CITY

OF

DOVER

NEW HAMPSHIRE

COMPREHENSIVE DEVELOPMENT PLAN

PHASE ONE

January, 1970

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January 30, 1970

Dover Planning Board
City Hall
Dover, New Hampshire

Attention: Mr. Albert O. Bernard, Chairman

Gentlemen:

In accordance with Articles of Agreement dated June 17, 1968 between the New Hampshire Department of Resources and Economic Development and Metcalf & Eddy, Inc. we are pleased to submit this Comprehensive Development Plan, Phase One for the City of Dover, New Hampshire.

This Phase One report is divided into two parts, the Inventory Studies and the 1990 Development Plan. Included in the Inventory Studies are our reports on Area of Influence, Existing Land Use, Land Capability, Population, Economic Base and Neighborhood Analysis. The 1990 Development Plan includes a statement of Goals and Objectives, our studies and plans for Water, Sewerage, and Drainage, and a Preliminary Future Land Use Plan.

This report was prepared by Mr. Richard L. Ball, Jr. A.I.P. and other members of our Planning Department Staff working under his direction

Very truly yours,

METCALF & EDDY, INC.

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INTRODUCTION

This Comprehensive Development Plan Phase One Report for the City of Dover presents the background investigation into the physical, economic, and social situation in Dover and a plan indicating the overall framework for growth in Dover over the next twenty years as expressed in the Preliminary Future Land Use Plan. Further, the plan for public utility service areas as is necessary to service the 1990 future land use plan is presented.

Subsequent phases of the Comprehensive Development Plan will present an inventory and recommendations concerning housing in Dover. Also to be presented are plans for various community facilities as are required to service the Future Land Use Plan such as Schools, Recreation and Conservation Facilities, City Buildings and Lands and Highways, Streets, and Parking. Also, programs for implementing various plan elements will be presented. These include studies and recommendations concerning a revised Zoning Ordinance, a Fiscal Analysis and Capital Improvements Program and study and recommendations concerning revised Land Subdivision Regulations.

This Comprehensive Development Plan, Phase One, presents a flexible guide to future development in Dover. However, it is only an initial step in what should be a continuous planning process. With the carrying out of subsequent phases of this plan, the City will complete the comprehensive guide to community growth and will be provided with the tools (Zoning, Land Subdivision and Capital Improvements Program) for implementing the most important elements of the City's development plan. However, it is by official action of the City that the various aspects of the Comprehensive Plan must be implemented. Therefore, the City must constantly refer to these plans and evaluate pending decisions in light of these plans.

SUMMARY

Inventory Studies

Area of Influence

Dover is affected by and in turn affects two levels of regional areas, a "Regional Area of Influence" and a "Local Area of Influence."

The Regional Area of Influence is identical with the area of jurisdiction of the Strafford Regional Planning Commission as defined by the State of New Hampshire, Department of Resources and Economic Development. This area, consisting of Dover and 14 area municipalities, is selected because Dover has been a part of many previous studies and inventories which have had very comparable area delineations with that of the Strafford Regional Planning Area and because Dover will participate in the development of future plans for this regional area.

The Local Area of Influence is identified as that group of municipalities which will have direct influences on planning and development problems in Dover. The Local Area of Influence is defined to include the cities of Portsmouth, Rochester, and Somersworth, and the towns of Barrington, Kittery, Rollinsford, Berwick, South Berwick, Eliot, Newington, Durham, and Madbury.

From comparing the Local Area of Influence municipalities, it is seen that Dover is primarily an employment and service center, and that Dover's public school and financial characteristics are generally above average for the local area. Of most significance to Dover over the past two decades has been the location of Pease Air Force Base which has caused pressures for residential development as military personnel sought housing in the areas adjacent to the air base. However, a shift away from this influence has been evident in the most recent years.

Thus, Dover's present role in the Local Area of Influence is that of an employment and shopping center. In addition, it provides vacant land for new residential development accommodating a growing population. The extent to which Dover retains this role or acquires another depends largely upon future outside pressures. Therefore, based on our analysis of the Local Area of Influence, we have concluded that planning for Dover should be cognizant of and reflect the following conditions and situations in its immediate area:

1. The presence of Portsmouth Navel Shipyard as a major source of employment and the presence of the Pease Air Force Base.

2. The recent improved regional accessibility provided by the Spaulding Turnpike, creating improved potential for industrial development along the turnpike and residential development in close proximity to it.

3. The regional demands for a variety of housing types reflecting the presence of various social and economic levels.

The subsequent studies and recommendations of the Dover Comprehensive Plan, Phase One, reflect these influences as a significant input to the overall plan development.

Existing Land Use

The existing developed land use pattern in Dover consists of an urbanized center with development extending radially out in decreasing intensity in proximity to existing roadways. The central business district is now the point at which the major roads in the municipality converge and has developed as the geographic, social, governmental, employment, and commercial center of the city. The resulting overall pattern appears to reflect the influence of physical base, existing roadways, and the service area of the public water and sewer systems.

Existing residential development is scattered in clusters throughout the city with the major concentrations near the center of the city. Commercial land use is concentrated in the central business district and along northwest Central Avenue in an area known locally as the "Miracle Mile". Industrial uses are distributed individually on separate sites. The majority of old areas are along the railroad in the downtown area. The new industrial uses are locating in industrial parks away from the center of the city but directly accessible to the Spaulding Turnpike.

The principal developed use is single-family residential. Over 78 percent of all land in the city is classified as undeveloped. Dover therefore has enough land remaining so that future development can have a significant influence on the future land use pattern.

Residential lot sizes throughout Dover vary considerably, ranging from 2,700 to 10,000 square feet in the center of the city to about 3,400 square feet to 35 acres in the remainder of the city. Most lots outside of the center of the city are served by only the public water system and have on-lot sewage disposal systems. Because of a combination of existing land use intensity and soil characteristics, some areas in Dover that do not presently require public sewer service will probably require it in the future.

Land values vary throughout the city depending upon location, lot sizes, zoning and use potential.

Dover contains 16,810 acres of land with about 22 percent of the total area presently developed. However, it is expected that this percentage will increase substantially in the future. It is believed that future development will continue to stress single-family residential development but with more emphasis placed on multifamily residential development than has been in the past.

Based on this analysis of existing land use patterns and trends in Dover, two basic alternative patterns of future land use appear probable. These have been designated as the "radial spread" and "nucleated" schemes. The radial spread pattern is based on continuous and spread development, with the central business district being enlarged and serving the major shopping needs of the city's residents for goods and services. The nucleated pattern is based on the development of cohesive neighborhood units separated by the open space corridors. The serving of the convenience shopping needs of the residents would be in neighborhood commercial centers with the central business district functioning as the community-wide shopping center.

The large amounts of raw land are available for new development. Thus the city can grow into these overall development patterns in many ways. First, the city must set for itself overall goals or objectives. Then, community emphasis must be directed toward these planned objectives as expressed in a development pattern as detailed in the future land use plan. It is in this fashion that new development will be directed towards the orderly and economic growth of the City.

After analysis of other factors affecting Dover's future, a future development pattern is selected and a Preliminary Future Land Use Plan is presented.

Land Capability

Significant natural resources are identified in Dover. These are water bodies, groundwater, sand and gravel deposits, tidal flats, and prominent hills. All of these have a direct impact on Dover's future development and are considered in the development of the future land use plan.

Dover's topography and geology were examined and generally found to pose no extreme limitations to future development.

Based on a detailed soils survey of Dover conducted by the Soil Conservation Service, existing soil types were grouped into five categories of land capability for development. It was found that land capable of development in Dover is limited because of slope and soil conditions. Furthermore, when land suitable for development is combined with land which is capable

of being developed in the future, only 53.7 percent of all land in Dover is judged developable, with only 34.3 percent estimated to be Grade I developable land or land with generally slight to moderate limitations for most types of development.

Since a large amount of Dover's soils is classified as having severe limitations in development capabilities (Grade II developable land) and further, since extensive areas in the city presently depend on private on-lot sewerage systems, it is important that land use policies reflect these conditions. Therefore, we have recommended minimum residential lot size standards ranging from 15,000 square feet to 600,000 square feet depending on soil percolation rates and public utility services.

Population

Dover's 1968 population was estimated to be approximately 22,680 persons. This compares to a 1960 and 1950 population of 19,131 and 15,874 persons, respectively.

The growth rate since 1950 has been fairly constant, averaging approximately 326 per year. This is in sharp contrast to the growth rate over the previous 30-year period which averaged only 95 persons per year.

Between 1950 and 1960, the trend in Dover's population composition was toward a younger population. The median age of Dover's residents in 1960 was 29.4 yrs. as compared to 32.7 yrs. in 1950.

A review of the social characteristics of Dover's population shows that residents have a higher average income and educational achievement than the population of surrounding municipalities. In 1960, the labor force consisted primarily of skilled craftsmen and operatives. The percentages of foreign born and foreign stock among Dover residents in 1960 were 7 percent and 29 percent, respectively. However, there does not appear to be present in the city any group whose presence will affect this Comprehensive Plan.

The majority of Dover's present population lives in, and adjacent to, the city center and in newly developed subdivisions along principal roadways. Population density varies throughout Dover. It is approximately 13.3 persons per residential acre, with densities as high as 17.5 persons per residential acre in the older city core neighborhoods.

Dover's recent population growth has been the result of a high birth rate and a net in-migration. The average annual natural increase since 1950 has been 243 persons. Between 1950 and 1960, approximately a third of the population growth was the result of net in-migration. This can be attributed to the growth of Pease Air Force Base. As a matter of fact, it has been reported

that when the military families are excluded from the Dover migration statistics, a net out-migration of civilians actually occurred. Since 1960, net in-migration has continued to play a significant role in Dover's population growth. However, this is most likely in the civilian population sector.

Based on a continuation to 1980 of the present trend of a slow growth in the natural increase rate, a more significant growth between 1980 and 1990, and further based on a significant in-migration rate between 1970 and 1990, the following estimates of Dover's future population have been made:

Estimated Population

Year	Estimated population
1970	23,360
1975	25,630
1980	27,900
1985	30,330
1990	32,890

With the probability that extreme conditions could affect migration and natural increases, Dover's 1990 population could be as low as 30,580 persons, or as high as 35,810 persons.

In general, Dover's present role as a center for industrial and commercial activity in the region is expected to continue. As a result, future population composition should remain young as better economic opportunities generally attract people in the younger productive age groups. Educational attainment and occupational skills should increase, which, in turn, will result in a greater median family income.

Of the eight neighborhoods dividing the City of Dover, four are expected to increase in percentage of total population. These neighborhoods are North End, North West Dover, Dover Point, and Morningside. It is further expected that the population density will range between 10 and 20 persons per residential acre.

Future residential land use needs are expected to increase by 500 to 1,000 acres by 1990. In addition, the projected population growth will require approximately 3,200 new dwelling units by 1990, approximately 55 additional classrooms, and additional jobs for over 4,000 persons.

Neighborhood Analyses

After consideration of such factors as physical boundaries, socioeconomic characteristics, and political and historically identifiable areas and discussion with the Dover Planning Board, the City of Dover was divided into eight basic neighborhoods. Each of the neighborhoods was divided into subdistricts. The neighborhoods contain some distinctive social and economic functions and which differ in some important characteristics from adjoining neighborhoods, and which will continue to be a meaningful division in the future.

In 1968, an external inspection was made by the staff of the Dover Planning Board under the direction of Metcalf & Eddy, Inc., of both residential and nonresidential structures in Dover. This data was coded and processed electronically, in accordance with a rating system developed to permit direct comparison with U. S. Census housing data, to produce inventories on building conditions for Dover as a whole, for the eight basic neighborhoods, and for the subdistricts. Comparing the findings of the 1968 field survey with the 1960 U. S. Census data, the number of standard housing units in Dover decreased from 5,117 in 1960 to 5,103 units in 1968, while the number of substandard increased from 735 in 1960 to 1,827 in 1968.

A city-wide map was prepared, indicating areas of blight in Dover. In general, blight is predominantly present in and around the central business district.

Data from various sources concerned with socioeconomic characteristics was collected, and a definite correlation was found to exist between structural deterioration and family characteristics, such as age, employment status, and dependence upon welfare programs.

The evaluation of community facilities and services, such as schools, streets and recreation facilities available to Dover's neighborhoods, indicate that community facilities and services are deficient in those neighborhoods which have a high incidence of blight.

The basic ingredients for blight are people and structures. Although the age and physical condition of a structure are important factors, the rate of deterioration is influenced by how people use and maintain the structure. However, there are other factors which appear to have a blighting influence in Dover. Included among such factors are mixing of incompatible land uses, heavy traffic through residential areas, and overcrowding of structures on small lots.

Presently the city is attempting to eliminate blight in a section of the central business district through the urban renewal process. Other sections of the city require action to eliminate and prevent future blight. We recommend that the city apply the following programs and studies to the city as a whole:

1. Code enforcement program.

2. Housing study.

3. Community facilities and services plan and program for improvement.

4. Periodic neighborhood review study.

In addition, specific programs should be applied to specific pockets of blight in order to eliminate them. Our recommendations call for the use of spot clearance, rehabilitation and redevelopment. These programs may be carried out privately, with local funds only or through the federal urban renewal program.

Economy

A view of the City of Dover, from the standpoint of economics, reveals that the city has important regional economic roles as an employment center, a manufacturing center, and as a market center. New factories have opened and old firms have expanded operations at a steady rate and unemployment has reached all time lows in the Dover Job Center in recent years.

Manufacturing is the principal economic activity in Dover with increased diversity in the types of firms. The labor force is oriented towards manufacturing, and employment in manufacturing has increased by almost 900 workers since 1963.

Retail, wholesale and service employment and receipts have increased steadily except in scattered cases. Wages have increased in all sectors as has effective buying income. All of these reflect a healthy and growing economy.

Dover has many economic resources, including easy access to major markets on the Spaulding Turnpike, available lands for growth and good utilities. Existing industrial parks, an efficient Economic Commission and committed local officials and residents also stand as strong assets. The combination of other assets (for example, good schools, hospital) and the expanding economic base of the region place Dover in an excellent economic position.

However, manufacturing growth seems to be slowing down, new housing is needed and new skills must be developed. The city must consider its economic goals and make policy and planning decisions directed toward these goals or much of the expected growth will be haphazard or will bypass the city completely.

1990 Development Plan

Long-Range Development Goals and Policies

Prior to the formulation of specific proposals and recommendations, it is necessary to establish long-range development goals as a basis for detailing the long-range Dover Comprehensive Plan. The following goals have been selected and are used as the overall basis of the Comprehensive Plan:

Goal I - Promote the orderly and appropriate use and reuse of land in Dover.

Goal II - Provide the highest levels of public service and facilities possible consistent with Dover's needs and availability of financial resources.

Goal III - Promote an overall sound economic base in Dover.

Goal IV - Improve and conserve the natural, visual and historical amenities of Dover.

Goal V - Promote the development of a variety of housing to meet the social, economic and health needs of Dover.

Goal VI - Establish Dover's role as an integral and dynamic member in the regional area.

Preliminary Future Land Use Plan

A preliminary future land use plan for Dover has been prepared showing the allocation of major land use areas by pattern and intensity. The design scheme chosen as the basis of this plan is the "nucleated" pattern. The overall plan has been given a 1990 target date. However, this plan design is considered in the light of much longer-range considerations. In this manner, the next 15 to 20 years of land development is also designed in accordance with an overall framework for the next 25 to 50 years.

Water

The existing Dover water facilities have been inventoried and evaluated with respect to both present and future needs. We have found that the present water supply requirements are for a maximum daily use of about 3.3 mgd (million gallons per day) in 1968. By 1990, this is expected to reach 9.0 mgd. With a present dependable yield of 4.2 mgd, new source(s) of water should be provided between 1970 and 1975. Also, the overall water distribution system requires reinforcement according to the report of the New Hampshire Board of Underwriters. Principal reinforcement is needed outside the central business area. Finally, the

distribution storage required for 1970 is estimated to be 4.8 million gallons as compared to an existing capacity of 4.0 million gallons. By 1990 the total required storage capacity is estimated to be 5.6 million gallons. Thus, additional storage facilities will be required during our planning period.

Based on the above evaluation, the following recommendations are made:

1. Service Area Extension. We recommend that existing service areas be extended in the future to the extent that all developed land in Dover will be serviced by the public water system. The timing on this should be coordinated with the development of a new source of supply and new storage facilities.

2. Supply. Based on water usage projections, we recommend an additional water source be developed in the immediate future, 1970-1975.

   Based on recommendations of the city's water consultants, the Hoppers area should be developed to provide the additional needed supply. This source has an estimated safe yield on the average of 10 mgd, which, in combination with existing sources, should be capable of serving Dover well beyond our planning period.

3. Distribution System. Because of the wide variations in elevations in the existing and proposed system, and because of the location of the proposed water source, a dual pressure service system has been proposed by the city's water consultants. This would lessen pressure at Dover Point, and increase pressure near Willand Pond.

   Also, the location of the proposed Hoppers water source will require that this water be delivered into the system in sufficient quantities. To this end, and in accordance with previous recommendations, large-capacity transmission mains should be provided.

   We also recommend that the outlying dead-end lines be provided with a loop of reinforcing mains so that a break in a single 6-inch or 8-inch main would not completely eliminate the water supply of a large area, such as Dover Point. Also, in accordance with previous recommendations of the New Hampshire Board of Underwriters, standby pumping capacity should be provided at the water sources. In addition, provisions should be made for auxiliary power sources.

4. Storage. Since a new source of supply will be located in the western high-level service area, and each service should be provided with a proper storage capacity, a storage facility should be provided on Long Hill, in accordance with recommendations of the city's water consultants. The capacity of the storage facility should be determined prior to construction in light of land use proposals of this Comprehensive Plan. Possible location for additional storage facilities include Mount Pleasant, Pudding Hill and an unnamed high point near the Barbadoes wells. Although all of these would not be required, the Mount Pleasant site would strengthen the reliability of the system in the central area and either the Pudding Hill or the Barbadoes site would substantially improve the system in the Industrial Park area.

   It should be noted that much of the overall distribution system must be reinforced if the storage facilities are to be at all useful.

Sewerage

Dover's existing municipal sewerage system consists of both combined and separate sanitary sewers, a main primary sewage treatment plant with a special industrial waste treatment section, and a small treatment facility serving a small development off Back River Road.

Presently, raw sewage from the principal collection system is discharged directly into the Cocheco River. However, with improvements now under construction and presently planned for the system, all combined sewers are to be eliminated and the treatment plant capacity is to be expanded to 4.4 mgd (million gallons per day) average flow.

The Back River Road system consists of separate sanitary sewers and a secondary treatment facility with discharge of treated effluent to the Bellamy River.

Based on our evaluation of the existing sewerage system, the State's present stream classifications and implementation schedule, and existing and potential sewerage problems, we feel that the present Dover municipal sewerage system and the planned improvements should meet the needs of the community throughout our planning period (to 1990).

This evaluation is based on a slight extension of the sewer service area as now planned as contributory to the sewage treatment plant, and a continued acceptance by the State of only primary treatment. However, it would appear likely that secondary treatment may be required in the near future.

Based on the above evaluation, the following recommendations are made relative to Dover's sewerage system through 1990:

1. The current program of separating the combined existing sewerage system should be continued until virtually complete separation is obtained in accordance with existing plans, and all existing and additional sanitary sewers in the central area are tied into the main treatment plant.

2. The existing service area should be extended to the 1990 proposed service area as development requires it. Priority should be given to the Middlebrook Road and Shawnee Lane areas where problems may occur in the near future.

3. The existing main treatment plant with improvements now under construction should be utilized until such time as secondary treatment is required by the State. At that time, an engineering study should be undertaken to determine the method of secondary treatment, the design flows, and the means of serving areas of Dover, both within and outside our recommended 1990 service area, if desirable.

4. Disinfection facilities should be provided at the Back River treatment facilities in accordance with State requirements.

5. The standards set forth by the New Hampshire Water Supply and Pollution Control Commission should be adhered to for on-lot sewage disposal. Also, present zoning should be altered to reflect the recommended minimum lot sizes recommended in the Land Capability section of this report.

Drainage

The greatest extent of formal (man-made) drainage facilities in Dover is located in the center of the city. These consist of both separate and combined storm drains. With the exception of some suburban subdivisions which have formal drainage, the remainder of the city is served only with street culverts and occasional easements. Stormwater drainage from all of the city flows through natural drainage ways (ponds, streams, and wetlands) to two major drainage districts: the Cocheco-Piscataway rivers district and the Bellamy-Oyster rivers district.

A 1965 report which recommends the separation of the combined storm sanitary sewer systems is the extent of drainage planning in Dover; otherwise, the city has done very little planning for drainage, but as yet the problems have been small. Some street flooding has occurred in the Fisher Street, Kirkland

Street, Moran Street, and Morningside housing areas. Also, Berry Brook has a less frequent flooding occurrence. Nevertheless, as development increases in the city, the amount of impervious surfaces will increase, compounding the strain on drainage facilities.

Four major inadequacies exist with respect to drainage in Dover. These are:

1. The existence of combined storm and sanitary sewers.

2. Inadequate formal drainage structures as indicated by the known problem areas.

3. The absence of a complete and accurate mapping of the existing drainage structures.

4. The absence of a comprehensive engineering drainage plan, which is based on the future land use plan for Dover.

The following steps are recommended for Dover's overall drainage plan:

1. It is recommended first of all, that the Department of Public Works, and the Planning Board adopt our proposed policies and standards as the basis for construction and as elements of the subdivision regulations.

2. A comprehensive engineering study should be undertaken to study the drainage system for Dover. The study should include accurate mapping of all existing drainage structures and natural drainage ways and should determine the locations and sizes of all new major storm drains, the capabilities of watercourses to carry the existing and anticipated future runoff, and requirements for and usefulness of temporary storage areas as well as layouts in areas where easements should be obtained. The study should be based upon the proposed policies and standards, particularly on the ultimate development of the drainage districts as described in the Future Land Use Plan.

Pending the results of the proposed engineering drainage study, certain streams, ponds and wetlands have been designated to be preserved to serve as major components of the drainage system as well as components of the city's open space plan.

The appropriate city agencies should move jointly to preserve the existing open streams, ponds, flood plains, and wetlands. Any combination of means should be used to derive preservation, including outright acquisition of fee or easement rights, eminent domain proceedings, and zoning controls. At the same

time, these agencies should develop plans for these areas which will allow for their multifunctioning as natural drainage facilities as well as conservation and recreation resources. More is to be said concerning this specific recommendation in the "Recreation and Conservation" section of a subsequent Phase of the Comprehensive Plan for Dover.

AREA OF INFLUENCE

The term "Area of Influence" refers to a group of municipalities which, because of similarities and interdependence in location, population, land development, economy, facilities and services constitute a logical regional planning area. The future of each municipality affects, and is affected by, each other municipality in the group.

The purpose of this section of the Comprehensive Plan is to select the Dover "Area of Influence" and to identify special planning and development issues which will affect the future of Dover. This will be accomplished by first, examining existing regional situations affecting Dover and second, comparing characteristics of Dover with other cities and towns in the Area of Influence.

Geographical Location

Dover is located in the northeast sector of the United States in the southeastern portion of the State of New Hampshire. The City of Dover is approximately 70 miles north of Boston, Massachusetts, 60 miles southwest of Portland, Maine, and 37 miles east of Concord, New Hampshire.

Selection of the Area of Influence.

Criteria for Selecting Area of Influence. Municipalities meeting the following criteria will be considered for inclusion in Dover's Area of Influence:

1. Municipalities that are part of a regional statistical area, joined in regional studies, or are included in regional service areas and exhibit reciprocal relationships.

2. Municipalities having social and economic ties of sufficient magnitude to create an element of interdependence.

3. All adjacent municipalities unless there is some significant physical barrier or type of land use which will block and prevent contiguous development or accessibility.

4. Municipalities interconnected by major and direct highway routes.

Regional Statistical Areas. The single most significant statistical area, of which Dover is a part, is the Strafford Regional Planning Area. This area is one of two areas which make up a "Primary Economic Area" as defined by the State of New Hampshire and is so delineated to include the whole of Strafford County and the community of Nottingham in Rockingham County. The two areas are shown in Figure 1.

The Strafford Regional Planning Commission was formed in accordance with Chapter 36, Section 38, New Hampshire Revised Statutes Annotated, 1955 to prepare a coordinated plan for the development of the region. The Commission consists of representatives from each municipality which has chosen to join the regional planning agency.

To date, the above Commission, whose powers are advisory, has had little impact upon the area. However, regional utility planning is now in process and it is expected that all future development in the defined region will be greatly influenced by the Commission.

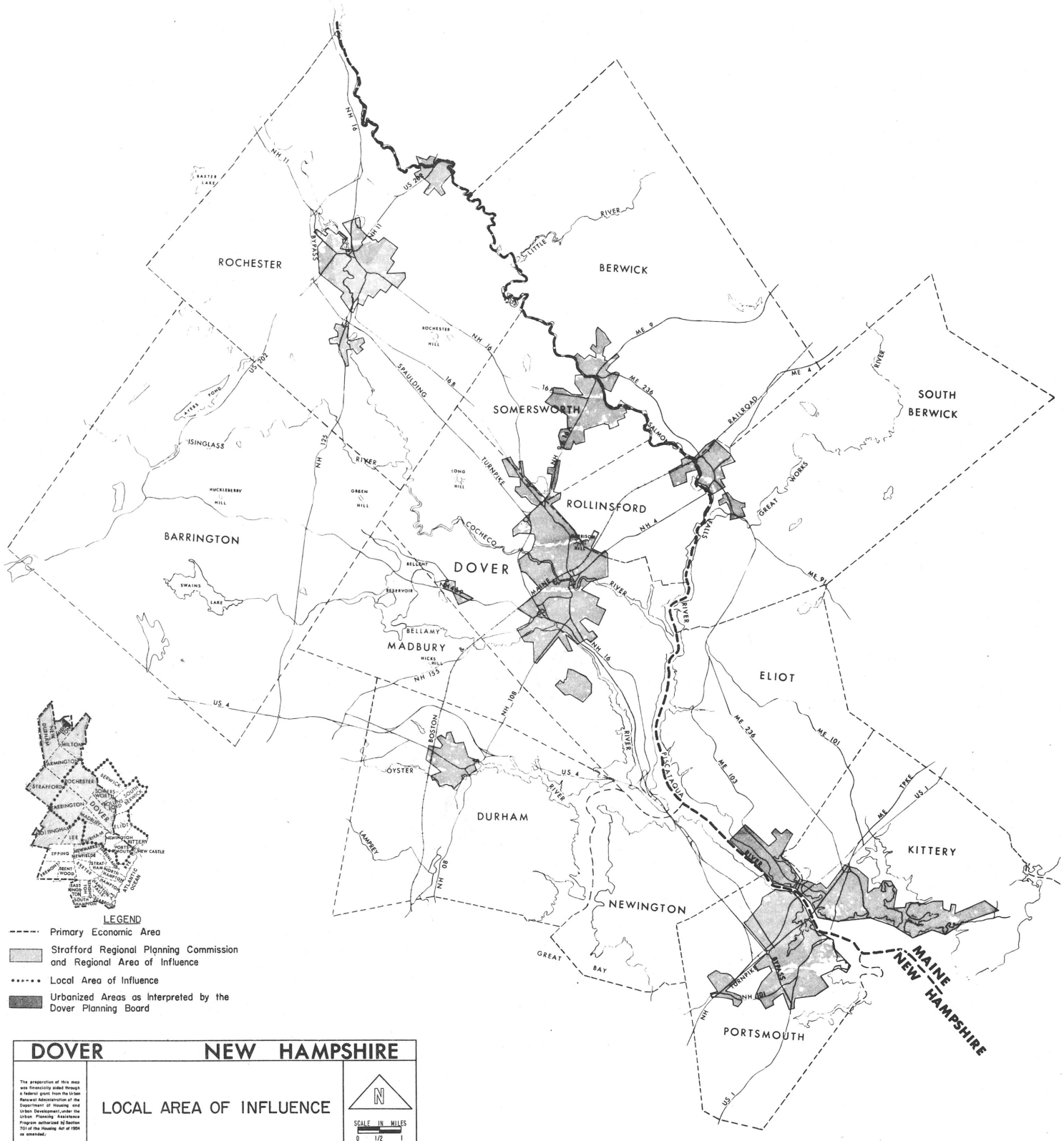
Another significant statistical area in which Dover is included is the Dover-Somersworth Job Center Area. In addition to the Cities of Somersworth and Dover, the Dover-Somersworth Job Center includes the municipalities of Barrington, Durham, Lee, Madbury, Rollinsford, and Nottingham. This study area has no legal implementation authority and is primarily concerned with compiling economic data.

Although primarily an economic base study, the Seacoast Regional Plan warrants mention as a statistical study area. This study gathered and compiled numerous statistics on some forty cities and towns in the southeastern portions of New Hampshire and in southwestern Maine. The Seacoast Regional Plan will be discussed further as a regional study area.

Regional Study Areas. Since 1960 three significant regional studies involving the City of Dover have been prepared. The Seacoast Regional Plan was begun in 1964 with the aid of a 701 federal grant. The study consisted of a two-phase program, the first of which was an in-depth, fact-finding effort. Phase II was concerned with the future development of the region's economy and resources based upon the research conducted in Phase I.

In April 1967 the results of the Dover-Somersworth Transportation Study were published. The purpose of this study was to develop a feasible plan to meet the current critical transportation needs of the Dover-Somersworth area and to make recommendations for a transportation system that would best meet the area's transportation needs of the future.

FIG. I



LEGEND

- Primary Economic Area
- Strafford Regional Planning Commission and Regional Area of Influence
- Local Area of Influence
- Urbanized Areas as Interpreted by the Dover Planning Board

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

LOCAL AREA OF INFLUENCE

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September, 1968

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The other regional study was the Wentworth-Douglass Hospital, Medical and Health Survey prepared and published by the Resources Development Center at the University of New Hampshire in 1967. This study involved the municipalities of Barrington, Dover, Durham, Lee, Madbury, Rollinsford, and Somersworth in New Hampshire and Berwick, Eliot, North Berwick, and South Berwick in Maine. The above named municipalities were selected for this study because it was found that the preponderance of the Wentworth-Douglass Hospital admissions resided in these municipalities. The purpose of the study was to provide data which would be of value to the municipalities in their effort to improve and expand medical services in the area.

Regional Service Areas. Service areas that cover more than one municipality give to them a common interdependence. Dover lies within several regional service areas and on the fringe of others, which either could be extended to Dover, or will at least have implications for the city in the future.

Daily newspaper circulation originates in Dover and extends throughout Strafford County and parts of Rockingham County in New Hampshire and to the Maine municipalities of Berwick, North Berwick, South Berwick, Eliot, and Lebanon.

The toll-free telephone calling area is composed of the New Hampshire towns of Barrington, Durham, Madbury, Newmarket, Rochester, Rollinsford, and Somersworth and the Maine towns of Berwick, Eliot, South Berwick, and South Lebanon.

As was mentioned above, hospital facilities originate in Dover but serve many of the neighboring municipalities. Finally, a local radio station exists in Dover, and the residents also receive radio broadcasts from Rochester and Portsmouth. Television broadcasts are received from Boston, Portland, Manchester, and the University of New Hampshire.

Accessibility. The Spaulding Turnpike, a limited access, toll facility connecting Portsmouth and Rochester and passing through Dover within a mile of downtown is the major highway in the area, and as such, carries the majority of the through-traffic. U.S. Route 4 passes through Dover Point and, although only a two lane roadway, is the principal highway route from Dover to Concord, New Hampshire.

