



REGIONAL ORGANIZATION
IN
THE MERRIMACK RIVER VALLEY

by

MALCOLM ALFRED BIRD

B.S., Pennsylvania State College

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Signature of Author

Department of Architecture and
City Planning, January 17, 1947.

Certified by

Thesis Supervisor

Chairman, Departmental Committee on Graduate Students

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M.I.T. Graduate House
Cambridge 39, Mass.

January 17, 1947

William W. Wurster, Dean
School of Architecture and Planning
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

Dear Sir:

In accordance with the rules of the Faculty, I am submitting this thesis, entitled "Regional Organization in the Merrimack River Valley," as a partial fulfillment for the requirements of the degree of Master in City Planning.

Respectfully submitted

Malcolm Alfred Bird

ACKNOWLEDGMENT

The author wishes to express his gratitude and sincere appreciation for the helpful guidance of Professor Frederick J. Adams and Professor Roland B. Greeley, throughout the duration of this investigation.

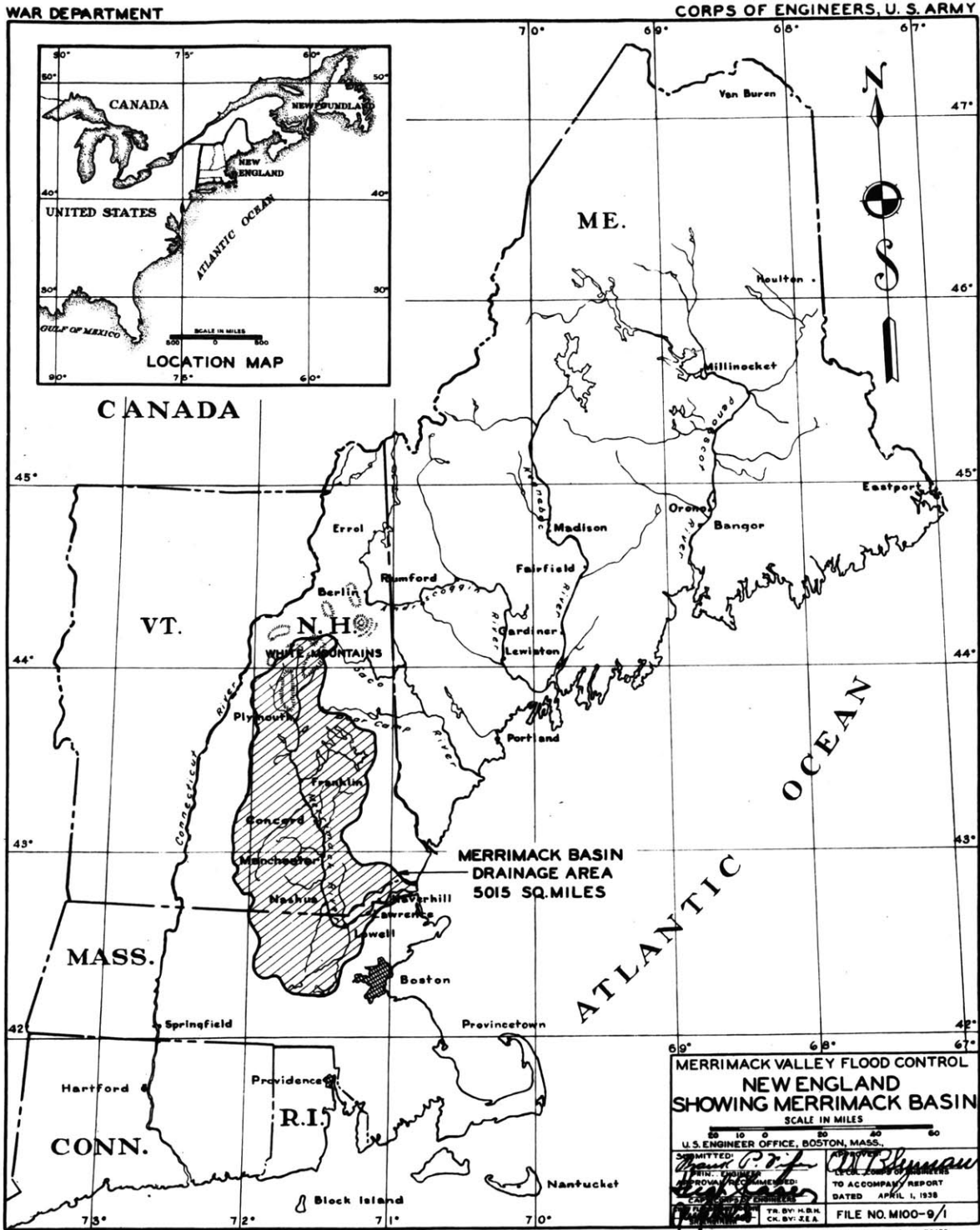


FIGURE 1

I.

INTRODUCTION

A. THE MERRIMACK RIVER VALLEY

1. General De-
scription.

The Merrimack Basin is the fifth largest in New England and comprises a total area of 5,015 square miles of which 3,815 square miles or 76 percent are in New Hampshire, and 1,200 square miles or 24 percent in Massachusetts.⁽¹⁾ The Basin is 134 miles in length along its north-south axis and its greatest width is 68 miles with an average width of 37 miles.

The Merrimack River is formed by the Pemigewasset and Winnipesaukee Rivers at Franklin, New Hampshire and from there flows slightly east of south to Lowell, Massachusetts, where it turns and flows northeastward until it enters the Atlantic

(1)

Area from House Document No. 689, 75th Congress, 3d Session, U.S. Army Engineers Report on Preliminary Examination and Survey of Merrimack River, Mass. and N.H., May 27, 1938.

Ocean at Newburyport, Massachusetts.

The main river is 116 miles long of which 22 miles is tidal, but as the Pemigewasset River, 64 miles long, which drains 1,021 miles of the basin, is distinguished from the main river by name only, the main stream may be considered to have a length of 180 miles.

Above Franklin, where the river is only 270 feet above sea level, the topography is extremely rugged, with steep slopes and high mountains. With peaks ranging to over 5,000 feet, numerous streams and lakes, the upper third of the basin forms one of the finest mountain recreational areas in the United States.

The lower half of the valley was one of the earliest industrial areas to develop in the United States and today remains one of the most important.

The population of the basin, in 1930, was estimated as 811,000, with 256,000 in New Hampshire and 555,000 in Massachusetts. Eighty percent of this population was concentrated in

towns of over 2,500 population. In New Hampshire four cities of over 10,000 accounted for 146,000 or 57 percent of the total. In Massachusetts, twelve cities of over 10,000 accounted for 407,400 or 73.4 percent of the total.

The average density, on the basis of total population and total square miles, is 69 per square mile in New Hampshire and 462 per square mile in Massachusetts. Outside of the above cities, the density per square mile is 30 for New Hampshire and 150 for Massachusetts.

2. Basic Problems. The Merrimack Basin has developed to its present state largely through the uncoordinated activities of individuals, corporations, local and State governmental agencies and more recently, Federal agencies. In general, these activities have been localized and accomplished by agencies with limited functions and jurisdictions and with little consideration being given to the effect of these activities on the general welfare and prosperity of the region.

Within this century several attempts have been made to solve problems on a regional basis, but no over-all organization is in existence today, and interstate collaboration is at a minimum.

Flood-control and pollution are major problems which may require solution on a regional basis with water supply and water-power closely related and all involved with recreational problems affecting both states.

Much of the highway traffic to the New Hampshire recreational areas passes through the congested areas of the Massachusetts portion of the basin thus complicating the traffic problems of its cities and indicating that the solution may lie in collaborative action.

The industrial development in both states is similar in character and too highly specialized. Existing competition for industry might be reduced through a study of industrial requirements in relation to available facilities for specific uses, particularly in relation to water resources.

Some areas of the basin may be so closely linked to metropolitan Boston as to be eliminated from the general area in which collaboration may be effective, but water resources are basic and for this reason no area can be eliminated from consideration in a study of the over-all problem.

B. PURPOSE OF THIS THESIS

The purpose of this thesis is to:

1. Discover whether the Merrimack River Basin, in whole or in part, represents a functional unit capable of regional development on the basis of its water resources.
2. Determine the desirability of, or the necessity for a Merrimack Valley regional association, or other instrument, for the purpose of coordinating the activities of all agencies concerned with problems, surveys, plans, programs, and other activities which may have a direct or indirect effect upon the region and through collaboration with these agencies, of investigating all problems and evaluating all proposals which relate to its general welfare and prosperity.

3. Define the structure of a proposed organization, if such an organization proves desirable or necessary; describe its relationship to established planning and administrative arms of government, and outline its functions especially as they relate to water resources development.

C. SCOPE OF THE INVESTIGATION

This investigation is concerned with local problems only when they have an impact on the region, or when their solution involves more than localized action, and when such action is now or may become imperative to the regional economy.

For instance, a depressed economic base in a mill city may have a serious effect upon that community and solution of its problems may depend upon state or other aid, but it may not become a regional problem unless its condition creates effects beyond state limits or the solution must be based upon regional action.

Similarly, the construction of a flood wall may solve the flood control problem of a particular city, but such construction becomes a regional problem if the necessary expenditure might result in a greater over-all benefit if used for a different type of treatment in another area, particularly in another state.

Therefore, the scope of this investigation will be limited to regional relationships; to locating duplication of effort; to discovering uncovered areas requiring planning and control; to seeking possible sources of new regional problems which may be created by localized activities and finally, to determine which problems previously attacked on a localized or state basis, are actually regional problems which should be considered on an over-all basis.

In view of the limited scope of this investigation, it must be assumed that the conclusions reached by the various commissions, departments and other organizations which have investigated specific problems of the Valley, are based on sound analysis

of the conditions investigated. Therefore, such conclusions will be accepted and studied in relation to the over-all problem.

D. A YARDSTICK FOR MEASURING THE ABILITY OF EXISTING AGENCIES TO FUNCTION ON A REGIONAL BASIS

If the planning and administrative agencies which exist today had been in existence in the past, many of the present problems which require such heavy expenditures for solution would never have developed. Even today, there may remain many uncovered areas, both in organization and jurisdiction.

If the Merrimack Valley is considered as a region for one or many purposes, there must be some means for guiding and controlling its development. In order to determine the need for regional organization, the following yardstick has been prepared to measure, on a regional basis, the ability of existing organizations to:

1. Organize and coordinate all elements concerned with its future development.
2. Determine existing problems.
3. Locate possible sources of future problems.
4. Investigate, clarify and evaluate these problems in order of urgency.

5. Develop a long-range program for the solution of existing and prevention of future problems.

6. Define the jurisdictional limits and areas of collaboration.

7. Establish the responsibilities of governmental or private agencies involved in the solution or prevention of these problems.

8. Apportion the program, according to priorities, to the involved agencies.

9. Evaluate existing, and initiate required, legislation.

10. Provide technical and administrative assistance, and where necessary, financial support, to enable localities to effectuate their scheduled portion of the program.

11. Provide assistance in obtaining supplemental appropriations and grants-in-aid for essential projects.

12. Provide a centralized source of essential data and information with a system of measuring progress against programs.

13. Facilitate and coordinate effectuation of programs.

14. Publicize needs, programs and accomplishments.

E. DEFINITIONS

Merrimack River Valley	Used as general terms
Merrimack Valley	to describe various
Valley	features of the inter-
	state basin considered
	as a region.
Lower Merrimack	Used solely in relation
Valley	to the limited area on
	the lower Merrimack River
	discussed in various re-
	ports in relation to
	navigation, sanitation,
	etc. It is defined by
	towns and has no relation
	to a complete basin or
	drainage area.
Merrimack Basin	Used specifically to dd-
or	scribe the entire tract
Basin	of country drained by the
	Merrimack River and its
	tributaries.

River Basin	Used to describe the basin or drainage area of a tributary lying within the Merrimack Basin. It may also be used to describe the area drained directly by the Merrimack River and small streams exclusive of major tributaries. The term river will differentiate it from the Merrimack Basin.
Drainage Area	Drainage area may be used synonymously with basin, but will generally be used to define a limited area such as "dam impounds fifty percent of the water from the Concord River basin."
Watershed	Used to describe the dividing ridge between two drainage areas or the general area of the divide.

II.

