An Information Packet

Merrimack Wastewater Management Study

For Use At Public Meetings

At 8 p.m. June 25, 1974

Northern Essex Community College

Elliott Street, Haverhill, Massachusetts

At 8 p.m. June 27, 1974

Chelmsford High School

250 North Road, Chelmsford, Massachusetts

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDPL-W

20 June 1974

An Information Packet
Merrimack Wastewater Management Study

	Page
Table of Contents	1
Foreward	2
Systems Along The Merrimack	4
Background Information	9
Wastewater Management Alternatives	10
Cost Summaries for Construction and Operation and Maintenance	32
Costs for Municipal Collection Systems	57
Flow Projections	59
Treatment Processes	63
Summary of Impacts	65

A Study With The Commonwealth of Massachusetts

Central Massachusetts Regional Planning Commission
Merrimack Valley Planning Commission
Metropolitan Valley Planning Commission
Montachusett Regional Planning Commission
Northern Middlesex Area Commission

Foreward

This packet describes wastewater management systems for the 24 cities and towns covered by the Merrimack Valley Planning Commission and Northern Middlesex Area Commission. These systems are in line with the 1972 Federal Water Pollution Control Act Amendments and they appear to be the most cost-effective way of renovating the domestic sewage, industrial wastes and the stormwater overflows of combined sewers which these communities contribute to the pollution of the Merrimack River.

These systems have been developed from several alternatives prepared by the Merrimack Wastewater Management Study, and their tentative selection reflects a consensus of the Federal, state and regional agencies which are study participants. To be cost-effective, the systems depart from the least-cost alternative only when the findings of public involvement and environmental, public health or other considerations warrant such a change.

The selection of the systems is not yet final. Changes in their makeup are possible both before public meetings at the Northern Essex Community College in Haverhill at 8p.m. June 25 and at Chelmsford High School at 8 p.m. June 27 and until the results of these meetings are complete. Additional public meetings are expected. Public response will be critical in the ultimate selection of the most favorable systems.

The study is to be finished and the report forwarded to the United States Congress by fall. The results will also be furnished to the Massachusetts Division of Water Pollution Control and the U. S. Environmental Protection Agency for future planning purposes. The study is a congressionally authorized planning effort that involves the U. S. Army Corps of Engineers, the Commonwealth of Massachusetts, EPA and five regional planning agencies.

The systems shown in this packet, like all the alternatives, incorporate past engineering reports to the cities and towns, regional land use and zoning maps, population projections, and industrial survey, the results of public meetings and workshops about wastewater management and the State Implementation Schedule for Water Pollution Abatement. The systems use the secondary treatment plants required by the present state program as a building block in providing the advanced treatment specified in the 1972 federal water pollution control law.

The law requires secondary treatment by 1977 and best practicable treatment by 1983. The mid-1983 goal is water that is clean enough for fishing and swimming. The law also requires best available treatment by 1985 and the goal at that time is no discharge of pollutants into the water. These systems are designed to be in compliance with the law, and they would be implemented in phases.

These systems will be necessary if the quality of water in the Merrimack River is to be improved. Their operation, however, does not guarantee that the goal of fishable-swimmable water will be achieved because of the pollution caused by non-point sources such as dumps and failing septic tanks. Further study and planning are needed to determine not only how much these non-point sources pollute the river, but also what kinds of remedial action are needed. It is expected that the public will be involved in a subsequent effort to accomplish this.

The reports about all alternatives are available at the offices of the Corps of Engineers in Waltham, the Merrimack Valley Planning Commission at 87 Winter Street, Haverhill, and the Northern Middlesex Area Commission at 144 Merrimack Street, Lowell.

Systems Along The Merrimack

The study has prepared an array of alternative wastewater management systems that vary in treatment processes and degrees of regionalization. In attempting to choose the most cost-effective systems from the alternatives, the participating agencies favored: (1) a minimum of regionalization or centralization, (2) land application systems over other treatment facilities that discharge effluent directly into waterways, (3) outfall locations that are sensitive to the aquatic environment, and (4) when possible, non-structural solutions to the sewage disposal problems of small communities.

Reports from the aesthetic, biological, engineering, hygienic and socio-economic consultants influenced these choices. Highlights of their assessment which are still under review follow:

--Aesthetic impacts: both the long transmission lines required by regional systems and the land application systems would disrupt the existing natural landscape. It was suggested that buffer zones of trees be planted around land application sites, especially at rapid infiltration sites.

--Biological impacts: the land application technique would be preferred over water-oriented technology because it provides a buffer zone between effluent and receiving waters. The negative impacts of possible failures in water-oriented treatment facilities on aquatic life would be minimized by non-regional systems. Ozonation would be better than the chlorination of treated effluent because it would eliminate the expected discharge of residual chlorine and ammonia from treatment facilities. A deep ocean outfall would be favored over a discharge to the estuary in order to permit the re-opening of shellfish harvest areas.

--Engineering impacts: the costs of transmission lines would offset the economics of scale found in regional systems. Land application systems would be preferred over water-oriented systems because they involve only one process -- managing the application of partially renovated wastewater onto land -- to achieve advanced wastewater treatment. Water-oriented systems would require several processes to achieve advanced treatment, each of them liable to failure. A comparison of operation and maintenance costs would also rule in favor of land application systems since they would not be as expensive as water-oriented systems.

--Hygienic impacts: land application would be preferred for communities which produce less than 10 million gallons per day of wastewater or which consistently produce the same constituents in their wastewater. Possible leaks in transmission lines would not favor regional systems. The possibility of operational failures would weigh heavily against both regional systems and water-oriented treatment facilities in favor of land application. Discharges to small tributaries of the Merrimack River such as the Concord and Powwow Rivers would not as ideal as discharges to the Merrimack or land application because of the extra assimilative capacity of the Merrimack River.

--Socio-economic impacts: least-cost systems would add least to the costs of municipal services. Non-regional systems would not cause a negative land use impact of long transmission lines. It would be desirable to avoid creating new sanitary districts that combine cities with small towns other than immediate suburban communities.

The most cost-effective systems for the nine communities that belong to the Northern Middlesex Area Commission follow. The systems have been derived from several alternatives and, to be cost-effective, they depart from the least-cost alternative only when the findings of public involvement and environmental, public health or other considerations warrant such a change.

--Pepperell: after building a secondary treatment plant as required by the present State Implementation Schedule, Pepperell would build an advanced waste treatment plant that would discharge effluent into the Nashua River. This system is taken from Alternative 1.

--Dunstable: this town would be expected to continue with on-site sewage disposal systems for as long as possible.

--Tyngsborough: when sewerage is required, the wastewater from the eastern part of Tyngsborough would be sent to a system in Lowell and the wastewater from the other part of the town would be sent to a system in Chelmsford. This system is taken from Alternative 1.

--Westford: land application, if acceptable, would be possible for the three small areas of town which need sewerage. If strict land use management controls were instituted and properly designed and carefully regulated privated septic systems required, it would be possible for the remainder of the town to continue with on-site sewage disposal systems. Otherwise, the town would need to become part of a wastewater management system, perhaps with a system in Chelmsford. This system is taken from Alternative 1.

--Chelmsford: after building a secondary plant for the northern part of Chelmsford, the town would build an advanced treatment facility that would discharge into the Merrimack River. The plant would also serve part of Tyngsborough. Raw wastewater from the soutern part of Chelmsford would be sent to Billerica for treatment. These systems are taken from Alternative 1.

--Billerica: this town would construct an advanced treatment plant and the effluent would be discharged to the Concord River. The exact point of discharge is still to be evaluated. The plant would also treat raw wastewater from the southern part of Chelmsford. This system is taken from Alternative 1.

--Dracut, Tewksbury and Lowell: an advanced treatment plant would be added to the secondary treatment plant under construction in Lowell to serve that city as well as Dracut, Tewksbury and part of Tyngsborough. Discharge would be into the Merrimack River. This system is taken from Alternative 1.

The most cost-effective systems for the 15 communities under the jurisdiction of the Merrimack Valley Planning Commission follow. The systems have been derived from several alternatives and, to be cost-effective, they depart from the least-cost alternative only when the findings of public involvement and environmental, public health or other considerations warrant such a change.

--Andover, Lawrence, Methuen and North Andover: these communities are part of the Greater Lawrence Sanitary District which would remain unchanged. An advanced treatment facility would be added to the secondary treatment plant now under construction which would discharge into the Merrimack River at North Andover. This system is taken from Alternative 1.

--Haverhill and Groveland: after constructing a secondary treatment plant as required by the State Implementation Schedule, these communities would expand their Bradford site to include an advanced treatment plant. This system is taken from Alternative 1.

--Boxford: if the town were to strengthen its policy of strict land use management controls and require properly operating and carefully regulated septic tanks, it would be able to remain with on-site sewage disposal systems.

--Rowley: if the town were to institute strict land use management controls and septic system regulations, it might be able to remain with on-site disposal. Otherwise, sewerage would become inevitable and Rowley would join a regional wastewater management system with communities to the south.

--Georgetown: though strict land use controls might still prevent the need for sewerage, it is probably that on-lot sewage disposal systems will not suffice indefinitely. Should sewerage become inevitable, Georgetown should make immediate provisions for joining an interceptor system running through Groveland to the facilities to the facilities at Haverhill.

--West Newbury: like Boxford, this town has a good chance of remaining with on-site sewage disposal systems given a policy of strict land use management controls. Otherwise, West Newbury would join a wastewater management system in Amesbury.

--Newbury, Newburyport and Salisbury: a secondary treatment plant located away from the Newburyport waterfront would serve these three communities. Effluent would be discharged not to the estuary but to a deep ocean outfall. This system is taken from Alternative 2.

--Merrimac: one of the two major options remaining for this town includes secondary treatment in Merrimac to be followed by spray irrigation or rapid infiltration in Merrimac. The other option is to transmit raw wastewater to Amesbury for secondary treatment to be followed by spray irrigation in the Merrimac and/or rapid infiltration in Amesbury. These systems are taken from Alternatives 5 and 6.

--Amesbury: this town has three options. It could follow augment the secondary treatment plant under construction with rapid infiltration in the town. Amesbury could also serve both Amesbury and Merrimac at its

secondary treatment plant to be followed by spray irrigation in Merrimac and/or rapid infiltration in Amesbury. Amesbury could also bring Merrimac into a spray irrigation facility for both towns, Merrimac already having provided secondary treatment for its wastewater independently. These systems are taken from Alternatives 5 and 6.

Background Information

The charts, maps and tables on the following pages show the wastewater management alternatives, treatment processes, cost summaries, present and projected wastewater flows and a summary of highlights of aesthetic, biological, engineering and socio-economic impacts which have been condensed from several still-unreviewed consultants' reports.

The summaries of the costs for construction and operation and maintenance do not present the current 75 per cent Federal and 15 per cent state grant participation for eligible items of work. Municipal sewage collection systems are not considered eligible. These costs, however, are included in the summaries. They are also presented separately. The construction and operation and maintenance cost summaries include costs for the collection and treatment of industrial wastes, but it should be realized that these costs will be paid by industry. The costs do not reflect a credit for existing or obligated facilities under the State Implementation Program. The costs of treating stormwater from combined sewers have been included, but combined stormwater collection and storage costs for Haverhill, Lowell and Lawrence are not included.

The summaries of costs for construction and operation and maintenance also do not include any contingencies for engineering or construction.

The least cost alternative represents the minimum monetary investment needed to solve regional wastewater management problems. However, this does not mean the lowest financial outlay for each individual community in the two regions because the alternative has been developed from the least expensive components of all the alternatives.

All reports are available for public inspection at the offices of the Corps of Engineers in Waltham, the Merrimack Valley Planning Commission at 87 Winter Street, Haverhill, and the Northern Middlesex Area Commission at 144 Merrimack Street, Lowell.

TABLE /

MERRIMACK WASTEWATER MANAGEMENT STUDY

NORTHERN MIDDLESEX AREA COMMISSION

WASTEWATER MANAGEMENT ALTERNATIVES

Community	Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water-Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternative 4 (Water-Regional)	Alternative 5 (Land)
Pepperell	Secondary Treatment Plant (Sec STP) (Proposed)	Advanced Wastewater Treatment Plant (AWT)	Sec. STP Effluent to Proposed Regional AWT in Ayer	Untreated Wastewater to Proposed Regional AWT in Ayer	Untreated Wastewater to Proposed Regional AWT in Ayer	Effluent to Sec STP in Pepperell; Rapid Infiltration (RI) Land Application Site in Pepperell
Dunstable*	Not Applicable	West Dunstable to Pepperell AWT; East Dunstable to North Chelmsford AWT	West Dunstable to Pepperell Sec STP; East Dunstable to Lowell Sec STP	West Dunstable to Ayer AWT; East Dunstable to Billerica AWT	West Dunstable to Ayer AWT; East Dunstable to Billerica Sec STP	West Dunstable to Pepperell Sec STP; East Dunstable to North Chelmsford Sec STP
Tyngsborough	Area East of Merrimack River to Lowell Sec STP	East Tyngsborough to Lowell AWT; West Tyngsborough to North Chelmsford AWT	Untreated Wastewater to Lowell Sec STP	East Tyngsborough to Lowell Sec STP; West Tyngsborough to Billerica AWT	East Tyngsborough to Lowell Sec STP; West Tyngsborough to Billerica Sec STP	East Tyngsborough to Lowell Sec STP; West Tyngsborough to North Chelmsford Sec STP
Westford*	Not Applicable	Untreated Wastewater to North Chelmsford AWT	Untreated Wastewater to Lowell Sec STP	Untreated Wastewater to Billerica Sec STP	Untreated Wastewater to Billerica Sec STP	Sec STP in Westford; Effluent to Spray Irrigation (SI) Land Application Site in Westford
Chelmsford	Five Million Gallons per Day (MGD) untreated wastewater to Lowell Sec STP	AWT in North Chelmsford; Sec STP in South Chelmsford; Sec STP Effluent to Billerica AWT	North Chelmsford Untreated Wastewater to Lowell Sec STP; South Chelmsford Untreated Wastewater to Billerica AWT	Untreated Wastewater to Billerica AWT	Untreated Wastewater to Billerica Sec STP	Sec STP in North Chelmsford; Effluent to RI Land Application Site in Tyngsborough; South Chelmsford Untreated Wastewater to Billerica Sec STP

*These communities will continue with on-lot disposal until sewerage is needed.
The alternatives are suggested for the day when the need for sewerage is demonstrated.

Sec STP: Secondary Treatment Plant AWT: Advanced Wastewater Treatment Plant RI: Rapid Infiltration SI: Spray Irrigation

TABLE 1 (Continued)

MERRIMACK WASTEWATER MANAGEMENT STUDY

NORTHERN MIDDLESEX AREA COMMISSION

WASTEWATER MANAGEMENT ALTERNATIVES

Community	Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water-Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternative 4 (Water-Regional)	Alternative 5 (Land)
Dracut	Untreated Wastewater to Lowell Sec STP	Untreated Wastewater to Lowell AWT	Untreated Wastewater to Lowell Sec STP	Untreated Wastewater to Lowell Sec STP	Untreated Wastewater to Lowell Sec STP	To Lowell Sec STP
Lowell	Sec STP (Under Construction)	AWT (If Space is Available) if not, Sec STP Effluent to Billerica AWT	Sec STP Effluent to Billerica AWT	Sec STP Effluent to Billerica AWT	Sec STP Effluent to Greater Lawrence Sanitary District (GLSD) in North Andover (AWT)	Sec STP in Lowell; Effluent to RI Land Application Site at Fort Devens in Lancaster
Tewksbury	Untreated Waste-water to Lowell Sec STP	Untreated Wastewater to Lowell AWT	Untreated Wastewater to Lowell Sec STP	Untreated Wastewater to Lowell Sec STP	Untreated Wastewater to Lowell Sec STP	To Lowell Sec STP
Billerica	Sec STP (Existing)	AWT; Effluent to Concord River at AWT Site	AWT; Effluent to Merrimack River	AWT; Effluent to Headwaters of Concord River	Sec STP; Effluent to GLSD in North Andover (AWT)	Effluent to Sec STP in Billerica; RI Land Application Site in Concord-Carlisle Area (Upper Concord River)