Other highway access to the city is provided by State Routes 9, 16, 108, and 155, all of which intersect near the center of Dover and provide intra-town circulation. However, these five highways are two-lane, open access facilities with capacities limited so as to restrict influence and interdependence to municipalities within close proximity to Dover.

There is no rail-passenger transportation service in Dover, but rail-freight service is available via a main line of the Boston and Maine Railroad. Local bus service, as such, between Dover and the neighboring municipalities, is not available. Limited service is provided by two bus companies to and from Portsmouth, and bus connection can be made to other nearby municipalities. In addition, regularly scheduled limousine service is provided to Logan Airport in Boston.

Economic and Social Ties. Statistics on commuting characteristics (employment and shopping) usually indicate the towns to which Dover has a strong relationship. However, no data as such is available. The Dover-Somersworth Transportation Study established that, on an overall basis, approximately sixty-six percent of the vehicles crossing the cordon line -- the line which defined most of Dover and Somersworth and within which an estimated ninety-four percent of the combined population of these two municipalities resided -- had origins or destinations in other parts of New Hampshire; approximately twenty-five percent had origins or destinations in York County, Maine; and the remaining nine percent had origins or destinations in other parts of New England. The study also showed that there was a very heavy concentration of traffic to and from the central areas of Dover and Somersworth and along the Spaulding Turnpike, indicating the possibility of a strong relationship between Dover and Somersworth and among the other municipalities along the Spaulding Turnpike.

There appears to be considerable economic dependence on the Portsmouth Naval Shipyard by the surrounding municipalities. Approximately nine percent of the shipyard labor force resides in Dover.

Selected Area of Influence. Because of the regional importance of the Strafford Regional Planning Area as a statistical and study area and as a logical planning area, this district as a whole should be considered in the identification of Dover's Area of Influence. Because Dover will be a part of the statistical inventory by the Strafford Regional Planning Commission, as well as a part of all regional plans to be developed in the future, we have selected the Strafford Regional Planning Area as Dover's Regional Area of Influence.

Whereas planning in Dover will affect and will be affected by planning for the Strafford Regional Planning Area, it is evident that several of the regional municipalities will have a more direct bearing over a broader range of planning matters than others. Such a smaller grouping with more direct influences is called Dover's Local Area of Influence.

Because of their common boundaries and the planning implications inherent in this fact, the municipalities immediately surrounding Dover should be considered as part of the Local Area

of Influence. These towns are identified as Barrington, Rochester, Somersworth, Rollinsford, Newington, Durham, and Madbury in New Hampshire, and South Berwick and Eliot in Maine.

From the facts previously discussed, it seems apparent that Dover has definite economic and social orientations to Portsmouth. In addition, Kittery, Maine, because of its strong proximity to and relationship with Portsmouth and because a portion of the naval shipyard is located within its town limits, should be considered as much an influence as is Portsmouth. Therefore, since Portsmouth and Kittery are the principal external influences on Dover, Portsmouth and Kittery should be included in its Local Area of Influence.

Although the town of Berwick, Maine does not share a common border with Dover, nor can Berwick be considered a principal external influence upon Dover, it is felt that Berwick should be included within Dover's Local Area of Influence on the basis of Berwick's inclusion in many of the local area studies. Also, Berwick relies heavily on Dover for many of its communication, economic and social facilities.

There appears to be marginal interrelationships between Dover and the other municipalities in the Strafford Regional Planning Area so these municipalities are not considered as part of Dover's Local Area of Influence.

Therefore, the Local Area of Influence for Dover is defined to include the cities of Portsmouth, Rochester, and Somersworth and the neighboring towns of Barrington, Kittery, Rollinsford, Berwick, South Berwick, Eliot, Newington, Durham, and Madbury. The Regional Area of Influence is defined as the Strafford Regional Planning Area presently consisting of fourteen municipalities. The limits of both the Local and Regional Area of Influence with the urbanized areas delineated are shown in Figure 1.

Comparisons in the Local Area of Influence

Population. As shown in Table 1, in comparison with the twelve other municipalities in the Local Area of Influence between 1950 and 1960, Dover ranked seventh in overall percent of population growth. However, if air base personnel and families were excluded from the count, percent population growth in Dover between those same years was approximately halved, ranking Dover tenth in comparison with the population growth of the other municipalities. In addition, tabulation of the net migration, between 1950 and 1960, exclusive of air base personnel, of each municipality in the Local Area of Influence shows that Dover, Newington, and Portsmouth suffered substantial out-migration during that period.

Table 1. Compared Population Change, 1950-1960

Municipality	Total population change		Pop. change excluding air base personnel		Net migration excluding air base personnel (Note: (-) indicates net out-migration)
	Number	Percent	Number	Percent	
Dover	3,257	20.5	1,577	9.9	-806
Barrington	-16	-1.5	*	*	*
Durham	734	15.4	734	15.4	*
Madbury	67	13.7	67	13.7	14
Newington	2,005	405.9	-78	-15.8	-106
Portsmouth	7,003	37.2	*	*	-3,548
Rochester	2,151	15.6	2,011	14.6	51
Rollinsford	283	17.1	283	17.1	70
Somersworth	1,602	23.1	1,497	21.6	353
Berwick	572	26.4	572	26.4	123
Eliot	624	24.8	624	24.8	287
Kittery	2,309	27.5	2,309	27.5	561
South Berwick	466	17.6	466	17.6	117

* Data not readily available.
Source: Characteristics of the Seacoast Region Population, by the Department of Resource Economics, University of New Hampshire.

Thus, the above facts show that when air base personnel are excluded from the population count, the population growth of certain municipalities, one of which is Dover, has been considerably slower than that which the total population statistics indicate. This, in turn, emphasizes the influence of Pease Air Force Base on the growth of certain municipalities in the area during this period. More recent evidence indicates that the air base is no longer an important factor in Dover's growth. This will be discussed in later sections of this plan.

As shown in Table 2 for the same compared municipalities for which data is available, Dover had the following rankings in population characteristics in 1960:

1. The seventh highest percentage of its population under 15 years of age.

2. The fourth highest percentage of its population 65 years of age and over.

Table 2. Compared Population Characteristics, 1960

Municipality	Percent pop. under 15 yrs.	Percent pop. 65 yrs. and over	Median family income	Median school yrs. completed persons 25 yrs. and over	Percent pop. 25 yrs. and over completed 1 yr. of college or more
Dover	31.1	10.0	$6,142	11.2	15.2
Barrington	*	*	5,159	*	*
Durham	16.9	4.1	6,742	14.5	67.0
Madbury	36.0	8.5	*	12.3	34.8
Newington	**	**	*	12.1	11.9
Portsmouth	31.2	7.3	5,762	12.1	17.6
Rochester	30.4	10.1	5,654	10.1	11.7
Rollinsford	34.6	7.5	5,872	9.9	12.6
Somersworth	31.8	5.3	6,088	8.9	9.8
Berwick	34.3	8.7	*	11.0	18.6
Eliot	32.7	10.1	*	12.2	17.6
Kittery	29.5	6.8	5,497	12.1	13.9
South Berwick	30.7	11.9	*	10.3	14.5

* Data not readily available
** Included in Portsmouth value.
Source: 1960 U.S. Census.

3. The second highest median family income.

4. The seventh highest median number of school years completed for those in the population 25 years of age and over.

5. The sixth highest percentage of population over 25 years of age that completed 1 year of college or more.

The above data indicates that, in the Local Area of Influence, Dover can be characterized as having a relatively older, financially productive, and well educated population.

As shown in Table 3, in comparison with the other cities and towns in the Local Area of Influence, Dover in 1960 ranked second in total labor force, and although only estimates are available for 1965, it can be reasonably assumed that Dover retained that position five years later. In 1960 Dover had the fifth lowest percentage of males in the total labor force, and in 1965, of the municipalities for which data is available, it is estimated that Dover ranked third lowest in this category, indicating that Dover has a relatively greater number of women in the labor force than have the other municipalities.

Table 4 indicates that Dover, in comparison with other municipalities in the Local Area of Influence, is an employment and service center. If similar data were available for the City of Portsmouth, it is believed that such data would show that Portsmouth also is an employment and service center and as such, is in direct competition with Dover.

The Portsmouth Naval Shipyard, because it is the largest civilian employer in the area, exerts a tremendous influence on Portsmouth and the neighboring cities and towns. As shown by Table 5, in 1966 approximately nine percent of the total civilian labor force at the shipyard resided in Dover. In comparison with the other municipalities within the Area of Influence, Dover provided the third highest number of workers employed at the shipyard.

From the available information, it can be concluded that, although the Portsmouth Naval Shipyard provides employment to a substantial number of Dover residents, Dover is predominately an employment and service center.

Municipal Water and Sewer Facilities. As shown in Table 6, of the Local Area of Influence municipalities for which there is pertinent data, only Barrington and Madbury do not have a municipal water system. All the other municipalities have municipal systems serving at least a portion of their population. Table 6 also shows that for all the municipalities in the Local Area of Influence, only Barrington, Madbury, and Newington have no public sewerage systems whatsoever.

Table 3. Compared Labor Force Change

Municipality	1960 Male	1960 Female	1960 Percent male	1960 Total	1965* Male	1965* Female	1965* Percent male	1965* Total	Percent change from 1960 to 1965
Dover	5,290	3,039	63.5	8,329	5,469	3,121	63.8	8,590	3.1
Barrington	239	87	73.4	326	152	76	66.7	228	-30.1
Durham	1,388	723	65.8	2,111	1,735	869	66.6	2,604	18.5
Madbury	146	57	71.9	203	155	62	71.5	217	6.9
Newington	**	**	**	**	**	**	**	**	**
Portsmouth	9,492	2,751	77.5	12,243	***	***	***	***	***
Rochester	4,380	2,689	62.0	7,065	***	***	***	***	***
Rollinsford	508	335	60.4	843	538	360	60.0	898	6.5
Somersworth	2,299	1,507	60.4	3,806	2,361	1,567	60.2	3,928	3.2
Berwick	737	439	62.8	1.176	770	402	65.6	1,172	-0.3
Eliot	792	326	70.9	1,118	794	321	71.1	1,115	-0.3
Kittery	3,770	900	80.7	4,670	***	***	***	***	***
South Berwick	804	441	64.5	1,245	851	444	65.8	1,295	4.0

* 1965 values are estimated.
** Included in Portsmouth values.
*** Data not readily available.

Source: Characteristics of the Seacoast Region Population, Department of Resource Economics, University of New Hampshire.

Table 4. Compared Number of Manufacturing Plants and Business Establishments, 1964

Municipality	Number of manufacturing plants	Number of business establishments other than manufacturing and agriculture
Dover	35	407
Barrington	0	12
Durham	1	48
Madbury	2	8
Newington	*	*
Portsmouth	*	*
Rochester	*	*
Rollingford	7	31
Somersworth	14	185
Berwick	4	56
Eliot	5	38
Kittery	*	*
South Berwick	6	76

* Data not readily available.
Source: Wentworth - Douglass Hospital Medical and Health Survey, Resources Development Center, University of New Hampshire.

Table 5. Compared Percentages of Labor Force Employed at Portsmouth Naval Shipyard, 1966

Municipality	Number	Percent
Dover	661	9.0
Barrington	8	0.1
Durham	27	0.4
Madbury	*	*
Newington	16	0.2
Portsmouth	1,139	15.4
Rochester	351	4.8
Rollinsford	39	0.5
Somersworth	238	3.2
Berwick	70	0.9
Eliot	239	3.2
Kittery	817	11.1
South Berwick	173	2.3
Total	3,778	51.1
Total civilian labor force at naval shipyard	7,378	100.0

* Data not readily available.
Source: Department of Resource Economics, University of New Hampshire. (Accurate as of May 18, 1966.)

Table 6. Compared Public Water and Sewer Facilities

Municipality	Municipal water supply system	Public sewerage facilities	
		Collection	Treatment
Dover	Yes	Yes	Yes
Barrington	No	No	No
Durham	Yes	Yes	Yes
Madbury	No	No	No
Newington	*	No	No
Portsmouth	Yes	Yes	Yes
Rochester	Yes	Yes	**
Rollinsford	Yes	Yes	**
Somersworth	Yes	Yes	**
Berwick	Yes	Yes	**
Eliot	Yes	Yes	Yes
Kittery	Yes	Yes	Yes
South Berwick	Yes	Yes	Yes

* Parts serviced by the City of Portsmouth.
** In planning or construction stage.
Sources: Town Profiles.
State of Maine Water Improvement Commission.
1963 Inventory of Municipal Water Facilities.

As those towns which do not have public water and sewage disposal systems grow, the need to construct such facilities will increase. In general, if and when such facilities are constructed, the City of Dover will benefit in that untreated sewage will not be discharged into rivers which later flow through Dover.

Planning and Development Controls. As shown in Table 7, the following is the status of planning and development controls in the Local Area of Influence:

1. All municipalities but one have Planning Boards.

2. All municipalities but one have or are in the process of completing Comprehensive Plans.

Table 7. Compared Plannning and Development Controls
January 1969

Municipality	Planning Board	Comprehensive plan	Zoning regulations	Subdivision regulations	Building code
Dover	Yes	Yes	Yes	Yes	Yes
Barrington	No	No	Yes	No	No
Durham	Yes	Yes	Yes	Yes	Yes
Madbury	Yes	Yes	Yes	Yes	Yes
Newington	Yes	Yes	Yes	Yes	Yes
Portsmouth	Yes	Yes	Yes	Yes	Yes
Rochester	Yes	Yes	Yes	Yes	Yes
Rollinsford	Yes	*	Yes	Yes	Yes
Somersworth	Yes	Yes	Yes	Yes	Yes
Berwick	Yes	*	No	No	No
Eliot	Yes	Yes	No	No	No
Kittery	Yes	Yes	Yes	Yes	Yes
South Berwick	Yes	*	No	No	No

* In process.
Source: Comprehensive Plans, New Hampshire Department of Resources and Economic Development - Progress in Maine Municipal Planning.

3. Ten, including Dover, have zoning regulations.

4. Nine, including Dover, have subdivision regulations.

5. Nine, including Dover, have a building code.

Thus, although the quality and appropriateness cannot readily be determined, the status of planning and development controls in the area appears to be relatively sound.

Schools. The four school characteristics most frequently examined by persons considering moving into a municipality and

by prospective teachers for a municipality are: 1) pupil-teacher ratio; 2) maximum teacher's salary; 3) equalized property valuation per pupil; and 4) expenditure per pupil. For the Local Area of Influence cities and towns, and for the characteristics shown in Table 8, Dover ranks as follows:

1. The seventh lowest elementary and fifth lowest secondary school pupil-teacher ratios.

2. Of the data available the fourth highest elementary and second highest secondary school maximum teacher's salaries.

3. The third highest equalized property valuation per pupil.

4. The fourth highest elementary and the fifth highest secondary per pupil expenditure.

In addition, Table 9 compares Dover with its neighbors in public school enrollments as a percentage of the municipal population. Dover was fifth highest in 1955 and sixth highest in 1965 with only a 4.9 percent increase over that period.

Thus, Tables 8 and 9 indicate that, in comparison with the other municipalities in the Local Area of Influence, Dover has relatively favorable values for the above mentioned school characteristics and has a relatively average percentage of its population enrolled in public schools.

Financial Situation and Ability to Pay. As shown in Table 10, in comparison with the municipalities previously used, Dover has the following rankings in various financial characteristics:

1. The fourth highest equalized tax rate.*

2. The second highest debt per capita.

3. The fifth highest tax levy per capita.

4. The fifth highest equalized evaluation per capita.

In comparison with its neighbors, Dover is in a relatively favorable financial position in relation to ability to pay (equalized valuation per capita and yearly family income).

*The equalized tax rate is that which would be in existence if property were assessed at 100 percent of its market value.

Table 8. Compared School Characteristics

Municipality	Pupil-teacher ratio, 1967-1968 Elementary	Pupil-teacher ratio, 1967-1968 Secondary	Maximum pay for teachers 1967-1968 Elementary	Maximum pay for teachers 1967-1968 Secondary	Equalized property valuation per pupil 1966-1967	Per pupil expenditure 1966-1967 Elementary	Per pupil expenditure 1966-1967 Secondary
Dover	26.4	19.5	$7,700	$8,800	$ 28,049	$384.21	$531.52
Barrington	30.4	-	5,200	-	23,064	327.67	-
Newington	20.0	-	6,000	-	165,036	682.75	-
Oyster River Coop.(1)	23.9	16.0	8,750	8,650	24,880	472.08	670.29
Portsmouth	25.4	21.2	9,000	9,645	24,701	410.11	582.15
Rochester	26.0	22.6	7,874	7,958	26,624	331.71	423.69
Rollinsford	39.3	-	6,000	-	22,628	334.12	-
Sommersworth	38.7	17.5	6,900	8,100	32,967	358.03	562.50
Berwick(2)	26.7	14.9	-(4)	-(4)	-(4)	297.85	523.42
Eliot(3)	22.6	16.3	7,050	7,550	12,973	315.22	557.26
Kittery	23.7	-	-(4)	-(4)	18,891	376.17	-
South Berwick	Included with Eliot values						

(1) Oyster River Coop. includes the towns of Durham, Lee, and Madbury.
(2) Values shown are for School Admin. District 60 of which Berwick is a part.
(3) Includes South Berwick also.
(4) Data not readily available.
Sources: State of New Hampshire Department of Education.
State of Maine Department of Education.

Table 9. Compared School Enrollments Versus Municipal Population[1]

Municipality	1955 percentage[2]	1965 percentage[3]
Dover	12.4	17.3
Barrington	16.9	19.4
Newington	12.6	11.6[4]
Oyster River Coop.[5]	10.2	13.8
Portsmouth	19.5	27.6
Rochester	14.1	17.1
Rollinsford	8.2	12.4
Somersworth	7.9	17.5
Berwick	-[6]	27.9
Eliot	-[6]	24.4
Kittery	-[6]	16.1
South Berwick	-[6]	-[7]

1. Municipal population figures are based upon state estimates.
2. 1955-1956 school enrollment figures with the 1956 state population estimate.
3. 1965-1966 school enrollment figures with the 1966 state population estimate.
4. Exclusive of military personnel.
5. Oyster River Coop. includes the towns of Durham, Lee, and Madbury.
6. No population estimate was taken for towns in Maine in 1955.
7. Included with Town of Eliot.

Sources: State of New Hampshire Department of Education.
State of Maine Department of Education.

Planning and Development Issues

The above statistical comparisons indicate that Dover's present role in the Local Area of Influence is that of an employment and shopping center. The extent to which Dover retains this role or acquires another depends largely upon future outside pressures. Based on an analysis of the above paragraphs, our findings and conclusions on planning and development issues caused largely by outside influences are as follows:

Table 10. Compared Financial Characteristics

Municipality	Equalized tax rate 1966	Debt per capita 1966 *	Tax levy per capita 1966	Equalized property valuation per capita 1966
Dover	$2.77	$285.10	$123.94	$4,537
Barrington	2.02	68.76	125.16	6,216
Durham	3.04	204.29	88.50	3,011
Madbury	3.12	205.55	163.76	5,393
Newington	0.81	60.12	276.68	8,631
Portsmouth	2.74	224.84	156.43	5,772
Rochester	2.42	294.51	105.43	4,426
Rollinsford	2.72	171.97	113.37	4,328
Somersworth	2.66	202.91	116.00	4,395
Berwick	1.59	37.34**	78.64	2,783
Eliot	0.68	0.88**	79.91	3,414
Kittery	2.54	42.17**	77.37	2,833
South Berwick	3.02	4.41**	81.10	2,808

* Includes both municipal and school debts.
** Actual debt as recorded for July 1, 1966-June 30, 1967 and 1966 State Population Estimate.

Sources: State of New Hampshire Tax Commission
State of Maine Tax Commission

1. As shown in Table 5, the Portsmouth Naval Shipyard is a major source of employment to Dover's labor force. In addition, although Pease Air Force Base today may not be the influential economic force, it once was, it is misleading to believe that the economy of the area is no longer affected by the air base. These two facts imply that the futures of the shipyard and the air base will have a direct impact on the economic sector of Dover.

Thus, a significant issue with which Dover is faced is the determination of the city's future economic role as part of the region. As a corollary issue to this, the future role of Dover downtown in relation not only to the region but to the possible future development of regional shopping centers at interchange locations along the Spaulding Turnpike must be determined.

2. Accessibility is a major determining factor to a company selecting a location for an industrial plant. It also affects residential locations relative to employment. With the recent construction of the Spaulding Turnpike, Dover's potential for industrial development along the turnpike and residential development in close proximity to it has improved significantly. Thus the determination of future land use patterns in light of regional accessibility is a significant development issue.

3. Outside pressures for new residential development should increase significantly in the future. As a result of the strong potential for industry locating along the Spaulding Turnpike, of the increased accessibility of the Portsmouth-Kittery area to Dover due to the turnpike, and of the growth of nearby University of New Hampshire in Durham, the demand for residential development raises a significant issue regarding types of housing units and population densities which are appropriate in terms of demand, community facilities and services, and land use patterns.

Survey and Mapping

In July 1968, the existing land uses in Dover were surveyed and recorded on a set of Assessor's Maps.* The land use classification system selected for the field survey consisted of 41 categories. Areas were delineated and tabulated according to these categories.

For mapping and discussion purposes in this report, the system was reduced to 12 categories.** The generalized land uses, which are shown on Figures 2 and 3 are defined as follows:

Developed Uses***

1. Single Family Residential

   Single family dwellings, whether occupied, vacant, or under construction, plus yards and outbuildings.

2. Multi-family Residential

   Dwellings containing two or more families, whether occupied, vacant, or under construction, including the adjacent yards and outbuildings.

3. Commercial

   Wholesale and retail trade and services, such as equipment distribution, restaurants, gas stations, doctors, realtors, and all accessory off-street parking.

4. Industrial

   Includes all types of manufacturing, the extractive industry (sand and gravel pits), the construction industry, and all accessory yards and off-street parking.

---

* Field survey and tabulation conducted by Dover Planning Board.

** Appendix Table A-1 shows the relationship between the 41- and 12-category systems.

*** Mixed land uses are placed in the category of the dominating land use.

5. Public and Institutional

Public and semipublic buildings and land (other than recreational) such as city hall, fire stations, schools, churches, nonprofit and fraternal organizations, etc. Accessory off-street parking is also included.

6. Transportation, Communication, and Utilities

Public and semipublic facilities, such as railway, telephone, radio, gas, electrical and water facilities and their appurtenances.

7. Circulation

All right-of-way areas for town, county, and state roads.

Open Space Uses

8. Recreational

Public, semipublic, and private parks, playgrounds, golf courses, camping areas and passive recreation areas.

9. Agricultural

Privately developed areas used for crops, orchards, pastures and poultry. Land occupied by accessory farm buildings are also included in this category.

10. Vacant Open Land

Areas which are neither developed, nor used for agriculture, nor support forest growth.

11. Vacant Woodland

Privately or publicly owned areas, including swampland which are covered by woods.

12. Water Bodies

Areas where water covers land throughout the year.

Land Use Patterns and Trends

From an examination of Figures 2 and 3, it is evident that the majority of the developed land is located in the central portion of Dover. In addition to this core development, other developed uses extend along major roadways throughout the city in

FIG. 2

BASE MAP PREPARED BY THE STAFF OF THE DOVER PLANNING BOARD AUGUST, 1968

LEGEND

- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Public & Institutional
- Transportation, Communication, and Utilities
- Recreational
- Agricultural
- Vacant Open Land
- Vacant Woodland
- Water Bodies
- Circulation

Source: 1968 Field Survey by Dover Planning Board

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

CITYWIDE EXISTING LAND USE MAP

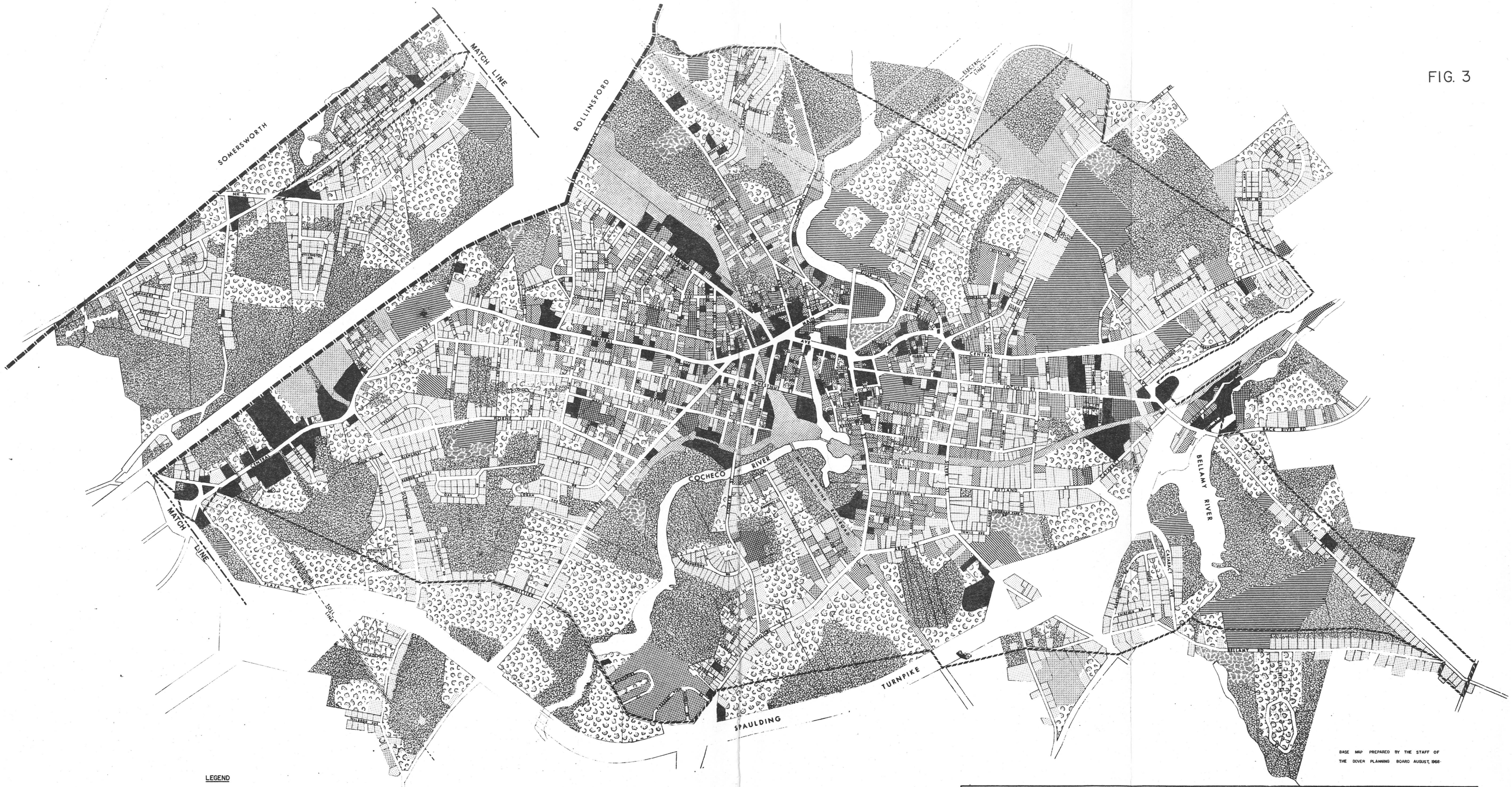
N

SCALE IN FEET
0 1000 2000 3000

February, 1969

METCALF & EDDY, INC. ▲ ENGINEERS & PLANNERS ▲ BOSTON NEW YORK PALO ALTO CINCINNATI

FIG. 3



LEGEND

- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Public & Institutional
- Transportation, Communication, and Utilities
- Recreational
- Agricultural
- Vacant Open Land
- Vacant Woodland
- Water Bodies
- Circulation
- Urban Compact Area Boundary as Defined by the N.H. State Highway Department.

Source: 1968 Field Survey by Dover Planning Board

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

URBAN COMPACT AREA EXISTING LAND USE MAP

N

SCALE IN FEET
0 400 800 1200

February, 1969

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generally decreasing intensity or are sporadically located throughout the city as medium density* subdivisions. The core of Dover development, the area within and surrounding the central business district, is the geographic, social, governmental and commercial center of the city. In this area the development is more dense in respect to buildings, population, and activities, and mixed uses are more common than in other sections of the city. The development pattern is almost continuous near the center and has major breaks in developed land use as it approaches the city boundary. In general, the northwest and much of the eastern portions of Dover remain in rural density.

Dover's land use growth in the past has been largely a process of discontiguous development. Such a growth pattern is generally one of urban sprawl which is costly to service and is difficult to control as to quality and timing of development.

The overall extent and pattern of Dover's development reflects the influence of the physical base, existing roadways, and the service area of the public water system. Whereas the original city development was influenced primarily by soils and physical suitability of land for development, more recently developers chose first those sections of the city which, in addition to being physically suitable for development, could also be served by public water. The existing major roadways have, to some extent, controlled the location of the new residential development in that they provide the link between the subdivision development and the remainder of the city as well as the outside areas.

The existing residential development is scattered in clusters throughout the city with the major concentration near the center of the city. The majority of multifamily units are located in this center area with the remaining residential areas being almost entirely single-family units. The recent trend in 1968 in residential development has been towards single-family dwelling units in residential subdivisions. This is indicated by the number of building permits requested and granted for single-family units as opposed to multifamily units. There appears to be no definite trend to the location of residential subdivisions in recent years other than that they are constructed in the open areas of the city and along the major roadways leading into the central business district.

In the past, commercial and industrial development was primarily located in the central portion of Dover. The principal commercial areas have been and still are in the central business district, the largest concentration of commercial land use, and the area along northwest Central Avenue, known locally as the "Miracle Mile". Industrial development in the past was distributed in individual, small parcels throughout the city. For the most part, this is still the case. The construction of the Spaulding Turnpike has affected the land use pattern considerably with

*Medium density is defined as 10-15 persons per acre.

respect to commercial and industrial development. New commercial development is locating along the turnpike at the interchanges, and new industrial development is locating in the "industrial park", an area southwest of the central business district and adjacent to both the Boston & Maine Railroad and the Spaulding Turnpike.

Tabulation

The acreage of each developed and open space land use, together with the percentage they represent of the total city area, is shown on Table 11. In this table, it is indicated that just over 22 percent (3,920 acres) of all land in the city is developed and some 53 percent (9,370 acres) is classified as vacant open land or woodland. Thus, it appears that sufficient undeveloped land is available to significantly influence Dover's future land use pattern.

The major land users are vacant land, agricultural, residential, and circulation. The principal developed land use in Dover is single-family residential with approximately 1,350 acres or 34.5 percent of the developed land. Together single-family and multifamily residential uses make up almost 43 percent of all developed land in the city.

Land devoted to circulation uses is significantly extensive (31.1 percent of all developed land), but as development increases, the percentage should be reduced.

Agricultural activities, although not presently a significant economic factor in Dover, is an extensive user of land. As seen in Table11, agricultural use amounts to just over 19 percent of the total land and is second only to vacant woodland as the largest land use category. Often agricultural land, especially that which is cultivated, is ideally suited to development. For this reason, the location of the agricultural lands could influence future development patterns.

Land Use Intensity

Land use intensity is a measure of the density of development whether residential, commercial or industrial throughout the city. It is usually expressed in terms of lot sizes or lineal feet of road-front property (front footage).