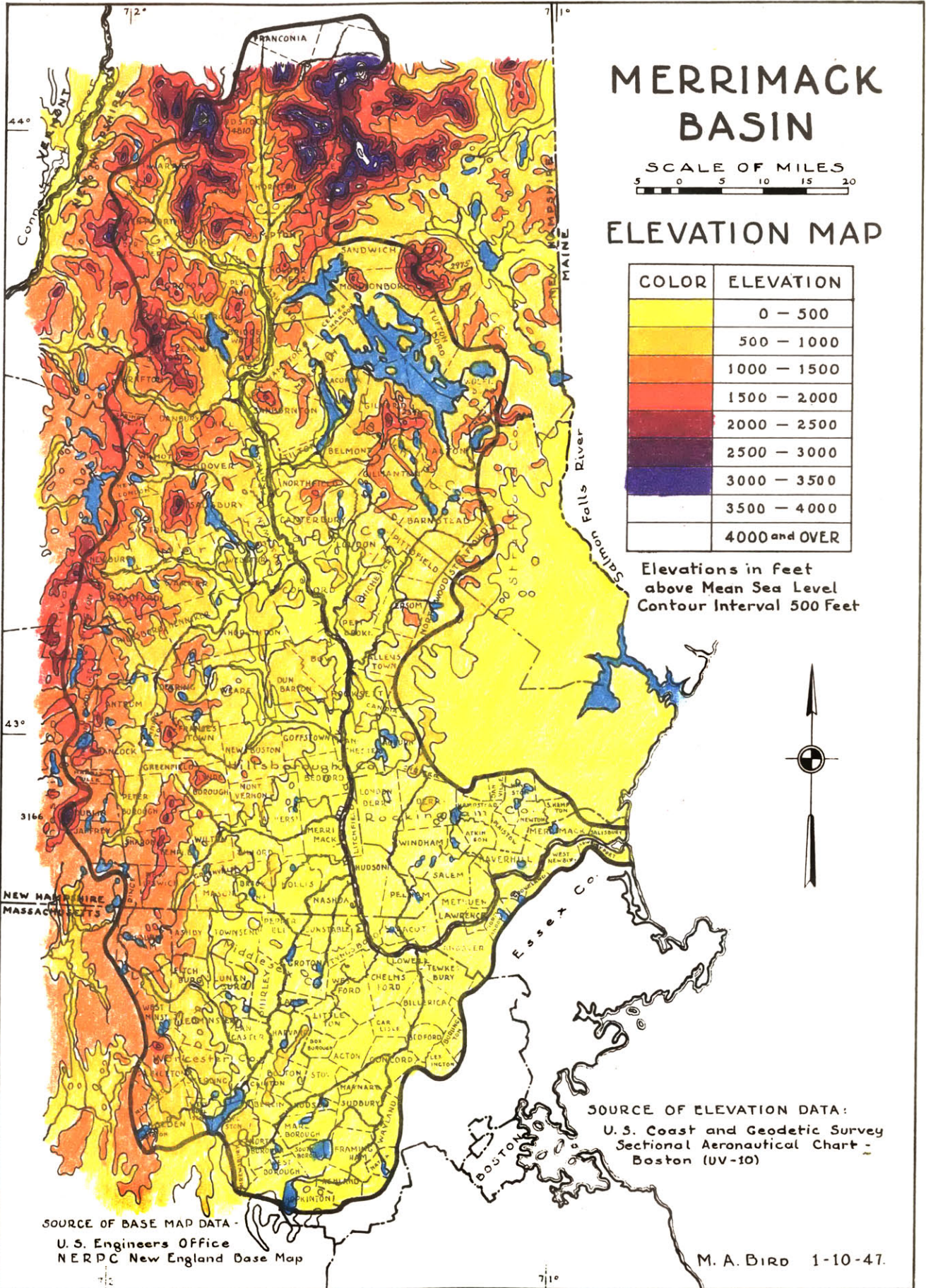
THE MERRIMACK BASIN

A. Geographical Description

The headwaters of the Merrimack River begin deep in the White Mountains at an elevation of 3,000 feet on the Baker River near Warren, New Hampshire. The East Branch of the Pemigewasset River begins at an elevation of 2,700 feet below Mt. Nancy.

The Pemigewasset River itself penetrates deep into the heart of the mountain resort country, beginning at Profile Lake in Franconia Notch, at an elevation of 1,970 feet. East of the Notch, Mt. Lafayette rises to an elevation of 5,249 feet.

The western watershed of the Merrimack extends southwest to a gap at the headwaters of the Baker River crossed by Route 25A at which point it is within five miles of the Connecticut River. See Map No. 1.



MERRIMACK BASIN

SCALE OF MILES
 5 0 5 10 15 20

ELEVATION MAP

COLOR	ELEVATION
Yellow	0 - 500
Orange	500 - 1000
Red	1000 - 1500
Dark Red	1500 - 2000
Dark Purple	2000 - 2500
Light Purple	2500 - 3000
White	3000 - 3500
White	3500 - 4000
White	4000 and OVER

Elevations in feet
 above Mean Sea Level
 Contour Interval 500 Feet



SOURCE OF BASE MAP DATA -
 U. S. Engineers Office
 NERPC New England Base Map

SOURCE OF ELEVATION DATA:
 U. S. Coast and Geodetic Survey
 Sectional Aeronautical Chart -
 Boston (UV-10)

M. A. BIRD 1-10-47.

From here it turns almost directly south and except for a gap near Grafton, crossed by Highway U.S. No. 4, continues at an elevation varying from 1,000 to 3,240 feet to Mt. Monadnock. From there it ranges between 1,000 and 1,500 feet elevation to Worcester except for a gap near Princeton.

The northern portion of the basin is comparatively narrow (maximum width 25 miles) to Squam Lake. From Franconia Notch the watershed turns almost directly east along Twin Mountains to Mt. Willey, then south to Mt. Nancy on the ridge above Crawford Notch.

From Mt. Nancy it turns westward to Mt. Hancock and then southward to Mt. Israel and Squam Lake, the above mountains dividing the Pemigewasset River Basin from that of the Saco River flowing eastward through Maine.

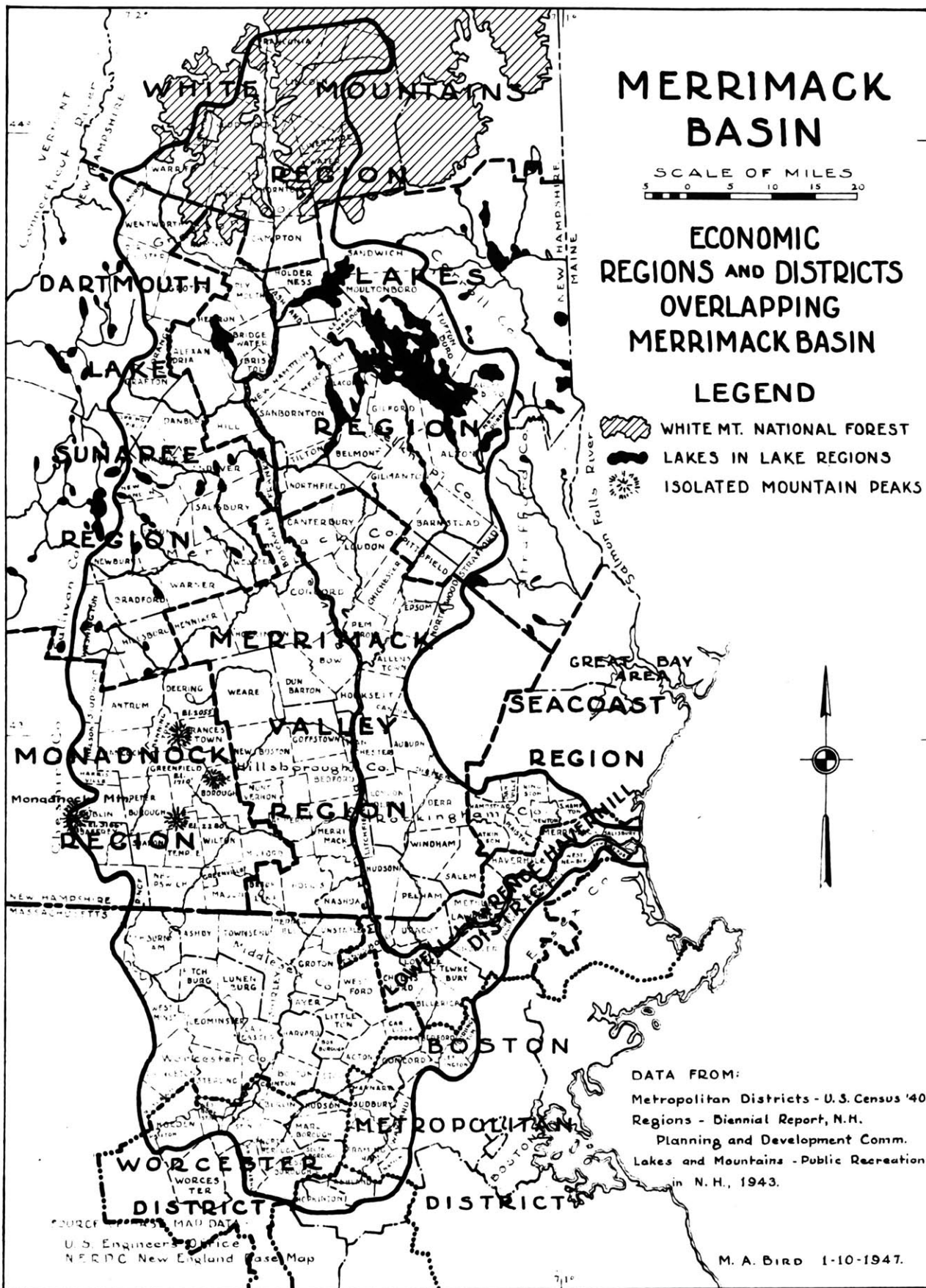
The ridge running from Mt. Nancy, elevation 3,810 feet, rises to Mt. Corragain at an elevation of 4,547 feet and then diminishes to Mt. Isreal at 2,630 feet and terminates at Mt. Prospect, elevation 2,072 feet, northwest of Squam Lake.

This is also the boundary of the New Hampshire White Mountains Region. See Map No. 2.

Here a distinct change occurs in the character of the terrain. From high and precipitous mountains the watershed drops generally to an elevation of from 500 to 1000 feet interspersed with irregular ridges. Turning eastward from Mt. Israel, the watershed for eight miles lies between 500 and 1000 feet above sea level.

From a comparatively level area, Mt. Shaw an isolated peak, rises to a height of 2,975 feet about four miles northeast of Lake Winnepesaukee.

From Mt. Shaw the watershed sweeps southeast around Lake Winnepesaukee, then turns slightly west until near Candia, the elevation breaks to less than 500 feet above sea level, then turns eastward to the coast with only one area exceeding 500 elevation between Candia and the coast. From Wolfeboro to Candia the basin averages about 42 miles in width.



From Mt. Israel to Pittsfield the eastern watershed divides the New Hampshire Lakes Region. The western watershed is a high mountainous ridge and its line is fairly obvious on the elevation map with a contour interval of 500 feet. The eastern watershed varies so little from the general elevation of the whole area that even approximate definition is impossible at this contour interval. See Map No. 1. This will be further discussed under geographical relationships.

The southern half of the basin has a general sweep southeastward toward the sea. Approximately 75 percent of the Massachusetts area of the basin is less than 500 feet above sea level and a broad area at this elevation extends north to Manchester, narrows at Hooksett and widens at Concord.

At Franklin, 93.7 miles above the mouth, the main stream is only 270 feet above sea level with an average slope of 2.9 feet per mile. Up to the junction with the Pemigewasset River at Plymouth river mile 115.7, the greater portion

of the basin is less than 1,000 feet above sea level.⁽¹⁾

B. Climate

The range in elevation from sea level to over 5,000 feet elevation provides considerable variation in temperature.

The industrial areas, both in New Hampshire and Massachusetts, are generally at an elevation of less than 500 feet above sea level and show little variation in mean temperature throughout the year. Between Lowell, Massachusetts, at an elevation of 85 feet and Plymouth, New Hampshire, at an elevation of 500 feet, approximately 108 river miles apart, the greatest variation was 7.6 degrees in January.

In a period of over forty years the Annual mean temperature varied from 43.1 at Plymouth to 48.4 at Lowell, a difference of only 5.3 degrees. Undoubtedly a further difference of several degrees would be recorded at Framingham, near the southern end of the basin, but the total variation is not of great importance from an industrial standpoint.

(1) House Document No. 689, 75th Congress, pp. 12-13

Extremes of 106 degrees at Lawrence, Mass. and minus 36 degrees at Franklin, New Hampshire, have been recorded, but such extremes are unusual.⁽¹⁾

From a recreational standpoint, the mountain areas of New Hampshire present temperature variations of great importance, particularly when combined with precipitation.

"The average for the year in the northern part of the state is 41 degrees (17 degrees for winter and 66.5 degrees for summer)".

"Snow precipitation varies from 150 inches in the mountains to fifty inches along the coast."⁽²⁾

Cool temperatures in the summer make the mountain regions highly desirable for resort purposes. Low winter temperatures and heavy snow precipitation provide an ideal climate for winter sports.

(1)

Complete Mean temperature data for each month from Lawrence, Mass. at an elevation of 50 feet to Bethlehem, N.H. at an elevation of 1440 feet is presented in House of Representatives Document No. 689, pp. 19 and 20.

(2)

Federal Writers Project-American Guide Series, New Hampshire, Boston, Houghton Mifflin Co., 1938, pp. 11-12.

C. Geographical Relationships

We are attempting to discover whether the Merrimack Basin represents a functional unit capable of regional development on the basis of its water resources, but water resources cannot be considered except in regard to geographical relationships.

If the watershed conformed with state boundaries, the problem would be simplified. In New Hampshire the Merrimack River almost bisects the lower two-thirds of the state and its watershed divides the six economic regions of the state. In Massachusetts, the major portion of the main river is along the northeastern boundary of the state and in the adjacent narrow portion of the basin comprises the Lowell-Lawrence-Haverhill Metropolitan District which occupies only 5.6 percent of the total area of the basin, yet contains 40.7 percent of its people. (1)

(1) Metropolitan Districts indicated are based on the Sixteenth Census of the United States, Population, Vol. 1, Number of Inhabitants, p. 484, which defines them as follows: "... in addition to the central city.., all adjacent and contiguous minor civil divisions having a population of 150 or more per square mile. ... not a political unit but rather an area including all the thickly settled territory in and around a city... It tends to be a more or less integrated area with common economic, social, and often, administrative interests."

Extending from the above district on the south-east is the Boston Metropolitan District occupying only 3.6 percent of the area, but with 8.3 percent of its population. Contiguous to this on the southern boundary is the Worcester Metropolitan District occupying 3.6 percent of the basin with 7.2 percent of its population.

Summarizing, these three districts on the south-east and southern fringe of the basin occupy only 12.8 percent of the total area yet contain 56.2 percent of its population. This total population of 455,476 exceeds by 77.8 percent the total population of the New Hampshire portion of the basin.

