Montague . . . . .	6,150	7,015	6,866	7,925	7,675	7,973	8,081	7,967
Greenfield . . . . .	7,927	9,156	10,427	12,618	15,462	15,246	15,500	15,903
Deerfield . . . . .	1,969	2,112	2,209	2,739	2,803	2,968	2,882	2,963
Sunderland . . . . .	771	910	1,047	1,278	1,289	1,290	1,159	1,182
Whately . . . . .	769	822	846	1,118	1,234	1,229	1,139	1,133
Hatfield . . . . .	1,500	1,779	1,986	2,630	2,651	2,702	2,476	2,433
Hadley . . . . .	1,789	1,895	1,999	2,666	2,784	2,888	2,682	2,711



COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC HEALTH  
**WATERSHED**  
 OF THE  
**CONNECTICUT RIVER**  
 CHAPTER 66 RESOLVES OF 1937



- SAMPLING STATION
- ▲ STREAM GAGING STATION



*Population of Municipalities Bordering Connecticut River — Concluded.*

	1900.	1905.	1910.	1915.	1920.	1925.	1930.	1935.
Northampton	18,643	19,957	19,431	21,654	21,951	24,145	24,381	24,525
South Hadley	4,526	5,054	4,894	5,179	5,527	6,609	6,773	6,838
Easthampton	5,603	6,808	8,524	9,845	11,261	11,587	11,323	10,486
Holyoke	45,712	49,934	57,730	60,816	60,203	60,335	56,537	56,139
Chicopee	19,167	20,191	25,401	30,138	36,214	41,882	43,930	41,952
West Springfield	7,105	8,101	9,224	11,339	13,443	15,326	16,684	17,118
Springfield	62,059	73,540	88,926	102,971	129,614	142,065	149,900	149,642
Agawam	2,536	2,795	3,501	4,555	5,023	6,290	7,095	7,206
Longmeadow	811	964	1,084	1,782	2,618	3,333	4,437	5,105
Amherst	5,028	5,313	5,112	5,558	5,550	5,972	5,888	6,473
Totals	196,019	220,480	252,939	288,712	329,251	355,913	365,001	364,004

*Flow of Stream.*

Gaging stations for the flow of this river have been maintained for many years by the United States Geological Survey, the Turners Falls Company and the Holyoke Water Power Company. The stations and periods for which records are available and published by the United States Geological Survey are as follows:

Turners Falls, Mass., January, 1915, to September, 1935.

Montague, Mass., October, 1929, to September, 1935.

Sunderland, Mass., March, 1904, to September, 1932.

Thompsonville, Conn., July, 1928, to September, 1935.

The gaging station at Sunderland was discontinued in 1932 and replaced by a gage 8 miles upstream at Montague, Massachusetts. The average results for the Sunderland gage are considered sufficiently reliable for purposes of comparison with other gaging stations on the Connecticut River, and the records of the flow at Montague are now used as a continuance of the record at the discontinued Sunderland gage.

An examination of the records of flow for the climatological years from October 1, 1928, to September 30, 1935, inclusive, are shown in the following table:

*Flow of Connecticut River, Climatological Years, October 1, 1928, to September 30, 1935, Inclusive.*

(1)	AT TURNERS FALLS, (DRAINAGE AREA = 7,138 SQUARE MILES).		AT MONTAQUE, <sup>1</sup> (DRAINAGE AREA = 7,810 SQUARE MILES).		AT SUNDERLAND, <sup>2</sup> (DRAINAGE AREA = 8,000 SQUARE MILES).		AT THOMPSONVILLE, (DRAINAGE AREA = 9,637 SQUARE MILES).	
	(2) Equivalent Flow in Cubic Feet per Second per Square Mile.	(3) Number of Days that the Flow was less than Amounts shown in Columns (1) and (2).	(4) Equivalent Flow in Cubic Feet per Second per Square Mile.	(5) Number of Days that the Flow was less than Amounts shown in Columns (1) and (4).	(6) Equivalent Flow in Cubic Feet per Second per Square Mile.	(7) Number of Days that the Flow was less than Amounts shown in Columns (1) and (6).	(8) Equivalent Flow in Cubic Feet per Second per Square Mile.	(9) Number of Days that the Flow was less than Amounts shown in Columns (1) and (8).
800	0.112	47	0.102	5	0.100	0	0.083	0
1,000	0.141	55	0.128	10	0.125	0	0.104	0
2,000	0.280	147	0.255	59	0.250	17	0.208	16
3,000	0.420	382	0.383	161	0.375	103	0.311	85
4,000	0.560	636	0.510	330	0.500	240	0.415	216
5,000	0.700	923	0.638	516	0.625	418	0.519	397
7,500	1.051	1,507	0.957	1,012	0.937	761	0.778	880
10,000	1.410	1,791	1.276	1,380	1.250	942	1.038	1,368
15,000	2.101	2,066	1.913	1,705	1.875	1,126	1.557	1,833
20,000	2.802	2,217	2.551	1,869	2.500	1,232	2.075	2,052
25,000	3.502	2,291	3.189	1,938	3.125	1,275	2.594	2,181
30,000	4.203	2,367	3.827	2,017	3.750	1,334	3.113	2,243
40,000	5.604	2,458	5.102	2,094	5.000	1,404	4.151	2,373

50,000	7 005	2,508	6,378	2,136	6,250	1,430	5,189	2,438
60,000	8 406	2,532	7,653	2,155	7,500	1,450	6,226	2,480
70,000	9 807	2,547	8,929	2,172	8,750	1,458	7,294	2,520
80,000	11 207	2,551	10,204	2,182	10,000	1,469	8,392	2,537
90,000	12 608	2,553	11,480	2,184	11,250	1,461	9,339	2,545
100,000	14 010	2,555	12,756	2,186	-	-	10,377	2,549
110,000	15 410	2,556	14 031	2,188	-	-	11,415	2,551
120,000	-	-	15,306	2,189	-	-	12,453	2,552
130,000	-	-	16,582	2,190	-	-	13,490	2,553
140,000	-	-	17,857	2,191	-	-	14,528	2,555
150,000	-	-	-	-	-	-	15,566	2,555
160,000	-	-	-	-	-	-	16,604	2,556

Last figure in Columns (3), (5), (7) and (9) indicates total number of days in records.

† 1928-1929 omitted.

\* 1932-1933, 1933-1934 and 1934-1935 omitted.

A comparison of the above figures with the estimated total population along the Connecticut River in Massachusetts shows that for 50 per cent of the time there is a flow in this stream from the drainage area in Massachusetts above the Connecticut line in excess of 7.5 cubic feet per second for each 1,000 population, while the flow for the entire drainage area above the Connecticut line, 50 per cent of the time, is in excess of about 26.9 cubic feet per second per 1,000 population that is distributed along the main stream in Massachusetts.

### *Water Supplies.*

In the cities and towns bordering the Connecticut River in Massachusetts, Agawam, Longmeadow and Springfield are supplied with water from the surface sources of the latter municipality, and Amherst, Chicopee, Erving, Greenfield, Hadley, Hatfield, Holyoke, Montague, Northampton, Northfield, South Deerfield Water Supply District of Deerfield, South Hadley Fire District No. 1, Sunderland and West Springfield also are supplied, for the most part, with water from surface sources located above the flood level of the river.

The Deerfield Fire District in the town of Deerfield, the towns of Easthampton and Gill, Montague Village in the town of Montague, and South Hadley Fire District No. 2 are supplied, for the most part, from ground water sources. The town of Whately has no public water supply, but is supplied in part with water from two privately owned ground water supplies. At times the surface water supply of the town of Greenfield is supplemented with water taken from the ground, and the ground water supply of South Hadley Fire District No. 2 is supplemented with water from a surface supply after filtration.

The water supply of the city of Springfield and the water supplies of Greenfield and West Springfield are treated by slow sand filtration. A source of water supply formerly used by the Northfield Schools, Incorporated, in Northfield is available for emergency use at the Seminary and in the village of East Northfield after slow sand filtration. The

water supply of the city of Chicopee is treated by rapid sand filtration.

The water supplies of Chicopee, Greenfield, South Hadley Fire District No. 1, West Springfield, Northfield Schools, Incorporated, Hatfield and South Deerfield Fire District are chlorinated, but the latter only seasonally. Provisions also are made for chlorinating the water supply of Northampton.

#### *Condition of River.*

Engineers of the Works Progress Administration collected samples of the river at various stations in composite parts at half-hourly intervals during periods of from twelve to twenty-four hours on September 1, September 15, September 29 and October 19, 1937, and the results of some of the analyses of these samples are summarized in a diagram attached to this report. In addition, the diagram contains the summary information of the results of the analyses of catch samples collected at approximately the same points by representatives of this Department. The samples were collected at points above Northfield, at Sunderland, at Northampton above the entrance of the Mill River which drains Northampton, above Holyoke, below Holyoke, at the Chicopee-Springfield line, immediately below Springfield, at the Connecticut line and at Enfield in Connecticut. In addition, samples were collected from the various tributaries at numerous points. All except the samples collected by this Department were analyzed by chemists employed by the Works Progress Administration. At many of the stations samples were collected by means of a boat, and at the Connecticut State line the samples were collected on both sides of the river.

The analyses show that the condition of the river as it reaches Massachusetts is unobjectionable, but there is an increase in the putrescible organic matter as determined by the biochemical oxygen demand as the river reaches Sunderland. This demand decreases as the river passes to Northampton.

The resolve provides for an investigation of the sanitary condition of the Millers River in the vicinity of Northamp-

ton. It is assumed that the Mill River is referred to, as there is no Millers River in this city. The Mill River in Northampton is polluted by the sewage of Northampton and by industrial waste, and the effect of the pollution by the sewage of Northampton and Easthampton is noticeable in the analyses of samples from the Connecticut River taken at a point above Holyoke. The effect of the pollution from Holyoke is not particularly marked in the analyses, but the sewage discharging into the river from the cities of Springfield and Chicopee and the towns of West Springfield, Longmeadow and Agawam increases the evidence of pollution judging from the analyses of both the Works Progress Administration chemists and those of this Department. Tests for the presence of dissolved oxygen in the stream also show pollution as the river passes the city of Springfield, and there is a decrease in dissolved oxygen as the stream passes from a point below Springfield to the state line.

The analyses of samples of the Mill River below Northampton and of the Manhan River at its mouth below Easthampton show that these streams are two of the most polluted streams in the State.

The analyses of the water of the main stream do not indicate all of the objectionable conditions, as in many instances sewage matters are discharged on to the banks of the stream in such a way that local nuisances are created.

#### *Sewage and Industrial Wastes.*

During the past year the engineers of the Works Progress Administration project have carried on sanitary surveys for the purpose of determining the sources of domestic sewage pollution and the kind and amount of industrial wastes discharged into the river and into the sewers tributary to the river. A summary of the results of the industrial survey is shown in the following table:

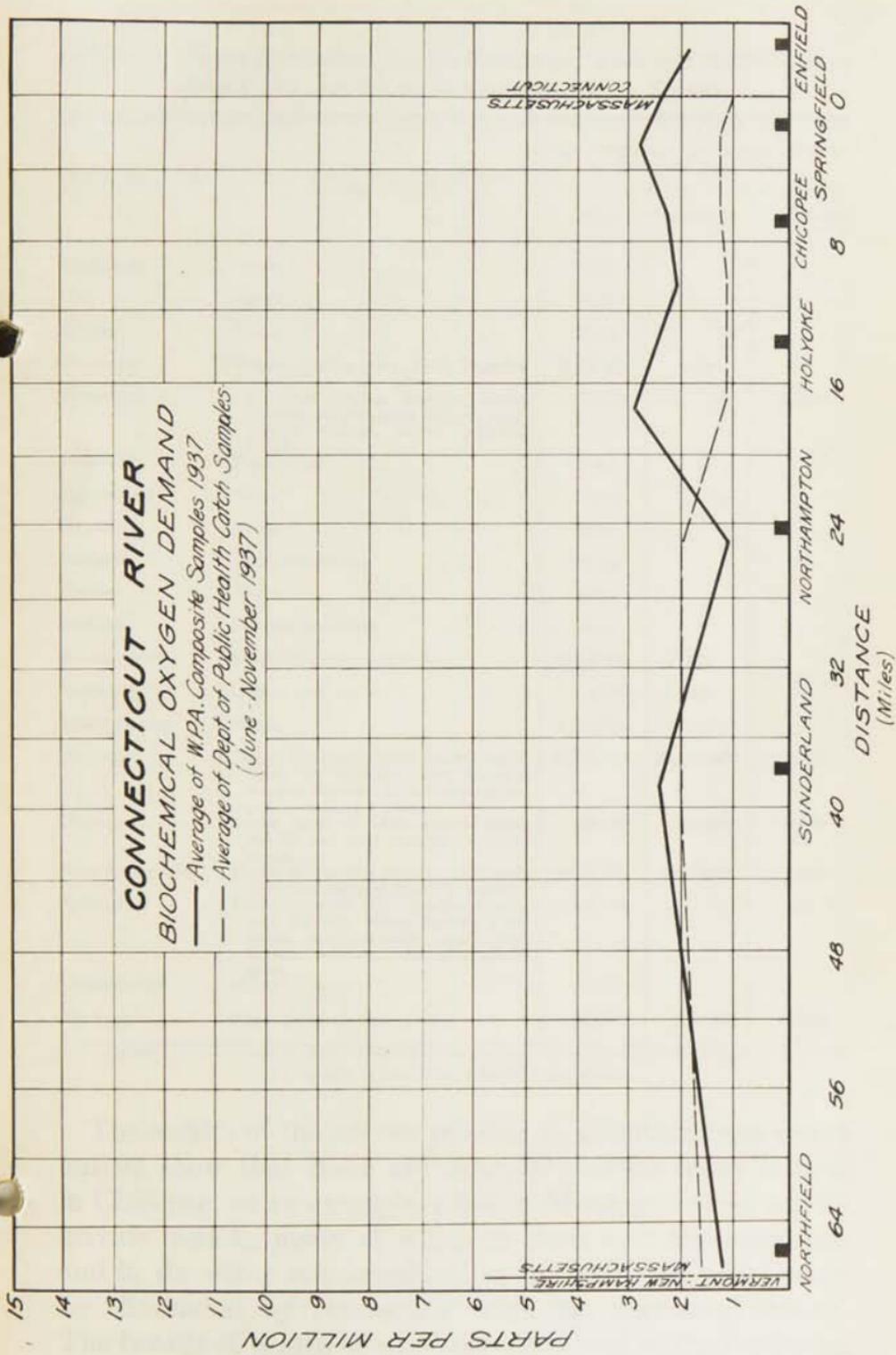
# CONNECTICUT RIVER

## BIOCHEMICAL OXYGEN DEMAND

— Average of W.P.A. Composite Samples 1937

- - - Average of Dept. of Public Health Catch Samples

(June - November 1937)





*Industrial Wastes Discharged into the Connecticut River and its Tributaries  
from Cities and Towns Bordering the Main Stream.*

CITY OR TOWN.	Kind of Manufactured Product, Process or Waste.	QUANTITY OF INDUSTRIAL WASTE (GALLONS PER DAY).		
		Total.	To Rivers.	To Sewers.
Northfield . . .	None . . . . .	None	—	—
Gill . . . . .	None . . . . .	None	—	—
Erving . . . . .	None . . . . .	None	—	—
Montague . . .	Paper, caustic soda, acid, laundry wastes.	3,870,400	All	—
Greenfield . . .	Cleansing, dyeing, laundry, metal plating, oakite, soda ash, oil, acid, bleach wastes, spent pickling liquor.	95,400	100	95,300
Deerfield . . .	Fertilizers . . . . .	None	—	—
Sunderland . . .	None . . . . .	None	—	—
Whately . . . . .	None . . . . .	None	—	—
Hatfield . . . . .	Light machinery . . . . .	None	—	—
Hadley . . . . .	None . . . . .	None	—	—
Amherst . . . . .	Leather novelties . . . . .	None	—	—
Northampton . . .	Sulphite paper mill waste . . . . .	2,750,000	All	—
Easthampton . . .	Cotton and rayon . . . . .	9,200	All	—
South Hadley . . .	Paper . . . . .	2,402,000	All	—
Holyoke . . . . .	Paper, de-inking waste, caustic soda, acid, dry cleaning and laundry wastes, worsted, cotton and rayon, paper coating wastes.	39,809,000	39,801,000 <sup>1</sup>	8,000
Chicopee . . . . .	Boiler blow off, dye, caustic soda, oakite and acid wastes, brewery, soaps.	195,000	130,000	65,000
West Springfield . . .	Paper, oil burners, heavy machinery, dry cleaning and laundry wastes.	2,088,000	2,087,000	1,000
Springfield . . . . .	Boiler blow off, dry cleaning, dyeing and laundry waste, plating solu- tions, acid, caustic, soap and bleach wastes, oils, chemicals, salts.	1,780,000	—	All
Longmeadow . . . . .	None . . . . .	None	—	—
Agawam . . . . .	Paper, woolen, dyes, soaps . . . . .	892,000	882,000	10,000

<sup>1</sup> Consists of much inoffensive rinse waters.

The results of the survey relating to pollution from sewer outlets show that there are some 90 private sewer outlets in Chicopee, as an example, while in Montague there are 28 private outlets, many of which in these two municipalities and in the other municipalities in the following table could be eliminated by connecting with the municipal sewers. The boards of health of all of the cities and towns bordering the Connecticut River are authorized to cause connections

to be made to public sewers when they are available. The provisions of the General Laws, chapter 83, section 11, and General Laws, chapter 111, section 127, as amended by chapter 339 of the Acts of 1937, authorize boards of health to make and enforce regulations relative to house drainage and connections to common sewers.

The following table is presented to show the number of municipal and private sewer outlets discharging into the main stream or its tributaries from the municipalities which border the Connecticut River:

*Sewer Outlets in Connecticut River.*

Town.	Total.	Municipal.	Private.
Northfield . . . . .	2	0	2
Gill . . . . .	15	0	15
Erving . . . . .	30	0	30
Montague . . . . .	34	6	28
Greenfield . . . . .	8	6	2
Deerfield . . . . .	3	1	2
Sunderland . . . . .	2	1	1
Whately . . . . .	3	0	3
Hatfield . . . . .	21	3	18
Hadley . . . . .	2	0	2
Amherst . . . . .	3	3	0
Northampton . . . . .	33	6	27
Easthampton . . . . .	114	8	106
South Hadley . . . . .	6	6	0
Holyoke . . . . .	15	15	- <sup>1</sup>
Chicopee . . . . .	121	32	89
West Springfield . . . . .	23	12	11
Springfield . . . . .	19	19 <sup>2</sup>	0
Longmeadow . . . . .	3	3	0
Agawam . . . . .	14	7	7

<sup>1</sup> Large number at mills discharging to canals and river.

<sup>2</sup> Seven submerged outlets.

*Investigation relative to Remedial Measures.*

In addition to the investigations and examinations referred to above, the engineers of the Works Progress Administration have made a survey for the purpose of determining the most suitable means of conveying the sewage from the Greenfield main sewer outlet to a suitable point for final disposal, and they have selected a site for necessary works at a point near the junction of the Green River and the Deerfield River, a short distance south of the present terminus of the main sewer of the town. They also have surveyed from a point near the outfall of the present Northampton sewerage system in a southerly direction to the Oxbow at Mount Tom, together with branch surveys from the Easthampton sewage filter beds to the Oxbow.

The sewage from Northampton is discharged into the Mill River through temporary outlets approved by the Department of Public Health only through 1915. The town of Easthampton has provided settling tanks, sludge beds and sand filters, but these works are inadequate, and objectionable conditions result below both municipalities. The survey shows that it is practicable to remove the sewage from these two municipalities to the Oxbow, where an area of land adequate for the construction of suitable treatment works is available. An examination of the site by engineers of this Department shows that it is a suitable one for the location of joint treatment works for these two municipalities.

The sanitary surveys in Holyoke have shown that there are 15 municipal outlets through which the sewage is discharged into the Connecticut River without treatment, and that no submerged outlets are provided. These outlets vary from 10 inches in diameter to 9 feet, 6 inches in diameter. The city of Holyoke does not appear to have made any investigations as to the collection of its sewage for disposal through sewage treatment works, but the engineers of the Works Progress Administration have made a preliminary study for the collection of the sewage at

treatment works in the southerly portion of the city. The collection of the sewage in Holyoke is a difficult problem, due to the large amount of industrial wastes and the fact that the canal system and the various tailraces at certain mills make it economically impossible to construct intercepting sewers by means of which the sewage can be removed by gravity. It appears possible, however, to construct a sewer to intercept the dry weather flow of sewage from all of the existing sewers, with the possible exception of the sewer at Smith's Ferry, and to carry the sewage in a southerly direction where it can be pumped to treatment works. In the collection of the sewage in this manner four or five pumping stations would be required, and it would be necessary to install pumps for pumping the sewage and industrial wastes from the paper mills. One location suggested by the Works Progress Administration engineers for treatment works is on municipal land in the industrial section of the city near Berkshire Street, and the other site is on a farm about a half mile north of the Holyoke-West Springfield line. The site near Berkshire Street is rather close to a considerable population, but if covered works are constructed this site may be a feasible one. The other site near the Holyoke-West Springfield boundary line is reasonably well isolated.

In the town of South Hadley, which is divided into two villages used largely for residential purposes, there are two separate sewerage systems in South Hadley Center and four municipal sewer outlets at South Hadley Falls. One of the latter outlets is submerged in the Connecticut River immediately above the Holyoke Dam. It has been impracticable thus far for the engineers of the Works Progress Administration to complete the preliminary survey of methods of collecting and disposing of the sewage from this town.

The topography makes a collecting system of sewers in South Hadley rather difficult of construction, but the information available would indicate that a pumping station could be constructed near the Stony Brook trunk sewer by means of which the dry weather flow could be pumped to an

extension of the Buttery Brook sewer, and an intercepting sewer could be constructed in South Hadley Falls between the Taylor Street sewer and the Smith Street sewer to treatment works to be located near the Chicopee city line. However, the area available for sewage disposal purposes is limited, but it might prove to be practicable to provide a plant for preliminary sedimentation in this region, which, if properly covered, would not cause objectionable conditions in the neighborhood.

Much of the pollution of the Connecticut River by domestic sewage in Massachusetts is from the city of Springfield, and the same is true of the Chicopee River in the vicinity of Indian Orchard. Most of the sewers of this city are combined sewers designed for the removal of domestic sewage and storm water, though in recent years some separation of storm water from the domestic sewage has been made. The engineers of the city have carried on much work of late with a view to the construction of intercepting sewers and pumping stations by means of which the dry weather flow of the existing sewers will be conveyed in a southerly direction, and thence ultimately pumped across the river to treatment works to be constructed on vacant land in Agawam near the mouth of the Westfield River where the sewage will be partially treated before being discharged. Consulting engineers have been retained and estimates of cost have been made. It is understood that the city is committed to start work on the construction of treatment works by 1942. It is understood that a contract has recently been awarded for the construction of a portion of the intercepting sewer, but the plan relative to disposal works has not as yet been completed. It has not seemed advisable for the engineers of the Works Progress Administration to carry on any surveys in this respect other than to confer with the local engineers from time to time. In connection with the further studies of this problem it would seem advisable that consideration be given to the treatment of sewage from West Springfield, Longmeadow and that of the thickly settled portions of Agawam at the works herein referred to.

Many years ago the city of Chicopee considered the possibility of sewage treatment works at a point near the Chicopee River between Chicopee Falls and the center of the city, but the works were not constructed. No recent study has been made in regard to the collection and treatment of the sewage of this city, although a preliminary study has been made by the engineers of the Works Progress Administration. The collection of the sewage of this city will require the construction of long intercepting sewers, along both the Chicopee and the Connecticut rivers. The pressing problem appears to be in the collection of the sewage from the center of the city, and judging from the preliminary examinations a suitable site for treatment works at no great distance from the center of population can be selected. It is probable, however, that most of the sewage must be pumped.

