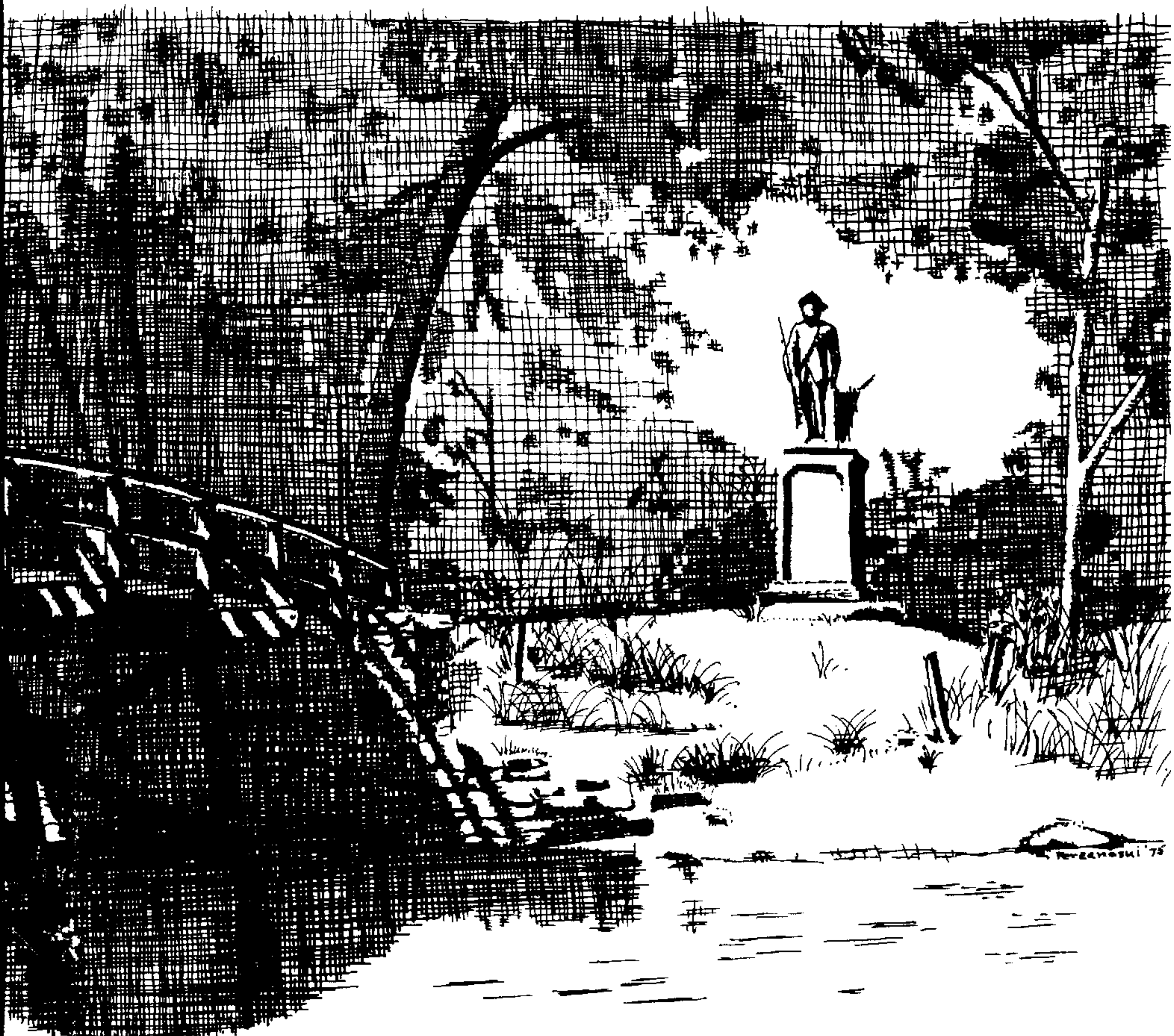
THE SUASCO RIVER BASIN

PART D - WATER QUALITY MANAGEMENT PLAN



department of environmental quality engineering

DIVISION OF WATER POLLUTION CONTROL

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SUASCO RIVER BASIN

1975

WATER QUALITY MANAGEMENT PLAN

Water Quality Section
Massachusetts Division of Water Pollution Control

Westborough

June 1976

Cover

The Minuteman Memorial and the North Bridge
at Concord, Massachusetts

Publication number: 9008
143-100-7-76-CR

Approved by:
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Purchasing Agent

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I. SUASCO RIVER BASIN PLAN

The following document is a Water Quality Management Plan for the designated communities within the SUASCO River Basin. The plan is formulated in accordance with the provisions set forth in the 1972 Amendments to the Federal Water Pollution Control Act, which are designated as PL92-500. Section 303(e) of PL92-500 describes the requirements and need for this document.

The need for a specific plan for pollution abatement has evolved from the increased public concern for the nature and the condition of the waters of the nation. This document sets forth an orderly, realistic, and technically feasible pathway toward the attainment of the goals of pollution abatement and the desired water quality of the waters of the SUASCO River Basin.

Many facets of information and study are coordinated and blended together in the formulation of this basin plan. The main aspects of this document are:

1. A discussion of the water use classifications designated for the waters of the SUASCO River Basin. The main goal of this plan is the attainment of the water use classifications through the proper implementation of this plan.

2. The present condition of the waters of the basin will be examined and it will be shown whether the rivers are meeting their designated classifications.

3. The reasons for pollution problems will be given and plans formulated to abate these problems.

4. A program will be developed to monitor the progress made in implementing this plan.

5. A discussion of the role of the public in the formulation and implementation of this plan.

Other inputs will be incorporated into this document to insure the development of the most sensible and comprehensive plan.

This plan is foremost concerned with the attainment of the 1977 goals of the federal law, which are to meet the water quality classifications established in 1967. The design life of this plan is a maximum of five years, by which time an evaluation will be made of the progress made towards the attainment of the goals of this plan. Revisions to this plan will be made when studies, stream analysis, and other viable inputs show that such changes will lead to a better achievement of the goals of PL92-500. The plan was formulated with the idea that succession from the 1977 goals to the 1983 goals of all fishable/swimmable waters can be successfully accomplished.

SUASCO RIVER BASIN

Located in east-central Massachusetts, the SUASCO River Basin is comprised of the Assabet and Sudbury Rivers which flow together to form the historic Concord River. The three rivers represent quite a contrast in waterbodies, each having its own unique physical characteristics and its own water quality problems. Figure I-A shows the location of the SUASCO River Basin in the Commonwealth, and Figure I-B shows the individual communities which comprise the SUASCO River Basin.

The Assabet River has its beginning in the Town of Westborough and flows northeast through the urban centers of Northborough, Hudson, Maynard, and Concord. The river is characterized by the following repeating sequence: a sewage treatment plant effluent discharging into the headwaters of an impoundment. The impoundments are highly eutrophic with large amounts of aquatic growth, especially algal blooms during certain periods of the summer. The river is thirty-one miles long and has a drainage area of 175 square miles. The basin is urban along most of the Assabet's course and rural in the outlying areas of the basin.

The Sudbury River also has its beginning in the Town of Westborough, flowing from Cedar Swamp eastward to Framingham, then north through the towns of Sudbury, Wayland, Lincoln, and into the Town of Concord. The Sudbury River is characterized by three distinct physical sections. Upstream of Framingham, the river is a narrow, rapidly flowing stream dotted with a few small impoundments. In Framingham, the river has two large impoundments: the first is part of the Metropolitan District Commission water supply, and the second is created by the Colonna Dam in Saxonville. The third and unique section of the river is that which flows through the National Wildlife Refuge meadowlands in the towns of Sudbury, Wayland, Lincoln, and Concord. Through this area (river distance of 12 miles), the river's elevation changes only <u>one</u> foot and the river is akin to an elongated lake.

The Sudbury River is 41 miles long with a drainage area of 169 square miles, 29 of which drain to the MDC reservoirs. This area is rapidly being urbanized with tremendous population growth rates in many of the towns within the basin. Table I-1 shows the population growth from 1950 to 1970.

The Concord River flows north through the towns of Concord, Carlisle, Bedford, Billerica, and the City of Lowell where it flows into the Merrimack River. The Concord River retains the slow-moving characteristic of the Sudbury River as it flows north through the Great Meadow Wildlife Refuge Area. From the Talbot Dam in Billerica, the river is an urban river, receiving industrial and municipal discharges and raw sewage discharges from the sewers and canals in the City of Lowell.

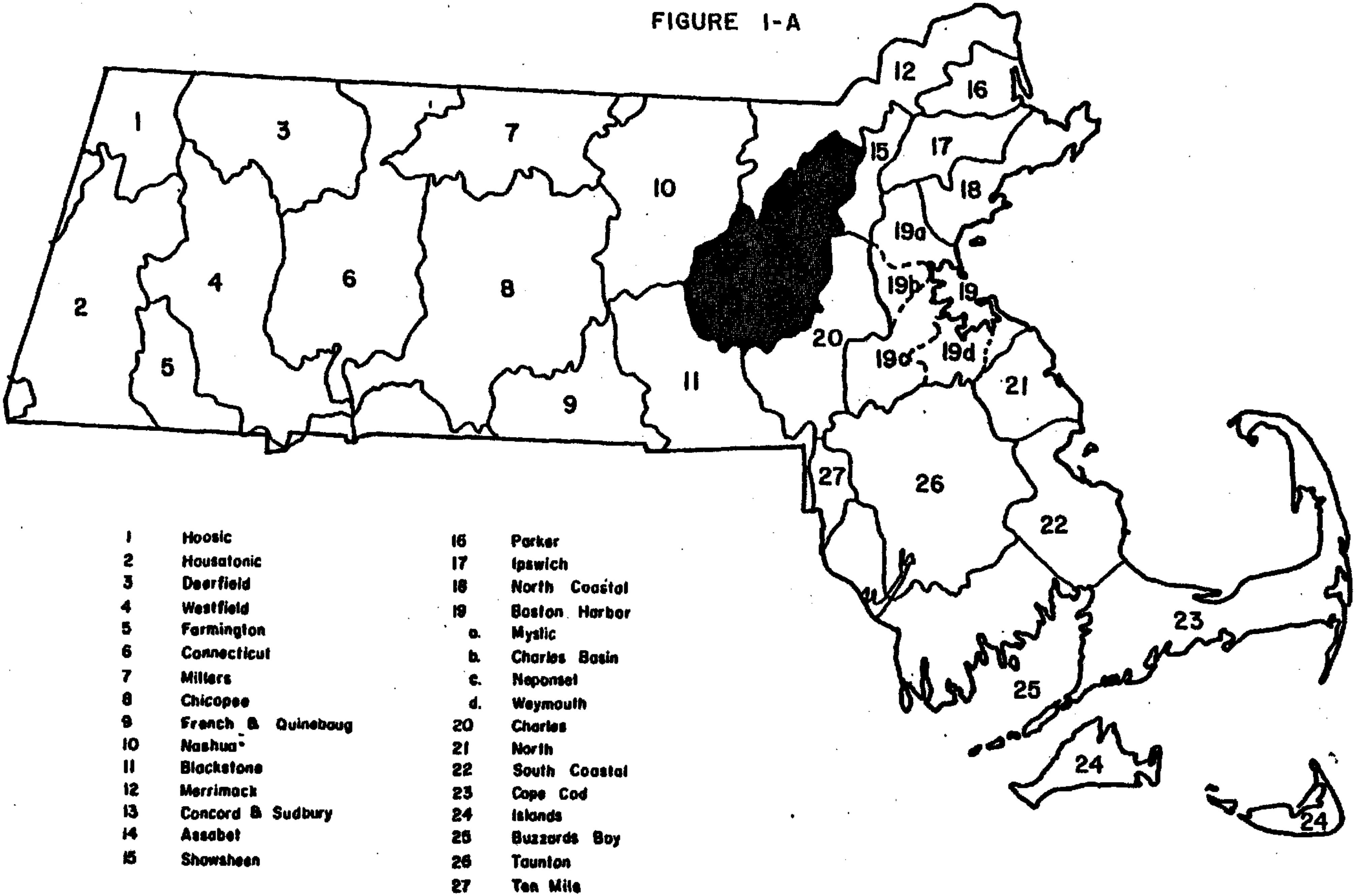
The Concord River is 15.8 miles long and drains 27 square miles, for a combined total (including the Assabet and Sudbury Rivers) of 381 square miles. The Concord River Basin has two main urban centers in the Lowell and Concord areas, and some rural areas such as those still found in Carlisle. The Concord area is steeped in history and culture. For example, the "shot heard round the world" was fired at the North Bridge in Concord. The transcendental literary geniuses, such as Thoreau, Emerson, and Whitman, resided in the area.