TABLE 1a

MERRIMACK WASTEWATER MANAGEMENT STUDY

NORTHERN MIDDLESEX AREA COMMISSION

WASTEWATER TREATMENT FACILITIES

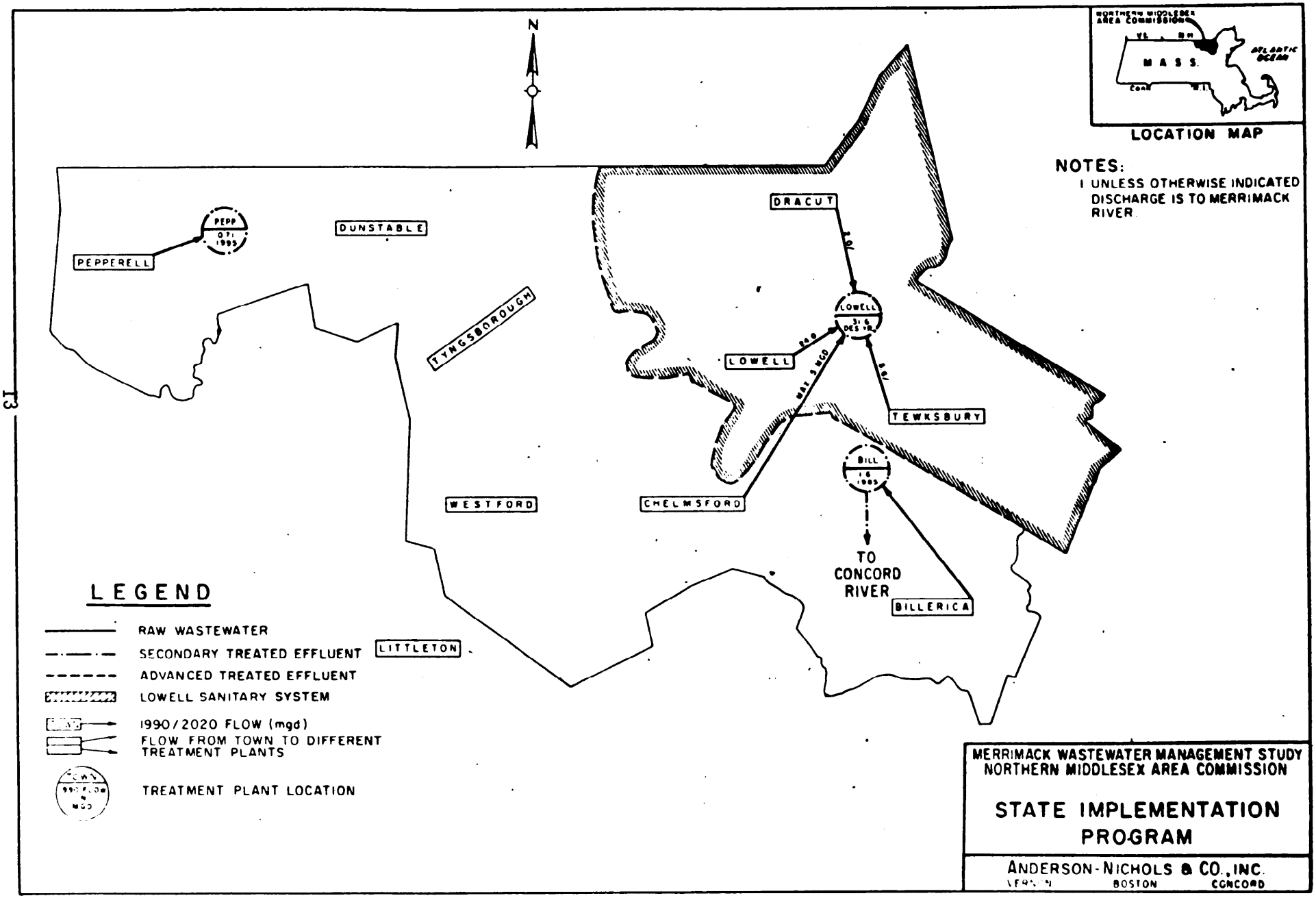
Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water-Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternative 4 (Water-Regional)	Alternative 5 (Land)
Secondary STP in Pepperell (Proposed)	Sec STP in 1) Chelmsford (South)	Sec STPs in 1) Pepperell 2) Lowell	Sec STP in 1) Lowell	Sec STPs in 1) Lowell 2) Billerica	Sec STPs in 1)Pepperell 2) Westford 3) Chelmsford (North) 4) Lowell 5) Billerica
Secondary STP in Lowell (Under Construction)	AWT's in 1) Pepperell 2) Chelmsford (North) 3) Lowell 4) Billerica	AWT's in 1) Ayer 2) Billerica	AWT's in 1) Ayer 2) Billerica	AWT's in 1) Ayer 2) GLSD in North Andover	Land Application Sites in 1) Pepperell (RI) 2) Tyngsborough (RI) 3) Fort Devens in Lancaster (RI) 4) Westford (SI) 5) Carlisle & Concord (RI)

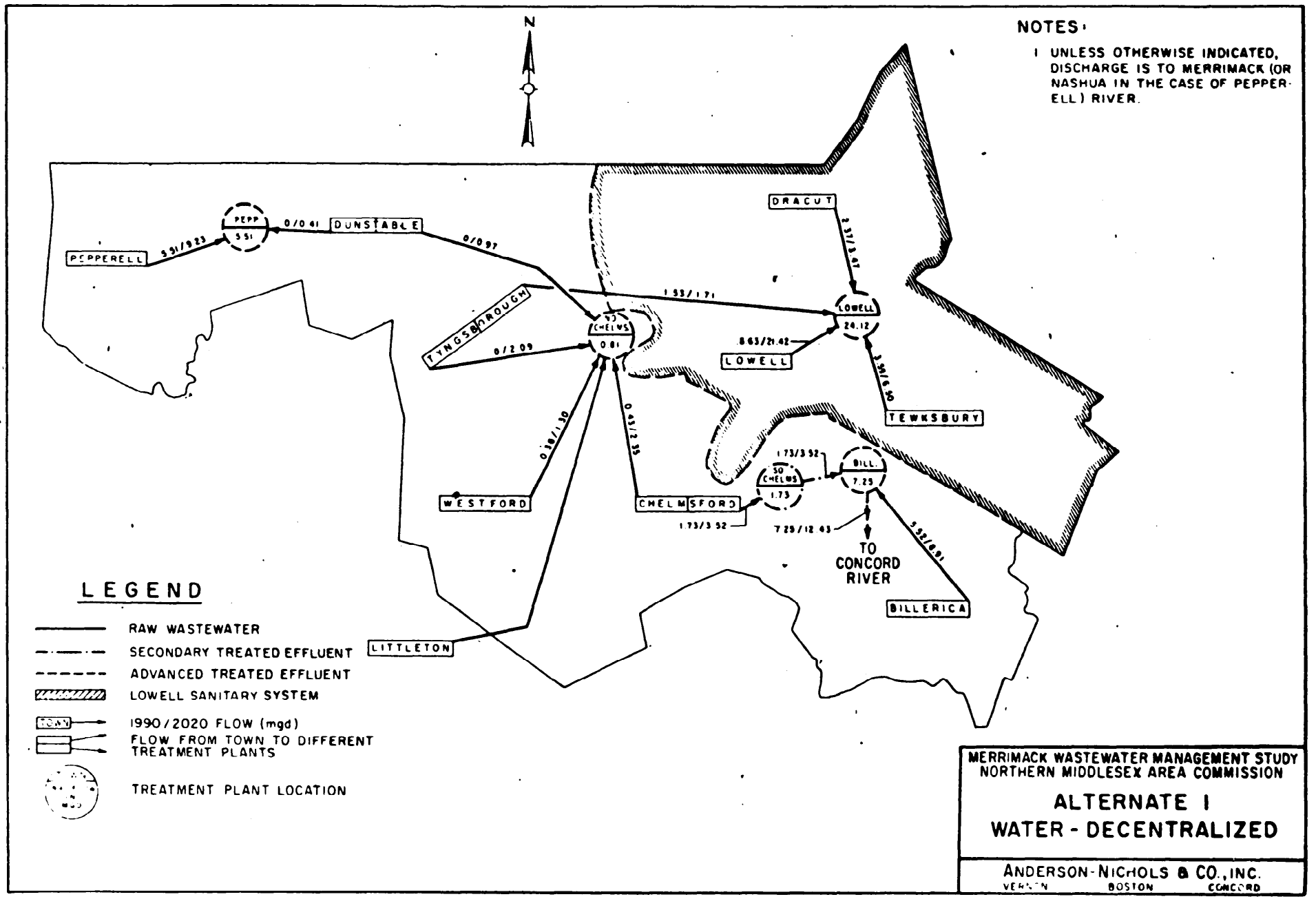
Sec STP: Secondary Treatment Plant

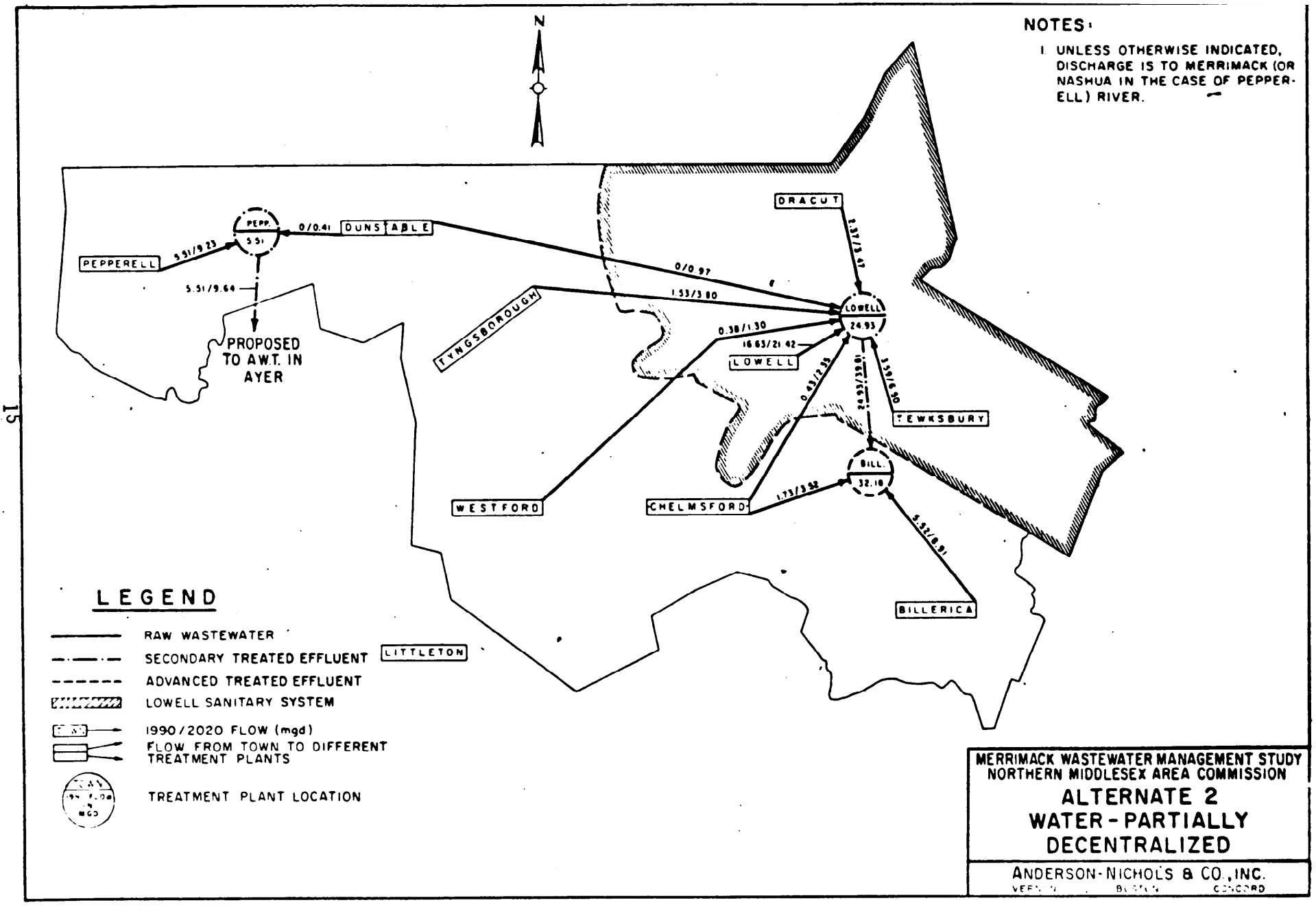
AWT: Advanced Wastewater Treatment Plant