The relation of population to area and a comparison of densities is clearly shown in Table I, page 20, and illustrated by Map No. II.

These regions and districts have an impact on the basin which may outweigh any coordinated attempt to develop the basin on the basis of water resources.

Table I

NEW HAMPSHIRE ECONOMIC REGIONS AND MASSACHUSETTS METROPOLITAN DISTRICTS

Showing Relation within Merrimack Basin of Population to Areas

	Area in square miles	Popu- lation	Percentage of Total		Popu- lation density per sq. mile
			Area	Popu- lation	
NEW HAMPSHIRE REGIONS					
White Mountains	433	7,893	8.6	0.9	18
Dartmouth- Lake Sunapee	647	8,661	12.9	1.1	14
Lakes	1,056	41,775	21.0	5.2	40
Monadnock	490	17,996	9.8	2.2	37
Merrimack	1,102	175,077	22.0	21.6	159
Seacoast	87	4,874	1.7	0.6	56
Sub-total	<u>3,815</u>	<u>256,276</u>	<u>76.0</u>	<u>31.6</u>	
=====					
MASSACHUSETTS METROPOLITAN DISTRICTS					
Lowell-Lawrence- Haverhill	279	329,644	5.6	40.7	1,182
Boston	181	67,446	3.6	8.3	372
Worcester	179	58,386	3.6	7.2	326
Areas outside Metropolitan Districts	<u>561</u>	<u>99,354</u>	<u>11.2</u>	<u>12.2</u>	177
Sub-total	<u>1,200</u>	<u>554,830</u>	<u>24.0</u>	<u>68.4</u>	
TOTAL	5,015	811,106	100.0	100.0	162 (Aver.)

1. New Hampshire Economic
Regions.

In 1939, New Hampshire's income from all productive sources was \$336,628,000, of which 70.5 percent was attributed to industry and 22.3 percent to recreation.⁽¹⁾

With industry and recreation constituting the major economic resources of the State, it was considered desirable to divide the state into areas most effective for these purposes.

"In order to increase the effectiveness of the state and local programs for economic promotion and development and for civic planning, the Planning and Development Commission tentatively divided the state into six regions and has encouraged the formation of regional associations on local initiative.

Associations have been working on five of these regions for several years. Each deals with problems peculiar to its region, assists local

(1) New Hampshire Council on Postwar Planning and Rehabilitation, Report of Concord, N.H., Dec. 1, 1944, p. 1.

communities in development efforts, and assists the Planning and Development Commission (and other agencies) to adapt its programs to regional and local needs."⁽¹⁾ Note: The Merrimack Valley Regional Association is now organized and beginning to function, 1947.

New Hampshire is bounded on the west by the Connecticut River, dividing it from Vermont, and on the east up to the center of the Lakes Region by the Salmon Falls River which separates it from Maine.

Map No. II shows the relation of these regions to the state, but because of limitations in scale of maps does not include all of the northern and western regions. The dominant factors of mountains and lakes are emphasized.

Table No. II, p. 23, shows the relation of these regions to the Merrimack Basin and the State.

From the map and table, it is obvious that the Merrimack River or basin is a dominating factor only in the Merrimack Valley Region.

(1)

The New Hampshire State Planning and Development Commission, Biennial Report, 1943-1944, Concord, N.H., 1945, p. 42.

Table II

NEW HAMPSHIRE ECONOMIC REGIONS

Showing Relation of Areas to Merrimack Basin and State					
NAME OF REGION	Percent of State Area	AREAS OF REGIONS (In square miles)			Percentage of Region in Basin
		Total Miles	Outside Basin	Inside Basin	
White Mountains	33.2	3,003	2,570	433	14
Dartmouth-Lake Sunapee	16.4	1,480	833	647	44
Lakes	19.2	1,725	669	1,056	61
Monadnock	12.2	1,095	605	490	45
Merrimack	14.3	1,291	189	1,102	85
Seacoast	4.7	430	343	87	20
Total	100.00	9,024	5,209	3,815	

(a) The White Mountains Region

Only 14 percent of this region lies within the Merrimack Basin, and only 0.9 percent of the basin's population. Its center lies north of the Merrimack Basin and Merrimack River problems are of minor interest. In 1937, the United States Forest Service reported a total of 2,766,818 out-of-state tourists passing through or using the White Mountains National Forest.

The major interest of this region in the Merrimack Basin would be confined to access from or across the Massachusetts portion of the Basin, and this would have little relation to water resources.

(b) Dartmouth-Lake Sunapee Region

Only 44 percent of this region lies within the Basin and its center of attraction - Lake Sunapee, lies outside the basin. This is a lightly populated region with only 1.1 percent of the basin's population. Recreational aspects, both summer and winter, are predominant, and water resources problems are State or State Region rather than Basin.

(c) The Lakes Region.

The Lakes Region is centered on Laconia and Lake Winnepesaukee, and includes most of the largest water areas in the southern half of the State. (1)

Major Water Areas

Lake	Elevation in Feet Above Mean Sea Level	Water Surface in Acres	
		Within Basin	Outside Basin
Winnepesaukee	504	44,586	
Winnisquam*	481	4,480	
Squam	562	7,172	
Wentworth	534	3,018	
Newfound Lake	586	4,106	
Merrymeeting	639	1,111	
Ossipee**	407		4,410

*

Lake Winnisquam area from House of Representatives Document No. 689, p. 11.

**

Note: In a chain near Ossipee Lake are numerous medium size lakes of undetermined area.

(1)

New Hampshire Water Resources Board and Water Control Commission, Second Biennial Report 1937-1938, Concord, New Hampshire, Table A6 (unpaged). Major Existing Storage Reservoirs for River Regulation.

As is clearly evident from Map No. 1, that the Lakes Region lies generally at an elevation of 500 to 1000 feet above sea level with numerous ridges or hills rising to from 1000 to 1500 feet. Functionally, as a recreation area and as a trading area, its geographical relationships extend beyond the eastern watershed of the Basin into the Lake Ossipee area which drains into the Saco River in Maine.

(d) The Monadnock Region.

Only 45 percent of the Monadnock Region lies within the Basin. Mt. Monadnock, a free-standing peak, dominates the region.

From its peak, "On a fair day the view embraces an area 150 miles in diameter. A hundred miles to the northeast, the peaks of the Presidential Range, with Mt. Washington in their midst, serrate the skyline. To the southeast the tower of the customhouse in Boston and Bunker Hill Monument are visible, 60 miles away. the long line of Vermont's Green Mountains forms the western horizon.

In addition some 40 ponds lie at its feet .."(1)

The general level of the watershed is slightly higher than the adjacent areas, but it seems quite logical to base this region on this spectacular peak and to extend it on the west to the Connecticut River and on the east to embrace the upper valley of the Contoocook River and include in its eastern boundaries the higher ridges which divide this area from the Merrimack Valley Region.

(e) The Merrimack Valley Region

The Merrimack Valley Region lies south and east of the mountains. Approximately 60 percent of the area is less than 500 feet above sea level, and, with the exception of ridges on its boundaries, only several hills exceed an elevation of 1000 feet.

With a population of 175,077, it occupies 22 percent of the area of the Basin and contains 21.6 percent of its people. Industrially, it is the heart of the New Hampshire portion of the Basin

(1) Federal Writers Project, American Guide Series, New Hampshire, p. 474.

and contains the best agricultural land.

Eighty-five percent of this region lies within the Basin, and flood control and pollution are major problems.

(f) The Seacoast Region

The Seacoast Region is the most easterly projection of the State, and its only outlet to the sea. The elevation of the whole area is less than 500 feet above sea level.

Only 20 percent of the region is within the Basin and this comprises only 1.7 percent of the Basin area, and contains only 0.6 percent of its population.

Mostly agricultural, within the Basin, the region's importance is based on the coast and the Great Bay area at the mouth of the Piscataqua River which, with the Salmon Falls River, drains a large portion of this region as well as 15 percent of the Merrimack Valley Region and about 15 percent of the Lakes Region.

Near the coast, the cities of Rochester and Dover alone had a combined population in 1930 of 28,068, compared with a total of 4,874 within the Merrimack Basin portion.

The total population of New Hampshire in 1930 was 465,293, of which 256,000 or 55 percent were in the Merrimack Basin and, from the sparse development of upper New Hampshire it may be assumed that the greater portion of the State's population are within the five economic regions lying south of the White Mountains.

If the Merrimack River were navigable in New Hampshire; if it possessed great resources of undeveloped power; or if it provided a surplus of water for future industrial use, then the river and its tributaries might make the Basin the predominant factor in economic development.

But, in the study of the present New Hampshire economic regions, we have seen that the justification for these regions was based on geographical areas centered on or near the watershed and in the White

Mountains and Seacoast Regions, entirely outside the Basin. Therefore, these regional factors must be weighed against those concerning the Basin in evolving a type of organization of mutual benefit.(1)

(1) Population data in Tables I and II were obtained from New England Regional Planning Commission, Merrimack Valley Water Resources Data. Publication No. 44, Boston, October 20, 1936.

Areas of regions were planimetered from base maps.

2. Massachusetts Metro-
politan Districts.

In New Hampshire

the state has been deliberately divided into economic regions by its planning agency and these regions, based on their relation to an economic or recreational center.

(a) The Lowell-Lawrence-Haverhill
Metropolitan District.

In Massachusetts, a different condition exists. The main river follows close to the state line in the northeastern portion of the Basin where, within a strip approximately 35 miles long with an average width of eight miles, are concentrated 329,644 persons, 40.7 percent of the Basin's population with a density of 1,182 persons per square mile compared with the highest density of the New Hampshire regions, the Merrimack Valley Region, which has a density of 159 persons per square mile. So much attention has been focused on this area by its economic, social, and physical problems that to most people, it is "The Merrimack Valley".

It has been considered in various reports as the Merrimack Valley Sewage District, the Valley

of the Merrimac River and by the U.S. Census is classified as the Lowell-Lawrence-Haverhill Metropolitan District. It has been investigated on the basis of flood control, sewage and pollution and in relation to economic problems due to its specialized industry.

In 1869, J. W. Meador stated, "It stands pre-eminent, and without a parallel the greatest manufacturing river in the civilized world".⁽¹⁾

He referred, of course, to both New Hampshire and Massachusetts, but in 1870, the cities and towns of Lowell, Lawrence, Haverhill and Newburyport had a combined population of 95,536. Without considering the other towns on which census data is unavailable, the density was then at least 340 persons per square mile within a concentrated area only 30 miles in length.

In New Hampshire at that time, the cities of Concord, Manchester and Nashua had a combined population of 46,310, but these cities were spaced along a distance of 64 miles.

(1)

J.W. Meador, The Merrimack River and its Tributaries, Boston, B.B. Russell, 1869, p. 40.

The industries established in this district were based on the use of water power by direct drive and their additional requirement was enormous quantities of water for processing goods. As a result, the industries and towns encroached on the flood plain, and polluted the river, thus creating the basic problems of today.

These problems of flood control and pollution must be solved, but they were self-created and are of little personal interest to Basin residents outside of this area. In the matter of flood control it would appear extremely difficult to persuade New Hampshire residents to give up land for flood control basins, particularly when part of the problem might be solved by removing industries and downstream slums from the flood plain on which they have encroached.

(b) Boston Metropolitan District.

On the southeastern edge of the Basin and contiguous to the above district, lies the fringe of the Boston Metropolitan District.

From the census definition of a metropolitan district previously quoted, it is evident that the people in this fringe are more closely allied with Boston than with the Basin.

Regional Factors in National Planning notes:

"Some of these areas, such as the Northeast, , are marked by so many fundamental natural, population, and cultural factors, that they create a regional consciousness in the minds of their inhabitants." (1)

Here, in 3.6 percent of the total area of the Basin, are concentrated 8.3 percent of its people.

Most of this district is within the Sudbury River Basin with part on the Assabel and not directly involved in the problems of the main river. Flood control is apparently of minor importance.

The major interests of the people seem to be related to Boston, and it seems unlikely that they would be seriously concerned with Basin problems outside their area.

(1)

Natural Resources Committee, Regional Factors in National Planning, Washington, D.C. U.S. Government Printing Office, 1935, p. VII.

(c) Worcester Metropolitan District

In the southern portion of the Basin is the Worcester Metropolitan District, with Worcester itself, the focus of interest, entirely outside of the Basin.

Here, 7.2 percent of the Basin's population live in 3.6 percent of its area at the headwaters of the Nashua and Concord Rivers.

Problems of the Basin seem of secondary importance.

(d) Areas Outside Metropolitan Districts

Outside of the metropolitan districts live 12.2 percent of the people of the Basin in 11.2 percent of its area. Of a total of 99,354 population, 62,502, or 63 percent, occupy the adjoining cities of Fitchburg and Leominster. The Nashua river in this area is involved in flood and pollution problems, and as it crosses into New Hampshire before emptying into the Merrimack this area has some interstate importance.

D. Resources and Human Relationships

The main resource of the Merrimack Basin is its manufacturing ability and equipment and its relatively highly skilled labor force. In New Hampshire, recreation based on natural features, is second and agriculture, third. In Massachusetts, agriculture is probably second and recreation is below local requirements.

Human relationships are fundamental in any attempt to solve the Basin's problems on a regional basis. While we are considering the possibility of development on the basis of water resources and watershed area, such development depends upon the natural, population and cultural factors necessary to create a regional consciousness.

Do such factors exist? From a study of the geographical relationships it appears that the Basin is subordinate to other centers of interest except immediately adjacent to the lower part of the main river.

Certainly, when flood disasters occur, there may be a temporary upsurge of interest, but

to accomplish objectives on a regional basis there must be sustained interest.