This basin plan for the SUASCO River Basin encompasses the following communities: Acton, Ashland, Berlin, Billerica, Boxborough, Carlisle, Concord, Framingham, Hopkinton, Hudson, Lincoln, Littleton, Marlborough, Maynard,

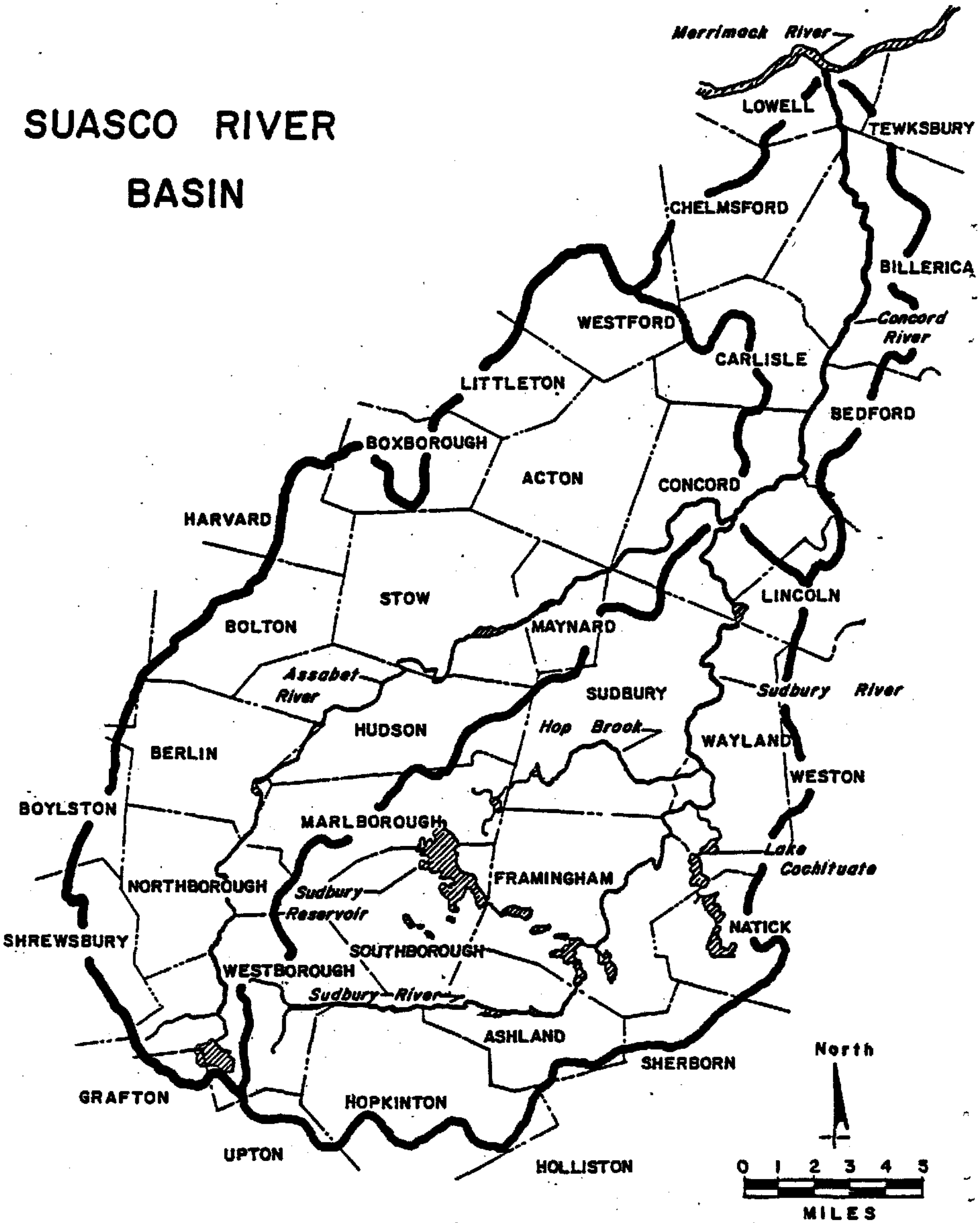
COMMONWEALTH of MASSACHUSETTS

DRAINAGE BASINS

FIGURE 1-A



1 Hoosic	16 Parker
2 Housatonic	17 Ipswich
3 Deerfield	18 North Coastal
4 Westfield	19 Boston Harbor
5 Farmington	a. Mystic
6 Connecticut	b. Charles Basin
7 Millers	c. Neponset
8 Chicopee	d. Weymouth
9 French & Quinebaug	20 Charles
10 Nashua	21 North
11 Blackstone	22 South Coastal
12 Merrimack	23 Cape Cod
13 Concord & Sudbury	24 Islands
14 Assabet	25 Buzzards Bay
15 Shawsheen	26 Taunton
	27 Ten Mile



SUASCO RIVER
BASIN
Merrimack River
LOWELL
TEWKSBURY
CHELMSFORD
BILLERICA
Concord River
WESTFORD
CARLISLE
LITTLETON
BEDFORD
BOXBOROUGH
ACTON
CONCORD
HARVARD
STOW
LINCOLN
BOLTON
MAYNARD
Assabet River
SUDBURY
Sudbury River
HUDSON
Hop Brook
WAYLAND
BERLIN
WESTON
BOYLSTON
MARLBOROUGH
Lake Cochituate
NORTHBOROUGH
Sudbury Reservoir
FRAMINGHAM
NATICK
SHREWSBURY
SOUTHBOROUGH
WESTBOROUGH
Sudbury River
ASHLAND
SHERBORN
North
GRAFTON
HOPKINTON
UPTON
HOLLISTON
0 1 2 3 4 5
MILES

FIGURE I-B

TABLE I-1

POPULATION GROWTH

SUASCO RIVER BASIN

MUNICIPALITY	POPULATION 1950	1960	1970
Acton	3,150	7,238	14,770
Ashland	3,500	7,779	8,882
Berlin	1,349	1,742	2,099
Billerica	11,101	17,867	31,648
Boxborough	439	744	1,451
Carlisle	876	1,488	2,871
Chelmsford	9,407	15,130	31,432
Concord	8,600	12,500	16,100
Framingham	28,086	44,526	64,048
Hopkinton	3,486	4,932	5,981
Hudson	8,211	9,666	16,084
Lincoln	2,427	4,463*	7,600
Littleton	2,349	5,109	6,380
Lowell	97,249	92,107	94,239
Marlborough	15,756	18,819	27,936
Maynard	6,978	7,695	9,710
Natick	19,938	28,831	31,057
Northborough	3,122	6,687	9,218
Shrewsbury	10,591	16,622	19,196
Southborough	2,760	3,996	5,798
Stow	1,700	2,573	3,984
Sudbury	2,596	7,446	13,506
Tewksbury	7,505	15,902	22,755
Wayland	4,407	10,444	13,461
Westborough	7,378	9,599	12,594

*1965

Source: Commonwealth of Massachusetts, Department of Commerce and Development, City and Town Monographs.

Natick, Northborough, Shrewsbury, Southborough, Stow, Sudbury, Wayland, and Westborough. The remaining communities which lie partly within the SUASCO River Basin will be discussed in other basin plans. Reference will be made to some of the remaining communities if sections of those communities may be sewered, at a future date, to one of the municipalities covered by the SUASCO River Basin Plan. Table I-2 lists all the municipalities which lie wholly or partly within the SUASCO River Basin and lists the corresponding basin plan pertaining to that community. Figure I-C delineates the planning area of the SUASCO River Basin Water Quality Management Plan.