No engineering study has been made by the town of Longmeadow for the location and construction of suitable sewage treatment works. Many years ago the sewage of Longmeadow was subjected to treatment on sand filters which have since been abandoned. The problem of constructing an intercepting sewer along the Connecticut River and locating a sewage disposal plant in this town is relatively simple, due to the large area of uninhabited land located along the river, but consideration might be given to the removal of this sewage with that of the city of Springfield to joint works already suggested at the mouth of the Westfield River.

No plans have ever been prepared for the collection and disposal of sewage from the town of West Springfield, but it would seem advisable that this sewage and perhaps that from the thickly settled portions of Agawam be collected and discharged to the suggested treatment works to be located near the mouth of the Westfield River.

The sites selected for sewage treatment works for Greenfield, Easthampton, Northampton, Holyoke and Springfield are, in the opinion of the Department of Public Health, suitable ones for further investigations.

*Present Sewage Treatment Works near Connecticut River.*

While the town of Amherst does not border the Connecticut River, it is included in this report because sewage from a portion of that town is discharged directly into the river through a submerged outlet approved by the Department in a communication dated October 21, 1912, with the condition that the discharge of untreated sewage into the Connecticut River shall be discontinued and the sewage purified whenever in the opinion of the Department the conditions affecting the stream make this change necessary. This town has provided treatment works for the disposal of the sewage from the easterly part of the town, and the engineers employed by the town have recently submitted plans to this Department for the removal of all of the sewage into the sewer which now extends through Hadley to the Connecticut River. Provision is made in these plans for preliminary sedimentation and separate sludge digestion.

The town of Ludlow, from which sewage is now discharged into the Chicopee River opposite the Indian Orchard portion of the city of Springfield, has recently submitted plans for the collection and treatment of sewage by plain sedimentation and aeration, and these plans have been approved by the Department of Public Health.

*Diversion of Water from Watershed.*

There has been some discussion of the diversion of water from the Connecticut River watershed for the Boston Metropolitan water supply so far as this has to do with the removal of sewage from this river. In the diversion of the Ware River the Metropolitan District Water Supply Commission is permitted to take only the flows in excess of 85,000,000 gallons per day at Coldbrook, which is about 1.36 cubic feet per second per square mile, but on any day when the natural flow does not exceed this rate no diversion can be made. Furthermore, this diversion cannot be made between June 1 and December 1, except with the permission of the Department of Public Health.

On the Swift River a flow of 20,000,000 gallons per day at Bondsville, 5 miles downstream from the main dam, must be maintained regardless of what the natural flow of the river may be. This is about 0.161 cubic foot per second per square mile of drainage area originally tributary at that point, or practically the dry weather flow of the stream.

In addition to restrictions by Massachusetts legislation, the War Department, in the interest of navigation on the Connecticut River, does not permit any diversion from the Ware River between June 15 and October 15, while for the Swift River 70 cubic feet per second must be discharged from the storage in Quabbin Reservoir on any day between June 1 and November 30, inclusive, when the flow of the Connecticut at Montague is less than about 0.625 cubic foot per second per square mile. On any day when the flow of the Connecticut at Montague is less than about 0.593 cubic foot per second per square mile, 110 cubic feet per second must be released from Quabbin Reservoir. These releases are not in addition to those required by Massachusetts legislation.

In other words, the taking and storing of water by the Metropolitan District Water Supply Commission will have no bearing on the need of sewerage works in the Connecticut River cities and towns.

*Previous Advice of Department on Sewerage and Sewage Disposal.*

The Department of Public Health has been called upon from time to time to advise various cities and towns in this valley as to sewerage and sewage disposal works. During the year 1937 the Department sent communications to the town of Greenfield, stating that the present method of sewage disposal, namely, the discharge of sewage directly into the Green River near its mouth in Greenfield, was unsatisfactory, and that, unless the information obtained in the investigation covered by this report shows an improvement, the Department must recommend that suitable action be taken by the town of Greenfield for providing sewage treatment works in order to relieve the river of

further pollution by sewage from the town of Greenfield. The results of the recent investigation have shown no improvement in conditions in this vicinity.

Plans for sewerage and sewage disposal with an outlet into the Connecticut River were presented to the Department by the town of Deerfield in 1936, and a temporary outlet into the Connecticut River was approved.

Under date of October 7, 1937, the Department advised relative to a proposed sewer outlet in the town of Montague, and recommended that it be constructed at such an elevation that it would be practicable to remove the sewage to treatment works when such works are provided.

The Department during 1937 has considered favorably a preliminary plan for the partial treatment of sewage of the town of Amherst by plain sedimentation before the sewage is discharged into the Connecticut River.

The sewage from Northampton is discharged into the Mill River, and for many years the Department sought to have a suitable outlet provided in the Connecticut River. Such an extension has not been made. Under date of November 3, 1936, the Department repeated an earlier recommendation that the matter of sewerage and sewage disposal for the town of Easthampton be carefully investigated, with a view to collecting the sewage for partial treatment before it is discharged into the Connecticut River.

The Department has recommended for adoption the construction of a number of submerged cast-iron outlets for the removal of the dry weather flow of sewage from various sewer outlets of the city of Springfield, the last instance being in connection with the Rowland Avenue outlet which has recently been extended into the Connecticut River. The Chamber of Commerce of the city of Springfield has requested from this Department a written statement relative to the suitability of the present method of sewage disposal of the city of Springfield, this statement to be used in connection with the Inter-City Health Conservation Contest. In answer to this request the Department stated in a communication dated January 30, 1937, that the condition of the river has changed but little during the past two

years, and that, while the oxygen content of the water has not been reduced to such an extent as to result in odor, the presence of bacteria and other matters common to sewage makes the river objectionable for bathing and certain other recreational uses. The Department also has indicated that the river below Springfield is not desirable for public bathing, nor well suited for fish life, though it has not reached the nuisance stage.

#### *Desirability of Separate Sewerage Systems.*

The sewers in the towns of Amherst, Greenfield, Deerfield, Agawam, Easthampton and Longmeadow are constructed largely on the separate plan, but the sewerage systems of Montague, Northampton, Holyoke, Chicopee and Springfield are constructed on the combined plan, for the removal of both domestic sewage and storm water, though some of the sewers in Northampton and Chicopee are designed for the removal of domestic sewage only. The system in West Springfield is constructed largely on the combined plan, though some of the smaller sewers are designed for the removal of domestic sewage only. As intercepting sewers are constructed in Holyoke, Chicopee and Springfield, provision will presumably be made only for the removal of the domestic sewage and a very small portion of the storm run-off, and overflows must be provided for the discharge of combined domestic sewage and storm water into the river during the periods of storm. The cost of collecting and treating all of the domestic sewage and storm water at sewage treatment works in these municipalities would be prohibitive. It is impracticable to effect the separation of the storm water from the domestic sewage in the existing sewerage systems in Holyoke, Chicopee and Springfield, but as the sewerage systems are extended, the Department recommends that the construction of combined sewers be discontinued and that all extensions in the future be made upon the separate plan. This policy, it is assumed, is now being carried out in the extensions of the various sewers in the municipalities above referred to.

*Recreational Uses of the Connecticut River.*

As indicated elsewhere in this report, there has been much discussion as to the uses of the Connecticut River for recreational purposes. This question is quite thoroughly covered in the report of the water resources committee of the New England Regional Planning Commission of 1937, where reference is made to the fact that the Federal and state governments have acquired large areas for recreational purposes, but that there is a need for additional facilities, as many of the favorable lakes and ponds in the basin have been set aside for public water supply purposes. The report of that commission also states that the main stream below Springfield is so polluted "that the great potential recreational assets of this river are almost entirely wasted." The examinations have indicated, however, that the river in the vicinity of Springfield and again below Hartford is used to a moderate extent for pleasure boating.

*Need of Sewage Treatment Works.*

There has been much activity in recent years in opposition to the continued pollution of the Connecticut River, chiefly as a result of complaints from the authorities of the State of Connecticut and from the recreational interests. In this connection the Department has found it necessary to advise against the use of the Connecticut for bathing in Agawam, Smith's Ferry, Holyoke and Hadley. No legislation has ever been adopted by the Massachusetts Legislature with a view to preventing pollution of the Connecticut River, but bills were proposed in 1935, 1936 and 1937 providing for investigations relative to the sanitary condition of this stream. Two bills were considered in 1937, one of which, House, No. 1388, was referred to the next session of the Legislature.

The General Laws relating to the protection of water supplies of the Commonwealth, included in chapter 111, sections 159 to 174, inclusive, provide in section 166 that these sections shall not apply to the Connecticut River, the Merrimack River and that part of the Concord River lying

within the limits of the city of Lowell. This exclusion would indicate that it was the intention of the General Court in earlier years to consider these streams as industrial streams and not for development for water supply for drinking. However, under the provisions of chapter 202 of the Acts of 1929 the Department was authorized to make an annual investigation of the Merrimack River, and under the provisions of chapter 60 of the Resolves of 1937 the special commission proposed legislation to prevent pollution of this latter river, which is printed in Senate Document, No. 100 of the current year.

Many of the cities and towns in the valley of the Connecticut River have obtained Federal funds through the Works Progress Administration for the construction of sanitary sewers, but under date of September 21, 1937, Mr. Harry L. Hopkins, Works Progress Administration in Washington, sent a telegram to all State Works Progress Administrators to the effect that no further funds would be granted for sanitary sewers unless evidence is transmitted showing that the sewage is to be treated. This arrangement has more recently been somewhat modified by the Works Progress Administration, however, and a circular letter was sent to all State Works Progress Administrators under date of January 3, 1938, from which the following is quoted:

1. The application shall state definitely whether all or a part of the sewerage system as planned will discharge its sewage into a treatment plant.

If any part of the sewage will not be discharged into a treatment plant upon completion of the project, the application should state whether a treatment plant has been planned, and whether or not the proposed work fits into the plan.

No project for sanitary sewers can be approved unless the work to be done is of a permanent character, lends itself to the ultimate development of a sewage disposal plant, and will not become obsolete or have to be torn up at a later date. This condition is essential, irrespective of whether a sewage treatment plant exists at the present time, is assured in the near future, or must be postponed until a later date.

Where a sewage treatment plant is not assured at the present time the information accompanying the application should specifically state

whether any of the proposed work will require revision as to gradient or location if and when a treatment plant is built. . . .

3. If plans for a sewage disposal plant have not been completed, but the project is for constructing interceptors which will eliminate conditions which are a menace to public health, without adding appreciably to the pollution which now enters creeks and rivers, this fact should be clearly shown in the information accompanying the application.

On all projects where sewage is not to be treated at the present time, full information should be given as to the name of the water course into which the proposed sewer will discharge, the average and minimum flow of the stream in cubic feet per second, and the use made of the stream below the sewer outlet.

If the purpose of a project is to provide for carrying treated effluent from a sewage disposal plant, that fact should be clearly stated. Such projects are eligible for approval.

4. The restrictions imposed by telegram serial No. 158 are not retroactive. Therefore previously authorized projects for sewer construction may be completed. Applications for supplemental authorizations may be submitted for consideration where they are necessary in order to complete useful units of projects which have already been started. Favorable consideration of such supplements and continuations will be greatly facilitated if they can be accompanied by evidence of compliance with the current requirements concerning sewage treatment.

5. Any doubtful cases, not covered by the above instructions, in which in your opinion general health conditions will be considerably improved by the construction of sanitary sewers, even though no sewage disposal plant will be built in the near future, should be submitted to the Project Control Division in Washington for consideration. Such applications should if possible be accompanied by statements from United States Public Health Service officials or State Boards of Health covering the manner in which the execution of the project will affect local health conditions.

It is understood that the city of Springfield, in connection with the use of Federal funds on flood protection improvements and sewerage, is committed to remove the dry weather flow of sewage from the sewers of this city to sewage treatment works before 1942.

The Department has no information that the condition of the Connecticut River at any point in Massachusetts is such as to be dangerous to the public health, but there is reason to believe that the degree of pollution is increasing and will persist unless collection and treatment works are provided. The local nuisances in the immediate vicinity

of many of the sewer outlets also will persist unless works are provided. In view of the fact that the population of the cities and towns in the Connecticut River Valley must increase in the normal development of this valley, the need of suitable works for sewage treatment is becoming increasingly important.

The river has not yet reached the nuisance stage, and even below Springfield is not as objectionable as the Neponset River, the Aberjona River, the Assabet River or Alewife Brook at the time of the adoption of mandatory legislation designed to reduce the pollution of these streams. It is probably not necessary to adopt legislation in connection with the Connecticut River as stringent as that provided for these other streams. Moreover, it probably is not necessary to require as great a refinement of the treatment of sewage or industrial wastes discharged into the Connecticut River, as the amount of water available in the Connecticut River for dilution is considerable. In view of the fact that certain floating matters discharged with domestic sewage and certain industrial wastes create offensive conditions on the banks of this stream in a manner which may be dangerous to the public health, legislation should be adopted which will authorize the Department of Public Health to require the treatment of the sewage for the removal of the solid and floating matters from the domestic sewage, or to provide additional treatment where necessary before it is discharged into the Connecticut River.

In this connection the Department must refer to the bill mentioned in this report under the Merrimack River, which has already been presented to the current session of the Legislature in Senate Document No. 100. Such a bill would authorize the Department to direct any city or town bordering the Connecticut River to install, maintain and operate sewage treatment works, and would give the courts the authority to enforce an order of the Department for this purpose. Legislation of this general character was proposed by the Special Commission to Study and Investigate Public Health Laws and Policies in House Document No. 1200 of

the Legislature of 1937, and by the Department of Public Health in Senate Document No. 50 of the Legislature of 1937.

*Recommendations.*

The Department recommends in connection with the Connecticut River (1) that the town of Greenfield give further consideration to a plan for the treatment of its sewage at a point not far from its existing outlet; (2) that the town of Montague give consideration to a plan for an intercepting sewer and works for the partial treatment of the sewage of the Turners Falls section; (3) that the town of Deerfield give consideration to the partial treatment of the sewage of the village of South Deerfield; (4) that the city of Northampton and the town of Easthampton consider the preparation of a plan for the collection and partial treatment of the sewage of these municipalities, preferably at joint works to be located in the vicinity of the Oxbow; (5) that the town of Amherst give consideration to the construction of works for the partial treatment of the sewage of the town in substantial accordance with a plan recently prepared and submitted by its consulting engineers; (6) that the town of South Hadley give consideration to a plan for the collection and partial treatment of the sewage of that town; (7) that the city of Springfield, acting jointly with the towns of West Springfield, Agawam and Longmeadow, study a plan for the collection and treatment of the sewage of these municipalities at works to be constructed near the mouth of the Westfield River; (8) that the city of Chicopee study a plan for the collection and treatment of the sewage of that city; and (9) that the city of Holyoke give consideration to a plan for the collection and treatment of the sewage of that city.

FRENCH AND QUINEBAUG RIVERS.

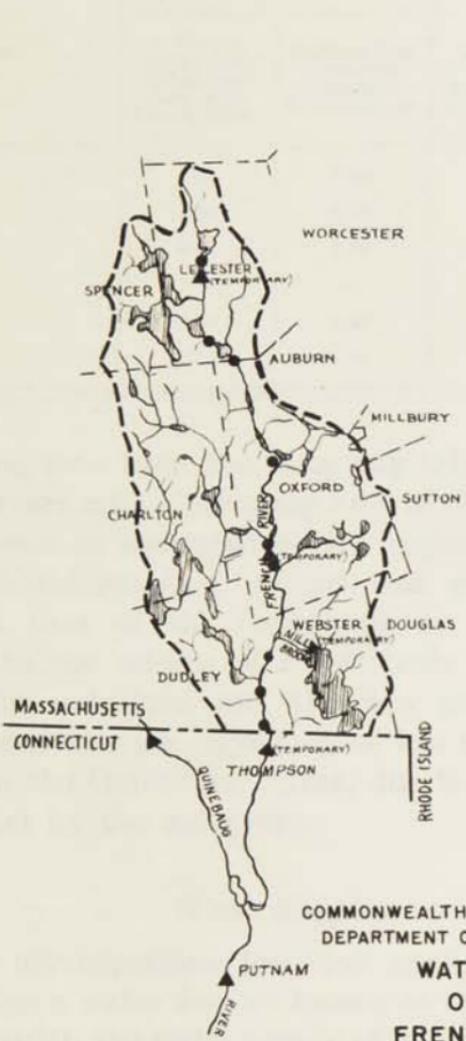
The French River, sometimes known locally as the Manexit River, has a drainage area above the Connecticut line of approximately 93 square miles. Below the state line this stream extends in a southerly direction and is one of the

main tributaries of the Quinebaug River, which in turn is an important tributary of the Thames River, which flows southerly through the State of Connecticut to an outlet in Long Island Sound.

The French River drainage area includes much of six municipalities and small parts of four other municipalities in Massachusetts. It contains some 36 ponds and storage reservoirs having a total surface area of about 3,800 acres, while 14 of these reservoirs and ponds have a storage capacity of approximately 357.5 million cubic feet, the largest of which is Lake Chaubunagungamaug in Webster. The estimated population residing within this area, based on the 1935 census, is 25,327. The river is quite thoroughly developed industrially in the upper, middle and southerly portions of its course in Massachusetts.

#### *Flow of Stream.*

Temporary gaging stations to determine the flow of the stream were established by the engineers of the Works Progress Administration project in the rear of the Leicester Woolen Company mill on Rawson Road in Leicester, below the temporary bridge on Dudley Road in Oxford, at Mill Brook which is the outlet of Lake Chaubunagungamaug in Webster, and at Thompson, Connecticut, just above the New York, New Haven & Hartford Railroad bridge 0.3 of a mile south of the Massachusetts-Connecticut line. In addition, use was made of the gages maintained by the United States Geological Survey at Quinebaug and Putnam, Connecticut. In connection with the collection of composite samples of water from the river for analysis during June and July, 1937, estimates were made of the flow at the stations above, in and below Webster and Dudley. During the periods of these measurements the flow near the state line, where the drainage area is about 93.3 square miles, varied from 90 to 131 cubic feet per second. The following comparison is made with the records of the flow of the Quinebaug River at Quinebaug and at Putnam, Connecticut, during periods when composite samples were collected:

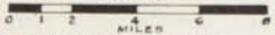


COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC HEALTH

**WATERSHED  
OF THE  
FRENCH RIVER**

CHAPTER 66 RESOLVES OF 1937

SCALE



- SAMPLING STATION
- ▲ STREAM GAGING STATION



*Flow.*

[Cubic feet per second per square mile.]

DATE.	FRENCH RIVER.		QUINEBAUG RIVER.	
	At Oxford-Dudley Road (Drainage Area, 60.45 Square Miles).	At State Line (Drainage Area, 93.3 Square Miles).	Quinebaug, Conn. (Drainage Area, 157 Square Miles).	Putnam, Conn. (Drainage Area, 332 Square Miles).
June 29 . . . . .	1.55	1.40	1.00	1.13
June 30 . . . . .	1.34	1.34	0.81	1.07
July 7 . . . . .	0.86	1.01	0.89	0.83
July 13 . . . . .	1.78	—	1.73	1.26
July 14 . . . . .	1.64	1.27	1.43	1.08
July 20 . . . . .	1.35	1.01	0.96	0.90

It will be seen from the foregoing table that, while the flow per square mile of drainage area of the French River in Massachusetts as measured by the engineers of the Works Progress Administration project was greater on certain days than that of the Quinebaug in Connecticut, due evidently to the release of water from the large lake at Webster for industrial use, the flow per square mile of drainage area on some days may be less than at the gaging stations on the Quinebaug River, due to the holding back of the water by the industries.

*Water Supplies.*

Of the municipalities included in the drainage area, Leicester has a water district known as the Leicester Water Supply District, the water supply of which is furnished from dug wells and a tubular well located in the town of Paxton. The water supply of the Cherry Valley and Rochdale Water District, also in the town of Leicester, and that of the town of Spencer, is taken from sources located outside the French River drainage area. The town of Oxford is supplied with water by the Oxford Water Company from tubular wells near a small branch of the French River, and there are some 707 services in this town, 81 per cent of which are metered.

The town of Dudley is supplied with water from tubular wells located near Merino Pond, a tributary of the French River. In connection with this supply there are 451 services, all of which are said to be metered. The water supply of the town of Webster, the largest municipality in the watershed, is furnished to about 1,700 services, 95 per cent of which are metered, from dug and tubular wells on the westerly shore of Lake Chaubunagungamaug.

#### *Condition of River.*

The engineers of the Works Progress Administration state planning projects have collected a considerable number of samples from the French River throughout much of its course, and several of these sampling tests included the collection of composite samples at fifteen-minute intervals throughout the whole twenty-four hours. The results of the analyses show no seriously polluted condition above Webster, but in Webster the discharge of offensive industrial wastes into a tributary from a large concern on Mill Brook was very marked. The most objectionable portion of the stream was just south of the thickly settled parts of Webster and Dudley, where the effect of the direct discharge of domestic sewage and industrial wastes was particularly noticeable, and the analyses of samples from this part of the stream showed evidence of considerable pollution.

#### *Sewage and Industrial Waste Disposal.*

The thickly settled portion of the center of Leicester and the thickly settled parts of Dudley and Webster are provided with sewers, but the other municipalities in the drainage area have no sewerage systems, and the domestic sewage is disposed of largely in cesspools and by means of privies. The sewage from Leicester is discharged through small settling tanks on to 5 sand filter beds having a total area of 0.44 of an acre. These works are inadequate for the proper purification of all of the sewage which they receive, and the Department of Public Health recommended under date of May 31, 1935, that additional works be provided. The

examination shows 14 sewer outlets in Leicester through which small quantities of sewage from houses are discharged into the river or its tributaries.

In Spencer no pollution of the French River was observed.

In Oxford 27 sewer outlets were observed, each serving one to four houses.

In Charlton two small sewer outlets were observed which serve a very small population.

In Dudley there are about 3.31 miles of public sewers which have 4 outlets through which the domestic sewage of the thickly settled parts of the town is discharged directly into the river. The examination disclosed 11 outlets serving from one to two houses to a complete section of the town. Very offensive conditions were noted in the vicinity of these outlets.

The town of Webster is very thoroughly sewered with outlets discharging directly into the river or tributaries thereof. There are said to be some 17 miles of public sewers for this town with 7 outlets, one of which was constructed in a part of Dudley under a special legislative act and discharges sewage into the river from the Dudley side. Including these 7 public sewer outlets, the examination showed 27 sewer outlets discharging domestic sewage into the stream or its tributaries in the thickly settled parts of the town of Webster.

The most serious source of pollution of the French River is the domestic sewage discharged from the towns of Webster and Dudley, and the Department has for many years recommended that this condition be remedied by the collection and disposal of sewage from these two municipalities through suitable disposal works. The first recommendation to Webster in this regard dates back to 1896. In 1925 local appropriations were made in these two towns for comprehensive sewerage surveys, the towns engaged engineers, and proposed plans for joint works were approved by the Department during that year. However, these works were not constructed, and in the summer of 1936 complaints were made by the authorities of the State of Connecticut to this Department relative to the pollution of this stream as it

entered Connecticut. After various conferences appropriations were made in both Dudley and Webster in 1937 for further engineering studies, and under date of December 20, 1937, a plan was approved by the Department for the treatment of the domestic sewage from the town of Dudley. It is to be assumed that the engineers of the town of Webster will shortly present their plans for approval.