To hold such interest, the focus must lie within the valley as in the Tennessee, Columbia River or Central Valleys. There must be a grandeur in scale, inspiring possibilities through the development of water power, navigation, reclamation of the desert, building a lightly developed area into a great industrial empire. One hundred years ago the Merrimack Valley was just becoming such an industrial empire, but today its problem is to retain its industries against competition from growing areas. Pollution elimination is a negative problem, costly to the taxpayer and this also applies to flood control unless the result of such control provides positive values.

In the Tennessee Valley flood control was linked with development of navigation; of vast opportunities for development of water recreational facilities where few natural facilities existed; of low cost electricity for industry, homes and

farms in an area where the majority of people had previously depended on wood-burning stoves, kerosene lamps and manual labor; of new agricultural possibilities through production of low cost fertilizers, erosion control and reforestation.

New England may have a regional consciousness, but can such a consciousness be developed for the Merrimack Valley. On the basis of geographical and human relationships the answer would seem to be, No!

III.

POPULATION

All comparative statistics on present population, of the Merrimack Basin, unless otherwise noted have, and will be based on the U.S. Census of 1930 as the basic source of data on the 189 towns of the Valley is the New England Regional Planning Commissions, "Merrimack Valley Water Resources Data, Publication 4, Boston, October 20, 1936, pp. 28-30.

The statistical task of recomputing changes for all or portions of these towns, particularly when annexation or changes in area have occurred, was not considered justified on the basis of the slight variations which have occurred between 1930 and 1940, confirmed by checking changes in the population of the states and major cities.

Except for the larger cities, long range population statistics can be based only on state populations as there are no sources for the Merrimack Basin as a unit.

A. Early Growth and Distribution

The early growth of New Hampshire was primarily due to agriculture and lumbering operations. The census of 1790 showed a total population of 141,885 with only 3.3 percent classified as urban. By 1830 the population had increased to 269,328, an increase of 90 percent, but only ten percent of the total population was classed as urban with only 13,475 persons living in urban areas.

Massachusetts, with Boston as a port, shows quite a contrast in those early days. In 1790 its population was 327,585 of which only 13.5 percent was urban. By 1830, with a population of 610,408 an increase of 86 percent, slightly less than New Hampshire's, 31.1 percent were classified as urban.

B.

The year 1840 apparently ushered in the development of the industrial era in New Hampshire with a 100 percent increase in urban population to a total of 28,531, of which 14,186, or approximately 50 percent, were in the towns of Concord, Manchester and Nashua.

Between 1840 and 1930 New Hampshire's population increased to 465,293, a total of 63 percent; total urban population increased to 273,079 or 855 percent, and urban population was 58.7 percent of that. During this same period the above cities increased to 119,339 or 840 percent, approximately the same as general urban growth.

In this same period, rural population declined from 256,043 to 192,214, a loss of 25 percent.*

In Massachusetts growth in urban population percentage was more gradual but there was a much greater increase in total population.

*

Part of the decline in rural population may be attributed to known abandonment of farms to forest, but urban increase may be largely due to change in census classification of growing towns indicating a relative increase in the three cities greater than the State average.

From 1840 to 1930 the total population increased from 610,408 to 4,249,614, an increase of 600 percent compared with 63 percent for New Hampshire. In this period, urban population increased 1270 percent and was 90.2 percent of the total population.

Fitchburg, Haverhill, Lawrence and Lowell are the major cities of the Basin. In 1840, Lawrence was too small to be recorded and the other three had a total population of 27,736. In 1930 the population of the three cities which can be compared was 189,636, an increase of 580 percent with Lowell increasing 400 percent; Haverhill 1000 percent, and Fitchburg 1450 percent, approximately.

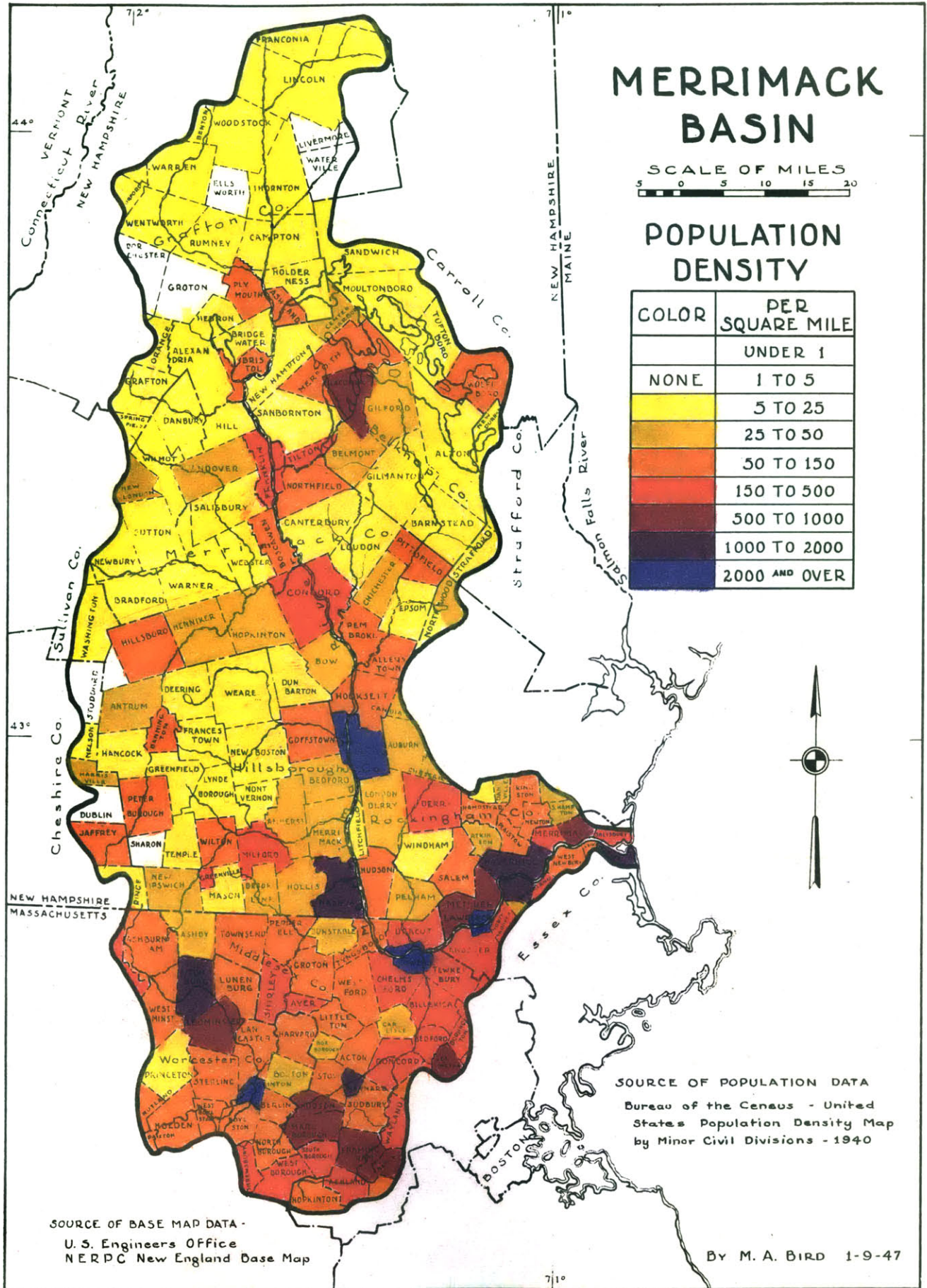
The increase in Lowell and Haverhill approximated the increase in the New Hampshire cities on the main river, the growth being founded upon similar water power resources, and similar industrial developments.

Table III for New Hampshire, and Table IV for Massachusetts, pages 43 and 44, show population

Table III

NEW HAMPSHIRE ECONOMIC REGIONS

Showing Relations Within New Hampshire Portion of Merrimack Basin of Population to Areas.					
<u>NAME OF REGION</u>	<u>Area in square miles</u>	<u>Popu- lation</u>	<u>Percentage of Total Popu- Area lation</u>		<u>Popu- lation density per sq. mile</u>
White Mountains	433	7,893	11.4	3.1	18
Dartmouth- Lake Sunapee	647	8,661	16.9	3.4	14
Lakes	1,056	41,775	27.7	16.3	40
Monadnock	490	17,996	12.8	7.0	37
Merrimack	1,102	175,077	28.9	68.3	159
Seacoast	87	4,874	2.3	1.9	56
Totals	3,815	256,276	100.0	100.0	67 (Aver.)



MERRIMACK BASIN

SCALE OF MILES
 5 0 5 10 15 20

POPULATION DENSITY

COLOR	PER SQUARE MILE
	UNDER 1
NONE	1 TO 5
Yellow	5 TO 25
Orange	25 TO 50
Red	50 TO 150
Dark Red	150 TO 500
Dark Purple	500 TO 1000
Black	1000 TO 2000
Dark Blue	2000 AND OVER

SOURCE OF BASE MAP DATA -
 U.S. Engineers Office
 NERPC New England Base Map

SOURCE OF POPULATION DATA
 Bureau of the Census - United
 States Population Density Map
 by Minor Civil Divisions - 1940

BY M. A. BIRD 1-9-47

Table IV

MASSACHUSETTS METROPOLITAN DISTRICTS

Showing Relations Within Massachusetts Portion of
Merrimack Basin of Population to Areas

DISTRICT	Area in square miles	Popu- lation	Percentage of Total popu- lation Area		Popu- lation density per sq. mile
Lawrence-Lowell- Haverhill	279	329,644	23.2	59.4	1,182
Boston	181	67,446	15.1	12.2	372
Worcester	179	58,386	14.9	10.5	326
Areas outside Metropolitan Districts	561	99,354	46.8	17.9	177
Totals	1,200	554,830	100.0	100.0	462 (Aver.)

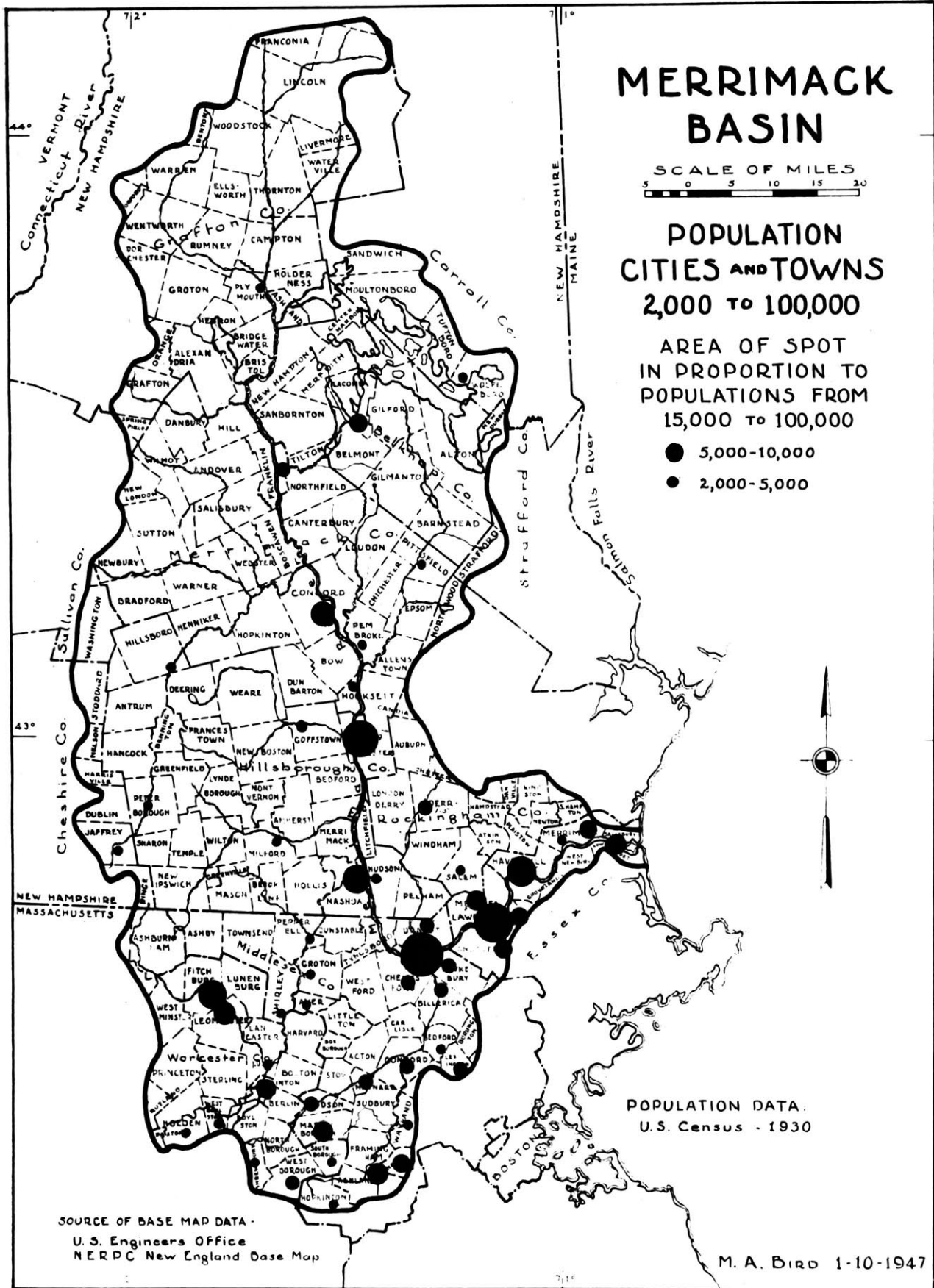
distribution and density by economic regions and metropolitan districts.