Where private on-lot sewage disposal units are in use, certain soil conditions permit a more intense use of land than do others. Poor soil and slope conditions require a less intense use of land, especially where private water systems are used in conjunction with private on-lot sewage disposal systems. This particular aspect is discussed in more detail in the Land Capability chapter of this Comprehensive Plan.

Table 11. Tabulation of Existing Land Use

Use	Acres	Percentage developed	Percent of total
Developed Uses			
Single-family residential	1,350	34.5	7.6
Multifamily residential	330	8.4	1.9
Commercial	170	4.3	1.0
Industrial	190	4.8	1.1
Public and Institutional	540	13.8	3.1
Transportation, Communication, and Utilities	120	3.1	0.7
Circulation	1,220	31.1	6.9
Subtotal	3,920	100.0	22.3
Open Space Uses			
Recreational	130	-	0.7
Agricultural	3,390	-	19.2
Vacant open land	2,040	-	11.5
Vacant woodland	7,330	-	41.5
Water bodies	840	-	4.8
Subtotal	13,730		77.7
Grand Total	17,650		100.0

Source: Field survey July, 1968,and tabulation by Dover Planning Board.

Under existing City zoning regulations, there are four minimum residential lot sizes (20,000 square feet, 10,000 square feet, 8,000 square feet, and 6,000 square feet) depending on the zoning district. Likewise, the minimum front footage of a residential lot is dependent on the zoning district and varies from 60 feet to 150 feet.

Since much of the city was developed prior to the adoption of zoning, lot sizes throughout Dover vary considerably. In the city center, residential lot sizes range from a low of about

2,700 square feet to a high of about 10,000 square feet. In general, these lots are served by both public water and public sewer service. The lot sizes in most of the remaining sections of the city vary with the zoning requirements (10,000 square feet to 20,000 square feet), although some lots, which developed prior to the zoning ordinance, are 3,400 square feet while others are as much as 35 acres. Generally, these lots are served by public water but have on-lot sewage disposal systems.

Because of the dependence of many of the residential uses on private on-lot sewage disposal systems, the intensity of use (lot size) is an important consideration. A combination of soil characteristics and lot size will determine the feasibility and expected life of sewage disposal by on-lot systems. Although a particular lot may be large enough to accommodate an on-lot subsurface sewage disposal system, it may not be sufficiently large for the relocation of the leaching fields when the existing one reaches saturation. The result will be that at some time in the future costly public sewerage systems will have to be installed in areas that do not presently require it. Lot size standards based on soil conditions and public utility service are presented in Table 14 of the Land Capability chapter of this Comprehensive Plan Report.

Land Values*

The value of land is the result of the interplay of supply and demand. It is where the land value is high that a municipality derives its best return in tax income. Community action should be directed to the maintaining and enhancing of land values by putting land to its most appropriate use. For example, a level tract of land with good soil characteristics located adjacent to an interchange along a major limited access highway is best suited to industrial or commercial development. On the other hand, a residential neighborhood, although desiring the same accessibility, would better be located a short distance from the interchange where it would be protected from the noise and other nuisances.

In the long run it is only through the efforts of City officials in implementing and enforcing land use controls that the City's land values and resultant tax return may be enhanced. Where special exceptions are permitted, any scheme of land uses is destroyed and land values decrease resulting in tax losses to the City.

Dover's land values vary considerably throughout the City, depending upon use and location. Based upon its quality (whether tillable or pastureland), farm land ranges in value from $10 to $100 per acre. Woodland is generally valued below agricultural land between $10 and $40 per acre. The value of building

*Values obtained from Dover City Assessor in January 1969.

lots varies depending upon location. The value of lots along Dover Point Road averages around $15 per linear foot, depending upon depth. In the area known as the "Miracle Mile", lots are valued approximately $100 per linear foot, while lots valued as much as $600 per linear foot and more can be found in the CBD. As pressures for development increase, the values will rise.

Future Land Use Demands

Dover contains 16,810 acres of land and an additional 840 acres of water, or a total 17,450 acres. Just over 22 percent of this land is developed. Future demands will depend to a great degree upon future policies and actions of the City. Past trends have been primarily toward single-family residential-type development, and it is expected that the principal increase in developed uses will continue to be such. However, it is expected that more emphasis will be placed on multifamily residential construction than has in the past.

As residential development occurs, the demand for commercial establishments should intensify, resulting in the growth of commercial activity.

Because of the heavy financial burden which single-family development places upon a municipality, industrial development, which adds greatly to the tax base but requires few services, should be promoted. Recently, emphasis in Dover has been placed in this direction. Many of the elements that attract industry, principally utilities and accessibility, exist in the City of Dover or are in the planning stage. A more detailed study of future land use demands for industry and an evaluation of potential industrial sites is presented in the chapter of this Comprehensive Plan covering Dover's Economic Base.

Demand for public land for additional city services and facilities such as schools, police and fire protection, etc. should increase as land is developed. Furthermore, as more leisure time becomes available and as the city becomes more densely settled, it is likely that demands for recreational facilities and open space will intensify.

The above paragraphs speak in general terms concerning the types of land uses likely to be in future demand. As this comprehensive plan develops, estimates are made of specific land use demands by type of use, land area and timing of development.

Alternate Land Development Patterns

The pattern of land uses in the developed sections of Dover is well established and not easily subject to change. Much of the area of the city, however, is undeveloped and vulnerable to a variety of development schemes. Factors which affect the future use of land include:

1. Physical barriers, including railroads, highways, and water bodies, which restrict development and influence its pattern.

2. Severe soil or topographical limitations.

3. Publicly owned land, which cannot be built upon.

4. Existing and projected areas of utility service.

5. Economic conditions, both in the local and regional Area of Influence.

6. Public controls which can restrict or shape development.

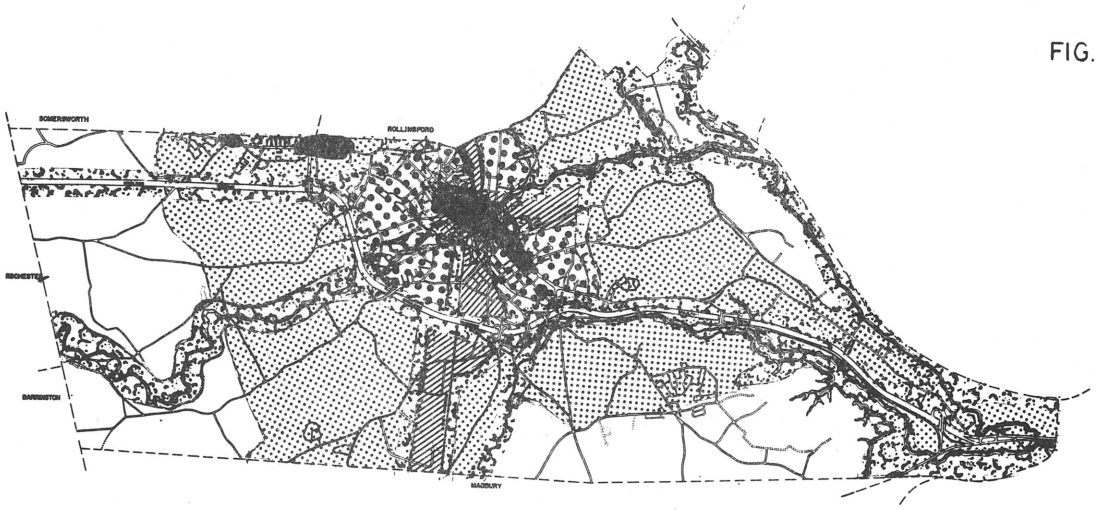
Items 1 through 4 in the above list are only slightly flexible; i.e., an area of poor soils can be built upon but will require costly construction. Likewise, utility service areas can be expanded but only within a reasonable time and money limit. The final two factors on the list, however, are subject to change. Economic pressures could quickly alter the undeveloped quality of Dover's outlying areas, perhaps in directions unsuitable to the overall goals of the City. In order to prepare for the best use of its undeveloped land, the city must determine now what type of community it ultimately desires to be and what new policies should be adopted to promote and retain the desired community character and to accept, deter, or direct development pressures. At that future date when now vacant land is proposed for development, the permitted developed land uses should be oriented in a pattern or scheme which not only promotes the desired community character, but which also maintains land values.

It is the intent of this Phase One of the Dover Comprehensive Plan to prepare a Preliminary Future Land Use Plan for Dover. An initial look at two alternate schemes and their respective implications are presented below. Both schemes assume economic pressures for development consistent with the pattern occurring presently throughout southern New Hampshire.

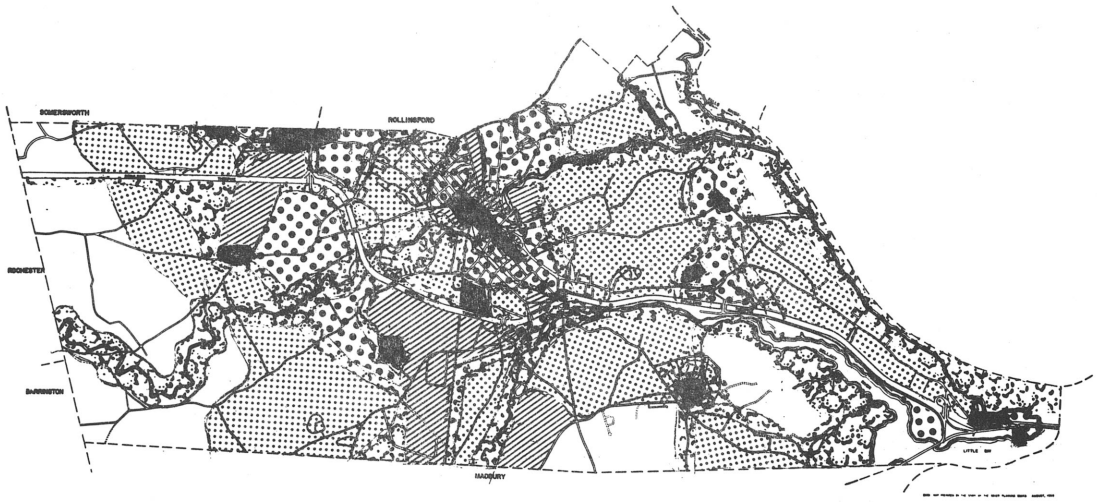
In general terms, Dover can direct its development pattern in one of two basic directions: a "radial spread" pattern of overall lower population density, or a "nucleated" pattern with varying densities of clustered development surrounding each activity core. These idealized patterns are shown on Figure 4.

Radial Spread Pattern. This scheme assumes a density pattern which radiates from one central core. In this pattern, the CBD would be strengthened; industrial areas would be arranged around this center, interspersed with medium to high density residential development, and out-lying areas would remain in low density residential development or open space. This pattern is, in effect, much like the existing zoning provisions for the city.

FIG. 4



RADIAL SPREAD PATTERN



NUCLEATED PATTERN

LEGEND

- Low Residential Density (Open Space and Estate Residential in Nucleated Pattern.)
- Medium Residential Density (Clustered in Nucleated Pattern.)
- High Residential Density
- Green Belt Buffer
- Commercial
- Industrial

COMPREHENSIVE PLAN • DOVER • NEW HAMPSHIRE

"The preparation of this figure was financially aided through a Federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended."

ALTERNATIVE LAND DEVELOPMENT PATTERNS

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Development in the more dense areas would be continuous with breaks only for public open space or land that is extremely difficult to develop. To serve this type of development, the city center (the central business area, a concentrated district providing a wide variety of shopping and convenience goods and services) would remain dominant and the neighborhood centers (small groups of convenience stores serving the local areas) would provide only those goods and services that are secondary to those available in the CBD. The development ring would require extension of public sewer service to the inner areas only within the planning period. Open-space in the inner districts would be publicly owned, of a limited area, and concentrated at sites that are difficult to develop. In the outer areas much of the land would remain open but split into 1 or 2 acre tracts held in private ownership.

Nucleated Pattern The important feature of this pattern is a concentration of development around neighborhood cores. This scheme assumes the supremacy of the CBD, with its total city public and social functions, but it provides for several multiple density development units. The population would be of a greater size in this scheme, and it would be more densely situated. Each developed core, however, would be buffered by greenbelt strips of open space. The intensity of development would require the extension of proposed sewer service areas, but the cost of this service could be more than offset by the tax benefits from more commercial and multifamily uses. The number and size of neighborhood centers would be expanded to provide goods and services to the individual residential cores. Industrial development in low density parks would be expanded.

Radial Spread Pattern The following are the advantages and disadvantages of this possible scheme for Dover's future land use.

Advantages:

1. A possibility of dependence on private on-lot sanitary sewerage system in more areas of the city exists, thereby enjoying a considerable delay in the ultimate extension of the public sewer system.

2. A possibility of saving in costs through the use of a less intricate drainage system in low density areas.

3. The requirement to acquire fewer areas for recreation and public open space.

4. The economic position and outlook of the commercial uses in the central business district strengthened by lessening the competition from smaller shopping areas.

5. The maintenance of a "small city" atmosphere.

Disadvantages:

1. Higher public water and street costs and maintenance per lot in portions of the city, owing to a wider lot frontage requirement.

2. The encouragement of scattered and sprawled development and inefficient use of land, and the resulting reduction of the amount and benefits of usable public open space.

3. The requirement of heavy public expenditure to adequately rehabilitate and expand the CBD. Only part of this expense can be offset by the use of the federal renewal assistance programs.

4. Unless stringent controls are placed on development, the overall effect of "sameness" throughout the entire city.

Nucleated Pattern The following are the advantages and disadvantages of this possible scheme for Dover's future land use.

Advantages:

1. A reduction in per lot costs of public water and streets because of a higher residential density.

2. Strengthening of the residential environment by creating identifiable cohesive neighborhoods resulting in improved land and building values.

3. Shorter and more convenient travel to the neighborhood centers and elementary school through reduced traffic.

4. The creation and maintenance of larger and well structured open space areas and strips, providing a better living environment and protection of the available groundwater sources.

Disadvantages:

1. The provision for community facilities on a smaller scale to serve the neighborhood units, which will increase the unit cost of these facilities.

2. Increased acquisition cost and maintenance of the public open space and buffer areas.

3. The problem inherent with obtaining first-quality business development and buffers between neighborhood centers and residential areas exists.

4. Public sewerage system extension to a larger area to serve the higher residential density.

5. Land use controls which are more difficult to adopt and administer because of the involved procedures under the "cluster" or planned unit development regulations.

The discussion presented above is a first look at some of the future land use possibilities which present themselves. Admittedly, it is difficult to foresee Dover's land totally developed, but in 15 or maybe as many as 25 years, Dover will not have the amounts of vacant and open land which it enjoys now. The large amounts of new development which are occurring must be directed toward a planned objective as expressed in a development pattern. After completing subsequent investigations into Dover's population, neighborhood housing conditions and economic base, a definite direction is chosen and a Preliminary Future Land Use Plan recommended.

LAND CAPABILITY

Land capability refers to the physical characteristics of land and its most appropriate use as determined by these physical characteristics. For example, swampy land has severe limitations as to its use, and is economically best left in its natural state and set aside as a wildlife refuge or simply open land. On the other hand, sandy or gravelly soils are best suited for building development, especially where private on-lot sewage disposal systems will be used.

This chapter of the report forms one of the bases, in this case largely physical, upon which to prepare a future land use plan of the city, as well as land development policies and proposals.

The determination of the physical capabilities of Dover's land is made only after a discussion of natural resources, topography, drainage characteristics, geology, and soils.

Natural Resources

Several significant natural resources exist in Dover, some of which have been developed and others which are presently undeveloped but could become a significant part of Dover's future land use scheme.

Water resources are extensive in Dover. The major water bodies (960 acres)are in the Bellamy, Cocheco, and Piscataqua Rivers which flow either through or partially through the city. In addition, Willand Pond and the Bellamy Reservoir are partially located in Dover.

The principal watercourse in Dover is the Cocheco River. This river has significantly influenced Dover's past development and its present environmental circumstances. In the past, the use of the river as a source for water supply and power was a prime consideration in industrial location. Today, the Cocheco River is used primarily for the discharge of certain treated and untreated domestic and industrial wastes.

Groundwater is also a valuable natural resource to Dover. Presently, Dover's municipal water supply is derived from wells, with additional wells proposed to meet the future

water needs of the city. The location of existing and possible future groundwater supplies as proposed by Camp, Dresser & McKee in their report of November 1965, are shown on Figure 14.

Surficial geological studies in Dover indicate that extensive sand and gravel deposits are located throughout the city. Inasmuch as such deposits are of value as a constuction material, they should be considered a natural resource.

Tidal flats and marshy areas, which are covered by a few inches of water at high tide and exposed at low tide, are a natural resource and should become an integral part of the future development pattern. Tidal flats are found along the downstream end of the Bellamy River and along the entire length of the Piscataqua River. Tidal flats should remain in their natural state providing a habitat for marine life and lands for suitable types of recreation.

Topography

Dover's terrain is predominantly rolling, with slopes from 0 to 15 percent. The elevations within the municipality range from less than 20 feet in the east and southeast portions of the city to over 300 feet above mean sea level in the northwest portion. Significant high points in Dover include Garrison Hill and Long Hill, the latter being the highest point with a peak elevation of some 300 feet. The lowest points are along the banks of the Bellamy and Piscataqua Rivers.

Generally, the topography is such as to pose no specific problem to future development. Furthermore, it appears possible that certain high points in Dover could be developed as scenic overlooks. This possibility will be further evaluated in a later phase of this Plan.

Drainage Characteristics

Dover is divided into three major drainage areas, the Piscataqua-Cocheco River Basin, the Bellamy River Basin and the Oyster River Basin. The limits of these are shown on Figure 5. Most of Dover's eastern border drains into the Piscataqua River, while the western and northern portions of the city drain into the Cocheco River. Most of the southern and central portions drain into the Bellamy River. The remaining portion is a small area along Dover's southern border which drains into the Oyster River. The Cocheco, Bellamy, and Oyster Rivers all eventually drain into the Piscataqua River, which in turn drains into the Atlantic Ocean.

Geology

The bedrock geology of Dover consists of metamorphic rocks with a granitic intrusion. With the exception of a small area underlain with granite, the entire northwest portion of Dover is underlain with a variety of schists identified as the Berwick formation. Within the vicinity of Dover's central business district, the bedrock is a combination of gray quartzite and biotite and quartz mica schists. In the remaining portion of Dover, the bedrock geology consists of gray calcareous slate , gray quartzite, and dark-grey, medium-grained diorite.

In those areas underlain with diorite and quartzite, and where the depth to bedrock is shallow, construction in or excavation of, this material may be very difficult due to the high resistance of this bedrock. However, we believe that bedrock geology will not appreciably affect the prospects of future development in Dover because such bedrock underlays those areas which are generally already developed. In general, the rural areas of Dover, the areas where development is likely to concentrate in the future, are underlain with softer bedrock.

The surficial geology of Dover, like the major portion of the state, is predominantly glacial till. The land area between the Piscataqua and Bellamy Rivers, however, is composed mostly of stratified sand and gravel deposits. In the western corner of Dover and extending east some fifteen miles between the Cocheco River and the Dover-Madbury boundary, the surficial geology consists of stratified sand and silt deposits often covering varved or marine clay. The third and last major land area not composed of glacial till is an approximate one mile-wide strip of stratified sand and gravel, extending from the Dover-Somersworth-Rollinsford boundary intersection to the south of Dover's central business district.

Where varved and marine clay exist near the surface, severe drainage problems may exist and thus hinder future development, especially where on-lot sewage disposal systems are required. This aspect will be discussed more fully under a later section of this chapter. In general, surficial geology appears to pose no extreme problem to future development.

FIG. 5

SOMERSWORTH
ROLLINSFORD
SOUTH BERWICK
ROCHESTER
BARRINGTON
MADBURY
ELIOT
MAINE (YORK CO.)
NEW HAMPSHIRE (STRAFFORD CO.)
DURHAM
NEWINGTON
BLACKWATER HILL
GARRISON HILL
LONG HILL
SPAULDING TURNPIKE
SALMON FALLS RIVER
COCHECO RIVER
PISCATAQUA RIVER
BELLAMY RIVER
LITTLE BAY
B & M RAILROAD

LEGEND

- Major Drainage District Boundary
- Significant High Points
- Tidal Flats
- Existing Ground Water Source
- Proposed Ground Water Source
- Sand and Gravel Deposits as Shown on the Surficial Geology Map of New Hampshire

BASE MAP PREPARED BY THE STAFF OF THE DOVER PLANNING BOARD AUGUST, 1968

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

PHYSICAL RESOURCES

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Soils

Soil characteristics are other important physical features which determine the suitability of land. The fineness or coarseness of the soil, the amounts of gravel, rocks and boulders, and the depths at which these characteristics are found all influence the most appropriate use for the particular soil. For example, sandy and gravelly soils are suitable for supporting development with private on-lot sanitary systems, but are often droughty, and therefore lawns and landscaping suffer from lack of moisture. On the other hand, a soil with an impermeable substrata at a shallow depth is not suitable for on-lot sewage disposal systems but is suitable for most woodland and wildlife uses.

The Soil Conservation Service of the U. S. Department of Agriculture undertook a detailed soils survey of Strafford County including the City of Dover. The survey consisted of evaluating soils for their limitations (capability) for the following seven uses:

1. Sewage effluent disposal
2. Sewage lagoons
3. Homesite foundations (three stories or less)
4. Lawns and landscaping
5. Streets and parking lots
6. Sanitary landfill
7. Cemeteries.

An interpretative report describes the survey and the limitations for each use, and was used as a basis for determining the soil limitation categories found on Figure 6.*

General Soil Areas. Developed as part of the soil study for the Seacoast Regional Plan, twelve different natural recurring groups of soils known as soil associations were identified in Dover. These soil associations were then delineated and shown on a General Soils Map. This map together with a detailed soils map provided sufficient information to determine the suitability of large areas in Dover for various land uses.

Land Capabilities

The classification of the existing soil types into five categories of land capability found on Figure 6 is shown in Appendix Table B-1, and has been reviewed by the Soil Conservation Service. Derived through the combination of slope and soil conditions, the following classes are sufficient for general

* The Soil Conservation Service soil maps and interpretive material used in this study represents advanced copy subject to change upon publication of the Strafford County Soil Survey about 1971.

planning purposes in determining the limitations of large areas of land for residential, commercial, industrial, recreational, and other uses.

Class I - Generally slight limitations in development capabilities. Variable suitability for most woodland and wildlife uses. This class consists of the Hinckley, Windsor, Gloucester, and Charlton soils. These areas generally consist of less than eight percent slopes, of soil that is suitable for on-site sewage disposal, and of suitable depths to bedrock to generally support residential, commercial, and industrial development. In addition, the soils in this class are generally able to provide foundation support for three-storied structures or less.

Class II - Generally moderate limitations in development capabilities. Variable suitability for most woodland and wildlife uses. This class generally consists of the same soils mentioned in Class I, and differs only in that the slopes in Class II range from 8 to 15 percent.

Class III - Generally moderate limitations in development capabilities for those uses where public sewage disposal is available. Suitable for most woodland and wildlife uses. The soils which form this class are the Sudbury, Suffield, Melrose, Elmwood, Acton, Sutton, and Deerfield soils. Characteristic of this class is the poor permeability and generally high water table of the soil. Consequently, on-site sewage disposal systems are generally not recommended for this type of soil. However, this soil class has only slight to moderate limitations for residential, commercial, and industrial development in those areas which are serviced by public sewerage. The presence of groundwater may limit deep excavations for foundations.

FIG. 6

SOMERSWORTH

ROLLINSFORD

SOUTH BERWICK

ROCHESTER

BARRINGTON

MADBURY

ELIOT

MAINE (YORK CO.)

NEW HAMPSHIRE (STRAFFORD CO.)

DURHAM

NEWINGTON

SALMON FALLS RIVER

COCHECO RIVER

PISCATAQUA RIVER

BELLAMY RIVER

LITTLE BAY

SPAULDING TURNPIKE

NEW HAMPSHIRE TURNPIKE

LEGEND

CLASS I
Generally slight limitations in development capabilities. Variable Suitability for most woodland and wildlife uses.

CLASS II
Generally moderate limitations in development capabilities. Variable Suitability for most woodland and wildlife uses.

CLASS III
Generally moderate limitations in development capabilities for those uses where public sewage disposal is available. Suitable for most woodland and wildlife uses.

CLASS IV
Generally severe limitations in development capabilities. Suitable for most woodland and wildlife uses.

CLASS V
Generally unsuitable for building development. Suitable for most woodland and wildlife uses.

Developed Land

Committed Land

SOURCE: U.S. Department of Agriculture, Soil Conservation Service

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

LAND CAPABILITY

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Class IV - Generally severe limitations in development capabilities. Suitable for most woodland and wildlife uses. This class consists of the Buxton, Shapleigh-Gloucester and Hollis-Charlton soils. In addition, many of the soils mentioned previously, but whose slopes range from 15-35 percent, are included in this class. Other characteristics which place severe limitations upon development are the poor soil permeability, high water table, and occasional shallow depths to bedrock.

Class V - Generally unsuitable for building development. Suitable for most woodland and wildlife uses. The most frequently found soils in this class in Dover are the Scantic, Swanton, and Ondawa soils. High water tables, steep slopes, and tendencies toward frequent floodings are characteristics of this class. Consequently, soils in this class are highly unsuitable for any development requiring construction.

Observation of the Land Capability Map indicates that the majority of Dover land has severe limitations or is unsuitable for development. For purposes of emphasizing this most important fact, we have compiled Table 12, using as a basis the detailed soils survey undertaken by the Soil Conservation Service. This table gives the breakdown of Dover's land by capability category.

Table 12. Land Capability

Class	Estimated acres	Estimated percent of total land area
I	3,160	18.8
II	820	4.9
III	2,980	17.7
IV	5,080	30.2
V	4,770	28.4
Total	16,810	100.0

Source: Measurements from Land Capability Map.

Developable Land

The above sections have discussed Dover's physical features individually. Now, through the combination of these features, and by further combining information on existing land uses, it is possible to delineate not only those portions of the city which are suitable for development but also those which are capable of being developed in the future. Such lands which are both suitable for development and capable of future development are termed developable lands.

The amounts of developed land, committed land, land unsuitable for development, and developable land for the City of Dover, are tabulated in Table 13. The following is a brief description of each of the above terms:

Developed land includes all land upon which exist man-made structures presently in use.

Committed land is land approved for development, but which has not been developed.

Land unsuitable for development consists of all wetlands, flood areas, and lands with slopes in excess of 35 percent. It is these areas which have very severe limitations for building purposes and which are most appropriately used for recreation, woodland, or wildlife purposes. Generally, these areas are identical with the land areas placed in Class V of the land capability classification.

Developable land refers to that land that is not developed, or committed to development, but is physically suited for development. Two grades of developable land have been delineated. They are listed as follows, along with a description of each:

Grade I - Generally slight to moderate limitations for most types of development. All developable land of land capability Classes I, II, or III are included in this category.

Grade II - Generally severe limitations for most types of development. All developable land of land capability Class IV are included in this category.

Table 13. Developable Land

Type of land	Acres	Percent of total city
Developed land	3,920	23.3
Committed land	130	0.8
Land unsuitable for development	3,730	22.2
Developable land		
Grade I - Generally slight to moderate limitations for most types of development	5,770	34.3
Grade II- Generally severe limitations for most types of development	3,260	19.4
Subtotal developable	9,030	53.7
Total	16,810	100.0

Sources: Existing Land Use Map,
Soils and Their Interpretation for Various Land Uses, Seacoast Region. October 1966
U.S. Soil Conservation Service soil survey field sheets, unpublished.

As shown in Table 13, 9,030 acres, or 53.7 percent of all Dover land is developable. However, only 5,770 acres or 34.3 percent is Grade I developable land.

Figure 6 shows that Grade I developable land is located generally throughout Dover. The most significant concentrations of Grade I land are in the southeastern and northwestern portions of the city. However, even though these concentrations exist, an extensive single tract of Grade I developable land is difficult to find.

Lot Sizes

The ability of land to support on-lot septic tank sewage disposal systems depends primarily on the permeability of the soil, the slope and depth to seasonal water table. Because of these three factors, 12,830 acres, or 76.3 percent (land capability Classes III, IV, and V) of the land in Dover is poorly suited for such development. Consequently, in residential districts, where dependence is placed upon both private water

and sewerage systems, lot sizes with land capability Class III, IV, or V land should be at least 60,000 square feet. Where public water service is available, the minimum lot size with such land should be 35,000 square feet unless it can be shown that each lot individually has adequate slope and sufficient permeability, in which case the minimum lot size may be reduced to 20,000 square feet. Under no circumstances is it recommended that residential lots dependent on private sewerage systems be less than 15,000 square feet.

Table 14 gives the recommended lot sizes as derived by relating land capability and public utility service areas. These standards are used later in this report for future land use planning.

Implications for Future Development

There is growing recognition in community planning that future land uses should be established in accordance with their land capability. This is particularly true in areas served by on-lot water and sewerage systems.

As shown in Figure 6, there are many areas of land capability Class III in the undeveloped portions of Dover. Inasmuch as such areas have only moderate limitations for development capabilities, it is expected that future development will depend on the extension of the present public sewerage system to these areas. In addition, soil conditions in some areas can provide support for preserving natural areas such as woodlands and wildlife sanctuaries where children as well as adults can observe the wonders of nature.

Table 14. Recommended Minimum Residential Lot Sizes

Utility Service	Minimum Lot Size (sq. ft.)			
	Excessively drained soils (percolation rate of 5 min. per in. or less)*	Well-drained soils (percolation rate of 6 to 20 min. per in.)	Moderately well-drained soils (percolation rate of 21 to 30 min. per in.)	Poorly drained and wet soils (percolation rate exceeding 30 min. per in.)
Private on-lot sewerage system (septic tank and leaching field) and private on-lot water system	35,000**	50,000	60,000	not suitable
Public water system; private on-lot sewerage system	20,000	30,000	35,000	not suitable
Public water system; private on-lot sewerage system initially, public system within 15 to 25 years	20,000	25,000	35,000	not suitable
Public water system; private on-lot sewerage system initially, public system within 10 to 15 years	15,000	20,000	20,000	not suitable

*Percolation rate is the time in minutes for water to fall 1 in. in a specific soil under saturated conditions.

**If public water system not provided within 20 years, 50,000 and 60,000 square feet are the minimum recommended residential lot sizes for excessively drained and well-drained soils, respectively.

Source: Recommended standards by Metcalf & Eddy, Inc., based on sanitary standards set forth by the State of New Hampshire.

Note: The final size for individual lots should be determined by detailed soils, ledge, and groundwater investigations.

POPULATION

Population, size, location, and characteristics are some of the determinants of a city's need for various land uses, circulation facilities, community facilities, and public utilities. It is the purpose of this chapter to analyze past and existing population trends in Dover in order to better predict Dover's future population. Consideration is also given to a variety of other aspects relating to population, including distribution, density, migration, age composition, and socioeconomic characteristics.

Size

The U. S. Census, taken in April 1960, recorded 19,131 persons living in the City of Dover. The Office of Planning and Research of the New Hampshire Department of Resources and Economic Development estimated Dover's population to be 22,231 as of July 1966. Further, based on the field survey of the number of occupied housing units, it is estimated that the 1968 population was approximately 22,680.