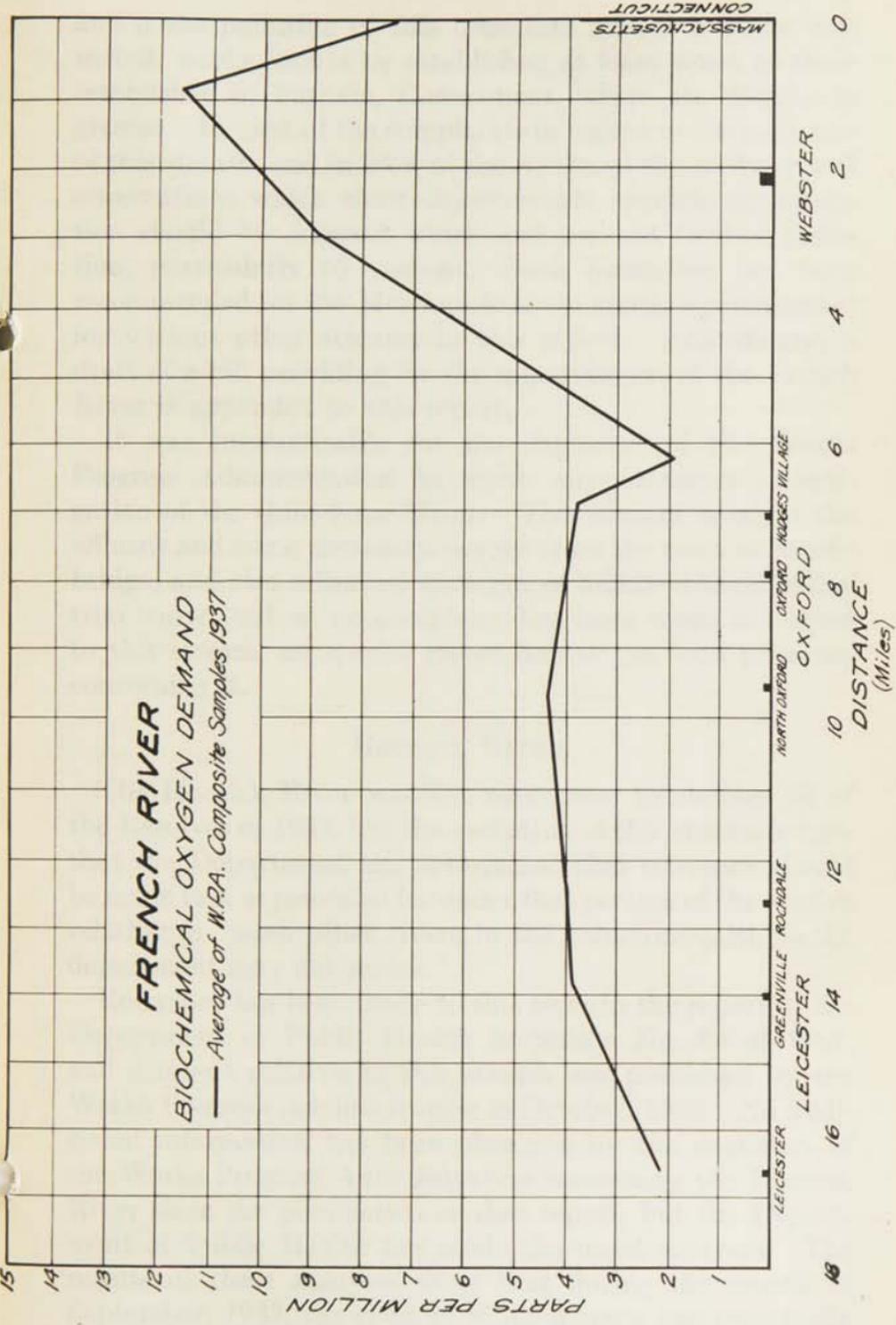
There has been considerable activity in recent years in the State of Connecticut with a view to preventing pollution of streams in that State, and in this connection the town of Putnam, Connecticut, where the river has a drainage area of 332 square miles, has within the past year constructed a plant for the treatment of sewage. Sewage disposal works should be provided by the towns of Webster and Dudley at an early date, as the dilution available in the river just below Webster and Dudley is less than at Putnam.

The engineers of the Works Progress Administration project have made estimates of the quantity of industrial wastes discharged directly into the French River, which show that the bulk of the industrial wastes result from processes carried on in Oxford, Dudley and Webster. The following table shows the amount and kind of industrial wastes discharging into the French River at the time of the recent examination:

CITY OR TOWN.	Kind of Manufactured Product or Process.	Quantity of Industrial Waste (Gallons per Day).
Charlton . . . . .	None in drainage area .	None
Dudley . . . . .	Lenses, bleachery, woolen cloth, worsted cloth.	653,000
Leicester . . . . .	Woolen cloth . . . . .	222,000
Oxford . . . . .	Woolen cloth, carpets, satin cloth.	581,000
Spencer . . . . .	None in drainage area .	None
Webster . . . . .	Printed dress goods, woolen cloth, water gas.	2,617,000

While the industrial wastes above referred to create objectionable conditions in the French River, the more important sources of pollution are the sewage discharged into the stream, particularly from Webster and Dudley,

**FRENCH RIVER**  
**BIOCHEMICAL OXYGEN DEMAND**  
 — Average of W.R.A. Composite Samples 1937



MASSACHUSETTS  
 CONNECTICUT

LEICESTER GREENVILLE ROCHDALE NORTH OXFORD OXFORD OXFORD RIDGES VILLAGE WEBSTER

DISTANCE (Miles)

16 14 12 10 8 6 4 2 0



and if the pollution of this interstate stream is to be corrected, works should be established at least equal to those established in Putnam, Connecticut, where the dilution is greater. In view of the complaints in regard to the pollution of this stream, and in view of the results of the analyses and observations which show objectionable conditions, legislation should be adopted which will prevent further pollution, particularly by sewage. Such legislation has been recommended for the Merrimack River and is recommended for various other streams in this report. Accordingly, a draft of a bill providing for the improvement of the French River is appended to this report.

It was impracticable for the engineers of the Works Progress Administration to make any extensive investigation of the Quinebaug River. This stream receives the effluent and some untreated sewage from the town of Southbridge, and also a limited quantity of highly colored industrial waste, but as no complaint has been made in regard to this stream, no special report has as yet been prepared concerning it.

#### HOOSICK RIVER.

The Hoosick River was not mentioned in chapter 66 of the Resolves of 1937, but the condition of this stream is such that the Department has determined that reference should be made to it as provided for under that portion of the resolve relating to "such other rivers in the commonwealth as the department may determine."

Reference has been made to this river in the report of the Department of Public Health in Senate No. 50 of 1937, and a report relative to this stream was published by the Works Progress Administration in October, 1936. No additional information has been obtained by the engineers of the Works Progress Administration concerning the Hoosick River since the publication of that report, but the Department of Public Health has made the usual analyses. The results of these analyses show that during the month of September, 1937, the river at Williamstown was practically devoid of oxygen, while the South Branch, which drains the

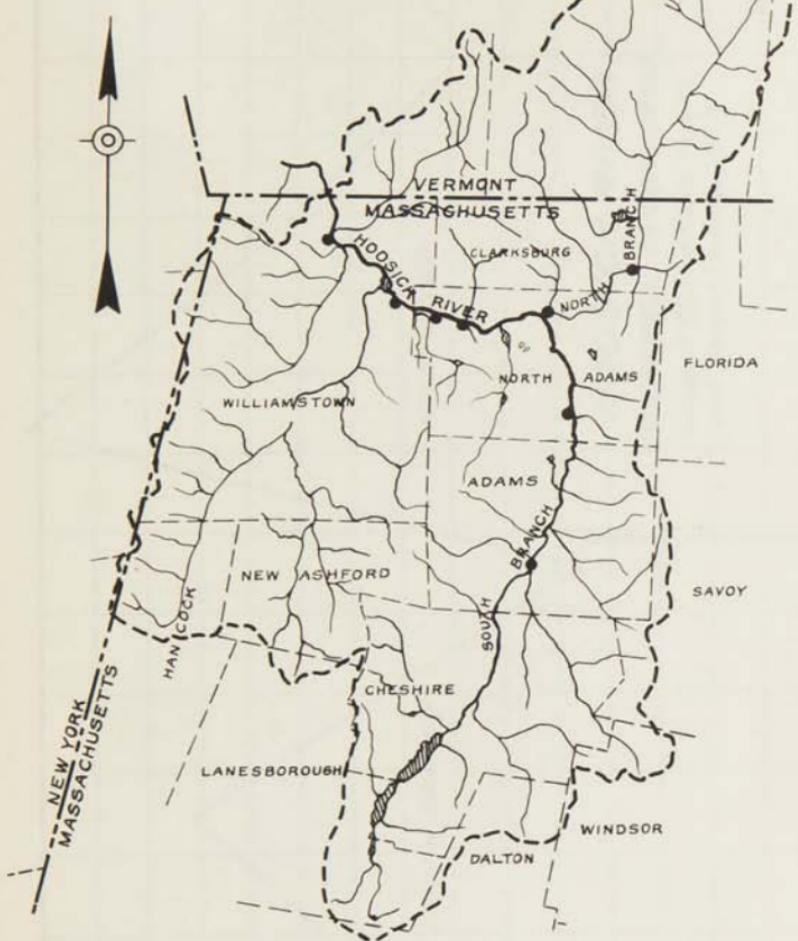
town of Adams, was also practically devoid of oxygen within the city of North Adams. This stream is seriously polluted by the sewage of the towns of Adams and Williamstown.

The former town presented plans for sewage treatment works in 1909, but the works have never been constructed. The Department has recommended on a number of occasions the construction of treatment works by this town, and recently the town engaged consulting engineers for the preparation of the necessary plans, but the municipal funds have been expended in other directions, and the much-needed sewage treatment works have not been constructed. Serious complaint about the pollution of this stream was made by officials of North Adams in the latter part of 1936, and if the condition of this stream is to be corrected, legislation similar to that proposed for the Connecticut River should be adopted. A draft of the necessary legislation is appended to this report.

#### HOUSATONIC RIVER.

The Housatonic River was considered in the report of the Department of Public Health to the Legislature of 1937 in Senate Document No. 50 of that year, and the report of the engineers of the Works Progress Administration on this stream was published in December, 1936. The engineers of the Works Progress Administration made no further examinations of this stream in 1937, but the results of the analyses of samples of water collected during 1937 under the direction of this Department show a slight improvement in the condition of this stream since the study of 1936. This may be due in part to the use of the new sewage filters in Pittsfield. The stream in portions of its course continues to be objectionable, due to the direct discharge of sewage, particularly from the towns of Hinsdale, Dalton, Lee and Great Barrington.

There is a marked interest in improving the condition of this river, and during the past year an organization known as the Housatonic Valley Associates was formed largely for this purpose and for promoting recreational facilities. This organization is made up of interested officials

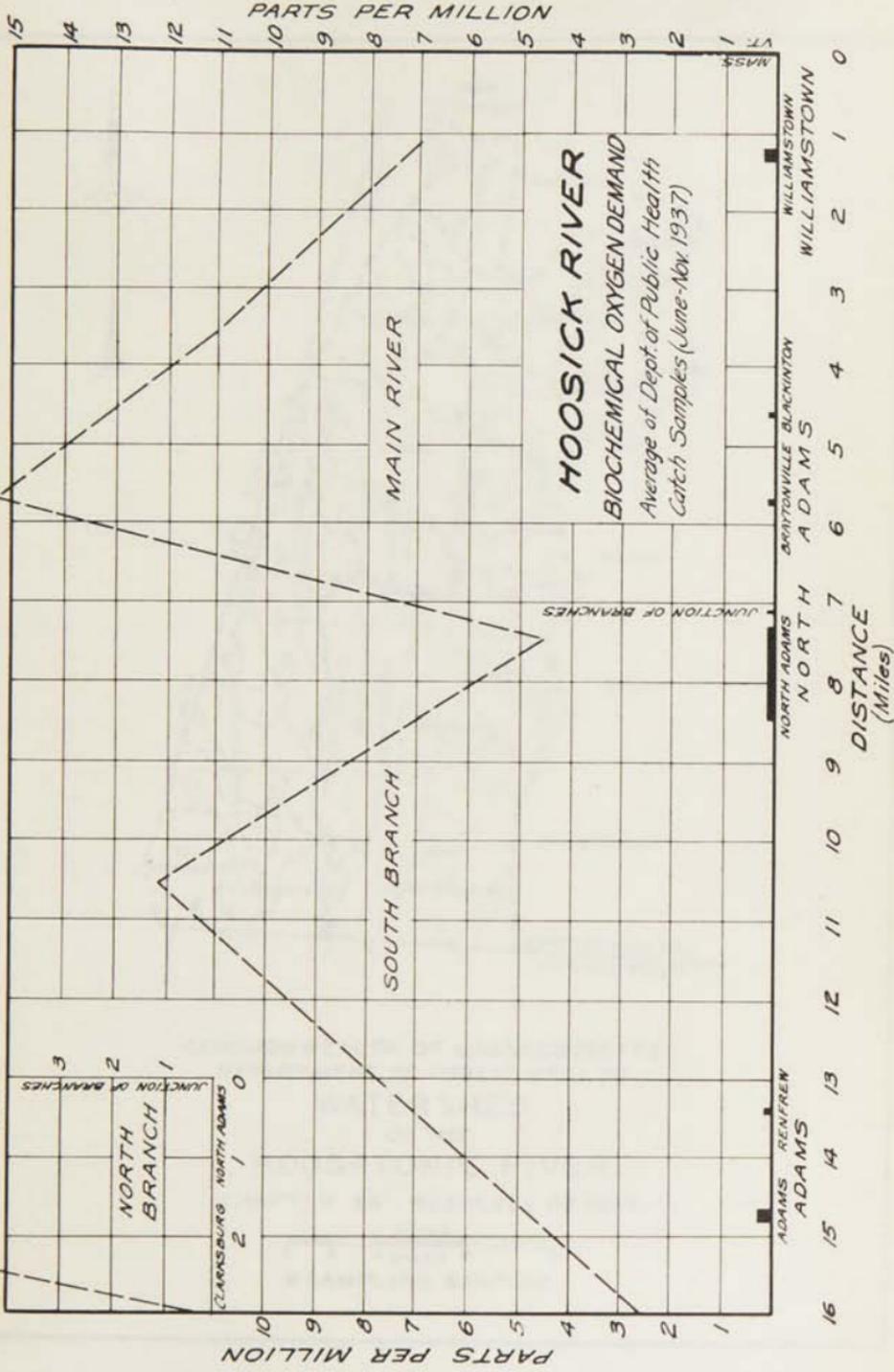


COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC HEALTH  
**WATERSHED**  
 OF THE  
**HOOSICK RIVER**  
 CHAPTER 66 RESOLVES OF 1937



● SAMPLING STATION





PARTS PER MILLION

PARTS PER MILLION

DISTANCE (Miles)

ADAMS REIFREN ADAMS  
 NORTH ADAMS  
 NORTH ADAMS  
 BRANTONVILLE BLACKINTON  
 WILLIAMSTOWN  
 WILLIAMSTOWN

260

NORTH BRANCH

SOUTH BRANCH

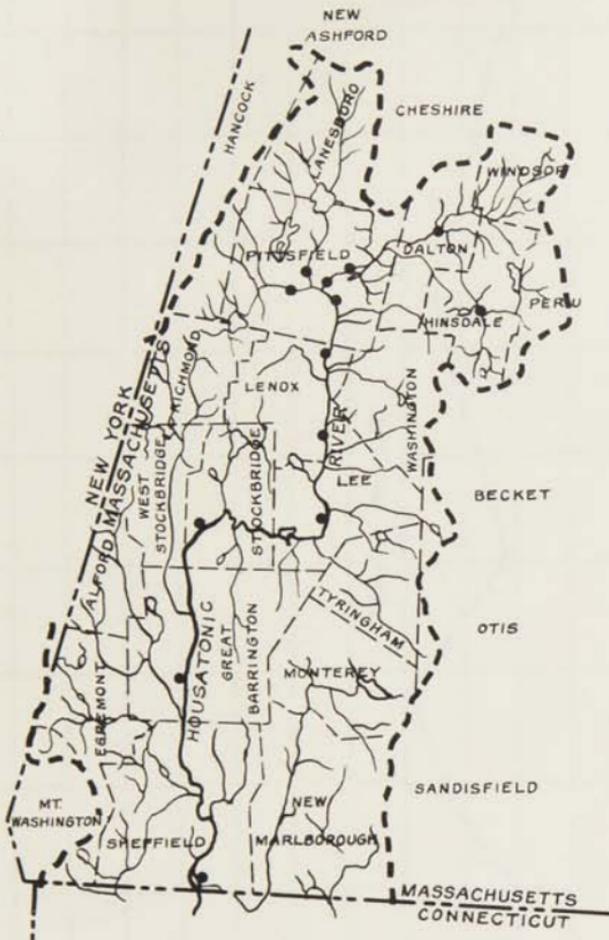
MAIN RIVER

JUNCTION OF BRANCHES

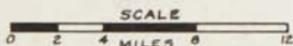
JUNCTION OF BRANCHES

CLARKSVILLE NORTH ADAMS





COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC HEALTH  
WATERSHED  
OF THE  
HOUSATONIC RIVER  
CHAPTER 66 RESOLVES OF 1937



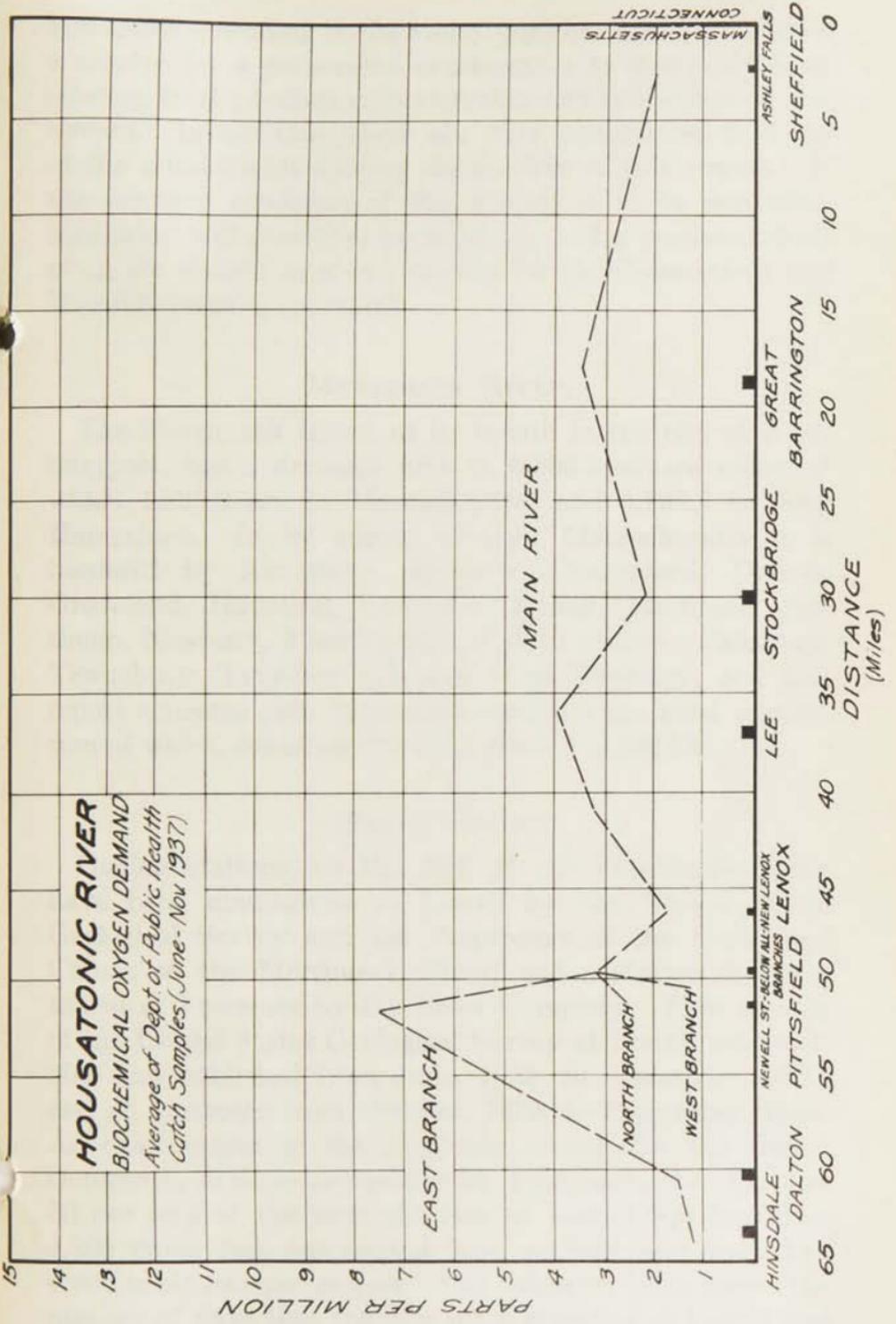
● SAMPLING STATION



# HOUSATONIC RIVER

## BIOCHEMICAL OXYGEN DEMAND

Average of Dept. of Public Health  
Catch Samples (June - Nov 1937)





and citizens residing in the valley, and has recently adopted a resolve for a permanent organization to study problems relating to the pollution, restoration and protection of this stream. In addition, there are river committees in many of the municipalities along the borders of this stream. If the sanitary condition of this stream is to be corrected, legislation will doubtless be required, and a proposed draft of an act similar to that proposed for the Connecticut and Hoosick rivers is appended.

#### MERRIMACK RIVER.

The Merrimack River, at its mouth in the city of Newburyport, has a drainage area of 5,006.5 square miles, of which 1,208.3 are in Massachusetts and 3,798.2 in New Hampshire. In its course through Massachusetts it is bordered by Amesbury, Andover, Chelmsford, Dracut, Groveland, Haverhill, Lawrence, Lowell, Merrimac, Methuen, Newbury, Newburyport, North Andover, Salisbury, Tewksbury, Tyngsborough and West Newbury, and this report concerns only these municipalities the total population of which, based on the 1935 census, is 332,236.

#### *Flow of Stream.*

Gaging stations for the flow of the Merrimack River have been maintained at Lowell by the United States Geological Survey and the Proprietors of the Locks and Canals on the Merrimack River, and a station is maintained at Lawrence by the Essex Company. Flow records of the United States Geological Survey at Lowell are available and published from June, 1923, to September, 1935, and at Lawrence from October, 1879, to September, 1934. An examination of the available records for the period October 1, 1928, to September 30, 1935, show that for over 50 per cent of the time the flow at Lowell was less than 4,300 cubic feet per second, and at Lawrence less than 4,400 cubic feet per second. The following table shows the number of days that the flow for this period at Lowell and Lawrence was less than the specified amounts, also the

equivalent of these amounts in cubic feet per second per square mile of drainage area:

(1) Flow in Cubic Feet per Second.	AT LOWELL BELOW CONCORD RIVER. (DRAINAGE AREA = 4,635 SQUARE MILES.)		AT LAWRENCE. (DRAINAGE AREA = 4,674 SQUARE MILES.) <sup>1</sup>	
	(2) Equivalent Flow in Cubic Feet per Second per Square Mile.	(3) Number of Days that the Flow was less than Amounts shown in Columns (1) and (2).	(4) Equivalent Flow in Cubic Feet per Second per Square Mile.	(5) Number of Days that the Flow was less than Amounts shown in Columns (1) and (4).
800	.173	76	.171	77
1,000	.216	113	.214	117
2,000	.431	440	.428	369
3,000	.647	851	.642	794
4,000	.862	1,167	.856	1,016
5,000	1.079	1,442	1.070	1,240
7,500	1.618	1,871	1.605	1,686
10,000	2.157	2,084	2.139	1,839
15,000	3.236	2,302	3.209	2,006
20,000	4.315	2,407	4.279	2,078
25,000	5.394	2,483	5.349	2,132
30,000	6.472	2,513	6.418	2,158
40,000	8.630	2,543	8.558	2,181
50,000	10.787	2,551	10.697	2,187
60,000	12.945	2,554	12.837	2,189
70,000	15.102	2,556	14.976	2,191

Last figure in Columns (3) and (5) shows total number of days in records.

<sup>1</sup> 1934-1935 omitted.