Map No. III, Population Density, indicates the present density of Basin population by civil divisions. It should be noted that civil divisions with densities of over 150 persons per square mile (colored from red to purple) are, when adjacent to a city, usually considered by the Bureau of the Census as part of the metropolitan. From the map it is evident that Fitchburg is on the verge of becoming a metropolitan district.

Map No. IV, showing Population of Cities and Towns, 2,000 to 100,000, graphically illustrates the heavy concentration of urban population in the southern portion of the Basin.

C. Composition and Trends

The cities along the main river were settled during the major development of the textile industry, largely by foreign-born. In Lowell, immigration was from Ireland, Canada, Southern



Europe. French is still spoken and the Greeks have the largest settlement in the United States. As late as 1940 only 27 percent were born of two parents born in the United States.(1)

Trends of today cannot be predicated upon past performances. The recent war disrupted old habits. Service in the Armed Forces has broadened the viewpoint and horizon of many of the younger generation. What effect it may have in causing shifting of population and breaking-down nationalistic groups is still to be determined.

For this and other reasons, particularly the tendency toward migration of industry, no attempt is made to estimate future population as such an estimate would require an economic survey of the Basin.(2)

(1) Roland B. Greeley, Urban Sociology, Ec. 83, Industrial Type of City Lecture, April 23, 1946.

(2) Mass. Senate Doc. No. 492, Dept. of Public Health, Special Report relative to Sewerage and Sewage Disposal in the Valley of the Merrimack River, Boston, April, 1924, p. 19, estimated on basis of 344,407 population in 1920 the future population of the Lowell-Lawrence-Haverhill District 432,860 in 1935 and 568,120 in 1965.

The Special Commission's estimate is an increase to 379,330 or 12 percent, by 1965. Admittedly, this new estimate was "based in general upon rates of growth existing in the past. In no case, however, was an estimate made for diminishing population, even though recent trends seemed to indicate declining population." At least their estimate was conservative even though not based upon economic factors!⁽¹⁾

(1)

Mass. Senate Document No. 100, Report of Special Commission to Make an Investigation and Study relative to Certain Problems in the Merrimack Valley, so-called, Boston, 1938, pp. 18-19, notes that population in 1935 was 338,886, a decline of 1.5 percent compared with the estimated increase of 25 percent.

IV.

THE REGIONAL ECONOMY

A. Natural Resources

The natural resources of materials are limited and most manufacturing of today is based upon processing of imported materials.

Some mineral deposits exist, particularly in New Hampshire, but are not of major importance in the Basin. In 1939, fisheries, mines and quarries produced only 0.4 percent of New Hampshire's income.

In 1869, J.W. Meador⁽¹⁾ reported nearly 10,000,000 feet of lumber carried by the Merrimack River.

In 1909 the State of New Hampshire produced 650,000,000 board feet of lumber, but only

(1)

J. W. Meador, p. 41.

210,000,000 board feet in 1941. However, in 1940, of the total land area of 5,775,843 acres, 4,446,174 acres (or 77 percent) were in forest, of which 776,000 acres (or 17.5 percent) of forest land was in public ownership. The exact forest acreage in the Merrimack Basin is unknown, but it does include approximately one-third of the White Mountain National Forest, or approximately 22,000 acres. (1)

The major natural resources of New Hampshire are its natural scenery, its mountains and water resources, which, through recreational use alone produced an income of \$75,000,000 or 22.3 percent of total income in 1939.

The Existing Economy and
Its Problems.

Previous to the development of recreation as a major resource of New Hampshire, the economy of the Valley in both states was based primarily upon similar types of manufacturing. Both states lost parts of their industry to other areas, particularly to the South.

(1)

New Hampshire Council on Post-War Planning and Rehabilitation, p. 19.

Today both states are in competition for industry. The basic objective of planning is to make the city or region a better place in which to live, and the campaign for new industry of the Division of Industrial Promotion, New Hampshire State Planning and Development Commission, is based upon the premise that New Hampshire is such a place. Part of its folder is worth quoting.

"Photographs of machine shops, assembly floors and shipping rooms seldom show the reasons why an industry enjoys solid, steady growth. They do not explain why men join a firm, and stay with it happily, all their lives. Plant pictures cannot answer questions about the quiet loyalty between small New Hampshire industries and their people. But the picture (illustration in folder) above holds one of the secrets of industrial smooth sailing.

For men find fuller satisfaction in this New England state. They buy homes with gardens, and raise families. They become a part of their community. They come to know and respect their fellow workers. In return they enjoy the

sense of 'belonging', for they too are liked and respected.

New Hampshire is a good place for industry because it is a good place for Americans to live."⁽¹⁾

Other advertising in national magazines has emphasized the opportunity for fishing, hunting and other recreation adjacent to industry.

Massachusetts does not show an equal recognition of these human values in relation to industry. In relation to future growth of the Lower Merrimack Valley, the Special Commission, in 1937, considered growth to be dependent upon the vitality and expansive quality of industry. "..... careful examination of the individual industries does not indicate that they are showing any definite signs of prolonged rapid expansion, nor are any of the new smaller industries large enough or of sufficient vitality and expansive quality to take their place and again produce the tremendous pay rolls of the boom periods of the past."

(1) N.H. State Planning and Development Commission, Biennial Report, 1943-1944, p. 30.

Among necessary precedents to any considerable growth they list:

"(a). The location of new, vital, diversified and expanding industries capable of employing large numbers of people and paying substantial wages.

(b). Sufficient promise in these industries to attract the capital necessary to recondition and expand outmoded plants.

(c). Rapid and sufficient growth to bring back the standard of living and encourage immigration to the region."⁽¹⁾

This Special Commission has considered the need of additional recreation facilities, but they seem to base future growth upon acquisition of new, large industries with little recognition of the fact that the present decentralization trend is based upon the location of small plants limited to a moderate number of employees, and that such plants are being

⁽¹⁾ Mass. Senate Document No. 100, p. 16.

located where existing standards of living are high in human values.

Both Sylvania Electric and Johnson and Johnson are locating their plants on the basis of a complete and fixed size unit. When expansion is required, a new unit is purchased or constructed in another town. The size is based upon, "A factory which one man can fully comprehend."⁽¹⁾ A size where a man is not a number to the personnel department, but "Bill" or "John" to the manager, and a town where "Bill" and the manager may meet on a man-to-man basis in community affairs.

These great industries in the past produced great employment, but because of specialization, they also created "boom and bust" conditions. They also created many of the flood control and pollution problems of today. In some instances the pollution by one industry may exceed the total pollution caused by domestic sewage of the whole city.

(1)

Robert Wood Johnson, Break it Up, Evening Post, Philadelphia, January 5, 1946, p. 20.

In the Massachusetts portion of the Basin, the Lower Merrimack Valley has a density of 1,182 per square mile compared with 177 for areas outside metropolitan districts, and compared with 159 per square mile.

If water resources are a basic factor in the economy of the Basin and pollution is partly based on the ratio of domestic sewage and industrial wastes to the total amount of water, the actual elimination of some industries which pollute an inordinate amount of water, might prove a blessing.

On an overall basis, planning might conceivably provide for the redistribution of industry and population, with new industries selected to provide for greater diversification and adapted to the varying skills of the population. Better living and working conditions should be paramount to sheer size of industry or population.

Agriculture is considered unprofitable in New Hampshire except in the river valleys, but produced 6.8 percent of the state's annual income, in 1939.

"The most productive farm land is in the southern part of the Basin, where the value per acre is the highest for farm land anywhere in Massachusetts."(1)

(1) New England Regional Planning Commission, Water Resources of New England, Publication No. 51, Boston, December, 1937, p. 151.

V.

WATER RESOURCES AND REQUIREMENTS

Without water in some form, life cannot exist. It is undoubtedly the most important physical factor in the development of mankind. Water to drink, to grow food and covering provided the early basis for existence.

Early cities began on the shores of water bodies and before the advent of the railroad provided the basic medium of transportation.

The water-wheel initiated industrial development in the Merrimack Valley. As early as 1700 one New Hampshire mill had four saws operated by a water-wheel crank and an elastic pole. By 1810 twelve cotton mills were in operation and by 1830 the industrialization of the Merrimack River and its tributaries was well advanced.⁽¹⁾

(1) American Guide Series, New Hampshire, p. 58, p. 54.

"The original installations were made when power had to be transmitted from the water wheels by pulleys and shafting. The majority of these have since been redeveloped for more efficient utilization through modern turbines and shafting."⁽¹⁾

The necessity for this direct drive required location close to the source of water with the result that the mills built before the development of electricity, encroached on the flood plain. Housing and commercial facilities developed adjacent to the mills.

Water in great quantities was essential for industrial processing and provided another reason for riverside location. If electric power had been available at the time the original mills were built, it might have been feasible through planning to have located the mills outside the flood plain and to have provided for industrial water requirements by canals or aqueducts. But,

(1)

House of Representatives, Document 689, p. 14

because this was not possible, development occurred adjacent to the river and this intensive development made it impractical to provide for future supplies of water away from the river with the result that later industries were compelled to locate close to the river to satisfy their water requirements.

As towns developed, individual water supplies were no longer adequate so ponds and lakes formerly available for recreational purposes were reserved for water supply use.

Diversion of basin water supplies to areas outside the basin has also reduced the amount of basin water available for sewage dilution.⁽¹⁾

In relation to navigation, Col. Frederic V. Abbot, Corps of Engineers, U.S.A., in his report of March 29, 1913, under "Rise and fall of surface water", said, "... the elevation of the water surface is dependent at any given time upon four factors, -

(1)

New England Regional Planning Commission, Merrimack River Valley Water Resources Data, p. 4, noted that 1,390,500 people outside Basin are served from sources in basin.

two natural and two purely artificial. They are the tidal stage at the mouth, the natural discharge in the river and its tributaries, the effect upon that discharge of the operation of the mills at Lowell and Lawrence, and the withdrawal for sanitary uses of water from the Nashua and Sudbury rivers formerly all tributary to the Merrimack."⁽¹⁾

Fishing is another aspect of water resources which may be affected by other uses of water. In the main river pollution and dams have eliminated migratory species of fish and both have rendered many of the basin's waters unsuitable habitations for the higher types of fish whose existence depends upon special conditions and which provide a recreational asset.

Merrimack Basin water supplies are limited by precipitation in relation to its watershed. Water uses are competitive. Through pollution they may be expended solely for the purpose of sewage dilution, whereas comprehensive planning may enable the same water to serve many successive purposes.

(1)
Massachusetts House Document No. 2169, Merrimack Valley Waterway Board, Development of Navigation and Power along the Merrimack River, Boston, January, 1914, p. 13.

A. The River and Its Tributaries

Map No. V, a reproduction of the Corps of Engineers, U.S. Army, Drawing "Location of All Reservoir Sites Investigated", outlines the various watersheds of the Merrimack Basin, and indicates the extent of reservoir site investigation involved in their flood control study. A complete summary of data on these reservoir sites is contained in House of Representatives Document No. 689, Table 30, pp. 48-49.

Table No. 5, p. 61, Tributaries of the Merrimack River, furnishes basic information which may be useful for general reference in relation to other data.

In considering water resources each tributary basin is a region in itself. As tributaries meet with larger rivers, larger regions are created and this enlargement continues until the water reaches the sea where it may become part of a world region.