Historic changes in Dover's population are shown on Table 15. Between 1910 and 1920, the city's population decreased slightly but during the following three decades, the population in Dover increased from 13,029 to 15,874. This is approximately a 95-person increase per year. During the 1950's, population increased by almost 21 percent, or an average yearly increase of 326 persons. This considerable increase in population growth is believed to be mainly the result of the opening of Pease Air Force Base in neighboring Newington in 1954.

Table 15. Population Change, 1910-1968

Year	Population	Change	
		Number	Percent
1910	13,247	-	-
1920	13,029	-218	-1.6
1930	13,573	544	4.2
1940	14,990	1,417	10.4
1950	15,874	884	5.9
1960	19,131	3,257	20.5
1966*	22,231	3,100**	16.2**
1968***	22,680	3,549**	18.5**

* Estimated by the Office of Planning and Research
** Base year is 1960
*** Estimated by Metcalf & Eddy, Inc.

Source: U. S. Census, 1960.
New Hampshire Local Population Estimates - 1966.

It is estimated that since 1960 the growth rate of Dover's population has remained approximately at that of the preceeding decade. Thus, since 1950, the population growth rate in Dover has been such as to indicate that the potential for high future growth exists.

Composition

The 1950 and 1960 age composition of Dover's population, with percentage changes in the respective age groups, is shown on Table 16. It is evident from this data that Dover's population is definitely becoming younger. Only the first two age groups, 0-4 and 5-14, have increased as a percentage of the total population between 1950 and 1960. As a result, the median age of Dover's population has dropped from 32.7 years in 1950 to 29.4 years in 1960. This trend has been the result of two factors: one, a relatively high birth rate prior to 1960, and two, a high in-migration of young families with children of school and preschool ages. School impact figures for Dover indicate that a significant number of the above young families in 1960 were military personnel associated with Pease Air Force Base. This trend continued into the mid-1960's as well.

Table 16. Changes in Population Composition

Age Group	1950		1960	
	Number	Percent	Number	Percent
0 - 4	1,552	9.8	2,319	12.1
5 - 14	2,346	14.8	3,626	18.9
15 - 24	2,202	13.9	2,469	12.9
25 - 34	2,359	14.8	2,558	13.4
35 - 44	2,223	14.0	2,465	12.9
45 - 54	1,907	12.0	2,087	10.9
55 - 64	1,579	10.0	1,688	8.9
65 and over	1,706	10.7	1,919	10.0
Total	15,874	100.0	19,131	100.0
Median Age	32.7 yrs.		29.4 yrs.	

Source: 1960 U. S. Census

Characteristics

Several population characteristics for Dover are shown on Table 2 in the chapter on Area of Influence. As was pointed out, Dover's 1960 population, in general, was relatively older and had a higher-than-average income and educational achievement than the population of surrounding municipalities. Although less than 7 percent of Dover's population in 1960 was foreign born, almost 29 percent was of foreign stock, with Canada being the country of origin representing the largest percentage. The nonwhite population for the same year was 27 persons, or less than 0.2 percent of Dover's total population. In addition, in 1960 Dover's labor force, for the most part, consisted of craftsmen, foremen, operatives and kindred workers, with less than 5 percent employed in professional, technical, and kindred occupations. Such a labor force composition indicates a high volume of manufacturing activity in the Dover area.

Similar statistics since 1960 are not available. However, there is no indication that any drastic change has occurred since then.

Distribution and Density

The present distribution of Dover's population is shown on Figure 7. The majority of the city's population is concentrated in or adjacent to the city center. However, subconcentrations are located in newly developed subdivisions on Dover Point, Back River and Littleworth Roads to the south, Old and New Rochester Roads to the north, and Glenwood Avenue to the west.

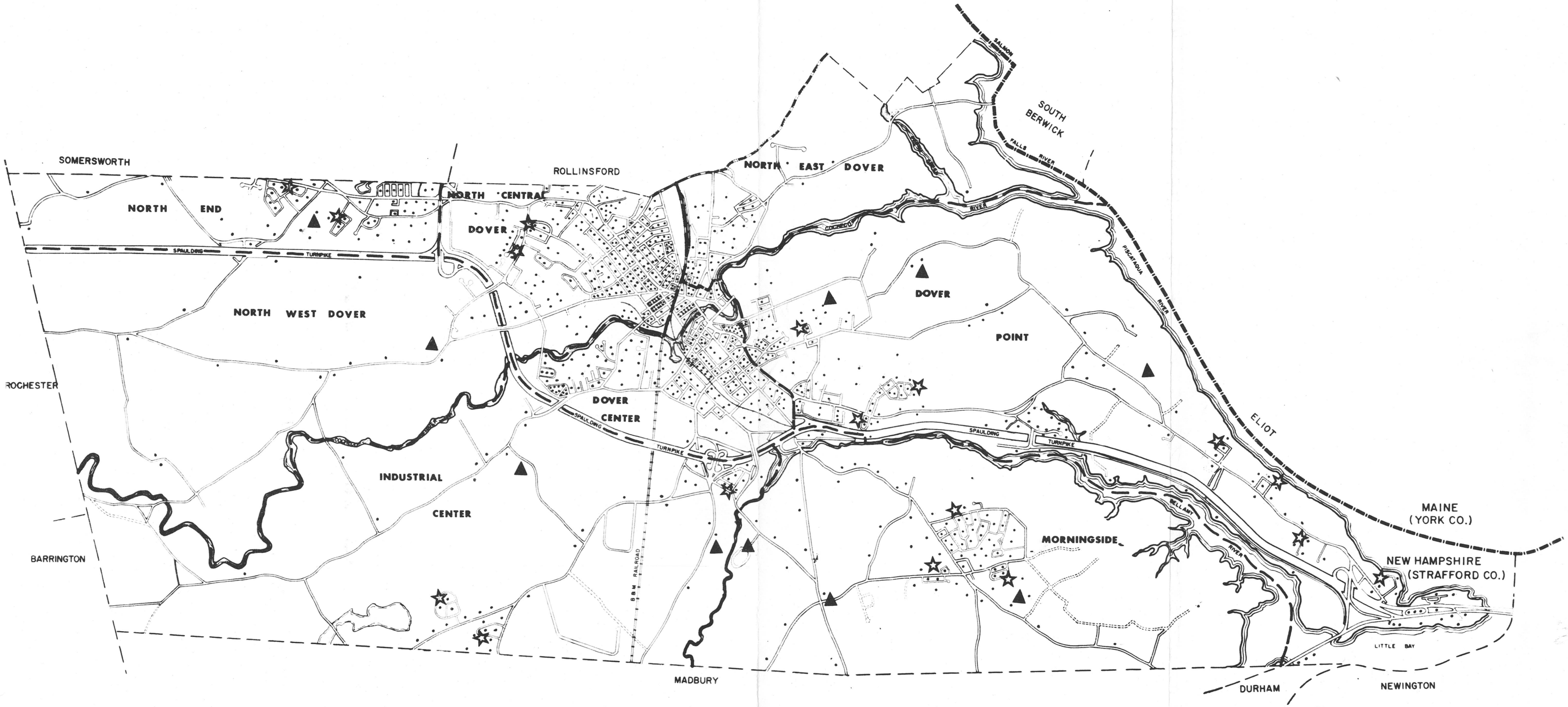
Population densities vary throughout Dover. In 1960, the overall population density was 1.1 persons per acre of land. Based upon the 1968 population estimate, the population density in Dover had increased in 1968 to approximately 1.4 persons per acre of land. In those areas where development has become contiguous, population densities are higher. Using the 1968 population estimate and the existing land-use survey, population density was found to be approximately 13.3 persons per residentially developed acre of land. However, in a number of blocks, the population density was as high as 17.5 persons per acre.

The Population Distribution map shows the population concentration in the central portion of Dover. The remaining relatively low densities indicate that considerable space remains available for further population growth.

Components of Change

The population of any geographical area changes because of two factors: one, natural increase or decrease; for example the difference between births and deaths; and two, the difference between in- and out-migration.

FIG. 7



LEGEND

- 25 Persons
- Recent Population Growth Areas
- Future Population Growth Areas

DOVER NEW HAMPSHIRE

POPULATION DISTRIBUTION

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

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July, 1969

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April, 1969

METCALF & EDDY, INC. ENGINEERS & PLANNERS BOSTON NEW YORK PALO ALTO CINCINNATI

Existing City-Wide Conditions

Evaluation Criteria. In order to evaluate the physical condition of the structures in Dover, a rating system was developed which permits direct comparison with U. S. Census housing data, is applicable on the basis of external observation only, and is suitable for electronic data processing.

A deficiency point system, employing criteria based generally on those established by the HHFA, APHA (American Public Health Association), and the U. S. Census Bureau, was developed. Since much of the HHFA-APHA material is intended for interior survey work, heaviest reliance was on the U. S. Census survey method.

The five-level rating system used in this survey is explained in Appendix Table A-3.The five categories and their designation are as follows:

Rating	Description
1	No defects
2	Slight defects
3	Intermediate defects
4	One or a few critical defects
5	Extensive critical defects

By definition, a structure with a rating of 1 or 2 on the five-level scale presented in Appendix Table A-3 is classified as Sound. A structure with a rating of 3 is classified as Deteriorating. A structure with a rating of 4 or 5 is classified as Dilapidated. These classifications permit direct comparison to U. S. Census tabulations. As a further simplification, Deteriorating and Dilapidated may be combined into a substandard classification.

This system is compatible with the system suggested by the Planning Section of the HHFA and the Urban Renewal Administration for Region I (New England), for use "in order to identify eligible project areas which are to receive Title I assistance."*

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Survey and Evaluation of Structures. During the early fall of 1968, an external inspection was made by the Dover City Planning Department, under the direction of Metcalf & Eddy, Inc., of both residential and nonresidential structures in Dover. A determination was made for each structure; of how many housing units, if any, were in the structure; the type of structure, if nonresidential; and the physical condition of the structure.

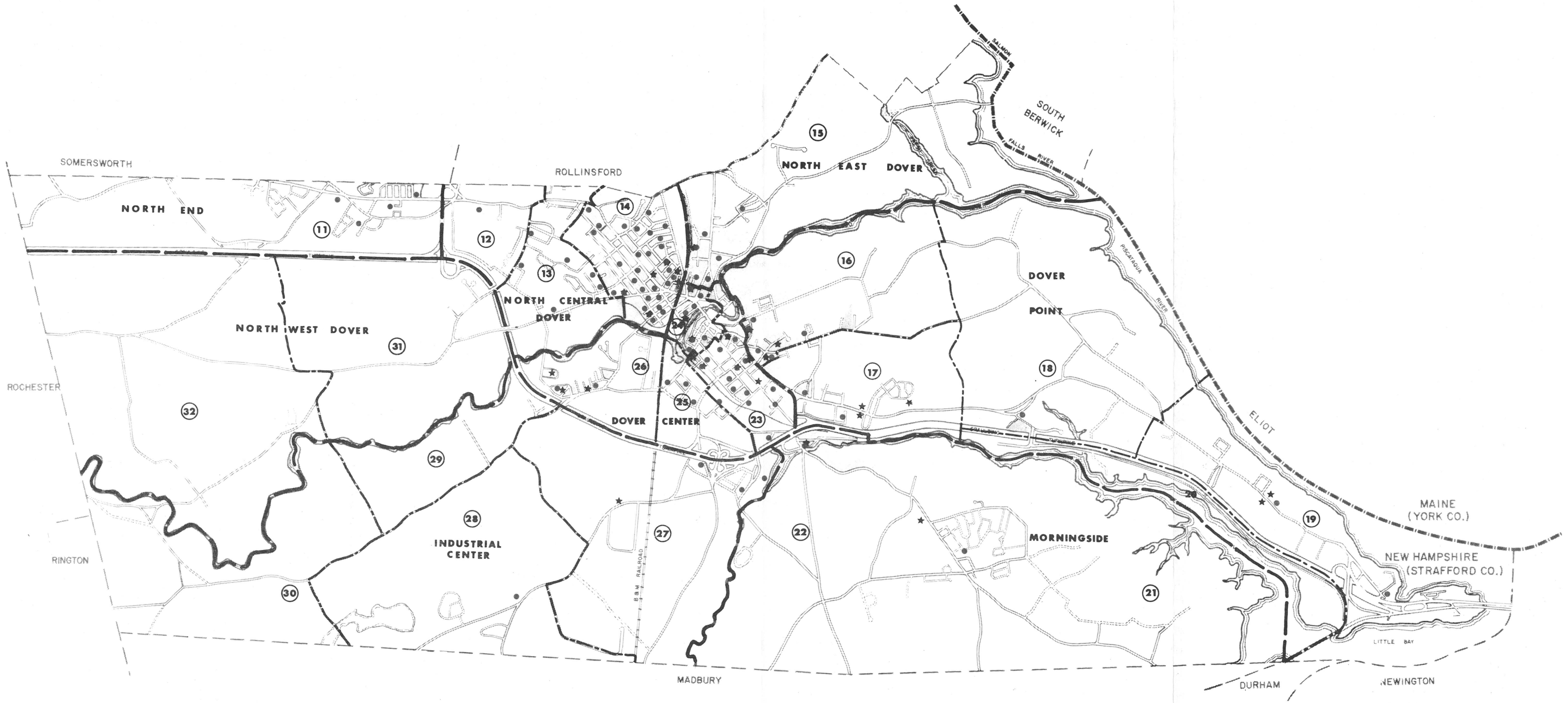
The information obtained during the field survey was coded and processed electronically to produce complete tabulations for Dover as a whole, for the eight basic neighborhoods, for the planning districts, and for the analysis districts. The complete tabulation for city-wide Dover is shown in Table 22.

Comparison with 1960 Census. When comparing the findings of the 1968 field survey with those of the 1960 U. S. Census of Housing, it is necessary to be aware of the differences between the two. The field survey, unlike the U. S. Census, deals with both residential and nonresidential structures as well as housing units. Consequently, when comparing the two, the only statistic which permits comparison is the number and condition of housing units. This is shown in Table 23.A more detailed breakdown of the data shown in this table will be discussed in a later section of this chapter.

Table 23 shows that the number of standard housing units in Dover decreased from 5,117 in 1960 to 5,103 units in 1968, while the percentages of deteriorating and dilapidated housing units approximately doubled. It is reasonable to assume that at least some of the difference in these numbers is due to the fact that both surveys were not conducted by the same person or persons; consequently, a certain degree of consistency was lost. Another explanation may be that the census workers, who were able to inspect interiors of housing units, may have allowed their observations of the interiors to affect their supposedly exterior-based ratings. However, it is probable that the number and percent of substandard housing units in 1968 was greater in the city as a whole, than in 1960, indicating that new and rehabilitated housing units are not replacing those units which are falling into disrepair. Figure 10 shows those areas where greater than thirty (30) percent of the housing units were evaluated to be substandard, based on the 1968 field survey.

Upon compilation of the 1968 field survey data, it was found that only 118 housing units of a total 6,940 were vacant. This amounted to less than two percent of the total housing units in the city and indicates a critical need for additional housing.

FIG. 10



LEGEND

Areas of 30 Percent or More Substandard Housing Units

★ General Location of Residence of Welfare Recipients. Each Symbol Represents 10 Recipients

● General Location of Residents Age 65 and Over. Each Symbol Represents 10 Persons.

Note: Nursing Homes and Public Housing for the Elderly were Exempt from the 1966 Survey.

DOVER NEW HAMPSHIRE

CONCENTRATIONS OF SUBSTANDARD HOUSING UNITS

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

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November, 1969

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TABLE 19 ESTIMATED FUTURE AGE COMPOSITION

AGE GROUPS	1960 POPULATION	1960 PERCENT	1970 POPULATION	1970 PERCENT	1975 POPULATION	1975 PERCENT	1980 POPULATION	1980 PERCENT	1985 POPULATION	1985 PERCENT	1990 POPULATION	1990 PERCENT
0-4	2,319	12.1	2,460	10.5	2,430	9.5	2,760	10.0	2,910	9.6	3,120	9.5
5-9	1,921	10.0	2,690	11.5	2,480	9.7	2,440	8.7	2,780	9.2	2,930	8.9
10-14	1,705	8.9	2,520	10.7	2,860	11.1	2,600	9.3	2,560	8.5	2,910	8.8
15-19	1,293	6.7	2,030	8.6	2,550	10.0	2,880	10.3	2,610	8.6	2,590	7.9
20-24	1,176	6.1	1,850	8.0	2,160	8.4	2,650	9.5	2,980	9.8	2,700	8.2
25-29	1,319	6.9	1,580	6.7	2,000	7.8	2,300	8.2	2,790	9.2	3,110	9.5
30-34	1,239	6.5	1,390	6.0	700	6.5	2,090	7.5	2,390	7.9	2,870	8.8
35-39	1,331	7.0	1,440	6.2	1,460	5.7	1,740	6.2	2,130	7.0	2,430	7.4
40-44	1,134	6.0	1,280	5.5	1,450	5.6	1,470	5.3	1,750	5.8	2,130	6.5
45-49	1,138	6.0	1,290	5.5	1,270	5.0	1,430	5.2	1,450	4.8	1,720	5.2
50-54	949	5.0	1,050	4.5	1,260	5.0	1,220	4.4	1,380	4.5	1,410	4.3
55-59	895	4.7	1,020	4.4	1,020	4.0	1,200	4.3	1,180	3.9	1,330	4.0
60-64	793	4.1	790	3.4	940	3.7	930	3.3	1,110	3.6	1,100	3.3
65 and OVER	1,919	10.0	1,970	8.5	2,050	8.0	2,190	7.8	2,310	7.6	2,550	7.7
TOTAL	19,131		23,360		25,630		27,900		30,330		32,890	

SOURCES:

ACTUAL: U. S. CENSUS, 1960

FUTURE: METCALF & EDDY, INC. ESTIMATES

Housing Needs. The projected population increase of approximately 10,200 by 1990 should necessitate the construction of approximately 3,200 new housing units in Dover, or an average of 145 new housing units per year over the next 22 years. This does not include replacement of existing units. Providing additional housing units is a significant factor in Dover's population growth, for the 1968 field survey showed that less than two percent of the total housing units in Dover were unoccupied. This indicates an immediate need of additional housing.

Labor Force. The productive age group, 20 to 64 years of age, is expected to grow by about 7,100 persons between 1968 and 1990. These additional people, better educated and better trained, will provide a continuing supply of good workers for new industry. This could be a considerable asset to attract industrial concerns to Dover in the future.

Educational Facilities. One of the most important areas for municipal actions is the provision of modern educational facilities to meet the needs of its children. The predicted increase of approximately 1,200 children of school age to the city's population by 1990 indicates that there will be definite needs for expanded educational facilities. This means an increase of approximately 55 classrooms, not including replacement of old facilities, by 1990, over the number existing today.

Other Community Facilities and Services. As Dover's population increases, pressures for new and expanded public utility systems will become more apparent not only to serve residential districts, but also to serve possible new industrial areas as an enticement for such development - a prime requisite toward reducing the tax burden on the home owner. Increased population will require more and better roads, expanded recreational and utility facilities, police and fire protection, and numerous other services. In subsequent chapters of this Comprehensive Plan, and in Phase II and III studies, the future requirements mentioned above are analyzed in greater detail.

NEIGHBORHOOD ANALYSES

The purpose of this study is to investigate the nature, general location, extent, and causes of blight or potential blight in the City of Dover. This study is aimed toward stimulating thought to programs of action which will eliminate existing blight and prevent future blight.

The term "blight" refers to the physical deterioration of an area, resulting in lost efficiency and economic value. The presence of blight is indicated by deficiencies in structural conditions and in the physical environment.

This Neighborhood Analyses Study delineates neighborhoods and other districts and assembles information on the following:

Housing conditions, including the location and extent of blight or potential blight;

Characteristics of families affected by poor housing;

Conditions in nonresidential areas, including location and extent of blight and potential blight;

Adequacy of community facilities and services, both public and private.

As a result of the above data, the extent of blight is identified in neighborhoods and subneighborhoods. At both levels, an attempt is made to determine the causes of deterioration and the steps needed to eliminate present, and prevent future blight.

By compiling specific data pertaining to housing and environmental conditions on a neighborhood or smaller area basis, a true characterization of the city's subareas can be realized. Existing related studies on this subject, such as the study entitled Dover's Neighborhoods - 1962, were reviewed; and wherever possible data was updated and utilized. All residential and nonresidential structures in Dover were surveyed from the exterior and the general physical condition of each structure evaluated, based on a five-point rating scale. Environmental conditions such as mixed land uses and building vacancies were also considered in the above survey. Various city, county and state agencies compiled and made available, additional information for this study. Existing land use data, compiled by the City Planning Department, was also vital. Particular attention was given to the existing pattern of land use as a determinate of neighborhood boundaries, and mixed land uses were recognized as blighting influences.

Based on the data gathered from the above sources, areas of blight in the city were identified and studied in order to determine the causes of, and possible solutions to, neighborhood deterioration.

Delineation of Neighborhoods and Subdistricts

Normally, a "neighborhood" contains from 1,000 to 2,500 families on a land area of varying size. In the more contemporary areas, it may be ideally characterized by a rather solid pattern of homes, linked by quiet streets, and centered about an elementary school, a meeting place (community hall) where people can gather to discuss their common problems, or a park where leisure hours may be whiled away. Generally, in the more established communities, neighborhoods have tended to develop rather spontaneously around shopping areas or other focal points, with boundaries "delineated along lines formed by geographic or natural barriers such as rivers or an abrupt change in the contour of the land, or by man-made barriers such as a major thoroughfare or highway, or by a different land use."*

In determining specific neighborhood boundaries in Dover, a variety of factors were considered. These factors are as follows:

1. Physical factors, such as streets, topography, soils, rivers, railroads and land uses to function either as boundaries or as similar areas.

2. Socioeconomic characteristics, such as income, family size, nationality and housing, where available.

3. Political and historical identity as indicated by ward boundaries, public school district boundaries, certain identifiable sections, such as Dover Point, Back River Area, Dover Center, and the County Farm Area.

It is impossible to fulfill all the above requirements for each neighborhood. However, after consideration of the above factors and discussion with the Dover Planning Board, it was determined that the strongest and most permanent boundaries in Dover today are the Cocheco and Bellamy Rivers and the Spaulding Turnpike. Consequently, wherever possible, these barriers were selected as neighborhood boundaries. Other lines chosen as neighborhood boundaries in Dover include the access road to the northern interchange of the Spaulding Turnpike, a section of the Boston & Maine Railroad right-of-way, a line along St. John and

* HHFA, Workable Programs for Community Improvement, Answers on Neighborhood Analyses, Program Guide 3.

Mechanic Streets, and a section of Central Avenue south of the central business district. Thus, the basic eight neighborhoods, as defined by the above boundaries and shown on Fig. 9 , are identified as follows:

North End - Neighborhood 1
North Central Dover - Neighborhood 2
North East Dover - Neighborhood 3
Dover Point - Neighborhood 4
Morningside - Neighborhood 5
Dover Center - Neighborhood 6
Industrial Center - Neighborhood 7
North West Dover - Neighborhood 8

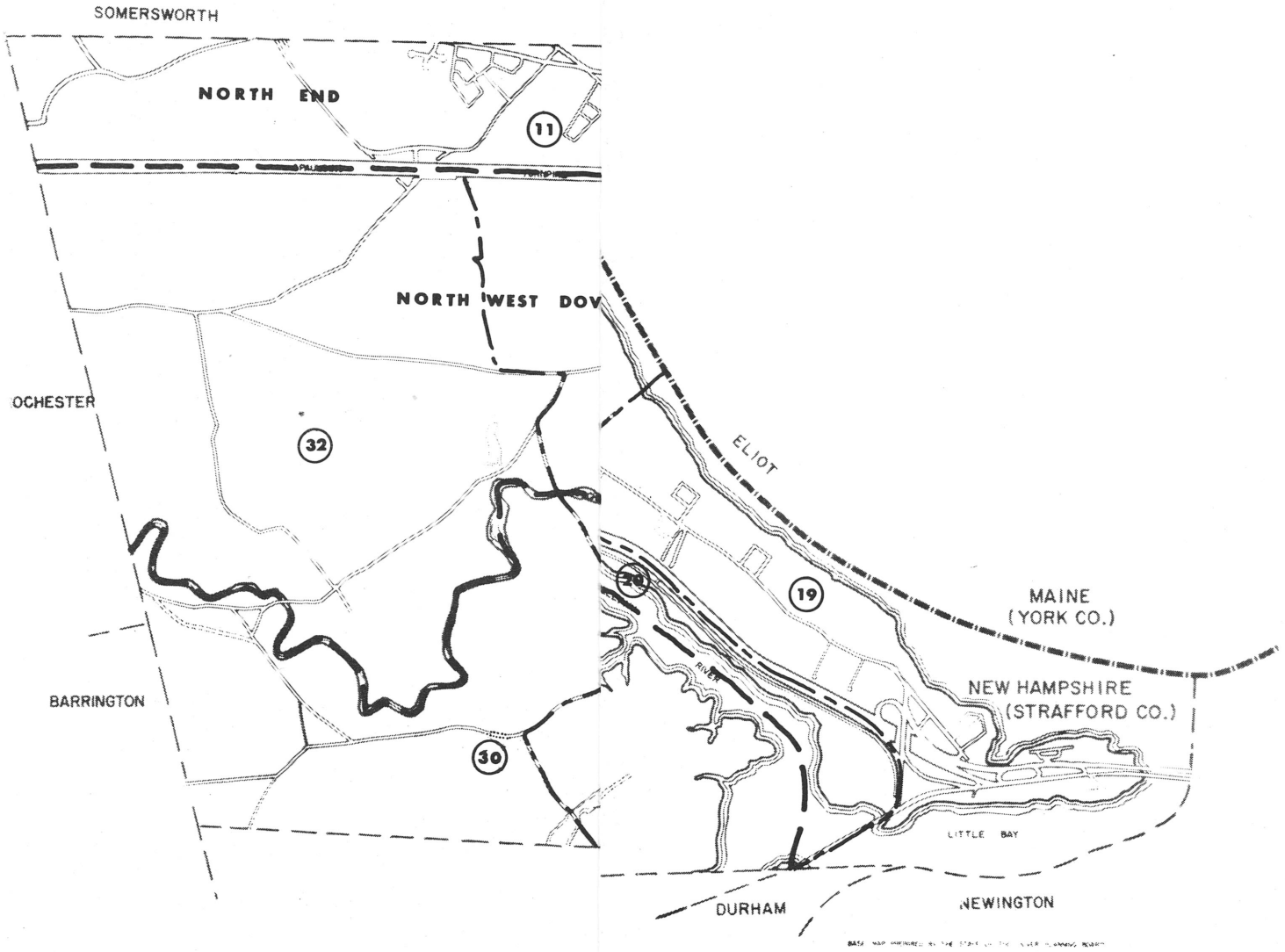
Each of the basic neighborhoods is intended to define an area which contains some distinctive social and economic functions, which differs in some important characteristics from adjoining neighborhoods, and which will continue to be a meaningful division in the future. To accomplish this, future development possibilities were considered as well as the physical barriers used for boundaries. These neighborhoods are used statistically in the population chapter of this Comprehensive Plan.

In addition to dividing the city into neighborhood districts, two types of subdistricts are identified within each basic neighborhood. The larger of the two types is the planning district, which is based mainly upon land use and physical barriers. The system of planning districts is extremely useful in carrying out the detailed land use and circulation planning which is needed in Dover. Each planning district, of which there are twenty-two in Dover, has sufficient internal homogeneity so that it may be studied and planned with only secondary consideration given to its relationships to adjacent planning districts and to the city as a whole.

The smaller of the two types of subdistricts into which each basic neighborhood is divided is called an analysis district. These smaller districts were created partly out of statistical necessity, and partly because some very small districts were needed in blighted areas to give the most accurate possible report. Analysis districts are subdivisions of planning districts or the larger basic neighborhoods. Boundaries were determined by the combination of boundaries for the three types of larger districts.

These analysis districts are useful for statistical purposes, and for providing information about particular small areas, when necessary. There are so many of them, however, that tabulations by analysis district cannot be presented adequately in this type of report. Complete tabulations are, however, on file at the office of the Dover City Planning Board.

FIG. 9


SOMERSWORTH
NORTH END
11
NORTH WEST DOV
OCHESTER
32
ELIOT
20
19
MAINE
(YORK CO.)
NEW HAMPSHIRE
(STRAFFORD CO.)
BARRINGTON
30
LITTLE BAY
DURHAM
NEWINGTON
NEW HAMPSHIRE
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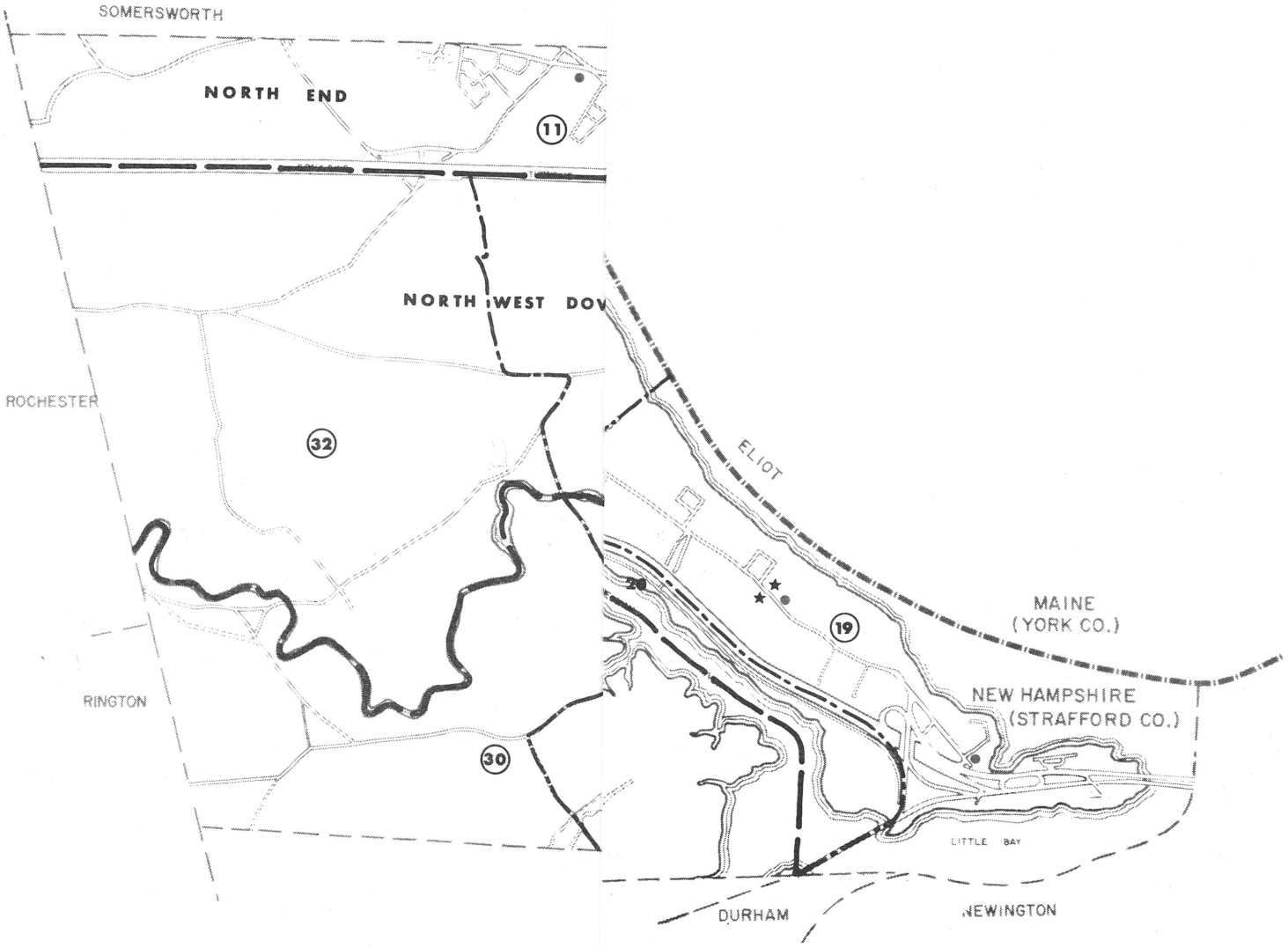

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NEW HAMPSHIRE

CONCENTRATIONS OF SUBSTANDARD HOUSING UNITS

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November, 1969

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Table 22. Condition of Structures and Housing Units

	Condition Code					
	1	2	3	4	5	Total
Residential Structures	2,294	1,620	783	200	25	4,921
Percent	46.6	32.9	15.9	4.1	0.5	100.0
Housing Units	2,812	2,291	1,357	445	35	6,940
Percent	40.5	33.0	19.6	6.4	0.5	100.0
Nonresidential Structures	617	791	704	357	165	2,634
Percent	23.5	30.0	26.7	13.5	6.3	100.0
All Structures	2,911	2,411	1,487	557	190	7,556
Percent	38.5	31.9	19.7	7.4	2.5	100.0

Source: 1968 Field Survey by Dover Planning Department.