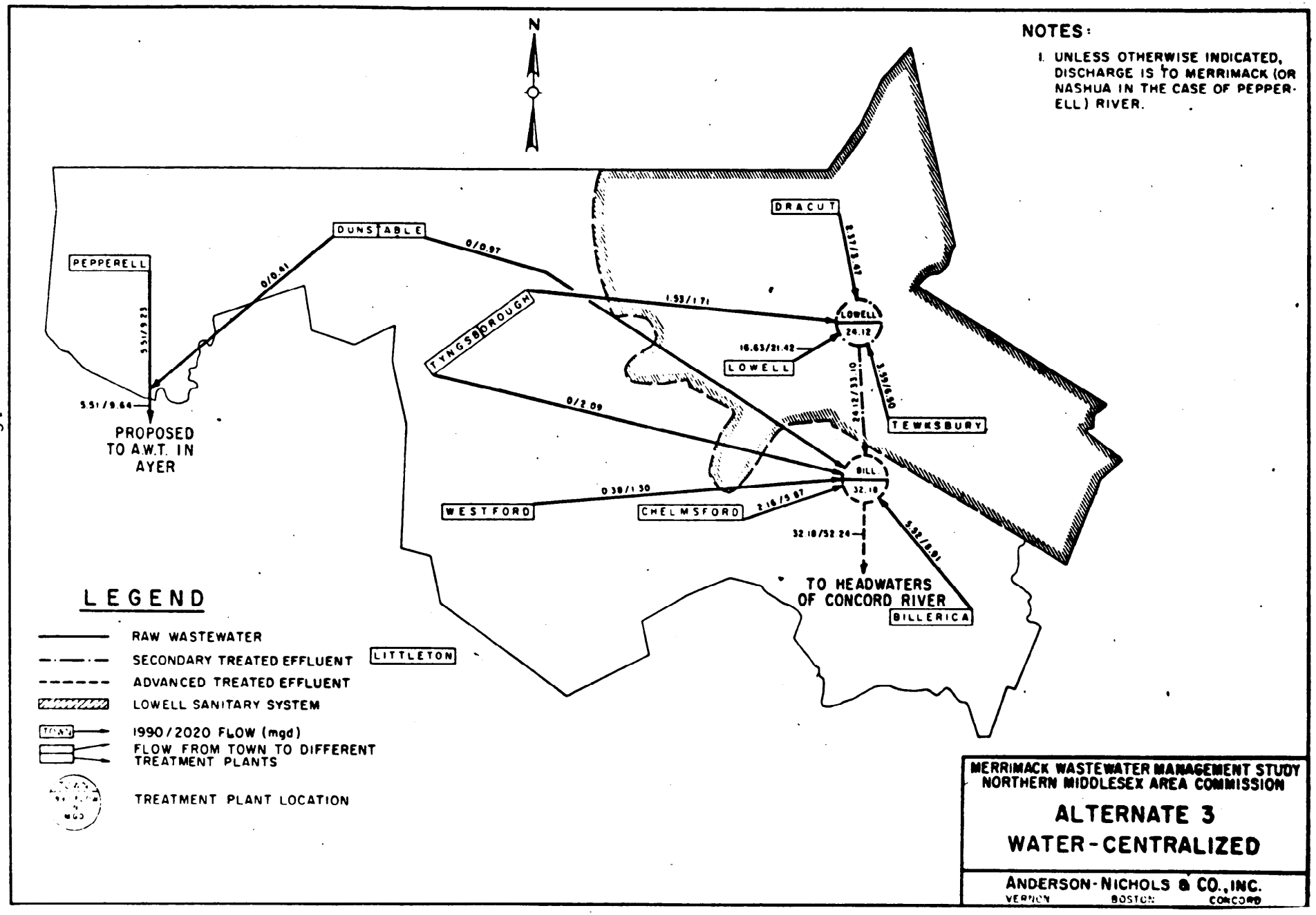
RI: Rapid Infiltration

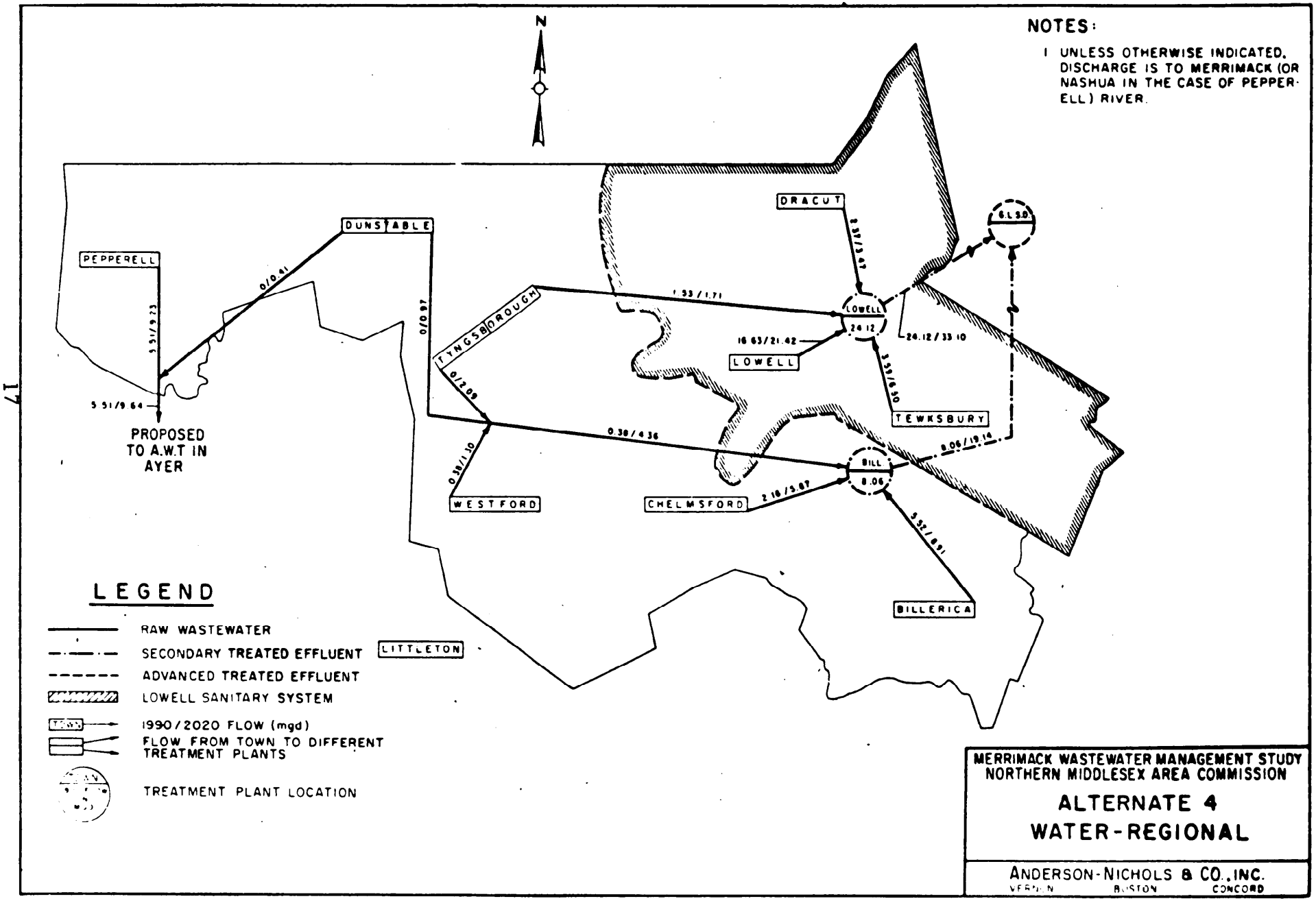
SI: Spray Irrigation

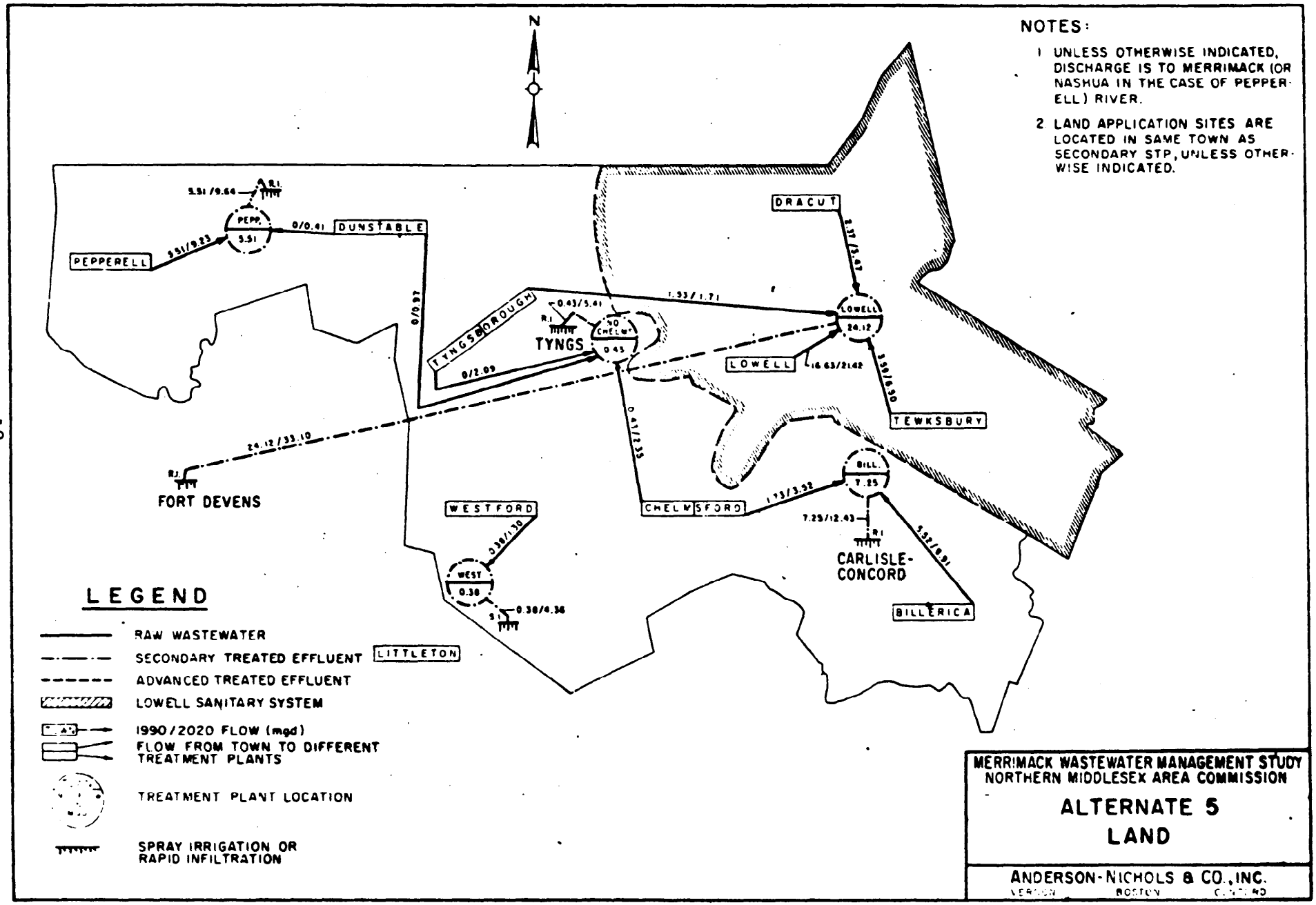

N
LOCATION MAP
NORTHERN MIDDLESEX AREA COMMISSION
MASS.
ATLANTIC OCEAN
NOTES:
1 UNLESS OTHERWISE INDICATED DISCHARGE IS TO MERRIMACK RIVER.
PEPPERELL
PEPP
DUNSTABLE
TYNGSBOROUGH
DRACUT
LOWELL
LOWELL
TEWKSBURY
WESTFORD
CHELMSFORD
BILL
TO CONCORD RIVER
BILLERICA
LITTLETON
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
STATE IMPLEMENTATION PROGRAM
ANDERSON-NICHOLS & CO., INC.
BOSTON
CONCORD


NOTES:
1 UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK (OR NASHUA IN THE CASE OF PEPPERELL) RIVER.
N
PEPPERELL
3.51/9.23
PEPP
3.51
0/0.41
DUNSTABLE
0/0.97
TYNGSBOROUGH
0/2.09
SO CHELMS
0.81
1.53/1.71
DRACUT
2.37/3.47
LOWELL
24.12
.863/21.42
LOWELL
3.91/6.50
TEWKSBURY
0.38/1.30
WESTFORD
0.43/2.35
CHELMSFORD
1.73/3.52
SO CHELMS
1.73
1.73/3.52
BILL.
7.25
7.25/12.43
TO CONCORD RIVER
3.32/8.01
BILLERICA
LITTLETON
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
TOWN
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
ALTERNATE 1
WATER - DECENTRALIZED
ANDERSON-NICHOLS & CO., INC.
VERNON
BOSTON
CONCORD


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK (OR NASHUA IN THE CASE OF PEPPERELL) RIVER.
N
PEPPERELL
5.51/9.23
PEPP.
5.51
0/0.41
DUNSTABLE
5.51/9.64
PROPOSED TO A.W.T. IN AYER
TYNGSBOROUGH
0/0.97
1.53/3.80
DRACUT
2.37/3.47
LOWELL
24.93
0.38/1.30
16.63/21.42
LOWELL
0.43/2.35
24.93/35.81
3.59/6.90
TEWKSBURY
BILL.
32.18
WESTFORD
CHELMSFORD
1.73/3.58
5.37/8.91
BILLERICA
LITTLETON
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
ALTERNATE 2
WATER - PARTIALLY DECENTRALIZED
ANDERSON-NICHOLS & CO., INC.


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK (OR NASHUA IN THE CASE OF PEPPERELL) RIVER.
N
PEPPERELL
DUNSTABLE
TYNGSBOROUGH
DRACUT
LOWELL
TEWKSBURY
BILL.
WESTFORD
CHELMSFORD
BILLERICA
LITTLETON
0/0.41
0/0.97
1.53/1.71
2.37/3.47
24.12
16.63/21.42
24.12/33.10
3.59/6.50
0/2.09
0.38/1.30
2.16/5.87
32.18
32.18/52.24
5.52/8.91
5.51/9.23
5.51/9.64
PROPOSED TO A.W.T. IN AYER
TO HEADWATERS OF CONCORD RIVER
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
ALTERNATE 3
WATER-CENTRALIZED
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD


NOTES:
1 UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK (OR NASHUA IN THE CASE OF PEPPERELL) RIVER.
N
PEPPERELL
DUNSTABLE
TYNGSBOROUGH
WESTFORD
LITTLETON
DRACUT
LOWELL
TEWKSBURY
CHELMSFORD
BILLERICA
G.L.S.D.
PROPOSED TO A.W.T IN AYER
5.51/9.64
5.51/9.23
0/0.41
0/0.97
0/2.09
0.38/1.30
0.38/4.36
1.53/1.71
2.37/3.47
16.63/21.42
24.12
24.12/33.10
3.59/6.50
8.06/19.14
2.16/5.87
5.52/8.91
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
ALTERNATE 4
WATER-REGIONAL
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD


NOTES:
1 UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK (OR NASHUA IN THE CASE OF PEPPERELL) RIVER.
2 LAND APPLICATION SITES ARE LOCATED IN SAME TOWN AS SECONDARY STP, UNLESS OTHERWISE INDICATED.
N
PEPPERELL
DUNSTABLE
DRACUT
TYNGSBOROUGH
TYNGS
LOWELL
TEWKSBURY
FORT DEVENS
WESTFORD
CHELMSFORD
CARLISLE-CONCORD
BILLERICA
LITTLETON
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
SPRAY IRRIGATION OR RAPID INFILTRATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
ALTERNATE 5
LAND
ANDERSON-NICHOLS & CO., INC.
BOSTON

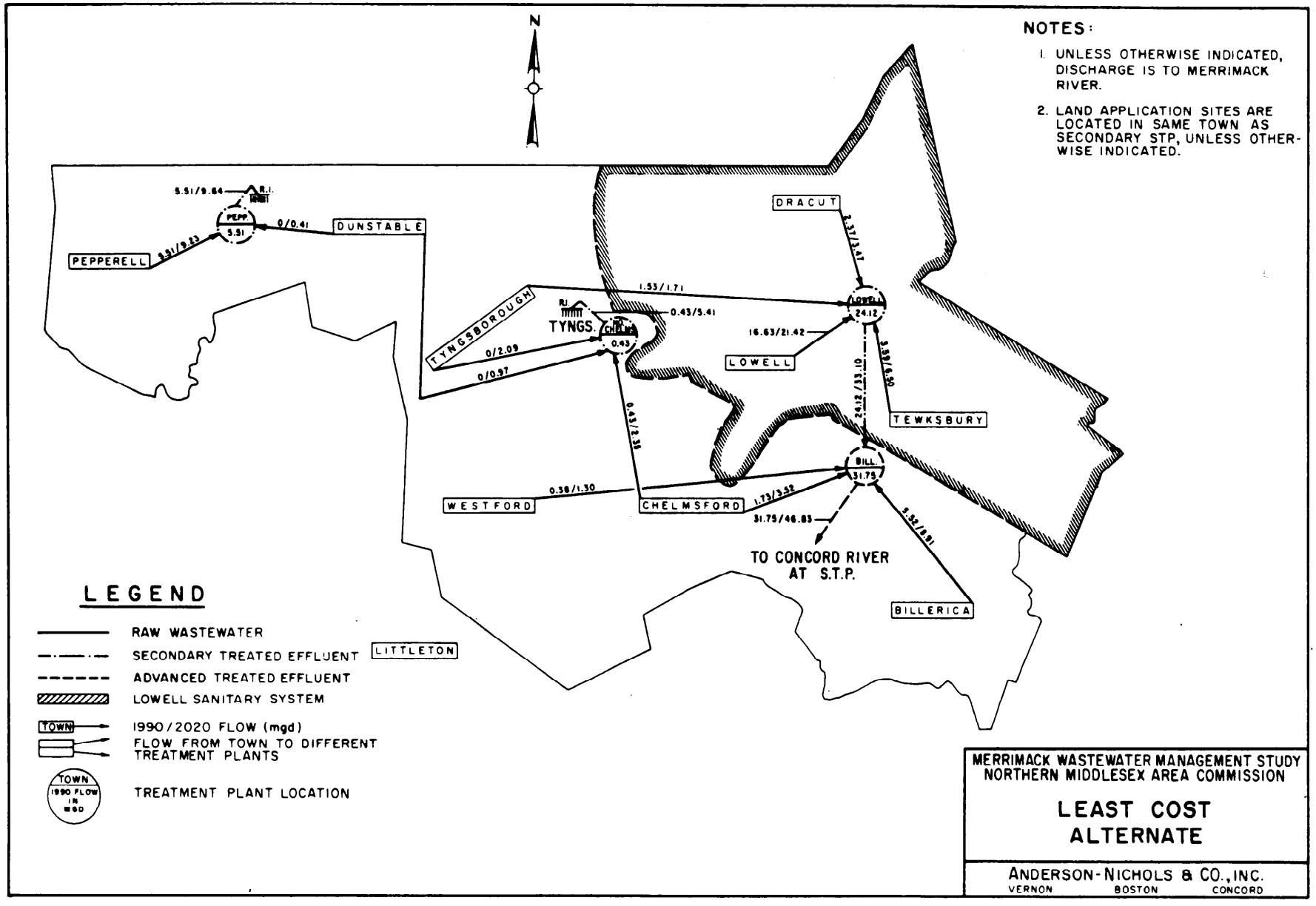

NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
2. LAND APPLICATION SITES ARE LOCATED IN SAME TOWN AS SECONDARY STP, UNLESS OTHERWISE INDICATED.
N
PEPPERELL
DUNSTABLE
TYNGSBOROUGH
TYNGS.
DRACUT
LOWELL
TEWKSBURY
WESTFORD
CHELMSFORD
BILLERICA
LITTLETON
TO CONCORD RIVER AT S.T.P.
5.51/9.64
R.I.
PEPP.
5.51
0/0.41
5.51/9.23
1.53/1.71
0.43/5.41
0/2.09
0/0.97
0.43
0.43/2.35
2.37/3.47
LOWELL
24.12
16.63/21.42
24.12/33.10
3.59/6.50
BILL.
31.75
0.38/1.30
1.73/3.52
31.75/46.83
5.52/8.91
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
LOWELL SANITARY SYSTEM
TOWN
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TOWN
1990 FLOW IN MGD
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
NORTHERN MIDDLESEX AREA COMMISSION
LEAST COST ALTERNATE
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD

TABLE 2

MERRIMACK WASTEWATER MANAGEMENT STUDY

MERRIMACK VALLEY PLANNING COMMISSION

WASTEWATER MANAGEMENT ALTERNATIVES

Community	Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternative 4 (Water-Regional)	Alternative 5 (Land) (Decentralized)	Alternative 6 (Land-Centralized)
Greater Lawrence Sanitary District (GLSD)	Secondary Treatment Plant (Sec STP) in North Andover (Under Construction)	Advanced Wastewater Treatment Plant (AWT) in North Andover	AWT in North Andover	AWT in North Andover	AWT in North Andover (this alternative includes Haverhill and Lowell area communities)	Insufficient Land Available; AWT in North Andover	Insufficient Land Available; AWT in North Andover
Andover	GLSD	GLSD	GLSD	GLSD	GLSD	GLSD	GLSD
Methuen	GLSD	GLSD	GLSD	GLSD	GLSD	GLSD	GLSD
Lawrence	GLSD	GLSD	GLSD	GLSD	GLSD	GLSD	GLSD
No. Andover	Northern Area to GLSD; Southern Area Not Applicable	GLSD	Northern Area to GLSD; Southern Area to MDC Study Area	GLSD	GLSD	GLSD	GLSD
Haverhill	Secondary Treatment Plant (Sec STP) (Proposed)	AWT; East Haverhill to Merrimac Sec STP	AWT; East Haverhill to Newburyport Sec STP	Sec STP Effluent to GLSD AWT; East Haverhill to Amesbury Sec STP	Sec STP Effluent to GLSD AWT; East Haverhill to Amesbury Sec STP	Sec STP in Haverhill; Effluent to Rapid Infiltration (RI) Land Application Sites in Groveland and Haverhill; East Haverhill to Merrimac Sec STP	Sec STP in Haverhill; Effluent to Rapid Infiltration (RI) Land Application Sites in Groveland and Haverhill; East Haverhill to Merrimac Sec STP

*These communities will continue with on-lot disposal until sewerage is needed.
The Schemes are suggested for the day when the need for sewerage is demonstrated.

**The infiltration of salt water into sewers may eliminate land application alternatives for Newburyport.

Sec STP: Secondary Treatment Plant AWT: Advanced Wastewater Treatment Plant RI: Rapid Infiltration SI: Spray Irrigation

TABLE 2 (Continued)

MERRIMACK WASTEWATER MANAGEMENT STUDY

MERRIMACK VALLEY PLANNING COMMISSION

WASTEWATER MANAGEMENT ALTERNATIVES

Community	Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternative 4 (Water-Regional)	Alternative 5 (Land) (Decentralized)	Alternative 6 (Land-Centralized)
Groveland	Untreated Wastewater to Haverhill Sec STP	Untreated Wastewater to Haverhill AWT	Untreated Wastewater to Haverhill AWT	Untreated Wastewater to Haverhill Sec STP	Untreated Wastewater to Haverhill Sec STP	To Haverhill Sec STP	To Haverhill Sec STP
Boxford*	Not Applicable	North Boxford to GLSD AWT; AWT in South Boxford, Effluent to 1) Pye Brook (R) 2) Penn Brook (R)	North Boxford to GLSD AWT; South Boxford to MDC Study Area	North Boxford to GLSD AWT; South Boxford to Haverhill Sec STP	North Boxford to GLSD AWT; South Boxford to Haverhill Sec STP	North Boxford to GLSD AWT; Sec STP in South Boxford, Effluent to Spray Irrigation (SI) Land Application Site in Boxford	North Boxford to GLSD AWT; South Boxford untreated Wastewater to Georgetown Sec STP
Georgetown*	Not Applicable	Untreated Wastewater to Haverhill AWT	Untreated Wastewater to Haverhill AWT	Untreated Wastewater to Haverhill Sec STP	Untreated Wastewater to Haverhill Sec STP	Sec STP in Georgetown; Effluent to SI Land Application Site in Georgetown	Sec STP in Georgetown; Effluent to SI Land Application Sites in Georgetown and Boxford
Newbury	Portions to Newburyport Sec STP	Untreated Wastewater to Newburyport Sec STP	Untreated Wastewater to Newburyport Sec STP	Untreated Wastewater to Newburyport AWT	Untreated Wastewater to Newburyport AWT	To Newburyport Sec STP	To Newburyport Sec STP
West Newbury*	Not Applicable	Untreated Wastewater to Merrimac Sec STP	Untreated Wastewater to Newburyport Sec STP	Untreated Wastewater to Newburyport AWT	Untreated Wastewater to Newburyport AWT	Sec STP in West Newbury; Effluent to SI Land Application Site in West Newbury	To Merrimac Sec STP
Merrimac	Sec STP (Proposed) Further Study Required	Sec STP Effluent to Amesbury AWT	Untreated Wastewater to Newburyport Sec STP	Untreated Wastewater to Amesbury Sec STP	Untreated Wastewater to Amesbury Sec STP	Sec STP in Merrimac; Effluent to SI Land Application Site in Merrimac	Sec STP in Merrimac; Effluent to SI Land Application Site in West Newbury

TABLE 2 (Continued)