MAP No. V

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

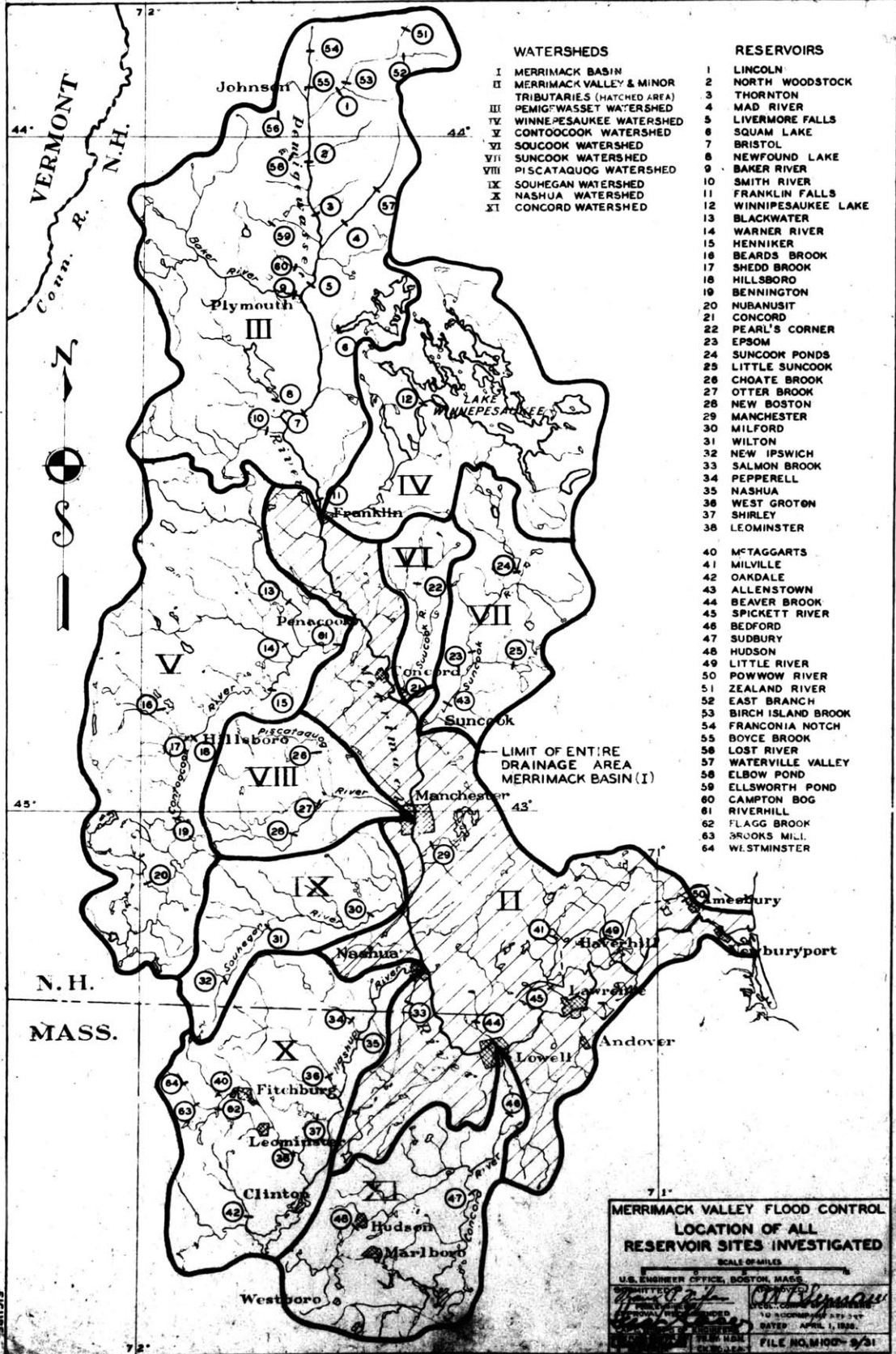


Table V

TRIBUTARIES OF THE MERRIMACK RIVER

	Enters at	Drainage area in sq. miles	Length in miles	Slope in feet per mile
I. <u>Merrimack Basin</u>		<u>5,015</u>		
II. Merrimack Valley and Minor Tri- butaries	From Franklin to the ocean	1,050	116	Franklin to Tidewater at Haverhill 2.9
III. Pemigewasset Watershed	Franklin	1,021	64	27
IV. Winnepesaukee Watershed	Franklin	486	10	23
V. Contoocook Watershed	Penacook	766	66	15
VI. Suncook Water- shed		90	28	29
VII. Suncook Water shed	Suncook	252	39	16
VIII. Piscataquog Watershed	Man- chester	214	24	22
IX. Souhegan Water- shed	Merri- mack	225	35	29
X. Nashua ⁽¹⁾ Water- shed	Nashua	516	56	13
XI. Concord ⁽²⁾ Watershed	Lowell	395	41	6

- (1) Includes 118 square miles from which flow is diverted for water supply.
- (2) Includes 93 square miles from which flow is diverted for water supply.
- (3) House of Representatives, Document No. 689, Table 3, pp. 12-13. These drainage areas vary considerably in some instances from data recorded in New England Regional Planning Commission, Water Resources of New England, Publication No. 51, Boston, Dec. 1937, pp. 146 and 149.

B. Navigation

Navigation, today, is the least important factor in water resource development of the Basin. Possible economic justification for further expenditures for commercial purposes is limited to the lower river from Haverhill to the sea.

However, as an example of the changes wrought by technological developments and of the importance of some continuing organization for comprehensive planning with one function, that of avoiding undue and unjustifiable expenditures through local pressures, inclusion of some navigation history seems desirable.

In the early days of development, before the advent of the railroad, the Merrimack River was a main transportation route.

"The period extending from 1790 to 1825 may very properly be called the 'era of canals'. As there were no railroads in those days, this was regarded as the most expeditious and economic mode of transporting heavy merchandise, and canal

schemes were as numerous as railroad enterprises at a later day."

"Canals for manufacturing purposes were constructed around many of the great water-powers and internal improvements were projected on a magnificent scale, but the Middlesex Canal was the most important of any which were completed and, with the many others along the course of the Merrimack to facilitate its navigation, was of the greatest consequence to the business interests from Concord to Boston."

"In 1814, the first packet-boat passed through the canal from Boston to Concord and in 1819, the first steamboat reached Concord; and a boat of thirty tons has even gone as far up the river as the foot of Webster's Falls in Franklin, the forks of the Merrimack." This period was terminated about 1835 with the opening of the Boston and Lowell Railroad."(1)

(1) J.W. Meador, p. 246-247.

Note: Mass. Senate Document No. 100, p. 71, notes that since 1828 there have been about twenty-five Federal reports on improvement of the river and that eleven of these since 1872 covered navigation on reaches between Haverhill and Manchester.

In 1914, the Merrimack Valley Waterway Board reached the conclusion that the Merrimack River should be improved and opened to navigation up to Lowell, with the Federal government responsible for the project to Ward Hill, about one mile above Haverhill, and that the State execute the work from Ward Hill to Lowell.⁽¹⁾

No action was taken by the local interests and the 1928 report of the Chief of Engineers reported, "the benefits would not be commensurate with the expenditures".

This was further supported by other agencies, including the New England Planning Commission, which in 1937, stated, "Navigation facilities in the Merrimack below Haverhill will be adequate when present dredging operations are completed. There is no justification for extension of navigation above that point".⁽²⁾

(1) Mass. House Document No. 2169, p. 95-96.

(2) New England Regional Planning Commission, Report for the New England Basins, U.S. Government Printing Office, Washington, D.C., Dec. 1937, p. 19.

One definite advantage of a strong regional organization is that its prestige will tend to improve the possibilities of securing Federal and other support for worthy projects, while at the same time reducing the expenditure of time and money on projects which lack economic justification.

For the purposes of this study, navigation itself is a localized problem, but from the standpoint of showing the necessity for regional coordination, its history is of extreme importance.

C. Water-power, Water-supply and Recreation

Numerous reports have been written concerning the separate factors of water-power, water-supply and recreation as they relate to the State, districts and localized areas, but in the Basin they are so closely related as to require coordinated investigation.

Pollution is also related, but except as it may apply to the above subjects, requires individual treatment. This also applies to flood control.

"Within the past twenty years (since 1918) most of the potential water-power sites of value have been developed, with the result that, except for the possibility of increasing power storage, the Merrimack River and its principal tributaries are now almost completely developed for power purposes. Concurrently, the water resources of the Basin have also been utilized to a high degree for water supply, sewage disposal and recreation."⁽¹⁾

(1)

House of Representatives, Document No. 689.

These conclusions are supported by various tables and other reports. The major problem today seems to be readjustment of these various uses to obtain the highest utilization.

In regard to existing development of water-power, there exists some discrepancy in reports, but not sufficient in installed capacity to warrant further investigation at this time as low cost power today is transmissible over long distances and establishment of new plants is rarely economically justifiable except where great potential power is available, backed by sufficient storage capacity. (1)

(1)

In regard to future possibilities, Water Resources of New England, p. 181, notes that while there are several thousand feet of head in main tributaries, "much of this fall, when developed, would have no storage back of it, hence its development would be impractical unless changing conditions in the future made run-of-the-river plants economically feasible."

Table VI
EXISTING POWER DEVELOPMENTS

	<u>From Water Resources Data (1)</u>		<u>From U.S. Engineers Report (2)</u>	
	<u>Operating Head (feet)</u>	<u>Installed capacity (h.p.)</u>	<u>Operating Head (feet)</u>	<u>Installed capacity (h.p.)</u>
Pemigewasset River	317	20,642	515	22,705
Merrimack River	<u>170</u>	<u>102,855</u>	<u>168</u>	<u>104,460</u>
Total				
Main Stream	487	123,497	683	127,165
Total on				
Tributaries	<u>4,640</u>	<u>78,963</u>	<u>2,434</u>	<u>89,709</u>
GRAND TOTAL	5,127	202,460	3,117	194,169

(1) New England Regional Planning Commission, Merrimack Valley Water Resources Data, pp. 11-13.

Note: Total head of 6,203 feet and installed capacity of 218,678 was given in Table III, p. 13, but this total was in error due to listing Nashua, N.H. and Nashua, Mass. separately; totaling and then adding all three figures in the grand total. Even this deduction does not explain the variation in head shown in the two reports.

(2) House of Representatives Document, No. 689, p. 15.

A comparison of Existing Storage Reservoirs and Suggested Power and Storage Developments shows that the main advantage of such developments may lie in the increased storage capacity as a factor in increasing downstream power possibilities and equalizing flow. These advantages, accruing through New Hampshire developments, would be interstate, but of particular importance to the Lowell-Lawrence-Haverhill District.

The development of additional storage capacity might increase water areas available for recreation in New Hampshire provided the drawdown could be limited to a few feet.

The Blackwater Reservoir, now built, is at present solely for flood control use, but as provision has been made to permit increasing its height for power development it may in the future have a recreational value.

Meador noted, in regard to Great and Little Squam Lakes in New Hampshire, "The great corporations along the lower Merrimack have provided artificial means to draw the whole surface of these two lakes,

Table VII

SUGGESTED POWER AND STORAGE DEVELOPMENTS COMPARED
WITH EXISTING STORAGE RESERVOIRS

	<u>Suggested Power and Storage Development</u>			<u>Existing Storage Reservoirs</u>	
	<u>Head ft.</u>	<u>Power h.p.</u>	<u>Capacity B.cu.ft.</u>	<u>Drainage area(sq.mi.)</u>	<u>Capacity B.cu.ft.</u>
NEW HAMPSHIRE					
Livermore Falls	119	22,000	11.50		
Blackwater Res.	200	15,000	4.30		
Stacy Pond			0.50		
Suncook Ponds			1.70		
Moore's Falls	25	10,000			
Water Loom Pond			40		
Total	344	47,000	18.40	622	12.00
MASSACHUSETTS				234	1.38
Grand Total	344	47,000	18.40	856	13.38

Note:

Data from Merrimack Valley Water Resources Data,
p. 15.

reducing them several feet when the dry season affects the natural volume of the river.(1)

In October 6, 1937, a petition was received by the New Hampshire Water Resources Board and Water Control Commission from cottage owners, regarding excessive drawdown at Squam Lake. Drawdown had been limited by court order to 75 cfs. Levels were considered satisfactory during 1939 and 1940 and the case continued for observation.(2)

The present extent of ownership as control of New Hampshire water storage areas by Massachusetts industries or power companies has not been ascertained.(3)

(1) J.W. Meador, p. 78

(2) N.H. Water Resources Board and Water Control Commission, Third Biennial Report 1939-1940, Concord, p. 52.

(3) In Massachusetts House Document No. 2169, there is an excellent review of opinions on water rights which shows a recognition by Congress, as early as 1909, of principles which have been attributed to the New Deal. "In a committee report dated February 25, 1909, the committee on interstate and foreign commerce, House of Representatives, discussing the subject of a general dam law, say: These immense natural resources.. should be developed for the real welfare of the country, and not solely for the benefit of those few individuals who had the shrewdness and foresight to acquire such property rights as may be sufficient to dominate and utilize mostly for themselves those privileges".....

In New Hampshire, the Commission on Water Conservation and Water Power in 1919 stated:
"The head waters of both the Connecticut and the Merrimack are in New Hampshire, and while New Hampshire mills receive much benefit from these rivers, Massachusetts mills do also. If water storage is developed in New Hampshire, it is only right and proper that financial assistance in some form should be received from Massachusetts, and it is gratifying to find that the Massachusetts Commission and Massachusetts mills are thoroughly in accord with this idea."⁽¹⁾

These comments antedate the increase in leisure time; the development of the automobile and the resultant increase in recreational developments.

Even then, they indicated some acceptance of principles which may be applied today in interstate and regional collaboration. It is evident

(1) New Hampshire Commission on Water Conservation and Water Power, Report of, Concord, Jan. 1, 1919, p. 9.

today that some readjustment may be required in the use of water for power, water supply and recreation.

In several reports regarding the Lower Merrimack Valley, the problem of recreation has resulted in consideration of releasing ponds which are now used for water supply for extensive development as recreational areas, and in order to obtain a substitute supply have concluded that a New Hampshire source would be more economically feasible than to obtain it from the Wachusett Reservoir, providing a compact could be effected.⁽¹⁾

Such a source might reduce certain recreational possibilities, but might well be balanced against compensating Mass. developments, particularly in relation to parkways or highways to facilitate access through the Lower Merrimack Valley to New Hampshire.

⁽¹⁾ Mass. Senate Document No. 100, p. 43.

Statistics on water supply show that the Basin has, up to the present, provided for its own requirements, with only 3,000 of its people or 0.37 per cent, served from sources outside of the Basin.

In addition, an estimated total of 1,390,500 people outside the Basin are served from sources within the Massachusetts portion of the Basin, mostly through the Boston Metropolitan System.⁽¹⁾

The Basin supplied 49,053,000,000 gallons per year, but now that the Ware-Swift River project is completed, an additional 70,000,000,000 gallons will be available from the Connecticut Basin, from which it seems that future needs of the Massachusetts portion may be met without recourse to New Hampshire supplies.

⁽¹⁾ Merrimack Valley Water Resources Data, p. 4.

D. Sewage and Pollution

Pollution and flood control have been listed in various New England Regional Planning Commission reports as the major problems of the Merrimack Valley. Regarding pollution, the report for the New England Basins states: "Pollution is so heavy in the Merrimack throughout its entire course that not only are recreational uses, including fishing, impossible, but conditions are obnoxious and, in some places, far from healthy for people living along the banks of the river and its tributaries."⁽¹⁾

It was originally assumed that pollution would be one of the main regional problems, but after considerable investigation it was found that the regional aspects in which there may be mutual advantages to be gained from collaboration, were limited to two points on the State line, namely - where the Nashua River enters New Hampshire from Massachusetts, and where the Merrimack River enters Massachusetts from New Hampshire.