TABLE I-2

COMMUNITIES AND DESIGNATED PLANNING AREA

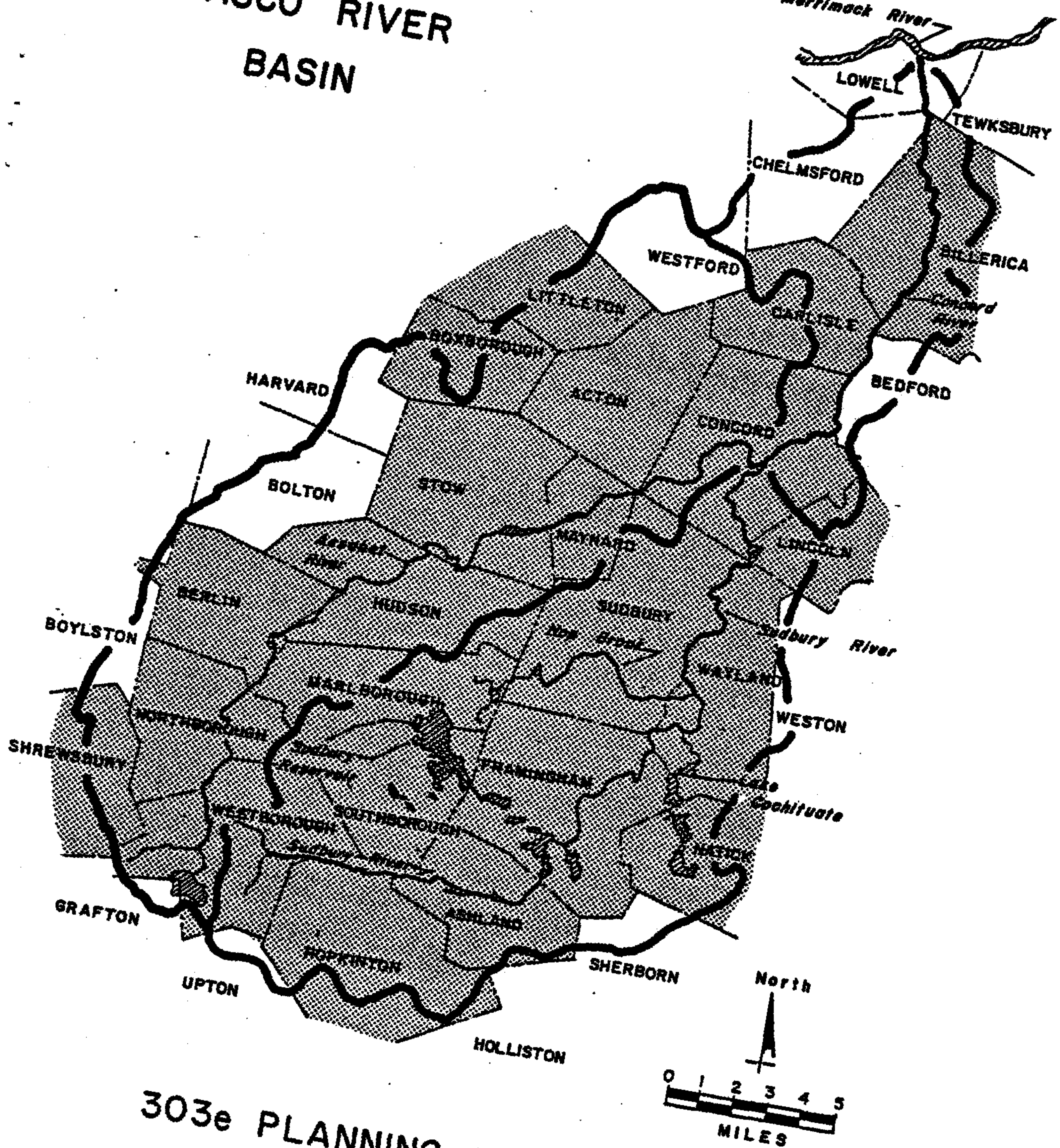
SUASCO RIVER BASIN

MUNICIPALITY	BASIN PLAN
Acton	SUASCO
Ashland	SUASCO
Bedford	Shawsheen
Berlin	SUASCO
Billerica	SUASCO
Bolton	Nashua
Boxborough	SUASCO
Boylston	Nashua
Carlisle	SUASCO
Chelmsford	Merrimack
Clinton	Nashua
Concord	SUASCO
Framingham	SUASCO
Grafton	Blackstone
Harvard	Nashua
Hopkinton	SUASCO
Hudson	SUASCO
Lincoln	SUASCO
Littleton	SUASCO
Lowell	Merrimack
Marlborough	SUASCO
Maynard	SUASCO

TABLE I-2 (Continued)

MUNICIPALITY	BASIN PLAN
Natick	SUASCO
Northborough	SUASCO
Sherborn	Charles
Shrewsbury	SUASCO
Southborough	SUASCO
Stow	SUASCO
Sudbury	SUASCO
Wayland	SUASCO
Westborough	SUASCO
Westford	Merrimack
Weston	Charles
Tewksbury	Merrimack
Upton	Blackstone

SUASCO RIVER BASIN



303e PLANNING AREA

FIGURE 1-C

II. WATER QUALITY STANDARDS

The Massachusetts Water Quality Standards were established by the Division in 1967 and revised in 1974. The standards consist of the definitions of the water use classifications, certain criteria for various physical and chemical parameters, general regulations, and present and future water use classifications. These standards, as revised in 1974, are presented in Appendix 2 of this document. (These standards should be studied before continuing with this document.)

The revision of the water quality standards requires the reclassification of the waters of the Commonwealth. Therefore, although the future use classification may remain unchanged, the application of the revised standards and regulations is, in actuality, a reclassification of the designated water. The reclassification requires a public hearing.

The changes to the classification definitions of the 1967 standards are as follows:

1. Numerical criteria for nutrients have been replaced by two general provisions. The first prohibits new discharges of nutrients to lakes and ponds or their tributaries. The second requires that discharges containing nutrients in concentrations that encourage eutrophication or the growth of algae or weeds shall be treated to the maximum extent technically feasible. The result of this change is that the need for nutrient removal at waste treatment facilities will be assessed on a case-by-case basis rather than through the use of state-wide effluent limits.

2. Modifications of the B and C classifications have been established for streams where all criteria for these classifications can be met except dissolved oxygen. A Class B1 stream would meet all the criteria for a Class B stream except dissolved oxygen, for which Class C criteria would be met. A Class C1 stream would meet all Class C criteria except dissolved oxygen, for which a minimum concentration of 2.0 milligrams per liter would be maintained. These modifications allow higher use classifications to be assigned to slow, sluggish streams with natural low dissolved oxygen values than were possible under the old standards.

3. Coliform bacteria levels of 5,000 per 100 milliliters have been established for Class C and SC waters. However, waters subject to urban runoff which do not meet this maximum level but do meet all other Class C criteria can be used as Class C streams. It is a long-term goal of the Division to solve all urban runoff problems and assign bacterial limits to all waters.

4. Class D has been eliminated. All waters assigned this classification for future use must be upgraded to at least Class C1. This represents a substantial upgrading, since Class C1 waters shall be suitable for a variety of uses, including recreational boating and wildlife habitat. Class D waters were suitable only for power, navigation, and limited industrial uses.

One of the most significant of the new general regulations is the anti-degradation clause which prohibits any new wastewater discharge upstream of the most upstream existing municipal discharge. This clause has great ramifications for communities which may need a sewerage system but are distant from a stream which is not classified anti-degradation. The major anti-degradation streams in the SUASCO River Basin are listed in Table II-1. The stream names are taken from United States Geological Survey topographic maps. The names may differ from the local names for these streams. All waters in the basin which do not receive a wastewater discharge are subject to the anti-degradation clause. The reclassification of the waters of the Commonwealth will apply this clause.

On April 24, 1967, at a public hearing in Lowell, the Division of Water Pollution Control proposed water use classifications for the waters of the SUASCO River Basin. All waters designated for use as sources of public water supplies were given a Class A classification. The Assabet, Sudbury, and Concord Rivers and their tributaries were given a B classification. Exceptions to the B classification were portions of the Assabet River below the Westborough, Shrewsbury, and Hudson sewage treatment plants, which were given C classifications, and the section of the Concord River from the Talbot Dam in North Billerica to the Merrimack River, which was given a C classification. Figure II-A shows these proposed water use classifications for the SUASCO River Basin.

This water quality management plan, in accordance with the 1974 revised Water Quality Standards, reclassifies the water use classifications of the SUASCO River Basin as follows:

> The sections of the Assabet River previously classified as Class C are upgraded to Class B1;
>
> The Concord River, from the Talbot Dam in Billerica to the Merrimack River, is designated as Class C;
>
> All public water supplies are designated Class A;
>
> All other sections of the SUASCO River Basin are designated Class B;
>
> The anti-degradation clause is applied throughout the SUASCO basin as stated in the revised Water Quality Standards.

Figure II-A shows the reclassifications for the SUASCO River Basin.

The objectives of this plan are to achieve the 1977 goals of the federal law, PL92-500, which are to attain the water use classifications proposed in 1967 and to improve those classifications wherever possible. This plan sets forth a program which will hopefully meet the 1977 goals and provides a logical sequence which can progress toward the 1983 federal goal of all Class A and B waters.

TABLE II-1

ANTI-DEGRADATION STREAMS

SUASCO RIVER BASIN

STREAM	MUNICIPALITY
Sudbury River Basin	
Sudbury River in its entirety upstream of its confluence with Wash Brook, Wayland	
Cowassock Brook	Ashland
Willow Brook	Ashland
Snake Brook	Cochituate
Baiting Brook	Framingham
Birch Meadow Brook	Framingham
Dunsdell Brook	Framingham
Eames Brook	Framingham
Cold Spring Brook	Hopkinton
Indian Brook	Hopkinton
Whitehall Brook	Hopkinton
Mowry Brook	Marlborough
North Branch Mowry Brook	Marlborough
Course Brook	Sherborn
Angelica Brook	Southborough
Stony Brook	Southborough
Bridge Brook	Sudbury
Cold Brook	Sudbury
Dudley Brook	Sudbury
Dugan Brook	Sudbury
Pantry Brook	Sudbury
Run Brook	Sudbury
Hayward Brook	Wayland
Hazel Brook	Wayland
Pine Brook	Wayland
Denny Brook	Westborough
Jackstram Brook	Westborough
Piccadily Brook	Westborough
Rutgers Brook	Westborough
Assabet River Basin	
Assabet River upstream of the Westborough Sewage Treatment Plant	Westborough
Nagog Brook	Acton
Gates Pond Brook	Berlin
Hog Brook	Berlin
North Brook	Berlin
Great Brook	Bolton
Elizabeth Brook	Boxborough
Fort Pond Brook	Boxborough
Guggins Brook	Boxborough
Heath Hen Meadow Brook	Boxborough
Dakins Brook	Concord
Spencer Brook	Concord

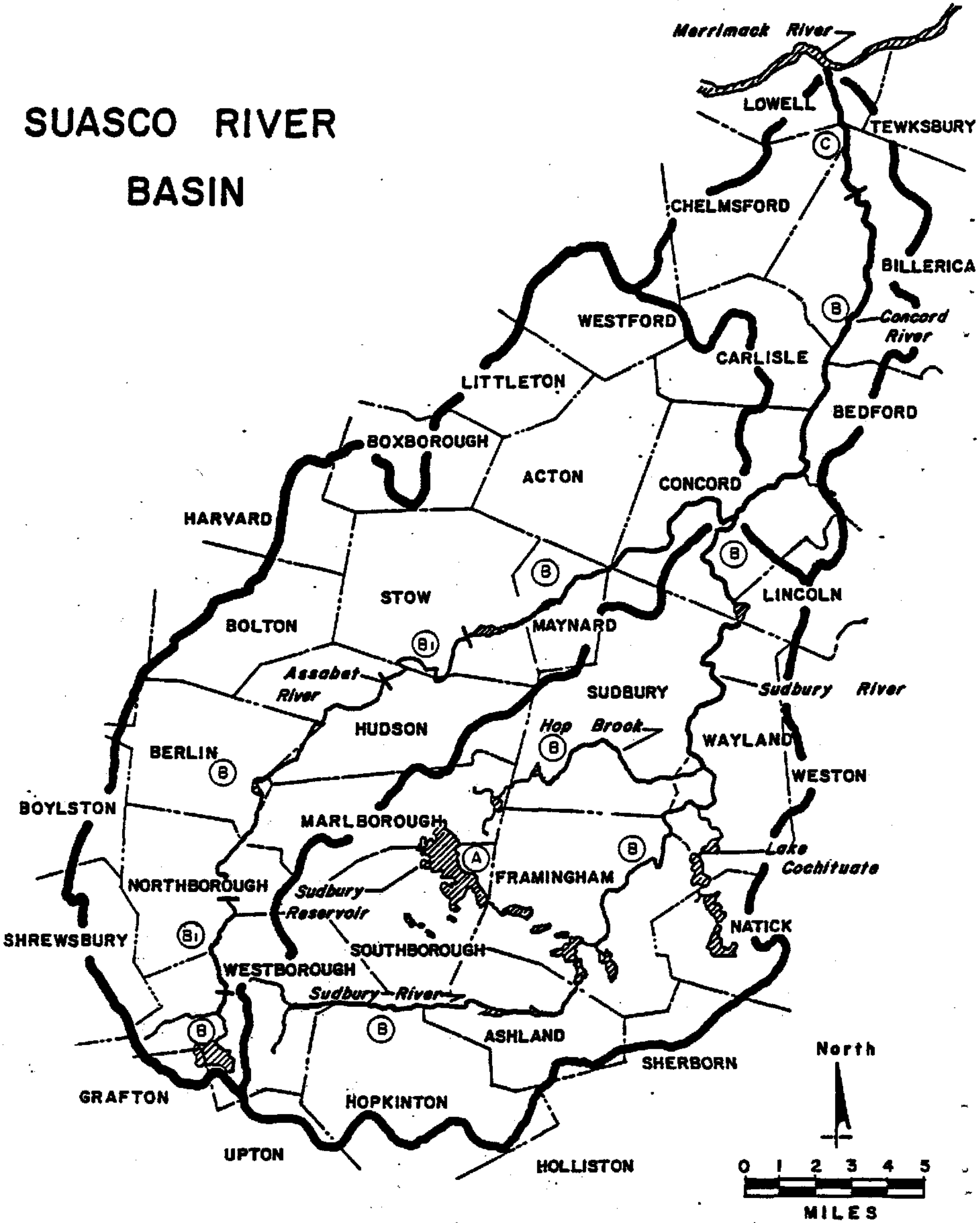
TABLE II-1 (Continued)