### *Water Supplies.*

Of the municipalities on this stream in Massachusetts, all except Newbury, Tewksbury and Tyngsborough have or are served by public water supplies. Water is supplied to a part of Newbury from the works of the city of Newburyport, and about 53 per cent of the population of the town of Tewksbury is included in the State Infirmary which is supplied from an approved source from the ground. In the report of the special commission established under the provision of chapter 60 of the Resolves of 1937, a recommendation is made for the passage of an act establishing



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**MERRIMACK RIVER**  
 CHAPTER 66 RESOLVES OF 1937



- SAMPLING STATION
- ▲ STREAM GAGING STATION



the Merrimack River Valley Water District and the Merrimack River Valley Water District Commission, and for supplying this district from some source which will permit the abandonment of certain sources of supply now in use. The report of this commission appears as Senate Document No. 100 of the current session of the Legislature.

#### *Condition of River.*

The Merrimack River is considerably polluted in its course through both New Hampshire and Massachusetts, but the results of the examinations and analyses made by the Works Progress Administration of composite samples over many hours, and the catch samples of this Department collected during the period from June to November, inclusive, show that the river as it enters Massachusetts is not sufficiently polluted to be objectionable for recreational purposes or to cause nuisances, although it is polluted so as to be unsuitable for water supply purposes even after treatment. These analyses show much pollution below Lowell and gross pollution below Lawrence and below Haverhill. The dissolved oxygen present in the stream is greatly decreased between Lowell and a point just below Haverhill. Tests made by chemists of the Works Progress Administration show that below Lawrence the average biochemical oxygen demand is over 6 parts per million, while the maximum found by the Department in 1937 was 21 parts per million in the month of August, with an average for 1937 of 13.5 parts per million. The lowest dissolved oxygen determination by the Department was below Haverhill in August of 1937, when the water was only 11.6 per cent saturated with oxygen. The pollution below Lawrence is so serious as to practically deplete the oxygen in the stream during the drier periods of the year, and this and other portions of the stream border on the nuisance stage. There is an improvement as the river reaches its mouth.

#### *Sewage and Industrial Waste Disposal.*

The question of the removal of domestic sewage and foul industrial waste from the cities and towns bordering

the Merrimack River in Massachusetts has received a great deal of consideration during the last few years. This question is reviewed in Senate Document No. 100 of the current Legislature, which contains the report of the special commission established under the provisions of chapter 60 of the Resolves of 1937. It also is discussed in the report of this Department to the Legislature of 1924, which appears as Senate Document No. 492 of that year, wherein a trunk sewer from Lowell to the sea was recommended. In the earlier report cost estimates were made both for the construction of a trunk sewer in the Merrimack River Valley and for the collection and disposal of sewage from each of the municipalities locally.

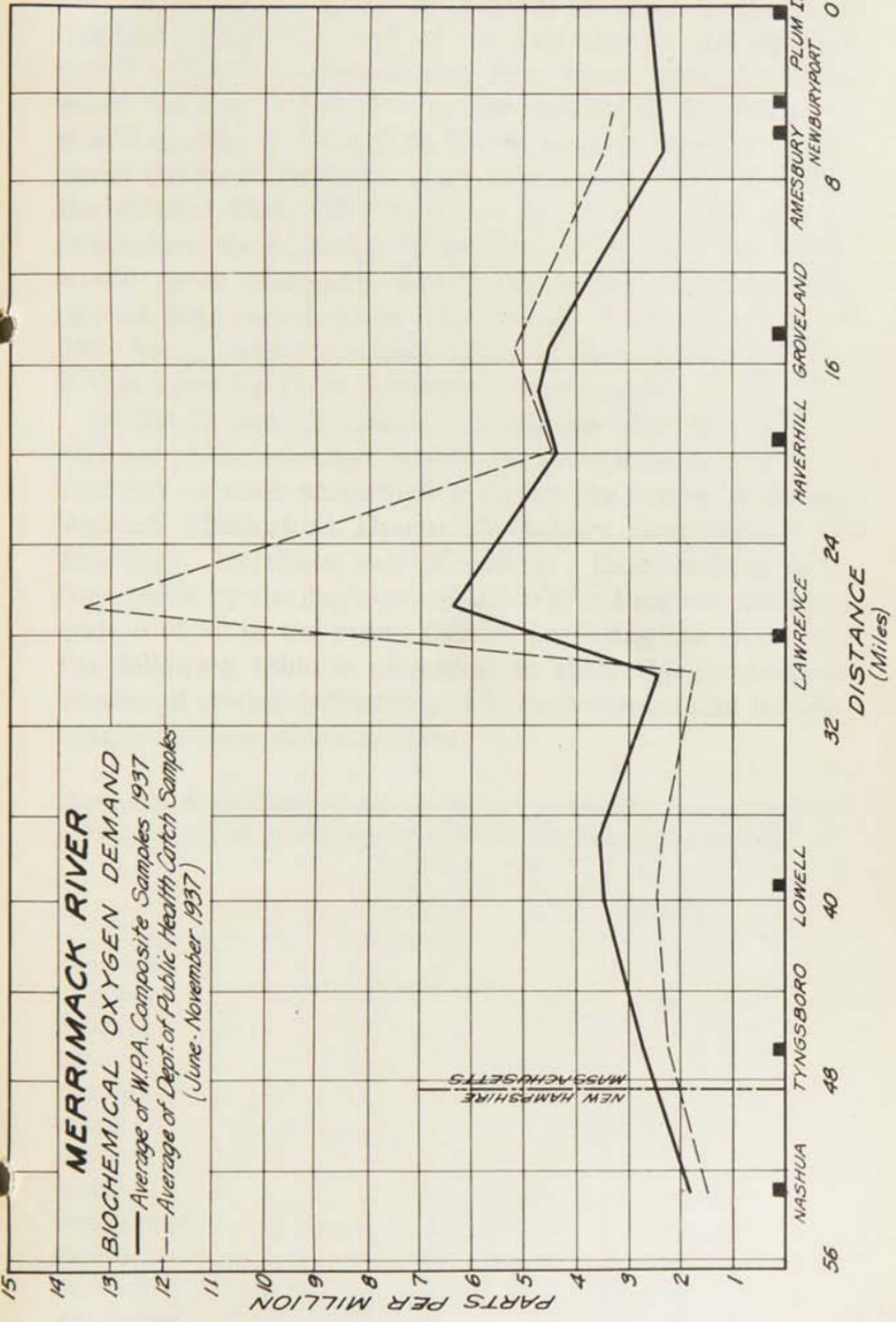
Development of Salisbury Beach since the comprehensive study of the Department in 1924 makes it desirable to provide some form of treatment near Newburyport if a trunk sewer is to be provided, and the engineers of the Works Progress Administration have made a survey of a site for such treatment works in Newbury, a short distance west of the Plum Island River. These treatment works would consist of a grit chamber, bar screens, plain sedimentation tanks and sludge digestion tanks and for chlorination of the effluent, if necessary. Such works would require a change in the location and elevation of the trunk sewer proposed in 1924, but it would be practicable under such a plan to treat the sewage without pumping at more than the one location proposed in 1924. It would, of course, be necessary to pump the sludge into the digestion tanks and to make arrangements for conveying the sludge to sea in barges. The location of the final outlet in the ocean off Newburyport for the treated sewage would be similar to that proposed by the Department in 1924.

The revised estimates contained in Senate Document No. 100 of the current year of the cost of the trunk sewer, including sewage treatment works, indicated that these works would cost about \$27,050,000, while the collection and disposal of the sewage through local disposal works would cost about \$20,088,000, or about \$7,000,000 less than for the trunk sewer plan. If consideration is given to the probable annual charges for maintenance and operation, the total

# MERRIMACK RIVER

## BIOCHEMICAL OXYGEN DEMAND

— Average of W.P.A. Composite Samples 1937  
- - - Average of Dept. of Public Health Catch Samples  
(June - November 1937)





capitalized cost is about \$1,250,000 in favor of the local disposal works. In view of the fact that in the summer months, during periods of low flow, there would be times when the flow of the river in the vicinity of Newburyport would consist of from 8 to 10 per cent of treated sewage under the local treatment plan, and in view of the fact that the effluent from such works, even if chlorinated, would not reduce the pollution to such an extent that the public would favor using this stream for bathing purposes, the special commission under chapter 60 of the Resolves of 1937 has indicated the desirability of the trunk sewer plan if this stream is to be developed for recreation.

Of the 17 municipalities bordering the Merrimack River, all have public sewerage systems covering more or less of the territory of each municipality except the towns of Tyngsborough, Chelmsford, Dracut, Tewksbury, Groveland, West Newbury, Merrimac and Newbury. Examinations have been made by the engineers of the Works Progress Administration of all of the municipalities bordering the river, and the following table is presented to show the locations of sources of sewage pollution of the main stream and its tributaries in these municipalities:

*Merrimack River Drainage Area. — Sources of Sanitary Sewage Pollution.*

	SEWER OUTLETS.		Cesspools Near or Overflowing to Stream.	Privies Over or Near Stream.
	Municipal.	Private.		
Tyngsborough . . . . .	0	17	0	20
Chelmsford . . . . .	0	4	103	2
Lowell . . . . .	27	21	0	5
Dracut . . . . .	0	33	0	11
Tewksbury . . . . .	0	2	0	0
Andover . . . . .	5	7	0	7
Methuen . . . . .	1	24	4	13
Lawrence . . . . .	18	17	0	0
North Andover . . . . .	2	3	0	0
Haverhill . . . . .	25	47	62	0
Groveland . . . . .	0	17	18	4
West Newbury . . . . .	0	1	0	0

*Merrimack River Drainage Area. — Sources of Sanitary Sewage Pollution*  
— Concluded.

	SEWER OUTLETS.		Cesspools Near or Overflowing to Stream.	Privies Over or Near Stream.
	Municipal.	Private.		
Merrimac . . . . .	0	15	1	25
Amesbury . . . . .	2	55	10	6
Newburyport . . . . .	4	7	1	5
Salisbury . . . . .	1	0	35	0
Newbury . . . . .	0	0	0	0

The results of examinations of the sites referred to in the foregoing table show that, in many instances, extensive deposits of sewage sludge have occurred in the vicinity of the sewer outlets, and that conditions in the vicinity of the large municipal sewer outlets in Lawrence, Lowell and Haverhill, which discharge into the river in populous regions and in many instances near mills and office buildings, are very offensive, especially during periods of low water in the river and during warm weather. Plans are being prepared by the project engineers showing the locations of the various outlets.

In many cases the sewage discharging through the private outlets could without much expense be discharged into the municipal sewers. This can be brought about by action of the local boards of health, who are authorized by the provisions of General Laws, chapter 83, section 11, to require the owner or occupant of any building upon land abutting on a public or private way, in which there is a common sewer, to connect the property therewith. Local boards of health also are given authority under the provisions of General Laws, chapter 111, section 127, as amended by chapter 339 of the Acts of 1937, to make and enforce regulations relative to house drainage and connections with common sewers.

It is important in the protection of the public health that, where practicable, the private outlets be abandoned and all sewage be discharged into the public sewers.

In Haverhill the dry-weather flow in several of the sewers is conveyed by means of cast-iron pipes to submerged outlets

in the river, but this has not generally been done, even with the main outlets in Lowell or Lawrence. The main outlet in Amesbury is submerged at low water.

The engineers of the project have visited practically all of the industrial plants in the municipalities bordering the main stream. In all but two instances the industrial wastes are discharged directly into the Merrimack River or its tributaries with no treatment, and in most instances the domestic sewage from these plants also is so discharged. The two exceptions referred to are where the wool-scouring wastes from two mills in Lawrence are treated for the removal of grease. The following table has been prepared to show the amount and kind of industrial wastes discharging into the Merrimack River or its tributaries from the industrial establishments in the municipalities along the banks of the main stream:

*Industrial Wastes Discharged into Merrimack River.*

CITY OR TOWN.	Kind of Manufactured Product or Process.	Estimated Quantity of Industrial Waste (Gallons per Day).
Chelmsford . . . . .	Wool scouring, carding and combing .	205,000
Tyngsborough . . . . .	None in drainage area . . . . .	None
Draeut . . . . .	Overcoating, commission dyeing, blankets.	180,000
Lowell . . . . .	Rayon, wool scouring, corduroy cloth, stockings, yarn, underwear, knit fabrics, cotton thread, carbonizing, tannery, mohair plush fabrics, worsted yarn, woolen cloth, illuminating gas, brewery.	3,249,000
Tewksbury . . . . .	None in drainage area . . . . .	None
Andover . . . . .	Rubber, men's wear . . . . .	6,346,000
North Andover . . . . .	Woolen cloth, worsted yarn, wool scouring, laundry.	221,000
Lawrence and Methuen . . . . .	Paper, bleachery, wool scouring, worsted yarn, woolen cloth, worsted cloth, printed cloth, fiber rugs and carpets, laundry.	35,040,500 <sup>1</sup>
Haverhill . . . . .	Woolen cloth, worsted cloth, illuminating gas, tannery, paper boxes.	5,364,000
Groveland . . . . .	None in drainage area . . . . .	None
Amesbury . . . . .	Laundry, wool hats . . . . .	694,200
Merrimac . . . . .	Automobile bodies . . . . .	None
West Newbury . . . . .	None in drainage area . . . . .	None
Salisbury . . . . .	None in drainage area . . . . .	None
Newburyport . . . . .	Electrical supplies, laundry, distillery, silverware, creamery, shoes and hats.	186,425
Newbury . . . . .	None in drainage area . . . . .	None

<sup>1</sup> Contains large quantities of unobjectionable wastes.

The total quantity of the industrial waste found discharging into the Merrimack River during the recent investigation was considerably less than that found during the 1924 examination.

The Department of Public Health, in its report to the Legislature, published as Senate Document No. 492 of 1924, recommended the construction of sewerage works to reduce the pollution of the Merrimack River, but it was not until 1935 that legislation was provided for the purpose. Chapter 446 of the acts of that year established the Merrimack River Valley Sewerage District. According to this act its effectiveness would cease on January 1, 1936, unless \$10,000,000 had been allocated by the Federal government. Such funds were not allocated. In 1936 further legislation was provided in chapter 420 of the acts of that year. The latter act re-established the Merrimack River Valley Sewerage District and made special provision relating to Federal funds which reads as follows:

The provisions of this act, except the provisions of section fifteen and the provisions of section two other than those which provide for the management and control of the district by the board, shall cease to be effective on January first, nineteen hundred and thirty-eight, unless prior thereto ten million dollars, or such smaller sum as, in the opinion of the proper federal authorities, is sufficient to cover the cost of the project authorized by section six has been allocated by the federal government under authority of appropriate federal legislation for the said project.

As no funds have been made available by the Federal government the Board has been unable to carry out any construction under the act.

Attention is called to the following recommendation of the special commission on the study of the Merrimack River Valley problems, as reported in Senate Document No. 100 of this year, for the adoption of legislation with reference to the construction of sewage treatment works and connections with sewerage systems in the valley:

SECTION 1. The department of public health, after a public hearing, due notice whereof shall be given by publication in one or more news-

papers published within the territory known as the drainage area of the Merrimack river and otherwise in its discretion to all parties interested, may by its order direct any city or town within such drainage area to install, maintain and operate, or to provide for the installation, maintenance and operation of, filter beds or other works for the treatment, purification and disposal of the sewage of such city or town.

SECTION 2. The supreme judicial court or the superior court, upon application to it by said department or any other interested party, may enforce any order made by said department under any provision of this act, and may restrain the use of any premises, or any portion thereof, which shall have been specified by said department in any such order until all pertinent orders of the department relative thereto shall have been complied with.

The Department concurs with the recommendation of the special commission for the adoption of such legislation.

#### MYSTIC RIVER.

The Mystic River rises in the town of Reading and flows in a general southerly direction through Woburn, Winchester, Medford, Arlington, Somerville, Everett, Chelsea and the Charlestown portion of Boston to an outlet into Boston Harbor. Its main tributaries are the Aberjona River, Alewife Brook which drains Belmont, Arlington, Cambridge and Somerville, and the Malden River which drains parts of Stoneham, Melrose, Malden and Everett. At its mouth in the inner harbor the Mystic River has a drainage area of 65.3 square miles, and included in this drainage area are the Mystic Lakes, the upper one of which was formerly a source of water supply of the city of Boston. The Mystic River is a tidal stream below the Cradoek Dam in Medford. The municipalities and the population within the limits of the drainage area are as follows:

CITY OR TOWN.	Estimated Population in Drainage Area.
Arlington . . . . .	38,000
Belmont . . . . .	15,000
Boston . . . . .	14,500
Burlington . . . . .	200
Cambridge . . . . .	39,000
Chelsea . . . . .	18,000
Everett . . . . .	12,000
Lexington . . . . .	2,100
Malden . . . . .	28,600
Medford <sup>1</sup> . . . . .	61,444
Melrose . . . . .	19,200
Reading . . . . .	2,140
Somerville . . . . .	40,300
Stoneham . . . . .	10,600
Wakefield . . . . .	830
Wilmington . . . . .	85
Winchester <sup>1</sup> . . . . .	13,371
Woburn . . . . .	15,800
Total . . . . .	331,170

<sup>1</sup> Wholly in watershed.

### *Flow of Stream.*

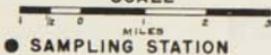
Owing to the flatness of the slope of this river and the manipulation of flow made necessary by the Cradock Dam development, there is no suitable place in the lower part of its course to operate even a semi-permanent gaging station.

During special investigations attempts have been made to measure the flow. One such period was from January 1, 1878, through December, 1897. This station was located near West Medford, and the period was before the Cradock Dam was constructed. The record of flow on file in this office is given in the following table, the quantity being expressed in cubic feet per second per square mile. The drainage area used in these computations was 26.9 square miles.



COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC HEALTH  
**WATERSHED  
 OF THE  
 MYSTIC RIVER**

CHAPTER 66 RESOLVES OF 1937  
 SCALE





*Flow of the Mystic River Near West Medford.*

[Cubic feet per second per square mile.]

YEAR.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1878 . . . . .	3.08	3.81	4.26	1.98	1.87	0.70	0.42	0.96	0.50	0.62	1.57	3.15
1879 . . . . .	1.05	2.24	2.87	3.56	1.69	0.87	0.47	0.61	0.43	0.29	0.40	0.60
1880 . . . . .	1.47	2.36	1.69	1.34	0.83	0.46	0.58	0.47	0.40	0.31	0.39	0.51
1881 . . . . .	0.71	2.06	5.89	1.95	1.31	1.84	0.75	0.30	0.28	0.25	0.45	0.75
1882 . . . . .	1.19	2.91	3.63	1.04	1.60	0.73	0.30	0.19	0.48	0.50	0.35	0.49
1883 . . . . .	0.61	1.37	1.63	1.46	1.04	0.47	0.26	0.19	0.16	0.34	0.38	0.38
1884 . . . . .	1.29	3.61	4.71	3.45	1.28	0.76	0.50	0.52	0.21	0.23	0.31	1.12
1885 . . . . .	1.55	1.74	1.78	1.82	1.89	0.77	0.41	0.47	0.30	0.59	2.16	2.07
1886 . . . . .	2.00	7.39	3.39	2.90	1.10	0.49	0.36	0.22	0.29	0.33	0.79	1.24
1887 . . . . .	2.74	3.47	3.12	3.36	1.64	1.14	0.75	1.17	0.43	0.49	0.64	0.79
1888 . . . . .	1.24	3.08	3.71	2.93	2.50	0.75	0.34	0.47	1.17	2.38	4.52	4.41
1889 . . . . .	3.91	1.76	1.39	2.03	1.89	1.69	1.15	1.78	0.95	1.05	2.23	2.65
1890 . . . . .	1.80	2.14	4.66	2.63	2.60	1.72	0.37	0.40	0.52	2.26	1.75	2.16
1891 . . . . .	5.46	5.73	6.25	3.07	1.21	0.91	0.36	0.38	0.38	0.50	0.50	0.76
1892 . . . . .	2.16	1.63	2.63	1.19	1.82	1.05	0.57	0.43	0.50	0.39	0.96	0.76
1893 . . . . .	0.65	2.05	3.92	2.44	3.83	0.93	0.41	0.60	0.37	0.48	0.64	1.10
1894 . . . . .	1.19	1.80	2.65	2.03	1.14	0.82	0.43	0.33	0.32	0.50	0.82	0.78
1895 . . . . .	1.34	0.84	2.74	2.64	0.98	0.48	0.52	0.69	0.32	1.27	2.12	1.84
1896 . . . . .	1.60	3.15	3.90	2.92	0.67	0.67	0.34	0.29	0.95	0.77	1.00	1.07
1897 . . . . .	1.21	1.34	3.00	1.92	1.59	1.96	0.43	0.82	0.37	0.34	0.91	1.70

Had it been practicable to continue the above measurements of the flow of the Mystic River, the flow during recent years of low rainfall probably would have been considerably less than shown in the foregoing table, due to the drawing of large quantities of water by industries from the ground in the valley of the river and the diversion of this water through the North Metropolitan sewerage system.

*Water Supplies.*

Of the towns within this watershed, all obtain water from the Metropolitan Water District except Winchester and Woburn. Woburn obtains its water supply from ground water sources near Horn Pond, while the town of Winchester obtains its water supply from what are known

as the North, Middle and South reservoirs. Both the city of Woburn and the town of Winchester are making investigations relative to additional sources of water supply to be obtained from the ground.

*Condition of the River.*

The engineers of the Works Progress Administration have made no special observations and have collected no samples from the Mystic River or its tributaries, but the results of the analyses of samples collected by the Department of Public Health show that the Aberjona River has been seriously polluted by sewage and industrial wastes in recent years. The pollution of this stream during the early part of the past summer up to about August first was so serious that consulting engineering advice was obtained by the Department. The improvement since this latter date has been mainly due to the use of the new Metropolitan relief sewer, to the raising of certain manholes in the Aberjona Valley sewer of the city of Woburn, and the decreased volume of wastes discharged from certain manufacturing concerns. The most objectionable portions of the stream before the use of the new sewer were those adjacent to the center of the town of Winchester and near the mouth of the river in Upper Mystic Lake. The samples collected after August, 1937, show a general decrease in pollution, due to the operation of a section of the new sewer and the adoption of other relief measures under the direction of this Department.

The results of the analyses of the samples collected by the engineers of the Department of Public Health from the Mystic River below the Mystic Lakes show that there has been a deterioration in the quality of the water just below the Lower Mystic Lake, believed to be due to the increased pollution of the Aberjona River in the early part of the year and the pollution by Alewife Brook. The river below Cradock Dam has shown evidence of serious pollution by the overflow of sewage from the temporary terminus of the North Metropolitan relief sewer located a short distance below the dam. Farther downstream it was also





polluted by the overflow of sewage from storm outlets in Somerville, when domestic sewage was found to be overflowing from them.

A number of samples were collected during the summer of 1937 from Alewife Brook by the Department of Public Health in connection with a special investigation under chapter 42 of the Resolves of 1937. The analyses show that this stream has become seriously polluted during the last few years. Septic action has been observed in various parts of this stream, and in parts of its course it was practically devoid of oxygen. The upper portion of the stream shows the effect of sewage overflows from the combined sewers of Cambridge. The lower portion, in addition, is also affected to a considerable extent by the overflow of sewage from the Alewife Brook pumping station of the North Metropolitan sewerage system. Tannery Brook, which is a tributary of Alewife Brook, was found early in the fall to be receiving wastes from a laundry establishment in Somerville, and also sewage from the combined sewers of Somerville.

The Malden River is affected by the discharge of waste and domestic sewage from four industrial concerns. The results of the analyses of the samples collected by the Department of Public Health at the mouth of this river show that the quality of the water has deteriorated considerably as compared with previous years.