Table 23. Trends in Condition of Housing Units

	Sound		Deteriorating		Dilapidated	
	No.	% of total	No.	% of total	No.	% of total
1960 U. S. Census of Housing	5,117	87.4	554	9.5	181	3.1
1968 Field Survey	5,103	73.5	1,357	19.6	480	6.9

Source 1968 Field Survey by Dover Planning Department and 1960 U. S. Census.

Interpreting the nonresidential data in Table 22, it was found that some 53 percent of the buildings were sound, approximately 27 percent were deteriorating, and approximately 20 percent dilapidated. Since the U. S. Census does not provide information on structural conditions of nonresidential buildings, a comparison with the above findings is not possible.

Existing Conditions by Neighborhoods

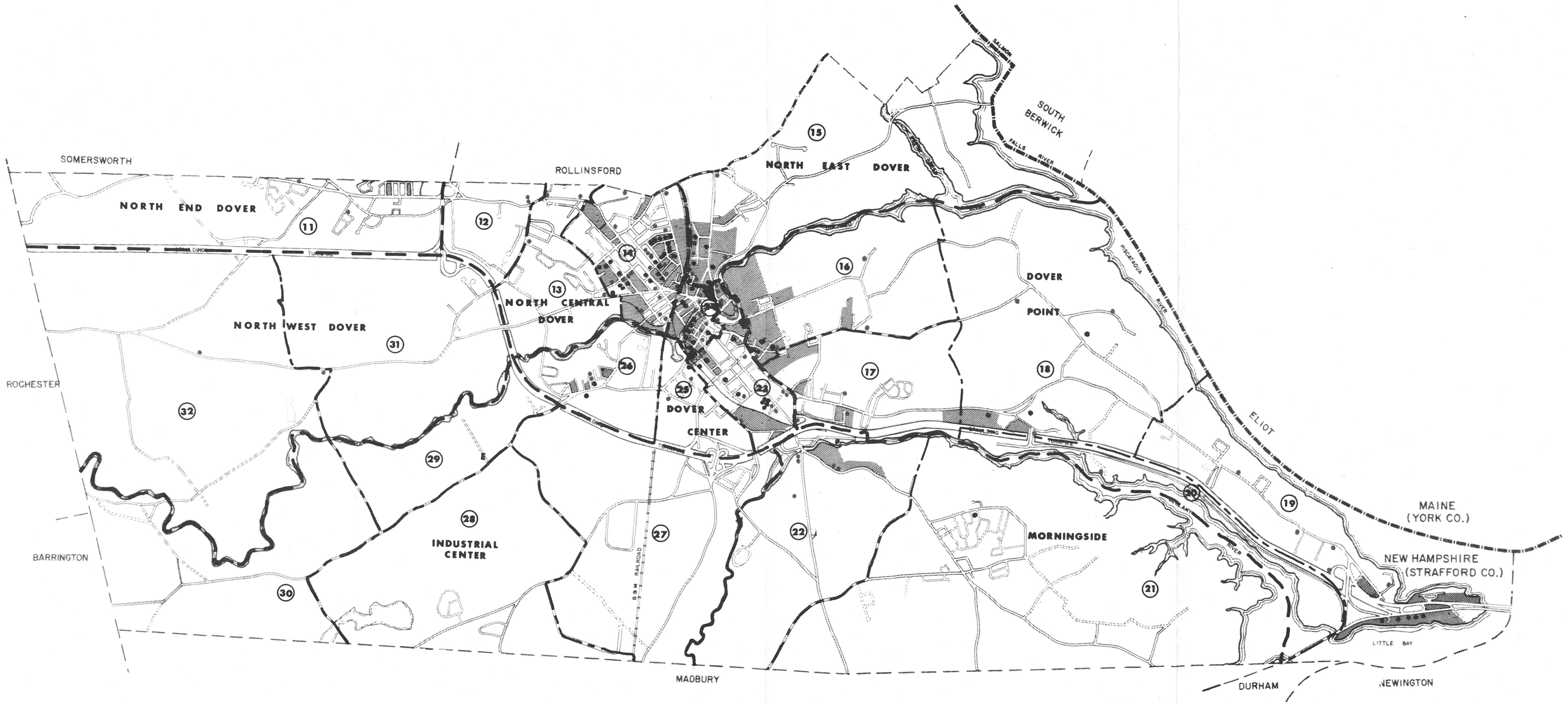
General. The relative status of blight or potential blight in each neighborhood is compared in Table 24 which indicates the percent of structures substandard for each of the eight neighborhoods and the twenty-two planning districts. For the purposes of this study, blighted areas are defined as concentrated areas where 30 percent or more of the structures have been rated substandard. Figure 11, indicates those developed areas where blight exists as defined above.

An effort was made to determine if any correlation could be found between any appropriate local records, and the findings of the 1968 field survey regarding nonresidential structures. The city fire department prepared a map showing locations of structural fires within the city during 1967 and 1968. In addition, although not applicable to nonresidential structures, the city housing inspector provided a map showing the locations of residential buildings on which some official action was taken by the Housing Standards Board between October 1967 and June 1969. In both cases, a definite correlation was found as is readily observable on Figure 11.

The following paragraphs briefly discuss the boundaries, general deficiencies, and structural conditions by planning district of each neighborhood.

North End - Neighborhood 1. This neighborhood is bounded by the Spaulding Turnpike on the south, the city line on the west and north, and the access road to the north interchange of the

FIG. II



LEGEND

Concentration of Blight

Location of Structures Inspected by the Housing Standards Board between Oct. 1967 and June 1969.

Location of Structural Fires Ocurring in 1967 and 1968.

DOVER NEW HAMPSHIRE

LOCATION OF BLIGHTED AREAS 1968

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

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Table 25. Blight and Family Characteristics

Neighborhood and planning district	Substandard housing units		No. of welfare recipi- ents	No. of persons listed as unemployed	Residents over 65 years of age**
	No.	Percent			
North End Dover					
11	23	6.0	9	15	44
North Central Dover					
12	8	7.1	1	3	18
13	23	6.5	6	15	68
14	456	30.6	78	65	251
North East Dover					
15	189	52.1	21	16	66
Dover Point					
16	220	52.6	31*	17	30
17	63	17.6	20*	13	41
18	23	10.6	2	8	20
19	79	24.9	21*	9	21
20	23	45.2	2	1	2
Morningside					
21	25	5.1	8	8	17
22	23	16.7	11	5	13
Dover Center					
23	243	29.7	72*	25	162
24	220	68.3	42	31	82
25	29	13.2	4	4	56
26	30	8.2	29*	8	31
Industrial Center					
27	26	20.0	9	1	15
28	21	12.8	-	2	7
29	22	53.7	-	-	5
30	8	66.7	-	2	1
North West Dover					
31	35	29.7	-	3	11
32	17	30.4	69*	-	1

*A public or quasi-public welfare institution is located within this area.

**Nursing homes and public housing are exempt from this tabulation.

Source: 1968 field survey by staff of Dover Planning Board; various state, county and local welfare agencies; Division of Employment Security; and Strafford County Community Action Commission.

concentrated in the blighted areas, indicating that broken homes, poverty, and other social problems may be associated with blighted areas in Dover.

The approximate location of the place of residence in Dover of each person listed as unemployed during the first quarter of 1969 was obtained from the Dover Office of the Division of Employment Security. Although it was found that the geographical distribution of these residences was general throughout Dover, a relationship was detected between the location of unemployed persons and the location of blighted neighborhoods. As shown in Table 25, the number of people listed as unemployed are greater, in general, in those planning districts which have a high percentage of substandard housing units.

The executive director of the Strafford County Community Action Program provided pertinent data to this study. The results of the door-to-door survey made in 1966, showing the addresses of those over 65 residing in Dover, were made available to us. When this information was plotted on a map, it was apparent that a significant number of elderly persons reside in those areas designated as blighted areas.

The percentage of families renting in Dover is generally high in the blighted areas. It is probable that this statistic is as significantly correlated with blight in Dover's neighborhoods as any other data available. This indicates that the problem of obtaining adequate maintenance of rental property should have a high priority in Dover.

Environmental Conditions and Community Facilities

The degree of maintenance of public facilities and the quality of services that a city provides reflect and often influence the care that its local citizens give to their property. People tend to migrate to areas where the services provided by the municipality are superior to those from whence they came. By the same token, they will tend to desert those communities where services are inferior. Consequently, the adequacy of community facilities and services may be an important factor in blighted areas.

Based on readily available published reports and exterior field observations, and further based on generalized planning standards established for use in this Neighborhood Analysis, the adequacy of community facilities and services available to Dover's neighborhoods are discussed and evaluated in the following paragraphs. Each of the community facilities or services discussed is studied in terms of present and future adequacy in other segments of the Dover Comprehensive Plan. For this reason, discussion of each is of a very general nature, and our judgment is made on the basis of the detailed evaluations where the particular

plan element is completed (utilities) and included in this Phase One report and on the basis of very general evaluations where the particular plan element is to be prepared in subsequent phases.

Based solely on field observation, there appears to be a lack of sufficient outdoor recreation space in several planning districts. Table 26 indicates a correlation exists between blighted areas and those areas which have observed deficiencies in recreation facilities.

Streets in the blighted planning districts are generally narrow, in poor repair, and are generally inadequate to handle the heavy commercial and industrial traffic caused by the nonresidential uses in predominantly residential areas. In addition, pedestrians are endangered due to the lack of, or very narrow, sidewalks along some streets in those areas.

Schools and other public buildings were not fully considered in this section. As mentioned previously, the adequacy of each public structure will be evaluated in a subsequent phase of the Comprehensive Plan. However, it is reasonable to assume that a correlation between schools and blighted areas does exist, inasmuch as older schools are found in older neighborhoods, which in turn, are generally the areas of blight.

Other community facilities and services important to neighborhoods, such as police and fire protection, sanitary sewers, drainage, and water supply are not so easily evaluated by field observation. Conversations with public officials and review of previous studies revealed the following information:

> There are no known inadequacies in the police and fire departments which might be affecting any specific planning districts.
>
> In the older sections of Dover, which as mentioned previously, generally coincide with the blighted areas, the sewerage system, which for the most part in the city is a combined system, is as much as 100 years old. In addition, there are several outfalls which discharge raw sewage directly into the Cocheco River.
>
> In general, the existing water system is adequate. However, the New Hampshire Board of Underwriters reported that fire flows in several areas were deficient. The planning district in which fire flows were found to be deficient are indicated in Table 26.

In addition to inadequate community facilities and services, other factors related to blight are the absence of health and fire safety considerations, incompatibility of adjacent land uses,

building vacancies, and traffic congestion. During the 1968 field survey, no health or fire safety hazards were noted that were characteristic of a certain area. The city fire department, however, provided information which tended to indicate a correlation between the blighted areas and the incidence of structural fires. Similarly, the information provided by the city housing inspector on the location of all housing units investigated by the Housing Standards Board, indicated that the incidence of conditions unfit for human habitation were greater in the blighted planning districts.

A more noticeable factor related to blight is the indiscriminate location of incompatible land uses. Noxious and noisy industrial plants adjacent to residential quarters are certainly not conducive to pleasant living. Furthermore, heavy truck traffic generated by this industry has an adverse effect on an area. Planning districts which are seriously hindered by incompatible land uses are shown in Table 26.

Building vacancies and traffic congestion in some cities are indications of blighted areas. In Dover, less than two percent of the total structures are vacant. Furthermore, building vacancies are not present in significant number in any particular area to conclude that building vacancies and blight are correlated. However, as mentioned previously, traffic congestion, caused by narrow streets and inadequate street pattern, is present in the blighted areas, particularly in and adjacent to the central business district.

Areas of frequent flooding can usually be identified with blighted areas. In Dover, there is no evidence to indicate that flooding occurs.

Evaluation of Causes of Blight

The basic ingredients for blight are people and structures. Although the age and physical condition of a structure are important factors, the rate of deterioration is influenced by how people use and maintain the structure. However, as the preceeding paragraphs indicate, other factors were identified as contributing to area blight in Dover.

Enumerated below is an inventory of those factors present in Dover, which appear to have a blighting influence in dilapidated areas of the city:

Old and obsolete structures

High percentage rate of renter-occupied housing units

Age of residents

Low socioeconomic standards of residents

Table 26. Summary of Blighting Factors

Neighborhood and planning district	Substandard structures		Structural fires	Residences inspected by H.S.B.	Inadequate recreational facilities	Utilities		Incompatible land uses without buffers	Inadequate streets or street pattern	Overcrowding of structures on small lots	Percent of housing units in multifamily residential structures
	Number	Percent				Inadequate water facilities	Inadequate sewer facilities				
North End Dover											
11	23	6.0	2	-	X						1.8
North Central Dover											
12	8	7.1	2	-		X	X				29.5
13	23	6.5	4	-			X				15.6
14	456	30.6	20	26	X		X	X	X	X	72.6
North East Dover											
15	189	52.1	6	9	X		X		X	X	47.9
Dover Point											
16	220	52.6	3	9	X		X				48.9
17	63	17.6	2	-	X						11.2
18	23	10.6	3	3		X					1.8
19	79	24.9	3	5		X					8.5
20	23	45.2	1	-							0
Morningside											
21	25	5.1	2	1	X						2.9
22	23	16.7	5	-							11.7
Dover Center											
23	243	29.7	15	15		X	X	X		X	76.8
24	220	68.3	7	11	X	X	X	X	X	X	90.7
25	29	13.2	2	1			X				55.5
26	30	8.2	2	2	X		X	X			65.6
Industrial Center											
27	26	20.0	1	-							8.5
28	21	12.8	-	-							1.2
29	22	53.7	-	-							0
30	8	66.7	1	-							0
North West Dover											
31	35	29.7	-	-							5.9
32	17	30.4	2	-							3.5

Sources: 1968 field survey prepared by staff of Dover Planning Board, field observation, and various city departments.

Practice of poor living habits by residents

Inadequate community facilities and services such as recreation facilities, streets, and utilities

Mixing of incompatible land uses with insufficient buffers

Stream pollution

Heavy traffic through residential areas

Overcrowding of structures on small lots

It cannot be determined whether these factors are actually causes of blight in particular cases. Blight itself cannot be defined quantitatively. It is hardly reasonable, therefore, to expect to determine the precise cause of something which cannot itself be quantified. Also, cause and effect may be clear enough when applied to physical phenomena, but in the realm of the social sciences such a concept has little utility.

It is more accurate, then, to say that if many of the above factors are present in a neighborhood, it is highly likely that that neighborhood will be blighted, whatever scale of measurement is used. Conversely, if all the above conditions are corrected in a presently blighted area, that area will tend to become and remain a sound neighborhood.*

Programs to Prevent and Eliminate Blight

Presented below are the future steps recommended for the elimination of present blight and the prevention of blight. These are the general steps required by the city to carry out the specific steps, such as redevelopment, recommended on an individual planning district basis in Table 27.

1. Strict Code Enforcement. The city should strictly enforce all codes and ordinances, particularly the housing code. The majority of the blighted residential structures appear to be multifamily residences. A strict and widespread positive application of the housing code will bring the problem of maintenance and repairs out into the open.

* It should be recognized that this is a physical planning approach. Planning for environmental improvements for the people who now reside in the blighted areas might take other directions completely. This would depend on the special characteristics of the population in these small districts.

2. Housing Study. The 1968 field survey conducted by the staff of the Dover Planning Board indicated that a housing shortage exists in the city of Dover. A city-wide housing study should be undertaken to determine the extent and nature of the housing problem. Furthermore, steps should be taken to implement the findings of the housing study.

3. Improved Community Facilities. In those areas designated as blighted areas where a contributing factor was designated as a deficient community facility, it is recommended that the city develop plans for providing such facility. This includes improving street patterns and providing adequate water, sewerage, and recreation facilities.

4. Periodic Neighborhood Review. Periodic review of substandard conditions and the contributing causes and potential causes should be carried out by the city. This should include a search for new causes. Only in this way can the city keep abreast of its neighborhood problems and improve conditions for those who reside in the neighborhood.

The specific steps which the city should take to eliminate blight and prevent future blight are also presented by planning district in Table 27. All of the listed activities are important and should be made continuous programs in Dover until blight is eliminated. Some recommended activities are related to and defined by federal assistance programs, while other activities relate more to a program of physical planning on a neighborhood basis, which must be carried out by the city in order to create the needed physical plans to provide meaning and direction for the other programs.

Presently, the city is in the process of eliminating a blighted section of downtown Dover through the use of the Urban Renewal program. Now in the planning stage, this project encompasses the area bounded by Central Ave., Washington St., the Boston and Maine Railroad right-of-way, and First Street. The city should consider the continued use of this program where, as indicated in Table 27, programs for spot clearance, rahabilitation, code enforcement and redevelopment are recommended.

Implementation programs including urban renewal will have to be more precisely identified and related to local needs by more detailed feasibility studies for the specific areas and the capital improvement program. It is suggested that the city investigate the possibility of obtaining funds in combating blight from federal and state programs. Several of these programs which could be used to achieve the specific recommendations are listed in Table 28.

Table 27. Recommended Programs

Neighborhood and planning district	Spot clearance	Rehabilitation	Improved community facilities	Change in land use	Improve street pattern or traffic conditions	Strict code enforcement	Redevelopment	Improvement of pedestrian facilities
North End Dover								
11	X		X			X		
North Central Dover								
12			X		X	X		
13			X			X		
14	X	X	X	X	X	X	X	X
North East Dover								
15		X	X		X	X		
Dover Point								
16		X	X			X		
17			X			X		
18	X		X			X		
19	X		X			X		
20						X		
Morningside								
21			X			X		
22						X		
Dover Center								
23		X	X	X		X		
24	X	X	X	X	X	X	X	X
25			X			X		
26			X	X		X		
Industrial Center								
27						X		
28						X		
29						X		
30						X		
North West Dover								
31						X		
32						X		

Source: Recommendations by Metcalf & Eddy, Inc.

Table 28. Selected Action Programs with Federal Support

Title	Possible application	Remarks
Urban Renewal	Purchase, clearance, and redevelopment of selected areas; rehabilitation assistance in selected areas.	Effectiveness depends on quality of planning and design.
Code enforcement program	Intensive code enforcement in areas adjacent to the central business district.	Can be coordinated with urban renewal so that power of eminent domain can be used; includes relocation assistance.
Advances for Public Works planning	Public facilities in portions of Dover.	Must be consistent with a program for a coordinated area-wide system.
Open space land and urban beautification grants	Important part of planning in central area; need open-space buffers between conflicting land uses and along major streets.	Must be part of comprehensive planning program.
Neighborhood facilities	Grants to aid in construction and/or rehabilitation of neighborhood centers.	Must be consistent with comprehensive planning; and so located as to be available to low- or moderate-income residents.
Demolition grants	Elimination of the blighting effects of abandoned, dilapidated structures.	Should be coordinated with city-wide enforcement program.

Source: Catalog of Federal Domestic Assistance, by the Office of Economic Opportunity.

At the present time, the programs listed in Table 28 appear to be the most helpful in combating blight in Dover. However, the city should be cognizant of the fact that the number and availability of federal assistance programs available to cities for eliminating and preventing blight is constantly changing. For this reason, it is suggested that the Catalog of Federal Domestic Assistance, an annual publication produced by the Office of Economic Opportunity, be consulted periodically for information on federal programs that could be utilized in combating blight.

ECONOMY

A sound economic situation is essential to the well-being of any community. The activities within the economy should be extensive enough to support the present population and varied enough to provide balanced interrelationships among the individual sectors of the economy. By analyzing past economic patterns and trends, it is possible to assess Dover's present situation and to guide its future economic growth and expansion. The latter goal is important, for any course of action chosen will ultimately have an effect on the range and quality of community services and facilities (schools, recreation facilities, public buildings, and streets) and the amount, type, and location of land needed in the future for particular categories or types of land uses.

Regional Economy

Dover is located in southeastern New Hampshire in an area of significant recent industrial growth. Economic growth of this region has been influenced greatly by the development of the Boston area and "spillover" effects of growth in Massachusetts, a phenomenon that can be expected to become increasingly important as the population density of the Boston Region increases.

For purposes of this chapter, the economic region includes the Portsmouth, Rochester, and the Dover-Somersworth Job Centers. The municipalities included in these Job Centers are as follows:

Dover-Somersworth*	Portsmouth	Rochester
Dover	Portsmouth	Rochester
Barrington	Greenland	Strafford
Durham	New Castle	
Lee	Newington	
Madbury	Rye	
Nottingham		
Rollinsford		
Somersworth		

The general economic orientation of the overall economic region, of which Dover is a part, is toward manufacturing with approximately 60 percent of the total covered employment in 1967 engaged in manufacturing. Of obvious importance to the regional economy, neither of which are included in the above figures, are the Portsmouth Naval Shipyard, located in Kittery, Maine, and the Pease Air Force Base in Newington. Civilian employment at the shipyard, despite the cutback in 1962, is about 8,000

* Newmarket and Newfields added November 24, 1967. However, all data in this chapter for the Dover-Somersworth Job Center is for prior dates.

persons. Although civilian employment at the Air Base is not significant, the economic effect of the military personnel is of importance.

The recent trend in the regional economy is evident from the figures in Table 29. The total covered employment has grown from 19,876 in 1963 to 22,805 in 1967, over a 15 percent increase in 4 years.

The Dover-Somersworth Job Center contains approximately 54 percent of the regional covered employment. However, it contains about 67 percent of the regional covered manufacturing employment. In contrast, it contains only 34 percent of the regional nonmanufacturing employment which is centered in the Portsmouth Job Center. This participation in total regional employment has remained about the same over the period 1963 to 1967.

A significant shift in the overall regional economy is found within the region, but the tendency has been for the balance to remain for the region as a whole. This refers to the shift to a greater percentage of non-durable manufacturing in the Dover Job Center, whereas the region as a whole has remained about the same.

The overall conclusion from the above is that Dover is located in an area which has seen significant economic growth in recent years and during this growth, the strong orientation toward manufacturing has remained. With this general picture of the broad regional situation, a more detailed analysis of the City of Dover can be better understood, and more reasonable projection can be made. These are presented in the following paragraphs.

Labor Force

The type of labor force* found within a municipality, as well as within its immediate area, is one of the factors influencing future economic development within the city. As an example, an electronics research industry usually will not locate in an area largely inhabited by a low or semi-skilled labor force. On the other hand, a manufacturing concern employing largely a low-skilled labor force usually will not construct a new plant in a community largely inhabited by high salaried executives.

Labor force statistics are compiled by the U.S. Bureau of the Census as part of the decennial census. Therefore, the most recent data available on certain characteristics of Dover's labor force are 1960 data. Therefore, their usefulness is in a general summarization of information.

*Labor force is defined as the residents of a community 14 years old or over who are working or seeking work.

Table 29. Employment by Job Center

Year	Job Center	COVERED MANUFACTURING EMPLOYMENT* Durable: Electrical Products	Durable: Machinery, Lumber, Metals	Non-Durable: Leather Products	Non-Durable: Other	COVERED NONMANUFACTURING EMPLOYMENT*: Construction	Trans., Comm., Util,	Trade	Finance, Insurance, Real Estate	Services, Other
1963	Dover-Somersworth	2,872	912	3,093	1,453	287	129	1,521	289	451
	Portsmouth	505		494	201	641	350	2,007	241	615
	Rochester	144	116	1,714	846	106	31	565	121	172
	Total - 19,876	4,549		5,301	2,400	1,034	500	4,193	651	1,248
				7,701						
	Percentage of Total	22.9%		38.7%		5.2%	2.5%	21.1%	3.3%	6.3%
1965	Dover-Somersworth	2,770	1,013	3,434	2,299	303	143	1,712	293	511
	Portsmouth	724		200	568	730	383	2,100	276	603
	Rochester	339		1,767	878	60	32	673	143	186
	Total - 21,930	4,836		5,301	3,745	1,093	558	4,485	612	1,300
				9,046						
	Percentage of Total	22.1%		41.2%		5.0%	2.5%	20.5%	2.8%	5.9%
1967	Dover-Somersworth	2,630	1,196	3,500	2,065	227	159	1,883	324	519
	Portsmouth	782	310	544	726	461	2,394	296	703	
	Rochester	482	1,530	978	144	89	727	173	173	
	Total - 22,805	4,880	5,340	3,587	1,097	709	5,004	793	1,395	
			8,927							
	Percentage of Total	21.4%	39.1%		4.8%	3.1%	21.9%	3.5%	6.1%	

Source: New Hampshire Department of Employment Security

*Figures for November.

As would be expected in an area where the orientation of industry is heavily toward manufacturing, the labor force skills are similarly oriented. In 1960, approximately 47 percent of the male labor force skills were classified as craftsmen, foremen, operatives and kindred workers. In addition, there was a high participation in the labor force by females (43 percent of those 14 years old and over) and the skills of the employed female labor force is strongly concentrated in the classification of operatives and kindred workers.

Although there are no statistics since 1960, it is expected that the trend in the labor force characteristics since 1960 has somewhat oriented itself to the trend in local employment, i.e., more toward the manufacturing types requiring higher skills. However, this is a slow trend and probably only a slight shift.

Commuting Patterns. Dover and its surrounding region has a very mobile labor force. Commuting patterns in the region revolve primarily around the established centers of Dover, Somersworth, Rochester and Portsmouth, but commuting distances, with few exceptions, rarely exceed 20 to 25 miles.* Industries employ workers in many towns. Based on a survey** of employees in the Southeastern New Hampshire Industrial Park, only about 30-35 percent of the employees live within the city. Rochester and Somersworth have about 25 percent while 29 area towns contribute the remaining commuting employment.

Specific statistics for other employers in Dover or for residents of Dover are not available. However, it is known that the major employer in the region, the Portsmouth Naval Shipyard, employs almost 800 city residents.

Work Force***

The recent industrial growth within the Dover area has meant increased total employment and decreased unemployment. Employment within the Dover Local Office Area****has grown gradually from over 27,200 in November 1963 to over 29,000 in November 1967. Percentage increases, in fact, have exceeded those of the state as a whole. Unemployment in the same area has decreased from 3.6 percent in 1963 to 2.0 percent in 1965 and 1.6 percent in 1967. Job Center unemployment has followed these

*Industrial New Hampshire, Office of Industrial Development 1969.
**February 1966 by the Dover City Planning Department.
***Work force is a term used by the New Hampshire Department of Employment Security, which refers to the total number of persons employed in an area, regardless of place of residence.
****Local Office Area is another classification created by the New Hampshire Department of Employment Security. It is larger than the Dover Job Center and includes the Rochester Job Center and the Farmington-Milton Job Center.

figures closely while the City of Dover's figures are often higher, often in the spring and summer months when certain industries cannot use their peak in labor force and must lay off workers for a time. For example, in May 1969 there were 250 unemployed persons living in Dover, which is over 3 percent of covered employment in the city and about 2.6 percent of the total employment.

Covered Employment*

Table 30 lists covered employment in the Dover Job Center from 1963 through 1967 and points out the extent to which the Dover Job Center is committed to manufacturing. (Dover City's covered employment is from 65-70 percent of the total Job Center.)

Although the proportion of Job Center covered employment engaged in manufacturing has decreased ever so slightly recently, the numbers employed in manufacturing have increased by about 1,038 since 1963. Within the city itself covered manufacturing employment has shown steady increases since 1963 increasing by 1,038 employees by 1967.

Table 30 Covered Employment, Dover-Somersworth Job Center*

Industry Group	1963 Number	1963 Percent	1965 Number	1965 Percent	1967 Number	1967 Percent
All Industries	11,007	100	12,477	100	12,503	100
Manufacturing	8,330	75.7	9,515	76.3	9,391	75.1
Nonmanufacturing	2,677	24.3	2,962	23.7	3,112	24.9
Construction	287	2.6	303	2.4	227	1.8
Transportation, Communications, Utilities	129	1.2	143	1.1	159	1.3
Trade	1,521	13.8	1,712	13.7	1,883	15.1
Finance, Insurance, Real Estate	289	2.6	293	2.3	324	2.6
Services and Other	451	4.1	511	4.1	519	4.2

*Figures for November

Source: New Hampshire Department of Employment Security.

Nonmanufacturing employment has become a slightly greater percentage of the total employment with steady increases in trade, finance, insurance and real estate. This indicates that other

*Covered employment includes all jobs insured under the State Federal Employment Security Program. Almost all manufacturing jobs are covered. The majority of nonmanufacturing jobs are covered with the major exception being employment in government, non-profit activities, self-employment and agriculture.

sectors of the economy have responded to the healthy atmosphere created by manufacturing and have grown accordingly.

The city's covered employment has increased steadily in the last 10 years with only minor drops in manufacturing prior to 1963. Rates of increase have fluctuated with a 13.6 percent increase in covered manufacturing from 1963 to 1965 and an increase of 6.3 percent from 1965 to 1967. (See Table 31). Nonmanufacturing growth is also not increasing as rapidly in the more recent period due perhaps to the decline in military personnel in 1965 to 1966. (Recent figures in nonmanufacturing employment show and upturn.)

Table 31. Trends in Covered Employment, City of Dover

	Employment			Yearly Change		Percentage Change	
	1963	1965	1967	1963-65	1965-67	1963-65	1965-67
Manufacturing	5,000	5,679	6,038	340	180	13.6	6.3
Nonmanufacturing	1,989	2,155	2,264	83	55	8.3	5.1

Source: New Hampshire Department of Employment Security

Wages and Income

Every economic sector, both in Dover and in the Dover Job Center, has increased the average annual wages paid to covered workers between 1963 and 1967. The largest increases took place in manufacturing. (See Table 32) Wages were higher in the Job Center than in the City of Dover in 1963 but annual wages increased at a greater rate in the City of Dover (16.5 percent) and by 1967, wages were almost equal in manufacturing and had surpassed the Job Center wages for nonmanufacturing.

During the same period effective buying incomes in the city increased from $6,953 in 1963 to over $9,100 in 1967.