STREAM	MUNICIPALITY
Dansforth Brook	Hudson
Fort Meadow Brook	Hudson
Butter Brook	Littleton
Nashoba Brook	Littleton
Nonset Brook	Littleton
Vine Brook	Littleton
Millham Brook	Marlborough
North Branch Brook	Marlborough
Second Division Brook	Maynard
Taylor Brook	Maynard
Barefoot Brook	Northborough
Cold Harbor Brook	Northborough
Howard Brook	Northborough
Rawson Hill Brook	Northborough
Stirrup Brook	Northborough
Assabet River	Stow
Hop Brook	Westborough
Little Bummit Brook	Westborough

Concord River Basin

Mill Brook	Bedford
Pages Brook	Carlisle
Beaver Brook	Chelmsford
Farley Brook	Chelmsford
Pond Brook	Chelmsford
Putnam Brook	Chelmsford
River Meadow Brook	Chelmsford
Mill Brook	Concord
Back Brook	Lowell
Marginal Brook	Tewksbury
All intermittent streams	---
All tributaries to the above-named streams	---

Stream names are taken from USGS Topographic Maps. Local names may vary.



WATER USE CLASSIFICATIONS

FIGURE II-A

III. EXISTING WATER QUALITY

BACKGROUND INFORMATION

In the summer of 1973, the Division of Water Pollution Control conducted an intensive water quality survey of the Concord and Sudbury Rivers. During the weeks of July 9-13 and August 28-31, samples were taken every six hours for a continuous 72-hour period. Five locations on the Concord River, nine on the Sudbury River, four on Hop Brook, and two on major tributaries were sampled both weeks. The results of this survey are published by the Division in the report entitled The Concord and Sudbury Rivers 1973, Part A.

During the weeks of June 4-8 and September 19-23, 1974, the Assabet River was intensively surveyed by the Division. Samples were taken every four hours for a continuous 72-hour period at nineteen locations on the mainstem of the Assabet River and at five locations on major tributaries. The results of this survey were published by the Division in the report entitled The Assabet River 1974, Part A.

The data obtained from the various surveys were analyzed in the following reports: The Concord and Sudbury Rivers 1973, Part C and The Assabet River 1974, Part C, published by the Division. These reports include an analysis of the data from the stream surveys complemented with discussions of the basin's history, the wastewater discharges, water uses, planning programs, and areas of future study. These reports are considered appendices to this plan.

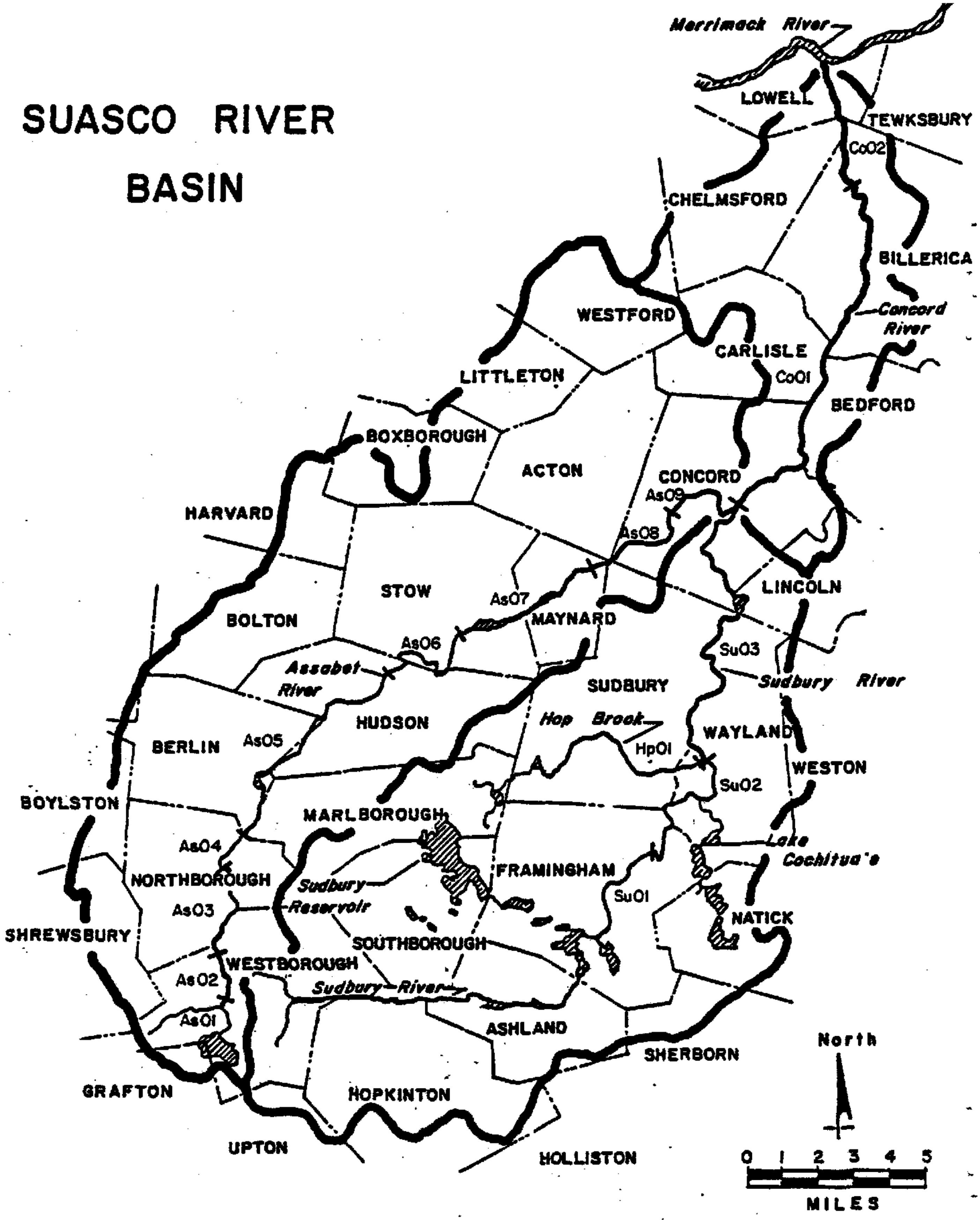
In order to properly evaluate the different causes of pollution in the major rivers of the SUASCO Basin, each river is divided into segments. Segments are chosen according to the existence of waste discharges and similar hydraulic conditions. Each segment receives a numerical rating based on seven water quality parameters. The rating is zero for no significant problem, one for a moderate problem, two for a major problem, and three for a severe problem. The total numerical rating is known as the severity rating for each segment. The seven water quality parameters rated are:

1. Coliform bacteria
2. Dissolved oxygen
3. Solids, color
4. Nutrients
5. pH, metals
6. Temperature
7. Other (floating solids, oil, pesticides, etc.)

Figure III-A shows the segments and Table III-1 lists the designated segments of the SUASCO Basin and their severity points. Table III-2 lists the segments, their condition based on most recent survey data, and their future water quality classifications.

The comparison of the severity ratings of the various segments must take into account the length of river comprising the segment. In an attempt to provide a "total severity ranking", the length of the segment has been multiplied by the severity points of the segment to give the total severity points. The total severity points for the SUASCO Basin are shown in Table III-3. This method is sometimes ambiguous but serves to point out the

SUASCO RIVER BASIN



BASIN SEGMENTATION

FIGURE III-A

TABLE III-1

SEGMENT SEVERITY RATING

SUASCO RIVER BASIN

SEGMENT NUMBER	DESCRIPTION	RIVER MILES	COLIFORM BACTERIA	D.O.	SOLIDS, COLOR	NUTRIENTS	pH, METALS	TEMP.	OTHER	TOTAL
SU01	Above outlet of Saxonville Pond	Above 16.4	1	1	0	1	0	0	0	3
SU02	Outlet of Saxonville Pond to Wash Brook	16.4-11.0	3	3	1	1	0	0	1*	9
SU03	Wash Brook to Assabet River	11.0-0.0	2	3	1	1	0	0	1	8
HP01	Marlborough East STP to Sudbury River	9.7-0.0	2	3	2	3	0	0	0	10
CO01	Sudbury River to Billerica STP	15.2-4.0	1	2	1	1	0	0	0	5
CO02	Billerica STP to Merrimack River	4.0-0.0	2	0	1	1	0	0	0	4
AS01	Above Westborough STP	Above 30.4	1	2	0	1	0	0	0	4
AS02	Westborough STP to Shrewsbury STP	30.4-29.6	3	3	1	3	0	0	0	10
AS03	Shrewsbury STP to dam, Rt. 20, Northborough	29.6-26.5	3	3	1	3	0	0	0	10
AS04	Rt. 20 dam, Northborough, to Marlborough West STP	26.5-24.0	1	2	0	3	0	0	0	6
AS05	Marlborough West STP to Hudson STP	24.0-15.9	1	3	0	2	0	0	0	6

TABLE III-1 (Continued)

SEGMENT	DESCRIPTION	RIVER MILES	COLIFORM BACTERIA	D.O.	SOLIDS, COLOR	NUTRIENTS	pH, METALS	TEMP.	OTHER	TOTAL
AS06	Hudson STP to outlet of Boons Pond	15.9-12.4	1	3	1	3	0	0	0	8
AS07	Outlet of Boons Pond to Maynard STP	12.4-6.8	1	2	0	2	0	0	0	5
AS08	Maynard STP to Concord MCI	6.8-2.6	3	2	0	3	0	0	0	8
AS09	Concord MCI to Sudbury River	2.6-0.0	3	2	0	2	0	0	0	7