#### *History of Pollution of Mystic River and its Tributaries.*

As indicated in the introduction to this report, the Legislature of 1884 directed the Massachusetts Drainage Commission to make an investigation of certain rivers in Massachusetts, including the Mystic. As a result of the recommendations in the report of that commission and the recommendations of the then State Board of Health printed in Senate Document No. 2 of the Legislature of 1889, the North Metropolitan sewerage system was constructed, which drains all of the sewered cities and towns in the Mystic River Valley. Since this system was first put into use in 1891, many branches of the original sewer have been constructed, including parallel sewers in the industrial district

in the northerly part of Winchester, in Woburn and in Stoneham, because of the development of this valley for industrial purposes into one of the largest Massachusetts tannery districts. An extension of the system was made in 1921 to Reading. The Mystic River is discussed on pages 202 to 212, inclusive, of House Document No. 1600 of the Legislature of 1937, which is the report of the special commission in the matter of the pollution of Boston Harbor. As indicated in that report the pollution of the Aberjona River has been a matter of discussion in the Legislature and elsewhere for many years. Legislation was provided in chapter 232 of the Acts of 1907 for the purpose of preventing the pollution of a tributary known as Horn Pond Brook and its tributary, Russell Brook, in Woburn and Winchester. This act is similar to that relating to the Neponset River referred to elsewhere in this report. Under the provisions of chapter 291 of the Acts of 1911 similar protection was afforded for the Aberjona River. Because of the surcharged condition of some of the Metropolitan sewers in the Aberjona River Valley in 1928, resulting in the overflow of sewage, the Legislature, under the provisions of chapter 124 of the acts of that year authorized the Department to permit the discharge of sewage into the Aberjona River for a period of three years.

Numerous investigations of the pollution of this stream have been made by the Department of Public Health, with the result that many of the industries in this valley subsequently constructed works for the treatment of their wastes. One of the important industries in this region was the old works of the Merrimac Chemical Company in North Woburn, where for many years sulphuric acid was manufactured from iron pyrites. An enormous quantity of spent iron pyrites has been deposited in the vicinity of this plant, and seepage from this material has given the river a rusty appearance from time to time. This condition may continue for many years. During the war large quantities of picric acid were manufactured at a plant near the Merrimac Chemical Company, and highly colored wastes were discharged into the stream. The Attorney General ruled in

1923 that the Department could not take action under the provisions of chapter 291 of the Acts of 1911 in order to prevent discoloration of the stream, nor could it take action because of an unpleasant appearance of the surface of the water.

The Department was required by the Legislature of 1918 to prepare a report relative to the cost of a sewerage system to prevent the pollution of the Mystic Lakes. This report appears as House, No. 1216 of the Legislature of 1920. Later in 1927 a sewer was constructed in the Aberjona River Valley in Woburn by that city, but it was necessary to reconstruct it in 1929 and 1930 because of an excessive amount of leakage of ground water into this sewer, and it was not available for the diversion of sewage and wastes from industries then polluting the Aberjona River until July 10, 1931. This trunk sewer has since been extended to North Woburn for the removal of sewage and wastes from certain works in that part of the city, including wastes from a plant engaged in the manufacture of glue which produces probably more foul waste than any other single industry in Massachusetts.

The new North Metropolitan relief sewer in the valley of the Aberjona River was not in complete use until October, 1937. Previous to and during the construction of this sewer large quantities of industrial wastes and domestic sewage overflowed into the stream, resulting in objectionable conditions not only in the river but in Upper Mystic Lake. This condition was due, in part at least, to the operations of one of the contractors, whereby one of the existing Metropolitan sewers near the Winchester-Woburn line was not used to its capacity and considerable quantities of sewage were permitted to overflow to the river. This made it necessary for the Department of Public Health to order the contractor to remove certain obstructions in the sewer and place it in complete use.

In connection with the Department's investigations of the Aberjona River sewer in the city of Woburn, which is now surcharged because of the discharge of excessive quantities of industrial wastes into it, and from which sewage

from time to time overflows, the Department has recommended to the Department of Public Works of the city of Woburn that that city take such steps as are necessary to prevent the further overflow of sewage from its sewers into the Aberjona River. The use of the new Metropolitan relief sewer has effected no material relief in the surcharged condition of the Woburn sewer except at its lower end. The Metropolitan District Commission has carried on certain surveys with a view to determining the proper location for a sewer parallel to a part of the Aberjona River Valley sewer of the city of Woburn, but it is understood that these surveys have not been completed.

As indicated elsewhere in this report, the Aberjona River, a tributary of the Mystic, rises in the northwesterly part of the town of Reading and includes the drainage from a corner of the town of Wilmington. It thence flows through Woburn and Winchester to its mouth in the Mystic Lakes. In the approved sewerage plan for the town of Reading the sewage from the northwesterly portion of that town was to be pumped into the Reading system. Since the approval of that plan the Aberjona River Valley sewer of the city of Woburn was constructed, and it is practicable to extend this latter sewer, if its capacity would permit, to intercept the sewage from Reading naturally tributary to this river valley. If such a sewer is to be used by Reading it would seem reasonable for the Metropolitan District Commission to take over or construct a new trunk sewer through Woburn.

There has been considerable interest for some years in connection with the pollution of Alewife Brook in Arlington, Belmont, Cambridge and Somerville, and under the provisions of chapter 88 of the General Acts of 1918 the Department of Public Health was authorized and directed to prohibit the entrance or discharge of sewage into the brook or its tributaries, or any other substance which might be injurious to the public health or might tend to create a public nuisance. The act is based on a similar act for the Neponset River referred to elsewhere in this report. Under the provisions of this act, the Department has sent communications to the city of Cambridge relative to the dis-

charge of sewage into the brook, and also to certain industrial concerns. As indicated elsewhere, there is a bill before the current session of the Legislature, House, No. 187, relative to the construction of additional sewers in the valley of Alewife Brook.

In 1906 a dam was constructed at the Cradock bridge in Medford, and a fresh-water basin formed above the dam with the water generally held at about 7 feet above mean low water in Boston Harbor. Further consideration has been given to the construction of a dam across the Mystic River, and House, No. 400 of 1932 contains legislation proposed by the Metropolitan District Commission and the Department of Public Health acting as a Joint Board for the construction, operation and maintenance of a dam across the Mystic River between the cities of Somerville and Everett, and the creation of a basin to be maintained at a surface elevation approximately 7 feet above low tide.

### *Industrial Wastes.*

The following table shows the amount and kind of industrial wastes discharging into the Mystic River so far as the records available to this Department are concerned:

*Industrial Wastes Discharged into Mystic River.*

CITY OR TOWN.	Tributary.	Kind of Manufactured Product or Process.	Quantity of Industrial Waste (Gallons per Day).	Remarks.
Woburn . . .	Aberjona . . .	Fish dehydrating . . .	840,000	Clean water from scrubber used in deodorizing.
Melrose . . .	Malden River	Rubber latex . . .	800	- -
Malden . . .	Malden River	Ice cream, gas, paint and varnish.	282,300	- -
Somerville . . .	Mystic River	Car shops . . .	Small quantity	Includes domestic sewage.
Everett . . .	Mystic River	Chemical works, oils and gas.	24,000,000 <sup>1</sup>	Condenser and cooling water.

<sup>1</sup> Much of this amount is unobjectionable.

The upper portion of the Aberjona River in Winchester and Woburn, now that the new North Metropolitan relief sewer is in use, should be in a satisfactory condition except

so far as it receives pollution from the Aberjona River sewer of the city of Woburn, but the Department is of the opinion that the question of providing a more adequate sewer in the portion of the stream above Montvale Avenue to and including the town of Reading should receive immediate attention. In view of the possibility of the removal by gravity of the sewage from the northwesterly part of Reading into the extension of such a sewer, rather than to pump this sewage into the Reading sewerage system as originally planned, and to pump it again at the Metropolitan pumping station in Reading, the Department is of the opinion that consideration should be given to the expenditure of state funds for such an extension when and if the town of Reading applies for such a connection.

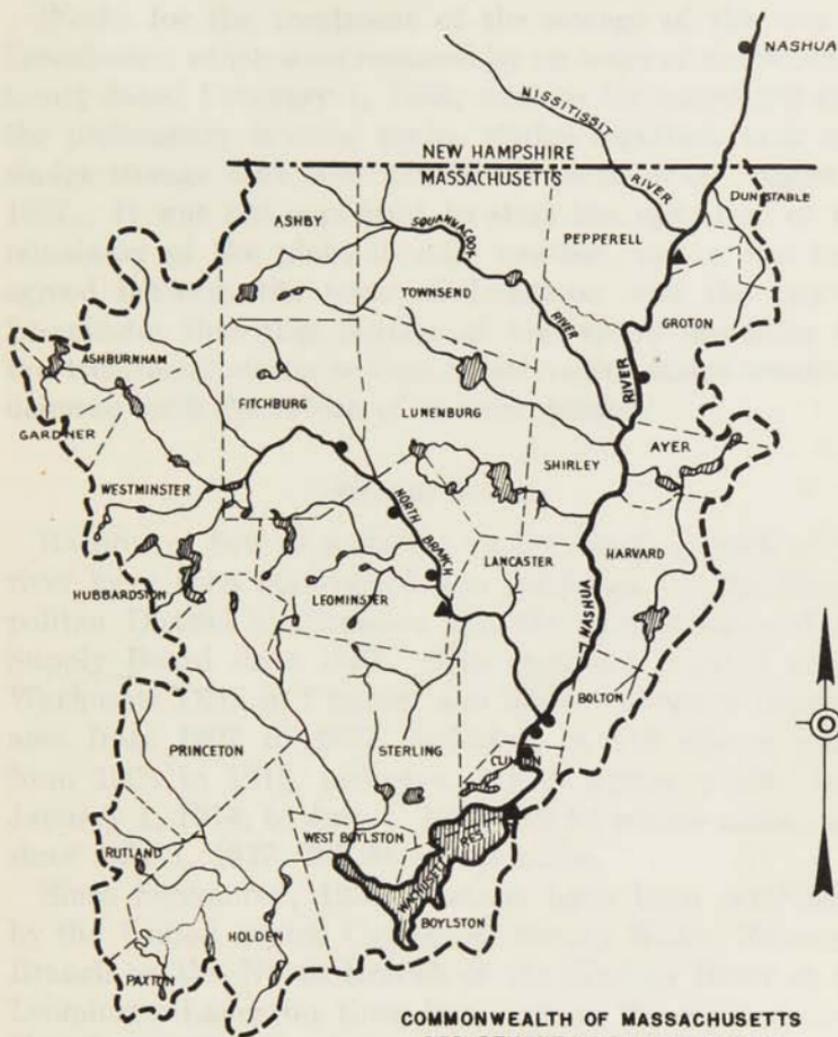
The Metropolitan District Commission and the Department of Public Health, acting as a joint board, have recommended in House Document No. 187 of the current session the construction of a relief sewer in the Alewife Brook district. Such a sewer is essential if the further pollution of this tributary of the Mystic River is to be corrected and nuisances in the valley of this stream are to be prevented.

Legislation has also been presented by the Metropolitan District Commission relative to the extension of the North Metropolitan relief sewer to the vicinity of the East Boston pumping station. The Department also has recommended the construction of such a sewer in order to prevent the pollution of the lower portion of the Mystic River.

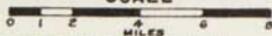
#### NASHUA RIVER.

The engineers of the Works Progress Administration have made no further observations of the sources of pollution of the Nashua River since the report published by them under date of October, 1936, nor have any samples been collected from this river by that organization. The results of the 1936 survey made by the Works Progress Administration were covered by the Department in its report to the Legislature of 1937 in Senate Document No. 50.

Accordingly, there appears to be no need for the Department to report at this time relative to this stream other



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- SAMPLING STATION
- ▲ STREAM GAGING STATION



than to indicate any change in its condition since the year 1936.

Works for the treatment of the sewage of the city of Leominster, which were required by an order of the Superior Court dated February 1, 1933, were so far completed that the preliminary settling tanks, sludge digestion tank and sludge storage tank were placed in operation on August 2, 1937. It was not expedient to start the operation of the remainder of the plant in cold weather, and it has been agreed between the town of Lancaster and the city of Leominster that that portion of the works providing for the treatment of the sewage in activated sludge would be deferred until the return of warmer weather.

#### *Flow of Stream.*

Records of flow at a station on the South Branch of the river have been maintained and published by the Metropolitan District Commission and the Metropolitan Water Supply Board since 1897. This station is located at the Wachusett Dam in Clinton, and had an effective drainage area from 1897 to 1907, inclusive, of 119 square miles; from 1908 to 1913, inclusive, 118.19 square miles; from January 1, 1914, to July 1, 1937, 108.84 square miles; and since July 1, 1937, 107.69 square miles.

Since September, 1935, stations have been established by the United States Geological Survey Water Resources Branch on the North Branch of the Nashua River at the Leominster-Lancaster town line, and on the main river at East Pepperell. The drainage area above the North Branch station is 107 square miles, while the area above the East Pepperell station is 433 square miles. Owing to the short duration of these two stations the United States Geological Survey Water Resources Branch has not published any data as yet.

#### *Condition of Stream.*

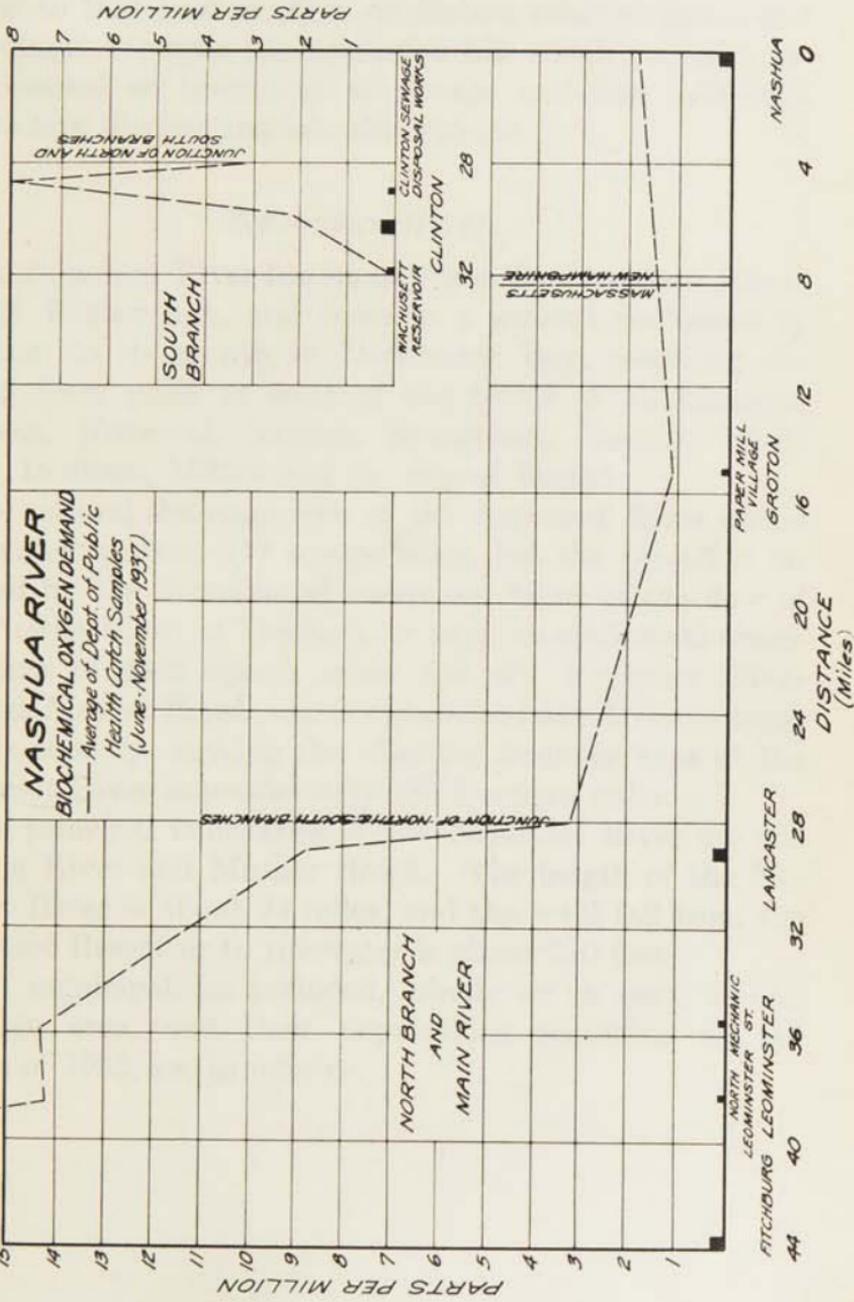
In connection with the Department's examinations of the various streams in the Commonwealth as required by law, samples have been collected during the months of June to

November, inclusive, 1937, from the Nashua River and its tributaries. The results of the analyses of these samples show a slight increase in pollution of the North Branch of the Nashua River below Fitchburg at a point above the sewage treatment works, evidently due to industrial wastes. A slight improvement in the condition of the river was noticed at North Leominster, and at the mouth of the North Branch in Lancaster there was a slight general improvement over the conditions found in 1936, although the amount of dissolved oxygen has shown a reduction, the lowest amount present being in the month of August, when it was only 19.1 per cent of saturation.

The analyses of the South Branch of the stream have shown a slight increase in pollution at a point below the sewage treatment works of the town of Clinton.

The main stream below the junction of the two branches has shown more evidence of pollution than in 1936, and the same is true in the stream as it enters the State of New Hampshire.

On the chart showing the biochemical oxygen demand of the water in the various rivers covered in this report, it will be noted that the biochemical oxygen demand of the North Branch of the Nashua River below Fitchburg is greater than any other stream shown on the chart. This is believed to be due to the discharge of industrial wastes, particularly from certain mills in Fitchburg. It is to be expected that the North Branch of the Nashua River will continue to be offensive, even after the new sewage disposal works for the city of Leominster are put into operation, unless the foul industrial wastes are either removed from the river or properly treated before being discharged. In 1920 the Department of Public Health recommended legislation for the North Branch of this stream similar to that then in effect on the Neponset, Assabet and Aberjona rivers. This legislation was not adopted. The Nashua River is one of the most seriously polluted streams in Massachusetts, and it is therefore to be expected that the inhabitants of the town of Lancaster who secured a favorable court decision in 1933 will not be too well satisfied if



PARTS PER MILLION

PARTS PER MILLION

DISTANCE (Miles)



this stream continues to be polluted by industrial wastes. The Department is of the opinion that legislation should be adopted relative to the North Branch of the Nashua River similar to that now in effect on certain other streams, and accordingly presents the appended bill which provides for the removal or treatment of sewage and foul industrial wastes now discharging into this stream.

#### NEPONSET RIVER.

The Neponset River has its source in the Neponset Reservoir in Foxborough, and flows in a general northeasterly direction to its mouth in Dorchester Bay, receiving the run-off from parts at least of the towns of Foxborough, Walpole, Norwood, Sharon, Stoughton, Canton, Westwood, Dedham, Milton and the city of Boston.

The natural drainage area of the Neponset River above tide water is about 117 square miles, but the run-off is increased by the diversion of about one third of the flow of the Charles River at Dedham, or from an additional drainage area of 66.2 square miles into the Neponset River through Mother Brook, one of the earliest canals constructed in this country, making the effective drainage area of the Neponset River approximately 183.2 square miles.

The principal tributaries of the Neponset River are the Canton River and Mother Brook. The length of the Neponset River is about 24 miles, and the total fall from the Neponset Reservoir to tidewater is about 280 feet.

The municipalities included, wholly or in part, in the drainage area, and their populations according to the census of 1935, are as follows:

CITY OR TOWN.	Population (1935 Census).
Boston . . . . .	89,900 <sup>1</sup>
Canton . . . . .	6,505
Dedham . . . . .	15,371
Dover . . . . .	1,305
Foxborough . . . . .	5,834
Medfield . . . . .	4,162
Milton . . . . .	18,147
Norwood . . . . .	15,574 <sup>2</sup>
Quincy . . . . .	76,909
Randolph . . . . .	7,580
Sharon . . . . .	3,683
Stoughton . . . . .	8,478
Walpole . . . . .	7,449
Westwood . . . . .	2,537

<sup>1</sup> Estimated population in watershed.

<sup>2</sup> Wholly in watershed.

The Neponset River is an industrial stream, particularly in Walpole, Norwood, Stoughton and Canton, and in the lower part of its course in Boston. The drainage area contains several large storage basins, viz., the Neponset Reservoir in Foxborough, Massapoag Pond in Sharon, Reservoir and Ponkapoag ponds in Canton, and Willetts Pond in Norwood and Walpole, the latter of which was designed, in part at least, to provide a greater amount of water for the purpose of diluting industrial wastes during the drier portions of the year. Practically all of these storage basins are under the control of the industries on this stream.

#### *Flow of Stream.*

A gaging station is maintained by the Department at Pleasant Street, Norwood, where the drainage area comprises 35.6 square miles and flow data are available for the climatological years October 1, 1917, to September 30, 1937. The number of days, during the period October 1, 1928, to September 30, 1935,<sup>1</sup> inclusive, that the flow was less than specified amounts is shown in the following table.

<sup>1</sup> July 1 to 13, October 1 to 15, and October 29 to 31, inclusive; 1934 omitted.

A column also shows the equivalent of these amounts in cubic feet per second per square mile of drainage area.

(1)	(2)	(3)
Number of Days that the Flow was Less than Amounts shown in Columns (2) and (3).	Flow in Cubic Feet per Second.	Equivalent Flow in Cubic Feet per Second per Square Mile.
13	5	.141
114	10	.281
353	15	.421
657	20	.562
887	25	.702
1,085	30	.842
1,423	40	1.124
1,604	50	1.405
1,768	60	1.685
1,916	70	1.966
2,024	80	2.247
2,157	90	2.528
2,215	100	2.809
2,381	150	4.213
2,472	200	5.618
2,512	250	7.022
2,522	300	8.427
2,525 <sup>1</sup>	350	9.832

<sup>1</sup> Total days.

### *Water Supplies.*

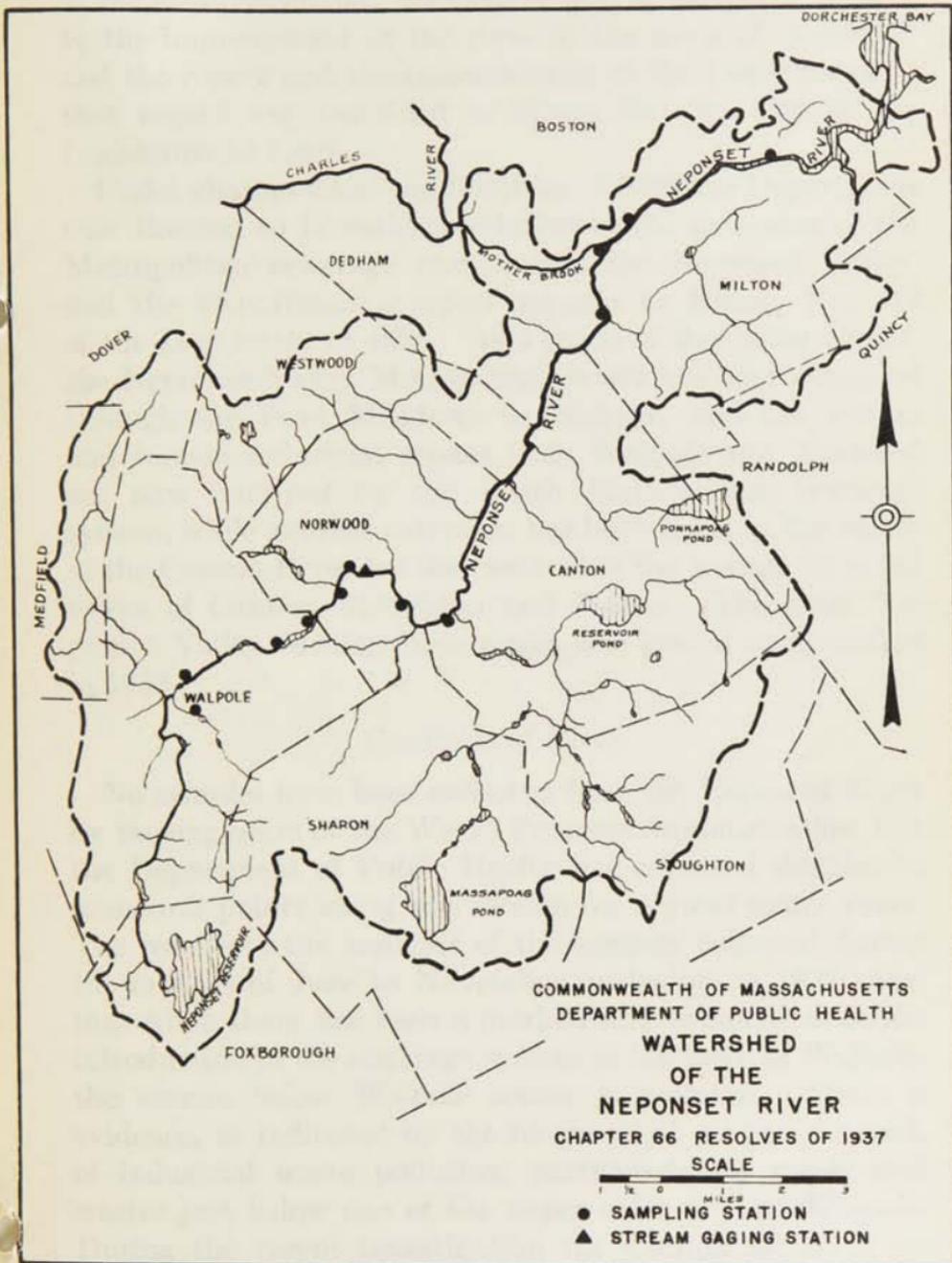
All of the municipalities in the Neponset River drainage area are provided with public water supplies obtained largely from the ground by means of tubular wells or springs located within the drainage area. The town of Stoughton obtains its water from a surface supply, and the town of Norwood obtains a part of its water supply from a surface source, the water of which is filtered.