MERRIMACK WASTEWATER MANAGEMENT STUDY

MERRIMACK VALLEY PLANNING COMMISSION

WASTEWATER MANAGEMENT ALTERNATIVES

Community	Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternaitve 4 (Water-Regional)	Alternative 5 (Land) (Decentralized)	Alternative 6 (Land-Centralized)
Amesbury	Sec STP (Under Construction)	AWT Effluent to Powwow River	AWT Effluent to Merrimack River	Sec STP Effluent to Newburyport AWT	Sec STP Effluent to Newburyport AWT	Sec STP in Amesbury; Effluent to RI Land Application Site in Amesbury	Sec STP in Amesbury; Effluent to RI Land Applicatio Site in Amesbury
Salisbury	Sec STP (Proposed) Further Study Required	Sec STP Effluent to 1) Estuary 2) Ocean	Sec STP Effluent to Joint Ocean Outfall with Newburyport	Sec STP Effluent to Newburyport AWT	Untreated Waste-water to New-buryport AWT	Sec STP in Salisbury; Effluent to RI Land Application Site in Salisbury	Sec STP in Salisbury; Eff-luent to RI Land Application Site in Salisbury
Newburyport**	Sec STP (Primary Plant in Operation) Further Study Required	Sec STP Effluent to 1) Estuary 2) Ocean	Sec STP Effluent to Joint Ocean Outfall with Salisbury	AWT Effluent to Estuary	AWT Effluent to Estuary	Sec STP in New-buryport; Effluent to Estuary	Sec STP in Newbury-port; Effluent to Estuary
Rowley *	Not Applicable	AWT Effluent to Rowley River	Untreated Waste-water to MDC Study Area	Untreated Waste-water to Newbury-port AWT	Untreated Waste-water to Newbury-port AWT	Sec STP in Rowley; Effluent to SI Land Application Site in Rowley	Sec STP in Rowley; Effluent to SI Land Application Site in Rowley

TABLE 2a

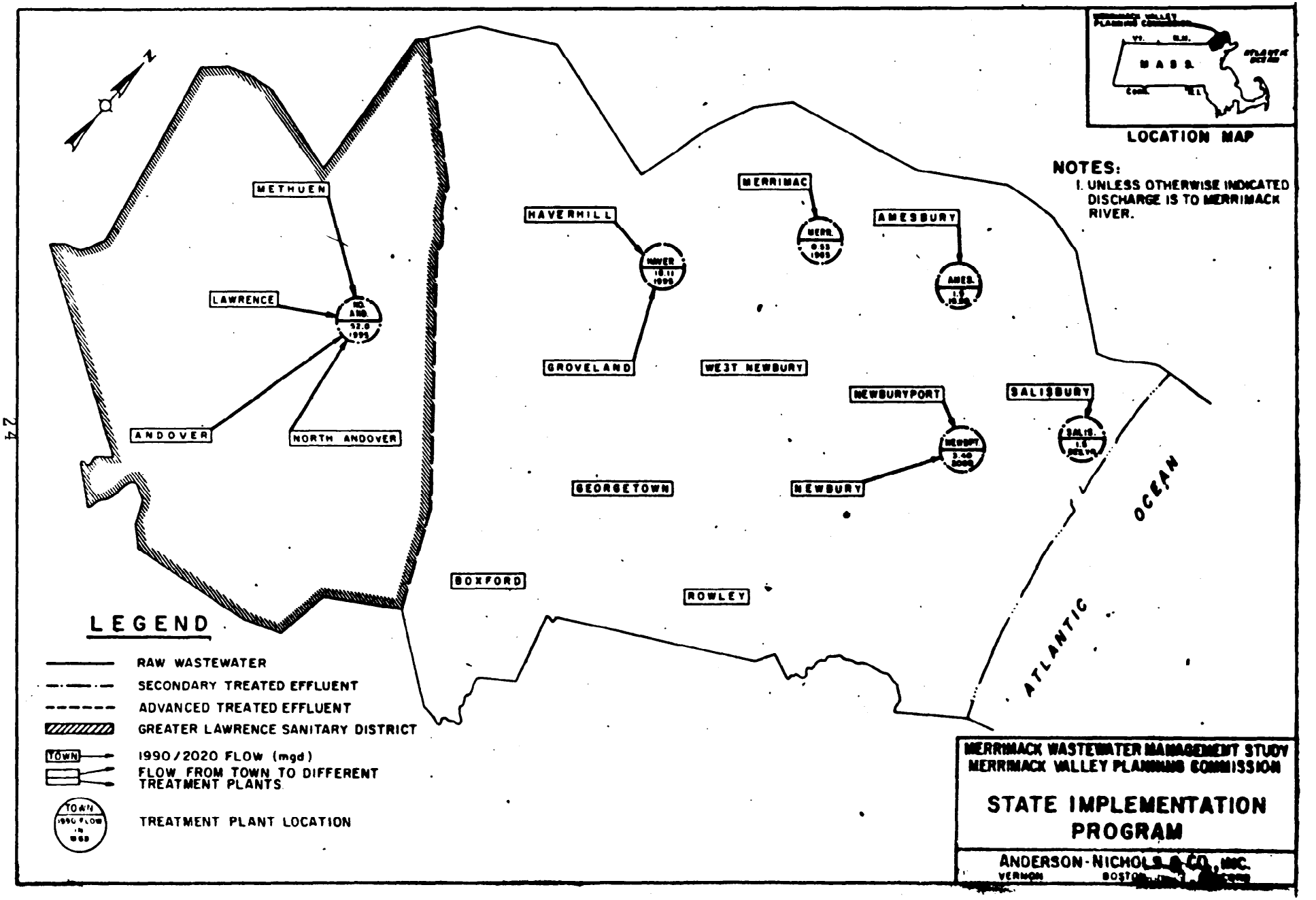
MERRIMACK WASTEWATER MANAGEMENT STUDY

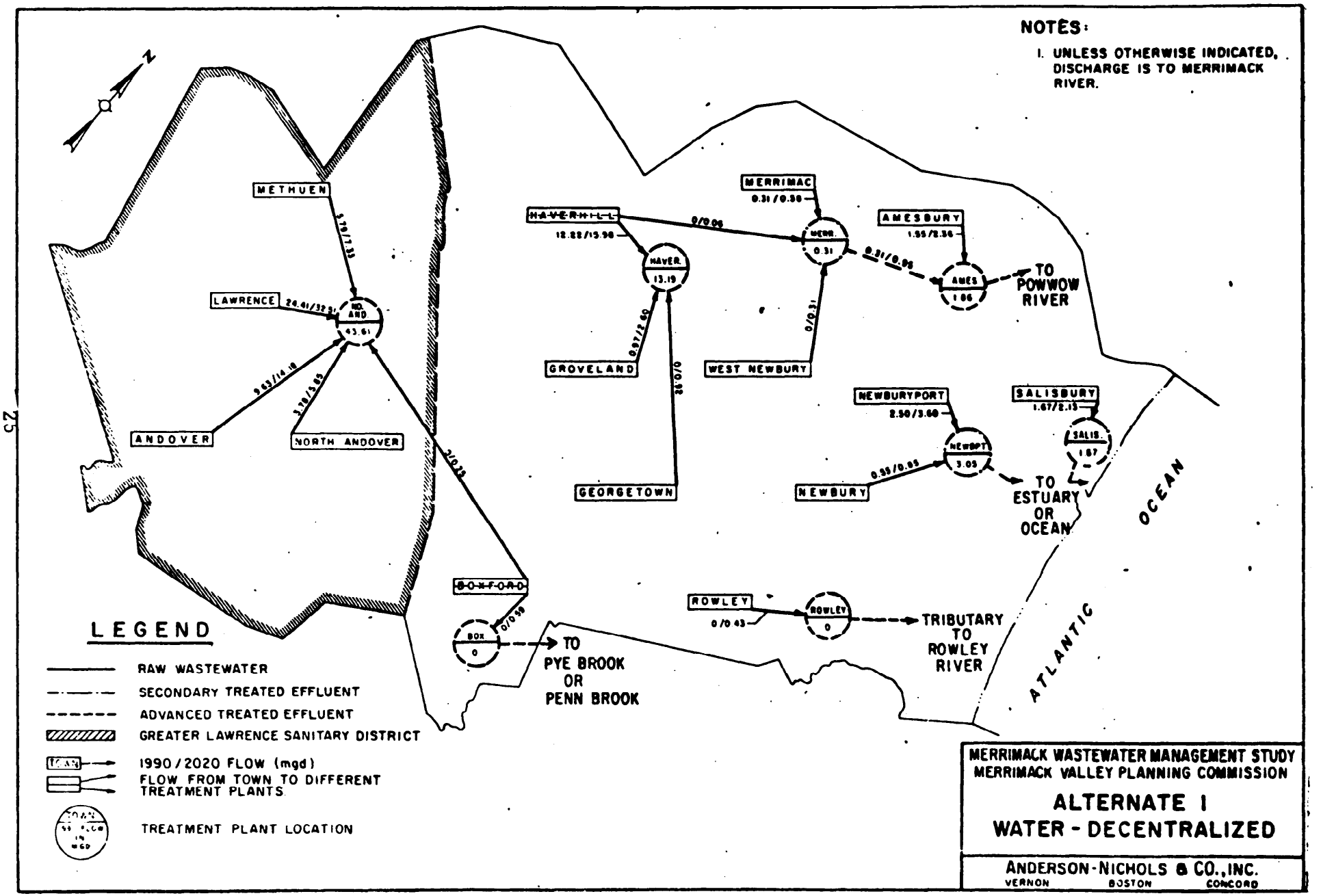
MERRIMACK VALLEY PLANNING COMMISSION

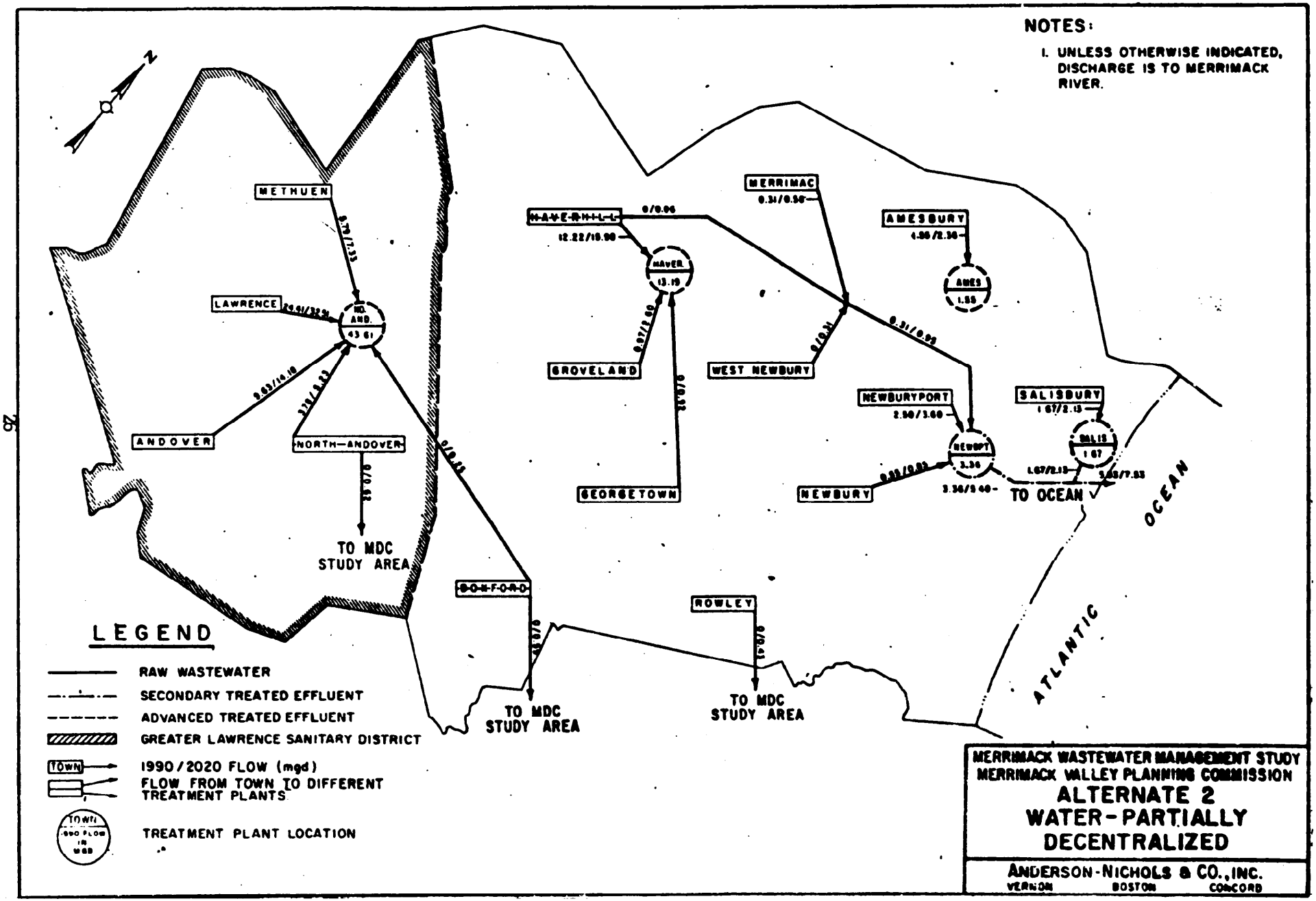
WASTEWATER TREATMENT FACILITIES

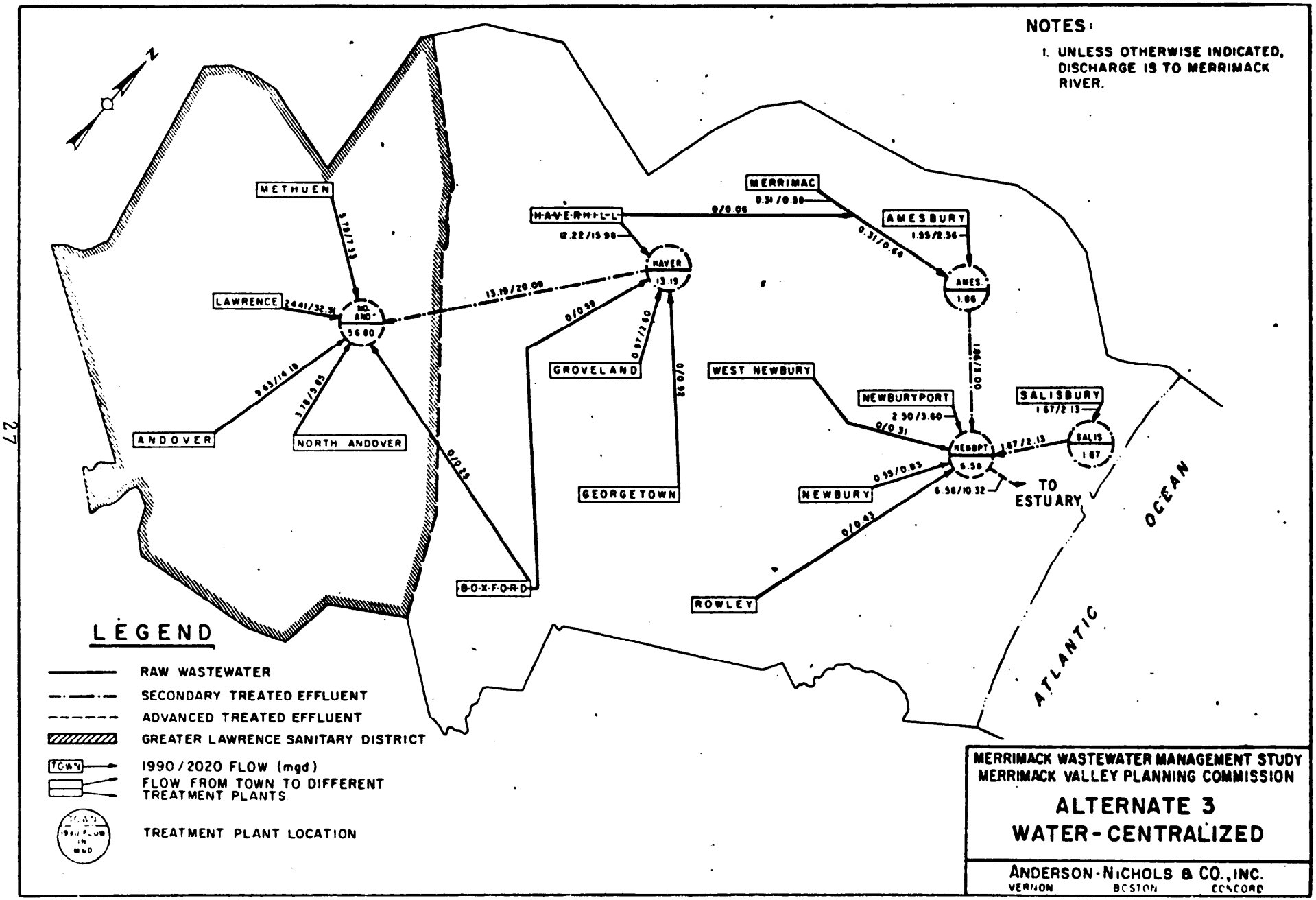
Current State Program	Alternative 1 (Water) (Decentralized)	Alternative 2 (Water Partially) (Centralized)	Alternative 3 (Water-Centralized)	Alternative 4 (Water-Regional)	Alternative 5 (Land) (Decentralized)	Alternative 6 (Land-Centralized)
GLSD Sec STP (Under Construction in North Andover) Haverhill Sec STP (Proposed) Merrimac Sec STP (Proposed) Further Study Needed Amesbury Sec STP (Under Construction) Salisbury Sec STP (Proposed) Further Study Needed Newburyport Sec STP (Primary Plant in Operation) Further Study Needed	Sec STPs in 1) Merrimac 2) Salisbury 3) Newburyport AWTs in 1) GLSD 2) Haverhill 3) Boxford 4) Amesbury 5) Rowley	Sec STPs in 1) Salisbury 2) Newburyport AWTs in 1) GLSD 2) Haverhill 3) Amesbury	Sec STPs in 1) Haverhill 2) Amesbury 3) Salisbury AWTs in 1) GLSD 2) Newburyport	Sec STPS in 1) Haverhill 2) Amesbury AWTs in 1) Newburyport 2) GLSD (This alternative includes Lowell Area Communities)	Sec STPs in 1) Haverhill 2) Boxford (south) 3) Rowley 4) Georgetown 5) West Newbury 6) Merrimac 7) Salisbury 8) Newburyport 9) Amesbury AWT in 1) GLSD Land Application Sites in 1) Haverhill & Groveland(RI) 2) Boxford (SI) 3) Rowley (SI) 4) Georgetown (SI) 5) Merrimac (SI) 6) West Newbury (SI) 7) Amesbury (RI) 8) Salisbury (RI)	Sec STPs in 1) Haverhill 2) Georgetown 3) Rowley 4) Amesbury 5) Newburyport 6) Merrimac 7) Salisbury AWT in 1) GLSD Land Application Sites in 1) Haverhill & Groveland (RI) 2) Boxford & Georgetown (SI) 3) Rowley (SI) 4) Amesbury (RI) 5) W. Newbury (SI) 6) Salisbury (RI)