Table 32. Average Annual Wages of Covered Employment, City of Dover and Dover-Somersworth Job Center

	Dover			Job Center		
	1963	1965	1967	1963	1965	1967
Manufacturing	$ 4,481	$ 4,831	$ 5,218	$ 4,622	$ 4,906	$ 5,241
Nonmanufacturing	3,594	3,867	4,196	3,602	3,925	4,188

Source: New Hampshire Department of Employment Security.

Economic Sectors

The following sections study in greater detail the Dover economic base in terms of the various economic sectors identified above. Each sector is analyzed according to its size, location, diversity, and employment. The behavior of each sector is important for identifying the economic resource capabilities or deficiencies and for determining Dover's overall economic prospects and land use needs.

Manufacturing Sector. Manufacturing in the Dover Job Center has increased in numbers of covered firms from 49 firms in 1963 to 52 in 1967, while employment increased from 8,330 to 9,391 in the same period.

The Dover Job Center, which was once predominantly a textile manufacturing area, has in the last 10-15 years developed a diversity of manufacturing establishments. The decline in textiles was followed by development in shoe manufacturing and leather products and activity in electrical products, rubber products and machinery.

Since 1963 leather products have increased more than any other manufacturing employer while electrical products have actually decreased in employment and percentage of manufacturing (26.1 percent in 1963 to 21.0 percent in 1967). Machinery, lumber wood and metal products have increased steadily during this time (See Table 33 .)

Table 33 Covered Manufacturing Employment, Dover-Somersworth Job Center*

	1963		1965		1967	
Industry Group	Number	Percent	Number	Percent	Number	Percent
Manufacturing	8,330	75.7	9,515	76.3	9,391	75.1
Durables	3,784	34.4	3,782	30.3	3,826	30.6
Electrical Products	2,872	26.1	2,769	22.2	2,630	21.0
Machinery, Lumber, Wood, Metal, and Other	912	8.3	1,013	8.4	1,196	9.6
Non-Durables	4,546	41.3	5,733	45.9	5,565	44.5
Leather Products	3,093	28.1	3,434	27.5	3,500	28.0
Other Non-Durables	1,453	13.2	2,299	18.4	2,065	16.5

*Figures for November

Source: New Hampshire Department of Employment Security

Within the City of Dover manufacturing employment in covered firms has continued to grow, increasing most rapidly in the 1963-1965 period when over 226 new employees were added on the average, per year. (See Table 34)

Covered manufacturing employment has continued to be over 72 percent of the city's total covered employment over the last 10 years, which reflects its importance to the economic base of the City. The Job Center's covered employment has remained around 76 percent manufacturing over the last 10 years.

Table 34. Covered Manufacturing Employment City of Dover

1963	1965	1967
5,000	5,679	6,038

Source: New Hampshire Department of Employment Security

Location of manufacturing within the city has changed greatly in the last 10-20 years. Once found near the Cocheco River, and near or in the central business district, more recent manufacturing firms have located south of the Spaulding Turnpike in more rural areas (See Figure 12). Many of these have located in the Industrial Parks, located along the Boston and Maine Railroad south of the Turnpike. The new industries are more interested in access and room for expansion and lower land costs. In the future much of the new growth is expected to follow this trend and locate within easy access of the Turnpike and away from the central business district.

Retail Sector. Based on U. S. Census of Business Data the number of retail establishments has increased from 249 in 1958 to 275 in 1963 along with a greater increase in sales per establishment. However, in some cases larger shopping centers have produced less establishments of a larger size making comparisons of numbers of retail establishments less meaningful. Looking at the growth in sales, however, we find much growth since 1963. Sales increased from $39,937,000 in 1963 to over $49,857,000* in 1967, a 24.8 percent increase.

Since 1963 retail sales in Dover have continued to increase on the whole, but certain establishments have lost sales, especially in the 1965-1966 period after the withdrawal of a large military population from Pease Air Force Base. These figures are shown in Table 35 by various categories of retailers. This list is not inclusive of all retailers but does include the majority (See Table 35). During the same time there have been decreases in the number of establishments in all but gas stations and eating and drinking places. Much of this decline

*Source: Editor and Publisher, Market Guide, 1963 and 1967.

in number of establishments is probably a case of smaller establishments going out of business or consolidating and development of larger stores, and shopping and business centers.

Table 35 . Retail Sales* for City of Dover

Establishment	1964 No.	1964 Sales ($1,000)	1966 No.	1966 Sales ($1,000)	1968 No.	1968 Sales ($1,000)
Hardward	11	3,098	11	2,021	11	2,617
General Merchandise	8	4,159	8	4,515	8	5,850
Food	66	10,668	58	9,864	58	12,774
Automotive	20	4,055	16	7,702	16	9,974
Gasoline	16	2,154	22	2,569	22	3,326
Apparel	27	5,257	23	2,739	23	3,547
Furniture	17	2,559	15	1,542	15	1,997
Eat, Drink	33	1,525	49	1,582	49	2,048
Drugs	4	1,065	3	883	3	1,143
Total	202	34,540	205	33,417	205	43,276

*Source: Editor and Publisher, Market Guide, 1968, 1966, 1964

It seems that "extra money" available with higher wages and greater employment has gone toward automobiles and general merchandise, but some of this extra money is being spent outside the city in Boston, Portsmouth and other areas, perhaps due to lack of good quality stores, especially furniture, appliance, and clothing stores in town.

Newer retail centers are larger and more diversified with many types of stores and other facilities. Extensive parking is provided and larger market areas are served.

The location of retail activity, once confined to the central business district and smaller neighborhood centers, has now spread out along the major roads within the city. Almost all retail types have been affected by this trend. The map of commercial sites (see Figure 12) shows this with retail activity extending out from the central business district. These newer areas are increasing in land area/employee and this trend is likely to continue.

An effective indicator of economic trends within a community is effective buying income and the percentage changes in households in the community within different cash income groups. Table 8 shows changes in effective buying income by household, which has increased rapidly in the last few years.

Households with incomes over $10,000 per year have experienced over a 22 percent increase in the last 10 years. This could indicate a strong professional and manager oriented labor force and increases in Research and Development and other higher paying occupations, or more wives working in the community. This may produce demand for specialty goods and services. Increases in services reflect this trend also.

Table 36 . Household Income - City of Dover

	Effective Buying/Household Income		
	1963	1965	1967
	$6,953	$8,028	$9,102

	Cash Incomes by Income Groups		
	1963 (Percent)	1965 (Percent)	1967 (Percent)
0 -$2,999	15.5	14.0	15.1
$ 3,000- 4,999	18.6	15.7	12.7
5,000- 7,999	33.1	32.9	27.6
8,000- 9,999	17.0	18.6	17.6
10,000+	18.6	18.8	27.0

Source: Sales Management, "Survey of Buying Power," 1964, 1966 1968.

Per capita sales have increased steadily from 1963 to 1967, increasing from $2,017 per capita in 1963 to over $2,221 per capita in 1967. These are relatively high per capita sales figures indicating Dover's importance as a regional shopping center and the increasing economic growth within the city. For comparison purposes, Nashua's per capita sales in 1965 were only $1,774. Per capita retail sales for the State of New Hampshire were $1,600 in 1965.

Per capita sales have increased steadily from 1963 to 1967, increasing from $2,017 per capita in 1963 to over $2,221 per capita in 1967. This is an indication of Dover's importance as a regional shopping center (i.e., Nashua's per capita sales in 1965 was only $1,774, State of New Hampshire $1,600), and of the increasing economic growth within the city.

south since the building of the Spaulding Turnpike. However, the Turnpike also encourages longer shopping trips (for example, to Portsmouth or even Boston).

If Dover is to remain competitive, "access" will continue to be their major resource. The fact that Dover is a manufacturing center with a relatively large concentration of population also points toward continued growth.

Dover's residents and their elected officials have shown great interest in new economic development. They have organized an Economic Commission that works with the State Industrial Development Board and interested industries. New areas have been zoned for industry and two industrial parks have been developed. The community climate is favorable for any potential industry and the city's history of good treatment is also an important attraction. Development standards are also adequate, with reasonable regulations and restrictions.

The Dover Economic Commission has been in operation over 4 years. In that time over $5,000,000 in new commercial and industrial construction has been completed. Over 200 acres of land was rezoned for industrial purposes and an industrial park was developed with the help of $2,000 from the State Industrial Development Authority for engineering work, the Dover Development Corporation and the City of Dover Public Works Department. Shopping centers have also developed and, over the last 4 years, 15 new buildings have been built, with a total area of 145,000 sq. ft. and an important tax value of about $1.65 million.

Dover has many other attractions that are considered important by industry. These include a high quality school system, proximity to the University of New Hampshire, access to the ocean and recreational areas, and a large well-equipped hospital. These combined with its other assets place Dover in a very good position in regards to economic growth.

Economic Prospects

Projections for the southeastern region* of New Hampshire by A.D. Little, Inc. in 1968 forecast increases in employment of more than 53 percent for this region between 1965 and 1980--a rate almost double that projected for New England. Manufacturing employment is expected to grow over four times as fast as other New Hampshire regions.

Dover is in a definite competitive position to receive a good share of this growth but cannot sit back and expect the growth to come to them with no work or improvement on their part.

The major manufacturing elements of Dover are firmly tied to nationwide regional prosperity. Fields such as electronics,

*Strafford, Rockingham, and Hillsborough counties

are likely to exhibit continuous growth. In addition, the firms which manufacture leather products, clothing, and furniture share the opportunity and increasing population growth in the northeast. It is not likely that they will experience growth as rapid as is probable in the electronics firms, but they are not expected to decline. Overall, Dover may expect to maintain a healthy and prosperous manufacturing base which employs an ever increasing number of workers.

As the manufacturing sector of the economy grows other sectors will follow. Retail and wholesale trades will continue to serve the increasing population of Dover and the surrounding towns while the construction industry will respond to the influx of new industries and increased population. Service establishments will increase as will utilities serving the city.

Covered manufacturing employment is expected to increase to 7,800-8,000 by 1990 while nonmanufacturing is forecast to increase to 3,400-4,000 employees by 1990 and much industrial and commercial lands will be put to use. (See Table 41.)

The characteristics of the labor force are expected to remain essentially the same. Dover will continue to be a manufacturing-service city with wage increases that go along with inflation and continued prosperity. Most of the residents will remain middle class and educational levels will rise. The central city is likely to grow slower than the suburban areas and retain the greater range of incomes.

Table 41 . Estimated Employment, Labor Force, and Industrial and Commercial Land Area Requirement for Dover.

	1965	1968	1990
Total Employment (covered)			
in Manufacturing	5,679	6,014	7,800-8,800
in Nonmanufacturing	2,155	2,388	3,400-4,000
Total Labor Force	8,815*	9,500*	15,690
Ratio of Employment to Labor Force	89:100	88:100	71:100-82:100
Land in Industrial Use	120	130	330-380
Land in Commercial Use	145	165	240-270

*Estimated

At present there are approximately 300 acres used for industrial and commercial purposes in Dover*, amounting to about 9 percent of the developed land within the city. The amounts of

*Mining and quarrying subtracted from industrial total.

land areas in industrial and commercial use are increasing with the continued development of Southeastern New Hampshire Industrial Park and the more recent development of Garrison Industrial Park and the shopping centers within the city. The above acreage figures are therefore quite volatile. Existing and future industrial and commercial developments are expected to double the land area in commercial and industrial land by 1990. In the following pages possible sites are analyzed and conclusions made as to the future development of industrial and commercial areas.

Potential Major Industrial and Commercial Sites

In surveying Dover for potential industrial and commercial development sites the following items were considered in order to determine the suitability of the site for industry and commercial use and the compatibility of the site with the long-range physical and economic development of the entire city.

1. Existing land use and commercial and industrial locations
2. Highway accessibility and other transportation services
3. Physical land characteristics (soils, topography, vegetation)
4. Existing and potential utility services
5. Existing zoning
6. Size of tracts
7. Availability of land and its value*

A total of 13 potential sites are indicated on Fig. 12. A discussion of each site is set forth in the following paragraphs.

Site No. 1. This site, consisting of approximately 230 acres is found along the east side of the Boston and Maine Railroad , south of the Spaulding Turnpike and adjacent to the existing industrial parks. Much of the soils in this area are poor but slopes are good and accessibility is excellent. Water, sewage and electricity are available to much of the area with gas service near the north of the site.

Site No. 2. This area of about 300 acres includes the existing industrial parks (southeastern New Hampshire and Garrison Industrial Parks) and a large portion of the land west of the Boston and Maine Railroad included in the re-zoning of 1966. Also included is a large parcel at the intersection of Littleworth

*Source: City assessor, Dover

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The major manufacturing elements of Dover are firmly tied to nationwide regional prosperity. Fields such as electronics,

*Strafford, Rockingham, and Hillsborough counties

highways. The Spaulding Turnpike cuts Dover in half from south to north and there are four interchanges within the city. Any part of the city is therefore accessible to the Interstate Highway System. In addition, the city is served by a branch of the Boston and Maine Railroad, so that shipments leaving Dover in the afternoon can be delivered to Route 128 and Boston firms the following day.

Dover has no airport facilities at present. Sky Haven Airport in Rochester handles private airplanes and charter service. (Pease Air Force Base may allow commercial traffic in the future.)

Dover is also close to the extensive harbor facilities of Portsmouth.

Industries in Dover are free of a state corporation tax and are subject to comparatively low property tax. Dover's 1968 full value tax rate* was $3.47 per $100 assessed value. Compared with other area cities and towns, this rate was about average.

Two other necessities for successful competition for industrial location, labor and land are abundant in Dover. Firms within the city can draw from an extensive force in the city and a rapidly growing regional labor force. Workers within the city and outside the city have good access along the Spaulding Turnpike and there is much available vacant land with over 50 acres zoned industrial and on the market and over 200 acres zoned industrial but not on the market at present.

Two industrial parks have been set up in Dover, the Southern New Hampshire Industrial Park, usually known as Dover Industrial Park, and Garrison Industrial Park. (See Figure 12) These parks are provided with all utilities and have excellent access.

Dover is well served with utilities of all types, most of which are available to new industrial property. Municipal water supply, public sewage (collection and treatment) and large gas lines and electric power serve the city and existing industries.

Prospective industrial concerns can choose between occupying existing buildings in the central areas of the city or industrial areas, either nearer the center or near the Spaulding Turnpike.

Nonmanufacturing in Dover benefits from the location and transportational access, also, and the fact that the smaller towns in the area cannot support large retail and wholesale establishments. Dover's influence has increased to the north and

*The equalized or full value tax rate is that which would be in existence if property were assessed at 100 percent of its market value.

access to the highway. These are not accessible to the downtown and the access of the turnpike is not as easy as it might be. In the future more commercial development will cluster at the interchanges, especially near the downtown, and serve local residents and regional shoppers and travelers. The city must identify goals for these areas and make this development as controlled as possible and work to make these areas an attraction rather than eyesores.

Table 40. Retail Strip Development

Type of commercial development	Miracle Mile	Route 16 To Town	Route 16 Dover Point	Spaulding Turnpike (Interchanges)
Motorist Oriented Services				
Gas Stations	5	1	1	4
Restaurants	3	1	4	2
Auto Repair	3	0	0	0
Motor Inns	0	0	0	1
General Retail				
Food Stores	4	2	0	1
Automobile Sales	3	2	0	0
Hardware	3	0	0	0
General Sales*	8	4**	5	3
Service	4	2	1	0
Industrial	0	0	0	1

*Department store, gift shop, TV sales, musical instruments, etc.
**Greenhouses and flower sales

Service includes - beauty shops, car wash, coin-op laundry, etc.

Economic Resources

Today's industry tends to be market rather than raw material oriented. This fact has given Dover its chief economic resource-location. Many of the technological industries along Routes 128 and I-495 in Massachusetts require materials in their work which are fragile and costly to ship and, therefore, must be produced within short distances of the consumers. Dover is less than 100 miles away and less than 2-hour drive from most of the Route 128 and I-495 markets.

Dover is linked to its major markets by an excellent transportation system. Route I-95 (the N.H. Turnpike), the Spaulding Turnpike and I-495 are four and six-lane limited access divided

At present this highway is only sparsely developed with concentrations at Dover Point and nearer the central business district but development should not be allowed to produce another "Miracle Mile" to the extent of sacrificing the central business district. There is little or no conflict with the central business district at present but if the central business district is to survive, this and other commercial highway strips must be properly developed. Goals must be identified and land use controls considered to help keep this road from development that will hurt the city.

Route 9 - "Miracle Mile". The commercial retail strip running along Route 9 in the north of the city has been called "Miracle Mile" by Dover residents. This intensive strip has developed randomly over the last 10 years with a large variety of establishments as noted in Table 40 . In recent years the scales of stores have increased and larger shopping centers are developing. Siegal City is a good example of combination of facilities within one center. If the nationwide trend to larger and larger centers continues, some of the existing stores on Miracle Mile will be driven out of business by larger centers or combined into these centers. This is especially true of smaller markets in this area. Ingress and egress along this strip is very difficult at present though recent roadcut improvements have been made. This may tend to help larger centers with better access and parking facilities.

This commercial strip is expected to grow in the future and many of the commercial activities may conflict greatly with those of the central business district while others will supplement the central business district. Branch banks and laundries and the like will find homes in the new centers while discount department stores may drain the smaller stores of the central business district where parking is difficult and older, poorer structures are common.

There are at present three types of business zoning including Neighborhood Business, Central Business District and Thoroughfare Business. Control of the latter may be the hardest but most important in future commercial development in the city and in this area. The city must identify goals to follow in regards to the future of this area. Should the "Miracle Mile" replace certain central business district functions? Land use controls must be considered to carry out the city's goals.

Spaulding Turnpike. At the present time, the Spaulding Turnpike has a small number of highway oriented facilities at its interchanges within Dover. There is easy access to 4 gas stations, a motor inn and two restaurants. These are the only facilities with good access and visual attraction from the highway. A restaurant is available at Howard Johnson but weekend travel alone could justify the consideration of another restaurant. Dover today has few high quality restaurants within the downtown. At Dover Point, however, there are 4 restaurants with

Pease Air Force Base were influential in producing increases in 1965. Pullout of personnel at Pease and decrease in demand for new houses helped produce a slump from 1966-1968. Transportation, communications, and utilities increased most at this time with industrial demands. Finance, insurance, and real estate establishments also grew to serve a larger market.

City employment has also continued to increase and now totals over 175 employees.*

Table 39 . Other Sectors, Number Employed
(Job Center Average for Year)

Industry Group	1963	1965	1966	1967
Construction	290	295	277	226
Transportation, Communications, Utilities	110	122	146	155
Finance, Insurance, Real Estate	290	288	299	308

Sources: Job Center Information
New Hampshire Department of Employment Security

As to location, construction has remained about the same through the years. Some transportation, communication and firms have moved outward from the central business district towards the newer retail areas. Various finance, insurance, and real estate firms have become orientated more to the highways and have opened offices in outlying areas.

Commercial Strips and Interchanges

Route 16 - Dover Point Road. Dover Point Road was the major north-south route in Dover until the construction of the Spaulding Turnpike and continues to carry large loads of traffic. Commercial activity along the country highway is sparse with a majority in greenhouses and florist shops (4), grocery stores (2) and auto dealers (2), concentrated mainly between Cushing Road and Elliot Circle.

At the intersection of Route 16 and the Spaulding Turnpike is a major service center which includes four restaurants. Much of this center at Dover Point has developed around the boating facilities and serves the marine and boat yard as well as the through highway traffic on Route 16 and the Spaulding Turnpike. With more recreational use this area will continue to grow and problems of ingress and egress could increase.

*School Department employees not included.

In 1963, per capita service receipts were only $151 in Dover while throughout the State they amounted to $210. However, Dover does not cater especially to seasonal populations which account for the high per capita rates in many other areas of New Hampshire. Therefore, the lower figure for Dover (in this category) than the state as a whole, is to be expected. The figures are for 1963, however, and since that time service to the immediate region has brought Dover much closer to the state's per capita service receipts. Service employment and receipts have increased greatly in the last 10 years in Dover and in most growing areas of the country. Higher effective buying incomes and growth in other economic sectors will help continue this trend.

Table 38. Trend in Selected Services in Dover

	Total			Number of Establishments by Kind-of-Business Group		
Year	Establishments Total (no.)	Receipts Total, all establishments ($1,000)	Paid employees workweek ended nearest Nov. 15 (full work week)(no.)	Personal services	Auto repair, auto services, garages	All other selected services
1963	147	3,030	350	71	25	51
1958	103	1,935	193	56	16	31

Source: 1963 and 1958 Census of Business, Bureau of the Census

Once concentrated in the central business district many of the more recent service establishments have found the "Miracle Mile" and other highway commercial areas better locations and have contributed much to the growth of these areas. (See Fig. 12)

Other Sectors of the Economy. The three remaining sectors of Dover's economy are construction; transportation, communications and utilities; and finance, insurance and real estate. As indicated in Table 39, the greatest proportional increase in number of covered employees in the Job Center since 1963 occurred in transportation, communications and utilities. Construction continued to grow with its innate fluctuations, especially in the winter, increasing through 1965, dropping over 20 percent in 1966-1967 and rebounding in 1968. Finance, insurance, and real estate have continued to grow.

The conclusions drawn from the above figures are that these sectors, too, are reacting to generally improved economic conditions created by changes in the manufacturing sector. Industrial growth and demand for housing for employees and personnel from

Wholesale Sector. Wholesaling within Dover has acted differently from the manufacturing and retail sectors. The number of wholesale establishments has increased from 22 in 1958 to 28 in 1963, and since then has continued to increase. The type of wholesaling, however, appears to be changing. The 1963 U.S. Census of Business listed 23 or 82.1 percent of all wholesaling firms as being merchant wholesalers as opposed to other operating types. This is an increase from 17 establishments or 77.1 percent from the 1958 census.

The sales of wholesalers increased 64 percent within the same period of time. Yearly sales of other operating types of wholesale establishments decreased at this time from $4.4 million to $3.7 million. It seems, then, that wholesaling to Dover's retailers is becoming profitable enough for independent agents to buy and sell on their own accounts. Wholesaling can be expected to increase in the future as the economy grows in scale. As retail trade increases wholesale trade will tend to keep pace.

Table 37 . Trend in Wholesale Trade in Dover

	Total				Merchant wholesalers		Other operating types	
Year	Establishments (no.)	Sales ($1,000)	Payroll entire year ($1,000)	Paid employees, workweek ended nearest Nov. 15 (no.)	Establishments (no.)	Sales ($1,000)	Establishments (no.)	Sales ($1,000)
1963	28	11,569	864	235	23	7,896	5	3,673
1958	22	9,219	653	202	17	4,851	5	4,368

Source: 1963 and 1958 Census of Business, Bureau of the Census

Selected Services. Service receipts increased by 56 percent between the U.S. Census of Business in 1958 and 1963. The total number of covered establishments rendering services to Dover area residents has grown continuously since 1958 but the types of service establishments have changed. (See Table 38). The U.S. Census of Business indicates that personal service establishments increased by 26.8 percent while the total number of service establishments increased by 42.7 percent and paid weekly employees increased by 79.3 percent (1958-1963). Auto repair, auto services, and garages in this period increased by 56.2 percent following the retail trend of more automobile sales. The remaining service groupings increased 64.5 percent.

An effective indicator of economic trends within a community is effective buying income and the percentage changes in households in the community within different cash income groups. Table 8 shows changes in effective buying income by household, which has increased rapidly in the last few years.

Households with incomes over $10,000 per year have experienced over a 22 percent increase in the last 10 years. This could indicate a strong professional and manager oriented labor force and increases in Research and Development and other higher paying occupations, or more wives working in the community. This may produce demand for specialty goods and services. Increases in services reflect this trend also.

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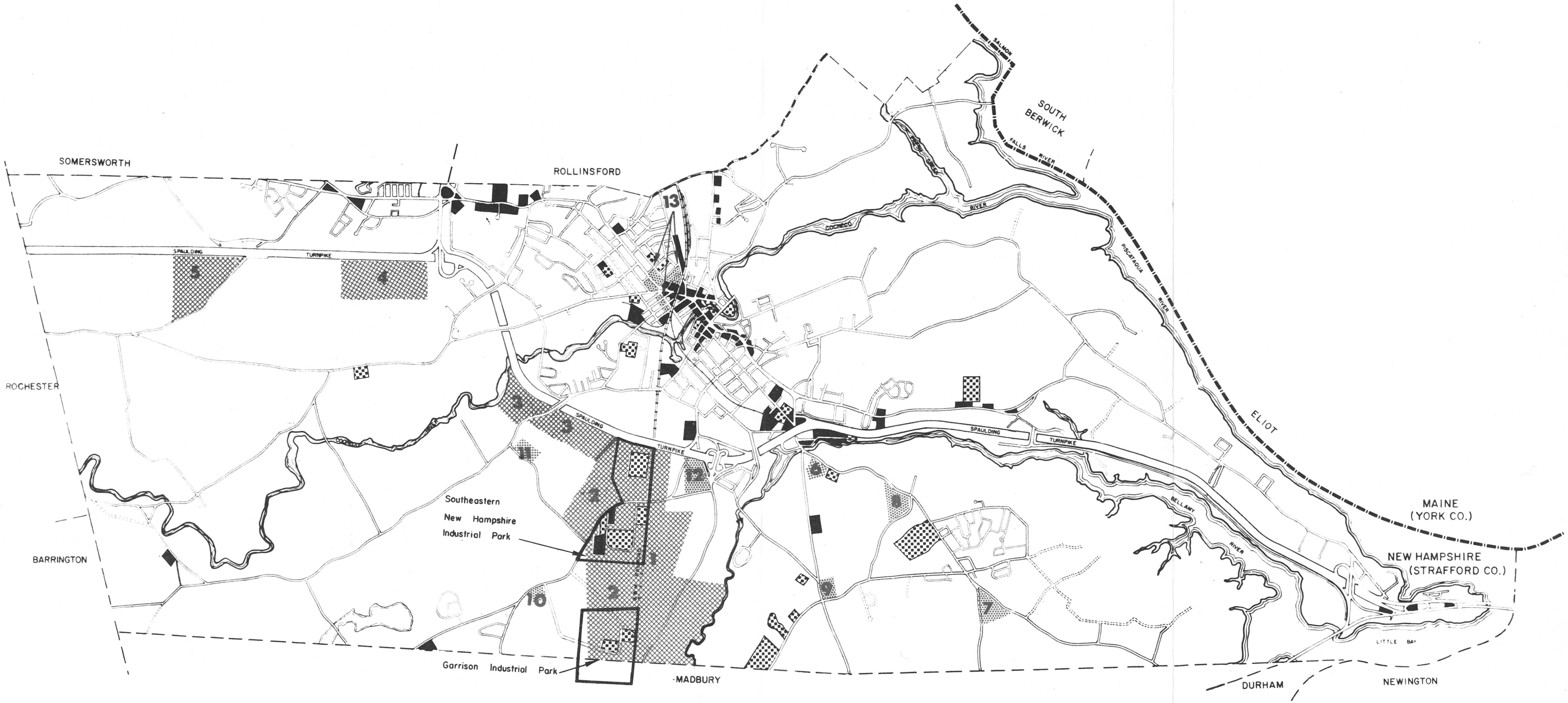
$ 3,000- 4,999	18.6	15.7	12.7
5,000- 7,999	33.1	32.9	27.6
8,000- 9,999	17.0	18.6	17.6
10,000+	18.6	18.8	27.0

Source: Sales Management, "Survey of Buying Power," 1964, 1966 1968.

Per capita sales have increased steadily from 1963 to 1967, increasing from $2,017 per capita in 1963 to over $2,221 per capita in 1967. These are relatively high per capita sales figures indicating Dover's importance as a regional shopping center and the increasing economic growth within the city. For comparison purposes, Nashua's per capita sales in 1965 were only $1,774. Per capita retail sales for the State of New Hampshire were $1,600 in 1965.

Per capita sales have increased steadily from 1963 to 1967, increasing from $2,017 per capita in 1963 to over $2,221 per capita in 1967. This is an indication of Dover's importance as a regional shopping center (i.e., Nashua's per capita sales in 1965 was only $1,774, State of New Hampshire $1,600), and of the increasing economic growth within the city.

FIG. 12



LEGEND

- Existing Industrial
- Existing Commercial
- Major Potential Industrial Site
- Major Potential Commercial Site

NOTE: Numbers refer to text

DOVER NEW HAMPSHIRE

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POTENTIAL COMMERCIAL AND INDUSTRIAL SITES

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Road and Columbus. Most of the area is served by electricity, water, gas and sewerage. Access is excellent and much is zoned industrial at present.

Site No. 3. This site of about 130 acres is located on the south side of the Spaulding Turnpike between the Cocheco River and the site of the new General Electric Plant. Access is only fair at present but is expected to improve. Soils are poor and slopes range between eight and ten percent. Only water is now available on the site of vacant open land but gas is proposed in the future.

Site No. 4. This site of 150 acres is visible from and borders on the Spaulding Turnpike and has good access, good drainage and is very level. Utilities are not available, however, except for electricity along Greenwood Avenue, and soils are poor.

Site No. 5. This 80-acre site along Spaulding Turnpike above Long Hill Road has only fair access, good soils and steep slopes (over 10 percent). Utilities are not available.

Site No. 6. With excellent access and all utilities this site is desirable for a neighborhood of community shopping center. Slopes, soils, and drainage are good. However, the site is zoned for residential uses.

Site No. 7. This site is located at the intersection of Drew Road and Piscataqua Road with adequate space for a large community commercial center. Soils and slopes may be restrictive but available utilities, existing zoning (neighborhood business) and access make the site an important consideration.

Site No. 8. Located at the intersection of Back River Road and Mast Road in an area of fair soils and slopes, this site is of adequate size for a community shopping center. Water and electricity are available and sewer lines are under construction. Land is vacant and zoned low density residential.

Site No. 9. Located at the intersection of Durham Road and Mast Road, this site has excellent soils but the area needs fill. The site is vacant with electricity, water and sewerage available and has adequate size for a community shopping center.

Site No. 10. Located on Littleworth Road and Crosby Road (bordering the Industrial Park expansion area), this site is adequate for a neighborhood shopping center. The area has water and electricity but no gas or sewer. Slopes are favorable but soils are very poor for development.

Site No. 11. Located at the intersection of Tolend Road and Columbus Avenue, this site is in an area of poor soils and difficult slopes for building. Water and electricity are available while sewerage is not; and the site is adequate in size for a neighborhood shopping center.

Site No. 12. Located at the intersection of Knox Marsh Road and the Spaulding Turnpike, this site is of adequate size for a community commercial center. Water, gas, sewer and electricity are available and slopes are favorable. There is some residential development in the area and soils are poor but its nearness to the population center and its location on two major access highways makes this site very desirable.

Site No. 13. This site is an extension of the existing central business district and is an expansion to the east and north. Development of this area with its existing amenities may help revitalize the central business district and provide a new community commercial center in that area.

Site No. 12. Located at the intersection of Knox Marsh Road and the Spaulding Turnpike, this site is of adequate size for a community commercial center. Water, gas, sewerage and electricity are available and slopes are favorable. There is some residential development in the area and soils are poor but its nearness to the population center and its location on two major access highways makes this site very desirable.

Of the above sites, numbers 1, 2, 3 and 4 appear to have the best potential for immediate and intermediate range development for industry. Site number 5 should be considered for inclusion for industry in the final future land use plan in Phase Two of this Comprehensive Plan.

The potential commercial sites should all be considered in the final design of the future land use plan and the preparation of the zoning. Their function can be either as community shopping centers or neighborhood shopping centers.