(1)

New England Regional Planning Commission, "Report for the New England Basins, Washington, D.C.", U.S. Government Printing Office, December, 1937, p. 17.

The most serious conditions exist in the Lower Merrimack Valley and their solution is dependent upon local or district action. This district would undoubtedly be benefited by upstream control of dry weather flow, but little benefit would accrue to New Hampshire. This is evident from a study of column 4 in Table 8, p. 78, which shows a dilution ratio in New Hampshire far exceeding that in Massachusetts.

In 1924 the Massachusetts Department of Public Health stated, "The Merrimack River as it enters Massachusetts has already received considerable pollution chiefly discharged from the sewers of the cities and towns and from the manufacturing establishments in the state of New Hampshire, but derived in part also from the sewers and factories in cities and towns in Massachusetts, especially in the valley of the Nashua River. Notwithstanding the pollution which it receives, the condition of the Merrimack River as it reaches North Chelmsford and Lowell, except for water supply uses, is not objectionable from a sanitary

TABLE VIII

Ratio of Domestic Sewage to Discharge of Water from Headwaters of Merrimack River As Indicated on Map No. VI

River Stations	(1) Location	(2) Domestic Sewage discharge accumulated. (Av. in 1000g/d)	(3) Water discharge (Minimum 1000g/d)	(4) Ratio Sewage to Water = 1 in Ratio Minimum discharge (1000g/d)	(5) 6 Per Cent of Time (X 5)	(6) Ratio of Dom. sewage to water between river stations at Min. discharge (1000g/d)	(7) In-dustrial wastes in (1000g/d)
A	Headwaters to <u>Plymouth G.S.</u>	240	29,200	120	600	120	
	Plymouth to Franklin Junction	<u>2,352</u>	162,000			69	
B	Total at Franklin <u>Junction G.S.</u>	2,592	162,000	60	300		
	Franklin Jct. to Garvins Falls G.S.	<u>1,904</u>	195,000			102	
C	Total at Garvins <u>Falls, G.S.</u>	4,496	195,000	44	220		
	Garvins Falls to Manchester, incl.	<u>4,916</u>	76,400			16	
D	Total below <u>Manchester G.S.</u>	9,412	76,400	9	41		
	Below Manchester to Merrimack G.S.	<u>360</u>	84,830			203	
E	Total below <u>Merrimack G.S.</u>	9,772	84,830	7	44		
	Merrimack G.S. to below Nashua, excluding Nashua River discharge	<u>1,968</u>	84,830			43	
F	Total excluding Nashua River discharge	11,740	84,830	8	37		

(continued)

Table VIII (con'd)

	(1)	(2)	(3)	(4)
From Nashua River		<u>6,160</u>		15,422 ⁽⁵⁾
G Total with Nashua River discharge at N.H.- Mass. State Line	11,740	90,990	8 39	46
From State Line to & including Lowell and Dracut	<u>8,000</u>	114,800		12 13,624 ⁽⁶⁾
H Total below Lowell ex- cluding Concord River	19,740	114,800	6 29	
Concord River Sewage (7)	<u>4,535</u>	115,500		25
I Total below Lowell incl. Concord River	24,275	115,500	5 24	
J Lowell to below Lawrence	<u>8,680</u>	129,600		15 41,407 ⁽⁶⁾
Total to below Lawrence	33,955	129,600	4 19	
K Haverhill to sea	<u>5,240</u>	139,600		27 6,244
Total domestic sewage	39,195	139,600	4 18	

(1) - From Merrimack River Water Resources Data, pp. 21-22. (Completely treated sewage not included). House of Representatives Document No. 689, p. 18, shows an estimated total daily discharge of sewage and industrial wastes (treated and untreated) of 42,500,000 gallons per day for the 53 plants in the Basin, whereas Merrimack River Water Resources Data, pp. 21-22, shows a total of 41,053,000 gallons based on domestic sewage only. Industrial wastes recorded from limited areas show a total of 66,697,000 gallons.

(continued)

Table VIII (con'd)

- (2) - Water discharge from House of Representatives Document No. 689, Table II, p. 22. (Calculated for Lowell and Lawrence on ratio of minimum to mean discharge at Manchester.
- (3) - Document 689, p. 18, shows a discharge of 200 c.f.s. 1% of the time; 1000 c.f.s. 6% of the time, and 2,000 c.f.s. 88% of the time, but does not indicate the point at which this flow was established so it was assumed to be at the lower end of the river.
- (4) - Ratio of sewage to water between River Stations shown on Map No. VI.
- (5) - Mass. Senate Document No. 50, Dept. of Public Health, Special Report, relative to the Sanitary Condition of the Blackstone, Hoosick, Housatonic and Nashua Rivers within the Limits of the Commonwealth, Boston, Dec. 2, 1936, p. 18. (Complete treatment of domestic sewage with main pollution due to industry).
- (6) - Mass. Senate Document No. 1735, Dept. of Public Health, Report on the Sanitary Conditions of Certain Rivers of the Commonwealth, Boston, February 1, 1938, p. 65.
- (7) - Partial treatment of all sewage. No record of industrial wastes.

point of view at the present time".⁽¹⁾

The above report recommended in the Lower Merrimack Valley, the creation of a sewerage district and in 1936 legislation established the Merrimack Valley Sewerage District as Chapter 446 of the Acts of 1935.

A similar act was passed in 1936, which also provided for an unpaid board, to be known as the Merrimack Valley Sewerage Board.

The effectuation of these Acts was limited by the proviso that, "No financial obligation shall be incurred, no money shall be expended and no work commenced until 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, (trunk sewer, etc.) shall have been allocated by the federal government."⁽²⁾

(1) - Mass. Senate Document No. 492, Dept. of Public Health, Special Report relative to the Matter of Sewerage and Sewage Disposal in the Valley of the Merrimack River, Boston, April 1924, p. 7.

(2) - Mass. Senate Doc. No. 100, p. 44-45.

As a one-way gravy train, this apparently did not appeal to Congress and the project lapsed on January 1, 1938, under provisions of the Act.

In 1945 a Merrimack Valley Commission was appointed to reinvestigate the pollution problem, with Mr. Berrigan of the Boston Metropolitan District Commission, as Chairman. This Commission retained Mr. Thomas R. Camp as consultant.

The Commission's report has been completed, but due to the long illness of Mr. Berrigan, is not ready for release. Information from Mr. Camp's office indicates that the trunk sewer is no longer considered desirable or economically justified and that the final report will recommend six primary treatment plants on the following basis:

Regional Sewerage Plants:

1. Lowell, Dracut, and Chelmsford.
2. Lawrence, Methuen, Andover, North Andover.

Municipal Sewerage Plants:

3. Haverhill.
4. Salisbury Beach.
5. Amesbury.
6. Newburyport.

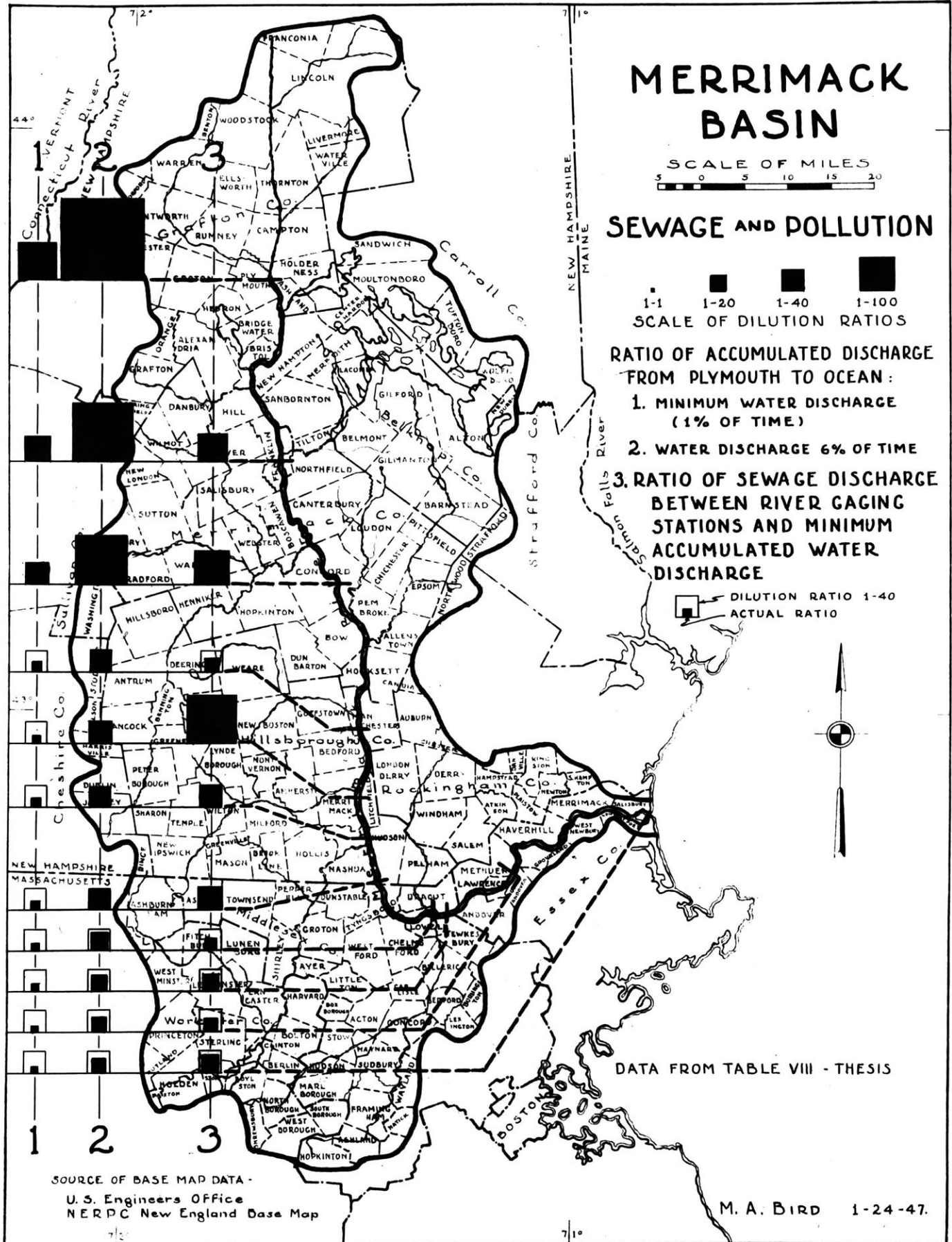
The above information has been included to show only that action is again contemplated on a district basis with no consideration being given to possible action in New Hampshire.

The 1938 report of the Department of Public Health stated:"..... 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 drinking purposes even after treatment."⁽¹⁾

Both the Nashua and Merrimack rivers are recognized as industrial rivers and the maximum objective in pollution elimination would not include their use for water supply, so it appears that the area requiring interstate collaboration is very limited and not of great Basin significance.

Map No. VI, "Sewage and Pollution, Showing Ratio Between Discharge of Domestic Sewage and Water", in conjunction with Table VIII, p. 80, presents only general relations, as long and exhaustive investigation

⁽¹⁾ Mass. House Document No. 1735, p. 61.



SOURCE OF BASE MAP DATA -
U. S. Engineers Office
NERPC New England Base Map

involving purification by dilution and distance, variety of industrial wastes and many other factors would be necessary to present a complete analysis.⁽¹⁾

(1) - Ernest W. Steel, Water Supply and Sewerage, New York, McGraw Hill Book Co., Inc. 1938, p. 480,

states, "If the diluting water was twenty to forty times the sewage, nuisances were considered possible under unfavorable conditions, while with a factor of over 40 no troubles were anticipated. Such rule of thumb methods should be superseded by use of the re-aeration formula, previously discussed. Minimum suggested standards of water pollution with regard to B.O.D., dissolved oxygen, and B. coli have already been given, and they should be correlated with dilution projects. To these should be added consideration of possible dangerous concentrations of toxic substances which may be discharged into streams with certain industrial wastes, either separately or mixed with municipal sewage."

E. Floods and Flood Control

The problem of flood control on the Merrimack River is extremely important and cannot be solved without interstate action, but it does not seem to be of over-all interest on the basis of a specific basin.

Within an 89-year period from 1852 to 1936, ten major floods were recorded of which that of March 1936 was the greatest on record.

1. Flood Damage

The 1927 flood caused estimated damages of \$2,365,000, mostly in New Hampshire. The March, 1936, flood caused total direct and indirect losses of \$34,400,000 of which \$20,840,000 or 60 per cent, was in Massachusetts.

Of the damage in Massachusetts, \$17,905,000 or 86 per cent was concentrated in the cities of Lowell, Lawrence and Haverhill in the metropolitan district which occupies only 23.2 per cent of the Massachusetts portion of the Basin, and only 5.6 per cent of the Basin.

Total losses in New Hampshire amounted to \$13,560,000 of which \$8,655,000, or 66 per cent, occurred in the cities of Manchester and Nashua.

The following summary is of interest in showing the relation of damages to population in the above cities in comparison with State and Basin totals.

Table IX

RELATION OF POPULATION TO DAMAGES IN THE MAJOR INDUSTRIAL CITIES ADJACENT TO THE MERRIMACK RIVER⁽¹⁾

	<u>Percentage of Basin Total</u>		<u>Percentage of State Total</u>	
	Population Flood Damage		Population Flood Damage	
<u>New Hampshire</u>				
Manchester and Nashua	13	25	39	66
<u>Massachusetts</u>				
Lowell, Lawrence and Haverhill	41	52	59	86

(1) - Compiled from House of Representatives Document No. 689, p. 42, and Census Data.