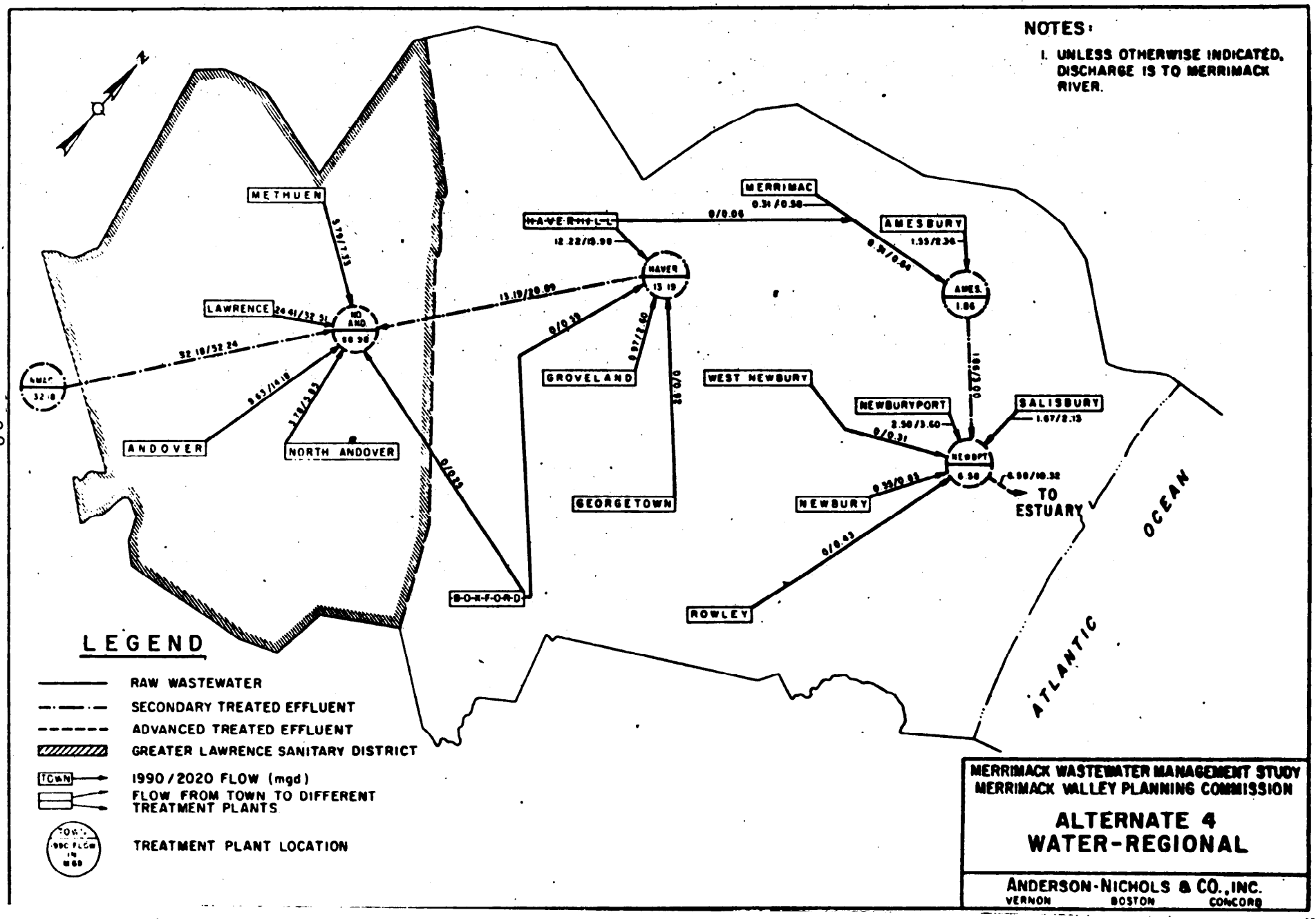
Sec STP: Secondary Treatment Plant
AWT: Advanced Wastewater Treatment Plant
RI: Rapid Infiltration
SI: Spray Irrigation

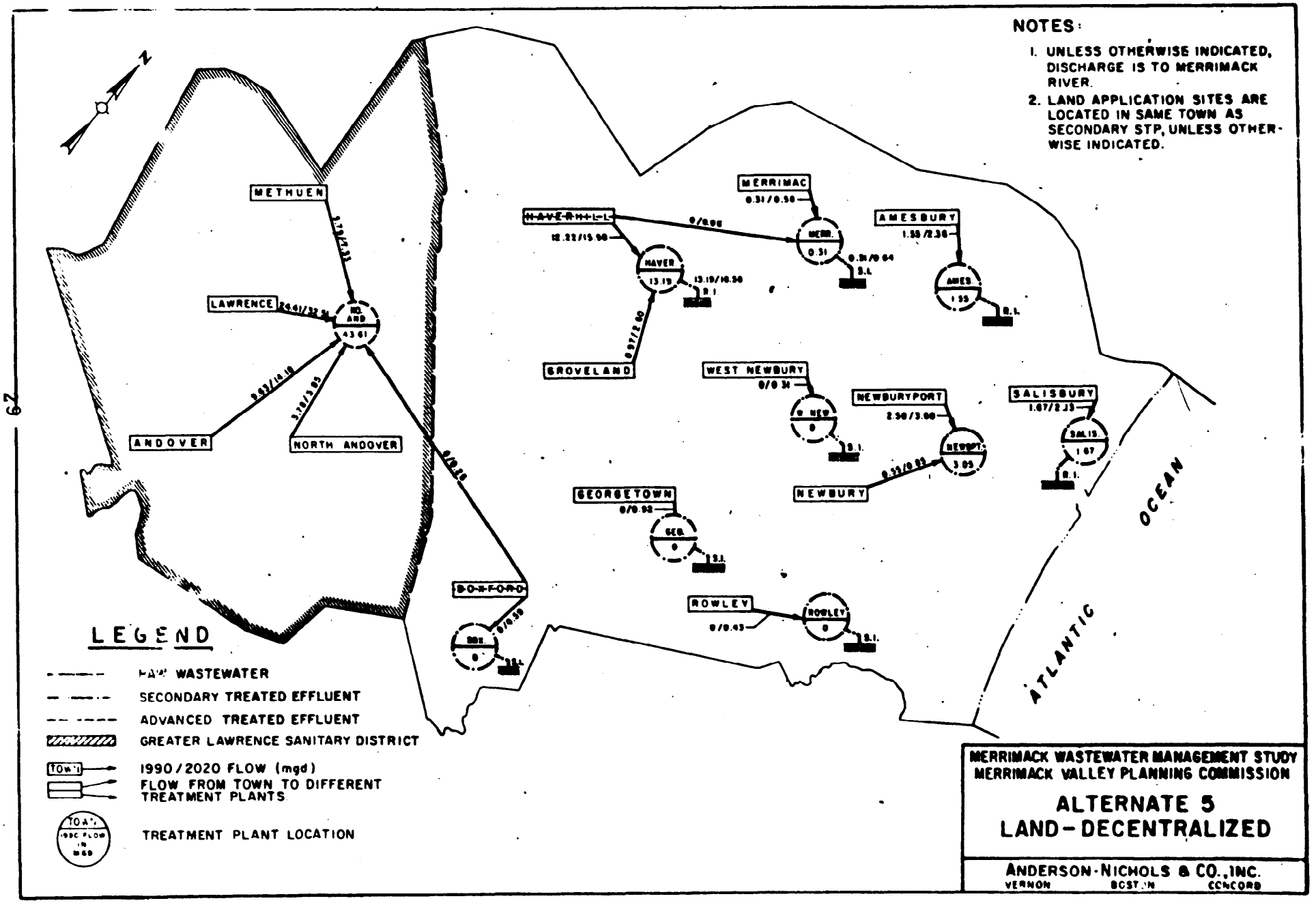

METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
HAVERHILL
GROVELAND
MERRIMAC
AMESBURY
WEST NEWBURY
NEWBURYPORT
SALISBURY
NEWBURY
GEORGETOWN
BOXFORD
ROWLEY
ATLANTIC OCEAN
LOCATION MAP
NOTES:
1. UNLESS OTHERWISE INDICATED DISCHARGE IS TO MERRIMACK RIVER.
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
TOWN
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TOWN
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
STATE IMPLEMENTATION PROGRAM
ANDERSON-NICHOLS & CO., INC.
VERNON
BOSTON

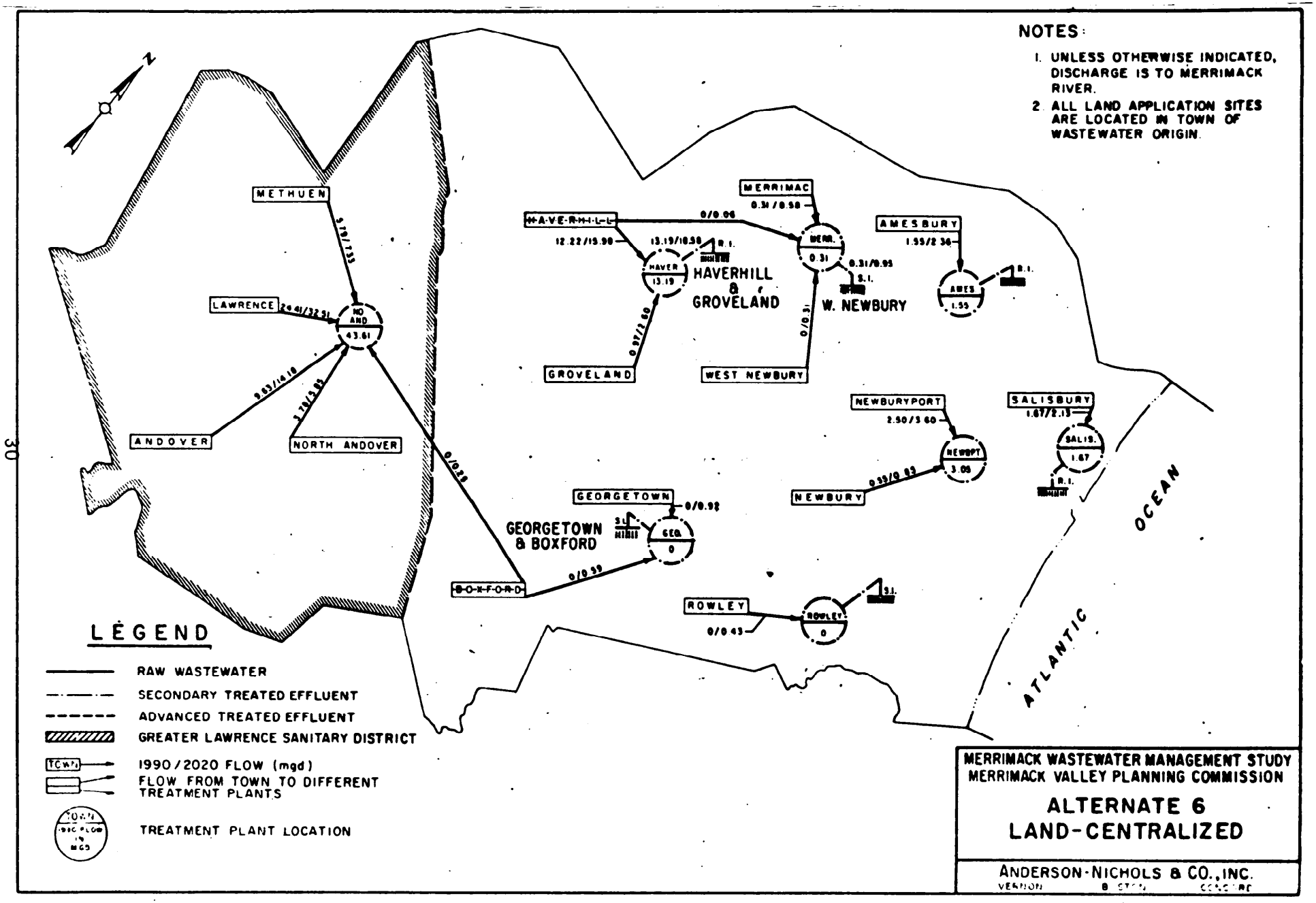

NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
N
METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
NO. AND
43.61
HAVERHILL
12.88/13.90
HAVER.
13.19
GROVELAND
GEORGETOWN
MERRIMAC
0.31/0.38
MERR.
0.31
WEST NEWBURY
AMESBURY
1.55/2.36
AMES
1.06
TO POWWOW RIVER
NEWBURYPORT
2.50/3.60
NEWBPT
3.05
NEWBURY
SALISBURY
1.67/2.15
SALIS.
1.87
TO ESTUARY OR OCEAN
ATLANTIC OCEAN
BOXFORD
BOX
0
TO PYE BROOK OR PENN BROOK
ROWLEY
0/0.43
ROWLEY
0
TRIBUTARY TO ROWLEY RIVER
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
ALTERNATE 1
WATER - DECENTRALIZED
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD

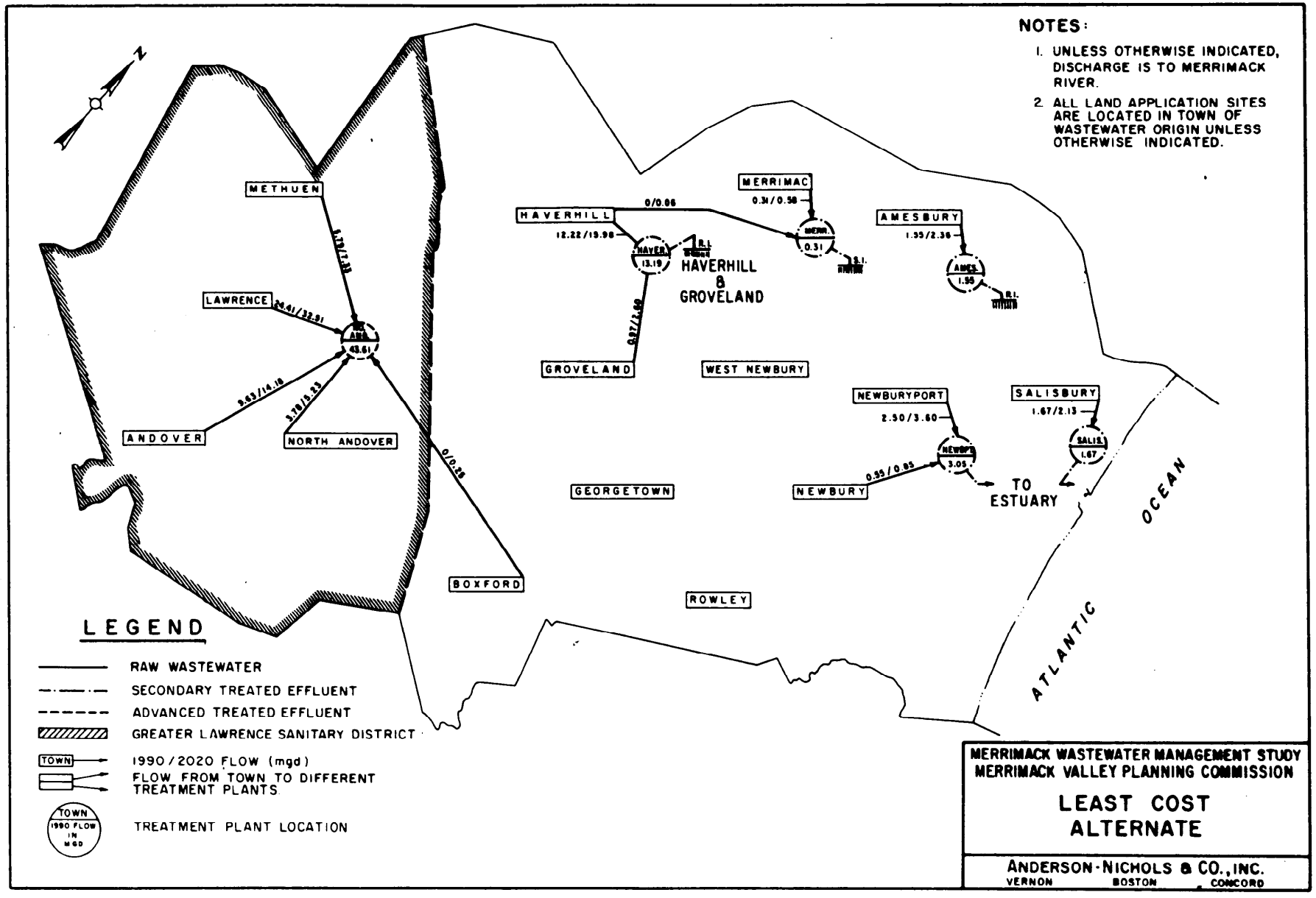

NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
N
METHUEN
LAWRENCE
ANDOVER
NORTH-ANDOVER
TO MDC STUDY AREA
HAVERHILL
GROVELAND
GEORGETOWN
BOXFORD
TO MDC STUDY AREA
ROWLEY
TO MDC STUDY AREA
MERRIMAC
WEST NEWBURY
AMESBURY
NEWBURYPORT
NEWBURY
SALISBURY
TO OCEAN
ATLANTIC OCEAN
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
TOWN
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TOWN
1990 FLOW IN MGD
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
ALTERNATE 2
WATER-PARTIALLY DECENTRALIZED
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
N
METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
NO. AND
56.80
HAVERHILL
HAVER
13.19
GROVELAND
GEORGETOWN
BOXFORD
MERRIMAC
AMESBURY
AMES.
1.86
WEST NEWBURY
NEWBURYPORT
NEWBPT
6.58
NEWBURY
ROWLEY
SALISBURY
SALIS
1.67
TO ESTUARY
ATLANTIC OCEAN
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
ALTERNATE 3
WATER-CENTRALIZED
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
HAVERHILL
HAVER
13.19
GROVELAND
GEORGETOWN
BOXFORD
MERRIMAC
AMESBURY
AMES.
1.86
WEST NEWBURY
NEWBURYPORT
SALISBURY
NEWBURY
ROWLEY
TO ESTUARY
ATLANTIC OCEAN
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
TOWN
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
ALTERNATE 4
WATER-REGIONAL
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
2. LAND APPLICATION SITES ARE LOCATED IN SAME TOWN AS SECONDARY STP, UNLESS OTHERWISE INDICATED.
N
METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
HAVERHILL
MERRIMAC
AMESBURY
GROVELAND
WEST NEWBURY
NEWBURYPORT
SALISBURY
NEWBURY
GEORGETOWN
ROWLEY
DOUGLAS
ATLANTIC
OCEAN
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
ALTERNATE 5
LAND-DECENTRALIZED
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
2. ALL LAND APPLICATION SITES ARE LOCATED IN TOWN OF WASTEWATER ORIGIN.
N
METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
NO AND
43.61
HAVERHILL
HAVER
13.19
HAVERHILL & GROVELAND
GROVELAND
MERRIMAC
MERR.
0.31
W. NEWBURY
WEST NEWBURY
AMESBURY
AMES
1.55
NEWBURYPORT
NEWBPT
3.05
NEWBURY
SALISBURY
SALIS.
1.67
GEORGETOWN
GEO.
0
GEORGETOWN & BOXFORD
BOXFORD
ROWLEY
ROWLEY
0
ATLANTIC
OCEAN
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
ALTERNATE 6
LAND-CENTRALIZED
ANDERSON-NICHOLS & CO., INC.