LONG-RANGE DEVELOPMENT GOALS AND POLICIES

Prior to the formulation of specific proposals and recommendations, it is necessary to establish long-range development goals as a basis for the detailing of the long-range Dover Comprehensive Plan. The basic goals of a community may be understood as the objectives or purposes which that community strives ultimately to achieve. A statement of these goals, and the policies necessary to implement them, is essential to the planning process. They will benefit the Comprehensive Plan in the following ways:

1. Facilitate public understanding and participation.

2. Encourage participation by all municipal officials.

3. Coordinate the decisions made by the many diverse agencies that may have an impact on development.

4. Provide stability and consistency in the planning process, since the goals will not be made obsolete by changing conditions.

5. Act as a guide for bodies responsible for adopting land use controls, to boards and commissions authorized to administer the controls, and to courts which must judge the reasonableness of the regulation and the fairness of its administration.*

An analogy may be made between the determination of development goals and policies and the decision involved in taking a trip. The first decision which must be made is where to go. Determining basic goals is similar to deciding on the trip's destination. Next it is necessary to decide on the most desirable route for reaching the destination. In specifying policies, the community expresses its decision on a route, or the favored way of achieving the objective. Finally a decision must be made as to the means, or vehicle, to be used. A statement of detailed policies expresses the approved means for carrying forth the policies and reaching the basic goals.

*Condensed from Principles and Practice of Urban Planning, International City Managers Association.

The definition of long-range goals and policies as used in this chapter is as follows:

Goal - This is defined as an objective or purpose which the community strives to ultimately reach through the systematic application of any set of alternative programs and policies. The planning goals should be the basic objectives of the entire community and reflect the aims of the community as expressed publicly by the majority of the citizens.

Policy - This is defined as the specific course or program of action initiated to guide the community toward obtaining the long-range goals. There are many varied methods in achieving the long-range community goals; therefore, the current policies can be modified or changed depending on the selection of the alternative design schemes and also to reflect new innovations and techniques.

Major Development Goals and Policies

The following long-range development goals and the general policies to implement them were selected in collaboration with the Dover Planning Board and other city officials:

Goal I - Promote the orderly and appropriate use and reuse of land in Dover:

Policies

1. Prevent development of physically unsuitable land.
2. Use land for a purpose to which it is best suited.
3. Make judicious use of the natural resources.
4. Develop an efficient system of streets to provide for both local and inter-community traffic while enhancing the city's physical and economic structure.
5. Provide for a balanced distribution of land uses in relation to the circulation system, public utility service areas, and other land uses.
6. Eliminate structural and environmental blight and prevent same in the future.
7. Establish an upper limit on the population.

Goal II - Provide the highest levels of public service and facilities possible consistent with Dover's needs and availability of financial resources.

Policies

1. Balance the present requirements for improvements of public facilities on the basis of a priority system directed toward stimulating the overall economic growth of Dover.

2. Adopt and insure compliance with the recommended standards for the improvements to and future construction of the public facilities.

3. Schedule the construction of municipal facilities with the development of areas of the city so that they may be in the proper location for their logical service areas.

4. Give a high priority to public facility needs where the safety of city residents is concerned.

5. Promote the development of neighborhood recreational facilities in conjunction with the elementary school facilities.

6. Provide for adequate civic, social, religious, and cultural facilities and services.

Goal III - Promote an overall sound economic base in Dover.

Policies

1. Utilize and promote the CBD as the major business, shopping and cultural area in Dover and promote it as the focus of regional business, shopping and culture.

2. Restrict commercial development outside of the CBD to primarily suburban neighborhood shopping and highway oriented commercial activity consistent with the extent of residential neighborhood development and industrial development.

3. Promote the development of physically suitable sites for business and industry which are compatible with the residential development pattern and public utility service areas.

4. Expand local employment opportunities by attracting a variety of smaller industrial activities.

5. Improve existing business conditions and provide for new business activities to serve the existing population and expected future growth.

6. Regulate the development of business and industrial activity so that it is usually attractive, has minimum detrimental environmental effects, and does not abuse the land or water resources.

7. Reserve a variety of sites that meet different industrial and business requirements of lot area, public services, and location to help broaden the economic tax base.

8. Recognizing the importance of accessibility to economic growth, provide high degree of access to the CBD and other business and industrial locations.

Goal IV - Improve and conserve the natural, visual and historical amenities of Dover.

Policies

1. Provide a reasonable amount of permanent open space distributed throughout the city to assure a variety of private and public recreation and conservation areas.

2. Encourage a high level of design in all public and private construction.

3. Establish and enforce land use controls which encourage originative design for development consistent with the natural land visual environment.

4. Establish the organizational structure for promoting historic preservation.

Goal V - Promote the development of a variety of housing to meet the social, economic and health needs of Dover.

Policies

1. Balance the distribution of housing throughout the city in conjunction with the sewer service areas, circulation facilities and public school attendance districts.

2. Determine minimum residential lot sizes in terms of planned public water and sewer service areas, soil condition and economic feasibility.

3. Promote programs to eliminate substandard housing and prevent future deteriorations.

4. Adopt municipal regulations which would permit and control various housing types and encourage innovative ideas.

Goal VI - Establish Dover's role as an integral and dynamic member in the regional area.

Policies

1. Encourage industrial development which will serve the regional area.

2. Promote the integration of development policies and plans with adjacent communities as well as with the overall regional area.

3. Encourage the arrangement and amount of land uses that permit quick, convenient, and safe access within the regional area between living, working and shopping areas.

PRELIMINARY FUTURE LAND USE PLAN

A Preliminary Future Land Use Plan for Dover, showing the allocation of future major land use areas by pattern and intensity is shown on Figure 13. Table 42 lists the amounts of the major land use areas. The following are the general parameters within which the Preliminary Future Land Use Plan has been developed.

Target Date. A 1990 target date has been given to the planned development. This approximately 20-year period is usually considered the foreseeable future, or the length of time for which reasonably accurate future predictions of population, land use damands and the like can be made. However, the overall plan design is considered in the light of much longer range considerations. In this manner, the next 15 to 20 years of land development is also designed in accordance with an overall framework for the next 25 to 50 years.

Design Scheme. The design scheme chosen as the basis for the Preliminary Future Land Use Plan is the "nucleated" pattern as discussed in the previous chapter on Existing Land Use. (See Figure 4.)

Major Land Use Areas. Three residential density designations are indicated for Dover. The urban density contemplates residential uses in single- and multifamily developments at densities of more than four families per acre. The suburban residential uses contemplate single-family development at densities of between two and four families per acre. In the rural development areas, residential single-family development at densities of less than two families per acre are contemplated. It should be noted that flexibility is intended in all areas by permitting clustering at higher densities of both single- and multifamily units. However, in any of the areas development must be consistent with public utility service areas.

Major industrial areas are designated consistent with the potential site evaluation of the Economy chapter of this report. Also, major commercial areas are generally located according to the overall design scheme needs.

FIG. 13

SOMERSWORTH

ROLLINSFORD

SOUTH BERWICK

ROCHESTER

BARRINGTON

MADBURY

DURHAM

NEWINGTON

ELIOT

MAINE (YORK CO.)

NEW HAMPSHIRE (STRAFFORD CO.)

SPAULDING TURNPIKE

SALMON FALLS RIVER

COCHECO RIVER

PISCATAQUA RIVER

BELLAMY RIVER

LITTLE BAY

B & M RAILROAD

LEGEND

- Major City Commercial Center
- Major Neighborhood and Highway Commercial Center
- Urban Development
- Suburban Development
- Rural Development
- Major Industrial

DOVER NEW HAMPSHIRE

PRELIMINARY FUTURE LAND USE

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Table 42. Preliminary Allocation of Future Land Use

Major Land Use		Land Use Area (Acres)
Residential -	Urban Development	3,250
	Suburban Development	1,700
	Rural Development	10,610
Industrial		1,250
	Total Land Area	16,810

Source: Measurements from Preliminary Future Land Use Map.

WATER

Presently, the City of Dover operates and maintains a municipal water system which serves about 96 percent of the present population. Responsibility for the system lies with the city's Public Works Department.

Inventory

Service Area and Population Served. The present public water system consists of about 5,500 services, of which about 95 percent are metered. The existing service area is shown, along with major water mains on Figure 14. It is estimated that approximately 22,000 persons depend upon the municipal water system, while approximately 1,000 persons depend upon private on-lot water supply systems.

Supply. Dover's municipal water supply is obtained entirely from ground sources. Planning data on these sources are presented in Table 43.

Table 43. Existing Water Supply Data *

Water Source	Recommended maximum draft (gpm)**	Pump capacity (gpm)***	Deliverable yield (gpm)
Barbadoes Well	700	700	700
New Barbadoes Well	700	700	700
R. B. Ireland Well	400	700	400
Pudding Hill Well (No. 107)	400	850	400
Cummings Well	750	750	750
Total Deliverable yield			2,950 gpm or 4.2 mgd

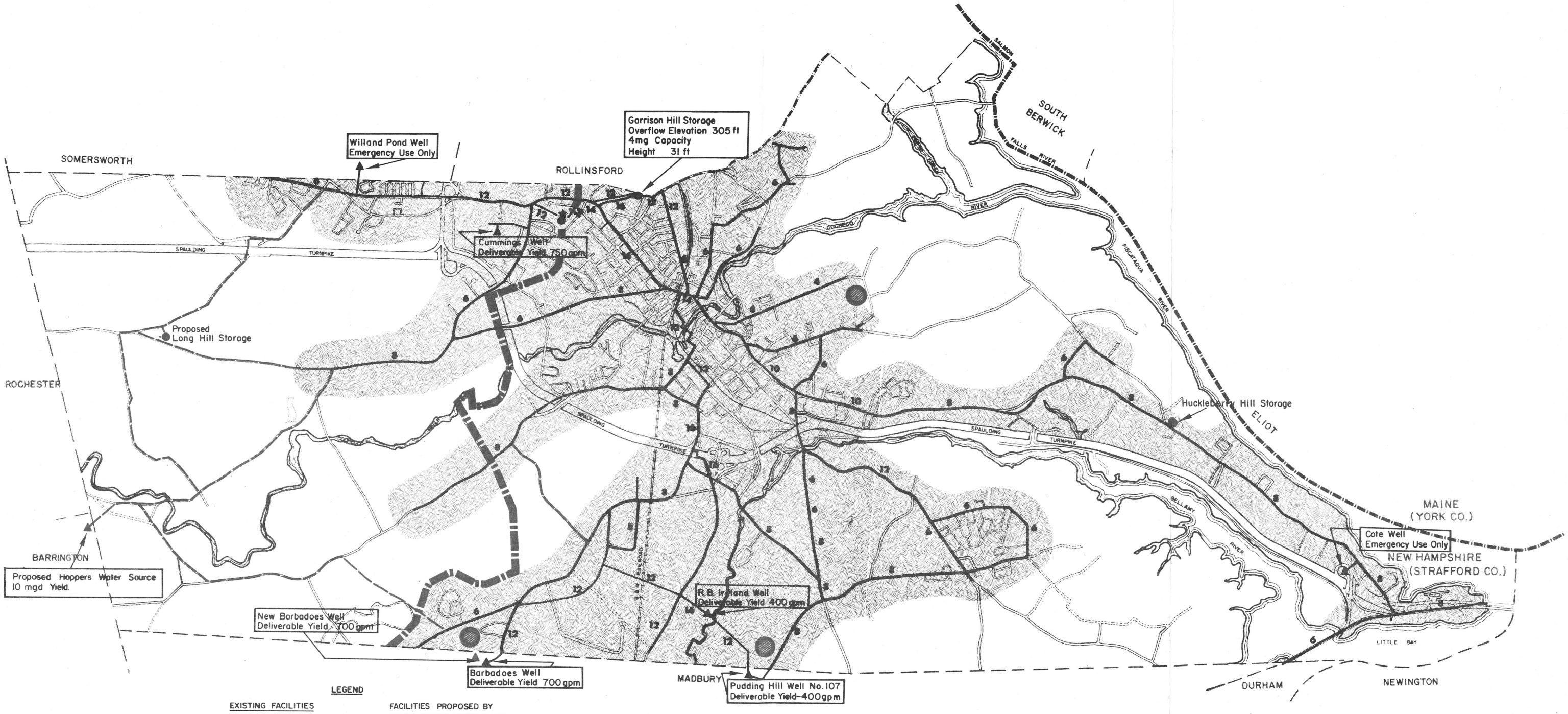
* In addition to the water sources shown of Figure 14, the Cote Well and the Willand Pond Well are available for use on an emergency basis only. However, these sources cannot be used for extended periods of time and therefore should not be considered as part of the city's reliable water supply.

** gallons per minute.

*** Pump capacities are estimated by the Dover Public Works Department. Variations occur depending upon the head against which the pump is operating. The capacities given are for the present pressure conditions at particular water source.

Source: Dover Public Works Department.

FIG. 14



LEGEND

EXISTING FACILITIES	FACILITIES PROPOSED BY DOVER WATER CONSULTANTS
Service Area	Major Water Main
Major Water Main	Storage Facility
Storage Facility	Water Source
Well and Pumping Facility	
Treatment Facility with Pump Station	
Proposed Pressure Zone Boundary	
Possible Location, Additional Storage Facility	

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

WATER

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The total safe deliverable yield from Dover's water supply sources is 4.2 mgd.

At present, all water sources have no standby pumping equipment for emergency. Also, only the Pudding Hill well No. 107 has an auxiliary power source.

Treatment. Dover's water supply receives treatment for quality purposes by the methods indicated in Table 44.

Table 44. Existing Water Treatment

Facility	Method of Treatment
Lowell Ave. Treatment Plant	Filtration, soda ash addition, aeration, and chlorination. Capacity is 1.0 mgd.
Pudding Hill well No. 107	Soda ash addition.
R. B. Ireland Well	Soda ash addition.
Barbadoes Well	Soda ash addition.

Source: Dover Public Works Department

In-System Storage. Dover currently has one storage facility located at Garrison Hill and constructed in 1969. It has a capacity of 4.0 million gallons, an overflow elevation of 302 feet, and a base elevation of 274 feet. It is a reinforced concrete reservoir.

The Lowell Avenue Treatment Plant has a capacity to store 0.5 mg, but because no auxiliary power exists to lift the storage in case of a power failure, this should not be considered useful storage.

Distribution System. The distribution system is fed both directly from the wells and from the Garrison Hill Reservoir. All wells, except the Cummings well, pump directly into the distribution system. The Cummings well pumps directly to the Lowell Avenue Treatment Plant. After treatment, this water is pumped, via three 450 gpm pumps, to the Garrison Hill Reservoir, from where it is supplied to the distribution system.

The distribution system consists mostly of cast-iron pipe, varying in size from 16 inches to 4 inches, with some sizes as small as 1 inch in isolated instances. For the last fifteen years, the city has been installing cement asbestos pipe.

Static pressures in the system are reported to range from 128-130 psi (pounds per square inch), occurring near the end of Dover Point, to 45-50 psi occurring in the Willand Pond area.

Past Studies. There have been several recent water reports which are pertinent to this Comprehensive Plan. Charles T. Main made recommendations for the City of Dover in 1949; Camp, Dresser, & McKee prepared a report in 1960 for the seacoast region of New Hampshire, including Dover, and also prepared a report in 1965 on improvements to Dover's water supply and distribution system. The New Hampshire Board of Fire Underwriters reported in 1964 on the fire fighting adequacy of Dover's water system.

All of these reports have been reviewed with respect to the overall planning considerations of this Comprehensive Plan. Where appropriate, reference is made to these previous studies.

Future Water Supply Requirements

To evaluate the adequacy of a water supply system, the amount of water that the system may be called upon to supply must be determined. Our estimates of future supply requirements for Dover are based on projected future population to be served, per-capita usage, the inclusion of unaccounted-for water, development characteristics, maximum one-day demand, and hydrant flow for fire fighting purposes.

Service Areas and Population Served. Based on the present extensive coverage of the existing service area, and in coordination with the Preliminary Future Land Use Plan, we recommend that basically all areas be serviced with water as they become developed. This would be fairly consistent with present water service policies in which about 96 percent of the present population is serviced by the municipal water system.

In our population chapter of this Comprehensive Plan, we have projected the following populations for Dover:

1970 - 23,360
1980 - 27,900
1990 - 32,890

These population figures are somewhat higher than those estimated by Camp, Dresser & McKee in 1965. It would therefore be expected that the rate of development of the plan proposals of the 1965 engineering report must be accelerated.

Water Usage. Water usage increased between 1960 and 1968 from 2.1 mgd to 3.0 mgd average use. With crude estimates of served population, per-capita usage is estimated to have increased from 110 gcd (gallons per capita per day) to 134 gcd. If service is provided to virtually all the population in 1990, as it is now, and an allowance for increased daily usage is made in accordance with Camp, Dresser & McKee's report of approximately 2.0 gallons per capita per day per year, then the average total water usage in 1990 should be approximately 5.9 mgd. Past and projected total future water usage is shown on Table 45.

Maximum One-Day Demand. In addition to meeting the average daily consumption needs, Dover's water system must be able to meet peak demands of short duration throughout the year. Maximum one-day demand is the highest 24-hour period and is commonly expressed as a percentage of the annual average daily demand. Table 46 shows the average and maximum one-day pumping rates for the last four years.

Table 45. Water Usage

Year	Served population	Estimated per-capita usage (gpd)	Average daily water use (mgd)	Maximum one-day demand (mgd)
1960	18,800	110	2.1	3.1
1968	22,000	134	3.0	3.3
1980	27,900	158	4.4	6.6
1990	32,900	178	5.9	9.0

Sources: Dover Public Works Department.
Estimates by Metcalf & Eddy, Inc.

Table 46. Annual Average and Maximum One-day Rates of Pumping

Year	Rate of pumping (mgd) daily average	Rate of pumping (mgd) maximum one-day	Percentage of maximum-day to average daily pumping
1965	2.28	3.24	142
1966	2.33	3.22	138
1967	2.46	3.76	153
1968*	2.96	3.34	113

Source: Dover Water Department

*Water restrictions were in effect part of the time.

Maximum one-day demand in public water systems generally varies from 150 to 300 percent of the average daily consumption, depending on the type of community. Lower percentages are usually encountered in industrial communities where industrial use of water remains relatively constant from day to day, thus tending to "dampen out" fluctuations in domestic demands. Higher percentages are generally encountered in residential communities where there is a demand for lawn sprinkling and car washing, etc.

Since Dover has substantial industry now, and its industrial growth will continue in the future (see Economic Base section of this Comprehensive Plan), and since the population will increase substantially (see Population Section), fluctuations of demand should be expected to remain about the same. For this

reason, we have allowed a maximum one-day demand of 150 percent of the average daily consumption. Thus, by 1990, a maximum one-day water use of 9.0 mgd can be expected.

Hydrant Flows Required for Fire Fighting. Another factor which must be considered when determining future water supply requirements is the quantity of water available for fire fighting.

The American Insurance Association has developed standards by which water supply systems may be rated with respect to fire fighting capabilities. This rating, together with similar ratings for the fire department and other factors related to fire fighting and fire prevention, is used for determining the fire insurance risk. Adherence to the Association's standards for water supply is considered good practice and should result in obtaining and maintaining favorable insurance rates in the city.

Required fire flows vary according to the district being considered. Maximum demands generally occur in the high-value district where the major portion of business and industrial buildings is located. Lesser flows are permitted in residential neighborhoods where density is not so great. Appendix Table A-4 gives the recommended fire flows for various land use categories as they pertain to Dover.

Adequacy of Existing System

Adequacy of a water supply system is determined by its ability to furnish water of both sufficient quantity and quality. In the case of the Dover system, adequacy should be based on the ability to meet not only average daily requirements, but also high rates of consumption, such as occur during extended periods of drought.

Supply. In accordance with sound engineering practice, ground sources of supply should have a dependable yield equal to the maximum one-day use rate, and the supply facilities should be capable of supplying the system at this rate. The present maximum daily use rate is approximately 3.3 mgd (it was as high as 3.8 mgd in 1967), and by 1990 the maximum water supply requirement is estimated to be 9.0 mgd. The dependable yield of all regularly used wells is approximately 4.2 mgd. Therefore, it is apparent that, while existing wells are sufficient at this time, in the immediate future, additional sources of supply will be necessary. According to our estimates, a new source should be provided between 1970 and 1975.

Distribution System. The adequacy of a distribution system is based on its ability to meet peak consumption requirements and to provide adequate fire protection. The New Hampshire Board of Underwriters reported in 1964 on Dover's fire protection. This report stated that the arterial system, grid system, and quantities available in the high-value district of Dover were

good. However, they reported that there were long unsupported lines in the outlying areas of Dover and that quantities available in these areas were 50 to 90 percent deficient. As can be seen on Figure 14, many of these still exist, most noteably, along Dover Point Road. Valves and hydrant spacing in this report was considered good.

Service Areas. The present service area seems for the immediate future to be adequate to the extent that it serves approximately 96 percent of the existing population, as well as the city's commercial and industrial areas. However, in the future, as development occurs and new sources of supply and storage are provided with the appropriate distribution mains from these new facilities, the service area should accordingly be extended to cover virtually the entire city. Also, according to the city's water consultants, the system should be divided into two pressure zones at the time the Hoppers water supply source is developed. (See Recommendations section of this chapter.)

Distribution Storage. Distribution storage serves as a supplementary supply to meet demands of short duration. It also serves as a reserve supply for fire fighting and is commonly based on the recommendations of the American Insurance Association. For a population of 22,700, the American Insurance Association recommends a storage volume capable of providing a flow of 4,500 gpm for a ten-hour duration in the major business and industrial districts. A volume providing 5,000 gpm for a ten-hour period is recommended for a population of 27,000, and a volume providing 5,500 gpm for a ten-hour period is recommended for a population of 33,000. At the same time, the system must be capable of meeting peak demands of a short duration.

Because there are existing structures in Dover's central business district which are three stories or greater in height, and because present zoning permits maximum height, which could exceed 50 feet, fire flows of 5,000 gpm should be provided at this time. This is in accordance with standards presented in Appendix Table A-5.

Table 47 shows the required usable storage capacities for Dover for 1970, 1980, and 1990.

Table 47. Required Usable Storage Capacity (million gallons)*

	1970	1980	1990
Fire flow for 10 hr. duration at 5,000 gpm (million gallons).	3.0	3.0	3.0
Peak demand of short duration** (million gallons)	0.6	0.9	1.2
Total	3.6	3.9	4.2

* Assumes supply yielding at a rate equal to at least the maximum one-day demand.
**Estimated to be 20 percent of average-day demand.

Source: Estimates by Metcalf & Eddy, Inc.

It is estimated that by 1990 the total usable storage required will be at least 4.2 million gallons. For general planning purposes, 75 percent of the total storage capacity is considered usable. Therefore, the total storage capacity required by 1990 will be about 5.6 million gallons. The total present storage available is 4.0 million gallons; thus by 1990 there will be a deficiency in storage requirements amounting to about 1.6 million gallons.

The usable storage required for 1970 is estimated to be 3.6 million gallons, or a total capacity of 4.8 million gallons. Thus, the present (1970) deficiency is about 0.8 million gallons.

It should be noted, however, that this estimate is based on an increase in the supply delivery capabilities to be at least equal to maximum one-day demand.

In addition to recommended volumes of available storage, the location of the storage facility and capacity of the connecting mains is important to the fire safety of the community. The water from the storage facility must be capable of reaching a fire at the required rate and pressure. Whereas the present storage facility and distribution mains were found by the Fire Underwriters to be adequate for the central business district, the size and location of new facilities providing increased storage capacity must be decided through engineering analysis and in coordination with our future land use plan.

In addition to supplying the system at a rate equal to the maximum one-day use rate, a water system should be capable of maintaining the supply when a portion of its facilities are out of service. In accordance with standards set forth by the American Insurance Association, a system's pumping and storage facilities should be capable of providing the required fire flow for the

specified duration during a period of five days with consumption at the maximum daily rate and with its two most important pieces of equipment out of service.

In the case of Dover, if the 700 gpm Barbadoes pump and the 700 gpm New Barbadoes pump are out of service, the city would have a capacity to pump at a maximum rate of only 2.2 mgd.

This reliability, plus the useable storage capacity of 3.0 million gallons, would not provide the present need of 3.3 mgd maximum daily demand plus the required fire flow of 5,000 gpm for 10 hours.

Also, in addition to the total lack of standby pumping capacity, a standby power source exists only at the Pudding Hill Well No. 107. Thus, the overall reliability of the system would be very inadequate in the case of a power failure.

Recommendations

Planning Objectives, Development Policies and Planning Standards. The following planning objectives and development Policies were used as the basis for preparing this water system plan:

1. The Dover Water Department should plan upon ultimately serving the entire city with a public water system.

2. The water system should be improved and maintained so as to meet requirements of the American Insurance Association.

3. No water pipe smaller than 8 inches in diameter should be used, except on short cross streets between mains of 8 inches or larger and separated by not more than 600 feet.

4. The proposed water plan should be coordinated with the future land use plan.

5. Subdividers building within 400 feet of the existing distribution system should be required to tie into the public system.

Recommended Improvements. The following recommendations are made with respect to future public water service for Dover:

1. Service Area Extension. We recommend that existing service areas be extended in the future to the extent that all developed land in Dover will be serviced by the public water system. The timing on this should be coordinated with the development of a new source of supply and new storage facilities.

2. Supply. Based on water usage projections, we recommend an additional water source be developed in the immediate future, 1970-1975.

   Based on recommendations of the city's water consultants, the Hoppers area should be developed to provide the additional needed supply. This source has an estimated safe yield on the average of 10 mgd, which, in combination with existing sources, should be capable of serving Dover well beyond our planning period.

3. Distribution System. Because of the wide variations in elevations in the existing and proposed system, and because of the location of the proposed water source, a dual pressure service system has been proposed by the city's water consultants. This would lessen pressure at Dover Point, and increase pressure near Willand Pond. Also, the location of the proposed Hoppers water source will require that this water be delivered into the system in sufficient quantities. To this end, and in accordance with previous recommendations, large capacity transmission mains should be provided as shown on Figure 14

   We also recommend that the outlying dead-end lines be provided with a loop of reinforcing mains so that a break in a single 6-inch or 8-inch main would not completely eliminate the water supply of a large area, such as Dover Point. Also, in accordance with previous recommendations of the New Hampshire Board of Underwriters, standby pumping capacity should be provided at the water sources. In addition, provisions should be made for auxiliary power sources.

4. Storage. Since a new source of supply will be located in the western high level service area, and each service should be provided with a proper storage capacity, a storage facility should be provided on Long Hill, in accordance with recommendations of the city's water consultants. The capacity of the storage facility should be determined prior to construction, in light of land use proposals of this Comprehensive Plan. Possible locations of additional storage facilities are shown on Figure 14. Although all of these would not be required, the Mount Pleasant site would strengthen the reliability of the system in the central area, and either the Pudding Hill or the Barbadoes site would substantially improve the system in the Industrial Park area. Ledge could be a problem at the Mount Pleasant Site.

   It should be noted that much of the overall distribution system must be reinforced if the storage facilities are to be at all useful.

SEWERAGE

Introduction

The City of Dover operates and maintains two public sewerage systems: the urban area system and the Back River Road system. These systems are under the control of the Dover Department of Public Works. The Strafford County Farm operates and maintains its own institutional (on-site) sewerage system. The remainder of the city's population depends on private on-lot disposal systems.

Inventory of Facilities

Service Areas. The existing service areas and the limits of the service area as planned by the city's sewerage consultants* are shown on Figure 15.

Collection Facilities. The City of Dover maintains a fairly extensive sewer system. In the older sections of the city, the system consists of combined storm and sanitary sewers, many of which are as much as 100 years old.

Most sewage collection on the south side of the Cocheco River is brought to the treatment plant. However, some sewage overflows directly to the Cocheco River during wet weather periods. Also, some combined sewage is discharged directly into the Cocheco River in addition to the overflow.

All sewage collected from the north side of the Cocheco River presently is discharged untreated into the Cocheco River. A separate municipal sewer line from a tannery in downtown Dover collects the industry's processing wastes and transmits them directly to special treatment units at the Dover treatment plant.

The Back River Road development collection system consists of separate sanitary sewers that serve approximately 400 houses and convey collected sewage to the Back River Road treatment plant. The treated effluent from this plant is discharged to the Bellamy River.

Treatment Facilities. The main sewage treatment plant, constructed during 1959 and 1960, is a primary treatment plant located on the Cocheco River just off River Court. It has two separate treatment sections and processes; one section handles the tannery wastes and has a capacity of 0.70 mgd average flow; the other section handles the domestic wastes and has a capacity of 0.93 mgd. This section will have a capacity of 4.4 mgd average flow after present construction is completed. The domestic

*Green Engineering Affiliates, Inc., "Report on Sewerage System Cocheco River Watershed in Dover, New Hampshire," December 1965. As supplemented by direct contact in 1969.

treatment plant serves between 4,000 and 7,000 persons, according to the city's sewerage consultants.* Effluent from both units is discharged into the Cocheco River.

The Back River municipal treatment plant serves approximately 400 houses at present. It consists of an Imhoff tank, open sand filters, and sludge beds. This plant was designed to serve approximately 150 to 200 houses. The effluent is discharged, unchlorinated, into the Bellamy River.

The Strafford County Farm maintains its own sewage disposal system. It was constructed in 1964, and consists of comminution equipment and two stabilization ponds which have a total water surface area of one acre. It was designed to serve 200 persons, but within two years, approximately 300 persons will have to be served. The effluent is discharged, unchlorinated, into the Cocheco River.

The remaining areas and population in Dover are served by private on-lot disposal systems. It is estimated that about 5,000 persons are served by these private systems.

Drainage Districts. Dover has been divided into four major drainage districts, as shown on Figure 15 . Although the major portion of the presently developed area in Dover drains to the Cocheco River, it should be noted that much of Dover which is likely to be subject to future development pressures drains to the Bellamy River and to that portion of the Piscataqua River which is downstream from the existing sewerage service areas.

Prior Studies and Reports. In 1965, Dover's sewerage consultants prepared a report on the Dover Sewerage System. This report outlines in detail the existing sewerage system and makes recommendations for improvements and additions to the system. The consultants have continued investigations and are currently under contract to Dover to design improvements to the sewerage system and the treatment plant. The improvements include extending the existing service areas, enlarging the treatment plant capacity (now under construction), intercepting sewers, separating combined sewers, and repairing the existing sewerage system where necessary.

Stream Classification and State Implementation Schedule

In accordance with the Federal legislation requiring the 50 states to adopt water quality standards, the State of New Hampshire Water Pollution Control Commission (now called the Water Supply and Pollution Control Commission) submitted its

*This does not include estimates of population served by the collection system, which discharges directly to the Cocheco River without any treatment.

FIG. 15

LEGEND

EXISTING MUNICIPAL FACILITIES

- Service Area, Combined Storm and Sanitary Sewers
- Service Area, Separate Sanitary Sewers
- STP- 1 Main Sewage Treatment Plant, 2 Back River Sewage Treatment Plant
- Pumping Station
- Sanitary Sewer
- Force Main
- Combined Sewer
- STP Institutional Sewerage System

- Major Drainage District Boundary
- D/B Stream Classification — For Existing Condition / For Future Use
- Limit of Classification
- a Potential Sewerage Problem Areas (Note: Letters refer to text)
- Raw or Inadequately Treated Sewage Discharge(s)
- Anticipated Additional Municipal Sewerage Service Area by 1990

MUNICIPAL FACILITIES AS PLANNED BY DOVER SEWERAGE CONSULTANTS

- STP Expanded Sewage Treatment Plant
- Limit of Planned Service Area

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

SEWERAGE

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water quality standards and implementation plan to the Federal government in June 1967. Dover must adhere to these standards and schedule, as amended. According to this schedule, the Cocheco River and the Piscataqua River are classified for future use by the New Hampshire Water Supply and Pollution Control Commission as B.* However, there are sections of the Cocheco where existing conditions in the river would place the water in a C* and D* classification. (See Figure 15 .)