*Pesticides

TABLE III-2

BASIN SEGMENTATION

SUASCO RIVER BASIN

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	SEGMENT CLASS	PRESENT CONDITION	WATER QUALITY CLASSIFICATION
SU01	Sudbury River	Above outlet of Saxonville Pond	Above 16.4	AD	C	B
SU02	Sudbury River	Outlet of Saxonville Pond to Wash Brook	16.4 - 11.0	WQ	C	B
SU03	Sudbury River	Wash Brook to Assabet River	11.0 - 0.0	WQ	C	B
HP01	Hop Brook	Marlborough East STP to Sudbury River	9.7 - 0.0	WQ	U	B
CO01	Concord River	Sudbury River to Billerica STP	15.2 - 4.0	WQ	C	B
CO02	Concord River	Billerica STP to Merrimack River	4.0 - 0.0	EL	U	C
AS01	Assabet River	Above Westborough STP	Above 30.4	WQ	C	B
AS02	Assabet River	Westborough STP to Shrewsbury STP	30.4 - 29.6	WQ	U	B1
AS03	Assabet River	Shrewsbury STP to Rt. 20 dam, Northborough	29.6 - 26.5	WQ	U	B1
AS04	Assabet River	Rt. 20 dam, Northborough, to Marlborough West STP	26.5 - 24.0	WQ	U	B
AS05	Assabet River	Marlborough West STP to Hudson STP	24.0 - 15.9	WQ	C	B
AS06	Assabet River	Hudson STP to outlet of Boons Pond	15.9 - 12.4	WQ	U	B1
AS07	Assabet River	Outlet of Boons Pond to Maynard STP	12.4 - 6.8	WQ	C	B

TABLE III-2 (Continued)

SEGMENT NUMBER	STREAM	DESCRIPTION	MILE POINTS	SEGMENT CLASS	PRESENT CONDITION	WATER QUALITY CLASSIFICATION
AS08	Assabet River	Maynard STP to Concord MCI	6.8 - 2.6	WQ	C	B
AS09	Assabet River	Concord MCI to Sudbury River	2.6 - 0.0	EL	C	B

AD - Anti-degradation
WQ - Water quality limited
EL - Effluent limited

TABLE III-3

TOTAL SEVERITY POINTS

SUASCO RIVER BASIN

SEGMENT	SEVERITY RATING	LENGTH	TOTAL SEVERITY POINTS	SOURCE
SU01	3	12.1	36	Non-point sources, urban runoff
SU02	9	5.4	49	Non-point sources
SU03	8	11.0	88	Non-point sources
HP01	10	9.7	97	Marlborough East STP, urban runoff
CO01	5	11.2	56	Concord STP, non-point sources
CO02	4	4.0	16	Billerica STP, Lowell sewers
AS01	4	1.4	6	Augmentation Pond, non-point sources
AS02	10	0.8	8	Westborough STP
AS03	10	3.1	31	Westborough STP, Shrewsbury STP
AS04	6	2.5	15	Westborough STP, Shrewsbury STP
AS05	6	8.1	49	Marlborough West STP
AS06	8	3.5	28	Hudson STP
AS07	5	5.6	28	Hudson STP, non-point sources
AS08	8	4.2	33	Maynard STP
AS09	7	2.6	18	Concord MCI STP, Maynard STP

magnitude of the effects of the individual pollution sources.

Following is a discussion of the individual segments and the reasons for their water quality. The water quality problems discussed are those which were found in the 1973 and 1974 surveys. The appendices, The Concord and Sudbury Rivers 1973, Part C and The Assabet River 1974, Part C, give a more detailed investigation of the water quality of the rivers and should be referred to if more information is necessary.

SEGMENT ANALYSIS

Segment SU01: Above the outlet of Saxonville Pond - This segment had coliform bacteria problems in the heavily populated areas of Ashland and Framingham. Urban runoff, septic leachate, storm sewers, or wastewater sewers were the probable sources of the bacteria in the stream. During the August 1973 survey, the dissolved oxygen levels were found to be below the designated Class B criteria. This section of the river is designated as anti-degradation.

Segment SU02: Outlet of Saxonville Pond to Wash Brook - This segment had extreme dissolved oxygen problems during the periods when the adjoining meadowlands were draining into the main channel of the river, carrying organic matter which created an oxygen demand in the river. This phenomenon is believed to be a natural occurrence. Coliform bacteria levels were high in this segment. Pesticides were heavily dosed in this area. The segment did not meet its Class B criteria.

Segment SU03: Wash Brook to Assabet River - A continuation of the dissolved oxygen problem from Segment SU02 was found in this section. Meadowlands on both banks of the river provided oxygen-demand material. Coliform bacteria levels were high, and there was a moderate nutrient problem. This segment did not meet the criteria for the designated B classification.

Segment HP01: Hop Brook, Marlborough East STP to Sudbury River - This segment had dissolved oxygen problems, moderate coliform bacteria levels, and extreme nutrient problems. The brook is a series of millponds which receive a treatment plant effluent at the headwaters of the first pond. An advanced waste treatment system was put into operation in December 1973, and an intensive re-survey is necessary to determine the up-to-date water quality. The benthic release of nutrients is expected to continue for a number of years, continuing to produce eutrophic conditions in the ponds. As the brook flows through a densely populated area in the Town of Sudbury, high coliform counts were found, probably from individual septic systems. The proposed classification for Hop Brook is B, but surveys showed that the water quality did not meet the B classification.

Segment CO01: Sudbury River to Billerica STP - As in the Sudbury River, dissolved oxygen problems caused by the meadowlands were found in this section. The problem occurs only during certain periods of the year but can be expected to be repeated annually. Coliform bacteria levels remained moderately high in this segment and can be attributed to meadowland runoff and individual septic systems. Nutrient levels were sufficient to support eutrophic conditions. This segment did not meet the criteria required for its B classification.

Segment CO02: Billerica STP to Merrimack River - This segment had coliform bacteria problems due to raw sewage discharges in Lowell. Dissolved oxygen did not appear to be a problem in this section. Nutrient levels were moderately high.

Segment AS01: Above the Westborough STP - Dissolved oxygen, coliform bacteria, and nutrients were all moderate problems in this section. The waters at the headwaters, flowing out of the recently constructed augmentation pond, did not meet Class B criteria, thus hampering the quality of the downstream waters.

Segment AS02: Westborough STP to Shrewsbury STP - The combination of low stream flow and sewage treatment plant effluent gives this section a U rating. Low dissolved oxygen levels and high nutrient levels were found in this segment of the stream. Periodic coliform bacteria problems occurred. The small amount of flow in this segment severely limits the assimilative capacity of the stream.

Segment AS03: Shrewsbury STP to dam, Route 20, Northborough - The addition of a secondary treatment plant effluent further degrades the water quality. Oxygen demand and nitrification cause severe dissolved oxygen problems. Nutrient problems were very high and remained so for many miles downstream. High coliform bacteria levels were present in this segment. The proposed Class B1 for this segment was violated, giving this segment a U rating.

Segment AS04: Dam, Route 20, Northborough, to Marlborough West STP - The ample nutrients from the upstream sewage treatment plants cause eutrophic conditions in the impoundment in this section. Dissolved oxygen levels throughout this segment were well below the Class B criteria proposed for this segment. Coliform bacteria from adjacent farmlands caused a moderate problem.

Segment AS05: Marlborough West STP to Hudson STP - This segment had dissolved oxygen problems due to the aquatic plant usage of the ample nutrients present in the stream, causing significant diurnal fluctuation of the dissolved oxygen level. A large impoundment in the upper section was found to be highly eutrophic. As the river flows through the Town of Hudson, coliform bacteria levels increased from sewer leaks and urban runoff. The section did not meet the Class B designation, and its quality was U.

Segment AS06: Hudson STP to outlet of Boons Pond - The Gleasondale impoundment, located in the upstream section of this segment, was found to be very eutrophic. The water quality problems were attributed to the sewage treatment plant discharge located at the beginning of this segment. At the outlet of the impoundment, there were low dissolved oxygen levels, high levels of nutrients, and moderate levels of coliform bacteria. As the river flows out of the impoundment, it begins to assimilate the waste load and begins to recover. At the end of the segment, moderate levels of nutrients and low dissolved oxygen, due to diurnal fluctuation from aquatic vegetation, were the problems. The segment was of U quality rather than the proposed Class B1.

Segment AS07: Outlet of Boons Pond to Maynard STP: During the 1974 survey, this section of the Assabet River was found to have the fewest water problems in the river. Dissolved oxygen problems were present because of aquatic vegetation activity. Sufficient nutrients were available to facilitate this activity. A moderate problem from coliform bacteria levels was found in this section. The quality of this segment was Class C.

Segment AS08: Maynard STP to Concord MCI - A sewage treatment plant discharge severely degrades the water quality of this segment. The non-chlorinated effluent produced extremely high coliform bacteria levels. High nutrient levels facilitated nitrification in the stream which resulted in low dissolved oxygen levels. The B classification was severely violated and the quality was U.

Segment AS09: Concord MCI to Sudbury River - This segment had dissolved oxygen, coliform bacteria, and nutrient problems associated with the upstream treatment plant discharge and the addition of a small discharge at the beginning of this segment. The Class B criteria for this section were clearly violated.

SIGNIFICANT WASTEWATER DISCHARGES

There are fourteen significant discharges in the SUASCO River Basin. These discharges affect to various degrees the water quality of the main stems of the rivers and their tributaries. There are other minor discharges in the basin but they are not included because they do not significantly affect the three main stems. These discharges need to be studied to properly assess their impact upon the receiving waters. Table III-4 lists the discharges, their location, the receiving water, existing treatment, and proposed treatment. The locations of the discharges are shown on Figure III-B.

Municipal sewage treatment plant discharges have the most significant effects upon the water quality of the rivers. The magnitude of industrial pollution has greatly diminished because some industries went out of business, others have their wastewater treated at municipal facilities, and some industries have constructed treatment facilities for their wastewater.

On the Assabet River, municipal sewage treatment plants greatly influence water quality. The municipal sewage treatment plants (see Table III-4) employ different modes of secondary treatment, but this degree of treatment is not adequate to attain the water quality classifications designated for the Assabet River. There are no significant industrial discharges to the Assabet River.

The Sudbury River has no municipal sewage treatment plant discharging to its main stem. The Raytheon Corporation of Wayland discharges a treated effluent to the Sudbury River. The Marlborough East STP discharges to Hop Brook, a tributary to the Sudbury River.