### *History of Neponset River Improvements.*

The Neponset River has been the subject of much consideration by the Department of Public Health and its predecessor, the State Board of Health, in the matter of

preventing pollution and improving drainage conditions. In 1895 the then State Board of Health was required by a resolve of the Legislature to investigate the Neponset River, and two recommendations were made: (1) legislation to prevent the further pollution of the stream by sewage and industrial wastes, and (2) the removal of flashboards at the Mattapan Mills, together with the deepening and reconstruction of the channel. As a result of the first recommendation, and as indicated earlier in this report, an act was passed by the Legislature of 1902, chapter 541, giving the Department certain authority in preventing the further pollution of the stream. This act was made mandatory by chapter 360 of the Acts of 1906, and has since been amended by chapter 180 of the Acts of 1916, so that at the present time the Department is authorized and directed to prohibit the discharge of sewage into the Neponset River and its tributaries, and the discharge of industrial wastes which may be injurious to the public health or may tend to create a nuisance. The original act as amended directs the Department to consult and advise the owner of any industrial plant as to the best practicable and reasonably available means of treating its waste, and gives the courts authority to enforce the provisions of the act. The act, with its 1906 amendment, carries a penalty of not more than \$500 for each offence. These acts have been the bases of similar acts relating to the Aberjona River, Alewife Brook and the Assabet River.

In connection with the Neponset River acts, the town of Norwood constructed a sewerage and sewage disposal system in 1909, and practically all of the industries on the stream constructed industrial waste treatment plants. Under the provisions of chapter 655 of the Acts of 1911, the course of the stream was deepened and straightened and a considerable area of the extensive Fowl Meadows, so called, was reclaimed. The channel was so constructed as to provide for a run-off of 4.0 cubic feet per second per square mile without overflowing the banks. The work of correcting the channel was completed up to a point in Norwood in 1915, but the tributaries and small water courses in the Fowl





Meadows have not as yet been corrected. Under chapter 21 of the Resolves of 1937 the Department investigated relative to the improvement of the river in the town of Norwood, and the report and recommendations of the Department in that regard are contained in House Bill No. 241 of the Legislature of 1938.

Under chapter 43 of the Resolves of 1926 the Department was directed to investigate relative to the extension of the Metropolitan sewerage system into the Neponset Valley, and the Department's report appears as House, No. 212 of the Legislature of 1926. As a result of this latter report, the Neponset Valley Metropolitan sewer has been extended through the Fowl Meadows to Walpole, and the sewage and certain industrial wastes from Walpole and Norwood are now removed by the South Metropolitan sewerage system, while another extension has been made in the valley of the Canton River for the removal of the sewage from the towns of Canton, Stoughton and Sharon. The main Neponset Valley Metropolitan sewer was placed in operation in 1932.

#### *Condition of River.*

No samples have been collected from the Neponset River by the engineers of the Works Progress Administration, but the Department of Public Health has collected samples at numerous points along this stream for a great many years. The results of the analyses of the samples collected during the months of June to November, inclusive, in 1937 show that while there has been a marked improvement since the introduction of the sewerage system in the town of Walpole, the stream below Walpole center is polluted. There is evidence, as indicated by the biochemical oxygen demand, of industrial waste pollution, particularly by paper mill wastes just below one of the paper mills in East Walpole. During the recent investigation the Canton River at its mouth showed no evidence of serious pollution.

The amount of dissolved oxygen in the main stream as it passes through the extensive Fowl Meadows is sometimes considerably depleted, and averaged in the dry months

of 1937 only 41.0 per cent of saturation. The analytical results have in general shown an improvement in the sanitary condition of this stream in recent years, but, nevertheless, in comparing the analyses of the water of this stream with those of the various other streams included in this report, it is found that, below East Walpole and even at points nearer its mouth, the river is in a none too satisfactory condition. The sanitary survey shows that this condition is not due to the discharge of domestic sewage into the streams, and any improvement must therefore be by the further treatment of industrial wastes.

It is a question as to how much further the manufacturers can go in expending funds for additional treatment works. The industries in this valley have already spent a considerable amount of money for waste treatment works, particularly before the Neponset Valley sewer was constructed, and in many instances the settling tanks constructed by the industries before the sewer was built are now in use for the sedimentation of the less objectionable wastes before they are discharged into the river. In order to properly treat their wastes one concern expends daily about \$135.

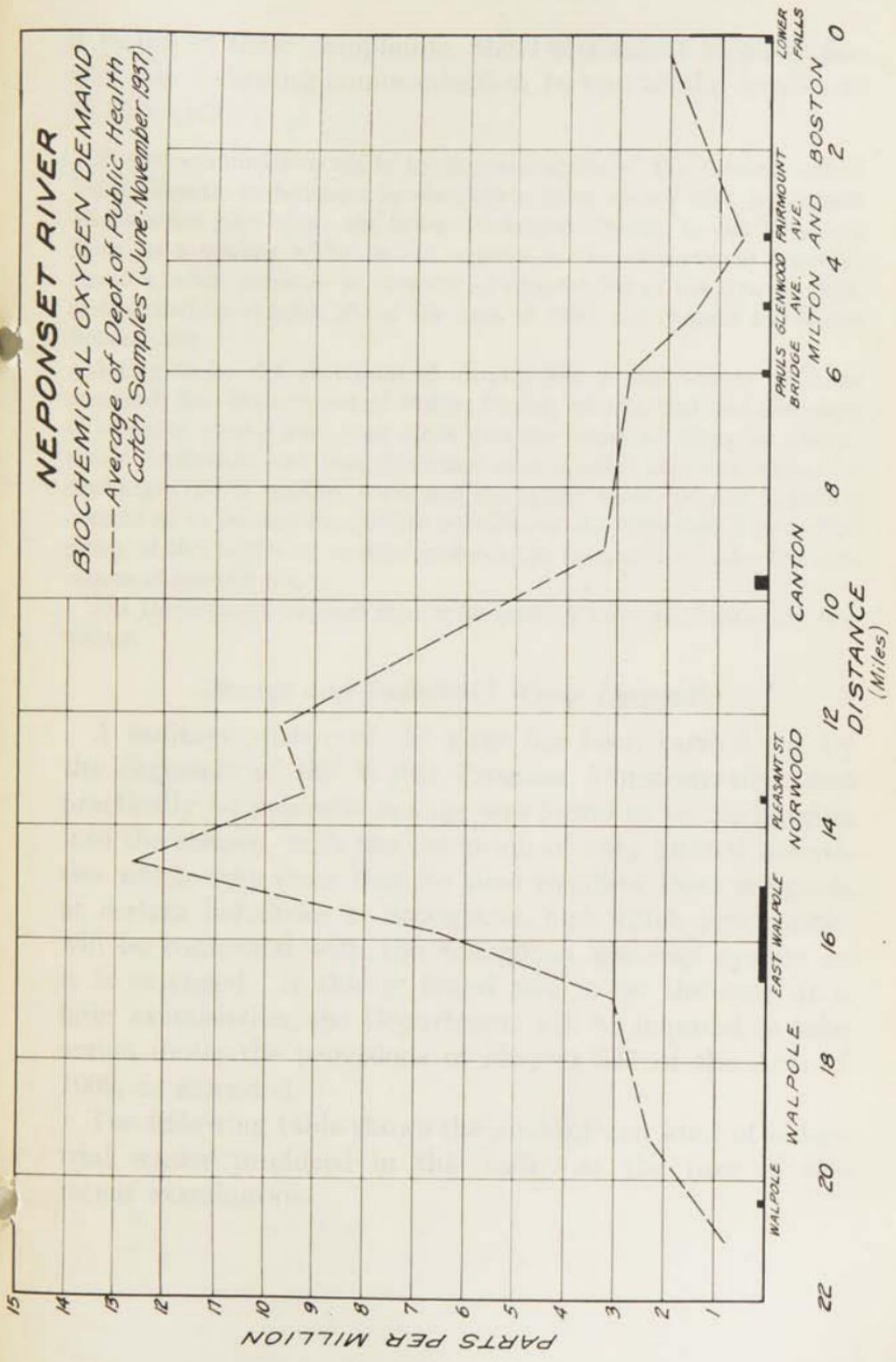
In connection with the extension of the Neponset Valley Metropolitan sewer, the Department made extensive investigations relative to the portion of the industrial wastes produced in the large industries in the valley which should be discharged into the sewer, and which after preliminary treatment could continue to be discharged into the river. As the flow of this stream is very low during the dry weather, and as at times much of the water is used for industrial purposes, it was impracticable to remove all of the lighter industrial wastes in the sewer; hence it appeared reasonable to continue to discharge the lighter wastes into the river after sedimentation.

The stream was the cause of a complaint by an official in Hyde Park during the year, and the recent examination showed that this complaint was due very largely to the discharge of paper mill and oily wastes from three of the larger industrial plants. Because of the conditions found as

# NEPONSET RIVER

## BIOCHEMICAL OXYGEN DEMAND

--- Average of Dept of Public Health Catch Samples (June-November 1937)





a result of these complaints, the Department recently has sent the following communication to two of the industries in this valley:

Recent examinations made by representatives of the Department of Public Health in response to complaints have shown that paper mill wastes from your plant are being discharged directly to the Neponset River in a manner which in the opinion of the Department tends to create a public nuisance in violation of chapter 541 of the Acts of 1902, as amended by chapter 360 of the Acts of 1906, and chapter 180 of the Acts of 1916.

Acting under the provisions of chapter 541 of the Acts of 1902, as amended, the Department of Public Health advises that the discharge of offensive wastes from your plant into the Neponset River be discontinued forthwith, and that the more objectionable of these wastes be discharged into a sanitary sewer and the lighter wastes treated in such a manner as to prevent the further pollution of the Neponset River. The giving of this advice in no way protects you from action under the provisions of the said act.

The Department requests that it be advised as to your action in this matter.

#### *Sewage and Industrial Waste Disposal.*

A sanitary survey of the river has been carried out by the engineers of the Works Progress Administration, and practically no domestic sewage was found to be discharging into the stream, with the exception of very limited quantities which may from time to time overflow from cesspools at certain industries in Stoughton, and which presumably will be connected with the Stoughton sewerage system as it is extended. If this is found not to be the case at a later examination, the Department will be required to take action under the provisions of chapter 541 of the Acts of 1902, as amended.

The following table shows the amount and kind of industrial wastes produced in this valley at the time of the recent examination:

*Industrial Wastes produced in the Neponset River Valley.*

CITY OR TOWN.	Kind of Manufactured Product or Process.	QUANTITY OF INDUSTRIAL WASTE (GALLONS PER DAY).			Remarks.
		To Sewers.	To River.	Total.	
Foxborough . . . . .	State Hospital sand filter effluent . . . . .	—	165,000	165,000	—
Walpole . . . . .	Paper mill machinery, tannery, cheesecloth and surgical dressings, gray iron castings, floor covering and roofing, rope and jute paper.	611,800	6,325,500	6,937,300	—
Norwood . . . . .	Tannery and wool scouring, printing, printers ink, book binders supplies, laundry, gray iron castings.	800,000	7,000	807,000	—
Stoughton . . . . .	Laundry, rubberized fabrics, rubber soles and heels, worsted cloth, elastic webbing, shoes, imitation leather, shoe polishes.	200,000	185,000	385,000	—
Canton . . . . .	Dyed and finished cotton cloth, dressed chickens, laundry, garnetted wool, baby underwear, music and tennis strings, rubber fabrics, basket and suiting cloth, felts.	—	1,575,400	1,575,400	Including nearly 1,000,000 gallons per day of clean cooling water.
Dedham . . . . .	Laundry, envelopes . . . . .	34,000	—	34,000	—
Milton . . . . .	Ice cream, chocolate . . . . .	1,800	5,600,000	5,601,800	Mostly clean water.
Boston . . . . .	Wool shoddy, wool scouring, paper, rubber goods . . . . .	507,000	1,200,000	1,707,000	—

The figures in the foregoing table differ somewhat from those presented in House No. 1600 of 1937. The slight reduction in Walpole in 1937 is due to the giving up of the use of certain machinery. No figures are given in House No. 1600 for Norwood, Dedham and Milton, as in the investigations covered in that report no record was made of the wastes discharged into the sewers in those towns. The figures in the foregoing table for Norwood represent a limited quantity of wastes discharged into a tributary of the river plus those discharged into the sewers. The difference in the Canton and Milton figures is due to the inclusion in the above table of considerable quantities of reasonably clean water used for cooling purposes which were not included in the earlier report. The figures given for Boston are the result of more accurate measurements by the engineers of the Works Progress Administration than it was practicable to make in connection with the investigation presented in House No. 1600 of 1937.

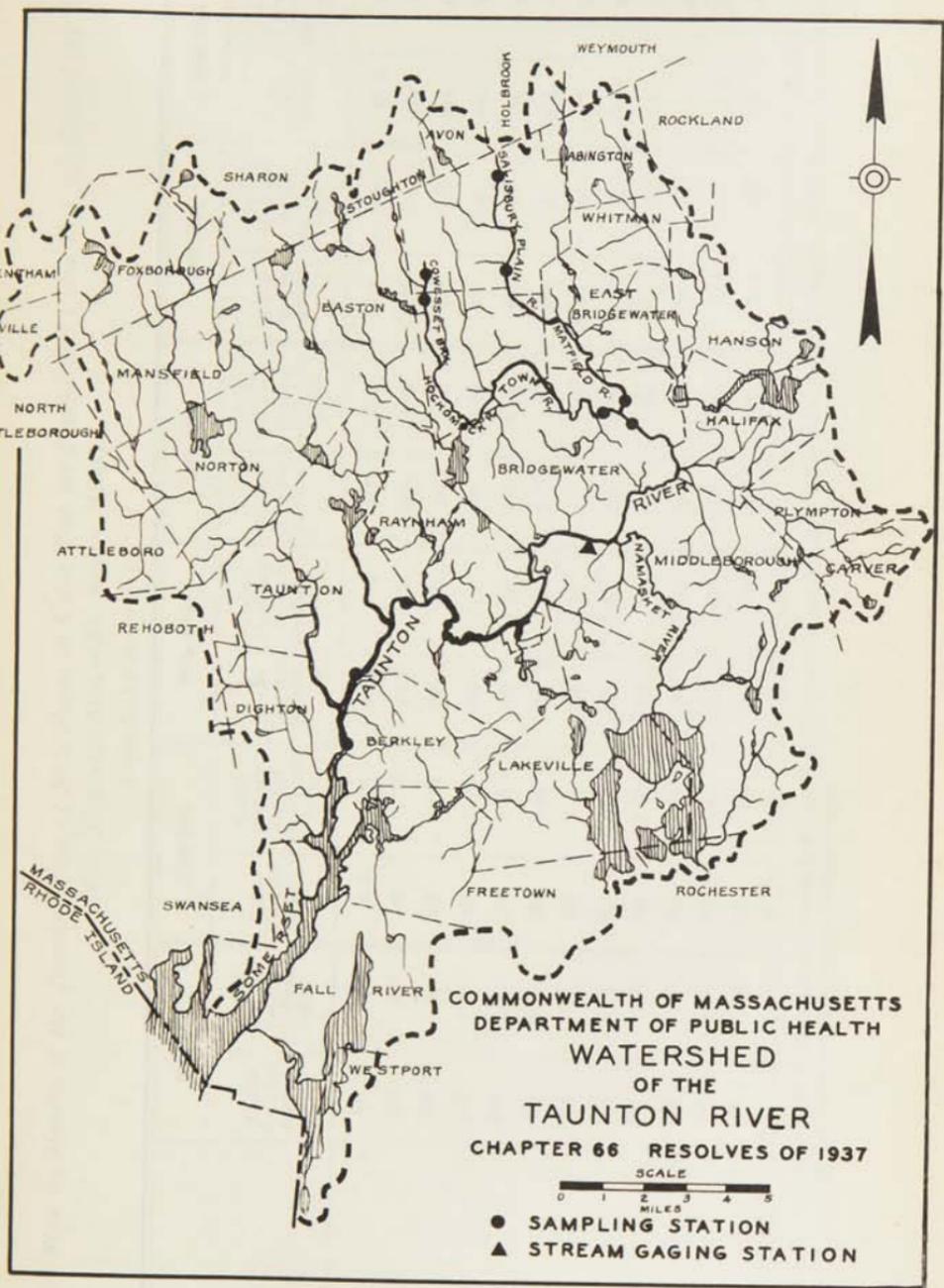
#### TAUNTON RIVER.

The Taunton River was not mentioned in the resolve calling for this report, but the condition of this stream in portions of its course is such that the Department is of the opinion reference should be made to it. This stream, which has several tributaries and drains the southeastern part of the State, has a drainage area at its mouth, above a line from Braytons Point in Somerset and the state boundary line at Fall River in Mount Hope Bay, of 568 square miles.

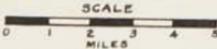
#### *Flow of Stream.*

Records of the flow in the Taunton River at Titicut, near the State Farm, were made and published by the United States Geological Survey Water Resources Branch for the period March 1, 1920, through September 30, 1925, at which time the station was discontinued, owing to the loss of control by the taking out of the dam at East Taunton. From October, 1929, through September, 1935, the Water Resources Branch of the United States Geological Survey

has maintained and published the records of flow from a station at the State Farm, which is about  $1\frac{3}{4}$  miles below the Titicut station. The drainage area at the State Farm station comprises 260 square miles. The following table shows the flow of this river at the State Farm station during the climatological years 1929–1930 through 1934–1935, the flow being stated as the daily mean in cubic feet per second and cubic feet per second per square mile:



COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC HEALTH  
 WATERSHED  
 OF THE  
 TAUNTON RIVER  
 CHAPTER 66 RESOLVES OF 1937



- SAMPLING STATION
- ▲ STREAM GAGING STATION



*Mean Daily Flow by Months of the Taunton River at State Farm in Cubic Feet per Second and Cubic Feet per Second per Square Mile (Drainage Area = 260 Square Miles).*

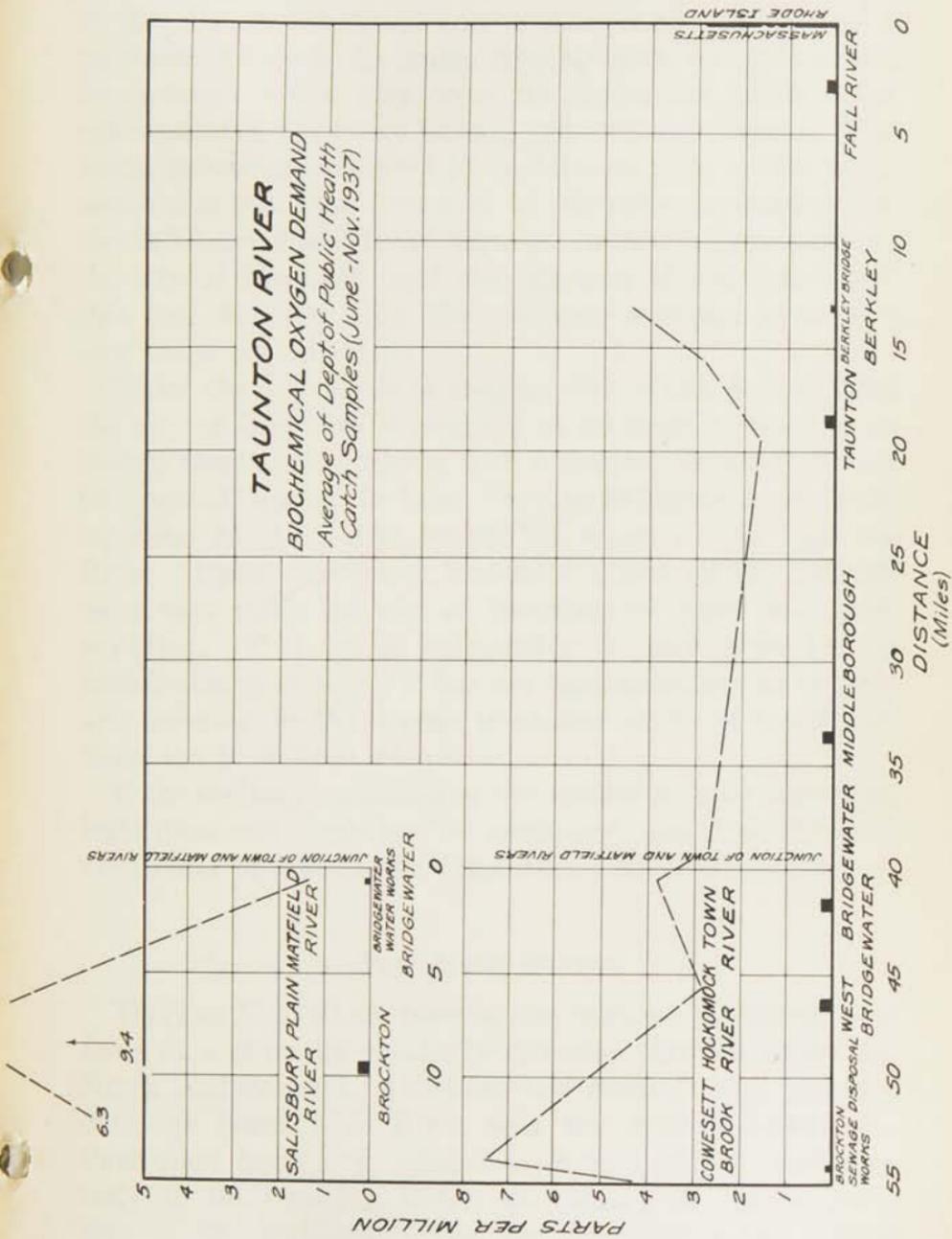
[Corrected for diversions.<sup>1</sup>]

	1929-1930.		1930-1931.		1931-1932.		1932-1933.		1933-1934.		1934-1935.	
	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.
October	107	.412	57.4	.221	140	.538	513	1.97	462	1.78	99.1	.381
November	230	.884	186	.715	169	.650	1,050	4.08	334	1.28	142	.546
December	358	1.38	231	.888	250	.962	452	1.74	425	1.64	283	1.09
January	575	2.21	425	1.63	680	2.62	509	1.96	875	3.37	490	1.88
February	684	2.63	536	2.03	595	2.29	610	2.35	438	1.68	584	2.25
March	602	2.32	982	3.78	700	2.73	1,110	4.27	1,095	4.21	828	3.18
April	444	1.71	809	3.11	710	2.73	1,610	6.19	1,035	3.98	1,315	5.06
May	283	1.09	657	2.53	355	1.37	521	2.00	485	1.87	470	1.81
June	230	.884	891	3.43	205	.762	269	1.03	255	.985	394	1.52
July	103	.396	315	1.22	123	.473	200	.779	98.6	.379	140	.538
August	934	3.59	231	.888	178	.685	358	1.38	43.5	.167	75.8	291
September	79.2	.305	221	.859	161	.619	854	3.28	53.0	.204	102	.392

<sup>1</sup> Diversions from Namasket River to the cities of Taunton and New Bedford, and for pumpage from Silver Lake into the Taunton River Basin for Brockton and other municipalities which receive water from the Brockton Water Works.