The Bellamy River is classified for future use as Class A above the dam at Bellamy Park and Class B below the dam area, but actually all sections above the dam do not presently meet the A classification.

The implementation schedule for Dover, adopted in 1967 by the New Hampshire Water Supply and Pollution Control Commission, is as follows:

Date for Completion	Work Element
November 1967	Preparation of Construction Plans
July 1968	Acceptance of Grants
February 1969	Start of Construction
December 1970	Placed in Operation

Since Dover is now in the construction stage, the State Water Supply and Pollution Control Commission feels that this schedule is still realistic and should be met.

Sewerage Problem Areas

Sewerage problem areas in a community are those areas where unsanitary conditions have resulted from the lack of, or improper functioning of, sewage disposal facilities. We have classified the sewerage problem areas in Dover as either existing or potential. The locations of particular problems in Dover are noted on Figure 15.

Existing Problem Areas. There have been 12 to 15 reported on-lot disposal failures in the Dover Point area, and two to three reported on-lot disposal failures in the northwest section of the city in the last seven years according to Dover's City Health Officer. Each of these cases has been the failure of the leaching field to properly drain the effluent, and each case has been successfully dealt with on an individual basis.

The raw sewage discharges along the Cocheco River from the municipal collection system is an existing problem which is in the process of being eliminated.

*See Appendix Table A-6 for Classification definition by use.

Finally, the Back River treatment plant effluent and the Stafford County Farm treatment plant effluent are not chlorinated. According to present State requirements, chlorination is required for disinfection.

Potential Problem Areas. This category includes problems that may develop, either because of existing land use, or because of certain present inadequate land use regulations.

In order to avoid on-lot disposal problems in the future, the recommended minimum residential lot sizes that are presented in Table 14 of the Land Capability Section of this report should be followed. There are some sections of the city that may become problem areas in the future because they now contain lot sizes that are insufficient for on-lot disposal and are developed or zoned in such a way that insufficient lot sizes for on-lot disposal would be allowed. Considering existing land use, present zoning regulations, the land capability map, and data contained in Table 14 of the Land Capability Section of Dover's Comprehensive Plan, the following areas were identified as potential problem areas:

a. Dover Point. The residential development on Dover Point on lots that are predominantly less than 20,000 square feet and are on soils that, in some cases, have severe limitations for supporting on-lot disposal systems could possibly cause on-lot disposal failures at some future time. Specific potential problem areas as noted on Figure 15 include those areas near or adjacent to Cote Drive with 10,000- to 15,000-square foot lots and Roberts Road, Riverside Drive, Pineview Drive, Pearson Drive, Evans Drive, and parts of Spur Road, all with 5,000- to 20,000-square foot lots.

b. Piscataqua Road. There are some residential lots near the Madbury line along Piscataqua Road that could possibly become problems because of poor soil suitability and lots that are not of sufficient size. Some lots here are between 20,000 and 30,000 square feet, and are not now serviced by public water. With public water service expected in the next five to ten years, these areas do not appear to be a serious problem.

c. Tolend Road. The residential lots along Tolend Road, in most cases, are between 20,000 and 30,000 square feet. According to the Land Capability chapter, there should be a minimum lot size of 35,000 square feet when serviced by public water, except in some cases where soil conditions and slope allow a size as small as 20,000 square feet. This area is serviced by public water, and since most of the built-up lots exist within the planned service area of the existing treatment plant, it is possible that the sewer lines will be extended before any major problems develop.

d. Richardson Drive. Another area within the planned service area of the existing treatment plant is Richardson Drive. With its small lots (10,000 to 15,000 square feet), this area could become a problem area before sewer service is provided.

e. Middlebrook Road Area. This area is presently unsewered and contains lots as small as 7,000 square feet. This could possibly develop into a disposal problem area in the future.

f. Comanche Street, Cheyenne Street, and Shawnee Lane. This area is unsewered and contains lots as small as 10,000 square feet, and could also develop into a disposal problem area.

Existing and Future Requirements

Service Areas. The existing sewer service area is shown on Figure 15 . However, much of the sewage collected does not actually reach the sewage treatment plant, but is instead discharged directly to the Cocheco River.

Through current construction work, and that contemplated in the near future, the existing sewerage system will be tied into the treatment plant. The area planned as tributary to the treatment plant, as determined by the city's sewerage consultants, is outlined on Figure 15 . This area was determined by considering the area most likely to develop under the 1965 zoning.

We have developed a proposed 1990 service area based on our future land use plan which generally falls within the City's consultant's area, except for an area at the Spaulding Turnpike from Glenwood Avenue westward, and at the Middlebrook Pond area.

Ultimate planning, however, should be based on the entire city being served with public sewerage in order to eliminate all sewage disposal problem areas, both existing and potential, and to be consistent with Dover's potential growth. The manner in which this should be accomplished will have to be determined through more extensive engineering studies.

The existing service area of the Back River Road sewerage system is shown on Figure 15 . Should the service area be extended any farther, it would probably overload the treatment facility. Ultimately, however, this area should be included in the overall service area of the city.

Sewage Flows. As mentioned earlier, between 4,000 and 7,000 people are served by the main treatment plant. This does not include the population of those areas whose sewage is discharged into the river untreated. It is estimated that approximately 18,000 persons are currently served by central public sewage collection systems including both those areas whose sewage is treated and those whose sewage is discharged untreated to the river.

Since only a portion of the total flow actually passes through the main treatment plant, and the population served by the treatment plant is not accurately known, an accurate existing per-capita flow cannot be determined. However, about 0.8 mgd flowed into the section of the plant for domestic wastes in 1968, and about 0.9 mgd flowed into the tannery section of the plant in 1968.

Coordinating the proposed 1990 service area and information contained in the Population Section of this Comprehensive Plan, the population to be served in 1990 is estimated to be approximately 25,000 persons. In addition, we estimate that approximately 350 acres of industrially used land and 200 acres of commercially used land will be within the 1990 public sewerage service area.

Based on these data, the estimated 1990 average sewage flow could be on the order of 4.4 mgd, which is in agreement with the present design flow of 4.4 mgd. It should be noted that industrial and commercial contributions at a relatively high rate could increase these average flows.

Adequacy

Service Areas. The existing service area of the central public sewerage system seems to be adequate for present conditions. However, as the population increases and development of land occurs, an extended service area must be provided. This report recommends that the services previously planned by the City's consultant for 1990 be slightly extended, as shown on Figure 15. Because of Dover's significant growth potential, the service area of the public sewerage system should be gradually expanded beyond 1990 until virtually all of the city is ultimately served.

Treatment Plant Capacity. The main treatment plant, with its new additional capacity, is designed to adequately handle average flows of 4.4 mgd. From our own estimates of population and development in Dover by 1990, we feel that an average flow of 4.4 mgd will be reached in 1990, or at some earlier date if industrial and commercial contributions are higher than anticipated. At that time, increased treatment capacity may be required.

From information obtained from the New Hampshire Water Supply and Pollution Control Commission, it seems likely that secondary treatment could be required sometime before 1990. Therefore, even though the capacity of the main treatment plant should be adequate almost to 1990, the present degree of treatment may become inadequate. At such time as this occurs, prior to providing the additional treatment units, an engineering study should be made to include a redetermination of the design sewage flows, and evaluation and recommendations concerning ultimate sewerage service to the entire community.

Recommendations

Planning Objectives and Policies. The following planning objectives and policies for sewerage facilities are recommended:

1. The city should provide sewer service by 1990 to those areas outlined on Figure 15.

2. The ultimate objective should be to provide sewer service for substantially the entire city.

3. Land use policies over the next 20 years should be consistent with 1 and 2 above. Specifically, in areas of expected future residential growth which are not scheduled for sewer service before 1990, minimum lot size under zoning should be revised, if necessary, to be within the physical capabilities of the soil (see Table 14 in the section on Land Capability).

4. Properties located within 400 feet of the public sewer system should be required to connect to the sewerage system.

5. Subdivisions within 1,000 feet of the public sewer system should be required to connect to the system where feasible.

Recommended Standards. Planning standards for municipal sewerage facilities are recommended in Appendix Table A-7.

Recommended Improvements. The following improvements are recommended for Dover's sewerage system through 1990:

1. The current program of separating the combined existing sewerage system should be continued until virtually complete separation is obtained in accordance with existing plans, and all existing and additional sanitary sewers in the central area are tied into the main treatment plant.

2. The existing service area should be extended to the 1990 proposed service area as development requires it. Priority should be given to the Middlebrook Road and Shawnee Lane areas where problems may occur in the near future.

3. The existing main treatment plant, with improvements now under construction, should be utilized until such time as secondary treatment is required by the State. At that time, an engineering study should be undertaken to determine the method of secondary treatment, the design flows, and the means of serving areas of

Dover, both within and outside our recommended 1990 service area, if desirable.

4. Disinfection facilities be provided at the Back River treatment facilities in accordance with State requirements.

On-Lot Sewage Disposal. The standards set forth by the New Hampshire Water Supply and Pollution Control Commission should be adhered to for on-lot sewage disposal. Also, present zoning should be altered to provide the recommended minimum lot sizes contained in Table 14 of the Land Capability Section of Dover's Comprehensive Plan.

DRAINAGE

Inventory

A drainage system consists of both formal drainage facilities (man-made structures such as culverts, storm drains, etc.) and natural drainage facilities (such as streams, ponds, and wetlands).

Formal Drainage Facilities. On Figure 16 is indicated the general location* of the existing formal drainage facilities in Dover. The formal system consists of storm drains, combined storm and sanitary sewers, cross-culverts and outfalls. No attempt was made to map the facilities along the Spaulding Turnpike, since these are not a part of the Dover system and are under the jurisdiction of the State.

The downtown area of Dover is served by the combined system. A 1965 engineering report** on Dover's sewerage system recommended complete separation of the combined system with some combined sewers to remain as storm drains. Additional storm drains were also recommended. These are shown on Figure 16.

Natural Drainage. On Figure 16 is also delineated the pattern of natural drainage in Dover. The city is divided into three major drainage areas, the Piscataqua-Cocheco River Basin, the Bellamy River Basin and the Oyster River Basin. The major developed portions of Dover drain into the Cocheco River either directly or via Fresh Creek, Berry Brook, Emerson Brook, Indian Brook or Reyners Brook. Kelly, Knox Marsh and Varney brooks drain to the Bellamy River. And a small portion of the southwestern edge of Dover drains through Madbury principally via Johnson Creek to the Oyster River. This system of natural streams and rivers functions as part of the city's natural drainage system and is indicated on Figure 16. These natural facilities are also identified as drainage potentials or natural facilities which should be preserved so as to function as part of the future drainage system.

There are five dams along the Cocheco River and three along the Bellamy which affect the flow of water in these streams.

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* Neither city or subdivision of plans of drainage facilities are totally available for all of Dover. Where definite information is lacking, general indications of facility locations were obtained from engineers of the Dover Department of Public Works.

**Green Engineering Affiliates, Inc., "Report on Sewerage System" December 1965.

The locations of these dams where known are shown on Figure 16. Any drainage engineering study for Dover should consider the legal and engineering implications of these dams. However, such a consideration is beyond the scope of this planning report.

The wetlands in the city will also have a function relative to the control of stormwater runoff. The storage and time lag effects on stormwater runoff in these areas does have a tendency to reduce peak runoff rates from the high-intensity short-duration rainstorms that usually are critical in urbanized areas. Thus, before any wetland area is filled, an engineering evaluation of such a filling should be made as to its effect on the downstream drainage conditions as a result of the filling. The existing major wetlands are shown on Figure 16.

Status of Planning. The 1965 report, mentioned above, which recommends the separation of the existing combined sewerage system in downtown Dover is the extent of drainage planning in Dover. No comprehensive planning has been conducted for a drainage system designed to consider the needs of the entire city or for that portion of the city which is planned for urban and suburban growth over the next 20 years. Nor have there been any plans developed for the multifunctioning (for example as natural drainage ways, linear greenbelts and municipal park) of natural drainage ways.

A study is now in process which is determining the feasibility of a relocation of the Cocheco River in downtown Dover. This relocation if found feasible and carried out would provide a new stream channel generally between Central Avenue and Cocheco Street north of Washington Street. The old channel looping to the south of Washington Street would be filled. Planning implications would be with respect to land use orientation in the CBD.

Present and Future Requirements

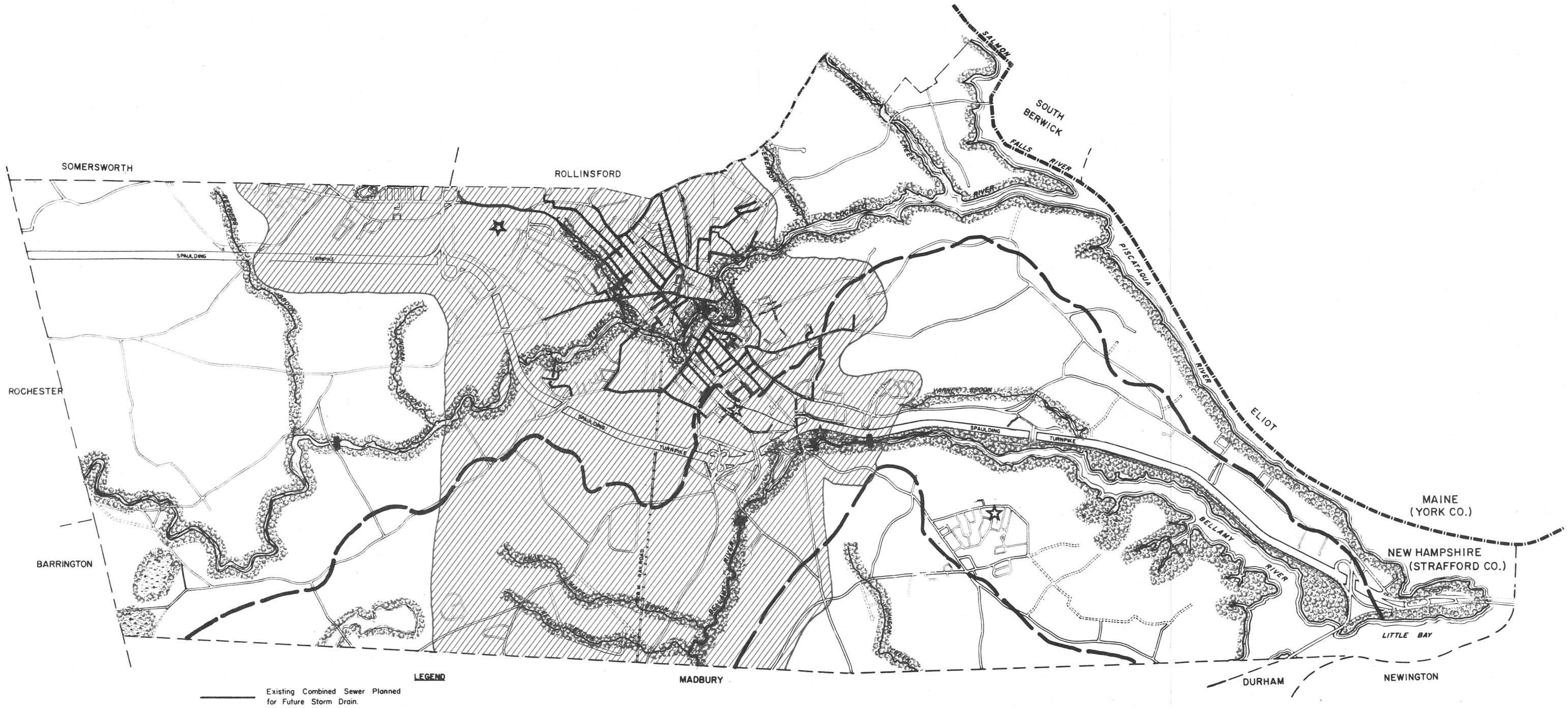
For the purposes of this planning report, the drainage requirements are determined by the identification of:

1. Existing proposals for a separate storm drainage system in downtown Dover.

2. Existing and potential problems of flooding due to inadequacies in existing drainage systems as designated by the Dover Department of Public Works.

3. Areas where within our planning period (to 1990), extensive development is likely to require construction of formal drainage structures.

FIG. 16



LEGEND

- Existing Combined Sewer Planned for Future Storm Drain.
- Existing Storm Drain
- Proposed Storm Drain as Planned by Dover's Engineering Consultants.
- Drainage District Boundary
- Drainage Problem Areas
- Existing Dam
- Existing Major Wetlands
- Existing Stream Belts, Ponds and Major Wetlands to be Considered for Preservation as Natural Drainage Ways.
- Planned 1990 Urban and Suburban Density Development Areas

DOVER NEW HAMPSHIRE

DRAINAGE

The preparation of this map was financially aided through a federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954 as amended.

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Separate Storm Drainage System for Downtown Dover. The separation of the combined sewer system in Downtown Dover is required at an early date in accordance with the recommendations of the city's consultants as described above.

Existing and Potential Problem Areas. According to the Dover Department of Public Works, there are several drainage problem areas in Dover. Specifically, these areas are Fisher Street, Kirkland Street, the Morningside housing area, Moran Street and Berry Brook. The first three of these areas all have the same problem; that is, they all receive a large volume of runoff with inadequate drainage structures. In the Moran Street area it has been necessary to construct a large pit into which storm water runoff is diverted. This is the result of a change in the areas runoff pattern due to extensive commercial construction on the northeast side of Route 16. Berry Brook has a less frequently occuring problem of backing up and flooding where it crosses streets on its way to the Cocheco River during heavy rainstorms. This is caused by inadequate pipe size to carry the stream under the streets. These problem areas are plotted on Figure 16.

Tidal flooding in Dover has not been reported as a serious problem. Continued protection should be maintained to ensure future safety by restricting development at elevations subject to high tide flooding. Based on the previously recorded high tide data in the Portsmouth area, as reported by the U. S. Coast and Geodetic Survey, we recommended that no building be permitted at an elevation lower than ten feet above mean sea level.

Potential Development Areas. Development of presently unused land has a variety of effects on the drainage situation of an area. A larger percentage of impervious surfaces is created, temporary storage areas are reduced by site preparation for development, existing drainage channels may be reduced or filled in, and piped drainage systems are created. In all cases, the effect normally is to increase the stormwater runoff. In addition, tolerance of flooding conditions in developed areas is considerably lower. Thus, there becomes a need for evaluation of the drainage situation on the basis of future needs. The situation, in general, requires a detailed comprehensive engineering study.

Areas where suburban and urban density development (generally more than one family per acre) exists and is likely to occur during our planning period are designated on Figure 16. There areas are the ones where total formal drainage or a combination of formal drainage and natural drainage systems will most likely be needed.

Adequacy of Existing Provisions

Four major inadequacies exist with respect to drainage in Dover. These are:

1. The existence of combined storm and sanitary sewers.

2. Inadequate formal drainage structures as indicated by the known problem areas.

3. The absence of a complete and accurate mapping of the existing drainage structures.

4. The absence of a comprehensive engineering drainage plan, which is based on the future land use plan for Dover.

Related to these inadequacies is the lack of guidelines or provisions for the protection of natural drainage ways.

Recommendations

Recommended Planning Objectives, Development Policies and Standards. The following planning objectives and development policies should be used as the basis for the plan:

1. Drainage must be considered on a city-wide basis, and should be based on an engineering report and the development objectives expressed as part of Dover's Comprehensive Plan.

2. Subdividers should be required to install storm sewers of adequate sizes to accommodate the ultimate development of the entire drainage area.

3. The multiple functioning of natural drainage channels should be encouraged by coordinating conservation, recreation and drainage needs. These should be reflected in the zoning and future land use plans.

4. Open-stream channels should be preserved in suburban and rural areas as integral parts of the city's drainage system. Under subdivision control, the city should require easements along such streams with maintenance and control of these channels by the city.

5. The disposition of stream channels in urban areas should be through appropriate engineering studies as to the relative merits of enclosed versus open channels.

6. The standards contained in Appendix Table A-8 should be used for the design of drainage facilities.

Recommended Plan. The following steps are recommended for Dover's overall drainage plan:

1. It is recommended first of all, that the Department of Public Works and the Planning Board adopt the proposed policies and standards as the basis for construction and as elements of the subdivision regulations.

2. A comprehensive engineering study should be undertaken to study the drainage system for Dover. The study should include accurate mapping of all existing drainage structures and natural drainage ways and should determine the locations and sizes of all new major storm drains, the capabilities of watercourses to carry the existing and anticipated future runoff, and requirements for and usefulness of temporary storage areas as well as layouts in areas where easements should be obtained. The study should be based upon the proposed policies and standards, particularly on the ultimate development of the drainage districts as described in the Future Land Use Plan.

Pending the results of the proposed engineering drainage study, the streams and ponds designated on Figure 16 should be preserved to serve as major components of the drainage system as well as components of the city's open space plan.

Certain wetlands of major proportions are also designated on Figure 16 to be preserved. This indicates that engineering evaluation of the downstream effect from any proposed altering of the retention capabilities of these areas should be determined as part of the engineering study.

The appropriate city agencies should move jointly to preserve the existing open streams, ponds, flood plains, and wetlands. (See Figure 16.) Any combination of means should be used to derive preservation, including outright acquisition of fee or easement rights, eminent domain proceedings, and zoning controls. At the same time, these agencies should develop plans for these areas which will allow for their multifunctioning as natural drainage facilities as well as conservation and recreation resources. More is to be said concerning this specific recommendation in the "Recreation and Conservation" section of subsequent phases of the Comprehensive Plan for Dover.

Appendix Table A-1. Land Use Categories

Field survey category	Generalized category
Single family (occupied) Single family (vacant)	Single family
Two family (occupied) Two family (vacant) Multifamily (occupied) Multifamily (vacant) Public (govt.) multifamily Public (Inst.) multifamily	Multifamily
Hotel and Motel off-street parking Retail sales off-street parking Wholesale and Storage off-street parking	Commercial
Durable manufacturing off-street parking Nondurable manufacturing off-street parking Mining (quarry)	Industrial
Public (institutional) off-street parking Public (governmental) off-street parking)	Public and Institutional
Circulation	Circulation
Trans., Comm., Utilities off-street parking Public, Governmental, Utility	Transportation, Communication, and Utilities
Public (recreational) off-street parking	Recreational
Agriculture	Agriculture
Vacant land (open) Public (inst.) vacant land (open) Public (govt.) vacant land (open) Public (recrea.) vacant land (open)	Vacant Open Land

Appendix Table A-1. Land Use Categories

Field survey category	Generalized category
Vacant land (wooded)	Vacant Wood-land
Public (inst.) vacant land (wooded)	
Public (govt.) vacant land (wooded)	
Public (recrea.) vacant land (wooded)	
Water bodies	Water Bodies

Appendix Table A-2. Land Capability Classification of Soils[1]

I	II	III	IV	V	V (cont.)
Hinckley (0-8% slopes)	Hinckley (8-15% slopes)	Sudbury	Windsor (15-35% slopes)	Ondawa	Muck & Peat
Windsor (0-8% slopes)	Windsor (8-15% slopes)	Suffield (8-15% slopes)	Suffield (15-35% slopes)	Suncook	Tidal Marsh
Gloucester (sandy loam, 3-8% slopes)	Gloucester (sandy loam, 8-15% slopes)	Melrose (0-15% slopes)	Buxton	Podunk	AuGres
Charlton (loam, 0-8% slopes)	Gloucester (stoney loam, 3-15% slopes)	Elmwood	Melrose (15-25% slopes)	Rumney	Biddeford
	Charlton (loam, 8-15% slopes)	Acton	Shapleigh-Gloucester (sandy loams)	Saco	Walpole
	Charlton (stony loam, 3-15% slopes)	Sutton	Gloucester (stony loam, 15-35% slopes)	Mixed Alluvial	Leicester
		Deer-field	Hollis-Charlton Complex (sandy loams)	Scarboro	Swanton
			Hollis-Charlton Complex (rocky, sandy loams, 3-8% slopes)	Scantic	
			Charlton (15-25% slopes)	Whately	
			Hinckley (15-35% slopes)	Shapleigh-Gloucester (rocky, sandy loams)	
				Whitman	
				Leicester, Ridgebury & Whitman	
				Hollis-Charlton Complex (rocky, sandy loams, 8-35% slopes)	

(1) Soil names used are those for unpublished soil survey field sheets. These names are subject to change upon publication of Strafford County Soil Survey.

Appendix Table A-3. A Five-Level Scale and Code for Rating Structural Condition

Deficiency points	Description	Definition[1]
1	No defects	-
2	Slight defects	Examples of slight defects are: lack of paint; slight damage to porch or steps; slight wearing away of mortar between bricks or other masonry; small cracks in walls, plaster, or chimney; cracked windows; slight wear on floors, door sills, door frames, window sills, or window frames; and broken gutters or downspouts.
3	Intermediate defects	Examples of intermediate defects are: holes, open cracks, rotted, loose, or missing materials over a small area of the foundation, walls, roof, floors, or ceilings; shaky or unsafe porch, steps, or railings; several broken or missing windowpanes; some rotted or loose window frames or sashes that are no longer rainproof or windproof; broken or loose stair treads, or broken loose, or missing risers, balusters, or railings of inside or outside stairs; deep wear on door sills, door frames, outside or inside steps or floors; missing bricks or cracks in the chimney which are not serious enough to be a fire hazard; and makeshift chimney such as a stovepipe or other uninsulated pipe leading directly from the stove to the outside through a hole in the roof, wall, or window. Such defects are signs of neglect which lead to serious structural deterioration or damage if not corrected.

Appendix Table A-3. A Five-Level Scale and Code for Rating Structural Condition (cont.)

Deficiency points	Description	Definition(1)
4	One or a few critical defects	Critical defects result from continued neglect or lack of repair, or indicate serious damage to the structure. Examples of critical defects are: holes, open cracks, or rotted, loose, or missing material (clapboard siding, shingles, bricks, concrete, tile, plaster, or floorboards) over a large area of the foundation, outside walls, roof, chimney, or inside walls, floors, or ceilings; substantial sagging of floors, walls, or roof; and extensive damage by storm, fire, or flood.
5	Extensive critical defects	-

(1) All definitions are direct quotes from the U. S. Census of Housing, 1960.

Appendix Table A-4. Recommended Hydrant Flows

Type of development	Hydrant flow gpm
Business & Industrial District	6,000
Residential Neighborhoods:	
(less than 3 stories in height)	
Low Density, small lot coverage	500
Low Density, moderate lot coverage	1,000
Medium Density, small lot coverage	1,500
Medium Density, moderate lot coverage	2,000
High Density, new development	2,500
High Density, older portions	3,000
High Density, any type, 3 stories or greater	5,000

Source: Nationally recognized standards adjusted to meet the needs of Dover.

Appendix Table A-5. Recommended Water Planning Standards

	Recommended standards
Basis of Design	50 years for supply
Minimum Pipe Size	6 inch
Distribution Storage	Sufficient to meet required fire flow of 6,000 gpm in Dover CBD for 10 hours duration with consumption at maximum daily rate and two largest pumps out of service.

Source: Nationally recognized standards adjusted by Metcalf & Eddy to meet the needs for Dover.

Appendix Table A-6. Stream Use Classifications

Class		Recommended use
A	I.	Class A waters shall be of the highest quality and shall contain not more than 50 coliform bacteria per 100 ml (milliliters). There shall be no discharge of any sewage or wastes into waters of this classification. The waters of this classification shall be considered as being potentially acceptable for water supply uses after disinfection.
B	II.	Class B waters shall be of the second highest quality and shall have no objectionable physical characteristics, shall be near saturation for dissolved oxygen, and shall contain not more than 240 coliform bacteria per 100 ml. There shall be no disposal of sewage or waste into said waters except those which have received adequate treatment to prevent the lowering of the physical, chemical or bacteriological characteristics below those given above, nor shall such disposal of sewage or waste be inimical to fish life or to the maintenance of fish life in said receiving waters. The pH range for said waters shall be 6.5 to 8.0 except when due to natural causes. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water shall not be such as to appreciably interfere with the uses assigned to this class. The waters of this classification shall be considered as being acceptable for bathing and other recreational purposes and, after adequate treatment, for use as water supplies.
C	III.	Class C waters shall be of the third highest quality and shall be free from slick, odors, turbidity, and surface-floating solids of unreasonable kind or quantity, shall contain not less than

Appendix Table A-6. Stream Use Classifications (Continued)

Class		Recommended use
		five parts per million of dissolved oxygen; shall have a hydrogen ion concentration within the range of pH 6.0 to 8.5 except when due to natural causes; and shall be free from chemicals and other materials and conditions inimical to fish life or the maintenance of fish life. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water shall not be such as to appreciably interfere with the uses assigned to this class. The waters of this classification shall be considered as being acceptable for recreational boating, fishing, or for industrial water supply uses either with or without treatment depending upon individual requirements.
D	IV.	Class D waters shall be the lowest classification and shall be free from slick, sludge deposits, odors, and surface-floating materials of unreasonable kind, quantity or duration, taking into consideration the necessities of the industries involved, and shall contain not less than two parts per million of dissolved oxygen at all times. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water shall result in a receiving water temperature not in excess of 90 deg F. The waters of this classification shall be aesthetically acceptable. Such water shall also be suitable for certain industrial purposes, power and navigation.

Source: Chapter 149, RSA and the New Hampshire Water Supply and Pollution Control Commission.

Appendix Table A-7. Recommended Public Sanitary Sewerage Planning Standards

Item	Recommended Standard	
	Sewers	Sewage Treatment Plant
Period of design	40 to 50 years	15 to 25 years
Average daily flow of domestic sewage	60 to 70 gallons per capita	110* to 120* gallons per capita
Infiltration	500 to 6,000 gad (gallons per acre per day) dependent on age of sewers and tributary area	*
Minimum pipe diameter	8 inches	
Minimum flow velocity	2 fps (feet per second)	
Maximum spacing manholes	300 feet	
Connection to system	All properties within 400 feet of sewer	

Source: Nationally recognized standards adjusted by Metcalf & Eddy, Inc., to meet the individual needs of Dover.

*For sewage treatment plants, increased flows due to infiltration are included in average domestic flows.

Appendix Table A-8 Recommended Storm Drainage Systems Planning Standards

Item	Recommended standards
Basis of design	Rational method for normal design of formal drainage structure. *
Design storn	5 years in normal residential area, 10 years in high-valued central commercial areas, and 50 years for bridge openings and major culverts.
Minimum pipe diameter	12 in.
Manhole spacing	At all changes of grade, alignment, and size of pipe. Maximum span, 350 ft.
Inlet spacing	At all upstream corners of roadway intersections unless the intersection is at the top of a vertical curve, at all sags in roadways and at a maximum spacing of 350 ft. on continuous roadway grades. Inlets should be connected to manholes only.
Open channel sections	Trapezoidal with side slopes at 1-ft. vertical to 2-ft. horizontal. A freeboard of at least 1 ft. shall be allowed during the design storm.

* Where another method is shown to be more appropriate to give the same degree of protection in a specific case, it should be permitted.

Source: Customary standards adjusted by Metcalf & Eddy to meet the individual needs of Dover.