The Concord and Billerica municipal sewage treatment plants, Middlesex House of Correction, Middlesex School, and the Raytheon Corporation of Lowell discharge to the Concord River or to one of its tributaries. There are several raw sewage discharges in the City of Lowell, many of which are

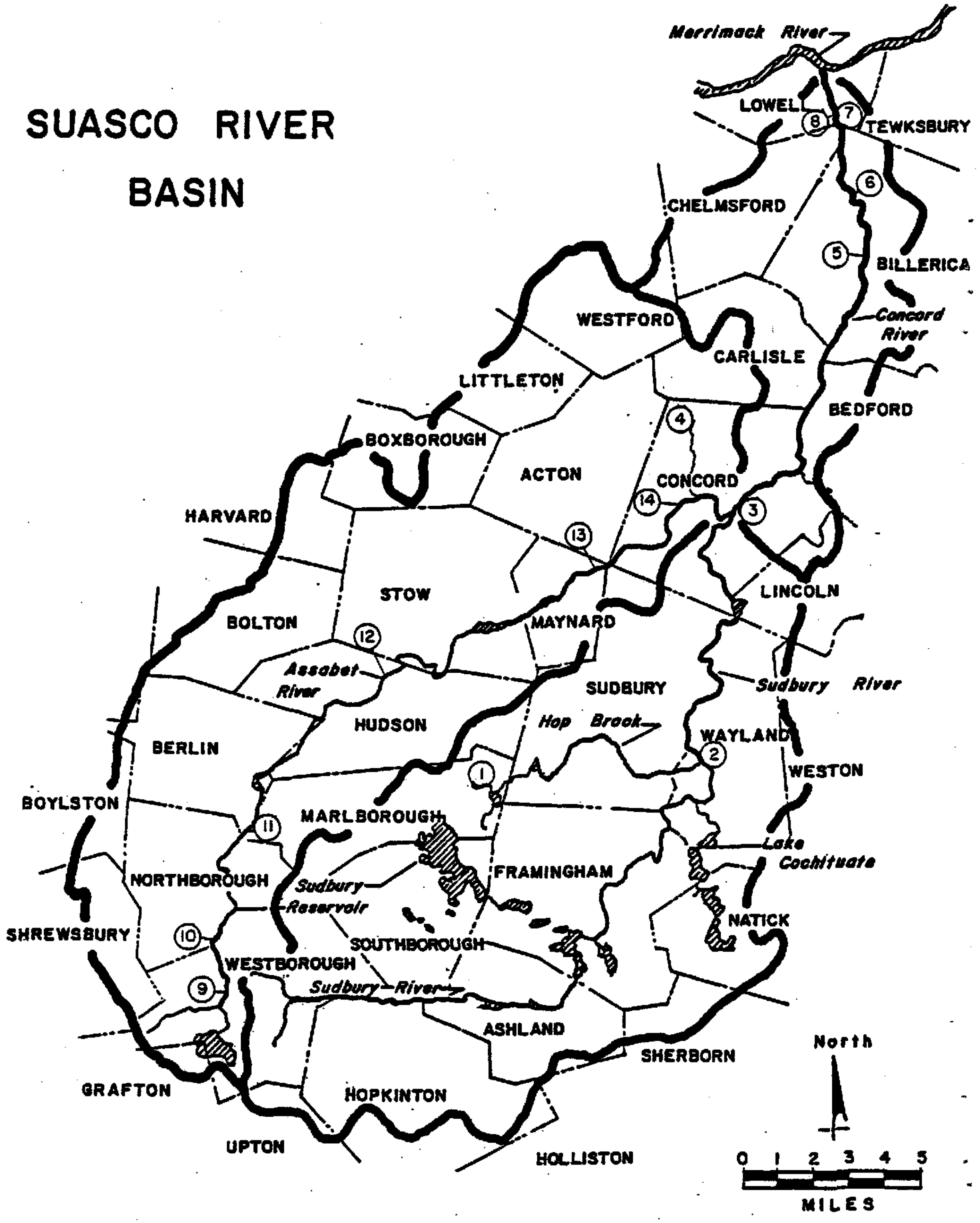
TABLE III-4

WASTEWATER DISCHARGES

SUASCO RIVER BASIN

NO.	SOURCE AND LOCATION	RECEIVING WATER	EXISTING TREATMENT	PROPOSED TREATMENT
1.	Marlborough East STP, Marlborough	Hager Pond (Hop Brook)	Advanced	Advanced
2.	Raytheon Co., Wayland	Sudbury River	BPT*	BPT
3.	Concord STP, Concord	Concord River (via Great Meadow Swamp)	Secondary	Advanced
4.	Middlesex School, Concord	Spencer Brook	Advanced	Advanced
5.	Billerica House of Correction, Billerica	Concord River	Secondary	Secondary
6.	Billerica STP, Billerica	Concord River	Secondary	Secondary**
7.	Raytheon Co., Lowell	Concord River	BPT	BPT
8.	Lowell sewers	Concord River	None	Secondary (Duck Island STP)
9.	Westborough STP, Westborough	Assabet River	Secondary	Advanced
10.	Shrewsbury STP, Northborough	Assabet River	Secondary	Advanced
11.	Marlborough West STP, Marlborough	Assabet River	Secondary	Advanced
12.	Hudson STP, Hudson	Assabet River	Secondary	Advanced
13.	Maynard STP, Maynard	Assabet River	Secondary	Advanced
14.	Concord MCI, Concord	Assabet River	Secondary	Advanced (possible future connection to regional facility)

*Best practicable treatment
**Maximum flow allowable to be determined



LOCATION OF DISCHARGES

FIGURE III-B

located on the antiquated Lowell Canal system.

The discharges in the SUASCO River Basin have been ranked according to their impact on water quality. This was accomplished by multiplying the severity ratings shown in Table III-1 by the river miles affected by the discharge. These rankings for the basin are shown in Table III-5. This list shows that the municipal treatment plants are the dominant factor in water quality, while the industrial discharges are much less significant.

TABLE III-5

RANKING OF SIGNIFICANT DISCHARGES

SUASCO RIVER BASIN

RANK	DISCHARGE	TOTAL SEVERITY POINTS
1.	Westborough STP - Shrewsbury STP	70
2.	Hudson STP	33
3.	Marlborough West STP	24
4.	Maynard STP	22
5.	Marlborough East STP	18
6.	Concord STP	8
7.	Billerica STP	8
8.	Remaining discharges	<5

IV. PAST ABATEMENT PROGRAMS

In order to provide a logical time sequence for a water pollution abatement program, the Division set up an implementation program in 1967. The Division identified municipalities and industries which needed to initiate water pollution control facilities or which needed to expand or upgrade their existing facilities. An implementation schedule, issued to the designated municipality or industry, contained specific dates for the submission of engineering reports and final plans, for the initiation of construction, and the expected completion and operation of the required construction. Legal orders were given those municipalities and industries not complying with the original implementation schedule. In some instances in the Commonwealth, court action was needed to insure the proper compliance with the implementation schedule.

As part of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), the implementation program was incorporated into the permit program. This is an effort of the Division and federal government which will be examined in Section VII of this document.

Following is a synopsis of the present status of the implementation schedules for various municipalities within the SUASCO River Basin. The Division issued schedules to those municipalities which exhibited the need for a sewerage program in order to alleviate water quality problems within the communities. Reference should be made to Table IV-1.

Billerica - The town has completed construction of an expansion of their Letchworth Avenue Sewage Treatment Plant. The plant's capacity was doubled and facilities for sludge handling were constructed. The treatment plant will serve an expanded service area and will treat the pre-treated wastes from the Corenco Company and the North Billerica Company. In 1972, the town completed a secondary treatment facility to serve a new housing development located in the eastern section of town. The effluent from this plant flows into the Shawsheen River, hence out of the SUASCO Basin. It is expected that this facility will be phased out and the sewage piped to the Letchworth Avenue plant.

Concord - The town was given orders in September 1973 for the expansion of their existing facility. An engineering report has been completed which recommends the construction of an advanced waste treatment facility and the expansion of the sewerage service area. This report has been reviewed and approved by the Division.

Framingham - An implementation order was given to Framingham in May 1970 for the expansion of the collection system by replacing and enlarging the pumping facilities in Saxonville. The system is part of the MSD system. The facilities have been constructed and put into operation.

Hudson - The town was given an order to replace a pumping station. The facility has been completed and put into operation.

Marlborough - The city has completed the construction of two sewage treatment plants. The Marlborough West Sewage Treatment Plant is a secondary treatment system with a discharge to the Assabet River. The plant will also treat sewage from the Town of Northborough. The plant was completed in 1969

TABLE IV-1

STATUS OF IMPLEMENTATION SCHEDULE FOR MUNICIPALITIES

SUASCO RIVER BASIN

MUNICIPALITY	UNDER ORDERS	PRELIMINARY REPORT	FINAL DESIGN	UNDER CONSTRUCTION	IN OPERATION	REMARKS
Billerica No. 1	No	X	X		X	Discharge to Shawsheen River
No. 2	Yes	X	X		X	Completion in 1975
Concord	Yes	X	X			Report approved by DWPC
Framingham No. 1	Yes	X	X		X	Collection system to MDC
No. 2	Yes	X	X		X	Collection system to MDC
Hudson	Yes	X	X		X	Sewer pumping station
Marlborough East	Yes	X	X		X	Advanced treatment
Marlborough West	Yes	X	X		X	Secondary treatment
Northborough	No	X	X		X	Connect to Marlborough We
Shrewsbury	Yes	X	X		X	Construction of grit chamber

and has received state certification.

The Marlborough East Sewage Treatment Plant, upgraded to advanced waste treatment, was completed in December 1973. The implementation schedules for both plants have been met successfully.

Maynard - The town is expanding and upgrading its treatment facility to a conventional activated sludge system with chlorination. The completed construction date is years past that given in the implementation schedule. An interim plan for the construction was accepted by the federal government. The construction is scheduled for completion in the fall of 1975.

Northborough - The town was not given an order but has successfully met implementation with the beginning of a collection system which will pipe the town's sewage to the Marlborough West Sewage Treatment Plant.

Shrewsbury - The town has fulfilled two implementation orders by expanding its collection system and by constructing a grit chamber at the sewage treatment plant.

INDUSTRIAL IMPLEMENTATION PROGRAM

Industrial discharges in the SUASCO River Basin do not have a great impact upon the water quality of the streams. Implementation of pollution abatement for industries is well within the program of the Division. Some industries have completely abated their pollution sources by going out of business, others have connected to municipal sewage treatment plants, and others have built their own treatment facilities. Table IV-2 shows the major industries in the basin and their status.

TABLE IV-2

STATUS OF IMPLEMENTATION SCHEDULE FOR INDUSTRIES

SUASCO RIVER BASIN

INDUSTRY	TOWN	UNDER ORDERS	PRELIMINARY REPORT	FINAL DESIGN	UNDER CONSTRUCTION	IN OPERATION	REMARKS
Nyanza Chemical	Ashland	X	X	-	-	-	Pre-treatment, connect to MSD system
Corenco Corporation	Billerica	X	X	X	-	X	Pre-treatment, connect to Billerica STP
North Billerica Company	Billerica	X	X	X	-	X	Pre-treatment, connect to Billerica STP
Roxbury Carpet	Framingham	X	X	-	-	-	Out of business
Raytheon Missile Systems Division	Lowell	X	X	X	-	X	Physical-chemical
Bay State Abrasives	Westborough	X	X	X	-	X	Pre-treatment, connect to Westborough STP

V. NON-POINT SOURCES

The evaluation of non-point pollution sources is an important aspect in the proper formulation of a pollution abatement program. Non-point sources are those which are not discharged to a waterbody at one direct point such as a pipe from a treatment plant. Non-point sources enter water through the air, by overland runoff, and below the ground surface through the groundwater. With the numerous point sources of pollution that enter the water, it is often difficult to evaluate the impact and magnitude of non-point sources upon water quality. With the eventual elimination or strict control of point sources, the impact of non-point sources will be better judged and programs established to alleviate those problems.