Under the provisions of chapter 29 of the Resolves of 1919 the Department was directed to investigate the Taunton River and to report to the Legislature as to any action necessary to properly dispose of sewage and industrial wastes then being discharged into this river and its tributaries. As a result of a comprehensive investigation of this stream the Department in its report to the Legislature, House, No. 1115 of 1920, recommended an act to provide for the protection of the public health in the valley of the Taunton River, the draft of this act being based on legislation then in effect on the Neponset, Aberjona and Assabet rivers. This proposed legislation was not adopted, and the river continues to be polluted by sewage and industrial wastes, the most objectionable instance being the discharge of sewage from the cities of Taunton and Fall River, the town of Bridgewater and the state normal school in this town (and the town of Middleborough), also the industrial wastes from the industrial centers of this valley.

The only works provided for the treatment of sewage in the valley of the Taunton River are those used for treating the sewage of the city of Brockton and those used for filtering the sewage of the State Farm in Bridgewater. Many years ago the city of Taunton obtained land for the construction of sewage treatment works, and plans have recently been prepared for treatment works at another location. Plans also have been prepared for the collection and treatment of large quantities of sewage discharged into the Taunton River from the city of Fall River. Much complaint has been made over the pollution of this stream, particularly in the vicinity of Fall River, and because of this pollution it has been necessary for the Department of Public Health to restrict the taking of shellfish from the Taunton River and Mount Hope Bay. The authorities of the State of Rhode Island also have found it necessary to condemn much of Mount Hope Bay for shellfishing, and under date of December 7, 1936, the Governor of Rhode Island brought the matter to the attention of the authorities of Massachusetts.





Chapter 309 of the Acts of 1888 provides for the approval by the Department of drainage systems within the limits of the city of Brockton, and in case of the creation of a nuisance by such drainage, appeal may be had to the Department which may order its abatement. This act is enforceable in any court having jurisdiction in equity. The Department has recently had occasion to refer to this act in connection with the discharge of offensive substances into the Salisbury Plain River through surface water drains of the city of Brockton, and the question of, the removal of this foul drainage into the sanitary sewerage system is now under consideration.

Under the provisions of chapter 350 of the Acts of 1892 the city of Brockton is required at all times to operate its sewage treatment works in such a manner as not to impair for domestic use by the State Farm in Bridgewater or render injurious to the public health the water of the Taunton River. Upon application and after a hearing the Department may order the city of Brockton to desist from such pollution. This act is enforceable by any court having jurisdiction in equity. It has not been necessary to use this act, however, as the sewage treatment works of the city of Brockton have been adequate.

If the sanitary condition of this stream is to be improved, legislation will doubtless be necessary, and a draft of an act similar to that on the Connecticut River is appended.

#### TEN MILE RIVER.

The Ten Mile River rises in the town of Wrentham and flows in a generally southerly direction through Plainville, North Attleborough, Attleboro and Seekonk to a junction with the Seven Mile River near the Attleboro-Seekonk-Pawtucket boundary, whence it flows southerly and westerly to the Seekonk River, an estuary of Narragansett Bay in Rhode Island. The Ten Mile River has a total drainage area of 55.5 square miles, of which 49.6 square miles, or about 90 per cent, are within the State of Massa-

chusetts. The drainage area contains considerable portions of four municipalities and comparatively negligible portions of three other municipalities.

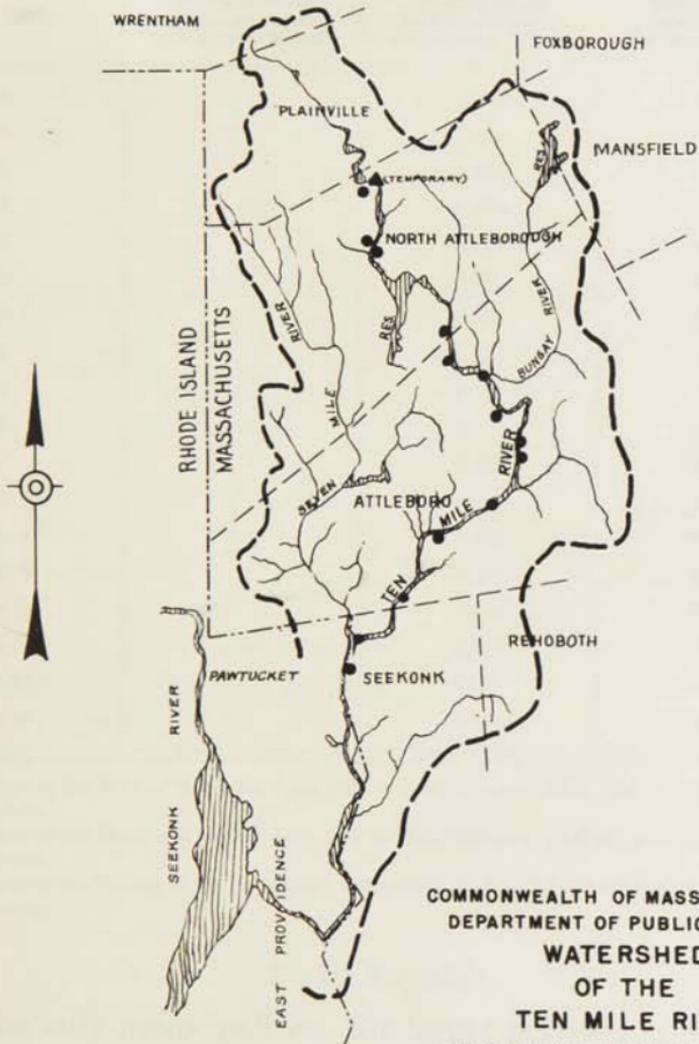
The river is quite thoroughly developed industrially in North Attleborough, Attleboro and Seekonk, and the total population within the drainage area based on the 1935 census is 30,427. The drainage area contains several storage basins in Mansfield, North Attleborough and Attleboro, and the flow is under considerable regulation by the industrial concerns on this stream.

#### *Flow of Stream.*

Five locations for gaging stations were selected by the engineers of the Works Progress Administration and later examined by an engineer of this Department together with other locations. No location was found to be suitable for a permanent station owing to channel conditions and the large amount of regulation in the daily flow. For the purpose of sampling and dilution studies staff gages were installed at four points on the river and three current meter gagings were made by the United States Geological Survey. These measurements of flow showed that only at the section below the Whiting's Mill opposite the North Attleborough Water Works pumping station could such measurement possibly be relied upon. As the work was originally laid out staff gage readings were to be made daily, but this was not possible.

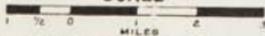
Should occasion again arise to measure the run-off from some of this drainage area, measurements might be made for low to medium high stages of the river by installing a recording gage in the channel below the Whiting's Mill, and by providing a low control several hundred feet below the gage.

The results of the current meter measurements made by the United States Geological Survey are shown in the following table, the rates being in cubic feet per second per square mile of drainage area:



COMMONWEALTH OF MASSACHUSETTS  
 DEPARTMENT OF PUBLIC HEALTH  
**WATERSHED**  
**OF THE**  
**TEN MILE RIVER**  
 CHAPTER 66 RESOLVES OF 1937

SCALE



- SAMPLING STATION
- ▲ STREAM GAGING STATION



*Comparison of Discharges of the Ten Mile River below the Whiting's Mill, and the Average Daily Discharge of the Wading River at Norton and the Taunton River at the State Farm in Bridgewater.*

[Cubic Feet per Second per Square Mile.]

1937.	Ten Mile River (Drainage Area= 3.75 Square Miles).	Wading River (Drainage Area= 42.4 Square Miles).	Taunton River (Drainage Area= 260 Square Miles).
June 15 . . .	-	1.156	1.269
June 16 . . .	-	1.178	1.000
June 17 . . .	-	1.014	0.876
June 18 . . .	1.546	0.943	0.865
June 19 . . .	-	0.850	0.762
June 20 . . .	-	0.826	0.484
July 23 . . .	-	0.543	0.392
July 24 . . .	-	0.472	0.316
July 25 . . .	-	0.377	0.181
July 26 . . .	0.693	0.330	0.131
July 27 . . .	-	0.472	0.085
July 28 . . .	-	0.425	0.150
August 8 . . .	-	0.130	0.154
August 9 . . .	-	0.210	0.208
August 10 . . .	-	0.306	0.358
August 11 . . .	0.560	0.283	0.346
August 12 . . .	-	0.425	0.454
August 13 . . .	-	0.471	0.462

Average of the Wading River for June, 1925 to 1936, inclusive, 1.179 cubic feet per second per square mile.

Average of the Wading River for July, 1925 to 1936, inclusive, 0.507 cubic feet per second per square mile.

Average of the Wading River for August, 1925 to 1936, inclusive, 0.453 cubic feet per second per square mile.

### *Water Supplies.*

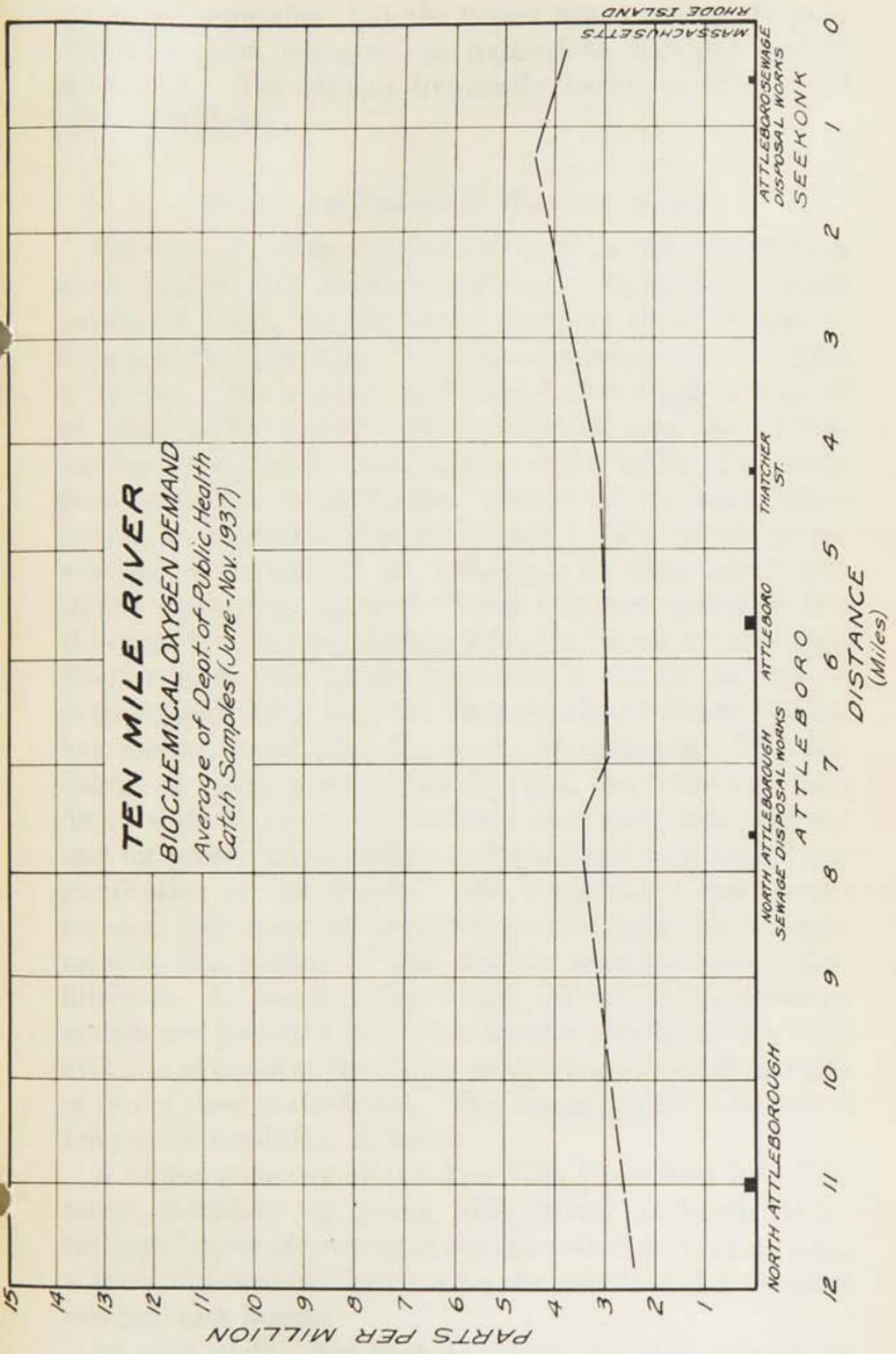
The only municipalities, the larger portions of which are in the drainage area, which have public water supplies are Plainville, North Attleborough and Attleboro. Plainville obtains water from the North Attleborough supply, which is from dug wells located in North Attleborough and Plainville. The city of Attleboro obtains water from dug wells, tubular wells and gravel-packed wells located in Attleboro and Mansfield.

*Condition of the River.*

It was impracticable for the engineers of the Works Progress Administration project to obtain any considerable number of samples of water from the Ten Mile River for analysis, but on October 27, 1937, composite samples were collected at half-hour intervals from 10 A.M. to 6 P.M. and analyzed by the Works Progress Administration chemists at the laboratory of the Worcester Sewer Department in Worcester. These results show that the river as it reached North Attleborough was in a satisfactory condition, and that pollution occurred in passing through this municipality. The analyses also show below Attleboro the effect of pollution, particularly by an increase in carbonaceous matter. The analytical results of the samples collected at Elm Street, North Attleborough, at Olive Street, and of Thatcher Brook opposite School Street, in Attleboro, show considerable evidence of pollution by industrial wastes or domestic sewage, while the Ten Mile River at Elm Street and Thatcher Brook opposite School Street showed the effect of certain acid industrial wastes.

The results of the analyses of samples collected by representatives of the Department and analyzed in its laboratories show that the condition of the stream during 1937 was but little different than has been found in recent years. As the river reaches North Attleborough it is well saturated with oxygen. The special samples taken just above and below the entrance of the effluent of the North Attleborough sewage treatment plant for the biochemical oxygen demand determination show no particular change in the condition of the water between these stations except during the month of October, when there was a marked increase in this determination. As the stream enters the city of Attleboro it contains a considerable amount of organic matter, but at the time of each examination during the year, except in June, the water was reasonably well saturated with oxygen. In June it was reduced to 43.5 per cent of saturation. Below Attleboro the amount of dissolved oxygen in the stream

**TEN MILE RIVER**  
**BIOCHEMICAL OXYGEN DEMAND**  
*Average of Dept. of Public Health*  
*Catch Samples (June - Nov. 1937)*



MASSACHUSETTS  
 RHODE ISLAND

NORTH ATTLEBOROUGH  
 NORTH ATTLEBOROUGH  
 SEWAGE DISPOSAL WORKS  
 ATTLEBORO  
 ATTLEBORO  
 SEWAGE DISPOSAL WORKS  
 THATCHER ST.  
 ATTLEBORO SEWAGE  
 DISPOSAL WORKS  
 SEEKONK  
 DISTANCE  
 (Miles)



decreased somewhat, but the lowest found during the year was in August, when it was reduced to 42.8 per cent of saturation. The stream frequently carries a film of oil below Attleboro.

*Sewage and Industrial Waste Disposal.*

The town of North Attleborough and the city of Attleboro are provided with sanitary sewerage systems and sewage treatment works. In the former there are some 18 miles of sewers, while in the latter there are somewhat over 37 miles of sewers. The sewage of North Attleborough is treated by plain sedimentation and filtration through sand filters having an aggregate area of 8.75 acres, while the sewage from Attleboro is discharged directly on to sand filters having an aggregate area of 15.5 acres. The results of the analyses of samples of the effluent from these two works show a reasonable degree of efficiency in their operation, but the quantity of sewage discharged to the North Attleborough filters is somewhat greater than the works are capable of properly purifying, and the Department of Public Health has recommended that the works be enlarged. The discharge of crude sewage directly upon the Attleboro sand filters without proper preliminary treatment increases the cost for proper maintenance, and interferes with the proper purification of the sewage. The Department has recommended that plans be prepared for the preliminary treatment of the sewage of this city by sedimentation before filtration. In North Attleborough portions of the sewerage system are provided with underdrains, and there has been evidence at times of the discharge of sewage from the outlets of two of these underdrains. This has appeared to be only a temporary condition, however.

A sanitary survey of the Ten Mile River and its tributaries, including the Seven Mile River, in North Attleborough, shows 36 sources of sewage pollution, varying from a privy adjacent to the river to the overflow of a cesspool serving three houses.

In spite of the fact that Attleboro operates a sewerage

system, there are still numerous cesspools, privies and septic tanks in this city, and several of the large industries in this city and also in North Attleborough discharge domestic sewage into the main stream or its tributaries more or less directly, even where public sewers are available. Where the public sewers are available, action should be taken by the local authorities of both of these municipalities to have the domestic sewage, at least, discharged into the public sewers. The examination of the main stream and its tributaries in Attleboro showed 23 sources of sewage pollution, varying from a privy overhanging the stream to the overflow from a cesspool serving some 80 employees. No sewerage system is provided in Plainville or Seekonk. The examinations showed that in Plainville there are 13 sources of domestic sewage pollution. The examinations along the river in Seekonk showed that there were 21 privies near or over the river, and 13 cesspools and septic tanks from which domestic sewage overflows to the stream.

The engineers of the project have visited all of the industrial plants of the municipalities within the drainage area of this stream, except those adjacent to the upper reaches of Thatcher Brook in Attleboro, for the purpose of obtaining information relative to the quantity of industrial wastes and domestic sewage and method of disposal from these plants. The bulk of the industrial wastes are produced in Attleboro and North Attleborough from processes in connection with the production of jewelry and other similar products. In many of these processes acids are used, and in several cases the wastes are discharged through tanks by means of which valuable metals may be recovered. In some instances the industrial wastes are discharged into the public sewers, but in general they are discharged into cesspools or passed through settling tanks and thence to the stream.

The following table shows the amount and kind of industrial wastes discharging into the Ten Mile River at the time of the recent examination:

*Industrial Wastes Discharged into Ten Mile River.*

CITY OR TOWN.	Kind of Manufactured Product or Process.	Quantity of Industrial Waste (Gallons per Day).	Remarks.
Plainville . . . . .	Gold and silver reclaiming, costume jewelry, metal mesh bags, laundry.	67,500	- -
North Attleborough . . . . .	Costume jewelry, tennis rackets, electroplating, vanity and cigarette cases, metal mesh bags, watch chains, mirror frames, metal buttons, metal badges and plaques, dairy, laundry.	308,000	Most of waste discharged to river. Limited quantity to sewer.
Attleboro . . . . .	Metal spools, electroplating, costume jewelry, silver studs and escutcheons, optical goods, chain jewelry, finishing and dyeing of woolen yarns, auto accessories, curtain goods, laundry.	500,000	Most of waste discharged to river. Limited quantity to sewer.
Seekonk . . . . .	Bleaching and dyeing . . . . .	500,000	Plant in Rhode Island, treatment works in Massachusetts.

As indicated previously in this report, samples have been collected by the engineers of the Works Progress Administration and by this Department of the rivers referred to in chapter 66 of the Resolves of 1937. The average results of the biochemical oxygen demand determinations are shown in the appended diagram.

In addition to the rivers mentioned in the foregoing report, chapter 66 of the Resolves of 1937 refers also to the Millers River in the vicinity of Northampton. There is no Millers River in Northampton, although there is a Mill River. Consideration of the pollution of the Mill River has been given in that part of this report relating to the Connecticut River. The Millers River rises in Gardner and flows westerly to the Connecticut River. Pollution of this river is to be considered by the Works Progress Administration's engineers in another report.

One other stream which has received a great deal of attention by this Department, but is not referred to in chapter 66 of the Resolves requiring this report, is the Danvers River and its tributaries in Salem, Peabody, Danvers and Beverly. This matter is covered in a report of the joint board consisting of the Department of Public

Health and the Department of Public Works, which appears as House Document No. 1250 of 1935. In this report the joint board recommended the enactment of legislation for the prevention of the pollution of this stream and its tributaries, based on the legislation relative to the Neponset, Aberjona and Assabet rivers.

#### SUMMARY AND RECOMMENDATIONS.

The recent investigations of the Nashua, French and Merrimack rivers have shown these streams to be seriously polluted by domestic sewage in addition to industrial wastes.

The Blackstone River also is polluted by sewage from certain municipalities where sewage disposal works have not been provided, and this stream and the Neponset, Nashua and French rivers are thoroughly developed for industrial purposes. The effect of the industrial waste pollution of the Neponset River disappears before this stream reaches any considerable concentration of population, and no further legislation should be required if suitable treatment works are provided for the industrial wastes not now discharging to the sewer. The North Branch of the Nashua River will in 1938, after the new sewage treatment works at Leominster are in operation, be fairly well protected from pollution by domestic sewage, but it will continue to be one of the most seriously polluted streams in Massachusetts, due to the discharge of industrial wastes, and if pollution from such wastes is to be prevented, then legislation similar to that in Rhode Island, Connecticut and other States must be provided.

The Taunton, Hoosick and Housatonic rivers are not mentioned in the resolve, but there has been much discussion of late relative to the pollution of the former stream because of its effect on shellfish near its mouth, and the State of Rhode Island has indicated a marked interest in preventing the further pollution of this stream. In 1920 the Department recommended legislation regarding the Taunton River similar to that for the Neponset River.

The city of North Adams has established sewage treatment works to prevent the pollution of the Hoosick River

by its sewage, and as early as 1909 plans were proposed for the collection and treatment of the sewage of Adams. The sewage from this latter town is still discharged into the river without treatment, and representatives of the city of North Adams have complained relative to the condition of the river below Adams. In any stream pollution legislation the Hoosick River should be considered.

Pollution of the Housatonic River has been a matter of much consideration in recent years by persons residing in the lower Housatonic Valley in Massachusetts, and the city of Pittsfield has recently constructed a substantial addition to its sewage disposal works, while the sewage from the towns of Lenox and Stockbridge is now treated by sand filtration. The Department has recently approved plans for the collection and treatment of sewage of the town of Dalton, and in view of the local interest in this stream, the Department has informally recommended that remedial legislation be introduced in the Legislature.

The Connecticut River also was found to receive large quantities of sewage, and while probably not in a condition to be dangerous to the public health, during the recent investigation there were many nuisances in the vicinity of sewer outlets which may be intensified during periods of drought, and it is obvious that some means of improvement should be considered.

In connection with the investigation of the special commission, under chapter 60 of the Resolves of 1937, which was directed to make a study relative to certain problems in the Merrimack River Valley, a report was filed with the current Legislature and printed as Senate Document No. 100, which recommends legislation whereby the Department may by its order direct any city or town in this drainage area to install and maintain works for the treatment of sewage.

As a result of the stream pollution investigations carried on with the Works Progress Administration in 1936, the Department recommended the adoption of legislation under which it might from time to time, after notice and a hearing, prescribe and establish rules and regulations for the purpose of preventing pollution of any or all lakes, ponds, streams

and tidal waters. A similar recommendation was made by the special commission established under the provisions of chapter 11 of the Resolves of 1935 to study and investigate the public health laws and policies.