In September 1938 record breaking floods occurred in the Ashuelot, Souhegan, Piscataquog and Upper Contoocook Rivers, which exceeded in many cases, the flows of 1936. Sixty-five dams were badly damaged and several gave way entirely. The city of Keene and the town of Winchester were damaged almost as badly as in 1936. (1)

This particular incident is cited because of the fact that the Upper Contoocook River is in the Merrimack Basin and Keene and Winchester are in the Connecticut Basin on opposite sides of the watershed, but all are within the Monadnock Economic Region. As previously noted, this region straddles the watershed. Shall the flood problems of the Monadnock Region be handled by two different agencies? If so, how would such agencies work with the State region authorities?

To further illustrate this point, the final proposals of the Corps of Engineers, Doc. No. 689,

(1) New Hampshire Water Resources Board and Water Control Commission, Second Biennial Report, pp. 57-67.

p. 4, included Riverhill Reservoir as one of the reservoirs in System 8. The people in the Merrimack Valley Region seriously opposed this project because it would flood a large part of the best agricultural land in the Contoocook Valley and flood out most of the village of Contoocook including its industries.

It was also opposed by the people above the dam site, including those in the Monadnock Region, because no provision had been made in the U.S. Engineers Plan to protect them from a repetition of flood damage. It would protect mainly the large industrial cities of Manchester and Concord.⁽¹⁾

2. Encroachment on the Flood Plain.

There has been a clear recognition of the fact that a large part of flood damage has been due to encroachment on the flood plain. The New Hampshire "Report on the 1936 Flood, p. 5, noted, The trend away from the hills, down into the

(1)

N.H. Water Resources Board and Water Control Commission, Second Biennial Report, pp. 71-73.

Valleys Before this change in the topographic location of the bulk of the population and commercial life of the state, floods of comparable severity ... would have wreaked far less havoc. Furthermore, in a number of cases property damaged by flood was on 'made land' - extensions by filling in on the naturally swampy overflow areas which had cared for flood waters for centuries.....

Mass. Senate Doc. No. 100, notes, p. 27,
"There are many structures and developments so located as to be exposed to damage from even moderate floods, and others so situated as to create channel constructions which cause serious flood problems."

In reference to the cities of Nashua, Lowell, Lawrence and Haverhill, Doc. No. 689, says: "During floods, large sections of the industrial and business areas are not only subject to inundation and heavy damage, but also seriously restrict the channel capacity of the stream.

It is like the weather - everybody talks about it, but nobody does anything about it!

In 1937, an Act established the Merrimack Valley District and the Merrimack Valley District Commissioners, but through failure of ".... its acceptance within five years by at least ten cities and towns...." it has never functioned. Section 9 provided for the creation of a division of planning and Section 10 defined its responsibilities. "It shall" plan for almost every type of improvement, including in detail such items as skiing or tobogganing but nowhere does it authorize zoning to prevent further encroachment.

If the State's share of costs of improvements are to be borne by general taxation, is it any wonder that those living outside of the industrial cities whose share, as evident from Table IX, would be proportionally greater in relation to benefits, are more interested in protection of their land?

3. Past and Present Flood Control Programs.

After consideration of various means of flood control, the U.S. Corps of Engineers recommended reservoirs as the most effective means of control.

The plan adopted under the provisions of the National Flood Control Act of 1936, was called the "Initial plan for Flood Control on the Merrimack River" and provided for the construction of the Franklin Falls Reservoir at Franklin on the Pemigewasset River, and the Blackwater Reservoir at Webster on the Blackwater River.

Under the above Act, the states would:

- (a) Provide without cost to the United States all land, easements, and rights of way necessary to the project.
- (b) Hold and save the United States free from damage due to construction work.
- (c) Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of War.

The Federal Government will, as their share, provide funds for the construction of the dam and appurtenant works.

The Franklin Falls Reservoir was designed for flood control with State option of retaining 50 per cent of capacity for conservation or recreational purposes.

The Blackwater Reservoir was designed so that at the option of the State, it might be further developed for conservation or power purposes.

Interstate compacts were expressly authorized by this Act entitled, "Public No. 738-74th Congress", for "flood control or the prevention of damage to life or property.....(1)

The "Compact", as later approved by the legislative bodies of New Hampshire and Massachusetts, provided for an equal share in the cost of lands, easements and rights of way. It failed of ratification by Congress.

In 1938, the Commissioners for the State of New Hampshire attempted to determine the reason for this failure to ratify the compact. They found that "the opposition had been based upon the provision authorizing the states to retain the title to the land and easements and to utilize the sites for water-

(1)

Interstate Compact Commission on Watersheds, Compact Covering Flood Control in the Merrimack River Basin, Manchester, N.H. Granite State Press, 1937, pp. 5-7, 16-17.

power and water conservation so far as may be done consistently with flood control.

After reading their report, it is evident that intelligent and factual comments upon the Commissioners' arguments could be based only upon a long and exhaustive investigation of the many acts and decisions mentioned in the report. Their argument is apparently based upon the fact that Congress "authorized the War Department to install penstocks", but did not authorize it to operate power projects. (1)

Both reservoirs were finally adopted by the U.S. Engineers and the projects approved by the New Hampshire Legislature in Chapter 149, Laws of 1939. Construction has been completed. The Black-water Reservoir can be raised at a later date for conservation storage.

According to information received from the U.S. Engineers, Boston Office, both projects are owned and will be operated by the Federal Government.

(1) Commissioners for the State of New Hampshire, Report on Interstate Compacts for Flood Control, Concord, N.H. Press, Feb. 15, 1938.

According to the same source, these projects are insufficient to give full protection and any flood similar to that of 1936 will overtop the river-wall at Haverhill.

In a new report, at present unavailable, they are attempting to show that future damage to New Hampshire cities would be much greater than in 1936 on the basis that industrial recovery has increased the number of plants in operation and the amount of material subject to damage. Maybe that is the only way to get more reservoirs approved in New Hampshire as the statement made in the Compact Covering Flood Control is to the effect that these two reservoirs "will eliminate the major flood damage on the Merrimack River".

U.S. Engineers computations show the following reductions:

Table X

COMPARISON OF PAST WITH PROSPECTIVE ANNUAL FLOOD LOSSES

	<u>New Hampshire</u> Amount	<u>Massachusetts</u> Amount
Computed Annual Flood Losses	\$660,200	\$458,500
Annual Benefits Blackwater and Franklin Falls	<u>426,800</u>	<u>225,000</u>
Balance annual flood losses	\$243,400	\$233,500
Percentage of re- duction in losses	64.5	46.4

Computed from House of Representatives Document No. 689, pp. 45 and 69.

VI.

EXISTING AGENCIES IN RELATION TO CONTROL AND
ACCOMPLISHMENT OF OBJECTIVES

As an example of the number of agencies which may be involved in collaborative problems, a recent investigation of Henry County, Indiana, revealed a total of 327 district units serving its citizens.⁽¹⁾

In New Hampshire, 6 Federal, 15 State, and 41 organized non-governmental agencies, a total of 62 agencies, were found to be engaged in some activity in the field of health.⁽²⁾

This investigation cannot locate and list all agencies which may be involved and shows only a generalized outline working upward from the grass roots.

(1) American Society of Planning Officials, News Letter, Vol. 12, No. 10, Chicago, Ill. October, 1946, p. 86.

(2) New Hampshire Council on Postwar Planning and Rehabilitation, Report of Dec. 1, 1944, p. 23.

Governmental and Quasi-governmental Agencies
which may be involved in regional problems.

1. Local Agencies

(a). The 189 Cities or towns in the Basin.

(In larger cities, divisions of government which may include Departments, Commissions, or other agencies concerned with finance, taxation, public health, public works, public utilities, planning, parks, etc.)

(b). Quasi-governmental agencies such as Chamber of Commerce, Taxpayers Associations, Parents-Teachers Associations, etc.

2. County Agencies (Not particularly strong)

12 counties.

3. Sub-regional or District Agencies

(a). Regional Associations-New Hampshire.

(b). Metropolitan District Agencies-Massachusetts

Water and Sewage Commissions or Boards.
Park Boards.
Planning Agencies.
Administrative Agencies.
Promotional Associations.

4. State Agencies

- (a). Planning agencies.
- (b). Water Resources Boards or Commissions.
- (c). Health Board or Department.
- (d). Conservation agencies related to parks, forests, fish and game.
- (e). Highway Departments.
- (f). Public Service Commissions.
- (g). Board of Education.
- (h). Public Welfare.

5. Federal Agencies

- (a). War Department U.S. Engineers.
- (b). Department of Interior -
 - Fish and Wildlife Service
 - National Park Service.
 - Geological Survey.
- (c). Department of Agriculture -
 - U.S. Forest Service.
 - Farm Services.
- (d). Federal Works Administration -
 - Public Roads Administration.

VII.

CONCLUSIONS AND RECOMMENDATIONS

A. Basin Development on Basis of Water Resources

The Merrimack River Basin does not represent a functional unit capable of basin-wide development, on the basis of its water resources for the following reasons:

1. Further development of navigation except for small boat use, is not economically justified.
2. Water-power supply is insufficient to justify regional organization. It is almost fully developed in Massachusetts and only a limited supply of potential power is available in New Hampshire and it is questionable whether this can be developed at present on an economic basis.
3. Flood damage possibilities, particularly in New Hampshire, have been reduced to a point which makes it questionable whether additional

control should be accomplished by more large reservoirs, which in the main, will protect the Lower Merrimack Valley, or whether the most desirable program will involve flood plain zoning and the gradual elimination of industry and housing from certain areas.

The major problem which remains is the reduction of flood damage on tributaries where protection is not afforded by large dams near their intersection with the Merrimack River.

4. Pollution involves only two points adjacent to the state lines and will not require extensive cooperation.

5. Recreational use of water does not overlap state lines except for the possibility of small-boat navigation. The possibilities would not justify extensive development.

6. Water-supply already overlaps the watershed area in Massachusetts and

because of the available supply from the Connecticut Valley, no interstate collaboration seems necessary.

B. Partial Development on Basis of Water Resources

The Merrimack River Basin, is not adapted in part, for development on the basis of its water resources:

1. On the western boundary of the Basin, its economic regions, based on what seems a desirable central focus, divide almost equally between the Connecticut and Merrimack Basins.

2. The White Mountains Region, at the northern end, has its center outside of the Basin.

3. The Lakes Region centers on Laconia and because of the slight variation in level, Lake Ossipee and other developments in the Saco and Salmon River basins, are within its economic and recreational orbit.

4. The small part of the Seacoast Region within the Basin is sparsely settled and the main emphasis is on Great Bay and the ports.

5. In the Lower Merrimack Valley, the latest proposal is for sewage treatment plants to reduce pollution. These plants will treat both domestic sewage and industrial wastes on a primary basis only. As this district is short of water for recreational use, it hardly seems that it can be further developed on the basis of water resources. However, a District organization seems desirable for general purposes.

6. The fringe of the Boston Metropolitan District and the Worcester Metropolitan District are in the Basin, but the Nashua River is heavily polluted, with the Concord River now in fair condition so no further development is possible on the basis of water resources.

7. The Fitchburg-Leominster area has established treatment of domestic sewage, but the N. Branch of the Nashua

River is grossly polluted by industrial wastes with little water available for further development.

C. Interbasin development on basis of water resources.

While it does not seem that any area entirely within the Merrimack Basin should be developed on the basis of one basin water resources, the Monadnock-Dartmouth-Lake Sunapee, and Lakes Regions may well be further developed on the basis of their relation to two or more basins.

D. Interstate Problems

New Hampshire, sharing parts of its various basins with other states, has definite problems concerning water resources which should be solved through joint action.

New Hampshire is a major recreation area for Massachusetts people and receives a large part of her annual income from that source. It would benefit by better access from Boston to the upper valley and might well work out compromises on regional problems as they

relate to both the Connecticut and Merrimack Basins, but it is believed that action might be best accomplished by compacts where required by the Constitution, but in other areas by cooperation with each doing its fair share within its area.

Again, Massachusetts, New Hampshire and Connecticut are involved in the solution of problems relating to the Connecticut Valley.

A rebirth of the New England Planning Commission might be of help in solving some of the major problems, but an organization from the grass roots up seems more desirable for specific problems of adjoining states.

E.

Proposed Organization.

The type of organization proposed is based on the use of the existing New Hampshire Regions and Massachusetts Metropolitan Districts. The Fitchburg-Leominster area might constitute the other region or district.

In New Hampshire, since 1937, the Legislature has appropriated \$2500 per year to the support of each regional organization, subject to the approval of the Planning and Development Commission.

In Massachusetts, Governor Bradford has recommended that the State Planning Board be empowered to coordinate departmental planning except for public buildings.

With six New Hampshire Regions each receiving \$2,500 per year, or a total of \$15,000, and these regions already working with the Commission on regional planning problems, it would seem desirable to assign or appoint a staff member to coordinate all problems and activities as they relate to the Merrimack Basin in New Hampshire.

This should also be done in Massachusetts with relation to Metropolitan Districts.

These coordinators would be responsible for all problems affecting the Basin. Plan scales, records and data might be coordinated. Through duplication of data for each state and transmission of copies each coordinator would be familiar with current problems in the adjacent state and be able to determine their interstate relationship.

Frequent meetings of these coordinators, and when required, of the State Planning Directors, would facilitate joint planning.

To begin, the New Hampshire coordinator might also cover problems of the Connecticut, Saco and Androscoggin Valleys as they affected Vermont and Maine.

His responsibility would relate solely to problems which might have interstate and Federal relationships.

This seems to be the most logical method of approach to these problems. Its success would depend to a large extent on coordination of data and the assemblage of the present mixture of miscellaneous data into such form as to be available for instant reference.