NOTES:
1. UNLESS OTHERWISE INDICATED, DISCHARGE IS TO MERRIMACK RIVER.
2. ALL LAND APPLICATION SITES ARE LOCATED IN TOWN OF WASTEWATER ORIGIN UNLESS OTHERWISE INDICATED.
N
METHUEN
LAWRENCE
ANDOVER
NORTH ANDOVER
BOXFORD
HAVERHILL
GROVELAND
WEST NEWBURY
GEORGETOWN
ROWLEY
MERRIMAC
AMESBURY
NEWBURYPORT
NEWBURY
SALISBURY
HAVERHILL & GROVELAND
TO ESTUARY
ATLANTIC OCEAN
LEGEND
RAW WASTEWATER
SECONDARY TREATED EFFLUENT
ADVANCED TREATED EFFLUENT
GREATER LAWRENCE SANITARY DISTRICT
TOWN
1990/2020 FLOW (mgd)
FLOW FROM TOWN TO DIFFERENT TREATMENT PLANTS
TOWN
1990 FLOW IN MGD
TREATMENT PLANT LOCATION
MERRIMACK WASTEWATER MANAGEMENT STUDY
MERRIMACK VALLEY PLANNING COMMISSION
LEAST COST ALTERNATE
ANDERSON-NICHOLS & CO., INC.
VERNON BOSTON CONCORD

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Billerica

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	40,061.4	337.69	419.10	861.4	65.55	84.83	6,054.5	279.80	347.90
2	43,631.4	362.37	449.38	462.0	50.62	57.58	3,871.0	289.24	327.64
3	39,360.0	310.74	384.32	487.5	55.35	62.10	11,953.0	402.67	436.43
4	38,852.0	320.22	417.58	13,125.4	185.39	191.66	3,180.0	274.58	307.28
5	39,121.0	317.66	366.42	861.4	65.55	84.83	12,600.5	132.79	134.76
6									
LEAST COST	39,658.4	317.36	403.52	861.4	65.55	84.83	6,054.5	279.80	347.90
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Chelmsford

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

PROGRAM									
ALTERNATE	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	12,569.4	158.57	235.49	1,466.3	56.80	68.35	4,506.1	151.70	203.10
2	15,093.8	200.93	242.32	1,974.0	58.36	59.85	2,488.5	185.94	210.63
3	12,193.0	178.90	221.16	292.5	33.21	37.26	8,706.0	259.18	279.44
4	11,971.4	178.45	218.60	10,373.6	141.76	145.93	2,120.0	183.06	304.86
5	12,887.4	175.35	205.66	692.6	35.13	50.47	7,329.6	73.45	74.88
6									
LEAST COST	12,464.4	171.17	230.13	627.3	33.00	48.40	4,506.1	151.70	203.10
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Dracut

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	17,337.2	131.75	151.38	257.4	21.70	23.80	2,124.0	126.40	136.10
2	18,739.4	152.51	173.44	2,510.0	57.31	60.29	1,659.0	123.96	140.42
3	16,973.0	131.90	150.68	2,424.0	57.66	60.36	5,107.0	164.80	178.30
4	16,913.0	130.59	148.43	5,033.8	73.39	75.48	1,060.0	91.53	102.43
5	16,771.9	131.75	138.05	194.6	21.67	23.81	7,991.9	95.96	96.19
6									
LEAST COST	17,337.2	131.75	151.38	257.4	21.70	23.80	2,124.0	126.40	136.10
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Dunstable

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	857.0	11.97	11.97	0	0	0	0	0	0
2	1,526.0	19.06	19.06	893.0	14.65	14.65	0	0	0
3	1,518.0	24.30	24.30	1,163.0	13.34	13.34	0	0	0
4	1,548.0	24.45	24.45	1,926.0	21.61	21.61	0	0	0
5	393.0	9.88	9.88	0	0	0	632.0	10.56	10.56
6									
LEAST COST	857.0	11.97	11.97	0	0	0	168.0	3.82	3.82
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Lowell

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

PROGRAM									
ALTERNATE	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	49,024.8	725.54	931.21	2,794.2	235.30	258.60	21,342.5	1,287.30	1,386.10
2	50,483.5	774.37	989.06	12,170.0	351.76	378.10	14,654.5	1,094.98	1,240.36
3	44,680.0	729.11	935.28	11,734.5	361.44	386.19	30,656.0	1,325.50	1,449.35
4	41,895.0	718.17	921.12	23,487.8	422.54	445.51	11,660.0	1,006.81	1,126.71
5	43,894.6	726.72	794.76	2,112.8	235.30	258.55	41,938.9	443.88	446.39
6									
LEAST COST	49,024.8	725.54	931.21	2,794.2	235.30	258.60	21,342.5	1,287.30	1,386.10
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Pepperell

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

PROGRAM									
ALTERNATE	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	5,622.0	93.35	105.95	1,010.0	81.80	96.30	8,740.0	381.00	483.20
2	5,612.0	93.30	105.71	2,127.0	42.67	42.67	0	0	0
3	5,134.0	57.71	57.71	0	0	0	0	0	0
4	5,134.0	57.71	57.71	0	0	0	0	0	0
5	5,612.0	93.30	105.71	1,010.0	81.80	96.30	9,131.0	75.99	82.89
6									
LEAST COST	5,612.0	93.30	105.71	1,010.0	81.80	96.30	9,131.0	75.99	82.89
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Tewksbury

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	11,230.5	138.03	172.52	477.9	40.20	44.2	3,829.9	229.1	246.7
2	13,521.6	167.85	204.65	4,262.0	96.62	101.59	2,765.0	206.60	234.03
3	10,523.0	139.13	174.17	4,097.0	97.02	101.52	8,744.0	277.32	299.82
4	10,469.5	137.59	172.50	8,712.6	130.23	134.40	2,120.0	183.06	304.86
5	10,163.9	138.01	149.59	361.4	40.25	44.23	13,683.5	162.72	163.14
6									
LEAST COST	11,230.5	138.03	172.52	477.9	40.20	44.20	3,829.9	229.10	246.70
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Tyngsborough

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

PROGRAM									
ALTERNATE	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	5,751.1	74.13	85.36	147.1	12.40	13.60	1,137.4	68.50	73.70
2	7,483.8	84.87	100.95	2,672.0	60.30	63.28	1,659.0	123.96	140.42
3	6,676.0	96.99	107.63	1,358.5	30.20	31.55	4,994.0	110.35	117.11
4	6,682.9	96.56	107.11	7,984.4	97.51	98.56	530.0	45.76	51.21
5	4,545.8	70.11	73.71	111.2	12.38	13.61	5,166.7	64.64	64.77
6									
LEAST COST	5,753.1	74.13	85.36	147.1	12.40	13.60	989.0	68.50	73.70
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Westford

PLANNING AREA: NMAC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	6,512.2	50.78	64.44	181.3	5.20	10.00	1,269.4	26.50	41.60
2	7,089.1	60.23	66.36	966.0	21.08	22.08	553.0	41.32	46.81
3	6,997.0	65.79	73.01	65.0	7.38	8.28	2,167.0	60.26	64.76
4	6,968.6	66.06	75.30	2,426.4	35.99	37.04	530.0	45.76	51.21
5	11,008.0	93.99	114.69	0	0	0	0	0	0
6									
LEAST COST	6,512.2	50.78	64.44	181.3	5.20	10.00	1,269.4	26.50	41.60
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Amesbury

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	5,900.8	95.00	129.26	1,114.1	46.19	52.62	2,794.5	121.12	143.69
2	5,901.7	86.61	119.58	1,289.4	52.09	59.39	3,240.0	143.90	169.7
3	6,665.4	96.81	116.78	2,128.5	43.76	47.63	1,805.0	97.98	113.35
4	6,665.4	96.81	116.78	2,128.5	43.76	47.63	1,805.0	97.98	113.35
5	5,564.4	84.01	99.37	460.0	34.80	42.10	2,214.4	20.82	21.32
6	5,564.4	84.01	99.37	460.0	34.80	42.10	2,214.4	20.82	21.32
LEAST COST	5,550.6	81.75	96.13	460.0	34.80	42.10	2,214.4	20.82	21.32
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Andover

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	29,854.8	395.59	492.90	724.5	80.64	93.74	6,230.0	481.64	541.49
2	29,875.8	396.02	493.33	724.5	80.64	93.74	6,230.0	481.64	541.49
3	29,808.8	395.36	488.77	670.4	77.44	90.03	5,880.0	489.28	550.08
4	29,833.8	395.48	404.89	516.6	63.42	72.82	4,770 0	411.88	460.93
5	29,854.8	395.59	492.90	724.5	80.64	93.74	6,230.0	481.64	541.49
6	29,854.8	395.59	492.90	724.5	80.64	93.74	6,230.0	481.64	541.49
LEAST COST	29,854.8	395.02	492.90	724.5	80.64	93.74	6,230.0	481.64	541.49
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Boxford

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	170.0	1.48	1.48	0	0	0	0	0	0
2	170.0	1.48	1.48	0	0	0	0	0	0
3	722.0	8.25	8.25	529.0	9.28	9.28	0	0	0
4	727.0	8.27	8.27	529.0	9.28	9.28	0	0	0
5	142.0	1.48	1.48	0	0	0	0	0	0
6	170.0	1.48	1.48	0	0	0	0	0	0
LEAST COST	170.0	1.48	1.48	0	0	0	0	0	0
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Georgetown

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	794.0	9.15	9.15	0	0	0	0	0	0
2	794.0	9.15	9.15	0	0	0	0	0	0
3	664.0	8.18	8.18	651.0	11.21	11.21	0	0	0
4	669.0	8.20	8.20	651.0	11.21	11.21	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
LEAST COST	794.0	9.15	9.15	0	0	0	0	0	0
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Groveland

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

PROGRAM									
ALTERNATE	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	10,276.4	91.89	112.13	146.4	14.85	17.35	1,423.0	93.02	105.72
2	10,276.4	91.89	112.13	146.4	14.85	17.35	1,423.0	93.02	105.72
3	10,195.4	90.90	107.50	1,707.7	42.31	44.67	1,102.5	91.74	103.14
4	10,297.4	90.99	107.54	1,696.8	41.88	43.97	1,060.0	91.53	102.43
5	10,457.7	94.91	103.10	146.4	14.85	17.35	2,748.0	26.29	26.61
6	10,457.7	94.91	103.10	146.4	14.85	17.35	2,748.0	24.40	24.40
LEAST COST	10,276.4	91.89	112.13	146.4	14.85	17.35	1,423.0	93.02	105.72
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Haverhill

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	37,025.1	512.79	702.45	1,783.1	172.26	201.06	12,955.4	837.18	951.48
2	37,427.6	516.88	706.54	1,683.6	170.75	199.55	12,955.4	837.18	951.48
3	38,765.2	519.19	728.85	9,077.5	259.68	279.36	9,187.5	764.5	859.5
4	37,691.7	519.32	710.18	8,891.0	244.39	260.05	7,950.0	686.46	768.21
5	36,094.0	514.38	609.09	1,683.6	170.75	199.55	23,019.6	144.09	147.77
6	36,032.0	513.02	609.97	1,683.6	170.75	199.55	22,888.6	120.12	120.12
LEAST COST	37,084.6	514.14	703.80	1,683.6	170.75	199.55	13,171.4	840.44	954.74
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Lawrence

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	31,400.2	711.19	969.81	2.035.5	226.56	263.38	17,110.0	1,353.17	1,521.32
2	31,474.2	712.46	974.89	2,035.5	226.56	263.38	17,110.0	1,353.17	1,521.32
3	30,782.2	710.62	973.05	1,759.8	203.28	236.33	15,435.0	1,284.36	1,443.96
4	30,833.0	710.88	973.31	1,435.0	176.18	202.28	13,250.0	1,144.10	1,280.35
5	31,400.2	711.19	969.81	2,035.5	226.56	263.38	17,110.0	1,353.17	1,521.32
6	31,400.2	711.19	969.81	2,035.5	226.56	263.38	17,110.0	1,353.17	1,521.32
LEAST COST	31,400.2	711.19	969.81	2,035.5	226.56	263.38	17,110.0	1,353.17	1,521.32
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Merrimac

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	4,050.0	35.24	43.73	1,075.9	20.81	22.30	655.5	27.95	33.71
2	5,409.0	47.62	52.17	0	0	0	0	0	0
3	4,618.9	46.39	52.08	632.5	11.10	11.87	361.0	19.60	22.67
4	4,618.9	46.39	52.08	632.5	11.10	11.87	361.0	19.60	22.67
5	3,862.0	33.97	37.97	913.5	1.40	1.80	1,553.8	24.06	27.66
6	3,830.0	31.94	35.94	913.5	1.40	1.80	1,646.8	25.15	28.75
LEAST COST	3,963.5	38.87	43.87	0	0	0	2,467.3	25.46	29.46
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Methuen

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	9,796.0	163.82	213.29	414.0	46.08	53.57	3,340.0	252.29	283.64
2	9,791.6	163.64	213.11	414.0	46.08	53.57	3,400.0	252.29	283.64
3	9,766.6	163.67	217.04	335.2	38.72	45.02	2,940.0	244.64	275.04
4	9,785.5	163.76	217.13	287.0	35.24	40.46	2,650.0	228.82	256.07
5	9,796.0	163.82	213.29	414.0	46.08	53.57	3,340.0	252.29	283.64
6	9,796.0	163.82	213.29	414.0	46.08	53.57	3,340.0	252.29	283.64
LEAST COST	9,796.0	163.82	213.29	414.0	46.08	53.57	3,400.0	252.29	283.64
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Newbury

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	8,444.5 9,120.5	73.70 76.68	80.39 83.77	0	0	0	0	0	0
2	9,756.6	81.56	88.27	0	0	0	0	0	0
3	8,922.4	80.82	90.46	94.5	8.13	9.52	649.8	35.27	40.81
4	8,807.3	78.16	86.75	94.5	8.13	9.52	649.8	35.27	40.81
5	8,452.6 9,128.6	74.41 77.79	79.74 83.12	123.5	10.32	12.24	0	0	0
6	8,452.6 9,128.6	74.41 77.29	79.74 83.12	123.5	10.32	12.24	0	0	0
LEAST COST	8,449.1	74.17	79.82	0	0	0	0	0	0
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Newburyport

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	9,740.5 11,768.5	123.08 133.22	153.86 164.00	0	0	0	0	0	0
2	12,203.8	144.86	175.72	0	0	0	0	0	0
3	10,728.3	143.32	184.24	399.0	34.31	40.20	2,743.0	148.92	172.29
4	10,535.6	137.72	175.40	399.0	34.31	40.20	2,743.0	148.92	172.29
5	9,771.5 11,799.5	127.94 138.08	150.75 160.89	526.5	43.98	52.16	0	0	0
6	9,771.5 11,799.5	127.94 138.08	150.75 160.89	526.5	43.98	52.16	0	0	0
LEAST COST	9,750.2	127.63	152.29	0	0	0	0	0	0
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: North Andover

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	8,584.4	122.63	158.22	276.0	30.72	35.71	2,320.0	183.48	206.28
2	8,494.4	120.50	276.59	276.0	30.72	35.71	2,320.0	183.48	206.28
3	8,558.4	122.50	152.09	251.4	29.04	33.76	2,205.0	183.48	206.28
4	8,577.4	122.59	158.18	229.6	28.19	32.36	2,120.0	183.06	204.86
5	8,584.4	122.63	158.22	276.0	30.72	35.71	2,320.0	183.48	206.28
6	8,584.4	122.63	158.22	276.0	30.72	35.71	2,320.0	183.48	206.28
LEAST COST	8,584.4	122.63	158.22	276.0	30.72	35.71	2,320.0	183.48	206.28
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Rowley

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	1,590.0	21.93	21.93	0	0	0	0	0	0
4	1,590.0	21.93	21.93	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
LEAST COST									
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: Salisbury

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

PROGRAM									
ALTERNATE	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	7,298.0 9,296.0	92.84 102.83	109.50 119.49	0	0	0	0	0	0
2	8,242.4	97.72	115.31	0	0	0	0	0	0
3	7,972.3	98.16	120.22	1,891.1	41.77	45.33	1,660.6	90.14	104.28
4	9,152.1	111.09	134.31	241.5	20.77	24.33	1,660.6	90.14	104.28
5	7,278.5	95.81	105.10	450.0	38.30	43.40	1,856.0	21.63	21.93
6	7,278.5	95.81	105.10	450.0	38.30	43.40	1,856.0	21.63	21.93
LEAST COST	7,316.7	95.27	106.33	0	0	0	0	0	0
PREFERRED ALTERNATE									

CONSTRUCTION AND OPERATION & MAINTENANCE COST SUMMARY

TOWN: West Newbury

PLANNING AREA: MVPC

NOTE: Costs in thousand of dollars.