The matter of pollution of our interstate stream is one which has received considerable discussion throughout the country in recent years. Many have suggested that the proper solution rests with the enactment of uniform state anti-pollution laws, while others argue that the only solution is the enactment of Federal mandatory acts. At the present time there are a number of proposed acts before Congress with a view to preventing stream pollution. One of these acts, H.R. 2711, which has passed the House of Representatives and the Senate of the 75th Congress, with amendments, now rests with congressional conferees. This act would set up a board of five commissioned engineer officers of the United States Public Health Service, whose duties would be to report on examinations, investigations, plans and surveys of stream pollution matters, and whose approval would be a prerequisite for Federal grants-in-aid or loans for the construction of necessary treatment works. This board also would have the power to classify the navigable waters of the continental United States into districts, to be known as sanitary water districts, to fix and define the boundaries of each such district, and might from time to time alter such boundaries. The areas of such districts would, in so far as practicable, conform to the areas of drainage areas not wholly contained within the boundaries of one State. The board would fix standards of purity in each such district for the navigable waters thereof, and for such tributaries from which pollution may flow, be washed or carried into such navigable waters; would establish minimum requirements as to the treatment of polluting material before it is discharged into such waters; and would promulgate regulations governing the discharge of any matter or materials into such waters.

Section 8 of this act would provide as follows:

Pursuant to the powers of the United States to regulate interstate commerce and navigation; to extend, change, and amend the Admiralty

and Maritime Act; to give due effect to the Migratory Bird Treaty; and to protect the fisheries, particularly the anadromous fish, Congress hereby declares the discharge or deposit of any waste, except the normal discharge of sewage from toilets of boats or from the galley sink drains or the normal amount of oil that may be discharged from the exhaust pipe of a motorboat, or other substance, whether in a solid, gaseous, or liquid state, into any of the navigable waters of the United States, or into any tributary from which the same may flow, be washed, or carried into any of such navigable waters, in violation of regulations promulgated by the board, if such waste or other substance is or may be injurious to human health or to any other form of life, including aquatic life, or to migratory birds as defined in the Migratory Bird Treaty of August 16, 1916, or impairs in any manner the utility of such waters for navigation purposes, to be against the public policy of the United States and to be a public and common nuisance. After the expiration of three years after the date of enactment of this Act an action to prevent or abate any such nuisance may be brought in the name of the United States by any United States attorney, and it shall be the duty of such attorneys to bring such an action when directed to do so by the Attorney General of the United States. Such action shall be brought as an action in equity and may be brought in any court of the United States in the district where the alleged nuisance exists.

Of the various States which have laws giving a maximum degree of stream pollution control are included the States of Connecticut and Rhode Island which receive the waters of the Housatonic, Connecticut, French, Quinebaug, Blackstone, Ten Mile and Taunton rivers.

In view of the marked interest by both the population of this State and the neighboring States of New York, Connecticut and Rhode Island in the prevention of pollution of streams, the Department recommends legislation to assist in preventing pollution of the French, Connecticut, Housatonic, Hoosick, Merrimack and Taunton rivers which are interstate streams, this legislation to be similar to that already recommended for the Merrimack River in Senate Document No. 100 of the current session of the Legislature, and that more drastic legislation, such as that already in effect for the Neponset, Aberjona and Assabet rivers and Alewife Brook, be adopted for the North Branch of the Nashua River and the Blackstone River. Drafts of the recommended legislation are appended.

The Department of Public Health has been requested to sponsor another Works Progress Administration project calling for Federal funds amounting to a total of \$70,759 which carries the following description:

To make field surveys, gather field data, correlate existing data and make reports relative to pollution of streams and existing conditions of water supply and sewage disposal systems throughout the State of Massachusetts for the purpose of supplying basic information for the proper planning for the improvement of the existing conditions. This project is a continuation of existing W. P. A. project No. 13683.

If this project is granted, certain state funds to supplement the Federal funds will be required. The Department recommends that it be authorized to assist in this and similar investigations, and that the sum of \$3,500 be appropriated in addition to any unexpended balance of the amount heretofore appropriated to carry out the provisions of chapter 66 of the Resolves of 1937 for the purchase of supplies, materials and equipment, provided, of course, all personal services are to be financed by the Federal government. A draft of the necessary legislation to carry this into effect is appended hereto.

HENRY D. CHADWICK, M.D.,  
*Commissioner of Public Health.*

JAMES L. TIGHE,  
GEORGE D. DALTON, M.D.,  
FRANCIS H. LALLY, M.D.,  
CHARLES F. LYNCH, M.D.,  
RICHARD M. SMITH, M.D.,  
RICHARD P. STRONG, M.D.,  
*Public Health Council.*

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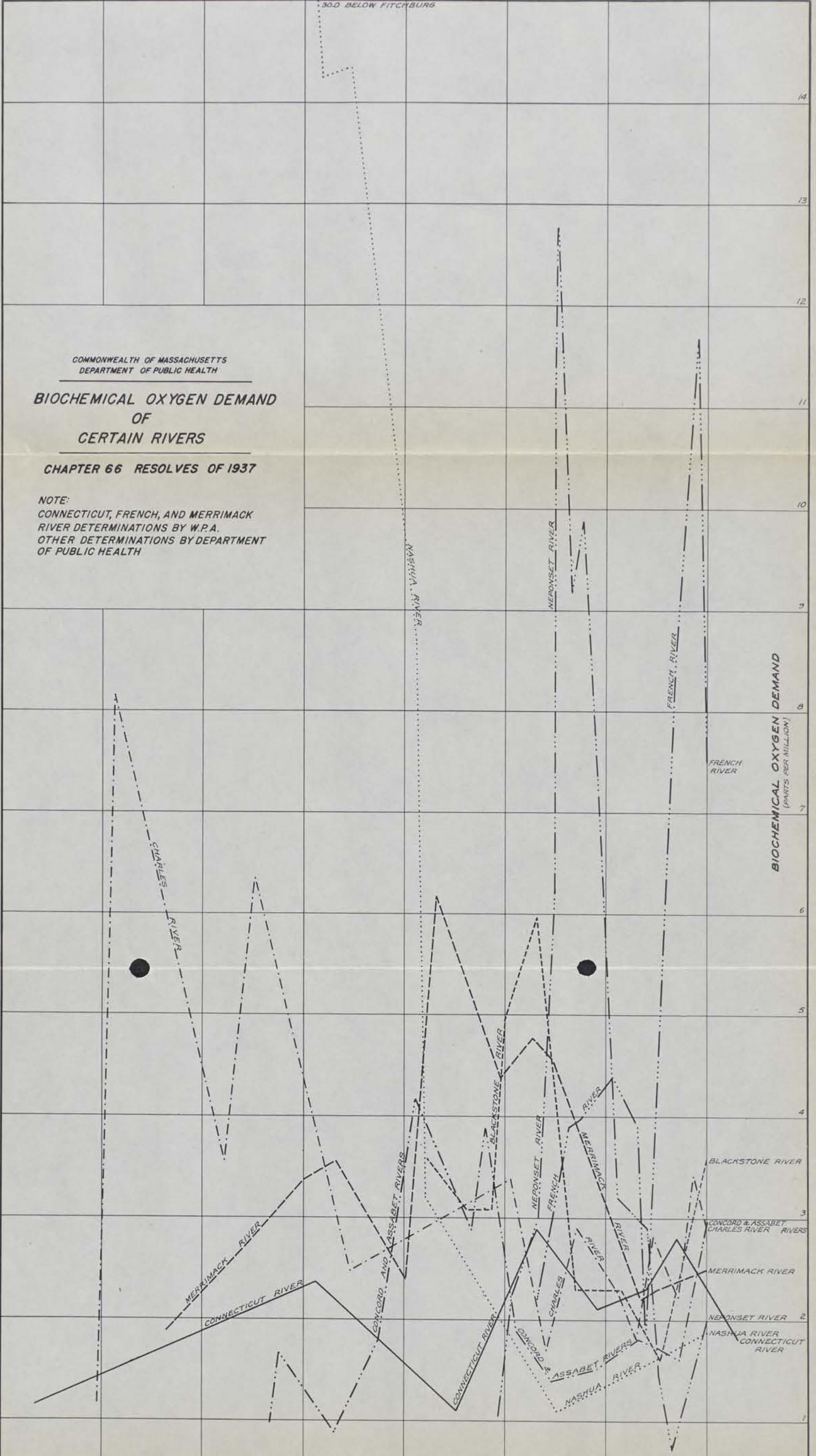
COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF PUBLIC HEALTH

**BIOCHEMICAL OXYGEN DEMAND  
OF  
CERTAIN RIVERS**

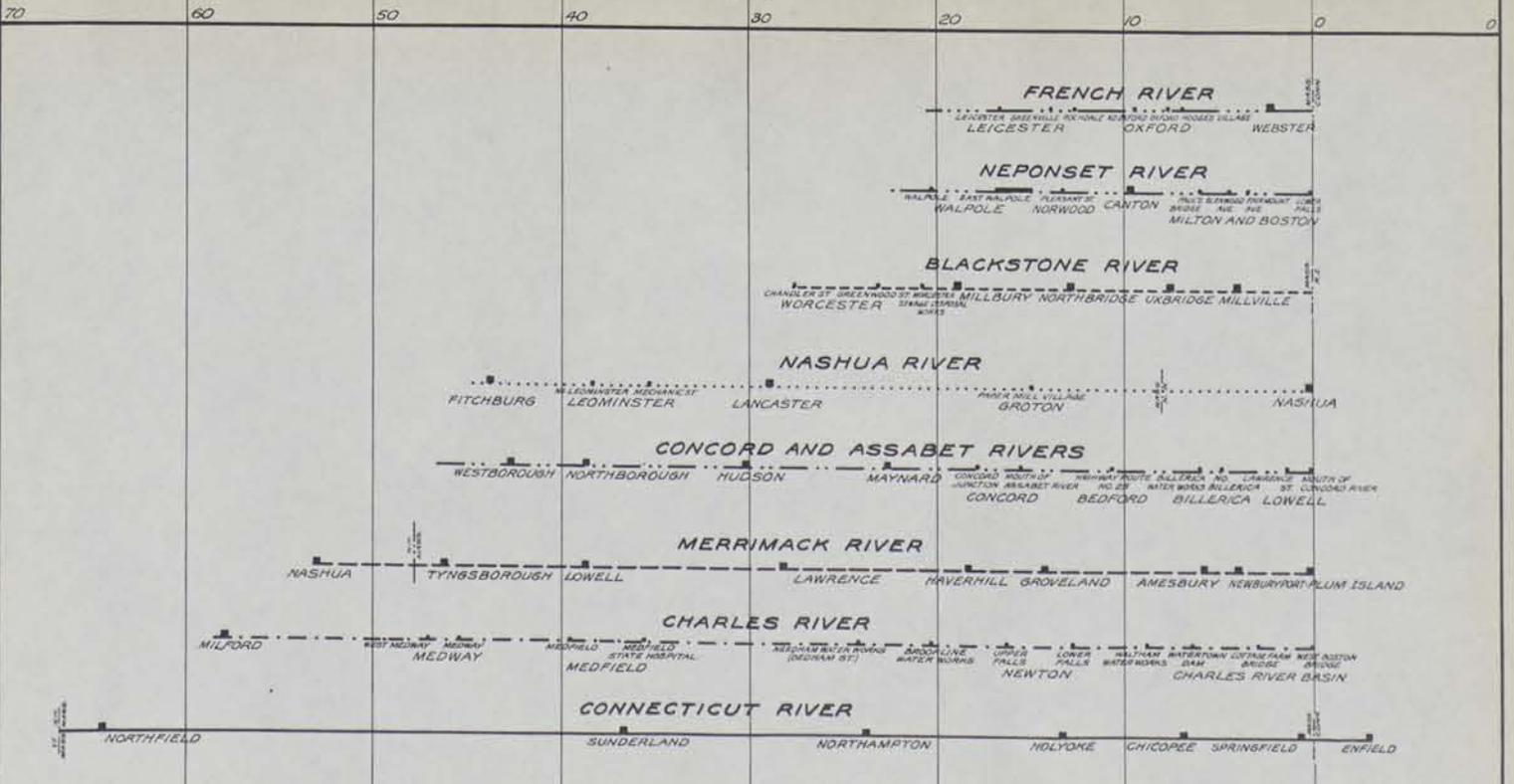
CHAPTER 66 RESOLVES OF 1937

NOTE:  
CONNECTICUT, FRENCH, AND MERRIMACK  
RIVER DETERMINATIONS BY W.P.A.  
OTHER DETERMINATIONS BY DEPARTMENT  
OF PUBLIC HEALTH

BIOCHEMICAL OXYGEN DEMAND  
(PARTS PER MILLION)



DISTANCE  
(MILES)





## PROPOSED LEGISLATION.

**The Commonwealth of Massachusetts**

In the Year One Thousand Nine Hundred and Thirty-Eight.

AN ACT TO PROVIDE FOR THE PROTECTION OF THE PUBLIC HEALTH IN THE VALLEY OF THE BLACKSTONE RIVER.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:*

1 SECTION 1. The department of public health is  
2 hereby authorized and directed to prohibit the entrance  
3 or discharge of sewage into any part of the Blackstone  
4 river, or its tributaries, and to prevent the entrance or  
5 discharge therein of any other substance which might be  
6 injurious to public health or might tend to create a public  
7 nuisance.

1 SECTION 2. The department shall consult and advise  
2 with the owner of any factory or other establishment  
3 situated on or near the said river or any of its tributaries,  
4 at his request or of its own motion, as to the best prac-  
5 ticable and reasonably available means of rendering the  
6 waste or refuse therefrom harmless.

1 SECTION 3. The supreme judicial court or any justice  
2 thereof, and the superior court or any justice thereof,  
3 shall have jurisdiction in equity to enforce the provisions

4 of this act, and any order made by the department of  
5 public health in conformity therewith. Proceedings  
6 to enforce any such order shall be instituted and prose-  
7 cuted by the attorney-general upon the request of the  
8 department of public health.

1 SECTION 4. Whoever permits the entrance or dis-  
2 charge into any part of the Blackstone river, or its  
3 tributaries, of sewage or of any other substance injurious  
4 to public health or tending to create a public nuisance  
5 shall be punished by a fine not exceeding five hundred  
6 dollars for each offence.

## The Commonwealth of Massachusetts

In the Year One Thousand Nine Hundred and Thirty-Eight.

AN ACT WITH REFERENCE TO THE CONSTRUCTION OF SEWAGE  
TREATMENT WORKS AND CONNECTIONS WITH SEWERAGE  
SYSTEMS IN THE CONNECTICUT RIVER VALLEY.

*Be it enacted by the Senate and House of Representatives  
in General Court assembled, and by the authority of the same,  
as follows:*

1 SECTION 1. The department of public health, after a  
2 public hearing, due notice whereof shall be given by  
3 publication in one or more newspapers published within  
4 the territory known as the drainage area of the Con-  
5 necticut river and otherwise in its discretion to all  
6 parties interested, may by its order direct any city or  
7 town bordering the Connecticut river to install, main-  
8 tain and operate, or to provide for the installation,  
9 maintenance and operation of, filter beds or other works  
10 for the treatment, purification and disposal of the sewage  
11 of such city or town.

1 SECTION 2. The supreme judicial court or the su-  
2 perior court, upon application to it by said department  
3 or any other interested party, may enforce any order  
4 made by said department under any provision of this  
5 act.

## The Commonwealth of Massachusetts

In the Year One Thousand Nine Hundred and Thirty-Eight.

AN ACT WITH REFERENCE TO THE CONSTRUCTION OF SEWAGE  
TREATMENT WORKS AND CONNECTIONS WITH SEWERAGE  
SYSTEMS IN THE FRENCH RIVER VALLEY.

*Be it enacted by the Senate and House of Representatives  
in General Court assembled, and by the authority of the same,  
as follows:*

1 SECTION 1. The department of public health, after a  
2 public hearing, due notice whereof shall be given by  
3 publication in one or more newspapers published within  
4 the territory known as the drainage area of the French  
5 river and otherwise in its discretion to all parties in-  
6 terested, may by its order direct any town bordering the  
7 French river to install, maintain and operate, or to  
8 provide for the installation, maintenance and operation  
9 of, filter beds or other works for the treatment, purifica-  
10 tion and disposal of the sewage of such city or town.

1 SECTION 2. The supreme judicial court or the su-  
2 perior court, upon application to it by said department  
3 or any other interested party, may enforce any order  
4 made by said department under any provision of this act.

## The Commonwealth of Massachusetts

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In the Year One Thousand Nine Hundred and Thirty-Eight.

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AN ACT WITH REFERENCE TO THE CONSTRUCTION OF SEWAGE  
TREATMENT WORKS AND CONNECTIONS WITH SEWERAGE  
SYSTEMS IN THE HOOSICK RIVER VALLEY.

*Be it enacted by the Senate and House of Representatives  
in General Court assembled, and by the authority of the same,  
as follows:*

1 SECTION 1. The department of public health, after a  
2 public hearing, due notice whereof shall be given by  
3 publication in one or more newspapers published within  
4 the territory known as the drainage area of the Hoosick  
5 river and otherwise in its discretion to all parties  
6 interested, may by its order direct any city or town  
7 bordering the Hoosick river or its tributaries to install,  
8 maintain and operate, or to provide for the installation,  
9 maintenance and operation of, filter beds or other works  
10 for the treatment, purification and disposal of the sewage  
11 of such city or town.

1 SECTION 2. The supreme judicial court or the  
2 superior court, upon application to it by said depart-  
3 ment or any other interested party, may enforce any  
4 order made by said department under any provision  
5 of this act.

## The Commonwealth of Massachusetts

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In the Year One Thousand Nine Hundred and Thirty-Eight.

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AN ACT WITH REFERENCE TO THE CONSTRUCTION OF SEWAGE TREATMENT WORKS AND CONNECTIONS WITH SEWERAGE SYSTEMS IN THE HOUSATONIC RIVER VALLEY.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:*

1 SECTION 1. The department of public health, after a  
2 public hearing, due notice whereof shall be given by  
3 publication in one or more newspapers published within  
4 the territory known as the drainage area of the Housa-  
5 tonic river and otherwise in its discretion to all parties  
6 interested, may by its order direct any city or town  
7 bordering the Housatonic river or its tributaries to install,  
8 maintain and operate, or to provide for the installation,  
9 maintenance and operation of, filter beds or other works  
10 for the treatment, purification and disposal of the sewage  
11 of such city or town.

1 SECTION 2. The supreme judicial court or the  
2 superior court, upon application to it by said department  
3 or any other interested party, may enforce any order  
4 made by said department under any provision of this act.

## The Commonwealth of Massachusetts

In the Year One Thousand Nine Hundred and Thirty-Eight.

AN ACT WITH REFERENCE TO THE CONSTRUCTION OF SEWAGE TREATMENT WORKS AND CONNECTIONS WITH SEWERAGE SYSTEMS IN THE MERRIMACK RIVER VALLEY.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:*

1 SECTION 1. The department of public health, after a  
2 public hearing, due notice whereof shall be given by  
3 publication in one or more newspapers published within  
4 the territory known as the drainage area of the Merri-  
5 mack river and otherwise in its discretion to all parties  
6 interested, may by its order direct any city or town  
7 bordering the Merrimack river to install, maintain and  
8 operate, or to provide for the installation, maintenance  
9 and operation of, filter beds or other works for the treat-  
10 ment, purification and disposal of the sewage of such  
11 city or town.

1 SECTION 2. The supreme judicial court or the su-  
2 perior court, upon application to it by said department  
3 or any other interested party, may enforce any order  
4 made by said department under any provision of this act.

## The Commonwealth of Massachusetts

In the Year One Thousand Nine Hundred and Thirty-Eight.

AN ACT TO PROVIDE FOR THE PROTECTION OF THE PUBLIC HEALTH IN THE VICINITY OF THE CITIES OF FITCHBURG AND LEOMINSTER AND THE TOWN OF LANCASTER.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:*

1 SECTION 1. The department of public health is  
2 hereby authorized and directed to prohibit the entrance  
3 or discharge of sewage into any part of the North Branch  
4 of the Nashua river, or its tributaries, and to prevent  
5 the entrance or discharge therein of any other substance  
6 which might be injurious to public health or might tend  
7 to create a public nuisance.

1 SECTION 2. The department shall consult and advise  
2 with the owner of any factory or other establishment  
3 situated on or near the said river or any of its tributaries,  
4 at his request or of its own motion, as to the best prac-  
5 ticable and reasonably available means of rendering  
6 the waste or refuse therefrom harmless.

1 SECTION 3. The supreme judicial court or any justice  
2 thereof, and the superior court or any justice thereof,  
3 shall have jurisdiction in equity to enforce the provisions  
4 of this act, and any order made by the department of

5 public health in conformity therewith. Proceedings to  
6 enforce any such order shall be instituted and prose-  
7 cuted by the attorney-general upon the request of the  
8 department of public health.

1 SECTION 4. Whoever permits the entrance or dis-  
2 charge into any part of the North Branch of the Nashua  
3 river, or its tributaries, of sewage or of any other sub-  
4 stance injurious to public health or tending to create a  
5 public nuisance shall be punished by a fine not exceeding  
6 five hundred dollars for each offence.

## The Commonwealth of Massachusetts

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In the Year One Thousand Nine Hundred and Thirty-Eight.

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AN ACT WITH REFERENCE TO THE CONSTRUCTION OF SEWAGE  
TREATMENT WORKS AND CONNECTIONS WITH SEWERAGE  
SYSTEMS IN THE TAUNTON RIVER VALLEY.

*Be it enacted by the Senate and House of Representatives  
in General Court assembled, and by the authority of the same,  
as follows:*

1 SECTION 1. The department of public health, after a  
2 public hearing, due notice whereof shall be given by  
3 publication in one or more newspapers published within  
4 the territory known as the drainage area of the Taunton  
5 river and otherwise in its discretion to all parties in-  
6 terested, may by its order direct any city or town border-  
7 ing the Taunton river or its tributaries to install,  
8 maintain and operate, or to provide for the installation,  
9 maintenance and operation of, filter beds or other works  
10 for the treatment, purification and disposal of the sewage  
11 of such city or town.

1 SECTION 2. The supreme judicial court or the  
2 superior court, upon application to it by said department  
3 or any other interested party, may enforce any order  
4 made by said department under any provision of this act.

## The Commonwealth of Massachusetts

In the Year One Thousand Nine Hundred and Thirty-Eight.

A RESOLVE AUTHORIZING THE CONTINUATION OF THE INVESTIGATION RELATIVE TO THE SANITARY CONDITION OF CERTAIN RIVERS IN THE COMMONWEALTH.

1 *Resolved*, That the department of public health is  
2 hereby authorized to continue the investigation under  
3 chapter forty-nine of the resolves of nineteen hundred  
4 and thirty-six and chapter sixty-six of the resolves of  
5 nineteen hundred and thirty-seven, in co-operation with  
6 the Federal Works Progress Administration, and to  
7 investigate the sanitary condition of any river within the  
8 limits of the commonwealth in co-operation with the  
9 Federal Works Progress Administration. For the said  
10 purposes said department may expend for services,  
11 other than personal services, and for traveling expenses,  
12 supplies, materials and equipment, such sums not  
13 exceeding, in the aggregate, three thousand five hundred  
14 dollars, as may hereafter be appropriated therefor, and  
15 in addition may expend the unexpended balance of the  
16 amount appropriated by item 36q of chapter four hun-  
17 dred and forty-five of the acts of nineteen hundred and  
18 thirty-seven. Said department shall report its recom-  
19 mendations, if any, together with drafts of legislation  
20 necessary to carry such recommendations into effect,  
21 by filing the same with the clerk of the house of repre-  
22 sentatives on or before the first Wednesday of December  
23 in the current year.