Following is a general discussion of the major types of non-point sources of pollution and their impact on water quality. The magnitude of their impact varies from stream to stream and from different sections of an individual stream. Also, a discussion, by segment, will be presented of the non-point sources in the SUASCO River Basin. Certain sources are known causes of water quality degradation, while others are judged to be problems or could develop into problems. Presently, non-point sources play a much larger role in the water quality of the Sudbury and Concord Rivers than in the Assabet River. However, with the construction of improved treatment facilities, non-point sources will play a more significant role in the water quality of the Assabet River.

SEPTIC SYSTEM LEACHATE

Leachate from septic systems can cause problems to groundwater and receiving waterbodies if such systems are used in areas too densely populated to allow proper percolation of the leachate. Also, many areas of the Commonwealth have poor soil conditions for the proper percolation of the leachate. Clay, hardpan, rock, and high water tables are poor conditions for proper percolation. Many communities obtain their drinking water from wells. Contamination of wells by poor septic disposal is a major threat to the public health of the community. The need for and the construction of sewerage systems or rehabilitation of septic systems can be justified by groundwater contamination even if there is no degradation of surface waters.

DUMPS AND LANDFILLS

For economic reasons, it has been the policy of many communities to locate dumps in wetlands or adjacent to a river. A myriad of solid wastes tumbles, washes into, and is carried by the wind into neighboring streams. With the advent of sanitary landfills, the problem of solid wastes ending up in a stream will be largely eliminated. Only a few communities actually have approved "sanitary landfills." However, decomposed waste materials can be washed into the stream through overland runoff and underground drainage, causing possible degradation of water quality. Leachate from landfills can contaminate nearby wells. Sludge from wastewater treatment facilities is often disposed of at landfills. This presents another possible source of contamination. Communities must plan the location of their landfills to insure a minimum of degradation of water quality.

AGRICULTURE

Fertilizers and wastes from farm animals are pollution sources which enter lakes and streams through overland runoff of rainwater. An example of water quality degradation by agriculture is the conversion of swamplands into corn-growing areas and the widespread application of cow manure on these areas. Runoff from these areas causes severe water quality problems in adjacent streams.

URBAN RUNOFF

Rainwater which drains into waters in urban areas often carries coliform bacteria, sand, oil, and other unbeneficial materials into the adjacent waters. This phenomenon is extremely difficult to control and presents possibly the biggest challenge in the control of non-point sources.

SALTING

Road salting during ice and snow storms can result in the addition of excessive chlorides to streams from runoff. Most basins have numerous roads and parking areas. To eliminate or control this condition, different agents should be utilized to control the hazardous road conditions of winter.

SILT AND EROSION

Silt is a problem in areas where construction sites are near a stream and drainage from the site can carry excessive silt into the stream. Gravel pits can produce a similar condition of excessive siltation. Badly eroded areas will add silt to waterbodies from runoff of rainwater.

PESTICIDES

Heavy dosing of pesticides in swamplands or agricultural lands can reach critical tolerance levels for the aquatic organisms and wildlife which inhabit the area. Past performance shows that pesticide application has not always followed judicious and ecologically sound procedures. Steps should be taken to insure that the type and amount of pesticide used will not adversely affect water quality and the wildlife species in the area. Preventive measures should take into account both the short- and long-term effects of pesticide application.

SWAMPS AND MEADOWLANDS

Many streams in eastern Massachusetts have wetlands and meadowlands bordering much of their course. During the spring thaw and rains, the river floods out of its main channel and into the meadowlands. It is this interaction between the stream and the meadowlands that is one of the most critical aspects of non-point sources. As the water in the meadowlands drains to the main channel of the stream, the water is oxygen deficient. The decomposition of organic matter, such as the cellulose in the grasses, by microorganisms depletes dissolved oxygen to an extent that, during certain periods of the year, the dissolved oxygen level is below even the C1 criteria (see page 15).

The following is a segment-by-segment analysis of non-point sources in the SUASCO River Basin.

Segment SU01 - Above the outlet of Saxonville Pond: The 1973 survey data showed high coliform bacteria levels at all sampling stations in this segment. In the upper portions of this segment, there were possible subsurface disposal problems. Urban runoff from the urban areas of Ashland and Framingham contributed significantly to the coliform bacteria levels, especially during rainstorms. The Metropolitan Area Planning Council (MAPC) will investigate the urban runoff problems in this segment. The investigation will be conducted as part of MAPC's 208 Areawide Waste Treatment Management Plan (see Page 81).

Segment SU02 - Outlet of Saxonville Pond to Wash Brook: This segment is greatly affected by the meadowlands which border the Sudbury River. The dissolved oxygen levels approach zero during periods when the meadowlands are draining into the main stem of the river. Total coliform bacteria from the swamplands were found to be at high levels.

Segment SU03 - Wash Brook to Assabet River: This segment is in the heart of the meadowlands and has extreme dissolved oxygen problems associated with the drainage from the swamps. Coliform bacteria levels were high in this segment.

In a state-wide pesticides study conducted by the Division of Fisheries and Game, sample fish studied from this segment showed pesticide levels among the highest found in the state. The study, which included 93 sample locations throughout the Commonwealth, was conducted over the eight-year period of 1963-1971.

Segment HP01 - Marlborough East STP to Assabet River: The entire course of Hop Brook comprises this segment. At the headwaters of Hop Brook, the Marlborough East Sewage Treatment Plant discharges its effluent and is the dominant factor influencing the water quality of Hop Brook. The dominance of the treatment plant effluent upon water quality makes it extremely difficult to properly assess the impact of non-point sources. The treatment plant was upgraded to an advanced waste treatment process in December 1973. The effluent from the treatment plant will continue to have a major impact upon the water quality of Hop Brook, but the degree of influence will be less. The Town of Sudbury is heavily populated in areas adjacent to Hop Brook. Coliform bacteria levels were found to increase in samples taken downstream from the center of the Town of Sudbury. This increase is from urban runoff and from septic leachate of the densely populated areas.

Segment CO01 - Sudbury River to Billerica STP: This segment of the Concord River is influenced by the meadowlands which border its banks. The low dissolved oxygen levels and high coliform levels found on the Sudbury River were also found in this segment. Pesticides would be expected to be high in this segment, as found in segments upstream in both the Sudbury and Assabet Rivers. In the lower portion of this segment, as the river flows through the heavily populated area of Billerica, urban runoff becomes a more significant factor.

Segment C002 - Billerica STP to Merrimack River: The non-point source problems of this segment are those associated with urban rivers. However, point sources--municipal and industrial effluents and untreated sewage discharges--dominate the water quality of this segment. When the direct sources are controlled, urban runoff will be the major non-point source.

Segment AS01 - Above Westborough STP: The major problem of this segment is the water quality of the augmentation pond located at the headwaters of the Assabet River. The quality of the water discharged from the pond was found to be below its assigned classification. Also, septic seepage is a minor problem in this segment.

Segment AS02 - Westborough STP to Shrewsbury STP: Non-point sources have little effect upon the water quality of this segment. The reasons are the short length of the segment and the great influence of the Westborough STP upon water quality.

Segment AS03 - Shrewsbury STP to dam at Route 20, Northborough: The combined effluents from the Westborough and Shrewsbury Sewage Treatment Plants are the dominant factors influencing the water quality of this segment. Septic seepage from individual homes and an apartment complex are known to create periodic problems. The treatment plant effluents greatly overshadow any pollutant contribution from non-point sources.

Segment AS04 - Dam at Route 20, Northborough, to Marlborough West STP: The water quality of this segment is dominated by the upstream treatment facilities. Septic leachate is a water quality problem as the river flows through heavily populated areas of the Town of Northborough. The town is being sewered to the Marlborough West STP so that much of the septic leachate will be eliminated. In the lower portion of this segment, farmlands contribute some non-point sources.

Segment AS05 - Marlborough West STP to Hudson STP: In the upper portion of this segment, wetlands and agricultural lands contribute some non-point sources. As the river flows through the Town of Hudson, coliform bacteria levels were found to increase, indicating urban runoff problems. In the lower portion of this segment, a piggery is located on the banks of the river and is the source of runoff problems associated with farmlands.

Segment AS06 - Hudson STP to outlet of Boons Pond: The effluent from the Hudson STP is the dominant factor in the degradation of water quality in this segment. Non-point sources are minimal in this segment, with overland agricultural runoff a contributor of nutrients.

Segment AS07 - Outlet of Boons Pond to Maynard STP: The major non-point source is urban runoff as the river flows through the center of the Town of Maynard where coliform bacteria levels were shown to increase. In the upper portion of this segment, agricultural runoff contributes nutrients. Non-point source problems are minimal in this segment.

Segment AS08 - Maynard STP to Concord MCI: The water quality of this segment is dominated by the effluent from the Maynard STP. Non-point sources are septic leachate from the heavily populated areas of West Concord and from urban runoff from the numerous roads that cross the river.

Segment AS09 - Concord MCI to Sudbury River: This section of the Assabet River is influenced by the Maynard STP and the treatment facility at the Concord MCI. Non-point contributions from septic leachate are problems in this segment. Runoff from the numerous roadways that traverse the river contributes some pollution sources. The previously mentioned pesticides study showed very high levels of pesticides found in sample fish collected in this segment.

To summarize, non-point sources of pollution are presently a very minor problem in the Assabet River compared to the six sewage treatment plants which discharge to the river. With the construction of advanced waste treatment at these facilities, the impact of non-point sources will increase but will still be overshadowed by the treatment plant effluents. Urban runoff, agricultural runoff, septic leachate, and pesticides are the major non-point sources of pollution in the Assabet River.

The Sudbury and Concord Rivers have major non-point problems in the lengthy section of river that flows through the vast meadowlands. Extremely low dissolved oxygen levels occur during periods of the spring and summer. High coliform bacteria levels were found due to drainage from the meadowlands. Urban runoff problems were found in the Framingham and Lowell areas. The problems associated with non-point source pollution will be addressed in the 208 Areawide Waste Treatment Management planning of the regional planning agencies.

VI. WASTE LOAD ALLOCATION

The major pollution source problems in the SUASCO River Basin are the discharges from the municipal sewage treatment plants, as discussed in Section III of this basin plan. These problems are summarized in Table VI-1. For point discharges, it is necessary to calculate the amount of pollutants which may be discharged without impairing the water quality of the receiving waterbody. This calculation is called a load allocation and is the basis for the effluent limitations of the discharge permit issued to the discharger (see page 54).