ALTERNATE	PROGRAM								
	1977			1983			1985		
	CONSTRUCTION	O & M (1977)	O & M (1997)	CONSTRUCTION	O & M (1983)	O & M (1997)	CONSTRUCTION	O & M (1985)	O & M (1997)
1	236.0	5.06	5.06	600.6	8.36	8.36	0	0	0
2	1,096.0	11.36	11.36	0	0	0	0	0	0
3	668.0	7.22	7.22	0	0	0	0	0	0
4	668.0	7.22	7.22	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	236.0	5.06	5.06	0	0	0	374.0	4.95	4.95
LEAST COST	0	0	0	0	0	0	0	0	0
PREFERRED ALTERNATE									

Costs for Municipal Collection Systems
Northern Middlesex Area Commission

	Alternative 1	2	3	4	5	Least Cost
Billerica	$30,733.6	$30,733.6	$30,733.6	$30,733.6	$30,733.6	$30,733.6
Chelmsford	4,760.5	4,760.5	3,950.2	3,950.2	5,161.8	4,760.5
Dracut	12,978.5	12,978.5	12,978.5	12,978.5	12,978.5	12,978.5
Dunstable	0	0	0	0	0	0
Lowell	25,595.8	23,470.6	25,595.8	25,595.8	25,595.8	25,595.8
Pepperell	2,496.6	2,596.6	2,596.6	2,596.6	2,596.6	2,596.6
Tewksbury	6,649.3	6,649.3	6,649.3	6,649.3	6,649.3	6,649.3
Tyngsborough	1,573.4	1,573.4	1,573.4	1,573.4	1,573.4	1,573.4
Westford	3,671.8	3,671.8	3,671.8	3,671.8	3,671.8	3,671.8

NOTES: (1) Costs are stated in thousands of dollars
(2) Municipal collection system costs are for 1990 sewer service areas

Costs for Municipal Collection Systems
Merrimack Valley Planning Commission

	Alternative 1	2	3	4	5	6	Least Cost
Amesbury	$ 3,317.6	$ 3,317.6	$ 2,645.0	$ 2,645.0	$ 3,317.6	$ 3,317.6	$ 3,317.6
Andover	16,786.3	16,786.3	16,786.3	16,786.3	16,786.3	16,786.3	16,786.3
Boxford	0	0	0	0	0	0	0
Georgetown	0	0	0	0	0	0	0
Groveland	7,361.4	7,361.4	7,361.4	7,361.4	7,742.5	7,742.5	7,361.4
Haverhill	22,773.9	22,773.9	22,773.9	22,773.9	22,773.9	22,773.9	22,773.9
Lawrence	7,285.5	7,285.5	7,285.5	7,285.5	7,285.5	7,285.5	7,285.5
Merrimac	2,922.3	2,604.6	2,604.6	2,604.6	2,922.3	2,922.3	2,922.3
Methuen	4,472.3	4,472.3	4,472.3	4,472.3	4,472.3	4,472.3	4,472.3
Newbury	5,366.7	5,366.7	5,086.8	5,086.8	5,366.7	5,366.7	5,366.7
Newburyport	5,296.1	5,296.1	5,296.1	5,296.1	5,296.1	5,296.1	5,296.1
North Andover	4,901.7	4,901.7	4,901.7	4,901.7	4,901.7	4,901.7	4,901.7
Rowley	0	0	0	0	0	0	0
Salisbury	4,454.4	4,454.4	4,454.4	4,454.4	4,454.4	4,454.4	4,454.4
West Newbury	0	0	0	0	0	0	0

NOTES: (1) Costs stated in thousands of dollars
(2) Municipal collection system costs are for proposed 1990 sewer service areas

TABLE 6

SUMMARY OF FLOWS

		1990			2020		
		sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)	sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)
NORTHERN MIDDLESEX AREA COMMISSION							
Billerica	Residential	31.79	82.1	2.61	47.43	100.1	4.75
	Industrial			2.00			2.50
	Infiltration			0.91			1.66
	TOTAL			5.52			8.91
Chelmsford	Residential	16.13	101.0	1.63	43.16	109.8	4.74
	Industrial			0.20			0.18
	Infiltration			0.33			0.95
	TOTAL			2.16			5.87
Dracut	Residential	24.48	66.2	1.62	26.78	79.9	2.14
	Industrial			0.43			0.90
	Infiltration			0.32			0.43
	TOTAL			2.37			3.47
Dunstable	Residential	*			13.5	85	1.15*
	Industrial						0
	Infiltration						0.23
	TOTAL						1.38
Lowell	Residential	84.0	91.3	7.67	99.79	100	9.98
	Industrial			4.36			5.45
	Infiltration			4.60			5.99
	Stormwater (Equalized)			10.84			10.84
				27.47			32.26
Pepperell	Residential	8.51	94.0	0.80	17.20	105.8	1.82
	Industrial			4.55			7.05
	Infiltration			0.16			0.36
	TOTAL			5.51			9.23

*Estimated flow based on 75% of 2020 population served at a sewage flow of 85 gpcd
These towns have no existing or presently proposed sewage systems for 1990.

TABLE 6 (continued)

		1990			2020		
		sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)	sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)
NORTHERN MIDDLESEX AREA COMMISSION							
Tewksbury	Residential	20.59	76.3	1.57	32.47	92.4	3.00
	Industrial			1.71			2.90
	Infiltration			0.31			0.60
	TOTAL			3.59			6.50
Tyngsborough	Residential	8.84	74.7	0.66	19.72	99.9	1.97
	Industrial			0.74			1.44
	Infiltration			0.13			0.39
	TOTAL			1.53			3.80
Westford	Residential	2.73	69.6	0.19	10.02	91.8	0.92
	Industrial			0.15			0.20
	Infiltration			0.04			0.18
	TOTAL			0.38			1.30
MERRIMACK VALLEY PLANNING COMMISSION							
Amesbury	Residential	12.4	73.4	0.91	17.75	76.6	1.36
	Industrial			0.32			0.52
	Infiltration			0.32			0.48
	TOTAL			1.55			2.36
Andover	Residential	31.5	74.6	2.35	34.3	80	2.74
	Industrial			6.45			10.48
	Infiltration			0.83			0.96
	TOTAL			9.63			14.18
Boxford	Residential	*			8.25	85	0.70*
	Industrial						0
	Infiltration						0.14
	TOTAL						0.84
Georgetown	Residential	*			9.9	76.8	0.76 *
	Industrial						0.01
	Infiltration						0.15
	TOTAL						0.92

*These towns have no existing or presently proposed sewage systems for 1990.

TABLE 6 (continued)

		1990			2020		
		sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)	sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)
MERRIMACK VALLEY PLANNING COMMISSION							
Groveland	Residential	7.7	76.7	0.59	10.5	93.3	0.98
	Industrial			0.26			1.42
	Infiltration			0.12			0.20
	TOTAL			0.97			2.60
Haverhill	Residential	49.0	93.3	4.57	59.0	100.2	5.91
	Industrial			4.91			6.58
	Infiltration			2.74			3.55
	Stormwater (Equalized)			5.50			5.50
				17.72			21.54
Lawrence	Residential	69.0	70.4	4.86	71.0	76.5	5.43
	Industrial			16.63			23.82
	Infiltration			2.92			3.26
	Stormwater (Equalized)			4.90			4.90
				29.31			37.41
Merrimac	Residential	2.6	69.2	0.18	4.0	90.0	0.36
	Industrial			0.09			0.15
	Infiltration			0.04			0.07
	TOTAL			0.31			0.58
Methuen	Residential	39.95	76.1	3.04	43.38	88.5	3.84
	Industrial			0.93			1.19
	Infiltration			1.82			2.30
	TOTAL			5.79			7.33
Newbury	Residential	4.0 (w)	104	0.46	6.0 (w)	112	0.71
	Industrial	1.0 (s)	40	0	1.0 (s)	40	0
	Infiltration			0.09			0.14
	TOTAL			0.55			0.85

(w) Denotes winter population
(s) Denotes summer population

TABLE 6 (continued)

		1990			2020		
		sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)	sewered population (in thous.)	sewage flow (gpcd)	sewage flow (MGD)
MERRIMACK VALLEY PLANNING COMMISSION							
Newburyport	Residential	16.7 (w)	80.2	1.36	22.5 (w)	85.8	1.95
	Industrial	0.5 (s)	40	0.66	0.5 (s)	40	0.97
	Infiltration			0.48			0.68
	TOTAL			2.50			3.60
North Andover	Residential	16.6	97.0	1.61	20.0	105	2.10
	Industrial			1.61			2.39
	Infiltration			0.56			0.74
	TOTAL			3.78			5.23
Rowley	Residential	*			4.28	85	0.36*
	Industrial						0
	Infiltration						0.07
	TOTAL						0.43
Salisbury	Residential	5.0 (w)	104	1.24	7.7 (w)	112	1.58
	Industrial	18.0 (s)	40	0	18.0 (s)	40	0
	Infiltration			0.43			0.55
	TOTAL			1.67			2.13
West Newbury	Residential	*			3.0	85	0.26*
	Industrial						0
	Infiltration						0.05
	TOTAL						0.31

*These towns have no existing or presently proposed sewage systems for 1990.

(w) Denotes winter population
(s) Denotes summer population

WATER ORIENTED BIOLOGICAL TREATMENT

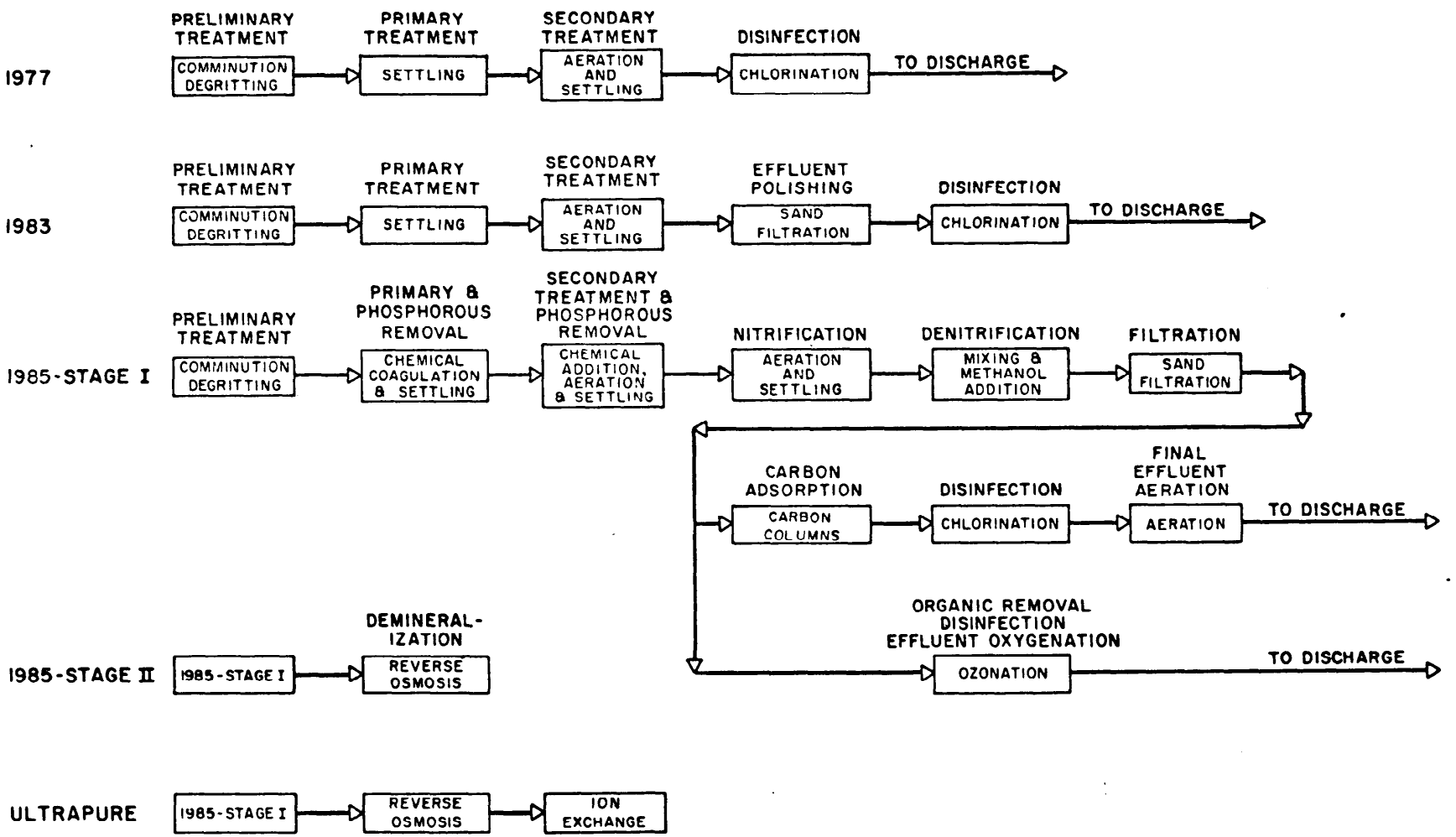


FIGURE 16

LAND ORIENTED

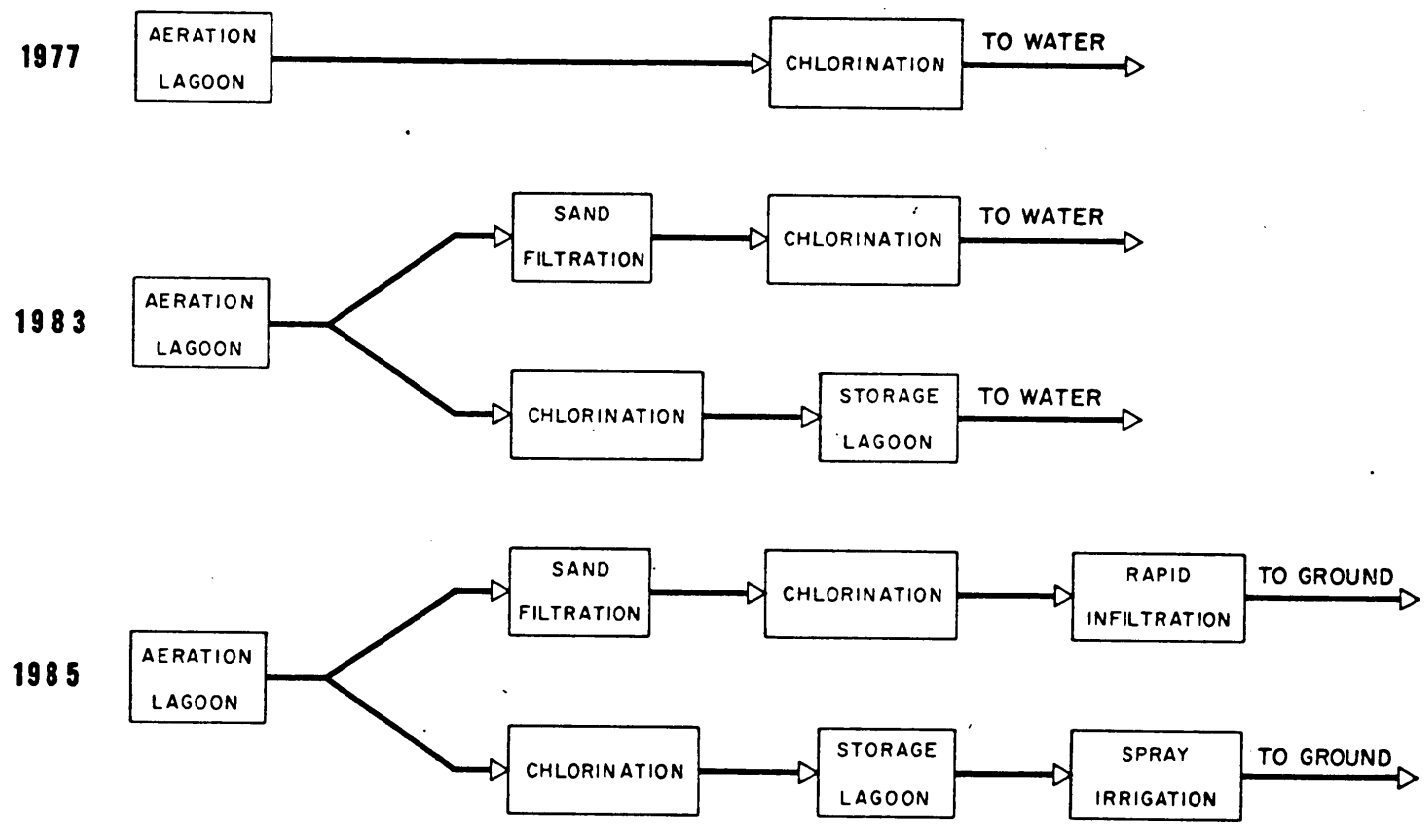


FIGURE 18

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Amesbury

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetic
				O	O	(-L) 80-acre rapid infiltration site would be visible from Route 495
				O	O	(-L) Existing landscape would be destroyed
				O	O	(+L) Recreation would be possible if additional land were acquired
						Biological
O						(+L) Effluent would augment low flow in Powwow River during summer
O						(+L) Increased flow would add to dissolved oxygen in Powwow River
O						(+L) Decrease in levels of toxic metals would allow sensitive game fish in Powwow River
O						(-L) Residual chlorine and ammonia in effluent would be toxic to some aquatic life near outfall during low flow periods in Powwow River
		O	O			(+L) Water quality in estuary would improve
						Engineering
				O	O	(+L) Operation would require one-half the manpower, two-thirds the energy needs and one-eight the chemicals of other alternatives
						Socio-Economic
				O	O	(-L) Site location in low density area would hinder industrial development
				O	O	(+L) Site location in low density area would maintain open space
O	O	O	O	O	O	(-L) Sewer service area in low density area would create pressure for development contrary to goals for open space
O	O	O	O	O	O	(+L) Sewer service area would permit economic development in low density area

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Boxford (75% of southern area)

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
Aesthetics						
(-L) 230-acre spray irrigation site would destroy existing character and landscape					o	
(+L) Recreation would be possible with the acquisition of extra land					o	
Biological						
(+L) Wastewater discharge outside Merrimack River watershed should have a good impact		o				
(-L) Transmission lines might create hazards from vandalism and leakage into groundwater			o	o		
Engineering						
(+L) Operation would require one-third the manpower, the same amount of energy and one-eight the chemicals of the other alternatives					o	o
Socio-Economic						
(+L) Site location would support both goals for economic development and open space					o	

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Georgetown

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.
						Aesthetics
		●	●		●	(+L) Transmission line would make possible one-mile path along Penn Brook
		●	●		●	(-S) Transmission line layout would disrupt landscape
				●		(-L) 460-acre spray irrigation site would be visible from village center
				●		(-L) Site would mar the existing landscape
				●		(+L) Recreation would be possible with acquisition of extra land
						Biological
●	●	●	●			(+L) Turbidity of Merrimack River would decrease
●	●	●	●			(-L) Tidal impoundment might cause toxicity from ammonia and residual chlorine near outfalls
●	●	●	●			(+L) Overall condition of Merrimack River would improve
						Engineering
				●	●	(+L) Operation would require one-third the manpower, the same amount of energy and one-eight the chemicals of other alternatives
						Socio-Economic
				●	●	(+L) Location would support economic development
				●	●	(-L) Location would detract from goals of maintaining public open space while regulating development
●	●	●	●	●	●	(+L) Sewer service area would cover area of maximum density

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Greater Lawrence Sanitary District
(Andover, Lawrence, Methuen and North Andover)

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetics
			o			(+L) Transmission lines would allow six miles of path along Merrimack River
			o			(-S) Transmission line construction would disrupt riverscape and areas of St. Francis Seminary, Greater Lawrence Vocational Technical School, Deer Jump Reservation and Riley Playground
						Biological
			o			(?) Effluent discharge might have significant impact
			o			(-S) Treatment plant failures would have severe impact on local aquatic life
o	o	o	o	o	o	(+L) Improved water quality would enhance condition of Merrimack River
o	o	o	o	o	o	(-L) Ammonia and residual chlorine in effluent might be toxic to aquatic life near outfall
		o	o			(-S) Work stoppages and treatment failure would create public health hazards
o	o	o	o	o	o	(-L) Stormwater overflows from combined sewers of Lawrence would exceed design capacity of system, causing public health hazards
						Socio-Economic
o	o	o	o	o	o	(-L) Sewer service area in Andover and Methuen would extend into low density area, creating pressure for development
o	o	o	o	o	o	(+L) Sewer service area in low density areas would permit economic development
o	o	o	o	o	o	(+L) Treatment Plant site would be compatible with land use plans

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Haverhill and Groveland

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetic
				●	●	(-S) Transmission line construction to Bagrall School would cause disruptions
				●	●	(-L) Landscape along Johnson Creek would be marred
				●	●	(+L) Two-mile path on transmission line to Johnson Creek would be possible
				●	●	(-L) 220-acre site would destroy existing landscape
				●	●	(+L) Recreation would be possible if extra land were acquired
						Biological
●	●	●	●			(+L) Turbidity in Merrimack River would be reduced
●	●	●	●			(+L) Overall condition of Merrimack River would be substantially improved
				●	●	(+L) Removal of wastewater from Merrimack would benefit aquatic life
●	●	●	●			(-L) Tidal impoundments might cause toxicity to aquatic life from ammonia and residual chlorine near outfall
				●	●	(+L) Effluent would flow toward Merrimack River and eliminate any threat to groundwater supply
						Engineering
				●	●	(+L) Operation would require one-half the man hours, two-thirds the power and one-eight the chemicals of other alternatives
						Socio-Economic
				●	●	(-L) 220-acre and 130-acre sites in Haverhill would not support economic development
				●	●	(+L) Sites in Haverhill would permit open space
				●	●	(-L) 180-acre site in low density area of Groveland would hinder economic development
				●	●	(+L) Groveland site would allow maintenance of open space
●	●	●	●	●	●	(+L) Sewer service areas in Haverhill would be consistent with goals of economic development
●	●	●	●	●	●	(-L) Sewer service areas would create pressure for development contrary to desires for open space
●	●	●	●	●	●	(-S) Street traffic would be disrupted by pipeline construction

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Merrimac

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetic
				o	o	(-L) 400-acre site would be visible from Route 495
				o	o	(-L) Site would destroy existing landscape
				o	o	(+L) Recreation would be possible with the acquisition of extra land
				o	o	(+L) Flow augmentation would enhance Cobbler Brook area
						Biological
o						(-L) Effluent might cause ammonia and residual chlorine to reach toxic levels to aquatic life near outfall during low flow periods in Powwow River
		o	o			(+L) Water quality in estuary would improve substantially
						Engineering
				o	o	(+L) Operation would require one-third the manhours, the same amount of energy and one-eighth the chemicals of other alternatives
						Socio-Economic
o	o	o	o	o	o	(+L) Sewer service area would be consistent with goals for economic development
				o	o	(-L) Land application site would hinder economic development
				o	o	(+L) Land application site would maintain open space

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Newbury and Newburyport

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetic
●				●	●	(-L) Treatment plant would be located in historic waterfront area
		●	●			(+L) Water sculpture would be possible at outfall
						Biological
●				●	●	(+L) Secondary effluent would have a negative effect on estuarine environment. Ammonia would remain toxic because of high alkalinity of salt water. Residual chlorine and chloramines would have sub-lethal effect on estuarine organisms
●	●			●	●	(+L) Ocean outfall would benefit shellfish beds and recreation areas in estuary
		●	●			(+L) Discharge of effluent into estuary after advanced treatment would improve water quality
		●	●			(-L) Possible treatment plant failures would endanger swimming areas and destroy shellfish beds
		●	●			(-L) Effluent discharge might be hazardous during low periods of low tides
						Engineering
		●	●			(-L) Ozonation instead of chlorination before using estuary outfall would require one-fifth the man hours and 10 times the energy of chlorination
●	●			●	●	(-L) Ocean outfall might be plugged by ocean current or damaged by storms
						Socio-Economic
●				●	●	(-L) Treatment plant on waterfront would be inconsistent with goals of economic development and open space
	●	●	●			(-L) Treatment plant in industrial zone would hinder economic development
	●	●	●			(+L) Treatment plant site would allow open space
●	●	●	●	●	●	(-L) Sewer service area inopen space would be contrary to maintaining open space
●	●	●	●	●	●	(+L) Sewer service area in open space would permit economic development
●				●	●	(+L) Ocean outfall would benefit commercial fisheries
●	●	●	●	●	●	(+L) Improved water quality would increase tourism and recreation
●	●	●	●	●	●	(-S) Pipeline construction in downtown Newburyport would disrupt street traffic

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Rowley

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.
						Aesthetic
				●	●	(-L) 200-acre spray irrigation site and treatment plant would degrade natural character of open space
				●	●	(+L) Some recreation would be possible if extra land were acquired
●						(-L) Landscape near Sand Creek would be disrupted
						Biological
	●					(+L) Out-of-basin transfer of wastewater would benefit Merrimack River Basin
		●	●			(+L) Discharge of effluent to estuary after advanced treatment would improve water quality
		●	●			(-L) Passage of transmission line through salt marsh would endanger public health if leak of raw sewage occurred
						Engineering
				●	●	(+L) Operation would require one-third the man hours, same amount of energy and one-eighth the chemicals of other alternatives
●				●	●	(-L) Sites would hinder goals of maintaining open space
●				●	●	(+L) Sites would favor economic development

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Salisbury

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetics
●	●	●				(-L) Treatment plan would be visible from Salisbury Beach and Merrimack River
		●				(-L) Pipeline would leave man-made scar on land
				●	●	(+L) Recreation would be possible with acquisition of extra land
				●	●	(-L) 110-acre rapid infiltration site would be visible from Route 95 and Elm Street
						Biological
		●	●	●	●	(+L) Possibilities of algae blooms would be reduced
		●	●	●	●	(+L) Diverse fish and shellfish species would be possible
		●	●	●	●	(+L) Build-up of toxic materials in fish would be eliminated
				●	●	(+L) Eliminating discharges would prevent bypassing of treatment plants
●						(-L) Discharging secondary effluent into estuary would release ammonia that would remain toxic due to alkalinity of salt water. Residual chlorine and chloramines would have sub-lethal effect on estuarine organisms. Heavy metals in secondary effluent would be toxic to aquatic life
				●	●	(+L) Reduced wastewater discharge would benefit sensitive aquatic life to estuary
						Engineering
				●	●	(+L) Operation would require one-half the man hours, two thirds the power and one-eighth the chemicals of other alternatives
						Socio-Economic
				●	●	(+L) 110-acre site would maintain open space and regulate development
				●	●	(-L) Site would not enhance property values
●	●	●	●	●	●	(+L) Sewer service area would encompass low density and commercial zones in support of economic development
●	●	●	●	●	●	(-L) Sewer service area in low density area would create development pressure contrary to goal of maintaining open space
●	●	●	●	●	●	(-S) Pipeline construction would disrupt street traffic

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area West Newbury

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
Aesthetic						
(-L) 460-acre spray irrigation site would destroy natural landscape					o	o
(+L) Recreation would be possible with extra land acquisition					o	o
(-L) Transmission line would degrade natural landscape		o				
Biological						
(-L) Effluent might create toxic levels of ammonia, chloramines and residual chlorine near outfall during low flow periods in Powwow River	o					
(+L) Discharging effluent to estuary after advanced treatment would improve water quality			o	o		
(+L) Effluent would flow toward Merrimack River and eliminate possibility of groundwater contamination					o	o
Engineering						
(+L) Operation would require one-third the man hours, the same amount of energy and one-eighth the chemicals of other alternativ es					o	o
Socio-Economic						
(+L) Sites in low density area would support goals of maintaining open space					o	o
(-L) Sites would not support goals of economic development or enhance property values					o	o

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Billerica

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
Aesthetic						
(+L) Recreation at treatment site would be possible with the acquisition of extra land	●					
(-L) Sludge incinerator would degrade natural skyline	●					
(-L) Rapid infiltration site near Walden Pond would destroy natural landscape					●	
Biological						
(+L) Ending discharge of effluent in Concord River would benefit aquatic life				●	●	●
(-L) Effluent would dominate Concord River during low flow periods with possible problems of toxicity from ammonia, residual chlorine and chloramines to aquatic life near outfall	●	●	●			
(+L) Effluent would augment low flow in Concord River during dry seasons		●	●			
(?) Substantial effluent discharge would affect Merrimack River near outfall				●		
(-S) Possible treatment failures would harm aquatic life				●		
(+L) Merrimack River would be able to assimilate effluent after treatment failure than Concord River				●		
(-L) Effluent discharge above water supply intake would create a public health hazard in event of treatment failure; downstream bypass would be needed	●		●			
Engineering						
(+L) Operation would require one-half the man hours, two-thirds the amount of energy and one-eighth the chemicals of other alternatives					●	●
(+L) Flow augmentation would ensure adequte water supply			●			
(+L) Sludge and solid waste resource recovery facility would provide revenue for town	●	●	●			
Socio-Economic						
(+L) Treatment site in industrial zone would support goals of economic development and maintenance of open space	●	●	●	●		

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Lowell, Dracut, Tewksbury and Eastern Tyngsborough

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						Aesthetic
O						(-L) Facility would destroy natural character of Duck Island and degrade riverscape
				O	O	(-L) 460-acre rapid infiltration site in Fort Devens area would be visible from Route 110
				O	O	(-L) Site would destroy existing woodland
						Biological
	O	O				(+L) Effluent discharge would augment low flow in Concord River during summer, add dissolved oxygen to river and lower solar heating
	O	O				(-L) Effluent discharge during low flow periods would dominate river with possible toxicity to aquatic life near outfall from ammonia, chloramines and residual chlorine
				O	O	(+L) Ending discharge into Merrimack River would benefit aquatic life
				O	O	(-L) Amount of wastewater would be too great and its consistency too variable to provide enough information for full public health assessment
				O	O	(-L) Long transmission line would present hazards of vandalism and leaks into groundwater
				O	O	(+L) If system were shown as feasible, it would improve water temperature of Nashua River and provide aquifer storage in dry weather
						Engineering
O						(O) Site existing in flood plain above 100-year minimum flood elevation would be extended with special flood-proofing and pumping
O						(-S) Repetition of 1936 flood would damage facility and contaminate Merrimack River
				O	O	(+L) Operation would require one-half the man hours, two-thirds the amount of energy and one-eighth the chemicals of other alternatives
				O	O	(-L) Operation would require substantial amounts of energy for pumping through transmission lines
						Socio-Economic
				O	O	(-L) Rapid infiltration site on land designated for public use in Lancaster, industrial use in Bolton and military training at Fort Devens would be contrary to goals of regional and local economic development and maintenance of open space

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Lowell, Dracut, Tewksbury and Eastern Tyngsborough (Cont'd)

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
⊖	⊖	⊖	⊖	⊖	⊖	(+L) Sewer service area in Tewksbury would support local goal of economic development
⊖	⊖	⊖	⊖	⊖	⊖	(-L) 1990 Sewer service area in Lowell might encourage suburban development against goal of maintaining open space
⊖	⊖	⊖	⊖	⊖	⊖	(+L) Sewer service area in Lowell would encourage intensive development consistent with goal of economic development
⊖	⊖	⊖	⊖	⊖	⊖	(-L) Sewer service area in East Dracut would not serve an industrial zone contrary to local goal of economic development
⊖	⊖	⊖	⊖	⊖	⊖	(-S) Expansion of pipeline would disrupt street traffic in Lowell

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Southern Chelmsford

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.
						Biological
o	o	o				(+L) Effluent would augment flow in Concord River during dry seasons
o	o	o				(+L) Efflunet discharge should add to levels of dissolved oxygen and reduce solar heating
o	o	o				(-S) Effluent would dominate river in low flow periods and many may be toxic to aquatic life near outfall because of ammonia, chloramine and residual chlorine
			o			(+L) Ending effluent discharge into Concord River would aid aquatic life
			o			(?) Substantial flows would have significant impact on Merrimack River
			o			(-S) Treatment failure would harm aquatic life near outfall
			o			(+L) In event of treatment failure, Merrimack River would be able to assimilate wastes better than Concord River
			o			(-L) Long transmission line would offer possibilities for vandalism and leaks into groundwater
						Engineering
					o	(+L) Operation would require one-half the man hours, two-thirds the amount of energy and one-eighth the chemicals of other alternatives
						Socio-Economic
o						(+L) Site in industrial zone would support goal of maintaining open space
o						(-L) Site would take space needed for economic development
				o	o	(-L) Site would not support goal of economic development

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Westford

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.						
Aesthetic						
(-L) 490-acre spray irrigation site would mar natural landscape					●	●
(-L) Site would be visible from Routes 495 and 22 and ski slope					●	●
(+L) Recreation would be possible with acquisition of extra land					●	●
Biological						
(+L) Effluent would improve water quality near outfall in Merrimack River	●					
(+L) Effluent would augment low flow in Concord River during summer		●	●			
(+L) Effluent should increase levels of dissolved oxygen and reduce solar heating		●	●			
(-L) During low flow periods effluent would dominate river flow with possibility of ammonia, chloramines and residual chlorine proving toxic to aquatic life near outfall		●	●			
(?) Discharge would have substantial impact on Merrimack River					●	
(-S) Treatment failure could prove toxic to aquatic life					●	
(+L) Spray irrigation sites would present no public health hazards					●	●
Engineering						
(+L) Operation would require one-third the man hours, the same amount of energy and one-eighth the chemicals of other alternatives					●	●
Socio-Economic						
(?) Need for sewage collection system would be eliminated by not allowing small house lots, large apartments or condominiums as soils are suitable for on-site disposal systems	●	●	●	●		
(-L) Limited sewer service areas would limit economic growth and provide concentrated housing development contrary to goals of economic development and town desires to maintain low density housing	●	●	●	●	●	●
(-S) Pipeline construction would disrupt street traffic	●	●	●	●	●	●

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Pepperell and Western Dunstable

ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6	
						These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.
						Aesthetic
				●	●	(-L) 280-acre rapid infiltration site would mar natural landscape
				●	●	(+L) Recreation at site would be possible with acquisition of extra land
				●	●	(+L) 105-mile recreation path would be possible along pipeline
●						(+L) Facility would discharge improved quality of water to Nashua River
●						(+L) Effluent discharge would augment flow in Nashua River during dry seasons
	●	●	●			(-L) Transmission line would be subject to vandalism and leaks into groundwater
				●	●	(+L) System would eliminate effluent discharge into Nashua River
●	●	●	●	●	●	(-L) On-lot disposal
						Engineering
●				●	●	(+L) Effluent could be reused by industry
				●	●	(+L) Operation would require one-half the man hours, two-thirds the amount of energy and one eighth the chemicals of other alternatives
						Socio-Economic
	●	●	●			(+L) Transfer of water to Ayer would maintain availability of industrial land in support of economic development goals
				●	●	(-L) Site would eliminate land for industrial use
●	●	●	●	●	●	(-L) Sewer service area would not cover industrial zone; instead, it would cover low density area and create pressure for housing development in lieu of maintaining open space

-L - Adverse impact - long term
-S - Adverse impact - short term
+L - Beneficial impact - long term
+S - Beneficial impact - short term

SUMMARY OF IMPACTS

Geographical Area Northern Chelmsford, Western Tyngsborough and Eastern Dunstable

These are preliminary findings of impacts which are subject to review and refinement by local, regional, state and Federal agencies.

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5	ALTERNATIVE 6
Aesthetic						
(-L) 210-acre rapid infiltration site in Tyngsborough would be visible from Route 3					●	●
(-L) Site would destroy existing landscape					●	●
Biological						
(+L) Effluent would improve water quality in Merrimack River near outfall	●					
(+L) Effluent would augment low flow in Concord River during summer		●	●			
(+L) Effluent should increase levels of dissolved oxygen and reduce solar heating		●	●			
(-L) Ammonia, chloramines and residual chlorine in effluent might prove toxic to aquatic life near outfall		●	●			
(?) High flow would have significant local impact on Merrimack River				●		
(-S) Treatment failure would prove toxic to aquatic life				●		
(+L) Removing effluent from rivers would enhance aquatic life					●	●
(?) Tyngsborough needs a sewage collection system	●	●	●	●	●	●
(-L) Transmission line for sewage from Dunstable would be subject to vandalism and leaks into groundwater	●	●	●	●	●	●
(+L) System would not create public health hazards					●	●
(-L) Site would be good well field					●	●
Engineering						
(+L) Operation would require one-half the man hours, two-thirds the power and one eighth the chemicals of other alternatives					●	●
Socio-Economic						
(-L) Sites would not support goals of industrial development or maintenance of open space	●				●	●
(-S) Transmission line construction would disrupt street traffic in Chelmsford	●	●	●	●	●	●