Load allocations are calculated through the use of water quality simulation models. Conditions observed during intensive water quality surveys are simulated by the model in order to determine the response of the receiving stream to pollutant discharges. Reaction rate coefficients are determined which describe the physical, chemical, and biological behavior of the stream. These rates can be utilized in the simulation of future water quality conditions. Water quality degradation is greatest when the ratio of waste discharge flow to stream flow is highest. In the simulation of future conditions, load allocations are calculated using the lowest stream flow expected for a seven-day period once in ten years and the design flow for each treatment facility. The stream flow, prescribed by the Massachusetts Water Quality Standards, is obtained from the United States Geological Survey, which calculates the flow from stream gage records. Design flow for treatment facilities is taken from engineering reports.

The Division employs a highly complex water quality simulation model for streams. Recent survey data, research project findings, and new treatment facility construction dictate the re-evaluation of the model of the SUASCO River Basin. This re-evaluation will be undertaken and the findings will be incorporated as an addendum to this basin plan.

Streeter-Phelps analysis methods have been performed to determine the waste load allocations included in this section. The analyses performed have dealt with the dissolved oxygen and nutrient problems, which are the most critical water quality problems in the SUASCO River Basin. The problem of high coliform bacteria levels will be modified by the provision of adequate degrees of chlorination. Concern has been raised about the effects of residual chlorine on aquatic life. This subject is being studied by the Division of Fisheries and Wildlife.

The load allocations presented in this section are considered preliminary and will be revised upon the completion of the re-evaluation of the SUASCO River Basin model. The allocations are included to enable communities and their respective engineering consultants to properly plan their sewerage programs. The next "round" of permits will designate the required load allocations and effluent limits.

The allocations represent ninety percent of the total oxygen demand which the segment of stream downstream from the discharge can adequately assimilate and maintain water quality standards. Total oxygen demand (TOD) refers to the total amount of oxygen required by bacteria to stabilize organic

TABLE VI-1

MAJOR POLLUTION SOURCE PROBLEMS

SUASCO RIVER BASIN

DISCHARGE	RECEIVING STREAM	SEGMENTS AFFECTED	MAJOR PROBLEMS
Westborough STP	Assabet River	AS02 AS03 AS04	Dissolved oxygen Nutrients
Shrewsbury STP	Assabet River	AS03 AS04	Dissolved oxygen Nutrients
Marlborough West STP	Assabet River	AS05	Nutrients
Hudson STP	Assabet River	AS06 AS07	Dissolved oxygen Nutrients
Maynard STP	Assabet River	AS08	Dissolved oxygen Nutrients Coliform bacteria
Marlborough East STP	Hop Brook	HP01	Nutrients
Concord STP	Concord River (via Great Meadow Swamp)	CO01	Nutrients
Billerica STP	Concord River	CO02	Nutrients
Lowell discharges*	Concord River Lowell canals	CO02	Nutrients Coliform bacteria

*See <u>Merrimack River Water Quality Management Plan</u>

matter, including organic compounds of nitrogen. The remaining ten percent of the total oxygen demand is attributed to upstream water and non-point sources in the segment. The upstream water is considered meeting its assigned water quality standards.

The allocations have been developed for various treatment plant flows to illustrate the different effluent limitations of various flows. The stream flow will vary according to the upstream treatment plant flows. Load allocations were developed for the present design capacity of the sewage treatment plant, for double the present design capacity, and, in some cases, for larger flows.

Table VI-2 shows the flow of the treatment plant, the upstream river flow, and the load allocation of total oxygen demand in pounds per day. Also, Table VI-2 shows the effluent limitations in milligrams per liter, which are calculated from the load allocations according to stream and treatment plant flows. Nutrient removal (ammonia and phosphorus) will be required at all treatment facilities at flows depicted in Table VI-2. A minimum dissolved oxygen concentration of 6.0 mg/l is required at all facilities. The limits were developed to attain the 1977 water quality goals and the 1983 goals of all Class A and B waters. The design of treatment plants should be in accordance with the 1983 goals.

Following is a brief discussion of the load allocations and effluent limitations for the various sewage treatment facilities.

Westborough-Shrewsbury: The two facilities are given one load allocation because of the proximity of their effluents and the strong possibility of a regional facility to serve both communities. The upstream flow, mainly from the Assabet River Impoundment Pond, is limited. This condition necessitates a very high degree of treatment, as reflected in the stringent effluent limitations.

Marlborough West: At the present time, the plant is hydraulically underloaded, but the planned expansion of the sewerage system will utilize the capacity. The effluent limits for the present design capacity show the need for nutrient removal facilities. Doubling the capacity would put further effluent limitations on the plant.

Hudson: The load allocations were developed for both Class C and Class B water quality in the Assabet River downstream of the discharge. The downstream segment is sluggish moving and highly eutrophic. Nutrient removal facilities are needed.

Maynard: Effluent limitations were developed for the present design capacity using two different upstream flows. Ninety percent of the town is sewered so that expansion might be limited. A larger flow was analyzed in case of industrial development or regionalization.

Concord: Allocations were developed for four different flow conditions. Plant flows were projected using the capacity of the existing plant, the

TABLE VI-2

MUNICIPAL WASTE LOAD ALLOCATIONS AND EFFLUENT LIMITATIONS[1]

SUASCO RIVER BASIN

FACILITY	PLANT FLOW (cfs)	UPSTREAM FLOW (cfs)	TOD (lbs/day)	TOD (mg/l)
Westborough-Shrewsbury	3.7	3.7	550	30
	7.4	3.7	800	20
Marlborough West	3.1	10.3	780	45
	6.2	14.0	1,170	35
Hudson	3.1	14.5	1,025[2]	60[2]
	3.1	14.5	600	35
	6.2	21.3	1,600[2]	50[2]
	6.2	21.3	1,050	30
Maynard	2.0	18.6	400	35
	2.0	28.5	590	55
	4.0	28.5	630	30
Concord	1.6	34.0	520	60
	3.7	34.0	550	30
	3.7	48.0	750	40
	7.4	48.0	800	20
Billerica	2.5	27.0[3]	1,000[2]	75[2]
	2.5	27.0[3]	570	40
	5.0	32.0[4]	1,260[2]	50[2]
	5.0	32.0[4]	720	25
	7.5	32.0[4]	1,325[2]	30[2]
	7.5	32.0[4]	750	20
Marlborough East	9.0	2.0	525	10

[1]All facilities will require nutrient removal (ammonia and phosphorus).
[2]Class C water quality.
[3]Billerica Water Treatment intake of 7.0 MGD.
[4]Billerica Water Treatment intake of 14.0 MGD.

projected capacity from the town's engineering study, and possible capacity needed for a regional facility. The allocations were developed considering that the effluent be discharged directly to the Concord River and not to the Great Meadow Swamp, as presently is the case. The swamp acts as a natural buffer for the effluent but the town can be required to discharge directly to the Concord River.

Billerica: Six load allocations were developed dependent upon various flows at the sewage treatment plant, two design intake capacities at the water treatment plant, and attaining Class C or Class B water downstream of the sewage treatment plant. The town is planning to expand its sewerage system and hence the capacity of the sewage treatment plant. The water treatment plant, with a present capacity of 7.0 MGD, is projected to expand to 14.0 MGD capacity. The effluent limits show that the present sewage treatment system at its design capacity of 2.5 cfs (1.6 MGD) can approach the attainment of Class C water downstream of the facility. However, the limits show that further expansion of the sewage treatment plant capacity or the upgrading of the river to Class B water will necessitate higher degrees of treatment.

Marlborough East: The load allocation was developed using the limits set forth in the discharge permit. Laboratory analysis shows that the plant is performing within the effluent limitations.

VII. FUTURE ABATEMENT PROGRAMS

This section of the basin plan for the SUASCO River Basin will set forth the Division's strategy for the attainment of the 1977 water quality goals of PL92-500. These goals are to attain the water quality classifications proposed in 1967. To evolve this strategy, the present and future sewerage needs of the individual communities are examined. The needs may be for the construction of treatment facilities, the expansion of existing facilities, the sewering of problem areas, or the assurance of proper subsurface disposal. With the establishment of municipal needs, an abatement program will be recommended which will provide an orderly progression toward fulfilling those needs and attaining the water quality goals. Another important aspect of the abatement program is the discharge permit program. This program establishes effluent limitations for existing discharges and sets forth implementation schedules for those dischargers which contribute to water quality violations.

The following is a general discussion of municipal needs and the discharge permit program. Next, the municipal needs, the discharge permits, and the abatement program for the individual communities of the SUASCO River Basin will be presented.

MUNICIPAL SEWAGE DISPOSAL NEEDS

In assessing municipal needs, the first input is an evaluation of the present situation of the municipality. The present mode of disposal of waste should be examined. If there is a municipal sewage treatment plant, it must be determined if the present treatment is adequate. On-lot subsurface systems must be examined for possible failures. The municipal zoning laws will show how development has proceeded and will show the anticipated future development.

In looking at future municipal needs, the projected population is of the utmost importance. Although sometimes erroneous, future projections are the best method of measuring the quantity of the future needs. The future population projections for the communities in the SUASCO River Basin are given in Table VII-1. If the municipality already has a treatment facility, the future population must be equated with the capacity of the facility. If individual subsurface systems will not adequately handle the increased population, the need for a municipal sewage treatment facility must be examined. The type of facility should be pursuant to water quality standards.

If the construction of additional on-lot subsurface systems is proposed, the capacility of the soil to adequately handle the increased leachate must be examined. Inadequate subsurface disposal systems can cause water quality problems in groundwater and receiving waterbodies.

Municipal sewerage needs are also dependent upon the zoning laws of each municipality. The size of house lots is important in assessing the capability of the soil to adequately assimilate septic leachate. Industrial growth can produce sewage treatment needs for the municipality and the industry.

TABLE VII-1

POPULATION PROJECTIONS

SUASCO RIVER BASIN

MUNICIPALITY	POPULATION 1970	1990	2000	2020
Acton	14,800	26,500	32,800	43,000
Ashland	8.900	14,400	17,500	22,200
Berlin	2,100	5,400	8,200	13,400
Billerica	31,600	39,700	42,000	48,500
Boxborough	1,500	5,300	8,200	13,300
Carlisle	2,900	11,500	14,900	20,400
Chelmsford	31,400	39,900	44,600	51,400
Concord	16,100	24,200	29,400	39,400
Framingham	64,000	77,500	84,500	91,800
Hopkinton	6,000	10.400	15,100	24,400
Hudson	16,100	23,600	26,500	30,300
Lincoln	7,600	11,400	14,000	18,600
Littleton	6,400	11,100	14,000	20,300
Lowell	97,249	101,200	100,800	---
Marlborough	27,900	35,500	38,700	43,600
Maynard	9,700	11,400	12,000	12,900
Natick	31,000	39,600	41,600	46,300
Northborough	9,200	14,600	18,600	26,300
Shrewsbury	19,196	26,550	---	31,950
Southborough	5,800	9,400	12,000	17,400
Stow	4,000	6,600	8,300	12,000
Sudbury	13,500	28,500	34,700	45,400
Tewksbury	22,600	29,000	32,200	36,000
Wayland	13,500	23,300	28,300	36,700
Westborough	12,600	17,900	20,800	26,300

Sources: MDC Wastewater Study: Summary - Small Area Population and Employment Design Forecasts; Corps-Commonwealth Study; Central Massachusetts Regional Planning Commission